S. HRG. 107–322

LISTING AND DELISTING PROCESSES UNDER THE ENDANGERED SPECIES ACT

HEARING

BEFORE THE

SUBCOMMITTEE ON FISHERIES, WILDLIFE, AND WATER

OF THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

ONE HUNDRED SEVENTH CONGRESS

FIRST SESSION

ON

THE REGULATIONS AND PROCEDURES OF THE U.S. FISH AND WILDLIFE SERVICE CONCERNING THE LISTING AND DELISTING OF SPECIES UNDER THE ENDANGERED SPECIES ACT

MAY 9, 2001

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LISTING AND DELISTING PROCESSES UNDER THE ENDANGERED SPECIES ACT

WEDNESDAY, MAY 9, 2001

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON FISHERIES, WILDLIFE, AND WATER,
Washington, DC.

The subcommittee met, pursuant to notice, at 9:32 a.m. in room 628, Senate Dirksen Building, Hon. Michael D. Crapo (chairman of the subcommittee) presiding.

Present: Senators Crapo, Corzine, Clinton, and Graham.

OPENING STATEMENT OF HON. MICHAEL D. CRAPO, U.S. SENATOR FROM THE STATE OF IDAHO

The hearing will come to order.

Good morning, everybody. The Subcommittee on Fisheries, Wildlife, and Water will focus today's hearing on the listing and delisting processes under the Endangered Species Act.

Let me begin by apologizing. It is our understanding that in about 5 minutes or so there is going to be a vote called on the floor. Rather than not start the hearing and go handle that vote, we thought that we would at least start the hearing and have opening statements by the Senators, so that we get that much done. We will probably, then, be interrupted by a vote, but I will assure you that we will run to the vote and return as quickly as we can, so that the break there will be as short as possible. It is my understanding that there is only vote, so it should not be much of an interruption.

Since the authorization for the Endangered Species Act expired in 1992, there have been many—and I would hate to hazard a guess how many—but a lot of hearings and a lot of legislation introduced aimed at both reauthorizing and reforming the Endangered Species Act. In the course of those hearings, dozens of witnesses from the various interests have offered impassioned explanations about the importance of strong Endangered Species Act reforms and the need for reauthorization. From my perspective, both are true. I am extremely concerned about the plight of the Columbia River Basin salmon and steelhead stocks. So I have proposed a $688 million funding package to recover these fish last week.

Extinction of a species is not an acceptable outcome, but neither are policies that cause economic hardship or burden private landowners unfairly. The fact, frankly, that we have recovered just 9 or 10 species since the ESA was passed is not a testament to its success. From the records I have seen, just nine species have been recovered, and three of those species were from one Pacific Island, Palau. Three of the nine species have been recovered on just one island. If you look at the continental United States, that means only six species during the history of the Act have been recovered. When you take into account the hundreds of millions of dollars that the United States spends each year in threatened and endangered species protection, something is clearly wrong with this picture.

While I have said that a significant amount of oversight has been conducted on the Endangered Species Act, there are a few areas that have not received adequate attention and are in need of more thorough examination. Listing and delisting are two issues that need to be addressed if we are to resolve some of the shortcomings of the Act. It is my hope that by conducting oversight that examines some of the problematic components of the Act, we can craft solutions to each of these which will increase our chances of success in reforming and reauthorizing the Endangered Species Act.

The quantity and quality of science is an issue that comes up again and again. I have been chairman of this subcommittee now for a little more than 2 years, and in that short time I can't think of an issue or a hearing in which the science was not called into question. There has to be a better way of getting better science and more consensus about the science to inform us in the policymaking process.

In addition to the Administration witnesses, there are a number of scientists testifying before the subcommittee today, and I look forward to having a productive discussion with all the witnesses on how to improve the science and, in turn, policy decisions with respect to conserving species.

I have other serious concerns about the listing and delisting process, but I am more interested in listening and learning from our witnesses who are here with us today. I hope that the witnesses have come to offer fresh ideas about how to specifically resolve issues in the context of listing and delisting. More rhetoric on the Endangered Species Act is not going to help bring resolution to what is potentially our Nation's most contentious environmental law.

Before moving along, I would like to note that we elected not to address the issue of critical habitat in this hearing, even though it is a part of the listing process. It is a significant issue and one that, frankly, could use up the entire hearing. We have focused significant attention on critical habitat in the past, most notably in the 106th Congress, when this committee reported out Senate bill 1100, which would modify the timing of critical habitat designations. The subcommittee will evaluate the need for critical habitat a bit further down the road.

Once again, I would like to thank everybody for coming. I think we are going to have a very interesting and productive hearing today.

[The prepared statement of Senator Crapo follows:]

STATEMENT OF HON. MICHAEL D. CRAPO, U.S. SENATOR FROM THE STATE OF IDAHO

Good morning. The Subcommittee on Fisheries, Wildlife, and Water will come to order. In today's hearing we will be examining the listing and delisting processes under the Endangered Species Act.

Since the authorization for the Endangered Species Act expired in 1992, there have been many—I would hate to hazard a guess with respect to how many—but a lot of hearings held and a lot of legislation introduced aimed at both reauthorizing and reforming the ESA. In the course of those hearings, dozens of witnesses from the various interests offered impassioned explanations about the importance of a strong Endangered Species Act and the need to reform it. From my perspective, both are true. I am extremely concerned about the plight of Columbia River Basin salmon and steelhead stocks—so concerned that I proposed a $688 million funding package to recover these fish last week.

Extinction of species is not an acceptable outcome, but neither are policies that cause economic hardship or burden private landowners unfairly. The fact that we have recovered and delisted just nine U.S. species since the ESA was passed is not a testament to its success. Just nine species have been recovered—and three of those species were recovered on the Pacific Island of Palaualone. When you take into account the hundreds of millions of dollars the United States spends each year in threatened and endangered species protections, something is clearly wrong with this picture.

While I have said that a significant amount of oversight has been conducted on the Endangered Species Act, there are a few areas that have not received adequate attention and are in need of more thorough examination. Listing and delisting are two issues that need to be addressed if we are to resolve some of the shortcomings in the Act. It is my hope that by conducting oversight that examines some of the problematic components of the Act, we can craft solutions to each of these, which will increase our chances of success in reforming and reauthorizing the Endangered Species Act.

The quantity and quality of science is an issue that comes up again and again. I've been chairman of this subcommittee for a little more than 2 years, and, in that short time, I can not think of an issue or a hearing in which the science was not called into question. There must be a better way of getting better science to inform the policymaking process. In addition to the Administration witnesses, there are a number of scientists testifying before the subcommittee today, and I look forward to having a productive discussion on how to improve science, and in turn, policy decisions with respect to conserving species.

I have other serious concerns about the listing and delisting process, but I am more interested in listening and learning from our witnesses who are with us today. I hope that the witness have come to offer fresh ideas about how specifically to resolve issues in the context of listing and delisting. More rhetoric on the Endangered Species Act is not going to help bring resolution to what is potentially our Nation's most contentious environmental law.

Before moving along, I would like to note that we elected not to address the issue of critical habitat in this hearing even though it is part of the listing process. It is a significant issue and one that could have consumed the entire hearing. We have focused significant attention on critical habitat in the past, most notably in the 106th Congress when this committee reported out S. 1100, which would modify the timing of critical habitat designations. The subcommittee will evaluate the need for critical habitat oversight a bit further down the road.

Senator CRAPO. At this point I would like to turn the time over to Senator Thomas from Wyoming for an opening statement.

Senator.

OPENING STATEMENT OF HON. CRAIG THOMAS, U.S. SENATOR FROM THE STATE OF WYOMING

Senator THOMAS. Thank you very much, Mr. Chairman. I am no longer on this committee, but I appreciate the opportunity. I have some fairly strong feelings about endangered species, have my prejudices reasonably well arranged, and so I wanted to share some of that with you.

I think it is an example of good intentions gone astray, basically. We need to have more effective public input, more effective landowners' input, and more effective input from the States that are affected. Obviously, when you have 1,245, or whatever it is, species listed and less than 20 really have been recovered, maybe you've got a problem of some kind. I think we need to take a look at it.

We have had firsthand experience in Wyoming a number of times that talks about the background. Preble's jumping mouse, for example, listed in Wyoming, and it turns out that there was no historical data there or current knowledge that it did not support the short-grass semi-arid plains. It basically turned out to be someone had done the windshield checking to do that thing and really had to back away from it because it wasn't done properly; couldn't even really identify the species that was there.

The State was not notified. I had a visit with Secretary Babbitt shortly before he left, and he had some ideas about how people are including more in the endangered species and many times could do something other than list them. I don't know that that plan was ever put into place.

We have petitions now for prairie dogs. I have lived there all my life. There are prairie dogs everywhere practically. It is really interesting that that would even be considered.

I think the problem is we have a kind of a "postage stamp" petition for nominating, and most anyone may nominate with very little background. We also don't have any priorities that have been set in terms of what is more important than another. Therefore, we just deal with whatever comes up.

I think there needs to be some peer review. Certainly, I don't question the idea of requiring protection of endangered species. I am for that, but I think we have to do it in a different way that makes it more important. The recovery goals really need to be what we talk about.

I have a bill, as a matter of fact, that says we ought to have the recovery plan along with the listing, along with the nomination, so that we know what we are going to do. Probably the most obvious one of those is the grizzly bear. Grizzly bears have been on the list forever. I can remember being in Yellowstone Park with the Superintendent 6 or 8 years ago when they said, yes, we have clearly exceeded the numbers. But we are still talking about habitat, and you can talk about habitat forever, and, apparently, we're going to. So there does need to be something that we do there. Of course, the bottom line is the game and fish in the State ends up spending the money to manage the bears, given rules by the U.S. Fish and Wildlife Service, because they are not delisted to go back into the State authority.

There's just an awful lot of things that need to be talked about and need to be changed. As I said, there are 1,200-and-some listed, and just very, very few—we are not really emphasizing, in my judgment, enough the recovery plan. That is really where we ought to at least be as interested in the recovery as we are in listing. Apparently, that is not the case.

So, Mr. Chairman, I think it is very important that we have some changes, and I am delighted that you are holding hearings. I hope we can make some progress this year. Thank you for the opportunity.

[The prepared statement of Senator Thomas follows:]

STATEMENT OF HON. CRAIG THOMAS, U.S. SENATOR FROM THE STATE OF WYOMING

Thank you, Mr. Chairman, for holding today's hearing on this important topic. In Wyoming, we have seen firsthand the need to revise the listing and delisting processes of the Endangered Species Act.

Listing should be a purely scientific decision. Listing should be based on credible data that has been peer-reviewed. Unfortunately, none of this is true regarding the current administration of the ESA. To date, 1,243 species have been listed in the United States under the Endangered Species Act. Twenty to twenty-five have been delisted. Clearly, the system is broken.

Not long ago, the Prebles Meadow Jumping Mouse was listed in the State of Wyoming, yet the listing process for this mouse demonstrates how the system has gone haywire devoid of good science.

One of the more significant shortcomings of the Preble's Rule relates to confusion about claims regarding the "known range" as opposed to the alleged "historical range" of the mouse. Historical data and current knowledge do not support the high, short-grass, semi-arid plains of southeastern Wyoming as part of the mouse's historical habitat range. The U.S. Fish and Wildlife Service has even admitted to uncertainties regarding taxonomic distinctions and ranges. Further, the State was not properly notified causing counties, commissioners, and landowners all to be caught off guard. Such poor practices do not foster the types of partnerships that are required if meaningful species conservation is to occur. Clearly, changes are desperately needed to the Endangered Species Act.

Not far behind the mouse in Wyoming, was the black-tailed prairie dog. Petitions to list the prairie dog were filed with the U.S. Fish and Wildlife Service. I've lived in Wyoming most of my life, and I've logged a lot of miles on the roads and highways in my State over the years. I can tell you from experience, there is no shortage of prairie dogs in Wyoming. Any farmer or rancher will concur with that opinion.

This petition, and countless other actions throughout the country, make it painfully clear that some folks are intent on completely eliminating activity on public lands, no matter what the cost to individuals or local communities that rely on the land for economic survival.

I believe we should take action to require the Secretary of the Interior to use scientific or commercial data that is empirical, field tested and peer-reviewed. Right now, it's a "postage stamp" petition: any person who wants to start a listing process may petition a species with little or no scientific support. I have introduced legislation, S. 347 to prevent this absurd practice by establishing minimum requirements for a listing petition that includes an analyses of the status of the species, its range, population trends and threats. The petition must also be peer reviewed. In order to list a species, the Secretary needs to determine if sufficient biological information exists in the petition to support a recovery plan. Under my proposal, States are made active participants in the process and the general public is provided a more substantial role.

Unfortunately, I have found that with several listings in the State of Wyoming, the Department of the Interior was unable to tell me what measures were required to achieve species recovery. The Agency could not tell me what acts or omissions we could expect to face as a consequence of listing. This is troubling since the Agency is supposed to be fully apprised of the status of the species. Conversely, if the Agency cannot clearly describe how to reverse threatening acts to a species so that we can achieve recovery, how can we be sure that the species is, in fact, threatened?

This ambiguity has caused much undue frustration to the people of Wyoming. If the Secretary believes that certain farming or ranching practices, or the diversion of a certain amount of water, or a private citizen's development of one's own property, is the cause for a listing, then the Secretary should identify those activities that have to be curtailed or changed. If the Secretary does not have enough information to indicate what activities should be restricted, then why list a species? Why open producers and others to the burden of over-zealous enforcement and even litigation without being able to achieve the goal of recovering the species?

Mr. Chairman, we must ultimately seek to design a system to support and improve the quality of information used to support a listing. If the Secretary knows enough to list a species, we should also know enough about what will be required for recovery. That should be the case under current law, unfortunately it is not the case today.

Just as the beginning of the process needs changes, we need to revise the end of the process—the delisting procedure. Recovery and delisting are quite simply, the goals of the Endangered Species Act.

Yet, currently, it is virtually impossible to delist a species. There is no certainty in the process and the States—the folks who have all the responsibility for managing the species once it is off the list—are not true partners in that process. Once the recovery plan is met, the species should be delisted.

Wyoming's experience with the grizzly bear pinpoints some of the problems with the current delisting process. The Interagency Grizzly Bear Committee set criteria for recovery and in the Yellowstone ecosystem, those targets have been met, but the bear has still not been removed from the list. We've been battling the U.S. Fish and Wildlife Service for years over this one to no avail, despite tremendous effort and financial resources to meet recovery objectives. Even with rebounded populations, we keep funneling money down a black hole.

Mr. Chairman, it is clear that something needs to be done. My constituents are angry and upset about the current situation and the trickling effects of countless listings. Real lives are being impacted.

It is time for some real changes. The changes I've suggested will have a significant affect on the quality of science, public participation, State involvement, speed in recovery, and finally the delisting of a species.

Species that truly need protection will be protected, but let's not lose sight of the real goal—recovery and delisting.

Thank you.

Senator CRAPO. Thank you, Senator. That was the vote that was just called, but I think, Senator Corzine, that we have time for you to make an opening statement before we break and run to the vote.

OPENING STATEMENT OF HON. JON S. CORZINE, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator CORZINE. Thank you, Mr. Chairman. I have a complete statement that I would ask for unanimous to put in the record.

Senator CRAPO. Without objection.

Senator CORZINE. Thank you. This is obviously a very, very important environmental law issue for us all to consider, the Endangered Species Act. It is complicated for a newcomer, and I am working my way through trying to be fully informed.

I am concerned, the people of New Jersey are concerned, about extinction rates. There are issues here that truly need to be addressed, and I appreciate the hearing or background note. But, maybe as important as anything, I am concerned, as I am on a whole series of issues, to make sure that we have the right kind of funding so that we address this issue properly, not in simplistic and underfunded formulas. I am very, very concerned that we are taking a step back in protecting our environment and endangered species. It is a very key issue, particularly on our coastline in our fisheries. So it is one of those things that I look forward to being an active participant in. Thank you very much for having the hearing.

[The prepared statement of Senator Corzine follows:]

STATEMENT OF HON. JON S. CORZINE, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Thank you, Mr. Chairman. I want to thank you for holding this hearing on one of our most important environmental laws, the Endangered Species Act.

Mr. Chairman, extinction is occurring at alarming rates worldwide. The World Conservation Union estimates that current global extinction rates are between 1,000 and 10,000 times higher than the normal background extinction rate. And extinction rates are increasing rather than decreasing.

Here in the United States, we are doing better than many places, but we still have a pressing problem. More than 1,200 species are listed as threatened or endangered under the ESA, more than 200 species are awaiting listing decisions, and some scientific experts believe that as many as 3,000 U.S. species may require protection under the ESA.

These are daunting statistics. For me, they put into focus the reasons why we need to continue to work to protect our natural heritage. From an ecological standpoint, there is still much we do not know about how our planet works and what is important to keeping it healthy. Aldo Leopold, in his seminal environmental work, A Sand County Almanac, observed that "the first rule of an intelligent tinkerer is to keep all of the pieces." Mr. Chairman, we are losing pieces here and abroad, and we do not understand the consequences.

From an economic standpoint, I observe that less than scientists have studied less than 1 percent of the world's species extensively. The potential of these unstudied species to provide medicines, food, and other benefits to humankind is vast, unknown and untapped.

Finally, I believe we owe it to our grandchildren and their grandchildren to hand them down a world rich in the biological diversity that we have inherited. A planet poorer in wildlife is a planet diminished, and we owe it to our heirs to preserve what we can.

So, for all these reasons, Mr. Chairman, I strongly support the goals of the Endangered Species Act and want to look for ways to strengthen it and make it more effective.

Today's hearing will focus on the listing and delisting processes under the Act, and I want to make several comments about these processes. First, some will suggest that the listing process is not based on sound science. I disagree. If you look at the history of the listing process, less than 1 percent of species that have been listed or proposed for listing have been withdrawn because they their listing was backed by incomplete data. That is an extremely low error rate, and does not suggest a systematic problem with the role of science in the listing process. I think that one reason for this is that peer-review is built into the listing process, which ensures that independent scientists review the information that the Government relies on.

Second, I have heard the suggestion that the listing process is secretive. That the data behind the listings are not available. This is simply not the case. The administrative record for a listing includes all relevant data, how the data supports listing, and the comments of the peer reviewers. All of this information is available to anyone who wants to see it.

Finally, I want to address ESA funding. Simply put, ESA has suffered from chronic underfunding. The listing program is no exception. Unfortunately, the President's budget does not remedy this problem.

Rather than limiting the ability of citizens to participate in the ESA process, as the budget proposes, we should provide the U.S. Fish and Wildlife Service and National Marine Fisheries Service with the resources they need to do the job right.

With that, I conclude my remarks, and look forward to the testimony of our witnesses.

Senator CRAPO. Thank you very much, Senator. Senator Clinton, they have just called a vote, but we figured we would try to finish the opening statements before we recess and run to the vote.

OPENING STATEMENT OF HON. HILLARY RODHAM CLINTON, U.S. SENATOR FROM THE STATE OF NEW YORK

Senator CLINTON. Well, I thank you very much, and I thank you for holding this hearing on such a critical issue. This is one of the many critical and pressing issues that this committee is discussing, everything from global warming to how we deal with our energy needs while protecting our environment. The issue of protecting threatened and endangered species is one that I put right up there with all of these other very important matters.

If there is nothing else that people on opposing sides of the ESA debate agree upon, the one thing that we do seem to agree upon is that all decisions under the Endangered Species Act should be based on sound science, the very best available science that we have. I think every one of us understands that many environmental decisions are complicated. Whether it's setting standards for drinking water or deciding what to do about PCB contamination in waterways, like the Hudson River, all of these decisions should be insofar as possible taken out of politics and put into the realm of science.

I guess, Mr. Chairman, what concerns me is that the Bush Administration budget cuts ESA science funding along with funding for recovery plans and habitat conservation plans and candidate conservation plans—all things that we know are critical to achieving success under the Act. In the budget, the Administration also asks for a rider. I think it's a little unusual to have a rider in the initial budget that is proposed by the Administration, but, nonetheless, there is one, to prohibit citizens from petitioning the U.S. Fish and Wildlife Service to list species as threatened or endangered or from designating critical habitat.

It is always preferable—I think, again, every one of us would agree that it is preferable that we do not have to resort to the courts to implement our environmental statutes. But our environmental statutes contain citizens' rights provisions for a reason, and I think these provisions need to be respected and not skirted.

It is my understanding, further, that in responding to these citizen petitions, the U.S. Fish and Wildlife Service can decide to list a species or not to list it, or it can put it on a candidate list and assign a low priority for listing, based upon listing guidance that has been in place since 1983. So, in this regard, I think we need to make very clear that citizens are not determining the listing priority of species. These decisions are still being based on the best available science, and they are ultimately the responsibility of the U.S. Fish and Wildlife Service.

I think rather than attaching riders to the budget, we should be addressing these issues as the chairman is having us do today, in the authorizing committee. Rather than saying we cannot deal with the backlog, which I understand is a serious issue and I have absolute sympathy for the positions that both Secretary Babbitt and Secretary Norton have found themselves in. I mean, it is a huge undertaking and it uses up a lot of resources, and it is a very challenging task that they face.

I would instead propose that we try to come up with the necessary resources to address the listing backlog to remove the uncertainty. We have landowners and developers who are really in a very disadvantageous position because they can't get an answer. Putting a rider in the budget and saying, well, we're going to postpone this, when they know there are citizens' groups out there that are going to say that, as soon as we are able to, we're going to come in and ask for listing, doesn't help us clear up the uncertainty.

It is my understanding that the Service estimates it would take roughly $80 to $120 million to clear up the backlog. I think we could develop a 5-year plan that would be certainly doable within our budget to get this work done, which would be keeping faith with the Act, keeping faith with the citizens who are concerned about these issues, keeping faith with good, sound science, and keeping faith with the needs of our landowners, our developers, and others who have very serious concerns about this.

So, while we might disagree about some of the topics that are to be discussed today, the context of ESA, I think we could all reach agreement that the ESA needs to be administered effectively and funded appropriately, so that we can deal with the backlog, deal with the uncertainty, put to rest some of the issues that are legitimate concerns of people throughout our country, but, particularly, in the region where the chairman comes from.

So, again, Mr. Chairman, I have found in my short term on this committee that, despite very great geographic differences and perspectives, acting in a collegial, open-minded manner can possibly lead to some solutions. I very much appreciate your holding this hearing and look forward to the results of it. Thank you very much.

[The prepared statement of Senator Clinton follows:]

STATEMENT OF HON. HILLARY RODHAM CLINTON, U.S. SENATOR FROM THE STATE OF NEW YORK

I would like to thank the chairman for holding this hearing on such a critical issue.

As with other topics we have been discussing in this committee, such as global warming, the issue of protecting threatened and endangered species is one that is absolutely critical to our planet's future. One that, if allowed to go without adequate attention and resources, could have irreparable consequences.

If there is nothing else that people on opposing sides of the ESA debate agree upon, the one thing that they do agree upon is that listing decisions—as all decisions under the Endangered Species Act—should be based on sound science, the best available science that we have.

Many environmental decisions are complicated ones. And I have always said, whether it is setting standards for drinking water, or deciding what to do about PCB contamination in the Hudson River, that these decisions should be based on the best available science.

Yet the Bush Administration's budget cuts ESA science funding, along with funding for recovery plans, habitat conservation plans and candidate conservation plans—all the things we know are critical to achieving success under the Act.

And in its budget, the Administration also asks for a rider to prohibit citizens from petitioning the U.S. Fish and Wildlife Service to list species as threatened or endangered, or from designating critical habitat.

It is always preferable that we not have to resort to the courts to implement our environmental statutes. But our environmental statutes contain citizens rights provisions for a reason, and I think those provisions need to be respected, not skirted.

It is my understanding that in responding to these citizen petitions, the U.S. Fish and Wildlife Service can decide to list a species, not to list it, or can put it on a candidate list and assign it a low priority for listing based upon listing guidance that has been in place since 1983. In this regard, citizens are not determining the listing priority of species. Those decisions are still based on the best available science, and ultimately made by the Service.

Rather than attaching riders to the budget, we should be addressing these issues in the authorizing committee, as we are doing today.

And rather than saying we can't deal with the backlog, we should focus on providing the necessary resources to address the listing backlog. It is my understanding that the Service estimates that it would take roughly $80–120 million to clear up the backlog. We could develop a 5-year plan to get this work done.

While we all might disagree about some of the topics to be discussed here today, we should all be able to reach agreement that the Endangered Species Act cannot achieve its goal of restoring threatened and endangered species if we starve it of funding.

I would like to thank the chairman and ranking member again for holding this hearing today, and I look forward to hearing the testimony from today's witnesses.

Senator CRAPO. Thank you very much, Senator. I think that your comments highlight one of the critical problems we face. The backlog in the listing process is significant. We do need to find the resources to deal with it. In fact, the backlog is not only there. There's a backlog in the recovery plan arena. There's a backlog in implementation.

You may or may not be aware, because of the issues in the Pacific Northwest on salmon, I just proposed last week that we double the amount of resources we are putting into the salmon recovery in the region up to—I think I proposed something in the neighborhood of $688 million just for that one species in terms of our efforts to try to recover it. So there's no disagreement on my part about the fact that we need to find a way to get resources to these issues.

Just to kind of highlight for the attendants here, before we recess and run to the vote, I have some interesting statistics on just the litigation that is involved with the listing process. Just consider this information for a minute.

As of March 1 of this year, 79 cases have been resolved through the entry of court orders or settlement agreements—and this is on listing litigation. As of the same date, the Service is still involved in 75 active section 4 lawsuits covering 400 species, including 17 lawsuits on petition findings for 41 species, 9 lawsuits covering 11 species regarding final determination, 36 lawsuits covering over 354 species regarding critical habitat, and 13 lawsuits covering 11 species regarding merit challenges. In addition, the Service has had 86 notices of intent to sue over 640 species relating to listing activities, including 34 NLI's regarding critical habitat determinations for 303 species.

Those statistics indicate the enormous task that we face just in the litigation that is surrounding the listing process. If this committee can find ways to build consensus toward helping us get a path forward, both in terms of getting the resources and the reforms necessary to help us move forward in protecting species, I think we can do a tremendous service for the environment and for the people of the Nation. I think that there is an opportunity for us to find that common ground.

If there are no further comments at this point, we will recess at this point. As I have advised everybody, there has been a vote called and we're getting toward the end of the timing for us to get to the vote. We'll rush down there and try to return as quickly as possible. Hopefully, it won't take long.

At this point the committee is recessed.

[Recess.]

Senator CRAPO. The hearing will come to order.

We've been joined by our ranking member, Senator Graham. Senator, if you would like to make any opening statement, you're welcome to do so at this point.

OPENING STATEMENT OF HON. BOB GRAHAM, U.S. SENATOR FROM THE STATE OF FLORIDA

Senator GRAHAM. Thank you, Mr. Chairman. I have an opening statement which I would like to submit for the record.

I want to commend you for holding this hearing. One of the centerpieces of the Endangered Species Act has been the ability of citizens to nominate species for consideration. I recognize that that has resulted in a significant backlog of court-administered cases. This hearing today I hope will give us some sense of what the range of options is to deal with that issue, and I appreciate your affording us that opportunity to do so.

[The prepared statement of Senator Graham follows:]

STATEMENT OF HON. BOB GRAHAM, U.S. SENATOR FROM THE STATE OF FLORIDA

Mr. Chairman, the Endangered Species Act was historic when it was passed by a nearly unanimous Congress over 25 years ago. The Act remains important in our efforts to balance human activities with the needs of imperiled wildlife. While this law is certainly not without its share of controversy, I have witnessed success stories such as the recovery of the American alligator, a keystone species in the Everglades and vital to the overall health of that ecosystem.

The State of Florida is home to some 111 threatened or endangered species. We can boast, rather unfortunately, that this number is third only to the States of Hawaii and California. Included in this list is the Florida Manatee, which I consider a poster child for the importance of the Endangered Species Act.

One of the strengths of the Endangered Species Act is that it allows citizens the opportunity to petition the U.S. Fish and Wildlife Service to list species that they have reason to believe are critically important. Citizens may also pursue legal recourse if they think that the U.S. Fish and Wildlife Service has not acted to protect these species.

I appreciate the fact that the U.S. Fish and Wildlife Service faces a severe listing and delisting backlog. An estimated $80-$120 million is needed to eliminate this backlog. However, I do not think that effectively cutting citizens out the process by limiting the ability of the U.S. Fish and Wildlife Service to respond to court orders is the most appropriate way to address this problem.

Most of our environmental laws include a process for citizen enforcement and oversight. Such opportunities for citizen involvement are necessary to compensate for times when administrative agencies are unable to fully implement the law.

I hope that today's hearing will present us with some ideas for solutions to eliminate the current backlog and address citizen and scientific concerns in a prudent manner.

I will submit my questions for the record.

Thank you, Mr. Chairman.

Senator CRAPO. Thank you very much, Senator.

Without anything further then, let's invite our first panel to come forward. Our first panel consists of Mr. Gary Frazer, who is the Assistant Director for Endangered Species at the U.S. Fish and Wildlife Service of the U.S. Department of the Interior. Please come forward, Mr. Frazer, and also, Mr. Don Knowles, the Director of the Office of Protected Resources for the National Marine Fisheries Service.

I would like to advise our witnesses, as well as all the witnesses on the future panels, that we would like to ask you to do your best to keep your testimony to 5 minutes, as you have been requested to do, so that we have time for questions and answers from the Members of the Senate.

You probably know how the lights work, but I'll re-explain it for everybody. The green light goes on during the beginning of your testimony. When you have 1 minute left, the yellow light comes on, and then when the time has expired, the red light comes on. When the time's expired, we ask you to try to summarize where you are. What we have found is that nobody—at least very few people—are ever able to get said in 5 minutes what they have to say, but please be assured that you'll have an opportunity to expand on your thoughts and to complete your statement during responses to questions and answers.

Without anything further then, Mr. Frazer.

STATEMENT OF GARY FRAZER, ASSISTANT DIRECTOR FOR ENDANGERED SPECIES, U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Mr. FRAZER. Mr. Chairman, thank you for this opportunity to discuss how the U.S. Fish and Wildlife Service carries out its duties relating to listing and delisting species under the Endangered Species Act.

Our procedures, some prescribed by statute and others by agency regulations or policies, are all focused upon ensuring that our decisions are objective, based on good science, and made in the open with peer review and public participation throughout. The U.S. Fish and Wildlife Service is committed to making the Endangered Species Act work in the eyes of the public, the Congress, and the courts, so that we can accomplish its purpose of conserving threatened and endangered species and protecting the ecosystems upon which they depend. This is a challenging task involving precious and irreplaceable natural resources, a complex statute, and many stakeholders with deeply held and often conflicting interests.

To meet this challenge, we work hard to base our decisions on the best available science, seek independent peer review of our decisions, to provide for public participation throughout our decision process, and to ensure that our decision process is understandable and open to scrutiny.

The Endangered Species Act requires listing determinations to be made solely on the basis of the best available scientific and commercial data. This careful evaluation of scientific evidence, including the involvement of independent peer reviewers and our colleagues in State fish and wildlife agencies, is fundamental to assessing species for listing and delisting under the Act.

To this end, the Service has issued a number of joint policies with the National Marine Fisheries Service which guide our listing and delisting efforts. Our policy on information standards provides direction to our biologists and managers on the use of scientific information in our decision process. Our policy for peer review ensures that independent peer review is built into our listing recovery and delisting activities. Our policy on the role of State agencies recognizes the unique capability of State fish and wildlife agencies to assist in implementing all aspects of the Act.

Listing under the Endangered Species Act becomes necessary when a species declines to the point where it is at danger of extinction throughout all or a significant portion of its range, or is likely to become endangered in the foreseeable future. The Secretary is required to list the species if, after reviewing the species' status using the best scientific and commercial data available, it is found that the species is endangered or threatened because of any one or a combination of the five listing factors laid out in the Act.

We have two ways to identify species in need of listing. The first is a candidate assessment process which is initiated by the Service. The second is a petition process which is available to the public. Through the candidate assessment process, the Service works with species experts, State natural heritage programs, and others to identify species that may be at risk and potentially in need of protection under the Act. The petition process allows any interested person to petition the Service to add or remove a species from the Federal list. If the petition is found to provide substantial information, we initiate a status review and issue an additional finding within 12 months as to whether listing may be warranted.

The Service issues proposed rules to list species when we have sufficient information to show that listing is warranted. If the issuance of a proposed listing rule is precluded by work on other higher priority listing actions, we add the species to our candidate list to be prioritized for a future listing proposal. We publish this list of candidate species annually and solicit information from species experts and the public to stay current on the status of the species that are on the candidate list.

At the other end of the process is delisting which marks the successful end point of the recovery process. The goal of the recovery process is to restore listed species to a point where they are secure, self-sustaining components of their ecosystems and do not require the protections of the Endangered Species Act, and thus, could be delisted.

Throughout the process the Service uses the best available science and input from the affected public to guide our actions toward successful recovery of listed species. Our listing and delisting actions are informal rulemakings published and proposed in final form in the *Federal Register*. Once a proposal is published, the Service must allow for a public comment period on the proposal; provide actual notice of the proposed regulation to appropriate State, tribal, and local government agencies; publish a summary of the proposal in a newspaper of general circulation in areas where the species occurs, and hold a public hearing, if requested. Since public participation is so important to effective conservation efforts, the Service will often hold multiple public hearings and extend the comment period beyond the minimum required by law and regulation.

Species are usually listed as a result of factors that cause their decline over many years, often decades or even centuries. As a result, recovery of listed species requires time and effort, but we have had real success. Recently, the Service removed peregrine falcon and the Aleutian Canada goose from the list of species protected under the Endangered Species Act, and the bald eagle, our Nation's symbol, is on the verge of complete recovery. We expect to downlist or delist at least six species next fiscal year, and many of the species that are on the list have had their declines arrested and the population stabilized or improving since the time they were added to the endangered species list, which is a real measure of the effectiveness of our recovery efforts.

In closing, I would like to emphasize the importance the Service places upon having a science-based, open-decision process in which the affected public can participate fully. Our listing and delisting decisions are sometimes difficult and contentious, and not all parties will agree with our final decisions. But it is critical that the public and the Congress view our work as an honest and objective effort to reach a decision required of us by the Act. Our success in implementing the Endangered Species Act is tied to that trust.

Mr. Chairman, this concludes my prepared statement. Thank you for your strong interest in the Endangered Species Act and how it is implemented, and for the opportunity to present testimony. I would be happy to respond to any questions you or the other members of the committee may have.

Senator CRAPO. Thank you, Mr. Frazer.

Mr. Knowles.

STATEMENT OF DON KNOWLES, DIRECTOR, OFFICE OF PROTECTED RESOURCES, NATIONAL MARINE FISHERIES SERVICE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

Mr. KNOWLES. Thank you, Mr. Chairman. I appreciate the opportunity today to testify on the process we at the National Marine Fisheries Service use to list and delist species under the Endangered Species Act. My name is Don Knowles. I am the Director of the Office of Protected Resources at National Marine Fisheries Service, an agency of the National Oceanic and Atmospheric Administration.

NOAA Fisheries is committed to making the implementation of the Endangered Species Act effective and to increase public support for its goals. We are also committed to working closely with the U.S. Fish and Wildlife Service to make sure our approach is consistent and to working with States, tribes, local governments, and others as partners. We are committed to basing our procedures and decisions on good science and making our decisions, any of them, with peer review and public participation throughout the process. We recognize it's a difficult challenge. We thank the committee for its support over the years.

Our listing and delisting regulations are jointly published with the U.S. Fish and Wildlife Service, so I won't duplicate a description of that process at this point. Let me just briefly summarize for you an overview of NMFS's Protected Species Program.

We currently have 55 species listed under the Endangered Species Act, much smaller than the U.S. Fish and Wildlife Service. Of our species, 26 are salmon and steelhead in California in the Pacific Northwest; Alaska contains no listed salmon species. Of those 26 ESUs that are listed, 21 of them have been listed since 1997. So, in effect, we have created an entirely new regulatory structure and process just in the last 6 years in the Pacific Northwest.

We have a little over 550 people working on endangered species and marine mammal issues. Over half of those, well over half of those, are full-time scientist. We have a very strong world-class science program in support of our listing program.

To be sure, NMFS's implementation of the ESA has been contentious and the subject of a significant amount of litigation. We have six cases pending now on listing issues. We have lost some cases and, hopefully, learned some valuable lessons in the Northwest to address the issue of whether NMFS's decisions are based on the best science. We spent a significant amount of effort in the mid-1990's collecting information from the Pacific Salmon Biological Technical Committee and interested parties, and established a Biological Review Team. While these efforts haven't eliminated the lawsuits, they have helped NMFS gather the best available science.

For all of the species under our jurisdiction, NMFS continues to look for new ways to ensure that it uses the best available science in the decisionmaking process.

I think I will stop there, Mr. Chairman. I've got a statement that, if you would be interested in including it in the record, I will thank you for the opportunity to testify and look forward to answering any questions you might have.

Senator CRAPO. Thank you very much, Mr. Knowles.

Mr. Frazer, I will begin my questions with you. I noted in your testimony that you referenced the U.S. Fish and Wildlife Service's language in the President's fiscal year 2002 budget request that is intended to comply with the current orders and settlement agreements with respect to critical habitat designations, as well as, to address the backlog of listing actions. Since I know that this question will come up—in fact, Senator Clinton has already raised the issue in her opening statement—in the context of the listing program, would you explain in a little more detail why the Administration has requested this language and how they are approaching the budget this year?

Mr. FRAZER. I would be happy to. For a number of years, the Service's workload in our listing program, all aspects of our listing program—processing petitions, adding species to the list, critical habitat—for a number of years, that workload has exceeded the resources we have available to carry out our program. As a result, we had a backlog accumulate. Many of these actions have mandatory deadlines laid out in the statute, and there is opportunity for us to be sued to comply with those deadlines, and we have been sued.

The result is that in this fiscal year, virtually our entire listing budget is dedicated toward complying with court-ordered actions, most of which are for designation of critical habitat for species that are already listed. Our goal in proposing this language in the President's budget is to be able to have the assistance of Congress to return to a more balanced listing program that addresses biological priorities.

The language would essentially do two things. It would say that, of the money that Congress appropriates for us to administer our listing program, that we are to use that to comply first with existing court orders, but then any that's left over would be spent on those listing actions—processing petitions, adding species to the list—that are driven by biological priorities. We would use a biological priority process for determining how to spend the remainder.

With this as our marching orders from Congress, we hope to be able to return to the kind of balanced listing program which I think the public expects, and that would have the greatest benefit for the species that are at risk and need protection under the Act.

Senator CRAPO. Now if I understand what you just said, what you're saying is that court orders are basically dragging the utilization of the budget rather than biological or science-based decisionmaking?

Mr. FRAZER. This year, in fiscal year 2001, the number of actions that are required by court order or court-sanctioned settlement agreement are such that we are using virtually every dollar that we have available in our appropriation to comply with those court orders and settlement agreements. So we have no money left over for discretionary actions—to be able to respond to a citizen petition or to be able to deal with any other sort of listing action.

Senator CRAPO. As has been indicated in some of the statements by the Senators already today, it would be helpful to have additional financial resources to meet all these needs, but given the budget situation that you deal with—well, first of all, let me ask you: Is the proposed budget for this year an increase or a decrease from previous years?

Mr. FRAZER. It's an increase of $2 million, about a 31 percent increase from the previous fiscal year.

Senator CRAPO. A 31 percent increase? So there is an increase in the dollars available but, even with that increase, you are still seeing the court orders essentially consume the flexibility with which you can use those dollars?

Mr. FRAZER. We have court orders and settlement agreements that are going to require us to do a substantial amount of work next year. With an increase, we hope to have some funds available that we will be able to apply to other parts of our listing program—to be able to respond to citizen petitions, to add species to the list. But the litigation is there. We have a large backlog. The potential remains for us to have additional lawsuits filed and court orders issued that will eat into that discretion as well. So this language was structured such that it would reflect the intent of Congress that we would certainly be complying with existing court orders, but for the remainder, biological priorities as opposed to lawsuits would drive the use of those dollars.

Senator CRAPO. Isn't this approach to how to manage the budget something that was started under the previous Administration?

Mr. FRAZER. We have had for a number of years a cap, a listing cap, that essentially is just language in the appropriations bill that says that the money that Congress appropriates to us for carrying out our listing program is the sum total that we can use to carry out those duties under section 4 of the Act. That's to prevent court orders from imposing obligations on us that are in excess of the dollars, the amount, that Congress appropriates for us to run our program. The cap language is to ensure that court orders for listing actions don't eat into other parts of the Endangered Species Act Program or other parts of the U.S. Fish and Wildlife Service's resource management account.

Senator CRAPO. It seems to me—and tell me if I'm right about this—but it seems to me that, to the extent that your utilization of these funds is driven by court orders and not by the biological, scientific evaluation that the Agency would like to apply to it, that creates an increased risk of further litigation because the Agency is not able to utilize the best science, but is instead being driven by judicial decisionmaking.

Mr. FRAZER. The deadlines that are imposed, understandably, courts would like us to undertake and complete these actions soon. In many cases we are well past the deadline. So there's an interest in having us complete these actions as soon as possible. But the deadlines do create real tension between making the best decision, using the best available information, and having a careful process that has everyone affected involved in the decision process, and facing a potential contempt hearing if we don't meet the deadline. So a number of our actions have been very difficult and we have had to do less outreach and had less time to consider the decisions before we went to final. As a result, we have a number of people that have criticized the outcome, and we have a number of merits lawsuits on some of our most recent critical habitat determinations.

Senator CRAPO. All right. Mr. Knowles, do you have any disagreement—or I wouldn't say "disagreement." Would you like to add any comment on this issue before I——

Mr. KNOWLES. No, I don't think we have—we're not in the same situation as the U.S. Fish and Wildlife Service.

Senator CRAPO. All right. With regard to the question of litigation, I would like to toss this question out to both of you. Before I do, I want to go over the statistics that I read earlier just to set the stage again.

According to the information I have—and this is from the U.S. Fish and Wildlife Service, so I hope that you will agree with the numbers here, Mr. Frazer—as of March 2001, 79 cases have been resolved through the entry of court orders or settlement agreement but, as of the same date, the Service is involved in 75 active section 4 lawsuits covering 400 species, including 17 lawsuits on petition findings for 41 species, 9 lawsuits covering 11 species regarding final determinations, 36 lawsuits covering over 354 species regarding critical habitat, and 13 lawsuits covering 11 species regarding merit challenges. In addition, the Service has 86 notices of intent to sue which involve another 640 species relating to listing activities, 34 of which are critical habitat determination issues for 303 species.

To me, that incredibly large amount of litigation says that something is broken. In other words, we are not getting to put the resources to the issue of species recovery the way we would like to because we are spending a tremendous amount of time in court. I assume that a large part of the budget goes for legal actions rather than environmental recovery actions.

The question I have is: What is it that is causing all of this litigation? What is the reason that we have this voluminous amount of litigation surrounding the listing process? I know that's a tough question, but really it's a question that has to be asked.

Mr. FRAZER. I'll give you my views. I think that it reflects the strong interest, and in many cases the impassioned interest, in the Endangered Species Act, in conserving fish and wildlife and plants that are at risk of extinction. We have a very vibrant economy, a lot of growth, and there are tensions between that kind of economic development and conservation of our plants and fish and wildlife. We have tools that address that, but they're not 100 percent effective and there's clearly a need for extending the protection of the ESA to species that we have not been able to satisfy because of the limited resources we have had to carry out our program.

The deadlines that are under the Act and the interest in ensuring that the Act is carried out where it's needed I think, has been the primary driver in the volume of litigation that is associated with our listing program. It does require a good bit of work of the people employed in our listing arena. Litigation support takes up an unfortunately large part of our time.

Senator CRAPO. How many lawyers have you got on staff?

Mr. FRAZER. Actually, our legal counsel is through our Solicitor's Office, and then the Department of Justice provides us with very capable legal support as well.

Senator CRAPO. Is that legal support included in your budget numbers or would that be in their budget numbers?

Mr. FRAZER. No, it's in their budget numbers. The only part in our budget, our listing budget, is the litigation support that we do: drafting declarations, doing document searches, and preparing records, those sorts of things.

Senator CRAPO. All right, let's move on to the peer review issue. Mr. Frazer, in your testimony you provided some reasons why peer review is not easy to obtain. As you know, sound science I think is critical to this listing process. Actually, if we could resolve some of the science issues, maybe we would reduce the litigation. I think that paying for peer review would resolve at least one obstacle. Am I correct in that?

Mr. FRAZER. It may. It's a function of whether covering the cost is a primary impediment or whether it is a matter of priorities and what other kind of rewards there might be for independent peer reviewers to get engaged.

Senator CRAPO. What would you recommend for us to remove some of the obstacles or disincentives for the peer reviewers to make this their high priorities?

Mr. FRAZER. Well, I don't think improving our capability to get peer review requires statutory change. There certainly are things that we can do. We can work with organizations that represent the scientific community. We can work with academic institutions, State agencies, Federal agencies to emphasize the importance of their involvement in our listing program activities and to understand what sorts of reward systems they need in order for them to be able to step up, and then work to address those.

We've got a pilot program underway already. One of the other witnesses this morning is going to, I think, discuss that in some fashion.

The other thing, though, is to have the volume of litigation associated with our listing program removed, so that when a peer reviewer does get engaged, they don't have to have the level of concern about whether this is going to be a long-term commitment involving them be drug in for depositions or called to be an expert witness, or whatever.

Senator CRAPO. So the litigation is actually impacting the peer review process, it sounds like?

Mr. FRAZER. It is. In some cases, we know that it is.

Senator CRAPO. Mr. Knowles, Mr. Frazer has indicated he doesn't think that there are legislative necessarily needed to improve the peer review process. Do you have any opinion on whether there are legislative changes that are needed? I guess I would also ask you to suggest what changes, if any, you think might be helpful in that context.

Mr. KNOWLES. I don't think legislative changes are needed. I do think that some of the testimony you are going to hear later today talks about the differences between peer review in a pure academic sense, the way it works, and peer review in a management sense like this, and I think there are some suggestions there that you could consider.

We have sort of taken a slightly different tack, I think, not necessarily for peer review for our listing packages, but peer review for other decisions. We have actually funded a group through the University of Miami called the Center for Independent Experts. We are essentially funding the University of Miami to select for us a series of peer reviewers to cover a number of actions throughout the year. We can schedule them in advance. We can get peer reviewers to agree to review, I think, and going through a university is easier than directly at this time.

So I think when we solicit the peer reviewers in the Pacific Northwest, I'm told that typically we get responses, positive responses, from a half to two-thirds of the people that we approach.

So I do think it's hurting us. I don't think it's hurting us in the same way that it is hurting U.S. Fish and Wildlife Service.

Senator CRAPO. Thank you. Mr. Knowles, let me ask another question to you. One of the criticisms of the listing process is the lack of scientific transparency. Without established criteria and thresholds, it seems to me that it is very difficult to arrive at objective decisions so we end up using the best data available, which often has significant gaps in it and is not considered to be reliable, which I think probably then leads to litigation.

Would you support some type of objective criteria for listing and delisting?

Mr. KNOWLES. By objective, you mean quantitative? I think in the National Marine Fisheries Service, because we have such a large number of people working in pure sciences, I think we have more quantitative data for our species than I expected. I have been at NMFS for a little over 18 months now. I think for Northwest salmon in the Columbia Basin, because of its long interaction with the hydropower system, we have quite a lot of data. For most of our listed species, I think we have a lot of quantitative data. I don't think it is the same level of problem.

Senator CRAPO. Well, thank you. I know because of our delay we are running late. So I will cut my questions short. I did want to say to you, Mr. Knowles, that, as you know, I am very interested in the salmon issue in the Pacific Northwest and look forward to working with you to solve our problems, not only at the listing levels, but with the recovery levels, and hope that we will be able to make some significant success there.

Mr. KNOWLES. I appreciate that, Mr. Chairman.

Senator CRAPO. Senator Graham, do you have any questions?

Senator GRAHAM. Yes, and if you have already asked this question, if you would just shut me up——

Senator CRAPO. Well, we'll see if they answer it the same way. [Laughter.]

Senator GRAHAM. One of the things that I suspect led to this hearing was the issue of the large volume of court-managed endangered species cases and a proposal that there be a hiatus in citizens' nomination of endangered species until that backlog has been reduced. Could you comment as to what would be the effect of that and your opinion as to what would be—and your suggestion as to what would be—other ways to deal with the same issue of the backlog of cases?

Mr. FRAZER. I did address this a little bit ago, but I would be happy to reiterate. We do have a significant backlog in listing actions that has accumulated over a number of years. The workload has been greater than the resources we have to carry out all our duties under the Act.

Senator GRAHAM. Could you give us a sense of what would have been the cost to have fully and expeditiously maintained your responsibility and what was your actual budget against that?

Mr. FRAZER. I would be happy to try to make that kind of estimate and get that to you.

The landscape has changed rapidly. We had a listing moratorium several years ago that affected our workflow. So it hasn't been a steady playing field.

In addition, the focus, whether it was to add species to the list or to deal with critical habitat designations, has changed as well. But I can try to give you some sense.

Senator GRAHAM. Mr. Knowles, could I ask the same question, and maybe you could provide us with something in writing on that issue, too?

Mr. KNOWLES. I would be glad to.

[The information referred to follows:]

NMFS is not in the same situation as FWS for several reasons. We have been able to list species and designate critical habitat (most of the time) within or close to the time limits proscribed by the Act. See species list below which includes critical habitat designations. Also, our budget requests target the needs of specific groups of species (e.g., Pacific salmon, sea turtles, marine mammals) and not specific ESA programs such as listing, critical habitat and section 7 consultations. This gives NMFS the flexibility to use our allocated funds for a variety of ESA programs, and wherever the need is greatest at the time.

NMFS ESA Species List.—June 2001

Listed/Proposed

Common Name	Population Name	ESA Status	Cites Classification	Scientific Name	Critical Habitat
Fish					
Salmon, Atlantic	Gulf of Maine DPS	Endangered	....	Salmo salar	
Salmon, chinook	Upper Willamette River	Threatened	....	Oncorhynchus tshawytscha.	Designated
	Snake River Fall-run	Threatened	....	Oncorhynchus tshawytscha.	Designated
	California Coastal	Threatened	....	Oncorhynchus tshawytscha.	Designated
	Central Vally Spring-run	Threatened	....	Oncorhynchus tshawytscha.	Designated
	Lower Columbia River	Threatened	....	Oncorhynchus tshawytscha.	Designated
	Upper Columbia River Spring-run.	Endangered	....	Oncorhynchus tshawytscha.	Designated
	Snake River Spring/ Summer-run.	Threatened	....	Oncorhynchus tshawytscha.	Designated
	Sacramento River Winter-run.	Endangered	....	Oncorhynchus tshawytscha.	Designated
	Puget Sound	Threatened	....	Oncorhynchus tshawytscha.	Designated
Salmon, chum	Hood Canal Summer-run.	Threatened	....	Oncorhynchus keta	Designated
	Columbia River	Threatened	....	Oncorhynchus keta	Designated
Salmon, coho	Central California Coast	Threatened	....	Oncorhynchus kisutch	Designated
	Southern Oregon/Northern California Coast.	Threatened	....	Oncorhynchus kisutch	Designated
	Oregon Coast	Threatened	....	Oncorhynchus kisutch	Designated
Salmon, sockeye	Snake River	Endangered	....	Oncorhynchus nerka	Designated
	Ozette Lake	Threatened	....	Oncorhynchus nerka	Designated
Sawfish, smalltooth	US–DPS	Proposed Endangered.	....	Pristis pectinata	
Sturgeon, Gulf	Range-wide	Threatened	II	Acipenser oxyrinchus desotoi.	
Sturgeon, shortnose	Range-wide	Endangered	I	Acipenser brevirostrum	
Totoaba	Gulf of California	Endangered	I	Cynoscion macdonaldi	
Trout, steelhead	Upper Willamette River	Threatened	....	Oncorhynchus mykiss	Designated
	Snake River Basin	Threatened	....	Oncorhynchus mykiss	Designated
Trout, steelhead	Southern California	Endangered	....	Oncorhynchus mykiss	Designated
	Middle Columbia River	Threatened	....	Oncorhynchus mykiss	Designated
	Upper Columbia River	Endangered	....	Oncorhynchus mykiss	Designated

NMFS ESA Species List.—June 2001—Continued

Listed/Proposed

Common Name	Population Name	ESA Status	Cites Classification	Scientific Name	Critical Habitat
	California Central Valley.	Threatened	....	Oncorhynchus mykiss	Designated
	Northern California	Threatened	....	Oncorhynchus mykiss	
	Lower Columbia River	Threatened	....	Oncorhynchus mykiss	Designated
	South-Central California Coast.	Threatened	....	Oncorhynchus mykiss	Designated
	Central California Coast	Threatened	....	Oncorhynchus mykiss	Designated
Mammal					
Dolphin, Chinese River	Yangtze River-China	Endangered	I	Lipotes vexillifer	
Dolphin, Indus River	Indus River-Pakistan	Endangered	I	Platanista minor	
Porpoise, harbor, Gulf of California.	Gulf of California	Endangered	I	Phocoena sinus	
Sea Lion, Steller	East of 144° Long (Eastern U.S.).	Threatened	....	Eumetopias jubatus	Designated
	West of 144° Long (Western U.S.).	Endangered	....	Eumetopias jubatus	Designated
Seal, Caribbean monk	Range-wide	Endangered	I	Monachus tropicalis	
Seal, Guadalupe fur	Mexico-Southern California.	Threatened	I	Arctocephalus townsendi.	
Seal, Hawaiian monk	Hawaiian Islands	Endangered	I	Monachus schauinslandi.	Designated
Seal Mediterranean monk.	Mediterranean Sea	Endangered	I	Monachus monachus	
Seal, ringed	Lake Saimaa-Finland	Endangered	....	Phoca hispida saimensis.	
Whale, blue	Range-wide	Endangered	I	Balaenoptera musculus	
Whale, bowhead	Range-wide	Endangered	I	Balaena mysticetus	
Whale, finback	Range-wide	Endangered	I	Balaenoptera physalus	
Whale, gray	Western North Pacific (Korean).	Endangered	I	Eschrichtius robustus	
Whale, humpback	Range-wide	Endangered	I	Megaptera novaeangliae.	
Whale, right, northern	Range-wide	Endangered	I	Eubalaena glacialis	Designated
Whale, right, southern	Range-wide	Endangered	I	Eubalaena australis	
Whale, sei	Range-wide	Endangered	I	Balaenoptera borealis	
Whale, sperm	Range-wide	Endangered	I	Physeter macrocephalus (catodon).	
Mollusk					
Abalone, white	California	Endangered	....	Haliotis sorenseni	
Reptile					
Turtle, green sea	Florida Breeding Populations.	Endangered	I	Chelonia mydas	
	Mexican Breeding Population.	Endangered	I	Chelonia mydas	
	Range-wide	Threatened	I	Chelonia mydas	Designated
Turtle, hawksbill sea	Range-wide	Endangered	I	Eretmochelys imbricata	Designated
Turtle, Kemp's ridley sea.	Range-wide	Endangered	I	Lepidochelys kempii	
Turtle, leatherback sea	Range-wide	Endangered	I	Dermochelys coriacea	Designated
Turtle, loggerhead sea	Range-wide	Threatened	I	Caretta caretta	
Turtle, olive ridley sea	Range-wide	Threatened	I	Lepidochelys olivacea	
	Mexican Breeding Population.	Endangered	I	Lepidochelys olivacea	
Seagrass					
Seagrass, Johnson's	Southeast Florida	Threatened	....	Halophila johnsonii	Designated

Mr. FRAZER. We did, though, ask for a significant increase in our listing program for this fiscal year, about a 31 percent increase. It's not going to be sufficient to be able to remove the entire backlog, not close, but it is a significant increase to our listing program capability. Hopefully, it will give us the ability for next fiscal year to be able to have some amount of funding that we would have discretion to apply to those listing actions of the highest biological priority, whether it is processing a petition from citizens to list or to actually prepare a proposed listing rule.

This fiscal year, we find ourselves in the uncomfortable position of having essentially every dollar that has been appropriated committed to a listing action, most of which are for designation of critical habitat for a species already listed. These are actions that are required by court order or under a settlement agreement. So we have no dollars available to process a citizen petition or add a species to the list, or to otherwise be able to carry out the other parts of our listing program.

The listing cap language that we requested was to have Congress recognize the backlog, the fact that the appropriation was not going to be enough to remove the backlog entirely, and to give us direction on how to spend the money that Congress provides: first, to comply with existing court orders and then to apply the remainder to listing actions that are biologically prioritized as opposed to having our priorities set by whichever court renders a decision on an order first.

Senator GRAHAM. Thank you. I do have just one other quick question I wanted to throw out to both of you, and that is: I noted that last week the U.S. Fish and Wildlife Service made a finding that there was a listing of a distinct population segment, or a DPS, of the western sage grouse that was warranted. I appreciate, Mr. Frazer, your explanation of use of distinct population segments in listing, but, as you probably know, a lot of debate circles around the use of distinct population segments in endangered species listing actions. Listing of distinct population segments certainly comes across as something that is highly subjective—to the point that, in fact, in 1979 this committee directed the Services to use this technique sparingly, which I think is the exact word that was used.

I would like each of you to respond to whether you believe that your respective agencies are following that guidance from the committee, that they are using distinct population segments sparingly.

Mr. FRAZER. I think that we are, in that we interpreted the intent of Congress to the best of our ability and issued a joint policy with NMFS that was designed specifically to provide direction to our field people and managers about how you make a determination of whether an entity is a distinct population segment and appropriate for listing under the Act.

Since the DPS policy was issued, the U.S. Fish and Wildlife Service has listed about 14 DPS's, which is about 3 percent of the species that were listed during that period. Of these 14, at least 4 of them were listed as a DPS so that we could exclude populations that had been established through artificial means or outside of their historic range, or they involved intergrades with other more abundant populations, so that they didn't require the protection of the Act. So our use there of DPS's was to actually ensure that the protections provided under the Act were focused upon those parts of the species' range that were at risk.

I think that the application the Service has made of the DPS policy has been with full knowledge of the direction of Congress to use it sparingly.

Senator GRAHAM. Mr. Knowles.

Mr. KNOWLES. I would also agree that we have used this discretion sparingly. We have long been aware of the need for a careful interpretation. In 1990, we received a petition to list five stocks of Pacific salmon and had to come up with a rigorous way of how to apply the DPS policy to Pacific salmon. We published an interim policy, and over the 2 years between 1990 and 1992, we did a fair amount of public interaction, convened workshops, published scientific papers, etc., and put out a final policy on the use of evolutionarily significant units in November 1991 applying the definition.

Then, in collaboration with the U.S. Fish and Wildlife Service, in 1994, we started and worked for 2 years on a final DPS policy. We do have 26 of our 55 or so listed species listed as distinct population units, or ESUs, because of the Pacific salmon. Except for Atlantic salmon, we don't have any other species listed as a DPS, although I think we have one in the pipeline.

Frankly, as the science evolves, and we are increasingly aware of the biological basis for distinguishing populations, we find ourselves confronted with the issue more significantly now than in the past. For example, recent advances in our understanding of the genetic structure of sea turtles indicate that there are genetically unique populations that may require different recovery strategies.

Senator CRAPO. Well, thank you. Because of time, we are going to have to move on, but I would like to thank this panel for coming before us today and excuse you. We appreciate your testimony and appearance.

Our second panel—and please come forward—is Dr. Deborah Brosnan, who is the president of Sustainable Ecosystems Institute in Portland, OR; Dr. David Wilcove, who is a scientist with the Wildlife Program for the Environmental Defense in Washington, DC, and Dr. Lev Ginzburg, a professor at the Department of Ecology and Evolution at the State University of New York at Stony Brook.

We appreciate your being here. I would like to remind you of the need to watch the lights here on the clock, so that we can have an opportunity to discuss matters in our dialog with you.

With that, why don't we proceed with you, Dr. Brosnan.

STATEMENT OF DEBORAH BROSNAN, PRESIDENT, SUSTAINABLE ECOSYSTEMS INSTITUTE, PORTLAND, OR

Dr. BROSNAN. Thank you. Good morning. I am Deborah Brosnan, president and founder of Sustainable Ecosystems Institute. The Institute is a public-benefit, nonprofit organization that provides impartial, scientific support for conservation. We're nonpartisan and we seek science-based, cooperative solutions that benefit both the environment and the human communities that depend on it. Currently, over 300 scientists work with the Institute to provide support to the Government, to the private sector, and to citizen groups.

Now in recent years, there's been extensive comment and critique of management under the Endangered Species Act. There are calls for wider and more effective use of independent and certainly impartial scientific analysis. Of course, U.S. Fish and Wildlife Service and National Marine Fisheries Service have committed to the use of scientific excellence and, indeed, they employ many fine scientists.

However, they would probably be the first to acknowledge the need for more resources and for better integration of their efforts with the Nation's other scientific resources. This is a point of view shared across the political spectrum.

Central to the idea of improving ESA science is the concept of peer review. Peer review is a scientific equivalent of quality control. It's our profession's established method of ensuring that analyses are carried out properly, so the best data are used, and that the conclusions drawn are appropriate.

It's already the policy of NMFS and U.S. Fish and Wildlife Service that important decisions such as listing actions are subject to external peer review. However, the widespread calls for increased peer review, as outlined in my accompanying table, testify to the general feeling that a more systematic and open process is desirable.

At least 63 diverse groups are all calling for peer review, and the detailed information in the table is revealing. Essentially, each group wants impartial review of actions affecting their primary concerns. So, for instance, resource users tend to call for review of listing actions while environmental groups favor review of habitat conservation plans and recovery plans.

The groups are, however, united in their common belief that an independent review would lead to better decisions and more effective management and conservation. Scientific peer review can, indeed, be of great use, and there's nothing to fear from the process. However, it is important to have a well-thought-out and a systematic process. Bad peer review is worse than no peer review.

In the past few months SEI has begun a pilot process to assess the U.S. Fish and Wildlife Service with peer review. This is a pro bono effort by our scientists, and it supports the Service's existing policies and processes. It's early days in this experiment, but we can provide some information on success rates.

Now in the accompanying graphic that is up here, I want to show you first that the Service has diligently been seeking independent peer review—this is the blue columns on the left—often without recourse to SEI's help. Their success rate has varied. Sometimes they have been successful, but other times they failed to get the cooperation of independent scientists.

For instance, on critical habitat are the Arkansas Shriner, the desert bighorn, and the California gnatcatcher, all affecting huge areas of habitat, not one single scientific review was received from any of the 17 scientists approached by the Service. Yet, the Service had to, and did, make a decision.

The Institute usually has higher success rates for our program with the Service and for other reviewers. Typically, we have obtained a 96 percent success rate, response rate. I believe our success can be explained by several factors.

As practicing scientists, we speak the same language as scientists and can explain the needs and the uses of science. We have an infrastructure that insulates scientists from political issues and pressures, and we also reward scientists both professionally and financially.

Peer review, however, is not a panacea. As I have previously outlined in an article in the National Academy Journal, simple extension of the academic model of peer review to applied management decisions won't work. Peer review itself needs to be re-examined and carefully designed in order for it to be effective.

For instance, peer review in public decisionmaking cannot be anonymous as it is in academia. Decisions have to be made even when the science is incomplete or we are going to face paralysis or analysis, and clear roads must be defined for the scientists as well as for the decisionmakers.

The lessons we have learned so far have been useful. Working within existing policies of the regulatory agencies, peer review can, indeed, contribute to effective management. Academic models of review and existing infrastructures, however, are insufficient for the task. With U.S. Fish and Wildlife Service and our other partners in academia, we have begun to build process that includes the necessary structures, and improvements are definitely possible.

Resources will be needed. We have, for instance, estimated that a national peer review program would cost $3 to $5 million. Of course, we're estimating as a nonprofit, which means we cost less than a Federal agency.

Peer review is a serious and professional undertaking. An ad hoc or poorly thought-out approach will lead to frustration. However, if properly implemented, peer review can contribute much to ESA and to other natural resource decisions.

Thank you for your time and the opportunity to address the committee.

Senator CRAPO. Thank you very much, Dr. Brosnan.

Dr. Wilcove.

STATEMENT OF DAVID WILCOVE, SENIOR ECOLOGIST, WILDLIFE PROGRAM, ENVIRONMENTAL DEFENSE, WASHINGTON, DC

Dr. WILCOVE. Thank you very much. I'm David Wilcove with Environmental Defense.

I think there are really two essential questions that we have to face pertaining to the listing process. The regulated community understandably wonders, are all of these species on the endangered list really in trouble? Do they really belong there? And conservationists wonder, well, how many really rare species are there that haven't made it onto the endangered list? Fortunately, we have empirical data with which to examine both questions, and the answers are, yes, the species on the endangered list really do belong there, based on the best available information and, yes, there are lots and lots of rare species that deserve to be on the list but haven't made it there yet.

Because the statutory guidance as to what constitutes an endangered or a threatened species is pretty vague, I think it is worth examining the Service's track record. In 1993, we published a study in the journal Conservation Biology in which we looked at the population sizes of plants and animals that were added to the endangered species list between the years 1985 and 1991. What we found was that the median population size for an animal going onto the list was less than a thousand individuals, which means that half of the animals that we add to the list are rarer than giant pandas are today. The median population size for plants going onto the list was fewer than 120 individuals. In short, we found that in essentially all of the cases we examined the empirical evidence in support of an endangered or threatened status was strong.

More recently, scientists at the National Center for Ecological Analysis and Synthesis have repeated our work using more recent data from 1996 to 2000, and they find that the situation hasn't changed. What we're adding to the list are species whose numbers have reached a critically low point.

Of course, sometimes after you list a species, you go out and you discover additional populations, but we could only find 5 out of 1,200 cases where enough new populations have been discovered to warrant taking the animal or plant off the list because it was clearly an erroneous decision. We're dealing with a low error rate here.

On that second question, as to whether there are lots of species that haven't made it on the endangered list but deserve to be there, we are actually fortunate that there is a new source of information out. I call your attention to the book, Precious Heritage: the Status of Biodiversity in the United States, which was produced by the Nature Conservancy and the Association for Biodiversity Information. It really represents, I think, the most complete and up-to-date assessment of the status of American wildlife.

The Nature Conservancy and the Association for Biodiversity Information classified the plants and animals of the United States with respect to their rarity based on the numbers of known individuals and the numbers of populations of these species. It brings together data from all 50 States and the natural heritage programs.

The Nature Conservancy and the Association for Biodiversity Information have identified well over 3,000 plants and animals in the United States that by any reasonable scientific standard should be on the endangered species list, and, in fact, that is more than double the current total for the list. So I don't think there is any doubt that we have a large number of imperiled species that are out there that haven't made it onto the list. The question is: What can Congress do about this?

I would suggest that, although the number of erroneous listings is quite small, Congress could reduce that even further by providing additional funds for biological inventories and for monitoring, because, after all, better information will produce more accurate listings.

On the matter of the backlog of deserving but unlisted species, let me make this suggestion. I think we can conservatively assume a backlog of about 2,000 species. At the current rate at which we're adding them to the endangered species list, it is going to take over 30 years to clear up that backlog. But we might set a goal of erasing the backlog within about a decade, and to do that I suggest Congress would want to approximately triple the amount of money that it provides for listing activities to about $20 million in the next fiscal year. I would suggest that the penalty for not doing that might well be the extinction of some of these plants and animals.

Thank you.

Senator CRAPO. Thank you very much, Dr. Wilcove.

Dr. Ginzburg.

STATEMENT OF LEV GINZBURG, PROFESSOR, DEPARTMENT OF ECOLOGY AND EVOLUTION, STATE UNIVERSITY OF NEW YORK AT STONY BROOK, AND PRESIDENT, APPLIED BIOMATHEMATICS, SETAUKET, NY

Dr. Ginzburg. Thank you, Senator Crapo. My testimony relates to consistency and transparency of the listing rules. I am sort of representing the science of ecological risk analysis here and the ideas of quantitative thresholds and clarity in the rules.

Certainly, the determination of endangerment status is the critical for the objectives of the Endangered Species Act. Yet, the protocol that used currently by U.S. Fish and Wildlife Service has been commonly criticized for being arbitrary because of lack of clarity in the law.

Risk-based criteria have been used in other environmental areas. There is a famous 10 to the −6 in human health, one in a million, if you're not familiar with that, and there is a famous 10 to the −5, I think, in the chances for meltdown for nuclear reactors per reactor per year. Those 10 to −6 and 10 to −5 didn't come easy, but they come through guidelines. This was not legislation. This was guidelines issued by the Nuclear Regulatory Commission and corresponding executive parts of the Government.

I think similar action can be attempted here. I'm not sure that it is necessary to change the whole Endangered Species Act. It may be sufficient to clarify it by appealing to scientifically based quantitative thresholds.

The example that I want to bring is a positive example of the so-called IUCN criteria. IUCN used to stand for International Union for Conservation of Nature. Now it is called World Conservation Union. It is based in Switzerland. It is an international organization of conservation biologists. The rules that they develop are in practice in about 20 countries, some as laws, some as guidelines, throughout Europe, Asia, Australia, New Zealand. It's widely used rules.

The World Conservation Union is an independent organization, but what they say is respected around the world. They have been publishing some Red Data Books from the 1960's, close to 40 years. The criteria that are in place right now, well, they are slightly different from what we have—we have two categories; they have three—are based on 12 quantitative estimates. I don't have time to explain all of them, but the most important one is be a risk factor. For instance, a 10 percent risk of extinction in 100 years is the threshold of the minimal listing. So below 10 percent risk in 100 years is a safe level. Ten percent and above, indicates a vulnerable, threatened, endangered species.

The numbers didn't just come from nowhere. There were tremendous negotiations by biologists around the world. The logic of the rule is pretty involved. Two out of three things should be correct, and if this is right or that is right, then you move to the next line.

But the important thing about these rules: They are very transparent; they are clear; they are consistent; they're accepted by the world. Of course, we are still measuring in inches and pounds. We don't necessarily do what the world does in the United States, but it might be good to look at what has been done.

These rules are doing quite well. They are extremely efficient from the point of view of the efficiency of listing process, I think about 10 times more efficient, I would say. They have analyzed and reviewed, not necessarily listed, analyzed 18,000 species in 5 years, and they continue to do that and regularly publish updates like this. A crude estimate of wildlife efficiency of what we do per year for the last year, 10 times would be a good estimate. The reason, of course, is the clarity of the rules that allows it to be used efficiently.

So I would suggest that we take a good look at these rules and try to evolve our system so it is more clear along this line, not necessarily adopting them literally, but generally moving along that line. If we do that, we would improve the listing system, make it more efficient, clear, transparent, and, hopefully, cut down those lawsuits that you mentioned, because I think the rules should be such that any individual or organization which wants to know whether this species has to be listed or not one way or the other has to come out with the same answer, using the same information.

Senator CRAPO. Well, thank you, Dr. Ginzburg.

Let me begin the questioning with you, Dr. Brosnan. As you indicated in your testimony, there are some disincentives for effective peer review in the system that we now use. You have covered this in some of your written and your oral testimony already, but I would like to ask you to just kind of summarize for me, how do we remove some of these disincentives, so that scientists are more willing to engage in peer review? How do we motivate scientists to provide those reviews?

Dr. BROSNAN. I think the first thing is to understand the scientific or the academic culture. There are few rewards for scientists who engage in public service. In fact, there are major disincentives. It doesn't count toward tenure or promotion. It is viewed as time taken away from publishing or doing basic research.

What we have found is that you need to provide rewards that are appropriate to the profession. In our case we found that, for instance, a letter from the member of the National Academy of Sciences or a senior scientist in that scientist field that goes in the file can be very effective and can be an incentive.

Second, a financial reward is an incentive for two reasons. First, it speaks to the seriousness of the effort and, second, it recognizes the professionalism of the scientist and the professional duty that they are performing.

A third issue that we found important is to provide an insulation or a buffer. Many scientists don't want to be dragged into a process that goes on for years where they are taken into court, set up against dueling scientists, and where their credibility as a scientist becomes questioned by one side or another. If you can provide a buffer that insulates a scientist from that process, that is very effective.

From the point of view of peer review, it is also important to in one sense dissuade the scientist and find they become a manager. As scientists, we're used to making decisions and making statements that we expect the world to follow. It is important to keep a clear distinction between scientific input and a management decision.

Senator CRAPO. Thank you very much. Who should provide and administer the peer review system?

Dr. BROSNAN. I think you have to recognize what you want from the peer review system. From what I can see, you need three main things. You want scientific excellence. You want scientific credibility and impartiality, and you want practical use from peer review. Peer review is not going to be used just for an academic publication. It is going to be used to make a natural resource decision that has huge impacts on society.

Finally, you want buy-in from the stakeholders into the peer review process. Some of the models that have been proposed, S. bill 1180, I think, suggests that the National Academy of Sciences should run peer review. I don't think that is a very good idea for two reasons. One, the Academy tends to deal in broader issues and have a much longer timeframe in producing its reports. Second, many of them are not familiar with the practicality side of natural resources. The academic model, again, lacks the practicality and also the reward structure, and it is a very different system.

I think what we need is a new infrastructure. We need a National Center for Peer Review that allows a scientist both to be independent, credible, and buffered.

Senator CRAPO. Thank you very much.

Dr. Wilcove, first of all, I have a note here that says that you are an affiliate professor with the University of Idaho; is that right?

Dr. WILCOVE. That is correct, Senator.

Senator CRAPO. Your stature has just increased. I'm glad to know that.

[Laughter.]

As we have been discussing with Dr. Brosnan the question of peer review, would you comment on the issues she has raised? Do you agree with those? Or do you feel that we can address it in a different way?

Dr. WILCOVE. I am certainly not opposed to peer review. I think it is a good idea. Unfortunately, a lot of people in my field of ecology steer clear of doing anything that's terribly useful or practical like peer review. I think Dr. Brosnan has outlined some of the reasons why that is the case.

My suggestion would be to keep the administration of a peer review system within the Services because I think they can do it better and more efficiently than some outside entity which is not tied into the movement of the various listing proposals and the like.

Having said that, I have to emphasize again that the track record of the Services from a scientific perspective isn't bad. We're not dealing with agencies that are making a lot of errors in terms of putting undeserving plants and animals on the list. So I have to say that it would not be my top priority to address. Frankly, I'm more concerned about the lag time or the delay in getting species that are in trouble onto the list.

Senator CRAPO. Let me ask you a question in that context. You heard me earlier, I assume, discuss the volume of litigation that the Service is now dealing with. I assume from you're testifying that your position would be that that litigation is a result primarily of the fact that the Agency or the Service is not getting to the issues quickly enough, but let me ask you in your own words to tell me, why do you think we have so much litigation over the listing?

Dr. WILCOVE. Well, I think it fundamentally stems from the fact that this is a big country with an awful lot of wildlife resources that has had a booming economy for a long, long time. That means we have a large number of plants and animals that are at some risk of disappearing. These are problems that have built up literally over the course of a couple of centuries, and we have been running the Endangered Species Act since 1973 and listing species at what we think is a rapid rate, but, in reality, it is not relative to the need out there. So there isn't going to be an easy way to get out of that.

I am certainly sympathetic to the Service's dilemma now and I would very much like to see more of these rare and often ignored species get on the list. My thought would be, let's try to address this by giving them significantly more resources to do that sort of work than we have previously given them. Even the increase that the Services received in the current fiscal year is still small relative to the need that is out there.

Senator CRAPO. Thank you. Let me ask you just one other quick question. I don't know if you have read it, but you heard Dr. Ginzburg's testimony about the potential to objectify the process and make it more scientifically evaluatable. Would you support objective criteria for listing and delisting?

Dr. WILCOVE. Two thoughts on that: First, I actually compared the track record of the Service against the criteria that Dr. Ginzburg talked about. Indeed, the species that they are putting on, by and large, fall within the categories of endangerment that the World Conservation Union outlines. So if we had objective criteria in place, we probably would not be throwing out very many, if any, of the species that are currently on the list.

Having said that, I think those criteria are thoughtful and very useful, and I would not be opposed to raising with the Services the possibility of incorporating them in their listing decisions.

Senator CRAPO. Thank you.

Dr. Ginzburg, I found your testimony to be very interesting. I am wondering, would you support that the same criteria be used for delisting as would be used for listing?

Dr. GINZBURG. Certainly. I think that they are clear and quantitative, unless something comes off.

Senator CRAPO. I think that the method that you suggest for determining a level of risk would be useful, although I remain concerned about the question of whether we have sufficient data or adequate science. It is a question that is often thrown up to us. How can the objective method that you talked about actually work when, as so often happens, we have major gaps in the data?

Mr. GINZBURG. Well, it is better to have clear uncertainty in quantitative data than an unclear, poetic statement of the Act. I guess in the recent Presidential election, we all heard about the fuzzy math—remember—that both candidates used? It actually is an area of mathematics for about 30 years called fuzzy arithmetic.

Senator CRAPO. Oh, is that right?

[Laughter.]

Dr. GINZBURG. Yes, it exists for 30 years. While we have been working on this, an application of this, through the listing, I am applying this algebra sort of of uncertain numbers. What it is concerned with is how to do judgments and mathematical operations with unclear values. They are still values. They are more than words——

Senator CRAPO. Trying to objectify something that isn't really subject——

Mr. GINZBURG [continuing]. But the values have uncertainties associated with that. So fuzzy math is not just a joke in the election. It is also a serious branch of mathematics.

Senator CRAPO. It's actually called fuzzy math, huh?

Dr. GINZBURG. Yes, it is called fuzzy mathematics and it was invented in the United States about 30 years ago.

Senator CRAPO. Well, that is very interesting. It is a good thing you didn't bring that up during the elections.

[Laughter.]

Dr. GINZBURG. Yes, I mean, I don't have time to explain what it is, but it is pretty easy. In about 10 minutes I could explain, but I don't have that.

Senator CRAPO. Well, it just still seems to me that any method that we use is going to be difficult to fill confident in if we have major gaps in the data. But you're telling me that——

Dr. GINZBURG. There is a way, and, also, the IUCN ruled specifically under their five categories of questions: How many individuals are left? How many populations are left? Whether the decline is more than so much percent over the next 30 years, and so on. There are various questions, but they recognize the data may not be sufficient to answer all of them. So they allow the decision to be made on part of them. So if you only know about the abundance or only about the decline or only about the geographic spread, the listing still takes place.

In fact, as you have more information, you could sort of read it back and see which of the five criteria pushed you into that category because the others may say classified is OK and that one may be vulnerable, things like that. But the absence of information does not prevent listing or delisting. That is how IUCN rules have been applied consistently for many years.

Senator CRAPO. OK, well, that makes sense although it still seems to me—and maybe it is just a problem that we will have—as long as we don't have the absolute data, whether we try to objectify the decision or subjectify the decision, we still live with it.

All right. Well, again, we're running short on time. I wish we go further, but I would like to thank this panel for both your written and your oral testimony and for your input into our decision-making. Thank you very much.

I would like to call up our third and final panel: Mr. John Echeverria, who is the director of the Environmental Policy Project at Georgetown University Law Center; Mr. Steven Quarles, counsel for the QuadState County Government Coalition and American Forest and Paper Association; Mr. Steve Moyer, the vice president of Conservation Programs at Trout Unlimited; Mr. Ralph Moss, director of Government Affairs at Seaboard Corporation, and Mr. Zeke Grader, executive director of the Pacific Coast Federation of Fishermen's Associations.

Gentleman, we appreciate your being with us and we will proceed in the order that I read your names, which will be from your right across the table. Again, I would like to remind you as well to try to remember to watch the lights here, so that we can have an opportunity for discussion.

Mr. Echeverria.

STATEMENT OF JOHN ECHEVERRIA, DIRECTOR, ENVIRONMENTAL POLICY PROJECT, GEORGETOWN UNIVERSITY LAW CENTER, WASHINGTON, DC

Mr. ECHEVERRIA. Thank you, Mr. Chairman. My name is John Echeverria, and I'm the director of the Environmental Policy Project at Georgetown University Law Center in Washington, DC, where I am also an adjunct professor. I appreciate the opportunity to be here.

My written testimony addresses a number of issues, and I would be happy to discuss those. But I thought in my brief oral testimony I would focus on the issue of citizen suits.

The Administration's recent budget submission to Congress includes a proposal that would prevent citizens from continuing to go to Federal court to enforce deadlines in section 4 of the ESA for the listing of threatened and endangered species and for the designation of critical habitat. In my view this proposal is unwise for two reasons. First, it would destroy one of Congress' most valuable tools for ensuring that Federal agencies comply with the ESA as Congress intended. Second, it fails to address the most obvious solution to the growing volume of ESA lawsuits being filed against the agencies.

As an attorney, I acknowledge that lawyers and lawsuits are at best a necessary evil. In an ideal world there would be little or none of either one of them. Unfortunately, this is not an ideal world, and I think we all recognize that lawyers and lawsuits are necessary for a variety of purposes, including the vindication of public and private rights. And I'm sure, whatever else Mr. Quarles has to say, that he will agree with me on that.

The legislative history of the ESA makes clear that Congress included a specific provision authorizing citizen suits for a very sensible reason. As the committee is aware, Congress has the opportunity to act on major legislation such as the ESA on a relatively infrequent basis. Therefore, an obvious concern for Congress has been what steps the agencies will take or will not take to implement the law during the long periods when Congress is focusing on other issues. Unfortunately, experience has shown that coalitions of regulated businesses tend to exert enormous influence by lobbying the agencies to delay implementation of the law or to adopt strained interpretations of the law that will lessen their regulatory burdens. These efforts are countered to a limited degree at least by environmental advocates who attempt to speak on behalf of the broad public interest protected by the law. Unfortunately, concentrated wealth and power frequently prevail over the broad public interest in this process. Academics talk about this phenomenon using fancy terms like the collective action problem and agency capture. Most citizens simply understand that money talks.

Citizen suits provide Congress a solution to this problem. By empowering individual groups and citizens to directly enforce the law as Congress has written it, Congress creates an important check on the agencies' ability to subvert Congress' will. The goal is not, as some have suggested, to set up the courts as the arbiters of environmental disputes or to assign citizen groups around the country some special policymaking responsibility. Instead, the goal is simply to use our established judicial procedures to see that Congress' will is carried out. In many cases the mere threat of successful litigation can prevent an agency from flouting the will of Congress and avoid the need for actual litigation.

Mr. Chairman, you asked the question, why is there so much litigation? The obvious answer is the enormous backlog of species listings and habitat designations that need to be carried out according to the standards and schedules that Congress included in the Endangered Species Act.

There has been a lot of criticism of litigation as a serious problem. But it seems to me that describing ESA litigation as a problem is a little bit like blaming the canary in the coal mine for chirping a little two loudly. The volume of litigation in this country over the ESA is, in my judgment, less a problem than a symptom of a problem.

I also want to observe that with respect to the Administration's proposal it is fair to observe that we have already been there and done that, so to speak. Prior to 1982, the Endangered Species Act did not have the kinds of specific enforceable deadlines that it has today. Under the earlier regime the agencies got very little done. As the legislative history of the 1982 amendments to the ESA reflects, Congress included enforceable deadlines in order to move the agencies along.

Finally, I would simply observe that, if the Administration's objective is to avoid unnecessary litigation rather than to gut the ESA, a ready solution is at hand: increased appropriations to address the backlog of ESA listings and habitat designations.

I understand that the U.S. Fish and Wildlife Service has estimated that a relatively modest $120 million over a period of years would eliminate the backlog and thereby eliminate the basis for many of the suits being filed. As compared to eviscerating the citizens' suit provision, increased funding levels will allow Congress to reduce the volume of litigation against the agencies while simultaneously preserving an important tool to prevent agencies from ignoring congressional mandates.

Thank you, and I will be happy to respond to any questions.

Senator CRAPO. Thank you very much. And it is "Echeverria"?

Mr. ECHEVERRIA. Echeverria.

Senator CRAPO. I'll get it right. I'm sorry.

Mr. Quarles.

STATEMENT OF STEVEN P. QUARLES, COUNSEL, QUADSTATE COUNTY OF GOVERNMENT COALITION AND AMERICAN FOREST AND PAPER ASSOCIATION, WASHINGTON, DC

Mr. QUARLES. Thank you. It's a pleasure to be here. I am representing the American Forest and Paper Association and the QuadState County Government Coalition, a coalition of six counties in four States that share portions of the Mojave and the Colorado Deserts.

Certainly the issue on which this subcommittee has chosen to hold a hearing is absolutely timely. Over the 3 decades since enactment of the Endangered Species Act, we have had many disputes over individual determinations of species' listings, but now for the first time, I think, we are beginning to see real contention over the basic process of listing, including the underlying science and law. That certainly has been heightened first by the announced moratorium of the Clinton Administration on consideration of new listings other than those required by court order, and then by the legislative language that is contained in the Bush budget proposal.

What I would like to talk about in my short time is the overbroad definition of species eligible for listing. I am going to emphasize the authority to list distinct population segments of vertebrates; efforts by Congress and this committee to restrict the use of that authority; how the authority has been expanded by the U.S. Fish and Wildlife Service and National Marine Fisheries Service well beyond the expectations of Congress, and, in particular, this committee; and the infiltration of that concept into other Endangered Species Act decisionmaking and listing. I also probably will not have time, but do have suggestions for at least a couple of ways of addressing these problems.

The Endangered Species Act, as has been noted, has really an unusual definition of species. It's not only true biological species, but recognized subspecies and distinct population segments of vertebrates. This is not the first definition of species in the ESA. In 1973, when the ESA was first enacted, the definition was very liberal. It included populations in common spatial arrangement. By 1978, Congress had had second thoughts about that very loose and liberal definition of populations of sub-subspecies category and passed what is now the definition of species that includes distinct population segment.

But that whole definition of sub-subspecies still met with criticism, including withering criticism from the General Accounting Office in their well-known "squirrels in the park" analogy in which they said in testimony before this committee, "The squirrels in a specific city park could be listed as endangered even though an abundance of squirrels lived in other parks in the same city and elsewhere."

This committee in 1979, in considering the 1979 amendments, decided to retain that definition even though the GAO had asked that the sub-subspecies category be deleted, but did issue a stern admonition to the Services, one you mentioned earlier, "The committee is aware of the great potential for abuse of this authority and expects Fish and Wildlife Service to use the ability to list populations sparingly and only when the biological evidence indicates such action is warranted."

I would argue the Services have used the authority unsparingly. The two policies that they put out in 1991 and 1996 have been criticized by environmental lawyers, including Dan Rohlf, as rife with discretion. The policies do nothing to limit and arguably substantially expand the authority to list distinct population segments—and, indeed, are expanding such listings rapidly.

In the last 5 years the Services have listed 38 distinct population segments, five times the number they listed in the previous 5 years. There are 35 distinct population segments in the rulemaking pipeline.

How have the Services been able to expand this authority? Well, first, there is no scientific agreement on the distinct population segment. The Services stated in the preamble to their policies: “Available scientific information provides little specific enlightenment in interpreting the phrase ‘distinct population segment.’ The term is not commonly used in scientific discourse.” The National Research Council admitted, even as it proposed a distinct population segment concept of its own, that such a concept was more a matter “of judgment” as much science. And Congress is complicit. Congress has chosen not to define distinct population segment, and the legislative history provides no real guidance.

Examples of abuse are many. We have seen the designation of distinct population segments in the lower 48 States without any discussion of reproductive isolation, biological distinctness, or problems of abundance outside of the United States.

We have also seen one other misuse—significant misuse—of the distinct population segment concept, and that is designating distinct population segments, or all but designating distinct population segments, after the listing is completed. The Services list a species, subspecies, or a large population, but then engaged in decisionmaking under provisions throughout the rest of the Endangered Species Act on smaller populations that never more considered in rulemaking, never were the subject of notice and comment and public participation. They divide what was a species or a subspecies or a large population segment into smaller recovery units in the recovery plan each of which is subject to a separate recovery goal, thereby extending the time in which the species remains on the books as a threatened species or an endangered species, and they also divide them into smaller populations when undertaking section 7 consultations thereby making it easier to find jeopardy—both clearly problems for landowners and private property interests.

I do have some suggestions for change which I would be happy to share with the committee at the appropriate time.

Senator CRAPO. Thank you, Mr. Quarles.

Mr. Moyer.

STATEMENT OF STEVEN N. MOYER, VICE PRESIDENT OF CONSERVATION PROGRAMS, TROUT UNLIMITED, ARLINGTON, VA

Mr. MOYER. Thank you, Mr. Chairman, Mr. Crapo. I really appreciate the opportunity to be here today to represent Trout Unlimited. Trout Unlimited is a national fisheries conservation group dedicated to protection and restoration of the Nation’s trout and salmon species and the watersheds on which they depend. We have 130,000 members in about 500 chapters across the country, and our members generally are trout and salmon anglers who contribute a lot of their time and money back into protecting and restoring a resource that they love.

Because of declining populations of native trout and salmon across the country, especially in the West, our members increasingly rely on the provisions of the Endangered Species Act to protect trout and salmon. So TU supports the Endangered Species Act and considers it to be one of the most important laws that we have for protecting and restoring trout and salmon populations.

I just wanted to begin by expressing my thanks to you, Mr. Crapo, for supporting the Snake River salmon appropriations package that you did. I think that is a bold step and very constructive, and fitting with your longstanding interest in that issue.

Senator CRAPO. Thank you.

Mr. MOYER. Now let me get straight to summarizing my summary by making the following statements.

TU believes that the listing and delisting processes as written in law are fundamentally sound. Implementation of the processes by the agencies is slowed unacceptably because of the huge listing backlogs and insufficient funding, most importantly. Implementation of the listing process clearly needs to be improved, but in our view the solution to the problem is not to weaken the process legislatively or administratively, but rather it is for the Bush Administration to propose and Congress to appropriate additional funding for listing decisions.

On the question of science, in our experience, applying sound science to listing and delisting decisions is not a substantial problem. We think the Services generally work very hard at getting the science right and giving people adequate chance to comment upon it.

Just on the current proposal that is before us that has been discussed, we don't support the current Bush Administration proposal to, among other things, restrict citizen lawsuit enforcement of the listing deadlines. And, again, what we think is the right thing to do is to, instead, appropriate a significant increase for listing.

Finally, one thing that I really wanted to raise, because I don't think it has been raised before, is that there are a number of good opportunities for the subcommittee and the committee that the committees can avail themselves of to really get at the root problem that we are talking about today, which is the substantial declines in species populations across the country. That is to support conservation initiatives other than in the Endangered Species Act which could actually reduce the need to list species in the first place.

Three examples that I talked about in my testimony were the CRA, the Conservation Reinvestment Act, the Fishable Waters Act, and front and center are the conservation programs under the farm bill. These are three pending issues that the committee will be looking at that could really get at the root problem.

A couple of other points I would like to elaborate and emphasize, and first is declining populations, especially of fish and wildlife. Populations of species that are vital to sport and commercial fisheries are reaching threatened and endangered status, and there are now 33 species of trout and salmon that are listed. These range all the way from the rivers of Maine, where Atlantic salmon are listed, to bulltrout of the intermountain West, to the Pacific salmon of the Northwest and California.

The ESA listing and delisting processes are fundamentally sound, we think, as I mentioned before. Congress wisely stated that the decisions to list or delist species should be based solely on the best available science. In our experience, the Services generally have used this authority appropriately. We have had disagreements with the agencies over their interpretation of the science, but in the main they have done a respectable job.

Similarly, ESA's mandate to protect distinct population segments is a wise, essential conservation tool, especially for species such as trout and salmon, which consist of an array of populations like fibers in a tapestry that give resilience and strength to species. These populations provide the genetic fitness that species need to survive the vagaries of weather, environment, and human-contrived obstacles that threaten them.

Conservationists would generally like to see National Marine Fisheries Service, for example, segment out the distinct populations even further, because biologically it probably would be a helpful thing to do in some cases. But, while we don't always agree, again, we will continue to debate these issues. We respect that the agencies have a difficult job to do in making these decisions and they are trying hard to do them well.

I just wanted to end by making two more points. One is that listing of trout and salmon has benefited all the species that have been listed. There's some thought that, because there have been so few delistings, that the species perhaps haven't benefited by listing. In fact, in our experience, all the species that have been listed have gained some benefit.

Two I will mention in particular are the greenback cutthroat trout in Colorado, the State fish of Colorado, and the Apache trout in Arizona. Both species, once on death's doorstep, have now been restored to the point where very limited, very restrictive catch-and-release fisheries can occur which provide great economic benefit to communities and individuals in those States. So there's two examples where the Endangered Species Act lifting has really helped, but we think it has helped across the board.

Finally, I just wanted to mention again the opportunity that the subcommittee and the committee have before them in other areas besides the Endangered Species Act. The bills that I mentioned before I think are three good examples where the committee could take very helpful action that would get at the root cause of the listing problem, which is that there's a whole lot of species that need to be listed.

So thanks very much for the opportunity to testify today.

Senator CRAPO. Thank you very much, Mr. Moyer.

Mr. Moss.

STATEMENT OF RALPH L. MOSS, DIRECTOR, GOVERNMENT AFFAIRS, SEABOARD CORPORATION, WASHINGTON, DC, ON BEHALF OF ATLANTIC SALMON OF MAINE

Mr. MOSS. Mr. Chairman, my name is Ralph L. Moss, and I'm testifying on behalf of Atlantic Salmon of Maine, which is the largest salmon aquaculture company in North America. Seaboard Corporation is a major stockholder in Atlantic Salmon of Maine, and I have been involved with this issue for the last 7 years. I appreciate the opportunity to testify before you this morning concerning our firsthand experience with the recent joint decision of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service to list the Maine Atlantic salmon as endangered under the ESA.

In our particular case, we believe that this Act is being implemented in an arbitrary and heavy-handed manner that is both inconsistent with congressional intent and counterproductive for the restoration of the species. We would like to be clear that our company is a strong partner in the State of Maine Atlantic Salmon Conservation Plan and supports salmon restoration in Maine rivers. But, like Maine's Governor, Angus King, and the members of our congressional delegation, our company opposes the Services' decision to list these fish as an endangered species. The listing is fundamentally wrong for scientific, legal, and policy reasons.

Maine salmon runs are restoration fish, the product of more than 120 years of hatchery stocking of non-indigenous salmon into these rivers and do not qualify as a distinct population segment for ESA listing. The Maine listing represents a dangerous backslide by the Services into an inflexible interpretation of the ESA that fails to honor the State conservation plans and creates an unsustainable burden on Federal wildlife programs.

It is widely recognized that the Federal Government alone cannot recover endangered or threatened species. The States, with their traditional authority over wildlife management and land use planning, are ideally positioned to fashion conservation plans that are custom-tailored to the resource, its habitat, and local conditions. This is especially true in Maine. Virtually all salmon habitat is in private landownership, and only the voluntary cooperation of landowners will enable salmon habitat upgrades.

In Maine's case, the Services initially recognized the value of the State's conservation plan. This plan was developed by a task force which included Federal fishery scientists. The Maine plan provides 5-year action plan to recover the species with specific priority actions for each of the rivers. The plan gives top priorities to the projects that directly benefit the resource and provides creative solutions for the agricultural, forestry, and aquaculture areas to minimize stock impacts and disruption of the Downeast businesses.

In December 1997, the Services celebrated the Maine plan as a national model that would open a new chapter in conservation history. The Services determined that a threatened ESA listing of the runs was not warranted because the State plan offered sufficient protections, but less than 2 years later, apparently in response to pressure from a lawsuit filed by environmental groups, the Services abruptly reversed course and decided to list Maine Atlantic salmon as endangered. The Services failed to provide a credible rationale for the listing or to demonstrate any truly changed circumstances in the status of the Maine run.

The State of Maine put $2 million into their plan. Our company alone put $200,000, at the State's request, into this plan. This was for an innovative adult restoration stocking program, raising wild fish from the river for later release, and natural spawning. Although highly successful to date, the adult stocking program's future is uncertain now with the listing.

By rushing into the listing, the Services effectively derailed the State plan. There is no appetite now for dealing with the Services on the part of the industry. Given their failure to be guided by the best available science and the poor track record on pragmatic solutions, the Services turned a deaf ear to the ESA mandate that the best scientific evidence be used to make listing determinations and failed to heed congressional cautions to use their power to list distinct population segments sparingly.

We heard the Services' representatives repeat many times in the Maine listing hearings that, although the genetic evidence was incomplete and that the genetic heritage of the Maine salmon was not clear, the precautionary principle required that the salmon be listed, given the low population levels. The agencies' growing reliance upon the precautionary principle in ESA represents a fundamental conflict with statutory authority and congressional intent on ESA listings.

I could go on, and I will be allowed during the questions. I hope to be able to make some suggestions, but I would like to conclude by saying that we, as an industry, have vowed to work with the State. We hope that this decision can be reversed, and we are prepared to work with you and your committee on this issue.

Senator CRAPO. Thank you very much, Mr. Moss.

Mr. Grader.

STATEMENT OF ZEKE GRADER, EXECUTIVE DIRECTOR, PACIFIC COAST FEDERATION OF FISHERMEN'S ASSOCIATIONS, SAN FRANCISCO, CA

Mr. GRADER. Thank you, Mr. Chairman. I appreciate this opportunity to discuss with you today the issues of listing and delisting of species under the Endangered Species Act. Our organization has had considerable experience working with the Endangered Species Act since at least 1986. My organization, as the name might imply, represents working men and women in the West Coast commercial fishing fleet. These people depend on fish, the productivity of the oceans and our rivers, for their livelihoods and they're food producers.

You have copies of our written comments, which are fairly extensive. Rather than summarize or repeat those, what I would like to do, rather, Mr. Chairman, is talk about one specific instance, one particular species, and give an example of what I think works and doesn't work with the listing and delisting process. That species I would like to talk about is the Sacramento winter run chinook salmon.

This, as you may know, was the first Pacific salmon listed under the Endangered Species Act, and it actually goes back to the efforts in 1986. This species, I should add, numbered about 120,000 spawners in 1969. This was a unique species along the Pacific Coast that spawned in the summertime, even during hot weather. It was a run that Livingston Stone wrote admiringly about when he first came to the West Coast on behalf of the Fish Commissioner in 1870. He was looking at problems with Pacific salmon.

Like I said, in 1969 there were 120,000 winter-run chinook spawners. By 1986 that number had declined to some 2,000 fish. The warning was sounded by the American Fisheries Society, which is the professional organization of fishery scientists in this Nation. That year AFS petitioned for listing of winter-run salmon under the ESA. They cited the various reasons for the causes of the declines—everything from warm water releases from a major Bureau of Reclamation reservoir at Shasta Lake, diversions from an irrigation diversion dam or irrigation projects on the Upper River that were entraining and putting fish into the fields, juvenile fish; a diversion dam downstream that was causing problems—creating habitat for predators, as well as problems further downstream in the Delta—the Sacramento-San Joaquin Delta, from two major pumping operations, State and Federal, as well as pollution from a Superfund site originating at an old mining operation.

Shortly after the petition was filed and a lawsuit was threatened, the agencies took upon themselves, the State and Federal agencies, to come together with a 10-point plan for the recovery of these fish. They looked at some of the issues that the American Fisheries Society had laid out.

But what they came up with was basically what we call the 10-point handshake. None of it was enforceable except for the restrictions on fishing in the river by the recreational fishermen. Ironically enough, that—the fishing—was not listed by the American Fisheries Society as one of the problems that had led to the decline of the fish.

By 1989 the run had declined to 400 fish. The fishery agencies still had not acted. Finally, the California Fish and Game Commission decided to act and did list the run under the State's endangered species act, more or less embarrassing the Federal agency the National Marine Fisheries Service to finally take action.

By 1991 the run was down to 191 fish and was quickly on the way to extinction. At that point my organization called together the State and Federal agencies that were responsible. It is ironic that a group of fishermen has to pull the agencies together, but that's, indeed, what happened, and said, we've got to do something. We embarked on a captive brood stock program, among other things, and started demanding enforcement of actions designed to address the declines.

Shortly after that, and under some threats from lawsuits from private groups such as our own, the American Fisheries Society and some of the recreational fishing groups, the Agency did take some action against some upstream water diverters. A $100 million plan was put in place to finally correct a temperature control at the Shasta Dam, and fish passage at the Red Bluff diversion dam was taken care of by lifting the gates during critical passage periods. Moreover, the State and Federal pumps in the Delta were curtailed during the critical migration periods.

What happened, then, is that the Agency did finally act hesitantly when the run was almost near extinction, and we have seen progress over the last few years. The Act, the ESA, does, in fact, work to restore fish. I think the winter run are a classic example. We are up to between an estimated 3,000 to 10,000 fish now. We are on our way to recovery.

But the concern with all of this is that we have to do something about getting the agencies to act in a timely fashion, not waiting until we're on the brink of extinction before we go to list these fish. Obviously, more funding is needed in the listing process. But, probably more important, we need funding in the delisting area to make sure that we can put in place those type of corrections for addressing habitat and other problems that caused the decline in the first place, so that we can then promptly and quickly get the runs back and recovered and then have them delisted. So funds are needed, yes, for listing, but we also need to be looking, too, as well as appropriations, to get on with delisting these species. That is going to take money, Mr. Chairman. Thank you.

Senator CRAPO. Thank you very much, Mr. Grader.

Let me go with my questions. First to you, Mr. Quarles, I wanted to follow up with the comment that you made when you were talking about distinct population segments. Either in your written testimony or your oral testimony—I can't remember which—there was something that caught my attention about the fact that the Services are apparently listing recovery units that are even smaller than distinct population segments; is that right?

Mr. QUARLES. What they're doing, which we find very disturbing, is they will list a species, a subspecies, or a distinct population segment, and then in implementing the rest of the Act, they will adhere to the category or the level that was listed.

Senator CRAPO. Right.

Mr. QUARLES. For instance, with red-cockaded woodpeckers, they listed a very large—now I can't remember whether it was a species or subspecies—but a bird that is found throughout the Southeast. Instead, when they do jeopardy determinations under the consultation process, they basically, without rulemaking, simply establish a small population of the wookpecker and determine whether the Agency action—timber harvesting or whatever—is jeopardizing that population, rather than jeopardizing the species which was actually listed.

The same thing happens in recovery plans. We're seeing more and more often that the Services will list a population like the grizzly bear or the Mojave population of the desert tortoise, and then in recovery plans, without any rulemaking, basically, relist as recovery units or distinct population segments a whole number of smaller populations. We believe that is clearly contrary to the Act.

Senator CRAPO. In your testimony you said you had some recommendations for how to solve the problem. What would those be?

Mr. QUARLES. Well, basically, it would be to enact into law what this committee said in its committee report in 1979. My view is that the way the Endangered Species Act now reads there is suggestion that all three categories, if found, must be listed—species, subspecies, and distinct population segments—if they're at risk in a portion of their range. My view would be to make listings of species and subspecies mandatory, but to make listings of sub-subspecies or distinct population segments discretionary, and to put into statutory form your command that that be done sparingly, perhaps putting a burden of proof on the Agency that it must have legally reviewable biological reasons for designating a distinct population segment.

Second, the law should be amended to make it clear that, once a species is listed as a species, subspecies, or distinct population segment, it must be treated in that form in decisions made under the rest of the Act—where the term “species” is used in consultation, in recovery, and in delisting.

Finally, I would, since no one else has, support the proposed legislative provision in the Bush budget. I believe it is far more sophisticated than the seldom mentioned November policy of Secretary Babbitt, which was to put a moratorium on all listings that were not ordered by a court. I believe that the Bush proposal provides an opportunity for as many listings as would have occurred under the Babbitt moratorium, but with the sophisticated, scientific expertise of the Agency prioritizing those that ought to be listed in a timely manner.

Finally, I would disagree that the Bush proposal removes citizen suit rights. All it does is eliminate the statutory listing and deadline under which many citizen suits are brought, but it does not stop a citizen to bring a suit, saying the failure to list is arbitrary—that the species is so endangered that the Agency just is acting in an arbitrary manner under the APA. There clearly is still an opportunity for citizens’ suits. So I disagree that it denies citizens’ suit ability.

Senator CRAPO. Well, let me talk with the panel in whole about that issue of litigation. Mr. Echeverria, you indicated that—and I think Mr. Moyer and Mr. Grader all have indicated concern with the Administration’s proposal for the moratorium, which actually was begun in the previous Administration, and I think in both situations was a response to the type of circumstance that we heard in the testimony from the first panel in terms of the concern about the resources that are being diverted into litigation.

It seems to me that we have a mounting issue here. I understand the point that is made with regard to the fact that we can increase resources, so that we can deal with the increased need for listing, but let me ask a question, and maybe, Mr. Echeverria, you can answer this. The litigation that I have described here in this hearing relates only to the listing and delisting process. Do we have similar amounts of litigation in other parts of the statute that the agencies face as they seek to administer the Endangered Species Act?

Mr. ECHEVERRIA. I want to respond as well to some of the points Mr. Quarles has made but let me first respond directly to your question. I think the majority of the litigation now being pursued under the Endangered Species Act is relatively straightforward litigation dealing with the failure of the agencies to comply with nondiscretionary duties to list or to designate critical habitat. In my prepared testimony I compare a lot of the litigation that is being filed, in terms of its complexity, to determining whether or not somebody has violated a 2-hour parking limitation. These are not adventurous, novel pieces of litigation being filed. They are essentially enforcement actions directing the Agency to comply with the deadlines that Congress has very carefully and very specifically set forth in the statute.

I want to take issue with Mr. Quarles' point that the proposed rider does not undermine citizen suits. What the proposed rider does do is it makes a current obligation of the agencies nonexistent, and, therefore, there's no legal duty. Obviously, no one can sue to enforce a nonexistent duty. So although it may in theory leave the citizen suit provision in effect, the proposal rider eliminates the legal duty that the agencies now have that provides the basis for citizen suits.

On the question of resource diversion, I would question the extent to which resources are being diverted. I wonder, for example, if either the U.S. Fish and Wildlife Service or the NMFS contends that any of the species that have been listed in response to citizen suits are not deserving of listings based on the underlying science. And, similarly, with respect to critical habitat designations, whether they feel that any of the critical habitat designations they've made in response to litigation aren't fully warranted by the science.

I think the fact of the matter is that there is an enormous backlog of work, a lot of scientifically justified work to be done in terms of listing species and designating critical habitat. The litigation that has gone forward has only gone a small way in forcing the agencies to do the work that needs to be done and that is scientifically justified.

Senator CRAPO. Do you think that litigation is the most efficient way to make this happen? I guess the question I am asking is, we have this same debate in the health care arena right now as to whether we should try to find some way to reduce the amount of litigation over health care. We have the same debate in the Superfund debate, the same issues here in the Endangered Species Act. In each of those areas we see tremendous amounts of dollars, of Federal appropriations as well dollars from other areas, whether it be State and local government or the private sector, being, I'm going to use the word, diverted but being put into litigation efforts which at first blush at least seem to be an incredible amount of resources being put into courtroom actions when they could be put into recovery actions or into some type of environmental restoration.

So my question is, without challenging the notion that we should have the right as citizens to enforce the Act, isn't there a way that we could somehow improve it so that we have a reduction in the amount of resources that we are committing to litigation? I don't limit that just to Mr. Echeverria, but anybody.

Mr. ECHEVERRIA. Well, I will just comment briefly. I think the agencies are being put in a very narrow box. On the one hand, they are being told to list endangered species and to designate critical habitat, and those obligations are enforceable through citizens' suits. On the other hand, they're not being given the resources to do the work. It seems to me that those two factors together are producing this boomlet in litigation.

If the agencies had the resources to do the job, even if they didn't have $100 million over the next several years, if they had a significant increase in resources, that would allow them to work down the backlog and it would eliminate a lot of these lawsuits.

Also, if the agencies had enough resources, simply the threat of litigation, the possibility of litigation, would be enough to make the agencies aware of their legal obligations, encourage them to comply with their legal obligations, and avoid the need for the filing of lawsuits in the first place.

Senator CRAPO. Anyone else want to respond on that?

Mr. Grader?

Mr. GRADER. Yes, Mr. Chairman. I think there are ways of dealing with the litigation, but I don't think they're necessarily very popular. That would be, first of all, some appropriations so that we can deal with these species before they get to the critical point where they qualify for listing, and that is doing a better job of protecting some of these habitats.

The Pacific salmon crisis didn't happen overnight. We had warnings back in 1971, when the California Citizens' Advisory Committee on Salmon and Steelhead Trout came out with a document called "An Environmental Tragedy," outlining clearly what was going to happen, and people blew it off. If we would have acted then, many of these stocks would not have been listed.

We know back in the 1980's, when we put together the programs for restoring Columbia River salmon stocks, what was going to happen and we chose to ignore the warning signs.

Second, when we get to a situation where species clearly are threatened or in danger of being extinct, the agencies simply have not acted quick enough. I mean, there's been criticism here today of the Bush Administration. Well, I can tell you under the Clinton Administration we were highly disturbed when it appeared that, particularly in the Pacific Northwest, they seemed to want to protect the Endangered Species Act by protecting it from itself; that is, not enforcing it until it was nearly too late for the species. The listing actions by the Agency were often only after it was brought by litigation. None of us want to be in court. We want to get these species recovered. For my members, we want to bring them back to productivity so we can sustain our livelihoods.

Senator CRAPO. Mr. Moss?

Mr. MOSS. Yes, and I would, again, go back to the State of Maine plan. The State of Maine has known for a long time of the problem with the Atlantic salmon. The State very sensibly came up with a plan that again had the input of the Federal Government, the U.S. Fish and Wildlife Service, the National Marine Fisheries, and the industry. We have worked spending hundreds of thousands of dollars trying to avoid a listing, trying to create restoration programs. In fact, Governor King was in consultation with the Federal agencies at the same time that Secretary Babbitt was issuing the listing. There was duplicity and the Federal Government was not straightforward with us in their dealings.

We had committed ourselves as an industry, with the State of Maine, to restore the Atlantic salmon, to preserve the Atlantic salmon. Then our feet were kicked out from under us by the Department of the Interior in the listing. It makes no sense. If you're trying to exert a good-faith effort and you have your feet kicked out from under you by the same agency that you're supposedly working with, there's a duplicity that should not be allowed to stand.

Senator CRAPO. Mr. Moyer and then Mr. Quarles.

Mr. MOYER. Chairman Crapo, just one observation that I would have on your question is that I think there is an opportunity for the Administration and probably this committee to deal with conservationists who are bringing these suits and with others in the regulated industry and make a proposal which would be: If specified amounts of increased funding were to occur over a time period, 5 or 10 years, to get at the backlog, then perhaps there would be more understanding among the conservationists about going to court to getting issues resolved.

I think the time is right, and perhaps this situation is tailormade for such a long-term plan that would have increased funding that would conservationists bringing the suit some assurance that the backlog would be cleared over a reasonable amount of time. So that's just one idea that I had that I think might have some merit.

Senator CRAPO. Mr. Quarles?

Mr. QUARLES. Yes, two points I wish to make: First of all, I think this is one place where, with a huge caveat, the regulated community is probably in agreement with the environmental community, and that is the lack of resources for the agencies. They are being starved.

The one thing that we would say, however, is that if more funding is to be given to listing, there must be a comparable amount of funding given to those actions that are important to landowners and the regulated community. Just as deadlines for listing are being missed consistently by the Services, so are deadlines for consultation on agency permits needed by landowners to develop their land and on Fish and Wildlife Service manual deadlines for processing habitat conservation plans and issuing incidental take permits.

So the simple matter is it only compounds the problem for landowners if, in fact, the money is placed on listing more species, and at the same time the Services continue to be starved in those programs or procedures that provide landowner relief. I think that's important.

Then one other comment I might make. This is my clients; I've never checked it with them. I think there is possibility of compromise even on the issue of the Bush proposal long term. I think it's needed short term to get the Agency back on its feet.

But one possibility is we now have arbitrary deadlines for listing in the Endangered Species Act, and they're the same arbitrary deadlines for both threatened and endangered species. It seems to me that the Act could be written so that at the time a petition is determined as prudent or at the time the Agency begins the listing process on its own behalf, that the scientists themselves set a deadline for that process based upon the degree of risk and the data gaps that may exist. Once that deadline is set by the scientists in the Agency with the best science, then that deadline becomes enforceable by citizen suit if the Agency fail to meet it. But it will allow the Services to set deadlines based upon the true degree of risk to the particular species involved.

Senator CRAPO. Well, thank you. In the remaining time that we have, I would like to kind of get into a broad question. Really this question is raised in my mind by all of your testimony, probably most significantly Mr. Moyer's point that there are conservation initiatives in other areas than the Endangered Species Act in which we can make a lot of progress. Mr. Grader has talked about the difficulty in the California situation of getting the action necessary from the Federal agencies under the statute. Mr. Moss has talked about the fact that the action under the statute derailed very positive efforts that were being undertaken in Maine. Mr. Moyer talked about the need to reinfuse resources into CRA or to the Fishable Waters Act or the conservation title of the farm bill.

By the way, I am very glad that you referenced that, Mr. Moyer, because I believe that a lot of the things that we are doing in those areas are at least hopefully going to make a big difference. In fact, as things would have it, I end up being the chairman of the Subcommittee on the Agriculture Committee that is working on the conservation title. So maybe we can find some ways to make progress.

But here's my question, and it's kind of a broad one which I would just like to get some discussion on: It seems to me that from the testimony that we have heard from the second panel, there are literally thousands of species out there that, at least according to some on that panel, should be listed. I don't know what the ultimate number is that should be listed, but if we assume that the problem here is that we don't have enough resources to list all the species that are waiting to be listed, we have to assume that there will be a significant number of listed species if we were to proceed along the lines that have been suggested by some.

Each time a species is listed, then under the Act we need to proceed and recover the species and take the steps necessary under the Act. As I indicated earlier, in just the set of species that we're dealing with salmon and steelhead in the Pacific Northwest, it appears that we are looking at the need for—well, the recent proposal I made was somewhere just under $700 million a year for some undetermined amount of years, but a large number of years, just in that group of species. I don't know whether that group is unique in terms of the amount of money that it will take to recover, but I hope that it is and that we aren't looking at those kinds of numbers across the board for all of these various numbers of species.

But my point is we're talking today only about the listing process and the fact that we need to put more money into the process of getting species listed. Then we're going to have to take the next steps and put more money into getting the species that are listed recovered and delisted. It seems to me that we are talking about a need, a financial need, there that I don't think anybody could put a handle on right now, but it is probably going to exceed what any Administration, Republican or Democrat, can meet in terms of the budget numbers that we are looking at, which raises the question to me:

What do we do with scarce resources? Do we continue—is the Endangered Species Act the beginning or the end or the middle, or whatever, of species protection? Do we look at CRA, the Fishable Waters Act, and the conservation title in the farm bill, the Clean

Water Act, or any number of other environmental statutes and put our dollars into those acts or to those efforts, so that we can try to avoid or at least improve the opportunity for action under the Endangered Species Act? Is the Endangered Species Act the Act that is supposed to kick in when these other efforts have failed and the species is threatened or endangered? Or is the Endangered Species Act to be sort of the mothership of all environmental actions, which is where all of our resources go in the first instance, and we then fund these other areas after we have funded the Endangered Species Act requirements?

It is a difficult question that I am asking, I think, but I would like to have your input on just, what is the purpose of the Endangered Species Act and where should we put our resources? Anybody want to take a shot at that?

Mr. MOYER. I'll do that because I think your health care analogy was a good one. The Endangered Species Act has largely been the emergency room triage. I think the point behind the thrust of my testimony was that much more needs to be done on the preventative care side. That's clearly got to be the cheapest and best way to conserve species, to keep them healthy when they're healthy and keep them out of the emergency room.

So that's why I think there is a real need for Congress and for the committee to look at ways that they can do that. I don't have a grand vision of how that would be in 10 or 20 years, but I just see the next year or two and I think there's some really good opportunities that I mentioned that you could grasp to really focus on preventative care rather than emergency room care.

Senator CRAPO. I would like to work with you on some of those opportunities.

Mr. Moss.

Mr. MOSS. I would like to join that statement and again refer to what the State of Maine was attempting to do, which was derailed. We now have a situation in which our industry is no longer trustful of the Federal Government.

I would like to make a statement. We as business people are not anti-environmental; we say this in Maine all the time. People approach us, "How can you do this? You're destroying the species. You're destroying the habitat." Well, we are not, and we try to explain to them that it is not in our best interest in any way to destroy. We are conservationists. We are employing people, producing a sound product. That is why we joined with the State of Maine, with the scientists they brought in, the independent scientists, with the State agencies, and with the Federal agencies to create a State conservation plan for the Atlantic salmon.

I would say that the Endangered Species Act has to be reviewed so that there aren't these kinds of abuses; so that they can't come in and derail a plan that was making progress. Now they've derailed it, and that progress is effectively stopped. There is not enough Federal money appropriated to take up from the point that the State's plan was derailed. There must be a review of this act and the abuses of the Act.

Mr. GRADER. Let me just add, Senator, however, we had just the opposite occurrence in California where it took the ESA to put recovery back on track, because, frankly—and this is a problem we're seeing—it is not just money. I once had a colleague, Molly Thomas, and I think she stated the problem very well. She said, "Fish don't swim in money." Fixing the salmon problem and some of these other species problems is going to take more than money. It's going to take a change of will. It's going to take some changes on the parts of agencies.

Right now part of our problem, I think, frankly, in California and the Pacific Northwest is not necessarily a dearth of money for salmon restoration; it is just the intransigence of some agencies not wanting to act. We have a joke in California that our biggest river is denial, and denial, in fact, is what often is happening. Because agencies just simply won't change until they are forced them to act. It's very expensive getting them to that point where they finally relent, if they ever do.

We have talked about the need for science. Well, part of the problem is we're not adhering to science. We have biological opinions, for example, in the Columbia River where the agencies have chosen to ignore their own scientists. Everybody is screaming for peer review. I would just like to see the first step is that the agencies begin listening to their science before we hear from others screaming that we need to have peer review and better science. We can start by having better science with the agencies listening to their scientists. I think that would certainly speed things up and could bring about recovery in a much less expensive way.

Senator CRAPO. Thank you.

Mr. Echeverria.

Mr. ECHEVERRIA. I have a couple of brief thoughts. First of all, I want to say that is a very thoughtful question and you've nominated yourself for a trip down the hill to Georgetown University Law Center to explain to our students the complexities of the Endangered Species Act.

[Laughter.]

I think you identify an important question about costs because we have been focusing today on administrative costs and the simple agency expenditures required to identify critical habitat and list endangered species. Those costs are not insignificant, but they are insignificant in comparison with the full public and private costs of carrying out species conservation, once we have identified the habitat that needs to be protected and the species that are endangered.

The the rubber hits the road, so to speak, when it comes to private land and the costs entailed in achieving species conservation on private land. This inevitably raises the whole property rights question, the takings question, and whether or not the burdens of carrying out species conservation can fairly and reasonably be imposed on private landowners or whether, instead, those are legitimately public costs and the Federal taxpayer has to pay for those costs through CARA, the Fish and Wildlife Foundation, or what some people have described as a New Marshall Plan for Species Conservation, something that could be very expensive.

Just a couple of thoughts on this: One key point to emphasize is that wildlife is a public property resource. Under the laws of each of the 50 States, wild animals, whether they are threatened or not, are public property that the State owns on behalf of all the citizens of the State. The courts have broadly held in a variety of different contexts that restricting private actions on private lands in order to protect a public property resource doesn't result in a constitutional taking under the Fifth Amendment. Thus, keeping in mind the fact that private real property rights are at stake, there's also a public property right involved here which is also important.

The second observation I want to make is that public payment programs, while useful in some circumstances, have a potential for abuse. I want to cite one example. There's a piece of proposed legislation moving through Congress dealing with a 1,500-acre property in Utah which is proposed to be included in a tortoise conservation area. This is a property that the owner bought apparently with full knowledge of the endangered species problems for, according to a recent press account, $1.1 million. The Fish and Wildlife Service has been trying to acquire this property. The owner acquired the property 11 years ago, and undoubtedly has spent some additional money since then. But he recently rejected a proposal from the Department of the Interior to purchase the property for some $28 million, claiming that he should be entitled to more than that. It seems to me that this case is symptomatic of a potential problem, which is that those confronting endangered species problems may demand too much of the Federal taxpayer. Federal financial assistance programs for wildlife conservation could lead to some of the kinds of abuses we've seen in other major Federal funding programs.

My ultimate conclusion is that the Federal taxpayer can't buy our way out of this problem. There is a place for financial incentives and financial assistance, but over the long term what we need is a change in values and a change in investment expectations. We need to put in place a flexible regulatory process that over the long term directs investors to invest in activities that don't present endangered species problems and discourages investment in projects that create more endangered species problems. Clearly, we need over the long term to reorient the economy in a way that reduces ESA conflicts and to avoid public policies that exacerbate those kinds of conflicts.

Those are somewhat general comments in response to a general question, but I appreciate the opportunity to comment on your very thoughtful question.

Senator CRAPO. Thank you.

Mr. Quarles?

Mr. QUARLES. Yes. Unfortunately, I don't have an answer, but I do have a concern. First of all, I heard it said that fish don't swim in money. Many landowners who have salmon habitat think that fish swim in their money. That's one of the problems.

Agencies like the Services that are desperate to husband the resources that they have have a real temptation—and one that I fully understand—having served in the Department of the Interior—to try to transfer as much of the responsibility as possible to the regulated party; let the regulated party spend the money rather than the Government. That is one thing that concerns me deeply.

I will give you only one minor example, which, unfortunately, if Gary Frazer is still sitting behind me, he's heard me talk about too many times before, which is my concern about designating critical habitat—and I know we're not talking about that in general—but the regulation requires the agencies to designate critical habitat by map boundaries. That's a very expensive process.

What we are seeing more and more is that the Service will draw very large map boundaries, name constituent elements that are important to the critical habitat, and then require the individual landowners to hire the biologists to determine whether or not their land has the constituent elements that would be critical habitat. So even though the Services are still mapping, they're leaving the real responsibility of determining what is and is not critical habitat to the landowner in some of their more recent listings rather than to the Agency itself.

I fear there is the danger of transferring significant responsibility, monetary responsibility, to the landowner as a way of husbanding taxpayer dollars. I think that would be inappropriate.

Senator CRAPO. Well, thank you. Obviously, this is an extremely complex issue, and we're just talking about sort of the initiation part of it now with regard to the listing process.

We have run out of time for the hearing. So I won't be able to ask any more questions. I should remind you that the record will remain open for 2 weeks. And all of the witnesses may receive questions from some of the Senators who were not here. You are also welcome to supplement what you have provided to us during that 2 weeks, if you feel that there is additional information that you would like to provide or things that you didn't get a chance to say or further thoughts that you have had. I can assure you that the material you provide is going to be carefully reviewed.

Senator CRAPO. I think all of the witnesses today have provided helpful information. This is obviously an issue on which it is going to be difficult to find consensus, but it is one on which I believe we have identified a number of areas in which we can make improvements and a number of areas in which our effort will potentially yield some significant results.

So, again, I thank you for your participation in this hearing and encourage you to continue to work with this committee as we seek ways to reform the Act and reform the administration of the Act, and to ultimately achieve our objective of recovering and strengthening species and improving our environment in this country.

With that, the hearing is adjourned. Thank you very much.

[Whereupon, at 12:14 p.m., the subcommittee was adjourned, to reconvene at the call of the Chair.]

[Additional statements submitted for the record follow:]

STATEMENT OF HON. BOB SMITH, U.S. SENATOR FROM THE STATE OF NEW HAMPSHIRE

Good morning and thank you Mr. Chairman. I am delighted to be here and discuss this very import issue.

The Endangered Species Act (ESA) was enacted in 1973 as an attempt to protect species with diminishing populations. The ESA makes it illegal to take or harm any listed species. It also prohibits any Federal action that will jeopardize the future of any listed species or critical habitat, and requires the development of recovery plans for listed species. The main idea behind ESA was to list a species and then recover that species so it could be delisted.

Unfortunately, it hasn't worked out that way. To date, 1243 species have been listed, yet only 9 have been delisted via recovery. Nineteen species have been delisted for other reasons, including extinction. While there are a few success stories, clearly the ESA has not worked as it was intended. The fact that only 9 listed species have been sufficiently recovered to be delisted should be cause for concern.

There have been attempts to address the flaws in the Act—the most recent serious attempt was by Senator Kempthorne in the 105th Congress—legislation that I cosponsored. That bill placed a strong emphasis on science—and I believe that to be critical.

ESA can be an emotional issue—and it is precisely for that reason that we must ensure that decisions are made based on science. Science that is peer-reviewed, defensible and non-partisan.

There have also been numerous concerns about the role of the private property owners and how ESA impacts them. Senator Kempthorne's bill would have expanded the participation of the public and provide new incentives for private property owners to preserve species. In short—it set out a more cooperative approach for dealing with species preservation—getting away from a top-down regulatory regime.

Needless to say, I strongly support this type of approach. My goal is an approach that will preserve species in the most effective manner possible and I believe that means working with, not against land owners. Make no mistake—I am a staunch defender of private property owners. I am also a firm believer that our true conservationists are those who live off of the land—who take being stewards of the land very seriously. In fact, the great majority of species are on private lands. We should recognize and embrace this fact by providing them incentives to help ensure that these species, both listed and delisted, are protected and private property rights preserved.

It is worth noting that, along with Senator Crapo, Senator Reid and others, I will soon be introducing a Comprehensive Conservation funding bill—this is not an ESA fix, but a separate bill that will, among other things, establish a new competitive matching grant fund that will allow private landowners and family farms to receive assistance to protect endangered and threatened species on their land. It is my hope my Conservation bill will help private landowners do what they really want to do—but it is not a fix for ESA.

I look forward to working with the subcommittee chairman, Senator Crapo, as well as Senator Graham and Senator Reid to address the ESA—possibly moving rifle shot reforms.

Mr. Chairman—thank you again for your efforts on this issue.

STATEMENT OF HON. HARRY REID, U.S. SENATOR FROM THE STATE OF NEVADA

The timing of this subcommittee hearing on the listing and delisting of species under the ESA couldn't be better. Why? Because the Administration's budget recently made two very strong statements about these ESA programs. Two completely wrongheaded statements. First, take science. I've read the testimony that will be presented here today. No one disputes that listing decisions—indeed all decisions under the ESA should be based upon the best science possible.

The Administration itself repeats the "sound science" mantra in its testimony, and throughout its budget request for ESA programs generally.

Sound science, to me, means good science, and we know that good science isn't cheap. But this Administration's budget cuts ESA science funding, along with funding for recovery plans, habitat conservation plans and candidate conservation plans—all the things we know are critical to achieving success under the Act.

Instead, the budget is a sop—it cuts these programs and tells our threatened and endangered species to look to the Land and Water Conservation Fund stateside grants for the funding to stay alive.

In my State of Nevada that will mean that desert tortoises, Lahontan cutthroat trout and Armagosa toads will compete with pools, ballparks and recreation centers for funding.

One example of this sop hits close to home. This budget cuts a program I helped start called the Nevada Biodiversity Initiative. We started it in 1993, but as a result of its tremendous success, it became part of the President's budget 5 years ago.

The Initiative has helped provide the scientific understanding of imperiled species throughout the West, and has helped direct conservation and recovery efforts in a scientifically effective way. The Administration zeroes out the Initiative in its budget. It cuts the science that is the foundation for every ESA-related activity in Nevada.

The second wrongheaded statement the Administration makes in its budget is to ask for a rider to prohibit citizens from petitioning the FWS to list species as threatened or endangered, or from designating critical habitat.

The Administration argues that the rider is necessary because compliance with citizen generated court orders will consume the entire budget for listings and critical habitat.

The Service argues that this litigation forces it to protect species under the Act based upon citizen and court priorities rather than according to its own priorities.

That argument simply doesn't hold up. The overwhelming majority of litigation over listings arises when the FWS fails to meet a statutory deadline to respond to a citizen petition to list. In responding to that petition, the FWS can decide to list a species, not to list it, or can put it on a candidate list and assign it a low priority for listing based upon listing guidance that's been in place since 1983. Is there a lot of litigation over the priority the FWS assigns to citizen-petitioned listings? Are citizens going in and reordering the priorities the FWS sets?

No. The suits force the Service to meet deadlines. Citizens, at least in this context, are not determining the listing priority of species. Do citizen suits often prompt important listings that might not happen because of political opposition?

Yes. Salmon, spotted owls, and—in Nevada—the desert tortoise, were all listed as a result of citizen suits. What's the answer to the backlog?

What about increasing the funding for the listing program? The Service estimates that it would take roughly $80–120 million to clear up the backlog. We could develop a 5-year plan to get this work done, rather than shutting the courthouse door to our citizens.

While we all might disagree about some of the topics to be discussed here today, we should all be able to reach agreement that the ESA can't achieve its goal of restoring threatened and endangered species if we starve it of funding.

STATEMENT OF HON. MAX BAUCUS, U.S. SENATOR FROM THE STATE OF MONTANA

Thank you Mr. Chairman for holding this important and timely hearing on the listing and delisting procedures of the Endangered Species Act. I would like to thank our distinguished panel of guests for appearing today to testify.

I believe strongly in preserving this country's unique biodiversity and I believe strongly in the mission of the ESA.

However, I have always been willing to explore ways to make the Act more effective in protecting and recovering endangered and threatened species, and more sensitive to the legitimate concerns of States and private landowners. I've worked hard on ESA reform in past Congresses, working with my colleagues on this committee to craft a bipartisan ESA re-authorization bill in the 105th Congress.

Our bill made significant improvements to the Act, improvements that we felt made the Act a more effective tool in the identification and recovery of endangered or threatened species. It's a shame that the bill did not pass. It wasn't perfect, but I believe it would have made a real difference, not only to overall species recovery efforts, but to the States and local communities that often find themselves at odds with the mandates of the ESA. The bill contained provisions that addressed some of the concerns that will be raised today about the listing process, such as independent peer review of listing and delisting decisions and more transparency in the listing process.

And yet, after all that time and effort, here we stand today, trying to figure out what's gone wrong with the listing process, a process that I've heard called both "broke and broken." Some say that the Fish and Wildlife Service is paralyzed, that it has too much work, not enough money, and is buried under citizen lawsuits. Only the most desperate cases get any protection. This in turn makes it more time consuming and expensive to help species recover, which in turn makes the Act seem that much more of a burden on private citizens.

I find this incredibly frustrating. We've had opportunities to make the ESA more efficient, effective, and more sensitive to private landowners and States, and we haven't capitalized on them. We continue to chronically underfund the entire Endangered Species Program, leading to the current crisis in the listing program that we're discussing today—species that warrant protection that aren't getting it, and their conditions are deteriorating, and listed species aren't being recovered to the point where they may be delisted.

I believe the current outcry over excessive court involvement in the listing process is a symptom of a far larger problem—an agency that is underfunded and overworked and that just can't get the job done. But, let me be clear, I don't think the answer is to yank the people's ability of to petition the Service to list a species, or to designate critical habitat. The last thing we want is less public participation in the Federal decisionmaking process. Federal Agencies face substantial political pressures, from all sides, especially in an area as controversial as the implementation of the ESA. Although some may view the process as having been abused by certain groups, and in some instances that may be true, the petition process is an important vehicle for local government and citizens to be heard in the larger national debate over endangered species. And, the shoe could easily land on the other foot—what if a citizen's group wants to oppose a proposed listing?

After all, this is not a new issue for any of us. As you should recall, we worked to improve State involvement in the process, to improve incentives for landowners to conserve species on private lands, to encourage better science at all stages of species recovery, from listing to delisting. For a variety of reasons, we just didn't deliver.

Clearly we've learned that gutting the Act is not the answer, nor is it something I support, or that I believe a majority of my colleagues support. But we should also have learned that continuing to underfund the Agency is not an appropriate or useful response, either. To simply padlock the Agency's toolbox, does little to address the daily list of chores we call upon the Agency to accomplish. A lot of Federal and State agencies depend upon the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service, to do its job, to do it well, and to do it in a timely fashion.

So, let me paint you a picture. Highway projects fund nearly 14,000 good-paying jobs for Montanans. In Montana the Fish and Wildlife Service is stretched thin. When a city, county or the State wants to widen a road, install a culvert, rebuild a bridge, before you can show up with the flagger or the concrete mixer or the heavy equipment, the project is often effectively tabled before it's begun for lack of enough agency support to complete routine biological opinions and assessments. Every Congress, I work hard to get money for Montana highway projects, which does Montanans little good when they have to wait months or even years for an ESA consultation process to be completed. The same can be said of time-sensitive salvage timber sales in Montana's National Forests, and other projects that support the livelihoods of people in my State.

The ESA was never, never supposed to trump good and necessary projects that can and should move forward. I know that this hearing is not about ESA consultations or other functions of the Fish and Wildlife Service under the ESA, but they are a good analogy to the problems the Service is facing under its listing program. The U.S. Fish and Wildlife Service's budget has not increased significantly since a 1990 Department of the Interior Inspector General's Report stated: It is obvious that the Service's mission cannot be fully accomplished at present funding levels.

I believe a lack funding has severely compromised the effectiveness of the Service in carrying out its duties under the ESA, resulting in project delays and frustration at the local, State and Federal level. No one's interests are served in this situation, not the local, county, State, or Federal Government's, not the private citizen's, not the public's, and not endangered species. It's easy to accuse a Federal agency of dragging its feet. But, it's far more challenging to fund the Agency at an appropriate level, to give it the resources it needs to do properly the job we ask of it.

I realize that the preservation of endangered and threatened species entails considerable financial burdens that should not fall solely on the U.S. taxpayer, and that we need to search constantly for new and innovative ways to preserve species and their habitats as our population continues to expand and our economy to grow. We owe it to our children and grandchildren, and all those who come after them. But again, increased funding would give the Fish and Wildlife Service more flexibility to be creative, to work with landowners, local communities and States to set priorities and to protect species and their habitats before they sit on the brink of extinction. Before the Federal Government has step in and contemplate a listing.

We owe it to the citizens of this country to follow-through on the duties we in Congress have imposed on the U.S. Fish and Wildlife Service and the National Marine Fisheries Service.

Again, I look forward to the testimony of the witnesses on this important issue and I thank them for their time.

STATEMENT OF GARY FRAZER, ASSISTANT DIRECTOR FOR ENDANGERED SPECIES, U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Mr. Chairman, I appreciate this opportunity to discuss how the U.S. Fish and Wildlife Service carries out its duties related to listing and delisting species under the Endangered Species Act (ESA or Act). Our procedures, some prescribed by statute and others by agency regulations or policies, are all focused upon ensuring that our decisions are objective, based on good science, and made in the open with peer review and public participation throughout.

The Fish and Wildlife Service (Service or FWS) is committed to making the Endangered Species Act work in the eyes of the public, the Congress, and the courts so as to accomplish its purpose of conserving threatened and endangered species and protecting the ecosystems upon which they depend. This is a challenging task, involving precious and irreplaceable natural resources, a complex statute, and many stakeholders with deeply held and often conflicting interests.

In this environment, the following principles provide the foundation for the Administration of our listing and delisting activities—ensure that our decisions are based on the best available science, seek independent peer review of our decisions, provide for public participation throughout our decision process, and ensure that our decision process is understandable and transparent.

SCIENCE, PEER REVIEW, AND PUBLIC PARTICIPATION IN THE LISTING AND DELISTING PROCESS

The Endangered Species Act requires listing determinations to be made solely on the basis of the best scientific and commercial data available. The careful evaluation of scientific evidence is fundamental to the assessment of species for listing or delisting under the ESA. The Service strives to make the most of scientific advances that improve our ability to understand nature and its processes. Our joint Fish and Wildlife Service/National Marine Fisheries Service (NMFS) "Policy on Information Standards Under the Endangered Species Act", published in the *Federal Register* on July 1, 1994 (59 FR 34271), provides criteria, establishes procedures, and provides guidance to our field biologists and managers regarding the use of scientific information in our decision process.

This "Policy on Information Standards" requires our biologists and managers to ensure that the information we use is reliable, credible, and represents the best data available; to impartially evaluate information that disputes existing positions or decisions of the Service; to document their evaluation of the available scientific and commercial data; to use primary and original sources of information as the basis for recommendations, where consistent with the Act and our obligation to use the best information available; and to conduct management-level reviews of the documents developed by staff biologists to verify and assure the quality of the science used in the decision process.

The ESA, the Administrative Procedures Act, and the regulations governing our listing and delisting activities ensure that States, tribes, other agencies, and the public have ample opportunity to participate in our listing and delisting actions. These established processes ensure that the public can participate fully in listing and delisting decisions. In addition, the requirement that the Service maintain and make available the administrative record in support of its decisionmaking assists in making the decision process open and transparent.

To further ensure that sound science underlies our decisions, the Service and NMFS established a joint "Policy for Peer Review in Endangered Species Act Activities", published in the *Federal Register* on July 1, 1994 (59 FR 34270). This policy works to ensure that independent peer review is incorporated throughout our listing and recovery programs in a manner that complements, but does not circumvent or supercede, other established public participation processes.

In recognition of the unique capability of State fish and wildlife agencies to assist in implementing all aspects of the ESA, the Service and NMFS developed a joint "Policy Regarding the Role of State Agencies in Endangered Species Act Activities", published in the *Federal Register* on July 1, 1994 (59 FR 34275). This policy recognizes that States possess broad trustee authorities over fish, wildlife, and plants and their habitats within their borders, as well as scientific data and valuable expertise on the status and distribution of such wildlife. The policy requires the Services to solicit State agency expertise and participation in the following activities, among others: determining which species should be included on the list of candidate species, conducting population status inventories and geographical distribution surveys, responding to listing petitions, preparing proposed and final listing and delisting rules, and designing and implementing recovery efforts.

The Executive Order 13175 of November 6, 2000, on government-to-government relations with Native American tribal governments also requires us to consult with the tribes on matters that affect them. Consistent with this and our Federal trust responsibility, we consult to the extent possible with Indian Tribes having tribal trust resources, tribally-owned fee lands, or tribal rights that might be affected by ESA activities.

THE LISTING PROCESS

Listing under the Endangered Species Act becomes necessary when a species declines to the point where it is in danger of extinction throughout all or a significant portion of its range (an "endangered species") or it is likely to become endangered in the foreseeable future (a "threatened species"). The Secretary is required to list or reclassify a species if, after reviewing the species' status using the best scientific and commercial data available, it is found that the species is endangered or threatened because of any one or a combination of the following factors:

- the present or threatened destruction, modification, or curtailment of its habitat or range;
- overutilization for commercial, recreational, scientific, or educational purposes;
- disease or predation;
- the inadequacy of existing regulatory mechanisms; and
- other natural or manmade factors affecting its continued existence.

There are two processes to identify species in need of listing. The first is the candidate assessment process, which is initiated by the Service. The second is a petition process, which is available to the public.

Part of the Service's Candidate Conservation program is the candidate assessment process, through which the Service searches for species of fish, wildlife and plants that may be at risk and in need of protection under the Act. In identifying candidate species, we rely on our own biological surveys, including status surveys conducted for the purpose of candidate assessment, information from State Natural Heritage Programs, other Federal and State agencies, knowledgeable scientists, and public and private natural resources organizations.

Each year, the Service publishes in the *Federal Register* the Candidate Notice of Review (CNOR). The CNOR identifies the species that we believe are candidates for listing under the Endangered Species Act. The CNOR lists those species previously identified as candidates, species for which petitions have resulted in "warranted but precluded" findings, as discussed below, during the prior year, and other species that appear to warrant listing under the ESA. When we identify a species as a candidate for listing, we have sufficient scientific information available to support a proposed rule to evaluate whether the species should be added to the list of threatened and endangered species. However, preparation of the proposed rule is precluded by higher-priority listing actions. We publish the CNOR, make individual candidate assessment forms available to the public, and solicit additional information about the status of candidate species, the threats they face, and conservation actions that are being implemented that may benefit the species. We accept information from the public about candidate species at any time. We use the public's comments in the preparation of listing rules for the highest priority candidates, and in revisions to subsequent CNORs. In addition, publication of the list of candidate species provides important information about potential listings that can be used by planners and developers.

The CNOR also serves to explain to the public our long-standing science-based priority system for adding species to the list, which was published in the *Federal Register* on September 1, 1983 (48 FR 43098–43105). Each candidate species is assigned a listing priority number (LPN), based on the immediacy and magnitude of the threats faced by the species and on its taxonomic distinctiveness. The candidate assessment forms, which are available to the public upon request, document our reasons for assigning a particular LPN to each candidate species. We use the LPN to prioritize listing actions. Species with lower LPNs are given a higher priority for action.

The second process for identifying species that may warrant listing is the petition process. Section 4 of the Act allows any interested person to petition the Secretary of the Interior either to add a species to, or remove a species from, the lists of threatened and endangered species. The Services ensure consistent and rigorous analysis of petitions by following the interagency "Petition Management Guidance" issued in July 1996.

Upon receipt of a petition, the Service must respond, within 90 days when practicable, with a finding as to whether the petition provides substantial scientific or commercial information indicating that the petitioned action may be warranted. If the Service determines that the petition did not provide such substantial information, the 90-day finding concludes the petition review process. However, if the Service determines that the petition does provide substantial information, the Service initiates a status review and issues an additional finding within 12 months of the receipt of the petition.

There are three possible outcomes of the "12-month finding" (1) listing is not warranted, and no further action is taken; (2) listing is warranted, and a listing proposal is promptly prepared; or (3) listing is warranted, but immediate action is precluded by higher priority actions. A "warranted but precluded" finding is made on the basis of the species' listing priority number and the listing workload. In such cases, preparation of a listing proposal is delayed until higher priority actions are completed.

We issue a proposed rule to list species when we have sufficient information to show that listing is warranted (as result of either process). If the issuance of the proposed rule is precluded by work on other higher priority listing actions, we add the species to our candidate list to be prioritized for a future listing proposal.

Our listing and delisting actions are informal rulemakings, published in proposed and final rule form in the *Federal Register*, and leading to revisions to Title 50, Part 17 of the Code of Federal Regulations. Once a proposal is published, the Service must allow for a public comment period on the proposal; provide actual notice of the proposed regulation to appropriate State, tribal, and local government agencies; publish a summary of the proposal in a newspaper of general circulation in areas where the species occurs; and hold a public hearing, if requested. *See* 16 U.S.C. § 1533(b)(5). The Service's implementing regulations require that the public comment period on a listing proposal be at least 60 days long. *See* 50 C.F.R. § 424.16(c)(2). Since public participation is so important to effective conservation efforts, the Service will often hold multiple public hearings and extend the comment period beyond the minimum required by the law and regulation.

We always solicit independent peer review of our listing proposals, and incorporate comments and recommendations that we receive. We have found such peer review to be a valuable element of the decision process. However, it is sometimes difficult to obtain the participation of experts in this process. Experts in academia and other agencies have other demands for their time and attention, and incentives to contribute their expertise to our listing efforts are not always apparent. We have also found that species experts may be reluctant to become involved when they view the listing action as likely to lead to subsequent litigation. The potential demands upon their time and reputations associated with depositions, cross examination, and other legal proceedings create a genuine disincentive for some experts. We are continuing, however, to explore ways to increase participation in and improve the effectiveness of the independent peer review process.

The Service reviews petitions, adds species to the list, reclassifies species from threatened to endangered, and designates critical habitat using funds appropriated specifically to our Listing program for these purposes. (Delisting and reclassification from endangered to threatened are part of the recovery process and are funded through the Recovery program.) The workload associated with these listing activities has for several years exceeded the resources available to the Service for listing, and a substantial backlog of listing actions has accumulated. To manage this backlog within appropriated resources, the Service, since fiscal year 1996, has employed a Listing Priority Guidance system to assign relative priorities to the listing actions to be carried out under section 4 of the Act. The objective of the Listing Priority Guidance is to focus available resources on those listing actions that have the greatest biological benefit to species in need of protection under the Act.

Unfortunately, most courts have not afforded deference to this priority system, and have instead concluded that they have no discretion but to order us to act as soon as possible on whatever backlogged action comes before them. As a result, court ordered actions have consumed essentially all of the listing budget this fiscal year. The Service does not have any remaining resources or staff to place new species on the list of threatened and endangered species or to respond to citizen petitions to list new species. In short, the Service does not currently have a balanced and effective listing program.

The President is continuing efforts begun by the last Administration to break this gridlock and get back to the important business of protecting imperiled species. We are asking Congress, through the fiscal year 2002 budget request, to help us address our backlog in two ways. We are seeking increased funding for our listing program so that we can begin to reduce the backlog of listing actions, and we are asking Congress to concur that these funds should be spent pursuant to current court orders or settlement agreements and on those listing actions that provide the greatest benefit for species at risk of extinction. This proposal would not change any of the underlying substantive requirements of the Act, but would allow the Service to use its resources to protect the species that are in greatest need of listing. The Service hopes to engage the public and interested groups in the development of a revised listing priority system and to put the resulting priority system out for public review and comment.

We recognize that this proposal has resulted in considerable controversy. While the problem is real and needs to be addressed, we would welcome the opportunity to work with this committee and other interested members to craft a solution that meets with wide approval.

DISTINCT POPULATION SEGMENTS

In carrying out our listing duties under the ESA, the Service has proposed and finalized rules to list a number of "distinct population segments" (DPS's) of species. Mr. Chairman, I would like to take this opportunity to explain how the Service decides whether to list a species as a "distinct population segment".

The ESA's definition of "species" includes "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." 16 U.S.C. § 1532(16); 50 C.F.R. § 424.10(k). This definition allows for listing at levels below taxonomically recognized species or subspecies. Accordingly, a DPS of vertebrate fish or wildlife may be listed as a "species" under the ESA.

The Service and the National Marine Fisheries Service (NMFS) have long recognized the importance of interpreting the term "distinct population segment" in a clear and consistent fashion. We collaboratively developed a policy to clarify our interpretation of DPS's for the purposes of listing, delisting, and reclassifying species under the ESA, and published that draft policy in December 1994 (59 FR 65885). The intent of the policy was to provide a well conceived analytical framework for considering whether to list, delist, or reclassify distinct populations segments of vertebrate species. The policy was also developed to ensure that DPS listing activities are carried out consistently throughout both agencies.

As is the case with the rulemaking process for listing species, we strive to develop our policies in a transparent process that solicits and incorporates public input and responds to public concerns. We solicited public review and comment on the draft DPS policy. After receiving, analyzing, and responding to public comments, the Service and NMFS published the final joint DPS policy on February 7, 1996 (61 FR 4722).

In the policy, we noted that listing a DPS would serve to protect and conserve species and the ecosystems upon which they depend before large-scale decline occurs that would necessitate listing a species or subspecies throughout its entire range. This may allow protection and recovery of declining organisms in a more timely and less costly manner, and on a smaller scale than the more costly and extensive efforts that might be needed to recover an entire species or subspecies. The Services' ability to address local issues (without the need to list, recover, and consult rangewide) will result in a more effective program.

Under the DPS Policy, the listing of a DPS involves a three-stage, sequential process. First, the Service decides whether the population is "discrete." Second, it determines whether it is "significant." If a population is both "discrete" and "significant," it constitutes a DPS. Third, the Service applies the listing criteria, 16 U.S.C. § 1533(a)(1), outlined earlier in this statement, to determine whether to list the DPS as endangered or threatened.

A population segment may be considered discrete if it is either (1) markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors, and/or (2) delimited by international governmental boundaries across which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the ESA.

If a population segment is determined to be discrete under one, or both, of these conditions, its biological and ecological significance will then be considered in light of Congressional guidance (*see* Senate Report 151, 96th Congress, 1st Session) that the authority to list DPS's be used "sparingly" while encouraging the conservation of genetic diversity. In making this "significance" determination, the Services consider the available scientific evidence of the DPS's importance to the taxon to which it belongs. This consideration may include, but is not limited to, the following: (1) persistence of the discrete population segment in an ecological setting unusual or unique for the taxon; (2) evidence that loss of the discrete population segment would result in a significant gap in the range of a taxon; (3) evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historic range; or (4) evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics.

The Policy's guidelines permit the use of agency discretion in evaluating discreteness and significance. Indeed, the Policy provides that:

> "[b]ecause precise circumstances are likely to vary considerably from case to case, it is not possible to describe prospectively all the class of information that

might bear on the biological and ecological importance of a discrete population segment." *Id.*

In responding to public comment on the draft version of the Policy published in the *Federal Register*, we stated "that the use of international boundaries as a measure of discreteness may introduce an artificial and nonbiological element to the recognition of DPS's," and that such determination "is sometimes undertaken as a matter of policy rather than science." The policy further noted that "it appears to be reasonable for national legislation, which has its principal effects on a national scale, to recognize units delimited by international boundaries when these coincide with differences in the management, status, or exploitation of a species."

Moreover, the policy recognizes that the "[r]ecognition of international boundaries in this way is also consistent with practice under the Convention on International Trade in Endangered Species of Wild Fauna and Flora [CITES], which is implemented in the United States by the Act." Under CITES, species protection may vary from country to country (e.g., prohibiting commercial trade for a species from one country, but not from another) depending on their management of the species. When appropriate, the ESA listings for species included in CITES can be specific to a country in order to reflect those management differences and support effective implementation of CITES (e.g., for the salt water crocodile).

THE RECOVERY PROCESS

Recovery of threatened and endangered species is the process by which the decline of an endangered or threatened species is arrested or reversed, and the threats to its survival are neutralized, so that long-term survival in nature can be ensured. The goal of the recovery process is to restore listed species to a point where they are secure, self-sustaining components of their ecosystems which do not require the protections of the ESA, and can be delisted.

For almost all species, a recovery plan is essential as a road map for the recovery process. A recovery outline, the first step in recovery planning, guides the development of a recovery plan that identifies Federal, State, tribal, and private actions needed to achieve recovery. The Service's policy is to complete a recovery outline within 60 days of listing a species. A recovery outline identifies the major and most imminent threats to a species, and the actions and partners needed to immediately begin reducing these threats while a recovery plan is being developed.

The ESA states that recovery plans shall be developed for the conservation and survival of threatened and endangered species unless such a plan will not promote the conservation of the species. There are very few exceptions to the need for a recovery plan, and most of these exceptions are for species that occur under very localized circumstances where other plans, such as a forest management plan, already contain the actions needed to recover the listed species.

Therefore, it is the case for most species that immediately upon listing the Service also begins the recovery planning process. A first step in the process is to identify the participants of a recovery team that will work to craft the recovery plan for a listed species. To guide our actions during the recovery process, the Service uses our May 1990 "Policy and Guidelines for Planning and Coordinating Recovery of Endangered and Threatened Species" and the following 1994 joint FWS/NMFS policies:

• Policy for Peer Review of ESA Activities—incorporates independent peer review into recovery actions, including the writing of recovery plans;

• Policy on Information Standards—directs that the best available scientific and commercial information be used when determining what actions are needed to recover species; and

• Policy on Recovery Plan Participation and Implementation (published in the *Federal Register* on July 1, 1994 (59 FR 34272)—directs the Service to solicit the participation of State, tribal, and Federal agencies, academic institutions, private individuals, and economic interests when determining the recovery actions needed to recover species.

The latter policy directed the Service to diversify the areas of expertise represented on a recovery team, develop multiple species plans when possible, minimize the social and economic impacts of implementing recovery actions, and involve representatives of affected groups and provide stakeholders the opportunity to participate in recovery plan development.

Because the Service bases our recovery decisions on sound science, we seek to involve experts in these decisions and include them on recovery teams. Therefore, when we initiate the recovery planning process for a listed species, we endeavor to identify experts on the species and its habitat, as well as the most knowledgeable individuals on land use and land management within the range of the species.

The Service must balance the need to have as many participants as possible on a recovery team, with the need to ensure that the size of the team does not compromise its efficiency. We often work primarily as the facilitator on recovery teams, providing guidance for experts on the team from other Federal agencies, State agencies, tribes, or the private sector.

In addition, the Service often uses one or more "recovery implementation teams" during the recovery planning process to allow for broader public participation. Participation on these teams is usually possible for any concerned individual that wishes to volunteer. As a recovery plan is drafted, the proposed, necessary recovery actions identified by the recovery team are presented to the implementation teams for their review. The implementation teams, which are often composed of members of the public and agencies whose interests may be affected by the recovery needs, provide valuable reviews of the feasibility of the proposed actions. The proposed actions may be modified based on the reviews and comments of the implementation teams.

It is the Service's intent to complete draft recovery plans for species within 1½ years from the time of listing. Once complete, draft recovery plans are available for public review and comment. A notice of availability is published and comments are solicited. Today, it is not unusual for the Service to receive hundreds, sometimes thousands, of comments on a single plan. These comments come from a wide range of interests: from advocates for the environment to private citizens who are worried about what effects the recovery of the species may have on their livelihoods.

The Service uses the recovery team to consider each comment on a recovery plan, and, where needed, incorporate the comments into the final recovery plan. A record of how comments on a recovery plan are considered is kept and made available for public review. When a final recovery plan has been completed and approved by the Service's appropriate Regional Director, it is made available to all interested parties. A Notice of Availability is published in the *Federal Register* and the Service ensures that all of the recognized concerned public is aware of the completion of the plan. In addition, notices are often placed in newspapers throughout the range of the species.

A recovery plan must address the threats to the species, describe the actions needed to recover the species, provide an implementation schedule of when the actions will be completed, identify the parties who will have primary responsibility for undertaking the actions, and assess the estimated costs of implementing the recovery plan. In addition, a recovery plan identifies the criteria that will be used to determine when a species may be sufficiently recovered to be downlisted from endangered to threatened, or delisted and removed from the list of species protected by the ESA.

The Service is increasing its use of multi-species recovery plans. At least 20 multi-species plans have been finalized since 1998. Addressing the recovery of multiple listed species in a single, multi-species, ecosystem-based approach is efficient in addressing common habitat needs and shared threats. This approach is often more cost effective and efficient than addressing species through single-species recovery plans.

Recovery plans must be dynamic documents. New information is constantly becoming available. As new information is recognized that may affect a species' recovery, the recovery team for the species may be reconvened to assess the information and determine if the plan needs to be revised. At the very minimum, the Service reviews plans every 5 years to determine if changes are needed. If significant changes to a plan are needed, then, following the process already outlined, a new draft plan is prepared, participation and comment is invited from all interested parties, and a new final recovery plan may result.

The Service is proud that, as of the beginning of this year, 88 percent of the species for which a recovery plan is required and due have approved recovery plans. Recovery plans are not prepared for some listed species, particularly international species not found in North America.

Recovery implementation is the undertaking of the actions needed to accomplish recovery plan tasks in a systematic manner. Implementation involves strategic planning and requires the tracking of results to determine if recovery actions are working and whether a recovery plan's objectives are being met. Recovery actions are prioritized. Priority 1 actions are those that must be taken to prevent extinction or to prevent the species from irreversible decline. Priority 2 actions are the actions that are needed to prevent a significant decline in a species' population or habitat, or would prevent some other significant negative impact. Finally, priority 3 actions are those actions that must be take to provide for a full recovery of a species.

In most cases, successful species recovery is too large a task for any one agency or interest group. Implementation must involve all affected parties, consider social and economic impacts, and must be scientifically sound. The Service must engage the multiple stakeholders throughout the recovery implementation process, and encourage them to effectively sustain, conserve and ultimately recover endangered and threatened species so that they may be delisted.

An example of stakeholder involvement in the recovery process is the multi-species recovery effort in the Southwestern United States involving the cactus ferruginous pygmy-owl and the threatened and endangered big river fish in the Lower Colorado River. The threats faced by these species include an increasing loss of both arid and aquatic natural habitat due to rapid population growth in southern Arizona, Nevada and California. The loss of habitat necessitates working with diverse and broad groups of stakeholders during recovery implementation to balance species conservation, economic viability, and "people protection". In the Southwest, the efforts of recovery implementation teams include participation by water, power, and wildlife agencies and municipalities, ranchers, and cultural and historical entities, all acting for the common good. Such interaction leads to enlightened understanding about how improved land and water quality and habitat cohesiveness assists species recovery while providing healthy habitats for everyone.

It usually takes many years, often decades, for a species to decline to the point where it needs the protection of the ESA. Likewise, recovery of a species is also a process that usually requires significant time to accomplish. Instances where habitat loss and degradation constitute the main threats to a species usually makes it more difficult to recover the species. Often the participants in the recovery planning and implementation for a species will change as time passes. The constant is the Service's direction of the recovery implementation process, ensuring that the best scientific and commercial information is used, that all willing participants are provided the opportunity to comment and participate, and that the progress toward recovery is monitored and, when necessary, changed through adaptive management.

THE DELISTING PROCESS

The same scientific rigor and full public participation is used in delisting species as was used in the listing of species. The Service regularly assesses the criteria listed in the recovery plan that are used to define when a species has sufficiently recovered to be reclassified as either a threatened species (recovered from being endangered) or as a fully recovered species and removed from the list of species protected by the ESA.

Likewise, the most recent scientific and commercial data, after being subjected to peer review, are used to assess the current status of the species. Often, the factors used to determine whether a species has recovered include the species' population size, recruitment, stability of habitat in terms of habitat quality and quantity, the degree to which habitat areas are connected to one another, and the control or elimination of the threats that led to the need to list the species.

The ability to list distinct population segments may also play an important role in the recovery of listed vertebrate species. Many species were listed before the ESA was amended in 1978 to allow the listing of distinct population segments. Therefore, the Service may consider that a portion of a listed species has recovered sufficiently to warrant downlisting or delisting. Of course, this population, and the populations of the species that may not have reached the recovery goals, must conform to the same criteria of substantiality and distinction that are used to list distinct population segments. If this is the case, then the Service may be able to use a distinct population segment to delist or downlist a portion of the species. This will provide regulatory relief for the public within the range of the recovered distinct population segment. As always, the Service uses the best scientific and commercial data, along with the opinions of experts and the public, when making these decisions.

As already mentioned during the previous review of the listing process, the public has the opportunity to petition the Service to delist a species at any time. Likewise, as already discussed, the petition will trigger a process where the petition is first reviewed for presenting substantial information, and, if it passes that test, within 12 months the action requested in the petition will be assessed, using the best peer reviewed scientific and commercial data and the opinions of experts. If it is judged that the petitioned action is warranted, the Service will move to propose delisting the species.

Outside of the petition process, as recovery of a species becomes more imminent, the recovery team is requested to assess the evidence that the species may have reached the goals identified for its recovery. Again, only the best peer reviewed scientific and commercial data are used, along with the opinions of experts on the species, its habitat, and land management practices. If the status of the species has improved sufficiently, then a proposal to downlist or delist the species will be prepared.

As is the case for the process of listing a species, a proposal to reclassify a species is published in the *Federal Register* and announced in selected newspapers throughout the range of the species. The Service schedules public meetings during the comment period for a reclassification so that all of the concerned public will have the opportunity to provide comments on the proposed action. All comments are carefully considered and a record, available to the public, is kept on the decisions made with respect to the comments.

If, after this process, it is determined that a species has recovered sufficiently to merit reclassification, then a final decision is made and published. A decision to reclassify a species from threatened to endangered likely requires a new recovery plan be developed, and the process already described will once again be initiated. A determination that a species has fully recovered will result in the species being removed from the list of species protected by the ESA.

As acknowledged earlier, species are usually listed as a result of factors that caused their decline over many years, often decades or even centuries. As a result, recovery of listed species requires time and resources. It is the goal of the Service to recover species as quickly as possible. Since 1998, the Service has specifically targeted $1 million each year to listed species that are nearing recovery. This funding provides the extra resources needed to either downlist or delist the species and ensures that they get this focused attention.

We have had success. Recently the Service was successful in taking the peregrine falcon off of the list of species protected by the ESA. The falcon was primarily threatened by pesticides and habitat loss, and the efforts of many agencies and individuals, over more than 30 years, were needed to recover the falcon. Likewise, just this year the Aleutian Canada goose was delisted. The goose was one of the first species to be protected under the ESA. Through cooperation with State governments and partnerships with private landowners, the threats posed by introduced foxes and habitat losses were reduced and recovery of the goose was accomplished.

Likewise, the bald eagle, our Nation's symbol, is on the verge of complete recovery. Once the Service has resolved how the delisting of the bald eagle will be addressed in our implementation of other wildlife laws, such as the Bald and Golden Eagle Protection Act, the Service will be able to proceed with this historic event. In all, as a result of recovery activities, the Service plans to delist or downlist four more species in fiscal year 2001 and at least six species in fiscal year 2002.

CONCLUSION

In closing, I would like to emphasize the importance the Service places upon having a science based, open decision process in which the affected public can participate fully. Our listing and delisting decisions are sometimes difficult and contentious, and not all parties will agree with our final decision. But it is critical that the public and the Congress view our work as honest and objective efforts to reach a decision required of us by the Act. Our success in implementing the Endangered Species Act is tied to that trust.

Mr. Chairman, this concludes my prepared testimony. Thank you for your interest in the Endangered Species Act and the way it is implemented, and for the opportunity to testify. I would be pleased to respond to any questions you and other members of the committee might have.

STATEMENT OF DON KNOWLES, DIRECTOR, OFFICE OF PROTECTED RESOURCES, NATIONAL MARINE FISHERIES SERVICE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

Mr. Chairman, my name is Don Knowles and I am Director of the Office of Protected Resources in the National Marine Fisheries Service (NMFS), an agency of the National Oceanic and Atmospheric Administration. Thank you for the opportunity to testify on the process we use to list and delist species under the Endangered Species Act (ESA).

The ESA provides for the recovery of threatened and endangered species and the conservation of their ecosystems. Terms such as conservation, species, threatened, endangered, and critical habitat are defined in the Act. Section 4 elaborates on listing, delisting, critical habitat and recovery. This section states that listing determinations are to be made solely on the basis of the best scientific and commercial data available after conducting a review of the status of the species and after taking into account those conservation efforts, if any, being made by any locality, State, foreign Nation or tribal government. In the 1988 amendments to the Act, the word "solely" was added to the above criteria to expedite the listing process and to prevent non-biological considerations, such as economic impacts, from affecting listing determinations. The Act also requires recovery plans that include specific management actions that will achieve the plan's goal. Plans must include measurable criteria, which, when met, will result in removing the species from the list.

Implementing regulations for listing, delisting, or designation of critical habitat were developed jointly with the U.S. Fish and Wildlife Service (FWS). The process for listing usually begins when we receive a petition to list a species. In some cases, when we have information indicating that a species may warrant listing, NMFS will begin the process without a petition. The next step is to evaluate the status of the species, that is, to conduct a status review. Based on the status of the species and after taking into account efforts made by others, NMFS will determine whether it is warranted to propose to list a species. Within 1 year of the proposal, NMFS will make a final determination on whether listing is warranted. In addition to implementing regulations, we have issued joint policies that elaborate on the listing and delisting process. For example, in 1994 NMFS and FWS issued a policy to clarify the role of peer review in ESA activities and a policy to provide criteria, establish procedures, and provide guidance to ensure that decisions made by the Services under the ESA meet the law's requirements. NMFS has also issued guidance on listing and recovery priorities as well as guidance on developing recovery plans. We plan to update the recovery plan guidance this year.

OVERVIEW OF NMFS' PROTECTED SPECIES PROGRAM

NMFS is currently responsible for 55 species listed under the ESA, including marine mammals, sea turtles, plants, salmon and other fish. Of these, 26 are salmon and steelhead in California and the Pacific Northwest (Alaska currently contains no listed salmon species). Only one NMFS species, the California gray whale, has recovered to the point where it could be delisted. However, several other species have stabilized and we consider this a successful result of the ESA.

To be sure, NMFS' listing decisions have been the subject of litigation, especially with regard to West Coast salmon and steelhead. NMFS has lost some cases and learned valuable lessons. To address the issue of whether NMFS' decisions were based on the best available science, NMFS collected information from the Pacific Salmon Biological Technical Committees and interested parties in Washington, Oregon, Idaho and California. NMFS also established a Biological Review Team (BRT) to review available information. While these efforts have not eliminated lawsuits, they have helped NMFS gather the best available science. For all the species under NMFS' jurisdiction, NMFS continues to look for new ways to ensure that it uses the best available science in its decisionmaking.

Mr. Chairman, thank you for this opportunity to testify. I look forward to answering any questions.

RESPONSES BY DON KNOWLES TO ADDITIONAL QUESTIONS FROM SENATOR BAUCUS

Question 1. Mr. Knowles, you are involved with these issues every day; please be honest, what do you see as the main problems with the ESA listing and delisting process? And please, be specific.

Response. The National Marine Fisheries Service (NMFS) is not in the same situation as the U.S. Fish and Wildlife Service concerning listing and delisting species. We are responsible for fewer species. Therefore, we have been able to list species and designate critical habitat close to the time limits proscribed by the Endangered Species Act. However, we do see a number of issues that affect the listing/delisting process. For example, by the time most species are listed, they have reached a point where their recovery is extremely difficult. If we strengthen our partnerships with States, tribes and private landowners so that we are working together to conserve species, we will lessen our dependence on the ESA as the primary source, and often the last resort, for species protection. Also, the timing is off for designating critical habitat at the time of listing. It would be more appropriate to designate critical habitat in conjunction with developing a recovery plan. We need to add more credibility to our listing, delisting and critical habitat decisions by making them more transparent. This would involve expanding opportunities for public participation and diversifying the make-up of recovery teams.

Question 2. What do you need to be able to do your job under the Endangered Species Act? A pot of money? Do you think you have adequate resources? I know that this hearing is confined to the listing and delisting process, but please answer my question in the context of your larger duties under the ESA. Why is it, for instance, that salvage timber sales in Montana just can't go forward? Because there aren't enough biologists on the ground to do consultations under section 7?

Response. We are able to do the highest priority items with current funding. Our budget requests target the needs of specific groups of species (e.g. Pacific salmon, sea turtles, marine mammals) and not specific ESA programs such as listing, critical habitats and section 7 consultations. This gives NMFS the flexibility to use our allocated funds for a variety of ESA programs, and wherever the need is greatest at the time. As for section 7 consultations on salvage timber sales in Montana, NMFS is not involved in habitat-related issues in Montana.

Question 3. Do you think that a lot of complaints and concerns about your agency's implementation of the ESA, such as in the listing process, is a symptom of a much larger problem—a lack of adequate funding? What else is contributing to your problems here?

Response. The larger issue is not the implementation of the ESA itself, but how it brings to light the ever-increasing demand for resources, especially habitat. Preventing the extinction of wildlife and plants becomes more and more difficult as their habitat is lost due to population growth and development. Yes, we need adequate resources to recover species, but we also need time to make the changes necessary to conserve the species as well as time for the changes to be effective. Often, the Federal agencies cannot say with authority exactly what measures need to be carried out to recover a species. Landowners and State and local governments are left with uncertainty about how their future may be affected by efforts to recover species. Therefore, the agencies responsible for implementing the ESA must be able to develop quickly the scientific information necessary to know what actions are needed to conserve species and there should be incentives that will increase public support to carry out these activities.

Question 4. Do you honestly believe that the citizen petition process is the real problem here? Do you honestly believe that getting rid of the provision will improve the ability of the Service to list or delist species. That it will improve the ability of the Service to do its job?

Response. As we responded in question 1, NMFS has been able to list species and designate critical habitat within or close to the time limits proscribed by the Endangered Species Act. So, we do not consider the provision in the ESA that allows citizens to petition NMFS to list, delist, or designate critical habitat a problem.

Question 5. Should a listing decision be left solely to the Services?

Response. The listing decision, which in the end should be made solely by the Services, is reviewed by many sources prior to that decision. For example, in response to a petition for NMFS to list several populations of West Coast steelhead, NMFS assessed the best available data by including information from the Pacific Biological Technical Committees and interested parties in Washington, Oregon, Idaho and California. The committees included scientists from Federal, State and local resource agencies, Indian tribes, industries, universities, professional societies and public interest groups with technical expertise. NMFS then established a Biological Review Team (BRT) composed of NMFS scientists and managers as well as scientists from other Federal agencies to conduct a coastwide status review for west coast steelhead. Based on the result of the BRT report and after considering other information and existing conservation measures, NMFS identified which of the steelhead populations should be proposed for listing and those that did not warrant listing.

Question 6. What do you think that expanded peer review would add to the listing and delisting process?

Response. It is a published policy of the Services to incorporate independent peer review in listing and recovery activities, during the public comment period. For listing, we solicit the expert opinions of those appropriate and independent specialists regarding pertinent scientific or commercial data and assumptions relating to the taxonomy, population models and supportive biological and ecological information for species under consideration for listing. We summarize in the final document the opinions of all independent peer reviewers and include all reports, opinions and other data in the administrative record of the final decision. We also solicit peer review to obtain all available information from appropriate local, State and Federal agencies, tribal governments, academic and scientific groups and any other party who may possess information during the development of draft recovery plans. Where appropriate, we have scientific data related to implementation of recovery peer reviewed, and we include these opinions in the final recovery plan. However, I believe the real issue concerning the use of peer review is to increase the credibility of ESA decisionmaking. Therefore, we continue our commitment to obtaining and using the best scientific information available for our ESA decisions, having this information peer reviewed, and ensuring that the public has access to the results of the peer review.

STATEMENT OF DEBORAH M. BROSNAN, PRESIDENT AND FOUNDER, SUSTAINABLE ECOSYSTEMS INSTITUTE

Good morning. I am Deborah Brosnan, president and founder of the Sustainable Ecosystems Institute (SEI). The institute is a public-benefit non-profit organization, that provides impartial scientific support for conservation. We are rigorously non-partisan, and seek science-based, cooperative solutions that benefit both the environment and the human communities that depend on it. Currently over 300 scientists work with the institute to provide support to government, the private sector and citizen groups. Our work ranges from fundamental research to mediation, and the integration of science with policy.

Since our inception in 1992, the institute has worked to strengthen scientific principles and methods integral to the application of the Endangered Species Act. The ESA remains a key piece of the Nation's environmental laws. In common with many other scientists, we support legislation that protects the biodiversity that, ultimately, supports us.

In recent years, there has been extensive comment and critique of management under ESA. These critiques come from every side of the debate, but contain some themes that are common to all points of view. All parties, for instance, agree that the role of science needs to be enhanced. There are many calls for a wider and more effective use of independent and impartial scientific analysis. Of course, the Fish and Wildlife and National Marine Fishery Services (USFWS and NMFS) have committed to the use of scientific excellence, and indeed employ many fine scientists. However they would probably be the first to acknowledge the need for more resources, and better integration of their efforts with the Nation's other scientific resources. This is a point of view shared across the political spectrum.

Central to the idea of improving ESA science is the concept of peer review. Peer review is the scientific equivalent of quality control—it is our profession's method of ensuring that analyses are carried out appropriately, that the best data are used, and that the conclusions drawn are appropriate. Peer review is a normal scientific process, for which there are long-established protocols, and which is widely applied to decisions about scientific publication and funding. However more practical applications, for instance to management of resources, are less frequent. The Magnusson Act is an example of an explicit application of peer review to an important conservation issue.

It is already the policy of NMFS and UWFWS that important decisions, such as listing actions, are subject to external peer review. However the widespread calls for increased use of peer review, as outlined in my accompanying table, testify to the general feeling that a more systematic and open process is desirable. At least 63 organizations, groups or individuals have separately called for inclusion of peer review into ESA revisions. The information in the table is revealing: resource user groups call for review of listing actions, while environmental organizations call for review of Habitat Conservation Plans and Recovery Plans. Essentially, each group wants to have impartial review of actions affecting their particular concerns. They are united in their common belief that an independent review would lead to better decisions and more effective management.

Perhaps these different groups all believe that their views on resource management would prevail following peer review. If so, they are mistaken. Science is value neutral. It can sometimes appear to favor one political point of view, sometimes another, though in fact it favors none. Scientific peer review can however be of great use in ensuring that good science is appropriately incorporated into management actions, in making decisions transparent, in ensuring that a fair and reasonable process is followed, and in making better decisions for natural resources. If the different groups want to see that conservation decisions are based on the best science, then peer review can indeed help. There is nothing to fear about the idea of peer review; however I will also argue that it is important to have a well thought-out, and systematic process.

In the past few months, SEI has begun a pilot process to assist the Fish and Wildlife Service with peer review. This is a pro-bono effort by our scientists, and supports the Service's existing policies and processes. Regional offices have been encouraged by the Service's Director to use SEI's assistance in finding and enlisting outside reviews. We have organized the National Network for Conservation Science, consisting of 300 volunteers, who provide help to the Service. Network participants are faculty at major universities and other experts, including 6 members of the National Academy of Sciences.

It is early days in this experiment, but we can provide some information on success rates. In the accompanying graphic I show that the Service has diligently sought out peer reviewers on their recent regulatory actions—often without recourse to SEI help. Sometimes they have been successful in obtaining reviews, as in the case of listing of the Alabama Sturgeon and other issues. Sometimes, however, the Service has sought reviews, but has not been successful in getting cooperation from the independent scientists. For instance, on Critical Habitat of the Arkansas Shiner, the Desert Bighorn and the California Gnatcatcher, all affecting large areas of habitat, no review was received from any of the 17 scientists approached by the Service. SEI usually has higher success rates in our program for the Service and other reviews. Typically we obtain 96 percent response rates.

I believe the elevated response rates are explained by several factors. First, we have provided an infrastructure that allows the effective engagement of interested scientists, and ensures that such scientists are willing and able to respond, within the limited timeframes of agency actions. Second, as practicing scientists, we "speak the same language" as the reviewers, and can explain our needs effectively. There is a substantial difference between the cultures of academia and regulatory agencies, so that the needs of one are not apparent to the other. Third, we provide rewards to reviewers, either financial or professional, that encourages their response. Fourth, we act as a buffer to protect the integrity of the scientist and science. We look forward to further development of this review program with the Service, and believe that innovative, cooperative programs could meet many of the goals of all interested parties.

Peer review is not however a panacea. As I have previously outlined in an article for the National Academy (attached) simple extension of the academic model of peer review to applied management decisions can lead to significant problems. Peer review itself needs to be reexamined and carefully designed in order for it to be effective. Some examples: peer review in public decisionmaking cannot be anonymous as in academia; the standard of proof criterion is different in the different contexts; decisions have to be made even when science is incomplete, or we will face 'paralysis by analysis'. Because the science is used in a non-academic and management arena, it is important to maintain the integrity of the science and scientists. Scientists should not be asked to become managers or to defend a manager's preferred option.

The lessons we have learned so far have been useful. Working within existing policies of the regulatory agencies, peer review can indeed contribute to effective management. Academic models of review, and existing infrastructures are however insufficient to the task. With the USFWS and our other partners we have begun a process to build the necessary structures—improvements are definitely possible, and resources will be needed. We estimate that a national program to provide peer review would cost between $3 to $5 million annually (of course as a non-profit we cost a lot less than a Federal agency would.) Peer review is a serious and professional undertaking. An ad hoc or poorly thought-out approach will lead to frustration. However, if properly implemented, peer review can contribute much to the ESA and other natural resources decisions.

Sustainable Ecosystems Institute

Examples of Calls for Peer Review Under the Endangered Species Act

Organization	Where is Peer Review Desired?				How to Implement Peer Review?	Who Pays For It?
	General Peer Review	Listing	HCP	Other		
Ecological Society of American Ad Hoc Committee on Endangered Species.	X	No	X	....	....	
9 Current and Past Presidents of Ecological Societies.	....	....	....	Recovery Plans.	....	
Society of American	....	X	....	....	....	
Society for Integrative and Comparative Biology.	X	....	X	....	Independent Scientist Panel.	Federal Government
Wildlife Society	....	X	....	Recovery Plans.	....	

Sustainable Ecosystems Institute—Continued

Examples of Calls for Peer Review Under the Endangered Species Act

Organization	Where is Peer Review Desired?				How to Implement Peer Review?	Who Pays For It?
	General Peer Review	Listing	HCP	Other		
Senator Ashcroft	....	X	....	....	....	
Senator Lieberman	....	X	....	Recovery Plans.	....	
Congressman Steve Largent.	X	X	....	....	....	
National Governor's Association.	X	....	....	....	....	
Western Governor's Association.	X	....	....	....	Independent experts chosen by USFWS and the States.	Task force to funding
Southern Governor's Association.	X	X	....	....	....	
Governor Marc Racicot (MT).	....	X	....	....	Scientific review and cost/benefit analysis.	Government task force finds a way to fund the process
State of Washington	X	....	X	....	Independent Scientific Review Board appointed by the Governor.	
Association of California Water Agencies.	....	X	....	....	Scientific review and cost/benefit analysis.	Federal Government
NW Power Planning Council.	X	....	....	....	Independent Scientific Review Team appointed by NWPPC (Chair) and NMFS (Regional Director).	Council
National Association of Conservation Districts.	....	X	X	....	Independent review from industry and university scientists on critical habitat.	National Land and Conservation Fund. Listing petitioners if frivolous petition
American Public Power Association.	X	....	....	....	....	
Audubon, Greenpeace, National Wildlife Federation, Environmental Information Center (in joint communication).	X	....	X	....	ndependent Scientific Review.	Imply Federal Government
California Native Plant Society.	....	X	X	....	Science Advisory Panel	Imply Government
Defenders of Wildlife	X	....	X	....	Call for scientific and community review.	
Environmental Protection Information Center.	....	....	X	....	....	
Forests Forever	....	Opposed	....	....	....	
National Wildlife Federation.	....	....	X	....	....	
New Jersey Audubon	....	....	X	....	....	Applicant
NW Ecosystem Alliance	....	....	X	....	Critical Habitat	
Natural Resource Defense Council.	....	....	X	....	Independent Oversight Committee.	Imply Government
SW Center for Biological Diversity.	X	....	....	....	National Academy of Science Nominations.	Federal taxes, permit fees, damages from E.S.A. lawsuits
Pacific Coast Federation of Fishermen's Associations.	X	....	....	....	Opposed to stake-holder representation.	
American Farm Bureau Federation.	X	X	X	....	....	
Farm Bureau	X	....	....	....	....	

Sustainable Ecosystems Institute—Continued

Examples of Calls for Peer Review Under the Endangered Species Act

Organization	Where is Peer Review Desired?				How to Implement Peer Review?	Who Pays For It?
	General Peer Review	Listing	HCP	Other		
Fairy Shrimp Study Group (California businesses and farmers).	....	X	....	....	....	
American Angus Association.	....	X	....	....	National Academy of Sciences.	
Cattlemen's Association ..	....	X	....	....	....	
Cattlemen on the Hill	....	X	....	Critical Habitat.	Blind panel, including natural resource user groups, states, and land grant colleges.	
American Sheep Industry Association.	....	X	....	....	....	Local Government
National Association of Wheat Growers.	....	X	....	....	....	
California Women for Agriculture.	....	X	....	....	Independent review	
American Water Works Association.	X	....	....	....	....	
American Society of Civil Engineers.	X	....	....	....	....	
American Road and Transportation Builders Association.	X	....	....	....	....	
Inland Rivers, Ports, Terminals, Inc. BOD.	....	X	....	....	Panel of scientific review.	
King County Navigation Bar.	....	....	X	....	Independent Recovery ...	
Building Owners and Managers Association.	....	X	X	....	Scientists and affected community.	
International Council of Shopping Centers.	X	....	....	....	....	
Utah Association of Realtors.	X	....	....	....	....	
American Forest and Paper Association.	X	....	....	....	Independent review cost benefit analysis.	
Pulp and Paperworkers Resource Council.	....	X	....	Recovery	....	
Boise Cascade Corporation.	....	X	....	....	Scientific, economic and social review.	Federal Government
NW Forest Resource Council.	X	....	X	....	Double-blind peer review. Want affected party representation.	Federal Government
Club 20	X	....	....	....	Independent cost/benefit analysis.	Imply Federal Government
Family Business First	....	X	....	....	....	
Family Business Fund	....	X	....	....	....	
National Grange of the Order of Patrons of Husbandry.	X	X	....	....	....	
Multiple Grange, Forestry, Industry Associations.	X	....	....	....	Public Input	
National Endangered Species Act Coalition.	X	X	X	....	National Academy of Sciences nominates scientists.	Federal and State Government
James McClure to NESARC.	X	X	X	Habitat Designations.	Peer scientists and affected parties.	Federal Government

Sustainable Ecosystems Institute—Continued

Examples of Calls for Peer Review Under the Endangered Species Act

Organization	Where is Peer Review Desired?				How to Implement Peer Review?	Who Pays For It?
	General Peer Review	Listing	HCP	Other		
National Wilderness Institute.	....	X	....	....	....	Imply Federal Government
Cattle ranchers and environmental coalition in New Mexico.	X	....	....	....	Scientific and public input.	
People for the USA!	....	....	....	Data	....	
L.A. Times	X	....	....	....	....	
National Jewish Community Relations Advisory Council.	X	X	....	....	Scientific review	Federal Government
Church of the Brethren ...	....	Opposed	....	....	....	
California Environmental Dialogue.	X	....	....	....	Permanent program with standing committees.	Government
Meridian Institute Workshop.	X	X	X	....	Societies and services with data base of experts.	Services HCP applicants

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Perspectives

CAN PEER REVIEW HELP RESOLVE NATURAL RESOURCE CONFLICTS?

(By Deborah M. Brosnan)

Congress, businesses, environmental organizations, and religious groups are all calling for peer review systems to resolve conflicts over the protection of this Nation's natural resources. A recent opinion poll found that 88 percent of Americans support the use of peer review in the application of the Endangered Species Act (ESA). The rising interest in peer review is the result of widespread unhappiness with natural resource policies, including ESA listing decisions and the establishment of ESA-sanctioned Habitat Conservation Plans (HCPs). The many interest groups believe that scientific peer review will support their particular viewpoints. The obvious problem is that they can't all be right.

A more important problem is that peer review as traditionally applied to examine scientific research is inadequate for supporting decisions about managing species, lands, and other natural resources. It does not take into account the complex political, social, and economic factors that must be factored into natural resource decisions.

Peer review can provide a basis for improving natural resource decisions, for reconsidering past decisions, and for settling disagreements. But to function effectively, the review system needs to be much different from the one used widely in academia today. In the meantime, traditional peer review is being applied on an ad hoc basis to important endangered species and habitat conservation issues, leading to contentious outcomes. In the rush to implement a popular policy, we are setting a precedent that is only institutionalizing our confusion.

EVERYONE WANTS IT

It is heartening that all sides want independent peer review; it seems that everyone acknowledges that better decisionmaking is needed. A survey by the Sustainable Ecosystems Institute found that at least 60 farming, ranching, logging, industrial, ecological, wildlife, religious, and Governors organizations are calling for scientific review in the application of the ESA. This includes reviews of HCPs, which are agreements between government agencies and private landowners that govern the degree to which those owners can develop, log, or farm land where endangered species live.

Why are so many diverse groups eager to embrace peer review? There is widespread distrust of the regulatory agencies involved in ESA and dissatisfaction with their administration of the Act. Many groups believe that agencies are making the wrong decisions. Disagreements among interested parties often end up in litigation, where judges, not scientists, make rulings on scientific merit. Most decisions to list species in the West, including those involving the northern spotted owl, marbled murrelet, and bull trout, have been made after lawsuits. Similarly, one approved HCP—the Fort Morgan Paradise Joint Venture project in Alabama, which would have affected the endangered Alabama beach mouse—was successfully challenged in court on the basis of inadequate science.

Many organizations see science as a way of reducing litigation. After all, judges are not scientists or land managers and are apt to make the wrong technical decision. Court actions are costly. Any means of reducing vulnerability to lawsuits is roundly favored.

There are striking differences in opinion as to where peer review is needed. Simply put, each group favors review of actions that it finds unpalatable. Development groups want fewer species listings and therefore demand review of listing decisions. Some professional and environmental societies oppose peer review of listings because they will unnecessarily delay much-needed conservation measures. Environmental groups are concerned about habitat loss under HCPs and want them independently reviewed.

Regardless of their perspective, most groups want less litigation, less agency control, and greater objectivity. Many also see peer review as a tool for overturning wrong decisions. Regulatory agencies want to reduce vulnerability to litigation and develop greater public support. Agency staff, frequently doing a difficult task with inadequate resources, would prefer to have a strong system to rely on. It is always better to have a chance to do it right than to do it over.

THE LURE OF HASTY IMPLEMENTATION

The move to implement some form of peer review is already under way. For example, the Magnuson Stevens Fisheries Conservation and Management Act calls for peer review in arbitrating disagreements over fisheries harvest levels. The U.S. Forest Service now calls for science consistency checks to review decisions about forest management. Unfortunately, the rush to implement random forms of peer review has created many ad hoc and ill-conceived methodologies.

Enthusiasm for peer review is so high that it is now central to efforts to reform ESA. In 1997, the Senate introduced the Endangered Species Recovery Act, which would have required peer review and designated the National Academy of Sciences (NAS) to oversee the review process. But few academy members or the scientists who serve on NAS committees have made their careers in applied science or have worked in an area in which legal and regulatory decisions are paramount. The bill was shot down, but the Governors of the western States have asked the Senate to reintroduce similar legislation in 2000. Whether or not legislation is taken up, it is clear that Congress wants better science behind natural resource decisions and sees peer review as the way to achieve it.

Most legislative and agency measures calling for peer review, however, do not describe how it should be structured, other than to say that it should be carried out by independent scientists. Yet an ill-conceived review process will just compound the problems. Furthermore, there is a tacit assumption that the pure academic model will be used. Although it is appealing to think that this system would work as well for management and policy decisions as it does for pure research findings, it won't. Traditional peer review cannot be applied as some kind of quality control in a political arena. Indeed, some attempts to use peer review in this way have backfired.

WHAT CAN GO WRONG

Development of the management plan for the Tongass National Forest, covering 17 million acres in Alaska, illustrates several problems in applying academic peer review to natural resource management. To make a more science-based decision regarding the management and protection of old-growth forests and associated wildlife species, the Forest Service set up an internal scientific review team that worked with forest managers on the plans. Because of Federal laws governing the use of nonagency biologists, the Service sent drafts to external reviewers, most of whom were academics. In reviewing the plan and the methodology, the Service concluded that science had been effectively incorporated and that managers and scientists had worked well together. Indeed, Service officials have portrayed the plan as a watershed event, bringing the Service's research and management arms together.

The conclusion of the external review committee was different. It independently issued a statement that was critical of the management proposed in the plan, concluding that, in certain aspects, none of the proposed actions in the plan reflected the reviewers' comments. The committee insisted that "the Service must consider other alternatives that respond more directly to the consistent advice it has received from the scientific community before adopting a plan for the Tongass." The reviewers noted that there were specific management actions that should be carried out immediately to protect critical habitat but that were not part of the plan. These included eliminating road building in certain types of forest and adjusting the ratio of high-quality and low-quality trees that would be cut in order to protect old-growth forests.

The Tongass experience holds several lessons. First, internal and independent reviewers reached opposite conclusions; decisionmakers were left to determine which set of opinions to follow. Whatever the choice, a record of dissent has been established that increases vulnerability to legal challenge and political interference. Second, the independent scientists felt ignored, which again increases the vulnerability of the decisions. Third, the independent scientists made clear management recommendations, believing that science alone should drive management decisions; most managers will disagree with this point of view. Thus, peer review in the Tongass case raised new problems. Confusion of roles and objectives was a major cause of these difficulties.

A different set of issues has arisen with the use of peer review in establishing two HCPs—one involving grasslands and butterflies in the San Bruno Mountains south of San Francisco, the other involving Pacific Lumber and old-growth forests near Redwood National Park. In both cases, scientific review panels were used from an early stage to guide interpretation of the science. The panels were advisory and scrupulously avoided management recommendations, sometimes to the frustration of decisionmakers. The panels avoided setting levels of acceptable risk and tended to use conservative scientific standards.

Another example comes from the State of Oregon Northwest Forest HCP, now being negotiated to cover 200,000 acres of second-growth forest that is home to spotted owls, murrelets, and salmon. The Oregon Department of Forestry sought reviews of their already-developed plan from 23 independent scientists representing a range of interest groups and expertise. Not surprisingly, diametrically opposed opinions were expressed on several issues. It will now be difficult to apply these reviews without further arbitration.

Hints of more endemic problems come from the Fish and Wildlife Service's use of peer review for listing decisions. Typically, a few reviewers are selected from a group of scientists who are "involved" in the issue. But the Service now reports that at best only one in six scientists contacted even replies to the request that they be a reviewer. If they do volunteer, they are often late with their responses or don't respond at all. Two problems are becoming clear: There is no professional or monetary benefit from being a reviewer, and many scientists are wary of becoming caught up in politicized review processes, which can become drawn out and expose them to attacks by interest groups.

Certain actions can determine the effectiveness of a peer review process: how it is structured, who runs it, who the reviewers are, and how they are instructed and rewarded. Lack of attention to details and blanket application of an academic model has already led to problems and will continue to do so.

CLEARING THE MINEFIELD

Peer review has always been a closed system, confined to the scientific community, in which the recommendations of usually anonymous reviewers determine the fate of research proposals or manuscripts. When scientific review is used outside this arena, problems arise because scientists, policymakers, managers, advocacy groups, and the public lack a common culture and language. Few scientists are trained or experienced in how policymakers or managers understand or use science. Scientists may be tempted to comment on management decisions and indeed are often encouraged to do so. However, they are rarely qualified to make such pronouncements. Natural resource managers must make decisions based on many factors, of which science is just one. Inserting academic peer review into a management context creates a minefield that leads to everything from misunderstanding to disaster.

More appropriate applications of peer review can be designed once the major differences between academic and management science are understood. They involve:

Final decisions.—Scientists are trained to be critical and cautious and to make only statements that are well supported. Managers must make decisions with whatever information is available. Scientists usually send incomplete work back for further study; managers typically cannot. Managers must also weigh legal concerns, public interest, economics, and other factors that may have little basis in hard data.

Best available science.—Managers are instructed to use the best available science. Scientists may regard such data as incomplete or inadequate. Reviewers' statements that the evidence in hand does not meet normal scientific standards will be irrelevant to a decisionmaker who lacks alternatives and must by law make a decision.

Competing ideas.—In pure science, two competing theories may be equally supported by data, and both may produce publishable work. Management needs to know which is best to apply to the issue in question.

Reviewers as advocates.—In academia, it is assumed that a reviewer is impartial and sets aside any personal biases. In management situations, it is assumed that reviews solicited from environmental advocates or development interests will reflect those points of view.

Speed.—Academic reviews are completed at a leisurely pace. This is not acceptable in management situations.

Anonymity and retaliation.—Academic reviews are typically anonymous to encourage frankness and discourage professional retaliation. Reviews in management situations usually must be open to promote dialog. Some scientists will be reluctant to make strong statements if they are subject to public scrutiny.

Qualified versus independent.—Often the scientists best qualified to be reviewers of a natural resource issue are already involved in it. Many HCP applicants, for example, do not want "inexperienced" reviewers from the professional societies. They prefer "experienced" scientists who understand the rationale and techniques of an HCP. This sets up a tension between demonstrable independence and depth of understanding.

Language.—Managers and decisionmakers may not be familiar with the language of science. Statistical issues are particularly likely to cause confusion.

Reward structure.—In academic science, reviews are performed free of charge for the common good and to add to scientific discourse. Hence they are typically given a low priority. In management situations, this will not work. Rewards—financial and otherwise—are necessary for timeliness and simply to encourage reviewers' interest in the first place.

A NEW MODEL

The troublesome experiences in recent cases such as the Tongass and appreciation of the different roles of academic and management science reviewers point the way to more effective integration of peer review into resource management decisions. The following principles provide a starting point:

- The goals of peer review in each case must be clearly stated.
- Clear roles for reviewers must be spelled out.
- Impartiality must be maintained to establish credibility.
- A balance must be sought between independence and expertise of reviewers.
- Training of reviewers may be necessary.
- A reward structure must be specified.
- Early involvement of scientists will give better results than will post-hoc evaluations.

Three other lessons are evident. First, because academic scientists are rarely familiar with management, the individual or organization coordinating the review needs to be experienced in both fields. The traditional sources of these "science managers"—academic institutions, professional societies, or regulatory agencies—either lack the necessary experience or are not seen as independent. We need a new system for administering peer review.

Second, a mediator or interpreter who clarifies roles and eliminates misunderstandings can be highly effective. Scientists may need pressing on some points and at other times may need to be dissuaded from trying to be managers. Conversely, managers who lack advanced training in disciplines such as statistics may need help in interpreting scientific statements on issues such as risk. The interpreter can also be a gatekeeper for scientific integrity, ensuring that reviewers do not become advocates, either voluntarily or under pressure.

Third, a panel structure gives more consistently useful results. This is probably the result of panelists discussing issues among themselves. Although panels can produce conflicting opinions, they appear more likely to give unequivocal results than would a set of individual reviews.

There is enthusiasm for science and peer review among most parties involved with ESA and general natural resource management. But there is little consensus on how to make the process succeed.

Nationally, we lack the necessary infrastructure for implementing peer review as a useful tool. In each case, environmentalists, developers, and any other regulated parties should be asked to design the appropriate system, because they will then accept its results. This means that advice on forming such groups and oversight of their progress would be needed. Peer review cannot be guided by managers alone nor by scientists alone. We need independent technical groups that have the necessary diverse skills but are seen as impartial.

Whichever route is taken, a better approach to peer review must be created. The rush to impose the old academic model must stop before it creates even more problems. By taking the time to properly devise review systems, we can ensure that the scientific voice is effective, understood, and utilized.

Threatened and Endangered Species System (TESS)

Delisted Species Report as of 5/7/01

Date Species First Listed	Date Delisted	Species Name	Reason Delisted
03/11/67	06/04/87	Alligator, American (Alligator mississippiensis	Recovered
02/17/84	02/06/96	Bidens, cuneate (Bidens cuneata)	Taxonomic revision
04/28/76	08/31/84	Butterfly, Bahama swallowtail (Heraclides andraemon bonhotei).	Act amendment
10/26/79	06/24/99	Cactus, Lloyd's hedgehog (Echinocereus lloydii)	Taxonomic revision
11/07/79	09/22/93	Cactus, spineless hedgehod (Echinocereus triglochidiatus inermis).	Not a listable entity
03/11/67	09/02/83	Cisco, longjaw (Coregonus alpenae)	Extinct
06/02/70	09/12/85	Dove, Palau ground (Gallicolumba canifrons)	Recovered
03/11/67	07/25/78	Duck, Mexican (U.S.A. only) (Anas ''diazi'')	Taxonomic revision
06/02/70	08/25/99	Falcon, American peregrine (Falco peregrinus anatum)	Recovered
06/02/70	10/05/94	Falcon, Arctic peregrine (Falco peregrinus tundrius)	Recovered
06/02/70	09/12/85	Flycatcher, Palau fantail (Rhipidura lepida)	Recovered
04/30/80	12/04/87	Gambusia, Amistad (Gambusia amistadensis)	Extinct
04/29/86	06/18/93	Globeberry, Tumamoc (Tumamoca macdougalii)	New information discovered
03/11/67	03/20/01	Goose, Aleutian Canada (Branta canadensis leucopareia)	Recovered
10/11/79	11/27/89	Hedgehog cactus, purple-spined (Echinocereus engelmannii purpureus).	Taxonomic revision
12/30/74	03/09/95	Kangaroo, eastern gray (Macropus giganteus)	Recovered
12/30/74	03/09/95	Kangaroo, red (Macropus rufus)	Recovered
12/30/74	03/09/95	Kangaroo, western gray (Macropus fuliginosus)	Recovered
04/26/78	09/14/89	Milk-vetch, Rydberg (Astragalus perianus)	New information discovered
06/02/70	09/12/85	Owl, Palau (Pyroglaux podargina)	Recovered
06/14/76	01/09/84	Pearlymussel, Sampson's (Epioblasma sampsoni)	Extinct
06/02/70	02/04/85	Pelican, brown (U.S. Atlantic Coast, FL, AL) (Pelecanus occidentalis).	Recovered
07/13/82	09/22/93	Pennyroyal, Mckittrick (Hedeoma apiculatum)	New information discovered
03/11/67	09/02/83	Pike, blue (Stizostedion vitreum glaucum)	Extinct
10/13/70	01/15/82	Pupfish, Tecopa (Cypinodon nevadenis calidae)	Extinct
09/26/86	02/28/009	Shrew, Dismal Swamp southeastern (Sorex longirostris fisheri).	New information discovered
03/11/67	12/12/90	Sparrow, dusky seaside (Ammodramus maritimus nigrescens)	Extinct
06/04/73	10/12/83	Sparrow, Santa Barbara song (Melospiza melodia graminea)	Extinct
11/11/77	11/22/83	Treefrog, pine barrens (FL pop.) (Hyla andersonii)	New information discovered
09/13/96	04/26/00	Trout, coastal cutthroat (Umpqua R.) (Oncorhynchus clarki clarki).	Taxonomic revision

Threatened and Endangered Species System (TESS)—Continued

Delisted Species Report as of 5/7/01

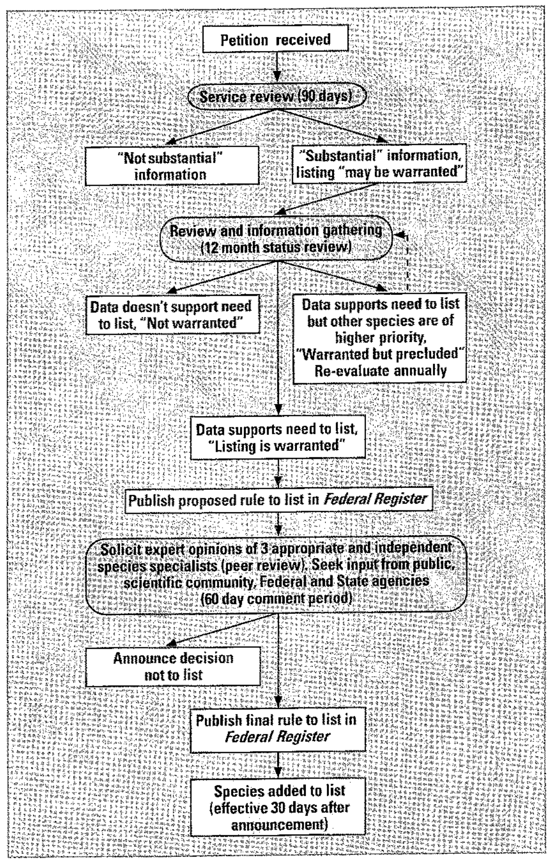
Date Species First Listed	Date Delisted	Species Name	Reason Delisted
06/14/76	02/29/84	Turtle, Indian flap-shelled (Lissemys punctata punctata)	Erroneous data
06/02/70	06/16/94	Whale, gray (except where listed) (Eschrichtius robustus)	Recovered

U.S. Fish & Wildlife Service

The Petition Process

For requests to list a species as threatened or endangered under the Endangered Species Act

What are petitions for listing?
Petitions are formal requests to list a species as endangered or threatened under the Endangered Species Act. They require published findings. We (or the National Marine Fisheries Service for most marine species) must make a finding within 90 days of receiving a petition (to the extent practicable) as to whether or not there is "substantial information" indicating that the petitioned listing *may be* warranted. If this preliminary finding is positive, a status review is conducted. Within one year of receipt of the petition, we must make a further finding that the listing either *is* or *is not* warranted. A positive one-year finding can be incorporated into a proposed listing or, if a prompt proposal is precluded by other listing activities, the proposal may be deferred. These "warranted but precluded" proposals require subsequent one-year findings on each succeeding anniversary of the petition until either a proposal is undertaken or a "not warranted" finding is made.



U.S. Fish & Wildlife Service
Division of Endangered Species
703/358 2105
http://endangered.fws.gov

March 2000

Sustainable Ecosystems Institute

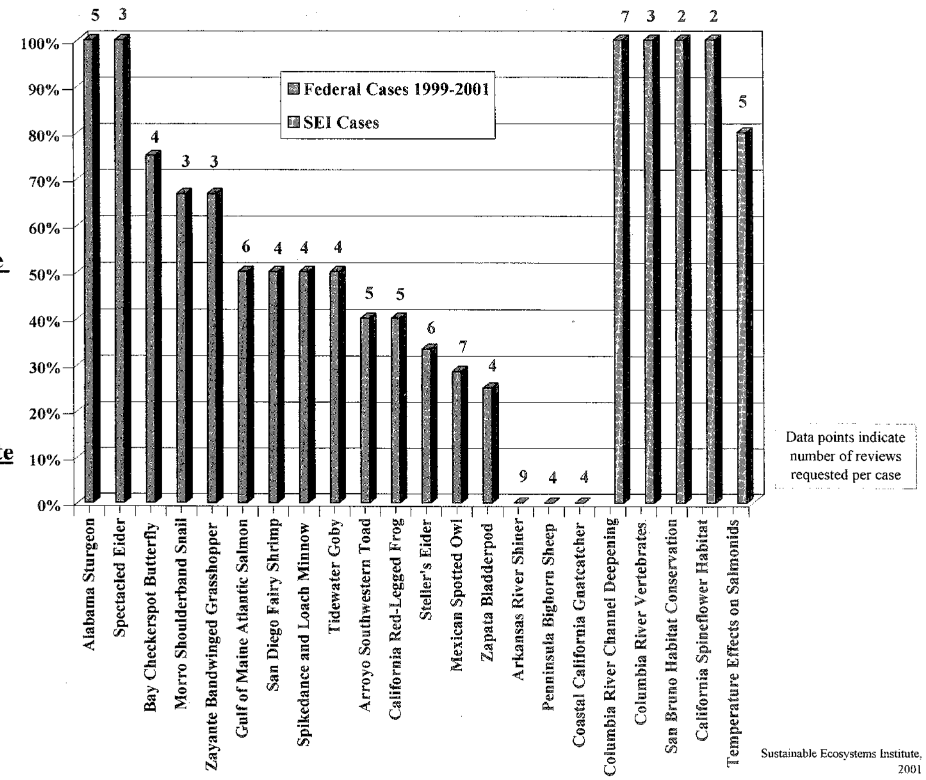
Average Success Rate

Federal Cases 46%
SEI Cases 96%

Total Response Rate

Federal Cases 35%
SEI Cases 95%

Peer Review Success



STATEMENT OF DAVID S. WILCOVE, SENIOR ECOLOGIST, ENVIRONMENTAL DEFENSE

Two simple questions underlie much of the controversy pertaining to the listing of plants and animals as threatened or endangered under the Endangered Species Act. Developers, loggers, miners, business leaders, and other members of the regulated community wonder whether all of the species currently on the endangered species list are truly in danger of disappearing. Because the Endangered Species Act can pose significant economic costs to these people, they are understandably concerned that only species truly at risk of extinction be afforded such protection. Conservationists, on the other hand, worry that many rare plants and animals are not making it onto the endangered species list and are therefore being denied the protection they desperately need. Neglect becomes a prelude to extinction.

The best available scientific information indicates that the answer to the first question—are lots of undeserving species somehow finding their way onto the endangered species list?—is a resounding "no." And new data demonstrate that the answer to the second question—are lots of gravely imperiled species somehow failing to receive protection under the Endangered Species Act?—is an equally resounding "yes." Below, I review these studies and their implications for administration of the Endangered Species Act.

In 1993, Margaret McMillan, Keith Winston, and I published a paper in the peer-reviewed journal *Conservation Biology* in which we examined the population sizes of U.S. species proposed for listing or added to the endangered species list from 1985–1991 (inclusive).[1] Nearly 500 plants and animals were either proposed for listing or added to the list during that 7-year period. We discovered that the median population size of a vertebrate animal (mammal, bird, reptile, amphibian, or fish) at time of listing was 1,075 individuals. The median population size of an invertebrate animal at time of listing was fewer than 1,000 individuals, while for plants, it was fewer than 120 individuals. (In fact, 39 plant species were listed when 10 or fewer individuals were known to exist.) These low numbers of individuals were clustered in a small number of populations: For animals, the median number of populations at time of listing was fewer than 3; for plants, it was 4. By any scientific standard, such low numbers make these species highly vulnerable to extinction.[2] One way to highlight this point is to note that half the animals added to our endangered species list are rarer even than the giant panda.

More recently, Dr. Sandy Andelman of the National Center for Ecological Analysis and Synthesis at the University of California—Santa Barbara has updated our study, using listing data from 1996–2000. She, too, found that the population sizes of plants and animals added to the endangered species list during this period were extremely low, meaning these species were highly vulnerable to extinction and worthy of Federal protection.[3] For vertebrate animals, in fact, the population sizes of those species added from 1996–2000 were even lower than the population sizes of species added from 1985–1991.

Thus, the scientific studies done to date—as opposed to the rhetoric often heard from opponents of the Endangered Species Act—strongly support the idea that the species finding their way onto the endangered species list fully fit the statutory definitions of "endangered" and "threatened" species.

Of course, it can be argued that the numbers I have cited are only as good as the data upon which they are based. If the U.S. Fish and Wildlife Service relies upon incomplete or inaccurate data when it decides to list a species, then it could end up listing a species that, upon further investigation, turns out to be fairly common. Supporters of this hypothesis are quick to point out that previously unknown populations of rare plants and animals are sometimes discovered after a species has been listed. The reason is simple: By putting a regulatory spotlight on a particular rare species, the Endangered Species Act forces developers, Federal agencies, and others to search more diligently for it.

The fact that additional populations are discovered is not, by itself, evidence of a problem with the listing process. Most ecologists would predict that, with more searching, more populations would be found. A problem arises only when the number of new populations is so great as to make one question whether the species ever belonged on the endangered species list. Thus, it is worth noting that of the more than 1,200 plants and animals that have been placed on the endangered species list since 1973, only 5 have been removed from the list because they turned out to be

[1] Wilcove, D.S., M. McMillan, and K.C. Winston. 1993. What exactly is an endangered species? An analysis of the U.S. endangered species list: 1985–1991. *Conservation Biology* 7: 87–93.

[2] IUCN/World Conservation Union. 1994. IUCN red list categories. Prepared by the IUCN Species Survival Commission, 30 November.

[3] S. Andelman, pers. comm., May 4, 2001.

far commoner than originally believed.[4] This amounts to less than one-half of 1 percent of the total list. Approximately 7 additional species have been removed from the list because additional studies revealed that they were not valid taxonomic entities (i.e., they turned out not to be distinct species, subspecies, or populations as required by the law).

In summary, the available evidence clearly indicates that virtually all of the U.S. plants and animals added to the endangered species list represent valid taxonomic entities at genuine risk of extinction.

To answer the second key question—Are there significant numbers of imperiled species in the United States that have not been added to the Federal endangered species list? We are fortunate to have available a new book produced by The Nature Conservancy (TNC) and the Association for Biodiversity Information (ABI).[5] *Precious Heritage: The Status of Biodiversity in the United States* is a compilation and analysis of data gathered by the natural heritage programs now established in all 50 States, plus TNC and ABI. It provides what is unquestionably the most up-to-date and complete picture of the status of American wildlife.

TNC and ABI rank plant and animal species on a scale from 1–5. Species classified as G1 (the "G" indicating that the rank in question pertains to the entire or "global" range of the species) are considered "critically imperiled." Such species typically occur in 5 or fewer places or have a total population of 1,000 or fewer individuals. A G2 species occurs in 6 to 20 places or has 1,000 to 3,000 individuals left. It is considered "imperiled." A G3 species is classified as "vulnerable." It typically occurs in 21 to 100 places or has 3,000 to 10,000 individuals remaining. Species ranked G4 or G5 are in no immediate danger.[6] Note that all of these ranks are based on numbers of individuals and populations; they do not take into consideration the degree or immediacy of the threats facing these species.

The authors of *Precious Heritage* have identified no fewer than 1,385 U.S. plants and animals with a rank of G1 (critically imperiled). An additional 1,737 species are classified as G2 (imperiled), while 3,338 are classified as G3 (vulnerable).[7] By any reasonable measure, all of the species ranked G1 or G2 would qualify for listing as endangered or threatened under the Endangered Species Act; these two categories alone contain well over 3,000 species—more than double the current endangered species list. And in all likelihood, a significant fraction of the species classified as G3 (vulnerable) would pass muster for listing, too. Thus, there are a great many rare plants and animals that are at risk of extinction but are not yet protected under the Endangered Species Act. Given what we now know about the endangered species list, what steps can be taken to reduce the risk of erroneous listings and to increase the proportion of deserving species covered by the Endangered Species Act? Although the risk of an erroneous listing is small, Congress can reduce it even further by providing additional funds for biological inventories and taxonomic research.

To reduce the backlog of deserving species awaiting protection, Congress must greatly increase funds to the U.S. Fish and Wildlife Service and National Marine Fisheries Service for listing activities. From 1991–2000, the U.S. Fish and Wildlife Service added an average of 63 U.S. species per year to the list. At that rate, assuming a backlog of about 2,000 imperiled, unlisted species, it would take the Service nearly 32 years to catch up. By that time, many of these rare plants and animals may be gone. A reasonable goal would be to erase this backlog within a decade. Doing so would require a tripling of the annual appropriation to the Service for listing and related activities, to approximately $20 million in fiscal year 2002.

Finally, we must not forget that simply placing a rare plant or animal on the endangered species list does not guarantee its survival, much less its recovery. If, as the data indicate, most species are added to the list only when their populations have reached critically low levels, then we must find ways to increase those populations. Doing so usually entails restoring or enhancing their habitats. For species that depend upon private lands, the key to restoring their habitats is to enlist the cooperation of the landowners. Incentive-based approaches, such as the U.S. Fish and Wildlife Service's safe harbor program or its Endangered Species Landowner Incentive Program, have proved to be very successful in making landowners active

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[4] These are Tumamoc globeberry, Rydberg milk-vetch, McKittrick pennyroyal, pine barrens tree frog (Florida population), and Dismal Swamp southeastern shrew. See: D. Wilcove and M. McMillan. 1994. An analysis of erroneous listing proposals and decisions under the Endangered Species Act. Environmental Defense, Washington, DC; http://ecos.fws.gov/webpage/webpage—delisted.html. These numbers are current as of May 4, 2001.

[5] Stein, B.A., L.S. Kutner, and J.S. Adams. 2000. *Precious heritage: The status of biodiversity in the United States*. Oxford University Press, Oxford, UK.

[6] Stein et al. (2000), Table 4.2, p. 97.

[7] Stein et al. (2000), Table 4.4, p. 104.

participants in recovery efforts. More support for programs such as these will go a long way toward saving our imperiled wildlife while removing much of the controversy associated with the Endangered Species Act.

STATEMENT OF LEV GINZBURG, STATE UNIVERSITY OF NEW YORK AT STONY BROOK AND APPLIED BIOMATHEMATICS

Determination of endangerment status is one of the most critical steps for reaching the objectives of the Endangered Species Act; it is crucial for implementing effective conservation strategies and for apportioning limited financial and human resources for species conservation. Yet, the protocol used by the U.S. Fish and Wildlife Service for listing species under the Endangered Species Act has been criticized as being arbitrary, because the system lacks explicit guidelines by which these decisions are made.

A risk classification system utilizing explicit guidelines and quantitative data would promote consistency in listing decisions and expedite the listing process. One such system has received wide acceptance from the international community and has been hailed by the National Research Council as the "most important scientific effort to date to reach consensus on standard criteria for assigning taxa to threat categories in a uniform, objective manner." This system was developed by the World Conservation Union (IUCN, formerly known as the International Union for the Conservation of Nature). IUCN is the principal international organization involved with categorizing species by extinction risk. Since the 1960's, it has been producing Red Data Books and Red Lists, which are among the most important tools for monitoring biodiversity at a global level.

Under the system used by the U.S. Fish and Wildlife Service, a species qualifies for listing if its populations meet one of five qualitative criteria, such as present or expected future loss of habitat, overharvesting, disease or predation. Species that qualify for listing are then ranked based on magnitude of threat, immediacy of threat, and taxonomic distinctiveness. There are no threshold values for deciding the magnitude or immediacy of threat. The final decision to list a species as either endangered or threatened is based on the level of perceived extinction risk. An endangered species is defined as being "in danger of extinction throughout all or in a significant part of its range" and a threatened species is "likely to become endangered throughout all or a significant part of its range".

The IUCN listing process is carried out by its specialist groups, each concerned with a particular taxonomic group. Species satisfying one of five criteria, based on thresholds of ecological variables such as population size, population growth trend, geographic distribution, and extinction probability, are classified into one of IUCN's three threatened categories of Critically endangered, Endangered, and Vulnerable. Species not meeting these criteria are given the status Least Concern. Threshold ranges of quantitative variables within each of five criteria separate each category of endangerment. In all, 12 quantitative variables are examined for each species under this system. If not all relevant data are available, as is often the case; a species may still be evaluated under this system because of the many variables examined.

The IUCN listing process was developed under wide consultation and is now recognized internationally by the public and scientific community. The lists of threatened species developed by IUCN are among the most widely used by conservationists around the world. The IUCN criteria were designed to detect risk factors for organisms of widely different taxonomic groups. While not all criteria may be relevant for a particular taxon, there are criteria relevant for assessing extinction threat of all groups (except microorganisms).

One difference between the IUCN and FWS systems is the efficiency and speed of the listing process. The most recent IUCN Red List includes over 18,000 species that have been assessed in the 5 years since the new IUCN system took effect. By contrast, the number of species listed by the FWS in the last 20 years is about one-tenth of this number.

Resources for conservation of species are limited. It is, therefore, imperative that decisions are made carefully to focus on species that will benefit most from conservation actions. In addition, many species at risk of extinction cannot afford an inefficient listing protocol. These considerations are mentioned in the endangered Species Act of 1973, yet the present process is both slow and subjective.

The most important difference between the IUCN and FWS systems is their transparency. The FWS relies heavily on qualitative criteria and expert judgment, and therefore often seen as ambiguous and subjective. The IUCN system is based on objective criteria, and results in efficient and scientifically defensible decisions.

It makes use of explicit guidelines for evaluating different variables that contribute to extinction risk and uses quantitative thresholds to determine degree of endangerment. As a result, decisions are consistent between people and specific reasons for each listing decision are clearly defined.

For most species, data that are valuable for evaluating extinction risk are deficient in one or more areas. It may not be possible to gather all relevant data for some species. Data collection may be costly or delaying action to gather all relevant data may place that species in greater danger of extinction. The IUCN system uses multiple criteria to accommodate this problem. Because meeting any one criterion is sufficient for listing, it is possible to list a species in a high threat category if sufficient data is only available for one criterion.

There is always some uncertainty involved in estimating extinction risk in the form of measurement error, probabilistic predictions, or semantic ambiguity. When this uncertainty is simplified for analysis, it is difficult to prevent human biases from entering the decisionmaking process. New methods have been developed that allow the evaluation of species according to the criteria of IUCN while objectively dealing with uncertainty in data. This allows efficient and non-biased classification of species of concern. However, such methods of dealing with uncertainty are applicable only to protocols that are based on objective, quantitative criteria, rather than subjective opinions.

To improve the Federal system under which threatened and endangered species are listed, it is essential that more explicit criteria and clear thresholds be incorporated, as in the IUCN system. There is a large amount of similarity in the nature of the factors considered under the USFWS and IUCN listing systems. A system similar to that of IUCN can easily be implemented in the United States, without requiring a change in the Endangered Species Act itself. Such a change will make the Act more efficient, objective, and science-based in dealing with the listing and delisting of threatened and endangered species.

STATEMENT OF JOHN D. ECHEVERRIA, DIRECTOR, ENVIRONMENTAL POLICY PROJECT, GEORGETOWN UNIVERSITY LAW SCHOOL

My name is John D. Echeverria. I am the director of the Environmental Policy Project and an Adjunct Professor at Georgetown University Law Center. The mission of the Environmental Policy Project is to conduct research and education on legal and policy issues relating to protection of the environment and conservation of natural resources. I appreciate the opportunity to testify today. In my testimony I will address three issues: (1) the proposal in the Administration's recent budget submission to Congress to effectively bar citizens from going to court to enforce certain provisions of the Endangered Species Act (ESA); (2) some of the likely difficulties and counter-productive consequences of seeking to advance species conservation goals through taxpayer-funded "incentive" programs; and (3) the value of critical habitat designations in furthering the objectives of the ESA.

CONGRESS SHOULD REJECT THE PROPOSED ESA "EXTINCTION RIDER"

The recent Administration budget submission to Congress includes a proposal to effectively bar citizens from continuing to go to Federal court to enforce deadlines in the ESA for the listing of threatened and endangered species and for the designation of critical habitat.[1] In my view this proposal is unwise for two reasons: first, it would undermine one of Congress' most valuable tools for ensuring that Federal agencies comply with the ESA and other environmental laws; and, second, it fails to address the most obvious solution to the growing volume of lawsuits being filed against the agencies: additional funding for the agencies so that they can perform their statutory responsibilities in timely fashion.

Environmental groups and others do not file lawsuits under the ESA simply because they believe it is in their self-interest to do so. Rather, they sue because Congress itself has specifically authorized and encouraged the filing these suits. Section 11(g) of the ESA provides in part "any person may commence a civil suit . . . to

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[1] The pertinent language, which some environmental advocates have called an "extinction rider," reads as follows: "That notwithstanding the specific timeframes and deadlines of section 4(a) and (b) of the Endangered Species Act of 1973, as amended, not to exceed $8,476,000 shall be used for implementing subsections (a), (b), (c)(1), (c)(2)(B)(iii) and (e) of section 4 for species that are indigenous to the United States, to be expended solely for (1) complying with court orders or settlements in effect as of the date of the passage of this law, and (2) undertaking such other actions as determined by the Secretary to be consistent with the priorities established by a listing priority system to implement these subsections and subject to the requirements of this appropriation."

enjoin any person, including the United States and any other governmental instrumentality or agency . . . who is alleged to be in violation of any provision of this chapter or regulation issued under the authority thereof." This so-called citizen-suit provision is similar to the citizen-suit provisions included in other major Federal environmental laws. *See*, *e.g.*, 33 U.S.C. 1365 (Clean Water Act citizen suit provision); 42 U.S.C. 7604 (Clean Air Act citizen suit provision).

It is important to emphasize that Congress has not authorized the filing of these suits on any of a variety of different, or potentially novel, legal theories. Rather, section 11 simply authorizes suit for "violations" of the ESA and ESA implementing regulations. Most citizen suits brought under the ESA involve entirely straightforward application of clear law to undisputed facts. In many cases, the legal issue presented is no more complicated than the question of whether a motorist has committed a parking meter violation.

The reason Congress has authorized these kinds of straight-forward lawsuits—in the Endangered Species Act and in many other laws—is because this type of litigation—or, equally important, the threat of such litigation—is an effective tool for ensuring that the agencies actually carry out the law as written. Congress has the opportunity to enact or thoroughly amend major statutes, such as the environmental laws, on a relatively infrequent basis. Over a decade has passed, for example, since Congress adopted major amendments to the ESA. On the infrequent occasions when Congress enacts major legislation, it is typically only after sustained public debate and focused congressional attention to the issues.

The difficulty frequently starts, as Congress has discovered through repeated, painful experiences, when the agencies begin to implement the legislation Congress has enacted. After legislation passes, public attention to an issue typically wanes. Coalitions of regulated businesses affected by new legislation typically lobby the agencies to delay its implementation or to adopt strained interpretations of the law that will lessen their regulatory burdens. These efforts are countered, to a limited degree at least, by environmental advocates, who attempt to speak on behalf of the broad public interest protected by the new law. Unfortunately, concentrated wealth and power frequently prevails over the broad public interest in this process. As a result, agency implementation of environmental laws all too frequently threatens to subvert the will of Congress, almost always in the direction of less environmental protection than Congress intended.

Citizens suits provide a solution to this problem. By empowering individual groups and citizens to directly enforce the law Congress has written, Congress creates an important check on the agencies' ability to subvert Congress' will. The goal is not to set up the courts as the arbiters of environmental disputes or to assign citizens groups around the country some special policymaking responsibility. Instead, the goal is simply to enlist our established judicial procedures and willing lawyers (motivated by a promise of attorneys fees if they bring a successful suit) in the effort to see that Congress' will is carried out. Ideally, the mere threat of successful litigation will prevent an agency from flouting the will of Congress and avoid the need for actual litigation.

The late Judge J. Skelley Wright, of the U.S. Court of Appeals for the D.C. Circuit, spoke eloquently about the issue of enforcement of environmental laws 30 years ago in a landmark case, *Calvert Cliffs Coordinating Committee, Inc.* v. *U.S. Atomic Energy Commission,* 449 F.2d 1109 (D.C. Cir 1971). Referring to the National Environmental Policy Act and other environmental legislation, he observed that "recently enacted statutes attest to the commitment of the Government to control, at long last, the destructive engine of material 'progress.'" The next step, he said, was to see that "important legislative purposes, heralded in the halls of Congress, are not lost or misdirected in the vast halls of the Federal bureaucracy." The citizen suit is Congress' most effective tool for ensuring that its objectives are not "lost or misdirected." The Administration's budget proposal, on the other hand, would encourage legal mandates to become lost or misdirected, weakening both the ESA and the authority of Congress.

In addition, the proposal in the Administration's budget submission fails to address one the most obvious and immediate causes of the growing volume of lawsuits being filed under the ESA. Environmental groups are in a position to sue over the failure of the government to list species and designate critical habitat because the agencies have a backlog of work that leads them to repeatedly violate their mandatory duties to carry out these steps under ESA. A major reason for these failures on the part of the agencies is a longstanding shortfall in funding to support the necessary scientific and other technical work. Congress could achieve significant progress in limiting the volume of lawsuits under the ESA by increasing appropriations to the agencies. As compared to the approach of eviscerating the citizen-suit provision, increased funding levels will allow Congress to reduce the volume of litigation against the agencies while simultaneously preserving an important tool to prevent agencies from ignoring congressional mandates.

THE POTENTIAL UNINTENDED CONSEQUENCES OF "INCENTIVES"

A great deal of attention has recently focused on the proposed use of financial payments to property owners—so-called "incentives"—as a complement, or possibly even as an alternative, to enforcement of the ESA. Financial incentives may have a potentially valuable, limited role to play in species conservation. In my view, however, the extensive use of incentive payments would create many difficulties and would likely be counterproductive to the goal of protecting and restoring threatened and endangered species.

First, according to some, expansive taxpayer-funded incentive programs can be justified on the ground that endangered species regulations routinely result in constitutional "takings" mandating the payment of compensation under the Takings Clause of the Fifth Amendment. Congress should agree up front to arrange payments to landowners subject to the ESA, according to this argument, to avoid the filing of takings claims by aggrieved property owners after the fact.

In reality, however, ESA restrictions rarely if ever result in constitutional takings. Indeed, while a number of takings claims have been brought under the ESA, I am not aware of a single case in which it has been definitively determined that a Federal ESA regulation has resulted in a taking. There are several explanations. First, the ESA is a relatively flexible law which rarely if ever produces the kind of severe economic impact that rises to the level of a constitutional taking. Second, wildlife has long been understood to be a public property resource which the public has broad authority to protect from harm or destruction. Because restrictions on an owner's actions that threaten wildlife prevent a trespass on public property rights such restrictions cannot logically be said to result in a taking of private property rights.

Second, the proposal to pay financial incentives to those subject to the ESA also raises significant questions of fairness, especially if the incentives would be funded out of general tax revenues. The value of land for development and for other forms of profitable exploitation reflects in large part the value-enhancing effect of public investments, from the public highway system to agricultural subsidies. Because a good deal of private property value is publicly created, an owner has no legitimate claim on the public fisc simply because he cannot exploit a property's full economic potential. A fairness problem also arises from the fact that a relatively small number of firms and individuals with large land holdings are likely to benefit the most from incentive programs. Approximately 125,000 timber or farm owners, less than two-tenths of 1 percent of all private landowners, own 38 percent of all the private land in the United States.[2] Timber and farm interests that amount to less than 3 percent of all landowners own more than 80 percent of all private land.[3] Thus, land owner incentive programs have a significant potential to create a significant new subsidy program for the relatively well-to-do at the expense of the ordinary taxpayer.

Finally, paying financial "incentives" to land owners has the potential to lead to over-investment in land the development of which could lead to endangered species problems. The ultimate goal of public policy should be to encourage investors to direct their attention to projects that avoid ESA (and other problems) rather in the direction of projects that can give rise to such problems. The ready availability of financial assistance to investors facing ESA problems would provide little incentive to investors to avoid investment opportunities that carry this type of risk. Ironically, therefore, financial assistance to landowners, while potentially useful in avoiding political conflicts in the short-term, could lead to more numerous and more serious clashes between development interests and ESA concerns over the long-term.

The nature of the problem can be illustrated in a number of ways. It is widely recognized that the availability of low-cost Federal flood insurance in flood plain areas, rather than protecting property in areas subject to flooding, has actually increased development in flood plains and exposed more property to the risk of flooding. In the view of some, International Monetary Fund bailouts of debtor nations, while useful in the short-term, have encouraged some nations to engage in too much borrowing and fiscal irresponsibility in the long-run. So too in the case of ESA incentives, by lowering the likely cost of investing in areas that present serious ESA problems, the availability of incentive payments could actually encourage investors

[2] See Environmental Defense Fund, "Why Takings Bills Threaten the Property Rights and Values of Most Landowners (1995)."
[3] Id.

to invest more in these areas, tending to exacerbate rather than reduce development conflicts.

As I suggested, this is not to indicate that financial incentives have no place in species conservation. In some cases, short of outright public acquisition of the property, the only way to achieve effective habitat management may to enlist the land owner as an active manager of land on behalf of the environment. The rather special case of managing woodpecker habitat in North Carolina, for example, provides an example of where public payments to enlist land owner cooperation may be useful and necessary. But in the general run of cases, where the basic issues are whether natural habitat can be destroyed for development, additional water withdrawn for irrigation or other purposes, or additional trees cut for commercial purposes, taxpayer-funded payments to landowners who face ESA problems are more problematic.

At a minimum, these concerns about the potentially perverse effects of incentive payments warrant caution in the design of incentive program. For example, a stronger case can be made for incentive payments to the subset of owners who can demonstrate that the enactment and implementation of the ESA seriously disrupted settled development plans than to investors who now or in the future make investments in the face of foreseeable ESA problems. Limiting incentive payments to owners whose plans have been significantly disrupted by new legal enactments would have the twin advantages of focusing financial assistance on those owners likely to have the strongest equitable claims to public financial assistance while simultaneously sending a clear message that such assistance will not be made available to owners who voluntarily make an investment in the face of known environmental problems.

THE VALUE OF CRITICAL HABITAT DESIGNATIONS

Finally, I wish to offer a brief word in favor of critical habitat designations and of the current legal requirement that critical habitat be designated concurrently with the identification of a species as threatened or endangered.

In the view of some, critical habitat designation is superfluous because it adds little to the legal mandates to avoid "jeopardy" to species under section 7 of the Act or to avoid a "take" of a species under section 9. In a sense this is a fair and accurate statement because a Federal agency likely can halt or control any activity based on section 7 or 9 which would adversely affect critical habitat. The critical role of habitat designation—and the reason Congress included separate proscriptions in section 7 against jeopardizing species and destroying critical habitat—is that it serves to constrain agency discretion. In practice, both the terms "jeopardy and "take" are rather elastic. The agencies therefore have a fair amount of discretion in applying these terms in particular cases. Certainly the courts are compelled to accord substantial deference to an agency's determination that a particular action will not jeopardize a species or produce an illegal take. By contrast, once critical habitat is defined and drawn on a map, the ESA's relatively clear prohibitions against actions that would result in the "destruction or adverse modification" of critical habitat presents a fairly straightforward obligation for the agencies to follow and for the courts to apply. For the reasons discussed above, there are compelling reasons to believe that the agencies, subject to constant pressure from the regulated community, will fail over time to carry out their ESA obligations as Congress intended. An enforceable command to the agencies to promptly designate and protect critical habitat helps ensure that Congress' ESA goals will actually be achieved.

The concern has been expressed that the requirement to designate critical habitat imposes an unreasonably heavy burden on the Agency at a point in time when it has only begun to identify the threats to the species and to devise a recovery strategy. However, the Act makes clear that the initial designation need not be definitive. The Act directs the Agency to rely on the "best scientific and commercial data available" and explicitly indicates that an agency may "from time-to-time . . . revise . . . [the] designation."

Furthermore, an agency is directed to take into consideration "the economic impact, and any other relevant impact, of specifying any particular area as critical habitat." Thus, an agency has wide latitude in selecting the factors to apply in designating critical habitat. Given the significant flexibility built into the Act, it cannot reasonably be said that the habitat designation requirement imposes an unreasonable strait jacket.

Thank you for the opportunity to testify. I would be happy to respond to any questions.

STATEMENT OF STEVEN P. QUARLES ON BEHALF OF THE AMERICAN FOREST & PAPER ASSOCIATION AND THE QUADSTATE COUNTY GOVERNMENT COALITION

My name is Steven P. Quarles. I am counsel to, and appearing on behalf of the American Forest & Paper Association (AF&PA) and the QuadState County Government Coalition. AF&PA is the national trade association representing the forest products industry. It has more than 130 member companies that grow, harvest, and process wood and wood fiber and manufacture a wide variety of products including pulp, paper, paperboard and wood products. AF&PA has more than 60 association members that represent all facets of the forest products industry and represent more than 10,000 companies. AF&PA's member companies, as a condition of membership, must also commit to conduct their business in accordance with the principles and objectives of the Sustainable Forestry Initiative (SFI)SM program. QuadState County Government Coalition is a coalition of six counties in the four States that share portions of Mojave and Colorado Deserts—Mojave County in Arizona; Imperial, Kern and San Bernardino Counties in California; Lincoln County in Nevada; and Washington County in Utah. The Coalition's principal concern is the effect of the listing of the Mojave population of the desert tortoise on its member counties' economic and revenue bases, their public works, and the businesses and properties of their constituents.

The topic to which the subcommittee has devoted this hearing is timely and significant. Individual determinations or "listings" of species to be endangered species or threatened species ("listed species") under the Endangered Species Act ("ESA") have frequently been contentious because the stakes are high; imposed with the listings is the full panoply of the ESA's controls over human behavior to benefit the listed species. However, for most of the ESA's life span of nearly three decades, the general process (and the underlying science and law) of listing species as endangered species or threatened species has not garnered the same degree of controversy, or at least attention, as many of the other processes and decisions under that Act.

Controversy over and attention to the species' listing process are now at hand, however—triggered by recent actions of both the Clinton and Bush Administrations. On November 17, 2000, FWS Director Jamie Clark announced that the Agency lacks sufficient funds to conduct any species' listings, including responding to any listing petitions, in fiscal year 2001 beyond those mandated by court order. This Clinton listings moratorium was followed by a legislative proposal in President Bush's budget to waive for fiscal year 2002 the ESA's statutory deadline for species listings (and designations of critical habitat) and to limit use of the available funding to implementing already issued court orders and those listings (and designations) the Secretary of the Interior in her discretion determines to be important. Both the Clinton moratorium and the Bush budget language, if enacted, should spawn litigation and enlist the judiciary in the intensifying species' listing controversy.

My topic will focus on one issue: the overbroad definition of "species" eligible for listing under the ESA. In particular, I will emphasize the authority to list distinct population segments of vertebrates, efforts by Congress to determine the use of that authority, and how that authority has been abused by the ESA-implementing agencies (the U.S. Fish and Wildlife Service ("FWS") and the National Marine Fisheries Service ("NMFS") (collectively, the "Services)). The Services' abuse of the distinct population segment concept has resulted in the expansion of their species' listing authority well beyond the expectations of Congress and, in particular, this committee, and the infiltration of the concept into other ESA decisionmaking processes for which it was not authorized or intended. I conclude with suggestions on ways Congress, in this time of funding scarcity, could limit the applicability of the distinct population segment concept for listing vertebrate species—a concept that provides the least amount of protection for genetic heritage, a principal purpose of the ESA.

BACKGROUND

The ESA only permits the Services to list an endangered species or threatened species if it is a "species" unit as defined by ESA § 3(16), and only if that "species" unit meets the definitions of "endangered species" or "threatened species" in ESA § 3(6) and 3(20) which requires a degree of risk over a "significant portion of [the] range" occupied by the species unit. 16 U.S.C. §§ 1532(6) and (20), 1533(a)(1) (FWS shall "determine whether any species is an endangered species or threatened species"), (a)(2), (a)(3), (b)(1), (b)(3)(A), and (b)(6)(A) (final "determination as to whether a species is an endangered species or a threatened species").

The ESA defines the crucial term "species" in an unusual way. An ESA-listable "species" unit includes not only a true biological species (those individuals that can interbreed and produce viable offspring), but also a recognized "subspecies of fish or wildlife or plants," and—in the case of a vertebrate species—"any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature" ("DPS"). 16 U.S.C. § 1532(16).

The ESA listing of any "species" unit has adverse consequences for private and public land uses within the range of that species. ESA § 9 and regulations prohibit the "take" of almost all listed wildlife species—the "take" prohibition bars any economic land use which would inadvertently harm even one member of that wildlife species. See 16 U.S.C. § 1538(a)(1); 50 C.F.R. §§ 17.3 and 222.102; *Babbitt* v. *Sweet Home Chapter of Communities for a Great Oregon*, 515 U.S. 687 (1995). Further, federally-assisted actions cannot be approved until an ESA § 7 consultation procedure has been completed, and must be disapproved if the action is likely to jeopardize the existence of the listed species unit. See 16 U.S.C. § 1536.

Each of the three branches of government has treated the authority to list distinct population segments of vertebrates in a strikingly different manner. If the analogy were to ships, two of the branches—Congress and the Executive—have passed in the night sailing in opposite directions; the third—the Judiciary—has never left port. Since the ESA's enactment, Congress has made several efforts to reduce, met by countervailing efforts of the Services to expand, the scope of listings below the subspecies level. The Federal courts have rarely been asked to pass judgment on these opposing efforts.

CONGRESSIONAL EFFORTS TO CONSTRAIN LISTINGS OF DISTINCT POPULATIONS

Distinct population segments did not enjoy protection under the ESA's predecessors. The Endangered Species Preservation Act of 1966 referred only to "species"; "subspecies" were added in the Endangered Species Conservation Act of 1969. The ESA's first attempt to provide protection to species units below subspecies was quite liberal. As enacted in 1973, the ESA defined "species" to "include[] any subspecies of fish or wildlife or plants and any other group of fish or wildlife of the same species or smaller taxa in common spatial arrangement that interbreed when mature."

Contrary to popular belief, many of the populations of charismatic megafauna that have been designated as endangered or threatened species were listed under this early, quite generous "common spatial arrangement" standard-less standard. These include species, such as the grizzly bear and bald eagle, that may have been rare in the lower 48 States but are common in Canada and Alaska. The listing documents made no attempt to demonstrate any degree of distinctness between the lower 48 species unit and the northern species unit; instead, they readily admitted that the two species units were not reproductively segregated and had no genetic or other biological differences. Moreover, the FWS made no effort to determine whether these "species" were suffering declines in Canada (or, for that matter, in the rest of the United States, *i.e.*, Alaska). Indeed, as one author noted, the FWS engaged in the ludicrous fiction of "defin[ing] the grizzlies' entire range as the lower 48 States even though it was obviously well aware that grizzlies existed in Canada and Alaska." (Daniel Rohlf, "There's Something Fishy Going On Here: A Critique of the National Marine Fisheries Service's Definition of Species Under the Endangered Species Act", 24, Envtl. L. 617, 653 (1994).)

By 1978, Congress had had second thoughts about this loose "common spatial arrangement" authority for species' listings. To restrict sub-subspecies listings, Congress amended the ESA by replacing the original definition of species with the present definition and its DPS language. Criticism continued, however; none more withering than that of the General Accounting Office ("GAO"). In 1979 testimony before this committee and a report, the GAO raised concern over any loose definition of a "distinct population" in what has become the well-known squirrels-in-the-park analogy. The Agency stated that the definition:

> permitted FWS to list populations of species, regardless of their size, location, or total numbers. Thus, squirrels in a specific city park could be listed as endangered, even though an abundance of squirrels lived in other parks in the same city and elsewhere. . . . Such listings could increase the number of potential conflicts between endangered and threatened species and Federal, State, and private projects and programs. . . . However, the purpose of the Endangered Species Act is to conserve endangered and threatened species and their critical habitats, not preserve every individual animal and plant.

Endangered Species—A Controversial Issue Needing Resolution 52, 58 (GAO Rep. CED–79–65, 1979). Although the particular quote referred to the 1973 "species" definition, two lawyers and a scientist from NMFS pointed out in a law review article that subsequent GAO statements indicated the same concern was relevant to the revised 1978 "species" definition. (Karl Gleaves, Michael Kuruc, Patricia Montanio, "The Meaning of 'Species' Under the Endangered Species Act," 13 Pub. Land L. Rev. 25, 31, n.30 (1992).)

This committee took note of the GAO's criticism (even if it viewed the problem as FWS's interpretation of the statutory definition) and the GAO's suggestion that the authority to list DPSs be deleted from the ESA. However, after FWS and others emphasized the importance of the listing flexibility afforded by the DPS portion of the "species" definition, this committee decided to retain that definition in the 1979 ESA amendments and issue a stern admonition to the Services to use the DPS listing authority "sparingly":

> [T]he General Accounting Office recommended that the subcommittee consider an amendment to the definition of species currently contained in the Act which would prevent the FWS from listing geographically limited populations of vertebrates as threatened or endangered. It is the GAO's contention . . . that FWS has interpreted the term "species" to include any population of the animal, regardless of its size, location, or total numbers. According to the GAO, this could result in the listing of squirrels in a specific city park, even if there is an abundance of squirrels in other parks in the same city, or elsewhere in the country. . . . *[T]he committee is aware of the great potential for abuse of this authority and expects FWS to use the ability to list populations sparingly and only when the biological evidence indicates that such action is warranted.*

S. Rep. No. 151, 96th Cong., 1st Sess. (1979) at 6–7 (emphasis added).

THE SERVICES' UNRESTRAINED USE OF THE DISTINCT POPULATION SEGMENT LISTING AUTHORITY

Contrary to the "sparingly" stricture of this committee, the Services have been more *unsparing* in their use of the DPS listing authority. They produced two documents purportedly defining and confining their DPS authority—NMFS's "Policy on Applying the Definition of Species Under the Endangered Species Act to Pacific Salmon," 56 Fed. Reg. 58612 (Nov. 20, 1991), which established the DPS concept of "evolutionarily significant unit" ("ESU"), and the Services' joint "Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act", 61 Fed. Reg. 4722 (Feb. 7, 1996). Both documents quoted, and paid lip service to, this committee's "sparingly" admonition. However, the Services' actual performance in listing DPSs is clear evidence that their DPS policies do nothing to limit and, arguably, substantially expand the authority to list DPSs.

According to a draft manuscript prepared by the Pierce Atwood law firm for an upcoming edition of the American Bar Association's *Natural Resources and Environment* magazine, since the existing "species" definition was added to the ESA in 1978, 59 DPSs have been listed by the Services, with the precise number dependant upon interpretation of decisions that, initially, did not always clearly identify the listings as DPSs. I suspect that there could be vigorous debate over whether 59 DPS listings in 22 years represents sparing use of the DPS listing authority. But once the trend—a rapid increase in DPS listings in the last several years—is examined, the nays should have it. The pace of DPS listings was relatively constant for the first 17 years (7 in 1978–1985; 6 in 1986–1990 (including NMFS' first listing of a West Coast salmonid DPS); and 8 in 1991–1995). From 1996 through 2000, the Services have listed 38 DPSs, more than quadrupling the number of listings of the previous 5 years. This trend can be expected to continue; about 35 DPSs are currently involved in rulemaking processes.

By contrast, despite the existence of the Services' two policies which ostensibly were to bring rigor to the DPS listing process, the Pierce Atwood authors could find only 13 instances over the past 22 years when either of the Services concluded that a particular population did not qualify as a DPS (excluding instances where DPS status was denied for delisting purposes and where a DPS existed but was not listed for conservation reasons). The Services have concluded that species units have qualified as DPSs more than 80 percent of the time. These statistics suggest that the Services rarely determine that a species unit—identified by petitioners or by themselves—does not qualify as a DPS, notwithstanding Congress' admonition to use the DPS listing authority "sparingly."

REASONS FOR THE LIBERAL USE OF THE DISTINCT POPULATION SEGMENT LISTING AUTHORITY

How did this frequent use of the DPS listing authority happen in the face of the Congressional caution? I can think of at least three reasons.

1. *No scientific agreement on the DPS concept.* In general, common and consistent scientific understanding and usage of any units below the species level is absent.

As one scientist put it: "The discussion of what makes a subunit within a species, be it a subspecies, race, ecotype, variety, or stock is such a durable source of dispute among systematic biologists that scientific consensus may never be achieved." (Robert Taylor, "Biological Uncertainty in the Endangered Species Act," 7 Natural Resources and the Environment 6 (1993).)

This scientific uncertainty becomes more severe at the DPS level. In the preamble to their 1996 joint DPS policy, the Services stated: "Available scientific information provides little specific enlightenment in interpreting the phrase 'distinct population segment.' This term is not commonly used in scientific discourse, although 'population' is an important term in a variety of contexts." 61 Fed. Reg. 4722. With so little common scientific understanding of, or agreement on, the term DPS, it is too easy for the Services to use "the best scientific and commercial data available", as required by ESA § 4(b) for listing decisions, to reach whatever conclusion they may wish. 16 U.S.C. § 1533(b)(1)(A). A committee of the National Research Council, in a 1995 report commissioned by Members of Congress, while supporting a population listing concept of its own devising ("evolutionary unit"), admitted that even the one criterion everyone—Congress, the 1991 NMFS policy, and the (later) 1996 joint Services' policy—could agree on for a listable population—"distinctness"—is as much a matter of judgment as science:

> The most difficult questions generally arise at taxonomic levels below the subspecies level. Because evolutionary units at such levels are not discrete but exist along a continuum, it is a policy *judgment as well as a scientific judgment* to determine the significance of an evolutionary unit. . . . [S]cience alone does not lead to a conclusion that any objectively definable degree of distinction is more significant than another.

National Research Council, *Science and the Endangered Species Act*, 56 (1995) (emphasis added).

In other words, DPS is in the eye of the beholder.

2. *The DPS policies of the Services are riddled with discretion.* Certainly, an important purpose of the Services' two DPS policies was to provide a measure of scientific rigor to the DPS decisionmaking in the listing process. The fact is they only pretend to do so. As one critic wrote about the more thoroughly analyzed and justified 1991 NMFS policy:

> Much like the Wizard of Oz employed smoke and mirrors to lend him an air of might and wisdom, NMFS invokes science in an effort to portray its definitions of distinct populations eligible for listing as beyond question. When one looks behind the curtain, however, it becomes apparent that NMF's ESU policy merely trades the discretion inherent in historic approaches to listing populations for a more technically complex but equally discretionary scheme. The tremendous discretion inherent in NMFS' ESU policy stems from two related sources: scientific uncertainty and extremely imprecise definitions of the two ESU criteria: reproductive isolation and whether a population represents an important component in the "evolutionary legacy" of a species. (Rohlf at 644.)

When the Pierce Atwood authors reviewed the broader, less fully explained 1996 joint DPS policy, they found so much discretion that they concluded: "We are, in other words, back to the listing of squirrels in the city park."

With this amount of discretion, the eyesight of the beholder can be quite poor, and yet suffice.

3. *Neither Congress nor the courts have provided helpful guidance.* The Service's discretion in designating DPSs is unconstrained by any useful legislative or judicial direction. Congress has chosen not to define DPS, and the "legislative history provides some discussion of the concept but provides no specific guidance. It is probably safe to conclude not only that the meaning of 'distinct population' is ambiguous, but also that Congress has not directly addressed or resolved this precise question." (Gleaves at 37–38.) The preamble to the 1991 NMFS policy concurs that "NMFS does not believe that the intent of Congress is clear as to the meaning of 'distinct population.' The ESA allows vertebrate populations that are 'distinct' to be considered 'species,' but does not explain how distinctness should be measured." 56 Fed. Reg. 58613. Few courts have addressed, and none has provided a significant decision on, the meaning and application of the DPS concept.

EXAMPLES OF MISUSE OR ABUSE OF THE DISTINCT POPULATION SEGMENT CONCEPT IN LISTING DECISIONS

The list of methods by which the Services expand their DPS listing authority by misuse or abuse of that authority could be lengthy. I will mention only three:

1. *Designation of DPSs by political boundaries.* In the early days, the Services listed species populations by international borders (*e.g*., grizzly), by State borders (*e.g.*, bald eagles), and even by parishes (American alligator). Today, the Services typically eschew State and local boundaries for DPS listing purposes, but still adhere in their joint 1996 policy to the notion that national boundaries are perfectly permissible means of delineating DPSs. As I have noted, when the national border of the lower 48 States is used, the Services typically make no attempt to determine any reproductive isolation of, or other distinctness for, the U.S. portion of the multinational population, nor do they make any effort to learn the status of the portion of the population across the border (which is often abundant) or the other country's management regime for that population portion. All too often, this is little more than species jingoism—a fervor to claim citizenship for as many species as we can. Moreover, since the Services ignore whether the species with the lower 48 DPSs are abundant in Alaska, they appear to side with the Seward's Folly crowd that preferred the State to remain in foreign ownership or, at a minimum, they wish to restore a biological form of territorial status to our 49th State.

Unfortunately, Congress is complicit here. In 1973 and again in 1979, House and Senate reports expressed their intent to allow the Services to list domestic populations of species whose principal ranges are in another country, asserting (in the Senate report) that "the U.S. population of an animal should not necessarily be permitted to become extinct simply because the animal is more abundant elsewhere in the world." H.R. Rep. No. 412, 93d Cong., 1st Sess. 10 (1973); S. Rep. No. 151, 96th Cong., 1st Sess. 7 (1979); quoted in Rohlf at 628–629.

Many scientists emphatically disagree. Unless the U.S. population is both reproductively isolated and biologically significant, both the National Research Council in its 1995 report and NMFS in its 1991 DPS policy found that there were no "sound scientific reasons" to delineate populations by political boundaries. NRC Report at 58; 56 Fed. Reg. 58613.

2. *Designation of DPSs that are not reproductively isolated.* One would have thought that an easy call for a criterion (but admittedly not always an easy matter of scientific proof) to determine a "distinct population segment" would be that the population must be reproductively isolated. After all, the plain ESA language connotes reproductive isolation. A population is "distinct" if it is separate from other members of the same biological species. A population develops "distinct" characteristics if it has a separate gene pool. The ESA phrase "population . . . which interbreeds when mature" suggests a population which interbreeds among itself but not with other populations. The NMFS lawyers and scientist in their law review article concur that this is the plain meaning of "distinct population":

> A common dictionary definition of "distinct" is "separate" or "apart from." In addition, as a biological term, "population" includes the idea of reproductive isolation or separation. (Gleaves at 46.)

However, in their continual search for discretion, the Services have all but discarded the necessity to find reproductive isolation. For example, the 1991 NMFS policy states that the first criterion for delineating a DPS is that the Pacific salmon stock "must be *substantially* reproductively isolated from other conspecific population units" and declares that the "first criterion, reproductive isolation, *does not have to be absolute,* but it must be strong enough to permit evolutionarily important differences to accrue in different population units." 56 Fed. Reg. 58618 (emphasis added). The Services' joint 1996 policy weakens the reproductive isolation factor further. The policy does demand that the DPS be "markedly separated" but this can be as a result of "physical, physiological, ecological, or behavioral factors." And, once again, "the standard *adopted does not require absolute separation* of a DPS from other members of its species. . . . The standard adopted is believed to allow entities recognized under the Act to be identified *without requiring an unreasonably rigid test for distinctness." 61 Fed. Reg. 4725, 4724 (emphasis added).*

As one observer put it: "FWS has likewise waffled on the importance of genetic make-up in distinguishing between population segments. Predictably, the Agency cited the presence or absence of genetic distinctiveness in instances in which it found reproductive isolation to be important, and downplayed genetics in cases where it had made listing decisions despite a lack of such isolation." (Rohlf at 657.)

3. *Designation of DPSs by disregarding the ESA's definition of "species" and relying instead on the ESA's definitions of "threatened species" and "endangered species."* In at least one listing of a population, the FWS abandoned any attempt to find any "distinct" quality to the population segment. It could not. It admitted the three-State population of Marbled Murrelets it wished to list was not reproductively isolated or particularly biologically distinct from the Canadian population. Therefore, it looked away from the statutory definition of species and DPSs, and, instead, dis-

covered helpful language in the ESA's definitions of "endangered species" and "threatened species." 16 U.S.C. § 1532(6) and (20). FWS adopted an entirely different and certainly clever approach to defining DPSs by suggesting that the "significant portion of its range" language in both the "endangered species" and "threatened species" definitions could be made to serve as a means to delineate distinct populations without the need to demonstrate reproductive isolation or genetic or other differences. If this approach is followed in future listings, any population segment of any relative size could qualify for listing and the statutory requirement that the population be "distinct" will be sapped of all meaning.

THE SERVICES HAVE INAPPROPRIATELY "RE-LISTED" SMALLER SPECIES UNITS, OFTEN AS THE DISTINCT POPULATION SEGMENTS, IN DECISIONMAKING UNDER OTHER SECTIONS OF THE ESA

I would also like to bring to the committee's attention our view that the Services are inappropriately redefining species units after their listing into smaller species units in decisionmaking under sections of the ESA other than the ESA § 4 listing section.

The ESA is quite clear that ESA § 7 compliance, ESA § 4(f) recovery plans, and species delistings decisions are to be made with reference to the same "species" unit that has been listed. See 16 U.S.C. §§ 1533(f), 1536(a)(2) and (b). Yet, in the case of the red-cockaded woodpecker ("RCW") and in several other instances where the Services have listed a biological species, they are assessing ESA § 7 compliance not with reference to jeopardy to the listed biological species as a whole, but jeopardy to smaller subgroupings, such as an individual population of RCWs. This approach makes it far more likely that a localized action will be found to jeopardize a localized population and to violate ESA § 7. We believe that this approach is unlawful under the ESA, is contentious, and should be discontinued.

There has also been unwarranted "population creep" into ESA § 4(f) recovery planning and species' delisting actions. In several instances, where the FWS or NMFS has listed a larger "species" unit (*e.g.*, the Mojave population of desert tortoises or grizzly bears in the lower 48 States), the Agency has subdivided that "species" unit for delisting purposes into smaller populations. These new multiple populations were, of course, designated without the formal rulemaking required for the listing of the original all-encompassing population (grizzly) or DPS (desert tortoise). The affected public was deprived of all the procedural protections of Administrative Procedure Act rulemaking which the ESA promised in its § 4 listing provisions. 16 U.S.C. § 1532(a)(1). Moreover, this division of the listed species, subspecies, or populations into smaller populations, often renamed with such titles as "recovery units," likely extends the time for delisting. For example, if five recovery units/mini-populations are designated in the recovery plan and four out of the five meet recovery plan standards for recovery, the FWS or NMFS likely could conclude that the entire listed population should be delisted. But, under the Services' practice, the Agency would de-list only the four recovery units/mini-populations and leave ESA burdens in place for the remaining recovery unit/mini-population. And, that listing could last for a very long time because, in most instances where this practice has been followed, at least one of the recovery units/mini-populations has little chance of ever recovering.

The desert tortoise rendition of this practice is particularly interesting for another reason. After listing the Mojave population of the desert tortoise in 1990, the FWS divided that DPS into 6 smaller DPSs termed "evolutionarily significant units" in the 1994 recovery plan. *FWS, Desert Tortoise (Mojave Population) Recovery Plan*, June 1994, p. 19. NMFS formally adopted use of ESUs in its 1991 DPS policy for Pacific salmon. But, FWS has never adopted, or invited public comment on application of, such a policy for the terrestrial species within its jurisdiction. Instead, it applied another agency's standard for certain anadromous fish to the tortoise. This isn't "population creep," its more of a "population scramble."

CONGRESS SHOULD CONSIDER AMENDING THE ESA SO THAT IT PROTECTS ONLY AN IMPERILED BIOLOGICAL SPECIES, OR TO CREATE A PRESUMPTION AGAINST LISTINGS BELOW THE TRUE SPECIES LEVEL, AND TO LIMIT THE USE OF SPECIES ELSEWHERE IN THE ESA TO THE FORM OF SPECIES ACTUALLY LISTED

If the local government and land use interests regulated by the ESA had been fully engaged when the ESA's broad definition of "species" was adopted in 1973 and then narrowed somewhat in 1978, they likely would have preferred that the ESA simply define a "species" as a recognized biological species. That definition would eliminate the trivialization of the ESA that occurs when the Services list and create ESA compliance burdens for a subspecies or distinct population which is locally rare, even though the biological species as a whole is not imperiled. It also both would address the concerns raised by the Clinton listing moratorium and Bush budget's legislative proposal by conserving the Services' resources and would conform with the original legislative intent to: (1) protect the "genetic heritage" associated with a species' unique gene pool, while (2) realizing that "it is beyond our capability to acquire all the habitat" needed by locally rare populations "without at the same time dismantling our own civilization." H.R. Rep. No. 93–412, at 4–5 (1973).

Indeed, in 1978, the House of Representatives voted to limit the ESA to a biological species. The full House adopted Representative Duncan's amendment defining "species" consistent with its biological usage (a group of "physically similar organisms capable of interbreeding but generally incapable of producing fertile offspring through breeding with organisms outside this group"). 124 Cong. Rec. 38154–56 (Oct. 14, 1978). Rep. Duncan stated:

> The legislation before us today is entitled, and I think this is important, "the Endangered Species Act." It is not entitled, and I think this is important, . . . "An Endangered Subspecies Act," or the "Endangered Variation-of-a-Species Act." The amendment preserves, again, the integrity of the legislation while sufficiently tightening up the definitions so that we do not afford protection of this legislation, to the detriment of man, to every individual creature on the face of the Earth that might differ in one degree or another from one of its brothers.

124 Cong. Rec. 38154.[1]

However, given the history of ESA listings of subspecies and distinct population segments of vertebrate species, we suspect that removal entirely of the listing authority for either subspecies or DPSs would be a difficult undertaking. We also, as suggested by the focus of my testimony, find far more troublesome the sub-subspecies listing authority than the subspecies listing authority.

I would therefore suggest, as a possible alternative, that the ESA could be amended to: (1) require the Services to list a species or subspecies if it is biologically threatened or endangered; but (2) grant the Services the discretion to list or not list a DPS. Indeed, it may be appropriate for Congress to state a presumption, or default position, that DPSs should not be listed under the ESA, and to require the Services to provide judicially reviewable reasoning if they decide to list such variations-of-a-species. This committee suggested such a presumption when its report on the 1979 ESA amendments stated that:

> the committee is aware of the great potential for abuse of this authority and expects FWS to use the ability to list populations sparingly and only when the biological evidence indicates that such action is warranted.

S. Rep. No. 151, 96th Cong., 1st Sess. (1979) at 6–7.

However, the ESA as written arguably requires the listing of any "species" unit (be it a biological species, a subspecies, or a distinct population segment of a vertebrate species) if that species unit is biologically endangered or threatened over a significant portion of its range. See 16 U.S.C. §§ 1532(6), (16) and (20), 1533(a) and (b)(1). Congress could remove these nagging questions on the Services' discretion to not list a DPS by amending the ESA to clearly make listing at the population level discretionary and to provide in the form of a statutory command its previous committee report admonition that such listing authority be exercised only "sparingly."

Finally, I would urge the committee to put an end to the inappropriate "population creep." The Services should be directed to determine ESA § 7 compliance, prepare ESA § 4(f) recovery plans, and conduct ESA § 4 delistings on the basis of the same "species" units that have been listed under ESA § 4.

STATEMENT OF STEVEN N. MOYER, VICE PRESIDENT OF CONSERVATION PROGRAMS, TROUT UNLIMITED

Mr. Chairman, members of the subcommittee, I appreciate the chance to appear today to give you the views of Trout Unlimited (TU) on the listing and delisting processes of the Endangered Species Act (ESA).

TU is a national fisheries conservation group dedicated to the protection and restoration of our Nation's trout and salmon resources, and the watersheds that sustain those resources. TU has over 130,000 members in 500 chapters in 38 States.

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[1] Though the House passed Rep. Duncan's amendment, he was not named to the Conference Committee. The conferees reinserted the "species" definition that had been reported by the House Committee.

Our members generally are trout and salmon anglers who voluntarily contribute substantial amounts of their personal time and resources to aquatic habitat protection and restoration efforts. Because of the declining populations of native trout and salmon in many areas, our members increasingly rely on provisions of the ESA to protect trout and salmon and their habitats. TU supports the ESA and considers the ESA to be one of the Nation's most important laws for protecting and restoring trout and salmon populations.

The subcommittee has asked our views on the listing and delisting processes of the ESA. To summarize, TU believes that the listing and delisting processes, as written in the law, are fundamentally sound. Implementation of the processes by the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) is slowed unacceptably because of huge listing backlogs and insufficient funding. Implementation of the listing process clearly needs to be improved, but in our view, the solution to the problem is not to weaken the process legislatively or administratively, but rather it is for the Bush Administration to propose, and Congress to appropriate, additional funding for listing. In our experience, applying sound science to listing and delisting decisions is not a substantial problem. If anything, the Services bend over backwards to check the science and give interested parties a thorough chance to comment on it.

We understand that there is considerable concern about the amount of litigation over species listing and designation of critical habitat. However, we don't support the current Bush Administration proposed solution to, among other things, restrict citizen lawsuit enforcement of listing deadlines. Simply restricting—or slowing down—the listing process could jeopardize a number of species that should be listed, such as the California golden trout, which is faced with extinction. Finally, we must take the opportunity to urge the subcommittee to get at the root problem of insufficient funding and support conservation initiatives which would actually reduce the need to list species, for example pass the Conservation and Reinvestment Act and Fishable Waters Act, and provide more funding for conservation programs under the Farm bill.

THE ESA LIST IS GETTING LONG, AND ESA IS GETTING MORE CONTROVERSIAL, IN LARGE PART DUE TO DECLINING FISH AND OTHER AQUATIC POPULATIONS AROUND THE NATION

If the subcommittee is looking for root causes of listing problems, consider these facts. Fish and other aquatic species are in bad shape in many places in the United States. A recent American Fisheries Society study found that over one third of all aquatic species are endangered or imperiled. The Forest Service's Forest Ecosystem Management Assessment Team (FEMAT) Report explicitly highlighted the fact that more than 100 stocks of Pacific salmon have become extinct since European settlement of the West, and emphasized that 314 stocks just within the range of the spotted owl were at risk of extinction.

Populations of species that are vital to sport and commercial fisheries are reaching threatened and endangered status. *Thirty-three salmonid species have already been listed (see attached list)*, including Atlantic salmon from the rivers of Maine, the bull trout of the intermountain west, and numerous stocks of Pacific salmon. Increasingly, the success of the ESA will be linked to the fate of these once-abundant sportfish species, especially the salmonids of the western United States.

THE ESA LISTING AND DELISTING PROCESSES ARE FUNDAMENTALLY SOUND AS WRITTEN IN LAW AND DO NOT NEED MAJOR REVISION

In the ESA, Congress wisely stated that the decisions to list or to de-list species are to be based solely on the best available science. In reality, there can be no other standard. The decision to list is, and should be, a question of biology, not politics or economics. Once a species is listed, there is flexibility in other parts of the Act, for example, in Section 10, which allows the taking of endangered species by private landowners pursuant to habitat conservation plans. Where conflicts between species and economic activity rise to regional or national significance, there is an exemption provision.

In our experience, the Services generally have used this authority appropriately. We have had disagreements with the agencies over their interpretations of science pertaining to listing, but in the main they have done a respectable job. If anything, the thoroughness with which the Services have conducted their scientific reviews has sometimes made the listing process frustratingly slow. For example, it took the Services 5 years to complete the listing of Atlantic salmon in part because of the rigorous scrutiny they applied to salmon genetic data and studies. During this time salmon numbers have plummeted to an estimated 200 to 300 wild fish.

Similarly, ESA's mandate to protect distinct population segments is a wise, essential conservation tool, especially for species such as trout and salmon, which consist of an array of populations, like fibers in a tapestry, that give resilience and strength to species. These populations provide the genetic fitness that species need to survive the vagaries of weather, environmental changes, and human-contrived obstacles that threaten them. The individual trout and salmon populations, which are the evolutionary legacy of species adaptation to site-specific habitat conditions, each contain the ingredients necessary for overall species survival. From a biodiversity and long-term species persistence standpoint, native salmon, steelhead, and resident trout at the population and sub-population level are irreplaceable.

Therefore, it is entirely appropriate to review the current endangered species list and to find 9 chinook Evolutionarily Significant Units (ESUs) and 10 steelhead ESUs. The ESU is NMFS' attempt to manage the ESA distinct population segment mandate in a practical way that is biologically defensible. Conservationists would generally like to see NMFS segment-out distinct populations within each ESU even more so than they have done. Conservationists were critical of NMFS' lumping of Snake River winter and spring runs into one ESU when that determination was made in 1992, for example. But while we don't always agree and we will continue to debate the biological and legal merits of these issues, we respect that the agencies have a difficult job in making these decisions and they are trying hard to do them well.

IMPLEMENTATION OF THE LISTING PROCESS NEEDS IMPROVEMENT, BUT THE ANSWER IS MORE FUNDING AND MORE AGGRESSIVE TACKLING OF THE BACKLOG, NOT RESTRICTING CITIZEN ENFORCEMENT OF DEADLINES

In our view, the most relevant listing issue is not inadequate or flawed scientific basis for listing decisions, but rather inadequate funding to get species listed that need the help that only the ESA can provide. In its fiscal year 2002 budget justification proposal, the FWS provides helpful detail about the bind it is in regarding court ordered steps in the listing process, its failure to address the listing needs of some species not in the court-ordered pipeline, and the limited funding it has to address its needs. Unfortunately the solution offered by the Agency and the Bush Administration is a mere $2 million funding increase to a wholly inadequate $8 million base budget for listing, and a plan that would among other things limit the ability of conservationists to go to court and enforce mandated ESA deadlines to save species.

The answer is not to limit access to courts but rather to fund the listing program. We recommend at least a doubling of the Agency's listing budget to not only address the court ordered backlog, but also to allow the FWS the flexibility it rightfully seeks to start the listing process for species that need ESA protection now.

REGARDING LISTED TROUT AND SALMON, THE DELISTING PROCESS IS NOT A PROBLEM

Unfortunately, there are no listed trout and salmon that have been restored sufficiently to trigger the ESA delisting process. This is not to say that the ESA has failed these species. In fact, listing has generally helped greatly, as I have detailed below. Greenback cutthroats and Apache trout are the closest to achieving their recovery targets, but in no way should their recovery be shortchanged. We want conservation programs in place that will last, not short-term fixes that may yield ephemeral results and a quick trip back on the list.

LISTING OF TROUT AND SALMON HAS BENEFITED ALL LISTED SPECIES, SOME MUCH MORE THAN OTHERS, BUT NONETHELESS ALL HAVE RECEIVED ATTENTION AND FUNDING THAT THEY MIGHT NOT OTHERWISE RECEIVE

The ESA has been effective for protecting and at least partially restoring species where it has been faithfully implemented and where political decisions have not undercut implementation, such as Apache trout and greenback cutthroat trout. These two species have been brought back from the brink of extinction to the point where restrictive, well-managed sport fisheries are occurring, providing valuable income to local and tribal economies in Colorado and Arizona. These species are not recovered yet, but they are no longer at critically low levels.

The State of Maine had failed to take steep declines in Atlantic salmon populations seriously enough until a petition started the listing process in 1994. Only after the Services proposed Atlantic salmon for listing did the State forge a conservation plan that, while it had some merits, did not provide what was needed for real salmon recovery. Following the listing of salmon in 2000, the State and the Services are working harder and better than ever before to keep wild salmon from going extinct, and hopefully some day, returning the fish to its rightful place as a the most sought after sportfish species in New England.

Snake River salmon have continued to decline since their listings in 1992, but their path to oblivion is no longer taken in relative silence. Saving Snake salmon is now a national imperative, the stuff of Presidential campaigns and an integral part of Pacific Northwest's resource debates.

Even for species for which petitions have been filed but are as yet unlisted—e.g., golden trout—the threat of listing helped get action. TU's petition to list the golden trout has prompted California's Department of Fish and Game to address the fact that their fish stocking program was causing hybridization of native golden trout. It has also encouraged the Forest Service to address the grazing program on allotments that were harming golden trout habitat.

Finally, the 1999 emergency listing of Jarbidge River bull trout distinct population segment was an especially positive example of a listing that TU was directly involved in. In the Jarbidge case, Federal agencies responded aggressively to a very specific resource problem facing the southernmost remaining bull trout population in the continental United States. The emergency listing process, rarely used in the history of the ESA, was completed for this listing within a year. This shows how quickly decisions can be made when the FWS aggressively presses the listing process.

THE ESA'S BURGEONING LIST OF SPECIES TELLS US THAT OTHER GOVERNMENT LAWS AND POLICIES ARE FAILING. DON'T SHOOT THE MESSENGER! FIX THE OTHER PROGRAMS!

ESA listing and protection is necessary to protect and restore many salmonid species because other Federal, State, and local conservation laws and policies have failed. Our assessment of the causes of the declines that justified the listing of 34 salmonid species showed that other Federal laws had failed to conserve the species, including the National Forest Management Act, the Northwest Power Planning Act, implementation of the United States/Canada Salmon Treaty, and the Clean Water Act. State conservation laws and policies have also contributed to declines, including stocking of nonindigenous species that has adversely affected greenback cutthroat as well as golden, Lahontan cutthroat, Gila, and Apache trout. If the impacts of declining fish stocks and ESA are a problem for the Nation—and clearly they are—then let us fix what needs to be fixed. The ESA is merely the messenger telling us that other policies are not working. Therefore, efforts to place blame upon the ESA are misplaced.

GOOD PROPOSALS ARE BEFORE CONGRESS NOW THAT COULD HELP CONSERVE SPECIES AND KEEP THEM OFF THE LIST

TU does not believe that conservation begins and ends with the ESA. Our members are deeply involved in conservation efforts with communities, States and Federal agencies. There are at least three bills before the Senate that could help to greatly improve partnerships and funding for conserving species, namely the Conservation and Reinvestment Act (HR 701), the Fishable Waters Act (S. 678), and the Farm bill conservation programs which are set to be reauthorized by 2002. I urge the subcommittee to look carefully at these measures and to support them. The swelling endangered species list tells us that much more needs to be done proactively to protect and restore species and their habitats. Passing legislation such as these items helps to get at the heart of the problem.

REMEMBER ALDO LEOPOLD'S ADMONITION TO SAVE ALL THE PIECES

Aldo Leopold, the father of wildlife conservation, spoke eloquently in his landmark book, *A Sand County Almanac*, of the importance of species diversity and need to keep all the parts of an ecosystem to keep it healthy. TU has embraced Leopold's philosophy and has made conservation of native trout and salmon a high priority for our organization. Listing species under the ESA goes to the heart of saving all the parts and ensuring species diversity. We urge the subcommittee to support measures that strengthen the listing process, such as increased funding for it, and oppose measures that would legislatively or administratively weaken it.

Threatened and Endangered Trout and Salmon Species

Atlantic salmon-Endangered-Gulf of Maine
Apache trout-Threatened-entire range
Bull trout-Threatened-lower 48 States
Chinook salmon-Endangered-Sacramento River; winter run
—Threatened-Snake River, mainstem and subbasins; fall run, natural pop.
—Threatened-Snake River, mainstem and subbasins; spring/summer run, natural pop.

—Threatened-WA, all naturally spawned populations in river and streams flowing into Puget Sound.
—Threatened-Columbia River and its tributaries to Willamette Falls, OR, natural pop.
—Threatened-Clackamas River and Willamette River above Willamette Falls, natural pop.
—Threatened-various tributaries of Columbia River, natural pop.; also some hatchery populations and their progeny.
—Threatened-Sacramento San Joaquin River, mainstem and tributaries, spring run, natural pop.
—Threatened-CA, Redwood Creek south to Russian River, mainstem and tributaries, natural pop.

Chum salmon—Threatened-Columbia River, mainstem and tributaries, natural pop.

—Threatened-Hood Canal and tributaries, Olympic Peninsula rivers between Hood Canal and Dungeness Bay; summer run, natural pop.

Coho salmon—Threatened-streams between Punta Gorda, CA and San Lorenzo River, CA, natural pop.

—River basins between Cape Blanco, OR and Punta Gorda CA, natural pop.

Gila trout—Endangered-entire range
Greenback cutthroat trout—Threatened, entire range
Lahontan cutthroat trout—Threatened, entire range
Little Kern golden trout—Threatened, entire range
Paiute cutthroat trout—Threatened, entire range
Sockeye salmon—Endangered-Snake River

—Threatened-Ozette Lake, WA and tributary streams, natural pop.

Steelhead—Endangered-from Santa Maria River, CA to Malibu Creek, CA

—Endangered-Upper Columbia Basin, Yakima River to US/Canada border
—Threatened-Sacramento and San Joaquin Rivers and tributaries
—Threatened-Snake River Basin
—Threatened-Russian River to Aptos Creek, CA, drainages of San Francisco and San Pablo Bays
—Threatened-streams and tributaries to Columbia River
—Threatened-Pajaro River to Santa Maria River, CA
—Threatened-Willamette River, winter run
—Threatened-above Wind River, WA, and above Hood River, OR to Yakima River, excluding the Snake River
—Threatened-Redwood Creek to Gualala River, CA

Statement of Ralph L. Moss, Director, Government Affairs, Seaboard Corporation, on Behalf of Atlantic Salmon of Maine

I. INTRODUCTION

Chairman Crapo and members of the committee, my name is Ralph Moss and I appear today on behalf of Atlantic Salmon of Maine, LLC, a Maine aquaculture company raising salmon and selling salmon food products to U.S. consumers.

We appreciate the opportunity to testify before this committee concerning our first-hand experience with the recent joint decision of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service to list Maine Atlantic salmon as endangered under the ESA. Our bitter experience reveals that this important act is subject to serious abuse and distortion, and in Maine's case, is being implemented in an arbitrary and heavy-handed manner that is both inconsistent with congressional intent and counterproductive for restoration of the species.

We would like to be clear that our company is a strong partner in the State of Maine Atlantic Salmon Conservation Plan and supports Salmon restoration in Maine rivers. But like Maine's Governor King and members of our congressional delegation, our company opposes the Services' decision to list these fish as an endangered species.

The listing is fundamentally wrong for scientific, legal and policy reasons. Maine salmon runs are restoration fish, the product of over more than 120 years of hatchery stocking of non-indigenous salmon into these rivers and do not qualify as a distinct population segment for ESA listing.

II. FAILURE TO HONOR STATE CONSERVATION PLANS

The Maine listing represents a dangerous backslide by the Services into an inflexible interpretation of the ESA that fails to honor State conservation plans and creates an unsustainable burden on Federal wildlife programs.

It is widely recognized that the Federal Government alone cannot recover endangered or threatened species. The States, with their traditional authority over wildlife management and land use planning are ideally positioned to fashion conservation plans that are custom tailored to the resource, its habitat, and local conditions. This is especially true in Maine, where virtually all salmon habitat is in private land ownership, and only the voluntary cooperation of landowners will enable salmon habitat upgrades.

In Maine's case, the Services initially recognized the value of the State's conservation plan. Developed by a State—appointed task force with input from Federal fisheries scientists. The Maine plan provides a 5-year action plan to recover the species, with specific priority actions for each of the rivers. The plan gives top priority to projects that directly benefit the resource and provides creative solutions for the agricultural, forestry and Aquaculture areas to minimize stock impacts and disruption to the businesses.

In December 1997, the Services celebrated this Maine plan as a "National Model" that would open "A New Chapter in Conservation History." The Services determined that a threatened ESA listing of the runs was not warranted because the State plan offered sufficient protections. But less than 2 years later, apparently in response to pressure from a lawsuit filed by environmental groups, the Services abruptly reversed course, and decided to list Maine atlantic salmon as endangered. The Service failed to provide a credible rationale for the listing or to demonstrate any truly changed circumstances in the status of the Maine runs.

The Services' failure to honor the State conservation plan represents the loss of the best opportunity to recover Maine salmon runs. The State had appropriated over $2 million in New money, had shifted existing staff and programs to support this plan, and had organized significant public-private partnership support. At the State's request, our company had contributed more than $200,000 in direct costs alone for an innovative adult restoration stocking program, raising wild fish from the river for later release and natural spawning. Although highly successful to date, the adult stocking program's future is uncertain after the listing.

By rushing into the listing the Services effectively derailed a State plan that was well on its way to achieving the goals jointly endorsed by the State and the Services. Although support for the Maine plan remains strong to date, it is highly unlikely that the private business community will continue that support if the Federal listing is not reversed. There is no appetite for dealing with the Services, given their failure to be guided by the best available science, and their poor track record on pragmatic solutions.

III. FAILURE TO FOLLOW LISTING CRITERIA

The Services turned a deaf ear to the ESA mandate that the best scientific evidence be used to make listing determinations and failed to heed congressional cautions to use their power to list "Distinct Population Segments" sparingly. The Maine case illustrates a continuing problem in ESA Administration: Congress intended that conclusive evidence, representing the best available scientific data, be used in listing decisions for distinct population segments. but increasingly, the Services rely upon the "Precautionary Principle" to justify listing decisions in the absence of complete data. We heard services representatives repeat many times in the Maine listing hearings that although the genetic evidence was incomplete, and that the genetic heritage of the Maine salmon was not clear, the precautionary principle required that the salmon be listed given the low population levels. The Agency's growing reliance upon the precautionary principle in ESA represents a fundamental conflict with statutory authorization and congressional intent in ESA listing.

Our written testimony offers a detailed explanation of the Services' multiple failures to follow listing criteria in the Maine salmon case.

IV. FAILURE TO HONOR THE NEEDS OF THE RESOURCE AND ITS HABITAT

The sudden and illogical reversal of the Services' position on the need for ESA listing of Maine salmon clearly reveals that this was a political listing that had nothing to do with the needs of the resource or with the best science available. We believe that the Services decided to take the path of least resistance, and list the species rather than defend its decision in the lawsuit. Ironically one of the documents that the Services attempted to suppress from FOIA disclosure argued that it was better to sacrifice one State plan so that the concept of State plans could be preserved for future use. This abandonment of the State plan, after encouraging the State and its citizens to implement the plan, represents a serious breach of faith by the Services, and a complete disregard for the real needs of the salmon restoration.

Having insisted on derailing the State plan, the Services have taken no effective action to address the priority needs of salmon restoration. The Services have actually cut funding for Maine River Restoration Programs, and ignored the agreed upon priority needs for salmon restoration reflected in the Maine plan. In the last budget proposal, the Services proposed to spend only $1.2M in Maine on the ESA stocks, an outright budget cut from pre-listing budgets. In contrast, the Services proposed to spend $6.2M on the restoration stocks to the south of Maine. The Services' own budget proposal is the most devastating possible critique of their disorganized and ineffective restoration programs.

Instead, the Services have chosen to follow their default course, seeking to bulk up staff to carry out section 7 consultations. They have lost no time in demanding new permit conditions for aquaculture that are wholly unsupported by science, and would cause massive disruption and losses to the Maine aquaculture industry if implemented. Refusing to consult with the Department of Agriculture experts on aquaculture, marking, or genetics issues, the Services have demanded marking technology that does not exist for fish, as well as immediate slaughter of perfectly healthy broodstock and fish being raised by the companies on the theory that they are not genetically compatible with Maine runs. The Services have no knowledge or understanding of our industry, but continue to turn a deaf ear to the expert State of Maine agencies and Federal Department of Agriculture on aquaculture issues. In spite of the tremendous potential losses to our company, the Services have arbitrarily repudiated their prior commitments to the State of Maine that non-North American origin atlantic salmon could continue to be used with effective containment. It is just this type of arbitrary and unaccountable services action that turns ESA listings into a nightmare for private citizens and creates strong opposition to ESA listings.

It should be noted that the Services' demands on aquaculture in this listing create very significant adverse precedents for agriculture in ESA listings generally, especially where the Services are proceeding upon the precautionary principle to justify their actions.

It is clear that the Services are attempting to scapegoat aquaculture, which did not even exist when the Maine salmon runs declined, in order to distract attention from the Services' failure to address the critical needs of the resource. Ironically, the Services have failed to fulfill the one exclusive Federal role that would benefit salmon restoration—to work through international treaty organizations such as the North Atlantic salmon Conservation Organization (NASCO) to secure a moratorium on the on high seas salmon fisheries. The National Fish and Wildlife Foundation led a similar moratorium effort in 1993–94, resulting in a 1995 population rebound—the only such rebound in recent history. Similarly the Services continue to shrink from effective independent peer review of their Maine salmon stocking programs, which are contributing to the decline of the species. Maine salmon cannot recover until these priorities are addressed.

CONCLUSION

After nearly 30 years, the ESA and its administration is in need of updating to reflect the advances in science and technology and to preserve traditional State roles in wildlife management. We request that Congress establish clear guidance to the Services that will protect and support State conservation plans in the listing process. Congress must take action to require strict adherence by the Services to ESA listing criteria and sparing use of the DPS concept. Finally, Congress must hold the Services accountable for post-listing decisions, requiring the Services to demonstrate that there is a quantifiable scientific basis for the permit condition or other Federal action, and that every effort has been made to minimize unnecessary disruption of private property rights and businesses.

Atlantic
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of
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May 7, 2001

Senator Crapo, Chairman
Sub-Committee on Fisheries, Wildlife and Drinking Water
Senate Environment and Public Works Committee
410 Dirksen Senate Office Building
Washington, DC 20510-6175

Re: May 9, 2001 Hearing on the Endangered Species Act

Dear Chairman Crapo:

Thank you for the opportunity to testify before the Senate Sub-Committee on Fisheries, Wildlife and Drinking Water concerning implementation of the Endangered Species Act of 1973, as amended, 16 U.S.C. section 1531 et seq. (ESA). Our testimony speaks to our first-hand experience with the recent joint decision of the United States Fish and Wildlife Service and National Marine Fisheries Service (the Services) to list certain Maine Atlantic salmon as an endangered species under ESA. Our bitter experience reveals that this important Act is subject to serious abuse and distortion, and in Maine's case, is being implemented in an arbitrary and heavy-handed manner that is inconsistent with Congress' original intent, sound science and good policy.

Atlantic Salmon of Maine, LLC, is a Maine aquaculture company, raising Atlantic salmon for sale to consumers as whole salmon and salmon products throughout the United States. We operate freshwater hatcheries, sea farm sites, and processing facilities designed to provide the most wholesome, cost competitive product in environmentally sustainable operations. Our operations are located in Washington and Hancock Counties, in Maine's most economically disadvantaged area, with a fragile economy, highly dependent upon fishing, forestry and farming for survival. ASM employs over 130 employees in Maine, and the entire salmon aquaculture sector employs over 1,000 Maine residents. Salmon aquaculture represents one of the few options for a full-time, well paid job with benefits in Downeast Maine, and the State of Maine considers aquaculture to be critical to the future of this area.

Atlantic Salmon of Maine has been a partner in the State of Maine's Atlantic Salmon Conservation Plan since the Plan's inception in 1997. We remain committed to the cause of restoration of wild Maine salmon runs, we have invested over $200,000 in direct financial and in-kind contributions to support the State of Maine's Conservation Plan to date. We are proud of our role in raising wild salmon for restocking as adults in the threatened rivers, a cooperative public-private partnership that is showing a great promise for the restoration of Maine salmon runs.

Senator Crapo, Chairman
Sub-Committee on Fisheries, Wildlife and Drinking Water
May 7, 2001
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We want to make clear that Atlantic Salmon of Maine strongly supports the restoration of these wild salmon runs, and also believes that the ESA has a vital role to play in the protection of indigenous species on the brink of extinction. However, the decision of the Services to list Maine Atlantic Salmon as an endangered Distinct Population Segment is wrong for a number of scientific, legal and policy reasons. Worse, the listing will actually hamper effective restoration of these fish.

The State of Maine and a coalition of Maine businesses and organizations (including Atlantic Salmon of Maine) have brought a judicial challenge to this ESA listing as unlawful. We have requested that the Services return to their original determination that listing is not warranted because the State of Maine Conservation Plan and other international efforts already underway on behalf of salmon and its habitat are sufficient to protect the resource. We continue to request that the Services focus on their one exclusive federal authority - working through international treaty organizations to protect Maine salmon runs from the **only** documented source of human-induced mortality - the ongoing high seas commercial harvest. Only the U.S. government can work through the North Atlantic Salmon Conservation Organization treaty organization (NASCO) and other international diplomatic channels to persuade Greenland, Iceland and Faroe Island governments to suspend the commercial fisheries that target salmon originating in Maine rivers during high seas migrations.

Our comments provide a brief chronology of the events surrounding this ESA listing, as well as a review of a few of the most significant errors in this listing process, including: the Services' failure to honor State conservation plans; the Services' failure to follow Congressional intent on listing criteria; and the Services' failure to focus on the unique needs of the resource and its habitat.

I. History of the Maine Listing

It is critical to understand that the Services did not propose this listing, even though they had been deeply involved in Maine salmon issues for decades through a hatchery augmentation program and as a technical advisor to the State. In 1993, the Services received a petition from environmental groups to list as endangered under ESA all Atlantic salmon throughout the United States. The Services found that the petitioned listing was not warranted, but then proceeded to consider a threatened listing for salmon in seven Maine rivers as part of that same petition initiated process. The Services eventually found that this "Seven Maine Rivers" listing also was not warranted. The environmental groups sued the Services for failure to list. Apparently the lawsuit pressured the Services to change their long-standing position that listing was not warranted, and the Services ultimately initiated a new listing proposal for Maine salmon and entered into a settlement agreement with the environmental group plaintiffs that bound the Services to a shortened time frame for review of the listing proposal. This process ultimately resulted in this contested listing decision. A brief chronology follows:

1993 Environmental groups petition to list all Atlantic salmon throughout historic US range.

1995 Services determine that listing throughout range was not warranted because salmon had already been extirpated in some rivers and there was doubt about genetic make up in many other rivers. But Services did propose a threatened listing for seven Maine rivers based upon conclusion that the seven Maine rivers comprised a Distinct Population Segment ("DPS"), and named that unit the "Seven Rivers DPS."

1995 Governor of Maine initiates Maine Atlantic Salmon Conservation Plan initiative, bringing together stakeholders from public and private sectors to identify potential threats to salmon and its habitat and to propose conservation and restoration strategies.

1997 In March, State of Maine launches the final Maine Atlantic Salmon Conservation Plan, a five year plan premised upon integrated watershed planning, combining salmon conservation, habitat preservation, scientific research and public education, as well as cutting edge adult restoration stocking using aquaculture sector's special expertise. A specific action plan developed for each river of concern.

1997 In December, Services conclude that Maine Atlantic salmon are not threatened and withdraw the rule, citing the Maine Atlantic Salmon Conservation Plan as a "national model," "opening a new chapter in conservation history" "highlighting the ESA's flexibility and Services' "willingness to consider state-designed plans."

1997-99 State of Maine makes substantial progress in implementation of State Plan, by appropriating over $2 million in new money for salmon projects, by re-deploying existing state personnel and spending, and by capturing additional financial and technical support from private sector partners and grants (See Attachment 1 letter from Maine's Governor King outlining State of Maine achievements).

1999 January. More than one year after Services decision not to list, petitioner environmental groups give notice of intent to sue for failure to list; litigation commenced in Washington, D.C. demanding emergency listing.

1999 In January, State of Maine submits first annual report. Services provide response and express concerns about new additional areas of work required. State provides a detailed response to each concern. State of Maine implements Services' requested regulatory changes to stop all catch-and-release fishing for salmon throughout State and submits final draft of regulations controlling aquaculture industry after extensive negotiations in summer and early fall with Services. In October, as State submits final detailed regulation proposal to Services, Services reveal to State that they have decided to list.

1999 June. Services draft a new Status Review, but withhold that Status Review from the State of Maine until after release to third parties and the press in October. It appears that Status Review was drafted as a basis for a re-initiated listing proposal, apparently in response to litigation pressure brought by environmental groups.

1999 November. Services propose endangered listing for newly defined "Gulf of Maine DPS." Services change definition to geographic-based definition and add another stream, Cove Brook, to the DPS.

2000 Governor of the State of Maine, Maine's entire Congressional Delegation, and thousands of Maine citizens submit comments and attend hearings to oppose the proposed listing and to request that Services recommit to support of State of Maine Conservation Plan. Extensive detailed scientific critique submitted by State of Maine and other listing opponents of the data relied upon by Services to justify existence of a DPS. Services had relied upon a single scientific study by a government scientist that had not been peer reviewed and was riddled with errors in methodology, sampling, analysis and conclusions. Listing strongly supported by out-of-state environmental groups and two special interest recreational fishing groups, pointing out that listing is the only way to access additional federal money for salmon restoration.

2000 **June.** Services enter into settlement agreement in Washington, D.C. lawsuit brought by environmental groups promising to truncate time for consideration of listing rule to 12 months, ruling out 6 month extension option provided by Congress for cases of scientific uncertainty.

2000 November. Congress appropriates $5 Million in funds for Maine salmon conservation, including funds specifically for a National Academy of Sciences peer review of the Maine Atlantic salmon listing and underlying science. Maine's Congressional Delegation requests that Services' review of the listing proposal be extended in order to accommodate National Academy of Sciences peer review anticipated by Congress.

November. Services refuse request for extension of review period, and issue final endangered listing for Gulf of Maine DPS. New definition of DPS is incomprehensible, based upon a geographic area (from Kennebec River to the Canadian border) and including "all naturally reproducing wild populations of Atlantic salmon having historical common river-specific characteristics."

2000-01 State of Maine brings judicial challenges to Services' failure to disclose documents under Freedom of Information Act critical to Services' final listing decision and to ESA listing decision. Coalition of Maine businesses and organizations also brings judicial challenge to listing decision. Federal government seeks to transfer listing cases from federal courts in Maine to Washington D.C., even though State of Maine is only state affected and Services previously had admitted that Maine was appropriate venue.

2000-01 Wild run Atlantic salmon population in Europe, Canada, and United States rivers number in the millions, even as Services isolate an artificially configured, theoretical "Gulf of Maine DPS" comprised of eight Maine rivers to justify endangered listing.

II. Services' Failure to Honor State Conservation Plans

One of the most troublesome issues raised by this divisive experience is the failure of the Services to honor the critical role of the States in the conservation and restoration of species. In December 1997, Interior Secretary Babbitt and Commerce Under-Secretary Garcia determined that a listing of Maine salmon rivers was not required in light of the protections already afforded by the State of Maine Atlantic Salmon Conservation Plan and other conservation programs. Prior to that date, Secretary Babbitt had repeatedly advised Congress during ESA re-authorization hearings that DOI would work with the States, defer to adequate state conservation plans, and

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proceed to listing in the face of a Governor's objection only after independent scientific review of the contested scientific issues. At the time of their 1997 decision not to list, Secretary Babbitt and Under-Secretary Garcia came to Maine to celebrate the Maine Plan as a "landmark" decision that would serve as a "national model" for a "new chapter in conservation history." They signed a memo of agreement to support the five year Maine Plan and its restoration goals.

Less than two years later, the Services broke their word and reneged on their commitment to the State Conservation Plan. The apparent motivation behind this abrupt reversal was the lawsuit challenging the Services' decision not to list, and the desire to compromise with environmental groups. (See Attachment 2 - Statement of Senator Collins in the November 14, 2000 Congressional Record.) Ironically, internal documents of the Services argued that it was better to avoid litigation over one State Plan, so that the concept of State plans could be protected for future use. Certainly none of the facts underlying the status of the population or its habitat had changed in any significant way since the Services' endorsement of the Maine Plan. The continuing low numbers of returning spawning adults during the first two years were fully anticipated in the original Maine Plan as an inevitable consequence of salmon's long life cycle and low population levels.

By the time of the Services' November 2000 reversal of policy, the State of Maine had appropriated more than $2 million in new money in support of its Conservation Plan, had redeployed existing state personnel and programs to focus on salmon issues, and had worked to raise grants and in-kind technical services from private sector partners to support this tremendous restoration project. The State had made extensive progress on its goals, and was well on its way to full implementation of the Plan within the anticipated five-year time frame. With its listing decision, the Services not only alienated an important state partner and the traditional manager of this stock, it literally derailed years of work that were already providing needed protections for the resource.

It is widely recognized that the federal government alone cannot recover our endangered species. The states are necessary and natural partners in every wildlife conservation model. The complexity of the issues surrounding wildlife and their habitat, the need for local knowledge, and the need to enlist and educate local landowners and citizens in the restoration goals mandates that the States become primary, if not principal partners, in restoration projects.

The Services initially recognized the unique advantages and value of the State of Maine Conservation Plan for shared Atlantic salmon conservation and restoration objectives. **Virtually all of salmon habitat in the State of Maine is in private ownership,** so the Maine Plan's emphasis on partnership with private landowners was critical to providing needed upgrades in salmon habitat (e.g. new streamside plantings or conservation easements around spawning areas). The federal government, working alone through the command/control ESA model of federal permit consultations and conditions, likely could not have resolved these habitat issues because most landowners do not need federal permits. Furthermore, the State Plan offered the innovative adult salmon restoration stocking project, building on a partnership with the aquaculture sector to rear wild salmon in protected areas for release in the rivers of concern for natural spawning. This project is now being implemented on a pilot project basis and, to date, has exceeded expectations - providing real excitement and hope for river stock restoration.

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But by November 2000, the Services had lost sight of the critical role of the States and suddenly took a pre-emptive and punitive approach to the State of Maine. The Services' listing decision sends a devastating message to any other State seriously considering a Conservation Plan. What State is likely to move forward with a conservation plan after learning that the Services pulled the rug out from under the State of Maine less than two years into a five year Conservation Plan, after the State had appropriated millions of new dollars for the program, and invested thousands of hours in implementing the Plan? (It is widely believed in Maine that this was precisely the purpose of the environmental group challenge to the Services decision to defer to the Maine Plan - to destroy the collaborative public-private partnership and any threat of similar State Plans in the future.) This centralized, pre-emptive federal approach to wildlife management will rob the states and private parties of any incentive to invest pro-actively in endangered species, for fear that the federal government will suddenly reverse position and destroy the project. The result is a creeping federalization of wildlife management and land use planning - roles best handled by states on the local level.

The appropriate role for the federal government in the case of Maine Atlantic salmon is to honor and support the Maine Conservation Plan with both financial and technical expertise, and to defer to the Maine plan in lieu of ESA listing. While we believe that the ESA currently authorizes such deference to state conservation plans in its listing authorization provisions, we encourage this Committee to consider all appropriate ESA amendments to clarify and strengthen the primacy of state conservation plans, especially where habitat lands are primarily in private ownership.

III. Services' Failure to Honor Congressional Intent in Listing Process

A second major flaw in the Maine Atlantic salmon listing process was the Services' failure to honor Congressional intent that the DPS concept be used sparingly, and that "best scientific evidence" be used in listing decisions. The Services have ignored controlling law and their own administrative precedent in order to justify their listing decision. The Services have engaged in a persistent pattern of conduct designed to suppress disclosure of scientific data and decision-making documents relied upon by the Services in their listing decision, all of which are critical to understanding their listing rationale. The State of Maine and private parties have been forced to seek judicial intervention to force disclosure of these key documents.

The Maine Atlantic salmon listing represents one of the most radical interpretations of the DPS concept to date by the Services - one which strays far from original Congressional intent. The Services justify their listing proposal on the basis that salmon in eight Maine rivers constitute a distinct subset of the large Atlantic salmon population throughout the world. Even though there are literally millions of non-aquaculture Atlantic salmon in rivers throughout the world - and many thousands in North American rivers - the Services create an artificial DPS defined by geographic boundaries, including a northern border based on politics (Canadian border) and a southern boundary based upon extinction (Kennebec River in Maine). There is no satisfactory scientific or biological based definition for the DPS, especially where salmon historically ranged south to Connecticut and north along Canada's east coast on the North American continent.

Nor do the Services offer any guidance on how a citizen is to distinguish a listed endangered salmon - that is, one that is "naturally reproducing" and shares "historical common river-specific characteristics" on one of the eight rivers - from any other wild salmon that may have strayed from a Canadian river wild salmon run, or may be descended from a non-DPS source stocked by the federal government during more than 120 years of hatchery stocking.

This confusing DPS listing ignores specific Congressional guidance to the Services on DPS issues. During the 1978 amendments to ESA, Congress recognized the "great potential for abuse" and accordingly instructed the Services to list such DPS populations "sparingly and only when the biological evidence indicates that such action is warranted." S. Rep. No. 151, 96th Congress, First Session, at 7 (1979). The Senate Committee acknowledged that a listing of populations might be appropriate where the "preponderance of evidence indicates that a species faces a wide spread threat, but conclusive data is available with regard to only certain populations." (emphasis added).

Yet the Services ignored these specific instructions from Congress to use the DPS concept sparingly and only where conclusive data warranted the DPS finding, to arrive instead at a highly speculative DPS definition. The Services ignored the best available scientific evidence in order to prop up their DPS rationale. They then refused to extend the comment period as authorized by ESA in order to obtain additional expert scientific opinion on the proposed listing in November 2000, even after receiving extensive scientific criticism of the single non-peer reviewed federal scientific genetic study relied upon the Services to justify the DPS finding. The Services relied upon the convenient settlement agreement terms as a shield, claiming that they were required to decide within twelve months, even though the settlement agreement expressly acknowledged that the Services could return to seek court authorization for additional time if necessary.

Instead of conclusive data that Congress determined was needed for a DPS finding, the Services' listing is premised upon a series of unsubstantiated assumptions:

- some remnant population persists in each of the eight Maine rivers that has some undefined quantum of the aboriginal Gulf of Maine genome, in spite of historic evidence of significant historical dam obstructions and pollution on each of the eight rivers;

- the remnant population exists in spite of over 120 years of a federal hatchery program that stocked non-indigenous fish at the time of extremely low stock abundance;

- that natural stray rates of up to 10% annually from non-DPS river runs would not have been sufficient to substantially or completely introgress with any remnant populations and eliminate reproductive isolation necessary to support a DPS finding;

- that "remnant stocks" have maintained the phenotypic traits of aboriginal stocks, including smoltification at mean age of two years and predominant returns as 2 sea winter (SW) fish (age four), and that these are genetically inherited traits, rather than predominantly environmentally determined traits assumed by salmon as they enter and "colonize" in the river;

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- partially completed genetic studies should be interpreted to indicate genetic distinct stocks in the eight Maine rivers, rather than genetic drift commonly associated with genetically bottlenecked stocks.

The Services also departed from their own administrative listing decision precedents. The Services had previously determined that the purely restoration Atlantic salmon stocks of the Connecticut and Merrimack Rivers did not qualify for listing under the ESA given confirmed historical stock extirpation before restoration. However, the Services determined that the identical Maine river stocks, all descended from the same mixed federal hatchery fish parentage, qualified for ESA listing. Furthermore, the Services ignored their own West Coast precedent, where they determined in 1991 and again in 1995 that the Lower Columbia River Coho salmon population did not qualify for ESA listing where the available information was inconclusive, and the Service could not "identify with certainty" "native, naturally reproducing populations." 56 Fed. Reg. 29,554 (June 27, 1991); 60 Fed. Reg. 38,001, 38,002 (July 25, 1995). In reaching this conclusion, NMFS specifically concluded that introgression into the native fish due to non-indigenous federal hatchery stocking efforts had likely occurred, where the hatchery stocking had occurred over a much shorter period of time, and over a far larger native population of fish than in the Maine case. Similarly, NMFS had honored the need for conclusive data and declined to list Coho salmon populations in the Scott and Wadell Creeks, California (59 Fed. Reg. 21,774 (April 26, 1994)) and the Elwha and Dungeness River Pink Salmon runs (60 Fed. Reg. 51,928, 51,931 (October 4, 1995), where they could not identify with certainty the reproductive isolation necessary to support a DPS listing.

But the very best evidence that the Services ignored "the best scientific information" is found in the Services' own decision documents. As noted by Maine's Senator Collins in her remarks to the Senate (November 14, 2000 Congressional Record), documents withheld in a FOIA response by the Services to the State of Maine "are disturbing because they show that legal considerations – and not solely . . .the best scientific and commercial data available as required by law – motivated the Services' decision to abandon the State plan and list Atlantic salmon in the Gulf of Maine as endangered. Senator Collins noted that the Services correspondence made the decision to list "appear more like a matter of litigation strategy than a matter of science."

In the Maine listing, the Services turned a deaf ear both to Congressional instructions on the sparing use of DPS and the need for the best available scientific evidence, and to guidance from its restoration partner, the State of Maine, concerning critical scientific data about the resource. The State of Maine and its citizens were faced with a seemingly irrebutable presumption by the Services that the DPS existed, regardless of the Services' inadequate research and inconclusive data.

IV. Services' Failure To Respect Unique Needs of the Resource and its Habitat

The swift and illogical reversal of the Services' position on the need for ESA listing of Maine salmon clearly reveals that this is a political listing that has nothing to do with science or the needs of the species. The Services, faced with environmental group lawsuits, and under fire nationally, as well as in Maine, for its poor hatchery management practices that contributed to the historic decline of Maine populations, decided to list. The Services abandoned their commitment to the "national model" Maine Plan designed to address the unique Maine issues. Instead, the Services took the easy path to list, while attempting to scapegoat the State of Maine and aquaculture companies to distract attention from the their inconsistent policies and poor hatchery management.

The eight Maine rivers of concern currently have no hydropower or water storage dams to impede access to salmon spawning habitat. There are no industrial discharges, and very few commercial wastewater discharges. The river shores are primarily undeveloped, and riparian lands are used primarily for low intensity agricultural or forestry purposes, subject to strict state land use and environmental regulations controlling activities in the shoreland zone and limiting impacts of human activities on the river watersheds. All Maine water quality standards are geared to protection of salmonids. Throughout the Maine Plan, the State had already persuaded the aquaculture sector to adopt a voluntary Code of Practices, designed to minimize the possibility of interaction between farmed and wild salmon. The State planned to adopt regulations codifying these containment measures. The State was in the midst of placing weirs at the mouths of the rivers closest to aquaculture operations in order to provide an additional safeguard against the possibility of an escaped farmed salmon from entering a river of concern. Thus, by November 2000, the State had fully addressed all rational regulatory requirements for protection of salmon and its habitat. A federal listing would add nothing but duplicative regulation designed to pre-empt state laws and regulations.

By listing the salmon, the federal government has lost the unique advantages of the Maine Plan's public private partnership and cooperation. Maine private landowners who control the salmon habitat can simply take a passive role and refuse to undertake the projects that are needed to improve existing habitat or create new spawning habitat. Because virtually all of the land in Maine remains in private ownership, this is a perennial problem for ESA listings in Maine.

Furthermore, the Services' breach of faith with the State of Maine and her citizens has seriously eroded private sector confidence in the Services and their reliability. This breach of faith will cause lasting damage to the cause of species restoration in Maine, as the private sector will remain suspicious of any initiative that would subject them to the Services' arbitrary and capricious change in policies. Atlantic Salmon of Maine has pledged its continued support for the Maine Plan, in the hope that the unlawful ESA listing will be overturned. This includes continued participation in the innovative adult restoration program that relies completely upon State of Maine and aquaculture industry voluntary cooperation. However, if the federal listing is allowed to preempt the Maine plan, it is widely understood in Maine that private sector support will be withdrawn, as companies are unwilling to trust the federal Services and their chaotic and changing policies.

Ironically, the Services have not yet fulfilled the single exclusive federal role that would benefit salmon restoration. Only the federal government can secure a moratorium through international treaty organizations and other diplomatic channels to prevent high seas fisheries targeting migrating salmon from Maine rivers. This is the one known source of human-induced mortality for salmon - yet the federal government continues to fail to use its resources to persuade allies to protect the species. We strongly request that Congress instruct the Services to recommit to the process of ensuring a moratorium on high seas fisheries, similar to the 1993-94 buy-out of the Greenland and other salmon fisheries that have historically devastated Maine river runs and continue to prevent their recovery. The National Fish and Wildlife Foundation has long provided leadership in this area, and we support their ongoing efforts to secure a complete moratorium on high seas mixed stock Atlantic salmon fisheries until stocks rebound. In fact, their efforts contributed to the last significant increase in returning spawning salmon to Maine rivers occurred in 1995, reflecting the benefits of the 1993-94 Greenland buyout. The moratorium will be one of the most important determining factors in the recovery of Maine salmon, and until it is implemented, Maine salmon stocks will continue to struggle.

Having listed Atlantic salmon, the Services have done little or nothing to advance salmon conservation. They have actually cut federal spending on Maine salmon runs, and their new funding requests for Maine reportedly focus on building more federal bureaucracy, not on getting funds to priority projects benefiting the resource. Instead the Services have insisted on attempting to use ESA Section 7 consultation powers to reopen Army Corps of Engineers Section 10 permits issued to the company many years ago to certify the lack of navigation hazard at sea farm sites. The Services have demanded insertion of wholly unreasonable permit conditions that would devastate our company and the entire Maine aquaculture sector. A few of the many conditions include: (1) a requirement that all fish be individually marked (even though the Services representatives have conceded that there is no commercially and operationally feasible marking system available), and (2) an immediate prohibition on the use of any salmon that descend from salmon in non-North American rivers. This demand is wholly unsupported by any scientific information and would have devastating economic consequences because aquaculture companies rely upon non-North American strains for current broodstock lines. This overly stringent demand would require destruction of some fish currently under cultivation and would seriously disrupt essential broodstock development programs essential for preserving viable operations in a fiercely competitive global marketplace. The result would be millions of dollars in immediate losses for the companies and a loss of years of broodstock development. The Services demand is inconsistent with their own prior position that the non-North American bloodlines could be used by the companies with adequate containment. There are many other examples of counter-productive, costly and wasteful Services demands in connection with this ESA consultation process. The Services' heavy-handed tactics, based on poor science and no knowledge of our industry, is powerful evidence of why State conservation plans should be encouraged. States generally have much greater detailed understanding of the land, the people and the resource, and tend to have a much more collaborative approach to complex issues.

V. Conclusion

Atlantic Salmon of Maine remains committed to the cause of salmon restoration in Maine, and believes that the State of Maine is best positioned to achieve that restoration goal. We disagree strongly with the Services' endangered listing of Maine salmon rivers, both because the runs are restoration stocks that were never intended for ESA protections by Congress, and because the Services have seriously abused the DPS concept and ESA listing criteria. We request that Congress provide sufficient safeguards in the ESA and through Congressional oversight of the Services to assure that State conservation plans and voluntary collaboration by public-private partnerships are encouraged as the best mechanism to protect certain species.

Finally, we request that Congress provide improved accountability and performance standards for the Services to assure that their listing decisions are based upon the best scientific information available and that their proposed protection initiatives be prioritized for effective species and habitat protection, and designed to minimize disruption of citizens' property rights and businesses.

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Thank you for the opportunity to submit this information to the Committee.

Sincerely,

D Peterson

David Peterson/KLM
General Manager
Atlantic Salmon of Maine, LLC

Attachment 1 – March 16, 2000 letter from Governor King
Attachment 2 – November 14, 2000 Senator Collins Senate Presentation

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OFFICE OF THE GOVERNOR
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AUGUSTA, MAINE
04333-0001

ANGUS S. KING, JR.
GOVERNOR

March 16, 2000

The Honorable Don Young, Chairman
Committee on Resources
U.S. House of Representatives
Washington, D.C. 20515

Dear Representative Young:

Thank you for your invitation to appear and testify before the House Committee on Resources in connection with H.R. 3160, Common Sense Protections for Endangered Species Act of 2000, on Wednesday, March 1. Unfortunately, my schedule did not permit me to do so. However, I am submitting these comments, which I hope you and your Committee members will review and include in the hearing record in connection with this bill.

Two years ago the State of Maine entered in a five-year agreement with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (the "Services") to implement a comprehensive conservation plan for the protection and restoration of Atlantic salmon. We are making steady and substantial progress under the plan. Despite our progress, only two years into that five-year plan, the Services abruptly changed course and decided to seek an endangered listing of Atlantic salmon in Maine. I strongly believe their decision to list is wrong and without justification, and undermines a promising partnership that is the best hope for protecting and restoring Atlantic salmon in Maine rivers.

I want to be clear about one thing at the outset – I am not opposed in any way to the Endangered Species Act itself. I consider myself to be a moderate, pro-environment Governor, and I recognize that the ESA has served an important role in preserving species literally on the brink of extinction like the California condor or the bald eagle. However laudable the underlying purposes of ESA may be, however, I believe the law is subject to abuse, and, in Maine's case at the moment, is being implemented in an arbitrary and heavy-handed fashion that is not consistent with Congress' original intent, sound science, or good public policy.

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Many of the specific amendments proposed in H.R. 3160 make good sense. They might help to avoid the kind of negative, divisive experience that we in Maine are undergoing at the present time. Before addressing the bill specifically, let me give you a brief background of Maine's experience with implementation of the Endangered Species Act in connection with Atlantic salmon.

1. Background

In 1993, the Services received a petition to list under the ESA all Atlantic salmon throughout the United States. Following review of scientific and other evidence, they determined in 1995 that listing Atlantic salmon throughout the entire United States was not warranted because salmon had already been extirpated in some rivers and there was doubt as to the origin and genetic make up in many others rivers. However, the Services did propose to list as threatened certain subpopulations of Atlantic salmon found in seven Maine rivers, based upon their conclusion that these salmon comprised a "Distinct Population Segment" (DPS) eligible for protection under the ESA.

In response to this proposed listing, I initiated an effort to develop a comprehensive plan to protect and restore Atlantic salmon in these rivers. Representatives of local, state, and federal governments, private industry, and interested non-governmental organizations worked for nearly two years to develop the plan. The Maine Atlantic Salmon Conservation Plan was launched in March 1997.

In December 1997, the Services concluded that Atlantic salmon were not threatened and withdrew the proposed rule in light of efforts being made to protect salmon in seven rivers under the Maine Conservation Plan. Interior Secretary Babbitt and Commerce Under Secretary Terry Garcia came to Maine and promoted this decision to withdraw the proposed threatened listing and support Maine's Conservation Plan as a landmark achievement showing the inherent flexibility of the ESA.

During the first two years of the five-year Maine Conservation Plan, the State of Maine together with its partners have made considerable progress. I am attaching a copy of the testimony delivered at a recent public hearing by a state official highlighting the progress made during this time.

Some ten months after the adoption of the Plan, however, notice of intent to bring a lawsuit against the Services was filed by Defenders of the Wildlife and other environmental groups contesting the December 1997 decision to withdraw the proposed threatened listing and requesting court intervention to order an immediate emergency listing of the salmon.

In January 1999, the State submitted its first annual report covering implementation of the Plan in 1998. The Services critiqued the State's annual report, setting out a number of concerns with the status of implementation efforts under the Plan. Four weeks later, the State provided a detailed response, and went to considerable effort to address each and every issue cited by the

Services. As an example, two primary recommendations made by the Services were: (1) abolish the limited catch and release recreational fishing established under the Plan; and (2) tighten regulation of Maine's aquaculture industry. In both instances, Maine responded. The Maine Atlantic Salmon Commission has promulgated a rule prohibiting all recreational salmon fishing on all Maine rivers. State representatives met with representatives of the Services over the course of the summer and early fall of 1999 to negotiate detailed upgrades for aquaculture operations. When a near final draft of that agreement was sent to NOAA counsel in early October, the response the State received was that the Services had changed their mind and were now going to embark on a listing process.

Meanwhile, it appears that during the period that the State was attempting, in good faith, to address concerns raised in the Annual Report, the Services were preparing a new Status Review to serve as a basis for a re-initiated listing proposal. The lawsuit apparently pressured the Services to change course. Although completed by early July, the Status Review was not furnished to the State until after the decision to list had been made in the Fall, and even then, only after it was released to the press and third parties.

A pivotal issue in this case is whether the particular Atlantic salmon found in certain rivers constitute a DPS with the meaning of the ESA. The Services have based their DPS determination upon a 1999 scientific study authored principally by a federally employed scientist. This study has not been peer reviewed. The State initially sought access to the underlying data for these studies last November, but ultimately had to file a Freedom of Information Act request and then a federal lawsuit to get that data.

2. H.R. 3160 Offers Several Key Improvements to ESA that Will Make a Difference

a. Mandatory Standards for Defining "Species"

In the case of Atlantic salmon, the Services justify their listing proposed on the basis that salmon in certain Maine rivers constitute a subset of the large salmon population, or something called a "Distinct Population Segment" (DPS). The irony here is that there are literally thousands upon thousands of non-aquaculture Atlantic salmon in North American rivers and the Atlantic Ocean. Yet, the Services have isolated seven or eight rivers, and claim that the salmon in these rivers are genetically distinct from all others, and therefore merit protection. This position of river-specific distinctiveness is not, in our view, supported by sound science. What is worse, the salmon in these rivers (as well as others in Maine rivers) have been hybridized by massive, federally supported stocking programs over the last 120 years that stocked over one hundred million Atlantic salmon from as far away as Quebec into Maine rivers.

Congress expressly permits use of the DPS concept, however, it clearly recognized the "great potential for abuse" and accordingly instructed the Services to list such populations "sparingly and only when the biological evidence indicates that such action is warranted." S. Rep. No. 151, 96th Congress, First Session, at 7 (1979). In our case, though, the Services have played fast and loose with the DPS concept, and are disregarding their mandate to use it "sparingly."

Moreover, in the course of the Atlantic salmon listing process, they have changed the very rules regarding DPS several times. Initially, they determined there was a "Seven Rivers DPS" consisting of Atlantic salmon of unique river specific genetic heritage. Then, in 1997, they renamed the "Seven Rivers DPS" as the "Gulf of Maine DPS." In 1999, the Services changed the rules again by adding another stream, Cove Brook, to the original seven, and further by making all watersheds in the northern two-thirds of the State eligible for inclusion in the DPS, without articulating a clear scientific basis for this expansion. Even more interesting, they excluded the most significant Atlantic salmon river in the United States, the Penobscot River, which sits in the middle of the geographic range they identified. This "gerrymandered" DPS determination makes no sense and is a far cry from the "sparing" use Congress intended to be based on a positive biological foundation.

Requirement that the Services develop clear, scientifically supported standards through a public rulemaking process makes eminent sense.

b. Independent Scientific Peer Review

The ESA is supposed to be based upon sound science. Independent peer review assures that administrative decisions will conform to the best science available. In the case of Maine Atlantic salmon, however, the agencies are "shooting first and asking questions later." And, the agencies themselves serve as advocates as well as decision makers.

There is considerable scientific dispute and uncertainty about the genetic basis for determination that Maine Atlantic salmon constitute a DPS. The 1999 listing proposal is based primarily upon one single genetic study that has never been subjected to independent scientific peer review and which, by its own terms, does not clearly support the conclusion that Atlantic salmon in Maine constitutes a separate DPS. An earlier study in 1997 by the same scientist was peer reviewed, and most of the reviews were critical or non supportive. This uncertainty is further compounded by the fact that (1) other reputable scientists which have studied the situation have come to an opposite conclusion, and (2) some key scientific and genetic work relevant to this determination has not yet been finished. Moreover, the scientific analysis in the biological status review fails to adequately address and resolve other scientific questions which merit some prior independent peer review. Ironically, at the same time the Services are moving toward a listing, the National Marine Fisheries Service has funded a two-year study that has direct relevance to the genetic basis for the DPS determination.

All of this points to the need to require as a prerequisite to listing clear and substantial evidence that is corroborated by an independent peer review before a listing is imposed. The ESA should not serve as a basis to "list first" and "ask questions later" when so much is at stake. And in our case, we are not in an emergency situation. The Services themselves are on record as strongly opposing an emergency listing and have said so unequivocally in their papers filed in federal court. For me, this highlights even more the need for Congress to be clear, as H.R. 3160 would suggest, that there be a solid scientific foundation before a listing is initiated and certainly before a listing is imposed.

c. Mandatory Disclosure of Data and Information

The foundation for good science, as well as fair process, is open access to information. Without free and open access, those interested in any way in a listing cannot adequately test the scientific basis nor prepare or present their case before the agency or in subsequent reviews.

In our case, for over three months the State sought information directly relevant to the 1999 scientific study upon which the Services rely to establish a DPS. Much of it is the same kind of data that was made publicly available in connection with an earlier (1997) study. Even after we filed a formal Freedom of Information Act request, we had difficulty getting a complete and accurate copy of the data. Over one month after our FOIA request, the Department of Interior delivered computerized data that was not useable. Several weeks later, an additional set of data was furnished, but his time without necessary files to evaluate it. Shortly thereafter, because the clock was ticking down on our time to file comments, the State of Maine felt it necessary to file a federal lawsuit to compel the production of data and extend the comment period. The Department of Interior appears to have now produced the data (although we are currently verifying this) and the Court extended the comment period to allow time to review the data.

In response to a second FOIA request seeking access to information relied upon in reaching the listing proposal, the Department of Interior is withholding, on the basis of privilege, over 250 documents we have requested. These are documents within the scope of our FOIA request and which may be relevant to the issues before the agency in the listing proceeding.

This is not right. A public agency should not be liberally invoking legalistic excuses for withholding information to any citizen, let alone another public and sovereign entity where that information is relevant to rights being determined in an underlying administrative listing proceeding. I can tell you that that it is certainly not the way we play the game in Maine. It should not be the way your federal agencies play that game, and H.R. 3160 would level the playing field in that respect.

d. Support for State Conservation Plans.

Mandatory consideration of future conservation benefits of conservation agreements could provide crucial congressional support to agreements like the Maine Conservation Plan. This would strengthen such agreements against judicial attack and provide much needed flexibility to the ESA. Attacks on state conservation plans like Maine and Oregon's is, in my view, shortsighted. The hallmark of these plans is support across a broad spectrum of constituencies, and that support is vital in order to carry out the kind of broad-based habitat protections and improvements that support restoration of the salmon. This kind of "voluntary" cooperation is particularly vital in states like Maine where the majority of the habitat is privately owned, unlike the situation in many west coast states where the majority of the property is under federal ownership and control. In a circumstance like Maine's, it is shortsighted to believe that a command and control process driven from Washington, D.C., can provide more effective management than the type of locally based system that the Maine Conservation Plan represents.

e. Justification by the Secretary and the President When a Governor Objects; Provision for De Novo Judicial Review.

Under law, courts give great deference to decisions of administrative agencies. While this doctrine has merit in many circumstances, its use in the administration of the ESA in particular, which has been called one of the most powerful pieces of legislation in the country, has engendered distrust, division, and suspicion among many. Additional measures of accountability, such as these two measures, will help to alleviate the concern that administrative agencies can take actions with minimal or no scientific justification. The requirements of written justification, presidential approval and de novo judicial review would restore some balance to the process and require agency staff to sharpen their scientific analysis in order that it be persuasive and solidly based.

I want to conclude my remarks by again emphasizing that I am far from a radical, anti-environmental, anti-conservation Governor. On the contrary, I take pride in the many environmental achievements my administration has accomplished over the last five years. This is consistent with a strong conservation ethic in Maine. But strong conservation programs and laws do not require processes that are arbitrary and fundamentally violative of the basic principles of due process and fundamental fairness. H.R. 3160 appears to me to be a vehicle which addresses these concerns and will actually strengthen the ESA by limiting the potential for its abuse thereby insuring its continued public support.

I hope these comments are helpful to the Committee in its deliberations.

Sincerely,

Angus King

Angus S. King, Jr.
Governor

cc: Senator Olympia J. Snowe
Senator Susan M. Collins
Congressman Thomas H. Allen
Congressman John E. Baldacci

P:/ATLANTIC SALMON/ESA Listing/ASKs Testimony – H.R. 3160

Activities and Achievements
Under the Atlantic Salmon Conservation Plan
1998 and 1999

Introduction

Comments at the public hearing in Ellsworth last night, to the effect that the Governor let down the Conservation Plan and, had he not, there would be no request for listing, demand a detailed response. The fact is that every major part of the plan has been advanced over the last two years. The fact is that more than $1 million of state funds has been spent to date on the effort, with another $1 million of state funds in the pipeline. And, the fact is that Governor King has personally met repeatedly with his commissioners and deputies who have specific assignments under the plan and demanded performance from them.

Assertions to the contrary are misinformed at best and contrived and disingenuous at worst.

Because those who, for their own purposes, would promote inaccurate accounts of the work done under the plan have elevated their versions to some kind of found truth, we can only counter them with a factual listing of the major activities and achievements to date. So here goes.

The Plan calls for action in five areas: fish management, habitat protection and enhancement, species protection, organization and outreach, and enforcement of rules. I will take these each in its turn.

Fish Management

- **Fish trapping and counting** -- important to assure that farmed Atlantic salmon do not escape into the rivers, and to have a method to conduct a census of returning wild salmon.

  - Designed, permitted, and constructed fish weirs on the Pleasant and Dennys Rivers. These weirs were in the water by mid-fall, now are in winter storage, and will be back in the water this spring;

  - Designed a fish weir for the East Machias River and are negotiating to place the weir at its optimal location for fish trapping;

  - Are in the process of modifying the design of the Narraguagus flood control dam at Cherryfield to make the trapping facility there more effective; and

  - Have completed preliminary design for a fishway on the Machias River Gorge.

- **Fish stocking** – implementing long-term plan for recovery of the Atlantic salmon.

- Continued river-specific fry stocking in six of the seven rivers, as called for in the Plan, with interruptions last year because of disease issues;

- Continued the collection of broodstock from six of the seven rivers, also according to the Plan.

○ **Fish assessments** – to better understand what is happening in the rivers

- Completed a smolt study on the Narraguagus to track juvenile survival;

- Placed a smolt trap on the Pleasant River to count downstream migration.

Habitat Protection and Enhancement

○ **Identification of habitat and habitat requirements**

- Completed habitat mapping of critical spawning and nursery areas in each of the seven rivers;

- Completed preparations of a methodology by which we can identify a scientifically justifiable riparian buffer adjacent to important spawning and nursery areas;

- Completed modeling, using the so-called Instream Flow Incremental Methodologies (IFIMs) for the Pleasant and Narraguagus rivers and Mopang Stream, giving us excellent information about the flow requirements of juvenile Atlantic salmon at critical reaches of each of these streams;

- Nearing completion of water use management plans based on this modeling – with the plan for the Pleasant River due at the end of this month and for the Narraguagus and the Mopang by June.

○ **Protection of habitat**

- Acquired, assisted in the acquisition of, or negotiating for acquisition of 4,806 acres with more than 40 miles of frontage along five of the seven rivers. More purchases will be possible with the passage in November 1999 of a $50 million bond issue to recapitalize the Land for Maine's Future Program;

- Restricted the direct withdrawal of water during dry summer months for blueberry irrigation through permit conditions each of the last two years by the Land Use Regulation Commission. In each year, the growers had to stop withdrawals during August because the limit had been reached. DEP is currently preparing a draft rule to establish minimum flow standards for waters in its jurisdiction;

- Captured $400,000 of funding from the National Fish and Wildlife Foundation for habitat conservation projects over the last 3 years. These funds have contributed to the purchase of riparian habitat, assisted watershed councils, restored eroding riverbanks, and assessed watershed conditions;

- Created 300 linear feet of riparian buffer by fencing out cows and providing an alternative water source away from the Sheepscot River. We hope the project will become a model for how resource agencies, watershed councils, and landowners can cooperatively solve problems affecting water quality without creating economic hardship for farmers;

○ Enhancement of habitat

- Removed 105 beaver dams on the downeast rivers;

- Removed part of an abandoned dam on the Pleasant River known as Cannan Falls;

- Improved fish passage on fishway on Cathance Stream, a tributary to Dennys River;

- Upgraded a number of road crossings, ditches, and culverts on paper company lands in Washington County to reduce nonpoint source pollution and sedimentation. Certain landowners (Champion) have undertaken a comprehensive improvement plan of their roads and have responded to a survey by the Land Use Regulation Commission, noting nonpoint source problems, by addressing these areas immediately last summer;

- Held approximately a dozen workshops promoting forestry BMPs to forestry, logging, and municipal officials.

Species Protection

○ Aquaculture

- Completed and implemented a voluntary Loss Control Code of Practices by the aquaculture industry;

- Drafted a rule to codify these practices, making them mandatory;

○ Recreational Fishing

- Adopted angling rules shortening the catch and release season on the seven rivers; then, following the first annual review of the plan, adopted a rule banning fishing for Atlantic salmon in all rivers in Maine;

- Adopted a rule requiring gear changes for elver fishermen to reduce by-catch;

- Adopted rules for trout and landlocked salmon fishing to protect Atlantic salmon.

Organization and Outreach

- **Organization**

    - Formed watershed councils on each of the seven rivers and secured funding for staffing assistance to them;

    - At the urging of a number of parties, including members of ASF, reorganized the Atlantic Salmon Authority into the Atlantic Salmon Commission, placed oversight of all matters relating to Atlantic salmon under one roof, and provided the funding necessary to staff it;

- **Baselines**

    - Provided grants to several watershed councils to prepare nonpoint source assessment and remediation plans; completed the riparian assessments for four rivers;

    - Set up an ongoing water quality monitoring program on each of the seven rivers and developed a master database that is managed by DEP, which now has been funded for a full-time position to do this work.

- **Outreach**

    - Assisted watershed councils in the set-up of educational kiosks in five of the seven watersheds;

    - A website has been created highlighting local salmon conservation activities (on ASF page);

    - Completed and received extensive comments on our 1998 Annual Progress Report and amended the Plan for 1999 accordingly.

Enforcement of Existing Rules

- Logged more than 700 hours of Warden Service Patrol to identify and halt any poaching;

- Enforced permit conditions for a large new cranberry development, including one of the largest fines ever levied for a permit violation;

- Followed through with inspections of several reported forestry violations;

- Built into code enforcement officer certification training programs awareness of the Atlantic Salmon Conservation Plan and the importance of enforcing shoreland zoning standards.

Commitment of New Funds for Implementation

- Jan. 1998 through June 1999: $546, 179, almost all state funds; plus federal funds for weirs
- July 1999 through June 2000: $710,771, almost all state funds, plus funds from Land for Maine's Future for land purchases, again primarily state funds;
- Supplemental allocation, January 2000: $810,000, all state funds
- TOTAL to date: $2,066,950, plus land acquisition funds and weir funds; does not include regular funding for hatchery and stocking program.

All of these activities and achievements have implemented specific assignments in the Conservation Plan. Of course, not everyone believed the Conservation Plan went far enough, seeking the much heavier hand of government in creating and implementing a plan rather than the collaborative approach the Governor believed was essential to gaining acceptance of and cooperation in the Plan.

But it can not be said that the proposed listing is the result of inattention or lack of commitment to the Plan. We have made good progress, sometimes in the face of serious resistance, in every aspect of the Plan. Had we been given the full five years originally agreed upon, instead of two, there is no doubt that the plan, under Gov. King's leadership, whould have been fully implemented. You have done neither the Plan nor the Atlantic salmon any good by instituting this divisive proceeding.

--Evan Richert, Director
Maine State Planning Office

the vote is accurate and fair. There is no need to pull the curtain down and say, no, we have to end it right now, when so much is in doubt, when the race is so close, and when a fair and accurate counting of the ballots may move it one way or the other.

I do not know; maybe Mr. Bush will win the election. As I have said, it is not important right now whether Mr. Bush wins or Mr. GORE wins. What is important is that every voter's vote in Florida is counted accurately and counted fairly, and whether that takes us 10 days or 12 days or 2 weeks. I believe the American people deserve to have those votes counted fairly and accurately.

Earlier today my colleague from Pennsylvania, Senator SPECTER, introduced a bill proposing the formation of a commission to examine methods to reduce the miscounting of votes at the polls. I have cosponsored that legislation with him because I believe we do need to look at this situation. I think we should carefully examine alternatives, given the experience we are now going through. We should examine the electoral college. Maybe it is not perfect, but I happen to think it may be more perfect than a direct election but I am willing to look at it. Perhaps we could allocate the elector's votes by electoral district as Nebraska and Maine have decided to do. Perhaps we should consider automatically giving these electoral votes to whoever wins the State, rather than electing individual electors who could actually vote against the will of the voters in their areas. But I am intrigued by having electoral votes determined by congressional districts as Maine and Nebraska do, as I said.

We ought to consider providing counties and States the necessary funds to assist them in modernizing and standardizing their voting methods. Although it may be somewhat more expensive—we don't know—there is voting technology that exists and is used today, or some of it may be not used, that could reduce voting errors and errors in vote tally. No technology will completely eliminate inaccuracies, but this election clearly demonstrates our current methods must be improved. That is why I joined with Senator SPECTER to cosponsor this legislation. I really do believe we need a more standardized methodology of voting machines in this country.

I asked my staff earlier, How many different kinds of voting machines do we have in this country? We have looked at this question and we do not know the answer.

The PRESIDING OFFICER. The Senator's additional 5 minutes have expired.

Mr. HARKIN. I ask unanimous consent for 2 additional minutes.

The PRESIDING OFFICER. Without objection, it is so ordered.

Mr. HARKIN. We do not know how many different kinds of voting machines there are in this country. Since we are a mobile people, we move from one State to another, one area of a State to another, they can go and be totally confused by a voting machine that is different than what they had used the election before. So I wonder aloud about maybe standardizing voting machines throughout the country so, no matter where you go, you have the same voting machine that you had before.

I also believe we have to look at the latest technology—it exists—which could reduce to the barest possibility that a person does not vote for whom he or she wants to vote. There are interactive devices; I have seen them demonstrated myself, devices that any person with a disability, whether you are blind or deaf or whatever you might be, could use alongside anybody else. It wouldn't differentiate.

It would ensure that when you walked out of that booth, you knew exactly for whom you voted or for what you voted in terms of some of the resolutions and other items that are on the ballots.

If nothing else, we ought to be about this in the next session of Congress. I commend my colleague from Pennsylvania for introducing this legislation in this session, and I look forward to cosponsoring it with him when we meet again in January.

I thank the Chair. I yield the floor.

The PRESIDING OFFICER (Mr. L. CHAFEE). The Senator from Maine.

Ms. COLLINS. Mr. President, I ask unanimous consent that I be permitted to proceed in morning business for 15 minutes.

The PRESIDING OFFICER. Without objection, it is so ordered.

ATLANTIC SALMON LISTING DECISION

Ms. COLLINS. Mr. President, it is with great disappointment that I rise today to comment on the decision announced yesterday by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service to list as endangered Atlantic salmon in Maine. The decision represents an opportunity lost and reflects a process gone badly astray. It also raises serious questions about the mechanics of the Endangered Species Act, a law that I support, and how the Services have chosen to interpret and follow its dictates.

I rise also out of deep concern for the Atlantic salmon. The rivers of Maine once played host to magnificent runs of Atlantic salmon. Scores of fish returned each year to the streams where they were born after two- or three-year journeys out to sea, venturing thousands of miles off the coast of Maine, as far away as Newfoundland. The question is, "What is the best way to protect and restore these extraordinary fish?"

Yesterday's announcement is no small matter to my home State. It has serious implications for the aquaculture, blueberry, cranberry, and forest product industries that form the backbone of the economy in the most economically challenged area of Maine. The cruel irony underlying the decision is that Maine believed it had laid the issue to rest some three years ago when the Services withdrew a proposed listing and joined with the State in pursuing the Maine Salmon Conservation Plan. On December 15, 1997, the Services announced they were withdrawing their proposed listing of Atlantic salmon to pursue a "cooperative recovery effort spearheaded by the State of Maine." At that time Secretary of the Interior Bruce Babbitt announced:

> We are unlocking the full potential of rivers in Maine and opening a new chapter in conservation history. The governor showed great leadership in forging this collaboration, which will enhance the ecology and economy of the state for years to come. The seven rivers will continue to attract more anglers, boaters and other sportsmen who will help grow and sustain new jobs and revenue as the rivers continue to stand as a model for the nation.

At the same time, Assistant Secretary of Commerce for Oceans and Atmosphere and NOAA Deputy Administrator Terry Garcia praised Maine's salmon conservation plan with these words:

> This plan, which was developed by a state-appointed task force with input and advice from federal fisheries scientists, is an innovative effort to resolve the real world conflicts that occur when preserving a species clearly means rethinking traditional uses of a river. Our decision to protect salmon through this plan rather than through a listing under the Endangered Species Act highlights the ESA's flexibility and our willingness to consider state-designed plans.

Bruce Babbitt's and Terry Garcia's statements purported to highlight the ESA's flexibility and the Services' willingness to consider state-designed conservation plans. But the decision to list Atlantic salmon exposes the statements as hollow rhetoric and reflects a policy of inflexibility and of rejecting potentially effective state plans as alternatives to listing. In the end, Secretary Babbitt and Mr. Garcia reneged on their commitment to work with the state, within the framework of the state plan.

The Services have taken the implicit position that they are under no legally-binding obligation to abide by their earlier commitments to work with the state through the Maine Salmon Conservation Plan. In proposing the salmon listing, they abandoned the Plan, which the Services relied on to withdraw their 1995 proposal to list Atlantic salmon as threatened. Indeed, in withdrawing the proposed listing three years ago, the Services referred to the Plan as "a comprehensive collection of measures and protective actions that offer[s] a positive benefit to the species" and as a substitute for listing. Moreover, at the time, the Services signed a statement of cooperation with the State of Maine to support the Plan as the means toward restoring Atlantic salmon in the seven identified rivers.

In short, the Services gave every indication that they were committing to the Plan as an alternative to listing the salmon under the Endangered Species Act.

And that is precisely how the ESA is meant to operate. Listing determinations may not be made until the Services take "into account those efforts, if any, being made by any State * * * to protect such species." As one court recently put it, "The ESA specifically requires [the Services] to consider conservation efforts taken by a state to protect a species." By its own terms, the ESA also encourages states "to develop and maintain conservation programs." This means that the Services can and should rely on a competent state plan to avoid listing a species as threatened or endangered. In Defenders of Wildlife v. Babbitt, decided just last year, the court ruled that the Fish and Wildlife Service properly relied, in part, on a cooperative state/federal conservation plan to withdraw a proposed rule to list the flat-tailed horned lizard under the ESA. The court reasoned as follows:

The ESA was not implemented to discourage states from taking measures to protect a species before it becomes technically or legally "necessary" to list the species as threatened or endangered under ESA guidelines. Rather, states are encouraged to work hand in hand with other government agencies and conservation groups to implement evolving policies and strategies to protect wildlife over time. Though the ESA regulations may represent many species' last chance at survival, Congress surely did not intend to make it the only chance at survival.

The court's decision in the Defenders of Wildlife case hits the nail on the head. The ESA encourages state/federal cooperative efforts to protect and restore species before listing is required. This goal is supported further by the Services' own regulations, which authorize Candidate Conservation Agreements between the Services, states, and private entities. These agreements are "designed with the goal of precluding or removing any need to list the covered species," a goal shared by the Maine Salmon Conservation Plan. The Services' stated policies, too, profess to "[u]tilize the expertise of State agencies in designing and implementing prelisting stabilization actions * * * for species and habitat to remove or alleviate threats so that listing priority is reduced or listing as endangered or threatened is not warranted." The Services also are working to establish criteria for evaluating the certainty of implementation and effectiveness of formalized state conservation efforts in order to facilitate the development of such efforts. Again, the goal is to make listing a species as threatened or endangered unnecessary.

In short, the Services are well-aware that the ESA encourages cooperative, responsible conservation efforts such as Maine's plan. Three years ago Commerce Department official Terry Garcia celebrated the Plan as "highlight[ing] the ESA's flexibility and [the Services'] willingness to consider state-designed plans." Today, the Plan has been rejected as not "adequately address[ing] the increasing threats salmon are facing from aquaculture, fish disease, habitat modification and catch-and-release fishing." No compelling record has been established indicating that the Plan has not met its interim goals. No request was made to modify the Plan. It was simply abandoned.

The Services contend that the proposed rule was the direct result of a status review that they conducted some time in 1999 and issued in October of that year. Yet, the Status Review is riddled with logical fallacies and unsupportable conclusions. Moreover, its timing presents cause for concern.

Under the ESA, "species" is defined to include any "distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." In other words, a subpopulation of a given species can be listed under the ESA if, indeed, it is distinct and self-contained. In the current circumstance, the Services rely on a supposed distinct population segment of Atlantic salmon remarkable only for its genealogical diversity. The population segment proposed for listing includes salmon in eight Maine rivers—each of which has long been under an intensive federal stocking program—and, curiously, does not include Atlantic salmon stocked in the Merrimack and Connecticut Rivers.

As far back as 1979, Congress expressed great concern about the Services' misuse of distinct population segments. In the report accompanying the bill to re-authorize the Endangered Species Act that year, the Senate Committee on Environment and Public Works, while acknowledging there may be some instances where different population segments of a single species are appropriate stated, "Nevertheless, the committee is aware of the great potential abuse of this authority and expects the FWS to use the ability to list populations sparingly and only when the biological evidence indicates that such action is warranted." In this case, the population distinction proposed by the Services fails to meet the standard set by Congress due to both a long-running stocking effort and the use of a territorial boundary that has little to do with reproductive isolation.

The July 1999 Status Review documents a stocking effort in the Kennebec, Sheepscot, Ducktrap, Narraguagus, Pleasant, Machias, East Machias, and Dennys Rivers that dates back to 1871. Up until 1992, these various stocking efforts took no account of the river-specific genetics that form the basis of this proposed listing. In 1871, 1,500 parr from the Canadian province of Ontario were released into the Sheepscot River. That was the first of many instances of planned introduction of foreign salmon for the purpose of interbreeding into what the Services now claim to be a genetically distinct population segment. Over eight years in the 1960s, 136,500 parr and 65,700 smolt—100 percent of which came from rivers in Canada—were stocked in the Sheepscot river. As late as 1990 and 1991, 13 percent of a substantial stocking effort used fish from New Brunswick.

In fact, from 1970 to 1992, while many substantial stocking efforts occurred putting millions of fry, parr, and smolt in these Maine rivers, not a single effort used salmon from the home river. In a stocking program 128 years old, only in the last seven years have river-specific salmon been used. For the Services now to try to claim that the fish in the eight rivers constitute a distinct population segment after this massive, century-long effort designed purposefully to introduce fish from other rivers and other countries into the eight is plainly disingenuous.

The Biological Review Team acknowledges that historic stocking practices may have had an adverse effect upon the genetic integrity of local stocks but claims that the limited stocking abilities of these early efforts minimized interference with the genetic purity of these river stocks. This is inconsistent with other assertions in the biological review.

The Services claim escaped aquaculture salmon pose a grave threat to the river-specific genetics of the salmon they propose to list. On the one hand, the Services argue that the enormous stocking of non-river specific species did not change the genetic composition of these stocks because the 128-year stocking effort was primitive, even in 1991. Yet, on the other hand, the Services claim an estimated 113 suspected adult escapees in the last ten years from aquacultural facilities in the Gulf of Maine pose a grave threat to genetic makeup of these river-specific salmon. Simply put, the Services' position defies logic.

The ESA requires that a listing decision be made on the basis of scientific data relating to the status of the species taking into account state protection and conservation efforts. Nowhere does the ESA permit a listing decision to be driven by a national interest group's lawsuit meant to force a listing to occur. Yet, it appears this sort of motivation may underlie the Services' decision to abandon the Plan. I wrote Secretary Babbitt and then-Secretary Daley requesting documents concerning the listing process and, in particular, the decision to conduct the Status Review. The Status Review appears to have commenced shortly after a lawsuit was filed to force an emergency listing of the salmon. The documents shed light on the Services' motivations in ordering the Status Review and, ultimately, deciding to list Maine's Atlantic salmon.

I would like to take a few minutes today to share with my Senate colleagues what I found when I examined the documents provided to me by the

Services, some pursuant to subpoena. I do so because the documents reflect a listing process that appears to have been badly out of step with the letter and spirit of the ESA.

It is important to keep some dates in mind. On December 18, 1997, the Services withdrew a proposed rule to list the very same Atlantic salmon under the ESA. Again, the withdrawal was made with much fanfare and was based in large part on the State's adoption of the Maine Salmon Conservation Plan. On January 27, 1999, Defenders of Wildlife and other plaintiffs filed suit against the Services claiming that the withdrawal was an arbitrary and capricious decision and seeking an emergency listing of the Atlantic salmon. Some time thereafter, the Services began a biological review of the status of Atlantic salmon in Maine. According to the Services, the review was completed in July 1999, though it was not released until October of the same year. In August 1999, a second lawsuit was filed against the Services. The two cases were eventually consolidated. Then, on November 17, 1999, the Services issued a proposed rule to list the Atlantic salmon as endangered. That proposed rule led to the recent listing decision.

More than anything else, the documents I requested show that concerns about losing the lawsuits influenced the Services ultimately to abandon the Maine Salmon Conservation Plan and to proceed toward an ESA listing. But the decision to abandon the plan was not easily reached. The documents show that, throughout much of 1999, the Services were in disagreement over whether to abandon the State plan. In a March 31, 1999 e-mail, for example, Department of Interior officials express dismay over the position of the Department of Commerce legal team, which purportedly believed that "the state should be given every opportunity to accomplish the conservation measures accepted under the 1997 non-listing decision." According to this same e-mail, the Commerce Department legal team felt that NMFS could "maintain a more productive relationship with the state if eventually forced to list by the court (as opposed to willingly listing)."

For its part, the Interior Department legal team apparently did not want NMFS to give the Maine plan a further chance. In an April 2, 1999 e-mail, an Interior Department lawyer wrote to a colleague at the Commerce Department that he had heard NOAA's general counsel had, "without consulting [the Fish & Wildlife Service], recommended that NMFS give the state a list of conservation plan deficiencies and a delay of several months to address them." The e-mail continues: "Today, I heard that NOAA Assistant Administrator for Oceans & Atmosphere Terry Garcia has picked up the idea and is running with it." The Interior Department lawyer went on to express his concern that giving Maine time to implement and improve the plan "will appear political, and will be difficult to defend on scientific grounds."

Another Interior Department attorney expressed her opposition to the NMFS proposal more pointedly. She argued that giving the State of Maine more time to conserve and restore Atlantic salmon through its plan would risk a loss in the ongoing salmon litigation. In her words, "racking up another loss on conservation agreements" such as Maine's would "threaten" the Service's ability to rely on such plans in the future in lieu of listing.

Yet this view was not shared equally by each Service. It appears that the Commerce Department was more optimistic that the Maine Salmon Conservation Plan could be relied upon as an effective defense to the ongoing litigation. Another e-mail, dated March 30, 1999 and between two Interior Department attorneys, notes a NMFS official's view that the state plan could provide "a viable defense" in the ongoing litigation. The Interior Department attorney disagreed, citing "serious litigation risks" and the potential for setting an adverse precedent that could "extend to future actions in lieu of listing."

The Services' differing stances on whether to support or abandon the State plan lasted at least into August 1999, mere months before the listing proposal was issued. An e-mail between two Interior Department attorneys, and which appears to have been written in August 1999, notes that "NOAA management apparently still feels ESA listing over state opposition is wrong." The e-mail goes on to characterize a Commerce Department attorney's "best scenario" as the State of Maine agreeing to a "friendly listing, perhaps as threatened." The notion of a "friendly" threatened listing also appears in an August 17, 1999 e-mail between the same two Interior Department lawyers. The e-mail discusses the view of the Commerce Department attorney as follows: "The Services could either immediately propose a threatened listing and start working on a 4(d) rule, or propose as endangered and back off to a threatened listing if the state plays ball for the next few months."

These documents are disturbing because they show that legal considerations—and not "solely . . . the best scientific and commercial data available," as required by law—motivated the Services' decision to abandon the state plan and list Atlantic salmon in the Gulf of Maine as endangered. Granted, there is a clear link between science and the viability of the Maine Salmon Conservation Plan. The plan is either effective in conserving and restoring Atlantic salmon, or it is not. But the fact that the Services differed as to whether the state plan could be relied upon as an effective defense in the salmon suits makes the decision to list appear more like a matter of litigation strategy than a matter of science. Indeed, in another e-mail, an Interior Department attorney explains the effort to complete the 1999 salmon status review as a means "to support whatever action [the Services] take next."

Ultimately, I believe that the Services should be able to rely on appropriate, effective state conservation plans in lieu of listing. At the same time, a state that makes the effort to craft an effective plan in cooperation with the Services, should be afforded assurances by the Services that the plan will not be abandoned, as Maine's plan was, after only one full year of implementation. A state should be encouraged to propose effective conservation plans and should be able to count on the Services' consistent support. A listing decision should not be affected by whether or not a state "plays ball." It should be affected by the actions a state has made and commits to make to conserve and restore a given species.

I wanted to speak to my colleagues today in the hope that the experience Maine has undergone will not be repeated. One potential solution was suggested five years ago, by President Clinton. In a 1995 white paper recommending changes to the Endangered Species Act, this administration wrote the following:

> To encourage states to prevent the need to protect species under the ESA, the ESA should explicitly encourage and recognize agreements to conserve a species within a state among all appropriate jurisdictional state and federal agencies. If a state has approved such a conservation agreement and the Secretary determines that it will remove the threats to the species and promote its recovery within the state, then the Secretary should be required to concur with the agreement and suspend the consequences under the ESA that would otherwise result from a final decision to list a species. The suspension should remain in place as long as the terms or goals of the agreement are met.

Were such a standard adopted by policy or statute, Maine and other states would have the incentive to devise and fully implement effective conservation agreements. The alternative is what has taken place in Maine. A plan is announced with great fanfare and a listing proposal is withdrawn. One year and a lawsuit later, the Services reverse course, deeming the plan as unfit to rely upon as a litigation defense. This is the wrong result, and I would hope that during the next Congress, we can change the Services' policy or change the law to encourage responsible, effective state conservation plans.

Mr. President, in order to avoid taxpayer expense, I will not ask that the documents I referred to be printed in the RECORD. Instead, I will post the documents on my Web site. Thank you.

Mr. President, I yield the floor and, seeing no one seeking recognition, I suggest the absence of a quorum.

The PRESIDING OFFICER. The clerk will call the roll.

The assistant legislative clerk proceeded to call the roll.

Mr. DODD. Mr. President, I ask unanimous consent that the order for the quorum call be rescinded.

The PRESIDING OFFICER. Without objection, it is so ordered.

THE IMPORTANCE OF GETTING IT RIGHT

Mr. DODD. Mr. President, I rise to share for a few moments this afternoon, before we adjourn for the day, if not for the week, some thoughts on the ongoing events, most obviously, the 2000 Presidential election.

I will talk about some of the mechanics of this and some of the comments made earlier in the day by my colleagues from Iowa and Pennsylvania, and some thoughts that they shared.

Before getting to the substance of that, I am a Democrat. Obviously, as a Democrat, I am hopeful AL GORE and my colleague from Connecticut, JOE LIEBERMAN, will be elected President and Vice President. Certainly, I fully understand how colleagues of a different political persuasion and other Americans hope that George Bush and Dick Cheney will win the election. I suspect maybe the Presiding Officer may share those views.

The most important belief everyone ought to have is that this process, at the end of it, whenever that comes—whether it is the end of this week or sometime over the next several days or weeks—that if it takes a little time, that is uncomfortable, but the most important conclusion is that it be one the American people support, even those who would have wished a different outcome in the election.

I served on the Select Committee on Assassinations 20 years ago in which we reopened the investigation of the assassinations of John Kennedy and Dr. Martin Luther King. What possible analogy could those two events have with this? Well, my colleague from Rhode Island and others may recall that the Warren Commission, which did the initial investigation into the tragic assassination of President Kennedy, was urged at the time to hurry up, to rush to get the job done, and they did. In retrospect, they did as well as they could have under the circumstances. But there was sufficient pressure to get the job done. Several years later, we had all sorts of questions raised that the Warren Commission did not address during the period of its consideration. I don't think we ever would have satisfied some of the elements who are always going to be convinced of conspiracy theories. But for an awful lot of other Americans, had the Commission taken a bit more time and gone through the facts a bit more carefully, we could have avoided the problems that ensued thereafter, including a whole new investigation of the assassination some 13 years after the events occurred in 1963.

The analogy is this: Obviously, we are not talking about that length of time, but while I hear people urging a quick decision, a fast decision, we all understand, while we like clarity and we would like a decision made immediately, we need to place at least as much emphasis, if not more, on this decision being the right decision, that the decision is seen as being fair and just and an expression, as close as we can have in an election involving more than 100 million people across the country, of the will of the American people.

That is going to be difficult because of the closeness of the race. It is important to get this done quickly, but it is more important to get it done correctly.

We do not want a substantial percentage of the American public questioning the legitimacy of the 43rd President of the United States—whether that is AL GORE or Gov. George Bush. The American people should support that choice and have confidence that the choice was the right one. I hope that, while there are those clamoring for a quick decision, we get the right decision. Utilizing the courts and utilizing manual counting ought not to frighten people. Courts are used in our country when there is a dispute that can't be resolved, where facts and theories of law are in dispute. If that is the case, you go to court and try to get an answer. You would do that if you were talking about county commissioner or secretary of State. In the State of Florida, we should do no less with the office of the President of the United States. In the final analysis, the new President will look back and be grateful that we took the time to get it right; that we did not rush to a quick judgment here for the sake of what may appear to be sort of an early way to achieve a win.

Having said all of that, there will be much talk in the coming weeks about what went wrong here, what could have been done differently, and issues around the electoral college, whether we ought to keep it, abandon it, or reform it. Are there things we can do from a Federal standpoint to assist our respective States so we don't have the kind of confusion that has emerged here and regarding some of the ballot choices and equipment used to record people's votes? There will be all sorts of ideas shared.

My first suggestion and hope would be that people take time to step back and examine our current situation. I get nervous when people have quick solutions for an immediate problem that has emerged, such as here with this close election. Lets not forget that we have been a republic for 211 years. This will be the fourth such election out of 43 Presidential races where there has been a close race, where the popular vote and the electoral votes—and we don't know the final outcome of this one—have a different result.

Before we decide we want to radically abandon this system, my strong suggestion to my colleagues and others who will be commenting, is to take some time to think it through carefully and not rush out and be offering proposals and bills that we may come to regret. There have been some 200 proposals made to amend the Constitution regarding the electoral college over the last 200 years, many of which have been suggested over the last 40 years. Before we jump to these proposals, I suggest that we think them through.

I listened with interest earlier this day to our colleague from Pennsylvania, Senator SPECTER, discuss two issues that are obviously timely and important ones at this moment about reform in the electoral college. I wish to address those issues for a few minutes. First, let me join my colleague from Iowa, Senator HARKIN, in congratulating Senator SPECTER for introducing the concept of a bipartisan commission to examine whether we might—at least in federal elections—develop more accurate and uniform methods of recording and reporting the votes cast by the citizens of our Nation. I know at least one newspaper in the country—the New York Times—has already editorialized on this topic in favor of modernizing what many consider to be a ballot system that is in many respects and in many areas of the country fairly archaic in terms of its technological sophistication. I will join Senator SPECTER and others in developing a more thoughtful approach to this dilemma. It is a dilemma because control of elections has been left to the decision of States across the country. The federal role is somewhat limited in this, to put it mildly. It is more a question of how we can work with the States in a cooperative fashion when it comes to federal elections—elections beyond mere consideration for the offices in the respective States and counties. I think we have a legitimate interest. Certainly, that has been borne out by the events of the last week in this country. Certainly, we have seen, as I say, in the last week issues raised that none of us could imagine would have been brought up prior to the results on Tuesday night.

I think the events of the past week have shaken many Americans out of a false sense that our system—or should I say systems—of tabulating ballots is absolutely error free. It never has been perfect. No one disputes that the hallmark of our system—namely free and fair elections—is as strong as it has ever been.

Indeed, if we have learned anything over the past week, it is the truth of the maxim that it is as ingrained in our consciousness as the Pledge of Allegiance or the Preamble of the Declaration of Independence: In America, every citizen counts.

That is a mantra we hear over and over again: Every citizen counts. Every citizen has a part to play in choosing how we shall be governed. Many of us have said over the last week: Don't ever let me hear anybody say again that every vote doesn't count, or a single vote doesn't count. You have seen

STATEMENT OF ZEKE GRADER, PACIFIC COAST FEDERATION OF FISHERMEN'S ASSOCIATION

Good morning, Mr. Chairman and subcommittee members, my name is Zeke Grader. I am the executive director for the Pacific Coast Federation of Fishermen's Associations (PCFFA), representing working men and women in the west coast commercial fishing fleet. We are a federation of many different fishermen's marketing associations, vessel owners associations and fishermen's cooperatives with member organizations as well as individual members in ports from San Diego to Alaska.

The fishing men and women and their organizations that make-up our federation are the economic mainstay of many coastal communities and cities. PCFFA members represent at least half a billion dollars in economic investments which generate tens of thousands of family wage jobs—not only in coastal communities, but far inland as well. In other words, hard working men and women who help put fresh, high-quality seafood on America's table, create a job base for coastal communities, and help support a multitude of Federal, State and local community services through our taxes, all from the bounty of the seas.

The commercial fishing industry represents a significant economic sector in this Nation, accounting for well over $50 billion in economic impacts and more than 700,000 jobs. When combined with another $15 billion per year generated by the marine recreational fishery, the whole offshore fishing industry now accounts for about $65 billion per year to the U.S. economy.[1] In addition to commercial fishing, the recreational sportfishing industry also contributes a mighty share to the U.S. economy. Fishing—whether for sport or commercially—is big business, with a combined economic input to the national economy in excess of $152 billion and supporting almost 2 million family wage jobs.[2]

Most of these jobs are to one degree or another dependant upon strong protection of the biological resources upon which they are based. In other words, our industry would not exist—nor would $152 billion dollars in annual income and 2 million jobs in this economy that we generate—without strong environmental protections. Our industry is a prime example of a basic economic principle:

> The fundamental source of all economic wealth is the natural environment. In the long-run environmental protection does not destroy jobs—it creates them and maintains them on a sustainable basis for the future.

In other words, the biological wealth of this country is its "natural capital." Like any economic capital, we can invest it wisely and reap its benefits indefinitely, or we can allow it to dissipate and waste it. Pushing species to the brink of extinction—and beyond—not only wastes future economic opportunities but helps destroy those industries we already have, such as the Pacific salmon fishing industry. The ESA is the law of final resort that prevents us as a society from negligently wasting our irreplaceable "natural capital"—and the jobs that this "natural capital" represents, both in the present and in our economy's future. Ultimately all economic wealth comes from our natural environment. In the final analysis this is all humanity has, and all it has ever had, from which to obtain its livelihood, and indeed its very existence.

The Endangered Species Act (ESA) dispute is not really a clash between *species* vs. *jobs*, nor even between *public trust values* vs. *private property rights*—fundamentally, the ESA dispute is a clash between short-term profiteering vs. *long-term and sustainable economic development.* The ESA merely establishes limits beyond which voracious human consumption should not go. That limit is the limit of "biological sustainability." *This is also the basis of economic sustainability as well*. As a society, we violate nature's biological limitations at both our biological *and* our economic peril.

Each species pushed into extinction is first and foremost a loss to the very fabric of our human food chain. However it also represents a lost future economic opportunity effecting our entire economy. The biological diversity of our natural resources represents the foundation upon which many industries of the present are maintained, but also upon which industries of the future will be built and people of the

[1] Economic figures from *Our Living Oceans, Report on the Status of U.S. Living Marine Resources*, 1992. NOAA Tech. Mem., NMFS-F/SPO–2. National Marine Fisheries Service, NOAA, U.S. Dept. of Commerce, Washington, DC. See also *Analysis of the potential economic benefits from rebuilding U.S. fisheries* (1992). National Marine Fisheries Service, NOAA.

[2] From *Fisheries, Wetlands and Jobs: The Value of Wetlands to America's Fisheries,* a report by William M. Kier Associates (March 1998) for the Campaign to Save California Wetlands, available on the Internet at: http://www.cwn.org/docs/reports/kier/kiertitle.htm. See also Maharj and Carpenter (1997), *The 1996 Economic Impact of Sport Fishing in the United States,* by the American Sportfishing Institute, Washington, DC.

future will be fed. Wasting our "natural capital" dramatically impoverishes our society by limiting our future industrial and economic growth.[3]

The commercial fishing industry has seen the Endangered Species Act up close and in operation for many years. Our industry is a highly regulated industry. We are, for instance, far more strictly regulated under the Endangered Species Act (ESA) than the Northwest timber industry, and for many more species. While the timber industry has recently suffered through curtailments caused by one or two ESA listings, the fishing industry has long been dealing with the impacts of listings for chinook salmon in both the Columbia and Sacramento Rivers, sockeye salmon in the Columbia, sea turtles in the Gulf, marine mammal species protected under both the ESA and the Marine Mammal Protection Act (MMPA), and various species of seabird protected under both the ESA and the Migratory Bird Treaty Act (MBTA). On the west coast, we have also learned to cope with ESA listings for coho and sockeye salmon and some runs of chinook as well. The cumulative effects of this multitude of listings is, frankly, *far* more restrictive than any past restrictions caused merely by spotted owls or marbled murrelets.

There is, in fact no industry more regulated under the ESA presently, nor more likely to be regulated in the foreseeable future, than the commercial fishing industry. We can therefore speak with some authority, as a regulated industry, on how well the ESA works. *Yet in spite of short-term dislocations created by listings, we view the protections offered by the ESA as vitally important in protecting and preserving our industry, our jobs and our way of life for the long term.* It is species declines and the forces which cause those declines which are the real enemy, not the ESA. The ESA is only the messenger.

It is, in fact, axiomatic that a species only qualifies for listing under the Endangered Species Act because it faces extinction. This point seems to have been missed by many who are calling for the elimination or curtailment of ESA protections. The best way to prevent listings, then, is to prevent the species' decline in the first place. Limiting or repealing the ESA itself only throws out the primary tool to achieve recovery, in other words shoots the messenger, but does nothing to reverse the underlying declines. In other words, the ESA is only the warning bell and not the problem itself. Disconnecting the warning bell is not a viable response to an emergency in the making.

72,000 SALMON JOBS AT RISK—SALMON AS A CASE IN POINT FOR HOW THE ESA PROTECTS JOBS

Salmon, once the economic mainstay of both the commercial and recreational fishing industry in the west have been reduced by decades of short-sighted human actions to a mere shadow of their former glory, largely as a result of a multitude of cumulative on-shore causes. The great salmon runs of the east coast are all but gone, more than 98 percent of those runs now extinct.[4] Salmon in east coast restaurants are almost always inferior Norwegian salmon raised artificially—which exports to Norway thousands of jobs that should have belonged to American fishermen. The virtual extinction of the east coast's once abundant salmon runs, which once extended well down into Georgia in colonial times, and the elimination of an entire segment of the fishing industry in the process, is one of our greatest American tragedies. The efforts now to bring those enormously valuable biological re-

[3] The $152 billion/year fishing industry is but one example of this principle. Fully 40 percent of the known medically valuable pharmaceuticals, for instance, are derived from natural sources. This represents an industrial economy also in the hundreds of billions of dollars worldwide, as well as many millions of lives saved. Yet only about 1 percent of all the plant species now known have been adequately surveyed for their pharmaceutical value, and only a small fraction of all plant species have even been cataloged categorized. Many will likely become extinct before that can be accomplished. The booming biotechnology industry is also another example. Their stock in trade is genes. These genes, however, can only come from known natural sources—even the simplest gene is millions of times too complex to synthesize in the laboratory by any known technology. Unknown plant species may contain genes for disease resistance worth billions to a failing crop industry, or worth billions more for any of a number of other unknown and as yet undiscovered industrial processes. Once extinct, however, the potential uses of the organism will never be known. Every species driven to extinction gives us fewer economic options.

[4] The last remaining wild salmon runs in the eastern coast of the United States are in a handful of rivers New England. These have recently been listed for protection under the ESA. There are in fact more dams in New England than there are individual adult wild salmon returning to your rivers—about 2,500 wild salmon still return to New England, while there are about 3,000 medium and small dams in the same area, many of them obsolete. However, as we have recently seen by the example of the removal of Maine's Edwards Dam, once these dams are removed, the fish runs can be restored. PCFFA has recently spearheaded the removal of several dams in the California Central Valley with the same result—provide them decent habitat and the salmon will return.

sources back from the brink through their listing under the ESA, and the modification of other industrial sectors to make that possible, is well worth the effort.

The destruction of salmon spawning and rearing habitat has also been ongoing and pervasive in the west for many decades—it is just a few decades behind the east coast but going along the same path leading to extinction. Every year fewer and fewer salmon survive the silting up of their spawning grounds by inappropriate or poorly planned logging, grazing and road building practices. Fewer still survive the nightmare ride through hydropower turbines and slack-water reservoirs in the more than 30 major Federal and State Columbia River Basin hydropower dams. In the eight federally operated Columbia and Snake River mainstem dams alone, each dam's turbines and hot water reservoirs combined kill up to 15 percent of the outmigrant fish making their long journey to the sea.[5] 3,000 miles of prime salmon spawning streams in the Sacramento Basin have now been reduced to less than 300, and much of what remains is biologically damaged or suffers from too little cold water during critical spawning times.

The relatively few wild salmon which remain alive after all these accumulated impacts are then subject to otherwise natural ocean fluctuations (El Niños) which, *combined with all the upstream human-caused assaults,* can be the final blow to an already highly stressed salmon ecosystem. Once the numbers of salmon in a stream drop below a certain threshold, the remaining fish cannot reliably find each other to mate. Even though many fish remain, the run has then dropped into what is called the Aextinction vortex and numbers drop precipitously from that point onward—only major intervention can then save them. This is precisely what seems to be happening over much of the west coast and has happened long since for salmon over most of the Atlantic seaboard.

Salmon are the most sensitive to their environment in the egg stage and as juveniles when they are still in freshwater streams just after spawning. Some species (such as coho salmon) spend a fairly long time in freshwater streams since they must "overwinter" there for up to 18 months before migrating out to sea. Even once they leave these freshwater streams, salmon must still spend additional time in coastal wetland estuaries and marshes in order to gradually adapt to life in salt water. They are "anadromous" fish, which means they are hatched in freshwater, then adapt to salt water, then return again to freshwater to spawn. In the ocean they are relatively large and relatively safe, but in inland streams they are subjected to every environmental problem created by mankind, in addition to natural predation and other natural impacts. Salmon evolved for drought, for El Niños, to avoid predators—but have not evolved to prevent themselves from being sucked into irrigation pumps, nor from being destroyed by hydropower turbines, nor stranded without water in unscreened irrigation ditches. They also have not evolved to survive water pollution, oil spills and the many other unfortunate environmental problems created by modern civilization.

Roughly speaking, we have lost about 80 percent of the productive capacity of salmon streams in the west coast as a direct result of various causes of watershed destruction. According to a 1991 comprehensive scientific study by the prestigious American Fisheries Society (AFS), *at least 106 major populations of salmon and steelhead on the West Coast are already extinct.* Other studies place the number at *over 200 separate stock extinctions in the Columbia River Basin alone.* The AFS report also identified 214 additional native naturally spawning salmonid runs at risk of extinction in the Northwest and Northern California: 101 at high risk of extinc-

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[5] Both the impacts from upper watershed activities (improper logging, overgrazing, road washouts, etc.) and the impacts from the hydropower turbines are largely *avoidable*. Many of these practices are obsolete and unnecessary, and profits in these industries will not greatly suffer from curtailing or mitigating these problems. The externalized damage caused by these poor management practices is, in many cases, more of a harm to society (and to the very industry itself) than any conceivable short-term benefits. As an industry ourselves, we are very sympathetic to the current plight of timber works (many of whom are also fishermen)—however, it is clear that short-sighted logging, grazing and hydropower practices conducted *without any regard to stream protection* has been disastrous for our industry and for the economies of many coastal communities. Most of the Federal hydropower dams were built without downstream salmon passage, and some (such as the Grand Coulee Dam) without any upstream passage whatsoever. Salmon are now totally extinct above Grand Coulee Dam, and this extinction was designed into the system. The fishing industry is federally regulated on the basis of biological sustainability (Magnuson Act). It is time that these other industries were as well. The current dislocations in these industries are fundamentally caused by past unrestricted overuse of their resource which now has to be balanced out and made more sustainable. The historical rate of timber harvesting over the last few decades has been many times what is biologically sustainable without doing major environmental damage to other industries. The fundamental problem with the timber supply is that after decades of overcutting old growth timber, the timber industry is simply out of big trees.

tion, 58 at moderate risk of extinction, and another 54 of special concern.[6] In a recent extensive GIS mapping study of present salmon habitat occupied versus historical habitat, based on the AFS data and updates, the data indicated the following distributions across the landscape:

Status of Salmon Species in the Pacific Northwest and California

Current Distribution as a Percentage of Historic Habitat

Species	Extinct [In Percent]	Endangered [In Percent]	Threatened [In Percent]	Special Concern [In Percent]	Not Known to be Declining [In Percent]
Coho	55	13	20	5	7
Spring/Summer Chinook	63	8	16	7	6
Fall Chinook	19	18	7	36	20
Chum salmon	37	16	14	11	22
Sockeye	59	7	3	16	15
Pink salmon	21	5	<1	<1	73
Sea-run Cutthroat	6	4	61	29	0
Winter Steelhead	29	22	7	18	24
Summer Steelhead	45	5	5	27	18

According to GIS mapping, Pacific Northwest salmon are already extinct in 38 percent of their historic range, between 50–100 percent of these species are at risk or extinct in 56 percent of their historic range, and *in only 6 percent of their historic habitat range are fewer than 50 percent of these salmon species at risk or extinct.*[7] The conclusions of this study (the best and most complete science to date) are chilling—9 out of 10 known species of Pacific salmon will be extinct in the lower 48 States in the near future unless land use patterns pressing those stocks toward extinction are reversed.[8]

The productive capacity of the salmon resource has always been enormous. Even as recently as 1988, and in spite of already serious existing depletions in the Columbia and elsewhere, the Northwest salmon fishing industry (including both commercial and recreational components) still supported an estimated 62,750 family wage jobs in the Northwest and Northern California, and generated $1.25 billion in economic personal income impacts to the region.[9] An additional estimated job loss from the Columbia River declines alone had already occurred by the 1988 baseline year, amounting to another $250-$505 million in annual economic losses as well as the destruction of an additional 13,000 to 25,000 family wage jobs. These jobs had already been taken out of the economy as a direct result of dam-related salmon declines in the Columbia basin prior to 1988.[10]

Hydropower and irrigation dams are probably the major leading factor in the collapse of the salmon fishery on this coast. Historically almost one-third of all west coast salmon were produced in the Columbia and Snake river systems, making that river the richest salmon production system in the world. Now, however, in the Columbia and Snake rivers the hydropower system accounts for about 90 percent of all human-induced salmon mortality, *as opposed to only about 5 percent for all commercial, recreational and tribal fisheries combined.* Official figures from the Northwest Power Planning Council indicate that the Columbia River dams kill the equivalent of between 5 million and 11 million adult salmon every year, with several mil-

[6] Nehlsen, et. al., 1991. "Pacific Salmon at the Crossroads: Stocks at Risk from California, Oregon, Idaho, and California," Fisheries 16:2(4–21).

[7] From GIS survey maps prepared by scientists on contract to The Wilderness Society, and published in The Wilderness Society's report *The Living Landscape: Pacific Salmon and Federal Lands (Volume 2).* Published by the Bolle Center for Forest Ecosystem Management (October 1993). The report and data were peer reviewed.

[8] The one exception was pink salmon, which now only occurs in the extreme upper portion of the Puget Sound area in limited populations. These are also (incidentally) the areas least affected by development since much of that area is in Olympic National Park—emphasizing the direct correlation between salmon production and intact watershed ecosystems.

[9] See the Endnote.

[10] From a report titled *The Costs of Doing Nothing: The Economic Burden of Salmon Declines in the Columbia River Basin.* Institute for Fisheries Resources (October, 1996), based on figures from peer reviewed reports by the Northwest Power Planning Council. Completion of the last main-stem Federal hydropower dams was in the late 1970's, and none were built with adequate fish passage. That study concluded that salmon losses in the Columbia Basin to date have amounted to the removal from the regional economy of between 13,000 and 25,000 jobs annually at a cost to the economy of between $250 to 505 million dollars annually, which translates to the loss of natural capital assets conservatively estimated as up to $13 billion.

lion more killed by a variety of dam related habitat loss factors in the upper watersheds of the region.[11] Many millions more fish are killed in the Central Valley Project and in the Klamath Basin by loss of in-stream flows.

Another problem is wetland losses throughout the west coast. California has already lost 91 percent of its original wetlands, Oregon has lost 38 percent and Washington has lost another 31 percent and the remaining percentages of original wetlands have been severely compromised in their biological functions.[12] These wetlands are vital in protecting overwintering salmon, helping them survive droughts and (for saltwater wetlands) helping them adapt to ocean conditions. A main factor in the destruction of the coastal salmon stocks in the Northwest has been the rampant destruction of the area's wetlands. Loss figures for the most valuable coastal and estuarine wetlands are much greater than the overall State loss averages.

There has been a lot of press recently about court ordered irrigation cutbacks in the Upper Klamath Basin that have been imposed to protect salmon and other fish from extinction, with the farmers blaming the Endangered Species Act for problems that are clearly caused by a drought. In fact, the Courts under the ESA have only been saying that, especially in a drought year, natural *public* resources should have enough water to survive. In short, the court said that the irrigators cannot take all the water for themselves, drying up the rest of the river system at the expense of everybody else.

In other words, the ESA requires the protection of the very ecosystem which supports all of these economies, and forbids wasting all of our natural resources (which are owned by the public in general) simply to benefit a few farmers for a few years. It just makes no sense to keep irrigating croplands as usual in the midst of what has become the Klamath Irrigation Project's worst drought in its entire 90 year history, particularly when the result will inevitably be a dried up river, dead lakes, the final extinction of several commercially valuable species and the total destruction of a whole downriver fishing economy that also supports thousands of coastal jobs—all this destruction just to keep feeding a bloated Federal irrigation project that produces federally subsidized surplus crops for which there is now little or no market.

The relatively large salmon harvest projected this year in Central California is an instructive exception to these decline trends. The primary cause of those increases has probably been water reforms in the Central Valley, driven by the listing under the ESA several years ago of the devastated native runs of Sacramento winter-run chinook salmon and the delta smelt. Although some of those reforms are now embodied in the Central Valley Project Improvement Act, the ESA listing predates the CVPIA by several years and forced these reforms to be made. Greater in-stream smolt survival coupled with fortunate ocean conditions have thus given us a large harvestable run and put a lot of California fishermen back to work while other areas along the west coast where habitat loss and water diversions still continue are still in decline.

In fact, the salmon rebounds in recent years from the California Central Valley is an ESA success story. ESA driven water reforms in California were long overdue, are starting to have their effect, and are now resulting in abundant and sustainable salmon harvests once again off the shores of California. The ESA has thus resulted in restoring jobs, communities and a tax base once again to schools and public services in many coastal fishing-dependent rural ports. There is a long way to go, but none of this could have been done had not the ESA forced society into a better balance in the protection of our fundamental Anatural capital, our priceless natural resources.

ESTIMATES OF SALMON JOB LOSSES DUE TO LACK OF PROTECTION OF SALMON RESOURCES

California's returning salmon harvests are certainly encouraging, and show us what better resource protection can accomplish. However, with the one major exception off California, and a few very minor mostly sportfishing exceptions in Washington and Oregon, most of the entire ocean going salmon fleet was closed down or severely restricted since 1994 because of these declines, particularly of coho salmon which is now ESA listed. Even with some harvests returning in central California, we estimate that coastwide we have still lost 90 percent of our industry income from

[11] Northwest Power Planning Council publication Strategy for Salmon, Vol. 2, page 17 and Appendices D and E.

[12] Facts on wetland losses by State from a report by the U.S. Department of the Interior entitled *Wetland Losses in the United States 1780's to 1980's* by Thomas Dahl. California has lost a higher percentage of its wetlands than any other State. If only coastal or estuarine wetlands is included in these figures, each State's wetlands losses would be much greater.

the commercial fishery as compared to the 1976–1993 averages—which translates to loss of 90 percent of the jobs created by the commercial salmon industry as a whole. The recreational salmon fishing industry has also suffered a similar decline of 70 percent in that same time period, with some areas (such as central Oregon) also suffering years of nearly complete closures. While there is some mismatch of figures (due to different averaged years) these two figures combined will give us a pretty good estimate of total salmon industry job losses since 1988. Doing the calculation we get job losses as follows: 15,250 x 90 percent = 13,725 jobs lost since 1988 in the commercial salmon fishery; 47,500 x 70 percent = 33,250 jobs lost since 1988 in the recreational salmon fishery; 46,975 jobs lost overall since 1988.

In additional, habitat losses and hydropower mortality in the Columbia and Snake rivers have also resulted in up to 25,000 lost jobs. Adding these lost jobs to the above figures for losses in the Columbia River which occurred even before 1988 indicates *a total west coast job loss within the last two decades of approximately 72,000 family wage jobs.*

In other words, roughly 47,000 jobs have been lost in the west coast Pacific salmon fishing industry (including both commercial and recreational) just since 1988, with a total of 72,000 fishing-generated family wage jobs lost—including losses due to the current operations of the Columbia and Snake river hydropower system—over the past three decades.

Overfishing is not a likely cause of these declines. Had overfishing been a major contributing factor in salmon declines (as some have claimed) then past harvest closures should have resulted in substantial rebuilding of populations. However, there is no evidence that these closures resulted in substantial population increases—indicating that the limiting factors are in the watersheds, not in ocean or in-river harvest levels.[13] There are also a number of other indications leading to the same conclusion, including: (a) the most precipitous declines have occurred primarily in the most inshore habitat sensitive species (coho salmon) as opposed to chinook salmon which spend much less time in inland watersheds and whose populations are still relatively robust; (b) precipitous declines have also occurred in species for which there is no sport or commercial harvest (searun cutthroat) but which originate in inland watersheds in which there has been substantial human disturbance (primarily clearcut timber harvesting and increased stream siltation from logging road washouts).

When seasons remain closed, the enormous economic investment already put into the Pacific fishing fleet goes to waste. Just in the Columbia River gillnet fleet alone an estimated $110—$129 million in capital assets is invested.[14] Yet the in-river gillnet fleet is only a relative handful of small boats and its capital investment is certainly only a very small fraction of the overall capital invested in the entire ocean salmon fishing fleet. This figure does not even include buyer and processor investment. Additional salmon extinctions essentially mean the bankruptcy of whole fishing-dependent coastal communities and the waste of a tremendous capital investment built up over generations.[15]

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[13] Dr. Chris Frissell, who did much of the GIS mapping for The Wilderness Society report cited above, took an independent look at whether harvest reductions were a significant factor in population dynamics for coho salmon. If overfishing were a significant cause of population declines, then harvest reductions should be effective in rebuilding depleted stocks. He concluded in his analysis as follows:

> Overfishing is often cited as a principle factor causing decline of salmon runs. However, there are few historical or recent records to indicate that curtailment of fishing has lead to increased spawning abundance of coho salmon. For example, curtailment of fishing seasons has been thought to have reduced harvest-related mortality rates on Oregon coastal coho substantially during the past decade. However, there has been no evidence of increased spawner escapement during this period, suggesting that fishing curtailment is at best merely keeping pace with rapid habitat deterioration and declining productivity of coho populations.

(Pacific Rivers Council petition for the coastwide listing of coho salmon, dated 10/19/93).

[14] Figures from Dr. Hans Radtke, Ph.D., fisheries resource economist.

[15] There is also a cascading effect of these salmon declines which impact Alaska's economy as well. Fishing is the leading industry in Alaska, greatly exceeding timber production as a source of economic support for its communities. Much of that fishing industry is now threatened because of international disputes with Canada over the collapse of the Pacific Salmon Treaty (PST). That treaty collapsed a few years ago primarily because of salmon losses in the lower 48 States (particularly the losses from the Columbia). Oregon and Washington salmon tend to migrate north toward colder water. Under the PST as presently written, Canadian-origin fish caught in Alaskan waters are supposed to be replaced by U.S.-origin fish swimming north into Canadian waters from the lower 48. However due to widespread salmon declines in the lower 48 States, those replacement fish are much fewer in number than the fish Canada is losing to

Continued

Again these extinctions represent lost jobs, lost family income and lost local tax revenues suffered by fishing communities as a result of poor environmental protection of west coast salmon. These losses are being suffered by real people, many of them third or fourth generation fishermen, who suddenly find they cannot feed their families, pay their home and boat mortgages or help maintain their communities. Better protection of salmon and their habitat (through the ESA and other strong environmental laws) will help restore these 72,000 jobs to the region and rebuild these local economies.

WHY THE FISHING INDUSTRY NEEDS THE ENDANGERED SPECIES ACT—$152 BILLION/YEAR AND 2.0 MILLION JOBS AT RISK

Most fish species spend only part of their lives in mid-ocean. During their juvenile stage, most live and thrive in the nearshore environment of streams, rivers and estuaries. Some, like salmon, reproduce and grow far inland in fresh water streams hundreds of miles from the ocean. However, salmon are just one example of commercially valuable species that are also dependent on inshore or nearshore habitat quality.

All around the country, *our industry is utterly dependent on species which themselves require healthy watersheds and estuaries for the most critical parts of their life cycle.* Nearshore waters, including rivers, streams and coastal wetlands, are essential nursery areas for fully 75 percent of the entire U.S. commercial fish and shellfish landings. These sensitive ecosystems are valuable national assets which contribute about $46 billion per year to the U.S. economy in biological value (including natural flood control and filtration of pollutants), as well as providing its healthiest food sources. Salmon are only one part of this whole economic picture, and only one of many commercially valuable species which need protection. The bottom line protection of all these species is the Endangered Species Act.

All the Nation's $152 billion fisheries have been put at risk as a result of the continuing destruction of fish habitat in the Nation's rivers, estuaries and coastal ecosystems. This destruction has already led to billions of dollars in lost revenue to the Nation every year, lost jobs, lost food production, and lost recreational opportunities. The collapse of the salmon fishery is only a small part of this overall habitat loss problem.

Nor is coastal habitat loss the only problem. Our entire inland freshwater fish resource is also in serious trouble. According to studies by the prestigious American Fisheries Society, roughly one-third of 790 known species of freshwater fish in the United States are in danger of extinction or of special concern. In the case of a whole family of nonanadromous (i.e., resident) salmonids, more than 50 percent of all known U.S. species in that family are close to extinction. Within the largest known family of fish (the Cyprinidae), which include 29.2 percent of all known fish species in the United States, the number of species classifiable as endangered (7.2 percent), threatened (9.4 percent), of special concern (10.8 percent) or already extinct (3.3 percent) totals 30.7 percent of this entire large family of fish species. Of the 18 States with greater than 10 imperiled fish species, 10 are located in the South and 5 in the West. The 11 States with the highest number of imperiled fish species are (in descending order) Nevada (43), California (42), Tennessee (40), Alabama (30), Oregon (25), Texas (23), Arizona (22), Virginia and North Carolina (21 each), and Georgia and New Mexico (20 each).[16]

This country is in the midst of an ecological disaster which is causing tremendous economic losses throughout the Nation in this and many other resource dependent industries. The large number of the Nation's fish and wildlife which qualify for listing under the ESA is just the symptom of this overall ecological disaster.

The Congress and the Administration need to make a serious commitment to the protection of those habitats and ecosystems that determine the future productivity of fish and shellfish resources in the United States. If this commitment is made, at least a doubling of anadromous fish and other near shore dependent marine fish

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the Alaskan fleet. Thus the Canadians have demanded cutbacks in the Alaskan catch to balance out their own losses. The Canadians are quite capable of enforcing these cutbacks through mandatory transit fees (already imposed for a short time last year) or even gunboat boardings on the high seas (as in the east coast's "Turbot War" between Canada and the European Union just a few years ago). To date the only thing that has driven salmon recovery efforts in the lower 48 is the threat or reality of ESA listings. *Without a strong ESA-driven recovery of these depleted lower 48 stocks there is no hope of Alaska long avoiding another "fish war" with Canada with no end in sight.* Were the ESA itself to disappear, this international problem would still force shutdowns of much of the salmon harvest in Alaska within the next few years. These shutdowns would be required not by the laws of Congress but by the laws of nature.

[16] American Fisheries Society, "Status of Freshwater Fishes of the United States: Overview of an Imperiled Fauna." *Fisheries,* Vol. 19, No. 1 (January 1994).

and shellfish populations of the "lower 48" States can be expected. This could produce an additional $27 billion in annual economic output (above and beyond the current level of $152 billion) and more than 450,000 new family wage jobs.[17]

Environmental regulations exist because after decades of neglect and pollution, policymakers finally realized that a healthy environment is the ultimate source of the Nation's economic wealth, its food and the well-being of its citizens. When all other efforts to save these valuable biological resources fail, however, the final safety net is the Endangered Species Act (ESA). In spite of the problems the ESA has created for individual fishermen, it is also the last hope for the restoration of whole industries (such as salmon fishing) in many areas. Without a strong ESA, the only available remedy for species recovery is closing down the fishery, even though the real problems lie elsewhere and are caused by rampant destruction of habitat.[18]

This is exactly what has happened to the salmon industry to date—as onshore habitat declined, as fewer and fewer fish survived to even reach the ocean, it has been the fishermen who have been cut back over and over again, and who have almost singlehandedly paid the price of inland environmental destruction on a massive scale. This is because under the Magnuson Act fishery managers can only manage fishermen—they have no legal jurisdiction over actions onshore which destroy the biological foundations of the fishery itself.[19] Only the ESA gives them the authority to modify or curtail such actions.

Thus without a strong ESA, there will never be salmon recovery in the Northwest, and the approximately 72,000 lost salmon jobs—which the salmon resource could still generate in this region with proper protection of the resource—would be gone forever. In short, salmon mean business, and it pays to protect them. Without the ESA to drive recovery, however, you can kiss the entire Northwest salmon industry—and many other components of the entire Nation's $152 billion/year fishing industry—goodbye!

The fishing industry represents a significant economic contributor to America's economy which is dependent upon a healthy environment. The ESA is not the enemy, it is only the messenger. Listing a species is like dialing the 911 number when you need an ambulance. It should be used rarely, but when it is needed it is real handy to have an emergency number to call. Often this can mean the difference between life and death.

THE "ENVIRONMENT VS. JOBS" ISSUE IS A FALSE DICHOTOMY—THE ESA DOES NOT CAUSE SUBSTANTIAL ECONOMIC DISRUPTION

There is absolutely no evidence that the ESA seriously impacts State or regional economies, and every reason to think that it does not. For instance, a study by the MIT Project on Environmental Politics and Policy, which looked at the statistical relationship between the number of species listed in each State as compared to that State's economic performance (over the period of 1975–1990) concluded:

> "The data clearly shows that the Endangered Species Act has had no measurable economic impact on State economic performance. Controlling for differences in State area, and extractive industry dependence the study finds that States with the highest numbers of listed species also enjoyed the highest economic growth rates and the largest increases in economic growth rates. . . . The one and a half decades of State data examined in this paper strongly contradict the assertion that the Endangered Species Act has had harmful effects on State

[17] Figures from *Marine Fishery Habitat Protection—A Report to the U.S. Congress and the Secretary of Commerce* (March 1, 1994), copublished by the Institute for Fisheries Resources, East Coast Fisheries Foundation and PCFFA, with extensive citations. Copy available from PCFFA upon request.

[18] Nowhere in the Nation is the link between inland environmental protection and fish production more obvious than in the Gulf States, where National Marine Fisheries Service scientists estimate that 98 percent of the Gulf commercial seafood harvest comes from inshore, wetlands dependent fish and shellfish. Louisiana's marshes alone produce an annual commercial fish and shellfish harvest of 1.2 billion pounds worth $244 million in 1991. Gulf shrimp clearly head the list of the region's wetlands dependent species. Without strong wetlands protection this extremely valuable commercial fishing industry resource would eventually no longer exist in those States. The shrimp industry is learning to cope with TED's and other devices to minimize unwanted bycatch problems. A far greater threat to that industry comes from estuary and wetlands habitat loss. The ESA is a tool which (in the last resort) can be used to halt and reverse these losses and protect that industry.

[19] Only recently has this begun to change, with the >Essential Fish Habitat' provisions of the Magnuson-Stevens Sustainable Fisheries Act, but this authority is still only a weak consultation process that allows fisheries management councils merely to comment on proposed Federal actions that would destroy fisheries habitat, not to stop them. There is no enforcement authority in these provisions.

economies. Protections offered to threatened animals and plants do not impose a measurable economic burden on development activity at the State level. In fact the evidence points to the converse. . . ."

The author of that study also noted that actual ESA listings are themselves only affecting a very small number of development projects undertaken and that, in economic context, these impacts are very small indeed in comparison to other much more major factors:

"In fact, for every tale about a project, business, or property owner allegedly harmed by the efforts to protect some plant or animal species there are over one thousand stories of virtual 'non-interference.' In reviewing the record of 18,211 endangered species consultations by the Fish and Wildlife Service/National Marine Fisheries covering the period 1987–1991 the General Accounting Office found that only 11 percent (2050) resulted in the issuance of formal biological opinions. The other 89 percent were handled informally—that is to say the projects proceeded on schedule and without interference. Of the 2050 formal opinions issued a mere 181—less than 10 percent—concluded that the proposed projects were likely to pose a threat to an endangered plant or animal. And most of these 181 projects were completed, albeit with some modification in design or construction. In short, more than 99 percent of the projects reviewed under the Endangered Species Act eventually proceeded unhindered or with marginal additional time and economic costs. Given the political and economic screening that occurs in listings cases it is not surprising that no measurable negative economic effects are detectable. . . .

Furthermore local economic effects must be considered in context. Hundreds of State and Federal policies have far more injurious impacts on local economies than wildlife protection. For example, the recent series of military base closings have had economic effects hundreds of times greater than all the listings during the 20-year life of the Endangered Species Act. Even greater economic and social harm resulted from the ill-conceived deregulation of the savings and loan industry during the 1980's. The number of jobs lost to leveraged buy-outs in the 1980's exceeds by many times the wildest estimates of jobs lost to endangered species; and no social good was accomplished in any of these cases."[20]

In the case of the fishing industry, as well as many other environment-dependent industries, judicious application of the ESA to protect the biological resources we depend upon can add a substantial number of jobs to the regional economy. At least 72,000 additional salmon-generated family wage jobs can be restored to the west coast by taking steps under the ESA to restore and recover the great salmon runs which once made this region the envy of the world. Without the ESA to drive recovery, however, this economic revitalization would likely never happen.

PROBLEMS WITH THE ESA AND THEIR SOLUTIONS

I think all sides of the debate will admit that the Endangered Species Act is not a perfect law. As a regulated industry ourselves, we certainly know firsthand some of the problems that the current Act has created, and are seeking to make the Act work better and more efficiently. However, what should not be in question is the need for the Act itself. The problems with the Act are not that it is too strong, but that it is too bureaucratic and too poorly funded to accomplish its purposes efficiently and with the least amount of economic pain.

As a regulated industry organization which also strongly believes in the importance of the goals of the Act, we also believe the ESA needs improvement in a number of ways, including the following:

(1) *The ESA Should Promote Species Recovery, Not Mere Maintenance on Indefinite Life Support.*—The principal flaw of the ESA is that it establishes a goal far short of actual recovery of species. The stated goal of the ESA is to prevent extinction and to establish plans for the "conservation and survival" of listed species. This minimal level of conservation does not result, in many cases, in ultimate population recovery. Under the current conservation standards, more and more species are thus pushed toward, and indefinitely maintained, just short of the line of extinction. Massive last ditch rescue efforts begun when a species is already hovering over the abyss of extinction is a *much* more expensive proposition than to simply keep the species well-distributed in several self-reproducing and interbreeding populations

[20] Stephen M. Moyer (March 1995). *Endangered Species Listings and State Economic Performance*. Massachusetts Institute of Technology, Project on Environmental Politics and Policy. Facts on actions cited from U.S. General Accounting Office (1992) *Endangered Species Act: Types and Numbers of Implementing Actions* (GAO/RECD–92–131BR).

from which the species will perpetuate itself naturally and at no cost to humans. Prevention is always cheaper than cure.

(2) There Should Be Recovery Plan Deadlines.—Recovery plans do not exist for most listed species, even many years later. How can any species be recovered enough to delist them without a plan? This is a recipe for keeping species on the ESA list forever, just perpetuating regulatory uncertainty. Regulatory uncertainty is in many instances the cause of more economic dislocation than the species conservation measures themselves would be once implemented.

At present there are *no statutory deadlines for the adoption of recovery plans*, thus perpetuating that uncertainty. For an industry such as ours or the timber industry or for farmers, this uncertainty makes it very difficult to develop long range business plans or to obtain business financing. The law should therefore require the Secretary to prepare *within 18 months of listing* a final recovery plan that incorporates the Recovery Target document and all implementation plans, and which also contains enforceable deadlines for all action items.

The first step toward a recovery plan is the identification of and designation of 'critical habitat.' This designation puts landowners on clear notice as to what will likely be required of them as a contribution toward recovery, and helps identify and ultimately to resolve ESA disputes. Designation of critical habitat is a vital step in the ESA recovery process that needs to be retained, as well as fully funded.

The law should also require the Secretary to ensure to the maximum extent practicable that the combined set of recovery implementation plans will, when implemented, achieve recovery of the species within a reasonable timeframe. The recovery plan should identify and prioritize actions that would have the greatest potential for achieving recovery of listed species.

Recovery plans should also emphasize implementing conservation measures which provide the greatest benefit with the least economic impact first, as well as include nonregulatory incentive-based efforts where appropriate. Again these are all principles that, as a regulated industry, we strongly support so long as the goal of ultimate and timely recovery is kept central to recovery efforts.

(3) Assuring Cost Effectiveness and Minimizing Conflicts with Private Landowners.—Most of the conflicts between private landowners and the government with respect to species protection are more perceived than real. Nevertheless, there is a need to minimize those conflicts to the extent possible as well as providing for conservation measures which achieve the recovery goal as cost effectively as possible. Some of the measures that should be incorporated into the law to achieve these goals include the following:

> The law should direct the Secretary to emphasize the role of Federal actions and public lands in achieving recovery. The law should be clearer in specifying that Federal agencies have a responsibility to use their existing programs to foster the implementation of recovery plans to the degree they can.
>
> If critical habitat occurs on privately-held lands, the law should direct the Secretary to identify land for acquisition in the recovery plan (including any land interests less than fee title, such as conservation easements) pursuant to section 5 of the Act, from willing sellers, and should set priorities for acquisition. This process should be well funded and the administrative procedures for financing these acquisitions should be simplified. Many landowners would be more than willing to help with recovery efforts if such financial incentives were more readily available.
>
> The law should also direct the recovery team and the Secretary, in preparing the list of recovery actions, to consider the cost effectiveness of conservation actions in order to identify ways of reducing costs of recovery without sacrificing species preservation or recovery goals. Landowners should be encouraged to provide habitat protection through a variety of incentive and financing programs, including the following:
>
> (a) Establish a revolving loan fund for State and local government entities to encourage such entities to develop regional, multi-species Habitat Conservation Plans (HCP's).
>
> (b) Enable landowners with proposed activities consistent with an approved regional HCP to obtain expedited approvals of those activities.
>
> (c) Authorize the Secretary to enter into cooperative management agreements with private landowners, providing financial incentives for conservation measures above and beyond those required by the ESA. Conservation activities to be funded under this provision would include those called for by an approved recovery plan, but could also be more pro-active in their approach, rather than reactive as so often the case once a species has been listed.

The Habitat Conservation Plan (HCP) procedure is a good tool for landowners to restore some certainty into the process as well as to provide for long-term protection measures. However, the current HCP process is *deeply flawed* and includes too little public notice and comment. Furthermore, HCP's can be inconsistent and even work at cross purposes with approved recovery efforts elsewhere. HCP's are not even required, under present law, to actually contribute toward the recovery of the species, thus shifting the burden onto the backs of other landowners who get their HCP later or not at all. The law should clearly require HCP's to be both *consistent with* and *contribute toward* species recovery as embodied in approved recovery plans and goals.

Both HCP's and recovery plans may have to occasionally be updated and revised in light of new scientific information or the results of plan monitoring. Current law is vague on how to go about amending an HCP in light of new data—including data that indicate that the HCP itself is failing. There should be a periodic review process, either automatically every 5 years or when triggered by new data indicating potential for further declines. During that review process, existing recovery plans should be kept in full force, but the Secretary should propose modifications to the plan to conform with any new standards. These proposed modifications should be widely published for public comment and adopted into the recovery plan only when they will promote equal or greater protection and faster recovery in a more cost effective manner.

(4) *Protection Should Be Aimed at Endangered Ecosystems, Not Just Individual Species, So That the Need for Future Listings Can Be Greatly Reduced.*—A species-by-species approach does not generally work. Multi-species plans for the protection of endangered ecosystems need to be developed so that those species which are part of such ecosystems do not begin the slide toward extinction to begin with. The ESA needs to become an "endangered ecosystem" act as well. Protection measures should be wholesale, not retail, in order to be cost effective.

(5) *Funding for Scientific Surveys and Recovery Efforts Should Be Greatly Improved.*—Generally the listing process is a good one, and it needs to be maintained as fundamentally a scientific decisionmaking process, not a political or economic one. Far from being missing from the ESA, economic factors come into play at almost every other decisionmaking process, only the listing/delisting process supposedly being truly free of such considerations. This makes sense: either a species is, or is not, headed for extinction. How we get to recovery, however, has a clear economic and social dimension, but the scientific fact of population dynamics is an issue that can only be decided on a scientific basis.

Nevertheless, the process would be better informed if there were more scientific data available earlier in the process on the particular species under consideration. This requires better funding for such things a upfront biological surveys, species status reviews and peer reviews. In other words, if Congress wants a better job done, it must properly fund the ESA and allow the agencies to do a better job.

Likewise there needs to be ongoing funding not only for the recovery plan implementation process itself, but for better scientific monitoring so that it is possible to tell whether recovery efforts are in fact succeeding. Adaptive Management (i.e., learning from past mistakes) is simply not possible without adequately funded and ongoing scientific monitoring.

(6) *Alternative Dispute Resolution for Property Owners.*—In our experience, and in spite of anecdotal media portrayals otherwise, there are really relatively few cases in which there are serious conflicts between the needs of ESA species and the rights of landowners. However, there are rare instances in which property owners were unfairly treated or in which government agencies made inappropriate decisions. This is inevitable in any large administrative process, and generally to sorts of disputes that courts are intended to resolve.

However, there should be a speedy and cost-effective way to put these problems to rights. Some internal dispute resolution mechanism would be very helpful for landowners to minimize unnecessary conflicts and resolve disputes. Some of these mechanisms already exist but are rarely used. There is, for instance, an existing Alternative Dispute Resolution process within the U.S. Court of Claims which allows aggrieved landowners to present their case to a Claims Court judge without needing a lawyer and without a lot of paperwork. This process does not even require a trip to Washington, DC—it can be done by fax and phone. At a minimum, the ESA process ought to formally include this type of mechanism as a "safety value" to prevent problems from escalating out of control.

(7) *All Known Information about the Existence and Range of Threatened or Endangered Species Should Be Available to the Public from a Centralized Data Source.*—The process of making a listing decision is (or should be) purely a scientific

judgment call, based on the best scientific and commercial information available. Though landowners frequently complain about the science, we believe the trustee agencies generally do a good job of gathering and using the best science. Generally we find that when landowners complain about 'junk science' what they are really saying is that the scientists either do not agree with their own biased viewpoints, or that the landowner does not fully understand the science behind the decision. Also, for many rare species even the best available scientific data can be very spotty and full of data gaps, simply because the species has not been well studied. It is generally only *after* a listing, and all the extra attention (and potential funding) that such a listing brings with it, that substantial scientific resources are brought to bear trying to study many of these species.

However, we do not feel that the trustee agencies generally do as good a job of making the scientific data base used in the decisionmaking process as fully available to the public as it should be. In the past this was because the tools for wide dissemination of voluminous scientific reports and species surveys was seriously deficient and expensive. In today's increasingly digital world, there is no excuse for this. Today, voluminous scientific documents can readily digitally scanned and converted to CD-ROM format and reproduced from that format for a few dollars a copy. The data bases can also be made available for easy public consumption on the Internet. All these techniques are being increasingly used by Federal agencies, and this trend should be encouraged and funded. The more data is freely and cheaply available to members of the public the more transparent the process will become and the more trust in the process itself the public will have, even if some disagree with the policy outcomes.

Information depositories should be created (perhaps made available through the National Biological Service and administered through State agencies) so that prospective purchasers of property would be able to ascertain quickly and inexpensively whether or not ESA listed species are known to exist on the property they are considering purchasing. Similar State-based information services are already available in States like California, through the local permit process. In theory, it would be possible to have all this information in readily searchable form with a quick computer inquiry for a very minimal fee. Some of this is being implemented now, as for instance the Ceres information system maintained by the State of California, or the Streamnet system run by the State of Oregon, both of which include extensive GIS data bases available on the Internet.

Most land use conflicts result when landowners have invested substantial money and resources in a development project and feel that they have no choice except to proceed in order to recoup their investment. If a prospective landowner know *before close of escrow* whether or not there might be conflicts between development plans and fish and wildlife protection obligations, he or she could plan accordingly, propose mitigation measures with acceptance a condition of close of escrow, and in general take a number of proactive steps to minimize or eliminate any potential future conflicts. The more savvy real estate developers are doing that now. Biological impact reviews of development plans by State fish and wildlife or local agencies is also now routinely done in many States as part of the permit process, and this additional data base would fit neatly into that process.

(8) *Citizen Enforcement Is Crucial.*—The Federal Government cannot be, nor should it be, everywhere all the time. The role and value of citizen enforcement of such statutes as the ESA and the Clean Water Act are well established. We strongly object to recent attempts by the Bush Administration to eliminate well established court avenues for resolving ESA disputes or to make government compliance with such court orders essentially voluntary. This is a recipe for lawless disregard by our own government for its own laws. The end result will be far more litigation, and not less, including against the very agencies who become scofflaws as a result of such a policy.

(9) *From Beginning to End, the Whole ESA Process Has to be Better Funded by Congress.*—The total funding for all ESA research and recovery efforts now amounts to *approximately 50 cents per U.S. citizen per year.* Given the level of problems the ESA needs to address, and given the potential economic return on this investment, and especially given the economic dislocation that could potentially result for more of the 'train wreck' policies of the past, Congress's current levels of funding for species identification and recovery borders on the ridiculous. Fifty cents per year is too little to invest in our biological future.

In summary, I ask you to remember that fishing is America's oldest industry as well as one of its most economically important resources. Protecting fish means protecting jobs, protecting food production, protecting commerce and protecting recreational opportunities. Without a fully-funded and operational ESA, it would be commercial and sport fishermen who will find themselves endangered. Where the fish go, so go the billions of dollars they produce and the jobs and communities they support. Thank you for this opportunity to testify.

ENDNOTE

Figures taken from *The Economic Imperative of Protecting Riverine Habitat in the Pacific Northwest* (Report 5, January 1992) published by the Pacific Rivers Council, based on official Federal statistics from the Pacific Fishery Management Council. The fishery related job breakdown by State, according to that report, was:

State	Commercial	Recreational	Total
Oregon	4,450	9,500	13,950
Washington	6,800	14,250	21,050
N. California	4,000	19,000	23,000
Idaho	Negligible	4,750	4,750
Pacific Northwest Total	15,250	47,500	62,750

Commercial fishery jobs are heavily concentrated in coastal areas. Recreational fishery jobs, while a larger number, are more diverse and are distributed more diffusely throughout inland communities.

[From the Fishermen's News, January 1995]

The Pacific Coast Federation of Fishermen's Associations

(By Zeke Grader, Executive Director and Glen Spain, Northwest Regional Director)

WHY FISHERMEN NEED THE ENDANGERED SPECIES ACT

Fish are creatures of their environment. Without strong laws to prevent water pollution and widescale habitat loss, the fish will be no more—and where the fish go, so go the fishermen.

Most fish species spend only part of their lives in midocean. During their juvenile stage, most live and thrive in the nearshore environment of streams, rivers and estuaries for the most critical parts of their life cycle. Nearshore waters, including rivers, streams and coastal wetlands, are essential nursery areas for about 75 percent of the entire U.S. commercial fish and shellfish landings. These sensitive ecosystems are valuable national assets which contribute about $46 billion per year to the U.S. economy as well as its healthiest food source. Yet all this has been put at risk by the continuing destruction of wetlands, watersheds and estuary habitat that these species depend upon for their very existence.

Environmental regulations exist because policymakers finally realized that a healthy environment is the ultimate source of all wealth. However, there is a strong national movement afoot to roll these protections back because, in the short-term, these protections are inconvenient barriers to unrestricted development and short-term profiteering. This movement may now have a majority of votes in Congress and in many State legislatures. These forces have mobilized to roll back and gut those very laws which protect our fisheries, including the Clean Water Act, the Safe Drinking Water Act, and the Endangered Species Act itself. It is time for our industry to stand up and be counted against any effort to demolish the environmental protections which fish—and fishermen—need to survive.

The crown jewel of all environmental protection is the Endangered Species Act (ESA). In spite of the problems the ESA may have created for individual fishermen, it is in many ways the last hope for restoration of whole species such as salmon. Without a strong ESA, the only available remedy for species' recovery is closing down the fishery. This is exactly what has happened to the salmon industry to date—as the productivity of onshore habitat declined, as fewer and fewer fish survived to reach the ocean, it has been the fishermen who have been cut back over and over again, and who have almost single-handedly paid the price of inland environmental destruction on a massive scale. This situation exists because under the Magnuson Act fishery managers can only manage fishermen—they have no legal jurisdiction whatsoever over actions onshore which destroy the biological foundations of the fishery itself.

Thus whole watersheds can be destroyed, salmon runs battered to extinction and rivers polluted to the point of catching fire, and yet the National Marine Fisheries Service (NMFS) can do nothing about it—*until* their ESA authority has been triggered by a listing. The ESA is thus the key to watershed restoration and salmon protection throughout the region. It is also the only hope for putting a stop to onshore practices which destroy fishermen's livelihoods.

That's not to say that the ESA is a perfect law. However, its flaws lie in the fact that it is too weak, not too strong. Under current law there are no deadlines on recovery plans, so species can sit there on the brink of extinction for years without any real effort to save them. Current law also does not promise full recovery, only maintenance of reproducing populations. Recovery efforts are bureaucratic and poorly funded. The recovery planning process also needs to be much more open, so we can avoid a repeat of the southern sea otter situation. These flaws, however, are fixable and should be remedied as soon as possible.

What should not be debatable is the need for a strong law itself. The ESA has been the legal basis for every suit filed by fishermen's groups to protect habitat and to force water policy reforms in the Columbia River and the Sacramento Delta. The fishing industry would be devastated if this last barrier to extinction of the species it depends upon were removed.

The fishing industry represents a major economic force which is directly dependent upon a healthy environment. It is vitally important that our voice be heard as the ESA and other environmental protection laws we depend upon come on the chopping block in the new Congress. It is also vitally important that we stand up as an industry for clean water, healthy watersheds and the stringent protection of the species upon which we depend for our livelihoods.

The ESA is not the enemy, it is only the messenger. Listing a species is like dialing 911 when you need an ambulance. It should be used rarely, but when it is needed it is invaluable. Often it means the difference between life and death.

[From the Fishermen's News, December 1995]

The Pacific Coast Federation of Fishermen's Association

(By Glen Spain and Zeke Grader)

A FISHERMEN'S AGENDA FOR THE ENDANGERED SPECIES ACT

Commercial fishermen have long had an ambivalent relationship to the Federal Endangered Species Act (ESA). On the one hand, the ESA represents the last hope for the restoration of hundreds of depressed Northwest and Northern California salmon runs which our industry depends upon for its long-term survival. On the other hand, all too often it has been the fishermen (and no one else) who have had to bear the burden of fish protections when these same fish are being destroyed in the millions by onshore dams, logging and water pollution.

The last two Republican Administrations were so hostile to the ESA that they deliberately created as much political heat as possible so the ESA would be repealed. Under the "train wreck" politics of those two Administrations, we saw the ESA used as a weapon to close down whole chunks of the Southeast Alaska fishery, supposedly to save a handful of Columbia River fish, while doing nothing whatsoever about the millions of fish killed by the Columbia River dams. In the Gulf States, the ESA was used to close down shrimpers because of bycatch on turtles, while ignoring other important problems elsewhere which were creating turtle declines.

Yet in neither case did it have to happen that way—any realistic strategy for actually dealing with salmon declines would have put the Columbia River dams and reversing widespread salmon habitat destruction as first priority for changes, not last. Any rational strategy for dealing with the turtle bycatch issue would have produced better and more effective TED's far sooner by seeking the active help of Gulf fishermen, instead of deliberately creating active resistance. These two fishing industry "train wrecks" were deliberately created by hostile Administrations and Agencies for their own political gains, not really to solve any of these problems.

The fact is that the loss of fish habitat is far more of a driving force in fish declines (for both sport and commercial fishing) than any other factor. The grim figures show clearly that much of this country's aquatic resource is in deep trouble and facing biological collapse. More than 75 percent of this Nation's entire $158 billion dollar/year commercial and recreational fishing industry depends on species that need unpolluted estuaries and healthy river systems for their very survival. In some places, such as the Gulf of Mexico, the commercial fishing industry is 98 percent dependent on coastal wetlands and in-river habitat, yet much of that habitat is being destroyed. As a result, far more shrimp are being lost in the Gulf due to habitat destruction than to any number of TED's.

According to recent estimates, this Nation's commercial fisheries already suffer losses equivalent to $27 billion/year (amounting to a loss of 450,000 family wage jobs), as the direct result of widespread habitat destruction in every coastal State. The inland sport fishing industry is also in deep trouble. North America has a huge number of native fish species, yet according to a recent survey by the prestigious American Fisheries Society, more than 30 percent of all this Nation's fish species are now at risk of extinction because of inland pollution and habitat loss.

Pacific salmon resources have been particularly hard hit. About 98 percent of the once abundant wild salmon runs in the Columbia Basin have now been destroyed, causing a total economic loss to the region of some $500 million/year and 25,000 family wage fishing-generated jobs. All told, about 72,000 family wage jobs have been lost to the west coast over the last 20 years due to salmon declines. Almost all of these losses are caused by habitat loss or hydropower dams.

Faced with a nation-wide aquatic crisis, there is little question that ESA protection will be necessary, when all else fails, to at least keep many of these fish species from extinction while we try to figure out how to save them. The problem is that the ESA as currently written does little else but keep species on emergency life support—there is no guarantee under the ESA as currently written that any of these fish species will actually be recovered enough to generate harvestable surplus.

Our own view is that since we are an industry that is going to be heavily regulated under the ESA anyway (far more heavily regulated, in fact, than the timber industry) that it is our duty to press Congress for an ESA that actually works! Congress is now considering major ESA reform. This creates a golden opportunity for the fishing industry as a whole to weigh in and get a better ESA—one which actually addresses the most fundamental issue facing our industry, which is habitat loss.

Every Congress there are a number of bills touted as "ESA Reform." Most were written by lobbyists as wish-lists for industries that destroy wildlife habitat and watersheds wholesale and thus caused the very declines they now seek to wriggle out of responsibility for. We think it is high time our own major industry, which depends utterly on the protection of these basic public resources, weighed into this debate for an ESA that *really works to protect and recover species.*

Here are PCFFA's major goals for ESA reform for this and future Congresses:

(a) *Real Recovery.*—As currently written, the ESA only guarantees protection to the point where the species is no longer at risk of extinction, i.e., self-sustaining populations. This is a very long step from actual "recovery," defined as abundant and widely distributed populations, such as would be needed to generate harvestable surpluses of fish.

None of the bills introduced in the last several years provide a better recovery goal than under present law. Some, such as those introduced in past years by Senator Gorton, former Senator Kempthorne (now Governor of Idaho) and Representatives Don Young and Richard Pombo are broad retreats even from the most minimal recovery requirements. Under those bills, the Secretary could choose (for purely political reasons) to do nothing whatsoever to rescue salmon or any other species, and this would be enough to meet legal requirements. This is clearly unacceptable.

PCFFA supports efforts to make real recovery the priority of ESA legislation. Only through real recovery can species once listed be kept off the endangered species list in the future.

(b) *Maintain Habitat Protection.*—Without access to the habitat that a species needs for food and shelter it is just as dead as if you shot it with a gun. Under current law and recent U.S. Supreme Court decisions, the ESA requires the protection of habitat on both public and private lands. Without this protection the only actions prohibited under the Act would be "direct take" actions—like fishing—while actions that take the water out from under fish, pollute their streams and destroy their food sources would be allowed and unregulated.

Past bills by Gorton, Kempthorne and Young/Pombo would have prohibited protection of habitat on private lands, period. This is also the case with a bill reintroduced by Congressmen Don Young and Richard Pombo in the 106th Congress (H.R. 3160). Since most species exist only or primarily on private lands, these bills would amount to a death sentence for most of this Nation's fish and wildlife. Without strong habitat protection there is hardly any point in having an ESA at all, since it would be biologically irrelevant.

The far more moderate efforts of a bill by Congressman George Miller (The "Endangered Species Recovery Act" (H.R. 960 in the 106th Congress)) leave the current laws alone, but also increase emphasis on payment and incentive programs to assist private landowners in conserving species on their lands, an approach we strongly favor.

(c) *Protection of Distinct Population Segments and Sub-species.*—Under the current definition of "species" in the Act, protection includes both subspecies and "distinct population segments." This provision has been loudly and agressively attacked by the timber industry because the Northern spotted owl (for instance) is considered a subspecies of owl, and the marbled murrelets in the United States are only a distinct U.S. population segment of a much larger range in Canada where populations are relatively robust.

The trouble is, almost every aquatic fish stock is a distinct population segment. Unlike owls, fish can't fly over mountains to interbreed, and their offspring cannot disperse in all directions. Fish are always isolated geographically from other fish (even of the same species) in other stream systems. Timber industry lobby efforts to get rid of the "subspecies and distinct population segment" language in the Act would make it virtually impossible to protect the habitat of individual U.S. salmon stocks ever again, at least so long as any healthy salmon populations of the same species still existed in (say) Siberia or Chile. This revision would simply make ESA recovery habitat protections impossible—but you can bet your fishery would be closed down under weak stock management under the Magnuson Act!

This revisionist definition of "species" has appeared in several bills sponsored by "property rights" and timber industry groups. PCFFA believes we must maintain the current legal definitions so that we do not tradeoff our weak fish stocks against all others, wherever they may be. We need more fish *where we are*, not just somewhere else.

(d) *Better Scientific Basis for Decisionmaking.*—There is broad agreement that the decisionmaking process called for in the Act could be improved with better science. All the recent bills have provided for scientific peer review of the scientific data at various points, in particular the recovery planning process and whenever critical habitat is designated. However they would have done so in very different ways.

In many of the bills in the past, a proposed new standard for basing the initial listing decision on "peer reviewed data" (rather than the current law's "best available scientific and commercial information" standard) was probably much too strict. Until a species is identified as "at risk" there is often very little scientific information on it at all, much less formally peer reviewed reports. Also, in many of these mock-reform bills, peer review panels would have specifically included representatives from industries such as timber or hydropower, and so would not have been truly independent nor unbiased. These peer review panels would also have been tainted by politically based selection mechanisms in some proposals.

PCFFA supports obtaining better scientific support for ESA actions. However, the science used must be the best available at the time, truly independent and completely free of potential political or industry bias.

(e) *More Public Input in Tile Listing and Recovery Planning Process.*—Many of the past problems with ESA recovery planning were caused by the almost totally closed nature of the planning process. Plans are developed by interagency teams with little or no public input or scrutiny. (A good example of this was the disasterous proposal by U.S. Fish and Wildlife Service a few years ago to translocate west coast southern sea otters as part of their recovery plan.) This closed shop practice has fueled charges of governmental arrogance. In some cases (such as with the first TED's in the Gulf) this also led to requirements which perhaps sounded good on paper to scientists in Washington, DC, but which were impossible to implement under real conditions.

All the recent bills provided for better public input. Some, however, would have so overburdened the process with additional bureaucratic hurdles that it is obvious that the intent of these bills was to disable the ESA, not make it more workable. The Young/Pombo bill in the 104th Congress, for instance (H.R. 2275), would have required over 5,000 separate public hearings (one in every county of the continental United States) before the listing of the bald eagle, had it been law at the time—at a cost of tens of millions of taxpayer dollars, before even one dollar could be spent on actual recovery.

PCFFA supports a more open and collaborative public process for developing plans for species recovery, but not one so overburdened with process that it amounts to paralysis. The recovery planning process also has to be driven by good science, not by politics and industry foot-dragging.

(f) *Getting Away from Species-by-Species Reactive Approaches and Moving Toward Proactive Ecosystem Protection.*—The ESA should be redesigned to encourage multi-species habitat protection plans as well as earlier measures designed to prevent the need for listing to begin with. Experience has shown that when an entire ecosystem is fragmented and destroyed, all the species within it will sooner or later face extinction. By protecting the ecosystem you protect everything else. Also, once a species has been pressed to the point where it qualifies for listing, options are fewer and any recovery efforts undertaken will be far more expensive than if protective actions had been taken much earlier on.

The Clinton Administration favors multi-species “Habitat Conservation Plans (HCP’s)” for broad geographical areas, and there has been considerable experimentation with this approach. Unfortunately, there are no standards for what an HCP must include under current law, nor are current HCPs required even to be consistent with or contribute toward overall species recovery. Thus each HCP can easily become a “hole” in the overall recovery safety net which is locked in for 50 years or more.

PCFFA believes that at a minimum HCPs must be both *consistent with* and *contribute toward overall species recovery* for any species they cover. To date, only the bills by Congressman George Miller make this important change?

(g) *Recovery Planning Deadlines.*—More than half of the species currently listed under the ESA have no recovery plan. Many have gone without one for over a decade. Unfortunately, there are currently no deadlines for producing these plans, so the end result of many listings is continuing economic disruption with no end in sight because there are no recovery efforts.

Just about everyone realizes that this problem must be fixed. All the recent bills contain deadlines on the development of recovery plans once a species is listed, though these deadlines vary. PCFFA supports deadlines for developing recovery plans and for listing critical habitat. It is inexcusable to just keep the ESA patient on life support forever without any effort toward cure or recovery.

(h) *Conservation Incentives for Private Landowners.*—At present there are a number of disincentives for private landowners who may wish to set aside wildlife or fish habitat on their lands, and too few economic incentives. Rather than rely solely on mandatory regulation, it is better to also bolster species protection incentives and to develop cooperative efforts with private landowners whenever possible.

However, PCFFA does *not* support “takings” language giving landowners the *legal right* to compensation for protecting what are in essence public resources. These provisions amount to economic extortion and would be terrible public policy. There is no reason landowners should be paid NOT to pollute or destroy public trust assets such as water, fish and wildlife which happen to be on their land at the time. Private property rights are not and never have beenabsolute—landowners have an absolute *prior* obligation to protect *public* property rights first. However, we do support voluntary financial support programs for landowners who wish to go above and beyond these minimum legal requirements, or who want to do more—as many of them do!

(i) *Better and More Stable Recovery Plan Funding.*—The primary reason ESA listings so often fail to lead to recovery is that the recovery process itself is crippled by lack of funding. The entire ESA recovery budget amounts to less than $1 per U.S. citizen per year—a truly pitiful investment in our biological future, given the magnitude of the problems we are trying to solve.

Better science, greater public input and speedier deadlines all cost money to achieve. Without far better and more stable funding, it is unlikely that the ESA will result in full recovery in most instances.

(j) *Streamlining of the Whole Process.*—At present, the listing process and recovery plan development and implementation processes are far too lengthy and bureaucratic. Various proposals for streamlining the process have been put forward for various reasons, but each will have to be judged on a case-by-case basis to see whether they are really helpful or merely obstructive. In general, PCFFA supports efforts to truly streamline the ESA administrative process, make it more efficient and ultimately to get more money applied directly toward species recovery.

ESA reform will be taken up in every Congress until there are final resolutions to these questions and concerns. The above are what PCFFA has developed as common sense reforms which would be of benefit to the entire $158 billion/year sport and commercial fishing industry nationwide.

The ESA is not going to go away—*nor should it*! Commercial fishermen and coastal communities need it to help restore salmon and other marine resources throughout the Nation, particularly those affected by onshore or nearshore habitat loss and estuary pollution, which is the vast majority. Many other inland fish species of concern to the sportfishing industry and inland economies are also in serious jeopardy for similar reasons. The ESA is always the last resort after all other efforts have failed, but it truly helps in an emergency to prevent permanent extinction until we can restore a balance so that fisheries are truly sustainable *biologically* as well as economically.

Most of these losses are not caused by fishermen, they are caused by habitat loss. The ESA is also the only statute that brings habitat loss on to the table as part of the recovery process. Unfortunately, fish managers do not have the legal authority to control onshore habitat destruction. Only once the ESA is triggered can they then act to reverse the destruction of salmon and other fish habitat which has been so economically devastating to our industry in recent years.

However, a number of the so-called "ESA reform" bills of the past would have amounted only to "Fishermen's Extinction Acts" and not true reform. False reform bills (usually promoted by habitat destroying industries) give us nothing, they result in no recovery or habitat protection, and their full burden would land on the backs of fishermen, not those who caused the extinction problem to begin with. These are "Trojan Horse" bills serve only to exonerate those who have caused the problem.

As always, fishermen need to be involved in creating the legislative alternatives so that whatever ESA bill eventually comes out of the process provides *meaningful* protection for our fisheries, including ultimate recovery of the biologically fragile resources upon which we all depend.

Note: Since this article originally appeared two Congresses have come and gone. Accordingly, this article, originally written in December 1995, was rewritten and updated November 1999, and will be periodically reviewed and updated as necessary. See also *"Why Fishermen Need the Endangered Species Act,"* in these archives.

Statement of American Farm Bureau Federation

The American Farm Bureau Federation, the Nation's largest general farm organization representing the interests of over five million member families, submits this statement for the hearing record.

America's farmers and ranchers own and use much of the land and waters that are inhabited by endangered and threatened species. They feel the impacts of listing species under the Endangered Species Act (ESA) every day.

The overriding purpose of the Endangered Species Act is the recovery of species on the brink of extinction. This is to be accomplished by placing them on a list of endangered or threatened species, where they are to be protected from adverse activity until they have achieved "recovery" as determined by a recovery team. The ultimate goal of the ESA is removal from the lists.

Species that are lawfully hunted or fished in other parts of the continent or country are listed under the ESA, while species that are truly on the brink of extinction are waiting. Courts, not the agencies, set the agenda for which species get listed. And once listed, species rarely are removed from the list, even though they have met stated recovery goals.

We have several concerns with the listing/delisting process, and offer some suggestions as to how the ESA might be amended to return to its original intent.

1. THE ACT SHOULD REQUIRE MINIMUM SCIENTIFIC STANDARDS NECESSARY TO SUPPORT LISTING AND OTHER DECISIONS AFFECTING LISTED SPECIES

The most serious deficiency with the ESA listing process is that it does not contain any minimum scientific standards to list a species.

The most celebrated case involving an endangered species remains the snail darter. This small fish halted a multibillion dollar water project in Tennessee. A lawsuit over this human-species conflict went to the Supreme Court, and remains the only substantive case on the Endangered Species Act to have been decided in that forum. Following the decision in *Tennessee Valley Authority* v. *Hill*, Congress passed a law exempting the Tellico Dam project from the strictures of the Act.

A few months later, several more areas were found to be inhabited with snail darters. The species was soon thereafter downlisted from "endangered" to "threatened." Millions of taxpayer dollars were wasted because of incomplete scientific information.

Recently, five snails located in the Snake River in Idaho were listed as either endangered or threatened, despite the fact that less than 1 percent of their possible habitat had ever been surveyed. The decision to list was made even though only approximately 300 square feet of the entire Snake River had ever been sampled for the presence of these species. That is not the use of sound science in the application of the Endangered Species Act.

Endangered Species Act decisions currently are required to be made on the basis of "the best scientific and commercial data available." The "best" scientific data available might be as little as one monograph on the subject by a single master's degree candidate.

With affected species occupying greater habitat areas and affecting more basic, pre-existing human activities than ever before, there is too much at stake to make such decisions on inadequate scientific evidence. Before basic human patterns are disrupted, jobs are lost and communities are stripped of economic vitality, we submit that the Endangered Species Act decisions must be based on more sound, scientific certainty than is currently required.

The current "best scientific data available" standard is really no standard at all. It provides no incentive for agencies involved in listing decisions to obtain accurate and up-to-date information necessary to make an informed decision. All too often, decisions are made on outdated, insufficient or misinformed data. Unverified hypotheses or assumptions made by one researcher often become truth for the next researcher who does nothing more than glance through the earlier work.

The problem with this non-standard can be illustrated by applying peer review principles to it. The only function of a peer review team would be to determine whether the information used was the "best available," not whether it is sufficient to support listing the species.

Often, the correct scientific data is easily obtainable through a little effort. For example, in the case of the listing of the five snails in Idaho, the Idaho Farm Bureau Federation hired an independent biologist to check the Fish and Wildlife Service (FWS) data. With minimum effort, he readily discovered that these snails exist in far greater numbers and in a far greater number of places than determined by the Government. Such information, however, was largely ignored in the final decision.

We are troubled that private landowners are being required to prove that government data is incorrect. Private landowners do not have the resources that are available to the Government; and even in the face of contradictory evidence, there is no guarantee that the Government will accept it. We submit that precious time and resources will be saved if the listing agency or the agency making the decision is required to do it right in the first place.

Furthermore, requiring an affected private person to disprove the Government's data places the ultimate burden of proof for Endangered Species Act decisions on the private party. Instead, the burden of proving that a species deserves to be listed or that certain management prohibitions are appropriate should be on the Government Agency proposing the action. The Act requires the FWS to make decisions whether or not to list certain species, and those decisions should at the very least be based on sound science. The Agency has greater resources available to it, is in a better position to obtain required data, and should be required to justify its actions.

The term "best scientific and commercial data available" must be defined to incorporate minimum scientific standards and procedures necessary to sustain a decision that a species be listed or that some other action be taken. This amendment is necessary to ensure that decisions affecting entire regions of the country are not being made on outdated information or on bare assumptions that could easily be disproved. Further, there must be some unbiased, objective review prior to decision to ensure that the proffered data meets minimum scientific standards.

To accomplish this, we suggest the creation of a truly independent Scientific Advisory Panel to peer review ESA proposals to ensure that there is sufficient scientific data to support the conclusion. We envision the Scientific Advisory Panel to have much the same role as the Scientific Advisory Panel within EPA, except that the panel would have authority to veto any proposal that did not meet minimum scientific standards.

2. THE ENDANGERED SPECIES ACT MUST ELIMINATE APPLICATION TO "SUB-SPECIES" AND "DISTINCT POPULATIONS"

One of the reasons leading to the enactment of the Endangered Species Act was the increasing number of species that were cited as becoming extinct each year. The Act was passed to try to reverse that trend. The stated tradeoff for restricting land uses, stifling the economy, causing the loss of jobs, and adding millions of dollars of regulatory costs as the cost of doing business is to keep species from becoming extinct.

Were the ESA limited to that goal, it would be much easier to accept by those who are directly affected by its harsh restrictions. By extending the law to "sub-species" and "distinct populations", however, the Act goes far beyond what the public is being told is the goal of the law. We submit that the definition of "species" should be amended to delete protection to sub-species and distinct populations.

Taxonomic definition to the "species" level is sufficient to separate different plants, animals and fish that should be protected under the Act. Further classification into sub-species often adds nothing to the taxonomic definition of a species. So-called sub-species are often indistinguishable from others of the species, and there is no practical reason for such sub-classifications to be protected separately. Classification at the species level is what gives the organism its identity—further sub-classifications add little or nothing.

If protection down to the sub-species level bears little relationship to whether a species becomes extinct, protection based on "distinct populations" has absolutely no relationship to the survival of the species. As with sub-classifications of species, a particular plant, animal or fish might be thriving as a whole, but the Act would allow that species to be listed as "endangered" or "threatened" if it is not thriving in one particular area of its historical range. To permit a listing on that basis where the species is thriving elsewhere flies in the face of everything that the Act is supposed to represent. Furthermore, this situation siphons scarce resources from species that really are in danger of extinction to protect distinct populations of more glamorous species. This sort of a listing will ultimately turn back the clock and remove people from the land and return it to the flora and fauna that might have lived there many years ago.

The clearest and most visible example of this "preservationist" strategy is the status of the so-called "gray wolf" under the Act. From a biological standpoint, all experts agree that the species of "gray wolf" is in no danger of becoming extinct or endangered. There are approximately 60,000 of these animals in Canada with an additional 8,000 in Alaska and 2,000 more in Minnesota, Wisconsin and Michigan. Based on the supposed goal of the Act, there is no conceivable way that this animal would or should be listed under the Act.

Using the "distinct population" idea, however, the gray wolf is listed as "threatened" in Minnesota and "endangered" in the other 47 lower-tier States. An introduction of wolves into Yellowstone Park and environmentalists touched off one of the more bitter controversies surrounding the Act. The Federal Government has conservatively estimated that it has spent nearly $6.5 million on the introduction project, which represents about one-half the total estimated cost.

Government officials state that introduction is necessary to "recover" the species. Yet the species is fully "recovered" in large numbers in Canada and Alaska, and a healthy population lives in northern Minnesota.

Aside from having no rational basis for inclusion in the Act, the "distinct population" criterion is being used in a manner that was not intended by the Act. "Distinct populations" are not being used to decide whether a proposed project should be begun in an area. As with the wolf introduction example, or in the example of specifying different runs of salmon as separated protectable species, these activities affect the basic fabric of people's lives. Instead of proposed, future activities, these actions affect the way people live and make their livelihoods. It is this very basic difference between intention and present reality that demands that the structure, functions and priorities of the Act be re-thought.

So much agency time, attention and money is devoted to listing and "recovering" "distinct populations" that species truly in need of Federal assistance are left wanting. We submit that both the agricultural community and the truly endangered species would benefit from a return to the central purpose of protecting those species which are in danger of becoming extinct. We submit that the only way this can be accomplished is if the Act focuses on plants and animals at the species level. Protection for sub-species and "distinct populations" should be removed from the Act.

There are a number of ways in which the "distinct population" concept is being abused by the Agency.

a. Species that are so plentiful that they are even hunted or fished in Canada or Mexico are listed in the United States. There are an ample number of gray wolves in Canada and Alaska that they are in no danger of becoming extinct. They are lawfully hunted. Likewise, there are a sufficient number of grizzly bears in Canada that they are not in danger of extinction. Canada lynx are plentiful in Canada, yet on the threatened list in the United States.

b. Atlantic salmon and many Pacific salmon are raised in captivity where they are fished and eaten, yet they are on the endangered species list. Atlantic salmon raised in fish hatcheries are the same fish as the salmon occurring in the wild. They have interbred for nearly 150 years and have been used to re-stock rivers and streams. They return to the river of origin to spawn, just like their brothers. Yet the hatchery-raised fish are not counted as part of the salmon population for ESA listing purposes. The same is true for Pacific salmon, where hatchery fish, whose only distinguishing characteristic is a hatchery clipped fin, are actually clubbed to death to prevent excess spawning. Both Atlantic and Pacific salmon are served in restaurants.

All of these listings have caused severe disruption to people residing in the affected areas. These species should never have been listed in the first place.

3. THE ACT MUST DIFFERENTIATE AND DISTINGUISH BETWEEN SPECIES LISTED AS ENDANGERED AND SPECIES LISTED AS THREATENED

When Congress first enacted the ESA, it created two classifications of listed species—those that were "endangered" and those that were "threatened." While the Act continues these distinctions, the Act is also being applied in such a way that there is no practical difference between an "endangered" species and a "threatened" species. Congress intended for FWS to adopt flexible management options for threatened species that are not as strict as the management mandates for endangered species.

FWS, however, has failed to carry out this intent of Congress. Instead, the prohibitions of section 9, applicable in the Act only to endangered species, are being applied *in toto* to threatened species as well.

The Act needs to be amended to carry out the original intent of Congress to realize the difference between an "endangered" listing and a "threatened" listing. We suggest that sections 7 and 9 be amended to provide a separate list of criteria for "threatened" species. An alternative to the amendment to section 9 would be to require the Secretary to implement conditions of "take" for each threatened species at the time of listing as part of the listing proposal. The Act must then provide that these will be the only conditions for "take" for that species.

4. LISTINGS SHOULD BE BASED ON THE THREAT OF EXTINCTION, NOT ON THE LOSS OF HISTORICAL HABITAT

The ESA sets forth five criteria to assist in the consideration in determining whether a species is endangered or threatened. They are factors to be considered, not ends in themselves. The ultimate determination is whether the species meets the ESA definition of "endangered" or "threatened."

One of those criteria is whether the species has been eliminated from all or a significant portion of its historic range. While the loss of habitat is a legitimate factor to consider in determining whether a species should be listed, a species should not be listed solely because it is not found everywhere it once was. Application of that principle alone leads to often absurd results, such as the move to list the black-tailed prairie dog as a threatened species, despite the fact that they are plentiful, spread out across a wide range, and repopulate quickly.

We believe the ESA should be amended to clarify that the five listed factors are only aids for consideration, and that the ultimate determination is whether the species is threatened with extinction or endangered.

5. THE ACT NEEDS TO BE AMENDED TO REQUIRE DELISTING UPON ATTAINING RECOVERY GOALS

The goal of the ESA is to delist species that have been on the endangered and threatened species list. That means they have met recovery goals and are considered "recovered."

The ESA requires the development of a recovery plan that is developed by a recovery team, a team of scientists and interested parties appointed to set the goals which determine when a species has recovered. Species meeting the goals are "recovered," and no longer warrant being on the list.

This has not worked in practice, however. Species that have attained recovery goals remain under the protection of the ESA when they should be delisted. Grizzly bear populations in both Glacier and Yellowstone National Parks have exceeded recovery goals since 1990, and there has been no move to de-list. Instead of delisting, the Agency changed the recovery goals. Still, these populations exceeded the new recovery goals. Wolves in the Great Lakes region have also exceeded recovery goals, there being almost twice as many wolves in Minnesota than required for recovery under the recovery plan. Yet, in a proposed reclassification of the gray wolf population in the United States published last year, the Great Lakes wolves were not proposed for delisting.

Clearly, a new process is needed.

We propose that the ESA be amended to require that upon attainment of recovery goals, a species should be automatically delisted, and that notice of the delisting be published in the *Federal Register*. A mandatory process like this is the only method that will allow reluctant agencies to do what they are required by the ESA to do.

We believe that these suggestions will improve the Act from the standpoint of both species listing and reducing conflicts between a species and affected landowners. We also believe that these suggestions will restore credibility to the Act and help re-focus the Act to the objectives that were originally intended.

We look forward to working with the committee on bringing about these changes.

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May 9, 2001

VIA FAX NO. (202) 228-2040
VIA FED EX – 8196 1165 9892

The Honorable Michael D. Crapo, Chairman
The Honorable Bob Graham, Ranking Member
Subcommittee on Fisheries, Wildlife, and Water
United States Senate
Washington, D.C. 20510

Dear Senators Crapo and Graham:

Thank you for your invitation to appear and testify at the Senate Subcommittee on Fisheries, Wildlife and Water's hearing today on the Endangered Species Act. Unfortunately, my schedule does not permit me to attend. However, I am pleased to have the opportunity submit these remarks which I hope you and your fellow Committee members will review and include in the hearing record in connection with this bill.

I am not and have never been opposed to the Endangered Species Act. The ESA can and does play an important role in preserving species literally on the brink of extinction, like the California condor or the bald eagle. As laudable as the underlying purposes of ESA may be, however, the Act has proven itself subject to abuse in practice. In the case of Atlantic salmon in Maine, which were recently listed as endangered, I believe the ESA was applied in an arbitrary fashion and in a manner inconsistent with Congress' original intent, sound science, or good public policy.

I would like to give a brief background and history of the Atlantic salmon controversy in Maine, and then offer for your consideration a few recommendations for improving the ESA based upon our recent experience. Because my remarks will be in summary form, I am also sending copies of (1) written comments filed in April 2000 by the State of Maine in opposition to the proposed listing of Atlantic salmon; and (2) the complaint Maine filed in U.S. District Court challenging the listing. These filings provide more detail and background on the issues, and I encourage you to read them and include them in the hearing record as well.

1. Background

In 1993, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (the "Services") received petitions to list all Atlantic salmon throughout their entire range in the United States (from Connecticut to the Canadian border). Following review of scientific and other evidence, in March 1995 the Services denied the petitions and determined that Atlantic salmon in this range did not meet the definition of "species" under the ESA since "indigenous" populations had been extirpated and replaced by non-indigenous restoration stocks.

Several months later, in September 1995, the Services issued a proposal to list as threatened smaller subpopulations of Atlantic salmon, i.e. those found in seven Maine rivers. It was suggested that these salmon were a genetically "distinct" subpopulation segment of aboriginal salmon that somehow—despite years of massive stocking from other rivers as well as straying of salmon from river to river—had persisted as a "distinct population segment" (or DPS), and therefore were eligible for protection under the ESA. As is discussed below, we believe that this determination lacks a sound scientific basis, and that is why we ultimately opposed this listing.

In response to the proposed listing, I initiated an effort to develop a comprehensive state-based plan to protect and restore Atlantic salmon in these rivers. Representatives of local, state, and federal governments, private industry, and interested non-governmental organizations worked for nearly two years to develop the plan. The Maine Atlantic Salmon Conservation Plan ("Maine Conservation Plan") was launched in March 1997.

In December 1997, the Services concluded, based on the "best scientific and commercial data available," that Atlantic salmon in the designated rivers were "not likely to become endangered in the foreseeable future." The Services withdrew the proposal to list this population as threatened, and entered into a five-year agreement with Maine endorsing the Maine Conservation Plan and committing to its implementation.

Former Interior Secretary Bruce Babbitt and Commerce Assistant Secretary Terry Garcia came to Maine to support the Maine Atlantic Salmon Conservation Plan as a landmark achievement. Secretary Babbitt praised the conservation plan as "a model for the nation" which was "opening a new chapter in conservation history." Assistant Secretary Garcia hailed the plan as an "innovative effort" that "highlights the ESA's flexibility." That flexibility was short-lived. In less than one year, and before there was even a chance to evaluate progress, groups that favored listing and opposed voluntary state conservation plans like Maine's began pressuring the Services to reverse their decision.

Ten months after adoption of the Plan, in the fall of 1998, Defenders of Wildlife filed a notice of intent to bring a lawsuit against the Services to contest the December 1997 decision to withdraw the proposed threatened listing and request court intervention to order an immediate emergency listing of the salmon. It is important to note that this action came before *any* assessment of progress under the Plan had been made. This group and others then filed suit in federal court in Washington, D.C. in January 1999, just as the State was submitting its very first scheduled progress report under the Maine Conservation Plan. That report, incidentally, showed that substantial progress had been made in the Plan's first year.

At that time, the Services raised two principal concerns—recreational fishing and aquaculture—and made two demands: (1) abolish the limited catch and release recreational fishing that had just been established under the Plan; and (2) tighten regulation of Maine's aquaculture industry. Federal officials assured us that if Maine addressed these two issues, a listing would not be necessary. In both instances, Maine responded.

However, during the time we were, in good faith, addressing these two issues, the Services were apparently laying the groundwork to list Atlantic salmon through the preparation of a new Status Review even though (i) circumstances had not materially changed since the December 1997 decision to withdraw the earlier proposal to list; (ii) top NMFS and USFWS officials strongly denied in sworn affidavits filed in the court action that there was any emergency need to list Atlantic salmon; and (iii) the Services continued to lead the State to believe a listing would be unnecessary if we addressed the two foregoing issues. We also learned later that the new (1999) Status Review – the foundation for what was to be the new listing proposal Review – was underway in the Spring of 1999 and substantially completed by early July, all at a time when the State was being told a listing would not be necessary if we addressed the two concerns. Federal officials did not share a copy of the draft report with the State until after the decision to list had been announced in early October, and then only after it was released to the press and third parties. Needless to say, these events did not strengthen our "partnership" with the federal agencies.

In November 1999, ten months after the filing of the Defenders of the Wildlife lawsuit and less than two years after concluding that the Gulf of Maine DPS was "not likely to become endangered in the foreseeable future," the Services totally reversed themselves and announced that these same Atlantic salmon were "in danger of extinction" and proposed a rule to list them as "endangered." The proposed rule added one more stream to the original seven, bringing the total number of rivers or streams to eight.

In order to prepare comments on the proposed listing, we attempted to obtain from the Services information they used to reach their decision. We were particularly interested in genetic or other scientific information that may have been the basis for the conclusion that these Atlantic salmon were a "distinct population segment" or DPS. As mentioned, a critical issue in this case is whether the Services had a legitimate scientific basis for concluding that a subset of Atlantic salmon in Maine rivers was a "distinct population segment." Remember, the Services had already determined that the vast majority of Atlantic salmon in Maine rivers are restoration stock and therefore ineligible for ESA protection. Thus, the scientific basis for the DPS determination was important. To understand and comment meaningfully on that, our experts needed access to the data.

The Services based their DPS determination principally upon a 1999 scientific study by a Department of Interior/USGS scientist, Dr. Tim King. We asked for his supporting data and other information, but it never came, and ultimately we were forced to file a Freedom of

Information Act request to get it. We even had to file suit in federal court—not once, but twice—to enforce the FOIA requests.

The comments we filed in opposition to the listing presented data and other information that directly and persuasively challenged the Services' data, assumptions and conclusions on key issues. For example, scientific reviews by two prominent geneticists were highly critical of the quality, sufficiency and accuracy of the genetic and other scientific bases for the DPS determination. Dr. Irving Kornfield of the University of Maine and Dr. John Gold of Texas A & M University both concluded that there were flaws in the sampling design, statistical assumptions, statistical analyses and data analyses that severely compromised the King study. Copies of Dr. Kornfield's and Dr. Gold's reviews are included with our comments and are summarized in the comments at pages 19-21 and 35-38.

Under the ESA, the Services had one year from the November, 1999 proposed listing to take one of the following actions: (1) issue a final rule listing the DPS; (2) withdraw the proposed rule; or (3) if they found that there was substantial disagreement regarding the sufficiency or accuracy of the available data, extend the November 17 deadline by six months. The deadline public comment was April 14, 2000. Just eight weeks of after the close of the comment period and five months before this November deadline, the Services agreed in stipulated court order in the Washington, D.C. Defenders of Wildlife lawsuit to voluntarily waive their authority to take a six-month extension to solicit additional scientific data. And to add insult to injury, the Federal agencies had opposed Maine's efforts to intervene as a full party, so this stipulation was negotiated without Maine's participation.

In November 2000, the Services published the final rule listing the Gulf of Maine DPS as endangered. As I read the rule and the responses to public comments, I was extremely disappointed to see that the Services did not address, and in some cases even acknowledge, data and information we presented that persuasively refuted key assumptions and conclusions relied upon for listing.

Maine has filed suit challenging the listing in federal court. That case is now pending.

2. Recommendations for Improving the ESA based on Maine's Experience with the Atlantic Salmon Listing

As I said at the outset, I do not take issue with the purpose and goals of ESA. I do take issue, however, with the way it was applied in this case. The agencies responsible for carrying out the ESA need to be held more strictly accountable to the Act's requirements as well as to standards of sound science and fair process. In that regard, I offer several suggestions for clarifying and improving the act.

a. Clarify Standards for Defining "Species" or Subpopulations Eligible for Listing, and Require Agency Adherence to the Standards

The central purpose of the ESA is, of course, to save a species from becoming extinct. As mentioned, in the case of Atlantic salmon, the Services did not list all Atlantic salmon in all Maine rivers. No one contends that Atlantic salmon – as a species – is either threatened or endangered, indeed today there are thousands upon thousands of Atlantic salmon in the rivers of Maine, New England and eastern Canada, and the North Atlantic ocean. This does not even include the millions more in aquaculture pens off the Maine and Canadian coasts. There are thousands more that are held for breeding in hatcheries here and in Canada. Rather, the Services determined that salmon in eight small Maine rivers were a "distinct population segment" (or DPS) that warranted listing under a narrow subset of the Act..

In other words, the key inquiry in this matter is whether the admittedly sparse populations of fish in these eight rivers are, in themselves, a separate and distinct breed of animal ("distinct population segment") worthy of protection under the Act.

Although the ESA originally did not include the notion of a "distinct population segment" or DPS in its definition of "species," a subsequent amendment to the Act added this provision. However, Congress was concerned enough about the "great potential for abuse" of this concept (is every localized animal population – Boston squirrels vs. Vermont squirrels, for example – a DPS?) that the Services were admonished to use it "sparingly and only when the biological evidence indicates that such action is warranted." S. Rep. No. 151, 96th Congress, First Session, at 7 (1979). This admonition was ignored in the case of Atlantic salmon.

Our comments address this point in detail. The Services failed to follow their own policies and administrative precedents; lacked sound genetic or other biological evidence to support a DPS determination; and failed to consider key data that directly disproves their assumptions and information. I urge you to read our Comments at pages 8 to 41 for a full account. However, let me highlight the issue in summary fashion.

A cornerstone of the "distinct population segment" concept is the notion that the subpopulation in question has become separated from the rest of the species, and has developed unique evolutionary significance that merits special protection. The Atlantic salmon in the eight rivers are not now, nor have they been for decades, a distinct, reproductively isolated population. In fact, these rivers have been massively stocked with tens of millions of other salmon from a variety of external sources for over 100 years, including Canadian rivers, the Penobscot River (already determined to be populated with "non-indigenous restoration stock"), other non-DPS Maine rivers, as well as numerous hatcheries. Moreover, salmon commonly stray from river to river. Bear in mind that the eight DPS rivers are not all located in one, isolated geographic area of Maine. In fact, Maine's largest salmon river—the Penobscot River—is in close proximity to and sits in the middle of the geographic region of the DPS rivers and streams.

The Services virtually ignored these facts. For example, they dismissed the impact of past stocking by asserting that the majority of stocks used came from "within the DPS." However, during the period from 1872 to 1969, millions of salmon were stocked into the DPS rivers, and 87% of these came from other (non DPS) rivers. From 1970 to 1992, millions more salmon were stocked in the DPS rivers, and over 97% from rivers outside the DPS.

To assert that these fish have been in any way "reproductively isolated" or are "distinct," simply does not pass the straight-face test.

The requirement that there ought to be biological evidence warranting the delineation of a DPS has been effectively neutralized by application of a "take no risk" principle not based on scientific method. I submit that the Services went well beyond Congress' intent in the case of Atlantic salmon, and there ought to be some clarification of definition of "species" and precise conditions for delineating a DPS; otherwise the Agencies and advocacy groups will pursue ever more narrow subpopulations, taking the Act far beyond its original laudable purpose. The Services also justified the delineation of a DPS in our case based on the international border, but that has no basis in science and has been criticized by the National Research Council.

b. Require Independent Scientific Peer Review Prior to Listing Proposals.

A listing under the ESA is supposed to be based upon sound science. Indeed, the ESA requires use of the "best scientific and commercial data available". Independent scientific peer review assures that administrative decisions will conform to the best science available. In our case, it seems as though the Services are "shooting first and asking questions later." Because these agencies serve in the dual capacity of advocate as well as decision-maker, and because courts typically defer to agency determinations, it is especially critical to assure that there are objective, reliable and independent scientific standards and analysis that support the decision to list.

Maine's experience with the Atlantic salmon listing is a case in point.

There is considerable scientific dispute and uncertainty about the genetic and scientific bases supporting the determination that Maine Atlantic salmon in seven or eight rivers constitute a DPS, separate from the thousands of other Atlantic salmon out at sea or in other Maine rivers. The genetic basis for the DPS determination in our case rested essentially upon one single genetic study (Dr. King's) that had not been subjected to independent scientific peer review and which, by its own terms and by Dr. King's own statements was not intended to support a finding of a separate DPS. Indeed, Dr. King's earlier study in 1997 (which was the basis for the 1999 study) had been peer reviewed, and a number of the reviewers were critical or non supportive. Deficiencies in the 1997 were repeated and not corrected in the 1999 study; the 1999 King study has serious and fundamental flaws.

This highlights the need for the establishment of clear criteria for scientific studies that should be required for listing. There ought to be requirements that listing determination be based upon field-tested, empirically verified and/or peer reviewed data. Moreover, studies relied upon should be peer reviewed, and the peer reviews ought to be done by independent entities—not the same federal agency staff who are advocating for the listing.

For this reason, I would also urge that the ultimate scientific decision be placed in an independent agency – the National Academy of Sciences, for example – rather than leaving it in the hands of the agency which also advocates for listing. It is fundamental to our concept of a fair process that the prosecutor not also be the judge.

c. Require Disclosure of Data and Information

Fair process also requires open access to information, especially relevant scientific information. Without access, interested parties cannot provide meaningful review and comment.

In our case, for several months after the listing proposal was announced, we sought information directly relevant to the DPS determination, in particular scientific data underlying the pivotal 1999 genetic study. We had to file a Freedom of Information Act request in order to be sure that we obtained this information in a timely fashion. For a sovereign state to have to bring suit in federal court to compel release of scientific data in a situation such as this is outrageous; one wag in Maine commented that it seemed that nuclear secrets might be easier to get.

Even after we filed a formal FOIA request, we had difficulty getting a complete and accurate copy of the data. Over one month after our FOIA request, the Department of Interior delivered computerized data that was not useable. With the period for filing comments on the listing running down, Interior sent an additional set of data, but this time without necessary files to evaluate it. Ultimately, we had to file a federal lawsuit to compel the production of data and extend the comment period.

In response to a second FOIA request seeking access to information relied upon in reaching the listing proposal, the Department of Interior withheld over 300 documents that are directly relevant to the listing decision. The State again filed suit in federal court to enforce its request. The Court ordered that 200 of the 300 documents be produced to the State and another 50 to the Court for closer inspection. We have yet to see those documents because the case is now on appeal to the First Circuit Court of Appeals, and the judge granted Interior's request to stay disclosure pending the outcome of the appeal.

This is not right. A public agency should not withhold scientific data and information relevant to a listing decision. This information should be made readily available to any citizen, let alone another sovereign entity whose traditional right to regulate its natural resources is in question. I suggest that Congress consider amending the ESA to require the Secretary to make publicly available *all* information on which the determination is based, including all scientific studies and underlying data as well as all information that does not support a listing determination. In short, all relevant information – pro or con – should be available, with no exceptions.

d. Expressly Endorse State Conservation Plans.

Section 6(a) of ESA directs the Secretary to cooperate with the states to the maximum extent practicable. Section 4(b)(2) requires the Secretary, in determining whether to list, to take into account the efforts of states to protect such species. Those provisions have now become dead letters, but they represent an essential part of a successful endangered species effort. I urge you to revisit those provisions, make them more specific and require the Secretary to honor them in the listing process.

State conservation plans like the Maine Atlantic Salmon Conservation Plan can be the most effective approach to protecting and enhancing endangered species habitat. The hallmark of these plans is support and cooperation across a spectrum of constituencies, and that is vital in order to carry out the kind of broad-based habitat protections and improvements often necessary for protecting and restoring a species like Atlantic salmon. State conservation plans have been attacked and undermined, but these attacks are, in my view, short-sighted. The kind of cooperative efforts of multiple stakeholders reflected in these plans are particularly vital in states like Maine where the majority of the habitat is privately owned, unlike the situation in many western states where considerable land is under federal ownership and control. In a circumstance like Maine's, it is naïve to believe that a command and control process driven from Washington, D.C., can provide more effective management than the type of locally based system that the Maine Conservation Plan represents.

I hope these comments are helpful to the Committee in its deliberations.

Sincerely,

Angus S. King, Jr.
Governor

cc: Senator Olympia J. Snowe
Senator Susan M. Collins
Congressman Thomas H. Allen
Congressman John E. Baldacci

F:/ATLANTIC SALMON/ESA Listing/ASKs Testimony - ESA Hearing - May 9, 2001

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ANGUS S. KING, JR.
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April 14, 2000

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RE: Proposed Endangered Status For a Distinct Population Segment (DPS) of Atlantic Salmon in the Gulf of Maine, 64 Fed.Reg.62627 (November 17, 1999)

Dear Ms. Colligan and Mr. Nickerson:

I am hereby submitting Comments of the State of Maine Concerning The Proposed Rule to List As Endangered Certain Atlantic Salmon Populations in Maine Rivers Under the Endangered Species Act of 1973.

Just over two years ago, in December 1997, United States Fish & Wildlife Service and National Marine Fisheries Service determined on the "best scientific and commercial data available" that Maine Atlantic salmon were not likely to become endangered in the foreseeable future. In current federal litigation pending in Washington, D.C., you are vigorously defending that determination. In November, 1999 -- 23 months later -- you proposed to list the same Maine Atlantic salmon as endangered. The State of Maine opposes the proposed listing, and respectfully requests that you re-examine your proposal based on the information submitted by the State and others.

I want to emphasize that the State's opposition should not be mistaken for a lack of commitment to restoration or protection of Atlantic salmon. We wholeheartedly agree with the goal of restoring and protecting Atlantic salmon in Maine rivers. We strongly disagree, however, that a listing under the ESA is proper or most effective means to achieve that goal. The

Maine Atlantic Salmon Conservation Plan, developed and implemented on the strength a five-year agreement with Secretary Babbitt, Secretary Daley and your agencies, remains a comprehensive and effective conservation program that embodies regulatory measures and harnesses the self-interest of a broad spectrum of constituents including landowners, volunteers serving on watershed councils, local municipal governments, interested private citizens, and representatives of the numerous industries that operate in the affected areas. The State is committed to the Conservation Plan and has made substantial progress in the two years of its operation.

As is set forth in the State of Maine's comments, a fair and objective review of the Notice of Proposed Rule as well as the underlying Status Review upon which it is based, clearly shows that the Biological Review Team ("BRT") did not use the best scientific information available in making this determination. Moreover, in circumstances like these, where the proposal to list does not involve an entire species but rather a "distinct population segment" of that species, Congress expects an affirmative showing that the scientific evidence warrants such a designation. Here, that burden has not been met, and the BRT has not followed the agencies' own policies and precedents in making their DPS determination.

The primary scientific study upon which the BRT relies--the March 1999 Study the USGS/BRD--is significantly compromised by unsound research methods and techniques. These flaws render the study unreliable. The study has not been subjected to independent peer review outside the federal agencies. Even its chief researcher, Dr. Timothy King, appears to question the BRT's use of it to determine whether the Atlantic salmon in the Downeast rivers constitute a separate ESU (DPS).

In addition, the Services have not demonstrated the scientific or empirical basis for the 180 degree reversal in position in 23 months. Rather, the Proposed Rule and the Status Review upon which it rests are replete with provisional assumptions, speculation, supposition, and inconsistencies which cannot, as a matter of common law and practical common sense, support the proposed action.

Finally, the Secretaries must take into account the "efforts of the State" in addressing risks posed to the species before listing. Just over two years ago, Interior Secretary Babbitt praised the Conservation Plan "as a model for the nation" which was "opening a new chapter in conservation history." Assistant Secretary of Commerce Terry Garcia hailed the Plan as an "innovative effort to resolve the real world conflicts that occur when preserving the species clearly means rethinking traditional uses of river" and proclaimed that adoption of the Plan rather than a listing "highlights the ESA's flexibility . . . ."

Since that time, the State of Maine has made remarkable progress in implementing the provisions of the Plan to significantly address potential threats and improve salmon habitat. In addition, the State has made considerable efforts to improve and strengthen the Plan itself. What, therefore, has changed? As the enclosed Comments demonstrate, the Services have not offered a credible answer based on science to that question.

The State is submitting as appendices to its comments scientific studies of Dr. Irving Kornfield and Dr. John Gold. I am very troubled by the conclusions that they have reached, particularly with respect to the appropriateness and efficacy of the river-specific stocking program that is advocated by the federal Services. According to the proposed rule, this program is considered "an essential component of the strategy to rebuild salmon stocks in the DPS," that has been "designed and implemented to maintain the genetic diversity and distinctiveness of the DPS." 64 Fed. Reg. 62627.

If the conclusions of Dr. Gold and Dr. Kornfield are correct, the current river-specific program may be a burden rather than a benefit to Atlantic salmon. Accordingly, I am calling for a comprehensive and object review of the current stocking program.

On behalf of the State of Maine, I respectfully request that the Services fully consider the comments being submitted today on behalf of the State of Maine. It is my belief if given fair consideration, the Services will conclude that the proposed listing is not warranted.

Sincerely,

Angus King

Angus S. King, Jr.
Governor

cc: Hon. Bruce Babbitt, Secretary, Department of Interior
Hon. William Daley, Secretary, Department of Commerce
Hon. Olympia J. Snowe, United States Senator
Hon. Susan M. Collins, United States Senator
Hon. Thomas H. Allen, United States Congressman
Hon. John E. Baldacci, United States Congressman

COMMENTS
OF THE
STATE OF MAINE

IN OPPOSITION TO PROPOSED ENDANGERED STATUS FOR
A DISTINCT POPULATION SEGMENT (DPS) OF
ATLANTIC SALMON IN THE
GULF OF MAINE

April 14, 2000

OUTLINE OF COMMENTS

I. INTRODUCTION.

A. SUMMARY OF STATE'S POSITION.

B. PROPOSED DPS.

II. SUMMARY OF ERRORS IN THE LISTING PROPOSAL.

A. THE DPS DETERMINATION IS BASED ON FLAWED SCIENCE, INADEQUATE DATA AND UNFOUNDED ASSUMPTIONS.

B. "NEW THREATS" OR OTHER FACTORS OFFERED AS BASIS FOR LISTING ARE NOT SUPPORTED BY SCIENCE OR DATA.

III. ESA LISTING AND DPS DETERMINATIONS.

A. STANDARD FOR ESA LISTING: "BEST SCIENTIFIC AND COMMERCIAL DATA AVAILABLE."

B. DELINEATION OF A DPS REQUIRES AN AFFIRMATIVE SHOWING THAT BIOLOGICAL EVIDENCE WARRANTS SUCH ACTION.

C. DPS POLICIES OF 1991 AND 1996.

IV. THE SERVICES' DETERMINATION THAT HATCHERY MAINTAINED ATLANTIC SALMON POPULATIONS IN DOWNEAST RIVERS CONSTITUTE A SEPARATE "GULF OF MAINE DPS" IS NOT SUPPORTED BY SOUND OR DEFENSIBLE SCIENTIFIC DATA, METHODOLOGY OR ANALYSIS.

A. THE SERVICES HAVE NOT DEMONSTRATED THAT THE PROPOSED DPS IS "DISCRETE" OR REPRODUCTIVELY ISOLATED.

1. **The Scientific Studies Supporting DPS Determination of Genetic Discreteness Contain Fundamental Flaws in Method, Technique, and Findings.**

a. **The Services Rely Heavily on the Study of King et al. 1999 in Delineating Proposed DPS.**

b. **Substantial Disagreement Concerning Delineation of the DPS is Reflected in Peer Review of the 1997 Study.**

c. Flaws Render Much of the King 1999 Genetic Study Unreliable and Compromise its Value to the DPS Delineation.

2. The Services Erroneously Underestimated the Prevalence of Straying by Atlantic Salmon in Maine Rivers.

3. The Services' Conclusion That Over One Hundred Years of Massive Stocking of Atlantic Salmon In These Rivers Has Not Resulted in Sufficient Substantial Introgression Populations In The Proposed DPS Rivers Does Not Withstand Scrutiny.

4. The Services' DPS Determination Is Inconsistent With Administrative Precedents Involving Pacific Salmon.

B. PHENOTYPIC AND LIFE HISTORY TRAITS RELIED UPON TO ESTABLISH THE DPS ELEMENT OF EVOLUTIONARY SIGNFICANCE ARE MORE LIKELY THE RESULT OF ENVIRONMENTAL INFLUENCES AND HATCHERY BROOD STOCK SELECTION, NOT ABORIGINAL GENETIC HERITAGE.

C. THE SERVICES FAIL TO ADDRESS THE OBVIOUS IMPLICATIONS OF THE KING STUDY: THE DATA INDICATES EXTENSIVE GENETIC DRIFT; AND THEREFORE A NEED TO RE-EVALUATE THE CURRENT DESIGN OF THE HATCHERY STOCKING PROGRAM.

D. THE SERVICES' ALTERNATIVE JUSTIFICATION FOR THE PROPOSED DPS, THE EXISTENCE OF THE INTERNATIONAL BOUNDARY IS NOT SUPPORTED BY FACT OR BIOLOGICAL CONSIDERATIONS AND IS CONTRARY TO THE EXPECTATIONS OF CONGRESS AND THE SERVICES' JOINT POLICY.

V. THE SERVICES HAVE NOT DEMONSTRATED A SIGNIFICANT CHANGE IN CIRCUMSTANCES TO JUSTIFY REVERSAL OF THEIR 1997 DETERMINATION THAT A THREATENED LISTING WAS NOT WARRANTED.

A. STANDARD FOR LISTING.

B. FACTORS IDENTIFIED AS A BASIS FOR ENDANGERED LISTING ARE NOT SUPPORTED BY SCIENCE OR DATA.

1. Adult Returns: The Services Consider Data Unreliable; Low Returns Were Anticipated During This Time Period.

2. **Lower Juvenile / Presmolt Survival: Data Does Not Support Services' Assumptions.**

3. **Fish Diseases: The Cited Disease Threats Are Exaggerated, Not New and Are Addressed by New State Regulation.**

   a. **As a general matter, the threat of disease cannot be realistically evaluated without the scientific collection, examination, and review of epidemiological data.**

   b. **The Services have either ignored or dismissed the new initiatives undertaken by the State of Maine to address potential disease threats.**

   c. **Deficiencies in the Services' Analysis of the Disease Threat.**

      1. **ISA.**

      2. SSSv.

      3. **Coldwater Disease.**

      4. **Aquaculture.**

      5. **Habitat.**

         a. **Water Withdrawl.**

         b. **Sedimentation; Peat Mining.**

         c. **Beaver Dams and other Obstruction to Passage.**

         d. **Input of Nutrients.**

         e. **"Chronic exposure to insecticides, herbicides, fungicides, and pesticides (in particular, those used to control spruce budworm)."**

         f. **Elevated Water Temperature; Removal of Vegetation.**

VI. "EFFORTS OF THE STATE" IN ADOPTING AND IMPLEMENTING THE ATLANTIC SALMON CONSERVATION PLAN FULLY ADDRESS POTENTIAL THREATS / RISKS, AND SERVICES SHOULD REAFFIRM THEIR 1997 COMMITMENT.

VII. MARINE SURVIVAL IS THE MOST SIGNIFICANT LIMITING FACTOR IN RESTORING AND PROTECTING ATLANTIC SALMON, AND IS BEYOND THE JURISDICTION OF THE STATE TO ADDRESS.

ATTACHMENTS

1. KORNFIELD, I., REVIEW OF GENETICS IN THE PROPOSED LISTING OF ATLANTIC SALMON, APRIL 11, 2000.

2. GOLD, JOHN R., REVIEW AND CRITIQUE OF "MICROSATELLITE AND MITOCHONDRIAL DNA DIVERSITY IN ATLANTIC SALMONITH EMPHASIS ON SMALL COASTAL DRAINAGES OF THE DOWNEAST AND MIDCOAST REGIONS OF MAINE."

3. STATE OF MAINE FISHERIES AGENCIES, RESPONSE TO JULY 1999 STATUS REVIEW, APRIL, 2000.

4. BAILEY, JOHN, CANADIAN LEGISLATION, REGULATIONS, AGREEMENTS AND POLICIES AND INTERNATIONAL CONVENTIONS AND AGREEMENTS CONCERNING ATLANTIC SALMON, MARCH 30, 2000.

5. EXISTING CANADIAN LAWS AND REGULATIONS.

6. EXISTING MAINE LAWS AND REGULATIONS.

7. MAINE ATLANTIC SALMON CONSERVATION PLAN FOR SEVEN MAINE RIVERS, 1999 ANNUAL PROGRESS REPORT.

8. SCIENTIFIC LITERATURE CITED, APRIL 14, 2000.

COMMENTS OF THE STATE OF MAINE IN OPPOSITION TO PROPOSED ENDANGERED STATUS FOR A DISTINCT POPULATION SEGMENT (DPS) OF ATLANTIC SALMON IN THE GULF OF MAINE, 64 FED. REG. 62627 (NOVEMBER 17, 1999)

April 14, 2000

I. INTRODUCTION.

"It is essential that the best science is used in all ESA decisions."

Testimony of Secretary of the Interior Bruce Babbitt before the Subcommittee on Drinking Water, Fisheries and Wildlife of the Senate Committee on Environment and Public Works (July 13, 1995).

The State of Maine concurs, and submits that if Secretaries Babbitt and Daley accept the proposal to list Atlantic salmon as endangered set forth in 64 Federal Register 62627 (November 17, 1999) ("Proposed Rule"), they will be departing from this standard and from their legal obligation under the Endangered Species Act to make determinations on the "best scientific and commercial data available."

A. SUMMARY OF STATE'S POSITION.

It is the position of the State of Maine[1]:

First, the Fish and Wildlife Service ("FWS") and the National Marine Fisheries Services ("NMFS") ("the Services") have not established that Atlantic salmon in the designated eight Maine rivers are a "distinct population segment" within the meaning of the Endangered Species

[1] The State's comments are based on information and/or analysis provided by various state agencies and individuals including the Departments of Marine Resources and Inland Fisheries and Wildlife, the Departments of Conservation, Environmental Protection, Agriculture and Transportation, the Atlantic Salmon Commission, and the State Planning Office, as well as from others including members of the Scientific Working Group of the Maine Salmon Rescue Coalition. All contributions are gratefully acknowledged. Reviews of the federal genetics studies were undertaken by Irv Kornfield, Ph.D., School of Marine Sciences, University of Maine (Orono) and John R. Gold, Ph.D., Center for Biosystematics and Biodiversity, Texas A & M University (College Station). Both Dr. Kornfield and Dr. Gold are specialists in genetics studies in animals and Dr. Kornfield has studied Atlantic salmon in Maine rivers for over twenty years. John K. Bailey, Ph. D., New Brunswick, Canada, assisted in preparation of information on relevant Canadian and provincial laws applicable to Atlantic salmon.

Act, 16 U.S.C. §§ 1531-1543 (the "ESA" or "Act"). In fact, the DPS delineation proposed by the Services constitutes a fundamental alteration of the DPS concept, lowering the bar in terms of the demonstration of genetic significance previously required by both agency policy and specific administrative decisions in closely analogous cases.

Second, the salmon sought to be protected by the proposed listing are, in fact, not aboriginal stock in any meaningful scientific sense, but rather are the product (or offspring) of massive, continuous stocking from outside the supposed DPS.

Third, the Services have not established by the "best scientific and commercial data available" any basis to reverse their December 1997 determination that Atlantic salmon are not likely to become endangered in the foreseeable future. On the contrary, a fair and objective view of the data compels the conclusion that a listing is not warranted.

Fourth, the Maine Atlantic Salmon Conservation Plan along with existing state law and regulation, in combination with existing regulatory mechanisms established by the federal government, Canadian federal and provincial governments, and international organizations, establish comprehensive and adequate protections for Atlantic salmon in Maine rivers. On that basis alone, the proposed listing is not warranted.

Finally, a disturbing development revealed during the close scientific analysis undertaken in compiling these comments is the failure of the Services and their scientists to consider the distinct possibility that their collected genetic samples imply -- the occurrence of extreme genetic drift, a phenomenon that may well pose a serious threat to the future prospects of salmon in Maine. As described in the attached reviews of Dr. Kornfield and Dr. Gold, the theory of genetic drift provides a unified, compelling interpretation of their studies, as opposed to the illusory conclusions of "discreteness" and "significance." The pervasiveness of a downward genetic spiral suggested in the collected samples strongly indicates the need for a prompt, critical review of the current salmon stocking program.

As the State's comments demonstrate, the proposed listing is not warranted. The State of Maine hereby requests that:

1. The Services determine that the biological evidence does not warrant the delineation of a distinct population segment as proposed;

2. The Services determine that the best scientific and commercial data available does not warrant the proposed listing as set forth in the proposed rule, or any listing, in accordance with 16 U.S.C. § 1533(a)(1).

3. In any event, determine that a listing is not warranted after taking into account the efforts being made by the State of Maine, through its Atlantic Salmon Conservation Plan and otherwise, as well as federal and international conservation efforts, in accordance with 16 U.S.C. §1533(G)(1)(A).

4. At a minimum, the Services determine that substantial and specific disagreement exists regarding the sufficiency and accuracy of the data relied upon both as to the proposed DPS delineation and as to conservation status of the salmon and this disagreement strongly compels the need for a six-month extension described under § 4(b)(6)(B)(i) of Act.

B. PROPOSED DPS.

The proposed Gulf of Maine DPS is defined by the Services as:

> All naturally reproducing wild populations of Atlantic salmon having historical, river-specific characteristics found in a range north of and including the tributaries of the lower Kennebec River to, but not including mouth of the St. Croix River at the U.S. – Canada border.[2]

64 Fed. Reg. at 62629. The proposed rule thus designates salmon populations in the following eight Maine rivers as comprising the DPS: the Dennys, East Machias, Machias, Pleasant,

[2] At the outset, we note that the Services establishment of a DPS range appears to be based on geography, not biology. This exceeds their legal authority, and suggests a misapplication of the DPS concept as intended by Congress. Moreover, if the Services intend, as is suggested, simply to add additional river populations on the basis of subsequently completed genetic analyses, then this deprives the State of Maine and others from meaningful opportunity to comment.

Narraguagus, Ducktrap, and Sheepscot Rivers, as well Cove Brook, a tributary of the Penobscot River. Other Maine rivers are mentioned in the proposed rule but are excluded from the DPS at this time because of incomplete or inconclusive genetic analysis. The proposal states also that the DPS includes early-run and late-run salmon and both "naturally reproducing populations," as well as "river-specific hatchery populations." 64 Fed. Reg. at 62638.

The record compiled by the Biological Review Team ("BRT") is certainly impressive in appearance. The 1999 Status Review is over 200 pages and cites voluminous scientific and other references. However, quantity can be misleading. In fact, the 1999 Status Review and the primary genetics study on which it relies are replete with fundamental flaws in scientific technique, errors of assessment and interpretation, unaccountable omissions of relevant scientific literature, misrepresentation of scientific studies, inconsistencies with prior determinations of the Services, and frequent assertions that are unsubstantiated.

The Services fail to meet the expectations of Congress in delineating "a distinct population segment." Nor do the Services substantiate their determination of evidence of a significant change in circumstances by which to justify the reversal of their December 1997 decision that "based on the best scientific and commercial data available" Atlantic salmon in these rivers are not likely to become endangered in the foreseeable future.

II. SUMMARY OF ERRORS IN THE LISTING PROPOSAL.

A. THE DPS DETERMINATION IS BASED ON FLAWED SCIENCE, INADEQUATE DATA AND UNFOUNDED ASSUMPTIONS.

- The scientific study supporting genetic distinctiveness--the USGS/BRD study by King et al. (1999), is fundamentally flawed in methodology and execution and its findings are compromised:

- Random sampling is a fundamental assumption in population genetics analysis. Individuals in the study of King et al. (1999) were not sampled at random.

- Extensive numbers of closely related individuals (sibs and half sibs) are present in population samples in King et al. (1999), demonstrating that sampling was not at random.

- Sample sizes were too small to characterize populations accurately, while the presence of related individuals causes sample sizes to be even smaller than reported.

- Systemic errors exist in assigning individual genotypes in half of the loci examined in King et al. (1999), and scoring errors for these loci are common in the North American data.

- Statistical analyses employed in King et al. (1999) are inappropriate, incomplete and misinterpreted, leading to a misunderstanding by the authors of the implications for reproductive isolation and distinctiveness in their samples.

- Cluster analyses of genetic variation are incomplete and misleading. Structural patterns for mtDNA were not subjected to confidence testing, and non-significant differences for microsatellite variation were exaggerated.

- Although apparently not recognized by the authors, multiple analyses of temporal stability in King et al. (1999) indicated highly significant variation in microsatellite frequency estimates between sample years.

- The presence of temporal instability compromises much of the subsequent analyses performed on the data by King et al. (1999) and has profound substantive implications for interpretation of the genetics findings.

- The Services have missed the most likely and disturbing conclusion of their genetics study--that the genetic profiles characterized by King et al. (1999) as "remarkable" reflect pronounced genetic drift and inbreeding depression, not evolutionarily significant genetic profiles of locally adapted river populations.

- In contrast to the study of King et al.(1999),[3] the Services misread or misinterpret the data on stocking and its impact. They are mistaken in asserting that most stocking was from "within the DPS." In fact, from 1872 to 1969, 87.3% of the millions of fish put into the eight rivers came from outside the proposed DPS. From 1970 to 1992, 97.3% of the millions of fish stocked came from outside the proposed DPS rivers.

- The BRT also asserts without the benefit of substantial scientific evidence that a century of stocking was almost wholly ineffective. This is certainly a useful device, eliminating in a single stroke the need to confront the impact on the proposed DPS populations of massive numbers of fish from outside the DPS rivers on the proposed DPS populations. However, the supposed failure of stocking is not substantiated by any scientific study or peer-reviewed literature, and indeed, is contradicted squarely by the stocking successes in the Merrimac and Penobscot Rivers.

- The dismissal of stocking impacts is inconsistent with agency policy and previous DPS determinations by NMFS wherein extensive stocking of non-indigenous salmon was a significant factor in denying a DPS designation.

- The Services erroneously understate the "straying rate" of spawning Atlantic salmon based on a selective review of scientific literature, and questionable analysis.

[3] These comments distinguish between the population genetics study of King et al. (1999) and the 1999 Status Review prepared by the Biological Review Team assembled by FWS and NMFS. While the study of King et al. (1999) is flawed, both as to technique and interpretation of data, the BRT takes the findings of King et al. well beyond the latters' claims for their data and well beyond what that data could comfortably sustain, even had the data been validly derived. Thus, the general reliance upon the King et al. 1999 Study as establishing a DPS goes beyond the intended purpose of the Study. See Section IV (A)(1), below. In addition, the quantitative genetics of life history traits deployed by the BRT to buttress the population genetics of King et al.(1999), is not a conclusion drawn in King et al.(1999). Instead is the BRT's own construction of the King data. See Section IV(B), below.

- Scientific literature does not support the Services' assumption that the biological and behavioral characteristics they identify are genetic traits of evolutionary significance in these Atlantic salmon. The study of King et al. 1999 did not purport to address this issue. The weight of scientific evidence strongly suggests that these traits are environmentally, not genetically, driven. And to the extent there is a genetic component, no consideration was given to the impact of hatchery selection processes which, over the years, was directed at the traits in question.

B. "NEW THREATS" OR OTHER FACTORS OFFERED AS BASIS FOR LISTING ARE NOT SUPPORTED BY SCIENCE OR DATA.

When examined, the seven factors constructed by the Services to support reversal of the 1997 decision not to list Atlantic salmon as threatened are without substance.

- Low Adult Returns. The Services themselves say that "adult counts do not provide a sound basis for concluding, in the short term, that the adult populations have substantially declined since 1996 or 1997." Moreover, in light of the decision made in 1992 to change to fry stocking and to suspend stocking efforts for several years on these rivers, decisions of which the Services were well aware, it was predictable and was in fact predicted in 1992 that adult returns would be low for a number of years.

- Juvenile/Presmolt Survival. The data does not support the assumption that juvenile survival rates are dropping or that smolt production is perilously low. In fact, whether considered absolutely or in historical context, preliminary data from the joint Atlantic Salmon Commission/NMFS Study on the Narraguagus River indicate that smolt production is higher than estimates for the early 1990s and is comparable to production during the 1960s, an era when adult returns were considerably higher than they are at present.

- "New" Fish Diseases. The prominence given by the Services to the alleged increased threat posed by two diseases, SSSv and ISAv, is exaggerated, unsupported by scientific study, and ignores new initiatives that the State of Maine has already taken to address these threats. First, FWS itself has concluded that the "data, although circumstantial, are sufficient to conclude that SSSv has not been a significant threat to Atlantic salmon." Second, ISA has never been documented in Maine, and was well known to exist in Canada at the time the Services determined in 1997 that a threatened listing was not warranted. The State of Maine has adopted in regulation one of the most stringent fish health protocols in the country. Commercial aquaculture operations have established and upgraded loss control, biosecurity, and particular ISAv action plans to address any potential threats.

- "New" Aquaculture Threats: Use of Non-North American Strains and Escapees. The Services offer no quantitative or other data to support claims that use of non-North American strain stock or potential escapes from aquaculture facilities pose any heightened risk. The Atlantic Salmon Conservation Plan anticipated use of such strains, and fully addressed both concerns through requirements for enhanced containment and in-river weirs.

- "New Threats" to Salmon Habitat. The Services cite no data, evidence, or scientific study to support suggestions that there has been degradation or new threats, actual or potential, with respect to salmon habitat in Maine. Indeed, the apparent attempt by the BRT and the Services to use the Narraguagus River study to imply new threats to freshwater habitat to support their listing proposal and deflect attention from the overarching factor of low marine survival is contrary to the data from that study and not supported by the historical context.

III. ESA LISTING AND DPS DETERMINATIONS.

A. STANDARD FOR ESA LISTING: "BEST SCIENTIFIC AND COMMERCIAL DATA AVAILABLE".

The Secretaries are directed to determine whether any species, as that term is defined in the ESA, is endangered or is threatened because of the existence of one or more of five factors set forth in section §4(a)(1) of the Act. 16 U.S.C. § 1533(a)(1). In the case of the first factor listed, which deals with destruction of habitat, the Secretary is not required to demonstrate that destruction, modification, or curtailment of habitat or range is a present condition; threat to habitat may be either a "present or threatened" condition. Each of the four other factors listed in section 4(a)(1) must be determined to be a threat that exists at present.

The Secretaries' determination of a threat must be made "solely on the basis of the best scientific and commercial data available to him after conducting a review of the status of the species . . . . " 16 U.S.C. §1533(b)(1)(A). Under that standard, the Services cannot disregard or decline to consider scientific data or information that is contrary or superior to the data upon which the determination is based. City of Las Vegas v. Lujan, 891 Fed. 927, 933 (D.C. Cir. 1989). In addition, the law requires a rational basis for conclusions, and due consideration and response to substantive public comment. See Idaho Farm Bureau Federation v. Babbitt, 58 F.3d 1392, 1404 (9th Cir. 1995).

In this case, the State suggests that a heightened degree of scrutiny must be given to the science and information upon which a listing determination is based. Two years ago, the Services determined on the basis of the "best scientific and commercial data available" that Atlantic salmon is not likely to become endangered in the foreseeable future (i.e. not even threatened). Clear and substantial evidence of changed circumstances or new, significant threats must be identified and supported in order to reverse this conclusion. Supposition or speculation is not sufficient to depart from an administrative determination made just two years ago.

B. DELINEATION OF A DPS REQUIRES AN AFFIRMATIVE SHOWING THAT BIOLOGICAL EVIDENCE WARRANTS SUCH ACTION.

When the Services prepare to list only a distinct segment of a species' population, there is a higher, affirmative burden of demonstrating that the biological evidence warrants the determination. The Services recognize this burden: "Congress has instructed the Secretary to exercise this authority with regard to DPS's . . . sparingly and only when the biological evidence indicates that such action is warranted." 61 Fed. Reg. at 4722 (emphasis added). The source of the foregoing language is a report of the Senate Committee on Environment and Public Works. The full quote from the Senate report says:

> Nonetheless, the committee is aware of the great potential for abuse of this authority and expects the FWS to use the ability to list populations sparingly and only when the biological evidence indicates that such action is warranted.

S. Rep. No. 96-151, 7 (1979) (emphasis added).

In November 1991, the Speaker of the House, Senator Hatfield of Oregon and Rep. Studds of Massachusetts formally requested that the National Academy of Sciences conduct a study of several issues related to the ESA. The first issue on which study was requested was that of the "definition of species" in the Act. According to the request: "One of the fundamental conceptual building blocks of the ESA is the concept of 'species.' There have been considerable discussions within scientific circles on how to identify the appropriate taxonomic units to achieve the purposes of the Act, with particular focus on the question of populations and population segments." Letter dated November 27, 1991, to the Director, National Academy of Sciences from Speaker Foley, Senator Hatfield and Congressman Studds, Appendix A in Science and the Endangered Species Act, National Research Council, Washington 1995 ("NRC Study").

The NRC Study proposed that increased scientific objectivity be brought to the examination of whether a given taxon below the rank of subspecies is eligible for protection by the ESA. Such objectivity is necessary to meet what the NRC Study characterized as "Congress's challenging expectation that distinct population segments be listed 'sparingly and only when biological evidence indicates that such action is warranted.' (S. Rep. 151, 96th Congress, 1st Session, 1979)." NRC Study, 56.

Congress's challenging expectation was that the "distinct population segment authority be employed only when biological evidence warrants such action. "Warrant" means to declare or maintain with certainty. Thus, while a conservation status determination by the Secretaries must be made "on the basis of the best scientific and commercial data available," 16 U.S.C. § 1533(b)(1)(A), the "great potential for abuse" caused Congress to establish a higher standard than simply "best available data," requiring that the Services proceed with certainty before deciding to list a distinct population segment.

In previous applications of the "distinct population segment" concept to Pacific salmon, NMFS has consistently acknowledged the higher degree of certainty that is required. See Lower Columbia River Coho Salmon, 56 Fed. Reg. 29553 (1991). ("No DPS where evidence inconclusive" and did not demonstrate that the Coho salmon were "distinct" from other wild coho salmon populations; extensive stocking of non-indigenous salmon at time of depressed wild populations led to an inference of "likely substantial introgression" and a declination to designate a DPS); Scott and Waddell Creeks, California Coho, 59 Fed. Reg. 21744 (1994) ("Available information does not make a strong case for reproductive isolation" in light of spawner straying coupled with extensive stocking that "may have affected the distinctiveness of the stock"); West Coast Pink Salmon, 60 Fed. Reg. 51928 (1995) (NMFS based DPS determination on compelling evidence of reproductive isolation and genetic differentiation); Six ESUs of Coho Salmon, 60 Fed. Reg. 3801 (1995); (NMFS relied primarily on solid genetic evidence to demonstrate sufficient reproductive isolation).

C. DPS POLICIES OF 1991 AND 1996.

In analyzing the requirements for a DPS in the 1999 Status Review, the BRT applied an internal policy entitled "Joint Policy Regarding the Recognition of Distinct Vertebrate

Population Segments," 61 Fed. Reg. 4721 (February 7, 1996) (the "1996 Policy" or "Joint Policy"). This policy requires three findings in order to establish a DPS.

First, the population segment must be "discrete" in relation to the remainder of the species, i.e. either (i) "markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological or behavioral factors" or (ii) "delimited by international governmental boundaries" within which exist significant differences in "control of exploitation, management of habitat, conservation status or regulatory mechanisms" that are significant in light of section 4(a)(1)(D) of the Act [adequacy of existing regulatory mechanisms].

Second, if a finding of "discreteness" is made, then the population segment must be "significant." This second criterion looks at a number of factors – "persistence" in a unique ecological setting; "marked genetic differences"; or evidence that its loss would result in a significant gap in the taxon's range or that it is the only surviving population. Id.

Third, consideration is given to analysis of conservation status of the population under the ESA. Id.

The 1996 Policy expressed a qualification with respect to DPS determinations for Pacific salmonids, explaining that a 1991 policy on Pacific salmonids "is a detailed extension of this Joint Policy." According to the 1996 Joint Policy, "NMFS will continue to exercise its policy with respect to Pacific salmonids." The referenced earlier policy is an internal NMFS policy entitled "Policy on the Definition of Species Under the Endangered Species Act," 56 Fed. Reg. 5892 (November 20, 1991) (the "1991 Policy"). These two policies are to be applied in a "clear and consistent fashion." 61 Fed. Reg. 4722. In other words, the 1991 Policy specifically applicable to salmonids is the appropriate standard in this case.

The 1991 NMFS Policy established the ESU (evolutionary significant unit) concept which was premised on the foundational principles that a DPS must (1) be reproductively isolated from other conspecific population units; and (2) constitute an important component in the evolutionary legacy of the species. See 56 Fed. Reg. 58612. In the 1991 Policy, NMFS recognized the need for consistency in evaluating the distinctiveness of the salmonid populations in order to meet congressional expectations in delineating a DPS. The 1991 Policy, then, would "accomplish the major goal of the Act—to preserve the genetic diversity of species and the ecosystems they inhabit." Waples, Definition of "Species" under Endangered Species Act: Application to Pacific Salmon, NOAA Technical Memorandum NMFS F/NWC-194, 3 ("NMFS Species Memo").

Use by NMFS of a special framework to evaluate Pacific salmon makes sense. Factors peculiar to salmonids, such as straying and artificial propagation (stocking) present unique opportunities for genetic exchanges among populations that blur the lines which normally demarcate distinct population segments from other species. Id. At 3-4. Therefore, in light of the tendency for such genetic exchanges among salmon populations, the 1991 Policy instructs regulators to give substantial weight to genetic evidence in making DPS determinations. The NMFS Species memo explained the role of genetic evidence in the DPS calculus as follows:

> The existence of substantial electrophoretic or DNS differences from other conspecific populations would strongly suggest that evolutionarily important, adaptive differences also exist. The failure to find electrophoretic or DNA differences (or the absence of genetic data) would not rule out the possibility that such adaptive differences exist, but it would place a greater burden of proof on data for other characters. NMFS Species Memo, 5. (emphasis added)

Thus, electrophoretic or DNA differences are the best evidence of evolutionary important, adaptive differences. While use of such evidence is not mandatory, its absence imposes a "greater burden of proof on data for other characters."

The principles embodied in the NMFS policy should be applied in a "clear and consistent manner" with respect to DPS determination of Atlantic salmon in this case. Both the 1995 Status Review and the 1999 Status Review acknowledge that the structure of Atlantic salmon populations is similar to Pacific salmonids. The 1995 Status Review concludes that "the ESU approach provides a practical framework for delineating Distinct Population Segments of Atlantic salmon under the ESA." 1995 Status Review, 1. In the 1999 Status Review, the BRT stated:

> Although the ESU approach was developed for Pacific salmon (Oncorhynchus sp.), Atlantic salmon populations have analogous population structure, ecology, and life history strategies. 1999 Status Review, 35.

It is unclear, therefore, why the BRT did not actually employ the 1991 Policy, given that population structure, ecology, and life history strategies of Atlantic salmon populations are similar to Pacific salmonids.

In light of the foregoing, under their own clearly-established policies the Services bear an affirmative burden of demonstrating that the biological evidence warrants a DPS determination. Under these formal policies, this evidence must clearly establish that the proposed DPS is both discrete (reproductively isolated) and evolutionarily significant. It is also clear that, particularly with respect to salmonid populations like Atlantic salmon, the DPS determination should be based upon a demonstration of genetic discreteness and significance.

IV. THE SERVICES' DETERMINATION THAT HATCHERY MAINTAINED ATLANTIC SALMON POPULATIONS IN DOWNEAST RIVERS CONSTITUTE A SEPARATE "GULF OF MAINE DPS" IS NOT SUPPORTED BY SOUND OR DEFENSIBLE SCIENTIFIC DATA, METHODOLOGY OR ANALYSIS.

The Services have concluded, based on the analysis of the BRT in the 1999 Status Review, that the populations in these eight rivers have a distinct genetic profile and possess heritable biological and behavioral traits that make these populations uniquely adapted to their environment. These alleged attributes are said to distinguish the proposed DPS Atlantic salmon from other Atlantic salmon in Canadian Rivers as well as in other Maine rivers. The Services' further conclude that these populations are, and historically have been, sufficiently "discrete" (reproductively isolated) to enable them to maintain these traits over time, and that this isolation was not compromised by the common tendency of Atlantic salmon to stray from one river to another or by extensive stocking (in the millions of fish) from outside sources that occurred in these rivers over a period of 100 years.

In reaching its determination, the BRT examined "three major indicators" of the "marked separation" requirement of the discreteness criterion in the 1996 Policy: "straying of spawners; recolonization rates external to the DPS; and genetic differences observed throughout the range of Atlantic salmon." 1999 Status Review, 46-47. As is demonstrated below, the BRT's conclusions are not supported by the best available scientific data and information. In fact, the science and data relied upon strongly suggest the contrary: that these populations are not "discrete" or reproductively isolated at all. With respect to the genetic distinctiveness of Maine versus Canadian salmon, the genetic studies relied upon are flawed in design, sampling, execution and analysis. In addition, the Services and the authors of the study both misinterpret disturbing inferences from the study, which suggest genetic drift serious enough to call for critical review of the Services' approach to river-specific stocking. Moreover, the Services misinterpret supporting data and substantially misanalyze other components of reproductive isolation—past stocking efforts and straying of spawning fish.

Likewise, in addressing the second element of a DPS determination – evolutionary significance – the Services depend upon these same flawed genetic studies to infer persistence in the rivers of uniquely adapted populations. The Services acknowledge, however, that it is "unlikely that aboriginal stocks persist in genetically pure native form," but go on to conclude that these populations are descendants of these aboriginal stocks, and their continued presence in their indigenous habitats indicates that important heritable adaptations still exist. 1999 Status Review at 51-51 (emphasis added). As we demonstrate in the following sections, the Services determination that heritable local adaptations exist is contradicted by the available scientific data. Clearly that determination falls short of the expectations of Congress (as well as agency policy and prior administrative decisions) that a strong case be made for delineation of a DPS.

A. THE SERVICES HAVE NOT DEMONSTRATED THAT THE PROPOSED DPS IS "DISCRETE" OR REPRODUCTIVELY ISOLATED.

1. The Scientific Studies Supporting DPS Determination of Genetic Discreteness Contain Fundamental Flaws in Method, Technique, and Findings.

a. The Services Rely Heavily on the Study of King et al. 1999 in Delineating the Proposed DPS.

At the heart of the BRT's DPS determination is a scientific study led by Dr. Tim L. King,[4] a researcher / scientist employed by the United States Geological Survey, Biological

[4] The presence or absence of population genetics data is the major factor driving the delineation of the proposed DPS. (1) According to the Services, population genetics studies can determine directly whether populations will be listed. "Surveys have also identified juvenile Atlantic salmon to be present in other river systems which have relatively limited juvenile production habitat such as Bond, Togus, Passagassawaukeag, Eaton, Felts, South Branch Marsh, Kenduskeag, and Pennamaquan Rivers (Buckley, 1999). Results from genetics studies of fish from these and other occupied rivers within the DPS range will be used to determine the appropriateness of adding these populations to the DPS." 64 Fed. Reg. at 62629. "It would be premature to determine the status of the Penobscot population in relation to the Gulf of Maine DPS without comprehensive genetic data." 64 Fed. Reg. at 62629. "In the future, DPS populations may be identified in additional rivers based on ongoing stream surveys and continuing genetic analyses." 64 Fed. Reg. at 62638. (2) According to the Services, population genetics studies are employed as direct support for evolutionary uniqueness and distinctness of fish in the proposed DPS. "Recent survey work also indicates that a naturally reproducing population that is genetically distinct (alleles found only in that population) remains in Cove Brook (Buckley, 1999; King et al., 1999). This information demonstrates that Atlantic salmon can retain unique genetic material in a relatively small drainage . . . . " 64 Fed. Reg. at 62629. "The Services conclude that there are adequate genetic and demographic data to demonstrate that an ecologically important separation exists between the Gulf of Maine DPS and other populations to the north . . . . " 64 Fed. Reg. at 62629. (3) According to the Services, presumed genetic differentiation in life history traits is employed as direct support for evolutionary uniqueness and distinctness of salmon in the proposed DPS. "The Services also conclude that while it is unlikely that any U.S. Atlantic salmon populations exist in a genetically pure native form, present populations are descendants of these aboriginal stocks, and their continued presence in indigenous habitat indicates that important heritable local adaptations still exist." 64 Fed. Reg. at 62629. "Since the proportion of 2 SW fish in an Atlantic salmon stock has a documented genetic basis . . . the Services conclude that the DPS has unique life history characteristics that have a heritable basis." 64 Fed. Reg. at 62630. (4) According to the Services, genetic composition is employed to dismiss the effects of straying and a century of hatchery stocking. "Given our current understanding of the genetic composition of these stocks . . . the documented persistence of native stocks . . . and the

Research Division (USGS/BRD) at Leetown, West Virginia. The study, entitled "Microsatellite and Mitochondrial DNA Diversity in Atlantic Salmon with Emphasis on Small Coastal Drainages of the Downeast and Mid-Coast Regions of Maine, a Report to Region 5, USFWS, Hadley, MA," was completed in March of 1999 ("King et al. 1999"). The Services describe it as "the most comprehensive survey to date" supporting genetic differences between U.S. and Canadian stocks. 1999 Status Review, 48. This study builds upon, and is the completion of, a preliminary study also undertaken by Dr. King and much of the same team of USGS/BRD scientists in 1997 entitled, "Genetic Diversity, Analysis of Mitochondrial DNA and Microsatellite DNA in Atlantic Salmon with Emphasis on the Downeast Rivers of Maine: A Preliminary Report to Region 5, USFWS Hadley, MA" ("King et al. 1997"). Even though the King et al. 1999 Study has not been subjected to independent peer review, the data assembled in the study is critical to the Services' DPS determination.[5]

b. Substantial Disagreement Concerning Delineation of the DPS is Reflected in Peer Review of the 1997 Study.

The Services solicited anonymous, ad hoc reviews of King et al. 1997. A number of the reviewers were highly critical of the King et al. 1997 Study's methodology, analyses, and

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fact that most of the hatchery stocking influences were internal to the Gulf of Maine DPS range including the Penobscot . . . the Services conclude that the influence of hatchery fish upon the DPS has not been sufficient to completely or substantially introgress with the remnant populations and genomes of the Gulf of Maine DPS." 64 Fed. Reg. at 62630. (5) According to the Services, it is the genetic characteristics of salmon in the proposed DPS that deserve protection. "The Services believe that there are components of an important genetic legacy remaining in these populations, and the loss of these populations would negatively affect the genetic resources of Atlantic salmon as a whole because it would contribute to further range reduction." 64 Fed. Reg. at 62630.

[5] The BRT cites two other sources in its discussion of the distinctness of Maine and Canadian Atlantic salmon. These sources are either outdated or inapposite. Moller, 1997, has been rejected by a later study. See Kornfield Review, Attachment 1. Bentzen and Wright, 1992, is only marginally relevant because it compared U.S. Atlantic salmon with Atlantic salmon in New Foundland, a comparison that has limited implications here since intermediate populations were not considered. Id.

inferences . These criticisms raised concerns about non-random field sampling, inadequate sample sizes, and genetic drift. Here are some of the comments of the peer reviews:

> Although it is clear why evidence of "unique" or distinctive genetic traits in particular groups of salmon would be of interest in a study such as this, sample size and locus variability issues strongly limit any useful inferences that can be made from observations about private alleles. (Ad Hoc Reviews of King et al. 1997: Reviewer 3)(emphasis added)

> The study has two major shortcomings. The first is the limited number and sizes for many of the samples. This makes it difficult to draw conclusions about regional variation within continents give[n] the relatively low level of differentiation displayed and to place much confidence in estimates of numbers and proportions of private alleles. (Ad Hoc Reviews of King et al. 1997: Reviewer 8) (emphasis added)

> These differences [in microsatellite allele frequencies among populations] are difficult to explain without invoking low effective size, non-random sampling, stock transfers, or artifactual data. (Ad Hoc Reviews of King et al. 1997: Reviewer 10) (emphasis added)

> Sampling is a particularly important consideration here because sample sizes are relatively small (so sampling error is relatively large) and genetic differences between populations are relatively small. [Random sampling] is difficult to achieve in any biological population, but the departures from randomness can be particularly acute in sampling juveniles (as presumably was done here). (Ad Hoc Reviews of King et al. 1997: Reviewer 10) (emphasis added)

> In talking with others with some knowledge of the collections, we have heard the following concerns expressed: 1) some of the Maine samples appear to comprise groups of related individuals, or progeny from a relatively few nearby redds; and 2) many Canadian collections were from streams that have been substantially affected by hatchery programs and thus do not necessarily represent populations of wild fish. (Ad Hoc Reviews of King et al. 1997: Reviewer 10)

> [T]here is no clear evidence that the samples from the northeastern states belong to a distinct evolutionary grouping from those in Canada. What differences exist between American and Canadian populations may simply be due to clinal changes in the genetic structure of North American populations, arising from a negative relationship between gene flow and geographic separation, or from chance differences among populations. (Ad Hoc Reviews of King et al. 1997: Reviewer 7)

> The analyses in the report have convinced me that there is no molecular genetic basis for designating the Atlantic salmon in the five downeast rivers as an ESU. There clearly is no genetic distinction between this group and the Canadian populations. (Ad Hoc Reviews of King et al. 1997: Reviewer 9)

> [I]t is worth noting that the "migration rates" among populations which are calculated in the report are really just transformations of the gene frequency data. They are based on equilibrium assumptions which could not be even approximately valid for these populations. (Ad Hoc Reviews of King et al. 1997: Reviewer 5)

And the final study—King et al. 1999—failed to correct these flaws or address noted deficiencies.

c. Flaws Render Much of the King 1999 Genetic Study Unreliable and Compromise its Value to the DPS Delineation.

Dr. Irving Kornfield of the University of Maine and Dr. John R. Gold of the University of Texas A&M both have concluded that there were flaws in sampling design, statistical assumptions, statistical analyses and data analyses of King et al. that severely compromise the study. Their reviews are Attachment 1 and Attachment 2, respectively. Dr. Kornfield has conducted, in the limited time available, an independent analysis of some of the data used by King et al. and determined there were, in addition, pervasive and systemic errors in assigning individual genotypes as well as numerous scoring errors that render suspect and unreliable some of the underlying data from which the study's inferences were drawn.

The following is a brief summary of the major irregularities they identified.

- **Individuals were not sampled at random.** Random sampling, a fundamental assumption in population genetic analysis, was not adhered to in this study. Collection of samples, in many cases, was limited to a few small areas of a stream rather than encompassing large areas, and included an extensive number of closely related individuals (sibs and half-sibs). The presence of related individuals within population samples and between samples from the same locality for different years inflates estimates of population differentiation and biases assignment tests.

- **Samples sizes too small.** The sample sizes in this study were inadequate. With highly variable markers (such as microsatellites), inadequate sample sizes can generate spurious results. In this kind of a study, small samples from individual populations will likely produce misleading or unreliable results. Further, small sample sizes have significant effects on the detection of unique or "private" alleles. A small sample size will exaggerate the presence of such unique alleles, and can be misinterpreted for greater population differentiation than is in fact the case. Expansion of sample sizes can reveal the presence of such alleles in other populations. This concern was explicitly noted in the ad hoc peer reviews of the Preliminary 1997 Study, but not addressed or corrected in the subsequent work.

- **Pervasive, systemic errors were made in assigning individual genotypes.** Errors in assigning individual genotypes were made for at least half (6 of 12) of the loci examined, and scoring errors for these loci were common in the North American data. Because these errors were so pervasive, inferences from these data are suspect and cannot be employed to support conclusions of isolation and significance. Because of the extent of the errors in the North American data, it would not be appropriate to include results from these loci in calculations of differentiation. It should be noted also that correct assignment of alleles may not be accomplished from re-analysis of the Genescan profiles, but could require instead that loci be rerun in order to distinguish genotypes.

- **Statistical analyses were inappropriate, incomplete and misinterpreted.** These weaknesses led to misreading of results and their impacts on inferences concerning isolation and distinctiveness of populations samples. Various tests used selected, non-independent, a posteriori comparisons. Cluster analyses of genetic variation were incomplete and misleading. Structural patterns for mtDNA were not subject to confidence testing and non-significant differences for microsatellite variation were exaggerated. Multiple analyses of temporal stability clearly indicated highly significant variation in microsatellite frequency estimates between sample years, but this was not recognized by King et al. 1999;

- **The presence of "temporal instability" compromises much of the analyses performed on the data.** Temporal stability of allele frequencies within locations is a fundamental assumption for analysis of differences among localities. Although the King et al. 1999 Study concludes that allele frequencies are stable over time, the data and analysis strongly indicate otherwise. For example, in the comparison between Cove Brook samples in 1994 and 1995 (table cite), significant heterogeneity (instability) was demonstrated. This had been previously noted by a reviewer of the King et al. 1997 Study, but was not accounted for in the final study. Therefore, in the data set under examination, because of highly significant variation among frequency estimates for the same population made at different times, no valid inferences can be made concerning differentiation. Further, given these extensive temporal differences, the absence of any examination of temporal variation in Canadian samples, and the fact that hatchery-obtained Canadian samples originated from rivers which themselves had long-term stocking histories, it is incorrect to assert that there are significant differences between samples of Atlantic salmon from Maine and samples of Atlantic salmon from the Canadian mainland on that basis.

Apart from the question of its reliability, the King et al. 1999 Study has been taken beyond its intended purpose and scope. First, the BRT attempts to employ the study directly as support for the DPS determination based on the presumed distinctiveness of Maine salmon as opposed to Canadian salmon. However, the study itself disavowed any specific finding of an ESU (or DPS) within the North American stocks:

> Atlantic salmon inhabiting North America and Europe are sufficiently divergent and reproductively isolated to warrant ESU status. Although no such rich phylogenetic disjunctions were readily observed within North America or Europe, shallower genetic subdivisions worthy of management consideration (i.e. management units) have been identified.

King et al. (1999) at 30.

And, Dr. King himself has publicly expressed concerns about this attempted use. A 1998 Science Magazine article covering this story said:

> "But the Maine salmon failed a key DPS test. King asserts: "The reproductive isolation just isn't there and Maine salmon share too many of the same alleles or gene variances with Canadian fish to be considered a distinct population." "Nothing jumps out as an ESU," King says.

Science Magazine, p. 800 (February 6, 1998).

In addition, the BRT also uses King et al. 1999 to support the conclusion that the salmon in the proposed DPS possess "unique life history characteristics that have a heritable basis." 64 Fed. Reg. At 62630. The King Study did not purport to address this issue. And was recently reported that Dr. King reiterated that his study was not intended to establish a DPS or to prove the continued existence of aboriginal fish in the eight rivers:

> King . . . is angered by what he views as mischaracterizations of his work by reporters filtering the reactions of other federal scientists. His study was very straightforward. He aimed to find out if there were genetic patterns to suggest that salmon in Maine are different from salmon in Canada.
>
> The study had nothing to do with determining if salmon now in Maine rivers shared genetic material with the salmon that lived there centuries ago before stocking took place, as other federal scientists have asserted.
>
> He also did not set out to prove that there was a distinct population segment, although the federal agencies have used his study to make that assertion.

Bangor Daily News (March 25, 2000)

2. The Services Erroneously Underestimated the Prevalence of Straying by Atlantic Salmon in Maine Rivers.

The Services conclude that available information indicates that documented straying is not significant and is limited to neighboring rivers within the proposed DPS geographical region. "As such, the 2% straying rates documented by Baum and Spencer (1990) indicate that interactions between populations, individual DPS rivers and the Penobscot River restoration program are no greater than would be expected in wild populations of similar geographic proximity." 1999 Status Review, at section 5.3.2.1.

This conclusion relies on a selective reading of technical literature, and fails to consider available data on straying rates. A review of the literature – even that cited by the BRT – does not support the finding of an absolute two percent straying rate, or the suggestion that straying rates do not have a significant influence on reproduction isolation. Baum and Spencer (1990) analyzed tag returns from hatchery smolts over a 21 year period (1966 – 1987). Because of intense angling and the lack of fish collection devices on some nearby rivers (Pleasant, East Machias, Dennys), these data have limited value. It is noteworthy, however, that the straying rates for the Narraguagus and Machias Rivers were 7.9 % and 15.9 %, respectively; the Penobscot River (which traps the total run) produced a 1.0 % straying rate (which probably reflects the numerical disproportion between Penobscot returns and those of other Maine rivers). Because the focus of the Status Review is the downeast rivers, however, the approximate straying rate should be assumed to be more in line with the rate actually observed on two of those rivers (8 – 16%), or a more appropriate weighted average. State of Maine Fisheries Agencies Comments on Stocking, Straying, Recovery and Comments (Attachment C).

The BRT cites Jonsson et al. (1991) as evidence that hatchery fish stray more than wild fish. While the study does support that assertion, it also demonstrates in addition that both groups of smolts--hatchery reared and wild--exhibited vastly greater straying rates than the two percent used in the Status Review. The straying rate for hatchery salmon was 25.2%; for wild salmon 9.5%. The latter rate for wild salmon is clearly higher than the two percent rate used by the BRT. Why this information from a study cited by the BRT for other purposes was omitted from the Status Review is not explained.

Another study cited, Hansen and Jonsson (1994), demonstrated straying rates ranging from 5-8 percent. Again, it is unclear why the Services settled upon the two percent straying rate in light of this other available information. Moreover, Hansen, Jonsson and Jonsson (1993), a paper not cited in the 1999 Status Review shows a straying rate of 16 percent for wild smolts released in the River Imsa or at a coastal location.

It is clear that the BRT understated both the frequency and the significance of straying. Even a conservative straying rate for wild stocks is clearly greater than 2%, with the higher rate doubled for hatchery fish. The bounds for Penobscot River strays extends, at a minimum, into that region of the proposed DPS rivers, and probably beyond. Strays from nearby Canadian populations can also reasonably be expected in Maine rivers, particularly in the eastern Maine area, and the Services do not adequately address this issue.

A detailed analysis of the straying and its application to this case is set forth in Attachment 3, at Appendix C, §I. The Services must address this in full in order to meet their burden of proof on the delineation of the DPS.

3. The Services' Conclusion That Over One Hundred Years of Massive Stocking of Atlantic Salmon In These Rivers Has Not Resulted in Sufficient Substantial Introgression Populations In The Proposed DPS Rivers Does Not Withstand Scrutiny.

The BRT concludes that, given their current understanding of the genetic composition of the salmon stocks in issue (which is based on the King et al. 1999 Study), the documented persistence of native stocks, and the "fact" that most of the hatchery stocking influences were from "within the DPS," the influence of hatchery fish upon Atlantic salmon in these eight rivers "has not been sufficient to completely or substantially introgress with the remnant populations and genomes of the Gulf of Maine DPS" 64 Fed. Reg. at 62630.

The BRT dismisses the impact of the magnitude of past stocking efforts by erroneously concluding that the majority of stocks used have come from "within the DPS" and therefore have not had a substantial genetic impact:

> The majority of stocks utilized for supplemental stocking within the Gulf of Maine DPS have been <u>from within the DPS geographic range</u> in both the USA and Canada (Baum 1997). <u>Because the source of most stocking efforts have been from within the DPS</u>, the genetic effects from stock mixing would be substantially less than from stocks from outside the DPS.

1999 Status Review, 49 (emphasis in original).

There are two fundamental problems with this conclusion. First, the BRT equates the "DPS geographic range" with the "DPS" for purposes of determining genetic impact. However, this is mixing apples and oranges; many rivers from within the "DPS geographic range" are not designated as part of the DPS in this proposed rule. Only eight rivers have been designated as part of the DPS by the proposed rule. Other Maine rivers, including the Penobscot River, have been specifically excluded because of incomplete genetic data, and, of course, Canadian rivers are note included.

This fundamental confusion leads to a second problem: the facts simply do not support the assertion that "most stocking efforts have been from within the DPS." In fact, during the period 1872 to 1969, 87.3% of fish stocked into the proposed DPS rivers came from outside the DPS. From 1970 to 1992, 97.3% of the fish stocked into the proposed DPS rivers came from outside the DPS. See Attachment 3, at Appendix C, §II. The following tables, which are based upon data from the 1999 Status Review and ASRCS Reports, substantiates these facts.

Stocking For The Period 1872 – 1969*

River	Total	Home	% Home	DPS	% DPS	Non-DPS	% Non-DPS
Dennys	1,732,000	3,200	0.2%	85,870	5.0%	1,642,930	94.9%
Ducktrap	N/A						
E. Machias	61,900	0	0.0%	7,000	11.3%	54,900	88.7%
Machias	1,286,900	206,895	16.1%	217,395	16.9%	862,610	67.0%
N'gaugas	2,249,000	135,590	6.0%	105,205	4.7%	2,008,205	89.3%
Pleasant	542,800	0	0.0%	14,600	2.7%	528,200	97.3%
Sheepscot	407,900	0	0.0%	19,800	4.9%	388,100	95.1%
Total	6,280,500	345,685	5.5%	449,870	7.2%	5,484,945	**87.3%**

Stocking For The Period 1970 - 1992 *

River	Total	Home	% Home	DPS	% DPS	Non-DPS	% Non-DPS
Dennys	314,500	0	0.0%	0	0.0%	314,500	100.0%
Ducktrap	82,700	0	0.0%	0	0.0%	82,700	100.0%
E. Machias	315,600	0	0.0%	0	0.0%	315,600	100.0%
Machias	615,500	15,770	2.6%	14,240	2.3%	585,490	95.1%
N'gaugas	307,600	9,895	3.2%	20,500	6.7%	277,205	90.1%
Pleasant	264,500	0	0.0%	0	0.0%	264,500	100.0%
Sheepscot	348,800	0	0.0%	1,020	0.3%	347,780	99.7%
Total	2,249,200	0	0.0%	35,760	1.6%	2,187,775	**97.3%**

* These tables were derived from data in Tables 4.2.2 (pages 26-29) and 4.3.2 (pages 31-33) of the Review of the Status of Anadromous Atlantic Salmon (salmo salar) Under the US Endangered Species Act. July 1999. Stock origin of salmon was verified by cross referencing the aforementioned tables with Appendix 6 from Maine Atlantic Salmon, A National Treasure. E. Baum, 1997.

The BRT attempts to minimize the significance of post-1970 stocking efforts by noting that most of this stocking was "from U.S. origin fish (Penobscot River and Gulf of Maine DPS) and all stocking within the Gulf of Maine DPS since 1991 has been river-specific in origin." 1999 Status Review, 55. As is demonstrated above, the vast majority (97.3%) of the stocking sources were <u>outside</u> the DPS. The Penobscot River is expressly excluded from the DPS, and was itself liberally stocked from Canadian rivers over the years. Stocking dropped off substantially after 1991, with a hiatus occurring on the seven downeast rivers for one to four years. When stocking resumed, it was fry only at levels which would not significantly contribute to adult returns according to the Services' own assumptions (50,000 fry would yield one returning adult). Moreover, the broodstock of these fry were, of course, descendants of previous stocking efforts.

There has been massive stocking of salmon into the rivers of Maine from Canadian rivers. From 1920 to 1945 and again from 1949 to 1968, large numbers of salmon eggs were imported from the Miramichi River in New Brunswick and the Gaspe hatcheries in Quebec. During the period 1920 to 1945, 2,436,425 fry and 95,000 parr of Canadian origin were stocked in the Maine rivers identified in the above tables; from 1949 to 1968, 29,280 fry, 1,454,515 parr, and 456,575 smolts of Canadian origin were stocked in these Maine rivers. Baum, 1997. To put the matter in perspective, smolt stocking alone of Canadian origin in the period 1949 to 1968 constituted 6.7 times the average annual smolt production (67,356) in these rivers. See Attachment 3.

The BRT deals with a century of massive stocking by simply dismissing the whole thing as a failure. A lack of stocking success prior to 1970 is cited as evidence that Atlantic salmon in the eight rivers qualify as a discrete or "markedly separate" population. Early stocking efforts (1871-1970) failed, it is claimed, and even if a few of the stocked fish came back they did not cause a breakdown of isolation. "Poor hatchery return rates coupled with remnant natural stocks led the BRT to conclude that while some negative effects upon the genetic integrity of these stocks are possible, introgression could not have supplemented native genotypes within the Gulf of Maine DPS." 1999 Status Review, at 33. As for stocking from 1970 to the present, that too is dismissed because 84 percent of the returns were from wild or hatchery fry.

The Services simply have offered no data or evidence to support the determination that this extensive use of non-indigenous stock was "unsuccessful" or had no impact upon genetic integrity. Their current understanding of the genetic composition of the proposed DPS stocks is based on studies so fundamentally flawed that they must be laid aside. Similarly, the so-called documented persistence of native stocks is a conclusory supposition based on the quantum leap that, because salmon may have had a more or less continuous presence in the proposed DPS rivers, they currently constitute components of an important genetic legacy. That is precisely what the August 1997 and March 1999 studies of King et al. do not demonstrate, nor were they intended to demonstrate.

The Services are well aware that other salmon restoration efforts have met with success. The Penobscot River stands as primary testament to this fact. In addition, the restoration program that uses Penobscot fish has been underway in the Merrimack River, and consistent increases in the number of returning Atlantic salmon have been documented.

The establishment of a salmon run on the Union River in Maine also serves as an example. An impassable dam has blocked fish passage on that river since 1908, therefore none of the salmon entering that river during the past thirty years could have been native. Moreover, FWS and the Maine Atlantic Salmon Commission have annually stocked the Union River with Penobscot River broodstock and those efforts have produced a healthy number of returning salmon. The experience on these rivers cannot be distinguished from the results that would have been expected on the proposed DPS rivers.

Moreover, the Services do not give due consideration to the fact that these early stocking efforts occurred during a time when native stocks had sharply declined, if not disappeared, because of heavy river pollution and obstruction. During most of this time, there was an extensive network of dams and obstructions on these rivers that substantially, if not completely, restrict access to historical spawning ground See generally Attachment 3.

4. The Services' DPS Determination Is Inconsistent With Administrative Precedents Involving Pacific Salmon.

The Services delineation of the proposed Gulf of Maine DPS in the proposed rule is not only unsupported by scientific data, it is contrary to administrative decisions that NMFS itself has made in closely similar circumstances with respect to West Coast salmon. Previous applications with respect to identifying distinct population segments of Pacific salmon have held that where data is uncertain or inconclusive concerning reproductive isolation or other significant biological information, a DPS determination is not warranted. NMFS has consistently acknowledged the high degree of certainty required to make a DPS determination in these circumstances.

For example, in Lower Columbia River Coho Salmon, 56 Fed. Reg. 29553 (1991), NMFS determined that coho salmon in the Lower Columbia River (LCR) did not constitute a DPS. NMFS found that "available information is not conclusive as to whether LCR coho salmon are reproductively isolated from coastal populations in Washington and Oregon." 56 Fed. Reg. 29533 (June 27, 1991). Further, NMFS found that the evidence on habitat utilization, life history characteristics, phenotypic and genetic traits was "inconclusive" and "did not demonstrate that LCR coho salmon are 'distinct' from other wild coho salmon populations." 56 Fed. Reg. at 29553. Thus, NMFS determined based upon the data available that the Lower Columbia River coho salmon did not constitute an important component in the evolutionary legacy of the species.

In support of its decision against designating Lower Columbia River coho salmon as a DPS, NMFS gave great weight to evidence that the Lower Columbia River had been stocked with non-indigenous salmon at a time of depressed wild populations beginning in the 1890's and that extensive transfers of hatchery fish into the river began in the early 1960's and continued up to the time of the decision. The extent and magnitude of such activity led NMFS to infer "likely substantial introgression," leaving NMFS no basis to designate Lower Columbia River coho salmon as a DPS. 56 Fed. Reg. at 29553. In sum, NMFS properly declined to designate a DPS where the genetic evidence was inconclusive and where stocking from outside the DPS supported the obvious conclusion that introgression of the indigenous population had occurred.

In Scott and Waddell Creeks, California Coho, 59 Fed. Reg. 21744 (1994), NMFS determined under the 1991 ESU policy that coho salmon in two California creeks did not constitute a DPS. According to NMFS, the "[a]vailable information does not make a strong case for reproductive isolation of Scott and Waddell Creeks salmon." 59 Fed. Reg. 21744 (emphasis added). NMFS found that spawner straying coupled with extensive stocking of rivers within straying range compromised the requisite reproductive isolation. "Even though Scott and Waddell Creeks have not been planted with outside sources of salmon since the early to mid-1970's, the effects of continuous hatchery plants prior to that time may have affected any distinctive phenotypic and life history traits that originally existed in these populations." 59 Fed. Reg. at 21746. (emphasis added). NMFS also noted that the evidence was inconclusive as to whether different peak spawning migration times exhibited by these salmon were the product of reproductive isolation or environmental factors such as increased water temperature and sedimentation: "The modest difference in peak spawn timing cited by the petitioner may reflect (or may be the result of) reproductive isolation, but the best available data is inconclusive regarding the cause of this difference." 59 Fed. Reg. At 21744.

Similarly, NMFS found the evidence of genetic differentiation among salmon to be inconclusive: "Little pattern in the distribution of variant alleles or genetic variation was observed, and only weak association between genetic identity and geographic location were found. The estimated average number of individuals exchanging genes among the California populations of coho salmon studied was greater than 1.0 fish per generation, which is large enough to prevent the tendency for fixation of different alleles in different populations." 59 Fed. Reg. at 21744. NMFS again declined to designate a DPS where the genetic evidence was inconclusive and where stocking from outside the DPS indicated that introgression of the indigenous population had occurred.

B. PHENOTYPIC AND LIFE HISTORY TRAITS RELIED UPON TO ESTABLISH THE DPS ELEMENT OF EVOLUTIONARY SIGNFICANCE ARE MORE LIKELY THE RESULT OF ENVIRONMENTAL INFLUENCES AND HATCHERY BROOD STOCK SELECTION, NOT ABORIGINAL GENETIC HERITAGE.

According to NMFS guidance for delineating distinct population segments in the case of Pacific salmon, the existence of substantial electrophoretic or DNA differences among populations would strongly suggest evolutionarily important, adaptive differences. The absence of such genetic evidence, while not necessarily decisive, "would place a greater burden of proof on data for other characters." NMFS Species Memo, 5. Because the population genetics study of King et al. (1999) demonstrates that genetic differences between U.S. and Canadian sampled "were small," the burden shifted to the BRT to make the case for significant genetic differences on the basis of "other characters," viz., life history traits. It is apparent that the BRT felt compelled to push the envelope very hard indeed to meet the "greater burden" stipulated by Waples in the NMFS Species Memo.

The Services conclude that Maine salmon are distinct from Canadian salmon in having significantly different life history attributes such as run timing, smolt age, and age at return from sea. The Services correctly characterize Maine salmon as predominantly age two smolts, early run adult returns, and 2-sea winter returns. Many Canadian stocks are predominantly composed of age 3 and 4 smolts, late run adults, and 1-sea winter adult returns. However, almost all Canadian stocks have some component of the run that is identical to Maine fish in their life history attributes.

The Services conclude that these characteristics are distinctive, and represent heritable local adaptations that make populations in the eight Maine rivers unique and evolutionarily significant. This conclusion is simply not supported by sound science.

First, the studies cited by the BRT do not support the claim that phenotypic or life history traits have a measurable genetic basis, or that observed differences between populations in different environments are the result of underlying genetic differences. In the studies cited -- Glebe and Saunders, 1986; Hutchings and Jones, 1998; Ritter et al., 1986; and Saunders, 1986, formal inheritance experiments were not conducted and variance components were not estimated.

Glebe and Saunder (1986) say that age of maturity in offspring is correlated with age of maturity of parents. No genetic parameters were estimated and the heritability of age at maturity was not determined. Ritter et al. (1986) say that differences were observed in sea age at first maturity among a number of salmon runs, but no genetic parameters were estimated. The review paper by Hutchings and Jones (1998) examined how spatial and temporal patterns in life history characteristics affect growth rate thresholds for sea-age maturity. The study does not make any inferences about genetic distinctiveness between populations, heritabilities of traits, or genetic correlations between traits. These studies, therefore, cannot be used to claim that the traits in question are the result of underlying genetic differences.

Second, one simply cannot, as the Services have done, take observed differences of traits between populations that are reared in different environments to mean that the two populations differ genetically. While many quantitative traits have measurable genetic variance components, such variation may be small relative to influences of the environment. Thus, observed trait values are confounded by the differing environments in which the genes influenced by those traits are being expressed. For example, weight in most organisms, including humans, has a measurable genetic variance component, but it is clear that the abundance and quality of food (environmental effects) can contribute much of the observed variation among different phenotypes, or traits.

In Atlantic salmon, both observational and experimental evidence indicate that life history attributes of adaptive significance that purportedly differentiate Maine fish from those of other areas are environmental, rather than genetic in origin. Early field studies provide compelling evidence of environmental effects:

> It is difficult to separate the effects of inherited habits from the influence of new and different surroundings on the growth or behavior of salmon. In at least two cases of which we have record the effects of planting fry in a strange river has produced habits of a decidedly different character from those of the parent fish.
>
> One of these cases occurs in the Penobscot, which is stocked with fry from Miramichi salmon. In their native river (Blair 1934) the Miramichi Smolts migrate as follows:
>
> | | |
> |---|---|
> | As two-year fish | 15.1 percent |
> | As three-year fish | 78.1 percent |
> | As four-year fish | 6.6 percent |
> | As five-year fish | 0.2 percent |
>
> Transported in the Penobscot they change their habits and migrate as follows:
>
> | | |
> |---|---|
> | As two-year fish | 89.0 percent |
> | As three-year fish | 11.0 percent |
>
> In this case the Penobscot River environment apparently overcomes the inherited instincts of the fish and sends them to sea a year earlier than the parent stocks of the Miramichi.
>
> In one other case Dr. Huntsman writes:
>
> We have had a precise experiment in testing out inheritance of behavior. Restigouche fry, whose parents run early and chiefly as 3.2 and 3.3 fish, were planted in Apple River at the head of the Bay of Fundy and marked when smolts. They ran only in September and October and nearly all as 2.1 fish, that is grilse, just as the local salmon.
>
> Here again is an example of the river overcoming the inherited instincts of the fish. In the Miramichi, approximately sixty percent of the fish that come back to the river are grilse. The progeny of Miramichi fish, transplanted in the Penobscot, produce few or no grilse.

(Dow, 1938, p. 14)

Experimental studies have demonstrated that environmental effects are much greater than genetic effects on quantitative life history characteristics. For example, environmental effects explain over 90 percent of the variation in the rate of salmon returns (Jonasson et al., 1997), and Saunders et al. (1983) found that the grilsing ratio is highly influenced by water temperature: the colder the water, the fewer grilse. The Services fail to address the conclusions of these studies with respect to Maine Atlantic salmon.

There is evidence that the predominance of age 2 smolts in rivers is heavily reliant on environmental conditions. A river with a good food supply and long growing season generally produces 1 or 2 year old smolts while nutrient poor rivers in more northerly areas generally produce age 3, 4 or older smolts. Attachment 3 at Appendix C, §IV.

Available scientific data make clear that individual rivers in New England and the Maritimes exhibit substantial variation in the characteristics of returning adults. In particular, grilsing rates are highly variable over time for any specific location. For example, during the period 1981 to 1998, grilsing rates of wild salmon in the St. Croix ranged from 17.1 TO 80%, but were under 25% for four of 18 years. In the Penobscot during the same period, grilsing rate ranged from 3.3 TO 39.2% but was over 25% for three of 18 years. See 1999 Annual Report of the U.S. Atlantic Salmon Assessment Committee, Table 3.2b. Similarly, Saunder et al.(1983) noted that grilsing ratios varied by an order of magnitude within stocks.

The same extent of variation exists for age at smoltification within rivers. For Cove Brook, for example, Meister (1958, p. 117) noted:

> Fluctuations in water temperature, competition, and abundance of age classes may influence the age of smolts for any stream and tend to disprove that age of smolt is typical for each stream. The smolt migrants of 1956 were predominately 1+ as compared with the 2+ age class composition of the 1957 runs.

Third, current life history characteristics found in Maine Atlantic salmon were very likely to have been affected by artificial hatchery selection processes. It has been the common practice of Atlantic salmon biologists and hatchery managers for many years to select out early run and large (2-sea winter) salmon for broodstock since the objective of the program was to produce a run that would be attractive to recreational anglers. Beland et al.(1997) reported "Sea run adults taken from the multi-sea winter salmon were collected as brood fish in addition to the traditional early summer broodstock collection." Early run fish would support an extended angling season, since the fish do not spawn until fall and large fish were highly sought after by recreational salmon anglers. The brood stock selection program thus selected out that portion of any adult returns that met the desired criteria. Hatchery selection thus probably played a role in the current life history attributes of Maine Atlantic salmon, yet this factor is not addressed by the Services.

C. THE SERVICES FAIL TO ADDRESS THE OBVIOUS IMPLICATIONS OF THE KING STUDY: THE DATA INDICATE EXTENSIVE GENETIC DRIFT AND THEREFORE A NEED TO RE-EVALUATE THE CURRENT DESIGN OF THE HATCHERY STOCKING PROGRAM.

One of the most remarkable aspects of the Study of King et al. (1999) and the 1999 Status Review is their failure to confront the issue of genetic drift. Rather than demonstrating discreteness and reproductive isolation, Drs. Kornfield and Gold conclude that King et al. (1999) suggests extensive gene flow among Canadian and U.S. rivers, particularly given the small effective population size of the stock in the eight Maine rivers in question and given the signals of severe genetic drift in the populations.

These observations were first brought to the attention of the USGS/BRD over four years ago by ad hoc reviewers of the 1995 draft Status Review.

> It would be appropriate to provide a brief discussion of the possible effects of genetic bottle necking as a result of the continual low numbers of spawners in most rivers. Ad Hoc Reviews of 1995 Draft Status Review: Reviewer A, pg. 002475.
>
> <u>It is a quantum leap to conclude</u> that because salmon have had a "continuous presence" in the seven Downeast Rivers <u>they currently represent an ESU of "wild" salmon with important local adaptations.</u> This is an extremely conservative assumption considering

> the historical genetic "bottlenecking" that likely occurred, and is currently occurring. Ad Hoc Reviews of 1995 Draft Status Review: Reviewer B, pg. 002517 (emphasis added).
>
> The flaw is that the "wild" remnant stocks probably have no relationship to native stocks, but are the end product of bottlenecking and the influence of stocking. Ad Hoc Reviews of 1995 Draft Status Review: Reviewer B, pg. 002524 (emphasis added).

Indeed, genetic drift provides a unified, compelling explanation of the data reviewed in their studies gathered by King et al. (1999) and is strong evidence that the "discreteness" and "significance" findings of the Services are illusory.

In his review, Dr. Kornfield points out that, owing to the inadequate sampling in King et al. 1999 of loci that are highly variable, it is difficult to separate the effects of genetic drift, and non-random sampling in the study makes absolute interpretation problematic. Nevertheless, an examination of microsatellite markers that have low allelic diversity may be instructive, according to Dr. Kornfield, because "they may not be as susceptible to the influences of population sampling effects." Attachment 1, page 17.

> Thus, for example, the differences observed in the Cove Brook 1995-1996 comparison for SSOSL438 (with 4 alleles) is significant as are the Bond 1994-1995 comparisons for Ssa14 (with 3 alleles) and SSLEEN82 (with 7 alleles) (Final Genetics Report, Appendix C2). Such observations are consistent with the presence of genetic drift. . . .
>
> Most important is the recognition that genetic drift affects quantitative traits as well as the genetic markers used to characterize populations. Because of this, there can be rapid, random changes in life history attributes considered important to local adaptation, to the extent that the variation in these traits is genetically based. Such drift induced stochastic phenomena could include changes in precisely those characteristics that may be critical to adaptation and population recovery. The effect of drift on life history characteristics can thus counteract the effects of multiple generations of adaptive selection, in essence erasing local adaptations and causing shifts in life history traits that may be detrimental to the long-term viability of the population. Coupled with the propensity for inbreeding
>
> and the cumulative impact of inbreeding depression on life history traits, the maintenance of a large number of broodstock is critical. Thus, it is critical that the restoration program itself be re-evaluated.

Kornfield 1, page 18. (emphasis added.)

The findings of Dr. Gold are similar. According to his Review/Critique, the inference from observed (and significant) variation in allele frequencies found among yearly samples at the same location is that extreme genetic drift may be operating in Maine waters.

> Taken together [the fluctuations in allele frequencies in King et. al (1999)] argue strongly that Atlantic salmon within Maine rivers are unstable genetically, in the sense that large-scale fluctuations in allele frequencies (likely due to genetic drift) even at the same sampling locality appear the norm rather than the exception. Surprisingly, even after having demonstrated significant heterogeneity within river systems and among temporal samples at the same site or locality, the authors assert (page 30 in Discussion) that the populations . . . are temporally stable, and even more surprisingly, pooled the spatial and temporal samples from Maine rivers for some of the tests of allele frequency homogeneity (middle of page 20). As the spatial and temporal samples from Maine rivers differed significantly in allele frequencies, such pooling is analogous to pooling apples and oranges to test whether the pooled samples are grapefruits (i.e., is highly inappropriate statistically).

Attachment 2, page 9. Dr. Gold concludes that, because of the small effective population sizes in Maine rivers, genetic differences (in allele frequencies at microsatellites) reported in King et al. (1999) may be important biologically only in "demonstrating the existence of genetic drift, not the existence of either historical subpopulations (stocks) or that genetically divergent samples represent a reservoir of adaptively important alleles at genes impacting significant life-history traits." Gold Attachment, page 14. In fact, concludes Dr. Gold, exactly the opposite may be true:

> Under conditions of extreme genetic drift, adaptively beneficial alleles also may fluctuate in frequency and be lost from a population. Moreover, under certain circumstances, such adaptively beneficial alleles may be replaced with selectively disadvantageous alleles (Lynch et al. 1995). <u>What this means is that theoretically the genetically divergent samples of Atlantic salmon (as measured by allele-frequency differences at selectively neutral microsatellites) in Maine rivers could actually signal the presence of accumulated, selectively disadvantageous alleles rather than the presence of historical, adaptively beneficial alleles. It is for that reason that river-specific (and perhaps even region-specific) restoration may prove counter-productive.</u>

Attachment 2, page 14. (Emphasis added.)

The likelihood of genetic drift and inbreeding depression are of clear significance, not only because they undermine the Services' conclusion with respect to the "discreteness" and "evolutionary significance" of the proposed DPS, but also because the concerns raised by Drs. Kornfield and Gold call into question the river-specific stocking program which the Services consider to be "an essential component of the strategy to rebuild stocks." 64 Fed. Reg. 62637. The Services state that this program "has been designed and implemented to maintain the genetic diversity and distinctiveness of the DPS," and because stocks are low, it is considered "an important tool" that would "greatly increase the effective population size" of the stocks.

However, if the 1995 Ad Hoc reviewers, and Dr. Kornfield and Dr. Gold are correct about the implications of the USGS/BRD studies, this program may only serve to undermine the genetic adaptability and reliability of these stocks. For that reason, the State of Maine believes that the entire hatchery stocking program must now be critically re-evaluated.

D. THE SERVICES' ALTERNATIVE JUSTIFICATION FOR THE PROPOSED DPS, THE EXISTENCE OF THE INTERNATIONAL BOUNDARY, IS NOT SUPPORTED BY FACT OR BIOLOGICAL CONSIDERATIONS AND IS CONTRARY TO THE EXPECTATIONS OF CONGRESS AND THE SERVICES' JOINT POLICY.

As a final resort, the Services invoke the international boundary between the United States and Canada to delineate the proposed DPS. The proposed rule dedicates two dated, conclusory sentences to the boundary justification for a DPS. 64 Fed. Reg. at 62630. The 1999 Status Review dedicates four sentences, also dated and also conclusory:

> There are substantial differences in the control of exploitation, management of habitat, conservation status, and regulatory mechanisms of Atlantic salmon between the U.S. and Canada (May 1993; Baum 1997). Management and conservation programs in the United States have similar goals, but differences in legislation and policy support the use of the United States/Canada international boundary as a measure of discreteness for the purposes of evaluating stock status (NASCO 1999). Highlighting these differences is the lack of aboriginal or commercial fisheries for Atlantic salmon in the marine waters of the U.S. (Baum 1997; USASAC 1999). Additional factors that are significant relative to section 4(a)(1)(D) [inadequacy of existing regulatory mechanisms] are differences in

> regulatory mechanisms between the federal and state system that exists in the U.S. and the federal and Provincial governments in Canada.

1999 Status Review, at 52.

Use of an international boundary to make a biological determination of a DPS is contrary to the underlying policy and intent of the ESA – particularly in the circumstances here. The National Research Council has pointed out that while international boundaries can be appropriate to delineate population segments for management, they often do not delineate EUs (evolutionary units), especially when the political boundaries do not coincide with major natural geographic boundaries. "Although there can be good policy reasons for such delineations, there are not sound scientific reasons to delineate species only in accordance with political boundaries." Science and the Endangered Species Act, 58 (National Academy Press, Washington 1995).

Recognizing that the use of an international boundary to determine whether a population is discrete is both artificial and unscientific, the Joint Policy restricts such use to instances where boundaries "coincide with differences in the management, status, or exploitation of a species." 61 Fed. Reg. at 4723. Here, that is not the case.

Appended to these Comments as Attachment 4 is a study entitled "Canadian Legislation, Regulations, Agreements and Policies and International Conventions Concerning the Control of Interactions Between Feral and Wild Atlantic Salmon," by John K. Bailey, Ph.D.
Dr. Bailey is a Canadian citizen who has been involved professionally in Atlantic salmon conservation and management for a number of years. He is familiar with regulations and policies relating to Atlantic salmon at the federal and provincial level. As Dr. Bailey's analysis confirms, in recent years differences in the control of exploitation, management of habitat, and regulatory mechanisms between the United States and Canada have been practically eliminated.

Management and conservation programs in the two countries have similar goals, legislation and policies.

Indeed, as the 1999 Status Review recognizes, "For the last 20 years, conservation measures to protect Atlantic salmon in the Canadian fishery have become more stringent, limiting seasons, restricting gear, and eliminating entire fisheries to reduce marine exploitation (Chadwick 1993; May 1993)." 1999 Status Review at 124 (emphasis added). In fact, Canadian federal and provincial laws relating to controlling and minimizing negative effects on salmon stocks, particularly laws specific to effects of aquaculture on wild salmon stocks, are closely analogous to those in the United States. Attachment 4.

Canada, like the United States, relies on common international agreements to provide a mechanism for protecting the country's aquatic resources from adverse effects occurring beyond its jurisdiction. And, on February 5, 1999, the Canadian Department of Fisheries and Oceans announced adoption of the precautionary approach, a stringent conservation policy, citing as evidence of implementation a continued closure of the commercial Atlantic salmon fishery for both Newfoundland and Labrador for an additional three years. Further, new restrictions have been established on Canadian recreational fisheries including the requirement to use only barbless hooks for angling in Newfoundland and Labrador, and coordination with watershed management groups.

Finally, appended as Attachment 5 a table indicating the range of Canadian laws and authorities that comprise its existing regulatory mechanism in Canada. The table essentially tracks Table 7.4.1 on page 166 of the 1999 Status Review where the Services published list of federal laws in the United States potentially applicable to Atlantic salmon. The similarities in policy and regulation between Canada and the United States are far more striking than differences.

It is amply clear that Canadian law and regulation is far more extensive than the Services have represented. On this basis alone, invocation of the international boundary is not justifiable from a practical or policy point of view.

V. THE SERVICES HAVE NOT DEMONSTRATED A SIGNIFICANT CHANGE IN CIRCUMSTANCES TO JUSTIFY REVERSAL OF THEIR 1997 DETERMINATION THAT A THREATENED LISTING WAS NOT WARRANTED.

A. STANDARD FOR LISTING.

The Services may not arbitrarily list a species as threatened or endangered nor may they arbitrarily abandon previous determinations. On December 18, 1997, the Services determined that Atlantic salmon in the seven Maine rivers were not likely to become endangered in the foreseeable future. The Services made that determination after full review and consideration of the status of, and the threats facing, the species at that time. This determination was made "solely on the basis of the best scientific and commercial data available and after taking into account those efforts being made by any state or foreign nation to protect the species." 62 Fed. Reg. at 66337. According to the Services, ongoing conservation actions, including those being carried out pursuant to the Maine Atlantic Salmon Conservation Plan, had "substantially reduced threats to the species" and "will facilitate the continued rehabilitation of the seven rivers DPS." Id.

To justify their about-face after 23 months, the Services point to seven reasons why the threat to the Gulf of Maine DPS has increased. None of these reasons bear up upon scrutiny. The Services offer no evidence, data or science to support their determination. Rather, the statements are conclusory and speculative. There are instances where contradictory data or science is not addressed. A determination to list made on the current record would not comport with applicable legal or scientific standards.

On the other hand, evidence and data advanced in these comments demonstrates that there has not been a significant adverse change in either the status of Atlantic salmon in Maine or the threats they face since December of 1997.

B. FACTORS IDENTIFIED AS A BASIS FOR ENDANGERED LISTING ARE NOT SUPPORTED BY SCIENCE OR DATA.

1. Adult Returns: The Services Consider Data Unreliable; Low Returns Were Anticipated During This Time Period.

The first stated reason for determining that Atlantic salmon in Maine rivers is in danger of extinction is that "documented adult returns have remained low despite projections of increased marine survival." 64 Fed. Reg. at 62627.

The Services acknowledge, however, that counts of adult returns are incomplete and unreliable, and do not provide a sound basis for concluding in the short term that adult populations have substantially declined since 1997. Total returns only reflect counts "for rivers with trapping facilities and only for times that those facilities are operational and therefore do not represent a complete count of returns to the DPS." 64 Fed. Reg. 62631. Moreover, no direct enumeration of returning adults was conducted on five rivers (East Machias, Machias, Pleasant, Ducktrap, and Sheepscot) in 1998; on four rivers in 1997 (East Machias, Machias, Pleasant and Ducktrap; and on four rivers in 1996 (East Machias, Machias, Pleasant, and Ducktrap).

Later, in a different forum, the Services unequivocally acknowledge that adult counts <u>do not provide a sound basis</u> for concluding in the short term that adult populations have substantially declined since 1996 or 1997.

Under penalty of perjury in a pending federal lawsuit,[6] FWS and have declared that documented adult returns referenced in the Proposed Rule are not reliable measures of species abundance. Joint Declaration of Jamie Rappaport Clark, Director, U.S. Fish and Wildlife Service, and Andrew A. Rosenberg, Deputy Assistant Administrator, National Marine Fisheries Service (dated October 15, 1999) (Clark/Rosenburg Declaration No. 1). According to this declaration:

- The Service's data on adult returns "are not accurate enough to make specific year/river comparisons at this time." Id. At ¶ 44(A) (emphasis added).

- "Adult counts do not provide a sound basis for concluding, in the short term, that the adult populations have substantially declined since 1996 or 1997." Id. At ¶ 44(B) (emphasis added).

- "The number of adult returns do not provide a full and complete evaluation of the state of the DPS population because they ignore the other life stages simultaneously present in the wild (fry, parr, smolts, and post-smolts at sea)." Id. at ¶ 44(D) (emphasis added).

- "[T]he current adult return data cannot be interpreted to support the conclusion that the wild adult salmon returns to DPS rivers, and the juvenile populations they produce, have suddenly and precipitously declined since 1997. Further, while adult returns are currently at low levels, the available data indicate that there is sufficient breeding populations in the wild and hatchery stocks to sustain the genetic viability of the DPS." Id. at ¶ 45 (emphasis added).

The decline in adult returns from the earlier part of the decade was both predictable and was in fact predicted. In 1992, a fundamental shift in hatchery and stocking practices was

[6] Defenders of Wildlife, et al. v. Bruce Babbitt, et. Al., Case No. CV002206-CKK (Atlantic Salmon I) and Trout Unlimited, et al. v. Bruce Babbitt, et. Al., Case No. CV02143-CC (Atlantic Salmon II), United States District Court for the District of Columbia (Consolidated).

promoted by FWS and the Technical Advisory Committee of the Maine Atlantic Salmon Authority. In that year, a decision was made to abandon the historic practice of smolt stocking and adopt wholesale a new policy of stocking with fry only. The effect of that policy change was predictable on adult returns. Indeed, at a February 1992 Atlantic Salmon Commission meeting, that impact was made clear:

> Mr. Baum stated that he wanted to make it perfectly clear that the fry recommendations were to utilize the available habitat that fry would use. I suspect they will contribute little to adult run. I suspect that we will have very poor runs in the downeast rivers for the next several years. Our goal is to produce river-specific stock which will produce better returns in the future. I think this is a long-term process. It will take many years to turn around what has gone on in the past. I want everyone to realize that the runs will be poor and continue to be poor until we develop the stocks we need to develop the proper runs." Atlantic Salmon Commission Meeting Minutes (February 27, 1992). (emphasis added)

As a result, of the 1992 change in stocking policy all stocking in these rivers was suspended for various periods in the early 1990s. The combination of the stocking hiatus and the switch to fry stocking during the period from 1992 to 1995 meant that low adult returns were a virtual certainty for a three or four year period commencing in 1996 or 1997, particularly given the numbers of fry stocked in the early years of the new program. See USASAC Report (March 1999) at Table 3.2.1. The BRT does not address or discuss this issue. FWS would have been fully aware of this anticipated impact, both at the time the proposed the new policy was instituted and at the time threatened listing was withdrawn at 1997.

Finally, low marine survival is also a major contributing factor to the reduction in adult returns, a fact acknowledged by the Services. 62 Fed. Reg. 66332.

2. Lower Juvenile / Presmolt Survival: Data Does Not Support Services' Assumptions.

The second factor identified by the Services as a basis for concern is that presmolt survival in the freshwater environment has been found to be lower than previously estimated. 64

Fed. Reg. At 62627. This "issue of concern" is based exclusively on preliminary results of a study on the Narraguagus River monitoring smolt outmigration. The Services suggest that over-winter freshwater survival from parr to smolt was less than 30 percent, the minimum estimate cited in previous studies, and thus conclude that "freshwater production is below rates for full freshwater production," and substantially lower survival rates "could be negatively impacting population recovery." 64 Fed. Reg. at 62632.

The Services first acknowledge that "it is unknown whether these over-winter survival rates are typical for the Narraguagus River on a long-term basis or if they are comparable to other rivers in the Gulf of Maine DPS." 64 Fed.Reg. at 62632. Not knowing whether the over-winter survival rates are typical for the Narraguagus River (or other rivers) undermines reliance on this factor to demonstrate a decline in Atlantic salmon abundance since December 1997. In fact, however, data is available, and it contradicts the Services' conclusions.

Estimates of the parr population for three successive years in the Narraguagus Study are based on electrofishing studies. During this time, parr have been removed from the Narraguagus River for the hatchery program. However, the parr population estimates do not reflect these removals. In 1989, 1990 and 1991, similar annual electrofishing surveys were conducted on the Narraguagus (Beland and Friedland, 1997). Parr population estimates were calculated for each year. The values were 16,088; 14,863; and 22,901 parr. Parr estimates for 1997 (27,000) and 1998 (25,362) were significantly higher than those reported in the 1989-1991 period. The Status Review itself notes that in 1997 the parr population in the Narraguagus River was the highest estimate with the years 1997 and 1998 showing substantial increases of parr in the river over all previous years during the decade of the 1990s.

For smolts as well the estimates from 1997 through 1999 have increased: 2871 (1997); 2925 (1998); and 3607 (1999). In terms of a percentage of survival, smolt numbers are up significantly this past year. In 1998, the survival percentage was 11.6 percent. In 1999, it was 17.1 percent. In addition, the parr to smolt survival estimate does not correct for the portion of a parr cohort that survives the winter but does not smoltify the following spring. Once this is determined, the parr to smolt estimates will be higher than expressed above.

The estimated smolt production numbers are consistent with earlier studies done on the Narraguagus River, and in fact, exceed those numbers. The ASRSC conducted a study of smolt production in the 1960s. From 1961 to 1965, smolts were trapped at the inlet to the Beddington Lake and marked for identification when recaptured at the Beddington Outlet Weir. It was noted at that time that "survival of the smolts seldom exceeded 30 percent." (Baum and Jordan, 1982)

From 1960 to 1969, the average smolt catch at the Beddington Weir was 1284, ranging from a low of 231 in 1969 to a high of 4139 in 1963. The 1963 estimate is an anomaly, with the second highest result occurring in 1960 at 1839. A complete table is set forth below:

Table 2. Beddington Weir Downstream Migrant Smolt Catch, 1960-1969

	NO. SMOLTS AT DOWNTRAP				
	Wild		Hatchery		
Year	**No.**	**(%)**	**No.**	**(%)**	**Total**
1960	1,721	(93.5)	118	(6.5)	1,839
1961	733	(62.9)	347	(32.1)	1080
1962	789	(93.7)	53	(6.3)	842
1963	1166	(28.2)	2,973	(71.8)	4,139
1964	953	(70.9)	391	(29.1)	1,344
1965	426	(32.5)	883	(67.5)	1,309
1966	134	(18.3)	597	(81.7)	731
1967	271	(39.4)	417	(60.6)	688
1968	245	(38.5)	392	(61.5)	637
1969	211	(91.3)	20	(8.6)	231
TOTAL	6,649	(51.8)	6,191	(48.2)	12,84
AVE:	665	(51.8)	619	(48.2)	1,284

Recognizing that the Beddington Weir is approximately half way up the watershed, even if one were to double the number shown in the foregoing table, the estimated 1999 smolt production of 3607 is still equal to or greater than all years during 1960 with the exception of 1963. This suggests that the current estimated smolt production is not significantly far off what is historically documented in the Narraguagus River. It should also be noted that adult returns during the decade of 1960s were significantly higher than those of the current year.

Based on Table 6.2 (1999 Status Review at 63) the Services estimated smolt production potential for the Narraguagus River as 3 smolts per unit for a total smolt production potential of 18,042 smolts, based on 6014 smolt production units. Baum and Jordan, 1982, reported "Known smolt production above Beddington Lake, measured as the number of wild smolts reaching Beddington weir, averaged 0. 5 smolts per unit of nursery area (unpublished data prepared by R.E. Cutting, March, 1967)" Id. This estimate was made for the period 1960-69. The total smolt production was estimated to be one smolt per unit of habitat, based on a projection of 50% predation mortality caused by chain pickerel as smolts descended through Beddington Lake to the counting weir. Chain pickerel are still abundant in the lakes and deadwater sections of the Narraguagus River and there is no reason to believe the predation rate has diminished since the aforementioned study. If the 0.5 smolt per unit survival rate is applied to the entire Narraguagus river smolt production habitat of 6014 units, the average annual wild smolt population leaving the river is 3007 smolts after accounting for predation. This number is very close to the smolt estimates for 1997 through 1999 (2,871; 2,925; and 3,607 respectively). If the actual smolt production estimates are doubled to pre-predation levels, the overwinter survival estimates from parr to smolt from 1996-1998 are 54%, 23.2%, and 34.2% respectively. These survival rates are well within the range of studies cited by Whalen (1998).

Accordingly, while data from the current Narrguagus River study will be beneficial to population modeling and perfecting of stocking rates, the data to date simply do not support the Services' hypothesis that inadequate river conditions or poor juvenile survival in the Narraguagus watershed explain the reason for diminished marine survival of salmon throughout Maine rivers. The attempt of the Services to construct from the Narraguagus River study an inland habitat threat is not supported by the data.

3. Fish Diseases: The Cited Disease Threats Are Exaggerated, Not New and Are Addressed by New State Regulation.

The third and fourth reasons offered by the Services for their determination that the Atlantic salmon DPS has declined since 1997 are the appearance in 1996 of the ISA virus and the discovery in 1998 of the retrovirus SSSv within the DPS (in a federal hatchery). 64 Fed. Reg., 62633. The Services also cite the potential adverse impact of coldwater disease (CWD). The 1999 Status Review also suggests that the presence of commercial aquaculture in locations proximate to the downeast rivers poses a higher risk of epidemic. The prominence given by the Services to the alleged increase threat posed by diseases is exaggerated, unsupported by scientific study, and ignores new initiatives that the State of Maine has taken to address any potential threats.

a. As a general matter, the threat of disease cannot be realistically evaluated without the scientific collection, examination, and review of epidemiological data.

This self-evident, scientific principle is confirmed by a letter dated March 10, 2000, from the Eastern Aquaculture Veterinary Association (EAVA), an association of veterinarians actively engaged in aquatic animal health management in the United States and Canada. A copy of their letter, which has been filed as written comment with the Services, is appended in Attachment 3. The EAVA expresses "the utmost concern" about many of the statements made by the Services, statements that EAVA believe are erroneous or unjustified on a scientific basis.

"Both documents [the 1999 Status Review and the Notice of Proposed Rule] lack an epidemiological evaluation of the respective disease agents an inadequate assessment of the risk associated with those diseases."

And, according to the EAVA:

"all organisms, from plankton to humans, are exposed to a host of infectious agents existing in the environment. Merely listing the pathogens found in Atlantic salmon without the context of the host-pathogen-environment associated with disease does not constitute a valid assessment of disease risk, but rather a serious misrepresentation of scientific evidence."

b. The Services have either ignored or dismissed the new initiatives undertaken by the State of Maine to address potential disease threats.

Last summer, the Maine Departments of Marine Resources and Inland Fisheries and Wildlife adopted joint fish health rules that are among the strictest in the nation. The Services do not credit or recognize the substantial regulatory oversight now in place in Maine to deal with fish health issues. This progressive, proactive fish health inspection and regulatory program coupled with other State and industry initiatives, including the following, provide a strong basis for monitoring and protecting the health of both cultured and wild salmonids.

- **Salmonid Fish Health Inspection Regulations.**

New regulations for Salmonid Fish Health Inspection were established in the spring of 1999. The new regulations greatly improve the responsiveness and effectiveness of the state in preventing disease and optimizing the health of aquatic resources. To accommodate the development of new, sensitive diagnostic procedures the emergence of new diseases, and the development of improved methods of prevention and disease control, the new health regulations establish a Fish Health Technical Committee (FHTC) to provide recommendations to the Commissioners regarding fish health.

The FHTC is composed of representatives from academia, industry, federal (USFWS & NMFS) and state regulatory agencies. The new regulations have also updated the list of diseases of regulatory concern to include measures for the prevention and control of ISAv. The FHTC was called upon to develop recommendations for managing the retrovirus, SSSv, in federal restoration efforts. Other activities of the FHTC have included providing guidance for industry efforts in disease surveillance, biosecurity and the disposal of salmon processing waste. The FHTC's involvement in state responses to fish health threats coupled with the efforts and diligence of the industry in both surveillance and biosecurity has so far helped to assure that the State of Maine's involvement is free from ISAv.

Because research conducted in Norway has demonstrated that ISAv infected salmon carcasses may be a significant factor in the spread of ISAv, regulations prohibiting the introduction of salmon racks into the coastal waters of Maine were established. The regulation was adopted in 1999 as a preventive measure.

- **Fish Health Inspections.**

  Fish health inspections are required for the introduction of fish into Maine coastal waters. In 1999 over 6,000 fish were examined for pathogens of regulatory control in association with transfer to coastal waters. No ISAv was detected using currently approved diagnostic procedures, nor were other diseases of regulatory concern detected among lots of fish transferred to marine waters of Maine.

- **ISAv Surveillance.**

  Because disease surveillance and early response is essential to disease prevention and control, the Department of Marine Resources (DMR) funded an ISAv surveillance program among net pen sites. Surveillance was conducted at 22 participating sites during the high risk period of late May and early August 1999. Detection methods involved RT-PCR, IFAT, viral culture and histopathology. Results from surveillance indicate that no ISAv was detected. Additional surveillance was also conducted and funded by individual aquaculture companies. No cases of ISAv were reported. Maine rules require testing for ISAv when fish are moved from freshwater to sea cages, and from one site to another. Current rules prohibit the movement of ISAv infected fish into Maine water.

- **Biosecurity.**

Biosecurity is a systematic and proactive effort to prevent the spread of infectious agents from infected to uninfected fish. Biosecurity uses epidemiological information to identify risk factors associated with disease transfer to develop management practices which seek to eliminate or reduce the risk of disease transfer. During 1999, DMR funded a biosecurity audit to assess the adherence and performance of individual companies with respect to biosecurity practice. The biosecurity audit involved in depth questionnaires coupled with site visitations. Results and analysis from the audit were provided to the companies along with recommendations for improved performance. Both marine sites and fish processing plants were involved in the audits.

While the industry has made significant improvements in biosecurity, DMR believes continued vigilance is essential, with particular emphasis on improving disinfection and mortality handling procedures. These issues have prompted the industry fish health committee to establish a waste subcommittee to improve waste disposal practices. The USDA APHIS veterinarian for Maine and the industry subcommittee have worked to identify safe disposal sites and to place disinfection equipment at these sites.

- **ISAv Action Plan.**

During 1999, the Industry Fish Health Committee of the Maine Aquaculture Association developed the ISAv Action Plan. The ISAv Action Plan establishes a proactive management plan for the prevention and control of ISAv. Protocols for biosecurity, disease surveillance, disease reporting, and compliance and action sequences for management of ISAv are clearly defined. The fact that ISAv has not yet been detected in Maine clearly reflects the industry's vigilance and efforts in support of the ISAv Action Plan. The effectiveness of the ISAv Action Plan hinges on disease surveillance, rigorous biosecurity, and swift and effective response to disease outbreaks. Continued support of disease surveillance, and biosecurity are essential to the effectiveness of the action plan.

- **ISAv vaccination.**

Vaccination has been a highly effective tool in salmon health management, and a variety of vaccines are available for the control of such diseases as Vibriosis and Hitra Disease. Because ISAv has not been detected in Maine or the United States, it is classified as an exotic disease. As an exotic disease, the importation of virus, as well as, research and development associated with ISAv is strictly controlled by federal law. The Maine FHTC worked with USDA APHIS Veterinary Services and the USDA Center for Veterinary Biologics to create a mechanism for research on the development of an ISAv vaccine and an application process for the use and field evaluation of an autogenous ISAv vaccine in Maine.

c. Deficiencies in the Services' Analysis of the Disease Threat

1. ISA.

Even though the Services cite the appearance of ISAv in Canada in 1996 as a major threat because of its proximity to the Maine stocks, they acknowledge ISAv has not appeared in Maine: "An extensive survey of Maine aquaculture operations found no ISAv virus present within the United States." 64 Fed. Reg. at 62634. Moreover, this disease is not a new concern. ISAv was first detected in New Brunswick in the fall of 1996 and subsequently confirmed in the early spring of 1997. There was considerable press coverage and the threat should have been well known in December 1997 when the determination was made that a threatened listing was not warranted.

Furthermore, there is no sound scientific basis for concluding it is a greater threat today than it was in 1997. The "threat of disease" can not be realistically evaluated without the examination of epidemiological data and adequate representation of the data. And ISAv has yet to be detected in Maine waters despite active and aggressive screening by the aquaculture industry and the State of Maine for ISAv among fish at hatcheries, net-pen sites and broodstock. Further, there has been no evidence of ISAv among wild salmonids in the limited surveys conducted on wild salmon within the State of Maine. In New Brunswick, where ISAv has been detected and prevalence established among aquaculture fish, ISAv has not been detected in free-ranging wild salmonids despite the screening of over 619 wild salmonids and 331 wild non-salmonids (MacKinnon, Campbell and Olivier 1998). The recent detection of ISAv in wild fish at a facility in the Magauadavic River does not establish that ISAv was transmitted by farm raised to wild salmon. A number of explanations are possible, including unintentional contamination of wild fish from hatchery fish based on the two types of fish being held together.

2. SSSv.

The Services also identify the SSSv retrovirus as a cause for concern. Wild parr taken from the Pleasant River and held in isolation at the North Attleboro National Fish Hatchery, a hatchery operated by USFW, experienced mortality associated with tumors in the swimblader, the causative agent being identified as a retrovirus named SSSv that had been documented only once previously in Scotland in the 1970s. Pleasant River fish at the private Deblois Hatchery were also found to be positive for the virus, though no disease or mortality occurred in the private hatchery.

The Proposed Rule states that the "retrovirus named SSSv had never been documented except once in Scotland in the 1970s." 64 Fed. Reg. at 62634. There is no evidence that the virus associated with swim bladder sarcomas observed in Scotland in 1976 is the same virus observed among fish held in federal hatcheries at North Attleboro, MA. The Scottish report observed clinical tumors in subadult fish while the North Attleboro fish were reproductively mature. Manuscripts documenting SSSv in Scotland clearly state that "the virus has not been isolated nor has transmission been demonstrated." (Wolf 1988) Numerous documents released by FWS have implied that the emergence of SSSv is associated with aquaculture practices and the use of European strains, yet there has been little effort to investigate the implied relationship.

No effort has been established to investigate the presence of SSSv among European aquaculture or wild stocks.

It is also unclear what the clinical manifestations of SSSv are in infected fish. Retroviruses target cells of the immune system. Drawing analogies from other retroviral infections of vertebrates, retrovirus infected subjects typically exhibit profound immunosuppression and succumb to a variety secondary infectious agents. A focus on the presence of tumors as the only clinical sign of SSSv without an evaluation of the effect of the virus on the physiology of the host may be a serious error.

Finally, despite raising this concern, the Proposed Rule notes: "the lack of any observation of symptoms in wild populations suggest that the threat of disease from SSSV is limited." 64 Fed. Reg. At 62634. In addition, FWS Northeast Regional Director Lambertson informed the State on March 20, 2000:

> We believe that data, although circumstantial, are sufficient to conclude that SSSv has not been a significant threat to Atlantic salmon. Analysis of wild salmon from the Downeast rivers and the Penobscot River which has been stocked with hatchery-reared salmon for multiple generations. Most recently hatchery offspring tested at two Service facilities and two commercial facilities have tested negative, reinforcing the value of the Service's egg disinfection protocols and the susceptibility of retroviruses, in general, to topical disinfectants. Based on their testing, Drs. Casey and Bowser from Cornell University, who are experts on the virus, have stated that the virus appears to be in harmony with its host.

March 20, 2000 letter from R. Lambertson to Commissioners George Lapointe and Lee Perry. (Attachment 3, at Appendix D)

3. Coldwater Disease.

Finally, with respect to Coldwater Disease (CWD), the Services state that "new information available in 1999 on the potential impact of coldwater disease (CWD) on salmon" constitutes one of [the three] recent events "that have increased our concern for disease as a threat to the DPS." 64 Fed. Reg. at 62633. According to the 1999 Status Review (p. 148), "Coldwater Disease, caused by the bacterium Flavobacterium psychrophilum, has recently been found to be a potentially serious to Atlantic salmon in New England waters." According to the Services, ongoing studies by the USGS/Biological Research Division at the Leetown Science Center "have shown that the pathogen induces pathology and subsequent mortality among juvenile Atlantic salmon and that the pathogen is vertically transmitted from carrier sea-run adults to offspring via the eggs." 64 Fed. Reg. at 62634.

The statements in the Proposed Rule regarding this disease are misleading, and do not establish CWD as a new or significant threat. Again, the failure to recognize the epidemiological information surrounding the respective infectious diseases and reliance upon "grey" non- peer reviewed information ("on-going studies" by the Biological Research Division of USGS) undermines the significance of the Services' "concern."

Information surrounding the association of CWD with fish gametes is not a new development, and has been recognized and documented in the literature for over 30 years. The disease has been routinely and effectively managed by a variety of standard hatchery practices by both the aquaculture industry and by prudently managed public fish culture facilities. The document also fails to recognize that the etiological agents (F. psychrophilus, F. maritimus and related Flexibacter (Flavobacterium) are common if not ubiquitous inhabitants of aquatic ecosystems. (AFS-FHS Blue Book 1994). Management of a disease by selecting or focusing on only one of many routes of infection is clearly imprudent and ineffective in controlling disease.

4. Aquaculture.

The Services conclude that the threat of escaped farm fish interacting with "wild" salmon is compounded by the fact that commercial aquaculture in Maine appears to be using increased numbers of European strain salmon. Threats identified include the potential for escaped farmed salmon to disrupt redds of wild salmon, compete with wild salmon for food and habitat, and interbreed with wild salmon. The Services' assertions are based on a series of unsubstantiated assumptions with respect to the fitness of local "wild" salmon, indeed, the Services do not even contemplate the possibility that interactions between escapee and "wild' individuals may in fact be positive due to the infusion of new genetic material. Instead the Services assume that individuals they class as "wild" are more fit due to local adaptations. Before outlining the flaws in the Services' position, we turn first to the matter of European strains.

The Services contend that the use by the Maine aquaculture industry of European strains presents a "new and increased" threat to "wild" stocks. The Services know full well that European strains have been used in Maine since the late 1980s. In fact the State has reported to FWS the origin and numbers of all salmon introductions and transfers on an annual basis. Furthermore, through a series of negotiations that took place between industry, the State, and the Services, the Services acknowledged that the use of hybrid European/North American strains was acceptable. The Services further acknowledged that the purpose of developing a code of containment was to address concerns about perceived threats from aquaculture escapees, regardless of strain. Accordingly, the historical record contradicts the Services' assertion that it was confused two years ago about the law in Maine (interaction risk has increased since two years ago, at which time "the Services believed that certain restrictions on the importation and use of foreign salmon stocks were in place and enforced . . . . " 64 Fed. Reg. at 62635.) We turn now to other difficulties in the Services' aquaculture position.

First, the Services rely on field sorting technique, i.e., examination of external phenotypic characteristics, to distinguish aquaculture escapees from "wild" salmon, but that is problematic.

Indeed, fish reported as escapees were classified a priori as escapees based on phenotypic characteristics and only then were tissue samples taken to characterize the group to which the individual should be assigned. No chain of custody evidence was presented to permit retroactive analysis of tissue samples and to allow an after the fact, double blind test of the subjective sorting technique. The two physical characteristics used to classify subjectively an individual, fin condition and scale annuli, are highly plastic characteristics, and no baseline studies have been conducted to verify their accuracy in classification using modern biochemical genetic techniques.

Second, assuming that aquaculture escapees can be distinguished from "wild" salmon, limited opportunity exists for interactions between river salmon and farm salmon. The 1999 Status Review identifies approximately 98 farm salmon or suspected farm salmon found in the downeast rivers (Dennys and Narraguagus) from 1993 to 1997. If these are accurate assignments, they translate to approximately 14 escapees per year in two of the eight rivers included in the proposed DPS. There is limited documentation as to whether any of these farm salmon were sexually mature or were present at a time when salmon in the river were also spawning.

Furthermore, in order for escaped farm or feral salmon to present a detrimental genetic threat, a number of obstacles would have to be overcome including the following: (1) the fish would have to survive in the wild; (2) reach sexual maturity; (3) find its way up river evading predators and other natural barriers; and (4) arrive at a spawning site at the appropriate time in the season. (Bailey 1999) A number of natural obstacles to interbreeding have been identified in the literature, including tendencies in feral salmon to spawn in the lower reaches of salmon rivers, as well as later in the season than wild salmon. Id. The BRT addresses none of these factors, each of which significantly reduces the prospect of a threat and all of which, taken together, reduce any threat to the level of de minimis.

Despite the fact that the percentage of escapes is extremely small, the Maine aquaculture industry has nevertheless adopted, across the board, a voluntary code of best management practices, for it is a fact that there are millions of fish in commercial aquaculture net pens and escapes should be controlled. In addition to the adoption of best management practices, by next year there will be effective barriers in all of the downeast rivers to intercept the exceedingly small percentage that could escape. The Narraguagus River has a fish trap operating in connection with the dam. In 1999, weirs were installed in the Dennys and Pleasant Rivers. This coming year a weir is to be placed in the East Machias River and the Atlantic Salmon Commission is close to completing design for placement of a weir in the Machias River. Even if the Machias River weir cannot be completed in time for this year's spawning season, the falls at the head of the river present a natural obstacle that, many believe, works effectively to prevent the in-migration of farmed salmon. The three other rivers (Sheepscot, Ducktrap, and Cove Brook) are sufficiently distant from aquaculture pens as not to present any material risk of interaction.

The Services assert that aquaculture fish represent a significant threat to fish in the proposed DPS and that there is a lack of data on loss of fish from the sea cage sites. More relevant than the loss rate is how many farmed salmon enter DPS rivers and how many of those are sexually mature and capable of mating with "wild" fish in the rivers. The following table sets forth federal estimates of farmed salmon in Maine rivers:

Federal Estimates of Atlantic Salmon of Farmed Origin in Maine Rivers

Year	St Croix*	Narraguagus	Dennys	Sea Cage Population	% of Escapes
1994	98	42	1	6.65 million	.00212
1995	13	4	0	7.46 million	.00022
1996	20	21	8	7.94 million	.00061
1997	27	2	0	8.94 million	.00032
1998	24	unk	0	9.00 million	.00026

* Note: Specifically excluded from proposed DPS.

The above data shows that the percentage of farmed salmon appearing in Maine salmon rivers is an exceedingly small percentage of the total standing crop of farmed salmon in sea cages. Even if one were to assume that there were ten times the number of farmed salmon entering Maine rivers than are observed, the potential interaction rate, based on adults actually entering the rivers, would range from 2/100ths to 2/1000ths of one percent. This also assumes there is no contribution of escapement from Canadian salmon farms which annually produce two times as many aquaculture salmon as does Maine.

Finally, the Services assert that some aquaculture salmon were intentionally released by the aquaculture industry. As far as the State is aware, there are no instances where aquaculture salmon were intentionally released by the Maine aquaculture industry. The citations for this allegation do not contain any documented instances where intentional releases occurred. The Services should acknowledge that the allegation of intentional releases is unfounded.

5. Habitat.

The seventh and final factor cited by the Services to support their determination that there has been a decline since 1997 of Atlantic salmon is that freshwater habitat in Maine "continues to be threatened by water withdrawal and sedimentation." 64 Fed. Reg. at 62627. Again, upon close scrutiny, these reasons last lack any credible scientific or factual support.

Water extraction, according to the Services, is "the most obvious and immediate threat" on some rivers within the DPS range because "it has the potential to expose or reduce salmon habitat." 64 Fed. Reg. at 62632. And "sedimentation from a variety of sources also warrants closer review," according to the Services, "as it may be altering habitat and rendering it incapable of supporting Atlantic salmon." Id.

While the Services implicate only water withdrawal and sedimentation as the habitat factors that have caused the status of the proposed DPS of Atlantic salmon to decline since December 1997, 64 Fed. Reg. at 62627, the following potential impacts on freshwater habitat from other causes are also mentioned by the Services: "beaver and debris dams and poorly designed road crossings, input of nutrients, chronic exposure to insecticides, herbicides, fungicides and pesticides, elevated water temperatures from processing water discharges, and removal of vegetation along stream banks." 64 Fed. Reg. at 62632.

It should be noted that not one of these factors was identified as a threat or even a potential threat in 1997. And even now, the Services hedge stating, "although there does not appear to be one particular habitat issue which poses a significant threat by itself, the cumulative impacts from habitat degradation discussed above may reduce habitat quality and limit habitat quantity available to Gulf of Maine DPS salmon at various stages in their life history within freshwater." 64 Fed. Reg. at 62632. There is no empirical support for this assertion. Information supplied with these comments from state agencies involved in salmon restoration shows that Maine habitat for salmon is in excellent condition.

According to the Services, "The relationship between these [habitat] factors and freshwater production and survival of salmon needs to be studied in detail so that cause and effect connections can be determined or ruled out." 64 Fed. Reg. at 62632. That is not what the law stipulates. The ESA requires the Secretary to make a determination as a predicate to listing; "to determine" means to fix conclusively or authoritatively, not to make a provisional assumption that can be studied later and only then "determined or ruled out." As demonstrated conclusively above, the attempt to create a threat to freshwater habitat from the Narraguagus River preliminary data is misplace.

Even these provisional assumptions (not actual determinations) in the proposed rule are contradicted by earlier determinations that water extraction is not a major threat and that state agencies have demonstrated an ability to address and minimize other habitat threats. Thus, the Services ignore an entire set of thorough determinations made in December 1997. Three year's ago, Maine's Conservation Plan was recognized as "a major new development . . . which has substantially reduced threats to the species," and that "will facilitate the continued rehabilitation of the seven rivers DPS." 62 Fed. Reg. at 66337. The Services offer no evidence or data to justify departing from this determination.

a. Water Withdrawal.

The Services state that water extraction poses a threat that, if unregulated, is likely to grow due to increased blueberry production, which requires irrigation. 1999 Status Review at 101. However, the Services then confirm that water extraction is regulated by the Land Use Regulatory Commission (LURC) in unorganized towns and by the Department of Environmental Protection (DEP) in organized towns. To obtain a permit from the foregoing agencies, an applicant must demonstrate that "the withdrawal (volume, timing and rate of withdrawal) will not adversely affect existing uses and natural resources."

In their 1995 proposal to list, the Services concluded that "agricultural practices [including water extraction] are not considered a major threat to Atlantic salmon." 60 Fed. Reg. 50530, 50532 (September 29, 1995).

When the Services' assertions are ground-truthed, it is evident that water withdrawal practices are not a threat, particularly in light of regulation in key rivers over the past two years. The Services must reconcile the following in citing unregulated water withdrawal as a continuing threat not being adequately addressed by the State:

- The State of Maine funded a $250,000 water-flow study to enable optimal flows to be set and water withdrawals limited. Initially under the plan, the federal government had committed to fund this study, but when it failed to come through, the State raised the funds to undertake the study.

- Based on this study, the Maine Land Use Regulation Commission (LURC) imposed irrigation restrictions on several rivers – the Pleasant, Machias and Narraguagus. Blueberry growers were issued LURC permits that restricted use, even in one of the driest summers on record. Permits will be required again this year.

- The State is currently completing work on comprehensive water management plans for these same three watersheds. A draft plan for the Pleasant River has been distributed among stakeholders for comments with the intention of finalizing the plan in June. Plans for the other two watersheds are currently in development, and will be finalized this summer.

- A storage and permitting workgroup has formed to expedite permitting and construction of irrigation alternatives to the Pleasant, Machias and Narraguagus Rivers.

Clearly the State has demonstrated substantial progress in addressing potential concerns for water use impacting Atlantic salmon. Furthermore, the Services offer no data – scientific or otherwise – to support their assumption that state regulated water withdrawals pose a threat.

b. **Sedimentation; Peat Mining.**

The theory that sedimentation is now an actual or potential threat does not square with the Services own determinations, and, once again, no data is offered to justify the change in position. In fact, the quality of water in the rivers in question is high. A recent survey published by the National Wildlife Foundation confirms the fact that water quality in Maine's rivers is exemplary, and the Downeast rivers in particular are among the highest quality waters in the State. See Attachment 3, at Appendix A. In addition, the EPA has approved the State's Non-point Source Pollution (NPS) Control Program Upgrade and 15 Year Strategy, noting that "Maine's NPS Program is exemplary." Attachment 3, at Appendix B.

- The Services assert that certain forestry activity, such as "poor logging practices and road construction can cause erosion resulting in the deposition of silt and sediment in [salmon] habitat." 1999 Status Review, at 108. However, in both their 1995 listing proposal and the 1997 withdrawal notice, the Services conclude that "while past forestry practices may have adversely affected salmon and their habitat, <u>the regulatory mechanisms currently in place are sufficient</u> to ensure that ongoing practices do not pose a major threat to the species." 62 Fed. Reg. at 66329 (emphasis added); 60 Fed. Reg. at 50532.

- The 1999 Status Review notes that forestry activity in Maine is concentrated in the watersheds of the Dennys, East Machias, Machias, Pleasant, and Narraguagus Rivers, that Champion Paper owns 433,000 acres within those watersheds and the company has implemented a riparian zone management plan that (i) "<u>exceeds state and federal regulations</u>," (ii) "recognizes the wildlife diversity of riparian zones and strives to protect water quality and accommodate the needs of wildlife," and (iii) establishes 100 to 660-foot wide protection zones around sensitive water bodies. 1999 Status Review, at 108 (emphasis added).

- The 1995 Status Review noted that removal of vegetation, production of silt and debris, and use of pesticides by the forestry industry all had the potential to impact salmon habitat. However, the Services concluded that "numerous state and federal laws exist to prevent adverse effects on Atlantic salmon and other species," and that "[c]urrent forestry practices are not considered a major threat to Atlantic salmon." 1995 Status Review, at 37 (emphasis added).

- Although the 1999 Status Review suggests that salmon and their habitat in the Narraguagus River "could be negatively impacted" by peat mining which, according to the Services, leads to "discharges of low pH water containing suspended peat silt and dissolved metals and pesticides," there are no documented instances where this is a problem. See 1999 Status Review, at 111. To the contrary, the Services acknowledged that Farm Pond and McCoy Brook trap sediment before it reaches the mainstem Narraguagus, and that waters in the vicinity of peat bogs exhibit low pH (below 5) regardless of whether it is mined (e.g., Denbo Heath on the Narraguagus) or unmined (e.g., the Great Heath on the Pleasant). 1999 Status Review, at 111.

- The 1999 Status Review also notes that in 1995 six sedimentation basins were built to curb peat laden discharges from disturbed areas of Denbo Heath, that partial failures of the new sedimentation basins were reported in the spring of 1996 and 1997 after which corrections were made to the sedimentation ponds and collection systems, and that no berm failures, water quality or other problems were observed in 1998. 1999 Status Review, at 111-112.

- In their December 1997 withdrawal notice, the Services concluded that there are "no known current impacts to salmon" caused by peat mining. 62 Fed. Reg. at 66331.

What empirical data now supports the implication that sedimentation is a problem? In identifying "continued" threats to salmon habitat from water withdrawal and sedimentation as a principal reason for the decline of Atlantic salmon since December 1997, 64 Fed. Reg. at 62627, the Services point to no specific deficiencies in forestry management practices and offer no evidence to support their assertion that normal farming practices "discharge nutrients, sediments and/or pesticides which could lead to habitat degradation." 1999 Status Review, at 101. The list of activity, study and education in the annual report by the Department of Conservation, see Attachment 7, effectively rebuts the Services' speculation. Moreover, the Services do not address the following:

- No data from any study presented show that normal agricultural practices such as plowing, disking, harrowing, and cultivation of crops are adversely affecting the riparian zone or salmon habitat;

- The Maine Forest Service (MFS) conducts educational seminars for woodlot owners, loggers and foresters on best management practices and riparian buffers and in the process has distributed maps of salmon watershed and habitat to private citizens;

- MFS Operations Notification Database is programmed so that landowners who submit notifications for harvest in towns with critical salmon habitat automatically receive notification of such habitat from MFS;

- Since March 1, 1999, MFS has reviewed approximately 2600 notifications of forestry operations, and has field-inspected 36 harvests near critical salmon habitat, finding no significant impacts on water quality resulting from such operations;

- LURC employed a summer intern to monitor the five ASC watersheds in order to compile an inventory of non-point pollution sources, identifying 34 relatively minor non-point pollution sources where LURC compliance staff developed with owners at each site mutually agreeable plans to correct problems.

- LURC compliance staff responded to all reports of sedimentation within the ASC watersheds and worked with responsible parties to stop such discharges and prevent recurrence.

Before any adverse determination is made by the Services on the basis of provisional assumptions of threats from sedimentation or peat mining, the Services should address the facts and provide a detailed explanation of why current State measures are no longer adequate to address such concerns.

c. Beaver Dams and other Obstruction to Passage.

The Services assert that obstructions to passage are caused by beaver dams and poorly designed road crossings, but offer no facts that passage is obstructed. On the contrary, the Services say the State, Project SHARE, and the watershed councils "have demonstrated an ability to annually remove or reduce that threat." 64 Fed. Reg. at 62632. Specifically, ASC field staff, with the assistance of volunteers from the Downeast Watershed Council and "volunteers" from the Washington County state prison system breached fifty beaver dams in 1998 and another 55 in 1999 on proposed DPS rivers. And local watershed councils have cooperated with private landowners to identify and correct problems caused by poorly designed and constructed roadways. Obstruction to passage has been aggressively pursued according to documented activity.

In addition, the Services' own data on habitat accessibility reveals that 100 percent of the historical salmon habitat of the Sheepscot, Ducktrap, Narraguagus, Pleasant, Machias, East Machias, and Dennys rivers is currently accessible to Atlantic salmon. 1999 Status Review, at 21, Figure 4.1.2. The units of accessible habitat on these rivers have increased between 1995 and 1999. Compare 1999 Status Review, at 21, Figure 4.1.2 with 1995 Status Review at 15, Figure 3.4. Moreover, existing salmon habitat on the Dennys "exceeds that which was available historically." See 1999 Status Review, at 97.

d. Input of Nutrients.

The only study of nutrients referenced in the 1999 Status Review, Taylor 1973, measured nutrient levels at two sites in the Machias and at sites in nine other rivers, streams, and hatchery water sources. Again, there is no basis for asserting that nutrient input is a current threat, especially when the Services did not previously consider it to be problem. Presumably, 25-year old data is of highly dubious value in determining current threats presented by nutrients. Nonetheless, the State took additional action since 1997 to strengthen protection in this area. In March 1998, the Maine Legislature passed "An Act Regarding Nutrient Management, 7 MRSA § 747 et seq., that requires each Maine farm with more than 50 animal units (one unit = 1,000 lbs. of body weight) to develop a whole farm nutrient management plan by January 1, 2001, and prohibits winter spreading of manure. The issue of nutrient input primarily would only affect one of the rivers in question – the Sheepscot. This new law with accompanying regulations under development will only serve to bolster and support the continuous improvement and maintenance of habitat envisioned under the Plan.

e. "Chronic exposure to insecticides, herbicides, fungicides, and pesticides (in particular, those used to control spruce budworm)."

The 1999 Status Review states that the herbicide hexazinone was detected at sites in the Narraguagus River during routine sampling by the State for an array of pesticides in 1991. According to the Services, "Although the concentrations detected are low, its presence throughout the summer and fall at low flow periods suggests that it is entering the river through groundwater flow rather than storm runoff." 1999 Status Review, at 93. However, according to the Status Review, "it is unknown whether chronic exposure to these background levels would adversely affect Atlantic salmon." 1999 Status Review, at 106. In addition, according to the Services, exposure of Maine salmon to pesticides "has not been fully investigated" and the effects of chronic exposure to pesticides "are largely unknown." 1999 Status Review, at 102. Moreover, "Recent studies to determine the long-term changes in macroinvertebrate abundance, diversity, and taxa richness at sites in the [Narraguagus] river suggest that a deterioration in water quality has not occurred at these sites (Siebenmann and Gibbs 1994)." 1999 Status Review, at 93.

Placing the hexazinone matter in context, the Environmental Risk Advisory Committee of the State Board of Pesticides Control reviewed available data on water samples from the seven rivers which were tested for 33 active pesticide ingredients. Hexazinone was identified as the only frequent contaminant. The concentrations of hexazinone were low, ranging from less than 2 ppb in surface water to 6 ppb in ground water. Because the lethal concentration for fish is documented at 100,000 ppb, the Environmental Risk Advisory Committee concluded that further toxicity testing was not warranted although annual tests will be conducted for monitoring purposes.

Metacil®1.8D, the spruce budworm pesticide singled out for mention by the Services in the 1999 Status Review (p. 109-110) has <u>not been used in Maine since 1985</u>. Even when it was used, marine and estuarine waters were buffered from spruce budworm applications for a distance of one-half mile for single engine aircraft and one mile for multi-engine aircraft. The Services claim that a constituent of Metacil®1.8D, known as "4-NP," can "interfere with the smoltification process," and that potential sources of 4-NP "include pulp and paper mills, textile manufacturing plants, petroleum production and leather manufacturing." 1999 Status Review, at 110. However, the Services identify no specific source of 4-NP in Maine nor do they reference any data that reveal the continued presence of either of the substances in Maine waters. Finally, the Services in 1995 concluded explicitly that the use of pesticides (including hexazinone) in blueberry agriculture does not present a major threat to Atlantic salmon:

> Numerous measures are implemented to reduce the potential for contamination of waterways from blueberry agriculture. Measures include the maintenance of vegetation throughout the year to reduce erosion and sedimentation and the maintenance of riparian buffers to protect streams. As is the case with forestry practices, blueberry agriculture is heavily regulated by both state and federal laws [and such practices] are not considered a major threat to Atlantic salmon.

1995 Status Review, at 38.

In February 1999, the Maine Department of Agriculture's Board of Pesticide Control conducted random samples on 22 wells adjacent to blueberry fields in February 1999. The highest detected level of hexazione contamination was 1.97 ppb, compared with 5.97 ppb in 1994.

f. Elevated Water Temperature; Removal of Vegetation.

Elevated water temperatures from processing water discharges is identified for its "demonstrated and potential" impacts on salmon habitat. The Services provide no information linking water discharges to salmon mortality and, indeed, to obtain a permit to discharge water into a Maine waterway, an applicant "must demonstrate that the discharge will not lower the water quality classification for the receiving water body." 1999 Status Review, at 103.

Finally, the Services identify removal of vegetation along streambanks as having "demonstrated and potential" impact on salmon habitat. Once again, no data, general or specific, is provided by the Services. In fact, LURC regulations require minimum vegetative buffer strips between water bodies and activities such as agriculture, clearing, mineral exploration and extraction, roads and water crossings, timber harvesting, and filling and grading. LURC Reg. § 10.17(A)(1)-(6). Enforcement and education are routinely performed.

VI. "EFFORTS OF THE STATE" IN ADOPTING AND IMPLEMENTING THE ATLANTIC SALMON CONSERVATION PLAN FULLY ADDRESS POTENTIAL THREATS / RISKS, AND SERVICES SHOULD REAFFIRM THEIR 1997 COMMITMENT.

The ESA permits the Secretaries to make a listing determination only after taking into account "the efforts, if any, being made by any state or foreign nation . . . to protect such species . . . ." 16 U.S.C. §1522(a)(a)(A). As mentioned, the State's efforts through the Conservation Plan was the principal basis for determining in 1997 that the proposed threatened listing was not warranted. At that time, the Services determined that the State's efforts through the ASCP in conjunction with other state, federal and international protections "substantially reduced threats to the species." (Attachment 6 is chart highlighting Maine laws and regulations).

Over the past two years, the State has made substantial, indeed remarkable progress in implementing the Plan. (A copy of the 1999 Annual Report summarizing progress made is Attachment 7). A partial list of accomplishments is as follows:

- Fish Trapping and Counting, to assure that farmed Atlantic salmon do not escape into Maine rivers and to monitor returning wild salmon:
  - Designed, permitted, and constructed fish weirs on the Pleasant and Dennys Rivers. The weirs were in the water by mid-fall 1999, are now in winter storage, and will be back in the water this spring.
  - Designed a fish weir for the East Machias River and are negotiating to place the weir at its optimal location for fish trapping.
  - Modifying the design of the Narraguagus flood control dam at Cherryfield to make the trapping facility more effective; and
  - Completed preliminary design for a fishway in the Machias River Gorge.

- Fish Stocking: Continued collection of broodstock and stocking efforts in six of the seven rivers

- Fish Assessments, to understand better what is happening in the rivers:
  - Undertaking a smolt study on the Narraguagus River to track juvenile survival; and
  - Placed a smolt trap on the Pleasant River to monitor downstream migration.

- Identification of Habitat and Habitat Requirements:
  - Completed habitat mapping of critical spawning and nursery areas in each of seven rivers;
  - Completed preparation of methodology by which to identify scientifically justifiable riparian buffer adjacent to important spawning and nursery areas;
  - Completed modeling, using the so-called Instream Flow Incremental Methodologies (IFIMs) for the Pleasant and Narraguagus Rivers and the Machias River (Mopang Stream), providing information concerning flow requirements of juvenile Atlantic salmon at critical reaches of each of these streams; and
  - Nearing completion of water use management plans based on IFIM modeling, with draft Pleasant River plan now under review and the plan for the Narraguagus River and the Machias River (Mopang Stream) due this June.

- Protection of Habitat:
  - Acquired, assisted in the acquisition of, and now in the process of negotiating for acquisition of 4806 acres with over 40 miles of frontage along five of the seven rivers. Additional purchases will be possible with passage in November 1999 of a $50 million bond issue to recapitalize the Land for Maine's Future Program;

- Restricted direct withdrawal of water for blueberry irrigation during dry summer months through LURC permit conditions. Grower withdrawals were discontinued during August in each of the last two years when withdrawal limits were reached. DEP is currently preparing a draft rule to establish minimum flow standards for waters under its jurisdiction;

- Secured $400,000 in funding from the National Fish and Wildlife Foundation for habitat conservation projects during the last three years, funds contributing to the purchase of riparian habitat, assistance to watershed councils, restoration of eroding riverbanks, and assessment of watershed conditions; and

- Created 300 linear feet of riparian buffer by fencing out cattle and providing an alternative water source away from the Sheepscot River, with the prospect that the project will become a model for cooperative solution of problems affecting water quality without economic hardship to farmers.

- Enhancement of Habitat:

  - Removal of 105 beaver dams on downeast rivers;

  - Removal of part of abandoned dam on Pleasant River known as Cannan Falls;

  - Improved fish passage on fishway on Cathance Stream, a tributary of the Dennys River;

  - Upgraded road crossings, ditches, and culverts on paper company lands in Washington County to reduce nonpoint source pollution and sedimentation. Certain landowners, including Champion Paper, have undertaken a comprehensive road improvement plan in response to a LURC survey taken last summer that noted nonpoint source pollution problems; and

- Held approximately a dozen workshops promoting best management practices to forestry, logging and municipal officials.

- Aquaculture:

  - Drafted and implemented a voluntary Loss Control Code of Practices for the aquaculture industry; and

  - Drafted a rule to codify the Loss Control Code of Practices.

- Recreational Fishing:

  - Adopted angling rules shortening the catch and release season on the seven rivers; following the first annual review of the plan, adopted a rule banning catch and release fishing for Atlantic salmon in all Maine rivers;

  - Adopted a rule requiring gear changes for elver fishermen to reduce by-catch; and

  - Adopted rules for trout and landlocked salmon fishing to protect Atlantic salmon.

- Organization:

  - Formed watershed councils on each of the seven rivers and secured funding for staffing assistance; and

  - On the urging of interested parties, including ASF members, reorganized the Atlantic Salmon Authority into the Atlantic Salmon Commission, placed oversight of matters relating to Atlantic salmon under one roof, and provided staff funding.

- Baselines
  - Provided grants to several watershed councils to prepare nonpoint pollution source assessment and remediation plans and completed riparian assessments for four rivers; and
  - Established ongoing water quality monitoring programs for each of the seven rivers and developed a master database managed by DEP, the work now funded for a full-time position.
- Outreach:
  - Assisted watershed councils in establishing educational kiosks in five of the seven watersheds;
  - Created website highlighting local salmon conservation activities; and
  - Completed 1998 Annual Progress Report, received extensive comment, and amended the plan for 1999.
- Enforcement
  - Logged more than 700 hours of Warden Service Patrol to identify and halt any poaching;
  - Enforced permit conditions for a large cranberry development, including one of the largest fines ever levied for a permit violation;
  - Undertook follow-up inspections of several reported forestry violations; and
  - Built into code enforcement officer certification programs awareness of the Atlantic Salmon Conservation Plan and the importance of enforcing shoreland zoning standards.

- Funding
  - From January 1998 through June 1999, $546,179 was committed to the plan, almost all in state funds with federal funding for weirs
  - For July 1999 through June 2000, $710,771 has been committed, again almost all consisting of state funds plus funds from Land for Maine's Future for land purchases.
  - In January 2000, a supplemental allocation of $80,000 was committed, all being state funds.
  - To date, $2 million at a minimum has been provided for the ASCP

Even the Services acknowledge that "[i]mplementation of the Conservation Plan as a State initiative remains an important tool for recovery of the Gulf of Maine DPS of Atlantic salmon and its habitat." 64 Fed. Reg. at 62637. A determination that the State's conservation program is "an important tool for recovery," but somehow not up to federal standards to protect and rehabilitate the species within Maine's rivers is arbitrary and a breach of trust, particularly in light of the flawed science and analysis offered as a basis for the proposed rule. It is also ironic because in all likelihood, the reasons for range-wide decline in Atlantic salmon have little to do with problems in Maine habitat, but are predominantly caused by conditions in the ocean, which the Services acknowledge, is "beyond the State's jurisdiction." 62 Fed. Reg. At 66331. Indeed, it is evident that Congress did not intend that the protective efforts of a State be deemed inadequate because of factors beyond its jurisdiction. Thus, ESA section 4(b)(1)(a) directs the Secretary to take into account the conservation efforts being made by a State within its jurisdiction to protect a species. By using the term "within its jurisdiction," it is apparent that Congress did not intend state efforts to be deemed inadequate simply because the reach of those efforts does not extend beyond its borders.

VII. MARINE SURVIVAL IS THE MOST SIGNIFICANT LIMITING FACTOR IN RESTORING AND PROTECTING ATLANTIC SALMON, AND IS BEYOND THE JURISDICTION OF THE STATE TO ADDRESS.

The Services conclude that one of the critical factors adversely impacting Atlantic salmon returns to the United States is the low natural survival of the species during that part of its life cycle in the open ocean due in part to sea surface water temperatures. 60 Fed. Reg. 50531, 50533 (September 20, 1995). Fluctuating ocean temperatures are thought to be related to theories about sun aging, global warming, melting polar caps, ocean pollution and ocean floor dynamics. 1999 Status Review, at 187. No state or federal laws are relevant to such factors.

In addition, the factor of the Greenland commercial fisheries must be addressed. The ocean feeding grounds of Atlantic salmon in the northwest Atlantic were first documented in the early 1960's from tagged smolts released in the Narraguagus River and recaptured in commercial fisheries in West Greenland. The West Greenland fishery peaked in 1971 with a catch of 289 metric tons. Due to declining stocks and increased regulatory measures to reverse stock declines, the fishery in recent years have been dramatically reduced and now consists primarily of a domestic use fishery for native Greenlanders. The fishery currently takes 11-20 metric tons. While marine survival has declined dramatically over the past decade from unknown or uncontrollable causes, the directed commercial fishery can be quantified and controlled.

Using estimates of (1) the number of fish per ton, (2) the percentage of fish from the West Greenland fishery that are of North American origin, and (3) the proportion of North American salmon that come from Maine, it is possible to estimate the number of Maine fish killed annually in the West Greenland domestic fishery.

HARVEST LEVEL	11 MT	11 MT	11 MT	20 MT	20 MT	20 MT
Number of fish killed (350/ton)	3850	3850	3850	7000	7000	7000
Number of North American fish (60% North American)	2310	2310	2310	4200	4200	4200
Proportion of North American fish from U.S. (Maine)	0.02	0.03	0.04	0.02	0.03	0.04
Number of Maine fish killed	46	69	92	84	126	168

The mortality estimate ranges from 46-168 fish. To put these numbers in context, the Services insist that every fish must be protected, and accordingly, urged the State to close its catch and release recreational salmon fishery. The 1999 Maine recreational catch / release salmon fishery was 216 fish. Catch and release mortality is estimated at 2-5%, therefore total estimated mortality in the Maine fishery for 1999 ranged from 4 to 11 fish. In order to further reduce mortality on this small number of fish, Maine closed the directed recreational fishery in December 1999. Thus, even assuming the low range of harvest in the Greenland domestic use fishery, it is evident that the intercept fishery in Greenland kills results in a mortality level five to ten times greater than the Maine recreational catch and release fishery.

The Greenland fisheries elimination appears dependent upon either a federal buyout or an international agreement, which in turn is dependent upon the agreement between the United States and a foreign nation. The protections of the ESA offer no additional protections in dealing with the overarching limiting factor of low marine survival. The federal government is not effectively addressing a known source of mortality – perhaps the greatest source of mortality – while simultaneously seeking to impose unnecessary burdens on the State of Maine.

Attachment #1

Review of Genetics in the Proposed Listing of Atlantic Salmon
Prepared for the State of Maine

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Listing of Atlantic salmon in the State of Maine is not justified on the basis of the scientific information presented. The genetic data and their analysis have significant errors. Non-random sampling of individuals, the absence of temporal stability of allele frequencies within rivers, and extensive errors associated with genotype assignments compromised the utility of genetic data to assay distinctiveness and evolutionary significance. Analysis of variation in quantitative life history traits is incomplete and misleading. There is substantial disagreement among scientists knowledgeable about the species regarding the sufficiency and accuracy of the available data relevant to the determination. Comprehensive review of the restoration effort for Atlantic salmon in Maine, particularly the role of river specific stocking, merits immediate review.

1. Use of Genetics as criteria for the Proposed Listing

Genetic data, analysis, and interpretation are central to the Proposed Rule. In the Proposed Rule, the Services rely upon genetic data and inferences from analysis of that data to argue for both discreteness and significance of salmon populations in the eight rivers.. There are two relatively distinct classes of genetic information and inferences about Atlantic salmon presented in the Proposed Rule: arguments based on population genetics, and arguments based on the quantitative genetics of life-history traits. The word "genetics" is used 38 times in the Proposed Rule and over 75 times in the Status Review. In all direct quotes (below), emphasis is added with ***bold italics***.

A. Population genetic studies can directly determine whether populations will be listed.

> "Surveys have also identified juvenile Atlantic salmon to be present in other river systems which have relatively limited juvenile production habitat such as Bond, Togus, Passagassawaukeag, Eaton, Felts, South Branch Marsh, Kenduskeag, and Pennamaquan Rivers (Buckley, 1999). ***Results from genetic studies of fish from these and any other occupied rivers within the DPS range will be used to determine the appropriateness of adding these populations to the DPS.***" (Proposed Rule p. 62629)

> "***It would be premature to determine the status of the Penobscot population in relationship to the Gulf of Maine DPS without comprehensive genetic data.***" (Proposed Rule p. 62629)

> "In the future, ***DPS populations may be identified in additional rivers based on ongoing stream surveys and continuing genetic analyses***". (Proposed Rule p. 62638)

B. Population genetic studies are interpreted as directly supporting the evolutionary uniqueness and distinction of fish in the proposed DPS.

> "Recent survey work also indicates that a naturally reproducing population that is ***genetically distinct (alleles only found in that population)*** remains in Cove Brook (Buckley, 1999; King et al., 1999). ***This information demonstrates that Atlantic salmon can retain unique genetic material*** in a relatively small drainage since juvenile habitat area in Cove Brook is estimated at only 23,500 sq. m (Ed Baum, Atlantic Salmon Authority (ASA), pers. comm., 1999)." (Proposed Rule p. 62629)

"Separateness of the Gulf of Maine DPS and other Atlantic salmon populations outside the DPS is strongly supported by the following: (1) Persistence of these populations, (2) geographic segregation; (3) limited stocking from outside the DPS, and (4) ***current genetic analyses***. The Services conclude that there are ***adequate genetic*** and demographic data to demonstrate that an ecologically important separation exists between the Gulf of Maine DPS and other populations to the north; all naturally occurring populations south of the DPS range have been extirpated." (Proposed Rule p. 62629)

C. Presumed genetic divergence in life history traits is interpreted as supporting the evolutionary uniqueness and distinction of fish in the proposed DPS.

"The Services also conclude that while it is unlikely that any U.S. Atlantic salmon populations exist in a genetically pure native form, present populations are descendants of these aboriginal stocks, and their continued presence in indigenous habitat indicates that important ***heritable*** local adaptations still exist." (Proposed Rule p. 62629)

"Remnant stocks have maintained the most characteristics of these factors: smoltification at a mean age of 2 and predominant adult returns as 2 sea winter (SW) fish (age 4). Since the proportion of 2SW fish in an Atlantic salmon stock has a documented genetic basis (Glebe and Saunders, 1986; Ritter et al., 1986; Hutchings and Jones, 1998), ***the Services conclude that the DPS has unique life history characteristics that have a heritable basis***." (Proposed Rule p. 62630)

D. It is concluded that straying and hatchery stocking have had no significant genetic effects on fish in the proposed DPS.

"***Given our current understanding of the genetic composition of these stocks*** ... the ***Services conclude that the influence of hatchery fish upon the DPS has not been sufficient to completely or substantially introgress with the remnant populations and genomes of the Gulf of Maine DPS***." (Proposed Rule p. 62630)

E. It is asserted that the genetic characteristics of salmon in the proposed DPS deserve protection.

"The Services ***believe that there are components of an important genetic legacy remaining in these populations***, and the loss of these populations would negatively affect the genetic resources of Atlantic salmon as a whole because it would contribute to further range reduction. The ***genetic resources*** of these most southerly stocks may be vitally important to the species' future survival." (Proposed Rule p. 62630)

"The conservation of the populations of the Gulf of Maine DPS is essential because these Atlantic salmon represent the remaining ***genetic legacy*** of ancestral populations that were locally adapted to the rivers and streams of the region." (Proposed Rule p. 62630)

"The Gulf of Maine DPS of Atlantic salmon has persisted in a unique setting in the United States, and its loss as the only naturally spawning stock in the United States would be a significant loss. The existence and ***genetic integrity*** of the DPS must be preserved so that the DPS can naturally adapt to changing future conditions in the freshwater and marine environment." (Proposed Rule p. 62636)

2. Use of population genetics analysis in the Proposed Rule

A. Analysis of population genetics is central to the Proposed Rule. The population genetics arguments are based on analysis of variation in mitochondrial DNA (mtDNA) and at microsatellite (SSR) loci conducted by Tim King and co-workers at the Leetown Laboratory of the USGS. Written results and interpretations were first disseminated as a Preliminary Genetics Report in August, 1997 (King et al., 1997; hereafter referred to as the Preliminary Genetics Report, and subsequently as a Final Genetics Report in March, 1999 (King et al., 1999; hereafter referred to as the Final Genetics Report). The Preliminary Genetics Report was subject to external (non-Federal), independent, anonymous peer review by the NMFS. The March, 1999 Final Genetics Report was not subject to external (non-Federal), independent, anonymous peer review. The Final Genetics Report increased the number of sample collections (from 37 to 66), made selected changes suggested by the ad hoc reviewers (e.g., Bonferroni corrections), and presented additional analyses for the entire data set. The basic conclusions of the Preliminary Genetics Report were affirmed and extended in the Final Genetics Report. The Status Review of Atlantic Salmon subsequently reiterated many of findings from the Final Genetics Report. The Proposed Rule to List Atlantic Salmon as an Endangered Species used genetic information presented in the Status Review.

The analyses and comments presented below are based upon two sources: the written documents identified above, and data requested from the Services under the Freedom of Information Act by the State of Maine. These data were requested because the Final Genetics Report of March, 1999 only contained summary tables and information based on analysis of these data. The *sina qua non* of scientific inquiry is the ability of independent investigators to reproduce the findings of other scientists; replication is at the core of hypothesis testing and helps to insure the validity of original conclusions. Thus, to fairly evaluate the analyses and claims advanced in the Final Genetics Report (as well as in the subsequent Status Review and Proposed Rule), it was essential to examine the raw data used by the Federal scientists, instead of relying upon summary tables and statistics. These data included: the raw GeneScan files for individuals included in the Final Genetics Report of March, 1999 (from which microsatellite genotypes were inferred), the Genotyper Template file used to interpret the multilocus microsatellite genotypes assigned to individuals for the Final Genetics Report, and the multilocus microsatellite genotypes assigned to individuals in the Final Genetics Report. Our examination of this information made use of a number of computer programs including: Perkin-Elmer Applied Biosystems GeneScan and Genotyper, GENPOP (Raymond, M., & Rousset, F. 1995), and Kinship (Queller, D.C. and K.F. Goodnight. 1989).

It should be noted that analysis of these data was exceedingly difficult because organization was idiosyncratic (river specific population samples were analyzed among multiple runs), colors used to designate loci were switched among runs (for example, sometimes locus Ssa202 was visualized with the fluorescent label fam, e.g, M2-95-11, while tet was used at other times, e.g., M3-94-28), and many individuals were examined multiple times (making it difficult to know which examination was correct). Without the use of the Genotyper Template file eventually provided by the Services, it would have been impossible to understand how individuals were assigned genotypes.

Because of these constraints, it was not possible to comprehensively reanalyze the raw GeneScan data in the period subsequent to the date when all of the requested information was made available. Regardless, given the extent of the systemic errors in data acquisition and analysis (detailed below), reanalysis would need to include comprehensive rescoring at least half of the loci examined in the Final Genetics Report

B. There is substantial disagreement among scientists knowledgeable about the species concerned regarding the sufficiency or accuracy of the available data relevant to the determination. External (non-Federal), independent, anonymous peer reviewers examined the August, 1997 Preliminary Genetics Report and concluded that many features of the study can provide misleading information and conclusions. Many of these concerns were not addressed in the Final Genetics Report. The Final Genetics Report did not receive external (non-Federal), independent, anonymous peer review. Quotations from the ad hoc reviews of the Preliminary Genetics Report appear directly below; additional quotations appear in sections associated with specific technical comments.

> "The analyses in the report have convinced me that there is no *molecular genetic* basis for designating the Atlantic salmon in the five downeast rivers as an ESU. There clearly is no genetic distinction between this group and the Canadian populations." (Ad hoc reviews of the Preliminary Genetics Report: Reviewer 9)
>
> "These differences [in microsatellite allele frequencies among populations] are difficult to explain without invoking low effective size, non-random sampling, stock transfers, or artifactual data." (Ad hoc reviews of the Preliminary Genetics Report: Reviewer 10)

"there is no clear evidence that the samples from the northeastern states belong[ing] to a distinct evolutionary grouping from those in Canada. What differences exist between American and Canadian populations may simply be due to clinal changes in the genetic structure of North American populations, arising from a negative relationship between gene flow and geographic separation, or from chance differences among populations." (Ad hoc reviews of the Preliminary Genetics Report: Reviewer 7)

C. Basic assumptions necessary for population genetic analysis are violated in the Federal genetic study of King et al. (1997, 1999). Data acquisition and data analysis contain numerous, substantive errors. Systemic errors in assigning individual genotypes were made for half (6 of 12) of the loci examined in the Final Genetics Report. Scoring errors for these loci were common in the North American data. Because these errors were so pervasive, it is both incorrect and misleading to include results from these loci in analyses of isolation and evolutionary significance. In aggregate, they compromise the results of this study and any interpretations from them regarding proposed listing of Atlantic salmon in Maine.

i. Individuals were not sampled at random within rivers. Random sampling is a fundamental assumption of population analysis.

Non-random sampling was suggested by ad hoc reviewers.

"In talking with others with some knowledge of the collections, we have heard the following concerns expressed: 1) some of the Maine samples appear to comprise groups of related individuals, or progeny from a relatively few nearby redds; and 2) many Canadian collections were from streams that have been substantially affected by hatchery programs and thus do not necessarily represent population of wild fish." (Ad hoc reviews of the Preliminary Genetics Report: Reviewer 10)

"Sampling is a particularly important consideration here because sample sizes are relatively small (so sampling error is relatively large) and genetic differences between populations are relatively small." "[Random sampling] is difficult to achieve in any biological population, but the departures from randomness can be particularly acute in sampling juveniles (as presumably was done here)." (Ad hoc reviews of the Preliminary Genetics Report: Reviewer 10)

The Federal study presumed that random samples were obtained.

"Taken together, these observations seem to support that the populations tested are temporally stabile [sic] and that ***non-random sampling was not a significant problem in this study***." (Final Genetics Report, p. 30).

During the collection of specimens, actual sampling in many cases was limited to a few small areas within streams rather than encompassing large areas; accessibility of the sites for electrofishing was a major criterion (Kircheis, 1998) such that sampling within some sites was extremely restricted. Since most Atlantic salmon rivers have very low numbers of breeding individuals, the probability of collecting individuals from only a few families when effectively using point-sampling is greatly increased.

Though the Final Genetic Report acknowledged the problem of family sampling by citing Hansen et al. (1997), it did not adequately evaluate the data with respect to this concern. This is reflected in the reanalysis of the microsatellite genotypic data for the Final Genetics Report which reveals that extensive numbers of closely related individuals (full-sibs and half-sibs) are present in population samples. Related individuals were recognized by direct inspection of the genotypic data and by examination with the programs Kinship, ver. 1.2, and Relatedness, ver. 4.2 (see Queller and Goodnight, 1989). For example, in the 1994 sample of 30 individuals from the Sheepscot River, five separate groups of close relatives were present: 3,26; 4,15,19; 5,26; 7,9; 13,20. At Cove Brook and other locations where temporal samples were available, large numbers of related individuals were identified both within samples and between samples. Of importance, observations of very closely related individuals were also extensive in the Canadian population samples from New Brunswick and Nova Scotia; those samples originated from hatcheries. The occurrence of these family groups means that sampling was not at random, and thus violates a critical assumption of statistical sampling methodology.

The presence of related individuals within population samples and between samples from the same locality for different years inflates estimates of population divergence. Because of the presence of related individuals, actual sample sizes are much smaller than reported because such sampling underestimates the amount of genetic variability present in that population. Thus, all statistical analyses that require random sampling are flawed.

ii. Samples sizes examined were too small to accurately characterize populations. With highly variable markers (such as microsatellites), inadequate sample sizes can generate spurious findings of heterogeneity among samples.

Concerns about sample size were explicitly noted in ad hoc reviews.

> "Although it is clear why evidence of "unique" or distinctive genetic traits in particular groups of salmon would be of interest in a study such as this, sample size and locus variability issues strongly limit any useful inferences that can be made from observations about private alleles." (Ad hoc reviews of King et al., 1997: Reviewer 3)

"The study has two major short comings. The first is the limited number and sizes for many of the samples. This makes it difficult to draw conclusions about regional variation within continents give[n] the relatively low level of differentiation displayed and to place much confidence in estimates of numbers and proportions of private alleles." (Ad hoc reviews of King et al., 1997: Reviewer 8)

For hypervariable genetic markers such as microsatellite loci, small samples from individual populations can produce positively misleading results (Ruzzante, 1998). Even repetitive samples from the same population will be significantly heterogeneous if the number of alleles is high and the sample sizes are small. For example, if a locus has 12 alleles, a sample of 43 individuals is required to be 95% confident of not producing significant divergence between repetitive samples (Kornfield and Parker, 1997). In the Federal study, seven of the twelve microsatellite loci examined had 12 or more alleles observed in the Maine sample (Final Genetics Report, Table 7b.), but the average sample size for Maine river collections was 32.3 individuals (Final Genetics Report, Table 8a), thus inflating the probability of finding significant heterogeneity between populations. Ruzzante (1998) also explicitly noted that tests of divergence are sample size dependent and recommends samples sizes be greater than thirty individuals. For the detection of linkage disequlibrium, Lynch and Walsh (1998, 100) note that unless disequlibrium is strong ($D > 0.4$), "...several hundred to thousands of individuals should be assayed to achieve a reasonable level of statistical power." The tests performed (Final Genetics Report, Table 10) were based largely on samples of ~30 individuals. Given this sampling requirement, the significant differences observed for most of the Maine samples again suggests the presence of related individuals as noted above.

Small sample sizes have significant affects on the detection of unique or "private" alleles. The detection of such alleles is sample size dependent; in the Federal genetic study, there is a highly significant correlation between the number of individuals sampled and the number of alleles observed ($r = 0.50$, $p<0.01$). The presence of unique alleles can be misinterpreted as indicating population divergence if sample sizes are inadequate. Further, small sample sizes also produce inaccurate estimates of allelic frequencies that will affect measures of genetic differentiation. Expansion of sample sizes can reveal the presence of such alleles in other populations.

iii. Microsatellite allele (gene) frequencies were not stable over time. Temporal stability of allele frequencies within populations is a necessary prerequisite to examine divergence among populations.

It was repeatedly noted in the Final Genetics Report and the Status Review that allele frequencies were stable over time.

"However, ***the temporal stability of allele frequencies*** and the occurrence of alleles that are unique to Maine indicate that this mixing has not overwhelmed all of the genetic differences between stocks (King et al. 1993; King et al. 1999)." (Status Review, p. 50)

> "***Pair-wise comparisons between collections within Maine rivers and between 1994 and 1995 samples suggested temporal stability*** accompanied by little readily detectable population subdivision." (Final Genetics Report, p. 3)
>
> "The relatively low estimates of variation attributable to differences between year-classes ***suggest an element of temporal stability in allele frequencies***." (King et al., 1999, p22).
>
> "Taken together, these observations seem to support that ***the populations tested are temporally stabile*** [sic] and that non-random sampling was not a significant problem in this study." (Final Genetics Report, p. 30).

Temporal homogeneity of allele frequencies within locations is a fundamental assumption for analysis of differences among localities (e.g., Allendorf and Utter, 1979; Gold et al, 1999; Tessier and Bernatchez, 1999). When there is significant temporal heterogeneity in allele frequencies within localities, it is difficult or impossible to correct for this source of error when evaluating overall variation. Such variance confounds geographic analysis. Despite claims of stability, in the analysis of the Final Genetics Report, virtually all tests of temporal stability within populations that the authors themselves performed were highly significant (Final Genetics Report, Tables 14G, 14H, 14I, 14J, 14K, 14L, 14N, 14O, & 14P, Appendix A, C1, C2). For example, in the comparison between Cove Brook samples in 1994 and 1995 (Final Genetics Report, Appendix C2), highly significant heterogeneity was demonstrated. This had been previously noted in ad hoc review of the Preliminary Genetics Report, but was not adequately addressed in the Final Genetics Report. The a posteriori tests presented in the Final Genetics Report were selective; some of the available comparisons were not presented. For example, for the East Machias River, many of the temporal comparisons were also significant (Table 1).

In the data set under examination, because of highly significant variation among frequency estimates for the same population made at different times, no valid inferences can be made regarding the divergence among different river samples. Further, given (1) these extensive temporal differences, (2) the absence of any examination of temporal variation in Canadian samples, and (3) the fact that hatchery obtained Canadian samples originated from rivers which themselves had long-term stocking histories, it is incorrect to assert that there is significant heterogeneity between samples of Atlantic salmon from Maine and samples Atlantic salmon from the Canadian mainland.

iv. Extensive errors were associated with the scoring of genotypes of individuals at microsatellite loci.

a. Allelic dropout (difficulty in detecting high mobility alleles in heterozygotes) is extensive at one locus. One additional allele is present in many populations but was not recognized. This compromises the use of that locus in all calculations that made use of it in the Final Genetics Report.

Table 1. Heterogeneity tests for 12 microsatellite DNA loci for population samples of the East Machias River between 1993 and 1995. Original data from the genotypic matrix used in the Final Genetics Report were analyzed using GENRPOP (Raymond and Rousset, 1995).

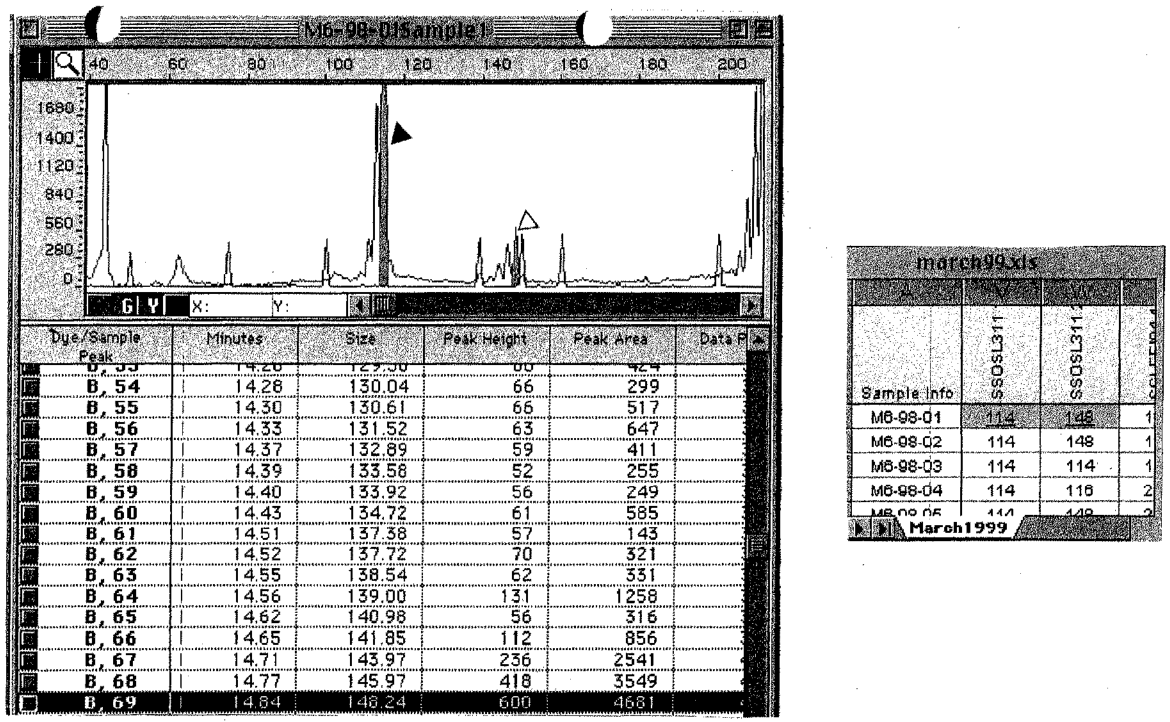
locus	1993- 1994	1994-1995	1993-1995
SSOSL438	0.462	0.5145	1.00
SSOSL25	0.563	0.0204	0.0076
SSOSL85	0.0222	0.0011	0.2100
Ssa289	0.1638	0.0532	0.1033
SSOSL311	0.4450	0.2797	1.000
SSLEEI84	0.0027	0.0011	0.6284
Sssa85	0.0000	0.0004	0.3408
Sssa171	0.0000	0.0000	0.0000
Sssa202	0.6838	0.6166	0.6838
SSLEEN82	0.5179	0.3076	0.5175
Ssa197	0.2470	0.0722	0.4486
Ssa14	0.0002	0.0171	0.0911

Allelic dropout (Tully et al., 1993; O'Reilly et al., 1998) exists at locus SSOSL311 for allele 148. This allele was scored in some individuals, but is present in several additional populations. For example, it is present and recognized in Felts Brook (Figure 1): M6-98-01 has an assigned genotype of 114/148 (with relative fluorescence of 5822 for allele 114, 600 for 148, and ~500 for an adjacent standard). However, it is present but not recognized in the East Machias River (Figure 2): M2-95-18 has an assigned genotype of 114/114 (with peak heights of 3630 for allele 114, 330 for allele 148, and ~500 for an adjacent standard). Reanalysis of the GeneScan data used in the Final Genetics Report demonstrates that allele 148 at locus SSOSL311 occurs in other rivers than those listed; in the East Machias, the allele has a frequency of approximately 10%. This is additionally significant with respect to interpretation since allele148 at locus SSOSL311 had been identified with other "Rare or unique alleles" in Table 7c. More generically, allele dropout has been recognized at other loci (O'Reilly et al., 1998), but that study only examined four of the twelve loci used in the Federal study

b. The use of identical color labels in runs for loci with overlapping allelic ranges resulted in extensive incorrect assignment of alleles. This is another systemic error that compromises analyses in the Final Genetics Report that used these loci.

In the study detailed in the Final Genetics Report, multiple loci were routinely characterized simultaneously in the same ABI 310 injection run. Scoring errors were generated because loci with overlapping allelic ranges used an identical fluorescent dye to label alleles. Assignment errors were made for at least three microsatellite loci: Ssa171, Ssa197, and Ssa202. In these cases, loci used fluorescent green (tet) to label overlapping alleles (Table 2). For example, in the Machias River, sample M1-95-08, was scored simultaneously at loci Ssa171 and Ssa197, and had reported genotypes of 199/231 and 172/200, respectively. However, inspection of the GeneScan pattern for this sample shows that a single peak was scored for two different alleles (199 and 200) at different loci, and additional peaks were ignored (Figure 3). Thus, there are many possibilities for the correct genotypes for this individual including: 199/199 & 172/232, 199/231 & 172/172. Similarly, genotypes were arbitrary for individuals scored simultaneously for loci Ssa171 and Ssa202. For example, in the Gander River, sample C12-94-21 had assigned genotypes of 227/251 and 246/294 for Ssa171 and Ssa202, respectively. However, since allelic ranges for those loci overlap, the correct genotypes could be quite different. Figure 4 presents the GeneScan results for that individual and for others in that sample injection with similar problems.

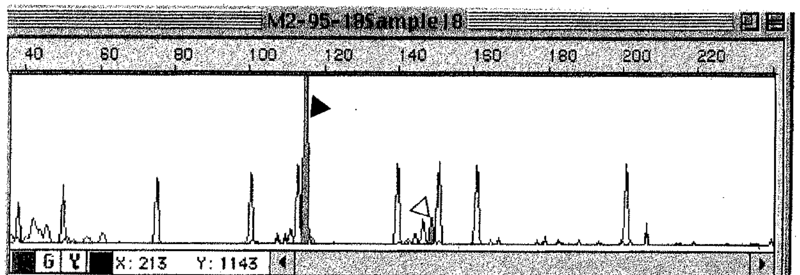
While USGS personnel appear to have been aware of this class of errors (modifications were implemented for runs involving the Penobscot River sampling), the errors present in the Final Genetics Report were not noted nor corrected. However, scoring errors for these loci were common in the North American data. Because of their extent, it is both incorrect and misleading to include results from these loci in calculations of divergence. Note than the correct assignment of alleles can not be accomplished



Dye/Sample Peak		Minutes	Size	Peak Height	Peak Area	Data P
B, 54	I	14.28	130.04	66	299	
B, 55	I	14.30	130.61	66	517	
B, 56	I	14.33	131.52	63	647	
B, 57	I	14.37	132.89	59	411	
B, 58	I	14.39	133.58	52	255	
B, 59	I	14.40	133.92	56	249	
B, 60	I	14.43	134.72	61	585	
B, 61	I	14.51	137.38	57	143	
B, 62	I	14.52	137.72	70	321	
B, 63	I	14.55	138.54	62	331	
B, 64	I	14.56	139.00	131	1258	
B, 65	I	14.62	140.98	56	316	
B, 66	I	14.65	141.85	112	856	
B, 67	I	14.71	143.97	236	2541	
B, 68	I	14.77	145.97	418	3549	
B, 69	I	14.84	148.24	600	4681	

Sample Info	SSOSL311	SSOSL311	
M6-98-01	114	148	1
M6-98-02	114	148	1
M6-98-03	114	114	1
M6-98-04	114	116	2

Figure 1. Allelic dropout at locus SSOSL311. In this individual from Felts Brook (sample M6-98-01), the sample is recognized as a heterozygote and assigned alleles 114 (solid arrow) and 148 (open arrow). Note the relative peak heights of the two alleles. Compare this to the allele assignment in Figure 2. GeneScan data from DOI.



Sample Peak	Minutes	Size	Peak Height	Peak Area	Data Point
B, 17	13.92	114.36	3630	22453	3794
B, 18	13.98	116.22	94	727	3811
B, 19	14.79	141.63	65	353	4033
B, 20	14.85	143.77	133	841	4050
B, 21	14.92	145.92	305	1654	4067
B, 22	14.98	148.08	330	2044	4084
B, 23	15.01	149.23	52	67	4093
B, 24	15.44	163.84	66	90	4209
B, 25	15.50	165.93	74	107	4226
B, 26	15.88	178.53	70	155	4331
B, 27	16.54	198.79	61	93	4509

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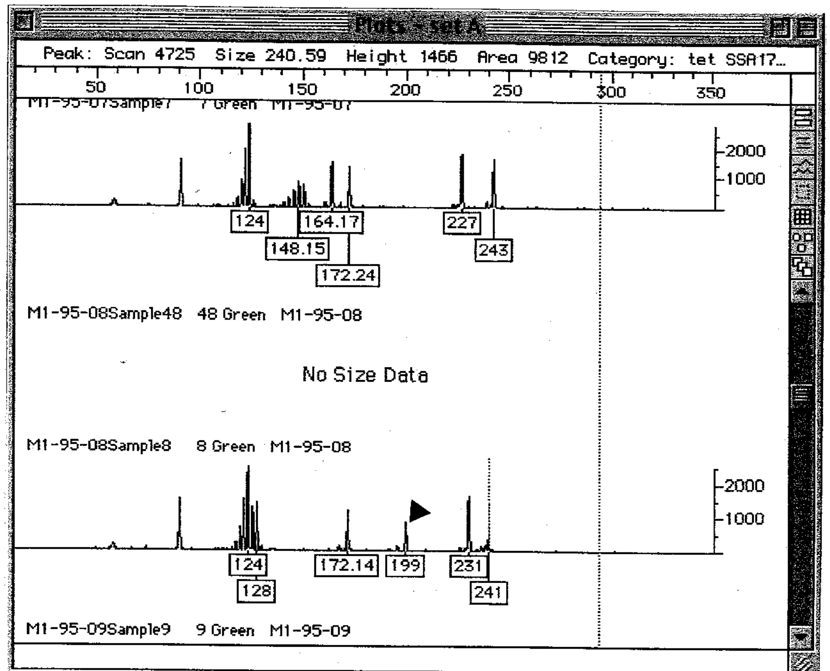
	A	V	W
1	Sample Info	SSOSL311	SSOSL311
809	M2-95-14	114	114
810	M2-95-15	114	116
811	M2-95-16	114	114
812	M2-95-17	114	116
813	M2-95-18	114	114
814	M2-95-19	114	114
815	M2-95-20	114	114
816	M2-95-21	114	114
817	M2-95-22	114	114

Figure 2. Allelic dropout at locus SSOSL311. In this individual from the East Machias River (sample M2-95-18), the sample is recognized as a homozygote and assigned allele 114 (solid arrow). Allele 148 (open arrow) is also present. The correct genotype of this heterozygote is 114/148. Note the relative peak heights of the two alleles. Compare to Figure 1. GeneScan data from DOI.

Table 2. Allelic overlap for loci examined simultaneously using the same color dye.

Alleles	Ssa171	Ssa197	Ssa202
199,200	199.2-200.2	199.0-200.7	
203,204	202.2-203.6	203.0-204.2	
207,208	206.4-208.15	207.0-208.2	
211,212	210.2-211.7	211.0-212.4	
215,216	214.0-215.4	215.0-216.2	
219,220	218.4-219.85	218.2-219.8	
223,224	222.4-223.4	222.2-224.0	
228,229	227.8-229.6	226.6-228.2	228.8-229.6
231,232	230.2-231.4	231.0-232.6	
235,236	234.0-235.2	234.0-236.0	
237,238	236.0-237.3		236.0-238.0
239,240	238.0-239.4	238.2-241.4	
243,244	242.0-243.3	241.8-245.4	
245,246	243.8-245.2	241.8-245.4	244.0-246.6
247,248	246.2-247.2	247.0-248.2	
249,250	248.1-249.6		248.2-250.6
251,252	250.0-251.2	250.5-252.0	
253,254	252.0-253.0		252.6-254.6
255,256	254.0-255.0	254.5-256.0	
257,258	256.0-257.2		256.4-258.6
259,260	258.15-259.0	258.6-260.6	
262,263	262.0-263.2		260.8-262.6
266,267	266.6-268.25		265.0-267.0



march99.xls

	A	D	E	F	G	H	I	J	K
1	Sample Info	SSA171 1	SSA171 2	SSA197 1	SSA197 2	SSA202 1	SSA202 2	SSLEEN82	SSLEEN82 2
683	M1-95-06	235	237	172	180	294	306	222	222
684	M1-95-07	227	243	164	172	306	310	204	222
685	M1-95-08	199	231	172	200	278	294	216	222
686	M1-95-09	229	241	164	172	290	310	220	222
687	M1-95-10	233	259	164	172	286	310	220	222

March1999

Figure 3. Ambiguous genotype assignment for different loci using identical fluorescent dyes. For an individual from the Machias River (M1-95-08), the indicated peak (arrow) was scored both as allele 199 and 200; multiple green peaks could have been scored as alleles for other samples (individual M1-95-07, above).

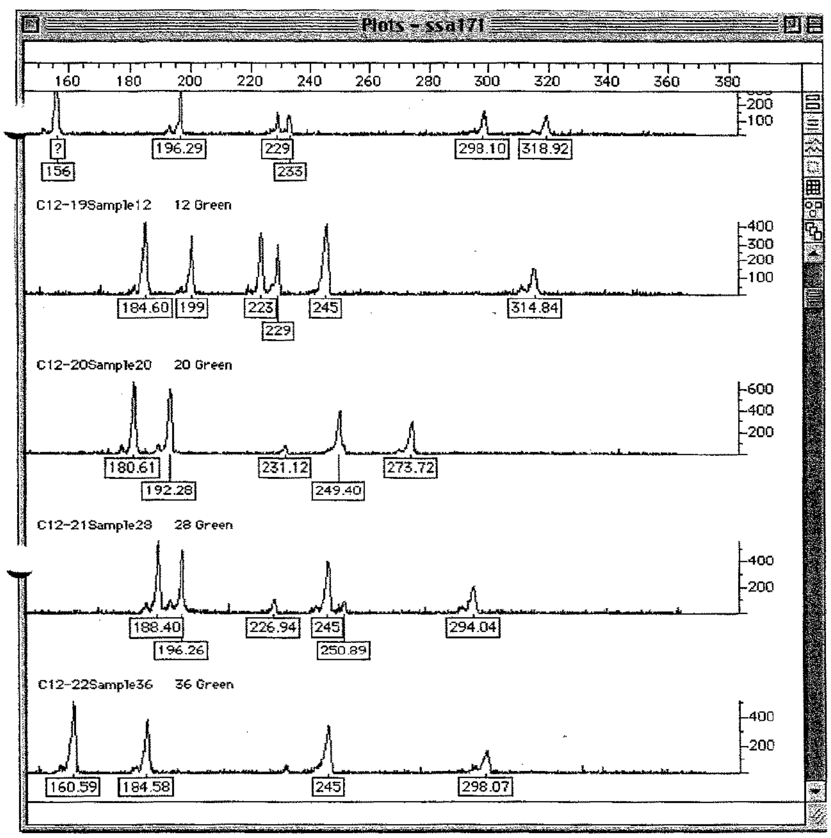


Figure 4. Arbitrary assignment of alleles for individuals scored simultaneous for Ssa171 and Ssa202. Individual C12-94-21 from the Gander River was scored as heterozygous at both loci: 227/251 and 246/294. However, since allelic ranges for these loci overlap (Table 2), additional allelic combinations are possible.

from re-analysis of the GeneScan profiles but instead requires that loci be rerun with a different design in order to distinguish genotypes.

c. The categories established in the Genotyper template file have significant errors that compromise consistent assignment of genotypes.

For two loci, sequential categories overlap in range making assignment of alleles arbitrary.

Ssa289

"107 Highest peak from 107.50 to 109.00 bp
109 Highest peak from 108.80 to 109.40 bp"

SSOSL311

"142 Highest peak from 140.80 to 142.60 bp
144 Highest peak from 142.50 to 145.00 bp"

In the case of Ssa289, allele 109 is identified as one of the "Rare or unique alleles observed in Maine Rivers" (Final Genetics Report, Table 7c), yet assignment of this allele can not be done in an objective manner with the category definitions that were employed (Figure 5). Similarly, for locus SSLEEI84, the upper and lower limits for sequential categories were shared for many alleles; given category definitions, minor mobility fluctuations created arbitrary allele assignments.

d. Assignment of alleles for the microsatellite locus Ssa202 did not conform to the requirements specified by the GeneScan software program.

The Federal study reported in the Final Genetic Report assigned microsatellite allele sizes to GeneScan peaks using the Local Southern Method. This size calling algorithm requires that two size standards are smaller than the unknown fragment of interest and that two size standards are larger than the unknown peak of interest (Perkin-Elmer, 1996). This is emphasized by the manufacturer (Perkin-Elmer) in the GeneScan Reference Guide under Sizing and Size Standards.

> "**IMPORTANT** For the Local Southern Method to work, you must have at least two size standard fragments larger than your largest unknown fragment" (no emphasis added) (Perkin-Elmer, 1997, p.5-2).
>
> "**IMPORTANT** Choose a size standard such that there [are] at least two size standard fragments larger than your largest unknown fragment." (no emphasis added) (Perkin-Elmer, 1997, p.5-7).

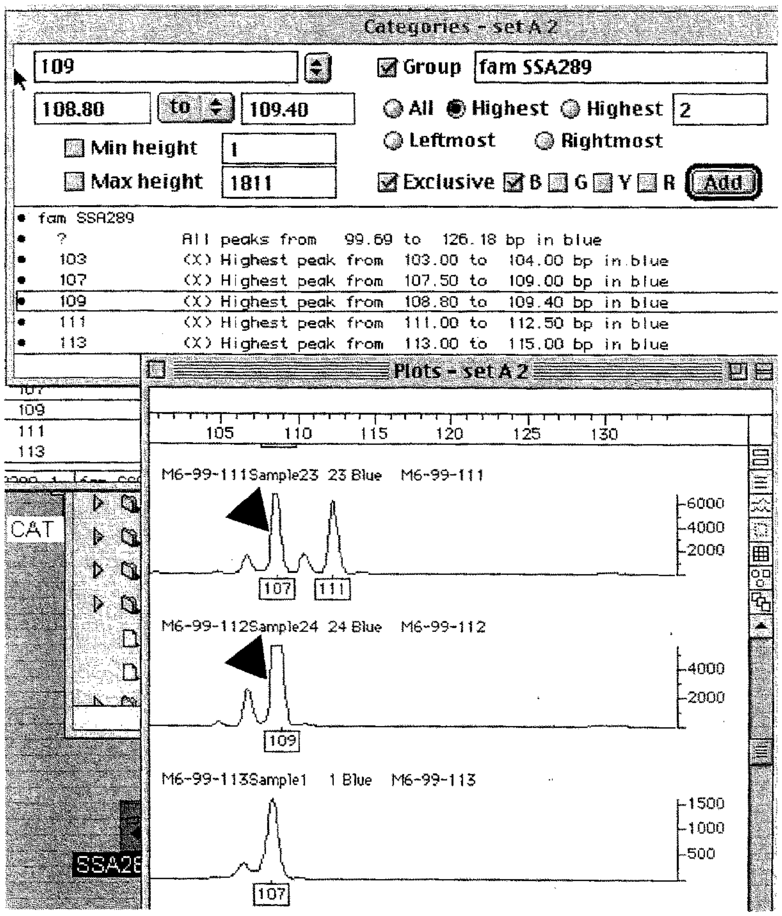


Figure 5. Arbitary assignment of alleles 107 and 109 for locus Ssa289 in samples of Atlantic salmon from the Penobscot River. Note that in two individuals (M6-99-111 and M6-99-112) different allele sizes are assigned for the same peaks (arrows). Overlap in categories for 107 and 109 appear in the template file (above). GeneScan data from DOI.

The Federal study used the GeneScan 500 set of size standard in their injection runs, but read only up to the 350bp size standard. In the size range from 300bp to 350bp, the study defined the 300bp size standard peak and the 350bp size standard peak, but they did not define the 340bp size standard peak. Thus, for the microsatellite locus Ssa202, alleles between 300bp and 350 bp were not assigned in accord with the requirements of the software programs utilized. This includes over 30% of the alleles at this locus: 302, 306, 310, 314, 318, 322, 326, and 330; some of these alleles occurred in high frequency. These alleles are important for two reasons. First, the largest reported allele at this locus, 330, was putatively unique for Dennys River (where it occurred with frequency of 7%). This 330 allele could, in reality, be another allele already identified in other populations, e.g., 326; it would thus not be "unique" and would not support the contention of distinctiveness of the Dennys population. Second, Ssa202 alleles in the range from 300-350 contributed to the presumed divergence of populations; changes in allele frequencies could alter conclusions about affinities.

e. Homology among alleles was assumed but not tested. Alleles with identical mobilities are presumed to be identical by descent but may have independent origins. North American salmon of putatively "European" origin may have arisen independently.

Microsatellite loci are highly variable because they can mutate at rates more frequent than other classes of markers used in population studies. Most mutations are viewed as step-wise events that change alleles in single steps corresponding to the size of the repeat unit (Estoup and Angers, 1998). For example, at a dinucleotide repeat locus, mutation of a '150 basepair' allele may produce a '148bp' or a '152bp' allele. Molecular and population biologists are acutely concerned with this process since alleles with identical mobilities which arise independently provide false homology (e.g., Estoup et al., 1995; Garza and Freimer, 1996). This process is exacerbated with microsatellite markers that have complex repeat structure resulting in alleles with sizes that do not conform to uniform steps (such as at locus SSOL85). In addition, alleles can independently converge on the same mobility if they accumulate substitutions in the regions flanking the microsatellite repeat. In Atlantic salmon, Angers and Bernatchez (1997) identified such convergence in microsatellites through careful breeding studies. In the Final Genetics Report it is likely that such convergence is present. For example, at locus Ssa14, allele 145 was reported in two individuals in the St. Croix sample and in one individual (a single allele) in one collection from Spain (out of a total of 166 Spanish alleles). This allele was absent from all other European, North American and aquaculture collections. The distribution and rarity of this allele suggests convergence. Similarly, at locus Ssa85, Cove Brook and the Kunduskeag Stream share allele 150 which is not present in any other North American samples, is absent from all aquaculture samples, but occurs sporadically in a few European collections. Again, there is a reasonable likelihood that these alleles are not identical by descent; similarity is thus misleading. For the Final Genetics Report to claim the occurrence of "European" alleles in Downeast rivers represents introgression of European-origin aquaculture fish is likewise misleading.

v. Alleles putatively "unique" to Downeast rivers occur in other populations. This allelic "uniqueness" was repeatedly emphasized by the Services to infer evolutionary significance. There is no indication that these rivers are discrete or evolutionarily significant.

"Recent survey work also indicates that a naturally producing population that is ***genetically distinct*** (***alleles only found in that population***) remains in Cove Brook as well (Buckley 1999; King et al., 1999)." (Status Review, p. 43)

"However, the temporal stability of allele frequencies and ***the occurrence of alleles that are unique to Maine*** indicate that this mixing has not overwhelmed all of the genetic differences between stocks (King et al. 1993; King et al. 1999)." (Proposed Rule, p. 50).

"Unique" microsatellite alleles were identified in the Final Genetics Report (Table 7c) from multiple sample collections in Maine and elsewhere. Such genetic variants were central to inferring the discreteness and evolutionary significance of Maine salmon. These "unique" alleles included several that were purportedly characteristic of individual rivers, thus demonstrating their evolutionary significance as distinctive and reproductively isolated. However, the detection of such genetic variants is absolutely dependent on sample size: inadequate sampling will miss such alleles in other areas, particularly if their frequencies are low. Because of the very limited sample sizes for most populations, such alleles were likely missed. For example, most of these alleles were not seen in repetitive sampling of the same body of water, e.g., the "unique" alleles defined for Cove Brook were not present in multiple samples, and "unique" alleles defined for the East Machias were absent from tributaries sampled in the same year. In addition, putative "unique" alleles for some locations had been already identified in other studies of North American salmon: in Cove Brook, the "unique" alleles 273 and 275 for locus Ssa171 were found in Canadian population samples from the Natashquan River (Fontaine et al., 1997). Further, because of technical errors in allele assignment summarized above, numerous "unique" alleles were not correctly identified, e.g., allele 148 at locus SSOL311, presumably restricted to the Penobscot drainage in Maine was present in high frequency in the East Machias River. Identical sampling arguments apply to the unique mitochondrial DNA (mtDNA) composite haplotypes identified in the Final Genetics Report (1999, Table 3a). For example, in the Narraguagus River, mtDNA haplotypes were restricted to single collections and were absent from other sample locations within that river during the same sampling period. Coupled with systemic errors in the laboratory work previously described, and sampling issues associated with "rare alleles", inferences made based on "unique" alleles are suspect.

vi. Atlantic salmon in Maine rivers can not be distinguished from those in nearby Canadian waters. Presumed "subtle distinctions" are not statistically supported.

The distinctiveness of Maine Atlantic salmon viz. Canadian populations was examined with a variety of techniques in the Final Genetic Report. All of the assessments depended on the correct assignment of individual genotypes. However, errors associated with genotype assignment, temporal instability, and non-random sampling compromised the utility of the microsatellite data set for statistical analysis.

> "However, it should be noted that although the number of loci (12) is good by current standards, the variable and often small sample sizes may have distorted the tree topology, making the value of the tree questionable in any event." (Ad hoc reviews of King et al., 1997: Reviewer 3)

Absent the errors noted above, there are significant misrepresentations in the interpretation of data as presented in graphical form in the Final Genetics Report. Both the results from analysis of mitochondrial DNA variation and microsatellites were presented as phenograms. In the mitochondrial tree (Final Genetics Report, Fig. 1), samples from Canadian locations clustered within groups containing samples from Maine and vice versa. However, the phenogram did not contain any confidence limits for the tree topology. Thus, no relationships were statistically supported as depicted. In the microsatellite phenogram (Final Genetics Report, Fig. 3), statistical support in the form of bootstrap values was presented. However, since significance of topology is generally recognized only for values greater than about 75% (Hillis and Bull, 1993; see Swofford et al. (1996) for discussion), the only relationship with significance is between European and North American samples. Based on biogeographic considerations (Whittaker, 1998), it is surprising that population samples from Newfoundland did not have higher support; in genetic studies of other fishes, that island is distinctive (e.g., Ruzzante et al., 1998). Regardless, virtually all of the relationships among samples from continental North America could not be distinguished.

Related individuals in the data, noted above, strongly bias the use of assignment tests. That is, individuals are more likely to be assigned back to groups containing their close relatives, regardless of river affinities. Microsatellite loci are particularly sensitive to this bias. In addition, the values reported for assignment tests indicate a lack of sensitivity for samples within Maine, within Canada, and between theses areas (Final Genetics Report, Tables 16 and 17). For example, in Maine and geographically proximate Canadian regions (Nova Scotia and New Brunswick), approximately 25% of individuals were not corrected assigned. Assignment with regions was particularly variable, with correct assignments as low as 10% in some Maine samples (Final Genetics Report, Table 19).

3. Alternative explanations (hypotheses) for observed data are not addressed in the Final Genetics Report, in the Status Review, or in the Proposed Rule.

A. **Very small population sizes, genetic drift, and inbreeding are most probably the principal causes of observed differences.** If genetic differences are principally due to stochastic changes in allele frequencies associated with small population sizes, differentiation of Atlantic salmon among coastal North American rivers is of no evolutionary significance. Consideration of this explanation was conspicuous by its absence.

Analysis of population genetic data rests upon evolutionary theory that determines the appropriateness of analytical perspectives and methodologies. The foundation underlying population genetics theory is the balance among evolutionary forces that serve to impact genetic variation. These forces are selection, mutation, migration, and genetic drift. The interaction of these elements determines the patterns that can be perceived by genetic analysis and the inferences that can be drawn. Indeed, contemporary analysis is explicitly based on examination of their interactions, e.g., Hartl and Clark, 1997. While mitochondrial and microsatellite DNAs are routinely viewed as selectively neutral, the other forces can exert considerable pressure. Mutation is a significant force determining alleleic variation for microsatellites, but its effect in a proximal time context, such as that applied here for Atlantic salmon, is probably unimportant (O'Reilly et al., 1998). However, genetic drift and gene flow are demonstrably significant variables molding the evolutionary history of salmonid populations (e.g., Fountaine et al., 1997; Jorde and Ryman, 1996; Tessier and Bernatchez, 1999). Population size is of critical significance because very small populations can be subject to the effects of genetic drift, a random and unpredictable process. In the Final Genetics Report, the absence of consideration of the fundamental evolutionary forces underlying population genetics, particularly population size, compromised the ability of the investigators to understand the implications of the data that were gathered. As Hansen and Mensberg (1998) concluded in their genetic study of brown trout, "Tests for nonrandom geographical distribution of phylogenetic groups of haplotypes showed that drift and gene flow are probably the predominant factors affecting the[ir] distribution."

The most remarkable aspect of the Final Genetics Report and the Status Review is the failure to consider genetic drift. This is remarkable because ad hoc reviewers made explicit recommendations that genetic drift and bottlenecks should be discussed, and the data produced by the Services themselves all point to its occurrence. Indeed, drift provides a unified, compelling explanation for the genetic observations: they are illusionary and do not provide evidence of discreteness and significance. Instead, the pervasiveness of genetic bottlenecks strongly suggests that design of the restoration program itself be critically re-evaluated.

> "It would be appropriate to provide a brief discussion of the possible effects of genetic bottle necking as a result of the continual low numbers of spawners in most rivers." (Ad hoc reviews of Draft Status Review (1995): Reviewer A, pg. 002475)

> "It is a quantum leap to conclude that because salmon have had a "continuous presence" in the seven Downeast Rivers they currently represent an ESU of "wild" salmon with important local adaptations. This is an extremely conservative assumption considering the historical genetic "bottlenecking" that likely occurred, and is currently occurring…" (Ad hoc reviews of Draft Status Review (1995): Reviewer B, pg. 002517).

> "The flaw is that the "wild" remnant stocks probably have no relationship to native stocks, but are the end product of bottlenecking and the influence of stocking." (Ad hoc reviews of Draft Status Review (1995): Reviewer B, pg. 002524).

From census data provided in the Status Review, it is readily apparent that populations in Maine are exceedingly small in size; the same is true for many Canadian rivers. Estimated effective population sizes (Crow, 1954) for four Maine rivers were less than 10 individuals (Table 3). Effective population is of importance because it is this size, not census size, which determines the magnitude of genetic drift. Effective size and the magnitude of drift are inversely related. Note that if a metapopulation model is appropriate for Atlantic salmon, effective population sizes so estimated need modification (Hedrick and Gilpin, 1997). Regardless, these are probably dramatic overestimates since effective population sizes in salmonids constitute only 10-20% of individuals actually encountered in a census (Hedrick et al., 1995). Thus, many, if not most, current populations are of the size where random sampling events can alter allele frequencies. Further, such genetic bottlenecks most probably occurred in the past. In addition to salmon in rivers, bottlenecks also probably occurred in hatcheries where limited numbers of adult broodstock were used for supplementation efforts.

The utility of microsatellites for characterization of effective population size (Ne) and detection of genetic drift has been reviewed by Estoup and Angers (1998). As they noted, Ne is among the most important parameters in conservation biology because it determines "…the potential for long-term maintenance of genetic variability (Simberloff, 1988)." Indeed, genetic measures such as F_{st} and R_{st} focus on changes generated by genetic drift (Goldstein and Schlotterer, 1999). Microsatellites have demonstrated extreme utility for characterizing population events, and a variety of methods are available for the estimation of Ne (see Beaumont and Bruford [1999] for discussion). Analysis of temporal variation in allele frequencies, an approach pioneered by Waples (1989) to estimate Ne, has been used in many investigations, e.g., Jorde and Ryman, 1996 in brown trout. This method exploits variation generated by drift, as the amount of variation from year to year is mathematically related to the effective population size. From this perspective, the prevalence and magnitude of temporal fluctuations in allele frequencies in the Final Genetics Report. (Tables 14G, 14H, 14I, 14J, 14K, 14L, 14N, 14O, & 14P, Appendix A, C1, C2) suggests extensive genetic drift. Given ad hoc broodstock management practices in the past, it is extremely probable that bottlenecks occurred in hatchery operations as well.

Table 3. Estimates of effective population size (Ne) for Maine Rivers using harmonic means of census sizes for the period 1970-1998. Note that if a metapopulation model is appropriate for Atlantic salmon, effective population sizes so estimated need modification (Hedrick and Gilpin, 1997). Data from Status Review.

	Dennys	East Machias	Machias	Pleasant	Narraguagus	Ducktrap	Sheepscot
No. years examined	29	24	24	25	29	9	28
Maximum size	68	46	226	38	244	9	35
Minimum size	0	0	0	0	22	0	0
Ne	6	5.41	7.83	3.15	49.71	19.29	12.3

In addition to erosion of genetic variation and changes in allele frequencies due to genetic drift, one of the correlates of extremely small population sizes is a high probably of close inbreeding. As noted above, very closely related individuals were identified in many collections. In salmonids, close inbreeding has been demonstrated by numerous workers to result in inbreeding depression (reviewed in Thornhill, 1993). For example, Kincaid (1983) demonstrated inbreeding depression for egg and fry survivorship, growth and feed conversion in *Oncorhynchus mykiss*. These observations are consistent with those observed in other fishes and anticipated from basic theory (Falconer and Mackay, 1996; Lynch and Walsh, 1998).

It is difficult to separate the effects of genetic drift *sensu stricto* from those produced by inadequate sampling of loci that are highly variable. However, an examination of those microsatellite markers that have low allelic diversity may be instructive in this regard since they may not be as susceptible to the influences of population sampling effects. Thus, for example, the differences observed in the Cove Brook 1995-1996 comparison for SSOSL438 (with 4 alleles) is significant as are the Bond 1994-1995 comparisons for Ssa14 (with 3 alleles) and SSLEEN82 (with 7 alleles) (Final Genetics Report, Appendix C2). Such observations are consistent with the presence of genetic drift. However, the effects of deviations resulting from non-random sampling (localized collections of closely related individuals) makes absolute interpretation of such results problematic.

Most important is the recognition that genetic drift affects quantitative traits as well as the genetic markers used to characterize populations. Because of this, there can be rapid, random changes in life history attributes considered important to local adaptation, to the extent that the variation in these traits is genetically based. Such drift induced stochastic phenomena could include changes in precisely those characteristics that may be critical to adaptation and population recovery. The effect of drift on life history characteristics can thus counteract the effects of multiple generations of adaptive selection, in essence erasing local adaptations and causing shifts in life history traits that may be detrimental to the long-term viability of the population. Coupled with the propensity for inbreeding and the cumulative impact of inbreeding depression on life history traits, the maintenance of a large number of broodstock is critical. Thus, it is critical that the restoration program itself be re-evaluated.

B. Explicit population models were not considered in the Genetics Study, Status Review or Proposed Rule. The models used, and the statistical inferences based upon them, must be chosen judiciously, particularly when making estimates of gene flow (Bossart and Prowell, 1998).

In the context of population analysis, it is critical that appropriate models of population structure be identified to validate the use of descriptive statistics. The perspective used in analysis in the Final Genetics Report assumed an "island model", but this was incorrect since equilibrium conditions required for this model could not be reasonably satisfied.

"…it is worth noting that the "migration rates" among populations which are calculated in the report are really just transformations of the gene frequency data. They are based on equilibrium assumptions which could not be even approximately valid for these populations." (Ad hoc reviews of King et al., 1997: Reviewer 5)

"The emphasis given to gene flow (Nm) estimates is also of doubtful significance."
"This is also another example of why gene flow estimates based on haplotype/allele frequencies are of dubious value." (Ad hoc reviews of King et al. (1997) Reviewer 3)

The use of an island model in the Final Genetics Report was unfortunate since isolation-by-distance models have been repeatedly recognized as important in understanding the biology of salmon, e.g., Koljoen et al., 1999. Isolation-by-distance means that geographically adjacent populations are more similar to each other than they are to more distant population. For selectively neutral markers, this pattern usually implies the presence of gene flow. Payne (1974) demonstrated a significant latitudinal cline in the frequency of a transferrin allele among North America populations of Atlantic salmon; Moller (1970) had previously analyzed transferrin variation, but Payne (1974) convincingly demonstrated this earlier analysis was incorrect. The clinal pattern of divergence in transferrin alleles, although consistent with an isolation-by-distance model, may have been caused by selection (Payne, 1974). Indeed, sequence analysis of transferrin from Atlantic salmon and three related taxa now strongly supports the role of natural selection (Ford et al., 1999). Given isolation-by-distance, in the absence of comparisons involving geographically intermediate locations, disjunct sampling may be misleading. For example, in a study examining divergence between salmon from Maine and Newfoundland, significant differences were observed between those locations (Bentzen and Wright, 1992). However, that investigation did not include comparisons involving mainland Canadian populations which are contiguous with Maine.

The data in the Final Genetics Report appear consistent with an isolation-by-distance model. In a recent analysis of the Atlantic salmon microsatellite data by Letcher and King (1999), the pattern of spatial divergence was clear: the monotonic cline in population divergence with collection locality suggested isolation-by-distance (Letcher and King, 1999, Fig. 5).

More recently, metapopulation models have been advocated to understand salmonid dynamics (National Research Council, 1996). The genetics of metapopulations, particularly with regard to effective population sizes, was reviewed by Hedrick (1996) and by Hedrick and Gilpin (1997). In a previous evaluation of Atlantic salmon genetics, Kornfield et al. (1995) suggested that a metapopulation model might be appropriate for Atlantic salmon populations in Maine. In presenting that model, the role of the Penobscot River as a central, continuous source that seeded other populations was stressed. However, in view of the probability that substantial bottlenecks in hatchery propagation may have repeatedly occurred, the role of the Penobscot in any metapopulation model merits scrutiny. In particular, the effective population size of the Penobscot may have been small and allelic variation may have been substantially reduced by genetic drift.

Regardless, a metapopulation perspective should be evaluated (but see Fontaine et al., 1997).

4. Genetics of Life History Traits

Arguments and genetic inferences based on variation in quantitative, life-history traits were articulated in the Status Review; this information was subsequently used in the Proposed Rule to List Atlantic Salmon as an Endangered Species. The Services made the arguments that: (1) life history differences of Atlantic salmon exist between Maine rivers and those in Canada, (2) these traits have a genetic basis, and (3) thus the differences in life history characteristics are indications of important distinctiveness.

"Isolation typically leads to genetic differences among Atlantic salmon stocks and relatively minor genetic differences have been linked to important adaptive morphological and life-history traits (Ritter 1975; Saunders 1981)." (Status Review, p. 48)

"Since age-at-maturity appears to be a trait that is least partially genetically determined (Glebe and Saunders 1986; Ritter et al. 1986; Saunders 1986), this provides further evidence of separateness of U.S. and Canadian Atlantic salmon populations." (Status Review, p. 49)

"Alternately, many Canadian stocks and several in Europe have a much higher grilse component with a concurrently lower 2SW component that is frequently less than 50% (Hutchings and Jones 1998). This life history trait is partially controlled by stock genetics (Ritter et al. 1986)." (Status Review, p. 56).

"Since the proportion of 2SW fish in an Atlantic salmon stock has a documented genetic basis (Glebe and Saunders1986; Ritter et al. 1986; Hutchings and Jones 1998), the BRT concludes that the DPS has unique life history characteristics that have a heritable basis." (Status Review, p. 57)

There are indeed geographic differences in North America for traits such as age to maturity and proportion of individuals that mature at age one (grilse) versus later (2SW) fish. However, there is no evidence that such life history characteristics are either "unique", or that differences are primarily genetic in origin.

Individual rivers in New England and the Maritimes exhibit substantial variation in the characteristics of returning adults. In particular, grilsing rates are highly variable over time for any specific location. For example, during the period from 1981 to 1998, grilsing rates of wild salmon in the St. Croix ranged from 0 to 100%, but were under 20% for 4 of 17 years. In the Penobscot during the same period, grilsing rate ranged from 2 to 36%, but was over 20% for 5 of 17 years (1999 Annual Report of the US Atlantic Salmon

Assessment Committee, Table 3.2b). Similarly, Saunder et al. (1983) noted that grilsing ratios varied by an order of magnitude within stocks. The same extent of variation exists for age at smoltfication within rivers. For example, for Cove Brook, Meister (1958, p.117) noted:

> "Fluctuations in water temperature, competition, and abundance of age classes may influence the age of smolts for any stream and tend to disprove that age of smolt is typical for each stream. The smolt migrants of 1956 were predominately 1+ as compared with the 2+ age class composition of the 1957 runs."

Variation in quantitative traits, such as life history characters, has two principal causal components: genetic variance and environmental variance. Phenotypic variance, the total variation observed in a trait, is the sum of the two. Genetic variance results from the variability of heritable genes on the resultant phenotype between individuals, while environmental variance refers to the effects of the environmental conditions. Some examples of environmental conditions are water temperature, food availability and quality, competition, etc. Through controlled breeding or selection experiments, it is possible to quantitatively estimate the contribution that genetics makes to the phenotypic variance; Lynch and Walsh (1998) provide a comprehensive review of the subject. While many quantitative traits have measurable genetic variance components, such variation may be small relative to the influences of the environment. One can not simply take observed differences of traits between populations that are reared in different environments to mean that the two populations differ genetically, because the observed trait values are confounded by the differing environments in which the genes influencing those traits are being expressed. For example, in most organisms, including humans, weight has a measurable genetic variance component, but it is clear that the abundance and quality of food (environmental effects) contribute most to the observed variation among different phenotypes, or traits. In Atlantic salmon, both observational and experimental evidence indicate that the life history attributes of adaptive significance that putatively differentiate Maine fish from those of other areas are environmental, rather than genetic in origin. Early field studies provided compelling evidence of environmental affects.

> "It is difficult to separate the effects of inherited habits from the influence of new and different surroundings on the growth or behavior of salmon. In at least two cases of which we have record the effects of planting fry in a strange river has produced habits of a decidedly different character from those of the parent fish. One of these cases occurs in the Penobscot, which is stocked with fry from Miramichi salmon. In their native river (Blair 1934) the Miramichi smolts migrate as follows:
>
> As two-year fish - 15.1 percent
> As three-year fish - 78.1 "
> As four-year fish - 6.6 "
> As five-year fish - .2 "

Transported in the Penobscot they change their habits and migrate as follows:

As two-year fish - 89.0 percent

As three-year fish - 11.0 "

In this case the Penobscot River environment apparently overcomes the inherited instincts of the fish and sends them to sea a year earlier than the parent stock of the Miramichi.

In one other case Dr. Huntsman writes:

'We have had a precise experiment in testing out inheritance of behavior. Restigouche fry, whose parents run early and chiefly as 3.2 and 3.3 fish, were planted in Apple River at the head of the Bay of Fundy and marked when smolts. They ran only in September and October and nearly all as 2.1 fish, that is grilse, just as the local salmon.' "(Dow, 1938, p. 12).

"Here again is an example of the river overcoming the inherited instincts of the fish. In the Miramichi, approximately sixty percent of the fish that come back to the river are grilse. The progeny of Miramichi fish, transplanted in the Penobscot, produce few or no grilse." (Dow, 1938, p. 14).

Experimental studies in salmon have demonstrated that the environmental effects are much greater than genetic effects on quantitative life history characteristics. For example, environmental effects explains over 90% of the variation in the rate of salmon returns (Jonasson et al., 1997). Saunders et al., (1983) found that grilsing ratio is highly influenced by water temperature; as waters become colder, the amount of grilse declines. Further, there appear to be strong maternal affects in these and other characters. In the studies cited by the Services in the Status Review (Glebe and Saunders, 1986; Hutchings and Jones,1998; Ritter et al., 1986; Saunders, 1986), formal inheritance experiments were not conducted and variance components were not estimated. Thus, those studies can not be used to claim these traits have a measureable genetic basis and that observed differences between populations in different environments are the result of underlying genetic differences. Because the environment profoundly influences quantitative traits, it is not correct to assert, as the Services did, that because a trait "has a genetic basis" it provides "evidence of separateness". Observed differences in life history characteristics of salmon may be largely non-genetic in origin, especially considering the diverse environments experienced during development. Based on the arguments and data presented in the Status Review about life history characters, there is no scientific basis for concluding that Atlantic salmon from Maine contain a unique evolutionary legacy that merits protection under the ESA.

5. There is significant and continuing debate within the scientific community concerning criteria for defining units needing protection.

Criteria for protecting natural resources have benefited from ongoing dialogue within the scientific community. As new techniques and analytical approaches are developed, their application to conservation problems is swift. Despite the desire, there are no uniformly recognized metrics available to determine the evolutionary significance of populations. This is of fundamental importance to the proposed listing, as a major requirement for listing a putative DPS is the demonstration of its evolutionary significance.

> "It is important to recognize (as Waples did, in press) that decisions about what constitutes "significance" and about the resource tradeoffs implicit in recovery plans are largely societal decisions that cannot be based solely on scientific grounds alone." (National Research Council, 1996).

As noted recently by one Federal scientist:

> "Unfortunately, it seems that a consensus [on criteria for protection] will not be achieved while the US EPA and laws similar to it (e.g. Australia's ESPA) remain vaguely worded and offer insufficient operational evolutionary framework or guidance (Wayne 1992; Vogler & DeSalle 1994; Mayden & Wood 1995; Pennock & Dimmick; Waples 1998)." (King and Burke, 1999, S3).

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VITAL STATISTICS

Date of Birth: July 16, 1945; U.S. Citizen
Married to Victoria Jean Porter; two wonderful daughters

EDUCATION

A.B.,	Syracuse University, Syracuse, New York	1968
M.A.,	State University of New York, Stony Brook	1972
Ph.D.,	State University of New York, Stony Brook	1974

POSTDOCTORAL TRAINING

Division of Fishes, Smithsonian Institution, Washington, DC
Department of Biology, University of Haifa, Haifa, Israel
Department of Genetics, Hebrew University, Jerusalem, Israel

APPOINTMENTS

University of Maine, Assistant Professor of Zoology	1977-1982
Associate Professor of Zoology	1982-1987
Professor of Zoology	1987-
Cooperating Professor of Biological Sciences	1998-
Supervisor, DNA Forensic Laboratory	1998-

UNDERGRADUATE TEACHING

Biometry, Ecology, Evolution, Introduction to Ecology (non-major), Marine Ecology, Research Methods, Science Writing

GRADUATE TEACHING

Molecular Systematics, Multivariate Analysis, Population Biology

AWARDS

Smithsonian Fellow	1975
Danforth Associate	1981-1988
H. Burr Steinbach Visiting Scholar, Woods Hole Oceanographic Institution	1992
Alumni Association Distinguished Maine Professor	1997
Maine Professor of the Year, Carnegie Foundation for the Advancement of Teaching	1998

RECENT PROFESSIONAL SERVICE

Member, Governor's Task Force on Atlantic Salmon	1995-
Panelist, NSF Doctoral Dissertation Improvement Awards	1996
Member, Maine Atlantic Salmon Technical Advisory Committee	1998-
Panelist, NSF Systematic Biology Program	1998,1999

SOCIETIES

American Society of Ichthyologists and Herpetologists
American Society for Molecular Marine Biology and Biotechnology
Maine Medico-Legal Society
Society for Molecular Biology and Evolution
Society for the Study of Evolution

FIELD WORK

Cuatro Cienegas and Media Luna, Mexico 1971, 1979-83
Lake Malawi, Malawi 1972, 1986-90, 1997-98
Sea of Galilee and Jordan Valley, Israel 1976-7
Lake Lanao, Philippines 1983
Lake Baikal, USSR 1984
Lake Titicaca, Bolivia 1991
Georges Bank, Gulf of Maine 1995, 1996

PUBLICATIONS

51 peer reviewed articles, 2 co-edited books, 5 book reviews, 228 DNA sequences deposited in GenBank

NEW SPECIES

Cichlasoma minckleyi Kornfield & Taylor (fish); Homarius capensis Kornfield, Williams, & Steneck (lobster); Oreochromis niloticus tana Seyoum & Kornfield (fish); Saccoglossus bromophenolicum King, Giray, & Kornfield (hemicordate)

RESEARCH

Population genetics and molecular systematics. My research exploits DNA technologies to applied problems and to pure research in evolution and systematics. Extramural funding totals $2,361,504. Current research projects in my laboratory:

Wildlife forensics. Maine Dept. Inland Fish. Wildlife.
Genetic signatures of Atlantic salmon. NOAA Sea Grant.
Rapid evolution in African fishes. National Science Foundation.
Biology of Georges Bank cod. National Science Foundation.
Training taxonomists for the 21st century. National Science Foundation.

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Kornfield I. and P. Smith. African cichlid fishes: model systems for evolutionary biology. Ann. Rev. Ecol. Syst.

IN REVIEW

Tam, Y. K. and I. **Kornfield**. Population structure of American lobsters, Homarus americanus. Can. J. Fish. Aquat. Sci.

Lage, C.R., M. Purcell, and I. **Kornfield**. Microsatellite evaluation of haddock (Melanogrammus aeglefinus) stock structure in the Northwest Atlantic. Can. J. Fish. Aquat. Sci.

IN PREPARATION

Haye, P., Y.K. Tam, and I. **Kornfield**. Molecular phylogenetics of mole crabs (Hippidae: Emerita)

Haye, P., K. Smith and I. **Kornfield**. Distinctive clades defined by molecular markers in Order Cumacea.

Parker, A. and I. **Kornfield**. Rapid diversification of the killifish species flock (Orestias, Cyprinodontidae) of Lake Titicaca.

ABSTRACTS

Kornfield, I.L. 1974. Implications of homozygosity in cichlids. Isozyme Bull. 7:52.

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http://globec.whoi.edu/globec-dir/reports/siworkshop.1995/report

BOOK REVIEWS

Kornfield, I. 1974. Laboratory and Field Investigations in General Ecology. Quart. Rev. Biol. 49:165-166.

Kornfield, I. 1975. The cichlid fishes of Lake Victoria, East Africa: The biology and evolution of a species flock. Quart. Rev. Biol. 50:487.

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LETTERS

Kornfield, I. and G.R. Smith. 1984. Lake Baikal: U.S.-Soviet cooperation. Science 226:912.

Attachment #2

A Review/Critique of:

Microsatellite and Mitochondrial DNA Diversity in Atlantic Salmon with Emphasis on Small Coastal Drainages of the Downeast and Midcoast Regions of Maine

A Report to Region 5, U.S.F.W.S., Hadley, MA

March 1999

Authors: Tim L. King, W. Bane Schill*, Barbara A. Lubinski, Mary C. Smith, Michael S. Eackles, and Roseanna Coleman

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Review/critique prepared by:
John R. Gold
Professor of Genetics
Center for Biosystematics and Biodiversity
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Introduction

The following is a scientific review/critique of a report (by King et al. 1999) that summarizes a survey of variation in restriction-fragment-length-polymorphisms (RFLPs) of fragments of mitochondrial (mtDNA) and in twelve, nuclear-encoded microsatellite DNA markers among samples of Atlantic salmon (*Salmo salar*) from Europe and North America, with emphasis on samples from selected rivers in the State of Maine. The stated purpose of the work performed by King et al. (1999) was to "...allow the most informed planning and implementation of biologically sound management efforts." This review/critique of the report by King et al. (1999) was commissioned with the charge of providing scientific/professional review and critique of the genetics work carried out by federal laboratories regarding Atlantic salmon and as that work relates to the listing process. In the course of reviewing the report, numerous other documents were read, including the July 1999 Status review published by the United States Fish and Wildlife Service (USFW) and the National Marine Fisheries Service (NMFS) on the Gulf of Maine DPS and the November 17, 1999 proposed rule notice. In reading those later documents, the importance of the report by King et al. became clear relative to establishing, based on genetics evidence, the concepts of genetic *discreteness* and *significance* of the Gulf of Maine DPS. The basis for genetic discreteness appears to have been the inference by King et al. (1999) that samples of Atlantic salmon from Maine differed from samples elsewhere in North America. The basis for genetic significance appears to have been the inference by the authors of the proposed rule (not necessarily by King et al. 1999) that fish in the Gulf of Maine DPS represented a sustaining, remnant of unique genetic material descendant from aboriginal stocks.

The review/critique is divided into five major sections. The first four address the major experimental aspects of the study: sampling, statistical analysis, analysis of mitochondrial (mt)DNA, and analysis of microsatellites. Within each section, comments generally address both the analytical approach employed by King et al. (1999) and (where applicable) the inferences drawn from the results. Differences between the inferences/interpretations drawn by King et al. (1999) and those of this reviewer also are noted. The fifth (and last) section is and discussion of the findings and conclusions reached by King et al. (1999) as regards (i) North American versus European Atlantic salmon, and (ii) North American (specifically Maine) salmon. Included within this section are a few brief recommendations, with emphasis on analytical approaches that would have enhanced considerably the analysis in the report. Salient "conclusions" reached by the reviewer relative to the data in the report, their analysis, and their use in the listing process for the Gulf of Maine DPS are noted in "bullet" form below.

Report by King et al. (1999):

- The sampling design is not clear with respect to whether samples taken in different years represent different year classes (cohorts). This could mean that allele-frequency differences between year classes, reflective of genetic drift, may have been minimized.

- Statistical approaches used in the study failed to employ methods, developed within the past few years, that ask important questions about populations, their structure, and their ecological and evolutionary dynamics. Deployment of these approaches would have enhanced data analysis and biological inference considerably.

- Problems in statistical analysis, including use of non-independent, *a posteriori* (and non-randomly) selected comparisons, impacts negatively inferences and arguments made in the report that observed genetic differences represent genetic isolation of samples from North America and are of significance biologically.

- Shortcomings in terms of data analysis and inference with respect to variation in mitochondrial (mt)DNA lead the authors to (i) overstate the degree of (statistically valid) genetic divergence among samples from Maine, and (ii) ignore evidence that observed differences in mtDNA haplotype frequencies among North American fish (especially those sampled in Maine) may stem from genetic drift.

- Numerous instances where significant differences in allele frequencies at microsatellites between/among yearly samples at the same locality in Maine waters were observed. The authors make no mention that the clear inference from these data (as with the mtDNA data) is that the samples are from localities where effective population size is small and the effects of genetic drift are large.

- The authors report that 36 rare or unique microsatellite alleles were found among fish from Maine. Over three-fourths of these alleles also are found in Maine and Canada, Maine and Europe, or Maine, Canada, and Europe. These findings are consistent with the notions that (i) gene flow (especially between fish from Maine and Canada) is more extensive that presently believed, and/or (ii) introductions of non-Maine fish into waters in Maine were successful in terms of genetic material from these sources having been incorporated into the genomes of fish currently inhabiting waters in Maine.

- Large fluctuations in frequencies of numerous microsatellite alleles between/among yearly samples of fish (especially from Maine waters) also are entire consistent with the inference that genetic drift accounts for much of the genetic heterogeneity observed.

- Results of assignment tests indicate strongly that the general pattern of allele frequency divergence among North American samples of Atlantic salmon is one of isolation-by-distance. This means that significant gene flow between Atlantic salmon in Maine and Canadian waters must have occurred historically, and moreover, that such genetic "straying" is a critical, adaptive feature of the life history of the species.

- There is clear indication that Atlantic salmon in Europe differ significantly from North American fish in allele frequencies at microsatellite and mitochondrial DNA loci. Whether this difference is significant evolutionary or biologically is a matter of perspective. Not appreciated by the authors is that European fish may represent a valuable resource of adaptively useful alleles that may have been lost in North American fish because of (what appears to be) extensive genetic drift.

- The conclusion in the report that "shallow" (spatial) genetic subdivisions exist among North American fish is compromised significantly by the inappropriate statistical approach employed and by the existence of highly significant, genetic instability between yearly samples at the same site/locality. The impacts of the inappropriate statistical approach are likely that (i) many of the reported "significant" differences are not significant (either statistically or biologically), and (ii) the statistical power of individual tests was reduced appreciably.

- The magnitude of genetic instability between yearly samples at the same site/locality indicates that extensive *random* variation in allele frequencies is ongoing among fish in the Gulf of Maine DPS. The present-day occurrence of extensive genetic drift in the Gulf of Maine DPS also is supported by approximate estimates of the minimum effective population size (N_e) of the entire DPS.

- The inappropriate statistical approach employed and the existence of highly significant, genetic instability between yearly samples at the same site/locality within the Gulf of Maine DPS raise questions regarding the genetic *discreteness* and genetic *significance* of fish occurring in the region. The latter, temporal genetic instability, is by far the more critical of the two, as the statistical "problems" can be rectified and additional analytical approaches can be utilized. The apparent existence of extensive genetic drift has the following implications.

    * Genetic discreteness may be illusory, in the sense that significant differences in allele frequencies may arise annually from small effective population size. Samples from any given site/locality may be the same or different from any other site/locality by chance alone.

    * The occurrence of genetic "uniqueness" may simply reflect chance events precipitated by small effective population size. A paradigm example of this could be the sample(s) from Cove Brook in the lower Penobscot River, where there was no variation in mitochondrial DNA in either of two yearly samples and where there was significant heterogeneity in allele frequencies at microsatellites among three yearly samples. This impacts the issue of genetic *distinctness* (which implies spatial genetic differences are stable).

    * The occurrence of genetic "uniqueness" also impacts the issue of genetic *significance*. Alleles at genes for adaptively useful traits reflecting variation in life-history traits also should fluctuate randomly under conditions of small effective population size and genetic drift. This means that slightly deleterious alleles at such genes could increase in frequency, whereas slightly advantageous alleles could decrease in frequency. Consequently, samples with unique genotypes may actually harbor ill-adaptive alleles, and the supposition that unique genotypes in Gulf of Maine DPS fish represent an important genetic legacy of aboriginal stocks is incredibly naïve.

Review/Critique of the Report by King et al. (1999)

A. Sampling:

In "Methods" it is stated first that tissues were sampled from parr and adults, then that efforts were directed at 0+ and 1+ parr, and finally that at least two year-classes were sampled. What's not mentioned is how individual fish were assigned to a given year class or how it was determined that at least two year classes were sampled at the localities listed, i.e., Bond Brook, Togus Stream, Cove Brook, Kenduskeag Stream, Narraguagus River, Pleasant River, and East Machias River. This potentially is a serious, critical omission, as the data are reported as if different year classes were tested for allele frequency homogeneity. What efforts (e.g., otolith analysis, lengths, et cetera) were made to insure that the same year class was sampled from a given locality at a given time, and that different year classes were sampled in different years? Given that parr of Atlantic salmon can remain in a stream/river for well more than one year (Status Review 1999), it's possible (likely, given the absence of any mention of attention to this detail in the report) that individual samples may have contained fish from more than one year class. It also may be the situation that some samples may have contained adults. If this is the case, *temporal variation* as assessed in the study does not mean allele-frequency changes from generation to generation but rather from year-to-year. This is a critical point for two reasons. First, allele-frequency changes from year class to year class would directly permit an assessment of the degree of genetic drift operative, and perhaps more importantly, permit quantitative assessment, based on the "temporal method" (Pollak 1983; Waples 1989; Laikre et al. 1998), of the genetic effective population size. The latter is a parameter of fundamental interest in the management of threatened and endangered biota (Nunney and Elam 1994). Secondly, what may have been measured in this study were allele frequency changes from year to year but where individuals from multiple year classes were included in the sample. What this means is that possible allele-frequency changes between year classes that might have occurred because of small effective population size (i.e., genetic drift) potentially could be obscured (minimized, at the least) because of the inclusion of multiple year classes. Given that the data (see below) indicate large-scale changes between yearly samples at some localities (e.g., Cove Brook), the actual amount of genetic drift operative may actually be greater than indicated by the data. The bottom line is that the failure to document the year class of the individuals within a sample represents a critical oversight or flaw in the study. Given that the tissue sampling appears to have been non-invasive, year class likely could have been ascertained by restricting sampling to parr smaller than the average size for individuals in the 0+ age class. It is likely that these data are available, and if so, they should be made available.

B. Statistical analysis:

In general, the approach taken is fairly standard and the authors have utilized most of the commonly used approaches (methods) for assessing allele-frequency homogeneity among samples. In subsequent sections of this review I will note a few approaches that have become available within the past two-three years and which ask different (but important) questions about populations, their structure, and their ecological and evolutionary dynamics. Some of these approaches would have enhanced considerably the analysis in this report (study). The absence of some of these analyses (e.g., testing whether samples were in the mutation-genetic drift equilibrium) suggests the authors are not especially up-to-date on molecular population genetic analysis beyond that necessary to test homogeneity in allele frequencies. [This includes assignment tests which generally ask the same sorts of questions.] The consequence of this, I believe, is that the singular, most important aspect of the genetic data, i.e., that Atlantic salmon in many of the rivers in Maine are suffering from (potentially extreme) reductions in genetic effective population size, was not considered at all in the report. The potential implications of such reductions in effective population size also are discussed in several sections elsewhere in this review. Three other comments regarding the statistical analysis are as follows. First, there are a large number of pairwise comparisons of samples in data analysis. In general, pairwise comparisons executed in this fashion are not all independent, violating a number of statistical assumptions and compromising the Bonferroni corrections (which are for multiple, independent tests carried out simultaneously). Secondly, a very large number of comparisons in this study were *a posteriori* and appear to have been selected somewhat non-randomly. In general, statistical testing of *a posteriori* comparisons is considerably weaker than testing of *a priori* comparisons. This "testing" is weakened even further when all possible comparisons are not made. Finally, use of Wright (1943) as a means to estimate the effective number of migrants is inappropriate for Atlantic salmon. Wright's equation is for an island model of population structure. The genetic data on Atlantic salmon indicate an isolation-by-distance effect (e.g., Letcher and King 1999), which means the operational model of population structure for this species is a stepping-stone model. The effect of the latter on inferences drawn by the authors in this study is not large, but the failure to acknowledge that the island model is inappropriate here reduces somewhat the credibility of the authors. The upshot of these "statistical" problems, particularly the non-independent tests carried out *a posteriori*, is that many of the "significant" allele-frequency differences noted in the report likely are seriously compromised. This impacts negatively the argument that the reported genetic differences represent isolation and/or are of biological significance.

C. Analysis of mitochondrial (mt)DNA:

1. The analysis of the mtDNA data suffers from some of the (statistical) issues noted above. Pairwise comparisons were made among "selected" samples, leading to the conclusion that there was "...some population subdivision." The statistical issues here minimally are twofold: (i) tests were *a posteriori* and potentially selected non-randomly (affecting probability values), and (ii) for proper application of Bonferroni correction, even given that all pairwise tests would not be independent, all 91 tests (pairwise comparisons of 14 samples) should have been carried out, with a corrected alpha of 0.00055 (0.05÷91). In short, except for the comparison between European and North American fish, the few "significant" comparisons discussed likely were not (significant).

2. The UPGMA phenogram shown as Figure 1 is interpreted to indicate the existence of five groupings of populations (samples). Although I was unable to discern five groupings *per se*, more important about this phenogram is what was left unsaid by the authors. Taken at face value, the phenogram places several (but not all) of the samples from Maine in a large cluster that includes samples from Europe. This is inconsistent with the notion that fish from Maine differ significantly from Canadian or European fish. Also troubling is that the two central clusters in the phenogram do not have geographic consistency: one cluster contains samples from Maine and Canada, while the other cluster contains samples from Maine, Canada, and Europe. A third troubling aspect about the phenogram is that samples from the Narraguagus River fall into both clusters. The significance of these clusters cannot be evaluated, as the authors did not attempt to place standard errors at any node in the phenogram. As a guess, however, only the two large clusters may be valid statistically, as the branch lengths for most of the nodes are shorter (considerably so in most cases) than the branches leading to the two large clusters. Overall, there appears to be little population subdivision (structure) based on mtDNA (genetic) distances. Given this, not to mention that UPGMA analysis is generally in disfavor because of its strict adherence to equal rates of sequence divergence among lineages, it puzzling why the authors carried out UPGMA analysis or included it in the document.

3. The AMOVA appears to indicate that more than half of the variation in mtDNA among all samples is attributable to differences between continents. Exactly why the authors executed multiple AMOVAs is not clear and may compromise statistical inference. The AMOVA analysis should be redone, with hierarchical subdivisions incorporated into a single design. I suspect the larger part of the mtDNA variation will still be attributable to differences between continents.

4. The mtDNA data indicate that the samples from Maine have small effective (female, in this case) population sizes and that genetic drift is playing or has played a major role in generating present-day mtDNA haplotype diversity. First, mtDNA variation is generally low to non-existent among samples from Maine. No mtDNA haplotype variation, for example, was found among the two samples from the Ducktrap River and the two samples from Cove Brook (Penobscot River). The clear inference, particularly given that some variation in microsatellites was observed in samples from these localities, is that the female effective size at these localities is very small. [For a related example in brook trout, see Ferguson et al. 1991.] Second, mtDNA variation among the samples from Maine versus the samples from Canada is quite low. Third, in those cases where mtDNA data were obtained either from samples at the same locality but taken in different years or from different localities in the same river system, there either was no mtDNA variation (Ducktrap River and Cove Brook) or the mtDNA variation differed significantly. Regarding the latter, I ran a simple Roff-Bentzen procedure (Roff and Bentzen 1989) on haplotype distributions from the two samples from the Kennebec River (Bond Brook-94 and Togus Stream-94) and from the three samples from the Narraguagus River (Route 9, Bog Stream, and Route 193) and found significant heterogeneity in haplotype distributions ($P = 0.000$, Kennebec River; $P = 0.005$, Narraguagus River). This not only suggests the occurrence of random fluctuations in haplotype frequencies (due in all likelihood to small effective female population size), it also compromises seriously the authors pooling of the (clearly heterogeneous) samples from the Narraguagus River in their tests of haplotype-distribution homogeneity. Finally, mtDNA is, in theory, four times as sensitive relative to detecting population subdivision as are analogous nuclear-encoded sequences (Birkey et al. 1989). This is because mtDNA is haploid (nuclear-encoded sequences are diploid) and inherited uniparentally (nuclear-encoded sequences are biparentally inherited). However, in this study, far fewer differences among samples were detected with analysis of mtDNA haplotypes (alleles) than with analysis of microsatellite alleles, a finding that should have alerted the authors that something unusual (or at least atypical in relation to numerous published population level studies where both mtDNA and microsatellites were employed) was occurring. In this case, part of the answer appears to be the low levels of mtDNA variation among many of the samples from Maine, i.e., the absence of appreciable variation in mtDNA (due in all likelihood to very small female effective sizes) diminishes effective use of mtDNA as a genetic marker for population subdivision. This represents another situation where the authors might have inferred that effective population sizes of Atlantic salmon in Maine rivers are quite small.

5. The effects of the above shortcomings in terms of data analysis and inference are that the authors (i) overstate the degree of (statistically valid) genetic (mtDNA) divergence among the samples from Maine, and (ii) effectively ignore all the evidence that the observed differences in mtDNA haplotype frequencies may stem largely from genetic drift. Thus, the statements in Discussion that "...[the] discovery of highly divergent populations...existing in an apparently sympatric manner is remarkable..." and "...large frequency differences in mtDNA haplotype frequencies..." are at best misleading. With regard to the former, most of the observed differences in mtDNA (at least among samples from Maine) are likely either not that large or at least are of the same general magnitude as differences between/among different localities within the same river system. This is all the more noteworthy when one considers that genetic divergence (due to random fixation or near fixation of alleles) is expected to increase with genetic drift. With regard to the latter, what's "remarkable" is that the authors have ignored completely the evidence, which indicates that the observed genetic divergence in all likelihood may be due in large part to genetic drift. Stated differently, it is entirely possible that many, if not most, of the observed (statistically significant or not) differences in mtDNA frequencies among samples from Maine have stemmed from increasingly small effective population sizes and not from adaptive processes acting on adaptively useful genetic variation. This raises a question as to whether the genetic differences observed are

meaningful biologically in terms of adaptation (i.e., reflect a remaining reservoir of significant and adaptively useful alleles). In fact, because genetic drift is a random, stochastic process, it is entirely possible that the observed genetic differences could reflect an increase in the frequency of slightly deleterious alleles (Lynch et al. 1995). Such a notion certainly is consistent with the observation that population fitness, as measured as adult returns and presmolt survival, appear to have decreased in Maine rivers. If this were the case, preserving extant genetic material via river-specific (or perhaps even region-specific) management would be contra-indicated.

D. Analysis of microsatellites:

At the outset, it should be noted that there is a very large quantity of (not easily digested) data in this aspect of the report. It also should be noted that I have assumed that scoring of alleles (phenotypes, actually) at all microsatellites was carried out correctly. This is not a trivial assumption, as microsatellites are among the most difficult genetic markers to score accurately and reproducibly. This is especially so for dinucleotide repeat loci, where "stutter" often makes reliable scoring difficult.

1. As pointed out by the authors, there are several instances where there are large differences in allele frequencies among samples. Significantly, there are instances (lower Penobscot and lower Kennebec rivers) where there are significant differences between/among samples from the same locality but taken in different years or between localities in the same river. The authors state that it is unclear whether this within-locality or within-river divergence is the rule or an exception. Astoundingly, the authors make no mention that the clear inference from these data (as with the mtDNA data) is that these samples are from localities where the effective population size must be very small and the effect of genetic drift rather extreme. This theme is discussed further below.

2. The authors note that numerous unique alleles were recorded. Not mentioned is that sample sizes per locality were relatively small, making the "discovery" of unique alleles at microsatellites not that unusual (or "extraordinary") at all. Stated differently, mutation rates at microsatellite loci are thought to be relatively high (Schug et al. 1998), such that "new" alleles may appear in populations on a fairly regular basis. Thus, rather extensive sampling is required before one could state unequivocally that an allele is truly unique. More interesting is the geographic distribution of the alleles the authors list (Table 7c) as rare or unique. Of the 36 (rare or unique) alleles found in Maine, nine are found in Maine and Canada, seven are found in Maine and Europe, and 12 are found in Maine, Canada, and Europe. This suggest one of three possibilities: either (i) gene flow is far more extensive that presently believed; (ii) introductions of non-Maine fish into waters in Maine were quite successful in terms of genetic material from these "outside" sources having been incorporated into the genomes of fish currently inhabiting waters in Maine; or (iii) these alleles are not identical by descent, having been derived (presumably by mutation) independently. These possibilities (hypotheses, actually) are not mutually independent and would be difficult to test empirically on an allele by allele basis. My experience suggests that possibilities (i) (ii) would be by far the most likely. Note that in both cases, the implication is that genetic material from outside Maine likely provided adaptive benefits to fish currently inhabiting Maine waters.

3. Of the eight (rare or unique) alleles found in waters of Maine, it's significant to note that these alleles do not necessarily occur in either temporal samples from the same locality or different localities from the same river: *Ssa*85-106 and *Ssa*171-213 occur only in one of five samples from the East Machias River; *Ssa*171-261 occurs in only one of five samples from the Narraguagus River; and three alleles (*Ssa*171-273, *Ssa*171-275, and *Ssa*289-103) occur in only two of three yearly samples taken at Cove Brook. This, again, suggests that sample sizes may have been too small to detect "true" unique alleles, and more importantly, that there may be a large stochastic component (i.e., random genetic drift) to the allelic variation. A large stochastic component also

is indicated by the observation that some of these (rare or unique) alleles are not that rare (*Ssa*85-106 was at a frequency of 8.3% in the East Machias River upper 94, and *Ssa*171-273 was at frequencies of 13.3% and 6.7% in Cove Brook 94 and 95, respectively). [Note: A stochastic component is indicated by the absence of *Ssa*85-106 from the 1995 sample from the upper East Machias River and by the absence of *Ssa*171-273 from the 1996 sample at Cove Brook].

4. The inference that rather extreme genetic drift may be operating in Maine waters is best indicated by the observed (and significant) variation in allele frequencies found among yearly samples at the same locality. Examination of Appendix A, for example, reveals at least 26 alleles where large shifts in allele frequencies were found among the three yearly samples at Togus Stream, and at least 19 alleles where large shifts in allele frequencies were found among the three yearly samples at Cove Brook. These loci (alleles) are: Togus Stream – *Ssa*85 (124, 128), *Ssa*171 (215, 229,231,233, 239, 245), *Ssa*197 (160, 164, 172), *Ssa*202 (282, 286, 298, 306), *Ssa*289 (111), *SSLEEN*82 (212, 220), *SSOSL*25 (162), *SSOSL*85 (180, 189, 195), *SSOSL*311 (114, 148), and *SSLEEI*84 (165, 195); and Cove Brook – *Ssa*85 (130), *Ssa*171 (239, 241), *Ssa*197 (152, 172, 192), *Ssa*202 (278, 282, 294, 310), *SSLEEN*82 (204, 212), *SSOSL*25 (140), *SSOSL*85 (191, 195, 197), *SSOSL*438 (106, 110),), and *SSLEEI*84 (203). In addition, the authors used AMOVA to test for homogeneity in allele frequencies between/among yearly samples within rivers and collection sites and between/among collection sites in Maine (Tables 14G, H, I, J, K, L, N, O, and P) and found very highly significant (P = 0.000) differences between/among yearly samples within rivers and collection sites in nearly every case. Moreover, in many of these comparisons, there was very highly significant (P = 0.000) heterogeneity between/among yearly samples at a locality but not between localities or tributaries in the same river or tributary (Tables 14 G, H, K, and N, representing the Narraguagus, East Machias, lower Penobscot, and lower Kennebec rivers, respectively). Finally, the authors reported significant heterogeneity between tributaries of Maine rivers (lower Kennebec and lower Penobscot rivers) and among the three yearly samples at Bond Brook and Togus Stream (bottom of page 20) based on tests of allele-frequency homogeneity (Appendix C). Taken together, these results argue strongly that Atlantic salmon within Maine rivers are unstable genetically, in the sense that large-scale fluctuations in allele frequencies (likely due to genetic drift) even at the same sampling locality appear the norm rather than the exception. Surprisingly, even after having demonstrated significant heterogeneity within river systems and among temporal samples at the same site or locality, the authors assert (page 30 in Discussion) that the populations (samples, actually) are temporally stable, and even more surprisingly, pooled the spatial and temporal samples from Maine rivers for some of the tests of allele frequency homogeneity (middle of page 20). As the spatial and temporal samples from Maine rivers differed significantly in allele frequencies, such pooling is analogous to pooling apples and oranges to test whether the pooled samples are grapefruits (i.e., is highly inappropriate statistically). The consequence of this is that many of the tests of allele-frequency homogeneity that involved samples from Maine were seriously compromised, reducing both the likelihood that reported "significant" probability levels were in fact significant and the power of the statistical test itself. Exactly which tests of allele-frequency homogeneity were carried out was not presented in this report.

5. The authors tested for genotypic disequilibrium (independence of genotypes, actually) at pairs of microsatellites in order to determine whether pairs of microsatellites might be linked genetically. Based on Bonferroni corrections, 48 of 726 pairwise comparisons yielded significant probability values, leading to the conclusions by the authors that none of the microsatellites were linked and that the disequilibrium observed in Maine rivers (or tributaries) was likely indicative of population subdivision, founder effects (genetic drift), or selection. This analysis and the conclusions drawn from it are troubling for a number of reasons. First, the authors pooled the spatial (same river) and temporal (same locality) samples from Maine. This pooling is statistically unsound for the same

reason as noted above under 4d (the spatial and temporal samples are from different sampling distributions). Second, in carrying out 66 pairwise comparisons for each river system, the Bonferroni adjusted alpha level is 0.05/66 or ~0.0007, meaning that the Bonferoni correction here may have been inappropriate (for an extended discussion of why this is so see Ferguson and Danzmann 1998). Third, the authors were not really measuring linkage disequilibrium but whether genotypes at any one microsatellite are independent of genotypes at a second microsatellite. This approach is generally accepted as a tractable substitute for a true measure of linkage disequilibrium but it is often unrecognized that a significant result merely indicates that genotypes may not be independent of one another, and that another factor, namely inbreeding, may also produce a significant result. Finally, even with the Bonferroni-adjusted alpha level, significance still was detected at localities in Maine (e.g., Bond Brook, Togus Stream, and Cove Brook) where significant allele-frequency heterogeneity was detected either between among sites within a river or between/among temporal samples at the same locality. In all likelihood the significant "disequilibrium" stemmed from non-random associations of homozygous genotypes as a function of genetic drift and associated inbreeding. Along these lines, inbreeding (and non-random, genetic relationships among individuals within a sample locality) was not at all considered by the authors. If it exists, especially among samples form Maine (and there is every indication that it could), such non-random genetic relationships among individuals within a sample would compromise seriously almost every test of population structure carried out by the authors. Other approaches that could have been be used by the authors to ask whether individuals within samples were closely related by descent are outlined in Ayres and Balding (1998), Saccheri et al. (1999), and Lynch and Ritland (1999).

6. The tests of allele-frequency homogeneity, including the F_{ST} and R_{ST} values and the AMOVA, are all variously compromised by a number of things discussed previously, viz., pooling of spatial and temporal samples from Maine rivers in some comparisons, non-independent and non-randomly selected *a posteriori* comparisons, and extremely low Bonferroni-adjusted alpha levels in several comparisons. Nonetheless, I believe the general findings that (i) the greatest degree of genetic divergence is between samples from North America and samples from Europe, and (ii) there is a general increase in the degree of genetic divergence with increasing geographic distance between samples, are probably correct. With respect to (i), the interpretation that the difference between samples from North America and Europe is evolutionarily significant is simply a matter of opinion. With respect to (ii), a positive relationship between genetic divergence and geographic distance is referred to as an isolation-by-distance effect (Sokal and Oden 1978) and certainly is consistent with the life history of anadromous salmonids. Almost identical results were obtained with the assignment tests, i.e., the proportion of misclassified USA fish increased with increasing geographic distance from the USA. Surprisingly, the authors point out (based on AMOVA) that the divergence found in the lower Penobscot River (i.e., between Cove Brook and Kenduskeag Stream) is more than two-fold greater than that observed in general among Maine rivers, and that there was less spatial divergence in the lower Kennebec river (i.e., between Bond Brook and Togus Stream) than there was among the yearly samples of the tributaries. What was surprising is that the authors did not make the obvious inference that the allele-frequency fluctuations likely were due to small effective population size and associated genetic drift.

7. The neighbor-joining topology (Figure 3) is used to depict genetic similarities among samples. A clear, distinct separation between samples from North America and samples from Europe is demonstrated. The authors state that in North America shallow but significant genetic structure was observed among rivers and among collections (samples) within rivers (page 24). This is a more than a little overstated, as the tests of allele-frequency homogeneity demonstrated significant heterogeneity among samples (e.g., the yearly samples from Cove Brook - Table 14L) that clustered with relatively high bootstrap support in Figure 3. Moreover, to be straightforward

about what the topology shows, the authors should have collapsed all of the nodes except those by bootstrap values well in excess of 50%. Had they done so, the "structure" in the topology, relative to fish from Maine, would have been limited primarily to the samples from Cove Brook (one group, reproducible at 83% and 96% bootstrapping) and the samples from Kenduskeag Stream (a second group, reproducible at 100% bootstrapping). What this means with regard to overall genetic structure in North American fish is that the neighbor-joining topology is essentially uninformative.

8. The assignment tests as employed in the report afford a different approach to the issue of sample distinctness. In general, the results, relative to fish from North America, are in accord with an isolation-by-distance model: most misclassified fish from the USA were assigned to New Brunswick, followed in sequence by Nova Scotia, Newfoundland, and Labrador. This should have been the salient "finding" noted by the authors, as an isolation-by-distance model of gene flow is consistent with the known life history of anadromous salmonids. Existence of an isolation-by-distance effect among North American salmon has the following important implications: (i) significant gene flow between Maine and Canadian Atlantic salmon undoubtedly occurred historically, and (ii) such gene flow was a critical, adaptive feature of the life history of the species. Not often understood is that an isolation-by-distance effect means that over time, alleles from opposite ends of a geographic distribution can "migrate" considerable distances and, if adaptively important, be incorporated into subpopulations between which little gene flow occurs on an annual basis. As an hypothetical example, an adaptive allele arising in a fish from Labrador eventually could makes its way (via a stepping-stone approach) to fish in southern Maine. That the general pattern of allele frequency divergence in North American Atlantic salmon is one of isolation-by-distance indicates that "genetic straying" actually is an important, adaptive life-history feature of the species. A second point is that the isolation-by-distance effect demonstrates that a stepping-stone, rather than an island model (*sensu* Wright 1943), should be employed for estimating the (genetic) effective number of migrants. Finally, it's worth noting that the assignment tests in this case also could provide a surrogate estimate of degree of gene flow (genetic straying). Fish from landlocked samples (Sebago 95 and Grand Lakes 95), for example, are misclassified less frequently than the stream/river samples (Table 20), consistent with this notion. If this is the case, "successful straying" rates (estimated approximately as one minus the per cent misclassification) could range from >13% to > 90%. The notion that microsatellite variation among Atlantic salmon in North American follows an isolation-by-distance model is well demonstrated by the follow-up paper (Letcher and King 1999) to this report.

E. Discussion of findings and conclusions reached by King et al. (1999):

The central findings in the study appear to be that (i) Atlantic salmon from Europe differ significantly in allele frequencies from Atlantic salmon in North America, and (ii) fish from North America generally can be assigned to their region (country) of origin more than 75% of the time, and (iii) fish from North America can be assigned to their collection of origin more that 65% of the time (Canadian localities) and more than 40% of the time (USA fish). Most of these findings are based on the analysis of allelic variation at the microsatellites. With regard to (i) the authors state that European and North American fish represent a "...deep evolutionary division..." and should be considered different ESUs (evolutionary significant units); with regard to (ii) and (iii) the authors suggest there are shallower genetic subdivisions (in this case in North America) that merit status as MUs (management units). Underlying the suggestion that these shallow genetic subdivisions merit direct management attention are the notions that (i) the differences in allele frequencies are minimal estimates of genetic differences in the remainder of the genome, and (ii) there remain in these "differentiated" management units a number of "local adaptations" that relate to population characteristics such a return time and spawning area to a discrete locality within a discrete riverine system. Central to the authors arguments appear to be the

"...discovery of highly divergent populations (Cove Brook and Kenduskeag Stream of the lower Penobscot River, and Bond Brook and Togus Stream of the Kennebec River) existing in an apparently sympatric manner." A final comment by the authors (page 31) is that supplementation, if applied to Maine rivers, should "...be in a manner that does not significantly perturb the recipient population by shifting gene frequencies." I assume this may form part of the basis for the notion of "river-specific" enhancement.

1. North American versus European Atlantic salmon:

There appears little doubt that European fish differ significantly from North American fish in allele frequencies at microsatellite and mtDNA loci. That this difference is evolutionarily significant is a matter of opinion. Clearly, there is little to no gene flow occurring among present day populations, and based on the genetic differences, one could estimate roughly the time since the two groups last shared a common ancestor. The authors mention 10,000 plus years of isolation but make no specific reference to a vicariant event with which this date is associated (other than a generic reference to Pleistocene glaciation) nor do they provide a time-since-divergence estimate based on the degree of genetic divergence and a rate of molecular evolution. In the absence of the latter two (i.e., a genetic distance value and an assumed evolutionary rate) it is difficult to place the divergence of European versus North American Atlantic salmon into any sort of evolutionary perspective. Moreover, to call the difference between European and North American fish a "...deep evolutionary division..." seems a bit of overstated hyperbole, as there are numerous examples in both freshwater and marine fish where genetic distances easily suggest existence of haplotype lineages before 10,000 years ago but where no reproductive isolation whatsoever apparently exists (e.g., Avise 1992; Kornfield and Bogdanowicz 1987). The authors provide no tables of genetic distances nor do the phenograms (Figures 1, 3-9) have "distances" indicated on the abscissa, meaning that "distance" as employed by the authors cannot be compared with "distances" between any operational units (i.e., individuals, populations, species, etc.) in any other organisms. To give a trivial example, if one employed microsatellites and compared genetic distances between full or half-sibs in human family A living in Maine with genetic distances between full or half-sibs in human family B living in Louisiana, there's a reasonable chance that a similar "deep evolutionary division" could be demonstrated. This is not to say that Atlantic salmon from Europe and North America salmon are not different subpopulations (stocks, in the management vernacular), or that they shouldn't be managed differently from the perspective of assessment strategies and allocation decisions. Rather, what's at issue here is whether the differences in allele frequencies at microsatellite and mtDNA loci between the two have biological relevance other than signaling reduced gene flow. In brief, the authors assert that differences in allele frequencies at microsatellite loci reflect minimal estimates of genomic differences and cite the book by Lewontin (1974) and the paper by Ståhl (1987). Not mentioned by the authors is that neither Lewontin nor Ståhl discussed microsatellites *per se* but rather referred primarily to allozymes and isozymes (which at least are products of coding, functional DNA sequences). More to the point, however, is the accumulated evidence that genes responsible for major, evolutionarily important characters appear not to follow the same evolutionary dynamics as genes or DNA sequences conventionally measured in population level studies (i.e., allozymes, mtDNA, and microsatellites). The trenchant example of this is the comparison between humans and our (presumed) closest evolutionary ancestors, chimpanzees. Humans and chimpanzees share at least 95% of their DNA (Gibbons 1998) yet the two species differ in any number of evolutionarily important morphological and behavioral characters. In contrast, many sibling species (i.e., species that are virtually identical in morphological and other quantifiable characters, including behavior) have genetic identities, in terms of similarities among (nuclear-coding) genes conventionally measured in population-level studies, on the order of 52% (Ayala et al. 1974a,b). The central point here is that DNA sequences used nowadays to measure gene flow (e.g., microsatellites) are not necessarily valid or appropriate surrogates for genes that impact adaptively important traits. This relates to another assertion by the authors (relative to European versus North American fish) that loss of stock characteristics due to hybridization of different gene pools " will result in the disappearance of local adaptations [such as] time of return and area of spawning." The potential independence of DNA sequences such as microsatellites from genes affecting behavioral and other adaptive characters means the authors' assertion is merely an opinion. Moreover, given the almost complete absence of rigorously obtained, experimental data in Atlantic salmon regarding the heritable proportion of the variation in traits such as return time and spawning area, one could just as easily postulate that many important alleles affecting traits such as these may have been lost in North American (especially Maine) fish because of the apparently intense genetic drift that appears to be ongoing, and moreover, that such alleles may still be present in European fish. This notion is not without precedent, in that many human-exploited/impacted species appear to have undergone a number of "bottleneck" (genetic drift) events such that many, adaptively-useful alleles appear to have been lost from present-day populations (Tanksley and McCouch 1997). In these cases, the only sources of adaptively useful alleles are wild relatives that either have not been exploited/impacted or at least not as intensely exploited or impacted. In short, the authors assertion that hybridization (presumably between European and North American fish) would result in the disappearance of local adaptations not only has no basis in robust empirical experimentation, it may be that European fish possess alleles that could be adaptively useful to North American fish. As a final thought, given the importance of the Atlantic salmon resource to North America (and specifically Maine), it would seem critical that this issue merits high scientific priority, as rigorous experimentation seems preferable to unsubstantiated opinion.

2. North American (specifically Maine) salmon:

With regard to Atlantic salmon in North America (specifically Maine), the authors assert that the shallow genetic subdivisions detected merit status as MUs (management units). Underlying this assertion are the following premises and/or assumptions: (i) the reported genetic differences (in alleles at microsatellites) are statistically valid, temporally stable, and biologically meaningful, and (ii) the reported genetic differences (in alleles at microsatellites) reflect the existence of historical, adaptively important alleles at genes that impact significant life-history traits. The first premise, that the reported differences are real, appears compromised; the second premise has very little support in either theoretical expectation or empirical observation. With regard to the first premise, much of the statistical inference in this study appears to have been compromised by the use of non-randomly selected, non-independent, *a posteriori* comparisons and by the "lumping" of statistically heterogeneous samples into individual test groups. Exactly how this impacted probability levels reported in various tests is not clear but it would seem a safe bet that (i) some of the reported "significant differences" either are not significant statistically or (at least) are not significant biologically, and (ii) the statistical power of the individual tests has been reduced appreciably. The statistical approach notwithstanding, what is clear in the report is that allele frequencies at microsatellites are not temporally stable in a number of Maine rivers, including the Narraguagus (Table 14G), the East Machias (Table 14H), the lower Penobscot (Table 14K), and the lower Kennebec (Table 14N). Taken together, both the statistical "problems" and the highly significant differences between/among yearly samples at the same locality indicate that virtually all the "tests" where temporal samples within sites/localities and spatial samples within rivers or tributaries were pooled (e.g., results reported in Tables 14 A - C) are potentially compromised. Finally, because a significant portion of the allele-frequency heterogeneity among fish from Maine appears to occur between/among yearly samples at the same site/locality, the heterogeneity potentially detected between/among rivers may not be meaningful in a biological or management sense unless one is willing to accept the premise that individual MUs, reflecting significant genetic differences in adaptively useful characters, are characterized by yearly samples at the same site/locality. The net of the above is that the regional (spatial) genetic differences reported by King et al. may not be valid statistically or meaningful biologically, in the sense of identifying stable genetic units that merit management attention (i.e., are discrete MUs). The allele frequency differences observed are meaningful biologically, in that they support the hypothesis that Atlantic salmon in a number of Maine rivers potentially have very small effective population sizes. This is discussed further below, along with the implications of genetic drift relative to maintenance of adaptively important alleles.

The evidence that Atlantic salmon in several Maine rivers likely have small effective population sizes stems from two observations. The first, discussed above, regards the fluctuations and significant differences in microsatellite allele frequency between/among yearly samples at the same site/locality. This is consistent with the notion that effective population sizes are quite small and that the allele frequency differences, over time, are randomly fluctuating because of genetic drift. [Note: This assumes that at least some of the fish sampled at the same site/locality in different years represent spawn of adults that returned to their natal site. However, the significant differences in allele frequency between/among temporal samples also are compatible with the hypothesis that temporal samples from the same site/locality include a significant proportion of "strays."] A second line of evidence regards the reported number of adult returns to Maine rivers and minimum estimates of the effective population size. Briefly, the total documented "natural" (wild and stocked fry) Gulf of Maine DPS spawner returns to the DPS rivers for the past five years are 83 (1995), 74 (1996), 35 (1997), 23 (1998) , and 29 (1999) (NMFS & FWS, 1999). Assuming the Gulf of Maine DPS to include seven rivers (the Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot rivers), the average (minimum) number of returning fish per year per river is seven (range = 3 - 12). [Note: Wright (1938) suggested that the best approach to estimating N was to use the harmonic mean, which further reduces the average (minimum) number of returning fish per year per DPS river to five.] As noted by several authors, effective population size, N_e, is generally less (sometimes appreciably less) than census size, N (Hedgecock 1994; Frankham 1995; Nunney and Elam 1994; Vucetich et al. 1997). Estimates of the ratio of N_E/N vary considerably (Frankham 1995): among fishes that inhabit marine waters during their lifetime, reported N_e/N ratios range from 0.004 in red drum, an estuarine-dependent sciaenid (Turner et al. 1999) to 0.04 in chinook salmon (Bartley et al. 1992), 0.24 in coho salmon (Simon et al. 1986), and 0.40 in white sea bass (Bartley et al. 1992). The estimates from chinook salmon, coho salmon, and white sea bass were from hatchery populations. Assuming the N_e/N ratio in Atlantic salmon is approximately that of hatchery-reared coho salmon (just for comparison sake), a minimum estimate of N_e per river per year among the seven Gulf of Maine DPS rivers would be in the neighborhood of two fish (or between nine and 12 fish for the entire DPS). These minimum estimates of N_e for Gulf of Maine DPS Atlantic salmon, when framed against estimates of the critical effective population size necessary to maintain long-term genetic stability of a species, i.e., between $N_e \cong 500 - 1{,}000$ (Franklin and Frankham (1998) or $N_e \cong 1{,}000 - 5{,}000$ (Lynch and Lande 1998) indicate that significant and extensive allele frequency changes due to genetic drift should be expected among Gulf of Maine DPS Atlantic salmon.

The implications of the foregoing are that the reported genetic differences (in allele frequencies at microsatellites) among samples of Atlantic salmon in Maine rivers very likely reflect stochastic (random) changes due to very small effective population sizes in individual rivers. This appears to be especially true for samples from the lower Penobscot (e.g., Cove Brook), lower Kennebec (e.g., Togus Stream and Bond Brook), East Machias, and Narraguagus rivers where significant allele-frequency differences were found between/among yearly samples. This suggests that the observed genetic differences may be important biologically only insofar as demonstrating the existence of genetic drift, not the existence of either historical subpopulations (stocks) or that genetically divergent samples represent a reservoir of adaptively important alleles at genes impacting significant life-history traits. In fact, exactly the opposite may be true. Under conditions of extreme genetic drift, adaptively beneficial alleles also may fluctuate in frequency and potentially be lost from a population. Moreover, under certain circumstances, such adaptively beneficial alleles may be replaced with selectively disadvantageous alleles (Lynch et al. 1995). What this means is that theoretically the genetically divergent samples of Atlantic salmon (as measured by allele-frequency differences at selectively neutral microsatellites) in Maine rivers could actually signal the presence of accumulated, selectively disadvantageous alleles rather than the presence of historical, adaptively beneficial alleles. It is for that reason that river-specific (and perhaps even region-specific) restoration may prove counter-productive. Regardless, the occurrence of adaptively beneficial alleles remaining in the genetically divergent samples from Maine waters (e.g., Cove Brook or Togus Stream) is not demonstrated by the data presented in the report. In addition, the effective absence of rigorous experimental evidence in Atlantic salmon regarding either the genetic component of phenotypic variation in adaptively useful traits or the relative fitness of individuals currently residing in Maine rivers mandates further study along these lines.

3. Analytical recommendations:

Much of the foregoing indicates directly and indirectly that the genetics study of King et al. (1999) is inadequate relative to assessing the distribution and significance of genetic variation in Atlantic salmon in North America and to risk assessment of management planing for restoration of the Atlantic salmon resource in Maine. First, it is not at all clear whether the genetic differences reported by King et al (1999) are valid statistically or meaningful biologically beyond demonstrating those random, stochastic fluctuations in allele frequencies at (presumably) selectively neutral genetic markers are occurring. More than anything, the occurrence and magnitude of the apparently random and stochastic genetic changes need to be better documented, as does the analysis of both temporal and spatial variation. This can be accomplished in part by better sampling and statistical design, and in part by incorporating more modern approaches in data analysis. Among the latter are (i) estimating genetic relatedness of individuals within samples (Ayres and Balding 1998; Saccheri et al. 1999; Lynch and Ritland 1999), (ii) estimating genetic effective population size based on the temporal and other methods (Pollak 1983; Waples 1989; Kuhner et al. 1995) and sampling of different cohorts over several generations, (iii) evaluating empirically whether individuals within a sample have been subjected to recent bottlenecks (Luikart and Cornuet 1998), and (iv) evaluating more rigorously the degree of genetic migration among localities by determining the most appropriate model of gene flow for the species (http://www.math.ntnu.no/~jarlet/migration). Second, because intensive genetic drift can result in an increase in the frequency of slightly deleterious alleles, it seems prudent to consider initiating a genetics (genomics) program in Maine that can enable experiments that will (i) estimate rigorously the genetic component of important life-history traits in Atlantic salmon, and (ii) assess rigorously the fitness of subpopulations (stocks) in Maine rivers and in the region. Several recent analytical approaches (e.g., Mousseau et al. 1998) are available that would facilitate this process.

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Member, NRC (NAS) Ocean Studies Board Committee for Atlantic Bluefin Tuna (1994)
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*Distinguished Teaching Award, College of Agriculture, Association of Former Students, Texas A&M University (1986)
Board of Governors, American Society of Ichthyologists and Herpetologists (1993-1999)
Outstanding Teacher, Genetics Undergraduate Society, Texas A&M University (1993)
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Invited Plenary Lecture, Eighth International Congress of Ichthyology, Oviedo, Spain (1994)
Outstanding Faculty Member, Undergraduate Biochemistry Society, Texas A&M University (1994)
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Integrated academic/research programs of intercollegiate faculty
Faculty membership increased from 30 to 65 by expanding college affiliations
Graduate student enrollment increased from 20 to 85; GRE scores increased from 1050 to 1200
Program officially recognized as first Intercollegiate Faculty at Texas A&M University
Program recognized as first university-wide graduate degree-granting program
Undergraduate degree program developed and implemented
Program budget developed and implemented through the Office of the Provost

Director, Center for Biosystematics and Biodiversity (1990-1996)

Developed proposal ($0.75 million) for Centers Program of the National Science Foundation
Developed blueprints for facility renovation to house Center upon receipt of NSF award
Supervised facility renovation and purchased all equipment and furniture
Hired Center staff and developed protocols/procedures for Center use
Redesigned Center and broadened mission

Research Facilitator, Texas Agricultural Experiment Station (1994-1996)

Developed/assimilated/promoted TAES Congressional Initiatives
Administrative liaison to scientists participating in multiyear DOE initiative for environmental restoration
Developed system-wide network to focus multidisciplinary expertise on ecosystem issues

Program Director, Division of Environmental Biology, National Science Foundation (1996-1997)

Managed program resources and administered peer-review process and panels
Participated in long-range planning and budget development for program and program cluster
Provided expertise to other programs/divisions/directorates within the Foundation
Represented program and program cluster to other federal agencies and universities

Leadership Development Activities:

Member, Class 4, ESCOP/ACOP (NASULGC) Leadership Program (1994-1995)
Invited Participant, Academic Administrators Development Program, Texas A&M University (1995)

TEACHING AND ACADEMIC ACTIVITIES

Current Teaching (1999-2000):

Perspectives in Genetics (92 students) - GENE 105 – Fall 1999 [Participant]
Honors Introductory Genetics – (25 students) - GENE 301H (25 students) - Fall 99 [Instructor]
Graduate Teaching Assistant Development – (10 students) - GENE 697 - Fall 99 [Participant]
Introductory Genetics (150 students) - GENE 301 – Spring 00 [Instructor]
Seminar for Graduate Students – (20 students) - GENE 681 (20 students) - Spring 00 [Participant]
Variable Student Credit Courses: GENE 485, GENE 491, GENE 685, GENE 691 [Instructor]

Teaching History:

Undergraduate:

Perspectives in Genetics (freshman majors) - GENE 105; Introductory Genetics - GENE 301; Principles of Heredity (non-science majors) - GENE 310; Human Genetics - GENE 320; Molecular Genetics - GENE 431; Genetics Seminar - GENE 481; Problems in Genetics - GENE 485; Research in Genetics - GENE 491

Graduate:

Introduction to Genetics - GENE 603; Population Genetics - GENE 612; Speciation and Evolution -GENE 625; Genetics Seminar - GENE 681; Problems in Genetics - GENE 685; History of Genetics - GENE 689; Theory of Genetics Research - GENE 690; Research - GENE 691; Graduate Teaching Assistant Development - GENE 697

Development:

Developed Undergraduate Honors Course in Genetics - GENE 301H (1980)
Developed Graduate Course for developing graduate teaching assistants - GENE 697 (1997)
Developed Undergraduate Curriculum in Genetics (1988); currently 200 majors
Developed Format for Undergraduate/Graduate Genetics Seminars - GENE 481 & GENE 681

Advising:

Departmental Undergraduate Advising (1975-present)
Departmental Graduate Advising (1975-present)
Graduate Advisor, Intercollegiate Program in Genetics (1984-1992)
Faculty Advisor, University Undergraduate Honors Program (1977-present)

UNIVERSITY ACADEMIC ACTIVITIES

Member, University Academic Revision Committee (1977-1980)
Member, Undergraduate Curriculum Committee, College of Science (1985-1987)
Member, Executive Council of the College of Agriculture and Life Sciences (1986-1989)
Member, Curriculum Committee, College of Agriculture and Life Sciences (1989-1992)
Member, Graduate Program Council, College of Agriculture and Life Sciences (1990-1993)
Selection Committee for Marine Fellows: Member (1989-1992), Chair (1993)
Member, Council of Principal Investigators (1990-1993)
Member, Panel for Enhancement of Scholarly and Creative Activities (1993-1994)
Member, Selection Committee, Association of Former Students Distinguished Achievement Awards (2000)

Academic Service Activities:

Faculty Representative, Memorial Student Center Council (1978-1980); Chair, SCONA 24 Delegate Selection Committee (1979); Member, Executive Committee, Intercollegiate Program in Genetics (1984-1992; 1994-present); Graduate Program Coordinator, Intercollegiate Program in Genetics (1982-1986; 1990-1992); Member, Biochemistry Graduate Studies Committee (1985-1987); Member, Wildlife and Fisheries Sciences Graduate Committee (1986-1988); Member, Undergraduate Honors Program Teacher/Scholar Award Committee (1987-1990); Member, Dean's Awards Committee (1988); Distinguished Graduate Student Award Committee - Member (1987-1988), Chair (1989); Chair or member of various other committees, e.g., faculty recruitment, teaching, seminars (1975-present)

Scholastic Review Activities:

Scientific Journals:

Editorial Board, *Copeia* - Journal of the American Society of Ichthyologists and Herpetologists (1984-1987)
International Editor, *Chromatin* (1991-1993)
International Editor, *Cytobios* (1991-1995)
Editorial Advisor, *Marine Ecology - Progress Series*, Springer International (1991-present)
Genetics, Development, and Morphology Editor, *Copeia* - Journal of the American Society of Ichthyologists and Herpetologists, 1993-1999

Invited Reviews: *Alabama Museum of Natural History; American Malacological Bulletin; Aquaculture; Aquatic Living resources; Biochemical Genetics; Biochemical Systematics and Ecology; Canadian Journal of Fisheries and Aquatic Sciences; Canadian Journal of Genetics and Cytology; Canadian Journal of Zoology; Chromatin; Chromosome Research; Comparative Biochemistry and Physiology; Contributions in Marine Science; Copeia; Cytobios; Evolution; Fisheries Research; Fishery Bulletin; Gene; Genetica; Genetics; Génétique, Sélection, and Évolution; Herpetological Conservation; Herpetological Monographs; Ichthyological Exploration of Freshwaters; Journal of Fish Biology; Journal of Heredity; Marine and Freshwater Research; Marine Biology; Marine Ecology-Progress Series; Marine Freshwater Research; Molecular Biology and Evolution; Molecular Ecology; National Geographic Research & Exploration; North American Journal of Fisheries Management; Proceedings of the National Academy of Sciences (USA); Progressive Fish Culturalist; Southwestern Naturalist; Systematic Biology; Transactions of the American Fisheries Society; World Mariculture Society; Zoological Journal of the Linnean Society*

Funding agencies:

Member, Advisory Panel for Systematic Biology, National Science Foundation (1984-1989)
Member, Advisory Panel for Postdoctoral and Mid-Career Fellowships, Division of Environmental Biology, National Science Foundation (1988-1989, 1993-1994)
Member, Review Panel for REP Program "Genetic Improvement of Crops and Animals", Texas Agricultural Experiment Station (1993-1994)
Member, Review Team, *Exxon Valdez Trustee Council*, Anchorage, Alaska (1995-present)
Member, Advisory Panel for Academic Research Infrastructure, National Science Foundation (1996)
Member, Advisory Panel for Integrative Graduate Education and Research Training Program, National Science Foundation (1997-1999)
Member, Advisory Panel for Postdoctoral Fellowships in the Biosciences, Division of Biological Infrastructure, National Science Foundation (1998-1999)
Member, Advisory Panel for Minority Postdoctoral Fellowships, Division of Biological Infrastructure, National Science Foundation (1999-2000)
Member, Advisory Panel for Doctoral Dissertation Improvement Grants, Division of Environmental Biology, National Science Foundation (1999-2000)
Member, Technical Review Panel, New York Sea Grant Program, 1999

Member, Technical Review Panel, Grand Canyon Monitoring and Research Center, Department of the Interior, 1999

Invited Reviews:

Alaska Sea Grant College Program; Binational Agricultural Research and Development Fund; Cooperative Institute for Fisheries Molecular Biology; Exxon Valdez Trustees Council; Florida Sea Grant College Program; Grants Program, Brigham Young University; Great Lakes Fishery Commission; Great Lakes Fishery Trust; International Science Foundation; Israel Science Foundation; Louisiana Sea Grant College Program; Maine/Hew Hampshire Sea Grant College Program; Marfin Program; Mississippi/Alabama Sea Grant Consortium; Natural Environment Research Council (UK); National Geographic Society; National Science Foundation (numerous programs); National Sea Grant College Program; New York Sea Grant College Program; North Carolina Sea Grant College Program; Ontario Ministry of Natural Resources; Saltonstall-Kennedy Program; South Carolina Sea Grant College Program; Texas Agricultural Experiment Station; Texas Sea Grant College Program; USDA Competitive Research Grants Program; USGS and National Institutes for Water Resources National Competitive Grants Program; Washington Sea Grant College Program

Professional Societies:

American Association for the Advancement of Science; American Fisheries Society; American Society of Ichthyologists and Herpetologists; Genetics Society of America; Sigma Xi; Society for the Study of Evolution; Society for Molecular Biology and Evolution; Society for Molecular Marine Biology and Biotechnology; Society of Systematic Biology; Southwestern Association of Naturalists; Texas Academy of Sciences

RESEARCH ACTIVITIES

Current Competitive Grant Support:

National Marine Fisheries Service (Marfin Program): Genetic analysis to determine mixing proportions by season of western Atlantic and Gulf of Mexico stocks of king mackerel - $164,696 (1997-1999)

National Science Foundation (Doctoral Dissertation Improvement Grant): Molecular phylogeny and evolution of *Notropis* - $10,000 (1997-1999)

Faculty Development Research Program, Texas Agricultural Experiment Station/Office of the Vice-President for Research, Texas A&M University: Equipment for the Center for Biosystematics and Biodiversity - $200,000 (1998-1999)

National Marine Fisheries Service (Marfin Program): Stock structure of red snapper in the Gulf of Mexico: Is their management as a single unit justified based on spatial and temporal patterns of genetic variation, otolith microchemistry, and growth rates - $404,534 -- CoPI with Dr. C. Wilson (Louisiana State University) and Dr. J. Cowan (University of South Alabama) – Total project funded at $1,100,000 (1998-2001)

Gulf and South Atlantic Fisheries Development Foundation: Genetic study of red snapper in the Gulf of Mexico - $30,000 (1999-2000)

National Marine Fisheries Service (Saltonstall-Kennedy Program): Development of hypervariable, nuclear-DNA markers for population structure analysis of Atlantic bluefin tuna - $58,548 -- CoPI with Dr. J. Graves (Virginia Institute of Marine Science) – Total project funded at $124,614 (1999-2000)

Competitive Grant Support since 1985:

National Science Foundation (Division of Environmental Biology): Chromosome banding and cyto-systematics in North American cyprinid fishes, with emphasis on the genus *Notropis* - $95,000 (1985-1987)

Texas Agricultural Experiment Station, Program Development: Molecular and evolutionary genetics of vertebrates genomes - $40,000 (Co-PI with J.W. Bickham and D.J. Schmidly) (1985)

NIH Biomedical Research Support Grant Program, Texas A&M University: Analysis of satellite DNA in *Notropis* fish (Cyprinidae) - $6,000 (1985)

Texas Advanced Technology Research Program, State of Texas: Nutritional, environmental, and genetic basis for red drum culture in Texas - $250,000 (Co-PI with E.H. Robinson and W.H. Neill) (1986-1988)

National Science Foundation (Division of Enviromnmental Biology): Chromosome banding and cyto-systematics in North American cyprinid fishes, with emphasis on the genus *Notropis* - $96,861 (1987-1989)

National Science Foundation (REU Supplement): Chromosome banding and cytosystematics in North American cyprinid fishes, with emphasis on the genus *Notropis* - $3,939 (1987)

Texas A&M University, Biotechnology ERA Program: Genetic engineering in aquatic species - $40,000 (1987-1989)

Texas A&M University Sea Grant College Program: Genetic variation within and among natural and domesticated populations of redfish - $106,844 (1987-1989)

NIH Biomedical Research Support Grant Program, Texas A&M University: Cytological and molecular analyses of variation in ribosomal RNA genes in cyprinid fish - $3,000 (1988)

National Science Foundation (REU Supplement): Chromosome banding and cytosystematics in North American cyprinid fish, with emphasis on the genus *Notropis* - $3,543 (1988)

National Marine Fisheries Service (Marfin Program): Population genetic studies of red drum in the Gulf of Mexico - $143,781 ($61,886 match provided by Texas Parks and Wildlife Department) (1989-1991)

Texas Agricultural Experiment Station, Program Development: Genetic engineering in largemouth bass - $25,440 (Co-PI with L. DiMichele and L. Skow) (1989)

National Science Foundation (International Programs): Cytosystematics of cyprinid fishes - $25,683 (1989-1991)

National Science Foundation (Division of Biological Infrastructure): Biological Facilities Center in Biosystematics - $492,500, with $260,500 match from Texas A&M University and the Texas Agricultural Experiment Station (1990)

Texas A&M University Sea Grant College Program: Mitochondrial DNA variation in red drum and evaluation of red drum stocking success in Texas bays - $127,689 ($15,708 match from Texas Parks and Wildlife Department) (1989-1991)

Texas A&M University, Animal Biology ERA Program: Genetic engineering in aquatic species - $45,000 (1989-1991)

National Marine Fisheries Service (Marfin Program): Genetic studies to determine stock structure of reef fishes in the Gulf of Mexico - $60,260 (1990-1991)

Texas A&M University Sea Grant College Program: Genetic variation among spotted seatrout in the Gulf of Mexico - $3,960 (1991)

Texas A&M University Sea Grant College Program: Population genetic studies of red snapper in the northern Gulf of Mexico - $146,290 (1991-1993)

National Science Foundation (Division of Environmental Biology): Molecular systematics of North American cyprinid fishes: *Cyprinella lutrensis* and the *C. lutrensis* complex - $175,000 (1992-1995)

National Marine Fisheries Service (Marfin Program): Population genetic studies of king mackerel in the Gulf of Mexico - $122,540 (1992-1994)

National Science Foundation (REU Supplement): Molecular systematics of North American cyprinid fishes: *Cyprinella lutrensis* and the *C. lutrensis* complex - $5,000 (1992)

Texas A&M University Sea Grant College Program: Genetic studies to determine effective female population sizes in finfish species impacted by the shrimp fishery bycatch - $11,700 (1993)

Alabama-Tombigbee River Coalition: Studies on biodiversity and endangered species -$11,400 (1994)

Program to Enhance Scholarly/Creative Activities, Office of the Vice President for Research, Texas A&M University: Conservation genetics of *Dionda* fishes - $5,194 (1994)

National Science Foundation (REU Supplement): Molecular systematics of North American cyprinid fishes: *Cyprinella lutrensis* and the *C. lutrensis* complex - $5,000 (1994)

National Marine Fisheries Service (Saltonstall-Kennedy Program): Genetic studies to determine stock structure of greater amberjack in the Gulf of Mexico and southeastern (US) Atlantic - $99,078 (1995-1996)

National Marine Fisheries Service (Marfin Program): Genetic stock structure and species identification of sharks involved in commercial and recreational fisheries of the Gulf of Mexico and southeastern (US) Atlantic - $155,842 (1995-1997)

National Science Foundation (REU Supplement): Molecular systematics of North American cyprinid fishes: *Cyprinella lutrensis* and the *C. lutrensis* complex - $5,000 (1995)

Cooperative Institute for Fisheries Molecular Biology (FISHTEC): Generation of microsatellite loci in Atlantic bluefin tuna - $24,900 (1995)

Research Enhancement Program, Texas Agricultural Experiment Station: Construction of a linkage map for the red drum (redfish) genome - $38,250 (1996-1997)

Advanced Research Program, State of Texas: A test of the hypothesis that variance in reproductive success limits effective population size in marine organisms - $117,000 (1996-1998)

National Marine Fisheries Service (Saltonstall-Kennedy Program): Development of microsatellite loci for stock-structure study of Gulf red snapper - $59,786 (1997-1998)

Cooperative Institute for Fisheries Molecular Biology (FISHTEC): Atlantic bluefin tuna genetics study - $32,000 (1997-1998)

National Marine Fisheries Service (Marfin Program): Genetic analysis to determine mixing proportions by season of western Atlantic and Gulf of Mexico stocks of king mackerel - $164,696 (1997-1999)

National Science Foundation (Doctoral Dissertation Improvement Grant): Molecular phylogeny and evolution of *Notropis* - $10,000 (1997-1999)

Faculty Development Research Program, Texas Agricultural Experiment Station/Office of the Vice-President for Research, Texas A&M University: Equipment for the Center for Biosystematics and Biodiversity - $200,000 (1998-1999)

National Marine Fisheries Service (Marfin Program): Stock structure of red snapper in the Gulf of Mexico: Is their management as a single unit justified based on spatial and temporal patterns of genetic variation, otolith microchemistry, and growth rates - $404,534 -- CoPI with Dr. C. Wilson (Louisiana State University) and Dr. J. Cowan (University of South Alabama) – Total project funded at $1,100,000 (1998-2001)

Gulf and South Atlantic Fisheries Development Foundation: Genetic study of red snapper in the Gulf of Mexico - $30,000 (1999-2000)

National Marine Fisheries Service (Saltonstall-Kennedy Program): Development of hypervariable, nuclear-DNA markers for population structure analysis of Atlantic bluefin tuna - $58,548 -- CoPI with Dr. J. Graves (Virginia Institute of Marine Science) – Total project funded at $124,614 (1999-2000)

Research Publications:

Book Chapters/Review Articles:

Gold, J.R. (1977) Systematics of western North American trout (*Salmo*), with notes on the redband trout of Sheepheaven Creek, California. Canadian Journal of Zoology 55: 1858-1873.

Gold, J.R. (1979) Cytogenetics. In: "Fish Physiology" (W.S. Hoar, D.J. Randall, and J.R. Brett, eds.). Volume VIII, Chapter 7: 353-405. Academic Press, New York and London.

Buth, D.G., Dowling, T.E., and Gold, J.R. (1991) Molecular and cytological investigations. In: "Cyprinid Fishes: Systematics, Biology, and Exploitation" (J.S. Nelson and I.J. Winfield, eds.). Chapter 4: 83-126. Chapman and Hall, London.

Amemiya, C.T., Powers, P.K., and Gold, J.R. (1992) Chromosomal evolution in the North American cyprinids. In: "Systematics, Historical Ecology, and North American Freshwater Fishes" (R. L. Mayden, ed.). Chapter 18: 515-533. Stanford University Press, Stanford, California.

Gold, J.R., Ragland, C.J., and Woolley, J.B. (1992) Evolution of genome size in North American fishes. In: "Systematics, Historical Ecology, and North American Freshwater Fishes" (R. L. Mayden, ed.). Chapter 19: 534-550. Stanford University Press, Stanford, California.

Magnuson, J.J., Block, B.A., Deriso, R.B., Gold, J.R., Grant, W.S., Quinn, T.J., Saila, S.B., Shapiro, L. and Stevens, E.D. (1994) An Assessment of Atlantic Bluefin Tuna. National Academy Press, Washington, D.C.

King, T.L., R. Ward, I.R. Blandon, R.L. Colura, and J.R. Gold (1995) Using genetics in the design of red drum and spotted seatrout stocking programs: a review. In: "Uses and Effects of Cultured Fishes in Aquatic Ecosystems" (H.L. Schramm, Jr. and R.G. Piper, eds.). American Fisheries Society Symposium 15:499-502.

Refereed Journal Articles:

Gold, J.R. and Green, M.M. (1974) A meiotic effect of a mutator gene in *Drosophila melanogaster*. Molecular and General Genetics 135: 245-255.

Gold, J.R. (1974) A fast and easy method for chromosome karyotyping in adult teleosts. The Progressive Fish-Culturalist 36: 169-71.

Gold, J.R. and Gall, G.A.E. (1975) Chromosome cytology and polymorphism in the California High Sierra golden trout (*Salmo aguabonita*). Canadian Journal of Genetics and Cytology 17: 41-53.

Gold, J.R. and Gall, G.A.E. (1975) The taxonomic structure of six golden trout (*Salmo aguabonita*) populations from the Sierra Nevada, California. California Academy of Sciences, Proceedings, XL(10): 243-263.

Gold, J.R. and Gall, G.A.E. (1975) Further record of Little Kern golden trout, *Salmo aguabonita whitei*, in the Little Kern River basin, California. California Fish and Game 61: 248-250.

Gold, J.R., Pipkin, R.E., and Gall, G.A.E. (1976) Artificial hybridization between rainbow (*Salmo gairdneri*) and golden trout (*Salmo aguabonita*). Copeia 1976: 597-598.

Gold, J.R. and Avise, J.C. (1976) Spontaneous triploidy in the California roach *Hesperoleucus symmetricus* (Pisces: Cyprinidae). Cytogenetics and Cell Genetics 17: 144-149.

Gall, G.A.E., Busack, C.A., Smith, R.C., Gold, J.R., and Kornblatt, B.J. (1976) Biochemical genetic variation in populations of golden trout, *Salmo aguabonita*: Evidence of the threatened Little Kern River golden trout, *S. a. whitei*. Journal of Heredity 67: 330-335.

Gold, J.R., Avise, J.C., and Gall, G.A.E. (1977) Chromosome cytology in the cutthroat trout series, *Salmo clarki* (Salmonidae). Cytologia 42: 377-382.

Avise, J.C. and Gold, J.R. (1977) Chromosomal divergence and rates of speciation in two families of North American fishes. Evolution 31: 1-13.

Gold, J.R. and Avise, J.C. (1977) Cytogenetic studies in North American minnows (Cyprinidae). I. Karyology of nine California genera. Copeia 1977: 541-549.

Avise, J.C. and Gold, J.R. (1977) Cytogenetic studies in North American minnows (Cyprinidae). IV. Somatic polyploidy in *Gila bicolor*. Canadian Journal of Genetics and Cytology 19: 657-662.

Gold, J.R., Nicola, S.J., and Gall, G.A.E. (1978) Taxonomy of the Colorado cutthroat trout (*Salmo clarki pleuriticus*) of the Williamson Lakes, California. California Fish and Game 64: 98-103.

Gold, J.R., Womac, W.D., Deal, F.H., and Barlow, J.A. (1978) Gross karyotypic change and evolution in North American cyprinid fishes. Genetical Research 32: 37-46.

Gold, J.R., Whitlock, C.W., Karel, W.J., and Barlow, J.A. (1979) Cytogenetic studies in North American minnows (Cyprinidae). VI. Karyotypes of thirteen species in the genus *Notropis*. Cytologia 44: 457-466.

Gold, J.R., Janak, B.J., and Barlow, J.A. (1979) Karyology of four North American percids (Perciformes: Percidae). Canadian Journal of Genetics and Cytology 21: 187-191.

Gold, J.R., Pipkin, R.E., and Gall, G.A.E. (1979) Notes on a hybridization experiment between rainbow and golden trout. California Fish and Game 65: 179-183.

Gold, J.R., Karel, W.J., and Strand, M.R. (1980) Chromosome formulae of North American fishes. The Progressive Fish-Culturalist 42: 10-23.

Gold, J.R. (1980) Chromosomal change and rectangular evolution in North American cyprinid fishes. Genetical Research 35: 157-164.

Gold, J.R., Womac, W.D., Deal, F.H., and Barlow, J.A. (1981) Cytogenetic studies in North American minnows (Cyprinidae). VII. Karyotypes of thirteen species from the southern United States. Cytologia 46: 105-115.

Gold, J.R. and Gall, G.A.E. (1981) Systematics of golden trout, *Salmo aguabonita*, from the Sierra Nevada, California. California Fish and Game 67: 204-230.

Rayburn, A.L. and Gold, J.R. (1982) A procedure for obtaining mitotic chromosomes from maize. Maydica 27: 113-121.

Gold, J.R. and Ellison, J.R. (1983) Silver-staining for NORs of vertebrate chromosomes. Stain Technology 58: 51-55.

Gold, J.R. (1984) Silver-staining and heteromorphism of chromosomal nucleolus organizer regions in North American cyprinid fishes. Copeia 1984: 133-139.

Amemiya, C.T., Bickham, J.W. and Gold, J.R. (1984) A cell culture technique for chromosome preparation in cyprinid fishes. Copeia 1984: 232-235.

Gold, J.R. and Price, H.J. (1985) Genome size variation among North American minnows (Cyprinidae). I. Distribution of the variation in five species. Heredity 54: 297-305.

Rayburn, A.L., Price, H.J., Smith, J.D., and Gold, J.R. (1985) C-band heterochromatin and DNA content in *Zea mays* L. American Journal of Botany 72: 1610-1617.

Amemiya, C.T. and Gold, J.R. (1986) Chromomycin A_3 stains nucleolus organizer regions of fish chromosomes. Copeia 1986: 226-231.

Gold, J.R. (1986) Spontaneous triploidy in a natural population of the fathead minnow *Pimephales promelas* (Pisces, Cyprinidae). Southwestern Naturalist 31: 527-529.

Gold, J.R. and Amemiya, C.T. (1986) Cytogenetic studies in North American minnows (Cyprinidae). XII. Patterns of chromosomal NOR variation among fourteen species. Canadian Journal of Zoology 64: 1869-1877.

Amemiya, C.T., Kelsch, S.W., Hendricks, F.S., and Gold, J.R. (1986) The karyotype of the Mexican blindcat, *Prietella phraeatophila* Carranza. Copeia 1986: 1024-1028.

Gold, J.R., Amemiya, C.T., and Ellison, J.R. (1986) Chromosomal heterochromatin differentiation in North American cyprinid fishes. Cytologia 51: 557-566.

Amemiya, C.T. and Gold, J.R. (1987) Chromomycin staining of vertebrate chromosomes: enhancement of banding patterns by NaOH. Cytobios 49: 147-152.

Gold, J.R. and Amemiya, C.T. (1987) Genome size variation in North American minnows (Cyprinidae). II. Variation among twenty species. Genome 29: 481-489.

Amemiya, C.T. and Gold, J.R. (1987) Karyology of 12 species of North American Cyprinidae from the southern United States. Cytologia 52: 715-719.

Karel, W.J. and Gold, J.R. (1987) A thermal denaturation study of genomic DNAs from North American minnows (Cyprinidae: Teleostei). Genetica 74: 181-187.

Gold, J.R., Amemiya, C.T., Karel, W.J., and Iida, N. (1988) The karyotype and genome structure of the pirate perch *Aphredoderus sayanus* (Aphredoderidae: Teleostei). Experientia 44: 68-70.

Amemiya, C.T. and Gold, J.R. (1988) Chromosomal NORs as taxonomic and systematic characters in North American cyprinid fish. Genetica 76: 81-90.

Gold, J.R. and Karel, W.J. (1988) DNA base composition and nucleotide distribution among fifteen species of teleostean fishes. Comparative Biochemistry and Physiology 90B: 715-719.

Gold, J.R., Zoch, P.K., and Amemiya, C.T. (1988) Cytogenetic studies in North American minnows (Cyprinidae). XIV. Chromosomal NOR phenotypes of eight species from the genus *Notropis*. Cytobios 54: 137-147.

Moyer, S.P., Ma, D.P., Thomas, T.L., and Gold, J.R. (1988) Characterization of a highly repeated satellite DNA from the cyprinid fish *Notropis lutrensis*. Comparative Biochemistry and Physiology 91B: 639-646.

Gold, J.R., Kedzie, K.M., Bohlmeyer, D.A., Jenkin, J.D., Karel, W.J., Iida, N., and Carr, S.M. (1988) Studies on the basic structure of the red drum (*Sciaenops ocellatus*) genome. Contributions in Marine Science 30 (Supplement): 57-64.

Zoch, P.K., Hanks, B.K., and Gold, J.R. (1989) The standard and NOR-stained karyotype of *Rivulus agilae* (Rivulidae: Teleostei). Texas Journal of Science 41: 104-106.

Ragland, C.J. and Gold, J.R. (1989) Genome size variation in the North American sunfish genus *Lepomis* (Pisces: Centrarchidae). Genetical Research 53: 173-182.

Amemiya, C.T. and Gold, J.R. (1990) Chromosomal NOR phenotypes of seven species of North American Cyprinidae, with comments on cytosystematic relationships of the *Notropis volucellus* species-group, *Opsopoeodus emiliae*, and the genus *Pteronotropis*. Copeia 1990: 68-78.

Gold, J.R., Ragland, C.J., and Schleising, L.J. (1990) Genome size variation and evolution in North American cyprinid fishes. Genetique, Selection, and Evolution 22: 11-29.

Bohlmeyer, D.A. and Gold, J.R. (1990) Extensive polymorphism at adenosine deaminase in the marine fish *Sciaenops ocellatus*. Animal Genetics 21: 211-213.

Gold, J.R. and Zoch, P.K. (1990) Intraspecific variation in chromosomal nucleolus organizer regions in *Notropis chrysocephalus* (Pisces: Cyprinidae). Southwestern Naturalist 35: 211-215.

Amemiya, C.T. and Gold, J.R. (1990) Cytogenetic studies in North American minnows (Cyprinidae). XVII. Chromosomal NOR phenotypes of 12 species with comments on cytosystematic relationships among 50 species. Hereditas 112: 231-247.

Gold, J.R., Jenkin, J.D., and Powers, P.K. (1990) Cytogenetic studies in North American minnows (Cyprinidae). XVIII. Chromosomal NOR variation among eight species. Cytologia 55: 483-492

Gold, J.R. and Richardson, L.R. (1990) Restriction site heteroplasmy in the mitochondrial DNA of the marine fish *Sciaenops ocellatus*. Animal Genetics 21: 313-316.

Gold, J.R., Li, Y., Shipley, N.S., and Powers, P.K. (1990) Improved methods for working with fish chromosomes with a review of metaphase chromosome banding. Journal of Fish Biology 37: 563-575.

Gold, J.R., Li, Y.C., Schmidt, T.R., and Tave, D. (1991) Nucleolar dominance in interspecific hybrids of cyprinid fishes. Cytobios 65: 139-147.

Bohlmeyer, D.A. and Gold, J.R. (1991) A protein electrophoretic analysis of population structure in the red drum (*Sciaenops ocellatus*). Marine Biology 108: 197-206.

Li, Y.C. and Gold, J.R. (1991) Standard and NOR-stained karyotypes of three species of North American cyprinid fishes. Texas Journal of Science 43: 207-211.

Gold, J.R., Ragland, C.J., Birkner, M.C. and Garrett, G.P. (1991) A simple procedure for long term storage and preparation of fish cells for flow cytometry. The Progressive Fish-Culturalist 53: 108-110.

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Indeed, fish reported as escapees were classified a priori as escapees based on phenotypic characteristics and only then were tissue samples taken to characterize the group to which the individual should be assigned. No chain of custody evidence was presented to permit retroactive analysis of tissue samples and to allow an after the fact, double blind test of the subjective sorting technique. The two physical characteristics used to classify subjectively an individual, fin condition and scale annuli, are highly plastic characteristics, and no baseline studies have been conducted to verify their accuracy in classification using modern biochemical genetic techniques.

Second, assuming that aquaculture escapees can be distinguished from "wild" salmon, limited opportunity exists for interactions between river salmon and farm salmon. The 1999 Status Review identifies approximately 98 farm salmon or suspected farm salmon found in the downeast rivers (Dennys and Narraguagus) from 1993 to 1997. If these are accurate assignments, they translate to approximately 14 escapees per year in two of the eight rivers included in the proposed DPS. There is limited documentation as to whether any of these farm salmon were sexually mature or were present at a time when salmon in the river were also spawning.

Furthermore, in order for escaped farm or feral salmon to present a detrimental genetic threat, a number of obstacles would have to be overcome including the following: (1) the fish would have to survive in the wild; (2) reach sexual maturity; (3) find its way up river evading predators and other natural barriers; and (4) arrive at a spawning site at the appropriate time in the season. (Bailey 1999) A number of natural obstacles to interbreeding have been identified in the literature, including tendencies in feral salmon to spawn in the lower reaches of salmon rivers, as well as later in the season than wild salmon. Id. The BRT addresses none of these factors, each of which significantly reduces the prospect of a threat and all of which, taken together, reduce any threat to the level of de minimis.

Despite the fact that the percentage of escapes is extremely small, the Maine aquaculture industry has nevertheless adopted, across the board, a voluntary code of best management practices, for it is a fact that there are millions of fish in commercial aquaculture net pens and escapes should be controlled. In addition to the adoption of best management practices, by next year there will be effective barriers in all of the downeast rivers to intercept the exceedingly small percentage that could escape. The Narraguagus River has a fish trap operating in connection with the dam. In 1999, weirs were installed in the Dennys and Pleasant Rivers. This coming year a weir is to be placed in the East Machias River and the Atlantic Salmon Commission is close to completing design for placement of a weir in the Machias River. Even if the Machias River weir cannot be completed in time for this year's spawning season, the falls at the head of the river present a natural obstacle that, many believe, works effectively to prevent the in-migration of farmed salmon. The three other rivers (Sheepscot, Ducktrap, and Cove Brook) are sufficiently distant from aquaculture pens as not to present any material risk of interaction.

The Services assert that aquaculture fish represent a significant threat to fish in the proposed DPS and that there is a lack of data on loss of fish from the sea cage sites. More relevant than the loss rate is how many farmed salmon enter DPS rivers and how many of those are sexually mature and capable of mating with "wild" fish in the rivers. The following table sets forth federal estimates of farmed salmon in Maine rivers:

Federal Estimates of Atlantic Salmon of Farmed Origin in Maine Rivers

Year	St Croix*	Narraguagus	Dennys	Sea Cage Population	% of Escapes
1994	98	42	1	6.65 million	.00212
1995	13	4	0	7.46 million	.00022
1996	20	21	8	7.94 million	.00061
1997	27	2	0	8.94 million	.00032
1998	24	unk	0	9.00 million	.00026

* Note: Specifically excluded from proposed DPS.

The above data shows that the percentage of farmed salmon appearing in Maine salmon rivers is an exceedingly small percentage of the total standing crop of farmed salmon in sea cages. Even if one were to assume that there were ten times the number of farmed salmon entering Maine rivers than are observed, the potential interaction rate, based on adults actually entering the rivers, would range from 2/100ths to 2/1000ths of one percent. This also assumes there is no contribution of escapement from Canadian salmon farms which annually produce two times as many aquaculture salmon as does Maine.

Finally, the Services assert that some aquaculture salmon were intentionally released by the aquaculture industry. As far as the State is aware, there are no instances where aquaculture salmon were intentionally released by the Maine aquaculture industry. The citations for this allegation do not contain any documented instances where intentional releases occurred. The Services should acknowledge that the allegation of intentional releases is unfounded.

5. Habitat.

The seventh and final factor cited by the Services to support their determination that there has been a decline since 1997 of Atlantic salmon is that freshwater habitat in Maine "continues to be threatened by water withdrawal and sedimentation." 64 Fed. Reg. at 62627. Again, upon close scrutiny, these reasons last lack any credible scientific or factual support.

Water extraction, according to the Services, is "the most obvious and immediate threat" on some rivers within the DPS range because "it has the potential to expose or reduce salmon habitat." 64 Fed. Reg. at 62632. And "sedimentation from a variety of sources also warrants closer review," according to the Services, "as it may be altering habitat and rendering it incapable of supporting Atlantic salmon." Id.

While the Services implicate only water withdrawal and sedimentation as the habitat factors that have caused the status of the proposed DPS of Atlantic salmon to decline since December 1997, 64 Fed. Reg. at 62627, the following potential impacts on freshwater habitat from other causes are also mentioned by the Services: "beaver and debris dams and poorly designed road crossings, input of nutrients, chronic exposure to insecticides, herbicides, fungicides and pesticides, elevated water temperatures from processing water discharges, and removal of vegetation along stream banks." 64 Fed. Reg. at 62632.

It should be noted that not one of these factors was identified as a threat or even a potential threat in 1997. And even now, the Services hedge stating, "although there does not appear to be one particular habitat issue which poses a significant threat by itself, the cumulative impacts from habitat degradation discussed above may reduce habitat quality and limit habitat quantity available to Gulf of Maine DPS salmon at various stages in their life history within freshwater." 64 Fed. Reg. at 62632. There is no empirical support for this assertion. Information supplied with these comments from state agencies involved in salmon restoration shows that Maine habitat for salmon is in excellent condition.

According to the Services, "The relationship between these [habitat] factors and freshwater production and survival of salmon needs to be studied in detail so that cause and effect connections can be determined or ruled out." 64 Fed. Reg. at 62632. That is not what the law stipulates. The ESA requires the Secretary to make a determination as a predicate to listing; "to determine" means to fix conclusively or authoritatively, not to make a provisional assumption that can be studied later and only then "determined or ruled out." As demonstrated conclusively above, the attempt to create a threat to freshwater habitat from the Narraguagus River preliminary data is misplace.

Even these provisional assumptions (not actual determinations) in the proposed rule are contradicted by earlier determinations that water extraction is not a major threat and that state agencies have demonstrated an ability to address and minimize other habitat threats. Thus, the Services ignore an entire set of thorough determinations made in December 1997. Three year's ago, Maine's Conservation Plan was recognized as "a major new development . . . which has substantially reduced threats to the species," and that "will facilitate the continued rehabilitation of the seven rivers DPS." 62 Fed. Reg. at 66337. The Services offer no evidence or data to justify departing from this determination.

a. Water Withdrawal.

The Services state that water extraction poses a threat that, if unregulated, is likely to grow due to increased blueberry production, which requires irrigation. 1999 Status Review at 101. However, the Services then confirm that water extraction is regulated by the Land Use Regulatory Commission (LURC) in unorganized towns and by the Department of Environmental Protection (DEP) in organized towns. To obtain a permit from the foregoing agencies, an applicant must demonstrate that "the withdrawal (volume, timing and rate of withdrawal) will not adversely affect existing uses and natural resources."

In their 1995 proposal to list, the Services concluded that "agricultural practices [including water extraction] are not considered a major threat to Atlantic salmon." 60 Fed. Reg. 50530, 50532 (September 29, 1995).

When the Services' assertions are ground-truthed, it is evident that water withdrawal practices are not a threat, particularly in light of regulation in key rivers over the past two years. The Services must reconcile the following in citing unregulated water withdrawal as a continuing threat not being adequately addressed by the State:

- The State of Maine funded a $250,000 water-flow study to enable optimal flows to be set and water withdrawals limited. Initially under the plan, the federal government had committed to fund this study, but when it failed to come through, the State raised the funds to undertake the study.

- Based on this study, the Maine Land Use Regulation Commission (LURC) imposed irrigation restrictions on several rivers – the Pleasant, Machias and Narraguagus. Blueberry growers were issued LURC permits that restricted use, even in one of the driest summers on record. Permits will be required again this year.

- The State is currently completing work on comprehensive water management plans for these same three watersheds. A draft plan for the Pleasant River has been distributed among stakeholders for comments with the intention of finalizing the plan in June. Plans for the other two watersheds are currently in development, and will be finalized this summer.

- A storage and permitting workgroup has formed to expedite permitting and construction of irrigation alternatives to the Pleasant, Machias and Narraguagus Rivers.

Clearly the State has demonstrated substantial progress in addressing potential concerns for water use impacting Atlantic salmon. Furthermore, the Services offer no data – scientific or otherwise – to support their assumption that state regulated water withdrawals pose a threat.

b. **Sedimentation; Peat Mining.**

The theory that sedimentation is now an actual or potential threat does not square with the Services own determinations, and, once again, no data is offered to justify the change in position. In fact, the quality of water in the rivers in question is high. A recent survey published by the National Wildlife Foundation confirms the fact that water quality in Maine's rivers is exemplary, and the Downeast rivers in particular are among the highest quality waters in the State. See Attachment 3, at Appendix A. In addition, the EPA has approved the State's Non-point Source Pollution (NPS) Control Program Upgrade and 15 Year Strategy, noting that "Maine's NPS Program is exemplary." Attachment 3, at Appendix B.

- The Services assert that certain forestry activity, such as "poor logging practices and road construction can cause erosion resulting in the deposition of silt and sediment in [salmon] habitat." 1999 Status Review, at 108. However, in both their 1995 listing proposal and the 1997 withdrawal notice, the Services conclude that "while past forestry practices may have adversely affected salmon and their habitat, <u>the regulatory mechanisms currently in place are sufficient</u> to ensure that ongoing practices do not pose a major threat to the species." 62 Fed. Reg. at 66329 (emphasis added); 60 Fed. Reg. at 50532.

- The 1999 Status Review notes that forestry activity in Maine is concentrated in the watersheds of the Dennys, East Machias, Machias, Pleasant, and Narraguagus Rivers, that Champion Paper owns 433,000 acres within those watersheds and the company has implemented a riparian zone management plan that (i) "<u>exceeds state and federal regulations</u>," (ii) "recognizes the wildlife diversity of riparian zones and strives to protect water quality and accommodate the needs of wildlife," and (iii) establishes 100 to 660-foot wide protection zones around sensitive water bodies. 1999 Status Review, at 108 (emphasis added).

- The 1995 Status Review noted that removal of vegetation, production of silt and debris, and use of pesticides by the forestry industry all had the potential to impact salmon habitat. However, the Services concluded that "numerous state and federal laws exist to prevent adverse effects on Atlantic salmon and other species," and that "[c]urrent forestry practices are not considered a major threat to Atlantic salmon." 1995 Status Review, at 37 (emphasis added).

- Although the 1999 Status Review suggests that salmon and their habitat in the Narraguagus River "could be negatively impacted" by peat mining which, according to the Services, leads to "discharges of low pH water containing suspended peat silt and dissolved metals and pesticides," there are no documented instances where this is a problem. See 1999 Status Review, at 111. To the contrary, the Services acknowledged that Farm Pond and McCoy Brook trap sediment before it reaches the mainstem Narraguagus, and that waters in the vicinity of peat bogs exhibit low pH (below 5) regardless of whether it is mined (e.g., Denbo Heath on the Narraguagus) or unmined (e.g., the Great Heath on the Pleasant). 1999 Status Review, at 111.

- The 1999 Status Review also notes that in 1995 six sedimentation basins were built to curb peat laden discharges from disturbed areas of Denbo Heath, that partial failures of the new sedimentation basins were reported in the spring of 1996 and 1997 after which corrections were made to the sedimentation ponds and collection systems, and that no berm failures, water quality or other problems were observed in 1998. 1999 Status Review, at 111-112.

- In their December 1997 withdrawal notice, the Services concluded that there are "no known current impacts to salmon" caused by peat mining. 62 Fed. Reg. at 66331.

What empirical data now supports the implication that sedimentation is a problem? In identifying "continued" threats to salmon habitat from water withdrawal and sedimentation as a principal reason for the decline of Atlantic salmon since December 1997, 64 Fed. Reg. at 62627, the Services point to no specific deficiencies in forestry management practices and offer no evidence to support their assertion that normal farming practices "discharge nutrients, sediments and/or pesticides which could lead to habitat degradation." 1999 Status Review, at 101. The list of activity, study and education in the annual report by the Department of Conservation, see Attachment 7, effectively rebuts the Services' speculation. Moreover, the Services do not address the following:

- No data from any study presented show that normal agricultural practices such as plowing, disking, harrowing, and cultivation of crops are adversely affecting the riparian zone or salmon habitat;

- The Maine Forest Service (MFS) conducts educational seminars for woodlot owners, loggers and foresters on best management practices and riparian buffers and in the process has distributed maps of salmon watershed and habitat to private citizens;

- MFS Operations Notification Database is programmed so that landowners who submit notifications for harvest in towns with critical salmon habitat automatically receive notification of such habitat from MFS;

- Since March 1, 1999, MFS has reviewed approximately 2600 notifications of forestry operations, and has field-inspected 36 harvests near critical salmon habitat, finding no significant impacts on water quality resulting from such operations;

- LURC employed a summer intern to monitor the five ASC watersheds in order to compile an inventory of non-point pollution sources, identifying 34 relatively minor non-point pollution sources where LURC compliance staff developed with owners at each site mutually agreeable plans to correct problems.

- LURC compliance staff responded to all reports of sedimentation within the ASC watersheds and worked with responsible parties to stop such discharges and prevent recurrence.

Before any adverse determination is made by the Services on the basis of provisional assumptions of threats from sedimentation or peat mining, the Services should address the facts and provide a detailed explanation of why current State measures are no longer adequate to address such concerns.

c. Beaver Dams and other Obstruction to Passage.

The Services assert that obstructions to passage are caused by beaver dams and poorly designed road crossings, but offer no facts that passage is obstructed. On the contrary, the Services say the State, Project SHARE, and the watershed councils "have demonstrated an ability to annually remove or reduce that threat." 64 Fed. Reg. at 62632. Specifically, ASC field staff, with the assistance of volunteers from the Downeast Watershed Council and "volunteers" from the Washington County state prison system breached fifty beaver dams in 1998 and another 55 in 1999 on proposed DPS rivers. And local watershed councils have cooperated with private landowners to identify and correct problems caused by poorly designed and constructed roadways. Obstruction to passage has been aggressively pursued according to documented activity.

In addition, the Services' own data on habitat accessibility reveals that 100 percent of the historical salmon habitat of the Sheepscot, Ducktrap, Narraguagus, Pleasant, Machias, East Machias, and Dennys rivers is currently accessible to Atlantic salmon. 1999 Status Review, at 21, Figure 4.1.2. The units of accessible habitat on these rivers have increased between 1995 and 1999. Compare 1999 Status Review, at 21, Figure 4.1.2 with 1995 Status Review at 15, Figure 3.4. Moreover, existing salmon habitat on the Dennys "exceeds that which was available historically." See 1999 Status Review, at 97.

d. Input of Nutrients.

The only study of nutrients referenced in the 1999 Status Review, Taylor 1973, measured nutrient levels at two sites in the Machias and at sites in nine other rivers, streams, and hatchery water sources. Again, there is no basis for asserting that nutrient input is a current threat, especially when the Services did not previously consider it to be problem. Presumably, 25-year old data is of highly dubious value in determining current threats presented by nutrients. Nonetheless, the State took additional action since 1997 to strengthen protection in this area. In March 1998, the Maine Legislature passed "An Act Regarding Nutrient Management, 7 MRSA § 747 et seq., that requires each Maine farm with more than 50 animal units (one unit = 1,000 lbs. of body weight) to develop a whole farm nutrient management plan by January 1, 2001, and prohibits winter spreading of manure. The issue of nutrient input primarily would only affect one of the rivers in question – the Sheepscot. This new law with accompanying regulations under development will only serve to bolster and support the continuous improvement and maintenance of habitat envisioned under the Plan.

e. "Chronic exposure to insecticides, herbicides, fungicides, and pesticides (in particular, those used to control spruce budworm)."

The 1999 Status Review states that the herbicide hexazinone was detected at sites in the Narraguagus River during routine sampling by the State for an array of pesticides in 1991. According to the Services, "Although the concentrations detected are low, its presence throughout the summer and fall at low flow periods suggests that it is entering the river through groundwater flow rather than storm runoff." 1999 Status Review, at 93. However, according to the Status Review, "it is unknown whether chronic exposure to these background levels would adversely affect Atlantic salmon." 1999 Status Review, at 106. In addition, according to the Services, exposure of Maine salmon to pesticides "has not been fully investigated" and the effects of chronic exposure to pesticides "are largely unknown." 1999 Status Review, at 102. Moreover, "Recent studies to determine the long-term changes in macroinvertebrate abundance, diversity, and taxa richness at sites in the [Narraguagus] river suggest that a deterioration in water quality has not occurred at these sites (Siebenmann and Gibbs 1994)." 1999 Status Review, at 93.

Placing the hexazinone matter in context, the Environmental Risk Advisory Committee of the State Board of Pesticides Control reviewed available data on water samples from the seven rivers which were tested for 33 active pesticide ingredients. Hexazinone was identified as the only frequent contaminant. The concentrations of hexazinone were low, ranging from less than 2 ppb in surface water to 6 ppb in ground water. Because the lethal concentration for fish is documented at 100,000 ppb, the Environmental Risk Advisory Committee concluded that further toxicity testing was not warranted although annual tests will be conducted for monitoring purposes.

Metacil®1.8D, the spruce budworm pesticide singled out for mention by the Services in the 1999 Status Review (p. 109-110) has not been used in Maine since 1985. Even when it was used, marine and estuarine waters were buffered from spruce budworm applications for a distance of one-half mile for single engine aircraft and one mile for multi-engine aircraft. The Services claim that a constituent of Metacil®1.8D, known as "4-NP," can "interfere with the smoltification process," and that potential sources of 4-NP "include pulp and paper mills, textile manufacturing plants, petroleum production and leather manufacturing." 1999 Status Review, at 110. However, the Services identify no specific source of 4-NP in Maine nor do they reference any data that reveal the continued presence of either of the substances in Maine waters. Finally, the Services in 1995 concluded explicitly that the use of pesticides (including hexazinone) in blueberry agriculture does not present a major threat to Atlantic salmon:

> Numerous measures are implemented to reduce the potential for contamination of waterways from blueberry agriculture. Measures include the maintenance of vegetation throughout the year to reduce erosion and sedimentation and the maintenance of riparian buffers to protect streams. As is the case with forestry practices, blueberry agriculture is heavily regulated by both state and federal laws [and such practices] are not considered a major threat to Atlantic salmon.

1995 Status Review, at 38.

In February 1999, the Maine Department of Agriculture's Board of Pesticide Control conducted random samples on 22 wells adjacent to blueberry fields in February 1999. The highest detected level of hexazione contamination was 1.97 ppb, compared with 5.97 ppb in 1994.

f. Elevated Water Temperature; Removal of Vegetation.

Elevated water temperatures from processing water discharges is identified for its "demonstrated and potential" impacts on salmon habitat. The Services provide no information linking water discharges to salmon mortality and, indeed, to obtain a permit to discharge water into a Maine waterway, an applicant "must demonstrate that the discharge will not lower the water quality classification for the receiving water body." 1999 Status Review, at 103.

Finally, the Services identify removal of vegetation along streambanks as having "demonstrated and potential" impact on salmon habitat. Once again, no data, general or specific, is provided by the Services. In fact, LURC regulations require minimum vegetative buffer strips between water bodies and activities such as agriculture, clearing, mineral exploration and extraction, roads and water crossings, timber harvesting, and filling and grading. LURC Reg. § 10.17(A)(1)-(6). Enforcement and education are routinely performed.

VI. "EFFORTS OF THE STATE" IN ADOPTING AND IMPLEMENTING THE ATLANTIC SALMON CONSERVATION PLAN FULLY ADDRESS POTENTIAL THREATS / RISKS, AND SERVICES SHOULD REAFFIRM THEIR 1997 COMMITMENT.

The ESA permits the Secretaries to make a listing determination only after taking into account "the efforts, if any, being made by any state or foreign nation . . . to protect such species . . . ." 16 U.S.C. §1522(a)(a)(A). As mentioned, the State's efforts through the Conservation Plan was the principal basis for determining in 1997 that the proposed threatened listing was not warranted. At that time, the Services determined that the State's efforts through the ASCP in conjunction with other state, federal and international protections "substantially reduced threats to the species." (Attachment 6 is chart highlighting Maine laws and regulations).

Over the past two years, the State has made substantial, indeed remarkable progress in implementing the Plan. (A copy of the 1999 Annual Report summarizing progress made is Attachment 7). A partial list of accomplishments is as follows:

- Fish Trapping and Counting, to assure that farmed Atlantic salmon do not escape into Maine rivers and to monitor returning wild salmon:

    - Designed, permitted, and constructed fish weirs on the Pleasant and Dennys Rivers. The weirs were in the water by mid-fall 1999, are now in winter storage, and will be back in the water this spring.

    - Designed a fish weir for the East Machias River and are negotiating to place the weir at its optimal location for fish trapping.

    - Modifying the design of the Narraguagus flood control dam at Cherryfield to make the trapping facility more effective; and

    - Completed preliminary design for a fishway in the Machias River Gorge.

- Fish Stocking: Continued collection of broodstock and stocking efforts in six of the seven rivers

- Fish Assessments, to understand better what is happening in the rivers:
  - Undertaking a smolt study on the Narraguagus River to track juvenile survival; and
  - Placed a smolt trap on the Pleasant River to monitor downstream migration.

- Identification of Habitat and Habitat Requirements:
  - Completed habitat mapping of critical spawning and nursery areas in each of seven rivers;
  - Completed preparation of methodology by which to identify scientifically justifiable riparian buffer adjacent to important spawning and nursery areas;
  - Completed modeling, using the so-called Instream Flow Incremental Methodologies (IFIMs) for the Pleasant and Narraguagus Rivers and the Machias River (Mopang Stream), providing information concerning flow requirements of juvenile Atlantic salmon at critical reaches of each of these streams; and
  - Nearing completion of water use management plans based on IFIM modeling, with draft Pleasant River plan now under review and the plan for the Narraguagus River and the Machias River (Mopang Stream) due this June.

- Protection of Habitat:
  - Acquired, assisted in the acquisition of, and now in the process of negotiating for acquisition of 4806 acres with over 40 miles of frontage along five of the seven rivers. Additional purchases will be possible with passage in November 1999 of a $50 million bond issue to recapitalize the Land for Maine's Future Program;

- Restricted direct withdrawal of water for blueberry irrigation during dry summer months through LURC permit conditions. Grower withdrawals were discontinued during August in each of the last two years when withdrawal limits were reached. DEP is currently preparing a draft rule to establish minimum flow standards for waters under its jurisdiction;

- Secured $400,000 in funding from the National Fish and Wildlife Foundation for habitat conservation projects during the last three years, funds contributing to the purchase of riparian habitat, assistance to watershed councils, restoration of eroding riverbanks, and assessment of watershed conditions; and

- Created 300 linear feet of riparian buffer by fencing out cattle and providing an alternative water source away from the Sheepscot River, with the prospect that the project will become a model for cooperative solution of problems affecting water quality without economic hardship to farmers.

- Enhancement of Habitat:

  - Removal of 105 beaver dams on downeast rivers;

  - Removal of part of abandoned dam on Pleasant River known as Cannan Falls;

  - Improved fish passage on fishway on Cathance Stream, a tributary of the Dennys River;

  - Upgraded road crossings, ditches, and culverts on paper company lands in Washington County to reduce nonpoint source pollution and sedimentation. Certain landowners, including Champion Paper, have undertaken a comprehensive road improvement plan in response to a LURC survey taken last summer that noted nonpoint source pollution problems; and

- Held approximately a dozen workshops promoting best management practices to forestry, logging and municipal officials.

- Aquaculture:
  - Drafted and implemented a voluntary Loss Control Code of Practices for the aquaculture industry; and
  - Drafted a rule to codify the Loss Control Code of Practices.

- Recreational Fishing:
  - Adopted angling rules shortening the catch and release season on the seven rivers; following the first annual review of the plan, adopted a rule banning catch and release fishing for Atlantic salmon in all Maine rivers;
  - Adopted a rule requiring gear changes for elver fishermen to reduce by-catch; and
  - Adopted rules for trout and landlocked salmon fishing to protect Atlantic salmon.

- Organization:
  - Formed watershed councils on each of the seven rivers and secured funding for staffing assistance; and
  - On the urging of interested parties, including ASF members, reorganized the Atlantic Salmon Authority into the Atlantic Salmon Commission, placed oversight of matters relating to Atlantic salmon under one roof, and provided staff funding.

- Baselines

  - Provided grants to several watershed councils to prepare nonpoint pollution source assessment and remediation plans and completed riparian assessments for four rivers; and

  - Established ongoing water quality monitoring programs for each of the seven rivers and developed a master database managed by DEP, the work now funded for a full-time position.

- Outreach:

  - Assisted watershed councils in establishing educational kiosks in five of the seven watersheds;

  - Created website highlighting local salmon conservation activities; and

  - Completed 1998 Annual Progress Report, received extensive comment, and amended the plan for 1999.

- Enforcement

  - Logged more than 700 hours of Warden Service Patrol to identify and halt any poaching;

  - Enforced permit conditions for a large cranberry development, including one of the largest fines ever levied for a permit violation;

  - Undertook follow-up inspections of several reported forestry violations; and

  - Built into code enforcement officer certification programs awareness of the Atlantic Salmon Conservation Plan and the importance of enforcing shoreland zoning standards.

- Funding
  - From January 1998 through June 1999, $546,179 was committed to the plan, almost all in state funds with federal funding for weirs
  - For July 1999 through June 2000, $710,771 has been committed, again almost all consisting of state funds plus funds from Land for Maine's Future for land purchases.
  - In January 2000, a supplemental allocation of $80,000 was committed, all being state funds.
  - To date, $2 million at a minimum has been provided for the ASCP

Even the Services acknowledge that "[i]mplementation of the Conservation Plan as a State initiative remains an important tool for recovery of the Gulf of Maine DPS of Atlantic salmon and its habitat." 64 Fed. Reg. at 62637. A determination that the State's conservation program is "an important tool for recovery," but somehow not up to federal standards to protect and rehabilitate the species within Maine's rivers is arbitrary and a breach of trust, particularly in light of the flawed science and analysis offered as a basis for the proposed rule. It is also ironic because in all likelihood, the reasons for range-wide decline in Atlantic salmon have little to do with problems in Maine habitat, but are predominantly caused by conditions in the ocean, which the Services acknowledge, is "beyond the State's jurisdiction." 62 Fed. Reg. At 66331. Indeed, it is evident that Congress did not intend that the protective efforts of a State be deemed inadequate because of factors beyond its jurisdiction. Thus, ESA section 4(b)(1)(a) directs the Secretary to take into account the conservation efforts being made by a State within its jurisdiction to protect a species. By using the term "within its jurisdiction," it is apparent that Congress did not intend state efforts to be deemed inadequate simply because the reach of those efforts does not extend beyond its borders.

VII. MARINE SURVIVAL IS THE MOST SIGNIFICANT LIMITING FACTOR IN RESTORING AND PROTECTING ATLANTIC SALMON, AND IS BEYOND THE JURISDICTION OF THE STATE TO ADDRESS.

The Services conclude that one of the critical factors adversely impacting Atlantic salmon returns to the United States is the low natural survival of the species during that part of its life cycle in the open ocean due in part to sea surface water temperatures. 60 Fed. Reg. 50531, 50533 (September 20, 1995). Fluctuating ocean temperatures are thought to be related to theories about sun aging, global warming, melting polar caps, ocean pollution and ocean floor dynamics. 1999 Status Review, at 187. No state or federal laws are relevant to such factors.

In addition, the factor of the Greenland commercial fisheries must be addressed. The ocean feeding grounds of Atlantic salmon in the northwest Atlantic were first documented in the early 1960's from tagged smolts released in the Narraguagus River and recaptured in commercial fisheries in West Greenland. The West Greenland fishery peaked in 1971 with a catch of 289 metric tons. Due to declining stocks and increased regulatory measures to reverse stock declines, the fishery in recent years have been dramatically reduced and now consists primarily of a domestic use fishery for native Greenlanders. The fishery currently takes 11-20 metric tons. While marine survival has declined dramatically over the past decade from unknown or uncontrollable causes, the directed commercial fishery can be quantified and controlled.

Using estimates of (1) the number of fish per ton, (2) the percentage of fish from the West Greenland fishery that are of North American origin, and (3) the proportion of North American salmon that come from Maine, it is possible to estimate the number of Maine fish killed annually in the West Greenland domestic fishery.

HARVEST LEVEL	11 MT	11 MT	11 MT	20 MT	20 MT	20 MT
Number of fish killed (350/ton)	3850	3850	3850	7000	7000	7000
Number of North American fish (60% North American)	2310	2310	2310	4200	4200	4200
Proportion of North American fish from U.S. (Maine)	0.02	0.03	0.04	0.02	0.03	0.04
Number of Maine fish killed	46	69	92	84	126	168

The mortality estimate ranges from 46-168 fish. To put these numbers in context, the Services insist that every fish must be protected, and accordingly, urged the State to close its catch and release recreational salmon fishery. The 1999 Maine recreational catch / release salmon fishery was 216 fish. Catch and release mortality is estimated at 2-5%, therefore total estimated mortality in the Maine fishery for 1999 ranged from 4 to 11 fish. In order to further reduce mortality on this small number of fish, Maine closed the directed recreational fishery in December 1999. Thus, even assuming the low range of harvest in the Greenland domestic use fishery, it is evident that the intercept fishery in Greenland kills results in a mortality level five to ten times greater than the Maine recreational catch and release fishery.

The Greenland fisheries elimination appears dependent upon either a federal buyout or an international agreement, which in turn is dependent upon the agreement between the United States and a foreign nation. The protections of the ESA offer no additional protections in dealing with the overarching limiting factor of low marine survival. The federal government is not effectively addressing a known source of mortality – perhaps the greatest source of mortality – while simultaneously seeking to impose unnecessary burdens on the State of Maine.

Attachment #1

Review of Genetics in the Proposed Listing of Atlantic Salmon
Prepared for the State of Maine

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Listing of Atlantic salmon in the State of Maine is not justified on the basis of the scientific information presented. The genetic data and their analysis have significant errors. Non-random sampling of individuals, the absence of temporal stability of allele frequencies within rivers, and extensive errors associated with genotype assignments compromised the utility of genetic data to assay distinctiveness and evolutionary significance. Analysis of variation in quantitative life history traits is incomplete and misleading. There is substantial disagreement among scientists knowledgeable about the species regarding the sufficiency and accuracy of the available data relevant to the determination. Comprehensive review of the restoration effort for Atlantic salmon in Maine, particularly the role of river specific stocking, merits immediate review.

1. Use of Genetics as criteria for the Proposed Listing

Genetic data, analysis, and interpretation are central to the Proposed Rule. In the Proposed Rule, the Services rely upon genetic data and inferences from analysis of that data to argue for both discreteness and significance of salmon populations in the eight rivers.. There are two relatively distinct classes of genetic information and inferences about Atlantic salmon presented in the Proposed Rule: arguments based on population genetics, and arguments based on the quantitative genetics of life-history traits. The word "genetics" is used 38 times in the Proposed Rule and over 75 times in the Status Review. In all direct quotes (below), emphasis is added with ***bold italics***.

A. Population genetic studies can directly determine whether populations will be listed.

> "Surveys have also identified juvenile Atlantic salmon to be present in other river systems which have relatively limited juvenile production habitat such as Bond, Togus, Passagassawaukeag, Eaton, Felts, South Branch Marsh, Kenduskeag, and Pennamaquan Rivers (Buckley, 1999). ***Results from genetic studies of fish from these and any other occupied rivers within the DPS range will be used to determine the appropriateness of adding these populations to the DPS.***" (Proposed Rule p. 62629)

> "***It would be premature to determine the status of the Penobscot population in relationship to the Gulf of Maine DPS without comprehensive genetic data.***" (Proposed Rule p. 62629)

> "In the future, ***DPS populations may be identified in additional rivers based on ongoing stream surveys and continuing genetic analyses***". (Proposed Rule p. 62638)

B. Population genetic studies are interpreted as directly supporting the evolutionary uniqueness and distinction of fish in the proposed DPS.

> "Recent survey work also indicates that a naturally reproducing population that is ***genetically distinct (alleles only found in that population)*** remains in Cove Brook (Buckley, 1999; King et al., 1999). ***This information demonstrates that Atlantic salmon can retain unique genetic material*** in a relatively small drainage since juvenile habitat area in Cove Brook is estimated at only 23,500 sq. m (Ed Baum, Atlantic Salmon Authority (ASA), pers. comm., 1999)." (Proposed Rule p. 62629)

"Separateness of the Gulf of Maine DPS and other Atlantic salmon populations outside the DPS is strongly supported by the following: (1) Persistence of these populations, (2) geographic segregation; (3) limited stocking from outside the DPS, and (4) ***current genetic analyses***. The Services conclude that there are ***adequate genetic*** and demographic data to demonstrate that an ecologically important separation exists between the Gulf of Maine DPS and other populations to the north; all naturally occurring populations south of the DPS range have been extirpated." (Proposed Rule p. 62629)

C. Presumed genetic divergence in life history traits is interpreted as supporting the evolutionary uniqueness and distinction of fish in the proposed DPS.

"The Services also conclude that while it is unlikely that any U.S. Atlantic salmon populations exist in a genetically pure native form, present populations are descendants of these aboriginal stocks, and their continued presence in indigenous habitat indicates that important ***heritable*** local adaptations still exist." (Proposed Rule p. 62629)

"Remnant stocks have maintained the most characteristics of these factors: smoltification at a mean age of 2 and predominant adult returns as 2 sea winter (SW) fish (age 4). Since the proportion of 2SW fish in an Atlantic salmon stock has a documented genetic basis (Glebe and Saunders, 1986; Ritter et al., 1986; Hutchings and Jones, 1998), ***the Services conclude that the DPS has unique life history characteristics that have a heritable basis***." (Proposed Rule p. 62630)

D. It is concluded that straying and hatchery stocking have had no significant genetic effects on fish in the proposed DPS.

"***Given our current understanding of the genetic composition of these stocks*** ... the ***Services conclude that the influence of hatchery fish upon the DPS has not been sufficient to completely or substantially introgress with the remnant populations and genomes of the Gulf of Maine DPS***." (Proposed Rule p. 62630)

E. It is asserted that the genetic characteristics of salmon in the proposed DPS deserve protection.

"The Services ***believe that there are components of an important genetic legacy remaining in these populations***, and the loss of these populations would negatively affect the genetic resources of Atlantic salmon as a whole because it would contribute to further range reduction. The ***genetic resources*** of these most southerly stocks may be vitally important to the species' future survival." (Proposed Rule p. 62630)

"The conservation of the populations of the Gulf of Maine DPS is essential because these Atlantic salmon represent the remaining ***genetic legacy*** of ancestral populations that were locally adapted to the rivers and streams of the region." (Proposed Rule p. 62630)

"The Gulf of Maine DPS of Atlantic salmon has persisted in a unique setting in the United States, and its loss as the only naturally spawning stock in the United States would be a significant loss. The existence and ***genetic integrity*** of the DPS must be preserved so that the DPS can naturally adapt to changing future conditions in the freshwater and marine environment." (Proposed Rule p. 62636)

2. Use of population genetics analysis in the Proposed Rule

A. Analysis of population genetics is central to the Proposed Rule. The population genetics arguments are based on analysis of variation in mitochondrial DNA (mtDNA) and at microsatellite (SSR) loci conducted by Tim King and co-workers at the Leetown Laboratory of the USGS. Written results and interpretations were first disseminated as a Preliminary Genetics Report in August, 1997 (King et al., 1997; hereafter referred to as the Preliminary Genetics Report, and subsequently as a Final Genetics Report in March, 1999 (King et al., 1999; hereafter referred to as the Final Genetics Report). The Preliminary Genetics Report was subject to external (non-Federal), independent, anonymous peer review by the NMFS. The March, 1999 Final Genetics Report was not subject to external (non-Federal), independent, anonymous peer review. The Final Genetics Report increased the number of sample collections (from 37 to 66), made selected changes suggested by the ad hoc reviewers (e.g., Bonferroni corrections), and presented additional analyses for the entire data set. The basic conclusions of the Preliminary Genetics Report were affirmed and extended in the Final Genetics Report. The Status Review of Atlantic Salmon subsequently reiterated many of findings from the Final Genetics Report. The Proposed Rule to List Atlantic Salmon as an Endangered Species used genetic information presented in the Status Review.

The analyses and comments presented below are based upon two sources: the written documents identified above, and data requested from the Services under the Freedom of Information Act by the State of Maine. These data were requested because the Final Genetics Report of March, 1999 only contained summary tables and information based on analysis of these data. The *sina qua non* of scientific inquiry is the ability of independent investigators to reproduce the findings of other scientists; replication is at the core of hypothesis testing and helps to insure the validity of original conclusions. Thus, to fairly evaluate the analyses and claims advanced in the Final Genetics Report (as well as in the subsequent Status Review and Proposed Rule), it was essential to examine the raw data used by the Federal scientists, instead of relying upon summary tables and statistics. These data included: the raw GeneScan files for individuals included in the Final Genetics Report of March, 1999 (from which microsatellite genotypes were inferred), the Genotyper Template file used to interpret the multilocus microsatellite genotypes assigned to individuals for the Final Genetics Report, and the multilocus microsatellite genotypes assigned to individuals in the Final Genetics Report. Our examination of this information made use of a number of computer programs including: Perkin-Elmer Applied Biosystems GeneScan and Genotyper, GENPOP (Raymond, M., & Rousset, F. 1995), and Kinship (Queller, D.C. and K.F. Goodnight. 1989).

It should be noted that analysis of these data was exceedingly difficult because organization was idiosyncratic (river specific population samples were analyzed among multiple runs), colors used to designate loci were switched among runs (for example, sometimes locus Ssa202 was visualized with the fluorescent label fam, e.g, M2-95-11, while tet was used at other times, e.g., M3-94-28), and many individuals were examined multiple times (making it difficult to know which examination was correct). Without the use of the Genotyper Template file eventually provided by the Services, it would have been impossible to understand how individuals were assigned genotypes.

Because of these constraints, it was not possible to comprehensively reanalyze the raw GeneScan data in the period subsequent to the date when all of the requested information was made available. Regardless, given the extent of the systemic errors in data acquisition and analysis (detailed below), reanalysis would need to include comprehensive rescoring at least half of the loci examined in the Final Genetics Report

B. There is substantial disagreement among scientists knowledgeable about the species concerned regarding the sufficiency or accuracy of the available data relevant to the determination. External (non-Federal), independent, anonymous peer reviewers examined the August, 1997 Preliminary Genetics Report and concluded that many features of the study can provide misleading information and conclusions. Many of these concerns were not addressed in the Final Genetics Report. The Final Genetics Report did not receive external (non-Federal), independent, anonymous peer review. Quotations from the ad hoc reviews of the Preliminary Genetics Report appear directly below; additional quotations appear in sections associated with specific technical comments.

> "The analyses in the report have convinced me that there is no *molecular genetic* basis for designating the Atlantic salmon in the five downeast rivers as an ESU. There clearly is no genetic distinction between this group and the Canadian populations." (Ad hoc reviews of the Preliminary Genetics Report: Reviewer 9)
>
> "These differences [in microsatellite allele frequencies among populations] are difficult to explain without invoking low effective size, non-random sampling, stock transfers, or artifactual data." (Ad hoc reviews of the Preliminary Genetics Report: Reviewer 10)

> "there is no clear evidence that the samples from the northeastern states belong[ing] to a distinct evolutionary grouping from those in Canada. What differences exist between American and Canadian populations may simply be due to clinal changes in the genetic structure of North American populations, arising from a negative relationship between gene flow and geographic separation, or from chance differences among populations." (Ad hoc reviews of the Preliminary Genetics Report: Reviewer 7)

C. Basic assumptions necessary for population genetic analysis are violated in the Federal genetic study of King et al. (1997, 1999). Data acquisition and data analysis contain numerous, substantive errors. Systemic errors in assigning individual genotypes were made for half (6 of 12) of the loci examined in the Final Genetics Report. Scoring errors for these loci were common in the North American data. Because these errors were so pervasive, it is both incorrect and misleading to include results from these loci in analyses of isolation and evolutionary significance. In aggregate, they compromise the results of this study and any interpretations from them regarding proposed listing of Atlantic salmon in Maine.

i. Individuals were not sampled at random within rivers. Random sampling is a fundamental assumption of population analysis.

Non-random sampling was suggested by ad hoc reviewers.

> "In talking with others with some knowledge of the collections, we have heard the following concerns expressed: 1) some of the Maine samples appear to comprise groups of related individuals, or progeny from a relatively few nearby redds; and 2) many Canadian collections were from streams that have been substantially affected by hatchery programs and thus do not necessarily represent population of wild fish." (Ad hoc reviews of the Preliminary Genetics Report: Reviewer 10)

> "Sampling is a particularly important consideration here because sample sizes are relatively small (so sampling error is relatively large) and genetic differences between populations are relatively small." "[Random sampling] is difficult to achieve in any biological population, but the departures from randomness can be particularly acute in sampling juveniles (as presumably was done here)." (Ad hoc reviews of the Preliminary Genetics Report: Reviewer 10)

The Federal study presumed that random samples were obtained.

> "Taken together, these observations seem to support that the populations tested are temporally stabile [sic] and that ***non-random sampling was not a significant problem in this study***." (Final Genetics Report, p. 30).

During the collection of specimens, actual sampling in many cases was limited to a few small areas within streams rather than encompassing large areas; accessibility of the sites for electrofishing was a major criterion (Kircheis, 1998) such that sampling within some sites was extremely restricted. Since most Atlantic salmon rivers have very low numbers of breeding individuals, the probability of collecting individuals from only a few families when effectively using point-sampling is greatly increased.

Though the Final Genetic Report acknowledged the problem of family sampling by citing Hansen et al. (1997), it did not adequately evaluate the data with respect to this concern. This is reflected in the reanalysis of the microsatellite genotypic data for the Final Genetics Report which reveals that extensive numbers of closely related individuals (full-sibs and half-sibs) are present in population samples. Related individuals were recognized by direct inspection of the genotypic data and by examination with the programs Kinship, ver. 1.2, and Relatedness, ver. 4.2 (see Queller and Goodnight, 1989). For example, in the 1994 sample of 30 individuals from the Sheepscot River, five separate groups of close relatives were present: 3,26; 4,15,19; 5,26; 7,9; 13,20. At Cove Brook and other locations where temporal samples were available, large numbers of related individuals were identified both within samples and between samples. Of importance, observations of very closely related individuals were also extensive in the Canadian population samples from New Brunswick and Nova Scotia; those samples originated from hatcheries. The occurrence of these family groups means that sampling was not at random, and thus violates a critical assumption of statistical sampling methodology.

The presence of related individuals within population samples and between samples from the same locality for different years inflates estimates of population divergence. Because of the presence of related individuals, actual sample sizes are much smaller than reported because such sampling underestimates the amount of genetic variability present in that population. Thus, all statistical analyses that require random sampling are flawed.

ii. Samples sizes examined were too small to accurately characterize populations. With highly variable markers (such as microsatellites), inadequate sample sizes can generate spurious findings of heterogeneity among samples.

Concerns about sample size were explicitly noted in ad hoc reviews.

> "Although it is clear why evidence of "unique" or distinctive genetic traits in particular groups of salmon would be of interest in a study such as this, sample size and locus variability issues strongly limit any useful inferences that can be made from observations about private alleles." (Ad hoc reviews of King et al., 1997: Reviewer 3)

"The study has two major short comings. The first is the limited number and sizes for many of the samples. This makes it difficult to draw conclusions about regional variation within continents give[n] the relatively low level of differentiation displayed and to place much confidence in estimates of numbers and proportions of private alleles." (Ad hoc reviews of King et al., 1997: Reviewer 8)

For hypervariable genetic markers such as microsatellite loci, small samples from individual populations can produce positively misleading results (Ruzzante, 1998). Even repetitive samples from the same population will be significantly heterogeneous if the number of alleles is high and the sample sizes are small. For example, if a locus has 12 alleles, a sample of 43 individuals is required to be 95% confident of not producing significant divergence between repetitive samples (Kornfield and Parker, 1997). In the Federal study, seven of the twelve microsatellite loci examined had 12 or more alleles observed in the Maine sample (Final Genetics Report, Table 7b.), but the average sample size for Maine river collections was 32.3 individuals (Final Genetics Report, Table 8a), thus inflating the probability of finding significant heterogeneity between populations. Ruzzante (1998) also explicitly noted that tests of divergence are sample size dependent and recommends samples sizes be greater than thirty individuals. For the detection of linkage disequlibrium, Lynch and Walsh (1998, 100) note that unless disequlibrium is strong ($D > 0.4$), "...several hundred to thousands of individuals should be assayed to achieve a reasonable level of statistical power." The tests performed (Final Genetics Report, Table 10) were based largely on samples of ~30 individuals. Given this sampling requirement, the significant differences observed for most of the Maine samples again suggests the presence of related individuals as noted above.

Small sample sizes have significant affects on the detection of unique or "private" alleles. The detection of such alleles is sample size dependent; in the Federal genetic study, there is a highly significant correlation between the number of individuals sampled and the number of alleles observed ($r = 0.50$, $p < 0.01$). The presence of unique alleles can be misinterpreted as indicating population divergence if sample sizes are inadequate. Further, small sample sizes also produce inaccurate estimates of allelic frequencies that will affect measures of genetic differentiation. Expansion of sample sizes can reveal the presence of such alleles in other populations.

iii. Microsatellite allele (gene) frequencies were not stable over time. Temporal stability of allele frequencies within populations is a necessary prerequisite to examine divergence among populations.

It was repeatedly noted in the Final Genetics Report and the Status Review that allele frequencies were stable over time.

"However, ***the temporal stability of allele frequencies*** and the occurrence of alleles that are unique to Maine indicate that this mixing has not overwhelmed all of the genetic differences between stocks (King et al. 1993; King et al. 1999)." (Status Review, p. 50)

"***Pair-wise comparisons between collections within Maine rivers and between 1994 and 1995 samples suggested temporal stability*** accompanied by little readily detectable population subdivision." (Final Genetics Report, p. 3)

"The relatively low estimates of variation attributable to differences between year-classes ***suggest an element of temporal stability in allele frequencies***." (King et al., 1999, p22).

"Taken together, these observations seem to support that ***the populations tested are temporally stabile*** [sic] and that non-random sampling was not a significant problem in this study." (Final Genetics Report, p. 30).

Temporal homogeneity of allele frequencies within locations is a fundamental assumption for analysis of differences among localities (e.g., Allendorf and Utter, 1979; Gold et al, 1999; Tessier and Bernatchez, 1999). When there is significant temporal heterogeneity in allele frequencies within localities, it is difficult or impossible to correct for this source of error when evaluating overall variation. Such variance confounds geographic analysis. Despite claims of stability, in the analysis of the Final Genetics Report, virtually all tests of temporal stability within populations that the authors themselves performed were highly significant (Final Genetics Report, Tables 14G, 14H, 14I, 14J, 14K, 14L, 14N, 14O, & 14P, Appendix A, C1, C2). For example, in the comparison between Cove Brook samples in 1994 and 1995 (Final Genetics Report, Appendix C2), highly significant heterogeneity was demonstrated. This had been previously noted in ad hoc review of the Preliminary Genetics Report, but was not adequately addressed in the Final Genetics Report. The a posteriori tests presented in the Final Genetics Report were selective; some of the available comparisons were not presented. For example, for the East Machias River, many of the temporal comparisons were also significant (Table 1).

In the data set under examination, because of highly significant variation among frequency estimates for the same population made at different times, no valid inferences can be made regarding the divergence among different river samples. Further, given (1) these extensive temporal differences, (2) the absence of any examination of temporal variation in Canadian samples, and (3) the fact that hatchery obtained Canadian samples originated from rivers which themselves had long-term stocking histories, it is incorrect to assert that there is significant heterogeneity between samples of Atlantic salmon from Maine and samples Atlantic salmon from the Canadian mainland.

iv. Extensive errors were associated with the scoring of genotypes of individuals at microsatellite loci.

a. Allelic dropout (difficulty in detecting high mobility alleles in heterozygotes) is extensive at one locus. One additional allele is present in many populations but was not recognized. This compromises the use of that locus in all calculations that made use of it in the Final Genetics Report.

Table 1. Heterogeneity tests for 12 microsatellite DNA loci for population samples of the East Machias River between 1993 and 1995. Original data from the genotypic matrix used in the Final Genetics Report were analyzed using GENRPOP (Raymond and Rousset, 1995).

locus	1993- 1994	1994-1995	1993-1995
SSOSL438	0.462	0.5145	1.00
SSOSL25	0.563	0.0204	0.0076
SSOSL85	0.0222	0.0011	0.2100
Ssa289	0.1638	0.0532	0.1033
SSOSL311	0.4450	0.2797	1.000
SSLEEI84	0.0027	0.0011	0.6284
Sssa85	0.0000	0.0004	0.3408
Sssa171	0.0000	0.0000	0.0000
Sssa202	0.6838	0.6166	0.6838
SSLEEN82	0.5179	0.3076	0.5175
Ssa197	0.2470	0.0722	0.4486
Ssa14	0.0002	0.0171	0.0911

Allelic dropout (Tully et al., 1993; O'Reilly et al., 1998) exists at locus SSOSL311 for allele 148. This allele was scored in some individuals, but is present in several additional populations. For example, it is present and recognized in Felts Brook (Figure 1): M6-98-01 has an assigned genotype of 114/148 (with relative fluorescence of 5822 for allele 114, 600 for 148, and ~500 for an adjacent standard). However, it is present but not recognized in the East Machias River (Figure 2): M2-95-18 has an assigned genotype of 114/114 (with peak heights of 3630 for allele 114, 330 for allele 148, and ~500 for an adjacent standard). Reanalysis of the GeneScan data used in the Final Genetics Report demonstrates that allele 148 at locus SSOSL311 occurs in other rivers than those listed; in the East Machias, the allele has a frequency of approximately 10%. This is additionally significant with respect to interpretation since allele148 at locus SSOSL311 had been identified with other "Rare or unique alleles" in Table 7c. More generically, allele dropout has been recognized at other loci (O'Reilly et al., 1998), but that study only examined four of the twelve loci used in the Federal study

b. The use of identical color labels in runs for loci with overlapping allelic ranges resulted in extensive incorrect assignment of alleles. This is another systemic error that compromises analyses in the Final Genetics Report that used these loci.

In the study detailed in the Final Genetics Report, multiple loci were routinely characterized simultaneously in the same ABI 310 injection run. Scoring errors were generated because loci with overlapping allelic ranges used an identical fluorescent dye to label alleles. Assignment errors were made for at least three microsatellite loci: Ssa171, Ssa197, and Ssa202. In these cases, loci used fluorescent green (tet) to label overlapping alleles (Table 2). For example, in the Machias River, sample M1-95-08, was scored simultaneously at loci Ssa171 and Ssa197, and had reported genotypes of 199/231 and 172/200, respectively. However, inspection of the GeneScan pattern for this sample shows that a single peak was scored for two different alleles (199 and 200) at different loci, and additional peaks were ignored (Figure 3). Thus, there are many possibilities for the correct genotypes for this individual including: 199/199 & 172/232, 199/231 & 172/172. Similarly, genotypes were arbitrary for individuals scored simultaneously for loci Ssa171 and Ssa202. For example, in the Gander River, sample C12-94-21 had assigned genotypes of 227/251 and 246/294 for Ssa171 and Ssa202, respectively. However, since allelic ranges for those loci overlap, the correct genotypes could be quite different. Figure 4 presents the GeneScan results for that individual and for others in that sample injection with similar problems.

While USGS personnel appear to have been aware of this class of errors (modifications were implemented for runs involving the Penobscot River sampling), the errors present in the Final Genetics Report were not noted nor corrected. However, scoring errors for these loci were common in the North American data. Because of their extent, it is both incorrect and misleading to include results from these loci in calculations of divergence. Note than the correct assignment of alleles can not be accomplished

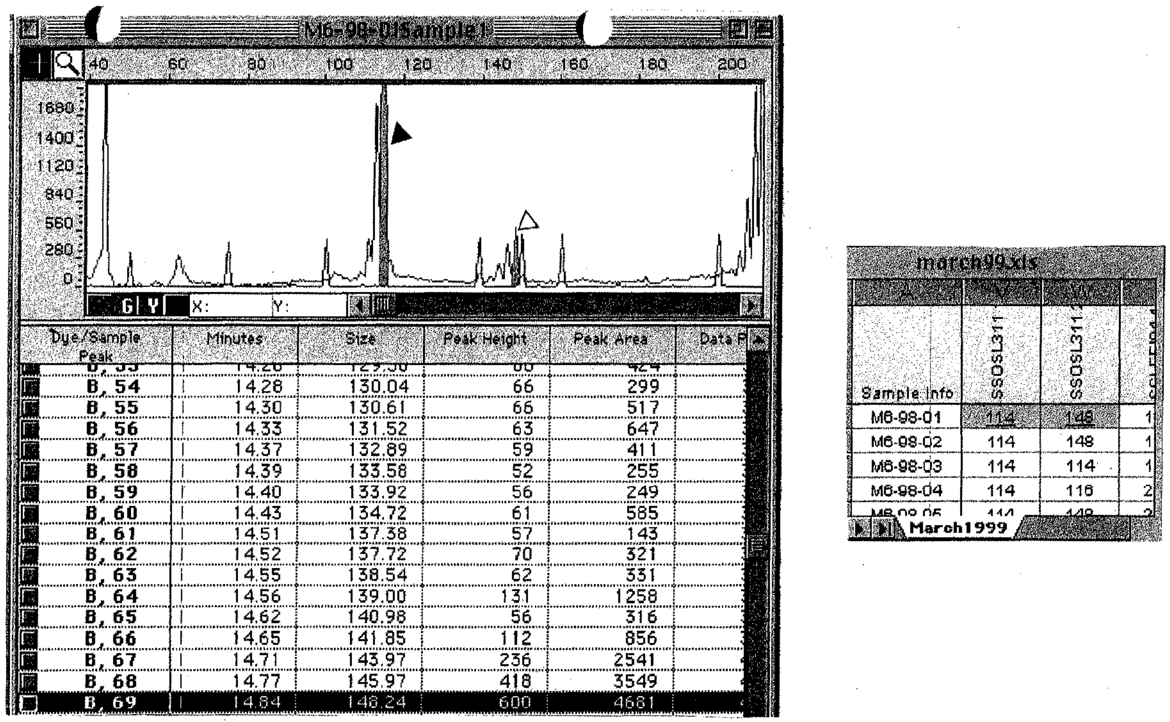
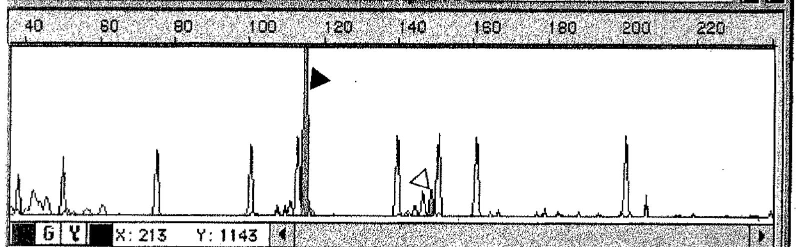


Figure 1. Allelic dropout at locus SSOSL311. In this individual from Felts Brook (sample M6-98-01), the sample is recognized as a heterozygote and assigned alleles 114 (solid arrow) and 148 (open arrow). Note the relative peak heights of the two alleles. Compare this to the allele assignment in Figure 2. GeneScan data from DOI.

M2-95-18Sample18



Sample Peak	Minutes	Size	Peak Height	Peak Area	Data Point
B, 17	13.92	114.36	3630	22453	3794
B, 18	13.98	116.22	94	727	3811
B, 19	14.79	141.63	65	353	4033
B, 20	14.85	143.77	133	841	4050
B, 21	14.92	145.92	305	1654	4067
B, 22	14.98	148.08	330	2044	4084
B, 23	15.01	149.23	52	67	4093
B, 24	15.44	163.84	66	90	4209
B, 25	15.50	165.93	74	107	4226
B, 26	15.88	178.53	70	155	4331
B, 27	16.54	198.79	61	93	4509

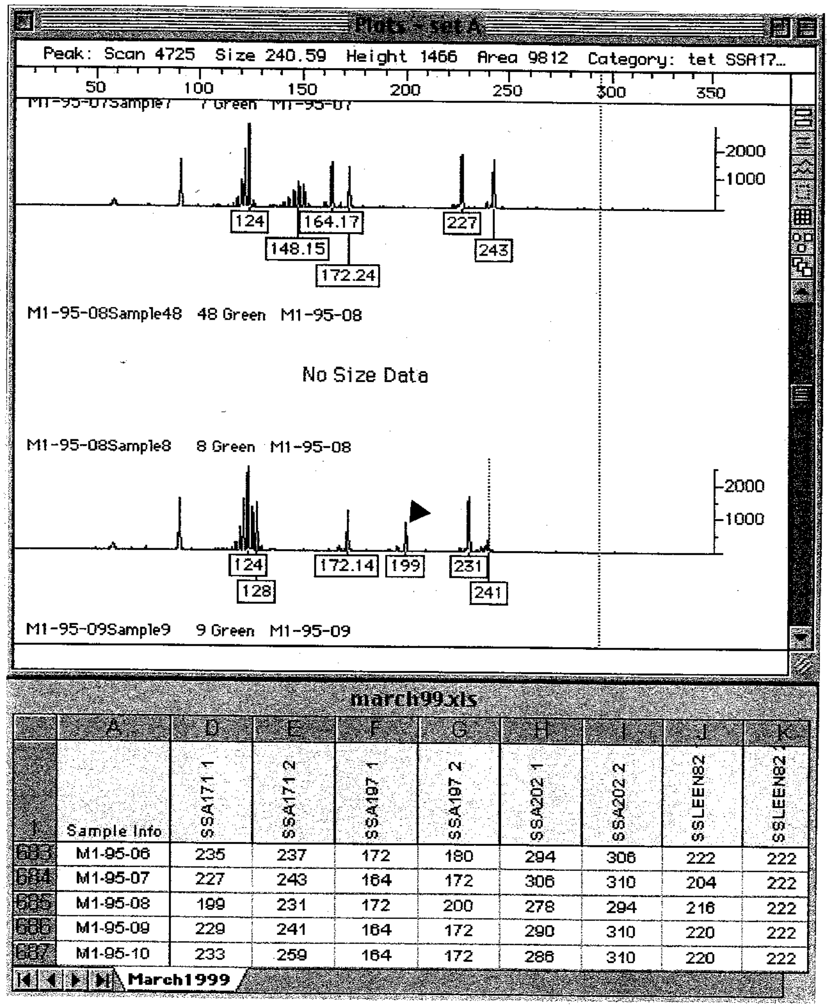
march99.xls

A	V	W
Sample Info	SSOSL311	SSOSL311
M2-95-14	114	114
M2-95-15	114	116
M2-95-16	114	114
M2-95-17	114	116
M2-95-18	114	114
M2-95-19	114	114
M2-95-20	114	114
M2-95-21	114	114
M2-95-22	114	114

Figure 2. Allelic dropout at locus SSOSL311. In this individual from the East Machias River (sample M2-95-18), the sample is recognized as a homozygote and assigned allele 114 (solid arrow). Allele 148 (open arrow) is also present. The correct genotype of this heterozygote is 114/148. Note the relative peak heights of the two alleles. Compare to Figure 1. GeneScan data from DOI.

Table 2. Allelic overlap for loci examined simultaneously using the same color dye.

Alleles	Ssa171	Ssa197	Ssa202
199,200	199.2-200.2	199.0-200.7	
203,204	202.2-203.6	203.0-204.2	
207,208	206.4-208.15	207.0-208.2	
211,212	210.2-211.7	211.0-212.4	
215,216	214.0-215.4	215.0-216.2	
219,220	218.4-219.85	218.2-219.8	
223,224	222.4-223.4	222.2-224.0	
228,229	227.8-229.6	226.6-228.2	228.8-229.6
231,232	230.2-231.4	231.0-232.6	
235,236	234.0-235.2	234.0-236.0	
237,238	236.0-237.3		236.0-238.0
239,240	238.0-239.4	238.2-241.4	
243,244	242.0-243.3	241.8-245.4	
245,246	243.8-245.2	241.8-245.4	244.0-246.6
247,248	246.2-247.2	247.0-248.2	
249,250	248.1-249.6		248.2-250.6
251,252	250.0-251.2	250.5-252.0	
253,254	252.0-253.0		252.6-254.6
255,256	254.0-255.0	254.5-256.0	
257,258	256.0-257.2		256.4-258.6
259,260	258.15-259.0	258.6-260.6	
262,263	262.0-263.2		260.8-262.6
266,267	266.6-268.25		265.0-267.0



	A	D	E	F	G	H	I	J	K
1	Sample Info	SSA171 1	SSA171 2	SSA197 1	SSA197 2	SSA202 1	SSA202 2	SSLEEN82	SSLEEN82
683	M1-95-06	235	237	172	180	294	306	222	222
684	M1-95-07	227	243	164	172	306	310	204	222
685	M1-95-08	199	231	172	200	278	294	216	222
686	M1-95-09	229	241	164	172	290	310	220	222
687	M1-95-10	233	259	164	172	286	310	220	222

Figure 3. Ambiguous genotype assignment for different loci using identical fluorescent dyes. For an individual from the Machias River (M1-95-08), the indicated peak (arrow) was scored both as allele 199 and 200; multiple green peaks could have been scored as alleles for other samples (individual M1-95-07, above).

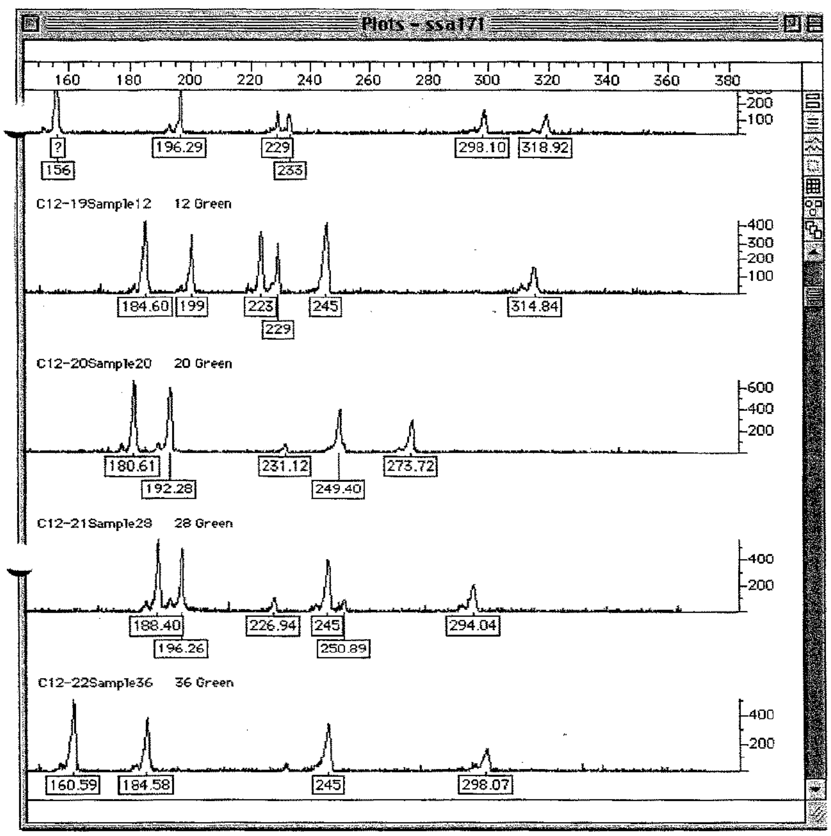


Figure 4. Arbitrary assignment of alleles for individuals scored simultaneous for Ssa171 and Ssa202. Individual C12-94-21 from the Gander River was scored as heterozygous at both loci: 227/251 and 246/294. However, since allelic ranges for these loci overlap (Table 2), additional allelic combinations are possible.

from re-analysis of the GeneScan profiles but instead requires that loci be rerun with a different design in order to distinguish genotypes.

c. The categories established in the Genotyper template file have significant errors that compromise consistent assignment of genotypes.

For two loci, sequential categories overlap in range making assignment of alleles arbitrary.

Ssa289

"107 Highest peak from 107.50 to 109.00 bp
109 Highest peak from 108.80 to 109.40 bp"

SSOSL311

"142 Highest peak from 140.80 to 142.60 bp
144 Highest peak from 142.50 to 145.00 bp"

In the case of Ssa289, allele 109 is identified as one of the "Rare or unique alleles observed in Maine Rivers" (Final Genetics Report, Table 7c), yet assignment of this allele can not be done in an objective manner with the category definitions that were employed (Figure 5). Similarly, for locus SSLEEI84, the upper and lower limits for sequential categories were shared for many alleles; given category definitions, minor mobility fluctuations created arbitrary allele assignments.

d. Assignment of alleles for the microsatellite locus Ssa202 did not conform to the requirements specified by the GeneScan software program.

The Federal study reported in the Final Genetic Report assigned microsatellite allele sizes to GeneScan peaks using the Local Southern Method. This size calling algorithm requires that two size standards are smaller than the unknown fragment of interest and that two size standards are larger than the unknown peak of interest (Perkin-Elmer, 1996). This is emphasized by the manufacturer (Perkin-Elmer) in the GeneScan Reference Guide under Sizing and Size Standards.

"**IMPORTANT** For the Local Southern Method to work, you must have at least two size standard fragments larger than your largest unknown fragment" (no emphasis added) (Perkin-Elmer, 1997, p.5-2).

"**IMPORTANT** Choose a size standard such that there [are] at least two size standard fragments larger than your largest unknown fragment." (no emphasis added) (Perkin-Elmer, 1997, p.5-7).

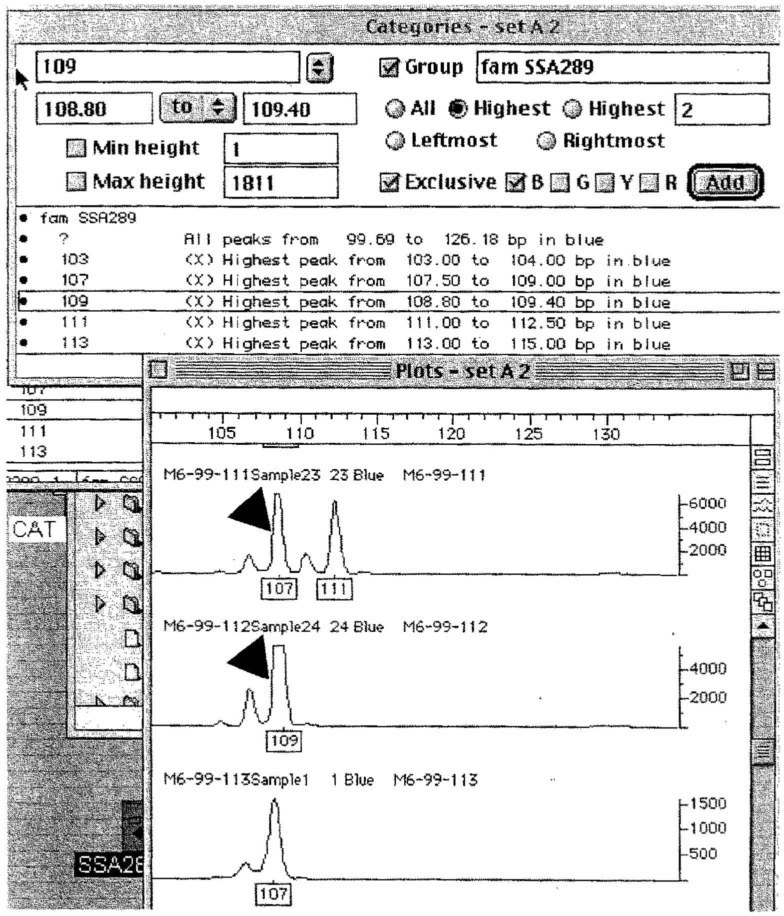


Figure 5. Arbitary assignment of alleles 107 and 109 for locus Ssa289 in samples of Atlantic salmon from the Penobscot River. Note that in two individuals (M6-99-111 and M6-99-112) different allele sizes are assigned for the same peaks (arrows). Overlap in categories for 107 and 109 appear in the template file (above). GeneScan data from DOI.

The Federal study used the GeneScan 500 set of size standard in their injection runs, but read only up to the 350bp size standard. In the size range from 300bp to 350bp, the study defined the 300bp size standard peak and the 350bp size standard peak, but they did not define the 340bp size standard peak. Thus, for the microsatellite locus Ssa202, alleles between 300bp and 350 bp were not assigned in accord with the requirements of the software programs utilized. This includes over 30% of the alleles at this locus: 302, 306, 310, 314, 318, 322, 326, and 330; some of these alleles occurred in high frequency. These alleles are important for two reasons. First, the largest reported allele at this locus, 330, was putatively unique for Dennys River (where it occurred with frequency of 7%). This 330 allele could, in reality, be another allele already identified in other populations, e.g., 326; it would thus not be "unique" and would not support the contention of distinctiveness of the Dennys population. Second, Ssa202 alleles in the range from 300-350 contributed to the presumed divergence of populations; changes in allele frequencies could alter conclusions about affinities.

e. Homology among alleles was assumed but not tested. Alleles with identical mobilities are presumed to be identical by descent but may have independent origins. North American salmon of putatively "European" origin may have arisen independently.

Microsatellite loci are highly variable because they can mutate at rates more frequent than other classes of markers used in population studies. Most mutations are viewed as step-wise events that change alleles in single steps corresponding to the size of the repeat unit (Estoup and Angers, 1998). For example, at a dinucleotide repeat locus, mutation of a '150 basepair' allele may produce a '148bp' or a '152bp' allele. Molecular and population biologists are acutely concerned with this process since alleles with identical mobilities which arise independently provide false homology (e.g., Estoup et al., 1995; Garza and Freimer, 1996). This process is exacerbated with microsatellite markers that have complex repeat structure resulting in alleles with sizes that do not conform to uniform steps (such as at locus SSOL85). In addition, alleles can independently converge on the same mobility if they accumulate substitutions in the regions flanking the microsatellite repeat. In Atlantic salmon, Angers and Bernatchez (1997) identified such convergence in microsatellites through careful breeding studies. In the Final Genetics Report it is likely that such convergence is present. For example, at locus Ssa14, allele 145 was reported in two individuals in the St. Croix sample and in one individual (a single allele) in one collection from Spain (out of a total of 166 Spanish alleles). This allele was absent from all other European, North American and aquaculture collections. The distribution and rarity of this allele suggests convergence. Similarly, at locus Ssa85, Cove Brook and the Kunduskeag Stream share allele 150 which is not present in any other North American samples, is absent from all aquaculture samples, but occurs sporadically in a few European collections. Again, there is a reasonable likelihood that these alleles are not identical by descent; similarity is thus misleading. For the Final Genetics Report to claim the occurrence of "European" alleles in Downeast rivers represents introgression of European-origin aquaculture fish is likewise misleading.

v. Alleles putatively "unique" to Downeast rivers occur in other populations. This allelic "uniqueness" was repeatedly emphasized by the Services to infer evolutionary significance. There is no indication that these rivers are discrete or evolutionarily significant.

"Recent survey work also indicates that a naturally producing population that is ***genetically distinct*** (***alleles only found in that population***) remains in Cove Brook as well (Buckley 1999; King et al., 1999)." (Status Review, p. 43)

"However, the temporal stability of allele frequencies and ***the occurrence of alleles that are unique to Maine*** indicate that this mixing has not overwhelmed all of the genetic differences between stocks (King et al. 1993; King et al. 1999)." (Proposed Rule, p. 50).

"Unique" microsatellite alleles were identified in the Final Genetics Report (Table 7c) from multiple sample collections in Maine and elsewhere. Such genetic variants were central to inferring the discreteness and evolutionary significance of Maine salmon. These "unique" alleles included several that were purportedly characteristic of individual rivers, thus demonstrating their evolutionary significance as distinctive and reproductively isolated. However, the detection of such genetic variants is absolutely dependent on sample size: inadequate sampling will miss such alleles in other areas, particularly if their frequencies are low. Because of the very limited sample sizes for most populations, such alleles were likely missed. For example, most of these alleles were not seen in repetitive sampling of the same body of water, e.g., the "unique" alleles defined for Cove Brook were not present in multiple samples, and "unique" alleles defined for the East Machias were absent from tributaries sampled in the same year. In addition, putative "unique" alleles for some locations had been already identified in other studies of North American salmon: in Cove Brook, the "unique" alleles 273 and 275 for locus Ssa171 were found in Canadian population samples from the Natashquan River (Fontaine et al., 1997). Further, because of technical errors in allele assignment summarized above, numerous "unique" alleles were not correctly identified, e.g., allele 148 at locus SSOL311, presumably restricted to the Penobscot drainage in Maine was present in high frequency in the East Machias River. Identical sampling arguments apply to the unique mitochondrial DNA (mtDNA) composite haplotypes identified in the Final Genetics Report (1999, Table 3a). For example, in the Narraguagus River, mtDNA haplotypes were restricted to single collections and were absent from other sample locations within that river during the same sampling period. Coupled with systemic errors in the laboratory work previously described, and sampling issues associated with "rare alleles", inferences made based on "unique" alleles are suspect.

vi. Atlantic salmon in Maine rivers can not be distinguished from those in nearby Canadian waters. Presumed "subtle distinctions" are not statistically supported.

The distinctiveness of Maine Atlantic salmon viz. Canadian populations was examined with a variety of techniques in the Final Genetic Report. All of the assessments depended on the correct assignment of individual genotypes. However, errors associated with genotype assignment, temporal instability, and non-random sampling compromised the utility of the microsatellite data set for statistical analysis.

> "However, it should be noted that although the number of loci (12) is good by current standards, the variable and often small sample sizes may have distorted the tree topology, making the value of the tree questionable in any event." (Ad hoc reviews of King et al., 1997: Reviewer 3)

Absent the errors noted above, there are significant misrepresentations in the interpretation of data as presented in graphical form in the Final Genetics Report. Both the results from analysis of mitochondrial DNA variation and microsatellites were presented as phenograms. In the mitochondrial tree (Final Genetics Report, Fig. 1), samples from Canadian locations clustered within groups containing samples from Maine and vice versa. However, the phenogram did not contain any confidence limits for the tree topology. Thus, no relationships were statistically supported as depicted. In the microsatellite phenogram (Final Genetics Report, Fig. 3), statistical support in the form of bootstrap values was presented. However, since significance of topology is generally recognized only for values greater than about 75% (Hillis and Bull, 1993; see Swofford et al. (1996) for discussion), the only relationship with significance is between European and North American samples. Based on biogeographic considerations (Whittaker, 1998), it is surprising that population samples from Newfoundland did not have higher support; in genetic studies of other fishes, that island is distinctive (e.g., Ruzzante et al., 1998). Regardless, virtually all of the relationships among samples from continental North America could not be distinguished.

Related individuals in the data, noted above, strongly bias the use of assignment tests. That is, individuals are more likely to be assigned back to groups containing their close relatives, regardless of river affinities. Microsatellite loci are particularly sensitive to this bias. In addition, the values reported for assignment tests indicate a lack of sensitivity for samples within Maine, within Canada, and between theses areas (Final Genetics Report, Tables 16 and 17). For example, in Maine and geographically proximate Canadian regions (Nova Scotia and New Brunswick), approximately 25% of individuals were not corrected assigned. Assignment with regions was particularly variable, with correct assignments as low as 10% in some Maine samples (Final Genetics Report, Table 19).

3. Alternative explanations (hypotheses) for observed data are not addressed in the Final Genetics Report, in the Status Review, or in the Proposed Rule.

A. **Very small population sizes, genetic drift, and inbreeding are most probably the principal causes of observed differences.** If genetic differences are principally due to stochastic changes in allele frequencies associated with small population sizes, differentiation of Atlantic salmon among coastal North American rivers is of no evolutionary significance. Consideration of this explanation was conspicuous by its absence.

Analysis of population genetic data rests upon evolutionary theory that determines the appropriateness of analytical perspectives and methodologies. The foundation underlying population genetics theory is the balance among evolutionary forces that serve to impact genetic variation. These forces are selection, mutation, migration, and genetic drift. The interaction of these elements determines the patterns that can be perceived by genetic analysis and the inferences that can be drawn. Indeed, contemporary analysis is explicitly based on examination of their interactions, e.g., Hartl and Clark, 1997. While mitochondrial and microsatellite DNAs are routinely viewed as selectively neutral, the other forces can exert considerable pressure. Mutation is a significant force determining alleleic variation for microsatellites, but its effect in a proximal time context, such as that applied here for Atlantic salmon, is probably unimportant (O'Reilly et al., 1998). However, genetic drift and gene flow are demonstrably significant variables molding the evolutionary history of salmonid populations (e.g., Fountaine et al., 1997; Jorde and Ryman, 1996; Tessier and Bernatchez, 1999). Population size is of critical significance because very small populations can be subject to the effects of genetic drift, a random and unpredictable process. In the Final Genetics Report, the absence of consideration of the fundamental evolutionary forces underlying population genetics, particularly population size, compromised the ability of the investigators to understand the implications of the data that were gathered. As Hansen and Mensberg (1998) concluded in their genetic study of brown trout, "Tests for nonrandom geographical distribution of phylogenetic groups of haplotypes showed that drift and gene flow are probably the predominant factors affecting the[ir] distribution."

The most remarkable aspect of the Final Genetics Report and the Status Review is the failure to consider genetic drift. This is remarkable because ad hoc reviewers made explicit recommendations that genetic drift and bottlenecks should be discussed, and the data produced by the Services themselves all point to its occurrence. Indeed, drift provides a unified, compelling explanation for the genetic observations: they are illusionary and do not provide evidence of discreteness and significance. Instead, the pervasiveness of genetic bottlenecks strongly suggests that design of the restoration program itself be critically re-evaluated.

> "It would be appropriate to provide a brief discussion of the possible effects of genetic bottle necking as a result of the continual low numbers of spawners in most rivers." (Ad hoc reviews of Draft Status Review (1995): Reviewer A, pg. 002475)

> "It is a quantum leap to conclude that because salmon have had a "continuous presence" in the seven Downeast Rivers they currently represent an ESU of "wild" salmon with important local adaptations. This is an extremely conservative assumption considering the historical genetic "bottlenecking" that likely occurred, and is currently occurring..." (Ad hoc reviews of Draft Status Review (1995): Reviewer B, pg. 002517).

> "The flaw is that the "wild" remnant stocks probably have no relationship to native stocks, but are the end product of bottlenecking and the influence of stocking." (Ad hoc reviews of Draft Status Review (1995): Reviewer B, pg. 002524).

From census data provided in the Status Review, it is readily apparent that populations in Maine are exceedingly small in size; the same is true for many Canadian rivers. Estimated effective population sizes (Crow, 1954) for four Maine rivers were less than 10 individuals (Table 3). Effective population is of importance because it is this size, not census size, which determines the magnitude of genetic drift. Effective size and the magnitude of drift are inversely related. Note that if a metapopulation model is appropriate for Atlantic salmon, effective population sizes so estimated need modification (Hedrick and Gilpin, 1997). Regardless, these are probably dramatic overestimates since effective population sizes in salmonids constitute only 10-20% of individuals actually encountered in a census (Hedrick et al., 1995). Thus, many, if not most, current populations are of the size where random sampling events can alter allele frequencies. Further, such genetic bottlenecks most probably occurred in the past. In addition to salmon in rivers, bottlenecks also probably occurred in hatcheries where limited numbers of adult broodstock were used for supplementation efforts.

The utility of microsatellites for characterization of effective population size (Ne) and detection of genetic drift has been reviewed by Estoup and Angers (1998). As they noted, Ne is among the most important parameters in conservation biology because it determines "...the potential for long-term maintenance of genetic variability (Simberloff, 1988)." Indeed, genetic measures such as F_{st} and R_{st} focus on changes generated by genetic drift (Goldstein and Schlotterer, 1999). Microsatellites have demonstrated extreme utility for characterizing population events, and a variety of methods are available for the estimation of Ne (see Beaumont and Bruford [1999] for discussion). Analysis of temporal variation in allele frequencies, an approach pioneered by Waples (1989) to estimate Ne, has been used in many investigations, e.g., Jorde and Ryman, 1996 in brown trout. This method exploits variation generated by drift, as the amount of variation from year to year is mathematically related to the effective population size. From this perspective, the prevalence and magnitude of temporal fluctuations in allele frequencies in the Final Genetics Report. (Tables 14G, 14H, 14I, 14J, 14K, 14L, 14N, 14O, & 14P, Appendix A, C1, C2) suggests extensive genetic drift. Given ad hoc broodstock management practices in the past, it is extremely probable that bottlenecks occurred in hatchery operations as well.

Table 3. Estimates of effective population size (Ne) for Maine Rivers using harmonic means of census sizes for the period 1970-1998. Note that if a metapopulation model is appropriate for Atlantic salmon, effective population sizes so estimated need modification (Hedrick and Gilpin, 1997). Data from Status Review.

	Dennys	East Machias	Machias	Pleasant	Narraguagus	Ducktrap	Sheepscot
No. years examined	29	24	24	25	29	9	28
Maximum size	68	46	226	38	244	9	35
Minimum size	0	0	0	0	22	0	0
Ne	6	5.41	7.83	3.15	49.71	19.29	12.3

In addition to erosion of genetic variation and changes in allele frequencies due to genetic drift, one of the correlates of extremely small population sizes is a high probably of close inbreeding. As noted above, very closely related individuals were identified in many collections. In salmonids, close inbreeding has been demonstrated by numerous workers to result in inbreeding depression (reviewed in Thornhill, 1993). For example, Kincaid (1983) demonstrated inbreeding depression for egg and fry survivorship, growth and feed conversion in *Oncorhynchus mykiss*. These observations are consistent with those observed in other fishes and anticipated from basic theory (Falconer and Mackay, 1996; Lynch and Walsh, 1998).

It is difficult to separate the effects of genetic drift *sensu stricto* from those produced by inadequate sampling of loci that are highly variable. However, an examination of those microsatellite markers that have low allelic diversity may be instructive in this regard since they may not be as susceptible to the influences of population sampling effects. Thus, for example, the differences observed in the Cove Brook 1995-1996 comparison for SSOSL438 (with 4 alleles) is significant as are the Bond 1994-1995 comparisons for Ssa14 (with 3 alleles) and SSLEEN82 (with 7 alleles) (Final Genetics Report, Appendix C2). Such observations are consistent with the presence of genetic drift. However, the effects of deviations resulting from non-random sampling (localized collections of closely related individuals) makes absolute interpretation of such results problematic.

Most important is the recognition that genetic drift affects quantitative traits as well as the genetic markers used to characterize populations. Because of this, there can be rapid, random changes in life history attributes considered important to local adaptation, to the extent that the variation in these traits is genetically based. Such drift induced stochastic phenomena could include changes in precisely those characteristics that may be critical to adaptation and population recovery. The effect of drift on life history characteristics can thus counteract the effects of multiple generations of adaptive selection, in essence erasing local adaptations and causing shifts in life history traits that may be detrimental to the long-term viability of the population. Coupled with the propensity for inbreeding and the cumulative impact of inbreeding depression on life history traits, the maintenance of a large number of broodstock is critical. Thus, it is critical that the restoration program itself be re-evaluated.

B. Explicit population models were not considered in the Genetics Study, Status Review or Proposed Rule. The models used, and the statistical inferences based upon them, must be chosen judiciously, particularly when making estimates of gene flow (Bossart and Prowell, 1998).

In the context of population analysis, it is critical that appropriate models of population structure be identified to validate the use of descriptive statistics. The perspective used in analysis in the Final Genetics Report assumed an "island model", but this was incorrect since equilibrium conditions required for this model could not be reasonably satisfied.

"...it is worth noting that the "migration rates" among populations which are calculated in the report are really just transformations of the gene frequency data. They are based on equilibrium assumptions which could not be even approximately valid for these populations." (Ad hoc reviews of King et al., 1997: Reviewer 5)

"The emphasis given to gene flow (Nm) estimates is also of doubtful significance." "This is also another example of why gene flow estimates based on haplotype/allele frequencies are of dubious value." (Ad hoc reviews of King et al. (1997) Reviewer 3)

The use of an island model in the Final Genetics Report was unfortunate since isolation-by-distance models have been repeatedly recognized as important in understanding the biology of salmon, e.g., Koljoen et al., 1999. Isolation-by-distance means that geographically adjacent populations are more similar to each other than they are to more distant population. For selectively neutral markers, this pattern usually implies the presence of gene flow. Payne (1974) demonstrated a significant latitudinal cline in the frequency of a transferrin allele among North America populations of Atlantic salmon; Moller (1970) had previously analyzed transferrin variation, but Payne (1974) convincingly demonstrated this earlier analysis was incorrect. The clinal pattern of divergence in transferrin alleles, although consistent with an isolation-by-distance model, may have been caused by selection (Payne, 1974). Indeed, sequence analysis of transferrin from Atlantic salmon and three related taxa now strongly supports the role of natural selection (Ford et al., 1999). Given isolation-by-distance, in the absence of comparisons involving geographically intermediate locations, disjunct sampling may be misleading. For example, in a study examining divergence between salmon from Maine and Newfoundland, significant differences were observed between those locations (Bentzen and Wright, 1992). However, that investigation did not include comparisons involving mainland Canadian populations which are contiguous with Maine.

The data in the Final Genetics Report appear consistent with an isolation-by-distance model. In a recent analysis of the Atlantic salmon microsatellite data by Letcher and King (1999), the pattern of spatial divergence was clear: the monotonic cline in population divergence with collection locality suggested isolation-by-distance (Letcher and King, 1999, Fig. 5).

More recently, metapopulation models have been advocated to understand salmonid dynamics (National Research Council, 1996). The genetics of metapopulations, particularly with regard to effective population sizes, was reviewed by Hedrick (1996) and by Hedrick and Gilpin (1997). In a previous evaluation of Atlantic salmon genetics, Kornfield et al. (1995) suggested that a metapopulation model might be appropriate for Atlantic salmon populations in Maine. In presenting that model, the role of the Penobscot River as a central, continuous source that seeded other populations was stressed. However, in view of the probability that substantial bottlenecks in hatchery propagation may have repeatedly occurred, the role of the Penobscot in any metapopulation model merits scrutiny. In particular, the effective population size of the Penobscot may have been small and allelic variation may have been substantially reduced by genetic drift.

Regardless, a metapopulation perspective should be evaluated (but see Fontaine et al., 1997).

4. Genetics of Life History Traits

Arguments and genetic inferences based on variation in quantitative, life-history traits were articulated in the Status Review; this information was subsequently used in the Proposed Rule to List Atlantic Salmon as an Endangered Species. The Services made the arguments that: (1) life history differences of Atlantic salmon exist between Maine rivers and those in Canada, (2) these traits have a genetic basis, and (3) thus the differences in life history characteristics are indications of important distinctiveness.

"Isolation typically leads to genetic differences among Atlantic salmon stocks and relatively minor genetic differences have been linked to important adaptive morphological and life-history traits (Ritter 1975; Saunders 1981)." (Status Review, p. 48)

"Since age-at-maturity appears to be a trait that is least partially genetically determined (Glebe and Saunders 1986; Ritter et al. 1986; Saunders 1986), this provides further evidence of separateness of U.S. and Canadian Atlantic salmon populations." (Status Review, p. 49)

"Alternately, many Canadian stocks and several in Europe have a much higher grilse component with a concurrently lower 2SW component that is frequently less than 50% (Hutchings and Jones 1998). This life history trait is partially controlled by stock genetics (Ritter et al. 1986)." (Status Review, p. 56).

"Since the proportion of 2SW fish in an Atlantic salmon stock has a documented genetic basis (Glebe and Saunders1986; Ritter et al. 1986; Hutchings and Jones 1998), the BRT concludes that the DPS has unique life history characteristics that have a heritable basis." (Status Review, p. 57)

There are indeed geographic differences in North America for traits such as age to maturity and proportion of individuals that mature at age one (grilse) versus later (2SW) fish. However, there is no evidence that such life history characteristics are either "unique", or that differences are primarily genetic in origin.

Individual rivers in New England and the Maritimes exhibit substantial variation in the characteristics of returning adults. In particular, grilsing rates are highly variable over time for any specific location. For example, during the period from 1981 to 1998, grilsing rates of wild salmon in the St. Croix ranged from 0 to 100%, but were under 20% for 4 of 17 years. In the Penobscot during the same period, grilsing rate ranged from 2 to 36%, but was over 20% for 5 of 17 years (1999 Annual Report of the US Atlantic Salmon

Assessment Committee, Table 3.2b). Similarly, Saunder et al. (1983) noted that grilsing ratios varied by an order of magnitude within stocks. The same extent of variation exists for age at smoltfication within rivers. For example, for Cove Brook, Meister (1958, p.117) noted:

> "Fluctuations in water temperature, competition, and abundance of age classes may influence the age of smolts for any stream and tend to disprove that age of smolt is typical for each stream. The smolt migrants of 1956 were predominately 1+ as compared with the 2+ age class composition of the 1957 runs."

Variation in quantitative traits, such as life history characters, has two principal causal components: genetic variance and environmental variance. Phenotypic variance, the total variation observed in a trait, is the sum of the two. Genetic variance results from the variability of heritable genes on the resultant phenotype between individuals, while environmental variance refers to the effects of the environmental conditions. Some examples of environmental conditions are water temperature, food availability and quality, competition, etc. Through controlled breeding or selection experiments, it is possible to quantitatively estimate the contribution that genetics makes to the phenotypic variance; Lynch and Walsh (1998) provide a comprehensive review of the subject. While many quantitative traits have measurable genetic variance components, such variation may be small relative to the influences of the environment. One can not simply take observed differences of traits between populations that are reared in different environments to mean that the two populations differ genetically, because the observed trait values are confounded by the differing environments in which the genes influencing those traits are being expressed. For example, in most organisms, including humans, weight has a measurable genetic variance component, but it is clear that the abundance and quality of food (environmental effects) contribute most to the observed variation among different phenotypes, or traits. In Atlantic salmon, both observational and experimental evidence indicate that the life history attributes of adaptive significance that putatively differentiate Maine fish from those of other areas are environmental, rather than genetic in origin. Early field studies provided compelling evidence of environmental affects.

> "It is difficult to separate the effects of inherited habits from the influence of new and different surroundings on the growth or behavior of salmon. In at least two cases of which we have record the effects of planting fry in a strange river has produced habits of a decidedly different character from those of the parent fish. One of these cases occurs in the Penobscot, which is stocked with fry from Miramichi salmon. In their native river (Blair 1934) the Miramichi smolts migrate as follows:
>
> As two-year fish - 15.1 percent
> As three-year fish - 78.1 "
> As four-year fish - 6.6 "
> As five-year fish - .2 "

Transported in the Penobscot they change their habits and migrate as follows:

As two-year fish - 89.0 percent
As three-year fish - 11.0 "

In this case the Penobscot River environment apparently overcomes the inherited instincts of the fish and sends them to sea a year earlier than the parent stock of the Miramichi.

In one other case Dr. Huntsman writes:

'We have had a precise experiment in testing out inheritance of behavior. Restigouche fry, whose parents run early and chiefly as 3.2 and 3.3 fish, were planted in Apple River at the head of the Bay of Fundy and marked when smolts. They ran only in September and October and nearly all as 2.1 fish, that is grilse, just as the local salmon.' "(Dow, 1938, p. 12).

"Here again is an example of the river overcoming the inherited instincts of the fish. In the Miramichi, approximately sixty percent of the fish that come back to the river are grilse. The progeny of Miramichi fish, transplanted in the Penobscot, produce few or no grilse." (Dow, 1938, p. 14).

Experimental studies in salmon have demonstrated that the environmental effects are much greater than genetic effects on quantitative life history characteristics. For example, environmental effects explains over 90% of the variation in the rate of salmon returns (Jonasson et al., 1997). Saunders et al., (1983) found that grilsing ratio is highly influenced by water temperature; as waters become colder, the amount of grilse declines. Further, there appear to be strong maternal affects in these and other characters. In the studies cited by the Services in the Status Review (Glebe and Saunders, 1986; Hutchings and Jones,1998; Ritter et al., 1986; Saunders, 1986), formal inheritance experiments were not conducted and variance components were not estimated. Thus, those studies can not be used to claim these traits have a measureable genetic basis and that observed differences between populations in different environments are the result of underlying genetic differences. Because the environment profoundly influences quantitative traits, it is not correct to assert, as the Services did, that because a trait "has a genetic basis" it provides "evidence of separateness". Observed differences in life history characteristics of salmon may be largely non-genetic in origin, especially considering the diverse environments experienced during development. Based on the arguments and data presented in the Status Review about life history characters, there is no scientific basis for concluding that Atlantic salmon from Maine contain a unique evolutionary legacy that merits protection under the ESA.

5. There is significant and continuing debate within the scientific community concerning criteria for defining units needing protection.

Criteria for protecting natural resources have benefited from ongoing dialogue within the scientific community. As new techniques and analytical approaches are developed, their application to conservation problems is swift. Despite the desire, there are no uniformly recognized metrics available to determine the evolutionary significance of populations. This is of fundamental importance to the proposed listing, as a major requirement for listing a putative DPS is the demonstration of its evolutionary significance.

> "It is important to recognize (as Waples did, in press) that decisions about what constitutes "significance" and about the resource tradeoffs implicit in recovery plans are largely societal decisions that cannot be based solely on scientific grounds alone." (National Research Council, 1996).

As noted recently by one Federal scientist:

> "Unfortunately, it seems that a consensus [on criteria for protection] will not be achieved while the US EPA and laws similar to it (e.g. Australia's ESPA) remain vaguely worded and offer insufficient operational evolutionary framework or guidance (Wayne 1992; Vogler & DeSalle 1994; Mayden & Wood 1995; Pennock & Dimmick; Waples 1998)." (King and Burke, 1999, S3).

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VITAL STATISTICS

Date of Birth: July 16, 1945; U.S. Citizen
Married to Victoria Jean Porter; two wonderful daughters

EDUCATION

A.B.,	Syracuse University, Syracuse, New York	1968
M.A.,	State University of New York, Stony Brook	1972
Ph.D.,	State University of New York, Stony Brook	1974

POSTDOCTORAL TRAINING

Division of Fishes, Smithsonian Institution, Washington, DC
Department of Biology, University of Haifa, Haifa, Israel
Department of Genetics, Hebrew University, Jerusalem, Israel

APPOINTMENTS

University of Maine, Assistant Professor of Zoology	1977-1982
Associate Professor of Zoology	1982-1987
Professor of Zoology	1987-
Cooperating Professor of Biological Sciences	1998-
Supervisor, DNA Forensic Laboratory	1998-

UNDERGRADUATE TEACHING

Biometry, Ecology, Evolution, Introduction to Ecology (non-major), Marine Ecology, Research Methods, Science Writing

GRADUATE TEACHING

Molecular Systematics, Multivariate Analysis, Population Biology

AWARDS

Smithsonian Fellow	1975
Danforth Associate	1981-1988
H. Burr Steinbach Visiting Scholar, Woods Hole Oceanographic Institution	1992
Alumni Association Distinguished Maine Professor	1997
Maine Professor of the Year, Carnegie Foundation for the Advancement of Teaching	1998

RECENT PROFESSIONAL SERVICE

Member, Governor's Task Force on Atlantic Salmon	1995-
Panelist, NSF Doctoral Dissertation Improvement Awards	1996
Member, Maine Atlantic Salmon Technical Advisory Committee	1998-
Panelist, NSF Systematic Biology Program	1998,1999

SOCIETIES

American Society of Ichthyologists and Herpetologists
American Society for Molecular Marine Biology and Biotechnology
Maine Medico-Legal Society
Society for Molecular Biology and Evolution
Society for the Study of Evolution

FIELD WORK

Cuatro Cienegas and Media Luna, Mexico 1971, 1979-83
Lake Malawi, Malawi 1972, 1986-90, 1997-98
Sea of Galilee and Jordan Valley, Israel 1976-7
Lake Lanao, Philippines 1983
Lake Baikal, USSR 1984
Lake Titicaca, Bolivia 1991
Georges Bank, Gulf of Maine 1995, 1996

PUBLICATIONS

51 peer reviewed articles, 2 co-edited books, 5 book reviews, 228 DNA sequences deposited in GenBank

NEW SPECIES

Cichlasoma minckleyi Kornfield & Taylor (fish); _Homarius capensis_ Kornfield, Williams, & Steneck (lobster); _Oreochromis niloticus tana_ Seyoum & Kornfield (fish); _Saccoglossus bromophenolicum_ King, Giray, & Kornfield (hemicordate)

RESEARCH

Population genetics and molecular systematics. My research exploits DNA technologies to applied problems and to pure research in evolution and systematics. Extramural funding totals $2,361,504. Current research projects in my laboratory:

Wildlife forensics. Maine Dept. Inland Fish. Wildlife.
Genetic signatures of Atlantic salmon. NOAA Sea Grant.
Rapid evolution in African fishes. National Science Foundation.
Biology of Georges Bank cod. National Science Foundation.
Training taxonomists for the 21st century. National Science Foundation.

PUBLICATIONS

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Attachment #2

A Review/Critique of:

Microsatellite and Mitochondrial DNA Diversity in Atlantic Salmon with Emphasis on Small Coastal Drainages of the Downeast and Midcoast Regions of Maine

A Report to Region 5, U.S.F.W.S., Hadley, MA

March 1999

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Introduction

The following is a scientific review/critique of a report (by King et al. 1999) that summarizes a survey of variation in restriction-fragment-length-polymorphisms (RFLPs) of fragments of mitochondrial (mtDNA) and in twelve, nuclear-encoded microsatellite DNA markers among samples of Atlantic salmon (*Salmo salar*) from Europe and North America, with emphasis on samples from selected rivers in the State of Maine. The stated purpose of the work performed by King et al. (1999) was to "...allow the most informed planning and implementation of biologically sound management efforts." This review/critique of the report by King et al. (1999) was commissioned with the charge of providing scientific/professional review and critique of the genetics work carried out by federal laboratories regarding Atlantic salmon and as that work relates to the listing process. In the course of reviewing the report, numerous other documents were read, including the July 1999 Status review published by the United States Fish and Wildlife Service (USFW) and the National Marine Fisheries Service (NMFS) on the Gulf of Maine DPS and the November 17, 1999 proposed rule notice. In reading those later documents, the importance of the report by King et al. became clear relative to establishing, based on genetics evidence, the concepts of genetic *discreteness* and *significance* of the Gulf of Maine DPS. The basis for genetic discreteness appears to have been the inference by King et al. (1999) that samples of Atlantic salmon from Maine differed from samples elsewhere in North America. The basis for genetic significance appears to have been the inference by the authors of the proposed rule (not necessarily by King et al. 1999) that fish in the Gulf of Maine DPS represented a sustaining, remnant of unique genetic material descendant from aboriginal stocks.

The review/critique is divided into five major sections. The first four address the major experimental aspects of the study: sampling, statistical analysis, analysis of mitochondrial (mt)DNA, and analysis of microsatellites. Within each section, comments generally address both the analytical approach employed by King et al. (1999) and (where applicable) the inferences drawn from the results. Differences between the inferences/interpretations drawn by King et al. (1999) and those of this reviewer also are noted. The fifth (and last) section is and discussion of the findings and conclusions reached by King et al. (1999) as regards (i) North American versus European Atlantic salmon, and (ii) North American (specifically Maine) salmon. Included within this section are a few brief recommendations, with emphasis on analytical approaches that would have enhanced considerably the analysis in the report. Salient "conclusions" reached by the reviewer relative to the data in the report, their analysis, and their use in the listing process for the Gulf of Maine DPS are noted in "bullet" form below.

Report by King et al. (1999):

- The sampling design is not clear with respect to whether samples taken in different years represent different year classes (cohorts). This could mean that allele-frequency differences between year classes, reflective of genetic drift, may have been minimized.

- Statistical approaches used in the study failed to employ methods, developed within the past few years, that ask important questions about populations, their structure, and their ecological and evolutionary dynamics. Deployment of these approaches would have enhanced data analysis and biological inference considerably.

- Problems in statistical analysis, including use of non-independent, *a posteriori* (and non-randomly) selected comparisons, impacts negatively inferences and arguments made in the report that observed genetic differences represent genetic isolation of samples from North America and are of significance biologically.

- Shortcomings in terms of data analysis and inference with respect to variation in mitochondrial (mt)DNA lead the authors to (i) overstate the degree of (statistically valid) genetic divergence among samples from Maine, and (ii) ignore evidence that observed differences in mtDNA haplotype frequencies among North American fish (especially those sampled in Maine) may stem from genetic drift.

- Numerous instances where significant differences in allele frequencies at microsatellites between/among yearly samples at the same locality in Maine waters were observed. The authors make no mention that the clear inference from these data (as with the mtDNA data) is that the samples are from localities where effective population size is small and the effects of genetic drift are large.

- The authors report that 36 rare or unique microsatellite alleles were found among fish from Maine. Over three-fourths of these alleles also are found in Maine and Canada, Maine and Europe, or Maine, Canada, and Europe. These findings are consistent with the notions that (i) gene flow (especially between fish from Maine and Canada) is more extensive that presently believed, and/or (ii) introductions of non-Maine fish into waters in Maine were successful in terms of genetic material from these sources having been incorporated into the genomes of fish currently inhabiting waters in Maine.

- Large fluctuations in frequencies of numerous microsatellite alleles between/among yearly samples of fish (especially from Maine waters) also are entire consistent with the inference that genetic drift accounts for much of the genetic heterogeneity observed.

- Results of assignment tests indicate strongly that the general pattern of allele frequency divergence among North American samples of Atlantic salmon is one of isolation-by-distance. This means that significant gene flow between Atlantic salmon in Maine and Canadian waters must have occurred historically, and moreover, that such genetic "straying" is a critical, adaptive feature of the life history of the species.

- There is clear indication that Atlantic salmon in Europe differ significantly from North American fish in allele frequencies at microsatellite and mitochondrial DNA loci. Whether this difference is significant evolutionary or biologically is a matter of perspective. Not appreciated by the authors is that European fish may represent a valuable resource of adaptively useful alleles that may have been lost in North American fish because of (what appears to be) extensive genetic drift.

- The conclusion in the report that "shallow" (spatial) genetic subdivisions exist among North American fish is compromised significantly by the inappropriate statistical approach employed and by the existence of highly significant, genetic instability between yearly samples at the same site/locality. The impacts of the inappropriate statistical approach are likely that (i) many of the reported "significant" differences are not significant (either statistically or biologically), and (ii) the statistical power of individual tests was reduced appreciably.

- The magnitude of genetic instability between yearly samples at the same site/locality indicates that extensive *random* variation in allele frequencies is ongoing among fish in the Gulf of Maine DPS. The present-day occurrence of extensive genetic drift in the Gulf of Maine DPS also is supported by approximate estimates of the minimum effective population size (N_e) of the entire DPS.

- The inappropriate statistical approach employed and the existence of highly significant, genetic instability between yearly samples at the same site/locality within the Gulf of Maine DPS raise questions regarding the genetic *discreteness* and genetic *significance* of fish occurring in the region. The latter, temporal genetic instability, is by far the more critical of the two, as the statistical "problems" can be rectified and additional analytical approaches can be utilized. The apparent existence of extensive genetic drift has the following implications.

  * Genetic discreteness may be illusory, in the sense that significant differences in allele frequencies may arise annually from small effective population size. Samples from any given site/locality may be the same or different from any other site/locality by chance alone.

  * The occurrence of genetic "uniqueness" may simply reflect chance events precipitated by small effective population size. A paradigm example of this could be the sample(s) from Cove Brook in the lower Penobscot River, where there was no variation in mitochondrial DNA in either of two yearly samples and where there was significant heterogeneity in allele frequencies at microsatellites among three yearly samples. This impacts the issue of genetic *distinctness* (which implies spatial genetic differences are stable).

  * The occurrence of genetic "uniqueness" also impacts the issue of genetic *significance*. Alleles at genes for adaptively useful traits reflecting variation in life-history traits also should fluctuate randomly under conditions of small effective population size and genetic drift. This means that slightly deleterious alleles at such genes could increase in frequency, whereas slightly advantageous alleles could decrease in frequency. Consequently, samples with unique genotypes may actually harbor ill-adaptive alleles, and the supposition that unique genotypes in Gulf of Maine DPS fish represent an important genetic legacy of aboriginal stocks is incredibly naïve.

Review/Critique of the Report by King et al. (1999)

A. Sampling:

In "Methods" it is stated first that tissues were sampled from parr and adults, then that efforts were directed at 0+ and 1+ parr, and finally that at least two year-classes were sampled. What's not mentioned is how individual fish were assigned to a given year class or how it was determined that at least two year classes were sampled at the localities listed, i.e., Bond Brook, Togus Stream, Cove Brook, Kenduskeag Stream, Narraguagus River, Pleasant River, and East Machias River. This potentially is a serious, critical omission, as the data are reported as if different year classes were tested for allele frequency homogeneity. What efforts (e.g., otolith analysis, lengths, et cetera) were made to insure that the same year class was sampled from a given locality at a given time, and that different year classes were sampled in different years? Given that parr of Atlantic salmon can remain in a stream/river for well more than one year (Status Review 1999), it's possible (likely, given the absence of any mention of attention to this detail in the report) that individual samples may have contained fish from more than one year class. It also may be the situation that some samples may have contained adults. If this is the case, *temporal variation* as assessed in the study does not mean allele-frequency changes from generation to generation but rather from year-to-year. This is a critical point for two reasons. First, allele-frequency changes from year class to year class would directly permit an assessment of the degree of genetic drift operative, and perhaps more importantly, permit quantitative assessment, based on the "temporal method" (Pollak 1983; Waples 1989; Laikre et al. 1998), of the genetic effective population size. The latter is a parameter of fundamental interest in the management of threatened and endangered biota (Nunney and Elam 1994). Secondly, what may have been measured in this study were allele frequency changes from year to year but where individuals from multiple year classes were included in the sample. What this means is that possible allele-frequency changes between year classes that might have occurred because of small effective population size (i.e., genetic drift) potentially could be obscured (minimized, at the least) because of the inclusion of multiple year classes. Given that the data (see below) indicate large-scale changes between yearly samples at some localities (e.g., Cove Brook), the actual amount of genetic drift operative may actually be greater than indicated by the data. The bottom line is that the failure to document the year class of the individuals within a sample represents a critical oversight or flaw in the study. Given that the tissue sampling appears to have been non-invasive, year class likely could have been ascertained by restricting sampling to parr smaller than the average size for individuals in the 0+ age class. It is likely that these data are available, and if so, they should be made available.

B. Statistical analysis:

In general, the approach taken is fairly standard and the authors have utilized most of the commonly used approaches (methods) for assessing allele-frequency homogeneity among samples. In subsequent sections of this review I will note a few approaches that have become available within the past two-three years and which ask different (but important) questions about populations, their structure, and their ecological and evolutionary dynamics. Some of these approaches would have enhanced considerably the analysis in this report (study). The absence of some of these analyses (e.g., testing whether samples were in the mutation-genetic drift equilibrium) suggests the authors are not especially up-to-date on molecular population genetic analysis beyond that necessary to test homogeneity in allele frequencies. [This includes assignment tests which generally ask the same sorts of questions.] The consequence of this, I believe, is that the singular, most important aspect of the genetic data, i.e., that Atlantic salmon in many of the rivers in Maine are suffering from (potentially extreme) reductions in genetic effective population size, was not considered at all in the report. The potential implications of such reductions in effective population size also are discussed in several sections elsewhere in this review. Three other comments regarding the statistical analysis are as follows. First, there are a large number of pairwise comparisons of samples in data analysis. In general, pairwise comparisons executed in this fashion are not all independent, violating a number of statistical assumptions and compromising the Bonferroni corrections (which are for multiple, independent tests carried out simultaneously). Secondly, a very large number of comparisons in this study were *a posteriori* and appear to have been selected somewhat non-randomly. In general, statistical testing of *a posteriori* comparisons is considerably weaker than testing of *a priori* comparisons. This "testing" is weakened even further when all possible comparisons are not made. Finally, use of Wright (1943) as a means to estimate the effective number of migrants is inappropriate for Atlantic salmon. Wright's equation is for an island model of population structure. The genetic data on Atlantic salmon indicate an isolation-by-distance effect (e.g., Letcher and King 1999), which means the operational model of population structure for this species is a stepping-stone model. The effect of the latter on inferences drawn by the authors in this study is not large, but the failure to acknowledge that the island model is inappropriate here reduces somewhat the credibility of the authors. The upshot of these "statistical" problems, particularly the non-independent tests carried out *a posteriori*, is that many of the "significant" allele-frequency differences noted in the report likely are seriously compromised. This impacts negatively the argument that the reported genetic differences represent isolation and/or are of biological significance.

C. Analysis of mitochondrial (mt)DNA:

1. The analysis of the mtDNA data suffers from some of the (statistical) issues noted above. Pairwise comparisons were made among "selected" samples, leading to the conclusion that there was "...some population subdivision." The statistical issues here minimally are twofold: (i) tests were *a posteriori* and potentially selected non-randomly (affecting probability values), and (ii) for proper application of Bonferroni correction, even given that all pairwise tests would not be independent, all 91 tests (pairwise comparisons of 14 samples) should have been carried out, with a corrected alpha of 0.00055 (0.05÷91). In short, except for the comparison between European and North American fish, the few "significant" comparisons discussed likely were not (significant).

2. The UPGMA phenogram shown as Figure 1 is interpreted to indicate the existence of five groupings of populations (samples). Although I was unable to discern five groupings *per se*, more important about this phenogram is what was left unsaid by the authors. Taken at face value, the phenogram places several (but not all) of the samples from Maine in a large cluster that includes samples from Europe. This is inconsistent with the notion that fish from Maine differ significantly from Canadian or European fish. Also troubling is that the two central clusters in the phenogram do not have geographic consistency: one cluster contains samples from Maine and Canada, while the other cluster contains samples from Maine, Canada, and Europe. A third troubling aspect about the phenogram is that samples from the Narraguagus River fall into both clusters. The significance of these clusters cannot be evaluated, as the authors did not attempt to place standard errors at any node in the phenogram. As a guess, however, only the two large clusters may be valid statistically, as the branch lengths for most of the nodes are shorter (considerably so in most cases) than the branches leading to the two large clusters. Overall, there appears to be little population subdivision (structure) based on mtDNA (genetic) distances. Given this, not to mention that UPGMA analysis is generally in disfavor because of its strict adherence to equal rates of sequence divergence among lineages, it puzzling why the authors carried out UPGMA analysis or included it in the document.

3. The AMOVA appears to indicate that more than half of the variation in mtDNA among all samples is attributable to differences between continents. Exactly why the authors executed multiple AMOVAs is not clear and may compromise statistical inference. The AMOVA analysis should be redone, with hierarchical subdivisions incorporated into a single design. I suspect the larger part of the mtDNA variation will still be attributable to differences between continents.

4. The mtDNA data indicate that the samples from Maine have small effective (female, in this case) population sizes and that genetic drift is playing or has played a major role in generating present-day mtDNA haplotype diversity. First, mtDNA variation is generally low to non-existent among samples from Maine. No mtDNA haplotype variation, for example, was found among the two samples from the Ducktrap River and the two samples from Cove Brook (Penobscot River). The clear inference, particularly given that some variation in microsatellites was observed in samples from these localities, is that the female effective size at these localities is very small. [For a related example in brook trout, see Ferguson et al. 1991.] Second, mtDNA variation among the samples from Maine versus the samples from Canada is quite low. Third, in those cases where mtDNA data were obtained either from samples at the same locality but taken in different years or from different localities in the same river system, there either was no mtDNA variation (Ducktrap River and Cove Brook) or the mtDNA variation differed significantly. Regarding the latter, I ran a simple Roff-Bentzen procedure (Roff and Bentzen 1989) on haplotype distributions from the two samples from the Kennebec River (Bond Brook-94 and Togus Stream-94) and from the three samples from the Narraguagus River (Route 9, Bog Stream, and Route 193) and found significant heterogeneity in haplotype distributions ($P = 0.000$, Kennebec River; $P = 0.005$, Narraguagus River). This not only suggests the occurrence of random fluctuations in haplotype frequencies (due in all likelihood to small effective female population size), it also compromises seriously the authors pooling of the (clearly heterogeneous) samples from the Narraguagus River in their tests of haplotype-distribution homogeneity. Finally, mtDNA is, in theory, four times as sensitive relative to detecting population subdivision as are analogous nuclear-encoded sequences (Birkey et al. 1989). This is because mtDNA is haploid (nuclear-encoded sequences are diploid) and inherited uniparentally (nuclear-encoded sequences are biparentally inherited). However, in this study, far fewer differences among samples were detected with analysis of mtDNA haplotypes (alleles) than with analysis of microsatellite alleles, a finding that should have alerted the authors that something unusual (or at least atypical in relation to numerous published population level studies where both mtDNA and microsatellites were employed) was occurring. In this case, part of the answer appears to be the low levels of mtDNA variation among many of the samples from Maine, i.e., the absence of appreciable variation in mtDNA (due in all likelihood to very small female effective sizes) diminishes effective use of mtDNA as a genetic marker for population subdivision. This represents another situation where the authors might have inferred that effective population sizes of Atlantic salmon in Maine rivers are quite small.

5. The effects of the above shortcomings in terms of data analysis and inference are that the authors (i) overstate the degree of (statistically valid) genetic (mtDNA) divergence among the samples from Maine, and (ii) effectively ignore all the evidence that the observed differences in mtDNA haplotype frequencies may stem largely from genetic drift. Thus, the statements in Discussion that "...[the] discovery of highly divergent populations...existing in an apparently sympatric manner is remarkable..." and "...large frequency differences in mtDNA haplotype frequencies..." are at best misleading. With regard to the former, most of the observed differences in mtDNA (at least among samples from Maine) are likely either not that large or at least are of the same general magnitude as differences between/among different localities within the same river system. This is all the more noteworthy when one considers that genetic divergence (due to random fixation or near fixation of alleles) is expected to increase with genetic drift. With regard to the latter, what's "remarkable" is that the authors have ignored completely the evidence, which indicates that the observed genetic divergence in all likelihood may be due in large part to genetic drift. Stated differently, it is entirely possible that many, if not most, of the observed (statistically significant or not) differences in mtDNA frequencies among samples from Maine have stemmed from increasingly small effective population sizes and not from adaptive processes acting on adaptively useful genetic variation. This raises a question as to whether the genetic differences observed are

meaningful biologically in terms of adaptation (i.e., reflect a remaining reservoir of significant and adaptively useful alleles). In fact, because genetic drift is a random, stochastic process, it is entirely possible that the observed genetic differences could reflect an increase in the frequency of slightly deleterious alleles (Lynch et al. 1995). Such a notion certainly is consistent with the observation that population fitness, as measured as adult returns and presmolt survival, appear to have decreased in Maine rivers. If this were the case, preserving extant genetic material via river-specific (or perhaps even region-specific) management would be contra-indicated.

D. Analysis of microsatellites:

At the outset, it should be noted that there is a very large quantity of (not easily digested) data in this aspect of the report. It also should be noted that I have assumed that scoring of alleles (phenotypes, actually) at all microsatellites was carried out correctly. This is not a trivial assumption, as microsatellites are among the most difficult genetic markers to score accurately and reproducibly. This is especially so for dinucleotide repeat loci, where "stutter" often makes reliable scoring difficult.

1. As pointed out by the authors, there are several instances where there are large differences in allele frequencies among samples. Significantly, there are instances (lower Penobscot and lower Kennebec rivers) where there are significant differences between/among samples from the same locality but taken in different years or between localities in the same river. The authors state that it is unclear whether this within-locality or within-river divergence is the rule or an exception. Astoundingly, the authors make no mention that the clear inference from these data (as with the mtDNA data) is that these samples are from localities where the effective population size must be very small and the effect of genetic drift rather extreme. This theme is discussed further below.

2. The authors note that numerous unique alleles were recorded. Not mentioned is that sample sizes per locality were relatively small, making the "discovery" of unique alleles at microsatellites not that unusual (or "extraordinary") at all. Stated differently, mutation rates at microsatellite loci are thought to be relatively high (Schug et al. 1998), such that "new" alleles may appear in populations on a fairly regular basis. Thus, rather extensive sampling is required before one could state unequivocally that an allele is truly unique. More interesting is the geographic distribution of the alleles the authors list (Table 7c) as rare or unique. Of the 36 (rare or unique) alleles found in Maine, nine are found in Maine and Canada, seven are found in Maine and Europe, and 12 are found in Maine, Canada, and Europe. This suggest one of three possibilities: either (i) gene flow is far more extensive that presently believed; (ii) introductions of non-Maine fish into waters in Maine were quite successful in terms of genetic material from these "outside" sources having been incorporated into the genomes of fish currently inhabiting waters in Maine; or (iii) these alleles are not identical by descent, having been derived (presumably by mutation) independently. These possibilities (hypotheses, actually) are not mutually independent and would be difficult to test empirically on an allele by allele basis. My experience suggests that possibilities (i) (ii) would be by far the most likely. Note that in both cases, the implication is that genetic material from outside Maine likely provided adaptive benefits to fish currently inhabiting Maine waters.

3. Of the eight (rare or unique) alleles found in waters of Maine, it's significant to note that these alleles do not necessarily occur in either temporal samples from the same locality or different localities from the same river: *Ssa*85-106 and *Ssa*171-213 occur only in one of five samples from the East Machias River; *Ssa*171-261 occurs in only one of five samples from the Narraguagus River; and three alleles (*Ssa*171-273, *Ssa*171-275, and *Ssa*289-103) occur in only two of three yearly samples taken at Cove Brook. This, again, suggests that sample sizes may have been too small to detect "true" unique alleles, and more importantly, that there may be a large stochastic component (i.e., random genetic drift) to the allelic variation. A large stochastic component also

is indicated by the observation that some of these (rare or unique) alleles are not that rare (*Ssa*85-106 was at a frequency of 8.3% in the East Machias River upper 94, and *Ssa*171-273 was at frequencies of 13.3% and 6.7% in Cove Brook 94 and 95, respectively). [Note: A stochastic component is indicated by the absence of *Ssa*85-106 from the 1995 sample from the upper East Machias River and by the absence of *Ssa*171-273 from the 1996 sample at Cove Brook].

4. The inference that rather extreme genetic drift may be operating in Maine waters is best indicated by the observed (and significant) variation in allele frequencies found among yearly samples at the same locality. Examination of Appendix A, for example, reveals at least 26 alleles where large shifts in allele frequencies were found among the three yearly samples at Togus Stream, and at least 19 alleles where large shifts in allele frequencies were found among the three yearly samples at Cove Brook. These loci (alleles) are: Togus Stream – *Ssa*85 (124, 128), *Ssa*171 (215, 229,231,233, 239, 245), *Ssa*197 (160, 164, 172), *Ssa*202 (282, 286, 298, 306), *Ssa*289 (111), *SSLEEN*82 (212, 220), *SSOSL*25 (162), *SSOSL*85 (180, 189, 195), *SSOSL*311 (114, 148), and *SSLEEI*84 (165, 195); and Cove Brook – *Ssa*85 (130), *Ssa*171 (239, 241), *Ssa*197 (152, 172, 192), *Ssa*202 (278, 282, 294, 310), *SSLEEN*82 (204, 212), *SSOSL*25 (140), *SSOSL*85 (191, 195, 197), *SSOSL*438 (106, 110),), and *SSLEEI*84 (203). In addition, the authors used AMOVA to test for homogeneity in allele frequencies between/among yearly samples within rivers and collection sites and between/among collection sites in Maine (Tables 14G, H, I, J, K, L, N, O, and P) and found very highly significant (P = 0.000) differences between/among yearly samples within rivers and collection sites in nearly every case. Moreover, in many of these comparisons, there was very highly significant (P = 0.000) heterogeneity between/among yearly samples at a locality but not between localities or tributaries in the same river or tributary (Tables 14 G, H, K, and N, representing the Narraguagus, East Machias, lower Penobscot, and lower Kennebec rivers, respectively). Finally, the authors reported significant heterogeneity between tributaries of Maine rivers (lower Kennebec and lower Penobscot rivers) and among the three yearly samples at Bond Brook and Togus Stream (bottom of page 20) based on tests of allele-frequency homogeneity (Appendix C). Taken together, these results argue strongly that Atlantic salmon within Maine rivers are unstable genetically, in the sense that large-scale fluctuations in allele frequencies (likely due to genetic drift) even at the same sampling locality appear the norm rather than the exception. Surprisingly, even after having demonstrated significant heterogeneity within river systems and among temporal samples at the same site or locality, the authors assert (page 30 in Discussion) that the populations (samples, actually) are temporally stable, and even more surprisingly, pooled the spatial and temporal samples from Maine rivers for some of the tests of allele frequency homogeneity (middle of page 20). As the spatial and temporal samples from Maine rivers differed significantly in allele frequencies, such pooling is analogous to pooling apples and oranges to test whether the pooled samples are grapefruits (i.e., is highly inappropriate statistically). The consequence of this is that many of the tests of allele-frequency homogeneity that involved samples from Maine were seriously compromised, reducing both the likelihood that reported "significant" probability levels were in fact significant and the power of the statistical test itself. Exactly which tests of allele-frequency homogeneity were carried out was not presented in this report.

5. The authors tested for genotypic disequilibrium (independence of genotypes, actually) at pairs of microsatellites in order to determine whether pairs of microsatellites might be linked genetically. Based on Bonferroni corrections, 48 of 726 pairwise comparisons yielded significant probability values, leading to the conclusions by the authors that none of the microsatellites were linked and that the disequilibrium observed in Maine rivers (or tributaries) was likely indicative of population subdivision, founder effects (genetic drift), or selection. This analysis and the conclusions drawn from it are troubling for a number of reasons. First, the authors pooled the spatial (same river) and temporal (same locality) samples from Maine. This pooling is statistically unsound for the same

reason as noted above under 4d (the spatial and temporal samples are from different sampling distributions). Second, in carrying out 66 pairwise comparisons for each river system, the Bonferroni adjusted alpha level is 0.05/66 or ~0.0007, meaning that the Bonferoni correction here may have been inappropriate (for an extended discussion of why this is so see Ferguson and Danzmann 1998). Third, the authors were not really measuring linkage disequilibrium but whether genotypes at any one microsatellite are independent of genotypes at a second microsatellite. This approach is generally accepted as a tractable substitute for a true measure of linkage disequilibrium but it is often unrecognized that a significant result merely indicates that genotypes may not be independent of one another, and that another factor, namely inbreeding, may also produce a significant result. Finally, even with the Bonferroni-adjusted alpha level, significance still was detected at localities in Maine (e.g., Bond Brook, Togus Stream, and Cove Brook) where significant allele-frequency heterogeneity was detected either between among sites within a river or between/among temporal samples at the same locality. In all likelihood the significant "disequilibrium" stemmed from non-random associations of homozygous genotypes as a function of genetic drift and associated inbreeding. Along these lines, inbreeding (and non-random, genetic relationships among individuals within a sample locality) was not at all considered by the authors. If it exists, especially among samples form Maine (and there is every indication that it could), such non-random genetic relationships among individuals within a sample would compromise seriously almost every test of population structure carried out by the authors. Other approaches that could have been be used by the authors to ask whether individuals within samples were closely related by descent are outlined in Ayres and Balding (1998), Saccheri et al. (1999), and Lynch and Ritland (1999).

6. The tests of allele-frequency homogeneity, including the F_{ST} and R_{ST} values and the AMOVA, are all variously compromised by a number of things discussed previously, viz., pooling of spatial and temporal samples from Maine rivers in some comparisons, non-independent and non-randomly selected *a posteriori* comparisons, and extremely low Bonferroni-adjusted alpha levels in several comparisons. Nonetheless, I believe the general findings that (i) the greatest degree of genetic divergence is between samples from North America and samples from Europe, and (ii) there is a general increase in the degree of genetic divergence with increasing geographic distance between samples, are probably correct. With respect to (i), the interpretation that the difference between samples from North America and Europe is evolutionarily significant is simply a matter of opinion. With respect to (ii), a positive relationship between genetic divergence and geographic distance is referred to as an isolation-by-distance effect (Sokal and Oden 1978) and certainly is consistent with the life history of anadromous salmonids. Almost identical results were obtained with the assignment tests, i.e., the proportion of misclassified USA fish increased with increasing geographic distance from the USA. Surprisingly, the authors point out (based on AMOVA) that the divergence found in the lower Penobscot River (i.e., between Cove Brook and Kenduskeag Stream) is more than two-fold greater than that observed in general among Maine rivers, and that there was less spatial divergence in the lower Kennebec river (i.e., between Bond Brook and Togus Stream) than there was among the yearly samples of the tributaries. What was surprising is that the authors did not make the obvious inference that the allele-frequency fluctuations likely were due to small effective population size and associated genetic drift.

7. The neighbor-joining topology (Figure 3) is used to depict genetic similarities among samples. A clear, distinct separation between samples from North America and samples from Europe is demonstrated. The authors state that in North America shallow but significant genetic structure was observed among rivers and among collections (samples) within rivers (page 24). This is a more than a little overstated, as the tests of allele-frequency homogeneity demonstrated significant heterogeneity among samples (e.g., the yearly samples from Cove Brook - Table 14L) that clustered with relatively high bootstrap support in Figure 3. Moreover, to be straightforward

about what the topology shows, the authors should have collapsed all of the nodes except those by bootstrap values well in excess of 50%. Had they done so, the "structure" in the topology, relative to fish from Maine, would have been limited primarily to the samples from Cove Brook (one group, reproducible at 83% and 96% bootstrapping) and the samples from Kenduskeag Stream (a second group, reproducible at 100% bootstrapping). What this means with regard to overall genetic structure in North American fish is that the neighbor-joining topology is essentially uninformative.

8. The assignment tests as employed in the report afford a different approach to the issue of sample distinctness. In general, the results, relative to fish from North America, are in accord with an isolation-by-distance model: most misclassified fish from the USA were assigned to New Brunswick, followed in sequence by Nova Scotia, Newfoundland, and Labrador. This should have been the salient "finding" noted by the authors, as an isolation-by-distance model of gene flow is consistent with the known life history of anadromous salmonids. Existence of an isolation-by-distance effect among North American salmon has the following important implications: (i) significant gene flow between Maine and Canadian Atlantic salmon undoubtedly occurred historically, and (ii) such gene flow was a critical, adaptive feature of the life history of the species. Not often understood is that an isolation-by-distance effect means that over time, alleles from opposite ends of a geographic distribution can "migrate" considerable distances and, if adaptively important, be incorporated into subpopulations between which little gene flow occurs on an annual basis. As an hypothetical example, an adaptive allele arising in a fish from Labrador eventually could makes its way (via a stepping-stone approach) to fish in southern Maine. That the general pattern of allele frequency divergence in North American Atlantic salmon is one of isolation-by-distance indicates that "genetic straying" actually is an important, adaptive life-history feature of the species. A second point is that the isolation-by-distance effect demonstrates that a stepping-stone, rather than an island model (*sensu* Wright 1943), should be employed for estimating the (genetic) effective number of migrants. Finally, it's worth noting that the assignment tests in this case also could provide a surrogate estimate of degree of gene flow (genetic straying). Fish from landlocked samples (Sebago 95 and Grand Lakes 95), for example, are misclassified less frequently than the stream/river samples (Table 20), consistent with this notion. If this is the case, "successful straying" rates (estimated approximately as one minus the per cent misclassification) could range from >13% to > 90%. The notion that microsatellite variation among Atlantic salmon in North American follows an isolation-by-distance model is well demonstrated by the follow-up paper (Letcher and King 1999) to this report.

E. Discussion of findings and conclusions reached by King et al. (1999):

The central findings in the study appear to be that (i) Atlantic salmon from Europe differ significantly in allele frequencies from Atlantic salmon in North America, and (ii) fish from North America generally can be assigned to their region (country) of origin more than 75% of the time, and (iii) fish from North America can be assigned to their collection of origin more that 65% of the time (Canadian localities) and more than 40% of the time (USA fish). Most of these findings are based on the analysis of allelic variation at the microsatellites. With regard to (i) the authors state that European and North American fish represent a "...deep evolutionary division..." and should be considered different ESUs (evolutionary significant units); with regard to (ii) and (iii) the authors suggest there are shallower genetic subdivisions (in this case in North America) that merit status as MUs (management units). Underlying the suggestion that these shallow genetic subdivisions merit direct management attention are the notions that (i) the differences in allele frequencies are minimal estimates of genetic differences in the remainder of the genome, and (ii) there remain in these "differentiated" management units a number of "local adaptations" that relate to population characteristics such a return time and spawning area to a discrete locality within a discrete riverine system. Central to the authors arguments appear to be the

"...discovery of highly divergent populations (Cove Brook and Kenduskeag Stream of the lower Penobscot River, and Bond Brook and Togus Stream of the Kennebec River) existing in an apparently sympatric manner." A final comment by the authors (page 31) is that supplementation, if applied to Maine rivers, should "...be in a manner that does not significantly perturb the recipient population by shifting gene frequencies." I assume this may form part of the basis for the notion of "river-specific" enhancement.

1. North American versus European Atlantic salmon:

There appears little doubt that European fish differ significantly from North American fish in allele frequencies at microsatellite and mtDNA loci. That this difference is evolutionarily significant is a matter of opinion. Clearly, there is little to no gene flow occurring among present day populations, and based on the genetic differences, one could estimate roughly the time since the two groups last shared a common ancestor. The authors mention 10,000 plus years of isolation but make no specific reference to a vicariant event with which this date is associated (other than a generic reference to Pleistocene glaciation) nor do they provide a time-since-divergence estimate based on the degree of genetic divergence and a rate of molecular evolution. In the absence of the latter two (i.e., a genetic distance value and an assumed evolutionary rate) it is difficult to place the divergence of European versus North American Atlantic salmon into any sort of evolutionary perspective. Moreover, to call the difference between European and North American fish a "...deep evolutionary division..." seems a bit of overstated hyperbole, as there are numerous examples in both freshwater and marine fish where genetic distances easily suggest existence of haplotype lineages before 10,000 years ago but where no reproductive isolation whatsoever apparently exists (e.g., Avise 1992; Kornfield and Bogdanowicz 1987). The authors provide no tables of genetic distances nor do the phenograms (Figures 1, 3-9) have "distances" indicated on the abscissa, meaning that "distance" as employed by the authors cannot be compared with "distances" between any operational units (i.e., individuals, populations, species, etc.) in any other organisms. To give a trivial example, if one employed microsatellites and compared genetic distances between full or half-sibs in human family A living in Maine with genetic distances between full or half-sibs in human family B living in Louisiana, there's a reasonable chance that a similar "deep evolutionary division" could be demonstrated. This is not to say that Atlantic salmon from Europe and North America salmon are not different subpopulations (stocks, in the management vernacular), or that they shouldn't be managed differently from the perspective of assessment strategies and allocation decisions. Rather, what's at issue here is whether the differences in allele frequencies at microsatellite and mtDNA loci between the two have biological relevance other than signaling reduced gene flow. In brief, the authors assert that differences in allele frequencies at microsatellite loci reflect minimal estimates of genomic differences and cite the book by Lewontin (1974) and the paper by Ståhl (1987). Not mentioned by the authors is that neither Lewontin nor Ståhl discussed microsatellites *per se* but rather referred primarily to allozymes and isozymes (which at least are products of coding, functional DNA sequences). More to the point, however, is the accumulated evidence that genes responsible for major, evolutionarily important characters appear not to follow the same evolutionary dynamics as genes or DNA sequences conventionally measured in population level studies (i.e., allozymes, mtDNA, and microsatellites). The trenchant example of this is the comparison between humans and our (presumed) closest evolutionary ancestors, chimpanzees. Humans and chimpanzees share at least 95% of their DNA (Gibbons 1998) yet the two species differ in any number of evolutionarily important morphological and behavioral characters. In contrast, many sibling species (i.e., species that are virtually identical in morphological and other quantifiable characters, including behavior) have genetic identities, in terms of similarities among (nuclear-coding) genes conventionally measured in population-level studies, on the order of 52% (Ayala et al. 1974a,b). The central point here is that DNA sequences used nowadays to measure gene flow (e.g., microsatellites) are not necessarily valid or appropriate surrogates for genes that impact adaptively important traits. This relates to another assertion by the authors (relative to European versus North American fish) that loss of stock characteristics due to hybridization of different gene pools " will result in the disappearance of local adaptations [such as] time of return and area of spawning." The potential independence of DNA sequences such as microsatellites from genes affecting behavioral and other adaptive characters means the authors' assertion is merely an opinion. Moreover, given the almost complete absence of rigorously obtained, experimental data in Atlantic salmon regarding the heritable proportion of the variation in traits such as return time and spawning area, one could just as easily postulate that many important alleles affecting traits such as these may have been lost in North American (especially Maine) fish because of the apparently intense genetic drift that appears to be ongoing, and moreover, that such alleles may still be present in European fish. This notion is not without precedent, in that many human-exploited/impacted species appear to have undergone a number of "bottleneck" (genetic drift) events such that many, adaptively-useful alleles appear to have been lost from present-day populations (Tanksley and McCouch 1997). In these cases, the only sources of adaptively useful alleles are wild relatives that either have not been exploited/impacted or at least not as intensely exploited or impacted. In short, the authors assertion that hybridization (presumably between European and North American fish) would result in the disappearance of local adaptations not only has no basis in robust empirical experimentation, it may be that European fish possess alleles that could be adaptively useful to North American fish. As a final thought, given the importance of the Atlantic salmon resource to North America (and specifically Maine), it would seem critical that this issue merits high scientific priority, as rigorous experimentation seems preferable to unsubstantiated opinion.

2. North American (specifically Maine) salmon:

With regard to Atlantic salmon in North America (specifically Maine), the authors assert that the shallow genetic subdivisions detected merit status as MUs (management units). Underlying this assertion are the following premises and/or assumptions: (i) the reported genetic differences (in alleles at microsatellites) are statistically valid, temporally stable, and biologically meaningful, and (ii) the reported genetic differences (in alleles at microsatellites) reflect the existence of historical, adaptively important alleles at genes that impact significant life-history traits. The first premise, that the reported differences are real, appears compromised; the second premise has very little support in either theoretical expectation or empirical observation. With regard to the first premise, much of the statistical inference in this study appears to have been compromised by the use of non-randomly selected, non-independent, *a posteriori* comparisons and by the "lumping" of statistically heterogeneous samples into individual test groups. Exactly how this impacted probability levels reported in various tests is not clear but it would seem a safe bet that (i) some of the reported "significant differences" either are not significant statistically or (at least) are not significant biologically, and (ii) the statistical power of the individual tests has been reduced appreciably. The statistical approach notwithstanding, what is clear in the report is that allele frequencies at microsatellites are not temporally stable in a number of Maine rivers, including the Narraguagus (Table 14G), the East Machias (Table 14H), the lower Penobscot (Table 14K), and the lower Kennebec (Table 14N). Taken together, both the statistical "problems" and the highly significant differences between/among yearly samples at the same locality indicate that virtually all the "tests" where temporal samples within sites/localities and spatial samples within rivers or tributaries were pooled (e.g., results reported in Tables 14 A - C) are potentially compromised. Finally, because a significant portion of the allele-frequency heterogeneity among fish from Maine appears to occur between/among yearly samples at the same site/locality, the heterogeneity potentially detected between/among rivers may not be meaningful in a biological or management sense unless one is willing to accept the premise that individual MUs, reflecting significant genetic differences in adaptively useful characters, are characterized by yearly samples at the same site/locality. The net of the above is that the regional (spatial) genetic differences reported by King et al. may not be valid statistically or meaningful biologically, in the sense of identifying stable genetic units that merit management attention (i.e., are discrete MUs). The allele frequency differences observed are meaningful biologically, in that they support the hypothesis that Atlantic salmon in a number of Maine rivers potentially have very small effective population sizes. This is discussed further below, along with the implications of genetic drift relative to maintenance of adaptively important alleles.

The evidence that Atlantic salmon in several Maine rivers likely have small effective population sizes stems from two observations. The first, discussed above, regards the fluctuations and significant differences in microsatellite allele frequency between/among yearly samples at the same site/locality. This is consistent with the notion that effective population sizes are quite small and that the allele frequency differences, over time, are randomly fluctuating because of genetic drift. [Note: This assumes that at least some of the fish sampled at the same site/locality in different years represent spawn of adults that returned to their natal site. However, the significant differences in allele frequency between/among temporal samples also are compatible with the hypothesis that temporal samples from the same site/locality include a significant proportion of "strays."] A second line of evidence regards the reported number of adult returns to Maine rivers and minimum estimates of the effective population size. Briefly, the total documented "natural" (wild and stocked fry) Gulf of Maine DPS spawner returns to the DPS rivers for the past five years are 83 (1995), 74 (1996), 35 (1997), 23 (1998) , and 29 (1999) (NMFS & FWS, 1999). Assuming the Gulf of Maine DPS to include seven rivers (the Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot rivers), the average (minimum) number of returning fish per year per river is seven (range = 3 - 12). [Note: Wright (1938) suggested that the best approach to estimating N was to use the harmonic mean, which further reduces the average (minimum) number of returning fish per year per DPS river to five.] As noted by several authors, effective population size, N_e, is generally less (sometimes appreciably less) than census size, N (Hedgecock 1994; Frankham 1995; Nunney and Elam 1994; Vucetich et al. 1997). Estimates of the ratio of N_E/N vary considerably (Frankham 1995): among fishes that inhabit marine waters during their lifetime, reported N_e/N ratios range from 0.004 in red drum, an estuarine-dependent sciaenid (Turner et al. 1999) to 0.04 in chinook salmon (Bartley et al. 1992), 0.24 in coho salmon (Simon et al. 1986), and 0.40 in white sea bass (Bartley et al. 1992). The estimates from chinook salmon, coho salmon, and white sea bass were from hatchery populations. Assuming the N_e/N ratio in Atlantic salmon is approximately that of hatchery-reared coho salmon (just for comparison sake), a minimum estimate of N_e per river per year among the seven Gulf of Maine DPS rivers would be in the neighborhood of two fish (or between nine and 12 fish for the entire DPS). These minimum estimates of N_e for Gulf of Maine DPS Atlantic salmon, when framed against estimates of the critical effective population size necessary to maintain long-term genetic stability of a species, i.e., between $N_e \cong 500$ - 1,000 (Franklin and Frankham (1998) or $N_e \cong 1{,}000$ - 5,000 (Lynch and Lande 1998) indicate that significant and extensive allele frequency changes due to genetic drift should be expected among Gulf of Maine DPS Atlantic salmon.

The implications of the foregoing are that the reported genetic differences (in allele frequencies at microsatellites) among samples of Atlantic salmon in Maine rivers very likely reflect stochastic (random) changes due to very small effective population sizes in individual rivers. This appears to be especially true for samples from the lower Penobscot (e.g., Cove Brook), lower Kennebec (e.g., Togus Stream and Bond Brook), East Machias, and Narraguagus rivers where significant allele-frequency differences were found between/among yearly samples. This suggests that the observed genetic differences may be important biologically only insofar as demonstrating the existence of genetic drift, not the existence of either historical subpopulations (stocks) or that genetically divergent samples represent a reservoir of adaptively important alleles at genes impacting significant life-history traits. In fact, exactly the opposite may be true. Under conditions of extreme genetic drift, adaptively beneficial alleles also may fluctuate in frequency and potentially be lost from a population. Moreover, under certain circumstances, such adaptively beneficial alleles may be replaced with selectively disadvantageous alleles (Lynch et al. 1995). What this means is that theoretically the genetically divergent samples of Atlantic salmon (as measured by allele-frequency differences at selectively neutral microsatellites) in Maine rivers could actually signal the presence of accumulated, selectively disadvantageous alleles rather than the presence of historical, adaptively beneficial alleles. It is for that reason that river-specific (and perhaps even region-specific) restoration may prove counter-productive. Regardless, the occurrence of adaptively beneficial alleles remaining in the genetically divergent samples from Maine waters (e.g., Cove Brook or Togus Stream) is not demonstrated by the data presented in the report. In addition, the effective absence of rigorous experimental evidence in Atlantic salmon regarding either the genetic component of phenotypic variation in adaptively useful traits or the relative fitness of individuals currently residing in Maine rivers mandates further study along these lines.

3. Analytical recommendations:

Much of the foregoing indicates directly and indirectly that the genetics study of King et al. (1999) is inadequate relative to assessing the distribution and significance of genetic variation in Atlantic salmon in North America and to risk assessment of management planing for restoration of the Atlantic salmon resource in Maine. First, it is not at all clear whether the genetic differences reported by King et al (1999) are valid statistically or meaningful biologically beyond demonstrating those random, stochastic fluctuations in allele frequencies at (presumably) selectively neutral genetic markers are occurring. More than anything, the occurrence and magnitude of the apparently random and stochastic genetic changes need to be better documented, as does the analysis of both temporal and spatial variation. This can be accomplished in part by better sampling and statistical design, and in part by incorporating more modern approaches in data analysis. Among the latter are (i) estimating genetic relatedness of individuals within samples (Ayres and Balding 1998; Saccheri et al. 1999; Lynch and Ritland 1999), (ii) estimating genetic effective population size based on the temporal and other methods (Pollak 1983; Waples 1989; Kuhner et al. 1995) and sampling of different cohorts over several generations, (iii) evaluating empirically whether individuals within a sample have been subjected to recent bottlenecks (Luikart and Cornuet 1998), and (iv) evaluating more rigorously the degree of genetic migration among localities by determining the most appropriate model of gene flow for the species (http://www.math.ntnu.no/~jarlet/migration). Second, because intensive genetic drift can result in an increase in the frequency of slightly deleterious alleles, it seems prudent to consider initiating a genetics (genomics) program in Maine that can enable experiments that will (i) estimate rigorously the genetic component of important life-history traits in Atlantic salmon, and (ii) assess rigorously the fitness of subpopulations (stocks) in Maine rivers and in the region. Several recent analytical approaches (e.g., Mousseau et al. 1998) are available that would facilitate this process.

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Simon, R.C., J.D. McIntyre, and A.R. Hemmingsen (1986) Family size and effective population size in a hatchery stock of coho salmon (*Oncorhynchus kisutch*). Canadian Journal of Fisheries and Aquatic Sciences 43: 2434-2442.

Sokal, R.R. and N.L. Oden (1978) Spatial autocorrelation analysis in biology. 2. Some biological implications and four applications of evolutionary and ecological interest. Biological Journal of the Linnean Society 10: 229-249.

Ståhl, G. (1987) Genetic population structure of Atlantic salmon. *In*: Population genetics & fishery management, p. 121-140. N. Ryman & F. Utter (eds.). University of Washington Press, Seattle.

Status review (1999) Review of the status of anadromous Atlantic salmon (*Salmo salar*) under the U.S. Endangered Species Act. July 1999 Status Review. U.S. Fish and Wildlife Service and National Marine Fisheries Service.

Tanksley, S.D. and S.R. McCouch (1999) Seed banks and molecular maps: unlocking genetic potential from the wild. Science 277: 1063-1066.

Turner, T.F., L.R. Richardson, and J.R. Gold (1999) Temporal genetic variation of mitochondrial DNA and the female effective population size of red drum (*Sciaenops ocellatus*) in the northern Gulf of Mexico. Molecular Ecology 8: 1223-1229.

Vucetich, J.A., T.A. Waite, and L. Nunney (1997) Fluctuating population size and the ratio of effective to census population size. Evolution 51: 2017-2021.

Waples, R.S. (1989) A generalized approach for estimating effective population size from temporal changes in allele frequency. Genetics 121: 379-391.

Wright, S. (1938) Size of population and breeding structure in relation to evolution. Science 87: 430-431.

Wright, S. (1943) Isolation by distance. Genetics 28: 114-138.

Curriculum Vitae JOHN RUSH GOLD

Position: Professor of Genetics and Wildlife and Fisheries Sciences
College of Agriculture and Life Sciences, Texas A&M University
Voice: (409) 847-8778; Fax: (409) 845-4096
Internet: goldfish@tamu.edu

Date of Birth: December 14, 1946 (Brownwood, Texas, USA) SSN: 457-74-6274

Personal: Married to Chara Joy Ragland (1985)
Two children -- Jeremy Philip (1987) and Jessica Rush (1989)

Education B.A. (Biology), Knox College, Galesburg, Illinois, 1968

Ph.D. (Genetics), University of California, Davis, California, 1973
Research Advisor: Dr. M.M. Green
Dissertation: Genetic studies of a mutator gene in *Drosophila melanogaster*

Postdoctoral Scientist, University of California, Davis, California, 1973-1975
Research Advisor: Dr. G.A.E. Gall
Research topic: Cytogenetic and morphological studies of *Salmo aguabonita*

Professional Experience:

Laboratory Technician, Brownwood Memorial Hospital, Brownwood, Texas, Summers (1963-1966)
Research Trainee, Elgin State Research Hospital, Elgin, Illinois, Summer (1967)
Teaching Assistant, Department of Biology, Knox College, Galesburg, Illinois (1967-1968)
NIH Predoctoral Fellow, Department of Genetics, University of California, Davis (1968-1973)
Postdoctoral Scientist, Department of Animal Science, University of California, Davis (1973-1975)
Assistant/Associate Professor of Genetics, Texas A&M University (1975-1983)
Greenback Cutthroat Trout Recovery Team, U.S. Fish and Wildlife Service (1977-1980)
Associate Professor of Genetics and Biochemistry, Texas A&M University (1983-1986)
Member, Editorial Board of *Copeia* - Journal of the American Society of Ichthyologists and Herpetologists (1984-1987)
Member, Advisory Panel for Systematic Biology, National Science Foundation (1984-1989)
Professor of Genetics and Wildlife and Fisheries Sciences, Texas A&M University (1986-present)
Chair, Intercollegiate Program in Genetics, Texas A&M University (1986-1989)
Member, Advisory Panel for Postdoctoral and Mid-Career Fellowships, Division of Environmental Biology, National Science Foundation (1988-1989, 1993-1994)
Director, Center for Biosystematics and Biodiversity, Texas A&M University (1990-1996)
Editorial Advisor, *Marine Ecology - Progress Series*, Springer International (1991-present)
Technical Advisor for Endangered Resources, Texas Parks and Wildlife Department (1991-present)
International Editor for the Biomedical Journal *Chromatin* (1991-1993)
International Editor for the Biomedical Journal *Cytobios* (1991-1995)
Genetics, Development, and Morphology Editor of *Copeia* - Journal of the American Society of Ichthyologists and Herpetologists (1993-2000)
Member, NRC (NAS) Ocean Studies Board Committee for Atlantic Bluefin Tuna (1994)
Member, Panel for King Mackerel Stock Assessment, National Marine Fisheries Service (1994)
Member, Class 4, ESCOP/ACOP (NASULGC) Leadership Program (1994-1995)
Technical Advisor, International Commission for the Conservation of Atlantic Tunas (1995-1997)
Member, Strategic Leadership Team, College of Agriculture and Life Sciences (1995-1997)
Member, Agriculture Program Think-Tank, The Texas A&M University System (1995-1997)
Member, Advisory Panel for Academic Research Infrastructure, National Science Foundation (1996)
Member, External Review Panel of the Fisheries Department, Virginia Institute of Marine Science (1996)

Program Director, Division of Environmental Biology, National Science Foundation (1996-1997)
Member, Advisory Panel for Integrative Graduate Education and Research Training Program, National Science Foundation (1997-1999)
Member, Advisory Panel for Postdoctoral Fellowships in the Biosciences, Division of Biological Infrastructure, National Science Foundation (1998)
Member, Red Snapper Review Panel, Gulf & South Atlantic Fisheries Development Foundation (1998)
Member, Advisory Panel for Minority Postdoctoral Fellowships, Division of Biological Infrastructure, National Science Foundation (1999-2000)
Member, Advisory Panel for Doctoral Dissertation Improvement Grants, Division of Environmental Biology, National Science Foundation (1999-2000)
Member, Technical Review Panel, New York Sea Grant Program, 1999
Member, Technical Review Panel, Grand Canyon Monitoring and Research Center, Department of the Interior, 1999

Professional Awards and Recognition:

NIH Predoctoral Fellow, University of California, Davis (1968-1973)
Research Fellow, Japan Society for the Promotion of Science, Tokyo, Japan (1980)
*Distinguished Performance Award, Undergraduate Teaching, Texas A&M University (1985)
*University Honors Program Teacher/Scholar Award, Texas A&M University (1986)
*Distinguished Teaching Award, College of Agriculture, Association of Former Students, Texas A&M University (1986)
Board of Governors, American Society of Ichthyologists and Herpetologists (1993-1999)
Outstanding Teacher, Genetics Undergraduate Society, Texas A&M University (1993)
*Distinguished Achievement Award for Teaching, Association of Former Students, Texas A&M University (1993)
Invited Plenary Lecture, Eighth International Congress of Ichthyology, Oviedo, Spain (1994)
Outstanding Faculty Member, Undergraduate Biochemistry Society, Texas A&M University (1994)
USDA (NASULGC) Food and Agriculture Sciences Excellence in Teaching Award (1999)
Elected Fellow, American Association for the Advancement of Science (1999)
Elected Faculty Fellow, Texas Agricultural Experiment Station (2000)

*Only person at Texas A&M University to have received all four university-level awards for excellence in undergraduate teaching

Awards Received by Students/Employees:

William Karel: Lechner Fellowship, Texas A&M University (1982-1983)
Chris Amemiya: 1985 Stoye Award - Best Student Paper, Annual Meeting of the American Society of Ichthyologists and Herpetologists, Knoxville, Tennessee
Chris Amemiya: Tom Slick Fellowship, Texas A&M University (1985-1986)
Chara Ragland: 1986 Best Student Presentation, TAMU Chapter of the American Fisheries Society
Patricia Zoch: Research Enhancement for Undergraduates ($3,939), National Science Foundation (1987)
Chris Amemiya: Alfred P. Sloan Foundation Postdoctoral Fellowship (1987-1989)
Kathryn Gamble: Research Enhancement for Undergraduates ($3,543), National Science Foundation (1988)
Claire Aldridge: Research Enhancement for Undergraduates ($5,000), National Science Foundation (1991)
Robert Barber: Regent's Fellowship, Texas A&M University (1991-1992)
Linda Richardson: 1992 Deputy Chancellor's Award in Excellence, The Texas A&M University System
Timothy Schmidt: Tom Slick Fellowship, Texas A&M University (1993-1994)
Asrun Kristmundsdóttir: 1993 Best Student Presentation, TAMU Chapter of the American Fisheries Society

Linda Richardson: 1993 Outstanding Staff Award, Department of Wildlife and Fisheries Sciences, Texas A&M University
Robert McClay: Research Enhancement for Undergraduates ($5,000), National Science Foundation (1994)
Linda Richardson: 1994 Outstanding Masters Student Award, Department of Wildlife and Fisheries Sciences, Texas A&M University
Carrie Sinex: Regent's Fellowship, Texas A&M University (1994-1995)
Aaron Brault: Research Enhancement for Undergraduates ($5,000), National Science Foundation (1995)
Joseph Bielawski: Tom Slick Fellowship, Texas A&M University (1998-1999)
Linda Richardson: 1998 Deputy Chancellor's Award in Excellence, The Texas A&M University System
Leah Stewart: 1999 Sigma-Genosys Outstanding Senior Award, Texas A&M University
Ruth Ann Dworak: 1999 ProdiGene Outstanding Senior Award, Texas A&M University

ADMINISTRATIVE EXPERIENCE

Chair, Intercollegiate Program in Genetics (1986-1989)

Integrated academic/research programs of intercollegiate faculty
Faculty membership increased from 30 to 65 by expanding college affiliations
Graduate student enrollment increased from 20 to 85; GRE scores increased from 1050 to 1200
Program officially recognized as first Intercollegiate Faculty at Texas A&M University
Program recognized as first university-wide graduate degree-granting program
Undergraduate degree program developed and implemented
Program budget developed and implemented through the Office of the Provost

Director, Center for Biosystematics and Biodiversity (1990-1996)

Developed proposal ($0.75 million) for Centers Program of the National Science Foundation
Developed blueprints for facility renovation to house Center upon receipt of NSF award
Supervised facility renovation and purchased all equipment and furniture
Hired Center staff and developed protocols/procedures for Center use
Redesigned Center and broadened mission

Research Facilitator, Texas Agricultural Experiment Station (1994-1996)

Developed/assimilated/promoted TAES Congressional Initiatives
Administrative liaison to scientists participating in multiyear DOE initiative for environmental restoration
Developed system-wide network to focus multidisciplinary expertise on ecosystem issues

Program Director, Division of Environmental Biology, National Science Foundation (1996-1997)

Managed program resources and administered peer-review process and panels
Participated in long-range planning and budget development for program and program cluster
Provided expertise to other programs/divisions/directorates within the Foundation
Represented program and program cluster to other federal agencies and universities

Leadership Development Activities:

Member, Class 4, ESCOP/ACOP (NASULGC) Leadership Program (1994-1995)
Invited Participant, Academic Administrators Development Program, Texas A&M University (1995)

TEACHING AND ACADEMIC ACTIVITIES

Current Teaching (1999-2000):

Perspectives in Genetics (92 students) - GENE 105 – Fall 1999 [Participant]
Honors Introductory Genetics – (25 students) - GENE 301H (25 students) - Fall 99 [Instructor]
Graduate Teaching Assistant Development – (10 students) - GENE 697 - Fall 99 [Participant]
Introductory Genetics (150 students) - GENE 301 – Spring 00 [Instructor]
Seminar for Graduate Students – (20 students) - GENE 681 (20 students) - Spring 00 [Participant]
Variable Student Credit Courses: GENE 485, GENE 491, GENE 685, GENE 691 [Instructor]

Teaching History:

Undergraduate:

Perspectives in Genetics (freshman majors) - GENE 105; Introductory Genetics - GENE 301; Principles of Heredity (non-science majors) - GENE 310; Human Genetics - GENE 320; Molecular Genetics - GENE 431; Genetics Seminar - GENE 481; Problems in Genetics - GENE 485; Research in Genetics - GENE 491

Graduate:

Introduction to Genetics - GENE 603; Population Genetics - GENE 612; Speciation and Evolution -GENE 625; Genetics Seminar - GENE 681; Problems in Genetics - GENE 685; History of Genetics - GENE 689; Theory of Genetics Research - GENE 690; Research - GENE 691; Graduate Teaching Assistant Development - GENE 697

Development:

Developed Undergraduate Honors Course in Genetics - GENE 301H (1980)
Developed Graduate Course for developing graduate teaching assistants - GENE 697 (1997)
Developed Undergraduate Curriculum in Genetics (1988); currently 200 majors
Developed Format for Undergraduate/Graduate Genetics Seminars - GENE 481 & GENE 681

Advising:

Departmental Undergraduate Advising (1975-present)
Departmental Graduate Advising (1975-present)
Graduate Advisor, Intercollegiate Program in Genetics (1984-1992)
Faculty Advisor, University Undergraduate Honors Program (1977-present)

UNIVERSITY ACADEMIC ACTIVITIES

Member, University Academic Revision Committee (1977-1980)
Member, Undergraduate Curriculum Committee, College of Science (1985-1987)
Member, Executive Council of the College of Agriculture and Life Sciences (1986-1989)
Member, Curriculum Committee, College of Agriculture and Life Sciences (1989-1992)
Member, Graduate Program Council, College of Agriculture and Life Sciences (1990-1993)
Selection Committee for Marine Fellows: Member (1989-1992), Chair (1993)
Member, Council of Principal Investigators (1990-1993)
Member, Panel for Enhancement of Scholarly and Creative Activities (1993-1994)
Member, Selection Committee, Association of Former Students Distinguished Achievement Awards (2000)

Academic Service Activities:

Faculty Representative, Memorial Student Center Council (1978-1980); Chair, SCONA 24 Delegate Selection Committee (1979); Member, Executive Committee, Intercollegiate Program in Genetics (1984-1992; 1994-present); Graduate Program Coordinator, Intercollegiate Program in Genetics (1982-1986; 1990-1992); Member, Biochemistry Graduate Studies Committee (1985-1987); Member, Wildlife and Fisheries Sciences Graduate Committee (1986-1988); Member, Undergraduate Honors Program Teacher/Scholar Award Committee (1987-1990); Member, Dean's Awards Committee (1988); Distinguished Graduate Student Award Committee - Member (1987-1988), Chair (1989); Chair or member of various other committees, e.g., faculty recruitment, teaching, seminars (1975-present)

Scholastic Review Activities:

Scientific Journals*:*

Editorial Board, *Copeia* - Journal of the American Society of Ichthyologists and Herpetologists (1984-1987)
International Editor, *Chromatin* (1991-1993)
International Editor, *Cytobios* (1991-1995)
Editorial Advisor, *Marine Ecology - Progress Series*, Springer International (1991-present)
Genetics, Development, and Morphology Editor, *Copeia* - Journal of the American Society of Ichthyologists and Herpetologists, 1993-1999

Invited Reviews: *Alabama Museum of Natural History; American Malacological Bulletin; Aquaculture; Aquatic Living resources; Biochemical Genetics; Biochemical Systematics and Ecology; Canadian Journal of Fisheries and Aquatic Sciences; Canadian Journal of Genetics and Cytology; Canadian Journal of Zoology; Chromatin; Chromosome Research; Comparative Biochemistry and Physiology; Contributions in Marine Science; Copeia; Cytobios; Evolution; Fisheries Research; Fishery Bulletin; Gene; Genetica; Genetics; Génétique, Sélection, and Évolution; Herpetological Conservation; Herpetological Monographs; Ichthyological Exploration of Freshwaters; Journal of Fish Biology; Journal of Heredity; Marine and Freshwater Research; Marine Biology; Marine Ecology-Progress Series; Marine Freshwater Research; Molecular Biology and Evolution; Molecular Ecology; National Geographic Research & Exploration; North American Journal of Fisheries Management; Proceedings of the National Academy of Sciences (USA); Progressive Fish Culturalist; Southwestern Naturalist; Systematic Biology; Transactions of the American Fisheries Society; World Mariculture Society; Zoological Journal of the Linnean Society*

Funding agencies*:*

Member, Advisory Panel for Systematic Biology, National Science Foundation (1984-1989)
Member, Advisory Panel for Postdoctoral and Mid-Career Fellowships, Division of Environmental Biology, National Science Foundation (1988-1989, 1993-1994)
Member, Review Panel for REP Program "Genetic Improvement of Crops and Animals", Texas Agricultural Experiment Station (1993-1994)
Member, Review Team, *Exxon Valdez Trustee Council*, Anchorage, Alaska (1995-present)
Member, Advisory Panel for Academic Research Infrastructure, National Science Foundation (1996)
Member, Advisory Panel for Integrative Graduate Education and Research Training Program, National Science Foundation (1997-1999)
Member, Advisory Panel for Postdoctoral Fellowships in the Biosciences, Division of Biological Infrastructure, National Science Foundation (1998-1999)
Member, Advisory Panel for Minority Postdoctoral Fellowships, Division of Biological Infrastructure, National Science Foundation (1999-2000)
Member, Advisory Panel for Doctoral Dissertation Improvement Grants, Division of Environmental Biology, National Science Foundation (1999-2000)
Member, Technical Review Panel, New York Sea Grant Program, 1999

Member, Technical Review Panel, Grand Canyon Monitoring and Research Center, Department of the Interior, 1999

Invited Reviews:

Alaska Sea Grant College Program; Binational Agricultural Research and Development Fund; Cooperative Institute for Fisheries Molecular Biology; Exxon Valdez Trustees Council; Florida Sea Grant College Program; Grants Program, Brigham Young University; Great Lakes Fishery Commission; Great Lakes Fishery Trust; International Science Foundation; Israel Science Foundation; Louisiana Sea Grant College Program; Maine/Hew Hampshire Sea Grant College Program; Marfin Program; Mississippi/Alabama Sea Grant Consortium; Natural Environment Research Council (UK); National Geographic Society; National Science Foundation (numerous programs); National Sea Grant College Program; New York Sea Grant College Program; North Carolina Sea Grant College Program; Ontario Ministry of Natural Resources; Saltonstall-Kennedy Program; South Carolina Sea Grant College Program; Texas Agricultural Experiment Station; Texas Sea Grant College Program; USDA Competitive Research Grants Program; USGS and National Institutes for Water Resources National Competitive Grants Program; Washington Sea Grant College Program

Professional Societies:

American Association for the Advancement of Science; American Fisheries Society; American Society of Ichthyologists and Herpetologists; Genetics Society of America; Sigma Xi; Society for the Study of Evolution; Society for Molecular Biology and Evolution; Society for Molecular Marine Biology and Biotechnology; Society of Systematic Biology; Southwestern Association of Naturalists; Texas Academy of Sciences

RESEARCH ACTIVITIES

Current Competitive Grant Support:

National Marine Fisheries Service (Marfin Program): Genetic analysis to determine mixing proportions by season of western Atlantic and Gulf of Mexico stocks of king mackerel - $164,696 (1997-1999)

National Science Foundation (Doctoral Dissertation Improvement Grant): Molecular phylogeny and evolution of *Notropis* - $10,000 (1997-1999)

Faculty Development Research Program, Texas Agricultural Experiment Station/Office of the Vice-President for Research, Texas A&M University: Equipment for the Center for Biosystematics and Biodiversity - $200,000 (1998-1999)

National Marine Fisheries Service (Marfin Program): Stock structure of red snapper in the Gulf of Mexico: Is their management as a single unit justified based on spatial and temporal patterns of genetic variation, otolith microchemistry, and growth rates - $404,534 -- CoPI with Dr. C. Wilson (Louisiana State University) and Dr. J. Cowan (University of South Alabama) – Total project funded at $1,100,000 (1998-2001)

Gulf and South Atlantic Fisheries Development Foundation: Genetic study of red snapper in the Gulf of Mexico - $30,000 (1999-2000)

National Marine Fisheries Service (Saltonstall-Kennedy Program): Development of hypervariable, nuclear-DNA markers for population structure analysis of Atlantic bluefin tuna - $58,548 -- CoPI with Dr. J. Graves (Virginia Institute of Marine Science) – Total project funded at $124,614 (1999-2000)

Competitive Grant Support since 1985:

National Science Foundation (Division of Environmental Biology): Chromosome banding and cytosystematics in North American cyprinid fishes, with emphasis on the genus *Notropis* - $95,000 (1985-1987)

Texas Agricultural Experiment Station, Program Development: Molecular and evolutionary genetics of vertebrates genomes - $40,000 (Co-PI with J.W. Bickham and D.J. Schmidly) (1985)

NIH Biomedical Research Support Grant Program, Texas A&M University: Analysis of satellite DNA in *Notropis* fish (Cyprinidae) - $6,000 (1985)

Texas Advanced Technology Research Program, State of Texas: Nutritional, environmental, and genetic basis for red drum culture in Texas - $250,000 (Co-PI with E.H. Robinson and W.H. Neill) (1986-1988)

National Science Foundation (Division of Enviromnmental Biology): Chromosome banding and cytosystematics in North American cyprinid fishes, with emphasis on the genus *Notropis* - $96,861 (1987-1989)

National Science Foundation (REU Supplement): Chromosome banding and cytosystematics in North American cyprinid fishes, with emphasis on the genus *Notropis* - $3,939 (1987)

Texas A&M University, Biotechnology ERA Program: Genetic engineering in aquatic species - $40,000 (1987-1989)

Texas A&M University Sea Grant College Program: Genetic variation within and among natural and domesticated populations of redfish - $106,844 (1987-1989)

NIH Biomedical Research Support Grant Program, Texas A&M University: Cytological and molecular analyses of variation in ribosomal RNA genes in cyprinid fish - $3,000 (1988)

National Science Foundation (REU Supplement): Chromosome banding and cytosystematics in North American cyprinid fish, with emphasis on the genus *Notropis* - $3,543 (1988)

National Marine Fisheries Service (Marfin Program): Population genetic studies of red drum in the Gulf of Mexico - $143,781 ($61,886 match provided by Texas Parks and Wildlife Department) (1989-1991)

Texas Agricultural Experiment Station, Program Development: Genetic engineering in largemouth bass - $25,440 (Co-PI with L. DiMichele and L. Skow) (1989)

National Science Foundation (International Programs): Cytosystematics of cyprinid fishes - $25,683 (1989-1991)

National Science Foundation (Division of Biological Infrastructure): Biological Facilities Center in Biosystematics - $492,500, with $260,500 match from Texas A&M University and the Texas Agricultural Experiment Station (1990)

Texas A&M University Sea Grant College Program: Mitochondrial DNA variation in red drum and evaluation of red drum stocking success in Texas bays - $127,689 ($15,708 match from Texas Parks and Wildlife Department) (1989-1991)

Texas A&M University, Animal Biology ERA Program: Genetic engineering in aquatic species - $45,000 (1989-1991)

National Marine Fisheries Service (Marfin Program): Genetic studies to determine stock structure of reef fishes in the Gulf of Mexico - $60,260 (1990-1991)

Texas A&M University Sea Grant College Program: Genetic variation among spotted seatrout in the Gulf of Mexico - $3,960 (1991)

Texas A&M University Sea Grant College Program: Population genetic studies of red snapper in the northern Gulf of Mexico - $146,290 (1991-1993)

National Science Foundation (Division of Environmental Biology): Molecular systematics of North American cyprinid fishes: *Cyprinella lutrensis* and the *C. lutrensis* complex - $175,000 (1992-1995)

National Marine Fisheries Service (Marfin Program): Population genetic studies of king mackerel in the Gulf of Mexico - $122,540 (1992-1994)

National Science Foundation (REU Supplement): Molecular systematics of North American cyprinid fishes: *Cyprinella lutrensis* and the *C. lutrensis* complex - $5,000 (1992)

Texas A&M University Sea Grant College Program: Genetic studies to determine effective female population sizes in finfish species impacted by the shrimp fishery bycatch - $11,700 (1993)

Alabama-Tombigbee River Coalition: Studies on biodiversity and endangered species -$11,400 (1994)

Program to Enhance Scholarly/Creative Activities, Office of the Vice President for Research, Texas A&M University: Conservation genetics of *Dionda* fishes - $5,194 (1994)

National Science Foundation (REU Supplement): Molecular systematics of North American cyprinid fishes: *Cyprinella lutrensis* and the *C. lutrensis* complex - $5,000 (1994)

National Marine Fisheries Service (Saltonstall-Kennedy Program): Genetic studies to determine stock structure of greater amberjack in the Gulf of Mexico and southeastern (US) Atlantic - $99,078 (1995-1996)

National Marine Fisheries Service (Marfin Program): Genetic stock structure and species identification of sharks involved in commercial and recreational fisheries of the Gulf of Mexico and southeastern (US) Atlantic - $155,842 (1995-1997)

National Science Foundation (REU Supplement): Molecular systematics of North American cyprinid fishes: *Cyprinella lutrensis* and the *C. lutrensis* complex - $5,000 (1995)

Cooperative Institute for Fisheries Molecular Biology (FISHTEC): Generation of microsatellite loci in Atlantic bluefin tuna - $24,900 (1995)

Research Enhancement Program, Texas Agricultural Experiment Station: Construction of a linkage map for the red drum (redfish) genome - $38,250 (1996-1997)

Advanced Research Program, State of Texas: A test of the hypothesis that variance in reproductive success limits effective population size in marine organisms - $117,000 (1996-1998)

National Marine Fisheries Service (Saltonstall-Kennedy Program): Development of microsatellite loci for stock-structure study of Gulf red snapper - $59,786 (1997-1998)

Cooperative Institute for Fisheries Molecular Biology (FISHTEC): Atlantic bluefin tuna genetics study - $32,000 (1997-1998)

National Marine Fisheries Service (Marfin Program): Genetic analysis to determine mixing proportions by season of western Atlantic and Gulf of Mexico stocks of king mackerel - $164,696 (1997-1999)

National Science Foundation (Doctoral Dissertation Improvement Grant): Molecular phylogeny and evolution of *Notropis* - $10,000 (1997-1999)

Faculty Development Research Program, Texas Agricultural Experiment Station/Office of the Vice-President for Research, Texas A&M University: Equipment for the Center for Biosystematics and Biodiversity - $200,000 (1998-1999)

National Marine Fisheries Service (Marfin Program): Stock structure of red snapper in the Gulf of Mexico: Is their management as a single unit justified based on spatial and temporal patterns of genetic variation, otolith microchemistry, and growth rates - $404,534 -- CoPI with Dr. C. Wilson (Louisiana State University) and Dr. J. Cowan (University of South Alabama) – Total project funded at $1,100,000 (1998-2001)

Gulf and South Atlantic Fisheries Development Foundation: Genetic study of red snapper in the Gulf of Mexico - $30,000 (1999-2000)

National Marine Fisheries Service (Saltonstall-Kennedy Program): Development of hypervariable, nuclear-DNA markers for population structure analysis of Atlantic bluefin tuna - $58,548 -- CoPI with Dr. J. Graves (Virginia Institute of Marine Science) – Total project funded at $124,614 (1999-2000)

Research Publications:

Book Chapters/Review Articles:

Gold, J.R. (1977) Systematics of western North American trout (*Salmo*), with notes on the redband trout of Sheepheaven Creek, California. Canadian Journal of Zoology 55: 1858-1873.

Gold, J.R. (1979) Cytogenetics. In: "Fish Physiology" (W.S. Hoar, D.J. Randall, and J.R. Brett, eds.). Volume VIII, Chapter 7: 353-405. Academic Press, New York and London.

Buth, D.G., Dowling, T.E., and Gold, J.R. (1991) Molecular and cytological investigations. In: "Cyprinid Fishes: Systematics, Biology, and Exploitation" (J.S. Nelson and I.J. Winfield, eds.). Chapter 4: 83-126. Chapman and Hall, London.

Amemiya, C.T., Powers, P.K., and Gold, J.R. (1992) Chromosomal evolution in the North American cyprinids. In: "Systematics, Historical Ecology, and North American Freshwater Fishes" (R. L. Mayden, ed.). Chapter 18: 515-533. Stanford University Press, Stanford, California.

Gold, J.R., Ragland, C.J., and Woolley, J.B. (1992) Evolution of genome size in North American fishes. In: "Systematics, Historical Ecology, and North American Freshwater Fishes" (R. L. Mayden, ed.). Chapter 19: 534-550. Stanford University Press, Stanford, California.

Magnuson, J.J., Block, B.A., Deriso, R.B., Gold, J.R., Grant, W.S., Quinn, T.J., Saila, S.B., Shapiro, L. and Stevens, E.D. (1994) An Assessment of Atlantic Bluefin Tuna. National Academy Press, Washington, D.C.

King, T.L., R. Ward, I.R. Blandon, R.L. Colura, and J.R. Gold (1995) Using genetics in the design of red drum and spotted seatrout stocking programs: a review. In: "Uses and Effects of Cultured Fishes in Aquatic Ecosystems" (H.L. Schramm, Jr. and R.G. Piper, eds.). American Fisheries Society Symposium 15:499-502.

Refereed Journal Articles:

Gold, J.R. and Green, M.M. (1974) A meiotic effect of a mutator gene in *Drosophila melanogaster*. Molecular and General Genetics 135: 245-255.

Gold, J.R. (1974) A fast and easy method for chromosome karyotyping in adult teleosts. The Progressive Fish-Culturalist 36: 169-71.

Gold, J.R. and Gall, G.A.E. (1975) Chromosome cytology and polymorphism in the California High Sierra golden trout (*Salmo aguabonita*). Canadian Journal of Genetics and Cytology 17: 41-53.

Gold, J.R. and Gall, G.A.E. (1975) The taxonomic structure of six golden trout (*Salmo aguabonita*) populations from the Sierra Nevada, California. California Academy of Sciences, Proceedings, XL(10): 243-263.

Gold, J.R. and Gall, G.A.E. (1975) Further record of Little Kern golden trout, *Salmo aguabonita whitei*, in the Little Kern River basin, California. California Fish and Game 61: 248-250.

Gold, J.R., Pipkin, R.E., and Gall, G.A.E. (1976) Artificial hybridization between rainbow (*Salmo gairdneri*) and golden trout (*Salmo aguabonita*). Copeia 1976: 597-598.

Gold, J.R. and Avise, J.C. (1976) Spontaneous triploidy in the California roach *Hesperoleucus symmetricus* (Pisces: Cyprinidae). Cytogenetics and Cell Genetics 17: 144-149.

Gall, G.A.E., Busack, C.A., Smith, R.C., Gold, J.R., and Kornblatt, B.J. (1976) Biochemical genetic variation in populations of golden trout, *Salmo aguabonita*: Evidence of the threatened Little Kern River golden trout, *S. a. whitei*. Journal of Heredity 67: 330-335.

Gold, J.R., Avise, J.C., and Gall, G.A.E. (1977) Chromosome cytology in the cutthroat trout series, *Salmo clarki* (Salmonidae). Cytologia 42: 377-382.

Avise, J.C. and Gold, J.R. (1977) Chromosomal divergence and rates of speciation in two families of North American fishes. Evolution 31: 1-13.

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Papers Presented at Meetings (1990-present):

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ATTACHMENT 3

STATE OF MAINE FISHERIES AGENCIES

RESPONSE TO JULY 1999 STATUS REVIEW*

Prepared April 2000

Atlantic salmon have persisted in the State of Maine for over 100 years because the State has had an active stocking program involving the transfer of fish from throughout Maine and Canada to rivers within Maine and New England. Wild fish persist throughout New England because of those efforts. Salmon from Maine rivers have moved freely throughout the Gulf of Maine testing available habitat and utilizing it when conditions permit. Without the availability of hatchery reared salmon and both the natural and man induced exchange of these stocks, the Atlantic salmon would have totally disappeared from Maine decades ago.

The status of sea run Atlantic salmon in the United States has been an issue of concern since the 1800's. In 1868, a Maine Fisheries Commissioner reported that the "ancient brood of salmon was long ago extinguished by dams." (Baum, 1997). Atlantic salmon habitat and salmon in New England rivers have benefited from the collective restoration efforts of state, federal and private conservation organizations since that time.

Maine was and continues to be one of the leaders in this program. A special committee to advise the Maine Legislature regarding the regulation of salmon fisheries was created in 1818. An interagency state and federal program to restore salmon to the Connecticut River drainage based on fish from the Penobscot River was initiated in the 1860's. The first Atlantic salmon hatchery in the United States was opened at Craig Brook in East Orland, Maine in 1871. The purpose of the hatchery was to culture and restore dwindling populations of Atlantic salmon to New England rivers. Over the years, salmon eggs were obtained from the Penobscot River and a number of Canadian rivers for distribution throughout Maine and New England. The Craig Brook site was purchased by the federal government in 1889 and has been the major source of salmon to stock Maine rivers since then.

In the late 1800's, reasons cited for the decline and elimination of runs within the Atlantic salmon's range, included dams which prevented adult salmon from reaching their spawning areas; water pollution and excessive commercial fishing. Maine salmon stocks were subjected to the same threats as runs in other New England rivers.

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* This review is based on information obtained from Baum, 1997, and the collective files at the Maine Atlantic Salmon Commission.

Early attempts to halt the decline of Atlantic salmon were not highly successful. Water quality was often inadequate to sustain life. Considerable stocking was done at a time when native salmon returns were low and spawning was seriously impeded by the presence of multiple dams and other obstructions. The fact that stocking programs were originally initiated indicates that stocks in many rivers were extirpated or seriously depleted to a point where impact of stocking practices could not be avoided. Millions of hatchery reared Atlantic salmon from throughout Maine and Canada were released into New England rivers. In spite of these huge efforts, adult returns continued to decline as fish passage remained blocked by dams and water quality deteriorated. Maine has since dramatically improved its water quality and is a national leader (see Appendix A, Letter from EPA to Maine DEP; Appendix B, Portland Press Herald article dated 4/6/2000).

Qualitative reports from various sources suggest that salmon populations varied from few to many among decades during the past century. The status review concedes that "some localized extirpations" may have occurred but it was followed by repopulation. Since no biological material exists prior to the initiation of stocking programs, there is no definitive data to support the Services' position that unique native genetic material exists for the eight rivers. We agree with the Services that the literature strongly suggests that each of the DPS rivers populations was extinct for many years. We do not agree that the repopulation of these rivers was just the result of natural repopulation from within one of the eight rivers. There is compelling evidence that the repopulation occurred as a result of stocking efforts and natural straying. **Between 1872 and 1969, over 87 percent of the 6.2 million salmon stocked in the proposed DPS rivers were obtained from non-DPS rivers** (see Appendix C, State of Maine Fisheries Agencies Comments)**. The number of Canadian smolt alone, stocked from 1949 through 1968, was 6.7 times the average annual wild smolt production in the downeast rivers.**

In the 1930's there was renewed national and local interest in restoring New England's Atlantic salmon. In Maine, the Legislature created the Atlantic Sea Run Salmon Commission effective August 13, 1947. The Commission which had authority over salmon in both salt and fresh water accomplished many projects supporting the restoration of Maine's salmon runs. Some of their key management activities included habitat surveys; improved habitat; fish passage improvements; water level management, the elimination of commercial fishing; and various fish stocking programs throughout Maine.

In 1967, following passage of the Anadromous Fisheries Conservation Act, efforts to restore salmon to the Connecticut River watershed were renewed. Penobscot River salmon were used to stock the Connecticut river in great numbers beginning in 1976. Since then "salmon returns have usually numbered in the hundreds" (USFWS, Region 5). A restoration program including the stocking of Penobscot fish has been underway in the Merrimac River as well. Consistent increases in the number of wild adult Atlantic salmon have been documented in the Merrimac through the present (US ASAC report). The establishment of a salmon run on the Union River serves to further rebukes the Services proposition that nonnative fish do not entering the river during the past 30 years could be native fish. Yet scores have returned. From 1971 to 1990 the US Fish and Wildlife Service and the Maine Atlantic Sea Run Salmon Commission annually stocked the Union River with progeny of Penobscot River brood stock. As is plainly evident from data in the USASAC Report, 1999, 2229 adult salmon were produced from stocking efforts utilizing exclusively nonnative fish. The experience on the Merrimac and the Union can not be distinguished from the results that would be expected on the DPS rivers.

To support the New England salmon restoration effort, 13 fish culture facilities are currently in operation (2 in Maine, 11 in other New England states). Millions of Atlantic salmon of various ages are released into the Gulf of Maine from throughout New England each year. Between 1970 and 1992, over 97 percent of the salmon stocked in DPS rivers were obtained from non DPS rivers. Programmed stocking of non-DPS occurred in all of the downeast rivers as recently as 1991. Prior to 1969, many of the fish were of Canadian origin and up until 1992, large numbers of Penobscot origin fry, parr, and smolts were stocked in those rivers.

Through the late 1970's and early 1980's, as a result of significant stocking and improved marine survival, adult salmon returning to New England, including Maine, increased significantly. The Services' presentation would suggest that this could not occur without river specific stocks (see appendix 4). However, several reports document returns of adult salmon ,who are the progeny of parents from US and Canadian non-DPS rivers, to several DPS rivers. From 1971 to 1993, 22.6 percent of all DPS river returns were actually progeny of non-DPS fish. The Services conclude that Maine salmon are uniquely different from Canadian salmon because smolts in Maine have a mean age of two years whereas many smolts in Canada are age 3 or older. The differences in mean age at smoltification vary throughout their range with salmon at the northern extreme of their range generally spending longer times in freshwater than fish at the southern end of their range. Much of the difference may be explained by differences in environmental conditions. Dow (1938) reported two cases in which fry planted in a strange river produced habits of decidedly different character from those of the parent fish. One of these cases occur in the Penobscot, which is stocked with fry from Miramichi salmon. In their native river the Miramichi smolts migrate predominately as three year old fish. Transplanted to the Penobscot they change their habits and migrate as predominately two year old fish. There are numerous populations of salmon throughout New England and Canada that exhibit the 2 sea winter trait in varying proportions (see appendix 5). The 2 SW trait is not unique to the DPS or Maine. Nor is straying a new phenomena. It is the reason that salmon show up in rivers such as the Androscoggin, Kennebec and Union, where returns each year far exceed any possible natural reproduction or response to token stocking effort. An even more salient example occurred in the Souadabscook Stream when an impassable dam that has been blocking fish passage for as long as anyone could remember was breached in 1998. Four redds were counted that fall, almost certainly from stray fish.

During the 1980's, salmon populations began to decline. So did financial and political support for salmon restoration. In Maine, changes in the structure of the salmon commission, declining license sales and austere state budgets resulted in the down sizing, changes in stocking practices and diminished effectiveness of the state's salmon restoration effort. The number and age of salmon stocked declined and, in some instances stopped. The rearing of smolts for the Connecticut River ceased due to budget constraints. In Maine, no stocking occurred on many

Maine rivers between 1992 and 1994, and upon resumption shifted to predominately younger fish (fry and parr stocking rather than smolts) whose chance of survival was less and years required to grow to maturity was longer. Given the reductions in the number of fish stocked; given the contribution that hatchery stocks play in reestablishing and maintaining salmon runs; and given the life cycle and growth characteristics of salmon, it was obvious to those who recommended the change that the number of adult salmon returning to those rivers would be diminished starting in the early 1990's and persisting through early 2000.

The marine survival rate of salmon is low throughout their range. It has been documented throughout North America - it is not unique to Maine rivers. In rivers where smolt stocking continued uninterrupted, the return rate is consistent with expected returns given the at sea survival. The number of salmon returning to the Merrimac River has increased over the past three years at a rate consistent with the number of smolts stocked and expected survival. The Penobscot River return is also a product of stocking levels and marine survival. In other Maine rivers the diminished returns are a direct result of stocking practices through the 1990's which have effectively removed entire year classes from these rivers. **Reduced stocking coupled with low marine survival of remaining fish has created this predicted low number of adult returns.**

There has been no significant, unpredictable change in the status of salmon since the salmon conservation plan was accepted in December, 1997. There are fish in the wild as well as being grown in the hatchery program throughout New England. Densities and survival of wild fish, as documented in scientific studies, is consistent with that demonstrated in past. The conclusion that poor pre - smolt survival based on preliminary results of the joint Atlantic Salmon Commission/NMFS study on the Narraguagus River is premature and does not support the inference that pre-smolt survival is at a precarious level. In fact the data show that the estimated smolt production has increased in number over the last three years. Moreover the estimated number of smolts produced are higher than the estimates in the early 1990's and comparable to estimated smolt production in the same river during the 1960's, a time when adult returns were considerably higher that they are today.

Changes in number and age of stocked fish will continue to be reflected in the future runs. Declines in adult returns were predicted at the time stocking policies were changed in 1992. The US Fish and Wildlife Service participated in this decision. The consequences were predicted and should have been apparent to federal fisheries scientists when the Plan was accepted.

Salmon disease and fish health is not a new concern. ISA was first detected in New Brunswick in the fall of 1996 and subsequently confirmed in the early spring of 1997. There was considerable press coverage and the threat was known by the Services at the time the rule was withdrawn. In a letter dated March 20, 2000, the US Fish and Wildlife Service advised us that the SSS virus is <u>not</u> a significant threat (see Appendix D, Letter from FWS to DMR). Maine DMR and IFW have promulgated fish health rules, which establish a standing fish health technical advisory group comprised of federal, state and private fish health professionals who routinely address fish health issues. The USFWS letter sets a different tone than portrayed in the Status Review, which concludes that disease is a significant concern that has substantial impact on the biological condition of the stocks. (See, also, Appendix E, Letter from EAVA to Services).

Occasional escape of commercially cultured salmon is not a new threat. We know of no instances when commercial aqua culture salmon have been intentionally released. The citations for this allegation do not contain any documented instances where intentional releases occurred. The industry working with DMR has made significant progress toward completing implementation of biosecurity measures. We are aware of "leakage" of juvenile salmon from the commercial salmon hatchery on Beaver Brook in Deblois, Maine. We are working to stop the leak.

In closing, we address the discovery of information during our review of the Services' proposal. It appears that the hatchery stock being supplied to the state salmon restoration program may not be genetically fit. Consequently, we may not be able to realize the full potential of the Maine restoration program. As the Penobscot strain has provided salmon for the other New England rivers, perhaps the New England restoration program is in jeopardy as well. We will be calling for the initiation of a genetics program in Maine which will allow us to fully assess the rigor of the Maine hatchery river specific stocks as well as associated stocking practices.

The Endangered Species Act was enacted to prevent a species from becoming extinct. Unfortunately, as historic records show, the aboriginal runs of Atlantic salmon are extinct. However their legacy has been preserved through the efforts of the New England and Maine Atlantic salmon restoration programs. Just as white tailed deer, antelope, wild turkey and the peregrine falcon have been restored in states throughout the nation, the Maine program has maintained Atlantic salmon for almost a century. We remain committed to continuing our cooperative efforts in Maine and in support of completing and insuring the restoration of salmon throughout New England.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

Appendix "A"

October 13, 1999

David Van Wie, Director
Bureau of Land and Water Quality
Maine Department of Environmental Protecti
17 State House Station
Augusta, Maine 04333-0017

Dear Mr. Van Wie:

I am pleased to approve the *Nonpoint Source Pollution (NPS) Control Program Upgrade and 15 Year Strategy* that your staff developed in response to Clean Water Action Plan requirements. We believe Maine's NPS program is exemplary. In fact, managers at our EPA Washington office, who have reviewed strategies from 40 states, consider Maine's plan one of the best in the nation.

Maine's report outlines many realistic, yet aggressive short and long range goals and actions aimed at reducing pollution from major source categories including, transportation, forestry, agriculture and development. We believe the unified nature of the report, encompassing elements from the Clean Water Act (CWA) and Coastal Zone Act Reauthorization Amendments (CZARA) of 1990, makes this a comprehensive and valuable guide for future action.

The State's reliance on strong partnerships is particularly impressive. As the lead NPS agency, the Maine Department of Environmental Protection (DEP) has done an admirable job of creating a sound network of local, state and federal partners that work collaboratively on many challenging NPS problems across the state.

Maine's commitment to providing outreach and technical assistance in priority NPS watersheds is also commendable. We are pleased that the State's "watershed approach" emphasizes projects in both threatened and impaired waters where water quality standards are not currently met.

At this time, we are approving Maine's NPS Program Upgrade Plan in accordance with the CWA, Section 319 program. EPA has determined that, Maine's NPS program is fundamentally sound and either meets or exceeds each of the "nine key elements" referenced in the Section 319 guidance (May, 1996). The review and approval process under CZARA will be performed separately and in coordination with the National Oceanic and Atmospheric Administration (NOAA).

We commend you and your staff, particularly Don Witherill and Norman Marcotte, as well as Todd Burrows at the Maine State Planning Office (SPO) for developing a model NPS program upgrade plan. As always, my staff in the Maine Unit of the Office of Ecosystem Protection look forward to assisting with efforts to control and prevent NPS pollution. We wish you continued success.

Sincerely,

John P. DeVillars
Regional Administrator

cc: Martha Kirkpatrick, ME DEP
Evan Richart, ME SPO
Don Witherill, ME DEP
Norman Marcotte, ME DEP
Todd Burrows, ME SPO
Dov Weitman, EPA HQ
Jeffrey Benoit, NOAA
Marcella Jansen, NOAA
Joelle Gore, NOAA
Steve Silva, EPA NE
Sandra Fancieullo, EPA NE

Appendix "B"

Portland Press Herald, Thursday, April 6, 2000

Group faults states for water harmed by runoff

● The National Wildlife Federation says 38 states are not complying with federal pollution laws.

The Associated Press

WASHINGTON — Three-fourths of the states are failing to address water pollution caused by runoff from farms and forests, ignoring a provision in the federal Clean Water Act, a leading conservation group charged Wednesday.

The National Wildlife Federation said a survey it conducted shows that 38 states have done little to address non-point pollution under the federal law.

"States have not stepped forward to systematically deal with polluted runoff and contaminated rain," the group said.

Michael Murray, the report's co-author, attributed the states' reluctance to "a combination of political intimidation ... and bureaucratic inertia" and said "our lakes, streams and coasts are paying the price."

The group evaluated compliance with a provision of the Clean Water Act aimed at protecting watersheds from pollution – pesticides, excessive nutrients and other chemicals – that come primarily from agriculture and forests as opposed to a specific smokestack or discharge pipe.

States are required to designate waterways impaired by such pollution, prioritize the severity of the problems and develop a plan to curtail the pollution. Murray said most states have done little beyond compiling lists.

A number of lawsuits have been filed challenging the Environmental Protection Agency's authority to limit pollution from non-point sources, while other lawsuits claim the agency has not been aggressive enough to implement the law.

A federal judge in San Francisco last week upheld the EPA's authority to control pollution in California's Garcia River from agricultural and forest runoff, the Justice Department said Wednesday, calling it the first court decision "to squarely address the issue."

The lawsuit involving the Garcia River had been filed by The American Farm Bureau Federation and other agriculture and timber groups.

Last August, the EPA proposed a rule that would strengthen compliance, requiring states to step up development of plans for watershed protection so that all impaired waterways are safeguarded within 15 years. The proposed EPA rule has been criticized by farm groups and even the Agriculture Department.

FINDINGS

Twelve states were found to meet "minimum" requirements: Connecticut, Kentucky, Maine, Massachusetts, Montana, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, South Dakota, and West Virginia.

States with the worst compliance were: Alabama, Alaska, Arkansas, California, Georgia, Hawaii, Idaho, Iowa, Louisiana, Minnesota, Mississippi, Missouri, Nebraska, New Mexico, New York, Texas, Virginia, Washington and Wisconsin.

APPENDIX C

State of Maine Fisheries Agencies
Comments on Straying, Stocking, Returns and Distinctness

Prepared April 2000[*]

I. STRAYING

Straying is a natural phenomenon whose magnitude varies with the origin of the stocks (aboriginal vs. wild vs. hatchery). Straying has occurred in all of Maine's rivers during the past decades with resultant and that there has been co-mingling with existing populations. Given the low population levels of the past we would anticipate a significant interaction between any remnant population(s) and the interloping strays.

It is also clear from the literature review that the BRT understated that significance of straying. An appropriate (straying) number for wild stocks is 10%, and at least twice that for hatchery fish. The literature indicates that straying has occurred over time and will continue indefinitely. The bounds for the Penobscot River strays extend, at a minimum, from the Saco to St. Croix Rivers. The St. John and other Fundy Rivers also have wide bounds, reaching the DPS Rivers and the potential introgression of St. John salmon is enormous. The lack of collection effort in the inner Fundy Rivers also leaves the magnitude of straying from these sources in question. Strays from smaller, nearby Canadian populations can also be expected in Maine rivers. Quinn (1984) who worked extensively with Pacific salmon, provided a hypothesis concerning factors that might induce straying.

"It is proposed that straying is under direct or indirect genetic control and it is an alternate life history strategy in dynamic balance with homing, the dominant trait. According to this hypothesis, large stable rivers should have higher proportions of homing salmon than smaller, less stable ones. Further, straying rates should be lower in species and populations that have become highly specialized for their freshwater environment and should also be lower in species with variable age at maturity. Natural disasters would also shift the population structure to contain relatively more strays. In addition, the spatial distribution of strays should be nonrandom with rivers geographically close and hydrographically similar to the natal stream receiving most of the fish."

There is evidence that when conditions in the natal streams are highly unfavorable, significant straying may occur (IPSFC 1965, Whitman et al. 1982).

Quinn proposed an interesting hypothesis that suggested that straying is accelerated by unfavorable environmental conditions. If true, then the climate change presently being experienced will produce more rather than less strays.

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[*] Atlantic Salmon Commission, U.S. Atlantic Salmon Assessment Commission, the Salmon Rescue Coalition, and Department Staff contributed data and analysis for this appendix.

Case Studies

Little information has been collected on straying of wild salmon. The existing data base is from a group of researchers, working predominately on Norwegian rivers. In combination, these workers produced a number of papers. Some overlap may exist in their data sets. Their findings are reviewed in the order of their perceived relevance to the most recent Status Review (Review).

Jonnson Et Al. 1991

This study involves collection, tagging and release of wild smolts in the river Imsa located near the southern tip of Norway. Hatchery smolts were also released. Adult returns were evaluated for homing and straying. This study was cited in the Review as evidence that hatchery fish stray more than wild fish. However, the magnitude (nearby versus distant rivers) of straying was not included. Thus the issue of "how far fish wander" was not quantified. Importantly, both groups of smolts exhibited vastly greater straying rates than the 2% number used in the Review. The following table summarizes straying of wild and hatchery smolts over the seven year study:

River Imsa, Norway (Jonnson et al, 1991)

Year	RECAPTURED IN FRESHWATER			
	No. of Wild	**% Wild Strays**	**No. Hatchery**	**% Hatchery Strays**
1981	96	8.3	90	10.0
1982	8	25.0	23	47.8
1983	43	4.7	13	46.2
1984	34	11.8	23	21.7
1985	19	10.5	140	22.9
1986	13	0.0	189	16.9
1987	46	6.5	418	11.0
Annual Means	37	9.5	128	25.2

While the straying rate for hatchery salmon was always greater than wild salmon (25.2% to 9.5%) the "annual means" for wild salmon is significantly greater (9.5%) than the 2% (hatchery smolts) given in the Review. Clearly the Review team has this information, as they cite it in the Review. It seems odd that these higher straying rates were omitted from the Review.

Hansen And Jonnson 1994

This is another report cited by the Biological Review Team (BRT) and is one of a series of studies on "homing" to Norwegian rivers, which provides useful information on straying. The relevant data is limited to "Imsa Smolts". In as much as the freshwater recapture totals both equal "96" we assume the same 1981 data set was used in Johnson 1991 (see above). This reference was also cited in the Review. What is unclear is how the reviewers turned 8.3% (8/96) into "straying rates ranged from 5-8%" unless they included the one stray from the Lone River smolt cohort group. In any event this study tends to contradict the "2%" used in the Review.

River Imsa and River Lone (Hansen and Jonnson, 1994)

Origin	NO. OF ADULT RECAPTURES No. Released	River of Release	Other Rivers	Sea	Total	%	% Strays
Imsa Smolts	2751	88	8	363	459	16.7	8.3
Hatchery Smolts Stocked in Imsa	974	69	0	45	114	11.7	0
Lone Smolts	845	19	1	36	56	6.6	5
Hathcery Smolts Stocked in River Lone	847	23	4	42	69	8.1	14.8

Hansen, Jonnson And Jonnson 1993

This paper was not cited in the Review and is another in a series of Norwegian studies on oceanic migration, homing and straying. Various groups of smolts (hatchery and wild strains) were stocked/released in river and coastal locations and the subsequent returns monitored. Some overlap in data may exist but only for the 1981-1982 study years. Of importance, the authors state "The mean observed straying rate of the total freshwater recovery was 9.6%. Most stray fish were caught in nearby rivers however Figure two indicates that some wild fish were recovered half way up the Norwegian coast. Among fish from the River Imsa [wild] stock, 90% of the total freshwater recaptures were made in the river of genetic origin." From the table below it appears that the straying rate was 16% (4/25) for wild smolts released in the river or at a coastal location.

Stock	No. Released	NO. RECAPTURED Norwegian Sea	Coast	Home River	Other River	Strays **
Imsa (wild)*	965	18 (1.9%)	117 (21.1%)	21 (2.2%)	4 (0.4%)	16%
Nidelva (hatchery)	1966	43 (2.2%)	82 (4.2%)	6 (0.3%)	3 (0.1%)	33%
Vefsna (hatchery)	6493	10 (0.2%)	207 (3.2%)	46 (0.7%)	8 (0.1%)	6.8%
Sandvik (mixed)	1041	2 (0.2%)	56 (5.4%)	6 (0.6%)	1 (0.1%)	14%

* Includes Both in River and Coastal Releases
** Strays = "other Rivers" divided by Total "home" and "other river" recaptures

Stabell 1984

In order to investigate "homing" in Atlantic salmon, Stabell reviewed 17 tagging studies. This publication is cited by the Review in reference to the straying rates of hatchery salmon being greater than wild fish (Review p 47). Several of these studies also produced "straying rates" for wild and hatchery salmon. A number of these studies claim to be investigations of so called "wild" populations (e.g. Miramichi River stocks). However, when examined, "wild" is a term of art, as most, if not all the study rivers actually included some component of hatchery stocks, either as adults or the progeny of stocked fish. It is also inappropriate to rely on Stabell's straying rates as some of these studies (e.g., Saunders, 1967) provide strays as a function of angler returns rather than more sophisticated weir/trap collections. Thus, while many of these studies are by highly reputed researchers, it is misleading to suggest that they are studies of aboriginal stocks and straying.

Piggins 1987

This paper is cited in the Review as support for "the straying rates of wild fish is typically lower than that of hatchery fish". Piggins discusses the survival, homing, run timing, growth, fecundity and behavior of several cohorts of wild and hatchery smolts but there is no mention of straying. While straying may be a reason for the differential returns among cohort groups, no straying information is provided and no reference is made to straying. The use of this reference is inappropriate.

Dfo 1994 Status Report On Anadromous Fish - Chaput Et Al. 1995

During the last century, the South Esk hatchery and more recently the Canadian Department of Fisheries and Oceans (DFO) has operated one or more "barrier nets" in the tidal waters of the Miramichi River. The barrier (blocking a fraction of the river) nets are located in the estuary and near the "head of tide" on the Northeast and Southwest Miramichi Rivers. The Miramichi has been heavily stocked since 1870. The early broodstock was often purchased from weir fishermen and was clearly a mixed stock. During the last half of the century weir collections appear to be from the Northwest Miramichi. Most importantly, stockings were always from fish within the drainage. During the last three decades the barrier nets have become a management tool used to provide information on run timing, abundance and the health of the fish. The netting sites (one in the bay and at least one in each of the two major branches) are typically operated from June though October and salmon are enumerated and tagged. In 1994 DFO analyzed the recapture of 1SW salmon (grilse) tagged at one counting site and recaptured at a different counting site (Chaput et al. 1994). The straying rates for fish tagged in the Northwest and recaptured in the Southwest was 14% and the straying rate for fish tagged in the Southwest and recaptured in the Northwest was 32%. The two branches of the Miramichi River diverge in Miramichi (formally Newcastle) which is at the end of the bay; it is likely these fish moved (strayed) through some saline environment. Straying of this magnitude by wild salmon (as opposed to aboriginal) is significant and the BRT erred when it failed to include and evaluate straying of this magnitude on DPS rivers.

Baum and Spencer 1990

Baum and Spencer summarized tag returns of hatchery smolts from five rivers (Penobscot, Orland, Union, Narraguagus, Machias) over a 21 year period (1966-1987). This as a compilation of data rather than a technical analysis of a scientific phenomonen. In addition, as some of the nearby rivers (Pleasant, E Machais, Dennys, Ducktrap) lacked fish collection devices and intense cooperative angling effort these data have limited value. Of importance is that the straying rates for the Narraguagus and Machias Rivers were 7.9% and 15.9% respectively while the Penobscot River (where the total run is trapped) produced a 1.0% straying rate. The Review used an average of 2%, which is heavily weighted to the Penobscot as this is where most of the fish were stocked. Since the Review is predicated that the DPS is essentially the downeast rivers the straying number should be the observed 8-16% or at the very least a composite weighed by the five rivers of 7.5%. The use of a 2% straying rate within the DPS context is inappropriate and does not represent the best available scientific information.

Other

Straying is not a new phenomena in Maine and is the reason fish show up in rivers such as the Androscoggin, Kennebec and Union, where returns each year far exceed any possible natural reproduction or token stocking effort. An even more salient example occurred in the Souadabscook Stream when the impassable dam (standing as long as anyone can remember), which barred access to reproductive areas, was breached in 1998. Four redds were counted that fall, almost certainly constructed by stray fish.

Another example is the East Machias River where anglers landed eight adipose fin-clipped salmon in 1976. These were all two sea-winter fish, but the river was not stocked in 1974. "However, theUnion River received stocking of nearly 10,000 fin-clipped salmon in 1974. Either these fish strayed from the Union River to the East Machias River or the fish were inadvertently stocked into the East Machias River." (ASRSC, Machias River1982, p. 60) If these fish were Union River strays, then we can determine the minimum straying rate for Union River fish in 1976. In 1976, 139 2-Sea-winter fish returned to the Union River. (ASRSC, Union, 1982, p.17). If the eight fish caught were the only strays from the Union then the rate is 5.75%. It is more likely that East Machias angling effort netted only 15-20% of the run (ASRSC Machias 1982, p. 59). Thus, 40 -53 fish are the more likely cohort and the stray rate is more likely 28.8% - 38%.

The Androscoggin River is located approximately 100 miles south of the Penobscot. There is no salmon reproduction and no record of stocking. A dam with no fish passage has existed at head of tide since 1809 and the Atlantic salmon run on this river was extirpated by 1840. Fish passage has only existed since 1983. In recent years (1983-1998) the Brunswick trap count has ranged from 1-185 fish, averaging 32 salmon a year....strays from somewhere (5 were known Penobscot fish).

Sources of Stray Atlantic Salmon Into the Proposed DPS

Regarding the DPS rivers, the BRT failed to consider the impact of non DPS Canadian stocks straying into the DPS during periods of low to moderate DPS spawning escapement e.g., 1970 - present. There are several likely sources, the most obvious of these being the St John River and the fish cultural station at Mactaquac Dam. The St. John stock is a mixture of wild and hatchery origin fish, with donor stocks from the Miramichi and Restiguoch Rivers . In recent decades few hatchery fish have been marked for later identification. When compared to Maine rivers, returns to the St John River have been quite impressive. The Miramichi Atlantic Salmon Museum has summarized Department of Fisheries and Oceans fishway trap data. These data include the return of wild and hatchery (one sea winter (1 SW) and multi sea winter [MSW]) salmon to Mactaquac Dam for the period 1972-1998.

ANNUAL COUNTS OF WILD AND HATCHERY ATLANTIC SALMON (ST. JOHN RIVER) REMOVED FROM THE FISH TRAP AT MACTAQUAC DAM								
	WILD FISH			**HATCHERY FISH**				
Year	**No. ISW**	**No. MSW**	**Total**	**1 SW**	**No. MSW**	**Total**	**Total Run**	**% WILD**
1972	784	4,831	5,615	246	583	829	6,444	87
1973	1,854	2,367	4,221	1,760	475	2,235	6,456	65
1974	4,775	8,164	12,939	3,700	1,907	5,607	18,546	70
1975	6,200	11,925	18,125	5,335	1,858	7,193	25,318	72
1976	5,511	12,308	17,819	7,694	1,623	9,817	*27,136	66
1977	7,247	10,753	18,000	6,178	2,089	8,246	26,246	69
1978	3,034	4,618	7,652	2,556	1,728	4,507	12,159	63
1979	1,993	8,227	10,220	3,521	892	4,413	14,633	70
1980	8,157	15,712	23,869	9,759	2,294	12,053	35,922	66
1981	2,441	7,012	9,453	3,782	1,089	4,871	14,324	66
1982	2,254	6,185	8,439	2,292	728	3,020	11,459	74
1983	1,711	5,324	7,035	1,230	299	1,529	8,564	82
1984	7,011	14,364	21,375	1,304	806	2,110	23,485	91
1985	6,388	11,721	18,109	1,746	571	2,317	20,426	89
1986	3,656	10,003	13,659	699	481	1,186	14,845	92
1987	3,091	8,197	11,288	2,894	344	3,238	14,526	78
1988	1,930	9,992	11,922	1,129	670	1,799	13,721	87
1989	8,417	3,854	12,271	1,170	437	1,607	13,878	88
1990	6,486	3,163	9,649	1,421	756	2,177	11,826	82
1991	5,415	3,639	9,054	2,160	589	2,747	11,801	77
1992	5,729	3,522	9,251	1,935	681	2,616	11,867	78
1993	2,873	2,601	5,474	1,011	372	1,383	6,857	80
1994	2,133	1,713	3,846	1,180	493	1,673	5,519	70
1995	2,429	1,681	4,110	2,541	598	3,139	7,249	57
1996	1,552	2,413	3,965	4,603	726	5,329	9,294	43
1997	380	1,147	1,527	2,689	629	3,318	4,845	32
1998	479	364	843	4,413	620	5,033	5,876	14
TOTAL	103,930	175,800	279,730	78,948	24,338	103,992	356,086	

Jonnson et al. (1991) provided straying rates of 9.5% and 25.2% for wild and hatchery raised salmon. Other authors providing similar straying rates, thus the Jonnson's percentages are appropriate numbers to predict the potential for introgression of St. John salmon on the five nearby "downeast" rivers. The following table was developed by multiplying the annual wild and hatchery component of the St. John fish trap catch by Jonnson's straying rates (9.5% and 25.2%). Assuming that strays not entering the St John River have an equal chance (50%) of moving North or South, number of projected strays are divided in half. Thus fish in the two right hand columns ("combined" and "wild") would be available to enter the "outer Fundy" rivers. These waters include five downeast DPS rivers.

ESTIMATED NO. OF ST. JOHN RIVER ATLANTIC SALMON STRAYS					
Date	**Wild (9.5%)**	**Hatchery (25.2%)**	**No. of Strays**	**50% of all Strays**	**50% of all Wild Strays**
1972	589	278	867	434	295
1973	443	749	1,192	596	222
1974	1,358	1,879	3,237	1,619	679
1975	1903	2,410	4,313	2,157	951
1976	1,871	3,290	5,160	2,580	935
1977	1,890	2,763	4,653	2,326	945
1978	803	1,510	2,314	1,157	402
1979	1,073	1,479	2,552	1,276	536
1980	2,506	4,039	6,545	3,272	1,253
1981	992	1,632	2,625	1,312	496
1982	886	1,012	1,898	949	443
1983	738	512	1,251	625	369
1984	2,244	707	2,951	1,475	1,122
1985	1,901	776	2,677	1,339	950
1986	1,434	397	1,831	916	717
1987	1,185	1,085	2,270	1,135	592
1988	1,251	603	1,854	927	626
1989	1,288	539	1,827	913	644
1990	1,013	730	1,742	871	506
1991	950	921	1,871	935	475
1992	971	877	1,848	924	486
1993	575	463	1,038	519	287
1994	404	561	964	482	202
1995	431	1,052	1,483	742	216
1996	416	1,786	2,202	1,101	208
1997	160	1,112	1,272	636	80
1998	88	1,687	1,775	888	44
TOTAL	29,364	34,849	64,213	32,107	14,682

Returns of salmon (1 SW and MSW) to the "downeast" rivers have been low to moderate in the last three decades. This Table (Status Review Table 6.3.1-1) summarizes (minimal) returns for wild (fish from natural production and fry stocking) spawners. Also included are the 50% of the St. John River strays projected to move South, possibility into the downeast rivers.

While there are some anatomical differences between some wild salmon stocks, there is no known in situ method of identifying "wild" salmon from individual rivers. Thus there is no method of enumerating "wild" strays. The salmon counts for "downeast" rivers (see below) demonstrate the potential for introgression by wild St. John River strays. In most years the projected number of strays exceeded the observed runs and would have exceeded the observed runs even at substantially lower straying rates.

COMPARISON OF EXPECTED STRAYS TO RETURNS OF WILD ATLANTIC SALMON IN FIVE DOWNEAST MAINE RIVERS (1970-1998)

Year	Dennys	East Machias	Machias	Pleasant	Narraguagus	Total	50% of St. John Wild Strays
1970	49	1	226	1	132	409	
1971	19	5	147	1	73	245	
1972	61	3	191	1	244	500	295
1973	40	5	28	2	142	217	222
1974	49	5	26	30	137	247	679
1975	40	1	41	8	109	199	951
1976	20	22	18	1	28	89	935
1977	26	0	15	3	117	161	945
1978	38	46	90	16	98	288	402
1979	38	18	58	8	49	171	536
1980	73	38	65	5	115	296	1,253
1981	46	29	34	23	51	183	496
1982	20	22	55	7	67	171	443
1983	28	5	17	38	71	159	369
1984	68	38	25	17	58	206	1,122
1985	14	30	27	31	57	159	950
1986	8	8	28	19	25	88	717
1987	1	6	4	5	26	42	592
1988	6	5	8		27	46	626
1989	1	9	9	0	27	46	644
1990	11	17	1	0	28	57	506
1991	6	2	1	0	68	77	475
1992	6	0	0	0	47	53	486
1993	7	0	13	0	74	94	287
1994	6			1	50	57	202
1995	5				56	61	216
1996	10				56	66	208
1997	0				35	35	80
1998	1				22	23	44
TOTAL	697	315	1,127	217	2,089	2,445	

Table 6.3.1-1 of the Review excludes identifiable (tagged, fin clipped, fin deformities) hatchery salmon. Had the known hatchery component been included, the annual returns would have increased by an average of 31%. Straying rates for hatchery fish are two-three times higher than wild fish, thus the estimated number of St John strays available to the downeast rivers increases dramatically.

Based on Table 6.3.1-1 and the likelihood of large number of St. John River strays in the Bay of Fundy during the last three decades, there was and still is a significant and very real potential for introgression of these wild and hatchery fish on DPS stocks. The BRT neither recognized nor analyzed this problem.

While the St. John River is the largest source of straying, other Bay of Fundy rivers to the east of the downeast rivers contain wild and stocked salmon populations that are a potential source of strays. The "inner" Bay of Fundy salmon stocks have an unique life history which includes a marine phase of remaining within the Bay of Fundy. Thus the likelihood of Canadian strays decreases with the more eastern rivers. However the potential for straying from the smaller nearby Fundy rivers should not be dismissed.

II. STOCKING

The Services cite a lack of stocking success prior to 1970 as evidence that the Atlantic salmon in the eight downeast rivers identified in the proposed rule qualify as a discrete or "markedly separate population." The Services argue that early (1870 - 1970) stocking efforts failed. The stocking from 1971 to present is dismissed because 84% of the returns were from either wild or hatchery fry. The Services' position is contradicted by a review of the stocking records.

Stocking From 1872 to 1991 of Non-DPS and Non-River Specific Fish was Extensive and Successful.

The following tables are summaries of hatchery stocking broken down by fish origin based on Home river, "DPS," and Non-"DPS" waters. The basic data is from the July 1999 Status Report with some reference to other published ASSRC commission reports.

a. Stocking For The Period 1872 – 1969*

River	Total	Home	% Home	"DPS"	%" DPS"	Non-DPS	% Non-"DPS"
Dennys	1,732,000	3,200	0.2%	85,870	5.0%	1,642,930	94.9%
Ducktrap	N/A						
E. Machias	61,900	0	0.0%	7,000	11.3%	54,900	88.7%
Machias	1,286,900	206,895	16.1%	217,395	16.9%	862,610	67.0%
N'gaugas	2,249,000	135,590	6.0%	105,205	4.7%	2,008,205	89.3%
Pleasant	542,800	0	0.0%	14,600	2.7%	528,200	97.3%
Sheepscot	407,900	0	0.0%	19,800	4.9%	388,100	95.1%
Total	6,280,500	345,685	5.5%	449,870	7.2%	5,484,945	87.3%

b. Stocking For The Period 1970 - 1992 *

River	Total	Home	% Home	"DPS"	% "DPS"	Non-"DPS"	% Non-"DPS"
Dennys	314,500	0	0.0%	0	0.0%	314,500	100.0%
Ducktrap	82,700	0	0.0%	0	0.0%	82,700	100.0%
E. Machias	315,600	0	0.0%	0	0.0%	315,600	100.0%
Machias	615,500	15,770	2.6%	14,240	2.3%	585,490	95.1%
N'gaugas	307,600	9,895	3.2%	20,500	6.7%	277,205	90.1%
Pleasant	264,500	0	0.0%	0	0.0%	264,500	100.0%
Sheepscot	348,800	0	0.0%	1,020	0.3%	347,780	99.7%
Total	2,249,200	0	0.0%	35,760	1.6%	2,187,775	**97.3%**

* These tables were derived from data in Tables 4.2.2 (pages 26-29) and 4.3.2 (pages 31-33) of the Review of the Status of Anadromous Atlantic Salmon (salmo salar) Under the US Endangered Species Act. July 1999. Stock origin of salmon was verified by cross referencing the aforementioned tables with Appendix 6 from Maine Atlantic Salmon, A National Treasure. Baum, 1997.

The Services state that "the majority of stocks utilized for supplemental stocking within the Gulf of Maine DPS have been from within the DPS geographic range in both the USA and Canada (Baum 1997). Because the source of most stocking efforts has been from within the DPS, the genetic effects from stock mixing would be substantially less than from stocks from outside the DPS." (Report p. 49). The data demonstrates that **the vast majority of fish stocked in both periods were from outside the DPS-87.3% and 97.3% respectively.**

Stocking from Canadian Rivers

While early production at the hatchery used brood stock obtained from commercial fishermen on the Penobscot river, dwindling Penobscot runs and disagreements with commercial fishermen led to curtailment of use of Penobscot brood stock by the early 1920's. From 1920 to 1945 and again from 1949 to 1968, large numbers of Atlantic salmon eggs were imported from the Miramichi River in New Brunswick and /or Gaspe hatcheries in Quebec. These were stocked in the earlier years (1920-45) as fry and/or parr in the Dennys, Machias, Narraguagus, St. George, Orland, Penobscot, and St. Croix rivers and in the later years (1949-1968) as fry, parr, and /or smolts into the Dennys, East Machias, Machias, Narraguagus, Orland, Penobscot, Pleasant, Sheepscot, Somesville Stream, Tunk Stream, and St. Croix river (Table 1). During the period 1920-1945; 2,436,425 fry, and 95,000 parr of Canadian origin were stocked in the aforementioned Maine rivers and 29,280 fry; 1,454,515 parr; and 456,575 smolts of Canadian origin were stocked from 1949 to 1968. (Baum, 1997, Appendix 6)

Table 1

Summary of Canadian Origin Salmon Stocking of Maine Rivers						
	1920 - 1945			1949 - 1968		
River	Fry	Parr	Smolts	Fry	Parr	Smolts
Dennys	1,897,700	70,000	---	---	346,225	66,080
E. Machias	---	---	---	---	---	10,480
Machias	50,000	---	---	---	204,130	140,560
Narraguagus	488,725	25,000	---	29,280	540,285	150,160
Pleasant	---	---	---	---	77,130	23,550
Sheepscot	---	---	---	---	286,745	65,745
Ducktrap	---	---	---	---	---	---
Totals	**2,436,425**	**95,000**	**---**	**29,280**	**1,454,515**	**456,575**
Tunk	50,000	---	---	---	---	---
Kennebunk	---	---	---	---	---	16,425
Hobart Stream	---	---	---	13,340	106,900	2010
Orland R.	---	2,290	---	10,085	---	150,830
Penobscot	7,054,850	772,605	---	---	504,240	101,825
Somes Stream	---	---	---	---	15,105	---
St. Croix	464,000	---	---	---	115,045	119,005
St. George	---	49,980	6730	---	---	---
Totals	**7,568,850**	**824,875**	**6730**	**23,425**	**741,290**	**390,095**

To put the above table in perspective, the most recent (1949-1968) smolt stocking alone of Canadian origin salmon in Downeast rivers (456,575) is 6.7 times the average annual wild smolt production (67,356) in these rivers. The adult return rate from fry stocking in the Penobscot River for the period 1979-1993 was 0.1 % (USASAC Report #11, 1998). Applying this return rate to the historical stocking of Canadian fry in Maine rivers would produce an adult return to the DPS rivers of 2436 Canadian origin salmon in the 1920-1945 period and 29 adults in the 1949-1968 period. Adult returns to the non-DPS rivers produces an adult return of 7568 Canadian fish in the 1920-1945 period and 23 adults in the 1949-1968 period. The contribution of parr to adult returns is very low although a few adults were likely produced from parr stocking. The smolt releases of Canadian origin had a .03 % return rate based on tag returns of Narraguagus River fish (Baum & Jordan, 1982) **In the 1949-1968 period, applying this return rate to smolt stocking in the DPS rivers of Canadian origin salmon yields an additional 137 fish return to the DPS rivers and 117 additional fish to the non-DPS rivers. A conservative estimate of the total adult return of Canadian origin fish in the time span from 1920-1968 to the above DPS and non-DPS rivers would have been 2,602 and 7,708 respectively.**

III. SUMMARY OF RETURNS

The Services explicitly state that pre-1971 stocking efforts likely failed (p. 57). They minimize the likely contribution to adult populations from 1970 to present (p. 58) and thus conclude "that most of the recolonization of the Gulf of Maine DPS stocks in individual rivers was achieved naturally through processes of recolonization from within river (below impoundment) and within DPS (neighboring river) refugia." (p. 58)

(i) Returns For The Period 1872 – 1971

Qualitative reports from various sources suggest the presence and absence of salmon in each river for any given decade varied within this time period. The Status Review concedes that "some localized extinction" may have occurred but it was followed by repopulation (p. 54). Since no data exists for any given river for the whole time series, and since a lack of salmon could only be proved by a directed effort to find the fish which did not occur, it is not possible to quantify population sizes. The Services are correct to conclude that the literature strongly suggests that <u>each</u> of the DPS-river populations was <u>extinct</u> for several years. At other times, the populations were at such low levels at times that inbreeding in all likelihood substantially impacted the genetic makeup of any remaining downeast stocks.

Several reports ignored by the Services quantify returns of non-DPS (including Canadian) <u>spawners</u> to DPS several rivers. It should be noted that these few reports indicate the absolute minimum number of non-DPS fish since so little data exists.

General -- "Limited survival of fall-stocked hatchery reared fish was instrumental in the change to spring stocking of smolt-sized fish in 1962. Survival has improved as indicated by the increased number of returns of marked post-smolts from the Bay of Fundy area [herring weirs and mackerel fishery]... Returns of hatchery-reared smolts to the rivers have increased from .034 percent to .11 percent since 1962... Hatchery-reared young-of-the-year released in streams where native populations are low or non-existent have survived to smoltification at rates approaching those attained by naturally-reared fish." (ASRSC, 1966, p. 14 – 18)

The same report identifies the egg sources for the "current" period [1966 era]: as 300,000 Canadian eggs and 300,000 Maine eggs. The Maine eggs were comprised of 127,000 from the Machias and 140,000 from the Narraguagus in 1965 and 140,000 from the Machias and 162,000 from the Narraguagus in 1964. This effort produced 300,000 smolts annually. (p. 13)

East Machias -- Anglers landed 8 adipose fin-clipped salmon in 1976. These were all two-sea winter fish, but the river was not stocked in 1974. "However, the Union River received a stocking of nearly 10,000 fin-clipped salmon in 1974. Either these fish strayed from the Union River to the East Machias River or the fish were inadvertently stocked into the East Machias River." (ASRSC, East Machias,1982, p. 60) This return rate of Non-DPS fish is .08%. More likely, the Angling effort netted only 15-20% of the run (ASRSC, East Machias, 1982, p. 59). Thus, 40 - 53 fish are the more likely cohort and the Non–DPS return rate is more likely .40% - .53%. These rates compare favorably with the Union cohort, i.e., 30,398 smolts stocked into the Union River in 1974 yielded 139 two-sea winter fish in 1976 for a rate of .457%

Machias -- From 1962 – 1973 hatchery smolts were marked and tagged to indicate either Miramichi or "native" (Penobscot, Narragaugus, or Machias stock) origin. Of those, 76

Miramichi spawners returned (71 grilse) and 114 native fish (12 grilse) returned. The return rates were .054% for Miramichi and .092% for native smolts. (ASRSC, Machias, 1982, p. 31 – 33)

Narragaugus -- "The timing of salmon runs... is somewhat biased by the large number of hatchery-origin (Miramichi River) grilse returning in the fall during the period 1963 – 68." (ASRSC, Narragaugus, 1982, p. 27)

Sheepscot -- "It should be noted that a fairly substantial segment of the escapement consisted of grilse (1-sea winter) returns. This was not unexpected, as fish from Canadian eggs were reared and released in the Sheepscot from 1948 – 1960." (ASRSC, Sheepscot, 1982, p. 34)

(ii) Returns For The Period 1972 – 1995

The U.S. Atlantic Salmon Assessment Committee Report for 1999 provides data on populations of salmon in various rivers. The report also identifies the components of each run based on age and origin, i.e., whether from stocking as a parr or smolt or "wild." The so-called wild fish include salmon produced either from natural reproduction or fry stocking. The report also provides a table (3.7.j.) identifying return rates of hatchery fry for year classes 1985, 1987, 1988, and 1989 for the Narragaugus River. These year classes are from non-river-specific fish and from outside of the DPS. It is therefore possible to calculate the predicted component of the "wild" run attributable to hatchery-produced fry during this period. The following data are assembled from the report.

	Total Run	Obvious Hatchery	% Obvious Hatchery	Predicted Run From Fry	Obv. Hatch Plus Fry	Total Hatchery As % of Tot
DENNYS	994	316	31.79%	360	676	68.0%
DUCKTRAP	33	0	0.00%	228	228	691.7%
E. MACHIAS	598	268	44.82%	385	653	109.2%
MACHIAS	1393	266	19.10%	481	747	53.6%
NARRAGUAGUS	2439	463	18.98%	204	667	27.3%
PLEASANT	234	16	6.84%	514	530	226.6%
SHEEPSCOT	389	44	11.31%	437	481	123.7%
TOTAL	6080	1373	**22.58%**	6185	7558	**124.3%**

Once the known hatchery component is calculated it is then possible to determine the contribution to the adult population of Non-DPS salmon.

	Total Run	Obvious Hatchery	Predicted Run From Fry	Obv. Hatch Plus Fry	Percentage Non-DPS	Number Non-DPS	Non - DPS as % Tot. Run
DENNYS	994	316	360	676	100.0%	676	68.0%
DUCKTRAP	33	0	228	228	100.0%	228	691.7%
E. MACHIAS	598	268	385	653	100.0%	653	109.2%
MACHIAS	1393	266	481	747	91.7%	686	49.2%

NARRAGUAGUS	2439	463	204	667	89.0%	593	24.3%
PLEASANT	234	16	514	530	100.0%	530	226.6%
SHEEPSCOT	389	44	437	481	99.5%	479	123.0%
TOTAL	6080	1373	6185	7558	96.1%	7267	**119.5%**

(iii) Union River

The above-predicted return rates for hatchery origin, non-river-specific fish are reasonable and are in fact, corroborated by catch data. The Union River serves as a biological control for the Services' proposition that non-native fish do not contribute to spawning runs. An impassable dam has continuously blocked the Union River since at least 1908. It is thus certain that the aboriginal run of salmon in that river is extinct. Therefore, none of the Atlantic salmon entering this river anytime during the last 30 years could be native fish. Yet, scores of salmon have returned to the Union River during this period.

From 1971 and 1990 the Fish and Wildlife Services and the Maine Atlantic Sea – Run Salmon Commission annually stocked the Union River. This effort used predominantly smolts and was initiated with progeny of Penobscot River broodstock. As the stocking effort took hold broodstock become available from the Union River itself. From 1990 to present fry and parr of Penobscot stock and/or aquaculture stock were planted into the river. Adult returns have been monitored at a fishtrap located within a "blind" fishway at the base of the dam (installed in 1972). Fish will only enter the fishway when a pump is operated. (ASRSC, Union, 1982, p.14) Therefore, run totals must be considered a minimum due to intermittent trapping effort. The following data is from the USASAC Report 1999:

Year	No. Stocked	Run	Year	No. Stocked	Run
1970	0	0	1986	55,400	67
1971	8,100	0	1987	47,100	63
1972	7,700	0	1988	30,600	47
1973	19,600	75	1989	20,400	30
1974	30,300	20	1990	20,400	21
1975	31,300	79	1991	0	8
1976	33,600	248	1992	0	4
1977	35,500	244	1993	171,700	0
1978	31,900	157	1994	0	0
1979	42,800	45	1995	54,800	0
1980	30,600	240	1996	53,500	69
1981	29,400	295	1997	81,300	8
1982	32,400	156	1998	165,000	13
1983	41,600	148	1999	N/A	70
1984	50,200	40			
1985	52,800	82	**TOTAL**	**1,178,000**	**2,229**

As is plainly evident from this data, significant numbers of spawners resulted from stocking efforts <u>utilizing exclusively non-native fish</u>. The <u>experience</u> on the Union River cannot be distinguished from results expected on the DPS rivers. Geographically the Union is located within the DPS, and it received hatchery fish predominantly from the same hatcheries as the DPS rivers, and those cohorts were handled by the same federal and Maine biological staff as in the DPS stocking efforts.

3. Summary

Prior to 1971 it is likely that many populations were extinct for **variable** periods of time. From quantitative reports of run sizes and their composition cited above, it is evident that certain occurrence non-native and non-DPS hatchery returns to DPS rivers occurred as recently as the 1950s, 60s and 70s.

The Services concede that excluding returns from hatchery fry, from 1971 to present 16% of all DPS returns were from non-DPS fish (p. 58). The date shows that from 1971 – 1993 22.6% of all DPS river returns were from Non-DPS fish.

The Services lump adult returns from hatchery fry with those of natural production. The Services understate the Non-DPS stocking effort and the influence of Non-DPS spawners on the gene pool.

IV. DISTINCTNESS BASED ON UNIQUE LIFE HISTORY CHARACTERISTICS

The Biological Review Team concluded: "that differences in life history characteristics historically contributed to the distinctness of the Gulf Of Maine DPS. Remnant stocks have maintained the most characteristics of these factors: smoltification at a mean age of 2 and predominant adult returns as 2 sea winter (SW) fish (age 4). Since the proportion of 2SW fish in an Atlantic salmon stock has a documented genetic basis (Glebe and Saunders, 1986; Ritter et al.,1986; Hutchings and Jones, 1998), the Services conclude that the DPS has unique life history characteristics that have a heritable basis . The Services conclude that both environmental and genetic factors make the Gulf of Maine DPS markedly different from other populations of Atlantic salmon in their life history and ecology.

While it is acknowledged that Maine salmon become smolts at a mean age of 2 and over 80 % of adult salmon returning to Maine rivers are 2-sea winter fish or older, all salmon runs throughout North America and Europe have varying proportions of 2 year old smolts and adult returns as 2 sea winter fish.

Predominance of 2 Year Smolts In Maine Waters.

The Services conclude that the uniqueness of Maine salmon from Canadian salmon is demonstrated by the fact that smolts in Maine have a mean age of two years whereas many smolts in Canada are age 3, 4, and older. The differences in mean age at smoltification vary throughout the range of salmon with fish at the northern extremes of their range generally spending longer periods of time in the freshwater environment than fish at the southern end of their range. Much of this difference may be explained by differences in environmental conditions. Longer growing seasons occur in the more southerly range and generally southern rivers are more nutrient rich than northern rivers. Dow (1938) reported the following: "It is difficult to separate the effects of inherited habits from the influence of new and different surroundings on the growth and behavior of salmon. In at least two cases of which we have record the effect of planting fry in a strange river has produced habits of a decidedly different character from those of the parent fish. One of these cases occurs in the Penobscot, which is stocked with fry from Miramichi salmon. In their native river (Blair 1934) the Miramichi smolts migrate as follows:

As two- year fish- 15.1 %
As three-year fish-78.1 %
As four-year fish- 6.6 %
As five-year fish- 0.2 %

Transplanted in the Penobscot they change their habits and migrate as follows:

As two-year fish- 89.0 %
As three-year fish-11.0 %

In this case the Penobscot river environment apparently overcomes the inherited instincts of the fish and sends them to sea a year earlier than the parent stock of the Miramichi. The accepted theory is that abundant food and favorable natural conditions produce early smolts, while conversely scanty food coupled with adverse natural conditions, such as occur in the rivers of the north, produce smolts of the three, four, and five year variety."

The predominance of these characteristics has not been shown to be a heritable trait unique to Maine Atlantic salmon. On the contrary, they are more likely results of environmental influences, and stocking from hatcheries that selected for certain traits.

Whalen et.al. (1998) conducted studies on the influence of winter temperature and feeding on energetics and smolt development of juvenile Atlantic salmon. They concluded that exposure of parr to low water temperatures and starvation delayed the onset of smolting. **"Our study demonstrated a direct link between winter energetics and the timing of smolt development and illustrated mechanisms by which environmental conditions in winter (water temperature and feeding) can influence smolt recruitment variability."**

The conclusion is that the predominance of 2 year smolts in Maine rivers does not substantiate the claim that these fish are the offspring of a persistent native salmon population. These fish are most likely the offspring of hatchery stocks from Canadian and non-DPS origin stocking that are heavily influenced by the environment into which they have been introduced.

Preponderance of 2SW salmon in salmon runs to selected Canadian Rivers

Canadian salmon runs have varying proportions of 2-sea winter fish returning to Canadian rivers. Table 1 summarizes recent returns of small and large salmon to selected Canadian rivers. [DFO Stock Status Report D3-14(2000)]

Table 1 – Salmon Returns to selected Canadian Rivers

Matapedia River	1-SW	MSW	Total	% 1-SW	% MSW
1994	1206	2293	3499	34.5	65.5
1995	1006	3319	4325	23.3	76.7
1996	2012	3749	5761	34.9	65.1
1997	1201	2682	3883	30.9	69.1
1998	1473	2084	3557	41.4	58.6
1999	1600	2591	4191	38.1	61.9
Totals	**8498**	**16718**	**25216**	**33.7**	**66.3**
Tabusintac R.					
1995	--	--	--	--	--
1996	615	920	1535	40.0	60.0
1997	--	--	--	--	--
1998	900	700	1600	56.0	44.0
1999	817	900	1717	47.7	52.3
Totals	**2332**	**2520**	**4852**	**48.0**	**52.0**

St Mary's River	1-SW	MSW	Total	% 1SW	%MSW
1995	2038	437	2475	82.3	17.7
1996	1535	590	2125	72.3	27.7
1997	709	110	819	86.6	13.4
1998	1926	74	2000	96.3	3.7
1999	559	150	709	78.8	21.2
Totals	**6767**	**1361**	**8128**	**83.3**	**16.7**

Miramichi (data from ICES C.M. 1993/assess:10-1993)

1988	121900	21700	143600	84.9	15.1
1989	75200	17200	92400	81.4	18.6
1990	83400	28600	112000	74.5	25.5
1991	60900	29900	90800	67.1	32.9
1992	152700	31800	184500	82.8	17.2
Totals	**494100**	**129200**	**623300**	**79.3**	**20.7**

St John

1992	7664	4203	11867	64.6	33.4
1993	3884	2973	6857	56.6	43.4
1994	3313	2206	5519	60.0	40.0
1995	4970	2279	7249	68.6	31.4
1996	6155	3139	9294	66.2	33.8
1997	3069	1776	4845	63.3	36.7
1998	4892	984	5876	83.3	16.7
Totals	**33947**	**17560**	**51507**	**65.9**	**34.1**

*Maine Rivers (data from USASAC Report 1999/11)

Penobscot 1970-1998	9535	42528	52063	18.3	81.7
DPS Rivers 1970-1998	251	5781	6032	4.2	95.8

* It should be noted that trapping facilities for salmon on Maine rivers utilize a 2 inch clear spacing between the bars on the traps to allow non-salmonids (e.g. river herring) to pass through and not be retained in the traps. Some unknown proportion of the 1SW salmon also pass through the bars and are therefore not counted. **Therefore, the counts of 1SW salmon returns are probably inaccurate and underestimated for Maine rivers.**

As can readily be seen from Table 1, there are numerous populations of salmon that exhibit the 2SW trait in varying proportions. Therefore the 2SW trait is not unique to the Maine DPS salmon population but is found throughout the range of Atlantic salmon in North America and Europe. The Services would have us believe that the **predominance** (>80 %) of the 2SW trait is what makes Maine salmon unique from Canadian salmon and that this trait has been passed down from a persistent native stock.. A more plausible explanation is that historical stocking of these eight rivers with salmon from external sources -- Canada and other rivers in

Maine (i.e. Penobscot) -- was liberal and successful. The 2SW trait is found in Canadian salmon runs in varying proportions and was present in fish stocked from Canada into Maine rivers. **Beland et.al., 1997, reported "Sea run adults are taken from the Penobscot River as brood stock to support smolt and fry stocking in the Penobscot river** (Penobscot fish were also stocked liberally in the DPS rivers until 1992). **For many years, only multi-sea winter salmon were collected as brood fish in addition to the traditional early summer brood stock collection.**"

We therefore conclude that the more likely reason for the preponderance of 2SW salmon in a Maine rivers is a direct result of the hatchery selection process. The existence of the predominant 2SW salmon run is proof that the brood stock selection program employed by state and federal salmon biologists for many years has produced the intended result. The objective of the brood stock hatchery selection program was to generate early run and large size adults returning to Maine rivers for recreational angling purposes.

Appendix "D"

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 Westgate Center Drive
Hadley, MA 01035-9589

MAR 24 2000
DEPT MARINE RESOURCES

In Reply Refer To:
FWS/Region 5/FR

MAR 20 2000

George LaPointe, Commissioner
Maine Department of Marine Resources
21 State House Station
Augusta, Maine 04333

Dear Mr. ~~LaPointe~~ George:

We are pleased that consensus was reached with respect to the disposition of the Atlantic salmon stocks from the Downeast and Penobscot rivers held at the Craig Brook National Fish Hatchery. At a March 1, 2000, meeting of representatives from all agencies involved, it was identified that we also need to come to closure on the acceptance of the U.S. Fish and Wildlife Service's "Craig Brook National Fish Hatchery Interim Disease Management Plan: Best Management Plan for Salmon Swimbladder Sarcoma virus" (SSSv Plan). We did not receive comments on the interim SSSv Plan during the time frame requested (see enclosure) and are extending the comment period until March 31, 2000.

Additionally, we would like to take this opportunity to outline the Service's position on SSSv. We strongly support the interim SSSv Plan developed in close consultation with Maine's Inland Fisheries and Wildlife, Atlantic Salmon Commission and Marine Resources representatives on the ad hoc Maine Technical Advisory Committee's Fish Health Subcommittee. We believe that data, although circumstantial, are sufficient to conclude that SSSv has not been a significant threat to Atlantic salmon. Analysis of wild salmon from the Downeast rivers and the Penobscot River indicate a prevalence of SSSv of two to four percent. It would be expected that if the virus was expanding, a greater percentage of fish would be infected, particularly in the Penobscot River which has been stocked with hatchery-reared salmon for multiple generations. Most recently hatchery offspring tested at two Service facilities and two commercial facilities have tested negative, reinforcing the value of the Service's egg disinfection protocols and the susceptibility of retroviruses, in general, to topical disinfectants. Based on their testing, Drs. Casey and Bowser from Cornell University, who are experts on the virus, have stated that the virus appears to be in harmony with its host.

Further, the current test for SSSv has not been validated. We do not know if the virus is the causative agent for tumors, or if it is harmless like the toga virus routinely picked up in net pen salmon. Unlike other diagnostic testing where at least two tests are used to arrive at the identity of an agent, preferably by different routes (i.e., culture, serological, immunological, molecular), there is no secondary or confirmatory test for SSSv at this time. Compounding the problem of virus identification is the apparent seasonality of virus detection which can cause false negatives.

As Cornell continues to work on these issues, including development of an immunological assay, we believe that more will be learned on how best to manage this virus in the near future.

Therefore, we propose acceptance of the Best Management Plan for SSSv as an interim plan and also consider this Plan as one that will be constantly updated as developing technologies and our understanding develops, thereby, sustaining it as truly the "Best Management Plan for SSSv".

We welcome your comments. If you have any questions or would like to discuss the Service's position, please contact Dan Kuzmeskus at 413-253-8400.

Sincerely,

Ronald E. Lambertson
Regional Director

Enclosures

Identical letter sent to:

Mr. Lee Perry, Commissioner, Maine Department of Inland Fisheries & Wildlife
Mr. Paul Frinsko, Commissioner, Atlantic Salmon Commission
Mr. Frederick W. Kircheis, Interim Executive Director, Atlantic Salmon Commission

EAVA

Eastern Aquaculture Veterinary Association
RR4 Box 2608, Belfast Maine 04615

Chief, Division of Endangered Species
US Fish and Wildlife Service
300 Westgate Center Drive
Hadley, MA 01035

Endangered Species Coordinator
National Marine Fisheries Service
1 Blackburn Drive
Gloucester MA 01930

10 March 2000

REF: Docket # 991108299-9299-01 ID 102299A: Endangered and Threatened Species: Proposed Listing for a Distinct Population Segment of Anadromous Atlantic Salmon in the Gulf of Maine.

Dear Sir/Madam

The Eastern Aquaculture Veterinary Association (EAVA) is an association of veterinarians actively engaged in aquatic animal health management in both the United States and Canada. EAVA membership is comprised of fish health professionals from private aquatic veterinary practice, university and private research laboratories, teaching and extension services, and both state and federal regulatory agencies. Members of EAVA have certification and advanced degrees in the fields of fisheries, veterinary medicine, bacteriology, virology, immunology, pathology and epidemiology.

As a professional organization with active involvement and responsibility in the arena of aquatic animal medicine and fish disease, EAVA is greatly concerned about the accuracy and the adequacy of statements made in both the 1999 Status Review, October 19, 1999 and in the proposed listing document published in the Federal Register Vol. 64 No. 221 Wednesday Nov 17, 1999. While members questioned the nature and validity of many of the statements made in these documents, we have chosen to confine our comments to issues specifically dealing with fish diseases.

While the respective agencies claim that much of the science has been peer reviewed, a statement of neither the peer review process, nor the expertise of the reviewers has been forthcoming. On a scientific basis, many of the statements are erroneous or unjustified. Both documents lack an epidemiological evaluation of the respective disease agents and an adequate assessment of the risk associated with those diseases. All organisms, from plankton to humans, are exposed to a host of infectious agents existing in the environment. Merely listing the pathogens found in Atlantic Salmon without the context of the host-pathogen-environment associated with disease does not constitute a valid assessment of disease risk, but rather a serious misrepresentation of scientific evidence. The "threat of disease" cannot be realistically evaluated without the systematic collection, examination and review of epidemiological data.

In this context the statement that "Fish diseases have always represented a source of mortality to Atlantic salmon in the wild though the threats of major loss due to disease are generally associated with salmon aquaculture" is extremely misleading. While aquaculture recognizes and manages disease through inspection, disease surveillance, biosecurity and the institution of control measures, similar recognition of the significance of disease in wild fish has rarely been assessed. It is relatively easy to state that diseases are not a problem in wild Atlantic salmon when those fish are rarely subjected to disease surveillance. In contrast to wild salmon, aquaculture fish are subject to intensive screening and disease surveillance. Increasing evidence indicates that diseases are not peculiar to cultured salmon but occur in the wild, often with greater prevalence than in cultured fish. Substantial evidence also indicates that some pathogens thought restricted to salmonids have a broad host range and may involve wild marine fish as reservoirs (Kent et. al. 1998). While admittedly a daunting task, federal agencies charged with maintaining the "health" of aquatic resources in Maine have rarely and only reluctantly committed the resources to developing realistic disease surveillance programs for wild fish. Disease surveillance and the application of epidemiology to wild fish management are long overdue and essential to the survival of wild fish stocks. We reiterate the position of a wide variety of scientists that management decisions are being made without consideration of the epidemiological evidence (Grenfell and Dobson 1995, Hedrick 1998, Thorburn 1999).

Statements regarding the inadequacy of Maine fish health regulations are also misleading. Both old and new fish health regulations for the State of Maine clearly prohibit the stocking or transfer of diseased fish. The State of Maine adheres to the New England Salmon Health Guidelines and has a long history of advocacy and participation in the development of fish health regulations. Both the Maine aquaculture industry and the State of Maine have adopted regulations for new and emerging infectious agents such as ISAv and SSSv. Management plans for ISAv exceed existing federal and international regulations. Additional surveillance is conducted at marine sites by both state regulatory agencies and industry veterinarians. Yet despite this surveillance, there is no evidence that ISAv and SSSv are present in fish held within production aquaculture facilities in the state of Maine.

We are equally concerned over the respective agencies authority and role in determining the adequacy of fish health practices. As veterinarians licensed in both the US and Canada, we believe this action usurps and violates both state and federal regulations under which we practice in delivering aquatic animal health services. Further the respective services have failed to provide adequate standards for fish health practice, certification of diagnostic procedures and quality assurance.

We view the inadequate representation of fish health issues in the listing document with utmost concern. Fish health management is a central feature of our client's operations and we believe that both "best science" and "best health management" are essential to the viability of both our industry and our fishery resources. Because we have worked cooperatively and exceptionally hard in cooperation with industry, state and provincial regulators and other cooperative federal agencies to advance and promote fish health management, we consider these documents an affront to our integrity, diligence and effort. Individually and as a professional organization we remain committed to resolving fish health issues associated with Maine's salmon resources. However, we are adamant that effective resolution can only be achieved by working as equal partners in an objective, scientific manner.

Sincerely,

Dr. Don Hoenig, Treasurer
Eastern Aquaculture Veterinary Association

Cc:
Maine Department of Marine Resources, Maine Department of Inland Fish and Wildlife,
Canadian Members: Dr. Larry Hammel, Dr. Leighanne Hawkins, Dr. Gerald Johnson, Dr. Steve Backman, Dr Roland Cusack, Dr. John O'Halloran, Dr. Dan Macphee
US Members: Dr. Russ Danner, Dr. Steve Ellis, Dr. Caroll Jones, Dr. Peter Merrill, Dr. Paul Waterstrat

Literature cited:
Grenfell, B.T. and A.P. Roberson (editors) 1995. Ecology of infectious diseases in natural populations. Cambridge University Press Cambridge U.K.

Hedrick, R.P. 1998. Relationships of the Host, Pathogen and Environment: Implications for Diseases of Wild and Cultured Salmon. Journal of Aquatic Animal Health 10:107-111.

Kent, M.L., et al. 1998. Survey of Salmonid Pathogens in Ocean-Caught Fishes in British Columbia, Canada. Journal of Aquatic Animal Health 10:211-219.

Thorburn, M.A. 1999. Applying epidemiology to infectious diseases of fish. Pages 689-722 in P.T.K. Woo and D.W. Bruno editors. Fish Disease and disorders Vol. 3 Viral, Bacterial and fungal infections. CABI Publishing. Wallingford UK.

Attachment #4

CANADIAN LEGISLATION, REGULATIONS,

AGREEMENTS AND POLICIES

AND

INTERNATIONAL CONVENTIONS AND AGREEMENTS

CONCERNING ATLANTIC SALMON

John Bailey, Ph.D.

30 March, 2000

Introduction

The authority to manage and regulate Canada's coastal and inland fisheries lies with the federal government according to the *Constitution Act, 1982*. Aquaculture is defined as a fishery, and is regulated by legislation contained in the *Fisheries Act*. The Department of Fisheries and Ocean (DFO) has been designated as the lead federal agency for aquaculture in Canada. There are a number of acts administered by DFO and other federal government departments which relate to the protection and conservation of fish, fish habitat, and the transportation and trade of fish and fish products. Regulations, national, regional and provincial policies, and international agreements are developed in recognition of these statutes.

In addition, each of the maritime provincial governments have co-signed *Memoranda of Understanding on Aquaculture Development* with the federal government. These are agreements that define the roles and responsibilities of the two levels of government with respect to aquaculture development and the conservation and protection of wild fish stocks. The federal government has also signed a number of international agreements designed to conserve Canada's natural resources and/or benefit Canadian aquaculture producers in the market place.

This paper identifies existing regulations, policies, and international agreements that relate to wild Atlantic salmon management in Atlantic Canada and identifies areas where they impact aquaculture development. The content will be confined to measures designed to reduce the risk of negative impacts from aquaculture on wild salmonid stocks. The main aspects of each are summarized and the implications on the aquaculture industry are discussed. **This paper is not a legal interpretation of federal statutes, federal-provincial agreements or international treaties, conventions or agreements.**

FEDERAL LAWS REGULATIONS AND POLICIES

Fisheries Act

By law, all aquaculture activities must conform to the *Fisheries Act*. All but Section 36 of the *Fisheries Act* is administered by The Department of Fisheries and Oceans. Section 36 is the responsibility the Department of the Environment.

Section 4

Under Section 4 of the *Fisheries Act*, the Minister of DFO has the authority to grant permission to obtain fish for purposes of stocking or artificial breeding for scientific purposes. This section has been used to import salmonid eggs from foreign countries and transfer eggs and/or live fish between provinces – even from sources that do not meet health certification requirements under the Fish Health Protection Regulations (see below). Rigorous disease testing of both the donor and recipient sites followed by a period of quarantine in a certified facility are required for approvals under Section 4. Importation requests are reviewed first by the Local Fish Health Officer in the receiving province, then by the DFO assistant Deputy Minister, Science, and finally by the DFO Regional Director General in the appropriate region.

Sections 34 to 42

Sections 32 to 42 of the *Fisheries Act* contain provisions for habitat protection, including pollution prevention. The majority of fish habitat protection and pollution prevention provisions are contained in Sections 35 and 36. Section 35 prohibits any activity or undertaking that results in detrimental alteration, disruption or destruction of fish habitat, unless authorized by the Minister. Section 36 prohibits the discharge or deposition of deleterious substances of any type in waters frequented by fish, unless authorized by regulation. This Section also provides the regulatory authority to name substances as "deleterious", and to set limits for their discharge.

Fisheries (General) Regulations

The Fisheries (General) Regulations were proclaimed under Section 43 of the *Fisheries Act*. Part VIII stipulates that a licence must be obtained to release live fish into fish habitat or to transfer live fish to a rearing facility. These licences may be issued if:

1. the activities would be in keeping with the proper management and control of fisheries;
2. the fish do not have any disease or disease agent that may be harmful to the protection and conservation of fish; and,

3. the release or transfer will not have an adverse effect on the stock size of fish or the genetic characteristics of fish or fish stocks.

Fish Health Protection Regulations (FHPR)

The FHPR are also promulgated under Section 43 of the *Fisheries Act.* They are designed to minimize the risk of importing infectious diseases of concern in shipments of live salmonid eggs, live fish, and/or dead non-eviscerated salmonids, into Canada or transferring infectious diseases of concern between provinces. The FHPR are designed to protect both wild and cultured fishes. They were last revised in August 1997.

All shipments into Canada and between provinces require an Import Permit issued by a Local Fish Health Officer in the receiving province. The source facility must have a valid Fish Health Certificate issued by a Fish Health Official. Fish Health Certificates are only issued to facilities with a history of disease testing so that any diseases/disease agents known. Import Permits can be issued only when the import of the eggs or fish will not result in the introduction of a disease agent of concern that is not already known to occur in a province.

Food and Drugs Act

The *Food and Drugs Act,* administered by Health Canada/Bureau of Veterinary Drugs, outlines the procedures required to obtain veterinary drug approval for use in aquaculture. Prescriptions to treat fish disease outbreaks must be issued by veterinarians.

Pest Control Products Act

This act regulates the manufacture, importation, labelling, sale and use of pesticides. Pesticides are defined as chemicals applied topically to treat external pests (e.g. sea lice) and must be registered for use in aquaculture. The Act is administered by Health Canada/Pesticide Management and Regulatory Agency.

Health of Animals Act

This act is concerned with protecting the health of food producing animals. It also contains legislation concerning the importation, production, testing, and sale of biologics (vaccines and antisera for diagnostics). The *Health of Animals Act* is administered by the Canadian Food Inspection Agency (CFIA).

Feeds Act

Regulations under this act control animal feeds, including those used in aquaculture. The *Feeds Act* is administered by CFIA

Fish Inspection Act

Administered by CFIA, this act is used to govern the safety and quality of fish products

Canadian Wildlife Act

A section of this act is concerned with habitat protection. The act also contains provision for the formation of protected areas. It is administered by the Department of the Environment (DOE).

Canadian Environmental Protection Act

A section of the CEPA regulates, by permit, disposal at sea of non-contaminated wastes, including fish waste. It is administered by DOE.

Oceans Act

The Oceans Act (1997) consolidates existing oceans legislation and provides the authority to define areas of the oceans for special protection. Marine Protected Areas influence aquaculture siting and leasing decisions.

Migratory Birds Convention Act

Administered by DOE. It is illegal to harass or kill migratory birds over bodies of water. Permits to frighten migratory birds can be obtained as protection against crop damage.

Navigable Waters Protection Act

The *NWPA* was developed to provide safe passage for watercraft. To minimize the risk of collisions between boats and fish cages, siting for aquaculture leases requires approval under the *NWPA* This section of the NWPA is administered by DFO.

Species At Risk Act (pending)

This act is still under development and will be "Canada's Endangered Species Act". It is largely patterned after the US counterpart and will be administered by the Department of the Environment.

DFO Policy for the Management of Fish Habitat

DFO published a *Policy for the Management of Fish Habitat* in 1986, which applies to marine coastal areas, as well as freshwater and estuaries (Anon 1986). The objective of the policy is to increase the natural productive capacity of habitats for the nation's fisheries resources, which includes aquaculture. There are three goals: fish habitat conservation, restoration, and development. The policy provides an implementation strategy, which includes, among other things, integrated resource planning and enforcement and compliance.

Wildlife Policy for Canada

The *Wildlife Policy for Canada* is a national policy, adopted in 1990, which provides a framework for federal, provincial, territorial and non-governmental policies and programs that affect wildlife, including fish (Anon 1990). The goal of the policy is to maintain and enhance the health and diversity of Canada's wildlife, for its own sake and for the benefits of present and future generations. DFO is obligated to take this policy into consideration when developing its fisheries policy and regulations.

Federal Aquaculture Development Strategy

DFO released an Aquaculture Development Strategy in 1995 (Anon. 1995). The objectives of the Strategy are: to create an economic and regulatory environment that allows aquaculture to prosper, and to continue to ensure the environmental integrity where aquaculture is practiced. The strategy identifies aquaculture development as a priority of the federal government and government policy and regulatory framework must not unduly constrain development. However, the strategy also states that aquaculture development must be consistent with government responsibilities in such areas as habitat and biodiversity. DFO's dual role is clearly identified. Section *6.5* deals with Environmental Sustainability and Interaction. It states that "Care must be taken to ensure the integrity of all aspects of the aquatic environment, including seafloor and substrate, biodiversity, habitat and disease transfer...... The federal government will .....develop and implement a responsive and effective regulatory and policy framework to ensure that aquaculture is conducted in an environmentally sustainable manner." The Strategy also states that aquaculture must be afforded equitable access, among commercial, recreational aboriginal and municipal users, to seedstock and to coastal and inland aquatic resources.

Draft Policy on Introduction and Transfers (Draft Only)

The purpose of this draft policy is to establish the criteria for the introduction and/or transfer of aquatic organisms. Introduction and transfer refers to the deliberate movement of live aquatic organisms into Canada , between provinces and territories, or within provinces or territories. The policy will not cover accidental introductions and transfers, where the transfer of an aquatic organism (and its eventual release into natural waters) is not deliberate or intentional. The draft policy will not cover research with, or introductions of transgenic organisms.

The measures proposed in this draft policy will minimize the negative impacts of intentional introductions and transfers by:

1. contributing to the reduction of the risk of introduction and spread of infectious fish diseases and parasites
2. reducing the risk of undesirable genetic changes in existing fish populations; and
3. reducing the risk of undesirable ecological changes in aquatic ecosystems.

The draft policy will apply to all aquatic organisms covered by the Fisheries Act. These include finfish, mollusks, crustaceans, echinoderms, and other invertebrates, aquatic plants, both attached and planktonic and other aquatic animals, and their habitats. It will apply to activities such as aquaculture, commercial and recreational fishing including the live-bait industry, live food-fish, aquarium rearing, and research and ecological control programs. It will also be applicable to fresh water plants and invertebrates which provide elements of fish habitat.

The policy will reflect, as far as possible, existing federal and provincial acts, regulations and policies, and regional and international standards that relate to introductions and transfers of aquatic organisms. The draft policy is intended for use as an interim measure and will form the basis for appropriate regulations enacted under the Fisheries Act.

PROVINCIAL LAWS, REGULATIONS AND POLICIES

New Brunswick

In New Brunswick, aquaculture development is controlled by the *Aquaculture Act* proclaimed in 1991, and administered by the (provincial) Department of Fisheries and Aquaculture (DFA). Regulations specific to aquaculture, known as the *General Regulation-Aquaculture Act*, were developed under the Act. Together they deal with the conditions necessary to issue and/or renew aquaculture licences and leases. They also include sections that outline the fish health testing and standards that must be met in order to move live fin-fish between hatcheries, between marine sites or between hatcheries and marine sites (and *vice versa*) unless written permission is received from the DFA Minister.

Under the Aquaculture Act, the Aquaculture Site Evaluation Committee considers input from other provincial and federal government departments in order to advise the Minister on site allocation, licensing and leasing. The Registrar of Aquaculture can impose additional conditions on licensing such as:

- Producing and implementing a site development plan approved by the Registrar.
- Site standards (species, capacity, stocking densities, *etc.*).
- Measures to minimize the risk of negative environmental impacts.
- Measures to minimize escapement.
- Measures to minimize the risk of spreading disease, parasites, toxins or other contaminants to other sites
- Measures to maintain health standards.
- Measures to maintain genetic standards.
- Any other measure the Registrar deems necessary.

The New Brunswick *Clean Water Act* compels freshwater hatcheries to screen their outflow as a condition for environmental impact registration. This is done to protect aquatic habitat. The act is administered by the Department of the Environment.

Published in *1995, "A Wildlife Policy for New Brunswick"* provides guidance on issues that affect wildlife (bacteria, plants and animals) and its use. The primary intent is to protect wildlife for present and future generations. Activities such as aquaculture are permitted provided they are conducted such that any risks of adverse effects on native wildlife are minimized. The provincial wildlife policy was developed by the New Brunswick Department of Natural Resources and Energy

The New Brunswick *Rainbow Trout Policy* is concerned with the introduction of Rainbow Trout. Recreational fisheries management, implications for native stocks and the requirements of the aquaculture industry are all considered. With some additional provisions, New Brunswick has a zoning system consistent with DFO policy and the NAC Protocols. With the exception of totally closed systems and closed farm or fish-out ponds, sterile rainbow trout are required in most Rainbow Trout Zones.

An *Environmental Monitoring Program* was implemented in 1995. Under the program, farms are assigned an annual rating of A, B or C, on the basis of environmental conditions under the cages. If the site is found to be impacted (C rating), the owner/operator will, in consultation with the Site Remediation Committee, develop a site-specific schedule of actions to mitigate his impact on the seafloor. All remediation plans must be approved by the Minister (DFA). Guidelines for developing a remediation plan are found in a DFA publication entitled "An Environmental Remediation Guide".

The New Brunswick *Fish Health Policy* is being developed by DFA in consultation with industry and is still incomplete. This policy will provide an operational mechanism to ensure that fish health procedures are environmentally acceptable. The objectives are to limit economic loss from disease, to optimize production and sustainability and protect public interest.

The New Brunswick *Site Allocation Policy for the Bay of Fundy* is also incomplete. When complete, the policy will provide guidelines for future allocation of marine leases for aquaculture. Topics covered under the proposed policy include environmental assessments, agreements on bay management strategies, year-class separation and site fallowing.

Nova Scotia

The Nova Scotia, *Aquaculture Act,* gives authority to the Minister to issue aquaculture licences and leases and to establish conditions to the licences and leases. The legislation was updated as the *Fisheries and Coastal Resources Act* in 1996. Nova Scotia enacted the *Aquaculture Regulations* of 1991 (and amended in 2000) under authority of the then extant *Aquaculture Act.* The regulations stipulate that no person shall transfer any salmonid (eggs, fry, fingerling or adult) for aquaculture purposes without a permit to be obtained from the Minister.

The Nova Scotia *Environment Act* (1995) includes conditions relevant to water withdrawal, effluent control etc.

The Nova Scotia *Wildlife Policy* (1998) makes no specific mention of aquaculture. The broader principles of the policy include the ethics of conservation and sustainable use of wildlife populations, habitats, and ecosystems in Nova Scotia.

The Nova Scotia *Rainbow Trout Policy* also includes zones and permits the use of rainbow trout for aquaculture in all zones. However rainbow trout would be given selective approval in some districts and proposals would be forwarded to the local DFO Introductions and Transfers Committee before permits are issued to move fish to a new location.

Prince Edward Island

Prince Edward Island does not have an Aquaculture Act. The authority to administer aquaculture licensing remains with DFO: however, the PEI Department of Fisheries and Aquaculture deals with the biological and technical development of the industry.

The Prince Edward Island *Environmental Protection Act,* states that no person shall contaminate or discharge harmful substances into waters of PEI, thereby helping to ensure the quality of water including water from aquaculture operations.

The Prince Edward Island Department of the Environment developed "*A Wildlife Policy for Prince Edward Island*" (1995) with the objectives of protecting and enhancing the Island's natural environment, etc. The policy was followed in 1998, by the *Wildlife Conservation Act* that reinforced the policy and provided a legal framework for enforcement. Under 'Aquaculture', the act states; "Specified native and exotic fish and other aquatic species may be kept in captivity for commercial production or for later introduction to the wild under a combination of federal and/or provincial permits that ensure the management needs and concerns described above are met".

The *Policy on Introductions and Transfers of Freshwater and Marine Organisms in the Waters of Prince Edward Island* provides guidelines and conditions that must be met to obtain transfer permits.

The Prince Edward Island *Rainbow Trout Policy* permits the culture of rainbow trout in sea cages. However, there are no sea cages containing rainbow trout and unfavourable environmental conditions preclude the sea cage culture of salmonids in PEI.

FEDERAL-PROVINCIAL POLICIES AND AGREEMENTS

Memoranda of Understanding (MOU)

Memoranda of Understanding for Aquaculture Development have been signed by DFO and the Departments of Fisheries and Aquaculture in both New Brunswick and Nova Scotia. The MOUs define the respective agencys' roles in aquaculture development. The MOUs give leasing and licensing authority and responsibility for their administration to the provinces. Proposals for aquaculture licences and leases are forwarded to DFO for comment and DFO maintains responsibility for its enactment. The MOUs specify shared responsibility for compliance monitoring and research and development.

Prince Edward Island and DFO signed an *Agreement for Commercial Aquaculture Development* in 1987. In PEI, aquaculture development and essentially all aspects of fish farming are managed by DFO. DFO issues aquaculture leases, licences, and transfer licences. Watercourse alteration, well drilling permits, and the enforcement of effluent guidelines are provincial responsibilities.

Introductions and Transfers Committees

Introductions and Transfers Committees have been established in each of the Maritime Provinces. The committees, which include experts in fish biology, habitat management, and fish health from various federal and provincial departments, are always chaired by DFO. All requests for Introduction and Transfer permits must be referred to the appropriate I&T Committee. The committees interpret existing policies and regulations and provide advice on the potential adverse risks that a proposed introduction or transfer may have on wild fish populations, on farmed fish and/or on fish habitat.

INTERNATIONAL CONVENTIONS AND AGREEMENTS

North Atlantic Salmon Conservation Organization (NASCO)

NASCO was established under the Convention for the conservation of salmon in the North Atlantic in 1982. The Organization consists of a Council and three regional Commissions: the North American Commission, the West Greenland Commission, and the North-East Atlantic Commission. The objective of NASCO is to contribute, through consultation and cooperation, to the conservation, restoration, enhancement and rational management of salmon stocks subject to the Convention, taking into account the best scientific advice. NASCO resolutions are not legally binding. However, Canada was party to their adoption and has committed to their implementation.

North American Commission Protocols for the Introduction and Transfers of Salmonids

There are two member states in the North American Commission (NAC), the United States and Canada. The NAC adopted salmon management guidelines entitled "Protocols for the Introduction and Transfers of Salmonids" for the Commission Area (North-eastern USA and Canada) in 1992. They were amended in 1994 and revised in 1998. The 1998 revision has not been ratified by Council but has been circulated for comments. The main elements of the Protocols were little changed in the 1998 revision.

The Protocols were developed to minimize adverse fish health, genetic and/or ecological effects on wild Atlantic salmon populations from introductions and transfers. There is no distinction made among introduced stocks used for aquaculture, commercial sea ranching or enhancement. The NAC area has been divided into three management zones on the basis of habitat degradation and/or wild gene pool perturbation (primarily stocking history). The Maritime provinces and the State of Maine east of Rockland are in Zone II. Maine, west of Rockland is in Zone III

Management guidelines vary by zone and address fish health, source of broodstocks and ecological considerations. A number of protocols have significant implications for the aquaculture industry. Some of the more contentious are:

- Reproductively viable strains of Atlantic salmon of European origin, including Icelandic origin, are not to be released or used in aquaculture in any NAC Zone.
- No live salmonid fishes, fertilized eggs, gametes, or fish products are to be imported from IHN enzootic areas, unless sources have an acceptable history of disease testing demonstrating the absence of IHN.

- Develop domesticated salmon broodstock using local stocks; or, if local stocks are limited, use nearby stocks.
- Non-indigenous salmonid stocks maybe introduced into the wild or used in cage rearing operations if the fish are reproductively sterile and the risk of adverse ecological interactions is minimal.
- In 1997, the NAC agreed that reproductively viable, transgenic salmonids would only be permitted in secure land-based facilities.

Oslo Resolution

In 1994, NASCO adopted a resolution (referred to as the "Oslo Resolution") to minimize impacts from salmon aquaculture on the wild salmon stocks. The Resolution is not legally binding on the members; however there was consensus and each country agreed to work towards the stated objectives. Again, as party to the development of the Oslo Resolution, Canada feels obliged to enact measures in accordance with the Resolution.

The Oslo Resolution affirms that NASCO members shall:

- Cooperate to minimize possible adverse effects from aquaculture on wild salmon stocks.
- Take measures to minimize escapes, straying of ranched salmon, and adverse genetic and other biological interactions from enhancement.
- Take measures to minimize the risk of transmission of diseases.
- Develop practices and foster research and development that will minimize effects on wild stocks and improve effectiveness of the measures contained in the Resolution.

The Annex to the Resolution lists measures that should be implemented. It emphasises measures to prevent interactions of cultured and wild salmon through minimizing escapes and efficient recapturing of escaped fish.

Precautionary Approach

When scientific information is uncertain, unreliable, or inadequate NASCO members agreed to adopt a Precautionary Approach to the conservation, and management of salmon (1998 annual meeting). NASCO's interpretation of the Precautionary Approach can be summarized by the following:

"The absence of adequate scientific information should not be a reason for postponing or failing to take conservation and management measures."

In recognition of the Precautionary Approach member states agreed to:

- Give priority to conservation when the potential for negative impact is uncertain.
- Identify and institute measures to avoid undesirable outcomes.
- Initiate corrective measures without delay.
- Avoid changes that cannot be reversed.
- Place the "burden of proof" on the party advocating change.

The Precautionary approach applies to the entire range of salmon conservation and management initiatives. The Agreement states that the measures contained in the NAC Protocols are consistent with the Precautionary Approach and that its implementation is essential.

Again, the Precautionary Approach agreement is not legally binding, however, since Canada agreed to its adoption, the precautionary principles will be applied. NASCO is presently developing an action plan for application of a Precautionary Approach.

North Atlantic Salmon Farming Industry and NASCO Liason Group

The North Atlantic Salmon Farming Industry and NASCO Liason Group (Liason Group) is an advisory group established in February, 2000 to provide an international forum for liason between the salmon farming industry in the North Atlantic and the relevant authorities responsible for wild Atlantic salmon stocks and aquaculture on issues of mutual interest, and to make recommendations for action. The objective is to establish mutually beneficial working arrangements in order to make recommendations on wild salmon conservation and sustainable salmon farming practices.

International Council for the Exploration of the Sea (ICES)

Code of Practice on the Introductions and Transfers of Marine Organisms, 1994

The ICES Code of Practice provides guidelines designed to reduce the risks of adverse impact from the intentional introduction and transfer of marine organisms. ICES has published two extended Guides to the Code -- the latest entitled "*Codes of Practice and Manual of Procedures for Consideration on Introductions and Transfers of Marine and Freshwater Organisms*". The ICES Code permits broad and flexible application for a wide range of circumstances and requirements. It was used in the development of the NAC Protocols. Member Countries of ICES are obligated to comply with the ICES Code.

Recommendations contained in the ICES Code are divided into five sections. They are:

- Steps to take before introducing a new species.
- Steps to take after deciding to proceed with an introduction.
- Prevention of unauthorized introductions.
- Policies for ongoing introductions or transfers which have been an established part of commercial practice.
- Steps to take before releasing genetically modified organisms.

United Nations

Convention on Biological Diversity (1992)

The Canadian Government with the support from the Provincial and Territorial governments ratified the *United Nations Convention on Biological Diversity* in 1992. As a signatory to the Convention, Canada is bound by its terms. The convention has three broad objectives:

1. The conservation of biological diversity.
2. The sustainable use of its components.
3. The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

Three of the Convention's 42 Articles are of particular relevance to potential interactions between feral and wild salmon populations. These are:

Article 8, "in-situ Conservation" (ensuring the conservation and sustainable use of biological resources).

Article 10, "Sustainable Use of Components of Biological Diversity".

Article 14, "Impact Assessment and Minimizing Adverse Impacts".

Each Member has an obligation to develop a national biodiversity strategy. The Canadian Biodiversity Strategy was published in 1995 and a significant influence on DFO policy with respect to impacts of aquaculture on aquatic biodiversity. The strategy makes specific reference to:

- Strengthening measures to reduce and eliminate the release of substance, or quantities of substances that are harmful to ecosystem, species and genetic resources.
- Reduce to acceptable levels, or eliminate, adverse impacts of species introductions on aquatic biodiversity resulting from aquaculture projects, fisheries enhancement programs and inter-basin transfers of water and organisms.
- Participate in international fisheries conservation efforts to develop and encourage the implementation of ecological management approaches, and to develop sustainable use agreements.

United Nations Convention on the Law of Sea (UNCLOS)(1982) (Pending)

Article 66, "Anadromous Stocks" relates to potential interactions between domestic and wild salmonids. It reads: "... states shall ensure their (stocks) conservation by the establishment of appropriate regulatory measures." UNCLOS has not been ratified and its terms are not binding. However, as a signatory, Canada has committed to the spirit of the Convention.

Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks (1995)(Pending)

This agreement advances the Precautionary Approach, and member states agree to use more caution when information is uncertain, unreliable or inadequate. The Agreement is pending ratification and its terms are not binding. Canada is signatory and will support its implementation.

Food and Agriculture Organization (FAO) - Code of Conduct for Responsible Fisheries

FAO formulated a global *Code of Conduct for Responsible Fisheries* consistent with previous conventions, UN laws, and agreements in 1995. It is non-mandatory, and establishes principles and standards applicable to the conservation, management and development of all fisheries. Although voluntary, some parts are based on international law and agreements. Fisheries apply equally to capture fisheries and aquaculture.

One of the General principles (Article 6.19) is that "States should consider aquaculture, including culture based fisheries, as a means to promote diversification of income and diet. In so doing, States should ensure that resources are used responsibly and the adverse impacts on the environment and on the local communities are minimized."

Article 9 of the Code specifically deals with aquaculture development and sets out principles and standards of behavior for responsible practices with a view to ensuring the effective conservation, management and development of aquaculture resources, with due respect for the ecosystem and biodiversity. The Code promotes sustainable development and steps to minimize adverse effects on environment and adverse genetic, disease and other effects of escaped farmed fish on wild stocks. FAO produced a technical guide that provides general advice in support of the implementation of Article 9. The technical guidelines have no legal status.

L 'Office International des Epizooties (OIE)

The OIE is the world organization for animal health. The OIE set up a specialist Fish Diseases Commission in 1960. The Fish Diseases Commission developed standardized aquatic animal health requirements for international trade in 1995. The standards are found in the OIE International Aquatic Animal Health Code (the OIE Code) and OIE Manual of Standards for Diagnostic Tests and Vaccines. The OIE standards for aquatic animal health are recognized as international standards by the World Trade Organization (WTO).

World Trade Organization (WTO)

The World Trade Organization administers the General Agreement on Tariffs and Trade (1994). GATT includes an agreement on the application of Sanitary and Phytosanitary Measures (SPS) which outlines standards by which countries can establish measures for protecting animal and plant resources, and human health. The WTO also has procedures and rules governing the settlement of trade disputes between countries, including disputes related to fish health issues.

North American Free Trade Agreement (NAFTA)

Signatories to NAFTA include Canada, USA and Mexico. As with GATT, the NAFTA includes a section on SPS, which gives the parties the right to develop measures to protect human, animal or plant life and health.

DISCUSSION

In addition to the many federal and provincial acts, agreements and policies that are designed to protect wild salmon stocks from the possibility of harmful interactions with feral salmon, Canada has entered into numerous international conventions, agreements, and obligations with the potential to impact aquaculture. International agreements can benefit aquaculture by providing consistent standards for conducting business in the global economy and providing mechanisms for protecting domestic aquatic resources from the activities of foreign states.

Although many of the international agreements are not legally binding, it is Canadian policy to uphold commitments endorsed by these agreements. In most cases, DFO personnel represent Canadian interests at international meetings concerned with fisheries management. Since DFO is the lead agency in the administration of fisheries legislation there is little doubt that they influence decisions concerning fisheries management and aquaculture. Although this

Attachment 5. Existing Canadian Laws and Regulation

Law or Agreement	Habitat Protection								
	Water Quality	Physical Alternation	Access Fish Passage	Harvest Regulation	Stock Conservation	Fish Health	Mgmt Coord	Research	Aquaculture
Constitution Act, 1982				X					
Fisheries Act	X	X			X	X		X	
Memo of Understanding on Aquaculture Development: DFO and each province								X	X
Fish Health Protection Regulation						X			
Food and Drug Act						X			X
Pest Control Products Act	X								X
Health of Animals Act						X		X	
Feeds Act									X
Canadian Wildlife Act	X	X				X			
Canadian Environmental Protection Act	X								
Oceans Act	X			X	X		X	X	X
Migratory Birds Convention Act							X		
DFO Policy for Management of Fish Habitat	X	X					X		X
Wildlife Policy for Canada					X				
Federal Aquaculture Development Strategy	X	X				X		X	X

Attachment 6. Existing Maine Laws & Regulation

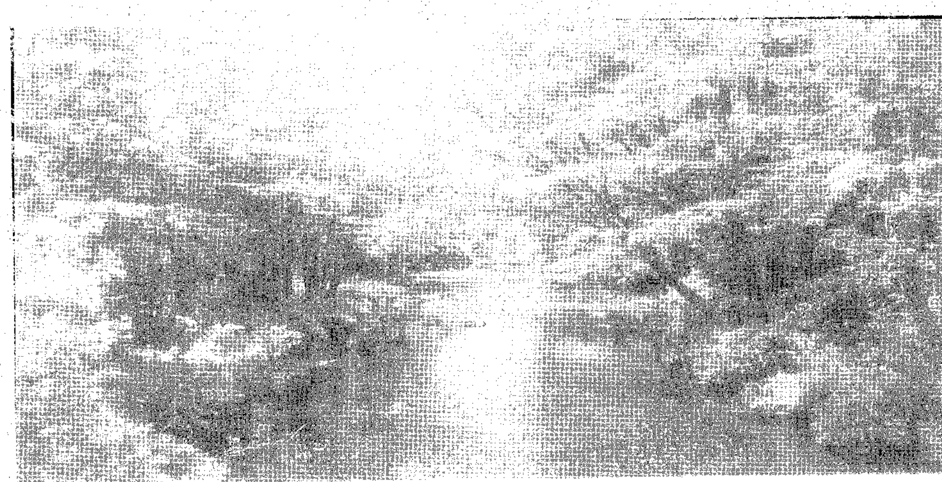
Law or Agreement	Habitat Protection: Water Quality	Habitat Protection: Physical Alteration	Habitat Protection: Access Fish Passage	Harvest Regulation	Stock Conservation	Fish Health	Mgmt Coord	Research	Aquaculture
Land Use Regulation Law, 12 MRSA §§ 681-689	X	X							
Forest Practices Act, 12 M.R.S.A. §§ 8867-8869		X							
Forest Product Refuse Act, 38 M.R.S.A. § 417	X	X							
Fishways Laws, 12 M.R.S.A. §§ 6121-6125			X		X				
Commercial and Sport Fishing Limits, 12 M.R.S.A. § 6553				X	X				
Importation, Leases, Research 12 M.R.S.A. §§ 6071(4), 6072, 6078	X	X			X	X		X	X
Fish hatcheries laws, 12 M.R.S.A. §§ 7611-7674					X				
Fishways and Dams Laws, 12 M.R.S.A. §§ 7701-A to 7702			X						
Maine Rivers Laws, 12 M.R.S.A. §§ 401-404, 405A - 407	X	X							
Water Quality Laws, 38 M.R.S.A. §§ 401-424, 451-452, 464-470, 571	X								
Mandatory Shoreland Zoning Act, 38 M.R.S.A. §§ 435-449, 436-A, 437, 438-A, 439-A – 441, 443-A - 449	X	X							
Natural Resources Protection Act, 38 M.R.S.A. §§ 480-A to 480-U	X	X						X	

Attachment 6. Existing Maine Laws & Regulation	Habitat Protection								
Law or Agreement	Water Quality	Physical Alteration	Access Fish Passage	Harvest Regulation	Stock Conservation	Fish Health	Mgmt Coord	Research	Aquaculture
Site Location of Development Law, 38 M.R.S.A. §§ 481 to 490-J		X							
Maine Waterway Development and Conservation Act, 38 M.R.S.A. §§ 630-637, 640	X	X							
Maine Dam Registration, Abandonment and Water Level Act, 38 M.R.S.A. §§ 815-818, 830-843	X		X						
Oil and Hazardous Materials, 38 M.R.S.A. §§ 543-550	X					X			
Atlantic Salmon Commission, 12 M.R.S.A. §§ 9901 to 9907				X	X		X	X	
The Right to Farm Law, 17 M.R.S.A. §§ 2805	X								
Board of Pesticide Control Laws, 7 M.R.S.A. §§ 601-625, and 22 M.R.S.A. §1471	X								
Manure Handling and Spreading Laws, 38 M.R.S.A. §§ 2701-B, 417-A	X								
Agreement between the State of Maine and the Kennebec Hydro Developers Group			X						
Saco River Agreement	X								
New England Atlantic Salmon Committee				X				X	
Agreement between the State of Maine and the U.S. Fish and Wildlife Service				X			X	X	
New England Interstate Water Pollution Control Commission	X								
Maine Indian Tribal State Commission	X	X							

ATTACHMENT 7

Maine Atlantic Salmon Commission

Atlantic Salmon Conservation Plan
for Seven Maine Rivers



1999 Annual Progress Report

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Acknowledgements

The following organizations submitted reports to the Land & Water Resources Council for use in developing this progress report:

Atlantic Salmon Federation – Maine Council
Cherryfield Foods Inc.
Downeast Rivers Coalition
Ducktrap Coalition
Knox/Lincoln County Soil & Water Conservation District
Maine Atlantic Salmon Commission
Maine Dept. of Inland Fisheries & Wildlife
Maine State Planning Office
Maine Department of Environmental Protection
Maine Department of Agriculture, Food, and Rural Resources
Maine Department of Transportation
Maine Department of Conservation
Maine Department of Marine Resources
Maine Wild Blueberry Commission
USDA Natural Resource Conservation Service
Project SHARE
Sheepscot River Watershed Council
University of Maine Cooperative Extension Service
US Fish & Wildlife Service
Washington County Soil & Water Conservation District
Wyman & Son Inc.

Individual reports form the Appendix.

I. Introduction

Calendar year 1999 marked the second full year of implementation of the State of Maine's Atlantic Salmon Conservation Plan for Seven Maine Rivers (ASCP). Much of the progress achieved in 1999 is attributable to initiatives begun in 1998 and earlier. The State of Maine added several new projects designed to strengthen conservation and restoration work in the seven salmon river watersheds. In several instances, the changes and resulting actions exceed the standards established in the 1997ASCP (http://www.state.me.us/asa/ascp.html). In other instances, State agencies have converted voluntary measures into regulation.

This report will start by summarizing accomplishments made since the ASCP began over two years ago. Following this summary, the report will cover activities during the last year in support of the ASCP as they relate to one or more of the Plan's14 goals. This report should not be considered a comprehensive, cumulative record of all the activities since the ASCP officially started in December 1997. The reader may want to refer to the first annual report, available online at http://www.state.me.us/spo/salmon/annual.htm. Furthermore, there are many conservation and restoration actions that have been in place for many years prior to the ASCP. These actions will also not be catalogued here unless they directly relate to progress on the ASCP in 1999.

Information in this report came from various agencies' and organizations' annual reports on their ASCP activities. These reports are appended to this report. Their content is the responsibility of the submitting organization, not the Atlantic Salmon Commission.

II. Summary of Accomplishments to Date

Under the direction of the Land & Water Resources Council and the Atlantic Salmon Commission's administration, the State of Maine has addressed, and is continuing to work on, threats facing Atlantic salmon populations in the seven rivers of concern (Sheepscot, Ducktrap, Narraguagus, Pleasant, Machias, East Machias, and Dennys). Many organizations and individuals are responsible for the ASCP's progress. As designed, the strength of the program is the cooperative, collaborative approach to solving problems affecting Atlantic salmon and its habitat. Few, if any, of the accomplishments to date can be attributed to a single government agency, business, or non-profit conservation organization. The following is an abbreviated list of accomplishments under the ASCP's four broad categories:

1) Fish Management

A) Fish trapping and counting -- important to assure maximum protection against farmed Atlantic salmon escaping into the rivers, and to have a means to assess Atlantic salmon returns and smolt outmigration.

- Designed, permitted, and constructed fish weirs on the Pleasant and Dennys Rivers. These weirs were in the water by mid-fall 1999, now are in winter storage, and will be back in the water this spring;
- Improved 3 fish passages on Cathance Stream, a tributary to Dennys River by rebuilding a flow control dam at Cathance Lake, replacing a fishway at the Great Works Dam, and improving fish passage at Marion Falls;
- Installed and operated smolt traps on the Narraguagus and Pleasant Rivers;
- Designed a fish weir for the East Machias River and are negotiating to place the weir at its optimal location for fish trapping;
- Currently in the process of modifying the design of the Narraguagus flood control dam at Cherryfield to make the trapping facility there more effective; and
- Have completed preliminary design for a fishway with trap on the Machias River Gorge.

B) Fish stocking -- implementing a long-term plan for recovery of the Atlantic salmon runs in six of the seven rivers.

- Continued river-specific fry stocking in six of the seven rivers, as called for in the Plan;
- Continued the collection of broodstock from five of the seven rivers, also according to the Plan; and
- Stocked adult broodstock back into their river of origin.

C) Fish assessments -- to better understand what is happening in the rivers

- Continued a smolt study on the Narraguagus to better understand parr-to-smolt survival;
- Placed a smolt trap on the Pleasant River to measure downstream migration;
- Continued annual juvenile population assessments on specific reaches of each river; and
- Continued annual redd counts on spawning areas in each of the rivers.

2) Habitat Protection

A. Identification of habitat and habitat requirements

- Completed habitat mapping of critical spawning and nursery areas in each of the seven rivers and distributed the information to regulatory agencies and key landowners;

- Completed a scientifically justifiable buffer methodology (http://www.state.me.us/spo/salmon/), a tool conservationists can use to establish site-specific protective riparian buffers adjacent to important spawning and nursery habitat in cooperation with willing landowners;

- Completed modeling, using Instream Flow Incremental Methodologies (IFIMs) for the Pleasant and Narraguagus Rivers and Mopang Stream (a major tributary to the Machias River), providing information about the flow requirements of juvenile Atlantic salmon along critical reaches of each of these streams; and

- Nearing completion of water use management plans based on this modeling -- with the plan for the Pleasant River due at the end of February 2000 and for the Narraguagus River and the Mopang Stream by June.

B. Protection of habitat

- Acquired, assisted in the acquisition of, or in the process of acquiring 4,806 acres with more than 40 miles of frontage along five of the seven rivers. Supported and worked for passage in November 1999 of a $50 million bond issue to recapitalize the Land for Maine's Future Program which will make additional purchases possible;

- Restricted the direct withdrawal of water during dry summer months for blueberry irrigation through permit conditions each of the last two years by the Land Use Regulation Commission (LURC). Each year, growers had to cease withdrawals during August because they reached the low flow limits. DEP is currently preparing a draft rule to establish minimum flow standards for waters in its jurisdiction;

- Captured $400,000 of funding from the National Fish and Wildlife Foundation for habitat conservation projects over the last 3 years. These funds have contributed to the purchase of riparian habitat, assisted watershed councils, restored eroding riverbanks, and assessed watershed conditions;

- Created 300 linear feet of riparian buffer by fencing out cows and providing an alternative water source away from the Sheepscot River. This project serves as a model for how resource agencies, watershed councils, and landowners can cooperatively solve problems affecting water quality without creating economic hardships; and

- Initiated non-point source inventories and riparian surveys on six of the seven rivers. These surveys will become the basis for remediation projects as specified in local watershed management plans.

3) Habitat Enhancement

- Removed 105 beaver dams on the downeast rivers;
- Improved fish passage by removing most of the remains of an abandoned dam on the Pleasant River known as Cannan Falls;
- Upgraded a number of road crossings, ditches, and culverts on paper company lands in Washington County to reduce nonpoint source pollution and sedimentation. Certain landowners have undertaken a comprehensive improvement plan of their roads and have responded to a survey by LURC, noting non-point source problems, by addressing these areas immediately last summer;
- Held eight workshops promoting forestry BMPs to forestry, logging, and municipal officials.

4) Species Protection

A. Aquaculture/Commercial Fishing

- Completed and implemented a voluntary Loss Control Code of Practices by the aquaculture industry;
- Currently developing a proposed rule to codify these practices, making them mandatory; and
- Adopted a rule requiring gear changes for elver fishermen to reduce by-catch;

B. Recreational Fishing

- Adopted angling rules shortening the catch and release season on the seven rivers; then, following the first annual review of the plan, adopted a rule prohibiting all angling for Atlantic salmon in all Maine rivers;
- Adopted rules for trout, black bass, chain pickerel, and landlocked Atlantic salmon fishing to protect Atlantic salmon.

III. Year Two, 1999

Several significant events and changes occurred over the past year influencing implementation of the ASCP and progress toward achieving the Plan's objectives. Early in the year the Land & Water Resources Council began a process to update the Atlantic Salmon Conservation Plan based on the first year's experience. The LWRC consolidated many of the original ASCP's strategies and actions under 14 distinct goals as a way of simplifying and accounting for a myriad of conservation and recovery measures. Furthermore, the LWRC added several key components to the ASCP including: a peer review of the federal stocking and hatchery program, a prohibition on angling for Atlantic salmon, preparation of locally-generated watershed management plans, pesticide monitoring on each river, rule making to codify loss control standards for aquaculture facilities, and a comprehensive review of all freshwater stocking programs in the seven river watersheds.

Scientists discovered a previously undetected fatal virus known as the salmonid swimbladder sarcoma virus (SSSv) in the federal fish hatchery in North Attleboro, Massachusetts, which was holding Pleasant River Atlantic salmon. Subsequent testing at the Craig Brook National Fish hatchery and at a private hatchery on the Pleasant River revealed positive existence of SSSv . Although there has been no occurrence in this country, Canadian scientists reported an outbreak of infectious salmon anemia (ISAv) in nearby New Brunswick, Canada. In each case, federal and private aquaculturalists in Maine took steps to increase their detection of these diseases. The Maine Departments of Marine Resources and Inland Fisheries and Wildlife jointly developed regulations adopting comprehensive fish health standards and protocols. The Fish Health Technical Committee, comprised of veterinarians from industry and government, initiated steps to screen for SSSv in other rivers and river specific stocks. Private aquaculture companies and government veterinarians initiated new fish health protocols designed to increase early detection of ISAv and control disease transmission.

Effective July 1st, the Maine State Legislature reorganized the Atlantic Salmon Authority into the Atlantic Salmon Commission (ASC), provided it with an Executive Director position, and made it responsible for the administration of the ASCP. The Legislature also substantially increased funding to the ASC providing over three times the amount of State funds from previous years.

In November, Maine voters approved a $50 million bond to recapitalize the Land for Maine's Future (LMF) program. Already, LMF has assisted in some important riparian conservation projects along three of the salmon rivers. The Atlantic Salmon Commission anticipates that new projects to protect critical habitat will favorably compete for the new funds.

Several local watershed conservation groups continued to evolve initiating projects and creating excellent opportunities for habitat protection projects over the coming months. With assistance from Project SHARE and the State of Maine, volunteers continued to catalogue watershed and riparian conditions on several of the downeast rivers. On the Sheepscot River, conservationists completed non-point source surveys, started protection projects, and secured an important parcel of riparian habitat at the confluence of the West Branch and Main Stem. The Ducktrap Coalition continued its superlative habitat protection strategy by permanently protecting significant portions of the watershed. Interested people can view many of these local accomplishments by visiting a website devoted to salmon habitat conservation by river watershed (http://www.asf.ca/MaineCouncils/).

The following summary, goal by goal, briefly highlights progress and challenges toward the ASCP's implementation. For some goals there are multiple organizations involved, each taking on responsibilities that are consistent with their identity. For example, multiple organizations are working on reducing non-point source pollution from either a regulatory approach or through contact with landowners and professionals working in salmon river watersheds. In most cases, lead agencies or organizations rely upon a wide variety of partners to achieve results. Most goals and related action strategies require a high degree of cooperation and coordination among participants. While individual organizations are constantly seeking improvements, this cooperation has become a hallmark of the ASCP's implementation to date.

Habitat Protection

Goal: 1) To further protect important in-stream Atlantic salmon habitat and adjacent riparian areas

Progress toward Goal: In 1999 the State of Maine and local partners initiated several important riparian land protection projects that provide direct benefits to Atlantic salmon habitat. On the Ducktrap River, the Coastal Mountains Land Trust acquired 70 acres (LaCombe project) in the watershed including 2640 feet of riparian buffer adjacent to critical spawning and nursery habitat. On the Sheepscot River, the Sheepscot Valley Conservation Association completed a significant land purchase that also permanently protects important Atlantic salmon habitat from potentially-damaging, adjacent land uses. The Land for Maine's Future (LMF) Board approved funding for riparian land purchases on the Machias and Narraguagus Rivers. LMF staff at the State Planning Office are working to complete these two projects. The Narraguagus project will eventually provide a permanent site for studying downstream smolt migration and the Machias project will protect important adult and juvenile habitat. The State Planning Office continues to work with a large forest landowner on a habitat management agreement including a permanent protection component to protect prime spawning and nursery areas. The ASC remains cautiously optimistic that the State and its partners will meet this goal's benchmark (50% of critical spawning and nursery areas protected) soon, pending the outcome of ongoing negotiations.

Findings: The ASCP's benchmark (ASCP –Amendment 4/23/99) calls for The State of Maine and associated partners to protect 50% of the critical spawning and nursery areas through management agreements, conservation easements, or acquisition by December 2000 [note: a previous version of the amended plan erroneously indicates a "December 1999" completion date]. Coastal Mountains Land Trust, with assistance from the State of Maine and several other organizations, has exceeded this benchmark by permanently protecting over 60% of the Ducktrap River. While the State Planning Office and local partners continues to pursue habitat protection under this goal, it is apparent that the benchmark is ambitious for most rivers. Agreements and purchases involving land are complex and time consuming. Any change to the

ASCP's benchmark should account for the nature of land protection and the sheer number of potential projects along each river. Concurrently, permanent habitat protection projects should remain a high priority with the Atlantic Salmon Commission and the State Planning Office. Recognizing the importance of this goal for the long term health of salmon populations, the Atlantic Salmon Commission will provide additional resources to develop worthy projects and assist local land trusts to protect (see IV. Conclusions/ Recommendations) important Atlantic salmon habitat.

Goal: 2) Improve or maintain water quality for Atlantic salmon in each of the rivers

Progress toward Goal: Several State Agencies, landowners, and local conservation organizations led and participated in projects toward this goal. The goal's broad nature means that there are numerous entities that are involved in maintaining or improving water quality in each watershed. For example, it is not unusual to find a county Soil & Water Conservation District working with an individual landowner to reduce the risks of excessive sediment movement, while at the same time the Maine Forest Service might be holding a workshop promoting practices that also reduce soil disturbance. Many of the programs are initiatives that organizations started years ago to address non point source pollution. These programs range from State and municipal shoreland regulations (and associated enforcement) to volunteer programs educating landowners about using best management practices (BMPs) to reduce non-point source pollution. The effectiveness of non-point source reduction and education programs are difficult to measure. The amount of non point source loading in the salmon rivers and tributaries depends on how much precipitation the area receives during a given storm and the quality and location of the land uses in and around the streams.

The following organizations led training and workshops aimed at protecting water quality in the salmon river watersheds through the use of BMPs and recognition of regulatory requirements.

Maine Department of Environmental Protection
Maine Forest Service
Washington County Soil and Water Conservation District
Knox-Lincoln County Soil and Water Conservation District
Natural Resource Conservation Service
University of Maine Cooperative Extension Service

The Land Use Regulation Commission (LURC) hired an additional staff person during the summer to help observe compliance with LURC's Districts and Standards in the field in the downeast salmon river watersheds. Working with an enforcement professional, the intern identified 34 possible non point source problems. Each site represented a minor problem and did not violate any land use standards. LURC staff brought these findings to the attention of the appropriate landowner, who took immediate corrective action.

The Maine Department of Transportation (MDOT) Office of Environmental Services took a very active role in promoting non point source pollution reduction within the seven river watersheds. Aside from extensive in-house training about the sensitive nature of Atlantic salmon habitat, MDOT carefully designed and executed their road and bridge construction projects in each of the seven river watersheds. Often MDOT consulted with local conservation groups prior to and during construction and responded to problems brought to their attention by improving road crossings and stabilizing road banks. MDOT is not named as a participant in the ASCP but has willingly and eagerly contributed to protecting water quality and helping local conservation organizations by ensuring their activities cause negligible harm. These efforts are additional to the requirements of the ASCP.

The University of Maine Cooperative Extension Service conducted several workshops throughout 1999 aimed at educating blueberry farmers about Integrated Pest Management and Integrated Crop Management, BMPs for pesticide use. Wild blueberry growers and the University successfully petitioned the Board of Pesticide Control to make changes to application practices, reducing levels of hexazinone in ground water.

Several local organizations made strides in assessing and cataloguing potential non point source problem areas in their river watersheds. Project SHARE, with help from volunteers, prepared a report documenting riparian conditions on the Narraguagus and Pleasant Rivers. Additionally, with the assistance of a so-called Section 319 grant from the Maine Department of Environmental Protection, local conservationists are compiling an inventory of watershed conditions that could affect water quality on the Narraguagus and Pleasant Rivers. These reports are the basis for restoration priorities and actions local groups will address over the next three years. Moreover, this information will also be incorporated into local watershed management plans as called for in the Amendments (4/23/99) to the ASCP.

In summer 1999, the State Planning Office (SPO) worked with the Maine Conservation Corps to document potential non-point source problems along important stretches of the Machias and East Machias Rivers. Currently, SPO is compiling the information from these surveys and will provide a written report to the Downeast Rivers Coalition for follow up action.

Elsewhere, the Sheepscot River Watershed Council (SRWC) completed a survey of non-point sources problem areas and riparian conditions also with the assistance from a Section 319 Grant and SPO. The Sheepscot Valley Conservation Association developed a tracking system for monitoring non point source pollution using the geographic information system (GIS). The Knox-Lincoln Soil & Water Conservation District (SWCD), using a DEP Section 319 grant, successfully developed alternative water sources for a farm in Weeks Mills along the West Branch of the Sheepscot River and create a non-accessible buffer to keep livestock out of the river. Using riparian surveys of the Main Stem and West Branch of the Sheepscot River, the SRWC and its partner organizations will systematically address non-point source problems similar to the farm project in Weeks Mills.

The Ducktrap Coalition completed a survey of riparian conditions as part of their contract with SPO. The Ducktrap River is not subject to the same types of land use activities as the other salmon rivers and the Ducktrap Coalition instead is concentrating on permanently protecting and improving in stream and riparian habitat through acquisition and easement. For example the Coastal Mountains Land Trust successfully purchased an old gravel pit and then the Ducktrap Coalition restored the property, which had been eroding into the river.

In 1999, The Department of Environmental Protection (DEP) hired a part time water quality monitoring coordinator to work with local volunteers on each of the rivers to collect baseline samples. Over winter 1999 an ad hoc group of water quality experts and salmon biologists developed a plan for capturing samples of parameters important to salmon survival, behavior and production. These parameters include: ph, conductivity, turbidity/water clarity, temperature, presence/absence of stoneflies as indicator of toxicity, alkalinity, and a suite of pesticides known to be used in forestry and agriculture. The object of the first year of sampling was to establish baselines for each river system. These baselines will allow the State of Maine to better evaluate measures to maintain or improve water quality over time.

Findings: The State and its partners have made substantial progress in implementing all projects related to water quality, laying the groundwork, as the ASCP envisions, for improving, maintaining, and ongoing monitoring of water quality in the seven rivers. DEP classifys six of the seven rivers as Class AA, the State's highest water quality classification. Additionally, the Maine Legislature upgraded several tributaries of the Narraguagus, Machias, and East Machias Rivers to Class AA.

Volunteers and professional staff continue to document riparian and watershed conditions on six of the seven rivers, having previously completed this work along the Ducktrap River. So far, these inventories have led to positive restoration actions in several of the rivers and will likely result in additional projects in 2000. Regulations designed to protect water quality coupled with local surveys and restoration activities are providing protection and incremental improvement to water quality on the salmon rivers. Future protection and improvement will depend on the commitment by regulators and volunteers to cooperatively work with landowners to find alternatives to problem practices and conditions.

Goal: 3) To ensure water withdrawals do not adversely affect Atlantic salmon

Progress toward Goal: The Maine State Planning Office, with the aid of Kleinschmidt Associates and a technical advisory group, completed an Instream Flow Incremental Methodology (IFIM) for the Pleasant, Narraguagus Rivers, and the Mopang Stream. This information establishes the optimal flow requirements of juvenile salmon on representative reaches in these three rivers. At its May meeting, the Land & Water Resources Council recommended that the Land Use Regulation Commission (LURC) restrict water withdrawals from the

Pleasant River to flow rates of 36 cubic feet per second (cfs) in July and 30 cfs in August and September in response to a permit request by Cherryfield Foods Inc. (CFI). The technical team, comprised of State and federal officials, consulting experts, and industry representatives, confirmed these flow rates as optimal to sustain Atlantic salmon habitat based on the IFIM analysis for the Pleasant River. LURC applied these permit restrictions to over a dozen different pumping sites in the three rivers. Unfortunately, flows in all the river downeast were at record lows due to the lack of rainfall last summer. This was the second abnormally dry summer in a row. CFI abided by the permit conditions despite the need for water for irrigation.

SPO convened a group of stakeholders and technical people to serve on an advisory committee overseeing the development of water use management plans for the Narraguagus, Pleasant Rivers and the Mopang Stream. This group met on seven occasions during 1999 to review the IFIM analysis and to understand the model the consultant is using to evaluate various alternative water sources. Currently, the U.S Army Corps of Engineer's consultant is completing the Pleasant River Water Use Management Plan and will have the other two written by June 2000. When complete, these plans will provide a valuable tool to help evaluate specific irrigation project proposals. Additionally, the water use management plans will identify several options to direct withdrawals during low flow periods such as storing water in reservoirs, irrigating from wells, and recharging ground water aquifers.

Findings: The State has made substantial progress toward the goal of protecting Atlantic salmon habitat from excessive water withdrawals. By setting limits based on sound scientific analysis, the State has established a policy that protects salmon habitat. LURC has adopted these standards into permit conditions. In order to consistently apply this policy, the Department of Environmental protection is drafting rules that incorporate the use of the best available information into future permitting decisions effecting stream flows. The Land Use Regulation Commission will continue to apply restrictions to water withdrawals from the Mopang Stream, and the Pleasant and Machias Rivers. The State is awaiting completion of the water use management plans by the U.S Army Corps of Engineers' consultant, and expect the Pleasant River Plan in February and the other two by June.

Goal: 4) To make historical habitat areas accessible to migrating Atlantic salmon

Progress toward Goal: In Fall 1999, Atlantic Salmon Commission biologists with assistance from the Atlantic Salmon Federation, volunteers and prisoners from a nearby correctional facility, removed 75 beaver and debris dams. This improved fish access by allowing fish to pass these obstructions without damaging their scales or fins. Additionally, the Atlantic Salmon Commission improved fish passage on Cathance Stream (tributary of the Dennys River) by repairing and improving existing fish ladders at Greatworks Dam and Marion Falls and repairing the Cathance Lake Dam to improve flows over its fish ladder. Another important project last summer was Champion International's removal of remnants of the old dams at Cannan Falls on the Machias River. This dam did not severely restrict fish passage but improvements to the site have resulted in restored riparian habitat, less erosion, and a free flowing river that mimics the river's natural state.

Findings: The State and its partners have substantially achieved the goal increasing accessibility to historic habitat improving fish passage. Because beaver populations are robust, removing their dams will be an annual activity each fall. Continued removal of beaver dams will allow returning adult spawners, overtime, to access important tributaries on a regular basis.

Habitat Enhancement

Goal: 5) To protect, enhance, and restore high and moderate value wetlands

Progress toward Goal: DEP has set up a registry of wetlands that applicants could draw upon for wetland mitigation projects. To date, DEP has not identified any high or moderate value wetlands that are degraded within the seven salmon watersheds. DEP is awaiting the completion of the Casco Bay assessment model to see if it could be applied to the salmon rivers. DEP staff anticipate completing the model in April 2000. If applicable, the model will help identify and highlight those wetlands that are of high value for water quality and fish habitat.

Both DEP and LURC processed applications for wetland alterations as part of their ongoing programs. There were few applications in the salmon watersheds to alter wetlands. Each agency has provided permitting staff with salmon habitat information and made staff aware of the sensitive nature of the salmon rivers.

In 1999 DEP processed one wetland permit in the seven salmon river watersheds. This project was located in Boothbay where the applicant was requesting to alter a wetland for a golf course expansion. The project was subject to DEP standards including compensation for impacts to the wetland. The project location is low in the Sheepscot River watershed with the area draining into the coastal estuary. Thus, there are no effects to Atlantic habitat from this project.

LURC's Districts and Standards regard flowing or standing waters as high value wetlands. In 1999 LURC issued four permits where wetlands were involved. Two involved stream crossings and two involved water withdrawals. In each instance LURC required the applicant to minimize impacts on the wetlands or restrict water use to protect Atlantic salmon habitat.

Findings: Based on the level of wetland alterations requiring a permit in the salmon watersheds during 1999, water quality and quantity have not been negatively affected by wetland projects. Continued vigilance by DEP and LURC should continue to provide adequate protection to wetlands. Once the assessment model is working, regulators, landowners, and local conservationists will have additional information identifying important wetlands for fisheries.

Species Protection

Goal: 6) Eliminate risk to Atlantic salmon from recreational angling or poaching

Progress toward Goal: The Atlantic Salmon Commission drafted and adopted rules (effective 12/30/99) prohibiting angling for sea-run Atlantic salmon in any Maine waters. This controversial action is a clear demonstration that the Atlantic Salmon Commission is committed to eliminating risks that compromise a salmon population's ability to thrive.

Wardens from the Maine Department of Inland Fisheries and Wildlife (IFW) continued their targeted patrols of the salmon rivers from April to November. Wardens logged over 700 patrol hours and did not uncover any poaching activity. During the last season of legal angling for the foreseeable future, wardens recorded anglers catching and releasing 13 juvenile salmon and only 1 adult, a grilse.

Findings:. The State is meeting the goal of eliminating risks posed by recreational angling or poaching. With the closure of the salmon fishery from angling, wardens will continue to concentrate on poaching activities. IF&W's angler education program will help reduce trout fishermen from incidentally catching Atlantic salmon in the seven rivers.

Goal: 7) To reduce the by-catch of salmon from riverine and estuarine commercial fishing activities

Progress toward Goal: Though not a directive in the ASCP, the Maine Legislature further restricted the elver fishery in 1999 by reducing the number of licenses available. This coupled with a depressed demand for elvers and a shortened season meant that few people fished for elvers in the salmon rivers in 1999. In fact, there were a total of 25 fyke nets on the salmon rivers with none sited on the Dennys or Sheepscot. Marine wardens observed no incidental catch of salmon from these operations and that they each include the required exclusion panels. After reviewing data, a DMR intern concluded that there was a low risk of by-catch from alewife or rainbow smelt fishing in the salmon rivers due to the location, timing, and amount of these fishing activities. Essentially, there is very little commercial fishing for alewives and even less for rainbow smelts. The Atlantic Salmon Commission does not consider by-catch of Atlantic salmon to be a problem due to oversight by marine and inland wardens and the level of activity.

Findings: Through the efforts of the Department of Marine Resources (DMR), in cooperation with the Department of

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Inland Fisheries and Wildlife, the State continues to meet this goal. Continued monitoring of these commercial fisheries will ensure that by-catch of Atlantic salmon remains a very low risk.

Goal: 8) To appropriately control natural predation of adult and juvenile Atlantic salmon in the rivers and estuaries

Progress toward Goal:. Predators of concern are double-crested cormorants and harbor seals, both of which are protected by Federal law. The ASCP (4/23/99) amendments call for the National Marine Fisheries Service (NMFS) and the US Fish & Wildlife Service (USFWS) to "develop federal depredation control policies to address threats to Atlantic salmon restoration." NMFS did not submit an annual report of their Conservation Plan activities and accomplishments to the Atlantic Salmon Commission. The USFWS's report mentions nothing about their responsibilities under this goal.

Findings: There continues to be much concern about the effect on salmon populations from natural predators, most notably seals and cormorants. Until there is some indication on the part of the federal services to seriously consider waivers to the Marine Mammal Protection Act or the Migratory Bird Act or population control policies, there appears to be little opportunity to control this problem, or at least complete research that would reveal the magnitude of the predation problem.

Goal: 9) Reduce the effect of competing fin fish species on Atlantic salmon populations

Progress toward Goal: The ASCP calls upon fisheries biologists from IF&W and the ASC to develop a Memorandum of Agreement on stocking programs after assessing current stocking practices to identify conflicts. IF&W has begun to compile information about finfish stocking programs in the seven salmon rivers. By Spring 2000 ASC and IF&W biologists will present recommendations to the Atlantic Salmon Commission aimed at minimizing any negative impacts from finfish stocking.

Findings: The steps associated with this goal are scheduled for completion in Spring 2000. Biologists must prepare recommendations early enough so that stocking professionals may institute any proposed changes to their schedules before the stocking of salmon and other freshwater finfish commences.

Goal: 10) To reduce the potential risks of pen raised fish interbreeding and competing with wild Atlantic salmon

Progress toward Goal: The Atlantic Salmon Commission constructed fish weirs on the Pleasant and Dennys Rivers. Each weir was operational for a couple of weeks in Fall 1999 before a contractor removed the structures for winter storage. Biologists discovered several minor design problems that engineers will correct before a contractor places the weirs back in the rivers in Spring 2000. Designs for a weir on the East Machias River have progressed, however, to date the Atlantic Salmon Commission has been unable to secure permission from the landowners of the preferred site to use their land to stage construction and weir operation. Engineers and biologists have prepared preliminary designs and costs for a fishway (and trapping facility) for the Machias River.

The combination of the two new weirs, the trapping facility at the dam on the Narraguagus, and the industry driven loss control code of practices has significantly reduced the threat of potential interactions between salmon in three of the five downeast rivers. With a weir on the East Machias River, improvements made to existing hatchery facilities, and adherence to containment practices with regulatory oversight will further reduce risk of potential interactions. A fishway and trap on the Machias River will enhance protections on that river which already has in place a natural barrier (Machias River Gorge) that already provide a reasonably effective barrier to farm fish attempting to swim up river. In addition, the two remaining rivers, the Ducktrap and Sheepscot, are sufficiently distant from current commercial aquacuture pens so as to not present a realistic risk of potential interaction.

The Aquaculture Industry operated its facilities under the second year of the industry's voluntary code of containment practices. In response to concerns about the effectiveness of voluntary management practices, the Department of Marine Resources is developing draft rules codifying the industry's containment code of practices. The Land & Water Resource Council approved this measure as an amendment to the ASCP on March 18th. DMR suspended the proposed rule making on containment standards and procedures in light of the federal government's listing proposal under the Endangered Species Act, and is currently considering an appropriate regulatory mechanism.

. Atlantic Salmon Commission biologists took samples from juvenile salmon in the Pleasant River to determine their origin. Laboratory results are not available yet. In addition, this study will help determine whether hatchery-raised salmon are escaping from these private hatcheries in any significant numbers.

Findings: The State of Maine and its partners have made significant progress toward reducing potential interactions between farmed and wild fish than ever before during 1999. With additional trapping facilities in place in 2000, potential interactions will be further reduced. Current challenges include obtaining landowner permission on the East Machias River, funding for the fishway at the Machias River Gorge, and obtaining operating funds for removing and installing the weirs each fall and spring.

Goal: 11) To reduce the potential of disease transmission between farmed fish and wild Atlantic salmon

Progress toward Goal: In 1999 the State of Maine made substantial progress toward this goal by taking several important steps to protect salmonids from disease. The Department of Marine Resources (DMR) and the Department of Inland Fisheries & Wildlife (IF&W) promulgated rules in July that establish pathogen testing procedures and set standards for introducing of salmonids into Maine waters. This new rule improves the State's response and effectiveness in preventing disease transmission and containing diseases that are detected through new, sensitive testing procedures. Moreover, for the first time, fish health rules cover protocols and standards in both commercial and public fish rearing facilities. Importantly, the rules do not merely cover known pathogens and viruses, but rather establish a mechanism for detecting and then responding to new disease threats. The new rule also prescribes standards for biosecurity for all fish culturing operations covering, but not limited to, testing levels and frequencies, restrictions on equipment reuse, and prohibitions on transfers of fish, eggs, or milt. The new fish health rules have greatly improved disease detection, response, and transmission prevention. Maine can now boast a level of sophistication in disease prevention and control related to fish culturing equal to standards in other agricultural, animal husbandry disciplines.

The new rule establishes a Fish Health Technical Committee (FHTC) comprised of veterinarians from industry and government. These individuals advise the Commissioners of Marine Resources and Inland Fisheries & Wildlife on technical fish health issues related to disease control. Since its inception the FHTC has helped hatchery technicians manage a new retrovirus (SSSv), advised commercial operators on biosecurity measures, and recommended actions to reduce disease transmission from fish wastes. The latter led DMR to promulgate rules prohibiting fish processors (or anyone) from discharging fish waste into coastal waters. For example, DMR prohibited the use of salmon "racks" (fish waste left from filleting process) as lobster bait. This action helps prevent the spread of Infectious Salmon Anemia virus (ISAv), a lethal virus that has occurred in New Brunswick, Canada. After extensive testing and surveillance, ISAv has not surfaced in any Maine salmonids.

DMR funded a biosecurity audit to assess the performance of different companies biosecurity practices. The audit determined that the whole the industry has made significant improvements but concluded that improvements to certain aspects of sea cage operations are necessary to further reduce disease.

Findings: With the new rules in place, the State of Maine is poised to become a leader in disease detection and control of cultured and wild salmonids. For the first time fish health standards apply evenly to commercial and public hatchery facilities. Moreover, the new rule provides mechanisms to quickly respond to diseases as yet discovered. With the oversight of veterinarians serving the FHTC, the State of Maine has significantly improved its capability to reduce disease transmission between farmed and wild salmonids, and thus is substantially achieving this goal.

Fish Management

Goal: 12) To achieve optimal smolt production commensurate with the habitat's production capacity

Progress toward Goal: Atlantic Salmon Commission and US Fish & Wildlife Service biologists continued their program of broodstock collection and fry stocking into five of the seven rivers. During the summer they collected parr from the Dennys, East Machias, and Sheepscot Rivers to raise in river-specific facilities at the Craig Brook National Fish Hatchery as future captive spawners. The annual broodstock collection program allows biologists to supply each designated river with enough fry to saturate known juvenile habitat in hopes that many will survive to become out-migrating smolts.

Last spring, biologists stocked, in total, 1.2 million fry into the Sheepscot, Narraguagus, Pleasant, Machias, East Machias, and Dennys Rivers and are expecting to place similar numbers of fry into the same rivers over the next three to five years. Fisheries experts halted the stocking program on the Pleasant River due to concerns about a newly detected retrovirus (SSSv) found in captive Pleasant River fish.

Researchers conducting a NOAA-Fisheries sponsored study on the Narraguagus River collected data for the third year on smolts leaving the river. Researchers continue to analyze the data accounting for smolt that survived but did not leave the river system until the following spring, which may affect the preliminary survival rate data. Due to the short duration of the study and factors influencing survival estimates, the Atlantic Salmon Commission cannot draw any conclusions as to whether the early study results represent a trend or if the study has any relevance to other rivers' smolt populations.

Findings: Smolt survival on each river is critical to a successful restoration of river populations of Atlantic salmon. Engineers are designing smolt traps for the Dennys and Pleasant River weirs to begin to gain a more accurate picture of smolt survival in those rivers. Biologists will continue to trap smolts on the Narraguagus to supplement existing data. Additional research is needed to determine the nature and extent of apparent declines in parr to smolt survival rates among all the rivers.

Goal: 13) Ensure that the current stocking/hatchery program for river-specific Atlantic salmon adapts to the best available science

Progress toward Goal: During Spring 1999 the Land & Water Resources Council (LWRC) amended the Atlantic Salmon Conservation Plan in response to concerns it had about certain aspects of restoration initiatives and conservation efforts. Understanding the effectiveness of the current stocking and hatchery program in restoring populations in six of the seven rivers was a primary concern of the LWRC and it added this goal to the ASCP. Accordingly, the State of Maine called for a comprehensive, independent peer review of the Atlantic salmon stocking and hatchery program.

Findings: Unfortunately, the State of Maine was compelled to withdraw its support for the process that was established early in 1999 to conduct a peer review out of concern for the composition of the review panel. Nevertheless, an objective review remains an important undertaking and the State will be appropriately considering options for reinitiating the review process.

Goal: 14) To annually assess stocks of wild Atlantic salmon and accurately estimate populations in each of the seven rivers to allow adjustment to stocking requirements and management measures

Progress toward Goal: The ASC has made significant progress toward achieving this goal with the addition of two, new fish counting weirs. As in past years, salmon biologists spend considerable time and effort measuring the health of Atlantic salmon populations in each of the seven rivers. Weather conditions, flow rates, available equipment, and skill play a role in biologists' ability to accurately calculate the runs in each river. Years of experience have endowed biologists with a good base of indicators to help measure the health a given river's population. The following population figures (preliminary for 1999) show numbers of observed, adult Atlantic salmon for each of the seven rivers since the beginning of the ASCP.

RIVER	ADULT COUNT 1997, 1998, 1999	ROD CATCH 1997, 1998, 1999	REDD COUNT 1997, 1998, 1999
Sheepscot	n/c	0, 0, n/a	8, 2, 21
Ducktrap	n/c	0, 0, n/a	2, 9, 29
Narraguagus	31, 22, 34	13, 15, n/a	75, 63, 43
Pleasant	n/c	0, 0, n/a	1, 2, 0
Machias	n/c	10, 5, n/a	57, 74, 46
East Machias	n/c	0, 0, n/a	11, 74, 24
Dennys	n/c	10, 0, n/a	37, 32, 23
TOTALS	31, 22, 34	23, 20, n/a	196, 249, 186
		n/c means no count in any year n/a means not available in 1999	

Salmon biologists continued to estimate juvenile populations in each river by measuring densities of parr through electrofishing. These data are not yet available.

Findings: There are several factors that confound biologists as they assess populations of native Atlantic salmon in the seven rivers. During the fall, unless weather and flow conditions are favorable, biologists frequently cannot finish the redd count by the time winter conditions set in. In 1999, these factors were less of a concern as biologists were able to complete redd counts before the onset of winter. Another factor impacting the number of redds is stocking of mature broodstock which often successfully spawn. In the fall (1999), biologists released far fewer broodstock back into the rivers, than in the previous three years, which may account for the proportionally lower number of redds last fall.

Biologists were only able to accurately count adult Atlantic salmon returning to the Narraguagus up until the Fall 1999, previously relying mostly on redd counts and rod catch information to assess a population's relative health. The ASC increased its capacity to monitor adult returns on the Pleasant and Dennys Rivers in 1999 and will expand its capacity on the East Machias and Machias Rivers in 2000.

Weirs and downstream trapping facilities will greatly aid biologists in assessing populations in the Pleasant, Dennys and the East Machias Rivers. Biologists will continue to rely upon field observations for the Ducktrap and Sheepscot counts. With a trapping fishway on the Machias and an improved dam structure on the Narraguagus, biologists will be able to gather more accurate adult return information.

IV. Conclusions / Recommendations

During the last 12 months the State of Maine and its partners have made steady and substantial progress toward meeting the ASCP's goals. Notably, fish health standards and protocols are more comprehensive than ever before, weirs are shielding native Atlantic salmon from aquaculture strays, and the State has limited direct water withdrawals from certain rivers to protect Atlantic salmon habitat. A consortium of volunteers and professionals have begun water quality monitoring on each identified salmon river, the State prohibited angling for Atlantic salmon throughout Maine, and many organizations, government agencies, and landowners have documented and are addressing a variety of non-point source pollution problems. Biologists continue to implement recovery measures through population assessments and scientifically based stocking programs, work continues toward permanent protection of critical riparian habitats on each river, and conservationists improved fish passage by removing beaver dams and upgrading fish passage facilities. Many of these actions and results stem from initiatives begun in 1998 the same way that much of the ASCP related work in 1999 lays the foundation for additional successes in 2000. For example, the work of local conservation groups to catalogue non-point source pollution problem areas and riparian conditions will lead to actual site restoration work in 2000. Similarly, discussions with key riparian landowners should result in additional permanent protection projects along important stretches of the seven rivers. While some conservation actions in 1999 yielded immediate, tangible results, many ASCP actions will not come to fruition for several years.

Several of the ASCP goals and associated tasks need additional attention in 2000. For example, lead agencies and organizations must monitor implementation and adherence to best management practices (BMPs) to evaluate their effectiveness. The Atlantic Salmon Commission (ASC) recommends that State agencies who promote BMPs as an effective way of protecting water quality, amend their ASCP workplans to annually assess rates of BMP use in each of the salmon river watersheds.

The ASCP's partners concerned with permanent protection of riparian habitat will require a heightened level of effort to achieve significant results in 2000. With new Land for Maine's Future funds, there is an opportunity to accelerate riparian protection projects. Enhanced coordination between State agencies and land conservation organizations for funding and project development will be necessary in 2000. The ASC recommends that it hire a part-time land protection specialist to develop projects and coordinate with State agencies and land trusts on riparian habitat protection projects.

While the ASC has completed construction of two fish weirs, two more trapping facilities are needed to fulfill the State's obligation under the ASCP, a weir on the East Machias River and a trapping facility on the Machias River. The ASC intends to complete both of these projects during the year 2000.

Several local conservation groups have successfully begun to document watershed and riparian conditions that are in need of improvement such as, but not limited to, poor salt and sand storage locations, unbuffered stream banks, eroding road shoulders, misplaced culverts, and inadequate stream shading. These inventories represent a critical first step in preparing functional watershed management plans. The ASC recommends that DEP amend its ASCP workplan to provide finite, targeted technical assistance to watershed councils preparing watershed management plans. DEP may assist by providing a citizens' guide and template for a river watershed management plan, training local conservationists about preparing watershed management plans, and providing technical review to plan drafts.

Finally, the ASC's new role as administrator of the ASCP requires that it closely monitor progress on a wide variety of tasks designed to protect and enhance Atlantic salmon and its habitat. Much of the field data is collected by, and held in files within various agencies working in the salmon river watersheds. The ASC is building a central database of Atlantic salmon and habitat related information and needs the cooperation of all organizations that are collecting this field information. The ASC recommends that each State Agency amend its ASCP workplan to provide up-to-date geographically referenced (GIS compatible) information (where applicable) to the ASC each quarter. The ASC will work with each agency to come up with an appropriate format and protocols for information that they can share routinely. In turn, the ASC will make its comprehensive database available to all cooperators for use in their own efforts to protect and restore habitat.

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Section 1 – State Agency Reports

Maine Dept. of Agriculture, Food and Rural Resources - Atlantic Salmon Conservation Plan - Annual Report

Date: December 15, 1999

Goal # 2: Improve or maintain water quality for Atlantic salmon in each of the rivers.

Project	*Responsible Person*	*Worktask*	*Subtasks or Necessary Steps*	*Completion Date*	*Comments / Status*
Project D: Set up non-point source (pesticides) pollution reduction programs targeting agricultural, forestry and other activities to reduce water quality impacts.	Robert Batteese	1. The BPC will identify the specific pesticides used for agricultural, forestry and other purposes and where they are applied in the seven Atlantic salmon river watersheds.	Specific pesticides used by the blueberry and forestry industries have been identified. Water quality monitoring program will look for these pesticides in water samples.	5/99	The primary pesticides used in blueberry culture are hexazinone an herbicide, azinphos-methyl and phosmet which are insecticides and propiconazole a fungicide. In forestry the primary pesticides used are tricolpyr and glyphosate, both herbicides. The Washington County Natural Resource Conservation Service has obtained aerial photos of all agricultural land in the watersheds and conducted an integrated crop management program that includes recording all pesticide use on blueberry acreage. They have informed the BPC that they will provide this information directly.
	Robert Batteese	2. Through a water quality monitoring program, coordinated with the Maine Department of Environmental Protection, the BPC will identify levels of pesticide residues in the seven Atlantic salmon rivers and their tributaries.	A total of 13 water quality monitoring sites on the Narraguagus, Pleasant and Machias Rivers (Mopang Stream) were selected in relation to known Atlantic salmon nursery habitat. Sampling will occur following two events: within 24 hours of pesticide application to detect drift; and following significant storm runoff events.	7/99	Thirteen sites were sampled along the Pleasant and Narraguagus Rivers and tributaries 24 hours after an aerial application to blueberry fields. In addition, sampling at the boat landing site on the Pleasant River in Columbia Falls is continuing on a monthly basis. Laboratory analyses of all summer and fall sampling have been completed but written reports have not yet been received.
	Robert Batteese	3. The BPC will consult with the Department of Environmental Protection and other agencies in order to secure funds to employ an environmental toxicologist to assist the	The BPC was unable to identify any funding for an environmental toxicologist and elected instead to reactivate its Environmental Risk Advisory Committee to	6/25/99	Board of Pesticides Control established the Environmental Risk Advisory Committee (ERAC). Four members will each serve 3 year terms and two other members will be ad hoc members asked to serve based on the particular issue for which the Board may need advice. At a July 28, 1999 meeting of the Board, the four standing positions were filled as follows: Dr. Alan Lewis, ecologist from the

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Project	Responsible Person	Worktask	Subtasks or Necessary Steps	Completion Date	Comments / Status
		Board in evaluating pesticide residue impacts on Atlantic Salmon based on the toxicity data obtained from water quality monitoring.	evaluate the potential impact of pesticides used in the watersheds. Evaluation of these products with regard to specific situations and local Maine conditions is critical to reducing potential adverse effects on the environment. The ERAC will provide expert advisors to assess the economic and environmental impacts of pesticides before the BPC rules on issues regarding their use.		University of Maine at Machias (chair); Richard Bradbury, entomologist from the Maine Forest Service; Dr. Kathrine Zeeman, environmental toxicologist from the Maine DEP; and Michael Loughlin, aquatic biologist working under contract with the Maine Atlantic Salmon Commission. On September 10th, the Board filled the two ad hoc positions with Barry Mower, biologist from DEP, and Norman Dube, anadromous fisheries scientist from the Atlantic Salmon Commission. The ERAC was then asked to evaluate the impacts of various pesticides used in the seven watersheds on Atlantic salmon from their federally-approved label uses. At its first meeting on October 28th, the ERAC focused on the available monitoring data for surface water samples. These samples were analyzed for 33 active ingredients with hexazinone as the only frequent contaminant. Based on the low concentrations of less than 2 ppb in surface water and less than 6 ppb in ground water plus the resistance of salmonoids to hexazinone at greater than 100,000 ppb for LC50s in adult fish, the ERAC concluded further toxicity testing is unwarranted. A literature review for hexazinone and aquatic plants and animals is being performed for review at the next meeting in late January 2000. In addition, 40 commonly used pesticides were identified in the 1997 Conservation Plan, and an aquatic data base is being developed to include their chemical and physical properties plus their toxicity to aquatic plants and fish.
	Robert Batteese	4. The BPC will respond to evidence of adverse effects of pesticides on Atlantic salmon by proposing amendments to the pesticide use regulations, recommending revisions to best management practices (BMPs), and	The Board will respond to complaints and conduct routine inspections of pesticide applications to determine if any problems are occurring.	ongoing	The BPC did not receive any complaints and its routine inspections have not detected any violations of applicable laws and regulations.

Project	*Responsible Person*	*Worktask*	*Subtasks or Necessary Steps*	*Completion Date*	*Comments / Status*
		revising product registration status, as appropriate.			
	Robert Batteese	5. The BPC will work cooperatively with state agencies and the University of Maine Cooperative Extension Service to update best management practices (BMPs), based on the water quality data and toxicological analysis, and specifically promote the use of these practices within the seven Atlantic salmon river watersheds and provide the revised BMPs to every farmer.	The Board of Pesticides Control on May 14, 1999 adopted a BMP for hexazinone, an herbicide used in blueberry culture. The draft BMP was presented at the Wild Blueberry School which was held March 15, 17, 18, and 20. The BMP should lead to a reduction in the use of the herbicide to control weeds in blueberries and reduce the likelihood of it reaching ground water or surface water.	1/2000	Verbal reports from the analytical laboratory indicate that the BMPs are working and that only very low levels of hexazinone are being detected in the surface water samples collected this year.
	Robert Batteese	6. The BPC will continue to monitor grower compliance with the July 1996 *Hexazinone State Management Plan for the Protection of Groundwater*, to evaluate the effectiveness of best management practices on ground water quality, and based on water quality data, recommend revisions to best management practices, as necessary.	A 1994 survey by the BPC of domestic wells in the blueberry growing areas of Maine, found 73% of the wells had detectable levels of hexazinone. Four years later, after two full cycles of blueberry production and hexazinone use, only 43% of surveyed wells showed detectable levels of hexazinone.	ongoing	As part of the BPC's statewide ground water sampling program, 22 randomly chosen wells adjacent to blueberry fields were sampled in February 1999. The highest level of hexazinone contamination was 1.97 ppb compared to 5.97 ppb in 1994. The percentage of wells showing detectable levels of hexazinone decreased from 75% in 1994 to 59% in 1999.

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Project	*Responsible Person*	*Worktask*	*Subtasks or Necessary Steps*	*Completion Date*	*Comments / Status*
			Monitoring will continue.		
Project D: Set up non-point source (sediment and nutrients) pollution reduction programs targeting agricultural activities to reduce water quality impacts.	Peter Mosher	1. Form an intra-departmental committee to coordinate implementation of the agricultural components of the state's Atlantic Salmon Restoration Plan; and also form an inter-agency committee with our partners to coordinate implementation of shared plan responsibilities.		Committees will meet formally in early 2000	Intra-departmental committee was formed. Interdepartmental members identified and many contacted. The contacted agree that coordination of all agricultural groups and reporting together will show progress being made in implementing Atlantic Salmon Plan.
	Peter Mosher	2. Identify every farm in the seven Atlantic salmon river watersheds, so that they can be provided technical and educational information.			
		3. Working with the Watershed Councils and the USDA Natural Resources Conservation Service, conduct a land use inventory in each watershed to identify agricultural lands and their use.		ongoing	A land use inventory for the Sheepscot River watershed has been completed.
	Peter Mosher	4. Using the information from the land use inventory, target specific		ongoing	Sheepscot River Watershed Council has conducted surveys to identify riparian problems. The survey results are being used to identify issues that need to be addressed.

Maine Dept. of Agriculture, Food and Rural Resources - Atlantic Salmon Conservation Plan - Annual Report

Date: December 15, 1999

Project	*Responsible Person*	*Worktask*	*Subtasks or Necessary Steps*	*Completion Date*	*Comments / Status*
		areas in each watershed for on-the-ground and on-river surveys to identify non-point pollution problems.			
	Craig Leonard	5. Respond to agricultural complaints in the Atlantic salmon watersheds and seek timely resolution, and document outcomes in a log for each Atlantic salmon river.		ongoing	The department has responded to agricultural complaints in the Atlantic salmon river watersheds a priority. A cataloging of complaints and responses will be maintained. In the last year, four complaints involving dairy cattle in the Sheepscot River or its tributaries have been resolved by working with the farmer and the Natural Resources Conservation Service to provide assistance to install fencing and improve pasture management.
	Peter Mosher	6. Respond to and resolve agricultural issues identified in the on-the-ground and on-water surveys of the Atlantic salmon rivers.		ongoing	Agricultural issues identified by surveys are being resolved, often through coordination with the Soil and Water Conservation Districts.
	Peter Mosher	7. Implement the nutrient management program on the seven Atlantic salmon rivers by working with the Soil and Water Conservation Districts and farmers/landowners, and monitor for compliance by reviewing water quality data.		ongoing	The following actions for the nutrient management program have been implemented: • Nutrient Management Board has been formed and an organizational meeting held. • Nutrient Management Coordinator will be interviewed and hired in January, 2000. • Certification and training for Nutrient Management Specialists implemented in 1999. Presently there are approximately fifty Nutrient Management Specialists are certified. • Ban on winter spreading initiated in 1999. • Nutrient Management Law revised and adopted in 1999. • Permitting of large animal feeding operations initiated.
	Peter Mosher	8. Develop best management practices for		ongoing - to be	Best Management Practices have been developed but need to be revised.

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Date: December 15, 1999

Project	*Responsible Person*	*Worktask*	*Subtasks or Necessary Steps*	*Completion Date*	*Comments / Status*
		sediment, nutrients and manure specifically targeted to the Atlantic salmon river watersheds, and work with Cooperative Extension and the Natural Resources Conservation Service to distribute the information to every agricultural operation.		initiated in 2000.	
	Peter Mosher	9. Continue working with the Natural Resources Conservation Service to provide technical assistance to farmers in implementing the site specific best management practices.		ongoing	
	Peter Mosher	10. Continue working with the Cooperative Extension Service to provide educational programs to inform farmers how to implement the site specific best management practices.		ongoing	
	Peter Mosher	11. Monitor effectiveness of technical assistance and educational programs in achieving implementation of best management practices.		ongoing	Survey completed on state wide bases, not specifically for the Atlantic salmon rivers as yet.
	Peter Mosher	12. Evaluation the effectiveness of the best management practices by		ongoing	Will need to obtain water quality data from Department of Environmental Protection.

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Date: December 15, 1999

Project	*Responsible Person*	*Worktask*	*Subtasks or Necessary Steps*	*Completion Date*	*Comments / Status*
		reviewing water quality monitoring data provided by the Department of Environmental Protection.			
	Robert Spear	13. Serve on and work with the various watershed councils developing and implementing non-point source control programs for agriculture.		ongoing	Continuing to meet with Sheepscot River Watershed Council.
	Robert Spear	14. Serve on and work with state committees involved in implementing the Atlantic Salmon Conservation Plan.		ongoing	Continuing to serve on Land and Water Resources Council.

Goal #3: To ensure water withdrawals do not adversely affect Atlantic salmon

	John Harker	Develop and adopt water use management plan	CoChair subcommittee on permitting requirements	12/1999	The subcommittee has developed a draft procedure for permitting impoundments. The plan includes a review of 5 potential sites for impoundments which, if established would reduce the impact of direct withdrawals on the Pleasant River.

Maine Atlantic Salmon Commission - Atlantic Salmon Conservation Plan - Annual Progress Report
Date: December 1999

Project	*Responsible Person*	*Work Task*	*Sub Tasks*	*Completion Date*	*Comments / Status*
Goal # 4: To make historical Atlantic salmon habitat areas accessible to migrating Atlantic salmon.	E. T. Baum, ME ASC	Identify, rank, and initiate improved fish passage programs at man-made and selected natural obstructions to Atlantic salmon migration in Maine Atlantic salmon rivers and streams.	Identify, rank, and remove debris blockages and beaver dams that are restricting access to prime habitat.	Fall, 1999 (Annual task)	On schedule -- much of this activity takes place in the fall of the year. Volunteers breached/removed more than 75 obstructions in the Washington Co. salmon rivers.
Goal # 6: To Eliminate risk to Atlantic salmon from recreational angling or poaching.	E. T. Baum, ME ASC	Reinstate rule making to close the seven rivers to Atlantic salmon fishing until populations recover sufficiently to support a recreational fishery.		August, 1999 to Jan. 2000	Possible area and time closures of selected areas to fishing for all fish species was discussed at 6/3/99 ASA meeting. Additional consultation with Maine IFW and DMR and NGO's took place during summer/fall. ASC held 2 public hearings in November, proposing a statewide closure of all Maine rivers to angling for Atlantic salmon in year 2000. The Salmon Board is scheduled to meet and act upon the rule-making proposal on 12/22/99. Rule changes would become effective in time for year 2000 angling season.
Goal # 9: To reduce the effect of competing fin fish species on Atlantic salmon.	E. T. Baum, ME ASC	Review and assess current stocking programs for all fin fish species in each of the seven rivers and develop Memorandum(s) of Agreement to minimize negative effects.		March, 2000	No activity during this reporting period; however ASC, IFW and DMR staff will be working on this subject during the winter months.
Goal # 10: To reduce the potential risks of pen- raised salmon from interbreeding and competing with wild Atlantic salmon.	E. T. Baum, ME ASC	Install weirs on the Dennys, Pleasant, and East Machias Rivers.	Install a portable fishway(s) with fish collection and monitoring facilities in the Machias River gorge in Machias.	Fall1999 in Dennys and Pleasant rivers; summer of 2000 in East Machias; sometime in 2001 for Machias R.	Pleasant and Dennys River weirs were installed and tested in late October, design deficiencies were documented and will be corrected overwinter. Technical review of East Machias weir design in progress. Negotiations regarding landowner permission and environmental permitting for this structure are ongoing. The Machias R. fishway/trap is dependent upon remaining funding after Dennys, Pleasant, and E. Machias weirs are built and operating.
# 12: To achieve	E. T. Baum,	Optimize fry production through	Wild-origin parr collected	Annually:	Approximately 1.2 million fry were stocked

Project	*Responsible Person*	*Work Task*	*Sub Tasks*	*Completion Date*	*Comments / Status*
optimal smolt production commensurate with the habitat's production capacity.	ME ASC	a program of broodstock collection and river-specific rearing and stocking on the Dennys, East Machias, Machias, Pleasant, Narraguagus and Sheepscot Rivers.	for FW rearing at CBNFH to maturity from Machias and Narraguagus to date; additional parr from Dennys, E. Machias, & Sheepscot rivers were collected in 1999.	broodstock collected each summer, fry stocked in April-June of following year.	in 5 of the 7 rivers in May -June 1999. Similar numbers of fry expected for these rivers in next 3-5 years.
Goal # 14: To annually assess stocks of wild Atlantic salmon and accurately estimate populations in each of the seven rivers to allow adjustment to stocking requirements and management measures.	E. T. Baum, ME ASC	Enumerate adult returns, spawning escapement and spawning success in the 7 rivers.	Continue to perform annual spawning ground surveys for each river. Continue electrofishing to gather juvenile population estimates. Identify factors that are negatively effecting Atlantic salmon populations and develop appropriate recommendations for addressing those factors in each watershed.	Annually: adults enumerated from May-Nov, redd counts in Nov-Dec. E-fish each summer-fall. Recommenda-tions included in annual reports.	The Narraguagus River adult salmon count in 1999 was 34 (+ an additional 3 aquaculture escapees). No adult salmon counts were available for any of the other 6 rivers. Rod catches (all fish were released) in the7 rivers were: 3 Dennys (probably NOT sea run salmon), 1 E. Machias and 8 in the Narraguagus. Fall redd counts in the 7 rivers were as follows: Dennys (23), E. Machias (24), Machias (42), Pleasant (0), Narraguagus (43), Ducktrap (29), Sheepscot (21). Juvenile salmon population assessments were conducted in all rivers, and data will be analyzed during the next several months. Overall, juvenile salmon populations in all rivers remained low. Escapees from a private aquaculture hatchery located on the Pleasant River were documented for the first time (smolts and parr).

Maine Department of Conservation
Atlantic Salmon Conservation Plan
Revised Annual Report Narrative
January 7, 2000

Maine Forest Service

Maine Forest Service has 3 broad commitments under the conservation plan; education and outreach; support of watershed council efforts; and field inspection and enforcement. MFS is in the process of increasing its attention to water quality/nonpoint source issues generally; actions under the Atlantic Salmon Conservation Plan in 1999 have built upon this broader effort. MFS has sought means to develop and bring information on salmon watersheds, logging practices, and BMPs to a wide audience, through workshops, presentations, one-on-one contacts, newsletters, Public Service Announcements, and printed materials. MFS has attended numerous meetings and developed working relationships with stakeholders, particularly watershed councils. MFS has provided financial and technical support on several watershed council projects. Finally, MFS has substantially to increased attention to water quality and forestry impacts, particularly through monitoring, inspection, and enforcement, involving personnel throughout the organization. Virtually all staff received field training in water quality issues this fall, and additional training is slated for early 2000. MFS has increased interactions, at both the field and policy levels, with other agencies and organizations involved with related issues. The MFS commitment to forest water quality issues has been expressed in numerous contexts outside of the conservation plan, and is moving ahead on a variety of fronts - and will, over time, benefit both salmon and water resources throughout the state.

MFS has primary responsibility for forest fire control, and requested comments on its handling of a forest fire in late August, for which water was briefly withdrawn from a salmon river. Salmon habitat issues were taken into consideration by MFS personnel; at a meeting of the Salmon Subcommittee of the Land and Water Resources Council (9/27), no strong recommendations emerged. MFS is looking at possible additional training on fire control/habitat issues, but has not taken action beyond internal discussions/review of the incident.

The recent federal status review identified two additional issues as potential threats to salmon; pesticides/herbicides, and clearcutting. MFS/DOC have no jurisdiction over normal pesticide/herbicide use; authority resides with the state's Board of Pesticide Control. Any water quality issues that may arise from pesticides/herbicides are similarly the province of water quality agencies, primarily DEP. MFS is in the process of compiling/digitizing information on pesticide spraying in past spruce budworm outbreaks, but has not yet completed this effort.

Clearcutting acreages are compiled for the state by MFS as reported by landowners, but are not current; also, for individual towns statistics are not typically made public due to confidentiality concerns. Planned clearcutting, based on recent Forest Operations Notifications, has not been assessed, and currently, MFS does not have the ability to compile information based on watersheds or similar geographical units, nor on proximity to riparian areas. Landscape analyses of land use change based on satellite images are in progress at the University of Maine, but MFS currently does not have access to, nor the ability to analyze, these data.

Land Use Regulation Commission

The Land Use Regulation Commission worked throughout calendar year 1999 to fulfill its obligations to the state's ASCP.

The Commission approved more stringent water withdrawal limits for blueberry irrigation in several of the Downeast salmon watersheds. This standard, recommended by the Land and Water Resources Council was based upon analysis conducted by Plan participants and the US Geologic survey that allowed for a decision that balanced both the needs of critical Atlantic salmon habitat and blueberry growers.

Permitting and planning staff, in conjunction with other Plan participants, have worked with blueberry growers to explore irrigation wells and water impoundments in order to minimize the seasonal conflict between water withdrawal and salmon habitat during harvesting times. The Commission expects to make a decision, pending application for an irrigation well in January, 2000. Planning staff have scheduled rulemaking for Spring, 2000 that will allow it to rezone critical salmon habitat as a protection subdistrict should voluntary land owner agreements not reach the targeted amounts of protection.

Compliance staff have worked to ensure that Commission and other state regulations are followed for all private and public development in the watersheds. The Commission continues to work with the DEP to reach a settlement agreement with Cherryfield Foods for a significant siltation event that occurred early in the year at its cranberry bogs. The Commission staff also alerted the DEP that state-funded construction of a fish weir also caused significant siltation during construction this summer. Compliance staff conducted an extensive inventory of Downeast salmon watersheds to catalog nonpoint source pollution events. This inventory found 34 instances where environmental standards were not being complied with or a potential problem existed. Followup meetings were conducted with landowners on all sites and all were either brought into compliance or put on a monitoring program to ensure no problem developed.

Commission's staff have attended numerous meetings of ASCP subcommittee's and workgroups throughout the year.

The Commission's Land Use Districts and Standards include regulations intended to prevent erosion and sedimentation to water bodies, and to protect vegetative buffers surrounding water bodies, from adverse effects of land use activities.

LURC standards require a minimum vegetative buffer strip be maintained between uses & activities allowed without a permit and waterbodies (Sections 10.17,A,1[Agricultural Management Activities], 10.17,A,3[Mineral Exploration & Extraction], 10.17,A,4[Roads & Water Crossings], 10.17,A,5[Timber harvesting], 10.17,A,6[Filling & Grading]). The width of the minimum buffer strip increases with an increase in slope of the surrounding topography. LURC standards also limit the amount of clearing, cutting and removal of vegetation allowed within 100 feet of a Great Pond and major flowing water, and 75 feet for a small stream draining less than 50 square miles (Section 10.17,A,2,[Clearing]). To exceed these standards requires site and activity specific permit approval from the Commission. To obtain permit approval to exceed these standards, the applicant must demonstrate how his/her proposal will be sufficiently protective not to cause an undue adverse effect to surrounding uses and resources, particularly the affected waterbody. The Commission's standards also require a minimum setback be maintained between all structural development, not demonstrated to be water related, and the shoreline of waterbodies. For Great Ponds and major flowing waters, this minimum setback is 100 feet from the shoreline. For minor flowing waters and wetlands, the minimum setback for residential development is 75 feet. The minimum setback requirement keeps most structural development and its associated soil disturbance and capacity for increasing run-off removed from the immediate shoreline of a waterbody, with a regulated vegetative buffer between it and the waterbody.

The Commission hired an intern for the summer, specifically for the purpose of conducting an intensive monitoring survey of the 5 ASA watersheds and compiling an inventory of any existing nonpoint pollution sources. The Commission also directed its Compliance Investigator for the Downeast Region to focus efforts on correcting violations and addressing nonpoint source pollution events within the 5 ASA watersheds. As a result, the LURC intern patrolled each of the 5 watersheds at least once during July & August, looking for existing and potential non-point source pollution problems, particularly those likely to cause accelerated erosion into a waterbody. The intern identified 34, relatively minor nonpoint pollution problem sites. LURC Compliance staff followed up by re-visiting the 34 sites with the landowners, and developing mutually agreeable action plans to correct the problems. LURC Compliance staff also spent considerable time inspecting and assessing compliance of a major natural gas pipeline project that traverses the ASA watersheds, and in addressing issues related to cranberry bog construction and blueberry irrigation activities in these watersheds. LURC staff promptly responded to all reports of siltation or sedimentation within the ASA watersheds, and worked with the responsible parties to cease the discharge and prevent it recurrence. Even in instances when the activities did not appear to be within or subject to LURC jurisdiction, LURC staff inspected the alleged activity, made recommendations for temporary stabilization measures, and forwarded reports of the activity to the agencies with jurisdiction.

Natural Resources Information & Mapping Center

In May of 1999, the Maine Geological Survey and the U.S. Geological Survey presented a plan to the Land and Water Resources Council to conduct a 5-year study of low-flow conditions on eastern Maine rivers, in order to support the permitting of water withdrawals. The plan was endorsed by the council and consists of the following tasks:

a) Identify 25 partial-record sites for data collection in eastern Maine based on a review of historical discharge data collection stations and a determination of points of priority existing and potential data needs. Install one additional continuous streamflow gage for use as a low-flow index site.

b) Collect low-flow discharge data at the partial-record sites during the 4 years of field data collection, 2000 through 2003. Ten to twelve discharge measurements will be made during independent low-flow periods at each of the sites. In the event of an extreme low-flow event all 25 sites will be measured.

c) Correlate the partial-record site low-flow data with concurrent flows at long-term gauging stations and estimate low-flow statistics for the partial-record sites. Preliminary results of these correlations, including estimates of low-flow statistics, will be available by January 2003.

d) Develop regression equations to estimate low-flow statistics at ungauged, unregulated sites in Eastern Maine by calculating topographic, climatic, and/or geologic characteristics. A summary report explaining the study and estimation techniques would be published in year 5 of the study.

In July, 1999, the Maine Geological Survey signed a cooperative agreement with the U.S. Geological Survey to conduct this study which will cost $275,000. The U.S. Geological Survey will pay half this cost, the remainder coming from the State. Funding was collected from most of the agencies represented on the Land and Water Resources Council.

In November, 1999, the USGS hosted a meeting with interested parties to begin selection of the 25 partial-record sites and one site for a continuous streamflow gage in Eastern Maine. Based on that meeting and comments received outside the meeting, a proposed list of 55 potential sites has been developed. Participants in the selection process are the USGS, MGS, LURC, DEP, IFW, Atlantic Salmon Authority, Champion International, Cherryfield Foods, and J. Wyman and Sons. The proposed sites span eastern Maine from the Union to the St. Croix River basins, with the majority concentrated in the Narraguagus, Pleasant, and Machias River basins. To facilitate the selection of a continuous gage site, the participants will select 26 sites in total and review those sites in the spring to decide which is most appropriate for a continuous gage. The list of proposed sites has been sent to the parties involved in the selection.

MGS is currently developing approximate basin areas and geologic characteristics for the 55 sites. Once that has been developed, on-site reviews of each location will be made by USGS and MGS staff to review site accessibility and discharge measuring conditions. With this information, a preliminary list of the final 26 sites will be decided upon and sent to the interested parties for comments. Based on comments received, a final site list will be developed by USGS and MGS staff. This should be completed by the end of January 2000.

Maine Dept. of Conservation - Atlantic Salmon Conservation Plan - Quarterly Progress Report

Date: **January 7, 2000** **Conservation Page1**

Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
***Goal # 1:** To further protect important in-stream Atlantic salmon habitat and adjacent riparian areas.*					
Project B: If significant progress is not made by December 2000, then initiate rulemaking to enhance protection of these areas through expanded enforcement of and modifications to NRPA, LURC zoning standards, and municipal shoreland zoning.	LURC (Fred Todd). Assigned to Andrew Fisk	1. If goals are appropriately addressed through LURC zoning standards, LURC will draft revised LURC standards and maps for a rezoning petition to place critical salmon habitat in a Fish and Wildlife Protection (P-FW) Subdistrict.	A. Review P-FW standards.	<u>March 2001</u> May 1999	A. Complete. Staff reviewed P-Fw standards for applicability to slamon habitat protection.
			B. Compare salmon habitat maps to existing LURC zoning maps for the five watersheds.	July 1999	B. Staff is preparing GIS maps showing ASCP salmon habitat and existing LURC zoning subdistricts. Analysis scheduled to take place in autumn 1999 has not yet occurred due to staff vacancy.
			C. Assess adequacy of existing standards for protection of salmon habitat.	June 1999	C. Complete. Existing P-FW standards protect upland habitats of deer and colonial seabirds, but not salmon habitats in adjacent P-WL1 subdistricts (Wetland Protection Subdistricts below normal high water mark of streams). Existing Recreation Protection Subdistrict (P-RR) standards adjacent to the down east ASCP rivers provide more relevant protection. Customized P-FW and P-RR riparian land-use and buffer standards, specific to the ASCP watersheds, could protect habitat within tributaries of salmon rivers. Existing P-WL1 standards protect the riverine habitat itself.

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Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
			D. If needed, draft revised standards.	March 2001	D. Proposed amendments for fall-winter 1999-2000 rulemaking will allow salmon habitat to be zoned P-FW, and will prohibit motorized recreational gold prospecting in P-WL1 subdistricts within ASCP watersheds. Rulemaking scheduled for hearing in March, 2000.
		3. If a finding of no "significant progress" is made, MFS, LURC, DEP with legislative approval and appropriate input from stakeholders, would seek to draft rules and/or modifications to NRPA, municipal shoreland zoning, or LURC zoning standards, with the January 1999 MFS report as a basis for discussion.	If finding of "no significant progress" in project A, hold stakeholder process to critique and build support for draft revised standards for P-FW and other applicable zoning subdistricts.	**February 2001**	No action; depends on outcome of project A.
Project B: If significant progress is not made by December 2000, then initiate rulemaking to enhance protection of these areas through expanded enforcement of and modifications to NRPA, LURC Zoning standards, and Municipal Shoreland Zoning. (DOC/DEP)	MFS (Morten Moesswilde)	2. MFS is in the process of implementing recommendations from nonpoint source report and will propose additional changes where needed.	MFS will discuss policy options identified in January 1999 NPS report with legislative oversight committee between sessions.	February 2001	Summary information on the proposed statewide standards is being developed to assist members of the legislative oversight committee.
		3. If a finding of no		February	No action to date.

Project	Responsible Person	Worktask	Subtasks or steps necessary	Completion Date	Comments / Status
		"significant progress" is made, MFS, LURC, DEP, with legislative approval and appropriate input from stakeholders, would seek to draft rules and/or modifications to NRPA, Municipal Shoreland Zoning, or LURC Zoning Standards, with the January 1999 MFS report as a basis for discussion, by February 2001.		2001	

Goal # 2: Improve or maintain water quality for Atlantic salmon in each of the rivers.

Project D: Set up nonpoint source pollution reduction programs targeting forestry, agriculture, and development activities to reduce water quality impacts from, but not limited to: salt and sand storage, fuel oil use, pesticide use, peat mining, livestock watering, timber harvesting, road maintenance and building, sludge spreading.	LURC (Andrew Fisk, Bill Galbraith).	1. In May 1999, and continuing annually as needed, hire an environmental intern to work through the summer with LURC enforcement officers to prepare an inventory of existing nonpoint pollution sources.	A. Draft job description & work plan for intern.	May 1999	A. Complete. Developed job description & work plan, with tasks and timetable, for intern.
			B. Hire intern.	May 1999	B. Complete. June 1, 1999 - Intern was hired and is currently being trained in applicable LURC standards, BMPs and erosion/sedimentation control techniques.
			C. Develop monitoring schedule & protocol for each watershed, & data collection & reporting format. Initiate monitoring program.	June 14, 1999	C. Complete. June & part of July, 1999: Intern was trained regarding LURC standards, particularly for timber harvesting and road and water crossing construction, as well as on-the-job training in field investigation techniques. Monitoring schedule & protocol

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Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
					established included monitoring each watershed via primary & secondary road network, and identifying existing and potential NPS sources. Reporting format includes a description of land-use activities observed, identifying location by latitude & longitude coordinates, identifying property owner, and describing nature of activity and extent of compliance with LURC standards. Protocol also included maintaining a weekly log of the intern's activities.
			D. Monitor watersheds on biweekly basis, document & report on findings of NPS sources.	June 28, 1999 & ongoing	D. Complete. All 5 watersheds were patrolled at least once, with some work time being diverted to monitoring water withdrawal activities associated with blueberry irrigation within the 5 ASCP watersheds, and some areas patrolled only once because of vehicle malfunction. NPS problem sites were identified and documented as to date of discovery, watershed location, lat./long. location, landowner, nature of activity and problem, and in some instances recommended corrective action
			E. Complete inventory report on existing	**September 1999**	E. Complete. Final Inventory Report compiled August 16,

Project	Responsible Person	Worktask	Subtasks or steps necessary	Completion Date	Comments / Status
			nonpoint source pollution sources.		1999, with intern leaving state service on August 20,1999. Final inventory identified 34 (relatively minor) NPS problem sites, most of which involved plugged or improperly installed water crossing or cross drainage culverts, with some other issues related to poor road maintenance, beaver activity and all terrain vehicle activity. Most serious of the NPS problems identified were associated with several stream sites being forded by all terrain vehicles, causing erosion and siltation into the waterbody. The intern prepared a location map showing the patrol routes and areas of each watershed monitored, as well as plotting the location of each NPS site. He also compiled the information on location (by lat./long. and by watershed), date of discovery, landowner, nature of the problem, etc., into a table that can readily be transcribed into a database for analysis and tracking purposes. Of the 34 sites identified, 27 were located on lands owned by two major landowners
		2. LURC enforcement staff will work with landowners on whose property nonpoint pollution sources have been identified for voluntary	Subtasks and steps will be dependent on situations identified.	**Ongoing**	LURC enforcement staff has conducted site inspections on 40 identified NPS sites and worked with landowners to bring most sites into compliance. Work has

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Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
		measures to reduce or eliminate any discharges.			included pulling and clearing culverts, stabilizing banks, and installing water diversions. Several sites did not warrant any remediation work upon inspection by LURC enforcement staff.
		3. Resolve violations of Land Use Regulation Commission standards through enforcement measures to stop discharges and penalize those responsible.	A. Identify existing active enforcement cases involving NPS discharges to the salmon watersheds & make resolution of those cases a priority. B. Monitor/inspect land use activities within the watersheds for compliance with applicable standards. C. Pursue enforcement measures for violations discovered, in conformance with Commission's Compliance & Enforcement Policies.	**Ongoing** Ongoing Ongoing	A. Ongoing. B. September - December 1999: 6 additional sites were identified from the summer survey during compliance visits with landowners. These were brought into compliance. C. September, 1999: Case closed on unauthorized water withdrawal from Machias River watershed described in June, 1999 report. No further action taken as case is within jurisdiction of Passamaquoddy Tribal government. It is not clear at this point whether the blueberry companies owned by the tribe will continue to withdraw water for blueberry irrigation as they have done yearly in the past. It is presumed that they will, but it is not known whether they will withdraw using existing or

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Project	Responsible Person	Worktask	Subtasks or steps necessary	Completion Date	Comments / Status
					proposed limits developed under the ASCP. September - December 1999: LURC staff continued to work in cooperation with DEP staff to draft and negotiate terms of settlement to resolve violations associated with a discharge to the Pleasant River that occurred from a permitted cranberry operation in T18 MD BPP. The discharge to the river has been halted
Project D: Set up nonpoint source pollution reduction programs targeting agriculture, development, and forestry activities to reduce water quality impacts from, but not limited to: salt and sand storage, fuel oil use, pesticide use, peat mining, livestock watering, timber harvesting, road maintenance and building, and sludge spreading. (DOC/DAFRR/DEP)	MFS (Morten Moesswilde)	1. MFS Augusta staff, Field Foresters, and Regional Enforcement Coordinators will conduct 4-6 BMP workshops annually highlighting salmon issues. Additional materials regarding salmon will be developed from existing/new information.		December 1999 (annually)	MFS staff participated in providing CLP training, including salmon and BMP issues, in Princeton, 12/8. Salmon presentation by MFS staff to 225+ consulting foresters and other resource professionals (required training to deliver state forestry cost-sharing programs). 10/18 SFI BMP workshop for loggers in Machias , scheduled for 10/1, canceled due to lack of registration. The four registrants were referred to a workshop in Dover-Foxcroft.

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Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
					An SFI BMP workshop scheduled for September in Orono was canceled due to weather (hurricane forecast). Approx. 10 registrants were referred to the Dover-Foxcroft workshop.
		2. MFS Foresters and Forest Rangers in salmon watersheds will receive additional BMP training to enhance their public education/outreach, monitoring and enforcement abilities.		December 1999	Half/full day BMP/water quality field training sessions for MFS rangers and foresters statewide took place in October, in cooperation with DEP. Salmon priority areas and mechanisms to improve enforcement coordination with DEP were also discussed. MFS staff report enhanced awareness of water quality issues and more effective communications/collaboration with DEP under the MOU. MFS personnel considered salmon habitat in their handling of a forest fire, recognizing habitat from maps on hand, tempering their withdrawal of water to control the fire and removing beaver dams to augment the flow. Additional internal training scheduled for January/February will address prevention/mitigation. as well as BMP monitoring.

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Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
					MFS staff met internally on several occasions to discuss plan implementation and related water quality issues. MFS Forest Policy and Management Division staff received an update on the salmon plan at the 9/27 Division mtg. Field foresters received (9/99) water quality information packets for their own reference and for distribution.
		3. The MFS Forestry BMP manual will be rewritten by MFS central and field staff. The revised manual will emphasize recognition of water resources/dynamics and harvest operations planning.	A. Convene partners in rewrite, including FORAT (Forestry Advisory Team) and Department of Environmental Protection.	June 2000	The planned BMP manual rewrite was discussed at August and October FORAT meeting (8/17). FORAT reviewed priorities for improvements to the manual. The subgroup formed to address this issue more intensively has met on three occasions (9/23, 10/19, 11/30). Work is expected to continue throughout the winter and into next year. The next FORAT meeting is scheduled for 1/18.
		4. The Forest Information Center at MFS Augusta office will develop additional materials and information to respond to citizen inquiries concerning forestry/water resources issues.		July 1999	A water quality information packet is complete for distribution upon request. MFS Stewardship newsletter to (approximately 250+) consulting foresters (11/99) included information on commercially available wooden mats suitable

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Project	Responsible Person	Worktask	Subtasks or steps necessary	Completion Date	Comments / Status
					for temporary logging bridges and to minimize erosion in sensitive areas. MFS drafted a letter (9/99) highlighting salmon issues/watersheds as part of our response to landowners applying/inquiring about MFS/federal cost-sharing under Forest Stewardship. (Not yet sent.) Maps of salmon watersheds and critical salmon habitat prepared by MFS have been provided (11/99) to USDA offices in Kennebec, Knox/Lincoln, Waldo, Hancock, and Washington counties, for use by consulting foresters and other interested persons. Consultants attending the 10/18 training were alerted that these would be available. MFS staff began participation in DEP's Nonpoint Source Training Center advisory board, 9/99. The University of Maine BMP video has been made distributed to all MFS Forest Management Division field staff.

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Project	Responsible Person	Worktask	Subtasks or steps necessary	Completion Date	Comments / Status
					MFS has developed and aired a series of Public Service Announcements urging
		5. MFS will continue support of salmon watershed councils from available state and federal resources to carry out monitoring and education related to NPS issues.	A. Complete projects under 1999 grants ($35,000 total) to watershed councils. B. Cooperate/collaborate in development of new grant proposals. C. Continue liaisons with WCs and attendance at Council meetings.	September 1999 ongoing ongoing	MFS grants to four Downeast watershed councils for a range of water quality assessment/streambank stabilization efforts were finalized in October. MFS staff have also assisted Narraguagus and Pleasant Watershed Councils with development and implementation of a 319 water quality grant project. A $4950.00 Stewardship grant has been awarded to Project SHARE to construct informational kiosks highlighting salmon and water quality issues at public access points along the Downeast rivers. At least Twelve have been constructed. Additional kiosks are planned for construction. Seven have been installed in public places along the Narraguagus and Machias River and Pleasant River Lake. One kiosk has been installed at the Wild Salmon Resource Center. MFS staff are assisting with a forest management demonstration project in the

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Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
					Ducktrap Watershed, in cooperation with the Ducktrap Coalition. MFS personnel have attended in excess of 15 meetings of watershed councils, Project SHARE, and related organizations, since 9/1, maintaining regular contacts with these groups. MFS reviewed approximately 1700 new Forest Operations Notifications since 9/1 (2600 since 3/1) for proximity to salmon habitat, and continues to update watershed councils periodically regarding such harvesting activity . Additional informal meetings/communications are ongoing.
		NPS - 1. In Jan 99 MFS issued NPS Report in collaboration with LURC, DEP and stakeholders, recommending implementation of statewide timber harvesting standards to minimize impacts of forestry on water quality. (See Project B for further description) Several recommendations are	A. The BMP site monitoring form developed by MFS and FORAT will be reproduced and distributed, with training by MFS staff as needed, for use by loggers, foresters, and other interested groups in evaluating harvest BMP use and effectiveness.	Summer 1999	MFS's BMP monitoring form was reviewed, with additional suggested improvements, at 10/19 FORAT meeting. A final version will be presented at the 1/00 FORAT meeting. MFS continues to meet with members of Maine Forest Products Council/Sustainable Forestry Initiative to assist with technical/training/policy issues

Project	Responsible Person	Worktask	Subtasks or steps necessary	Completion Date	Comments / Status
		being implemented, including:			relating to water quality. SFI has set a statewide training schedule for 2000 that includes 5 Basic BMP workshops (2 in French language), 2 Advanced BMP workshops, and 2 workshops on logging aesthetics.
			B. MFS and LURC are in the final stages of implementing improvements to the databases that track Timber Harvest Notifications and citizen complaints.	Summer 1999 (notification) June 2000 (complaints/ tracking)	Notifications received from towns that contain critical salmon habitat continue to generate a letter to the landowner noting the presence of habitat and referring the landowner to MFS for further information. Information relevant to critical salmon habitat continues to be relayed to watershed councils, IFW, DEP. Possible enhancement of the notifications database to allow complaints tracking is in a trial phase at the regional level.
			C. Once fully operational, the databases will facilitate tracking of timber harvests, monitoring, and disseminating information to concerned parties, and enforcement actions.	Summer 1999 (notification) June 2000 (complaints/ tracking)	MFS and DEP discussed coordination/referral of water quality issues during field training statewide (10/99).
			D. MFS is in the process of implementing BMP monitoring program for non-point source issues	December 1999	MFS staff have used the BMP monitoring form on 15 site inspections, all near critical salmon habitat in the downeast

Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
					participation in the Wetlands Interagency Team. The department will determine proposed rules to submit prop in the next legislature after they receive recommendations from their oversight committee on the January 1999 nonpoint source report.
Project G: Implement enhanced enforcement efforts to address salmon issues.	LURC (Andrew Fisk, Bill Galbraith).	1. LURC staff will continue to collaborate with MFS, DEP in enforcement of water quality statutes.		**Ongoing**	September - December 1999: LURC staff continued to work in cooperation with DEP staff to draft and negotiate terms of settlement to resolve violations associated a discharge to the Pleasant River that occurred from a permitted cranberry operation in T18 MD BPP. The discharge to the river has been halted.
		2. LURC enforcement staff will work with landowners on whose property nonpoint pollution sources have been identified	A. Draft job description & work plan for intern. B. Hire intern. C. Develop monitoring schedule & protocol for	**May 1999** **May 1999** June 28, 1999 & ongoing	A. Complete. Developed job description & work plan, with tasks and timetable, for intern. B. Complete. June 1, 1999 - Hired intern, who is receiving training in applicable LURC standards, BMPs, and erosion/sedimentation control techniques. C. Complete. June & part of July 1999: Intern in training regarding

Project	Responsible Person	Worktask	Subtasks or steps necessary	Completion Date	Comments / Status
		for voluntary measures to reduce or eliminate any discharges.	each watershed, & data collection & reporting format. Initiate monitoring program.		LURC standards, particularly for timber harvesting and road and water crossing construction, as well as on-the-job training in field investigation techniques. Monitoring schedule & protocol established included monitoring each watershed via primary & secondary road network, and identifying existing and potential NPS sources. Reporting format included a description of land-use activities observed, identifying location by latitude & longitude coordinates, identifying property owner, and describing nature of activity and extent of compliance with LURC standards.
			D. Monitor watersheds on bi-weekly basis, document & report on findings of NPS sources.	**September 1999**	D. Complete. All 5 watersheds were patrolled at least once, with some work time being diverted to monitoring water withdrawal activities associated with blueberry irrigation within the 5 ASCP watersheds, and some areas patrolled only once because of vehicle malfunction. NPS problem sites were identified and documented as to date of discovery, watershed location, lat./long. location, landowner, nature of activity and problem, and in some instances recommended corrective action.
			E. Complete inventory report on existing nonpoint source pollution sources.		E. Complete. Final Inventory Report compiled August 16, 1999, with intern leaving state service on August 20,1999. Final inventory identified 34

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Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
					(relatively minor) NPS problem sites, most of which involved plugged or improperly installed water crossing or cross drainage culverts, with some other issues related to poor road maintenance, beaver activity and all terrain vehicle activity. Most serious of the NPS problems identified were associated with several stream sites being forded by all terrain vehicles, causing erosion and siltation into the waterbody. The intern prepared a location map showing the patrol routes and areas of each watershed monitored, as well as plotting the location of each NPS site. He also compiled the information on location (by lat./long. and by watershed), date of discovery, landowner, nature of the problem, etc. into a table that can readily be transcribe into a database for analysis and tracking purposes. Of the 34 sites identified, 27 were located on lands owned by two major landowners in the region. LURC enforcement staff has conducted site inspections on 40 identified NPS sites and worked with landowners to bring most sites into compliance. Work has included pulling and clearing culverts, stabilizing banks, and installing water diversions. Several sites did not warrant any remediation work upon inspection by LURC enforcement staff.

Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
		3. Take enforcement measures to resolve violations of Land Use Regulation Commission standards to stop discharges and penalize those responsible.	A. Identify existing active enforcement cases involving NPS discharges to the salmon watersheds & make resolution of those cases a priority. B. Monitor/Inspect land use activities within the watersheds for compliance with applicable standards. C. Pursue enforcement measures for violations discovered, in accordance with the Commission's Compliance & Enforcement Policies.	**Ongoing** **<u>Ongoing</u>** Ongoing	A. Ongoing. B. September - December 1999: 6 additional sites were identified from the summer survey during compliance visits with landowners. These were brought into compliance. C. September, 1999: Case closed on unauthorized water withdrawal from Machias River watershed described in June, 1999 report. No further action taken as case is within jurisdiction of Passamaquoddy Tribal government. September - December 1999: LURC staff continued to work in cooperation with DEP staff to draft and negotiate terms of settlement to resolve violations associated a discharge to the Pleasant River that occurred from a permitted cranberry operation in T18 MD BPP. The discharge to the river has been halted.
Project G: Enforce existing standards for buffering	MFS (Morten Moesswilde)	1. Continue to give priority to monitoring and		ongoing	MFS field staff received additional field training in October, enhancing their ability to identify/resolve or refer

Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
activities near streams. (DOC/DEP)		enforcement efforts in salmon watersheds. Inspect 90% of active harvests in the vicinity of critical salmon habitat.			water quality problems associated with timber harvesting. MFS field efforts have prioritized critical salmon habitat. Maps showing habitat and watershed boundaries have been digitized, including priority salmon areas at the subwatershed level, and are used by daily by staff to assess potential impacts to salmon from new harvest notifications.. MFS rangers also continued routine/random inspections of harvest sites, including in the salmon watersheds, under Forest Practices Act (FPA) and other authority. Twenty-six harvests in salmon priority areas (near critical salmon habitat) have been identified (22 Downeast, 4 Midcoast) since 9/1. While only 58% have been inspected to date, most of the total were received in November, and will be inspected by end of December. None of those inspected were found to be impacting water quality. Overall harvest activity with potential to impact salmon appears to have declined, particularly in downeast areas, due in part to wood markets and other factors, but possibly in part due to heightened attention to salmon in some locations.
		2. Maintain increased		ongoing	Periodic aerial inspections of timber

Project	Responsible Person	Worktask	Subtasks or steps necessary	Completion Date	Comments / Status
		overflights as part of enforcement efforts in Salmon watersheds.			harvest activity are ongoing, and assist in investigations of complaints.
		3. Continue to collaborate with LURC, DEP and municipal Code Enforcement Officers in enforcement of existing water quality statutes.		ongoing	To date, MFS interventions have emphasized remediation, with no forestry-related water quality enforcement yet initiated in salmon watersheds. MFS field staff statewide received training in cooperation with DEP on field enforcement under the existing MFS/DEP Memorandum of Understanding regarding enforcement/referrals of complaints.
		4. Implement a BMP monitoring program, as outlined in recent MFS Compliance with forestry BMPs report.		December 1999	MFS staff have used the BMP monitoring form on 15 site inspections, all near critical salmon habitat in the downeast watersheds since June 1999. Additional monitoring to be developed with MFS staff during early 2000.
		5. Implement use of BMP site monitoring form developed by MFS and FORAT by June 2,000.		December 1999	MFS's BMP monitoring form was reviewed, with additional suggested improvements, at 10/19 FORAT meeting. A final version will be presented at the 1/00 FORAT meeting.
Project G: Implement	LURC (Andrew	1. LURC staff		**Ongoing**	September - December 1999: LURC

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Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
enhanced enforcement efforts to address salmon issues.	Fisk, Bill Galbraith).	will continue to collaborate with MFS, DEP in enforcement of water quality statutes.			staff continued to work in cooperation with DEP staff to draft and negotiate terms of settlement to resolve violations associated a discharge to the Pleasant River that occurred from a permitted cranberry operation in T18 MD BPP. The discharge to the river has been
		2. LURC enforcement staff will work with landowners on whose property nonpoint pollution sources have been identified for voluntary measures to reduce or eliminate any discharges.	A. Draft job description & work plan for intern.	**May 1999**	A. Complete. Developed job description & work plan, with tasks and timetable, for intern.
			B. Hire intern.	**May 1999**	B. Complete. June 1, 1999 - Hired intern, who is receiving training in applicable LURC standards, BMPs, and erosion/sedimentation control techniques
			C. Develop monitoring schedule & protocol for each watershed, & data collection & reporting format. Initiate monitoring program.	September 1999	C. Complete. June & part of July 1999: Intern in training regarding LURC standards, particularly for timber harvesting and road and water crossing construction, as well as on-the-job training in field investigation techniques. Monitoring schedule & protocol established included monitoring each watershed via primary & secondary road network, and identifying existing and potential NPS sources. Reporting format included a description of land-use activities observed, identifying location by latitude & longitude coordinates, identifying property owner, and describing nature of activity and extent of compliance with LURC standards.

Project	Responsible Person	Worktask	Subtasks or steps necessary	Completion Date	Comments / Status
					Protocol also included maintaining a weekly log of the intern's activities.
			D. Monitor Watersheds on bi-weekly basis, document & report on findings of NPS sources.	September 1999	D. Complete. All 5 watersheds were patrolled at least once, with some work time being diverted to monitoring water withdrawal activities associated with blueberry irrigation within the 5 ASCP watersheds, and some areas patrolled only once because of vehicle malfunction. NPS problem sites were identified and documented as to date of discovery, watershed location, lat./long. location, landowner, nature of activity and problem, and in some instances recommended corrective action.
			E. Complete inventory report on existing nonpoint source pollution	September 1999	E. Complete. Final Inventory Report compiled August 16, 1999, with intern leaving state service on August 20,1999. Final inventory identified 34 (relatively minor) NPS problem sites, most of which involved plugged or improperly installed water crossing or cross drainage culverts, with some other issues related to poor road maintenance, beaver activity and all terrain vehicle activity. Most serious of the NPS problems identified were associated with several stream sites being forded by all terrain vehicles, causing erosion and siltation into the waterbody. The intern prepared a location map showing the patrol routes and areas of each watershed monitored, as well as plotting the location of each NPS site. He also

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Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
					compiled the information on location (by lat./long. and by watershed), date of discovery, landowner, nature of the problem, etc. into a table that can readily be transcribe into a database for analysis and tracking purposes. Of the 34 sites identified, 27 were located on lands owned by two major landowners in the region.
		3 Take enforcement measures to resolve violations of Land Use Regulation Commission standards to stop discharges and penalize those responsible	A. Identify existing active enforcement cases involving NPS discharges to the salmon watersheds & make resolution of those cases a priority.	Ongoing	A. Ongoing
			B. Monitor/Inspect landuse activities within the watersheds for compliance with applicable standards	Ongoing	B. September-December 1999: LURC staff conducted inspections of a large natural gas project, to assess compliance with permit requirements. One streambank on Machias required stabilization and was remediated according to staff's recommendation. Pipeline work is substantially completed. September, 1999: Pre-application site visit conducted in the Pleasant River watershed with blueberry grower to assess proposed site for water impoundments to be used for future irrigation.
				Ongoing	November, 1999: LURC staff participated in an informational meeting

Project	Responsible Person	Worktask	Subtasks or steps necessary	Completion Date	Comments / Status
			C. Pursue enforcement measures for violations discovered, in accordance with the Commission's compliance & Enforcement Policies.		regarding water impoundments to provide public with information on the commission's standards and requirements. See above.

Goal # 2 Improve or maintain water quality for Atlantic salmon in each of the rivers cont.

Project H. Report on progress annually	Ginger Jordan-Hillier	Submit annual progress report of DOC responsibilities on nonpoint source pollution reduction programs and enforcement of existing standards for buffering activities near streams.	1. Produce standardized format for DOC to report progress by June 1999.	June 1999	Completed for June report.
			2. Submit complete progress report by September 15 annually	September 1999	
			3. Submit complete progress report by December 15	December 1999	Submission also served as annual report with a narrative addition.

Goal # 3: To ensure water withdrawals do not adversely affect Atlantic salmon

Project C: Collect flow information for the Pleasant and Machias Rivers using accepted QA/QC plans in cooperation with agricultural interests.	NRIMC/ MGS (Robert Marvinney)	1. Maine Geological Survey will cooperate with the US Geological Survey to provide input into development and implementation of basin flow studies, review interim and final results of flow studies,	*A) work with USGS to develop low-flow study plan*	October 1, 1999 4/15/99 5/10/99	Agreement completed. MGS contributed some of its own funds and marshalled the remainder from agencies of the Land and Water Resources Council and the USGS to ensure that this project could be

Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
		participate in necessary meetings, provide information on affects of ground-water withdrawal.	*B) Present study plans to Flow Technical Team* *C) Present study plan to Land and Water Resources Council* *D) Identify funding* *E) MGS and USGS sign cooperative agreement*	 5/20/99 7/1/99 7/15/99	completed. A cooperative agreement was signed in July, 1999, between the USGS and the Maine Geological Survey to conduct the low-flow study of eastern Maine rivers. MGS has been working with the USGS to implement the program (see below).
		2. The USGS will conduct a 5-year basin flow study for eastern Maine.	 *A) Develop low-flow proposal per above.* *B) Identify one stream gage site and 25 partial record sites for data collection during the study* *C) Collect data* *D) Interim report* *E) Final report*	**<u>September 30, 2004</u>** 4/15/99 10/1/99 10/1/99-12/31/03 1/31/03 9/30/04	Work has started on selection of the 25 partial-record and one continuous streamflow gages in Eastern Maine. Based on a meeting held at the USGS office on Nov. 9 and comments received outside the meeting, a proposed list of 55 potential sites has been developed. Comments and suggestions were received from the USGS, MGS, LURC, DEP, IFW, Atlantic Salmon Authority, Champion International, Cherryfield Foods, and J. Wyman and Sons. The proposed sites span Eastern Maine from the Union to the St. Croix River basins, with the majority concentrated in the Narraguagus, Pleasant, and Machias River basins. It was decided at the meeting to delay discussion of the location of the continuous gage, but to select 26 sites in total and review those sites in the spring to decide which is most

Project	Responsible Person	Worktask	Subtasks or steps necessary	Completion Date	Comments / Status
					appropriate for a continuous gage. The list of proposed sites has been sent to the parties involved in the selection. MGS is currently developing approximate basin areas and geologic characteristics for the 55 sites; this information will to help identify the most suitable of the 55 sites.

Goal # 5: To protect, enhance, and restore high and moderate value wetlands.

Project D: Ensure that all wetland permitting decisions take into account Atlantic salmon needs.	LURC (Marcia Spencer-Famous)	1. Continue to apply LURC wetland rules to permitting decisions involving wetlands in riparian areas of the salmon watersheds.	Ongoing application of wetland rules review to permits.	**Ongoing**	Since September, 1999, LURC has issued 2 building permits for additions to existing structures, one each in the Dennys and E. Machias watersheds. One Advisory Ruling was issued to the ASA indicating that a permit was not required for work on the fishway at Cathance Lake in No. 14 Twp in the Denny's watershed.
		2. Obtain DOT wetlands study.	Obtain DOT wetlands study.	**June 1999**	Completed. . Copy of Information available
Project E: Continue education and compliance with current wetland regulations	DEP: Jeff Madore (Marcia Spencer-Famous for LURC)	1. Continue participation in the State Planning Office's Code enforcement Officer Certification Program. (Wetland delineation training for LURC staff comparable to the State Planning Office's Code Enforcement Officer Certification Program)	Prepare two one-day workshops for LURC staff in cooperation with the State Soil Scientist.	**Ongoing** July 30, 1999	MFS, LURC, and Maine Natural Areas Program (MNAP) staff participated in development and review of the Wetland Conservation Plan presented to the Land and Water Resources Council in September.

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Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
					MFS and LURC staff participate in the now formalized Wetlands Interagency Team.
		2. Provide information as needed on wetland protection to the Watershed Councils.	Attend riparian buffers analysis training workshop provided by the Sheepscot Watershed Council	April 29, 1999	LURC staff consulted with other DOC staff and DEP and SPO staff to stay involved in policy-making and activities associated with the Wetlands Conservation Plan.
		3. Continue interagency coordination on wetland permitting issues.	Obtain membership on State Wetlands Interagency Team Attend all Team meetings to ensure LURC permitting decisions consider salmon.		1. Completed 2. Regular meetings begin, December 2, 1999.

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Project	Responsible Person	Worktask	Subtasks or steps Necessary	Completion Date	Comments / Status

GOAL # 1: TO FURTHER PROTECT IMPORTANT IN-STREAM ATLANTIC SALMON HABITAT AND ADJACENT RIPARIAN AREAS

Project B: If significant progress [on nonregulatory approaches to habitat protection] is not made by December 2000, then initiate rulemaking to protect these areas through a designation under NRPA, LURC zoning standards, and municipal shoreland zoning.	Jeff Madore	1. A finding from SPO and the Watershed Councils that significant progress was or was not made by December 1999, and a decision from the LWRC as to whether a regulatory alternative should be pursued by DEP and LURC.		December 1999	The matter has yet to be considered by SPO and the LWRC. It is anticipated that a decision on this issue will be made in the spring of 2000.

GOAL # 2: IMPROVE OR MAINTAIN WATER QUALITY FOR ATLANTIC SALMON IN EACH OF THE RIVERS

Project A: Establish water quality baselines on parameters important for salmon production in each river	Dave Courtemanch	1. Working with SPO, ASA, Project Share, and others, identify parameters important for salmon production.		Completed Summer of 1999	Program is now ongoing. Baseline data has been collected on each river by volunteers, laboratory results have been received and screened for quality control. The draft data results are in the Water Quality Monitoring attachment and a final report is in progress.
		2. Put all existing available data on each river on the website.		December 1999	All data on website except ASA temperature data. The finalized data set of baseline, stormwater and biological samples will be added to the website, when they become available.
					In 1999, the Department proposed legislation that would upgrade many waters in the state including waters in the watersheds of the Atlantic salmon rivers. Waters identified as having important Atlantic salmon conservation value were proposed for upgrade to Class AA. The great majority of habitat in the 7 rivers in the Conservation Plan and their larger tributaries is already classified AA (the state's highest water quality classification). All the recommended changes were enacted by the Legislature. These include upgrades to: 1. Four tributaries of the Narraguagus River, Baker Brook, Pork Brook, Schoodic Brook and Shorey Brook from Class A to Class AA. 2. 2. One tributary of the Machias River, Crooked

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					River from Class A to AA. 3. 3. One tributary of the East Machias River, Beaverdam Brook from Class A to Class AA. Additionally, the Legislature upgraded Cove Brook (winterport) from Class B to Class AA recognizing the unique salmon population that exists in that water, and Souadabscook Stream from Class A to AA recognizing the salmon restoration efforts that have occurred on that water. Many tributaries of the Penobscot River were also upgraded including section sof the Piscataquis and Mattawamkeag watersheds.
Project B: Set up an ongoing monitoring program for each river	Dave Courtemanch	1. Water quality monitoring group (DEP, SPO, ASA, Project Share, IFW, Watershed Councils) identifies the basic components of an ongoing water quality program for each river.		June 1999	Water quality monitoring program for each river has been developed and implemented during the summer of 1999. The program used volunteers from the Watershed Councils to collect baseline, stormwater and biological samples. Baseline and stormwater samples where sent to the UMO's Water Research Institute for analysis and results have been summarized.
		2. Hire a contractor or a staff person ½ time to serve as monitoring coordinator for the 7 salmon rivers.		Ongoing	Staff person hired as of June 1999, set up monitoring protocols, trained volunteers for data collection, produced a draft data summary of all sampling efforts.
Project D: Set up nonpoint source pollution reduction programs targeting forestry, agriculture, and development activities to reduce water quality impacts from, but not limited to: salt and sand storage, fuel oil use, pesticide use, peat mining, livestock watering, timber harvesting, road maintenance and building, sludge spreading.	Norm Marcotte	1. Work with other state agencies and SPO to secure a couple of summer interns to assist with watershed surveys.		April 1999	Interns hired through SPO. DEP provided assistance as needed.

Project	Responsible Person	Worktask	Subtasks or steps Necessary	Completion Date	Comments / Status
		2. In the 1999 grant process, identify the seven salmon rivers as a priority for CWA Section 319 funding.		May 1999	Seven salmon rivers identified as priority. NPS Grants RFP (released in 1/99) included a "Preference for Projects" for waters on the NPS Priority Watersheds List. The 7 Salmon Rivers are included. In 1999, DEP helped to develop, fund, and implement 3 new projects. 2 projects were on the Sheepscot River and 1 on the Narraguagus and Pleasant Rivers. DEP selected (11/99) "Watershed Survey of NPS in the Dennys River, Project SHARE" for NPD grant funding expected about 3/00.
		3. Provide 319 grants to the Pleasant and Narraguagus Rivers to do a watershed survey of portions of the rivers near salmon habitat.		October 1999	DEP NPS grant (NPS Project #99-13) provided (4/99) to Project Share for NPS watershed survey work and outreach in 1999-2000. Project report is due in March 2000. Approximately 75% of the Narraguagus and Pleasant Rivers have been surveyed. The primary focus of these surveys was the salmon habitat identified by the ASA. Two educational workshops were held with local selectmen, clerks and code enforcement officers.
		4. In accordance with the recent MOA between DEP and the Bureau of Forestry, provide the educational tools and other support to the Department of Conservation for its training programs on logging and forestry related activities.		Ongoing	Land Resources Regulation staff (LRR) provided field training for all MFS Rangers during Octover 1999. The training consisted of identification of natural resources, use of BMP's, and proper erosion control techniques. LRR staff also provided training to approximately 375 forestry professionals during 1999 that have the potential to work in the salmon watersheds. The training was either part of the Certified Logging Professionals program, Sustainable Forestry Initiative, or at the request of a company. The training encompassed water quality impacts and the regulatory requirements of the NRPA and Shoreland Zoning. In addition, LRR staff also provided training to approximately 400 earth-moving contradctors which have the potential to work in the salmon watersheds. The training consisted of proper erosion control

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					techniques and the regulatory requirements of the NRPA.
Project E: Set up a pesticide monitoring program for each river to account for type, amount, timing, and geographic location of pesticides used in each river watershed.	Dave Courtemanch	1. Board of Pesticides Control identifies what pesticides are being used where in the 7 watersheds.		May 1999	BPC has identified pesticides and they have been included in this monitoring plan. Volunteers collected stormwater samples for pesticides in the Narraguagus and Pleasant River drainages, the preliminary results are included in Water Quality Monitoring attachment.
		2. BPC and DEP review samples taken last summer and do an assessment as to whether further testing is needed.		June 1999	This review has been completed.
		3. DEP incorporates pesticide monitoring for the identified pesticides in selected locations into the water quality monitoring plans for the seven rivers and/or into its Surface Water Ambient Toxics Monitoring Program.		Ongoing	This information has been incorporated into the plan, and is now part of water quality monitoring program. Recently published data on organochlorines in the Dennys will be incorporated into the website.

GOAL 5: TO PROTECT, ENHANCE, AND RESTORE HIGH AND MODERATE VALUE WETLANDS.

Project B: Maintain a registry of potential restoration projects from information provided by applicants in need of mitigation projects in the watershed.	Jeff Madore	1. The DEP will set up a registry that will serve as a repository of information on wetlands that may be used for mitigation.		March 2000	This project has been initiated but no wetland projects which would have provided information on viable mitigation opportunities have been submitted to date. The Department will continue to monitor future projects for such information. The availability of such information will facilitate potential application review processes in the future.
Project C: Explore potential of using Casco Bay Wetlands pilot project wetlands assessment model to identify wetlands providing high value for water quality and fish habitat.Jeff Madore1. Casco Bay	Jeff Madore	1. Casco Bay assessment model will be completed by November 1999.		April 2000	Casco Bay project is now scheduled for completion in the Spring of 2000. Follow up with this task will occur subsequently.

Project	Responsible Person	Worktask	Subtasks or steps Necessary	Completion Date	Comments / Status
assessment model will be completed by November 1999.April 2000On target for 11/99.					
Project D: Ensure that all wetland permitting decisions take into account Atlantic salmon needs.	Jeff Madore	1. By June 1999, OGIS has provided DEP with digitized maps of the salmon spawning habitat provided to them from the Atlantic Salmon Authority.		June 1999	These maps have been completed and are now available.
		2. Permits issued by DEP that have the potential to impact salmon habitat will be reviewed by IF&W and the Atlantic Salmon Authority, and their comments addressed.		Other activities are ongoing.	All applications for projects within the salmon watersheds are being reviewed by IF&W and ASA on an ongoing basis.
		3. Watershed Councils are sent a monthly list of pending applications in their watersheds.			Information on all permit by rule notices and full NRPA applications are provided monthly to the Salmon Watershed Councils.
Project E: Continue education and compliance with current wetland regulations.	Jeff Madore	1. Continue participation in the State Planning Office's Code Enforcement Officer Certification program.		Work is ongoing	DEP provided state-wide training for municipal code enforcement officers (CEOs) in conjunction with the State Planning Office on 3 different topics during 1999. These topics included shoreland zoning, identification of freshwater coastal wetlands, land use permitting, reporting and erosion control procedures. The CEOs, who are responsible for much of the administration of the shoreland zoing in their towns, received accreditation towards licensure for their attendance in these sessions. We reduced the number of towns without certified CEO's from six to four. Currently 93% of municipalities within the watershed of the salmon rivers have code enforcement officers in compliance with SPO requirements for shoreland zoning. In May, a full day workshop was offered at 4

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Project	*Responsible Person*	*Worktask*	*Subtasks or steps Necessary*	*Completion Date*	*Comments / Status*
					locations state wide, including Edmunds, Maine. In September, we participated in a full-day workshop on wetlands offered at 5 locations, including Orrington and Harrington, Maine. In August, we participated in 2 Cracker Barrel Training Sessions, both of which were offered at 4 locations, including Bangor.
		2. Provide information as needed on wetland protection to the Watershed Councils.			Work is ongoing.

INITIAL ASSESSMENT OF WATER QUALITY DATA 1999

The Maine Department of Environmental Protection, the Maine Atlantic Salmon Authority, and the Maine Department of Agriculture and Rural Resources initiated a study of water quality in the seven rivers in the Atlantic Salmon Conservation Plan. Sampling was conducted with the assistance of the watershed councils for each of the rivers. Previously the Maine DEP had compiled all available water quality data for these waters. The purpose of this study was to begin to gather data that was found to be missing or inadequate in the database. This was the first of an expected multi-year sampling effort.

For this first year, monitoring was designed to look at two aspects of water quality. First, was to determine similarities and differences in water quality between the waters. Second, was to determine differences within each waterbody, with the possibility that stress conditions might also be detected among the differences detected. This new dataset represents only one year of data with small sample sizes therefore, any of the following observations should not be considered conclusive. Additional observations under different seasonal and annual conditions will be required.

Specific Conductance – (measure of total dissolved solids). All waters are low ionic strength typical of Maine waters. Most values ranged from 30-70 us/cm. Sheepscot River had higher values (up to 132 us/cm) although still within range of many Maine waters.

pH and ANC - (measure of acidity and acid neutralizing capacity). All waters are circumneutral with almost all readings between 6.0 and 7.9. All waters have modest ANC values (typical of Maine waters) and would not be expected to exhibit low pH episodes. However, these parameters should be retested in spring during snowmelt and other runoff conditions.

Nutrients – (measure of primary production potential). Nitrate and phosphorus values are low in all waters except Sheepscot River. Nitrate values are particularly low (most values <2 ueq/l), except in the Sheepscot, suggesting that these waters may be naturally nitrogen limited. High nutrient values (NO3 and P) occurred in the Sheepscot associated with a storm event (9/17/99) at several stations and at a few other stations in the other watersheds (8.9/99 and 9/17/99) indicating that runoff events may cause transient changes in nutrient quality. Additional nutrient testing during storm events is recommended. Other measures of primary production should be considered.

TSS and turbidity (storm event monitoring for solids). The monitoring program intercepted few storm events. A few events were captured (8/9/99 and 9/17/99), however, TSS and turbidity values were not particularly high for any of these events at any of the stations monitored (most values < 4 mg/l).

Pesticides. Little of the proposed monitoring for pesticides was completed. Immediate post treatment monitoring was not conducted since early applications occurred in 1999 before the monitoring program was started. Baseflow monitoring for pesticides was accomplished for one date in the Narraguagus River and two dates in the Pleasant River. Of the suite of pesticides analyzed, only hexazinone was detected (at the majority of sites sampled). Highest detected value was 1.22 ug/l. Monitoring for these materials needs to be repeated next year according to the original proposal, particularly during post treatment since many of these materials have very short half-lives.

Biological monitoring. Observation of the occurrence of sensitive stoneflies and mayflies did not reveal any chronic pattern of absence except at Branch Lake outlet on the Sheepscot. It is expected that the lake outlet may be a natural warm water habitat unsuitable for stoneflies rather than an indication of human caused stress. Observations should be continued, especially timed to coincide with pesticide treatments.

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Date: **December 14, 1999**

Goal # 6

Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
Project B: Enforce existing Atlantic salmon and inland fishing regulations designated to protect Atlantic salmon, including monitoring of key salmon holding areas.	Col. Tim Peabody, Maine Warden Service	Enforcement of fishing regulations on the 7 Down East salmon rivers and their tributaries, documentation of enforcement efforts and associated observations.	1. Development and implementation of a patrol strategy to include regular checks of salmon holding areas, routine reconnaissance of river sections which receive moderate to heavy fishing pressure, and other areas required to assure fishing regulations are being adhered too. 2. Documentation of results 3. Reporting of results	End of Open Fishing Season.	A total of 786 patrol hours and 485 angler checks have been reported by the Warden Service. Field notes included: 3 parr caught and released on Dennys, 1 grilse caught and released on Dennys, salmon in Old Stream springhole, 10 parr reported catch and release Old Stream. One violation of fishing regulations was found.
Project C: Develop and implement a program of angler education	Don Kleiner, Department of Inland Fisheries and Wildlife	Inform anglers of Atlantic Salmon restoration initiatives, increase awareness of and compliance with fishing regulations designed to protect both adult and juvenile Atlantic salmon, improve angler ability to	1. Develop a poster showing the key identifying features of adult and juvenile Atlantic salmon, catch and release information, etc. 2. Coordinate distribution and posting of the above	July 1999 July 1999	500 signs were printed advising anglers: the water is closed to the taking of Atlantic Salmon, to identify their catch, and release all Atlantic Salmon. Tips for catching and releasing fish are also included on the sign. Atlantic Federation agreed to distributed posters showing key identifying features of Atlantic Salmon to councils.

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Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
		identify adult and juvenile Atlantic salmon.	poster and related information at appropriate locations. 3. Include information in the inland fishing law summary regarding Atlantic salmon fishing regulations, and the importance of compliance with these regulations. 4. Public news release regarding Atlantic salmon restoration initiatives. 5. Article in Department magazine on Atlantic salmon restoration initiatives.	Feb. 2000 Sept. 1999 Spring 2000	Signs were distributed to local wardens, watershed councils, and other interested parties. In Progress. To be included in next publication of the inland fishing law summary. Postponed until ASC and its Executive Director are up and running /need input from ASC Scheduled/ article to be written by ASC staff.
Goal 7					
Project B: Monitor sucker, alewife, and smelt fishing in locations	Peter Bourque, Department of Inland	Review application for permits to take suckers and alewives	Application screening	Ongoing	

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Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
inhabited by adult and juvenile Atlantic salmon.	Fisheries and Wildlife	commercially and deny or appropriately restrict these activities to ensure no by-catch mortality.			
Goal 9					
Project A: Review and assess current stocking programs for all fin fish species in each of the seven Downeast Rivers and develop a Memorandum of Agreement.	Peter Bourque, Department of Inland Fisheries and Wildlife/ ASA	Assess interactions and associated impacts of socking on fin fish in the seven Down East rivers.	1. Document current stocking programs in the seven rivers. 2. Review available information on the interactions between species stocked in each river. 3. Identify and evaluate concerns and potential ways of minimizing impacts. 4. Develop recommendations for the Commissioners of IF&W and DMR , and the ASA 5. Finalize MOA	May 2000	Information regarding stocking programs in the 7 downeast watersheds is being compiled. Department and ASC biologists will identify and evaluate areas of concern and potential ways to minimize impacts. Information regarding the stocking of inland species in watersheds supporting runs of Atlantic Salmon have been compiled by the Department's Regional Fisheries Biologist, along with an assessment of potential interactions. Similar information for the Ducktrap and Sheepscot Rivers in being developed. Department and ASC biologists will be meeting in the near future to evaluate this information and develop recommendations to be presented to the Commissioners of Inland Fisheries and Wildlife, Marine Resources, and ASC. Work is scheduled to be completed next spring.

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The Maine DMR has primary responsibility for implementing and monitoring activities designed to minimize potential adverse impacts of aquaculture on river specific Atlantic salmon in the seven downeast rivers. Additionally, DMR monitors and evaluates various fishery activities that could potentially impact river specific Atlantic salmon. The following report summarizes activities undertaken during the past year (January 1-December 31, 1999):

Elver Fishery: Entry into the 1999 elver fishery was limited by emergency legis- lation passed in March, 1999. Only those who held licenses and gear tags in each of the three years of 1996, 1997, and 1998 were allowed to participate in the fishery in 1999. Of the 827 eligible people, only 741 purchased licenses in 1999. The emergency legislation also reduced the season by three weeks, thus delaying opening of the fishery for one week (until March 22) and closing the fishery two weeks early (May 31 instead of June 15). In addition, the amount of gear each harvester was allowed to use was reduced significantly from six units (one dip net & five fyke nets) to two units (two fykes or one fyke & one dip net). The DMR issued gear tags for 808 fyke nets and 434 dip nets for statewide use in 1999. DMR Marine Patrol Officers and biological staff checked the seven downeast rivers for the presence of elver nets during the open season. Due to poor market condi- tions which deteriorated as the season progressed, many fishermen pulled their nets or stopped fishing before the season officially closed on May 31. The follow- ing numbers of fyke nets were observed in the downeast salmon rivers during the elver season: Dennys (0), East Machias (8), Machias (5), Pleasant (4), Narragua- gus (6), Ducktrap (1), and Sheepscot (0). In the Sheepscot River, only dip nets are allowed above the U.S. Route 1 bridge; on the Pleasant River, only dip nets are allowed above the main river bridge in Addison from May 1 to December 1 annually. The four fyke nets observed in the Pleasant River were fished prior to May 1. No incidental catch of salmon was reported or observed in the elver fishery on the seven downeast rivers in 1999.

Sucker, alewife, and smelt fisheries: The DMR's state government intern (Kelly Beaudoin) compiled the fishing laws and regulations on each of the seven down- east rivers. Fisheries which could incidentally catch adult salmon or smolts on the seven downeast salmon rivers include the following:

Dennys River - Low risk from commercial alewife fishery at Meddybemps Lake outlet. This fishery occurs near the headwaters of the Dennys River upstream of the Atlantic salmon spawning areas and juvenile production habitat. There was a commercial alewife fishery on the Dennys River in 1999. This fishery is permitted by IF&W based on recommendations from DMR. There is no known commercial rainbow smelt fishery in the lower Dennys River.
East Machias River - Low risk from commercial alewife fishery at Gardner Lake outlet. This fishery is located on a tributary to the East Machias River and is up- stream of Atlantic salmon spawning and juvenile nursery habitat. Low risk of salmon smolt bycatch in the rainbow smelt estuarial gill net fishery (the fishery closes on 30April annually). The majority of the smolt emigration occurs in the months of May and June.
Machias River - Low risk of salmon smolt bycatch in the rainbow smelt estuarial gill net fishery (the fishery closes on 30April annually). There is no alewife fishery on the Machias River.
Pleasant River - Low risk of salmon smolt bycatch in the rainbow smelt estuarial gill net and bag net fishery (the fishery closes on 30April annually). Low risk of salmon bycatch in the alewife fishery, which is restricted to hand dip net by town residents only, with a one peck daily limit on harvest.
Narraguagus River - Low risk of adult salmon bycatch in the commercial alewife fishery. Low risk of salmon smolt bycatch in the rainbow smelt estuarial gill net fishery (the fishery closes on 30April annually).
Ducktrap River - Low risk of adult salmon bycatch in the commercial alewife fishery. This fishery has been inactive for over five years due to the low abundance of alewives.
Sheepscot River - Low risk of adult salmon bycatch in the commercial alewife fishery. This fishery occurs at the Coopers Mills fishway and is extensively monitored annually by enforcement and biological staff.

There are no commercial sucker fisheries in any of the tidewater areas of the seven downeast salmon rivers.

Fish Health:

Rules -

In cooperation with the Department of Inland Fisheries & Wildlife, DMR held a joint hearing on proposed rules on June 17, 1999. The DMR rules were unani- mously approved by the DMR Advisory Council on July 21, 1999 and became effective July 28, 1999. These rules establish procedures for testing live salmonids and gametes for pathogens of concern to wild and cultured salmonids and sets minimum health standards necessary to permit the introduction of salmonids into Maine waters. The rules also establish a Fish Health Technical Committee, consisting of fish health professionals from state and federal fishery agencies, academia, and the private sector.

The FHTC is charged with providing technical advice to the Commissioners of DMR and IF&W on issues associated with maintaining the health of Maine's wild and cultured salmonid populations.

The new regulations greatly improve the state's response and effectiveness in preventing disease and optimizing the health of aquatic resources. The Fish Health Technical Committee (FHTC) provides recommendations to the Commis- sioners regarding fish health to accommodate the development of new, sensitive, diagnostic procedures; the emergence of new diseases; and the development of improved methods of prevention and disease control. The new regulations have also updated the list of diseases of regulatory concern to include measures for the prevention and control of ISAv. The FHTC was called upon to develop recommendations for managing a newly detected retrovirus, SSSv, in federal restoration efforts. Other FHTC activities include providing guidance for industry efforts in disease surveillance, biosecurity, and the disposal of salmon processing waste. The involvement of the FHTC in state responses to fish health threats, coupled with the efforts and diligence of the industry in both surveillance and biosecurity, has so far allowed the State of Maine to remain free from ISAv.

Because research conducted in Norway has demonstrated that ISAv-infected salmon carcasses are a significant factor in the spread of ISAv, an additional regulation prohibiting the introduction of any dead salmonid fish species or salmon remains, parts, or viscera into the coastal waters of Maine was promul- gated by DMR and became effective on November 29, 1999. The regulation was necessary because of the prevalence of ISAv in New Brunswick and because current federal regulations do not prevent or control the movement of salmon waste across the US/Canadian border.

Fish Health Inspections -
Fish health inspections are required for the introduction of fish into Maine coastal waters. In 1999, over 3,000 fish were examined for pathogens of regulatory con- trol in association with transfer to coastal waters. No ISAv

detected among lots of fish transferred to marine waters of Maine.

ISAv Surveillance -
Because disease surveillance and early response is essential to disease preven- tion and control, the Department of Marine Resources funded an ISAv surveil- lance program at net pen sites. Surveillance involved 123 organ pools of 206 moribund or "fresh dead" fish collected from 22 participating sites during the high risk period of

late May and early August, 1999. Detection methods involved RT-PCR, IFAT, viral culture, and histopathology. Results from surveillance indi- cate no ISAv detected. Additional surveillance was conducted and funded by individual aquaculture companies. No cases of ISAv were reported.

Biosecurity -
Biosecurity is a systematic and proactive effort to prevent the spread of infectious agents from infected to uninfected fish. Biosecurity uses epidemiological informa- tion to identify risk factors associated with disease transfer to develop manage- ment practices which seek to eliminate or reduce the risk of disease transfer. During 1999, the Department of Marine Resources funded a biosecurity audit to assess the adherence and performance of individual companies with respect to biosecurity practice. This audit involved in-depth questionnaires, coupled with site visitations. Audit results/analysis were provided to the companies, along with recommendations for improved performance. Both marine sites and fish process- ing plants were involved in the audits. While the industry has made significant improvements in biosecurity, ongoing improvement and refinement is considered essential to industry viability. At marine sites, the adoption of single year-class stocking, improvements in disinfection procedures, and mortality handling procedures were areas of concern. While general improvements in these areas have been made, optimization of these practices have been constrained by logistical concerns. For example, full adoption of single year-class stocking is limited by the number of available and suitable marine sites. Concerns associated with processing plants include standardization of disinfection protocols and waste disposal and prompted the Industry Fish Health Committee to establish a waste subcommittee to improve waste disposal practices. The USDA APHIS veterinarian for Maine and the industry subcommittee worked to identify safe disposal sites and to place disinfection equipment at these sites.

ISAv Action Plan -
During 1999, the Industry Fish Health Committee of the Maine Aquaculture Association developed an ISAv Action Plan which establishes proactive manage- ment for the prevention and control of ISAv. Protocols for biosecurity, disease surveillance, disease reporting, and compliance and action sequences for management of ISAv are clearly defined. The fact that ISAv has not yet been detected in Maine clearly reflects the industry's vigilance and efforts in support of the Action Plan. Its effectiveness hinges on disease surveillance, rigorous bio- security, and swift and effective response to disease outbreaks. Continued support of disease surveillance, biosecurity efforts, and the development of indemnity programs necessary for prompt eradication of ISAv-infected stocks are essential to the effectiveness of the Action Plan.

ISAv vaccination -

Vaccination has been a highly effective tool in salmon health management, and a variety of effective vaccines are available for the control of such diseases as Vibriosis and Hitra Disease. Because ISAv has not been detected in Maine or the USA, it is classified as an exotic disease. As an exotic disease, the importation of virus, as well as research and development associated with ISAv, is strictly controlled by the federal government. The Maine FHTC worked with USDA APHIS Veterinary Services and the USDA Center for Veterinary Biologics to create a mechanism for research on the development of an ISAv vaccine as well as an application process for the use and field evaluation of an autogenous ISAv vaccine in Maine.

Code of Containment Rules: The DMR has had several meetings with the aqua- culture industry, NMFS, and the USF&WS

been developed by DMR staff. Among other things, the rules will address the most significant sources of risk of loss by focusing on net strength, equipment integrity, and predator control measures. The proposed rules should be available for public review and comment in the early part of year 2000. The original schedule proposed to have rules adopted by December 31, 1999, **but due to uncertainties associated with a potential ESA listing, progress on development of these rules has been delayed.**

Maine Dept. of Marine Resources- Atlantic Salmon Conservation Plan - Annual Report
Date: 15 December 99

Goal # 11 - To reduce the potential of disease transmission between farmed fish & wild Atlantic salmon

Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
Project A: Develop & adopt fish health rules to protect wild & cultured salmon from diseases & pathogens	Paul Waterstrat	DMR, IF&W, DAFRR, USF&WS, NMFS & other fish health professionals identify pathogens of concern, fish health testing procedures & transfer procedures to minimize the risk of disease introduction into Maine waters	Meet w/fish health professionals to determine specific requirements of rules to protect wild & cultured salmon	9/30/98	Extensive meetings have been held w/industry & fish health professionals over the past several years
		Draft rules on fish health	Review proposed rules with industry, state/federal fish health experts & academia	4/30/99	Two meetings were held in April, 1999 w/the Ad Hoc Fish Health Technical Committee to finalize proposed rules for public hearing.
		Adopt & implement rules	Hold public hearing(s) on proposed rules	6/17/99	A hearing was held on 6/17/99 at the Augusta Civic Center. The rules were adopted unanimously by the DMR Advisory Council on 7/21/99 and became effective 7/28/99.
			Adopt rules via Advisory Council	No later than 12/31/99	In response to concerns about ISAv, an additional rule effective 11/29/99 was adopted to prohibit the introduction of any dead salmonids, parts, or viscera into Maine coastal waters.

Maine Dept. of Marine Resources- Atlantic Salmon Conservation Plan - Annual Report

Date: 15 December 99

Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*

Maine Dept. of Marine Resources- Atlantic Salmon Conservation Plan - Annual Report
Date: 15 December 99 - *Goal #7 Continued*

Goal # 7 - To reduce the potential for bycatch of salmon from riverine & estuarine commercial fishing activities

Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
Project A: Require exclusion panels for all elver fyke nets	Lewis Flagg	DMR scientists & enforcement staff will continue periodic checks of elver fyke nets for compliance w/the excluder panel requirement & will monitor nets for the presence of juvenile salmon	Develop & distribute a survey questionnaire/reporting form to enforcement staff & eel scientists	6/30/99	A survey was sent to enforcement officers & eel scientists in June, 1999
			Formalize annual reporting requirements from enforcement & scientific staff	10/31/99	A report format was developed & will be sent to DMR staff annually
			Provide annual report on bycatch of salmon in elver fishery	12/31/99	Information has been received from DMR enforcement staff on enforcement observations made during the 1999 elver season. The total number of fyke nets in the statewide fishery was reduced from 3,806 in 1998 to 808 in 1999. Of the 24 fyke nets observed on the seven downeast salmon rivers, all were in compliance with the excluder panel requirement. There were no reported catches of salmon as a bycatch in the 1999 elver fishery.
Project B: Monitor sucker, alewife & smelt fisheries in locations inhabited by adult & juvenile Atlantic salmon	Lewis Flagg	Review current fisheries & regulations on the seven downeast rivers to determine the overlap of salmon migration w/other fishing activities to determine the risk of bycatch mortality of Atlantic salmon.	Compile & analyze laws & regulations on the seven downeast salmon rivers	8/31/99	A compilation of tidewater fishing laws/regulations was completed by DMR intern Kelly Beaudoin. DMR enforcement reports indicate no bycatch of Atlantic salmon in alewife, smelt, and/or sucker fisheries.
		Report on relative risks of salmon bycatch		10/31/99	Analyses indicate that the risks of salmon bycatch in the smelt and alewife fisheries is low due

Maine Dept. of Marine Resources- Atlantic Salmon Conservation Plan - Annual Report

Date: 15 December 99 - ***Goal #7 Continued***

Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*
		Monitor current fisheries activities to verify if salmon bycatch occurs		April-June, 2000	to location of fisheries within the seven downeast rivers and/or time of year restrictions on commercial fisheries.

Maine Dept. of Marine Resources- Atlantic Salmon Conservation Plan - Annual Report
Date: 15 December 99

Project	*Responsible Person*	*Worktask*	*Subtasks or steps necessary*	*Completion Date*	*Comments / Status*

Goal # 10 - To reduce the risks of pen-raised fish interbreeding & competing with wild salmon

Project C: Develop & promulgate rules to codify the loss control code of practices for sea cage & hatchery operations	Sebastian Belle	Promulgate rules based on the aquaculture industry voluntary practices to minimize escapes of cultured fish from fresh-water & sea cage rearing facilities	Consult w/aquaculture industry & other interested parties in the development of proposed rules	August, 1999	DMR staff have met with the aquaculture industry, USF&WS, and NMFS to review criteria to be included in the code of containment. Preliminary draft rules have been developed.
			Hold public hearing(s) on proposed rules	Sept., 1999 (revised to May, 2000)	Public hearing(s) on proposed rules should be held in May, 2000
			Adopt & implement loss control rules via the public hearing process	Dec. 31 1999 (revised to June, 2000)	

Maine State Planning Office - Atlantic Salmon Conservation Plan - Annual Report
December 15, 1999

Project	Responsible Person	Worktask	Subtasks or steps necessary	Completion Date	Comments / Status
Goal #1, Project A: Based on ASC habitat maps, ASC definition of "critical spawning and nursery areas," and an appropriate tool for designing protective buffers, negotiate management agreements, conservation easements and/or fee acquisitions for the long term protection of habitat with riparian landowners.	Mark DesMeules	1. The State Planning office will work with at least one large industrial forest owner to secure a management agreement which will protect critical Atlantic Salmon spawning and rearing habitat.	Develop draft management agreements Complete agreed upon management agreements	July 1999 Date revised to October 2000	Management agreements finalized but not signed. Signing contingent on progress toward permanent protection agreement.
		2. The State Planning office will work with at least one large industrial forest owner to secure permanent protection through conservation easements to protect critical Atlantic Salmon spawning and rearing habitat.	Landowner and State to agree upon locations for permanent protection projects Develop project proposal, schedule an appraisal,finaliz e contract, and establish funding sources.		Due to the complexity and time needed to complete the permanent protection component of this effort, the anticipated date of completion is October 2000. Appraisal phase of the permanent protection component underway.
		3. The State Planning	Meet with local	October	Complete for the Sheepscot

M... e State Planning Office - Atlantic Salmon Co... ervation Plan - Annual Report
December 15, 1999

Project	Responsible Person	Worktask	Subtasks or steps necessary	Completion Date	Comments / Status
		Office will work with willing local conservation organizations to help develop a local riparian land protection strategy.	groups to develop a strategy for targeting certain riparian properties and contacting landowners	_1999	River
		4. Close tranactions on the three salmon river Land for Maine's Future proposals funded during the 1999 Board funding decisions.	Projects accepted by LMF Raise funds for match Establish title holder Prepare documentation and complete transaction(s)	January 2000	Closed on the LaCombe project in the Ducktrap Machias and Narraguagus projects are on schedule. Appraisals complete and negotiations underway. Atlantic Salmon Commission has agreed to be title holder. Early spring appears to be a more likely completion date.
Goal #3, Project A: Assess Atlantic salmon habitat needs by priority river reaches using the Instream Flow Incremental Methodology	David Keeley	1. A Flow Technical Team consisting of State, Federal, businesses and nonprofits skilled in salmon habitat flow issues IFIM reports will solicit proposals from qualified consultants.	prepare RFP and select contractor	July 1999	task completed on time
		2. The State Planning Office will enter into a contractual arrangement	Complete contract with	July 1999	Task completed on time

Maine State Planning Office - Atlantic Salmon Conservation Plan - Annual Report
December 15, 1999

Project	Responsible Person	Worktask	Subtasks or steps necessary	Completion Date	Comments / Status
		with the successful consulting firm	Kleinschmidt Associates		
		3. The IFIM report for each river will document the methodology used and present salmon habitat flow recommendations.		May 1999	All three IFIMs for the Narraguagus, Pleasant, and Mopang basins are complete and accepted by the Flow Technical Team. Based on the results, the L&WRC established new limits on irrigation form the Pleasant River.
Goal #3, Project B: Develop and adopt a water use management plan	David Keeley	1. The Land & Water Resources Council will organize a diverse Water Use Management Plan Committee consisting of all stakeholders and direct them to oversee the development of water use management plans			Committee formed and meeting
		2. The State Planning	Contract for	Feb. 1999	Contracts with a professional

Maine State Planning Office - Atlantic Salmon Conservation Plan - Annual Report
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Project	Responsible Person	Worktask	Subtasks or steps necessary	Completion Date	Comments / Status
		Office will contract for a range of consulting services to both facilitate Committee discussions and provide the requisite technical expertise to analyze biological and human uses of the water resources in these watersheds.	facilitator services		facilitator and technical consultant are complete
			Complete agreement with the ACOE for consulting services	Feb. 1999	Delivery of the Water Use Management Plans are behind schedule due to an expansion in the scope of the work and the complexity in establishing acceptable alternative water sources. The Pleasant River Plan will be completed in March and the Narraguagus and Mopang Rivers completed by June, 2000. Irrigation limits already in place on the Pleasant River; the plan is expected to provide for alternative sources of water for irrigation.
			Submit Water Use Management Plan(s) to the LWRC	October 1999	

Atlantic Salmon Conservation Plan (ASCP) - MDOT Annual Report 1999 *12/15/99*

General Activities:

Funded FY 2000-2001 continuation of MDOT Office of Environmental Services (OES) efforts to assist MDOT in implementing the ASCP, its participation on the ASC, and coordination with the Watershed Councils. Non-Project Program PIN 9362.46; $60,000 budget. Approximately $22,000 has been spent from this and a prior PIN during 1999 on this effort.

Funded a project in the MDOT FY 2000-2001 Biennial Transportation Improvement Program (BTIP) to survey Atlantic salmon watersheds, emphasizing those covered by the ASCP, to identify any sources of pollution or other impacts from MDOT facilities or activities and to develop a plan to mitigate those impacts. BTIP PIN 7771.00; $50,000 funding, including federal participation. Approximately $1,330 has been spent on this project.

Funded an MDOT Surface Water Quality Protection Program (SWQPP) in the BTIP which is broader than the water quality protection program funded in the previous BTIP. The latter program was restricted to mitigating the impacts of runoff from state highways on lake water quality. The new program covers all surface water and all transportation facilities. Project proposals involving Atlantic salmon rivers and streams are now therefore eligible to be considered for funding under this program in competition with other proposals. Several project proposals are being developed in coordination with Watershed Councils. BTIP PIN 7765.00; $600,000 funding, including federal participation.

Pledged $2,000 per year for FY 2000-2004 from MDOT as a Land and Water Resources Council member agency for the Eastern Maine Rivers Low-flow Study to be conducted by MGS. Funds for FY 2000 and 2001 to come out of the PIN 9362.46 program described previously.

Created sets of paper and laminated maps of each of the seven ASCP watersheds and distributed multiple copies to Maintenance Division Engineers at their March meeting for use by crews, supervisors, and managers. Copies distributed to other units in MDOT and to Watershed Councils.

In coordination with Watershed Councils, established an MDOT/Watershed Councils communication system with designated contact people. Distributed MDOT contact list, FY 2000/2001 BTIP, and active construction project list to Councils. Mailed notices of MDOT FY 2000-2002 Statewide Transportation Improvement Program (STIP) to Councils.

Completed Environmental and Safety Audits on Maintenance facilities located in Atlantic salmon watersheds. No impacts on Atlantic salmon habitat were found.

Continued efforts by Bureaus of Maintenance & Operations and Project Development to communicate and cooperate with the Watershed Councils and Atlantic Salmon Commission in working to protect salmon habitat when conducting maintenance activities and in designing and constructing transportation projects.

Construction projects in Atlantic salmon watersheds were visited weekly by environmental staff from the Construction Division or OES.

All Construction managers attended Erosion Control Plan classes in the winter of 1999 at which Atlantic salmon rivers and sensitivity were specifically mentioned.

Erosion Control Plans were required on all Construction jobs. Atlantic salmon watershed projects were considered at the highest level of sensitivity.

Individual Watershed Activities:

Dennys:

Two meetings were held at the Rte 1 crossing by Watershed Council and OES personnel, one with MDOT Maintenance Division 2 and one with MDOT Design. As a result of above meetings, 300 cubic meters of woodwaste mulch, 65 cubic meters of rip rap, 140 square meters of geotextile, and 175 meters of bituminous curb were installed at this crossing of the Dennys River by the Construction Division to mitigate highway runoff impacts. Approximate cost was $13,400.

After a meeting of Watershed Council and OES personnel at the Rte 86 crossing, OES proposed a runoff mitigation project for consideration for funding under the MDOT SWQPP.

Ducktrap:

Construction Division added rip rap with permanent sediment traps to an active construction project (PIN 1872.00) in Lincolnville (Rte 1) for additional slope stabilization at the request of DEP. Estimated additional cost to project was $30,000.

OES personnel reviewed Rte 52 Ducktrap River crossing in coordination with DEP 319 grant project.

On-site reviews of erosion/sedimentation problems near the Rte 52 crossing were conducted by Watershed Council, DEP, MDOT Maintenance Division 5 and consultant personnel.

East Machias:

OES personnel reviewed the erosion problem at the Rte 9 Crawford Rest Area and developed recommendations to stabilize the site. Stabilization to be done in 2000 by the Construction Division as part of the Crawford project (PIN 9135.00).

Technical assistance regarding erosion/sedimentation control on the Rte 1 Machias/East Machias construction project (PIN 8611.00) to protect East Machias River water quality was provided by OES personnel. The erosion/sedimentation control measures for 1999 on this project cost approximately $25,000.

The Rte 9 construction project in Wesley (PIN 4874.01) was completed in August 1999. Water quality protection measures taken by the Construction Division included numerous permanent ditch turnouts, elimination of direct discharge to streams, and installation of a permanent sediment trap as part of a ditch turnout before Beaverdam Stream. Approximately $50,000 was spent in addition to the contractor's original bid price for this item.

The above project in Wesley won the 1999 Project of the Year Award from the International Erosion Control Association, in large part due to the daily commitment to erosion control.

Machias:

The erosion/sedimentation control measures taken on the Rte 1 Machias/East Machias construction project (PIN 8611.00) described previously also served to protect the Machias River water quality as well as that of the East Machias.

Construction Division added a permanent sediment trap at the end of a ditch on the T30MD/Devereaux project (PIN 4622.30) to protect Mopang Stream.

Airline Community School students visited the T30MD/Devereaux wetland mitigation and bridge replacement projects (PINs 5602.33; 4622.30). They participated in mitigation work, which involved stream restoration, and visited the Mopang Stream bridge site where Atlantic salmon habitat protection efforts were discussed.

Narraguagus:

Construction Division installed a sediment basin at a catch basin outlet along Rte 1 adjacent to the Narraguagus River to help keep sediments out of the river as part of the Cherryfield construction project (PIN 7673.00). The approximate cost of this and other project water quality protection measures taken was approximately $10,000.

Construction Division installed three sediment basins and two woodwaste berms at the Rte 1A crossing as part of the Milbridge construction project (PIN 7653.00). The approximate cost of this and other project water quality measures taken was approximately $20,000, with $5,000 being for special measures.

Maintenance Division 2 installed three sediment basins and one downspout at the Rte 193 crossing in Deblois to help at least partially correct a chronic erosion/sedimentation problem caused at least in part by ATV, motorcycle, snowmobile and boat access foot traffic. The approximate cost of this effort was $6,000. This problem was brought to the attention of MDOT by the Downeast Rivers Coalition.

OES has submitted a preliminary project proposal regarding the above Deblois situation for consideration for funding under the SWQPP.

The Maintenance Division 2 Highway District Manager whose district includes this watershed attended two Council meetings and coordinated with the regional ASC staff regarding proposed drainage improvements.

Pleasant:

OES staff field reviewed crossings of the main stem of the Pleasant River, the Western Little River, and the Little River regarding possible slope stability problems at the request of the Downeast Rivers Coalition. The slopes were found to be reasonably stable.

OES staff field reviewed the Bells brook and Branch Brook crossings regarding possible fish passage problems at the request of the Downeast Rivers Coalition. Fish passage was found to be adequate although improvements should be considered when the structures are due for replacement in the future.

OES and Maintenance Division 2 personnel field reviewed a slope erosion problem along the East Side Road in Addison. OES is developing an erosion control project proposal for consideration for funding under the SWQPP. This situation was brought to the attention of MDOT by a local citizen.

Sheepscot:

OES pledged to participate in a DEP 319 grant project concerning the West Branch of the Sheepscot and assigned a consultant to that effort. The consultant has participated in meetings and field reviews.

OES staff visited crossings of Rtes 194 and 218 in Alna and Whitefield and Rte 105 in Somerville with a representative of the Watershed Council to review erosion and winter sand problems. Project proposals will be developed by OES for consideration for funding under the SWQPP. Maintenance Division 5 may be able to address some of the concerns, at least partially.

OES reviewed a Rte 126 site in N. Whitefield and will develop a project proposal for consideration for funding under the SWQPP.

Section 2 – Watershed Council Reports

Downeast Watershed Councils A.S.C.P. Progress Report
Oct. '98 – Oct. '99
Provided By: Dwayne Shaw, Watersheds Coordinator

Note: The activities described below were conducted by a collaborative effort of the Downeast Rivers Coalition, Project SHARE, the Watershed Councils, the Downeast Salmon Federation and various governmental and industry partners.

Water Quality Monitoring and Assessment Activities:

- Over fifteen volunteers recruited and trained under cooperative program with DEP to do limited sampling on the all five downeast rivers.
- DEP sponsored 319 NPS Assessment project funded and underway in the Pleasant and Narraguagus watersheds. Approximately 30 volunteers trained to survey NPS locations. The survey is now nearly complete and a project report will be prepared by March of 2000.
- DEP 319 NPS Assessment project approved for year 2000 for the Dennys river watershed.
- Inventoried problem areas impacting buffer zone function along the mainstem and major tributaries of the Pleasant and Narraguagus Rivers.

Water Flow Monitoring:

- Daily flow measurements taken by volunteers at the Saco Falls gage site on the Pleasant River.

Habitat Improvements:

- Portions of Pleasant R. dam removed and river bank site stabilized.
- Several DOT road crossings of the Narraguagus and Dennys Rivers stabilized at the request of the Councils.
- Cathance Lake dam rebuilt to maintain existing condition of watershed.
- Marion Falls and Great Works fish passage structures upgraded.
- Cannan dam remains removed and site stabilized and revegetated.
- Dennys River Sportsmens Club streambank erosion stabilized.

- Road ditch near Eastern Little River stabilized.
- Road ditch and development activity near Route 1 in Columbia Falls stabilized.
- Plans and partial funding put in place for removal of the East Machias Dam.
- Plans being developed to remove the Addison Tidal Baffles on the West Branch of the Pleasant River.
- Beaver dams removed on the Narraguagus, Pleasant and Machias Rivers.

Habitat Protection:

- Working with landowners and Town of Columbia on a pilot project to protect habitat and other values along the Pleasant River Corridor in Columbia.
- Working with the Land For Maine's Future Program to protect two large parcels on the Narraguagus and Machias Rivers.
- Working with a small landowner of a derelict property in Cherryfield on the Narraguagus River to protect and restore habitat and other values of the property.

Wild Salmon Resource Center Development:

- Presented educational programs to school, civic and local government audiences regarding Atlantic salmon biology and conservation issues.
- Acted as clearinghouse for information to the general public for information about Atlantic salmon and the Atlantic Salmon Conservation Plan and GIS-based habitat maps.
- Began to develop a watershed management and cold water fisheries resource library available to the public.
- Acted as a focal point for activity related to the development and support of the Downeast Rivers Coalition and the Councils.
- Assisted with creation of a resource manual for watershed council volunteers and a web site for council and ASCP activities.
- Assisted the Councils with educational and awareness building activities such as canoe trips, fishing derbys, picnics, watershed conferences / festivals and kiosk construction.

Planning Projects:

- Worked with professional facilitators to develop a strong organizational network to efficiently relegate responsibilities between the Councils, SHARE, the Downeast Salmon Federation and the Downeast Rivers Coalition (see organizational chart).

Final Report

Coordination of the Ducktrap Coalition, Ducktrap River Watershed

per
Agreement No. 698583

October 5, 1999

Report by
Scott Dickerson, Executive Director
Coastal Mountains Land Trust, Coordinator of the Ducktrap Coalition
P. O. Box 101
Rockport ME 04856
207-236-9701

I. Background

The Ducktrap Coalition, watershed council for the Ducktrap River Watershed under the March, 1997 Atlantic Salmon Conservation Plan for Seven Rivers, has the broad purpose to "cooperatively guide Atlantic salmon conservation activities related to land use and other activities within each watershed." In addition, the Watershed Councils will "continue to review the status of threats in each watershed and determine the need for continued or new efforts to further minimize any potential threat to Atlantic salmon from future activities present in the watershed." The Ducktrap Coalition shares specific Plan implementation tasks with other agencies, including working with land owners to develop agreements and conservation easements that protect salmon habitat, informing land owners on the importance of conserving riparian wetlands, informing land owners and logging contractors on appropriate management of forest lands, and working to remediate conditions that are resulting in degradation of the river. Coastal Mountains Land Trust is responsible for coordination of the Ducktrap Coalition activities.

Coastal Mountains Land Trust entered into an Agreement, No. 698583, with the Maine State Planning Office for the purpose of providing services to coordinate the Ducktrap Coalition and implement certain objectives of the Plan. As this report and enclosures will describe, the agreed services have been completed satisfactorily.

II. Accomplishment of Work Tasks

Members of the Ducktrap Coalition, including Coastal Mountains Land Trust (hereafter CMLT), have conducted work on several of the Plan activities since the September 28, 1998 report provided to the Maine State Planning Office. The following narrative describes the results of the Coalition's work.

II.A Staff Management

The Agreement specifies that CMLT redirect existing staff resources to coordinate the work of the Ducktrap Coalition on Plan activities. This has been accomplished as detailed below regarding the work products under the Agreement.

II.A.1 Work Plan.

A work plan for the term of the contract was prepared and submitted to the Maine State Planning Office. The work plan was approved by Henry Nichols.

II.A.2 Salmon Benchmarks and Outcomes Annual Report

This report was prepared and submitted to the Maine State Planning Office on September 28, 1998. It was approved by Henry Nichols and included in the state report to the Federal agencies for the first year progress of the Plan. The following benchmarks are specified to be included in the 1998 report and this report.

II.A.2.a. Surveys/Assessments Of Riparian Buffer Area Conditions And Water Quality Conditions Of The Ducktrap River.

Staff at CMLT and participating organizations of the Ducktrap Coalition (primarily the Ducktrap Riverkeepers) have surveyed the riparian buffer area of the

Ducktrap River on a regular, continuing basis. The full length of the river is monitored by on-site visits at least once per year, and those areas with primary habitat for spawning and juvenile salmon (2 miles upstream and downstream of Route 52 bridge and the outlets areas of Black and Kendall Brooks) are monitored by on-site visits several times per year. This monitoring process has found that the buffers are fully forested in the area within 250 feet of the river or its riparian wetlands, except in a few places:

1. Route 1 bridge at the mouth of the river
   A new bridge was constructed at this site during 1998. Staff from CMLT consulted with the Maine Department of Transportation (MDOT) project supervisor on several occasions regarding construction issues that had the potential to impact salmon in the river. Construction has been completed. The use and maintenance of the highway in the vicinity of the bridge will probably result in introduction of salt, sand, and other materials to the river. The project supervisor has requested that volunteers from the Ducktrap Coalition dredge out the silt trap pools that were constructed with the new bridge project in order to keep sand and silt from washing into the river when the trap pools fill with sediments. Responsibility for this task has not been accepted by the Coalition since the necessary equipment for such maintenance dredging is not available to the member organizations.
2. In the vicinity of the Tanglewood 4-H Camps center of operations
   Tanglewood has some trails that are located beside the river. Some of these trails had become bare due to the substantial impact of the many participants of the program. Tanglewood has taken steps to reduce the impact of the trails by relocation of the trails to be more distant from the river and to revegetate the old locations.
3. Route 52 bridge at the mid-point of the river
   This highway crossing of the river occurs in a valley with steep, long hills on both sides of the bridge. The highway ditches are in a securely vegetated condition for most of the hill sections, but one ditch area is not vegetated and is eroding and releasing silt and other sediments into a tributary brook that flows into the river. Staff at CMLT have met with staff from the MDOT and the Maine Department of Environmental Protection (MDEP) to discuss correcting the condition. A final resolution of the problem has not yet been determined and no corrective action has been taken. The tributary brook that receives and transports this road ditch sediment passes across land owned by CMLT, which has sought and obtained an EQIP grant from the Natural Resource Conservation Service to stabilize the banks of this section of the tributary. This work will occur in 2000 following receipt of permits from MDEP. No silt trapping pools or other ditch structures are present to capture winter maintenance sand.
4. Crossing of the Central Maine Power powerline corridor
   This corridor is maintained in a treeless condition by cutting and herbicide application from backpack sprayers, but is covered with grass and shrubby vegetation in most parts except for the ATV-4x4 truck trail that follows along the corridor. This trail is eroding is some sections, though not in the vicinity of the river. The only cure for the erosion that is occurring would be to keep the wheeled vehicles off of the corridor which may not be feasible for CMLT.

5. Dickey Mill Road bridge near the outlet of Tilden Pond at the headwaters of the river.
   There is extremely little if any sediment entering the river from this bridge area.

There is no comprehensive water quality monitoring program on the Ducktrap River. This summer MDEP and CMLT conducted a minimal baseline water quality monitoring program. On four occasions—once monthly in July, August, and September and during one stormwater runoff event—water samples, benthic insect presence, and substrate photographs were collected by CMLT staff at three sites on the river. The water samples were sent to the University of Maine for analysis of these parameters—alkalinity, conductivity, pH, Phosphorus, nitrogen, turbidity, total solids. It has not been determined if this sampling program will continue or be expanded in future years.

II.A.2.b. Identification And Corrective Action Plans Concerning Non-Point Pollution Sources.

Under the Plan, the Maine Forest Service and the Maine Department of Agriculture, Food, and Rural Resources have lead responsibility to identify sources of non-point pollution and develop plans with land owners and town officials. CMLT assists in this process through two project areas—gravel pit restoration and the distribution of educational materials to landowners and loggers concerning forest management practices.

There are three gravel pits located near the river that need to be revegetated to improve infiltration of precipitation into the groundwater and to contain release of sediments from two of these pits.

One gravel pit is located beside Rt. 52 and the river, but this pit is very small (<1 acre in worked area), is largely revegetated by natural succession, and precipitation is fully contained on the site. No remediation is planned for this site at this time, though if CMLT is able to purchase it from the owner the areas that are not yet vegetated will be planted.

A second gravel pit is located ca. 1/4 mile upstream from Rt. 52 and within 400 feet of the river. It has not been an active pit for several years but was releasing sediments to a small tributary brook to the river. It is also located in the center of the only mapped sand and gravel aquifer beside the river. This gravel pit is the site of a wetlands mitigation project under permit process of MDEP and the U. S. Army Corps of Engineers. The site has been fully regraded and planted by contractors for the Five Town Community School District which destroyed ca. 3 acres of wetlands in construction of the new high school in Rockport. The property is now owned by CMLT as part of its Ducktrap River Preserve.

The third gravel pit is located ca. 1.6 miles upstream of Rt. 52 and ca. 1000 feet from the river. It was actively worked until September, 1999, when it was purchased by CMLT. It was releasing sediments into a small tributary brook to the river. Part of the purchase agreement required that the owner of the pit regrade and revegetate the gravel pit. This was completed prior to closing of the purchase by CMLT.

In the 1998-1999 fiscal year CMLT worked on a contract with the Maine Forest Service to provide landowners and loggers with information related to harvest practices and to work with landowners on the conservation of forested lands. When MFS provided copies of Forest Operations Notifications, CMLT staff wrote the respective landowner and/or logger to explain the importance of using best management practices for the operation and included in the mailing the MFS booklet on BMPs. In addition, CMLT worked with many landowners to conserve their forested lands by conservation easements or conservation purchase. These projects are detailed in II.A.2.d. below.

II.A.2.c. Need For Improved Vegetative Cover In Riparian Areas.

As noted above in II.A.2.a, there is very little need for improved vegetative cover in the riparian areas of the Ducktrap River.

II.A.2.d. Long-Term Protection Of Riparian Areas That Buffer Salmon Habitat.

The Ducktrap Coalition has identified permanent conservation protection of the riparian area of the Ducktrap River as a feasible objective and has commenced work on achieving this protection. The principal methods of implementing this conservation protection are conservation easements and fee simple acquisition, conducted by working on a voluntary basis with the riparian land owners. Coastal Mountains Land Trust is conducting and coordinating this land protection project, in collaboration with the Land for Maine's Future Program, Maine Coast Heritage Trust, Ducktrap Wildlife Preserve, the Maine Department of Conservation, The Nature Conservancy, and Belfast-Northport-Lincolnville Land Trust.

During 1998 and through October 1, 1999, twelve land conservation projects were completed by Ducktrap Coalition organizations. CMLT completed 8 of the projects, Maine Department of Inland Fisheries and Wildlife and the Land for Maine's Future Program completed 2 projects, Maine Coast Heritage Trust completed 1 project, and the Ducktrap Wildlife Preserve completed 1 project. These properties cumulatively protect the riparian area along 31,757 feet of riverfront and 1,187 acres. When added to lands previously conserved, 63,528 feet of riverfront and 2,348 acres of land are in conservation management and ownership on the Ducktrap River. This is approximately 65% of the riparian buffer of the river.

II.B. Watershed Council Management

The Agreement specifies that CMLT will recruit and organize volunteers from the Ducktrap River watershed to serve on the Ducktrap Coalition. That has been accomplished. This has been accomplished as detailed below regarding the work products under the Agreement.

II.B.1. Current Mailing Lists

Current mailing lists of participants have been provided to Henry Nichols at the Maine State Planning Office and a large set of other interested parties.

II.B.2. Meeting Minutes

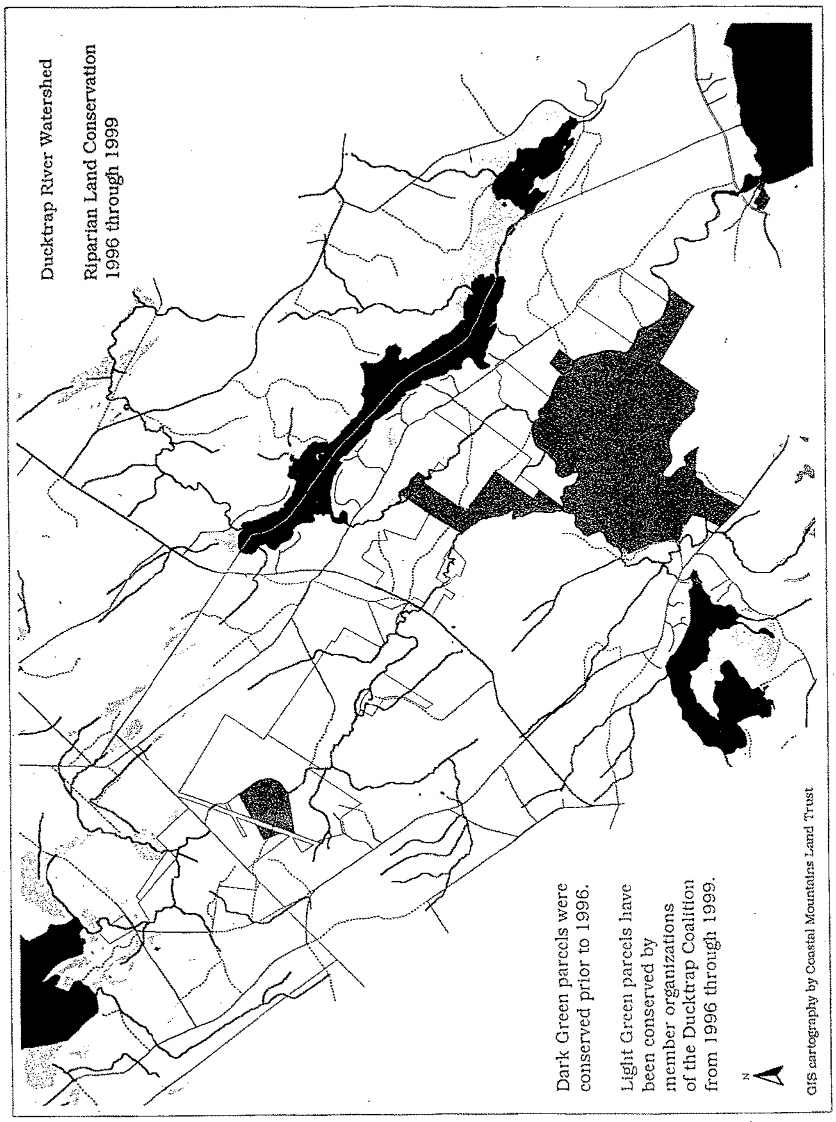
Minutes of the meetings of the Ducktrap Coalition are distributed to the mailing list.

II.C. Project Management

The Agreement specifies that CMLT will develop and coordinate conservation projects that directly address the watershed council tasks as described in the Plan and have been determined to be critical to meeting the objectives of the Plan and the Ducktrap Coalition, and are feasible with available resources. The work products related to this task are copies of watershed surveys/assessments and baseline data. As indicated above, the surveys/assessments have been completed, and the identified areas of concern are being addressed or have already been corrected. Baseline data has been collected by agencies other that CMLT—for instance, the water quality monitoring data collection by MDEP, and salmon habitat data is collected by the Atlantic Salmon Commission and U. S. Fish and Wildlife Service—so there is no baseline data to transfer from CMLT to the Maine State Planning Office.

III. Conclusion

The services to be provided by CMLT under the agreement have been completed with submission of this report.


Ducktrap River Watershed
Riparian Land Conservation
1996 through 1999
Dark Green parcels were conserved prior to 1996.
Light Green parcels have been conserved by member organizations of the Ducktrap Coalition from 1996 through 1999.
N
GIS cartography by Coastal Mountains Land Trust

Sheepscot Watershed Council
1999 Progress Report
by Jeff Reardon, SVCA

Activities of the Watershed Council and The Sheepscot Valley Conservation Association in Support of the Maine Atlantic Salmon Conservation Plan

Sheepscot River Watershed Council Membership

The Sheepscot River Watershed Council (SRWC) was formed in the spring of 1997 by a group of individuals, governmental agencies, and non-profit organizations who were already working together to address non-point source pollution on the Sheepscot as part of the development of Maine's Atlantic Salmon Conservation Plan for Seven Rivers (the Plan). Many of these organizations had already begun efforts to protect Atlantic salmon and/or the Sheepscot Watershed. Since 1997 the Sheepscot Watershed Council has been part of the implementation of the Plan.

During 1999, the Council continued efforts to broaden membership and participation. Current members are shown below:

Federal Agencies

- Denise Buckley, US FWS
- Jerry Marancik, US FWS
- Mary Thompson, USDA-NRCS
- Jed Wright, US FWS
- Peter Newkirk, USDA-NRCS

State Agencies

- Fred Kircheis, ASC
- Norm Dube, ASC
- Peter Mosher, DAFRR
- Lew Flagg, DMR
- Mark DesMeules, SPO
- Morten Moesswilde, DOC
- Jim Stallnecker, IFW
- Henry Nichols, ASC
- Craig Leonard, DAFRR
- Mike Clark, DOT
- Tom Squiers, DMR
- Norm Marcotte, DEP
- Jim Lucas, IFW

Town Government

- Mike Dostie, Somerville CEO
- Ed Leary, Palermo Planning Board
- Jerry Nault, Windsor Selectman
- Joe Blair, Sr., Windsor Planning Board
- Carroll York, Windsor Planning Board
- Frank Hample, Somerville Selectman
- Gerry Maines, Windsor Selectman
- Dave Stanley, Somerville Selectman

Non Governmental Organizations

- Mike Herz, Sheepscot Valley Conservation Association
- Jan MacNitt, Kennebec SWCD
- Barry Tibbets, Knox/Lincoln SWCD

Jeff Reardon, SVCA
Nick Barth, SVCA
Sean McCormick, Trout Unlimited
Rich Backer, BFI
Dave O'Neal, SSC

Nigel Calder, SVCA
Paul Hoffman, SVCA
Clyde Sproul, Time and Tide
George Pretat, Sheepscot Salmon Club

Individuals

Melissa Evers
Bob Webber

Watershed Survey

In 1997 the SRWC identified four critical information needs to guide future work in the watershed:
--A survey of agricultural land use in the watershed.
--A survey of non-point source pollution in the watershed.
--A survey of riparian buffers along the river and stream corridors in the watershed.
--A survey of stream segments in the watershed which lack adequate canopy cover.

Many of the efforts of the Council and its members since that time have been directed towards collecting this information. The Knox/Lincoln and Kennebec County offices of the USDA/NRCS have compiled information on all farms in the watershed, including areas of the West Branch watershed where riparian vegetation is lacking or banks are eroding due to agricultural activities. Although this information is not available to the Council or to the public, it is being used to guide work by NRCS staff. During 1998, field work was conducted to identify areas along the mainstem Sheepscot where riparian buffers were inadequate, as well as areas where non-point source pollution was noted. In 1999 this work was presented as a report, Sheepscot River Main Stem Riparian Inventory.

The second stage of the riparian buffers survey was also begun on the West Branch on 1999. Data have been collected and summarized for 6 of 10 river sections on the West Branch. The remaining sections will be surveyed and a report written during the summer of 2000.

These two surveys, combined with existing information on agricultural land use, will provide watershed council and its members with the locations of all areas where stream bank erosion, lack of riparian vegetation, or lack of canopy cover affect the river.

Two additional surveys within the West Branch sub-watershed, performed by the SVCA and the Maine Coastal Program of the State Planning Office in 1996 and 1997, gave an initial look at a more detailed watershed survey, which would include tributaries and upland areas for an analysis of all possible inputs of NPS pollution. Another brief survey looked at road crossings of the mainstem and its coldwater tributaries, identifying several areas where road related erosion from state highways is a problem. Extending these existing surveys to include the entire watershed and all tributaries would be a huge undertaking. It probably makes more sense to focus on tributaries where either water quality data or anecdotal information on land use indicate that there may be problems.

Restoration

With the survey work well underway, the Council has begun to pick priorities for restoration. One initial effort, begun in 1998, has faltered. Trout Unlimited received funding to stabilize two large eroding stream banks adjacent to the hatchery in Palermo. Although land owner interest was high, several factors essentially scuttled the project. There was considerable concern about the design that NRCS provided for the site (a large amount of rip rap), and some feeling that the erosion might be from natural causes. In addition, the Palermo Planning Board was unwilling to issue a permit for the riprap. In light of both concern about the proposed solution and local opposition, the project has been shelved.

The SVCA has planned one restoration project. A section of stream bank on the West Branch in Maxcy Mills lacks riparian cover due to a series of powerline crossings and parallels. SVCA has negotiated with CMP, and CMP has agreed to plantings and a buffer maintenance schedule. SVCA is working on a planting plan for next spring.

Two council members have funding to pursue restoration work. SVCA has received an EPA 319 grant that provides for consultation and planning for restoration of sites identified by the existing watershed surveys. This will provide for staff through March, 2001. The Kennebec County Soil and Water Conservation District has received an Incremental 319 grant for the West Branch watershed, and has significant funds available to correct road related non-point source pollution at sites already identified in the West Branch. This funding should provide for a staff person and implementation funds for the next two years.

The Maine Department of Transportation has applied for grant funding to restore an area along Route 17 where road run-off has undercut a culvert and is causing a large input of sediment during storm events.

Staffing: Watershed Coordinator

In order to support the SRWC, as well as its own conservation and land protection activities, in 1998 the Sheepscot Valley Conservation Association (SVCA) sought funding for a full-time Watershed Outreach Coordinator. Grants from the Atlantic Salmon Watersheds Collaborative and EPA's 319 program provided funding to hire Jeff Reardon in March of 1998. Originally, 20% of Jeff's time was budgeted to provide staff support to the SRWC. An additional grant of $17,000 from the State of Maine in 1998 allowed SVCA to devote more of Jeff's time to work on SRWC projects and support. SVCA has extended its 319 funding through March of 2001, and will continue to employ a Watershed Coordinator. However, discussions within the Watershed Council indicate that it might be preferable to provide an additional staff person to coordinate the Council and undertake a series of outreach activities (see below). This would allow the SVCA's staff person to focus exclusively on the watershed survey and restoration work funded by the 319 grant. The council is currently looking for funding to add to the Maine Atlantic Salmon Authority's $20,000 for 2000 to provide a Watershed Council staff person, possibly housed at Time and Tide.

Outreach

Through its initial work with towns in the watershed, the Council has discovered that most residents of the Sheepscot watershed are unaware of the Watershed Council and know very little about the watershed or its use by Atlantic salmon. Consequently, the Council identified the development of outreach materials, and a staff person to focus on community outreach, as a top priority for 2000. The SVCA has been awarded a $6,700 grant from the Maine Coastal Program to develop outreach materials. A bit over half of this money will go to the Watershed Council to develop a brochure which describes the Council and its activities, as well as two brochures directed at educating residents about the importance of riparian buffers and about how to protect riverfront lands through conservation easements. The Council has approached the Time and Tide Rural Conservation and Development Council about hosting a staff person if funding can be found. Time and Tide is willing to provide office space if funding for a staff person can be found.

Land Protection

In 1997, when the Maine Atlantic Salmon Conservation Plan began, the SVCA held one conservation easement adjacent to Atlantic salmon habitat, protecting about 1,000 feet of frontage in Whitefield near the Alna town line. In 1999, the SVCA bought the Crowe Rope property, protecting almost 5,000 feet of frontage at the junction of the West Branch and Mainstem. Early in 2000 the SVCA will donate an easement to the Maine Department of Inland Fisheries and Wildlife to ensure that the property remains forever wild and allows public access.

In addition to this purchase, the SVCA has been working on two additional easements adjacent to salmon habitat. The CEI parcel is adjacent to the Crowe Rope parcel and will protect over 3,500 feet of frontage on the West Branch. The easement should be completed in January, 2000. The Sandy Sage property in Alna has over 3,000 feet of river frontage, and that easement should also be completed early in 2000. Another Alna landowner has committed to a conservation easement on over 2,000 feet of frontage, and that easement should be completed by the summer of 2000. Combined, these parcels represent over 2 ½ miles of river frontage adjacent to salmon habitat that will be in permanent conservation protection, almost all of it since 1998.

To date, these land conservation efforts have been opportunistic. In order to successfully meet the Conservation Plan's habitat protection goals, a more focused effort, involving multiple groups, will be required to set priorities for land conservation. To that end, in the fall of 1999 the SVCA asked for a meeting with the Maine Atlantic Salmon Commission to decide which sections of the river were of the highest priority as salmon habitat. An initial meeting was held in October of 1999, and a follow up meeting will be held in January, 2000.

The SVCA has received a $28,000 grant from the Maine Atlantic Salmon Collaborative to cover the costs of establishing easements on up to 7 properties over the next 18 months. The Maine Coast Heritage Trust has agreed to help with drafting of easements.

Section 3 – Private Partners' Reports

Maine Council – Atlantic Salmon Federation
RR 3 Box 86 • Bangor, ME 04401
Tel. (207) 848-3670 • Fax (207) 848-3670

December 16, 1999

To: Henry Nichols, Atlantic Salmon Commission
Subject: Achievements of the Maine Council- ASF and Atlantic Salmon Federation in 1999 including those supporting the State Conservation Plan.

1. **New legislation, LD 2028:** Council and ASF members acted as catalytic proponents of a movement to consolidate management of Maine's Atlantic salmon rivers- including the 7 Downeast rivers.This resulted in the formation of a new commission which replaced the former Atlantic Salmon Authority. In order to prove its effectiveness, the 3 person management format plus a newly created position of executive director must keep the needs of Atlantic salmon profiled at a much higher level in state government than has been experienced in the past. Futhermore, the new ASC must be able to control all funds aimed at improving wild salmon habitat including budgeting the required field personnel, etc.

2.Habitat improvement, dam removals: *

2.1 Pleasant River at Columbia Falls- The hydro dam at the mouth (tide water) of this river was breached in 1990 to open up 28 miles of river. This year, 1999, as a result of inputs from the Pleasant River Watershed Council, MC-ASF, and ASF in cooperation with the NRCS, utilizing a federal WHIP program, fish passage and smelt spawning habitat was markedly improved when a remaining portion of the old dam was removed.

Total project cost	=	+/- $12,000

2.2 Dennys River, Cathance Lake
The MC-ASF cooperated with the Dennys River Watershed Council and NRCS using funding from the federal WHIP program to replace water control structure at the outlet of Cathance Lake and install a new fishway.

Total project cost	=	+/- $85,000

*Section 2.1to 2.8 reflect the work done as a result of leadership provided by NRCS personnel.

2.3 Souadabscook River , a Penobscot tributary-
MC-ASF worked with affiliate F.I.S.H. (Facilitators for Improved Salmonid Habitat) to purchase and remove or modify the last two dams on this river to allow access upstream and downstream for wild salmon and other anadromous species. The success of this project, linking the first step in 1998 when the Grist mill dam was removed in Hampden at the head of tide, was a result of a unique partnering arrangement established by the Department of Interior's "Coastal America Program."
Participating partners included : USDA & NRCS, USFW Service, Gulf of Maine Project, Penobscot Indian Nation, John Jones Co., and many others.

1999 expeditures paid out of Maine Council/ASF	=	$46,343.00
Total project cost which includes payment for the grist mill dam removal in 1998	=	+/- $120,000

2.4 Pleasant River – Brownville dam on the Piscataquis River, a Penobscot tributary-
MC-ASF worked with affiliate F.I.S.H. to purchase and remove the old hydro dam and ancillary structure in the town of Brownville. Removal of this dam opened over 300 miles of the Penobscot River watershed recreating excellent wild salmon habitat. This entire project , like the Souadabscook , was a success because of input from the NRCS personnel and utilization of the Coastal America Partnering Program.

1999 expenditures paid out by MC-ASF and affiliate (FISH)	=	$17, 938
Total project cost	=	+/- $84,000

2.5 Canaan dam on Old Stream- tributary of the Machias River.
The fish passage obstruction was removed in 1999 through the efforts and cooperation of Champion Paper Co. and the NRCS (WHIP).
Total project cost = +/- $20,400

2.6 Dam(log) at 1st Machias Lake, part of the Machias River Watershed .
This fish passage obstruction was also removed in 1999 as a result of a Champion Paper Company and N.R.C.S. partnership.
Total project cost = +/-$5,800

2.7 Stetson dam on the Sebasticook river, a tributary of the Kennebec River-
The dam was removed and a fishway into Pleasant Lake was also required. This project was the result of cooperation between NRCS (WHIP program) and DMR.
Total project cost = +/- $63,000

2.8 Two fishways installed in the Orland River-
The fishways were a cooperative effort by Champion Paper Compay, USFW Service and NRCS (WHIP Program).
Total project cost = +/-$100,000

2.9 Edwards Dam on the Kennebec River-
MC-ASF contributed significant manpower and money toward the successful lobbying efforts of the Kennebec Coalition which resulted in the removal of Edwards dam in July. The dam removal recreated 17 miles of excellent habitat for wild salmon and other anadromous fish.
Total cost = $3,000,000

3.0 MC-ASF personnel attended countless meetings directed at finding ways of establishing agreements and regulations which will help to provide better habitat for wild Atlantic salmon in the downeast rivers and other rivers in Maine. The list includes:

3.1 Project SHARE bi-monthly director meetings and public meetings. MC-ASF personnel played a leading role in securing funding for the SHARE operations.($25,000 for 5 years)
3.2 LURC Hearings
3.3 EPA meetings
3.4 WUMP
3.5 ASA/ASC meetings
3.6 TAC
3.7 State planning meetings
3.8 DMR- elver hearings
3.9 Gulf of Maine, Falmouth, on habitat
3.91 Fish Health Regulations- State of Maine
3.92 Aquaculture siting permit hearings
3.93 Legislative hearings re: wild salmon

4. **ASF Regional Director, Mike Hill and Project SHARE executive secretary, Matt Scott organized a Public Forum on Atlantic salmon Management, past, present and the future.**

4.1 Feb. 13, 1999 at the UMM, Machias
The workshop was designed to explain various concerns and responsibilities connected with Wild Atlantic salmon restoration. The workshop featured knowledgeable speakers such as Dr. Vaughn Anthony- MC-ASF, Dr. John Kocik- NMFS, Mary Colligan- NMFS, Dwayne Shaw- WSRC, and Dave Garcelon- NRCS
Approximate attendance = 100 people

4.2 July 9 & 10 at Meddybemps Community Center.
The 2 day workshop covered a variety of topics including wild salmon predation by seals, the EPA superfund site, volunteer lake monitoring, beaver populations in Washington County, watershed council activities, electro-fishing, site visits to the EPA superfund site, and a canoe trip down the Dennys River.

Approximate attendance for 2 days = 35 people

5. **MC-ASF support for watershed councils:**

5.1 Utilized a $49,000 outreach grant from NMFS to develop a watershed resource guide at the Columbia Falls –Wild Salmon Resource Center. (distribution dates expected by 1/15/00)

5.2 Designed a website for the State Conservation Plan utilizing technical assistance from the ASF Conservation Center in St. Andrews, NB.
5.3 Worked with the Ducktrap Coalition Education Committee to expand their watershed cirriculum for local teachers. Due date 6/00.
5.4 Assisted the Sheepscot River Watershed Council Education Committee with the development of a watershed brochure. Due date 1/20/00.

6 MC-ASF Fish Friends Program
ASF Regional Director, Mike Hill, chairperson of the SHARE education committee, also extends SHARE's programs by hosting Fish Friends Workshops which include in 1999:

6.1	Jan. 16 in Saco, Maine at SRSC	30 people attended
6.2	Feb. 6 in Presque Isle, Maine	12 people attended
6.3	November 13 in Holden, Field Pond	10 people attended
6.4	December 4 in Lisbon, Beaver Park	16 people attended

7 ASF Regional Director , Mike Hill's Field and Stream Activities-

7.1 Coordinated with the inmate program from the Downeast Correctional Facility in Buck's Harbor to provide the manpower to assist with the removal of 55 beaver dams between June and September 1999. This program opened up miles of salmon rearing habitiat. Many landowners and volunteers from the Machias, East Machias, Pleasant and Narraguagus watersheds also participated.

7.2 The removal of ASC's weirs on the Pleasant and Dennys rivers in November also benefited from a coordinated program with DECF which provided a crew of 6 inmates and a crew boss.
Total time required for this project was 6 hours total for both weirs.

7.3 An Atlantic salmon "swim through" on the Dennys river was organized by Mike Hill as a result of the Dennys River Watershed Council request for a salmon assessment. Volunteers from the WSRC, Americorps and UMM made this a successful exercise even though no adult wild salmon were noted. Next year more rivers will be included in this program.

Submitted by: Ralph Keef, Pres. MC-ASF

Mike Hill, ASF Regional Director

CHERRYFIELD FOODS, INC.
Park Street • P.O. Box 128 • Cherryfield, Maine 04622
Phone (207) 546-7573 • FAX #207-546-2713

14 December 1999

State Planning Office
Atlantic Salmon Conservation Plan
Attn: Mr. Henry Nichols
Station 38
Augusta, Maine 04333-0038

RE: CFI 1999 contributions to the Atlantic Salmon Conservation Plan.

Dear Henry;

RE. In 1999 CFI has undertaken the following actions in support of the Maine Atlantic Salmon Conservation Plan:

1: Removed the irrigation pump site at El Meadow on the Pleasant River. This site has been replaced by a well outside of the watershed. This new site is in a non-salmon watershed.

2. CFI has developed a well for irrigation in the Machias River watershed to water previously un-irrigated blueberry acreage.

3: Developed and began to implement a weather monitoring system to monitor precipitation on CFI holding to better manage the use of irrigation water withdrawal. This is in real time monitoring to a central point.

4: CFI has undertaken an aggressive search program to develop new sources of irrigation water and to develop irrigation strategies that lessen or end direct impact to Atlantic Salmon habitat.

5: Held the first and only hazardous spill response exercise in western Washington County. CFI has implemented a training program to cover the company role and is under taking a leadership role to meet the spill response needs of western Washington County.

6: CFI has installed 110% containment structures at irrigation sites to protect the land and waters of the watersheds from fuel spills at irrigation.

7: CFI has implemented the first Spill Protection Control and Countermeasure Plan directly related to irrigation in the state.

8: CFI has build a state of art pesticide storage building to protect the overall environment of pesticide spills.

CHERRYFIELD FOODS, INC.
Park Street • P.O. Box 128 • Cherryfield, Maine 04622
Phone (207) 546-7573 • FAX #207-546-2713

page 2

RE. In 1999 CFI has undertaken the following actions in support of the Maine Atlantic Salmon Conservation Plan:

9: CFI started a company wide review of 319, (non-point source pollution) issues and is developing a policy and the implementation of a 319 plan of the company.

10: CFI installed a rock barrier at Crebo Crossing bridge on the Pleasant River to stop run away vehicles from going into the river.

11: CFI has begun a program of resizing and the installation of new culverts to stop non-point source pollution and to allow better free and natural flows of surface waters.

12: CFI continues to work with and support the local watershed councils in the watersheds that is farms in. This includes the donation of funds to SHARE, supplies to Narraguagus and Pleasant Rivers 319 program and mailing and office help to the Pleasant River Watershed Council to name a few of the actions undertaken.

13: Decreased use of pesticides through intense Integrated Crop Management program.

14. Developed a program of peat and organic material spreading on bare crop land to improve the water holding capacity of the soil and to decrease the vertical movement of pesticides on bare soil.

These are the most important contributions that CFI has undertaken in 1999. CFI estimates that it has spent $468472 in direct support of the Atlantic Salmon Conservation Plan. This figure does not count the cost of personnel involvement or time spend on these issues by upper management. Many of these are long term commitments by the company to support the Maine Atlantic Salmon Plan.

Sincerely:

William Patrick

William Patrick
Company Engineer

cc. David Wilby, Governor's Office

Knox-Lincoln Soil and Water Conservation District
191 Camden Road - Warren, ME 04864-4207 - Phone (207) 273-2005

Henry Nichols
ASCP Coordinator
Atlantic Salmon Commission
C/o State Planning Office
38 State House Station
Augusta, ME 04333

Dear Henry:

This letter is in reply to your e-mail message that was dated November 22, 1999 concerning a progress report of the activities completed in the Sheepscot River Watershed. This is a summary of the activities in the watershed by the Kennebec, Knox-Lincoln and Waldo County Soil & Water Conservation Districts for the year 1999.

The Knox-Lincoln SWCD continues to implement the Alternate Watering Facility Section 319 grant they received in 1996. Accomplishments this year include:

1. At a farm in Weeks Mills along the West Branch of the Sheepscot River a spring was developed using 4-foot well tiles and water was gravity fed to a watering tub for the livestock. At this spot a buffer area (about ½ acre) was created by fencing out the spring and its run into the West Branch. This project will prevent nutrients and sediment from reaching the river but will also supply a good source of water for the livestock.

2. In this same pasture, at a different location, the livestock was fenced out of river for 325 linear feet. Thus the streambank is protected and a buffer area was created with a width of 30 to 100 feet. A pasture pump was installed to provide water. A pasture pump actually causes the livestock to pump their own water! The Kennebec County SWCD helped the Knox-Lincoln SWCD with this project and the above one.

3. At a farm in Alna a spring was developed to provide water to livestock to protect a tributary to the main stem of the Sheepscot River. A buffer area around the spring and its drainage will be created and the installation of a water tub is soon to follow.

4. The project at the Sheepscot Valley Farm is near completion.

The Knox-Lincoln SWCD worked on two Environmental Quality Incentives Program educational projects which are funded through the USDA Natural

Resources Conservation Service. The District has received approval to demonstrate the proper storage of gas and diesel tanks at a farm on the Townhouse Road in Whitefield. This $3940 project will be constructed next year. The other project is to demonstrate on-farm composting methods to utilize various agricultural waste products, such as, manure, spoiled feed and bedding. Currently two farms are participating in this $2670 project.

The Knox-Lincoln SWCD received $2000 from the US Fish & Wildlife Service to pay for fencing livestock from the Sheepscot. The monies have been earmarked for three separate projects that will be completed next year.

The Kennebec County SWCD has received a Section 319 grant from the Maine DEP titled, "Water Quality Restoration on the West Branch of the Sheepscot River". The total cost of this project is $413,000 with federal monies of $254,070. A coordinator has been hired and the work has begun!

All three Conservation Districts (Kennebec, Knox-Lincoln and Waldo) participate in the Sheepscot River Watershed Council.

Maine Wild Blueberry Commission

INFORMATION FOR YEAR END PROGRESS REPORT TO MAINE'S ATLANTIC SALMON CONSERVATION PLAN

December 14, 1999

12. ACTIVITY: Pesticide Use Target Crops

Comprehensive training sessions were again provided to Wild Blueberry growers through University of Maine Cooperative Extension. These training sessions provide growers with the information they need to minimize their reliance on pesticides through the use of knowledge based pest management approaches commonly referred to as Integrated Pest Management (IPM) and Integrated Crop Management (ICM). IPM and ICM provide growers with a menu of Best Management Practices. Based on the pest complexes they observe in their fields growers select the appropriate practice. Additionally, training such as calibration for applications provide growers with skills they need to apply pesticides in accordance with the Federal EPA label and State of Maine Board of Pesticide Control regulations.

All of the activities below benefitted the five downeast watersheds and the Sheepscot watershed (we are not aware of growers in the Duck Trap watershed). Funding was provided to the University of Maine Cooperative Extension Service by Wild Blueberry growers through the Wild Blueberry Commission at levels in excess of the $15,000 agreed to in Maine's Conservation Plan for education. Additionally, IPM/ICM services provided to Wild Blueberry growers through the efforts of the Extension Blueberry Specialist exceeded $30,000.

Following is a summary of Wild Blueberry IPM/ICM educational sessions.

A Wild Blueberry pest management session was presented to growers at the State Agricultural trade show in January. The presentation reviewed Integrated Pest Management strategies in Wild Blueberries. Attendees received 1 pesticide re-certification credit for this session.

The annual Spring Wild Blueberry Schools were held in 4 locations around the State in March. The Union, Ellsworth and Machias, Maine locations are located in or are close to Atlantic salmon watersheds and serve growers raising Wild Blueberries throughout the watersheds. The presentation on "Granular Herbicide Application and Calibration" by Dr. David Yarborough, University of Maine Cooperative Extension educated growers on the updated recommendation included in the revised "Hexazinone Best Management System for Wild Blueberry Fields" (see below). The Board of Pesticide Control also made a presentation to all growers on recent changes including an update on monitoring activities in Atlantic salmon watersheds and a reminder on the importance of proper and responsible use.

Approximately 200 growers attended these sessions. Growers received 2 pesticide re-certification credits for attendance. It should be noted, updated IPM/ICM recommendations are also included in the Wild Blueberry Growers Guide and are mailed to over 700 on the grower list.

<u>Integrated Crop Management Field Training Sessions</u>

Three different Integrated Crop Management field sessions were conducted by Dr. David Yarborough during May and June. Each session was repeated in three locations (Warren, Orland, and Jonesboro, Maine) which were accessible to growers located in the Conservation Plan watersheds. The first session was devoted to the calibration of granular herbicide applications, blight identification and control, and insect sweeping (for scouting) and identification. The second session stressed blight (disease) identification and control, insect sweeping and identification, and weed identification and management. The third session focused on blueberry maggot fly trapping, leaf and soil sampling (fertility), and weed identification and management. Dozens of growers attended. Attendees at each session received 1 pesticide re-certification credit.

<u>Annual Field Day, Blueberry Hill Farm, Jonesboro</u>

The annual field day was held in mid-July at the experimental farm in Jonesboro. Dr. David Yarborough. Researchers provided updates on research related to insect and weed control IPM and ICM programs. Related practices were reviewed with over 100 growers. Attendees received 1 pesticide re-certification credit for this program.

II. ACTIVITY: Revision of Hexazinone Best Management Practices

Maine's Wild Blueberry growers became concerned that not enough progress was being made by vendors of a hexazinone product to address performance and potential environmental issues. Hexazinone is an effect broad spectrum herbicide commonly used by blueberry growers. The Wild Blueberry (research) Advisory Committee took up the issue at their October 1998 meeting. The recommendation of the Committee was to take the issue to the Board of Pesticide Control (BPC) and ask for a review and revision of the Hexazinone Best Management System (BMS) for Wild Blueberry Fields. The first BMS grower bulletin was developed in response to ground water detections of hexazinone and was incorporated in the State of Maine Hexazinone State Management Plan For the Protection of Ground Water adopted in 1996.

The Wild Blueberry Advisory Committee requested that Dr. David Yarborough, the Cooperative Extension Blueberry Specialist, make a presentation to the Board of Pesticide Control (BPC) on the concerns of growers and request that the Hexazinone Best Management Committee review and revise, if necessary, the recommendations contained in the BMS. The BPC agreed and requested the Maine Department of Agriculture to convene the technical Hexazinone BMS Committee for the review.

The Committee reviewed and revised the recommendations during the winter of 1999. Significant changes were made related to the use of solid blends of hexazinone and fertilizer. The BMS committee also incorporated significant format changes requested by Wild Blueberry growers that stressed cultural practices, alternatives to hexazinone and cross references to other Wild Blueberry fact sheets.

The Board of Pesticide Control reviewed the finalized "Hexazinone Best Management System for Wild Blueberry Fields" fact sheet at their June 1999 meeting. The Board readily endorsed the changes and also commended Wild Blueberry growers for actively initiating the changes and for their efforts to reduced the intrusion of (low concentrations) of hexazinone into ground water. We believe the changes made to the BMS will further reduce the potential for intrusion of hexazinone into ground water.

III. ACTIVITY: Wild Blueberry Integrated Crop Management Research

Based on the Wild Blueberry Commission's Wild Blueberry Advisory Committee recommendations, $214,500 of grower and USDA grant funds were expended on research to support the improvement of Integrated Crop Management practices. Once new ICM practices are proven, they are then taught to growers through Extension out reach activities. The funds for the researchers come from Maine's Wild Blueberry growers and a United States Department of Agriculture grant for wild lowbush blueberry research. In addition, the University of Maine College of Natural Sciences, Forestry and Agriculture and the Maine Agricultural and Forestry Experiment Station contributed services and facilities toward ICM research in excess of $200,000.

In November 1999 the Wild Blueberry Advisory Committee recommended funding a research project which has the goal of refining Wild Blueberry water needs by crop stage over the two year growing cycle. Refined information will provide growers the tools to make decisions to wisely use and conserve water resources. The first year (2000) cost of this project is estimated at $95,000 with $46,700 coming from grower and UDSA research grants. It is expected that this project will be 4-6 years in duration, providing the weather is cooperative. Since Wild Blueberries are managed on a 2 year cropping cycle, this is equivalent to a 2-3 year project for other crops. The total cost of this research project over the next 4-6 years is expected to be $450,000.

IV. ACTIVITY: Follow up Hexazinone Monitoring by the Board of Pesticide Control

In 1999, the Board of Pesticide Control reported 1998 results of follow up monitoring for hexazinone as outlined in the <u>State of Maine Hexazinone State Management Plan For the Protection of Ground Water</u> adopted in 1996. Comprehensive monitoring was first conducted by the BPC in 1994. Wells were selected to <u>maximize the likelihood of detection</u> (down gradient from fields etc.). In 1994 approximately 75% of wells tested positive for levels of hexazinone two orders of magnitude below health advisory levels. Follow up monitoring conducted in 1998 resulted in 43% of the wells testing positive for similar low levels of hexazinone. The change implemented by growers from the early 1990's was the aggressive introduction of the "Hexazinone Best Management System for Wild Blueberry Fields". (Note: This may be reported by the BPC).

Project SHARE

Salmon Habitat And River Enhancement
RFD 1, Box 428 – Belgrade, ME 04917 – Tel. 207-495-3409
e-mail: mscott@clinic.net

1999 Annual Progress Report
Maine's Atlantic Salmon Conservation Plan
Project SHARE's Program Highlights
October 1998—October 1999

Contract Administration and Fund raising

- State Planning Office contract for hiring and managing a fulltime Watershed Coordinator to assist and organize a coalition of the five-downeast watershed councils.
- Provide limited funding to each of the five watershed councils as necessary.
- Utilize the Wild Salmon Resource Center as headquarters and provide overhead funding of the facility to the Downeast Salmon Federation
- Secured a 319 non-point source grant from the Maine Department of Environmental Protection to do surveys on the Pleasant and Narraguagus Rivers.
- Obtained a small grant from the Maine Forest Service to construct educational Kiosks for all five downeast rivers.
- Raised over $27,000 from downeast businesses and large landowners that was contributed to the Wild Salmon Resource Center for education, grants, and operation funds.
- Funded the AmeriCorps position under the SPO contract to assist and work for the Downeast Watershed Coordinator.

Project SHARE meetings, Steering Committee, and Education

- Six public Forums were held mostly at the Airline Snack Bar in T22MD with over 180 persons in attendance
- We also held six Steering Committee meetings in Bangor for the Board, to make decisions on action items of SHARE business that would assist or help the watersheds.
- Participated in two major workshops and worked at various planning meetings to assist in facilitating these meetings.
- The Executive Secretary attend a number of watershed coalition meetings during this time period.
- Participated in four Water Use Management Plan meetings in Columbia Falls. These are critical regarding the future methods of water withdrawals and proposed regulations on water use.
- Project SHARE has a very active Education Committee that has provided workshops, training and assistance to the watershed councils through collaborative planning.

Meetings, Legislation and Listing

- SHARE's Steering Committee voted twice not to participate in the listing process or lawsuit but rather to focus all its resources in support of the State of Maine Atlantic Salmon Conservation Plan.
- Project SHARE supported legislation for funding of the five-downeast watershed councils.
- SHARE also participated in a number of invitational meetings to make presentations on its mission and progress work on the PLAN to various organizations outside of the five-downeast rivers during this past year.

University of Maine Cooperative Extension's 1999 Cranberry IPM Program
(Led by Charles Armstrong, UMCE Cranberry Professional):

Grower Visits and Pest Monitoring:

Charles made149 grower site visits from May 28th-Sept 3rd for the 23 Maine growers who enrolled in the UMCE Cranberry IPM Program (avg. of 6.5 visits per grower) (increase of 2 growers and 51 more visits versus 1998 season!!). A total of 65 cranberry beds constituting 101 acres (out of 261 total) were monitored weekly for pest problems. There were roughly 40 occasions when growers' beds were at or above the economic threshold levels for a given insect pest, but insecticides were only used on roughly 28 (or 70%) of those occasions. Two of the state's 32 growers are certified "organic." As a result of Charles's educational efforts and grower encouragement, 15 cranberry acres were treated with Bt (Dipel) to combat early-season caterpillar pests, and control was superb--even better than one would typically see from a *chemical* insecticide. Not a single caterpillar was found while scouting during the first few weeks following the applications!

Cranberry Grower IPM/BMPs Training:

In addition to the Maine Cranberry Website's "IPM Bulletin Board," which provided Maine cranberry pest findings, alerts, control recommendations and images, etc. on a nearly daily basis for at least 15 of our state's 32 growers, Charles also participated in the following cranberry conferences with (and for) Maine's growers:

- Early January: Agricultural Trades Show (Augusta Civic Center): Charles gave a one-hour presentation on Cranberry IPM strategies and techniques, with roughly 20 of Maine's cranberry growers in attendance;
- January 27th: Charles attended the day-long UMass Advanced Cranberry School in Plymouth, Massachusetts along with one Maine grower and one potential Maine grower. Among other things, important cranberry insect and disease problems were discussed, along with the latest tools for controlling such problems in an IPM/BMP fashion. **The conference was videotaped and several Maine growers viewed the tape. Charles also typed detailed notes of each presentation which were later mailed to all of Maine's current and potential growers.**
- March 9th: Charles attended the UMass Annual Cranberry Research & Extension Update along with two Maine growers and one potential Maine grower. The latest weed, insect and disease studies were discussed. **Again, the conference was videotaped and several Maine growers viewed the tape. Detailed notes of each presentation were later mailed to all of Maine's current and potential growers.**
- March 12th: Charles, plus one Maine grower, attended the Nova Scotia Cranberry Management 2-day course in Coldbrook, Nova Scotia. One day focused particularly on cranberry IPM and BMPs. Charles mailed detailed notes of the relevant presentations to all of Maine's current and potential growers.

- May--2 pesticide credit hours of IPM Training at Black Bear Inn, Orono (14 growers and 5 potential growers); Charles Armstrong spearheaded a weed and insect identification self-test for growers, followed by a 30-minute slide presentation entitled "UMass Cranberry Chart Book: How Maine is Different." Kathleen Murray from the Maine Dept. of Agric. then gave a 30-minute presentation on IPM Certification and the potential for such in Maine.

December 1999

Charles D. Armstrong - Cranberry Professional
University of Maine Cooperative Extension
5722 Deering Hall - Room 410
Orono, ME 04469-5722

Tel: (207) 581-2940 or if in Maine, 1-800-897-0757
Fax: 207-581-2941
e-mail: charlesa@umext.maine.edu
Maine Cranberries: http://www.nemaine.com/rc&d/cranberry.htm
UMaine Cooperative Extension: http://www.umext.maine.edu

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Fax: 207-581-2941
e-mail: charlesa@umext.maine.edu
Maine Cranberries: http://www.nemaine.com/rc&d/cranberry.htm
UMaine Cooperative Extension: http://www.umext.maine.edu

Washington County Soil and Water Conservation District
P.O. Box 121
Machias, ME 04654
(207) 255-4659 / 255-3995
fax (207) 255-6817
e-mail conservation@nemaine.com

The Washington County Soil and Water Conservation District is pleased to submit this report of our projects and activities as they relate to Atlantic Salmon and their habitats in Washington County for 1999.

The District is governed by five volunteer Supervisors, Stephen Ftorek, Reinald Nielsen, Sanford Kelley Jr., Dwayne Shaw, and Stephen Follette. They are assisted by ten volunteer Associate Supervisors, eleven staff members, the Natural Resources Conservation Service and our many partner organizations and agencies.

The district provides a voluntary delivery system to provide broad - based conservation programs for the Federal and State governments and the various departments within them.

The Machias field office of NRCS is colocated with the District as we work on many projects as partners. NRCS - Machias has submitted a report on the Wildlife Habitat Incentive Program (WHIP) and the Environmental Quality Incentive Program (EQIP). We will report on those aspects of these programs that the soil and water district carry out. The District Manager, representing the local conservation partners, sits on the USDA State Technical Committee that determines priorities and amounts of Federal funds that go into Federally funded programs.

The Integrated Crop Management (ICM) program funded by the USDA EQIP and managed by NRCS, is used to encourage and assist wild blueberry growers with the information necessary to do a better job of pesticide management to control insects, weeds, and diseases while minimizing the use of pesticides and using the least toxic alternative or cultural practice and use proper timing. Nutrient Management is also a part of this important program.

The District provides scouting services to accomplish this program. In 1999 there were 16 growers in the Pleasant River Watershed, 9 in the Machias, 9 in the East Machias, 5 in the Narraguagus, 3 in the Dennys and 8 in other Atlantic Salmon Watersheds that used the Soil and Water District scouts and this intensive ICM program. Of the fields scouted in this program in 1999 thirty percent needed no insecticide for the blueberry fruit fly. An additional seventeen percent needed only spot spraying in sections of the field. Other insecticides were also not used due to the scouting of fields. Some growers chose to use less toxic pesticides as a result of scouting. Sadly there are not Federal funds enough for all growers who wish to use this program.

The Environmental Quality Incentive Program (EQIP) on Stream Quality addresses nutrient management including manure storage and spreading plans as well as rotational grazing, pasture management, fencing from streams and wetlands, erosion control and other management practices. The District works closely with farmers promoting this project and assisting them with these practices. During 1999 there were 8 farmers in the Machias Watershed, 3 in the East Machias Watershed, 2 in the Pleasant Watershed, 4 in the Denny's Watershed and 12 in other watersheds.

Washington County Soil and Water Conservation District maintains an office in Machias to assist landowners with information and services. During 1999 we assisted the following listed here by Atlantic Salmon watersheds.

Machias	81
Pleasant	38
East Machias	35
St Croix	27
Dennys	24
Narraguagus	20
Tunk	7

There were an additional 63 people requesting services relating to Atlantic Salmon who live in other watersheds.

The Soil and Water District provided workshops on a variety of topics that relate to Atlantic Salmon and their habitats.

Two Irrigation workshops with 50 attendees and 43 attendees were designed to address the interest shown by blueberry growers, cranberry growers, crop and livestock producers to get into irrigation or improve their current practices. Topics covered include water management plans, system design and layout, pond permitting and construction, and conservation of water amounts / timing.

We have provided assistance on eight irrigation projects this past year. One well was drilled with our assistance and seven ponds were dug to supply water.

A Road workshop for municipal officials and public works crews to discuss sizing culverts, stream crossing, ditching and best management practices. There were 20 people for the entire day of training.

There were two Best Management workshops for forestry contractors, one on the Pleasant River and another on the Dennys River. These workshops were cosponsored by the Maine Forest Service.

A workshop for Code Enforcement Officers to hear from Maine Dept. of Environmental Protection personnel and the Land Use Regulation Commission staff as well as Watershed Council members concerns was held last spring.

We sponsored a workshop on Septic System design and construction cosponsored by Maine Dept. of Health Engineering, Maine DEP and the State Soil Scientist.

We provided a workshop in cooperation with Maine DEP to certify contractors in the use of BMP's. A number of contractors have been certified and are doing excellent work in the Atlantic Salmon watersheds.

We have provided assistance to the Aquaculture industry by assisting with their manure spreading programs in Atlantic Salmon watersheds.

We have assisted several communities with their municipal sludge and septic sludge spreading programs by taking soil samples and helping to manage the spreading sites, several of which are adjacent to salmon streams.

Through our Envirothon program we are educating high school students about Atlantic Salmon and their habitats while recruiting volunteers for the watershed councils and their projects.

In addition the District is providing assistance to the watershed councils at their request.

District staff and Supervisors are very active in attending watershed council meetings, serving as officers, helping to do surveys, setting priorities, and providing technical services and guidance for watershed projects.

The District has invested more than fifty thousand dollars this year from local sources to provide assistance on Atlantic Salmon projects. In addition we have assisted our partners at NRCS with focusing most of the Federal dollars available through EQIP, and WHIP in Washington County to be spent in Atlantic Salmon watersheds.

Additional information is available at the District office on specific projects listed above and on other projects too numerous to mention in this brief summary.

December 23, 1999

Henry G. Nichols, Coordinator
Atlantic Salmon Conservation Plan
Atlantic Salmon Commission
38 State House Station
Augusta, ME 04333-0038

Dear Henry:

I apologize for being late in responding to your request for a summary of Jasper Wyman & Son's activities in 1999 in support of the Governor's Atlantic Salmon Conservation Plan (ASCP). Our participation as a partner in the ASCP over the past twelve months includes the following activities:

Participant	Activity
Gary Willey	Attended SHARE meetings and member of SHARE Steering Committee
David Brooks	Attended WUMP meetings and member of WUMP Flow Team
Fred Olday	Attended WUMP, Downeast Rivers Coalition, and Narraguagus Watershed Council meetings
	Member of WUMP Subcommittee on Water Sources and Planning
	Represented the Narraguagus Watershed Council on the ASCP Advisory Committee
	Member of DEP Non-Point Source Pollution (319) Grant Executive Steering Committee for the Narraguagus and Pleasant Rivers
	Participant in DEP water quality sampling program on the Narraguagus River

Jasper Wyman & Son
Route 193, Box 20D, Deblois, ME 04622 Tel: 207.638.2201 Fax: 207.638.2145

In addition, in 1999, Jasper Wyman & Son contributed: (a) $500 to Project SHARE in the form of dues, (b) $2000 in support of the Wild Salmon Resource Center in Columbia Falls, (c) $15,000 toward IFIM studies on the Pleasant River, and (d) $30,964 to support David Brooks' involvement as a member of the WUMP Advisory Committee and Flow Team.

The foregoing activities and financial contributions underscore our commitment to the success of the Governor's Plan, support which we plan to continue, regardless of whether Listing occurs, or not.

Sincerely,

Fred C. Olday
Director of Farm Research

Jasper Wyman & Son

Section 4 – Federal Agency Reports

Office of the Maine Fisheries Program Coordinator, and Craig Brook National Fish Hatchery Atlantic Salmon Conservation Plan Activities January 1999 - November 1999

- care and maintenance of the following green egg numbers (rounded to the nearest 1000) spawned in Nov/Dec 1998:

Dennys River:	216,000
East Machias River:	228,000
Machias River:	279,000
Narraguagus:	221,000
Sheepscot:	338,000

- Assisted in stocking Atlantic salmon fry, as follows (numbers rounded to nearest 1000) May 1999:

Dennys:	173,000
East Machias:	210,000
Machias:	169,000
Narraguagus:	156,000
Sheepscot:	302,000

- Assisted ASC in stocking Atlantic salmon 0+ parr as follows (numbers rounded to nearest 100) June and Oct 1999:

Dennys:	3,000
East Machias:	1,000
Machias:	1,000
Narraguagus:	18,000 (est.)
Sheepscot:	4,800

- Assisted ASC in releasing 81 surplus adult captive broodstock into the Dennys River Oct 1999.

- PIT tagged all 2,115 broodstock at Craig Brook NFH, blood sampling 510 of them for SSSv. March 1999

- Blood sampled 1,028 fish to be spawned from the 5 rivers for SSSv. Sept. 1999

- With ASC, collected, PIT tagged, and genetically sampled parr broodstock as follows:

Dennys:	150
East Machias:	127
Machias:	238
Narraguagus:	255
Sheepscot:	86

- Assisted NMFS and ASC personnel with tag retention studies on River Specific fish being held in sea cages from March through October.

- With MASC conducted standard population estimate electrofishing activities on all rivers.

- Conducted a time of shocking study to determine the most opportune time to collect juvenile Atlantic salmon by electrofishing from June to Oct.1999. More work needs to be done next year before conclusions can be made.

- Collected, and submitted to NBS, non broodstock Atlantic salmon genetics samples from: Ducktrap River, Eaton Brook, Felts Brook, Cove Brook, Kenduskeag Stream (Lower Penobscot tributaries), and Brown Trout samples from Bond Brook and Togus Stream (Lower Kennebec River tributaries). Genetics samples were also collected from Landlocked salmon being raised at two state fish hatcheries (Grand Lake Stream and Casco).

- Spawned from the five rivers, the following numbers of female fish (as of 29 November 1999). The numbers may include fish which were stripped of eggs more than once (referred to as partials). *At this time we are unable to supply you with the estimated number of green eggs. This should be available later in December or early January, and will be a very rough value, as the eggs will not be volumetrically measured until they have eyed up and been shocked*:

Dennys:	56
East Machias:	59
Machias	108
Narraguagus:	137
Sheepscot:	59

- Conducted tributary habitat surveys on the Sheepscot River, and Kennebec Rivers.

- Continued to support Project SHARE by maintaining memberships on the Steering Committee, Research, and Management subcommittees.

- Continued to support the program as Chair and Secretary of the Maine Atlantic Salmon Technical Advisory Committee. Staff members also participate on several of the TAC Working Groups.

- Conducted fish health sampling on suspected aquaculture escape salmon caught in the St. Croix Rive Milltown fish trap.

` Assisted MASC with maintaining the newly installed weirs and traps on the the Dennys and Pleasant rivers, as well as the previously existing trap on the Narraguaugus.

- With other FWS and NMFS personnel established a database to allow us to genetically mark all of our fry, by tracking parental crossings.

- Continued developing methodologies to stock fry and monitor their contribution to the juvenile and (ultimately) returning adult populations with special emphasis on genetic marking.

- Began training in stream habitat restoration. Projects may be initiated within one year.

USDA United States Department of Agriculture | Natural Resources Conservation Service | 967 Illinois Ave. Bangor, ME 04401 (207)990-9100, ext. 3

January 3, 1999

Henry Nickels
Policy Development Specialist for
Atlantic Salmon Authority
State Planning Office
38 State House Station
Augusta, ME 04333

Dear Mr. Nickels:

Attached is a copy of the 1999 Atlantic Salmon Habitat Conservation Annual Report for the Natural Resources Conservation Service. We are very proud of our accomplishments to improve Atlantic Salmon habitat during 1999.

If you have any questions concerning the attached report, please feel free to give me a call at 990-9100, extension 3.

Sincerely,

M. D. Dominick

M. DARREL DOMINICK
State Conservationist

Attachment

NRCS' 1999 ANNUAL REPORT – ATLANTIC SALMON HABITAT CONSERVATION

INTRODUCTION

The Natural Resources Conservation Service (NRCS), an agency in the USDA, works cooperatively with local entities and private landowners to accomplish conservation on the land through locally led conservation processes. USDA, in 1996, renewed a mutual agreement with Governor King and Maine's 16 Soil and Water Conservation Districts (SWCD's). NRCS, at this time, renewed the cooperative partnership with the 16 SWCD's. NRCS programs, services and technical assistance are delivered through the 16 SWCD's.

The demands on this unique delivery system are mounting. The NRCS and SWCD's, in partnership with the Maine Department of Agriculture (MDA), are working closely to assist private landowners with nutrient management that includes the need for building manure storage facilities and projects linked to fishery habitat improvements. This workload, along with day –to- day technical assistance and program delivery, has placed a strain on the available resources. A recent workload assessment shows the need for almost a doubling of staff. SWCD's are working with the MDA for additional support. NRCS is 20 staff years below what is needed to handle known work with Maine landowners and natural resources. Additional support is critical for this delivery system or the expectations will not be met.

Despite limited financial and staff resources NRCS and its partners have accomplished a great deal to correct environmental concerns. The following Annual Report is a summary of what has been accomplished to improve Atlantic Salmon Habitat during 1999.

ENVIRONMENTAL QUALITY INCENTIVES PROGRAM/NRCS TECHNICAL ASSISTANCE

The Environmental Quality Incentives Program (EQIP)is a cost share program that is designed to improve water quality by working with landowners to correct environmental concerns. Nationally, the request for EQIP funding has been at $300 million annually. The program was funded at $200 million. The last two years it has been funded at $174 million. Fewer cost share funds nationally results in fewer cost share funds in Maine.

A significant amount of EQIP funds ($511,500 the past two years) have been used within the watersheds of the Seven Downeast Atlantic Salmon Rivers as well as other critical watersheds in the state. These projects will have a positive benefit on the water quality that benefit fisheries.

Sheepscot River Watershed – Total EQIP financial assistance for the past two years for 28 contracts was $195,041. Landowner contributions will be approximately $65,000. Education assistance grants total $10,700.

EQIP projects include:
- 6 projects to fence livestock from various water sources.
- 2 projects to reduce erosion from woodlots
- 3 animal manure handling and storage facilities
- 6 livestock stream crossings
- 2 erosion control projects
- 9 other water quality projects

Other assistance to landowners in the watershed include integrated crop management and nutrient management on blueberry land.

NRCS has been an active participant on the Sheepscot River Watershed Council and has provided technical assistance in evaluating and solving conservation issues in the watershed.

Ducktrap River Watershed – Total financial assistance for three contracts was $4,723

- Conservation plans were developed to address forest erosion, streambank stabilization, and riparian buffers on 393 acres of woodland.
- A demonstration project was completed involving critical area treatment of a gravel pit. Cost share assistance provided with EQIP funds was $4,900.
- An NRCS representative attends Ducktrap Coalition quarterly meetings and provides technical advice on soil and water quality issues.

Machias, Narraguagus , Pleasant , East Machias and Dennys River Watersheds

EQIP projects include:

- 33 Integrated Crop Management active Long Term Contracts (LTC's) are being carried out with blueberry growers in the Salmon River Watersheds. Total contract funds for these 33 LTC's is $287,714.

- $80,077 was expended in payments in 1999 under Integrated Crop Management to complete conservation practices under ICM EQIP contracts in these watersheds. Examples: water control structures, critical area planting, rock waterways, mulching and others conservation practices.

- Four Long Term Contracts have been developed for livestock producers to complete conservation practices under Stream Quality EQIP. The total funds in these four LTC's amounts to $24,000.

Other NRCS and district activities related to Atlantic Salmon include:

- Provided assistance and information on NRCS/USDA programs to groups such as SHARE, Atlantic Salmon/Councils, towns, five Rivers Coalitions and others by participating in over two dozen meetings related to the Atlantic Salmon issue.
- The District Conservationist is currently providing technical assistance to the Passamaquoddy Pleasant Point Environmental Department and the Northeastern Blueberry Company concerning water use and irrigation issues on the tribe's blueberry lands.
- NRCS has provided $1,000 through EQIP Educational Assistance Funds for the expenses of two workshops on irrigation coordinated by the Washington County Soil and Water Conservation District.

CONSERVATION ACTIVITIES - PENOBSCOT WATERSHED

Significant conservation activities are also occurring in the Penobscot River Watershed. Although not one of the designated Seven Atlantic Salmon Rivers, the Penobscot is considered the premier Atlantic Salmon river in Maine. NRCS activities are addressing resource concerns that will help to improve the aquatic environment for the Atlantic Salmon of the Penobscot while protecting the land resource base for food and fiber production. Most of the conservation practices are in the watersheds of smaller rivers and streams in the southern part of the county. The following is a summary of NRCS conservation activities that have a positive effect on the salmon habitat in the Penobscot River Watershed.

- By using a variety of NRCS programs and working closely with a variety of our conservation partners, NRCS has developed 19 conservation plans on 10,400 acres. Conservation practices were applied on another 5,000 acres.

- 4,900 acres were treated for erosion control resulting in 22,000 tons being saved; this translates into tons of sediment not being deposited in the tributaries of the Penobscot River. Erosion control practices also prevented pesticides and excessive nutrients from being deposited in the waterways along with the sediment.

- Nutrient management plans were developed on 3,666 acres for 73 landowners in the Penobscot watershed. Nutrient management planning and utilization will protect rivers and streams from excessive nutrients and thereby help the aquatic habitat.

- In the Kenduskeag Stream Watershed, through the PL-566 Small Watershed Land Treatment Program, NRCS provided $150,000 to install conservation practices. Since 1990 over $4,000,000 has been committed to resources protection in the Kenduskeag Watershed.

- The EQIP program has helped to address a number of conservation issues on Penobscot Nation lands. Erosion control and improved stream crossings, as well as ditching activities, have helped to reduce erosion and the resulting stream sedimentation on forestlands of the Penobscot Nation.

- Since 1997, $2,000,000 has been committed to long term agreements with 91 landowners so that they can implement structural, vegetative and management practices on agricultural land.

These conservation efforts will have long-term benefits for the water quality along miles of stream and brook habitat in the Penobscot River Watershed. Reduced amounts of sediment covering critical salmon habitat along with reduction in the amount of pesticides and nutrients reaching these waters, are added benefits of the conservation efforts of NRCS, the land owners assisted and conservation partners. Many farmers are actively engaged in applying conservation practices to their land to protect the soil resource and improve farm productivity. Their conservation efforts on the land are also benefiting water quality in general, and salmon habitat in particular, in the Penobscot River Watershed.

MAINE'S NRCS WILDLIFE HABITAT INCENTIVES PROGRAM – WHIP AND THE COASTAL AMERICA PROGRAM PARTNERSHIP

DOWN-EAST ATLANTIC SALMON RIVER WATERSHEDS COMPLETED/PLANNED/ IN PROGRESS PROJECTS

The Wildlife Habitat Incentives Program (WHIP) is a NRCS program designed to create and enhance critical wildlife habitats within the state. A major emphasis of the WHIP is wildlife and fisheries habitats of national and state significance. WHIP is another tool that can help improve the habitat for the Atlantic Salmon.

COMPLETED

Pleasant River Dam Removal, Columbia Falls – (Completed October 1999)

- The remnants of the Pleasant River Dam in Columbia Falls was removed by the Down East Salmon Federation, and cost shared thru the USDA NRCS WHIP. The total cost was $14,000. This work was completed in October 1999. The primary benefit was to sea run smelt spawning habitat restoration. However, this contributes to ecosystem restoration of an important Atlantic Salmon river.

Dennys River (Cathance Stream) Atlantic Salmon Fish Passage and Flow Augmentation (Completed November 1999)

- Dam repair for flow augmentation and fishway restoration or replacement at three locations:

  Marion Falls Fish Passage
  Great Works Flowage Fish Passage
  Cathance Lake Flow Augmentation and Passage

- The total cost of these activities will be approximately $100,000 to $125,000

- Maine Atlantic Salmon Authority, Project SHARE, the Atlantic Salmon Federation and the National Fish & Wildlife Foundation will provide cost share assistance to match WHIP or other Coastal America partners.

Machias River (Project completed November 1999)

- Old stream (Canaan Dam Removal) WHIP contributed $12,000 to the $20,000 project.
- First Machias Lake Dam Removal – WHIP contribution $0

IN PROGRESS

Watershed Flow Assessments and Management Plans for the Pleasant, Narraguagus and Machias Rivers in Down East Maine

- The State of Maine Atlantic Salmon Conservation Plan requires that these rivers have total water management plans developed to be able to plan for the restoration of Atlantic Salmon and agricultural irrigation needs.

- The State of Maine Land and Water Resource Council member agencies, USGS, private industry, the U.S. Army Corps of Engineers, NRCS and others are cooperating in the development of the inventories and assessments.

- NRCS has financially contributed, through an agreement with the Maine State Planning Office, to the development of the water use management plan and the flow assessment for the Pleasant and Narraguagus Rivers and Mopang Stream.

PLANNED PROJECTS

East Machias dam and power station removal and riparian habitat restoration

- Town of East Machias, Down-East Salmon Federation, Atlantic Salmon Authority, NRCS WHIP has obligated $162,000.

- Cost share match for U.S. Army Corps of Engineers' (COE) 206 program may be $125,000 donation of riparian land downstream of dam. Bangor Hydro Electric Co. may donate land and facility to State of Maine Atlantic Salmon Authority, pending soil testing. NFWF will assist in the cost share match. Town of East Machias has committed $10,000 to match WHIP funding.

Narraguagus River in Cherryfield "Ice Dam" modification

- The U.S. Army COE built a dam to reduce flooding in Cherryfield, Maine in 1961.
- The dam causes significant problems for management of Atlantic Salmon and needs to be modified to facilitate salmon management or potentially removed at some time in the future, if requested.
- The Maine Atlantic Salmon Authority, U.S. Army COE and Town of Cherryfield will develop plans. Champion International, Woodlands Division will contribute materials for in-kind match. National Fish & Wildlife Foundation/Salmon Collaborative may provide additional funding.

Sheepscot River Fish Passage at Coopers Mills

- The Sheepscot River has only one fish passage problem for anadromous fish species. The dam at Coopers Mills is leaking, which causes the fishway to be inoperable due to lack of adequate flow during critical periods. The common resource agency judgment is that the dam should be removed to avoid operation and expensive maintenance.
- NRCS, U.S. Army COE, the Atlantic Salmon Authority, Department of Marine Resources and the Town of Coopers"Mills will partner in the removal of the dam and restoration of the stream above the dam site.

Sheepscot River Fish Passage at Head of Tide

- The Maine Atlantic Salmon Authority has requested the removal of the dam at head of tide. This effort has the support of the Maine Department of Marine Resources and the Sheepscot River Conservation groups. The Town of Alna would like to see the dam breached, but not necessarily removed and wants to consider options.

<u>OTHER RIVER WATERSHEDS (Non-Salmon Conservation Plan)</u>

<u>Penobscot River Watershed WHIP Projects:</u>

Souadabscook Stream Restoration Program, Town of Hampden – (Completed August 1999)

- Two abandoned dams were removed and one was breached on the Souadabscook Stream in Hampden and cost shared through the USDA NRCS WHIP. The removal of these dams eliminated barriers for anadromous fisheries, including Atlantic Salmon. The WHIP share for this work was $60,000. This project was accomplished through the cooperative efforts of many Coastal America Partners including Facilitators Improving Salmonid Habitat (FISH).

Pleasant River Dam Removal, Town of Brownville – (Completed September 1999)

- The remnants of the Brownville Dam on the Pleasant River were removed by Facilitators Improving Salmonid Habitat (FISH) with WHIP cost share of $51,000. Dam removal and associated fish stream improvement will create fish passage and improve habitat for several species of fish including Atlantic Salmon.

George's (St. George) River Fish Passage

- Details for fish passage needs are currently being developed for the Sennebec Pond Dam. Sea run trout, Atlantic Salmon, shad and alewives are the primary species of concern.

Kennebec River Watershed WHIP Project

Stetson Stream Dam Removal, Town of Stetson – (Completed October 1999)

- The remnants of the Archer Sawmill Dam on Stetson Stream was removed as well as accumulation of bark and other debris from the channel above and below the former dam. WHIP cost share for the project was $13,500. Removal of the dam and associated fish stream improvement is part of the Kennebec River Restoration Program for Anadromous Fisheries.

FOR MORE INFORMATION ON NRCS ACTIVITIES IN THE SEVEN SALMON NEWS LETTER, CONTACT

THE NATURAL RESOURCES CONSERVATION SERVICE
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UNITED STATES DISTRICT COURT
FOR THE
DISTRICT OF MAINE

STATE OF MAINE, Plaintiff, v. BRUCE BABBITT, in His Official Capacity as the Secretary of the United States Department of the Interior, NORMAN Y. MINETA, in His Official Capacity as the Secretary of the United States Department of Commerce, JAMIE RAPPAPORT CLARK, in Her Official Capacity as the Director of the United States Fish and Wildlife Service, and PENELOPE D. DALTON, in Her Official Capacity as the Assistant Administrator for Fisheries of the National Marine Fisheries Service, Defendants.	CIVIL ACTION NO.: **INJUNCTIVE RELIEF SOUGHT**

COMPLAINT

Introduction

1. Plaintiff State of Maine brings this action to challenge the defendants' issuance of a final regulation listing Atlantic salmon found in certain Maine rivers (referred to as the "Gulf of Maine population of Atlantic salmon") as endangered under the Endangered Species Act (the "ESA"), 16 U.S.C. §§ 1531 – 1544. *See* 65 Fed. Reg. 69,459. The action is brought pursuant to the Administrative Procedure Act ("APA"), 5 U.SC. § 701-706, which governs, *inter alia*, judicial review of administrative decisions involving the ESA.

2. In December 1997, defendants determined that the Gulf of Maine population of Atlantic salmon was "not likely to become endangered in the foreseeable future." Less than two years later,

and despite the absence of any material changes affecting the conservation status of Atlantic salmon, defendants determined that the Gulf of Maine population of Atlantic salmon "is in danger of extinction." This determination was arbitrary, capricious, an abuse of discretion and otherwise not in accordance with law inasmuch as, among other things, defendants 1) improperly determined that the Gulf of Maine population of Atlantic salmon is a "distinct population segment" within the meaning of the ESA; 2) failed to share with the State of Maine potentially critical genetic data relied on by defendants in making the distinct population segment determination; 3) failed to base their listing decision on the best available scientific and commercial data; 4) ignored scientific and commercial data demonstrating that the Gulf of Maine population of Atlantic salmon is neither a "distinct population segment" nor in danger of extinction; 5) ignored the significant efforts being made by the State of Maine to protect and restore Atlantic salmon; and 6) failed to consider and respond to Maine's comments on the proposed listing.

3. By way of this lawsuit, the State of Maine requests that the regulation listing the Gulf of Maine population of Atlantic salmon as endangered be declared unlawful and set aside.

The Parties

4. Plaintiff State of Maine is a sovereign state. The State of Maine has an interest in the management of all wildlife and other natural resources within its jurisdiction, including the Atlantic salmon which are the subject of defendants' ESA listing. It further has an interest in the physical and economic well-being of its citizens. An ESA listing of Atlantic salmon will interfere with the State of Maine's ability to regulate and manage its own natural resources, including its efforts to protect and restore Atlantic salmon. An ESA listing of Atlantic salmon will also result in significant and adverse impacts on various industries operating within Maine, including the aquaculture, agricultural, and forestry products industries. These industries provide

jobs for many of Maine's citizens and provide tax revenues and other benefits to the State, which, in turn, allow the State to provide increased services to its citizens. In bringing this lawsuit, the State of Maine seeks to retain its right to manage its own natural resources and to prevent harm to itself, its citizens, and its economy.

5. Defendant Bruce Babbitt is the Secretary of the United States Department of the Interior ("DOI") and is being sued in his official capacity. DOI is an agency of the United States and, along with the United States Department of Commerce, is responsible for implementation of the Endangered Species Act.

6. Defendant Norman Y. Mineta is the Secretary of the United States Department of Commerce ("DOC") and is being sued in his official capacity. DOC is an agency of the United States and, along with DOI, is responsible for implementation of the Endangered Species Act.

7. Defendant Jamie Rappaport Clark is the Director of the United States Fish and Wildlife Service ("FWS") and is being sued in her official capacity. FWS is a federal agency within the DOI. FWS is the agency within the DOI that has been delegated the responsibility for implementing the Endangered Species Act.

8. Defendant Penelope Dalton is the Assistant Administrator for Fisheries for the National Marine Fisheries Service ("NMFS") and is being sued in her official capacity. NMFS is a federal agency within the DOC. NMFS is the agency within the DOC that has been delegated the responsibility for implementing the Endangered Species Act.

Jurisdiction

9. This Court has jurisdiction over this action pursuant to 5 U.S.C. §§ 701 – 706, 28 U.S.C. § 1331, 28 U.S.C. §§ 2201-02, and 28 U.S.C. § 1361.

Venue

10. Venue is proper in this Court pursuant to 28 U.S.C. § 1391.

The Endangered Species Act

11. The Endangered Species Act ("ESA"), 16 U.S.C. §§ 1531 – 1544, was enacted in 1973 to provide a means to protect species determined to be either "endangered" or "threatened." 16 U.S.C. § 1531(b).

12. A species is "endangered" if it is "in danger of extinction throughout all or a significant portion of its range," and a species is "threatened" if it is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." 16 U.S.C. § 1532(6) & (20).

13. The term "species" is not limited to its ordinary taxonomic meaning. Rather, the term "species" as used in the ESA also includes "any distinct population segment of any species." 16 U.S.C. § 1532(16).

14. It is illegal to "take" an endangered species. 16 U.S.C. § 1538. "Take" is broadly defined to including harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting an endangered species or attempting to engage in any such activities. 16 U.S.C. § 1532(19).

15. The ESA delegates to the Secretary of the DOI and/or the Secretary of the DOC (collectively, "the Secretaries") the authority to determine whether to afford ESA protection to a species. 16 U.S.C. § 1532(15).

16. The Secretaries determine whether a species is endangered or threatened because of any of the following factors: 1) the present or threatened destruction, modification, or curtailment of its habitat or range; 2) overutilization for commercial, recreational, scientific, or educational purposes;

3) disease or predation; 4) the inadequacy of existing regulatory mechanisms; or 5) other natural or manmade factors affecting the species' continued existence. 16 U.S.C. § 1533(a).

17. The determination as to whether to afford ESA protection to a species must be made solely on the basis of the best scientific and commercial data available and after taking into account those efforts being made by any State, foreign nation, or political subdivision of a State or foreign nation to protect the species. 16 U.S.C. § 1533(b)(1)(A).

18. Any interested person may petition the Secretaries to designate a species as endangered or threatened. Upon receipt of such a petition, the Secretaries must make a finding as to whether the petition presents substantial scientific or commercial information indicating that such a designation is warranted. If they find that the petition does present such information, the Secretaries must then, within a year, determine whether designating the species as endangered or threatened is warranted. 16 U.S.C. § 1533(b)(3).

19. If the Secretaries determine that designating a species as endangered or threatened is warranted, they must publish said determination in the Federal Register, along with the complete text of a proposed regulation to implement such a determination. 16 U.S.C. § 1533(b)(5).

20. Following publication of the proposed regulation in the Federal Register, the Secretaries must give interested persons an opportunity to submit written data, views, or arguments regarding the proposed regulation, and, if requested, hold at least one public hearing. 16 U.S.C. §§ 1533(b)(4) & (b)(5); 5 U.S.C. § 553.

21. Within one year after the proposed rule is published in the Federal Register, the Secretaries must issue either a final regulation or a notice that the proposed regulation is being withdrawn. 16 U.S.C. § 1533(b)(6).

22. If the Secretaries find that there is substantial disagreement regarding the sufficiency or accuracy of the available data relevant to the determination of the status of a species, they may extend by six months the one-year deadline referred to in paragraph 21 for purposes of soliciting additional data. 16 U.S.C. § 1533(b)(6)(B).

23. In the event that the Secretaries determine that there is an emergency posing a significant risk to the well-being of a species, they may immediately issue a regulation protecting the species, but such a regulation ceases to have force and effect 240 days after issuance unless the normal rulemaking procedures relating to a non-emergency listing are complied with prior to the expiration of the 240-day period. 16 U.S.C. § 1533(b)(7).

24. Any publication in the Federal Register of a final regulation listing a species under the ESA must include a summary of the data upon which the regulation is based and must show the relationship of such data to such regulation. 16 U.S.C. § 1533(b)(8).

25. If, during the comment period following publication of a proposed regulation listing a species under the ESA, a State agency which is responsible for the management and conservation of fish, plant, or wildlife resources within a State in which the species is believed to occur files comments disagreeing with all or part of the proposed regulation, and the Secretaries issue a final regulation which is in conflict with such comments, the Secretaries must submit to said State agency a written justification for their failure to adopt regulations consistent with the agency's comments. 16 U.S.C. § 1533(i).

Life Cycle of Atlantic Salmon

26. Atlantic salmon (*Salmo salar*) are a species of fish. In the United States, Atlantic salmon are found in rivers from Connecticut to Maine. Atlantic salmon are also found in rivers in Canada.

27. Atlantic salmon spend part of their life cycle in rivers, and part at sea. Adult salmon ascend the rivers from the sea beginning in the spring and continuing into the fall. The adult salmon generally spawn in October and November and deposit their eggs into nests in the beds of the rivers, referred to as "redds."

28. The eggs generally hatch in March and April, and the young salmon, referred to as "alevins," remain in the redds for approximately six weeks. When they emerge from the redds and begin feeding, they are referred to as "fry." As they continue to grow, they develop vertical bars on the sides of their bodies and are then referred to as "parr."

29. When parr become two to three years old, they undergo various morphological and physiological changes which allow them to make the transition from fresh water to salt water. When the parr undergo this process, they are referred to as "smolt."

30. Smolts descend the rivers and migrate to the sea in the spring, and generally spend one or two winters at sea. In the spring, they return to either their natal river or "stray" to another river, where they then spawn and repeat the life cycle.

Background to the Atlantic Salmon Listing

31. In October and November, 1993, FWS and NMFS (collectively, "the Services") received petitions to list under the ESA Atlantic salmon throughout their entire range in the coterminous United States. The Services found that the petitions presented "substantial information" indicating that such a listing may be warranted. 59 Fed. Reg. 3067.

32. On March 17, 1995, the Services determined that Atlantic salmon, throughout their entire range in the coterminous United States, do not meet the definition of a "species" under the ESA, and, therefore, that listing said salmon under the ESA was not warranted. 60 Fed. Reg. 14410. Specifically, the Services found that "indigenous" Atlantic salmon populations in rivers south of

Maine's Kennebec River (including salmon in the Connecticut and Merrimack Rivers) were extirpated during the nineteenth century, and that current Atlantic salmon in those rivers were the result of restoration efforts using nonindigenous stocks and, according to the Services, therefore not eligible for listing under the ESA. 60 Fed. Reg. 14411.

33. While finding that Atlantic salmon throughout their entire range in the coterminous United States were not eligible for listing, the Services determined that Atlantic salmon populations in seven Maine rivers (the Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot Rivers) were "indigenous," rather than the result of restoration efforts, and met the criteria to be considered a distinct population segment ("DPS") eligible for protection under the ESA. 60 Fed. Reg. 14,412. The Services referred to this population as the "Seven Rivers Distinct Population Segment," or "Seven Rivers DPS."

34. While there are other rivers, such as the Penobscot River, lying north of the Kennebec River and within the geographic range of the seven rivers, the Services did not include the salmon in these rivers within the DPS because the Services could not determine whether these salmon were "indigenous" or, like the salmon in the Connecticut and Merrimack Rivers, were the result of restoration efforts.

35. On September 29, 1995, the Services proposed a regulation to list the so-called Seven Rivers DPS as "threatened" under the ESA, and the Services held hearings and solicited comments on the proposed rule. 60 Fed. Reg. 50,530.

36. On March 5, 1997, the State of Maine submitted to the Services its Atlantic Salmon Conservation Plan for Seven Maine Rivers (the "Conservation Plan"), and asked that the Services withdraw the proposed rule in light of, among other things, the significant protections afforded to Atlantic salmon under the Conservation Plan. 62 Fed. Reg. 28,414.

37. The Conservation Plan called for a variety of measures to be implemented over a five-year period to restore and protect Atlantic salmon in Maine rivers. Upon review of the Conservation Plan, defendant Babbitt praised the Plan and stated that it removed the threats upon which the proposed listing was based.

38. The Services gave the public the opportunity to comment on the Conservation Plan. Following this public comment period, the Services, on December 18, 1997, announced that they were withdrawing the proposed rule which would have listed the Seven Rivers DPS as "threatened" under the ESA. 62 Fed. Reg. 66,325.

39. In withdrawing the proposed rule, the Services stated that the salmon in the seven rivers were "not likely to become endangered in the foreseeable future" and that an ESA listing was therefore not warranted. 62 Fed. Reg. 66,337. The Services also announced that henceforth, in light of the possibility that the Services might add salmon in additional rivers to the DPS, they would refer to the population of Atlantic salmon in the seven Maine rivers as the "Gulf of Maine Distinct Population Segment," or, the "Gulf of Maine DPS." *Id.*

40. The term "Gulf of Maine DPS" is a misnomer to the extent that it implies that all Atlantic salmon within the Gulf of Maine geographic region are part of the Services' distinct population segment. In fact, it refers only to the allegedly "indigenous" salmon in the specified seven rivers, and does not include salmon in other rivers within the Gulf of Maine region, such as the Penobscot River.

41. In withdrawing the proposed rule, the Services stated that the process for listing Atlantic salmon under the ESA would be reinitiated only if 1) an emergency which poses a significant risk to the well-being of the Gulf of Maine DPS is identified and not immediately and adequately addressed; 2) the biological status of the Gulf of Maine DPS is such that the DPS is in danger of

extinction throughout all or a significant portion of its range; or 3) the biological status of the Gulf of Maine DPS is such that the DPS is likely to become endangered in the foreseeable future throughout all or a significant portion of its range. 62 Fed. Reg. 66,338.

District of Columbia Litigation and Subsequent Events

42. On or about January 27, 1999, various individuals and environmental organizations, including Defenders of Wildlife, filed a lawsuit (the "Defenders of Wildlife lawsuit") in the United States District Court for the District of Columbia challenging the Services' December 1997 decision to withdraw the proposed rule which would have listed the Gulf of Maine DPS as threatened under the ESA. The State of Maine was given leave to intervene in the lawsuit.

43. In the Defenders of Wildlife lawsuit, plaintiffs, as part of their request for relief, requested that the Services be ordered to immediately issue an emergency rule listing the Gulf of Maine DPS as endangered under the ESA.

44. On November 17, 1999, ten months after the Defenders of Wildlife lawsuit was filed, and less than two years after the Services had determined that the Gulf of Maine DPS was "not likely to become endangered in the foreseeable future," the Services announced that the Gulf of Maine DPS was now "in danger of extinction" and proposed a rule listing the so-called Gulf of Maine DPS as "endangered" under the ESA. 64 Fed. Reg. 62,627. Electronic mail communications between DOI attorneys indicate that the Services' decision to propose this listing was based, at least in part, on a desire to end or stay the Defenders of Wildlife litigation and thus avoid what the DOI attorneys viewed as a potentially adverse judgment and an unfavorable precedent.

45. In proposing the endangered listing, the Services explicitly declined to include in the DPS Atlantic salmon in the Penobscot River, because, despite that the Penobscot River is within the Gulf of Maine region, and is flanked by rivers included within the DPS, the Services were unable

to conclude that the salmon in the Penobscot were "indigenous" salmon as opposed to being the result of restoration efforts. The Services did, however, include salmon in an eighth waterway, Cove Brook, to the DPS, despite that Cove Brook is a tributary of the Penobscot River. The Services stated that, based on "ongoing stream surveys and continuing genetic analyses," salmon in additional waterways might be added to the DPS in the future. 64 Fed. Reg. 62,638.

46. Following issuance of the proposed rule, the State of Maine, in conjunction with its Atlantic Salmon Commission, Department of Marine Resources, and Department of Inland Fisheries and Wildlife, submitted comments disagreeing with the proposed rule and demonstrating that the proposed listing was arbitrary, capricious, and otherwise not in accordance with law. Maine pointed out that, among other things, the Services 1) failed to use the best available scientific evidence; 2) ignored relevant factors; 3) failed to take into account the efforts of Maine to restore Atlantic salmon; 4) improperly determined that the Gulf of Maine population of Atlantic salmon is a "distinct population segment;" and 5) failed to adequately explain what developments in the past twenty-three months warranted changing their finding that the Gulf of Maine population of Atlantic salmon is "not likely to become endangered in the foreseeable future" to a finding that the population is "in danger of extinction." Maine's Atlantic Salmon Commission, Department of Marine Resources, and Department of Inland Fisheries and Wildlife also submitted separate comments to the Services disagreeing with the proposed listing.

47. Maine's Atlantic Salmon Commission is responsible for, among other things, the protection, preservation, enhancement, restoration and management of the Atlantic salmon and its habitat. 12 M.R.S.A. § 9901. Maine's Department of Marine Resources is responsible for, among other things, the conservation and development of the State's marine and estuarine resources. 12 M.R.S.A. § 6021. Maine's Department of Inland Fisheries and Wildlife is

responsible for, among other things, the preservation, protection and enhancement of the State's inland fisheries and wildlife resources. 12 M.R.S.A. § 7011. Thus, all three agencies are responsible for the management and conservation of fish, plant or wildlife resources within Maine, within the meaning of 16 U.S.C. § 1532(18).

48. Pursuant to the terms of the ESA, the Services were required, by November 17, 2000, to either issue a final ruling listing the Gulf of Maine DPS as endangered or withdraw the proposed rule. Alternatively, if the Services found that there was substantial disagreement regarding the sufficiency or accuracy of the available data relevant to the determination of whether the Gulf of Maine DPS should be listed, the Services were permitted by statute to extend the November 17, 2000 deadline by six months to solicit additional data. 16 U.S.C. § 1533(b)(6)(B).

49. Despite issuance of the proposed rule listing the Gulf of Maine DPS as endangered under the ESA, the Defenders of Wildlife lawsuit progressed, with plaintiffs and defendants each moving for summary judgment. Plaintiffs maintained that the Services 1997 withdrawal of the proposed rule was improper, and argued that an emergency existed requiring that the Gulf of Maine DPS be immediately listed. The Services argued that the 1997 withdrawal was proper, and that the Gulf of Maine DPS does not face any emergency so as to warrant immediate listing.

50. On June 14, 2000, the Services voluntarily entered into a stipulation in the Defenders of Wildlife lawsuit pursuant to which the parties agreed to stay further proceedings in the lawsuit pending a determination by the Services as to whether the proposed listing of the Gulf of Maine population of Atlantic salmon would become final.

51. In the stipulation, the Services agreed that they would make a final determination on the proposed rule no later than November 17, 2000 and that they would thus waive their authority to take a six-month extension to solicit additional scientific data. The Services entered into this

stipulation despite that just two months previously Maine had submitted to the Services extensive information challenging the sufficiency and accuracy of the data upon which the Services relied in proposing that the Gulf of Maine population be listed as endangered, and over Maine's written objection that the Services were improperly restricting their ability to take a six month extension before the Services had an adequate opportunity to determine if the uncertainty of the relevant data might warrant such an extension.

52. The stipulation was endorsed by the court, and the stipulation specifically provided that any party may ask the court to alter the terms of the stipulation.

53. On November 2, 2000, Maine's Governor wrote to defendants to request that they take the six-month extension in order to consider the results of a study to be conducted by the National Academy of Sciences which would provide the defendants with additional scientific data regarding whether the Gulf of Maine population of Atlantic salmon is a distinct population segment. Citing the stipulation entered into in the Defenders of Wildlife lawsuit, and despite that defendants voluntarily entered into the stipulation and could, in any event, have asked the court to modify the terms of the stipulation, the defendants refused to take an extension. In refusing to take the extension, James Baker, Administrator of the DOC's National Oceanic and Atmospheric Administration and Under Secretary for Oceans and Atmosphere at the DOC, stated that if the National Academy of Sciences study concludes that the Gulf of Maine population of Atlantic salmon is not a distinct population segment, the defendants would initiate the process to remove the population from the Endangered Species List. In so stating, Under Secretary Baker implicitly acknowledged that the National Academy of Sciences study would be the best scientific data on the issue of whether the Gulf of Maine population of Atlantic salmon is a distinct population segment.

54. On November 17, 2000, the Services issued in the Federal Register a final regulation listing as endangered the Gulf of Maine population of Atlantic salmon. 65 Fed. Reg. 69,459.

55. Despite a legal obligation to do so, 16 U.S.C. § 1533(i), the Services failed to submit to the State of Maine, its Atlantic Salmon Commission, its Department of Marine Resources, or its Department of Inland Fisheries and Wildlife, a written justification for the Services' failure to adopt regulations consistent with the State of Maine's, and its agencies', comments on the proposed regulation. Further, the final regulation does not respond to many of the comments made by Maine, and, on information and belief, the Services did not consider all of Maine's comments.

56. Further, contrary to law, the final regulation does not include a summary of all data on which the regulation is based, nor does it show the relationship of the data to the regulation.

57. In issuing the final regulation, the Services identified various activities that could result in the "take" of Atlantic salmon and thus would be unlawful. These activities include the escape of certain strains of salmon from aquaculture facilities, siting and/or operating aquaculture facilities in certain manners, discharging silt, fertilizers, pesticides, organic wastes and other materials into "waters supporting the DPS," and application of pesticides and herbicides, even when such applications are in compliance with label restrictions. 65 Fed. Reg. 69,479-80. Restricting these activities will unlawfully and significantly impair the ability of certain industries, including the aquaculture, agriculture, and forest products industries, as well as of individuals, to operate within Maine.

Basis for the Services' Determination that the Gulf of Maine Population of Atlantic Salmon is a Distinct Population Segment

58. The ESA permits the Services to list under the ESA not only a species, but also a "discrete population segment" ("DPS") of a species. Recognizing the potential for abuse in designating a population as a DPS, Congress stated that it expects the DPS designation to be used "sparingly"

and "only when the biological evidence indicates that such action is warranted." S. Rep. No. 96-151, 7 (1979).

59. On February 7, 1996, the Services issued a policy which purported to clarify their interpretation of what constitutes a distinct population segment. 61 Fed. Reg. 4721. According to this policy, the Services consider three elements in determining whether a population segment is a distinct population segment: 1) the discreteness of the population segment in relation to the remainder of the species to which it belongs; 2) the significance of the population segment to the species to which it belongs; and 3) the population segment's conservation status in relation to the ESA's standards for listing. 61 Fed. Reg. 4725.

60. Pursuant to the Services' policy, a population segment may be considered "discrete" if it either 1) is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors; or 2) is delimited by international governmental boundaries within which significant differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist. 61 Fed. Reg. 4725.

61. Pursuant to the Services' policy, the Services, in determining whether a population segment is significant, consider, among other things, evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics. 61 Fed. Reg. 4725.

62. The Services' policy regarding their interpretation of the term "distinct population segment" is arbitrary, capricious, an abuse of discretion, and not in accordance with law. In short, the Services have expanded the distinct population segment concept far beyond that which was intended by Congress and consider factors which Congress did not intend to be considered.

63. In determining that the so-called Gulf of Maine population of Atlantic salmon is a distinct population segment, the Services purported to apply the criteria set forth in the policy issued by the Services on February 7, 1996. In fact, though, the criteria set forth in the policy do not support a finding the Gulf of Maine population of Atlantic salmon is a distinct population segment, and the Services' determination that it is a distinct population segment is arbitrary, capricious, an abuse of discretion, and otherwise not in accordance with law.

64. For example, in support of their determination that the Gulf of Maine population of Atlantic salmon is discrete, the Services relied upon their finding that the "straying rate," that is, the number of salmon that return to a river other than the one in which they hatched, is between one and two percent. 65 Fed. Reg. 69,466. This finding is not supported by, and in fact is contradicted by, the best available scientific and commercial data. The Services failed to consider scientific evidence submitted by Maine during the comment period demonstrating that straying rates are far in excess of two percent.

65. As another example, in support of their determination that the Gulf of Maine population of Atlantic salmon is discrete, the Services relied upon their finding that there has been "limited stocking [of salmon within the Gulf of Maine population with salmon] from outside the population segment." 65 Fed. Reg. 69,460. This finding is not supported by the best available scientific and commercial data, and, in fact, in making this finding, the Services failed to adequately consider scientific evidence submitted by the State of Maine demonstrating there has been significant stocking from outside of the population segment, including evidence demonstrating that from 1872 to 1969, 87.3% of salmon stocked in the DPS rivers came from outside the DPS, and that from 1970 to 1992, 97.3% of the stocked salmon came from outside the DPS. The Services' failure to acknowledge the impact of stocking from outside of the DPS is inconsistent with previous

determinations by the Services with respect to West Coast salmon in which they refused to designate a population as a DPS because of prior stocking of the population with non-indigenous members of the species.

66. As another example, in support of their determination that the so-called Gulf of Maine population of Atlantic salmon is discrete, the Services relied upon their finding that salmon in the Gulf of Maine DPS have unique genetic characteristics. In so finding, however, the Services failed to consider evidence submitted by the State of Maine during the comment period demonstrating that the principal study upon which this finding is based was fundamentally and systemically flawed, and they failed to consider evidence demonstrating that the Gulf of Maine population of Atlantic salmon does not have unique genetic characteristics.

67. As another example, in support of their determination that the Gulf of Maine population of Atlantic salmon is significant, the Services relied upon their finding that salmon within the population have "unique life history characteristics that have a heritable basis." 65 Fed. Reg. 69,460. In so finding, however, the Services failed to consider evidence submitted by the State of Maine during the comment period demonstrating that these "unique life history characteristics" are environmental, not genetic, and therefore are not evolutionarily significant and do not support a determination that the Gulf of Maine population of Atlantic salmon is a distinct population segment.

68. As another example, in support of their determination that the Gulf of Maine population is discrete, the Services relied upon their finding that "there are substantial differences in the control of exploitation, management of habitat, conservation status, and regulatory mechanisms of Atlantic salmon between the United States and Canada." 65 Fed. Reg. 69,460. Reliance on this factor was improper inasmuch as the ESA does not contemplate that differences in management of a species

from country to country warrant a determination that the species is a distinct population segment. Further, the Services ignored evidence submitted by the State of Maine during the comment period which demonstrates that there are few differences between the United States and Canada with respect to control of exploitation, management of habitat, conservation status, and regulatory mechanisms of Atlantic salmon.

69. As another example, in support of their determination that the Gulf of Maine population of Atlantic salmon is a distinct population segment, the Services relied upon their finding that native Atlantic salmon to the south of the Kennebec River have been extirpated and that present populations of salmon to the south represent "restoration" stocks. Reliance on this factor was arbitrary and capricious inasmuch as the Services fail to articulate a rational scientific distinction between the salmon populations to the south and the Gulf of Maine population with respect to the Services' determination that the former are "restoration" populations while the latter is an "indigenous" population.

70. In support of their determination that the Gulf of Maine population of Atlantic salmon is a distinct population segment, the Services relied upon two studies which, on information and belief, were not made available to the public – or Maine – during the comment period. 65 Fed. Reg. 69,465. Reliance on these studies was arbitrary and capricious inasmuch as Maine did not have an opportunity to comment on the sufficiency or accuracy of these studies.

Defendants' Failure to Provide Maine With Underlying Scientific Data

71. Under the Services' February 7, 1996 policy, genetic analysis plays a major role in determining whether a population segment is discrete and significant, and therefore, a potential distinct population segment. For example, a population may be considered "discrete" if it "is markedly separated from other populations of the same taxon as a consequence of physical,

physiological, ecological, or behavioral factors," and "quantitative measures of genetic or morphological discontinuity may provide evidence of this separation." 61 Fed. Reg. 4725. Similarly, one of the factors that is examined in determining whether a population is "significant" is whether there is evidence that the population "differs markedly from other populations of the species in its genetic characteristics." 61 Fed. Reg. 4725.

72. Genetic analysis was essential to the Services' determination that the Gulf of Maine population of Atlantic salmon is a distinct population segment.

73. The Services relied upon genetic analysis in support of their determination that the Gulf of Maine population of Atlantic salmon is "discrete" from other populations because there are allegedly genetic differences between salmon in the Gulf of Maine and salmon outside of the Gulf of Maine. 65 Fed. Reg. 69,460.

74. The Services relied upon genetic analysis in support of their determination that, despite artificial stocking of Atlantic salmon in the Gulf of Maine rivers, the salmon in these rivers retain "an important genetic legacy." 65 Fed. Reg. 69,460.

75. The principal genetic study relied on by the Services is a March 1999 study entitled "Microsatellite and mitochondrial DNA diversity in Atlantic salmon with emphasis on small coastal drainages of the Downeast and Midcoast of Maine," (the March 1999 Study) performed by, among others, Dr. Timothy L. King, an employee of the DOI's United States Geological Survey ("USGS").

76. Wanting to conduct an independent evaluation of the 1999 Study, Maine, through a Freedom of Information Act request served on defendants on December 21, 1999, and after seeking to obtain the information by less formal methods, sought all "original genetic data underlying the summary data" upon which the March 1999 Study was based.

77. After initially sending computer disks which Maine found to be useless, Department of the Interior, through its agency, the USGS, on February 16, 2000, provided Maine with usable computer disks which USGS represented as containing the data that Maine requested.

78. Soon after receiving these computer disks, Maine determined that DOI had failed to include a key computer file needed to interpret the data on the disks. This file is referred to as the "Genotyper template file."

79. Subsequently, DOI informed Maine that while the Genotyper template file exists, it had been modified after the March 1999 Study was completed. Maine requested the file either in its current form or a form with the post-March 1999 modifications removed. DOI initially refused to provide Maine with the file in either format.

80. On February 24, 2000, Maine filed a lawsuit in this Court seeking, among other things, the Genotyper template file. *State of Maine v. Department of the Interior, et al.*, No. 00-CV-30 (D. Me., Feb. 24, 2000). On March 2, 2000, DOI produced to Maine the Genotyper template file. Subsequently, the lawsuit was dismissed pursuant to a Consent Order entered on March 8, 2000.

81. In producing the Genotyper template file to Maine, DOI represented that the file had been reconstructed to its March 1999 format (that is, that the post-March 1999 modifications had been removed) but that no other alterations had been made.

82. Upon receipt of the Genotyper template file, Maine, through a consultant, analyzed the Genotyper template file and the other genetic data produced by USGS. Maine's consultant then prepared a written critique of the March 1999 Study, which the State of Maine submitted to the Services as part of the State's formal comments on the proposed rule to list Atlantic salmon as

endangered. These comments were submitted on April 14, 2000, the deadline for submitting such comments.

83. On April 20, 2000, the State of Maine received reliable information that Dr. King, before producing to Maine the Genotyper template file, intentionally made alterations to the data contained in the file, alterations other than simply removing the post-March 1999 modifications.

84. On June 13, 2000, Maine filed a lawsuit in this Court seeking, among other things, an unaltered copy of the Genotyper template file. *State of Maine v. Department of the Interior, et al.*, No. 00-CV-122-B-C (D. Me., June 13, 2000). Defendants, while acknowledging that "minor errors" were made when they attempted to remove the post-March 1999 modifications, nevertheless moved to dismiss Maine's claim for the Genotyper template file. The Court denied defendants' motion and permitted Maine to conduct discovery regarding what alterations were made to the Genotyper template file.

85. Until discovery is completed, Maine will not know the quantity or the nature of the alterations made to the Genotyper template file. However, Maine submitted its comments regarding the sufficiency and accuracy of the defendants' genetic analysis on the assumption that it was provided with an accurate reconstruction of the Genotyper template file. If this assumption is incorrect, then Maine's critique of the March 1999 Study may be flawed, and Maine may thus have been denied the opportunity to fully comment on the proposed listing of Atlantic salmon and the scientific data underlying the proposed listing.

Basis for the Services' Determination that the Gulf of Maine Population of Atlantic Salmon is in Danger of Extinction

86. In determining that the Gulf of Maine population of Atlantic salmon is in danger of extinction, the Services purported to apply the five factors set forth in the ESA: 1) the present or threatened destruction, modification, or curtailment of its habitat or range; 2) overutilization for

commercial, recreational, scientific, or educational purposes; 3) disease and predation; 4) the inadequacy of existing regulatory mechanisms; and 5) other natural or manmade factors affecting the species' continued existence. With respect to those factors upon which the Services relied in determining that the Gulf of Maine population of Atlantic salmon is in danger of extinction, said reliance was not consistent with the best available scientific and commercial data and was arbitrary, capricious, and not in accordance with law.

87. With respect to the first factor, the Services found that "at present, the scientific and commercial data available do not show that loss of habitat is creating a danger of extinction to the DPS." 65 Fed. Reg. 69,475. With respect to the second factor, the Services found that "the best data presently available do not show that overutilization is creating a danger of extinction" to the Gulf of Maine DPS. 65 Fed. Reg. 69,476. Thus, the first two factors were not relied upon by the Services in support of their decision to list as endangered the Gulf of Maine DPS. Rather, the Services relied upon the three remaining factors – disease and predation, inadequacy of existing regulatory mechanisms, and other natural or manmade factors. As set forth below, the Services' reliance on these factors was arbitrary and capricious.

Disease and Predation

88. The Services found that "the best available scientific and commercial data show that disease presently creates a danger of extinction" to the Gulf of Maine DPS, but that "there are insufficient data at this time to show that predation creates a danger of extinction to the DPS." 65 Fed. Reg. 69,477. The Services' reliance on the disease factor is arbitrary, capricious, and not in accordance with law, inasmuch as, as the Services have acknowledged, the best available scientific and commercial data does not show that disease creates a danger of extinction to the Gulf of Maine DPS. Rather, the threat posed by disease is, at best, speculative. Further, the

Services failed to consider the comprehensive regulatory scheme adopted by Maine to address most, if not all, potential disease threats.

89. In support of their determination that disease creates a danger of extinction, the Services rely upon "the appearance of the ISA [Infectious Salmon Anemia] virus in 1996 in Canada." 65 Fed. Reg. 69,476. Reliance upon this factor is arbitrary and capricious, given that the Services were aware of the presence of this virus in December 1997, when they determined that the Gulf of Maine population "is not likely to become endangered within the foreseeable future," and the Services point to no new information indicating that any threat posed by ISA has increased since then.

90. In the Defenders of Wildlife lawsuit, defendant Clark and the Deputy Assistant Administrator of NMFS stated, under oath, that the ISA virus "represents a potential threat" to the Gulf of Maine population of Atlantic salmon only if the virus becomes established in aquaculture pens within the United States in close proximity to DPS rivers. In issuing the final regulation listing the population as endangered, however, the Services stated that "an extensive survey of Maine aquaculture operations found no ISA virus present within the United States." 65 Fed. Reg. 69,476.

91. Defendant Clark and the Deputy Assistant Administrator of NMFS further stated, under oath, in the Defenders of Wildlife lawsuit, that 1) "there is currently no evidence to indicate the [ISA] virus is present in the wild in North America, or that the presence of the virus in the wild will lead to symptoms of the disease in the wild;" 2) the virus has been present in the aquaculture industry in Norway since 1994, in Canada since 1996, and in Scotland since 1997, and in these countries "extensive wild salmon populations have existed in proximity to the infected aquaculture pens, but no transmission of the virus to the free-ranging wild salmon has been

documented." 3) "juvenile salmon and eggs imported from Canada for use by aquaculture growers in the United States are required by the State of Maine to be from commercial sources that have been inspected and found to free of ISA." Given the above, the Services' reliance on the ISA virus as a factor supporting their listing decision was arbitrary and capricious.

92. In support of their determination that disease creates a danger of extinction, the Services also rely upon "the discovery in 1998 of the retrovirus SSSV [Salmon Swimbladder Sarcoma Virus] within the DPS." 65 Fed. Reg. 69,476. The Services' reliance upon this factor is arbitrary and capricious, given that, as the Services have acknowledged 1) there has never been any "clinical indication of disease" or "observation of symptoms" in the DPS "wild" salmon populations; 2) the threat of disease from SSSV "is limited," and 3) that "until future research or experience provides additional information, the threat associated with this virus remains uncertain." 65 Fed. Reg. 69,476. Given this, the Services' reliance on the SSSV virus as a factor supporting their listing decision was arbitrary and capricious.

93. In support of their determination that disease creates a danger of extinction, the Services also rely upon "new information available in 1999, on the potential impact of coldwater disease (CWD) on salmon." 65 Fed. Reg. 69,476. Inasmuch as 1) this "new information" comes from "ongoing studies" conducted by the USGS; 2) in violation of 16 U.S.C. § 1533(b)(8), the results of these "ongoing studies" were not summarized in the final rule; and 3) Maine was not given the opportunity to review and comment upon these "ongoing studies," the Services' reliance upon CWD as a factor supporting their listing decision was arbitrary and capricious.

94. Further, the Services' reliance upon CWD is arbitrary and capricious given that CWD was recognized and documented in the scientific literature years before the Services concluded in

December 1997 that the Gulf of Maine population "is not likely to become endangered within the foreseeable future."

Existing Regulatory Mechanisms

95. With respect to the fourth listing factor, the Services determined that existing regulatory mechanisms are inadequate to address the threats to Atlantic salmon. 65 Fed. Reg. 69, 477. Specifically, the Services determined that existing regulatory mechanisms are not sufficient to remove the threats allegedly posed by agricultural water withdrawals, disease, and aquaculture. *Id.*

96. The Services' reliance upon their finding that existing regulatory mechanisms are not sufficient to remove the threat posed by agricultural water withdrawals from the Gulf of Maine rivers is arbitrary and capricious, inasmuch as, among other things, the Services ignored current regulations on water withdrawals and failed to point to any scientific or commercial data indicating that the currently regulated water withdrawals pose any threat to the Gulf of Maine population of Atlantic salmon.

97. The Services' reliance upon their finding that existing regulatory mechanisms are not sufficient to remove the threat posed by disease is arbitrary and capricious, inasmuch as the Services 1) failed to consider evidence submitted by Maine during the comment period regarding the extensive regulatory measures adopted by Maine to address potential disease threats, and 2) failed to demonstrate that disease currently poses any threat to the Gulf of Maine population of Atlantic salmon.

98. The Services' reliance upon their finding that existing regulatory mechanisms are not sufficient to remove the threat allegedly posed by aquaculture is arbitrary and capricious, inasmuch as, among other things, the Services 1) failed to consider evidence submitted by Maine

during the comment period regarding mandatory and voluntary regulatory mechanisms imposed on the aquaculture industry; 2) failed to demonstrate that aquaculture poses a threat to the Gulf of Maine population of Atlantic salmon; and 3) failed to demonstrate that there has been any reduction or relaxation of regulatory mechanisms since December 1997, when the Services determined that the Gulf of Maine population of Atlantic salmon is "not likely to become endangered within the foreseeable future." 62 Fed. Reg. 66,327-28.

Other Natural or Manmade Factors

99. With respect to the fifth listing factor, the Services determined that other natural or manmade factors create a danger of extinction to the Gulf of Maine population of Atlantic salmon. Specifically, the Services found that aquaculture practices and low marine survival create a danger of extinction.

100. With respect to aquaculture practices, the Services rely upon "the threat of non-native Atlantic salmon used in aquaculture facilities." 65 Fed. Reg. 69,477. The Services' reliance upon this factor is arbitrary and capricious given that aquaculture facilities have been using non-native Atlantic salmon since the late 1980s, and the Services nevertheless concluded in December 1997 that the Gulf of Maine population "is not likely to become endangered within the foreseeable future." 62 Fed. Reg. 66,327-28.

101. The Services' reliance on this factor is arbitrary and capricious inasmuch as the Services failed to consider evidence regarding methods used to prevent escapes of aquaculture salmon, and failed to demonstrate that escapes of non-native aquaculture salmon present a threat to "native" salmon.

102. The Services' finding that low marine survival creates a danger of extinction is arbitrary and capricious, inasmuch as the best available scientific and commercial data fails to

demonstrate that the marine survival rate has changed significantly since December 1997, when the Services determined that the Gulf of Maine population "is not likely to become endangered within the foreseeable future." 62 Fed. Reg. 66,327-28.

The Services' Findings Regarding Population Abundance

103. Reasoning that "abundance is the critical criterion in assessing the status of a species under the ESA," the Services found that "naturally reproducing Atlantic salmon populations of the Gulf of Maine DPS are at extremely low levels of abundance." 65 Fed. Reg. 69,461. This finding is not supported by the best available scientific and commercial data, and is arbitrary and capricious.

104. In assessing population abundance, the Services failed to include Atlantic salmon currently being held in hatcheries, despite the Services' acknowledgement that said hatchery salmon are part of the Gulf of Maine population and have been referred to by the Services as "a buffer against extinction." 65 Fed. Reg. 69,461. The Services' failure to include these hatchery-held fish in assessing population abundance is arbitrary and capricious. Further, given the Services' acknowledgment that these hatchery fish are a "buffer against extinction," the Services' finding that the Gulf of Maine population of Atlantic salmon is in danger of extinction is necessarily wrong.

105. The Services' determination that the Gulf of Maine salmon population is at a low level of abundance is based, in part, on their finding that documented returns of adult salmon to their natal rivers are low. 65 Fed. Reg. 69,461. Inasmuch as the Services stated in the Defenders of Wildlife lawsuit that adult returns are not a reliable indicator of population abundance, the Services' reliance on this factor is arbitrary and capricious.

106. In the Defenders of Wildlife lawsuit, defendant Clark and the Deputy Assistant Administrator of NMFS stated, under oath, that adult counts "can vary greatly year to year in the

same river due to factors not related to actual abundance of spawning adults, and probably always underestimate the actual numbers." They further stated that "these numbers alone do not provide an accurate representation of the total DPS population." Finally, "adult counts do not provide a sound basis for concluding, in the short term, that the adult populations have substantially declined since 1996 or 1997."

107. In the Defenders of Wildlife lawsuit, defendant Clark and the Deputy Assistant Administrator of NMFS explained why counts of returning adults are not a reliable indictor of population abundance:

a. First, "in many years . . . there was no attempt to collect count data for several of the DPS rivers, even though some adults probably did return to those rivers."

b. Second, it is difficult to compare adult counts from one year to another because sampling efforts varied. "For example, the 1996 adult count on the Dennys River is based on approximately 5 months of weir operation . . . as compared to the count for that river in 1998 being based on only 5 weeks of weir operations." In some rivers, the count one year was based on samples taken from weirs, while in another year it was based on "casual observation with no sampling." Further, sampling efforts varied from year to year based on "differing water conditions, available equipment, seasonal work priorities among rivers, and available staff."

c. Third, defendant Clark and the Deputy Assistant Administrator of NMFS stated that the counts do not reflect hatchery-based adults that produce juveniles which are released into the DPS rivers. "Large releases of fry (over 200,000) started and continued in 1997, 1998, and 1999, the returning adults of which will not be seen until 2001, 2002, and 2003, respectively."

d. Finally "the number of adult returns do not provide a full evaluation of the state of the DPS population because they ignore the other life stages simultaneously present in the wild (fry, parr, smolts, and post-smolts at sea)." In fact, there were "increases reported in juvenile populations . . . in both 1997 and 1998 within the DPS rivers."

108. The Services' determination that the Gulf of Maine salmon population is at a low level of abundance is also based on an estimate of a low abundance of Atlantic salmon in the Greenland region of the North Atlantic ocean. 65 Fed. Reg. 69,461. The Services' reliance on this estimate is arbitrary and capricious inasmuch as, among other things, the Services 1) failed to demonstrate that the estimate has decreased since December 1997, when the Services determined that the Gulf of Maine population "is not likely to become endangered within the foreseeable future;" 62 Fed. Reg. 66,337; and 2) failed to demonstrate a correlation between the estimate of numbers of Atlantic salmon in the Greenland region and the numbers of Atlantic salmon expected to return to the DPS rivers.

109. The Services' determination that the Gulf of Maine salmon population is at a low level of abundance is also based on their finding that smolt survival rates are lower than previously reported. 65 Fed. Reg. 69,461. The Services' reliance on smolt survival rates is arbitrary and capricious, inasmuch as, among other things, 1) the Services' finding that the smolt survival rate has decreased is based on a single study, which makes lower survival estimates than were previously reported in four other studies, and the Services do not explain why the results of the single study are more reliable than the results of the other studies; and 2) the study upon which the Services rely examined only salmon in the Narraguagus River, and did not examine salmon in the seven other Gulf of Maine rivers.

Count I

110. Plaintiff State of Maine realleges the allegations contained in paragraphs 1 through 109 and incorporates them herein.

111. Defendants' action in listing as endangered under the ESA the Gulf of Maine population of Atlantic salmon is a final agency action. The State of Maine has no adequate remedy in court other than review under the APA.

112. Defendants' action in listing as endangered under the ESA the Gulf of Maine population of Atlantic salmon is arbitrary, capricious, an abuse of discretion and/or otherwise not in accordance with law within the meaning of 5 U.S.C. § 706, inasmuch as defendants, among other things, 1) improperly determined that the Gulf of Maine population of Atlantic salmon is a distinct population segment; 2) by entering into a stipulation in other litigation, unlawfully deprived Maine of a procedure specifically made available by Congress for use when there exists a substantial disagreement regarding the sufficiency or accuracy of the data relevant to a proposed ESA listing; 3) failed to provide the State of Maine with genetic data relied on by defendants in determining that the Gulf of Maine population of Atlantic salmon is a distinct population segment, thereby precluding Maine from fully commenting on the proposed regulation; 4) in determining that the Gulf of Maine population of Atlantic salmon is a distinct population segment, relied upon scientific studies which were not made available to the public during the comment period, thereby precluding the public – and Maine – from commenting on the accuracy and sufficiency of the studies; 5) failed to make the determinations that the Gulf of Maine population of Atlantic salmon is a distinct population segment and that the population is in danger of extinction solely on the basis of the best available scientific and commercial data, and, in making said determinations, considered factors which they are not lawfully permitted to consider; 6) in determining that the Gulf of Maine population of Atlantic salmon is in danger of extinction, failed to adequately take into account efforts being made by the State of Maine to protect Atlantic salmon; 7) in issuing the final regulation listing the Gulf of Maine population of Atlantic salmon as endangered, failed to

include a summary of the data on which the regulation is based and showing the relationship of such data to the regulation; 8) failed to submit to the appropriate agencies of the State of Maine a written justification for defendants' failure to adopt regulations consistent with the comments submitted by said agencies; and 9) failed to consider and respond to all of the comments submitted by the State of Maine.

Requests For Relief

Plaintiff State of Maine requests from the Court the following relief:

a. a declaration and order setting aside as unlawful and void the final regulation listing the Gulf of Maine population of Atlantic salmon as endangered under the ESA;

b. a declaration and order setting aside as unlawful and void defendants' determination that the Gulf of Maine population of Atlantic salmon is a distinct population segment within the meaning of the ESA;

c. in the event that defendants' determination that the Gulf of Maine population of Atlantic salmon is a distinct population segment within the meaning of the ESA is not set aside, a declaration and order that defendants may not add Atlantic salmon in additional waterways to the distinct population segment without conducting the administrative rule-making process that would otherwise apply to the listing of a species under the ESA;

d. a temporary, preliminary, and permanent injunction enjoining the final regulation listing the Gulf of Maine population of Atlantic salmon as endangered under the ESA from taking effect, and enjoining defendants and their agents from taking any action to enforce said regulation;

e. an order compelling defendants to comply with the legal duties imposed on them by the ESA, including the duty to make a listing determination solely on the basis of the best available scientific and commercial data, the duty, in issuing a final regulation, to summarize the data on which the regulation is based and to show the relationship of the data to the regulation, and the duty to submit to Maine a written justification for their failure to adopt regulations consistent with Maine's comments on the proposed regulation listing the Gulf of Maine population of Atlantic salmon as endangered under the ESA.

f. an order awarding to plaintiff State of Maine its attorneys' fees and costs it incurred in bringing and maintaining this action pursuant to 28 U.S.C. § 2412; and,

g. such further and additional relief as the Court may deem just and proper.

Dated: December 7, 2000

Respectfully submitted,

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/S/ CHRISTOPHER C. TAUB

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