

Wyoming Aquatic Invasive Species Management Plan



Prepared by

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Date

ACKNOWLEDGMENTS

Cover Photos: quagga mussels (top left) by Utah Division of Wildlife Resources; bighead carp (top center) by U.S. Geological Survey (USGS); New Zealand mudsnail (top right) by Dan Gustafson, Montana State University; Eurasian watermilfoil (middle left) by Alison Fox, University of Florida, Bugwood.org; zebra mussels (middle center) by USGS; hydrilla (middle right) by Chris Evans, River to River Cooperative Weed Management Area, Bugwood.org; fish infected with viral hemorrhagic septicemia (bottom left) Mohammed Faisal, USGS; rusty crayfish (bottom center) by USGS; Asian clam (bottom right) by Noel Burkhead, USGS.

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EXECUTIVE SUMMARY

Aquatic invasive species (AIS) are a significant threat to the natural resources of Wyoming and have the potential to cause substantial ecological, economic, and social impacts. Several invasive species currently exist in Wyoming, and other potentially more damaging species are present in neighboring states. In 2009, due to the increasing threat from invasive zebra and quagga mussels, the Wyoming Game and Fish Department increased efforts to prevent the spread of these and other aquatic invasive species into Wyoming. Various AIS efforts in Wyoming are also being conducted by Wyoming State Parks and Cultural Resources, the Aquatic Nuisance Species Subcommittee of the Greater Yellowstone Coordinating Committee, United States Fish and Wildlife Service, United States Forest Service, National Park Service, and Bureau of Reclamation. The purpose of this management plan is to develop a coherent, cohesive response to the threat posed by AIS and to coordinate efforts between federal, state, tribal, local, and private entities.

The plan includes an overview of the need for this plan, which has never been greater with the increased threat to Wyoming waters from numerous AIS, primarily zebra and quagga mussels. Invasive mussels are the highest priority species in this plan, but other priority species include rusty crayfish, Asian carp, viral hemorrhagic septicemia, hydrilla, New Zealand mudsnail, whirling disease, Asian clam, Eurasian watermilfoil, and nonnative invasive fishes. The goal of the Wyoming AIS Plan and Program is to fully implement a coordinated strategy to prevent, control, contain, monitor, and whenever possible, eradicate aquatic invasive species from the waters of the state.

Specific plan objectives to achieve this goal are:

1. To coordinate and implement a comprehensive management program,
2. To prevent the introduction of new AIS into Wyoming,
3. To detect, monitor, and eradicate AIS in Wyoming,
4. To control and eradicate established AIS that have significant impacts on Wyoming waters,
5. To educate resource user groups about the risks and impacts of AIS and how to reduce their harmful impacts, and
6. To support research on AIS in Wyoming and develop efficient systems to disseminate information to research and management communities.

Key actions to achieve these objectives include:

- Implement a Wyoming AIS program
- Coordinate all AIS management activities within Wyoming and collaborating with regional and national efforts
- Develop a permanent funding mechanism for the program
- Review and evaluate state efforts addressing AIS
- Identify AIS with the greatest potential to infest Wyoming and pathways of spread
- Enforce AIS legislation and regulations
- Prohibit, control, or permit importation of nonindigenous species based on invasion potential

- Implement a surveillance and early detection program
- Develop a rapid response mechanism for detected and potential AIS
- Eradicate pioneering populations of AIS
- Limit the dispersal of established AIS to new waters or to new areas of a water
- Control and/or eradicate known AIS populations where economically, ecologically, and technically feasible
- Develop and distribute AIS outreach materials to increase agency and public awareness
- Train individuals on AIS identification and watercraft inspection/decontamination
- Support research on aspects of all AIS
- Facilitate the collection and dispersal of information research and data on AIS

Plan recommendations are to continue and expand AIS outreach, watercraft inspections, and monitoring of AIS in Wyoming and to partner with state, federal, and local entities to increase efforts in these areas. While several state and federal entities have authority and programs related to AIS, there is a need to better coordinate activities to reduce redundancy and increase effectiveness.

This management plan recommends feasible, cost-effective management strategies to be implemented by federal, state, tribal, and local programs to prevent and control AIS in Wyoming. In addition, establishment of long-term funding to implement the plan is critical in the success of the Wyoming AIS Program. The implementation table summarizes the program's current funding from all sources and needed future funding. A one-time \$1.5 million appropriation was allocated by the Wyoming State Legislature as part of the Wyoming Aquatic Invasive Species Act to fund the initial year of an AIS prevention program in Wyoming for 2010. The amount of any legislative appropriation to fund the program in future years is unknown.

This plan requests additional funding of \$35,000 from the Aquatic Nuisance Species Task Force (ANSTF) for 2011 to assist in securing a more permanent source of annual funding for the program.

The plan has been reviewed by affected stakeholders and was open for public comment from June 21 to July 31, 2010. Very few comments were received on the plan; comments can be found in Appendix C.

LIST OF ACRONYMS AND ABBREVIATIONS

Acronyms and abbreviations used in this management plan are as follows:

AIS -	Aquatic invasive species
ANS -	Aquatic nuisance species
ANSTF -	Aquatic nuisance species task force
BLM -	Bureau of Land Management
BOR -	Bureau of Reclamation
CDOW -	Colorado Division of Wildlife
HACCP -	Hazard Analysis and Critical Control Point
HUC -	Hydrologic Unit Code
IANST-	Idaho aquatic nuisance species task force
IDA -	Idaho Department of Agriculture
IPANE -	Invasive Plant Atlas of New England
MRBP -	Missouri River Basin Panel on Aquatic Nuisance Species
MTFWP -	Montana Fish, Wildlife and Parks
NANPCA -	National Aquatic Nuisance Prevention and Control Act
NOAA -	National Oceanic and Atmospheric Administration
NPS -	National Park Service
NZMS -	New Zealand mudsnail
PCR -	Polymerase chain reaction
PSMFC -	Pacific States Marine Fisheries Commission
SDW -	South Dakota Division of Wildlife
WD -	Whirling disease
WDA -	Wyoming Department of Agriculture
WDEQ -	Wyoming Department of Environmental Quality
WDOT -	Wyoming Department of Transportation
WGFC -	Wyoming Game and Fish Commission
WGFD -	Wyoming Game and Fish Department
WSP -	Wyoming State Parks and Cultural Resources
UDWR -	Utah Division of Wildlife Resources
USFS -	United States Forest Service
USFWS -	United States Fish and Wildlife Service
USGS -	United States Geological Survey
VHS -	Viral hemorrhagic septicemia
WRP -	Western Regional Panel on Aquatic Nuisance Species

INTRODUCTION

Aquatic invasive species (AIS) are organisms that are not native and cause significant harm to an ecosystem when introduced. Adverse impacts can occur to municipal water supplies, recreation, agriculture, aquaculture, and other commercial activities. Aquatic invasive species including amphibians, crustaceans, fish, pathogens, plants, and mollusks are currently present in Wyoming, most notably the New Zealand mudsnail (Benson 2009a) and the parasite that causes whirling disease. While these species cause problems and need to be controlled, the most significant known threat to Wyoming is from zebra and quagga mussels based on their proximity and demonstrated impacts in neighboring states. As a headwater state with waters draining into the Columbia, Colorado, Great Basin, and Missouri River basins (Figure 1), Wyoming can help limit the downstream spread of these and other detrimental AIS. Wyoming is home to several major rivers including the North Platte River, Green River, Snake River, Wind-Bighorn River, and Powder River. In addition, Wyoming has several major interstate waters, notably Flaming Gorge Reservoir (Wyoming-Utah), Palisades Reservoir (Wyoming-Idaho), and Big Horn Lake (Wyoming-Montana; Figure 1). Coordination with neighboring states on these interstate waters is critical to preventing the spread of AIS.

A successful Wyoming AIS Management Plan and Program must be proactive, coordinated, and thorough. By taking an aggressive, proactive approach, Wyoming can minimize the risk of new AIS introductions, such as zebra/quagga mussels, and of spreading AIS that currently exist in the state. The issue of AIS is a broad issue affecting the entire state including federal, state, tribal, local, and private entities. A coordinated approach involving all interested and affected stakeholders is critical to a successful AIS program. To be effective, the program must implement plans to control the spread of all AIS that threaten our waters. Necessary elements of the management plan include prevention, surveillance (monitoring), control, and eradication.

Prevention through outreach is the best approach to managing AIS, and has been shown to be more effective and affordable than dealing with invasive species after they become established (Lee et al. 2007). Outreach includes disseminating information through brochures, signs, posters, media, fishing and boating regulations, and public activities. Additional AIS education and training for state, local, and private individuals are critical components of this effort. Prevention also includes inspection of watercraft coming to Wyoming from high-risk or infected waters and decontamination or quarantine of infected watercraft. Surveillance will be a key component of the AIS program and includes an assessment to determine which waters are most at risk for a zebra/quagga mussel infestation. A monitoring plan has been developed and implemented to sample at-risk waters for the presence of these mussels and other AIS. A control element in an AIS program will outline the protocol for dealing with an infestation. A rapid response component of the program will control the further spread of AIS. The final element of an AIS program is eradication of established AIS populations. Although there are currently no known eradication methods for zebra/quagga mussels that do not cause harm to the rest of the environment, eradication will be considered where feasible for populations of AIS in Wyoming. Supporting research on prevention and eradication methods for invasive mussels and other AIS will be an important component of this plan.

Ecologically, AIS can completely alter a system through competition, disease, shifts in food availability, and may cause direct mortality. For example, invasive mussels can out-compete

native mussels for space and resources and will attach to and smother native mussels causing mortality (Cummings and Mayer 1992, Strayer 2008). Zebra and quagga mussels filter plankton out of the water column at high rates (up to a liter per day per individual) so that little plankton remains available for fish populations, resulting in their decline (Benson 2009b).

Invasive mussels, clams, mud snails, and plants can negatively impact water delivery systems and power generation facilities by clogging pipes, pumps, turbines, and filtration systems. They can also impede the delivery of water for municipal, industrial and agricultural purposes. The annual cost to control an infestation has been estimated at over \$1 million per hydropower facility and \$40,000 per drinking water facility (Idaho Aquatic Nuisance Species Taskforce [IANST] 2009). Aquatic invasive species have the potential to drastically impact recreational revenue as the degradation of aquatic resources can decrease boating and fishing in Wyoming. Additionally, the presence of mussels can discourage boaters by plugging the water circulation system in boats causing serious engine damage. In 2006, Wyoming had over 200,000 anglers who spent over \$500 million in retail sales. State and local taxes on angler related purchases totaled over \$60 million in 2006 (Southwick Associates 2007). A decline in revenue from impacts related to aquatic invasive species would have severe effects on local businesses, state natural resource agencies, and all Wyoming citizens. Mandated conservation actions of additional Endangered Species listings due to AIS invasions may also impact local economic development.

This management plan was drafted by the Wyoming Game and Fish Department (WGFD) with guidance and reviews provided by state, tribal, local, and private entities as well as the public. Wyoming's AIS Management Plan will be reviewed annually and revised as needed as new AIS threats can arise unexpectedly. While the Wyoming Game and Fish Department will be the state agency responsible for administration of this plan, it is expected that there will be broad participation in AIS programs and activities by various federal, state, tribal, local, and private entities. This plan will provide guidance in coordinating these programs and activities. During plan preparation, establishing a state invasive species council was discussed but was not deemed necessary at this time. Coordination among agencies and groups has been sufficient without a formal council to this point.

The plan will allow for increased coordination with approved state management plans of neighboring Idaho, Montana, South Dakota, and Utah and plans under development in Colorado and Nebraska. This plan will also guide AIS activities in Wyoming to allow coordination with regional and national initiatives such as the Quagga-Zebra Mussel Action Plan for Western U.S. Waters (Britton et al. 2010), the National Management and Control Plan for the New Zealand Mudsnaill (Proctor et al. 2007), and Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States (Conover and Whalen 2007).

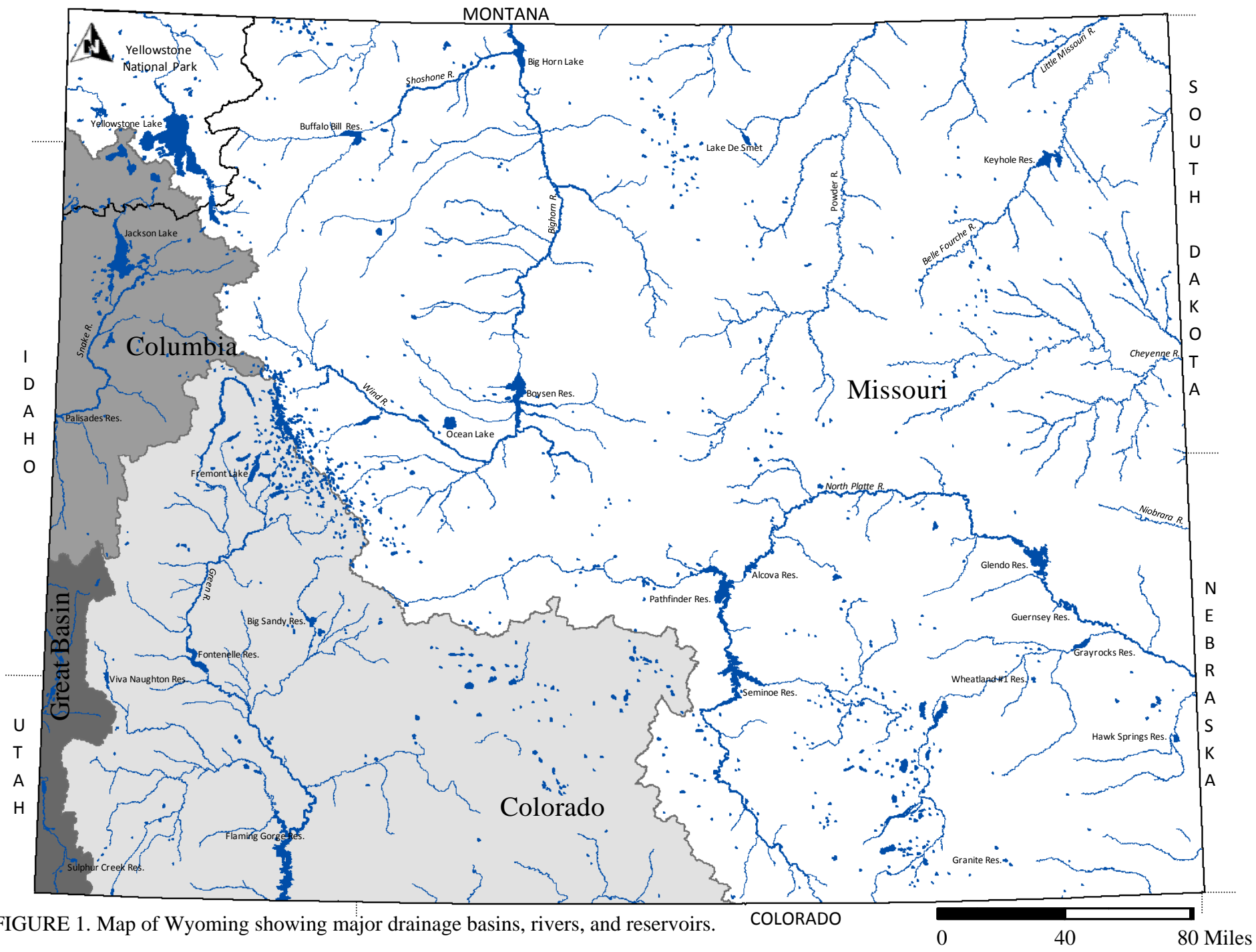


FIGURE 1. Map of Wyoming showing major drainage basins, rivers, and reservoirs.

PROBLEM DEFINITION AND RANKING

Aquatic invasive species of all kinds have the potential to cause substantial economic and ecological harm to Wyoming. Several AIS are already present in Wyoming and have caused harmful ecological impacts through competition, hybridization and habitat alteration. More damaging species are at or near our border and annual estimates to control infestations of those species, particularly zebra and quagga mussels, in the West are several million dollars (IANST 2009). In addition, recreation dollars in Wyoming exceed \$500 million annually and loss in that revenue from AIS infestations could be significant. The ecological costs of AIS are far reaching including declines in fisheries and native mollusk species, and harmful algal blooms. The economic and ecological benefits of AIS prevention, the cornerstone of Wyoming's plan and program, far exceed any costs incurred.

New AIS can arrive in Wyoming through several pathways. Aquatic invasive species already present in Wyoming were likely introduced through baitfish introductions, illegal and legal fish introductions, and recreation activities such as angling and boating. Currently, the most significant pathway for new AIS into Wyoming is through transport on trailered watercraft. Preliminary evidence suggests that the majority of non-resident use of Wyoming waters is from neighboring Colorado and Utah, both with confirmed populations of invasive mussels and other AIS not yet known in Wyoming such as Eurasian watermilfoil. Although these states have substantial programs to prevent the spread of AIS to other states, trailered watercraft entering Wyoming from infested waters in neighboring states are still a major concern. In addition, trailered watercraft from areas with considerable populations of invasive mussels, such as Lake Mead, Lake Havasu, and many eastern waters, have the potential to spread these AIS to Wyoming. As trailered watercraft are the primary vector of concern for spreading new AIS into Wyoming, watercraft inspections and outreach to the boating community is the cornerstone of AIS prevention activities in Wyoming. Additional pathways include interstate waters that may become infested in other states, thereby spreading the species to Wyoming, and illegal introductions.

Implementation of a program to review and regulate species intentionally allowed into Wyoming, and to monitor the pathways by which species may be unintentionally spread, is necessary to slow the rate at which new species become established. Understanding the means by which vectors serve as conduits for AIS into Wyoming is critical for intercepting species and preventing introductions. Prevention is the most effective strategy in preventing the spread of AIS into and within Wyoming.

The ability to rapidly detect new AIS invasions and the spread of established AIS in Wyoming is critical to implement rapid response plans while the potential exists to eradicate pioneering species. After AIS have arrived in a new location there is a small window of opportunity to eradicate populations, but often new species are not detected until they become a nuisance. By initiating a detection and monitoring program, Wyoming will be able to discover and manage pioneering AIS populations and determine if eradication is feasible and cost effective.

Established AIS populations can spread to uninfested waters, thereby increasing their potential for economic and ecological damage. New Zealand mudsnails were first discovered in Wyoming

in 1996 in the Madison River inside Yellowstone National Park, and have since spread to waters outside the park. Whirling disease was first found in Wyoming in 1988 and now occurs throughout the state. Recently, Asian clam were discovered in Wyoming but their extent remains unknown. Some invasive aquatic plants, such as purple loosestrife and salt cedar, are presently managed by the Wyoming Department of Agriculture (WDA) as noxious weeds and are therefore not included in this management plan. Management activities are most effective when they are directed at limiting the affects of a population or stopping that population from spreading to new waters. More funding and research is needed regarding management of aquatic invasive species. Of primary importance is a more thorough understanding of the distribution and abundance of AIS in Wyoming. Although the extent of some AIS in Wyoming is fairly well understood (mudsnails, whirling disease), the long-term impacts from these species remains unknown. Research to address this issue includes determining the risks associated with vectors of spread, the relationship between environmental conditions and colonization of AIS, interactions between AIS and native species, and management options for control and/or eradication is needed.

The introduction of new AIS occurs through a variety of pathways, most of which are closely related to human activities. Public awareness of AIS, the threats posed by them, and means to prevent their spread in Wyoming is still inadequate. Current efforts over the last several years have increased public awareness, especially that of boaters. However, the vast majority of water users in Wyoming are still unaware of AIS threats and their role in prevention. Increasing public awareness of the AIS threats that already exist in Wyoming, as well as threats from new species, is a critical component on the program.

Non-indigenous aquatic species currently in Wyoming include crustaceans (1 species), fishes (28), mollusks (4), pathogens (1), and plants (21; Appendix A). Geographic distribution and population abundance of many of these species is largely unknown. More comprehensive monitoring of AIS in Wyoming is needed and is a goal of the plan and program. Species to be considered under this plan include priority species in Appendix A in addition to those not currently found in Wyoming. The priority species listed in this plan will be the major focus of management activities under the Wyoming AIS program. Several species have caused harm in other areas, and may become priorities for AIS management in Wyoming in the future including spiny water flea (*Bythotrephes longimanus*), round goby (*Neogobius melanostomus*), ruffe (*Gymnocephalus cernuus*), and curly pondweed (*Potamogeton crispus*). Due to the dynamic nature of AIS, problems and concerns may change over time and Wyoming's plan and program will adapt to meet the challenges posed by new species.

Aquatic invasive species discussed in this management plan are given a rank of priority class one through four.

Priority Class 1

Priority Class 1 species are those not known to be present in Wyoming, but that have a high potential to invade. Management techniques for these species are impractical, ineffective, or unknown. Therefore, management for these species will focus on prevention of introductions and containment of new populations.

Zebra mussel (*Dreissena polymorpha*) and Quagga mussel (*Dreissena rostriformis*)



FIGURE 2. Photo of quagga mussel (top left), zebra mussel (bottom left), and quagga mussel encrustation of boat propeller (right). Photo credit: Myriah Richerson, U.S. Geological Survey (USGS); Utah Division of Wildlife Resources (UDWR).

Invasive zebra and quagga mussels were first discovered in Michigan in 1988 and spread rapidly throughout eastern waters, but were contained east of the 100th Meridian for nearly 20 years (Figure 2). However, in 2007 invasive mussels first appeared west of the 100th Meridian. As of 2009, zebra and quagga mussels now occur in Colorado, Utah, Nebraska, Kansas, Nevada, Arizona, and California (Benson 2009b, Benson 2009c). Zebra and quagga mussels have high reproductive potential and spread rapidly. They are naturally dispersed through water currents, but human transport via recreational watercraft trailered from infested waters is a primary vector for upstream and between drainage introductions (O'Neill 1996).

Power generation facilities in the Great Lakes region have spent millions of dollars per facility due to mussel infestations (Magee et al. 1996). Cities and industries in the region also spend hundreds of millions of dollars annually to prevent invasive mussels from clogging water pipes.

Zebra and quagga mussels have not been documented in Wyoming's waters, but pose an immediate threat to the state as they are present 50 miles from the border in Utah's Red Fleet Reservoir. Whereas invasive mussels have not been found in Wyoming waters, they have been found on watercraft being transported into Wyoming. Preventative measures such as increased public awareness, and watercraft inspection and decontamination at high-risk waters will be critical in preventing the spread into Wyoming.

Rusty crayfish (*Orconectes rusticus*)



FIGURE 3. Photo of rusty crayfish; photo credit: USGS.

Rusty crayfish are native to the Ohio, Tennessee, and Cumberland drainages in eastern United States (Figure 3). The species has been introduced into 12 other states, most likely by baitfish introductions. Rusty crayfish have the potential to outcompete native crayfish and established populations can destroy plant bed abundance and diversity (Lodge et al. 2000; USGS 2009).

Rusty crayfish are not currently present in Wyoming, but were found in 2006 in the North Platte River drainage, where they had been illegally stocked. Illegal stocking of the crayfish occurred in 2000, 2002, and 2006 in three ponds in the drainage as forage to enhance sport fisheries. Two of the ponds were drained for repair in 2006, and it is believed that crayfish migrated to a small section of nearby Wagonhound Creek at that time. The WGFD determined the distribution of rusty crayfish using extensive trapping. Control was attempted because the crayfish were reproducing, yet the distribution was still limited and water levels could be controlled to increase the chance of a successful eradication. In 2006 and 2007, the water levels in the ponds and creek were lowered and then treated with rotenone, a piscicide also lethal to crustaceans. The company responsible for illegally stocking the rusty crayfish was convicted of a Lacey Act violation and paid fines for the violation and restitution to the WGFD. Subsequent monitoring using minnow bait traps has not resulted in the documentation of any rusty crayfish in the drainage. Continued prevention of future introductions will include outreach and education, and enforcement of existing regulations.

Asian carp (four species including fertile grass carp)



FIGURE 4. Photos of Asian carp: bighead carp (top left), silver carp (top right), black carp (bottom left), and grass carp (bottom right). Photo credit: bighead carp, USGS; silver carp, Department of Fisheries and Allied Aquacultures, Auburn University; black carp, Rob Cosgriff, Illinois Natural History Survey; grass carp, U.S. Fish and Wildlife Service (USFWS).

Asian carp consist of four species: bighead carp (*Hypophthalmichthys nobilis*), silver carp (*Hypophthalmichthys molitrix*), black carp (*Mylopharyngodon piceus*), and grass carp (*Ctenopharyngodon idella*; Figure 4). Bighead carp are native to China and were intentionally introduced in 1972 in Arkansas in an attempt to improve water quality and increase fish production in culture ponds (Fuller et al. 1999). The species now occurs in at least 18 states and is naturally reproducing. Bighead carp may deplete zooplankton populations and therefore compete with native fishes (Nico and Fuller 2009).

Silver carp are native to Southeast Asia and east Russia and were intentionally introduced into the United States in 1973 for phytoplankton control and as food fish (Fuller et al. 1999). The species now occurs in 12 states and is naturally reproducing. The effects of introduced silver carp are the same as those for bighead carp (Nico 2009a).

Black carp are native to Asia and east Russia and were unintentionally introduced in the early 1970s as a stowaway with intentionally introduced grass carp (Fuller et al. 1999). The species was then intentionally introduced in the early 1980s as a food fish and for biological control of yellow grub. Black carp now occur in Arkansas, Illinois, Louisiana, Mississippi, and Missouri. Black carp may reduce populations of native mussels and snails through predation and negatively affect the aquatic ecosystem (Nico 2009b).

Grass carp are native to Russia and China and were introduced to the United States in 1963 for vegetation control. The species now occurs in 45 states and stocking of grass carp for aquatic vegetation control continues throughout the country. Grass carp can compete for food with native crayfish, change the composition of the aquatic vegetation community, and transmit disease to native fish (Nico et al. 2009). Current Wyoming Game and Fish Commission (WGFC) regulations on grass carp stocking require hatchery health certificates, verification that the importing hatchery is free of New Zealand mudsnails, and a certificate from the United States Fish and Wildlife Service (USFWS) indicating they are triploid and sterile. All requests to stock grass carp must be approved by the WGFD Fish Chief. The WGFD considers only fertile grass carp to be a Priority Class 1 AIS.

Prevention of illegal Asian carp introductions in Wyoming will be conducted through increased public awareness on the negative impacts of Asian carp and existing fish transport and stocking regulations.

Viral Hemorrhagic Septicemia (VHS)



FIGURE 5. Photo of fish infected with VHS; photo credit: Mohammed Faisal, USGS.

Viral Hemorrhagic Septicemia (VHS) is a viral fish disease that affects a variety of fish species and has caused large scale fish kills (Figure 5). The virus was first discovered in the Great Lakes in 2003 in Lake St. Clair, Canada and is now present in lakes Ontario, Erie, and Huron, the St. Lawrence River, in upstate New York, in the Columbia River system, and along the West Coast from Alaska to California. The mode of introduction into the United States remains unknown, but may have been through ballast water exchange. Recent evidence suggests that VHS may be

enzootic in the Great Lakes and was present for several years before causing fish mortality (Bain et al. 2010). Once introduced, the most common vectors of spread of VHS are human induced movement of infected fish between waters, natural movement of fish between waters, and movement of infected water. Clinical signs of the disease in fish are hemorrhaging in the skin with large, red patches typical on the sides and anterior of the head and internal hemorrhaging (Idaho Invasive Species Council Technical Committee 2007; Whelan 2009). Existing WGFC regulations requiring fish health inspections for importation of fish and regulations prohibiting the transport of live fish will help prevent the spread of VHS to Wyoming.

Hydrilla (*Hydrilla verticillata*)

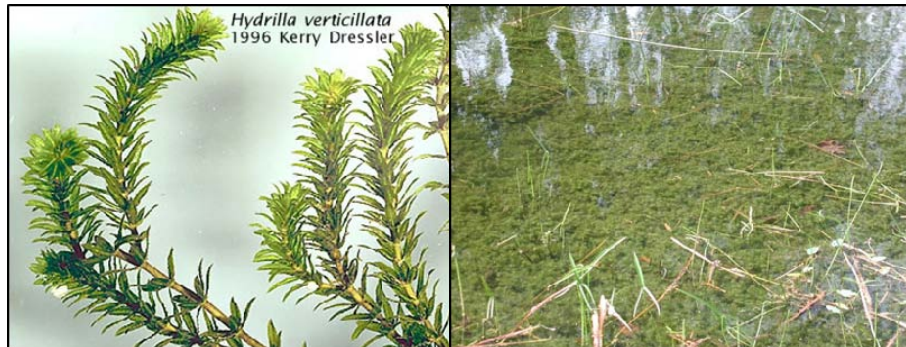


FIGURE 6. Photo of hydrilla stem (left) and a hydrilla infestation (right). Photo credit: Kerry Dressler; Leslie Mehrhoff, Invasive Plant Atlas of New England (IPANE).

Hydrilla is native to Asia and was introduced into the United States in the early 1950's for use in aquariums (Figure 6). The species spread into open water through discarded fragments or by planting in canals. Since its initial introduction, hydrilla has spread to 27 states, most likely transported on trailered watercraft. Hydrilla displaces native vegetation, alters physical and chemical properties in lakes, reduces fish foraging efficiency, obstructs boating, fishing, and swimming, and impedes water delivery (Jacono et al. 2009). Preventing the spread of Hydrilla to Wyoming through outreach and watercraft inspections will be critical.

Priority Class 2

Priority Class 2 species are present in Wyoming and have the potential to spread. Management techniques for these species may be ineffective in some instances. Management of these species will focus on prevention of spread to other waters through increased public awareness, and control of population size and eradication when economically and ecologically effective.

New Zealand Mudsnaill (*Potamopyrgus antipodarum*)



FIGURE 7. Photo of a New Zealand mudsnail close-up (left) and an infestation (right). Photo credit: Dan Gustafson, Montana State University.

The New Zealand Mudsnaill is native to mainland New Zealand and adjacent small islands. It was probably introduced into the United States through transoceanic ships or transported with live game fish (Figure 7). The species was first discovered in the Snake River, Idaho in 1987 and has since spread to Oregon, Montana, Wyoming, California, Arizona, Washington, Colorado, and lakes Ontario, Erie, and Superior. The mudsnail is parthenogenic and densities have been recorded over 300,000 per square meter. It is transported by fish and birds, natural downstream dispersal, upstream through rheotactic behavior, and by humans on fishing gear. Impacts of introduction include outcompeting native species and inhibiting their colonization and altering water chemistry.

New Zealand mudsnails were first discovered in 1996 in the Madison River in Yellowstone National Park, Wyoming. The pathway of introduction into Wyoming is unknown, but spread on recreational angling gear is likely given the first location of introduction. Currently, populations in Wyoming occur in Yellowstone National Park (Madison, Firehole, Gibbon, Gardner rivers, Nez Perce Creek), Grand Teton National Park (Polecat Creek) and in the Bighorn, Shoshone, and Snake rivers (Benson and Kipp 2009; Figure 8).

The importation, possession, confinement, transport, sale, and disposal of New Zealand mudsnails in Wyoming is prohibited by WGFC regulation. Over the last decade, numerous agencies and groups have worked on outreach to prevent the further spread of mudsnails in Wyoming and the West. Management of this species entails reducing or slowing the further spread in Wyoming through angler education and enforcement of regulations. Signing of mudsnail positive waters with prevention tips for anglers will be important in further limiting the spread.

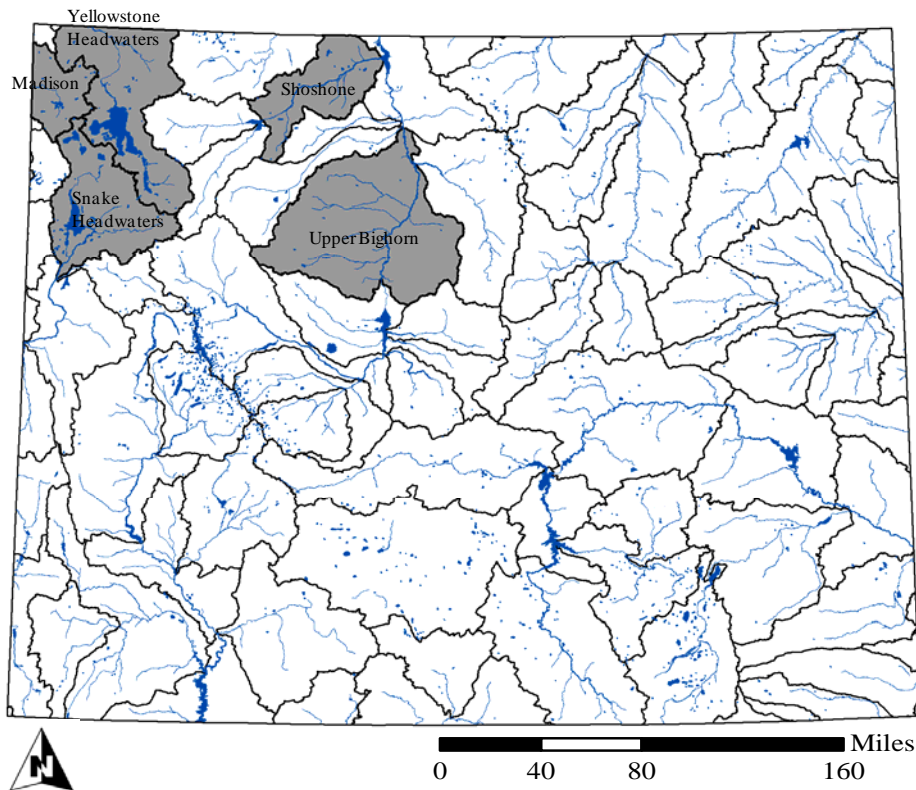


FIGURE 8. Map of New Zealand mudsnail distribution in 8-digit HUC watersheds in Wyoming (Data source: USGS). Shaded watersheds indicate documented occurrence of New Zealand mudsnail.

Whirling disease (*Myxobolus cerebralis*)



FIGURE 9. Photo of a Salmonid infected with whirling disease. Photo credit: Whirling Disease Initiative.

Whirling disease is caused by the microscopic parasite, *Myxobolus cerebralis* and was introduced from Europe in the 1950's. The parasite has a two-host life cycle, infecting both Salmonids and a common aquatic worm, *Tubifex tubifex*. The parasite is spread through movement of infected fish and through water or mud containing the parasite spores. The parasite infects cartilage tissue of Salmonids and may cause a blackened tail, deformities of the head and spine, whirling behavior, and death of the fish (Figure 9). Whirling disease has been associated with fishery losses and high economic costs. The disease is known to occur in 23 states including Wyoming (Whirling Disease Initiative 2006).

Whirling disease was first discovered in the North Platte and Laramie rivers in Wyoming in 1988 and has since spread throughout the state (Figure 10). The pathway of introduction was through the legal stocking of fish from Colorado, not known at the time to contain the pathogen. The cause of the spread to other waters in Wyoming is unknown.

Declines in rainbow trout populations were reported in the 1990s in Colorado and Montana. To date, there have been no confirmed large-scale fish mortalities or population declines that have been directly linked to whirling disease in Wyoming. The WGFD continues to monitor for whirling disease in Wyoming through analysis of fish sampled in rivers not known to contain the pathogen. In addition, inspections are conducted at state hatchery facilities to monitor for whirling disease. Major renovations have been made to state hatcheries to effectively deal with whirling disease.

A fish health inspection report is required by WGFC regulation for fish importation to reduce further spread of whirling disease into Wyoming. Management of this pathogen involves education to prevent the spread through mud or water on recreational gear and enforcement of regulations. Signing of whirling disease positive waters with prevention tips for anglers will be important in further limiting the spread.

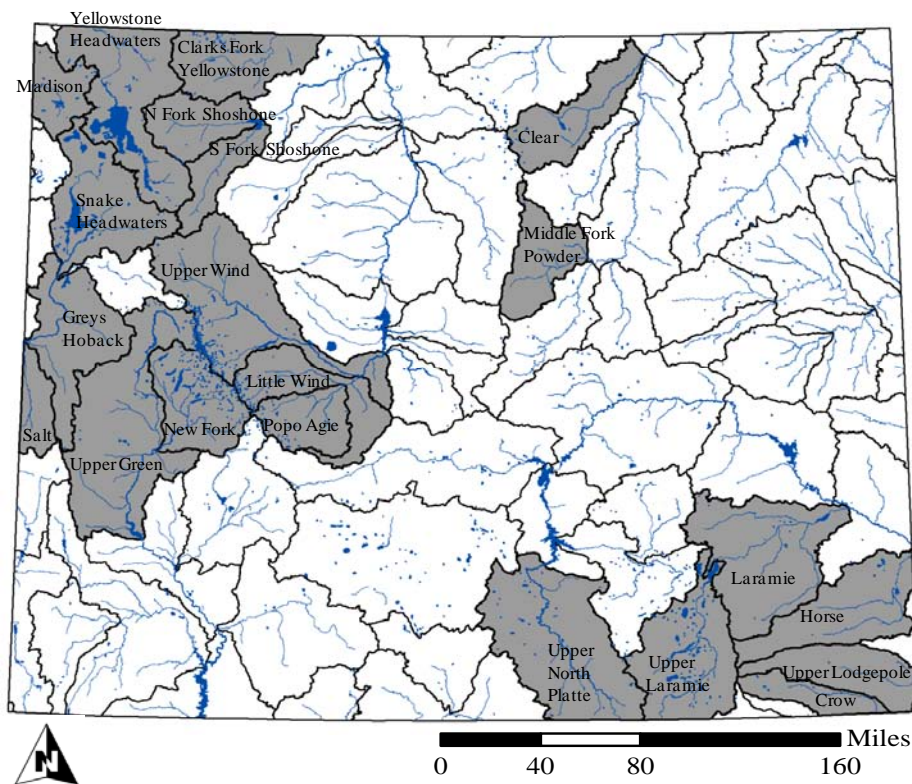


FIGURE 10. Map of whirling disease distribution in 8-digit hydrologic unit code (HUC) watersheds in Wyoming as of 2003 (Data source: USFWS). Shaded watersheds indicate documented occurrence of whirling disease.

Asian clam (*Corbicula fluminea*)



FIGURE 11. Photo of Asian clam. Photo credit: Noel Burkhead, USGS.

The Asian clam is native to Asia, Africa, the Mediterranean, and Australia and is believed to have been introduced intentionally as food or incidentally imported with the Pacific oyster (Figure 11). It was initially discovered in 1938 in the Columbia River and now occurs in 38 states. Asian clams are spread through bait bucket introductions, accidental introductions with aquaculture species, illegal introductions for food, and through water currents. Much like zebra and quagga mussels, the Asian clam can clog pipes at power generation and water supply facilities, causing millions of dollars in damage (Foster et al. 2009).

Asian clams were not known to occur in Wyoming, but recent collection information from the University of Wyoming indicates they are present in the Laramie River. Samples collected indicate the species is present at three locations in the River and were found in 2005, 2006, and 2007 (Figure 12). No specimens were found during sampling in 2008 or 2009. Further sampling continues to determine the range extent of this population.

Management of new populations will involve education to prevent spread of Asian clams to other drainages in Wyoming and enforcement of existing regulations. Signing of Asian clam positive waters with prevention tips for anglers will be important in further limiting the spread.

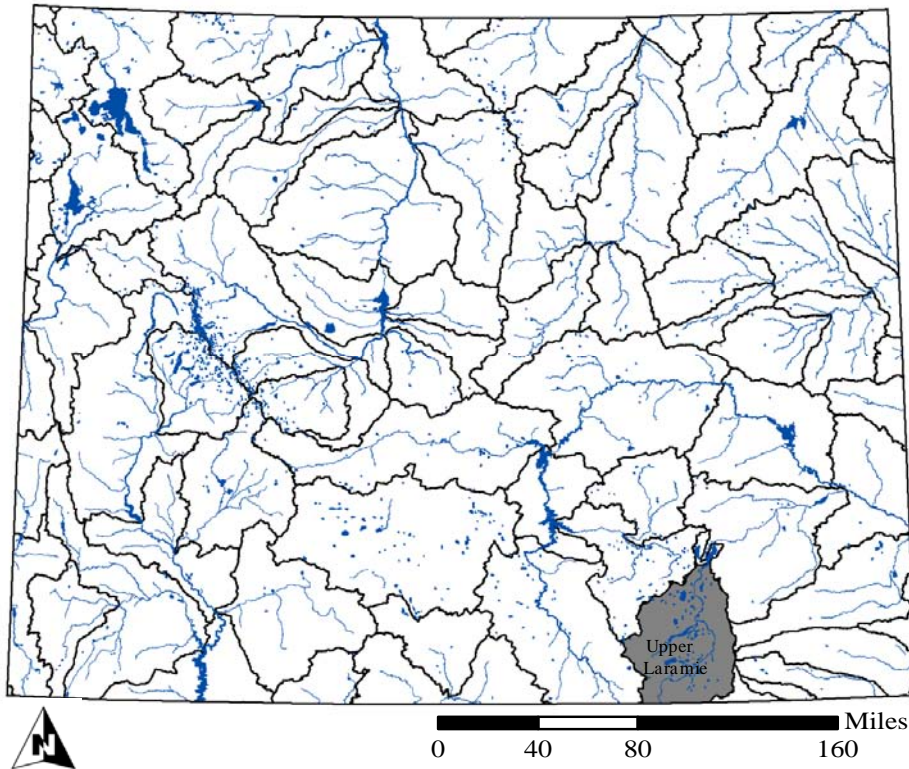


FIGURE 12. Map of Asian clam distribution in 8-digit HUC watersheds in Wyoming (Data source: University of Wyoming). Shaded watersheds indicate documented occurrence of Asian clam.

Priority Class 3

Priority Class 3 species are those not known to be present in Wyoming, have a high potential to invade, but some management techniques are available for these species. Management for these species will include prevention of introductions and eradication of new populations.

Eurasian watermilfoil *Myriophyllum spicatum*



FIGURE 13. Photo of Eurasian water milfoil stem (left) and infestation (right). Photo Credit: USGS; Leslie J. Mehrhoff, IPANE.

Eurasian watermilfoil is native to Europe, Asia, and northern Africa and may have been intentionally introduced into the United States. It was first documented in Washington D.C. in 1942, and now occurs in 45 states and Canada. The species is spread on trailered watercraft and fragments can spread naturally downstream; one stem or leaf fragment can start a new colony. Eurasian watermilfoil is an aggressive plant, displacing native plants leading to reduced diversity. Dense beds form canopies and reduce light penetration, invertebrate abundance, fish forage space, and fish predation efficiency (Figure 13). In addition, it degrades water quality and reduced oxygen levels. Dense beds can also hamper recreation by restricting swimming, fishing, and boating (Jacono and Richerson 2009). Preventative measures such as watercraft inspections, eradication of any new populations, and enforcement of existing regulations will be critical in preventing the spread of Eurasian watermilfoil into Wyoming.

Priority Class 4

Priority Class 4 species are present in Wyoming and have the potential to spread, but some management techniques are available for these species. Management for these species will include prevention of spread and eradication of existing populations where feasible.

Nonnative invasive fish (nonnative trout, burbot, walleye, white sucker, brook stickleback)



FIGURE 14. Photo of brook stickleback. Photo Credit: Konrad Schmidt, USGS.

These species have been introduced into a location out of their native range intentionally or unintentionally and have become established in some areas. Some species, such as brook stickleback (*Culaea inconstans*) are invasive throughout Wyoming. However, several other nonnative fish species such as burbot and white sucker are native to a portion of the state, and have been illegally introduced elsewhere in Wyoming and have become invasive.

While in some areas nonnative fish may be controlled for conservation and restoration of natives, nonnative sport fish support popular fisheries that provide recreational and economic benefits elsewhere. However, illegal introduction of nonnatives such as lake trout in Yellowstone Lake, walleye in Buffalo Bill Reservoir, and burbot in the Green River drainage, may have undesirable ecological, recreational, and economic impacts.

Management through existing fishing regulations and public education is critical in preventing further illegal fish introductions in Wyoming. In 2010, an amendment to Wyoming's illegal fish stocking law was passed that increased the penalty to a high misdemeanor with the possibility of lifetime revocation of hunting and fishing privileges. The intent is for this increase penalty to be a deterrent to any future illegal fish stocking activities in Wyoming.

GOAL

The goal of the Wyoming AIS Plan and Program is to fully implement a coordinated strategy to prevent, control, contain, monitor, and whenever possible, eradicate aquatic invasive species from the waters of the state.

This goal will be achieved through implementation of a plan and program that:

- emphasizes prevention of new introductions;
- allows for early detection;
- permits appropriate and timely management response to new and existing populations;
- incorporates education and research elements;
- requires an assessment and review for all aquatic nonindigenous species prior to their importation, transport, or use in Wyoming;
- includes development of contingency plans;
- protects aquatic habitats and native species communities;
- recommends funding levels adequate for effective implementation;
- provides easy access to updated species distribution and management information;
- fosters agency collaboration;
- facilitates coordination with local, state, federal, and tribal agencies;
- seeks cooperative solutions with the private sector and user groups;
- contributes to the accomplishments of the goals of the ANSTF, USFWS, National Oceanic and Atmospheric Administration (NOAA) fisheries, and other relevant federal AIS programs.

This plan will be adaptable as it is not intended to address all potential invading species, their impacts, and the constraints and contingencies that may develop.

EXISTING AUTHORITIES AND PROGRAMS

State Authorities and Programs

State agencies currently operating or cooperating on AIS efforts in Wyoming include the WGFD, Wyoming State Parks and Cultural Resources (WSP), Wyoming Department of Transportation (WDOT), WDA, and Wyoming Department of Environmental Quality (WDEQ).

The 2010 Wyoming Aquatic Invasive Species Act (Enrolled Act 62) is a comprehensive law which provides for prohibition of AIS, inspection and decontamination of watercraft, authority for the WGFC and WSP to develop rules and regulations, civil and criminal penalties, a user fee to help pay for the program in the future, a \$1.5 million one-year appropriation, and an AIS program coordinator position within the WGFD. Prior to 2010, the AIS Program in Wyoming was very limited in scale, but has increased substantially with new legislation and funding.

Wyoming Game and Fish Department: Currently manages all wildlife in Wyoming. As a result of new legislation, the WGFC passed an emergency regulation (Chapter 62) in March 2010 and a permanent regulation in July 2010 to address the AIS threat. This regulation allows for the establishment of AIS check stations, watercraft inspection and decontamination guidelines,

authority for impoundment and quarantine of watercraft if necessary, a requirement for mandatory reporting of AIS, and specific user fees and requirements. Other WGFC regulations pertaining to AIS include Chapter 10 which prohibits the possession and importation of New Zealand Mudsnail, rusty crayfish, zebra mussel, and requires notification of whirling disease status of fish proposed for import.

A one-time \$1.5 million appropriation was allocated by the Wyoming State Legislature as part of the Wyoming Aquatic Invasive Species Act to fund the initial year of an AIS prevention program in Wyoming for 2010. In addition, a user fee (boat decal) was mandated to generate a continuous funding mechanism for the program in the future. Projections for funds generated from this fee are close to \$400,000 annually. Fees from the decal implemented in 2010 will cover program costs for 2011. In general, the 2010 appropriation has gone to fund outreach (\$325,000) including signage at waters, brochures, self-certification forms, decal printing and media; personnel (\$600,000) including salary, travel and associated costs for one program coordinator, one contract program assistant, and 29 seasonal watercraft inspectors; equipment (\$550,000) including purchase and lease of vehicles, purchase of 11 mobile and seven stationary watercraft decontamination units; and monitoring (\$25,000) gear for larval and adult mussel sampling.

During 2010, the WGFD has been the lead agency in the implementation of the Wyoming AIS Program. The program includes outreach, watercraft inspections, and monitoring. Extensive outreach was conducted to increase public awareness of AIS threats and prevention activities. Outreach activities included distribution of brochures, self-certification forms, key chains, bumper stickers; public presentations; boater contacts and interviews; highway billboard and traveler information signs; and radio and newspaper advertising.

In the 2010 boating season, 30 seasonal personnel were trained to conduct watercraft inspections at priority waters throughout the state. These inspectors, along with permanent WGFD personnel and volunteers, conducted over 30,000 watercraft inspections at 24 different waters.

Monitoring of waters for AIS in Wyoming has been limited until 2010 and consisted of monitoring mainly within the Greater Yellowstone Area by various groups. With new legislation and funding, monitoring has increased to include larval and adult mussel sampling on 53 waters in Wyoming through plankton tows and artificial substrates. The WGFD has worked in cooperation with the Bureau of Reclamation (BOR) and Montana Fish, Wildlife and Parks (MTFWP) to conduct and analyze samples. Larval analysis was conducted by BOR and MTFWP laboratories and no cost to the WGFD for 2010.

The intent of the program in the future is to maintain similar levels of outreach, to expand watercraft inspections with permanent personnel and additional seasonal inspectors, and to expand monitoring to sample additional priority AIS.

Wyoming Department of State Parks and Cultural Resources: Currently manages state parks, trails, and historic sites in Wyoming. Eight major waters in Wyoming reside within State Parks. Under Enrolled Act 62, the WGFC and WSP will work cooperatively to promulgate rules and regulations and to administer and enforce the provisions of the Act. The WSP provides logistical support to establish watercraft inspection stations and law enforcement support when needed during inspections. Personnel from WSP are trained as authorized AIS inspectors in Wyoming

for assistance at watercraft inspection stations. The WSP also conducts outreach and education on AIS issues in Wyoming.

Wyoming Department of Transportation: Provides logistical support for establishment and operation of watercraft inspection stations. The WDOT provides AIS outreach using highway information signs on major interstates in Wyoming and additional signage at watercraft inspection stations.

Wyoming Department of Agriculture: Currently manages all terrestrial and some aquatic plants in Wyoming. The Wyoming Weed and Pest Control Act of 1973 established Weed and Pest Districts and the establishment of a program for the control and designation of weeds and pests. The Wyoming State Weed Team developed the Wyoming Weed Management Strategic Plan (2003) to “assist and encourage the people of Wyoming to maintain healthy ecosystems with desirable, sustainable vegetation consistent with the land management goals of affected agencies, organizations, and individuals”.

The WDA manages the State Noxious Weed list that currently includes purple loosestrife and saltcedar. As required by state statute, county weed and pest districts are required to develop and implement effective control plans for state noxious weeds. The WDA conducts extensive outreach in Wyoming on weeds, including purple loosestrife and salt cedar.

Wyoming Department of Environmental Quality: Mandated to protect, conserve and enhance the quality of Wyoming’s environment. The Water Quality Division regulates wastewater discharge and has provided guidance on location of watercraft decontamination activities to ensure effluent meets all state requirements. The WDEQ will continue to be instrumental in aspects of the plan related to potential control of AIS.

Other: Private entities play a vital role in a successful Wyoming AIS program. Private entities support the program through funding for establishment of inspection stations, purchase of decontamination equipment, and outreach.

Federal Authorities and Programs

Federal laws applicable to the introduction of invasive species include the Lacey Act, the Noxious Weed Act, the Clean Water Act, the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990, the National Invasive Species Act of 1996, and Executive Order 13112.

Lacey Act: Prohibits the importation of designated mammals, birds, amphibians, reptiles, fish, crustaceans, and mollusks that are injurious to human, agriculture, horticulture, forestry, and wildlife interests. Prohibits the interstate transport of designated species and allows for federal prosecution of such transport. The USFWS is the lead agency for enforcement of the Lacey Act.

Noxious Weed Act: Requires the development and establishment of a management program by federal land management agencies to control noxious, harmful, injurious or poisonous plants on federal lands.

Clean Water Act: Regulates discharge of pollutants including AIS and ballast water and fill materials to waters of the United States.

Nonindigenous Aquatic Nuisance Prevention and Control Act: Established a federal program to prevent the introduction and control the spread of introduced aquatic nuisance species. Provides a framework to promote and coordinate research, develop and apply prevention and control strategies, establish national priorities, educate and inform the public, and coordinate public programs. The act also calls on states to develop and implement comprehensive state aquatic nuisance species (ANS) management plans and established the ANSTF.

National Invasive Species Act: This act amended the NANPCA to mandate ballast water exchange for vessels entering the Great Lakes and voluntary ballast water exchange for vessels on other U.S. waters. This amendment also modified research priorities of the ANSTF and requirements for the mussel demonstration program.

Executive Order 13112: The goals of the order are to improve coordination of federal agency efforts to further prevent, control, and minimize impacts of invasive species. The order also established the National Invasive Species Council to address issues concerning all invasive species.

Federal agencies currently operating or cooperating on AIS efforts in Wyoming include the United States Forest Service (USFS), USFWS, National Park Service (NPS), BOR, and the Bureau of Land Management (BLM). The Wyoming AIS Plan also includes ongoing coordination with the Eastern Shoshone and Northern Arapaho tribes in Wyoming.

United States Forest Service: The USFS manages five national forests and one national grassland in Wyoming, encompassing over six million acres of public land and numerous lakes and reservoirs. The USFS also manages Flaming Gorge National Recreation Area, home to one of the largest and most used reservoirs in Wyoming. The USFS Rocky Mountain Region has developed a comprehensive invasive species management strategy to address the AIS threat on forest lands in Wyoming and provides AIS outreach and information to forest users. The USFS Intermountain Region has provided funding to the WGFD for the purchase of a decontamination unit and one seasonal technician to conduct watercraft inspections on Flaming Gorge Reservoir in 2010 - 2012. Regional forests in Wyoming also conduct AIS outreach and survey work. The USFS will be a major partner in implementing the Wyoming AIS Management Plan and assisting with the survey, prevention, and control of AIS in Wyoming.

United States Fish and Wildlife Service: The USFWS co-chairs the ANSTF and has multiple programs that address AIS management. The agency also provides technical assistance to Wyoming regarding AIS management, the development of this plan, and is the agency responsible for administering federal funds for approved state management plans. The USFWS administers the Lacey Act and supports programs including the 100th Meridian Initiative and national ANS hotline.

National Park Service: The NPS manages over 2.5 million acres in Wyoming, including two national parks and one national recreation area. Yellowstone National Park (YNP) does not fall under state statute or management and therefore AIS activities in this plan only apply to Grand Teton National Park and Bighorn Canyon National Recreation Area. However, YNP does have an extensive AIS program including outreach, education, control, and watercraft inspections. The NPS provides logistical and personnel support at NPS waters in Wyoming for outreach and watercraft inspections.

Bureau of Reclamation: The BOR is involved in ongoing research on AIS prevention and control. The BOR manages recreation activities on over 15 waters in Wyoming, many of which are high priority waters for AIS prevention. In 2009 and 2010, the BOR conducted sampling for invasive mussels on seven waters in Wyoming. In 2010, the BOR laboratory in Denver will also analyze larval samples from an additional 31 waters in Wyoming for the WGFD.

Bureau of Land Management: The BLM manages over 18 million acres of public land in Wyoming, including lands surrounding many of Wyoming's lakes and reservoirs. The BLM provides assistance with AIS outreach in Wyoming and the BLM and WGFD are working together to incorporate AIS prevention into oil and gas permits in Wyoming.

Eastern Shoshone and Northern Arapaho tribes: The tribes have supported the Wyoming AIS program and AIS information signs are present at tribal waters on the Wind River Reservation. They are considering enacting rules pertaining to AIS prevention on Reservation lands, as state statute and regulations do not apply to these lands.

Current known gaps in AIS authorities and programs include:

- Wyoming needs an organized and centralized approach to AIS management to prevent duplication of effort and eliminate gaps in coverage of AIS issues. State AIS management efforts need to be coordinated with regional and national efforts. Outreach and monitoring efforts in Wyoming are conducted by various agencies and groups, and there is a need to better coordinate these activities to decrease duplication and ensure a consistent message to the public.
- Lack of long-term funding to implement state program and plan. The 2010 Wyoming Aquatic Invasive Species Act gave the WGFD and cooperating agencies the necessary authority to implement a comprehensive AIS prevention program. However, the appropriation included in the Act was short-term funding, and the program still lacks long-term, consistent funding. The Act also mandated a user fee (decal) for all boaters using Wyoming waters, in an attempt to provide long-term funding for the program. However, projections indicate funds generated from this fee will be inadequate to run a successful AIS program into the future. Increased, long-term state and federal funds are needed to continue AIS prevention in Wyoming.
- Lack of permanent personnel to implement state program and plan. The WGFD currently has one full-time position, AIS Coordinator, working on implementing the AIS program. No other agencies in the state have full-time personnel dedicated to AIS activities. There is a need for additional permanent personnel to more effectively implement the program, particularly watercraft inspection and monitoring activities.

OBJECTIVES, STRATEGIES, AND ACTIONS

OBJECTIVE 1: To coordinate and implement a comprehensive AIS management program.

Strategic Action 1A1: The WGFD and partners will implement the Wyoming AIS Management Plan. Cost estimates for implementing the following tasks are for travel expenses and personnel salary for plan development by the Wyoming AIS Coordinator.

Task 1A1a: The WGFD will submit the draft Wyoming AIS Management Plan to AIS stakeholders, including affected federal, state, tribal, local, and private entities, to review and provide input. Key stakeholders for review of the plan include the WDA, WDOT, and WSP.

Task 1A1b: The WGFD will present the Wyoming AIS Management Plan to the WGFC for review and final approval.

Task 1A1c: The WGFC will submit the Wyoming AIS Management Plan to the Governor of Wyoming for final approval.

Task 1A1d: The Governor will submit the final Wyoming AIS Management Plan to the federal Aquatic Nuisance Species Task Force for approval.

Strategic Action 1A2: The WGFD will coordinate all AIS management activities within Wyoming and collaborate with regional and national programs. Cost estimates for implementing the following tasks are for travel to conferences and meetings by the AIS Coordinator and logistical support for AIS forums.

Task 1A2a: The WGFD will work with WDA, WDOT, WSP, and others to identify and coordinate with key personnel in local, state, federal, tribal governments, and private entities on AIS responsibilities. The WGFD will develop implementation plans for waters to determine key stakeholders and coordinate watercraft inspection and monitoring efforts.

Task 1A2b: The WGFD will establish working partnerships with regional states to facilitate data sharing and coordination of management activities. The WGFD will coordinate management activities with regards to watercraft inspections and monitoring with Colorado Division of Wildlife, Idaho Department of Agriculture (IDA), Montana Fish, Wildlife & Parks (MTFWP), South Dakota Division of Wildlife, and the Utah Division of Wildlife Resources (UDWR).

Task 1A2c: The WGFD will ensure the AIS strategy is coherent and consistent throughout Wyoming. The WGFD will solicit annual input from partners (WDS, WDOT, WSP, etc.) on the AIS Plan and Program.

Task 1A2d: The WGFD and WSP will conduct periodic forums focused on AIS in Wyoming and potential management alternatives. These agencies will continue to host an annual AIS Summit to provide updates and receive input from the public and partners.

Task 1A2e: The WGFD will work with the WDA to develop a list of all established AIS in Wyoming. The WGFD will work with state and federal partners to ensure the continued accuracy of the established AIS list.

Task 1A2f: The WGFD will work with the WDA to develop management strategies for established AIS listed by priority class and to ensure feasibility of management strategies.

Task 1A2g: The WGFD will work with the WDA to develop a set of uniform definitions and terms relating to AIS.

Task 1A2h: The WGFD will participate in regional and national forums to ensure AIS efforts in Wyoming remain current and coordinated with regional and national programs.

Task 1A2i: The WGFD will provide support for and/or participation in the ANS Task Force's Western Regional and Mississippi River Basin Panels and the 100th Meridian Project. The WGFD will provide annual updates on the state program for panel meetings and will work to increase attendance by Wyoming representative at meetings. The WGFD will provide annual boater movement information for inclusion in the 100th Meridian database.

Strategic Action 1A3: The WGFD will work to develop a permanent funding mechanism for AIS management in Wyoming. Cost estimate for this action is minimal and includes personnel salary and travel.

Task 1A3a: The WGFD will work with the USFWS to seek federal funding from the ANS Task Force through completion and approval of state management plan. The WGFD will support initiatives, such as the Quagga-Zebra Mussel Action Plan, which seek to increase funding for state AIS programs.

Task 1A3b: The WGFD and WSP will continue to work with the Wyoming legislature to establish a permanent funding mechanism for the AIS Program. The WGFD will continue implementing the boater decal to partially fund program activities.

Task 1A3c: The WGFD will develop partnerships with stakeholder groups to help fund prevention and eradication efforts. The WGFD will seek funding for AIS monitoring from municipalities, power companies, and other stakeholders.

Strategic Action 1A4: The WGFD will review and evaluate state efforts in addressing AIS. Cost estimate for this task includes personnel salary.

Task 1A4b: The WGFD will update the Wyoming AIS Management Plan as needed, and will provide annual progress reports and program reports at 5-year intervals.

OBJECTIVE 2: To prevent the introduction of new AIS into Wyoming waters.

Strategic Action 2A1: The WGFD and partners will identify AIS with the greatest potential to infest Wyoming waters and identify existing and potential pathways of spread. Cost estimates for this action include salary for seasonal watercraft inspectors, equipment, gear, and other supplies.

Task 2A1a: The WGFD and WDA will develop a regional list of AIS and evaluate the potential threat posed to Wyoming waters by each.

Task 2A1b: The WGFD and WSP will utilize existing guidelines (Blogoslawski et al. 1996; Kriesch et al. 2007) to define invasion pathways and identify high-risk waters for all AIS of concern. The risk-assessment for mussel colonization potential in Wyoming waters will be reviewed annually based on new boater use, movement, and water quality information.

Task 2A1c: The WGFD will work with WSP, NPS, USFS, and other water managers to implement and expand a program to inspect and/or decontaminate trailered watercraft and water-based equipment prior to contacting waters or upon entering Wyoming. These agencies will work to expand the capabilities of the current watercraft inspection program to increase number of waters covered and days of inspections at waters.

Task 2A1d: The WGFD will work with WSP, NPS, USFS, and other water managers to implement a self-certification program to ensure proper decontamination of watercraft prior to launch at waters without inspection stations. The WGFD will consider revising the existing self-check program to make it mandatory prior to launch.

Task 2A1e: The WGFD will work with other state agencies (WDA, WSP, WDOT, WDEQ) to expand the use of Hazard Analysis Critical Control Point (HACCP) practices to assess risk of AIS introductions during routine activities. These agencies will consider utilizing existing HACCP protocols developed for controlling the spread of New Zealand mudsnails (Hosea and Finlayson 2005), and for preventing the spread of AIS through baitfish and aquaculture operations (Gunderson and Kinnunen, year unknown), and native mussel sampling (Cope et al. 2002).

Strategic Action 2A2: The WGFD and partners will enforce AIS legislation and regulations that allow the state to control the introduction and/or spread of AIS. Cost estimates for this action include travel and supplies for training.

Task 2A2a: The WGFD will train enforcement personnel (from WSP, NPS, and others) on AIS identification and regulations to increase enforcement of AIS laws.

Task 2A2b: The WGFD will work with IDA, MTFWP, and UDWR to develop cooperative agreements on interstate waters.

Strategic Action 2A3: The WGFD and partners will work to prohibit, control, or permit the importation of nonindigenous aquatic species based on their invasion potential. Cost estimate for this action includes personnel salary.

Task 2A3a: The WGFD will work with the WDA to research invasiveness of aquatic plant and animal species currently imported and those with potential for importation into Wyoming.

Task 2A3b: The WGFD and WDA will utilize invasiveness information to prohibit species with highest invasion potential and highest risk of ecological and economic harm.

OBJECTIVE 3: To detect, monitor, and eradicate AIS in Wyoming.

Strategic Action 3A1: The WGFD and partners will implement a surveillance and early detection program. Cost estimates for this action include personnel salary, equipment, and lab analysis.

Task 3A1a: The WGFD will implement the state monitoring plan to monitor major waters for invasive mussels. The WGFD will work with partners to expand monitoring of AIS in Wyoming to include lower priority waters and all priority AIS.

Task 3A1b: The WGFD will use existing personnel to conduct annual surveys on Wyoming waters to document the presence and distribution of invasive mussels where feasible. The WGFD will work to secure additional permanent personnel to assist with AIS monitoring activities in Wyoming.

Task 3A1c: The WGFD and WDA will update and distribute a complete listing of known AIS in Wyoming based on survey data to the public and partners. The status of waters monitored for the presence of invasive mussels will be updated annually upon completion of lab analysis.

Task 3A1d: The WGFD will train and encourage citizen-monitoring groups to work with cooperating agencies such as WDA, WSP, NPS to increase effectiveness and scale of AIS monitoring.

Task 3A1e: The WGFD will maintain a list of AIS microscopy and polymerase chain reaction (PCR) labs acceptable for veliger analysis. The WGFD will develop cooperative agreements with laboratories to process veliger samples.

Strategic Action 3A2: The WGFD and partners will develop a rapid response mechanism for detected and potential AIS and will consider adoption of the National Incident Management System approach to rapid response planning (Smits and Moser 2009). The cost estimate for this action includes personnel salary for development of plans.

Task 3A2a: The WGFD will develop a rapid response plan for Wyoming waters to guide future containment and/or eradication activities for priority AIS that pose an immediate threat. Rapid response plans will be reviewed and updated as needed as new AIS threats may emerge.

Task 3A2b: The WGFD will coordinate with WSP, WDA, and other key stakeholders on the development and implementation of rapid response plans.

Task 3A2c: The WGFD, together with WSP and WDA, will identify alternative funding sources for implementing rapid response plans and will consider building an emergency rapid response fund.

Strategic Action 3A3: The WGFD and partners will work to eradicate pioneering populations of AIS in Wyoming. The cost estimate for this action is unknown as the cost of AIS eradication is highly variable depending on the species and the affected water.

Task 3A3a: The WGFD will work with the WDA and WDEQ to develop and explore implementing an eradication and management program for pioneering AIS in Wyoming and will assess the environmental and ecological feasibility of eradication efforts.

Task 3A3b: The WGFD, WDA, and WDEQ will develop cooperative eradication policies with Idaho, Montana, and Utah on interstate waters.

OBJECTIVE 4: To control, contain, or eradicate established AIS that have significant impacts on Wyoming waters.

Strategic Action 4A1: The WGFD and partners will work to limit the dispersal of established AIS to new waters or to new areas of a water. The cost estimate for these tasks includes decontamination equipment and personnel, and signage.

Task 4A1a: The WGFD will create a list of waters infested with AIS in Wyoming and will update the list annually.

Task 4A1b: The WGFD will develop and implement containment strategies in cooperation with state (WDA, WSP), federal (NPS USFS), and local entities.

Task 4A1c: The WGFD will work with partner agencies to implement mandatory decontamination procedures for gear/equipment used in management activities by partner agencies. The WGFD will expand the internal decontamination protocols developed for use by other entities.

Task 4A1d: The WGFD and WSP will implement mandatory decontamination procedures for conveyances used in infested waters to limit the dispersal of AIS to uninfested waters.

Task 4A1e: The WGFD and WSP will disseminate information about infested waters in Wyoming including signs at all infested waters. These agencies will consider inclusion of messages established by national campaigns (Stop Aquatic Hitchhikers) to maintain consistency and increase boater recognition of message.

Task 4A1f: The WGFD and WSP will develop guidelines for restrictions and/or closures of infested waters of the state (any waters within the jurisdiction of Wyoming) with cooperation from stakeholders. Restrictions may include closure of launching after dark, closure of boat ramps to consolidate use and allow for decontamination of all watercraft leaving water, prohibition of launching from any site other than designated boat ramps, and/or seasonal closure of water. Additional stakeholders may include NPS, USFS, and other water managers in Wyoming.

Strategic Action 4A2: Partner agencies will work to control and/or eradicate known AIS populations where economically, ecologically, and technically feasible. Cost estimates (amount unknown) for this action include personnel and any associated costs for control techniques.

Task 4A2a: The WDA through county Weed and Pest districts will continue current regional control programs for purple loosestrife and salt cedar, including eradication where feasible.

Task 4A2b: The WDA and WGFD will investigate inclusion of aquatic invasive plants in Wyoming Weed Management Strategic Plan to allow for better coordination among agencies on management of invasive plants.

Task 4A2c: The WGFD will investigate management strategies to minimize impacts of established non-plant AIS (whirling disease, New Zealand mudsnail, Asian clam) including eradication where feasible. The WGFD will coordinate with private and public landowners on these management activities.

OBJECTIVE 5: To educate resource user groups about the risks and impacts of AIS and how to reduce their harmful impacts.

Strategic Action 5A1: Partners will develop and distribute AIS outreach materials to increase agency and public awareness. Cost estimates for this action include personnel time for outreach development, materials and supplies, signs, media contracts, etc.

Task 5A1a: The WGFD and partner groups will increase involvement in established, national public education campaigns including Stop Aquatic Hitchhikers, 100th Meridian Initiative, and Habitattitude. Partners will incorporate national messaging into Wyoming outreach materials.

Task 5A1b: The WGFD will implement a public survey on AIS awareness to evaluate the effectiveness of current outreach messages.

Task 5A1c: The WGFD and WSP will continue to develop and distribute AIS outreach materials to educate agency personnel and the public on what AIS are, the problems they cause, and means to prevent spread including: fact sheets, identification cards, bumper stickers, key chains, brochures, posters, etc.

Task 5A1d: The WGFD will further expand signage to include access points on all flowing waters with messages specific to AIS prevention tips for non-motorized watercraft and anglers.

Task 5A1e: The WGFD and WDOT will develop signs on highways entering Wyoming to inform travelers of AIS laws and regulations.

Task 5A1f: The WGFD and WDOT will continue use of the Traveler Information System to disseminate information on locations of watercraft inspections.

Task 5A1g: The WGFD will continue inclusion of AIS information in hunting, fishing, and watercraft regulations to reach a wider audience of public recreating in Wyoming.

Task 5A1h: The WGFD and WSP will expand press releases, public service announcements, radio interviews, and newspaper advertisements about AIS to increase public awareness.

Task 5A1i: The WGFD will maintain and update AIS information (status of water sampling, current laws and regulations, decal and watercraft inspection information, and

frequently asked questions) in a prominent location on the WGFD website. The website will include an online sighting reporting feature. The WGFD will work with partners to consider adding or enhancing AIS information to websites of partner agencies (WSP, NPS).

Task 5A1j: The WGFD will continue use of AIS hotline (877-WGFD-AIS) to allow public to easily access AIS information on watercraft inspections, decals, and frequently asked questions.

Task 5A1k: The WGFD and WSP will work to create an educational curriculum that meets state standards on AIS for schools to allow for easier inclusion of AIS information into the classroom.

Task 5A1l: The WGFD will enhance distribution of AIS information at conferences, shows, tournaments and to marinas, boat dealers/mechanics, aquaculture industry, sports clubs, etc.

Task 5A1m: The WGFD and WSP will further develop working relationships with sporting groups and conservation organizations to foster outreach and education activities related to AIS.

Strategic Action 5A2: The WGFD and partners will train individuals on AIS identification and watercraft inspection and decontamination. Cost estimates for this action include personnel time for training and materials and supplies.

Task 5A2a: The WGFD will coordinate with Pacific States Marine Fisheries Commission to certify State personnel as authorized AIS watercraft inspection and decontamination trainers. Several WGFD personnel will become certified Level II trainers.

Task 5A2b: The WGFD and WSP will develop an AIS training program specific for Wyoming and conduct training sessions at least annually to certify individuals as authorized inspectors.

OBJECTIVE 6: To support research on AIS in Wyoming and develop efficient systems to disseminate information to research and management communities.

Strategic Action 6A1: The WGFD will support research on all aspects of AIS. Cost estimates for this action include contracts through universities to conduct research. No funds are currently available for research but an increase in future funds would allow for this action to be accomplished.

Task 6A1a: The WGFD will investigate alternative funding to conduct future AIS research as funding is currently not available.

Task 6A1b: The WGFD will support a University project to identify life histories and environmental conditions needed for successful colonization of priority AIS not currently in Wyoming. The project will expand on the existing mussel colonization risk-assessment developed by the WGFD.

Task 6A1c: The WGFD will support a University project to research the possible influence of climate change on AIS invasion pathways and colonization success.

Task 6A1d: The WGFD will support a University project to determine effects of the New Zealand Mudsail and whirling disease introductions on fish and invertebrate populations in Wyoming.

Task 6A1e: The WGFD will support a University project to investigate and develop new and innovative methods for preventing and controlling AIS.

Task 6A1f: The WGFD will support a University project to investigate the relationship between potential contributing factors (i.e., human disturbance) and AIS invasion, establishment, and impacts.

Strategic Action 6A2: The WGFD will work to facilitate the collection and dispersal of information, research, and data on AIS in Wyoming. Cost estimates for this action include personnel for database development and sampling and equipment.

Task 6A2a: The WGFD will create and coordinate a central database on AIS information to easily exchange species absence/presence information between agencies, partners, and the public.

Task 6A2b: The WGFD and partners will utilize existing field personnel and citizen monitoring groups to further document the distribution and abundance of AIS.

PRIORITIES FOR ACTION

The purpose of the Wyoming Aquatic Invasive Species Management Plan is to develop a coherent, cohesive response to the threat posed by AIS and to coordinate efforts between federal, state, tribal, local, and private entities. In addition, a priority of the plan is to identify and provide funding for additional AIS management actions, especially those relating to priority species. Species in the plan are categorized into four priority classes: Priority Class 1 species are those not known to be present in Wyoming, but that have a high potential to invade. Priority Class 2 species are present in Wyoming and have the potential to spread. Priority Class 3 species are those not known to be present in Wyoming, have a high potential to invade, but some management techniques are available for these species. Priority Class 4 species are present in Wyoming and have the potential to spread, but some management techniques are available for these species.

This plan focuses on the Priority Class 1 and 2 species listed below, but the major focus will be to develop and implement new programs designed to prevent or control the introduction of the zebra and quagga mussel. Invasive mussels are perceived by the WGFD and others as the greatest threat to the economic and ecological stability of Wyoming. Legislative funds were received to combat the AIS issue as a whole, but also to specifically address the threat posed by zebra and quagga mussels. In addition to the negative ecological impacts on sport fisheries and native species, invasive mussels would cost Wyoming several million dollars annually in containment and control, thus they are they priority for this plan. In addition, by addressing the pathways of introduction for invasive mussels, the introduction of other lower priority, or perhaps unidentified AIS, may also be prevented since many share common pathways of introduction. Currently, the most significant pathway for new AIS into Wyoming is through transport on trailered watercraft hence another major focus of the program is watercraft inspections.

However, other AIS are spread through angling, bait, aquarium releases, etc. It is the intent of the AIS program to conduct outreach and prevention efforts specific to these pathways and the AIS associated with them as well. Wyoming currently has ongoing projects to control some AIS plants, yet prevention and control projects for invasive animal species are lacking. In the future, if resources are available, focus will then be on the Priority Class 3 and 4 species for which management projects do not exist.

Lastly, focus on Priority Class 1 and 2 species in this initial iteration of the plan will aid in coordination and cooperation with ongoing regional and national efforts such as the Quagga-Zebra Mussel Action Plan for Western U.S. Waters, the National Management and Control Plan for the New Zealand Mudsnaill, and Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States.

TABLE 1. Species considered Priority Class 1 through 4 in this plan.

Priority Class 1	Priority Class 2	Priority Class 3	Priority Class 4
Zebra mussel	New Zealand mudsnail	Eurasian watermilfoil	Nonnative invasive fish
Quagga mussel	Whirling disease		
Rusty crayfish	Asian clam		
Asian carp			
Viral hemorrhagic septicemia			
Hydrilla			

IMPLEMENTATION TABLE

Action #	Action/Task	Fund Source	Lead Agency	Cooperating Agency	Recent (\$000/FTEs)		Planned (\$000/FTEs)		
					FY09	FY10	FY11*	FY12*	FY13*
Objective 1: Coordinate and implement a comprehensive management program									
1A1	Implement a Wyoming AIS management plan								
1A1a	Send plan to stakeholders for review	WGFD	WGFD	WDA, WDOT, WSP	0/0	0/0	0/0	0/0	0/0
1A1b	Receive plan approval by WGFC	WGFD	WGFD	WGFC	0/0	0/0	0/0	0/0	0/0
1A1c	Receive plan approval by Governor	WGFD	WGFD	Governor's Office	0/0	0/0	0/0	0/0	0/0
1A1d	Receive plan approval by ANSTF	WGFD	WGFD	USFWS	0/0	0/0	2/0.1	0/0	0/0
1A2	Coordinate AIS management activities within Wyoming and collaborate with regional and national programs								
1A2a	Identify key personnel with AIS responsibilities	WGFD	WGFD	WDA, WDOT, WSP	0/0	0/0	0/0.05	0/0.05	0/0.05
1A2b	Establish partnerships with regional states	WGFD	WGFD	CDOW,IDA,MTFWP, SDW,UDWR	0/0	0/0	0/0.1	0/0.2	0/0.2
1A2c	Ensure coherent and consistent strategy	WGFD	WGFD	WDA, WDOT, WSP	0/0	0/0.05	0/0.05	0/0.05	0/0.05
1A2d	Conduct annual AIS forum in Wyoming	WGFD	WGFD	WDA, WSP	0/0	1/0.05	1/0.05	1/0.05	1/0.05
1A2e	Develop AIS list and definitions	WGFD	WGFD	WDA	0/0	0/0	0/0.05	0/0.05	0/0.05
1A2f	Develop management strategies for priority AIS	WGFD	WGFD	WDA	0/0	0/0	0/0.1	0/0.1	0/0.1
1A2g	Develop uniform definitions and terms	WGFD	WGFD	WDA	0/0	0/0	0/0.05	0/0.05	0/0.05
1A2h	Participate in regional and national forums	WGFD	WGFD	USFWS	0/0	1/0.05	2/0.05	4/0.1	4/0.1
1A2i	Participate in ANSTF panels	WGFD	WGFD	USFWS, WRP, MRBP	0/0	2/0.05	2/0.05	4/0.1	4/0.1
1A3	Develop a permanent funding mechanism for AIS management in Wyoming								
1A3a	Seek ANSTF funding	WGFD	WGFD	USFWS	0/0	0/0.05	1/0.05	0/0.05	0/0.05
1A3b	Establish permanent funding with WY legislature	WGFD	WGFD	WDA, WSP	0/0	0/0	0/0.1	0/0.1	0/0.1
1A3c	Develop partnerships for private funding	WGFD	WGFD		0/0	0/0	0/0.1	0/0.1	0/0.1
1A4	Review and evaluate state efforts in addressing AIS								
1A4a	Update WY AIS Plan and provide progress reports	WGFD	WGFD	WSP	0/0	0/0	1/0.05	1/0.05	1/0.05

*Funding and FTE for FY11 – FY13 are projections of anticipated need and do not reflect secured funding.

Table legend: CDOW (Colorado Division of Wildlife), IDA (Idaho Department of Agriculture, MRBP (Missouri River Basin Panel), MTFWP (Montana Fish, Wildlife and Parks), SDW (South Dakota Division of Wildlife), UDWR (Utah Division of Wildlife), WDA (Wyoming Department of Agriculture), WDOT (Wyoming Department of Transportation), WGFC (Wyoming Game and Fish Commission), WGFD (Wyoming Game and Fish Department), WRP (Western Regional Panel), WSP (Wyoming State Parks), USFWS (United States Fish and Wildlife Service).

IMPLEMENTATION TABLE

Action #	Action/Task	Fund Source	Lead Agency	Cooperating Agency	Recent (\$000/FTEs)		Planned (\$000/FTEs)		
					FY09	FY10	FY11*	FY12*	FY13*
Objective 2: Prevent the introduction of new AIS into Wyoming waters									
2A1	Identify AIS with the greatest potential to infest Wyoming waters and identify existing and potential pathways of spread								
2A1a	Generate regional AIS list	WGFD	WGFD	WDA	0/0	0/0	0/0.05	0/0.05	0/0.05
2A1b	Define invasion pathways and high-risk waters	WGFD	WGFD	WSP	0/0	0/0	1/0.05	1/0.1	1/0.1
2A1c	Implement watercraft inspection program	WGFD	WGFD	WSP, NPS, USFS	0/0	650/0.1	485/0.2	650/2	650/2
2A1d	Implement self-certification program	WGFD	WGFD	WSP, NPS, USFS	0/0	2/0.05	15/0.05	25/1	25/1
2A1e	Expand use of HAACP practices related to AIS	WGFD	WGFD	WDA, WSP, WDOT, WDEQ	0/0	0/0	0/0.05	5/0.05	5/0.05
2A2	Enforce AIS legislation and regulations that allow the state to control the introduction and/or spread of AIS								
2A2a	Train enforcement personnel on AIS laws	WGFD	WGFD	WDA, WSP, WDOT	0/0	0/0.05	1/0.05	1/0.05	1/0.05
2A2b	Develop cooperative agreements with other states	WGFD	WGFD	WDA, WSP, WDOT	0/0	0/0	0/0.05	0/0.05	0/0.05
2A3	Prohibit, control, or permit the importation of nonindigenous aquatic species based on their invasion potential								
2A3a	Research invasiveness of imported species	WGFD	WGFD	WDA	0/0	0/0	0/0.05	0/0.1	0/0.1
2A3b	Prohibit species of highest risk	WGFD	WGFD	WDA	0/0	0/0	0/0.05	0/0.1	0/0.1

*Funding and FTE for FY11 – FY13 are projections of anticipated need and do not reflect secured funding.

Table legend: WDA (Wyoming Department of Agriculture), WDEQ (Wyoming Department of Environmental Quality), WDOT (Wyoming Department of Transportation), WGFD (Wyoming Game and Fish Department), WSP (Wyoming State Parks), USFS (United States Forest Service).

IMPLEMENTATION TABLE

Action #	Action/Task	Fund Source	Lead Agency	Cooperating Agency	Recent (\$000/FTEs)		Planned (\$000/FTEs)		
					FY09	FY10	FY11*	FY12*	FY13*
Objective 3: Detect, monitor, and eradicate AIS in Wyoming									
3A1	Implement a surveillance and early detection program								
3A1a	Implement AIS monitoring plan	WGFD	WGFD	WDA	0/0	0/0	0/0.05	0/0.1	0/0.1
3A1b	Conduct annual presence/distribution surveys	WGFD	WGFD	WDA	0/0	1/0.05	25/0.05	15/1	15/1
3A1c	Distribute and update known AIS list	WGFD	WGFD	WDA	0/0	0/0	0/0.05	0/0.05	0/0.05
3A1d	Train and encourage citizen- monitoring groups	WGFD	WGFD	WDA, WSP, NPS	0/0	0/0	1/0.05	1/0.05	1/0.05
3A1e	Develop agreements with labs for analysis	WGFD	WGFD	BOR, MTFWP	0/0	0/0	0/0.05	25/0.05	25/0.05
3A2	Develop a rapid response mechanism for detected and potential AIS								
3A2a	Develop rapid response plan for waters	WGFD	WGFD	WDA, WSP	0/0	0/0	5/0.1	5/0.2	5/0.2
3A2b	Identify key stakeholders and coordinate on plans	WGFD	WGFD	WDA, WSP	0/0	0/0	0/0.05	0/0.05	0/0.05
3A2c	Identify funding sources to implement plans	WGFD	WGFD	WDA, WSP	0/0	0/0	0/0.05	0/0.05	0/0.05
3A3	Eradicate pioneering populations of AIS in Wyoming								
3A3a	Develop and implement eradication programs	WGFD	WGFD	WDA, WDEQ	0/0	0/0	Unk/0.05	Unk/0.1	Unk/0.1
3A3b	Develop cooperative eradication policies	WGFD	WGFD	WDA, WDEQ, ID, MT, UT	0/0	0/0	0/0.05	0/0.1	0/0.1

*Funding and FTE for FY11 – FY13 are projections of anticipated need and do not reflect secured funding.

Table legend: BOR (Bureau of Reclamation), MTFWP (Montana Fish, Wildlife and Parks), NPS (National Park Service), WDA (Wyoming Department of Agriculture), WDEQ (Wyoming Department of Environmental Quality), WGFD (Wyoming Game and Fish Department), WSP (Wyoming State Parks).

IMPLEMENTATION TABLE

Action #	Action/Task	Fund Source	Lead Agency	Cooperating Agency	Recent (\$000/FTEs)		Planned (\$000/FTEs)		
					FY09	FY10	FY11*	FY12*	FY13*
Objective 4: Control and eradicate established AIS that have significant impacts on Wyoming waters									
4A1	Limit the dispersal of established AIS to new waters or to new areas of a water								
4A1a	Update infested waters list	WGFD	WGFD	WDA, WSP	0/0	0/0	0/0.05	0/0.05	0/0.05
4A1b	Develop and implement control strategies	WGFD	WGFD	WDA, WDEQ, NPS, USFS	0/0	0/0	0/0.1	0/0.1	0/0.1
4A1c	Implement mandatory decon. protocol for gear	WGFD	WGFD	WSP	0/0	0/0	50/0.1	75/0.1	75/0.1
4A1d	Implement mandatory decon. protocol for conveyances	WGFD	WGFD	WSP	0/0	0/0.05	150/1	200/1	200/1
4A1e	Disseminate information on infested waters	WGFD	WGFD	WDA, WSP	0/0	0/0	20/.1	30/.1	30/.1
4A1f	Develop guidelines for infested water closures	WGFD	WGFD	WDA, WSP, NPS, USFS	0/0	0/0	0/0.1	0/0.1	0/0.1
4A2	Control and/or eradicate known AIS populations where economically, ecologically, and technically feasible								
4A2a	Continue current noxious weed control programs	WDA	WDA	WGFD	0/0	0/0	Unk/1	Unk/1	Unk/1
4A2b	Investigate inclusion of AIS plants into Weed Plan	WDA	WDA	WGFD	0/0	0/0	0/0.05	0/0.05	0/0.05
4A2c	Investigate strategies to minimize impacts	WGFD	WGFD	WDA	0/0	0/0	0/0.05	0/0.05	0/0.05

*Funding and FTE for FY11 – FY13 are projections of anticipated need and do not reflect secured funding.

Table legend: NPS (National Park Service), WDA (Wyoming Department of Agriculture), WDEQ (Wyoming Department of Environmental Quality), WGFD (Wyoming Game and Fish Department), WSP (Wyoming State Parks), USFS (United States Forest Service).

IMPLEMENTATION TABLE

Action #	Action/Task	Fund Source	Lead Agency	Cooperating Agency	Recent (\$000/FTEs)		Planned (\$000/FTEs)		
					FY09	FY10	FY11*	FY12*	FY13*
Objective 5: Educate resource user groups about the risks and impacts of AIS and how to reduce the harmful impacts									
5A1	Develop and distribute AIS outreach materials to increase agency and public awareness								
5A1a	Increase involvement in national education campaigns	WGFD	WGFD	USFWS	0/0	0/0.05	5/0.1	5/0.1	5/0.1
5A1b	Conduct survey on public awareness	WGFD	WGFD	None	0/0	0/0	10/0.2	10/0.2	10/0.2
5A1c	Continue to develop and distribute outreach materials	WGFD	WGFD	WSP	3/0.1	274/0.2	100/0.2	150/0.5	150/0.5
5A1d	Expand signage to all flowing waters	WGFD	WGFD	BOR, BLM, USFS, NPS	0/0	2/0.1	40/0.05	40/0.1	40/0.1
5A1e	Develop and post highway signs	WGFD	WGFD	WDOT	0/0	40/0.05	0/0.05	20/0.1	20/0.1
5A1f	Continue use of Traveler Information System	WGFD	WGFD	WDOT	0/0	0/0.05	0/0.05	0/0.05	0/0.05
5A1g	Include info. in fishing, watercraft, and hunting regs.	WGFD	WGFD	None	0/0	0/0	0/0.05	0/0.05	0/0.05
5A1h	Continue press releases, PSAs, and newspaper ads	WGFD	WGFD	WSP	0/0	50/0.05	20/0.05	30/0.2	30/0.2
5A1i	Maintain and update AIS info on WGFD website	WGFD	WGFD	None	0/0	0/0	0/0.05	0/0.05	0/0.05
5A1j	Continue use of Wyoming AIS hotline	WGFD	WGFD	None	0/0	12/0.05	15/0.05	15/0.05	15/0.05
5A1k	Create AIS educational curriculum for schools	WGFD	WGFD	WSP	0/0	0/0	0/0.05	1/0.05	1/0.05
5A1l	Continue AIS info. at public events and arenas	WGFD	WGFD	WSP	1/0.2	0/0	0/0.05	2/0.05	2/0.05
5A1m	Further partnerships with sporting/conservation groups	WGFD	WGFD	WSP	0/0	0/0	0/0.05	0/0.05	0/0.05
5A2	Train individuals on AIS identification and watercraft inspection/decontamination								
5A2a	Coordinate with PSMFC to certify trainers	WGFD	WGFD	PSMFC	0/0	0/0	1/0.05	1/0.05	1/0.05
5A2b	Develop training program and certify inspectors	WGFD	WGFD	WSP	0/0	0/0	4/0.05	10/0.4	10/0.4

*Funding and FTE for FY11 – FY13 are projections of anticipated need and do not reflect secured funding.

Table legend: BLM (Bureau of Land Management), BOR (Bureau of Reclamation), NPS (National Park Service), PSMFC (Pacific States Marine Fisheries Commission), WDOT (Wyoming Department of Transportation), WGFD (Wyoming Game and Fish Department), WSP (Wyoming State Parks), USFS (United States Forest Service).

IMPLEMENTATION TABLE

Action #	Action/Task	Fund Source	Lead Agency	Cooperating Agency	Recent (\$000/FTEs)		Planned (\$000/FTEs)		
					FY09	FY10	FY11*	FY12*	FY13*
Objective 6: Support research on AIS in Wyoming and develop efficient systems to disseminate info. to research and management communities									
6A1	Support research on all aspects of AIS								
6A1a	Investigate alternative funding to conduct research	WGFD	WGFD	University	0/0	0/0	0/0.05	0/0.05	0/0.05
6A1b	Identify life history and colonization info. for AIS	WGFD	WGFD	University	0/0	0/0	0/0	50/1	50/1
6A1c	Determine influence of climate change on AIS								
6A1d	Determine effects of NZMS and WD in Wyoming	WGFD	WGFD	University	0/0	0/0	0/0	50/1	50/1
6A1e	Develop new prevention and control methods	WGFD	WGFD	University	0/0	0/0	0/0	50/1	50/1
6A1f	Investigate contributing factors and AIS	WGFD	WGFD	University	0/0	0/0	0/0	50/1	50/1
6A2	Facilitate the collection and dispersal of information, research, and data on AIS in Wyoming								
6A2a	Create and coordinate central database	WGFD	WGFD	WSP, WDA	0/0	0/0	0/0	1/0.05	1/0.05
6A2b	Use existing personnel to document AIS in WY	WGFD	WGFD	WSP, WDA	0/0	0/0	10/0.5	15/1	15/1

*Funding and FTE for FY11 – FY13 are projections of anticipated need and do not reflect secured funding.

Table legend: WDA (Wyoming Department of Agriculture), WGFD (Wyoming Game and Fish Department), WSP (Wyoming State Parks).

PROGRAM MONITORING AND EVALUATION

The evaluation process of Wyoming's AIS Management Plan will enable us to monitor our progress towards the goal to prevent, control, contain, monitor, and whenever possible, eradicate aquatic invasive species from the waters of the state. By evaluating the plan, we will be able to ensure appropriate implementation of our management actions and make any needed adjustments. The evaluation process will include 1) oversight, 2) evaluation, and 3) dissemination of information.

Oversight

An oversight committee will consist of interested parties, state entities, the Governor's Office, and members of the authorizing ANSTF. The committee's role will be to examine progress on management actions focused on the goal of the management plan. The committee will evaluate the success on each objective, strategic action, and task annually.

Evaluation

The evaluation efforts should identify progress of the plan as well as additional funding needs required to successfully accomplish the objectives of the plan. Evaluation should include information from groups affected by the plan's implementation. Metrics used to measure the effectiveness of management actions outlined in the plan may include: change in public awareness through surveys, compliance by boaters at watercraft inspection stations, reduction in watercraft requiring decontamination, number of waters monitored for presence/absence of AIS, change in abundance and/or distribution of AIS currently in Wyoming, change in number of AIS found in Wyoming, amount of ongoing research on AIS, and success of any eradication efforts.

The effectiveness of management actions, and the success of accomplishing plan objectives, may be impacted by unforeseen factors currently affecting Wyoming waters including drought and habitat degradation. Program evaluation will assist in determining whether additional stressors are impacting AIS management in Wyoming and in foreseeing any needed change in activities or objectives.

Dissemination

An annual report will be produced highlighting the progress made on the management actions in this plan. The report will include actions completed that year towards achieving the plan's goal as well as future plans for implementation. The annual report will be available to the public and local, state, and federal entities.

GLOSSARY

Accidental introduction: the introduction of non-indigenous aquatic species that occurs as the result of activities other than the purpose of intentional introduction of the species involved, such as the transport of non-indigenous species in ballast water or in water used in the transport of fish, mollusks, or crustaceans for aquaculture or other purposes.

Aquatic invasive species (AIS): a non-indigenous species that threatens the diversity and abundance of native species or the ecological stability of infested waters, or commercial, agricultural, or recreational activities dependant on such waters.

Aquatic nuisance species: see aquatic invasive species.

Baitfish: fish species commonly sold for use as bait for recreational fishing.

Ballast water: any water or associated sediments used to manipulate the trim and stability of a vessel.

Biological control: The use of living organisms, such as predators, parasites, and pathogens, to control pest insects, weeds, or diseases.

Community: an assemblage of interacting populations occupying a given area.

Control: to limit the distribution or abundance of a species.

Conveyance: a motor vehicle, vessel, trailer or any associated equipment or containers, including but not limited to live wells, ballast tanks and bilge areas that may contain or carry an aquatic invasive species

Ecosystem: the biological organisms in an ecological community and the non-living factors of the environment.

Environmentally sound: Methods, efforts, actions, or programs to prevent introductions or to control infestations of aquatic invasive species that minimize adverse environmental impacts.

Eradicate: the act or process of eliminating an aquatic invasive species.

Exotic: any species or other biological material that enters an ecosystem beyond its historic range. See non-indigenous.

Great Lakes: Lake Ontario, Lake Erie, Lake Huron (including Lake St. Clair), Lake Michigan, Lake Superior, and the connecting channels (Saint Mary's River, Saint Clair River, Detroit River, Niagara River, and Saint Lawrence River to the Canadian border), and includes all other water bodies within the drainage basin of such lakes and connecting channels.

Hybrid: the offspring of two animals or plants of different breeds, varieties, species, or genera.

Infested: any water body where an aquatic invasive species is known to occur.

Intentional introduction: all or part of the process by which a non-indigenous species is purposefully introduced into a new area.

Native: originating naturally in a particular country or region.

Non-indigenous species: any species or other biological material that enters an ecosystem beyond its historic range. See exotic.

Parthenogenic: an asexual form of reproduction found in females where growth and development of embryos occurs without fertilization by a male.

Pathogen: a microbe or other organism that causes disease.

Pioneer infestation: a small aquatic invasive species colony that has spread to a new area from an established colony.

Population: a group of individual organisms occupying a particular area at the same time.

Priority species: an aquatic invasive species that is considered to be a significant threat to Wyoming waters and is recommended for immediate or continued management action to minimize or eliminate their impact.

Rheotactic: oriented movement of an organism in response to a current of fluid such as water.

Veliger: a larval stage of certain mollusks.

Watershed: an entire drainage basin including all living and nonliving components.

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APPENDIX A: The following is a list of nonindigenous species known to be likely present in Wyoming. Species in bold are discussed in detail in this management plan. Not all species in this list are AIS. It also contains species that the state would not currently classify as AIS species due to their beneficial nature in selected waters, such as introduced game fish species. Data from Baxter and Stone (1995) and USGS database: <http://nas.er.usgs.gov/>.

Common name	Scientific name
CRUSTACEANS	
Opossum shrimp	<i>Mysis relicta</i>
FISHES	
Black crappie	<i>Pomoxis nigromaculatus</i>
Bluegill	<i>Lepomis macrochirus</i>
Brook stickleback	<i>Culaea inconstans</i>
Brook trout	<i>Salvelinus fontinalis</i>
Brown trout	<i>Salmo trutta</i>
Common carp	<i>Cyprinus carpio</i>
Emerald shiner	<i>Notropis atherinoides</i>
Freshwater drum	<i>Aplodinotus grunniens</i>
Gizzard shad	<i>Dorosoma cepedianum</i>
Golden shiner	<i>Notemigonus crysoleucas</i>
Golden trout	<i>Oncorhynchus aguabonita</i>
Goldfish	<i>Carassius auratus</i>
Grass carp	<i>Ctenopharyngodon idella</i>
Green sunfish	<i>Lepomis cyanellus</i>
Kokanee	<i>Oncorhynchus nerka</i>
Lake trout	<i>Salvelinus namaycush</i>
Largemouth bass	<i>Micropterus salmoides</i>
Northern pike	<i>Esox lucius</i>
Pumpkinseed	<i>Lepomis gibbosus</i>
Rainbow trout	<i>Oncorhynchus mykiss</i>
Rock bass	<i>Ambloplites rupestris</i>
Smallmouth bass	<i>Micropterus dolomieu</i>
Splake	<i>Salvelinus fontinalis x namaycush</i>
Tiger muskellunge	<i>Esox lucius x E. masquinongy</i>
Tiger trout	<i>Salmo trutta x Salvelinus fontinalis</i>
Western mosquitofish	<i>Gambusia affinis</i>
White crappie	<i>Pomoxis annularis</i>
Yellow perch	<i>Perca flavescens</i>
MOLLUSKS	
Asian clam	<i>Corbicula fluminea</i>
New Zealand mudsnail	<i>Potamopyrgus antipodarum</i>
Red-rim melania	<i>Melanoides tuberculatus</i>
Glass physa	Physa skinneri
PATHOGENS	
Whirling disease	<i>Myxobolus cerebralis</i>

Common name	Scientific name
PLANTS	
Barnyard grass	<i>Echinochloa crusgalli</i>
Bittersweet nightshade	<i>Solanum dulcamara</i>
Black-grass rush	<i>Juncus gerardii</i>
Crack willow	<i>Salix fragilis</i>
Curly pondweed	<i>Potamogeton crispus</i>
Flattened rush	<i>Juncus compressus</i>
Narrow-leaved cattail	<i>Typha angustifolia</i>
Oak-leaved goosefoot	<i>Chenopodium glaucum</i>
Poison hemlock	<i>Conium maculatum</i>
Purple loosestrife	<i>Lythrum salicaria</i>
Rough-stalked meadow grass	<i>Poa trivialis</i>
Saltcedar	<i>Tamarix spp.</i>
Spearmint	<i>Mentha spicata</i>
Spotted knotweed	<i>Polygonum persicaria</i>
True forget-me-not	<i>Myosotis scorpioides</i>
Water bentgrass	<i>Agrostis gigantea</i>
Water foxtail	<i>Alopecurus geniculatus</i>
Water-cress	<i>Nasturtium officinale</i>
Weeping alkali grass	<i>Puccinellia distans</i>
Western water horehound	<i>Lycopus asper</i>
White willow	<i>Salix alba</i>

APPENDIX B:

Names, positions and affiliations, and addresses of members involved in preparation of management plan.

- Beth Bear
Aquatic Invasive Species Coordinator
Wyoming Game & Fish Department
528 S. Adams, Laramie, WY 82070

Names, positions and affiliations of individuals involved in the Wyoming AIS program.

- Beth Bear
Aquatic Invasive Species Coordinator
Wyoming Game & Fish Department
- Milward Simpson
Director
Wyoming State Parks and Cultural Resources
- Slade Franklin
Weed and Pest Coordinator
Wyoming Department of Agriculture
- Erin Williams
Regional Aquatic Invasive Species Coordinator
Western Regional Panel Coordinator
U.S. Fish and Wildlife Service
- Cynthia K Tait
Regional Aquatic Ecologist
U.S. Forest Service, Intermountain Region
- Denise Hosler
Environmental Applications and Research Group
Bureau of Reclamation, Denver Federal Center
- Cassity Bromley
Chief of Resources
Bighorn Canyon National Recreation Area, National Park Service
- Susan E. O'Ney
Resource Management Biologist
Grand Teton National Park
- Eileen Ryce, Ph.D.
ANS Coordinator
Montana Fish, Wildlife & Parks

APPENDIX C: Comments received on plan and responses to comments.

Public comments: Public comment on the plan was accepted online or in writing from June 21 – July 31, 2020. Eight public comments were received; seven of them commented on the regulation and decal fee which is outside of the scope of the plan.

The one comment received related to the plan is below:

Ms Bear, I've been following with great interest G&F plans for getting in front of the AIS threat presented to our fisheries by, most particularly, the quagga and zebra mussels. G&F is to be commended for its proactive prompting of the legislature to provide preliminary funding for measures to reduce the potential for introduction. Having attended the public presentation here in Cody, and read the draft proposal, I am still disappointed in what seems to be a relatively passive attempt at stopping the invasion at the state lines. If we are in fact mussel free now, it would seem that maximum effort should be expended to prevent infection, and that effort would include mandatory inspection of watercraft (and uncertified water carriers) at the state line on any highway entering the state. I've suggested this before and been told it would be too costly. That may be the case, but I'm told that Colorado has enacted exactly that policy for this year, (see <http://wildlife.state.co.us/Fishing/MandatoryBoatInspections.htm>), and on a budget very similar to that established by the Wyo legislature. Certified inspection stickers could be issued to both in-state and out-of state watercraft, and that certification honored by cooperating agencies in other states. At any rate it would appear in this instance a pound of prevention is the only option. The draft proposal covers a lot of issues from a lot of angles, and it is easily seen that more knowledgeable heads than mine have put a massive effort into planning to make this thing work. All involved are to be commended, but please don't back away from a fairly draconian approach. As a boater, fisherman, and longtime Wyo resident, I appreciate the work done by G&F. This issue needs to be addressed by all means available. Sincerely, Jim Terry

Response: The WGFD and WDOT did investigate the use of port-of-entry inspection stations to intercept watercraft entering Wyoming. However, this option was deemed by WDOT to be cost-prohibitive (tens of millions to retrofit existing facilities) in addition to concerns regarding public safety. Current WGFD regulations do require any watercraft that has been in an infested water within 30 days be inspected before launching in any Wyoming water. The WGFD and cooperating agencies will continue to evaluate the effectiveness and efficiency of the AIS program and will incorporate any needed improvements into the program.

Stakeholder comments: The draft plan was distributed to affected stakeholders for additional input and comment. Comments are as follows:

The Wyoming State Geological Survey has reviewed the Draft Aquatic Invasive Species Management Plan and we have no comments or concerns relative to the plan at this time. We appreciate the opportunity to review the plan.

Sincerely,
Alan J. Ver Ploeg
Assistant Director/Senior Geologist,
Wyoming State Geological Survey

Dear Mr. Ferrell:

The proposed Aquatic Invasive Species Management Plan (hereafter referred to as the "Plan"), in accordance with the Non-indigenous Aquatic Nuisance Prevention and Control Act (Title 1 of P.L. 101-646; 104 Stat. 4761, 16 U.S.C. 4701), enacted November 29, 1990, seeks to establish policy for managing non-native species introduction through education, monitoring, and public outreach efforts. The proposed Wyoming Invasive Species Act (2010) outlines the establishment of a task force to address the issues associated with undertaking such a plan, and would earmark \$2.5 million dollars to create the infrastructure for the program until 2012, or when the program becomes self-sustaining. Becoming active in nationwide initiatives, like the 100th Meridian Initiative, that focuses on preventing the western spread of the zebra mussel will provide opportunities for research and access to documented efficacy of management efforts employed by other states.

As funding is available, thorough baseline surveys need to be conducted, within each river drainage system (Colorado, Columbia, Great Basin, and Missouri), to determine the nature and extent of current non-native aquatic invasive species in Wyoming. Subsequent surveys would spot check critical areas of concern to assess accomplishment of Plan objectives.

Concerns about the proposed Plan include the large expanses of Wyoming waterways to monitor, allowing fishermen and other aquatic recreation enthusiasts to self-certify, developing sustainable funding sources through state and federal programs to hire staff to manage check stations and boat ramp entry points. Essential to such a plan are development of comprehensive risk analyses and Hazard Analysis Critical Control Point (HACCP) plans specific to Wyoming river drainages.

While U.S Fish and Wildlife Service and Wyoming Game and Fish have comprehensive programs for their fish facilities, the Wyoming Department of Corrections will implement similar compliance measures for the Aquaculture facility at the Wyoming Women's Center to prevent any inadvertent introduction of non-indigenous invasive species with importation of any permitted species (tilapia, fathead minnow, or Pacific white shrimp).

If further information is needed, please do not hesitate to contact me.

Sincerely,
R. O. Lampert
Director, Wyoming Department of Corrections

Response: It is a goal of this plan to increase involvement in national AIS campaigns, and to monitor waters to assess the presence/absence of AIS through Wyoming as suggested in the comment. To address concerns raised in this comment, the WGFD will work in conjunction with partners to monitor the expansive waterways in Wyoming as it is unlikely to be feasible for one agency. In addition, major standing waters have been prioritized using a risk-assessment to allow focus of limited resources. Self-certification has been shown to be successful in other areas in the West and is a model the state will continue to pursue on waters without inspection stations. It will never be feasible to check every watercraft entering the state, and self-certification aids in preventing the transport of AIS to waters without inspections, and in

increasing public awareness. Establishing a permanent funding source is a very real concern and is therefore a main priority of this plan. Lastly, the plan points to increased use of HACCP analysis for agencies using Wyoming water in order to prevent the spread of AIS through management activities.



Wyoming
DEPARTMENT OF Agriculture

Dave Freudenthal, *Governor*
Jason Fearnelyhough, *Director*
2219 Carey Ave. • Cheyenne, WY 82002
Phone: (307) 777-7321 • Fax: (307) 777-6593
Web: agriculture.wy.gov • Email: wda1@state.wy.us

The Wyoming Department of Agriculture is dedicated to the promotion and enhancement of Wyoming's agriculture, natural resources and quality of life.

July 27, 2010

Beth Bear
Aquatic Invasive Species Coordinator
Wyoming Game and Fish Department
528 S. Adams
Laramie, WY 82070

Dear Ms. Bear:

Following are the comments from the Wyoming Department of Agriculture (WDA) on the Draft Wyoming Aquatic Invasive Species Management Plan (Plan) prepared by the Wyoming Game and Fish Department (WGFD).

Our comments are specific to our mission within state government: dedication to the promotion and enhancement of Wyoming's agriculture, natural resources, and quality of life. As this proposal has major impacts upon our agriculture industry, our natural resources and the welfare of our citizens, we believe it is important you continue to inform us of proposed actions and decisions and provide us the opportunity to express pertinent issues and concerns.

The WDA greatly appreciates the proactive approach the WGFD has taken with the release of the Plan. We believe recent efforts to inform recreationists and inspect their watercrafts is proving successful thus far. The introduction of species such as the Zebra mussel and Quagga mussel to Wyoming waters could have significant negative impacts to Wyoming agriculture, specifically those landowners who depend on irrigation.

Zebra and Quagga mussels as well as rusty crayfish transported from contaminated water bodies through irrigation canals would likely reach irrigation pivots and side rolls. Damage from mussels or even crayfish to irrigation equipment would cost agricultural producers thousands of dollars in repairs and lost crop productivity. We strongly encourage the WGFD work closely with and educate Wyoming Irrigation District staff and irrigators on invasive species identification. Irrigators regularly monitor an expansive area and can quickly notify WGFD of any possible findings.

Additionally, we believe field staff working for Weed and Pest Districts, Conservation Districts and Department of Environmental Quality provide additional opportunities for timely identification of possible invasive species. The staff are out in the field on a regular basis sampling water bodies and implementing water related projects and would provide an additional resource enhancing WGFD's efforts for surveillance and early detection.

BOARD MEMBERS

Juan Reyes, *District 1* • Jim Hodder, *District 2* • Shaun Sims, *District 3* • Jim Bennage, *District 4* • Joe Thomas, *District 5*
Bryan Brost, *District 6* • Jim Price, Jr., *District 7*

YOUTH BOARD MEMBERS


Patrick Zimmerer, *Southeast* • Dalin Winters, *Northwest* • John Hansen, *Southwest* • Bridget Kukowski, *Northeast*

Wyoming Department of Agriculture comments continued.

7/27/2010
Aquatic Invasive Species
Page 2

We support the Plan as proposed and look forward to your implementing the final draft statewide. The WDA thanks the WGFD for their efforts and for the consideration of our comments.

Sincerely,


Jason Fearneyhough
Director

JF/jw

Cc: Governor's Planning Office
WDA Board of Agriculture
Wyoming Stock Growers Association
Wyoming Wool Growers Association
Rocky Mountain Farmers Union
Wyoming Association of Conservation Districts
Wyoming Farm Bureau Federation
Wyoming State Grazing Board

Response: The WGFD will continue to work with the WDA on the implementation of this plan and will work with irrigation districts, irrigators, weed and pest districts, conservation districts, the WDEQ on monitoring and outreach.

Ms. Bear,

The Wyoming Department of Transportation has reviewed the draft Aquatic Species Plan and we are committed to work with the Wyoming Game and Fish Department and other participants in this effort.

The Chief Engineer, Del McOmie, and myself would like to visit with you about this plan. We look forward to visiting with you.

Gregg C. Fredrick, P.E.
Assistant Chief Engineer
Engineering and Planning
Wyoming Department of Transportation
5300 Bishop Blvd
Cheyenne, Wyoming 82009

Response: The WGFD has been in contact with WDOT regarding this plan and will continue to coordinate closely with WDOT on implementation of the plan.

ANSTF preliminary review comments: The draft plan was submitted to the ANSTF for preliminary review. Comments are as follows (responses to comments are italicized and occur after the comment):

**Combined Preliminary Comments on the Wyoming Aquatic Nuisance Species Plan
From The Members of the Aquatic Nuisance Species Task Force
(Aug. 4th, 2010)**

**1) From Donald MacLean, U.S, Fish and Wildlife Service, Administrative Staff to the
Aquatic Nuisance Species Task Force and State ANS Management Plan Coordinator**

Note: The comments below are based on the ANSTF Guidance for State and Interstate Aquatic Nuisance Species Management Plans, which is available on the ANSTF web site (<http://www.anstaskforce.gov/stateplans.php>). In the comments below, the term “Guidance” refers to this document.

General Comments

- The preliminary draft of the Wyoming AIS Management Plan is good basic information that serves as a solid foundation for an ANSTF approved State ANS Management Plan. Although the plan contains all required sections detailed in the Guidance, many of those sections are lacking some of the required pieces of information. See next section below for more information.
- The use of maps to show the watersheds where various ANS are located are very well done.

Comments on Missing Content by Section

Add A note in this section regarding fact that missing components do NOT need to be long.

- **Executive Summary (Page 1)** – The executive summary is not a summary of the entire AIS plan, but instead seems more like a summary of the Introduction and Goals sections. According to the Guidance, the executive summary should give the reader an overview of the entire AIS Management Plan, and the existing text does not do so. The Guidance states:
 - “The executive summary should briefly summarize each management plan section and its major recommendations. The purpose of the plan, the background on ANS problems, the authorities and current programs of involved organizations, and the central focus should be mentioned. In addition, present and proposed management actions to overcome problems along with program goals and objectives should be succinctly outlined. Finally, a summary of the implementation table (to include funding required for implementation in the initial and future years by objectives and major strategies) and program monitoring and evaluation plans should be provided.”
 - Note: For the management actions, the whole implementation table does not need to be repeated. Perhaps just the objectives and strategic actions could be summarized.

- Additional comments on this section can be found in specific comment section below.

Response: The Executive Summary has been revised following the guidance provided.

- **Introduction (Page 3)** – The introduction of the plan has some information on the AIS problem in general, but not much information specific to Wyoming. The addition of a description of the unique aspects of the AIS in Wyoming should be included. Also, the following items, listed in the Guidance, are not included in the preliminary draft:
 - Geographic scope of plan, including a map and discussion of the geographic area showing water bodies, drainage basins, and major structural features.
 - Note: The draft plan does contain a nice map (page 4) that shows the 4 major drainage basins of Wyoming’s geography, but it lacks much additional detail. The map would be more useful if it was bigger and included an accompanying discussion and perhaps a few more details based on the discussion.

Response: The map has been revised to include more detailed information and has the discussion on Wyoming waters.

- Discussion of any scientific review and/or public comment on the plan as well as a summary of specific comments and any indication of how those comments and reactions were addressed in the final plan.
 - Note: Since this is a preliminary review of a plan, I don’t necessarily expect to see much information on specific comments yet, but the final plan should contain an appendix with highlights on the important comment periods and any comments that helped shaped the overall development of the plan with a shorter summary in the main report.

Response: An overview of the public comment has been included.

- An explanation of the connection of the ANS plan to other plans (ANS or otherwise) produced by adjacent states or entities with overlapping jurisdictions covering shared waters. This is important information that is often overlooked.

Response: Information on connection on the plan to other plans and efforts has been included.

- **Problem Definition and Ranking (Page 5)** – The plan does have a specific section that covers this topic, but it lacks several of the crucial pieces of information that characterize the problem and its unique aspects particular to Wyoming. The following information from the Guidance is missing and should be included wherever possible:
 - Brief description of the overall history of AIS problems in Wyoming.
 - An estimation of the number of species or other taxa in various classes, in the geographic area.
 - Description of pathways by which these species arrived in the State or region.
 - Description of how connecting water bodies outside the plan boundaries may introduce new ANS into the affected area.
 - Discussion of major problems and concerns, such as key introduced species and introduction pathways, lack of scientific knowledge, or limited public knowledge.

- The plan should also identify all known and suspected ANS concerns and problems, even if no consensus exists about what species warrant attention.
 - The plan should acknowledge that problems and concerns may change over time. If problems and concerns are to be further described in the context of individual objectives, this section can provide a brief overview and summary discussion.
 - Discussion of:
 - Cryptogenic species (i.e., those which have not been determined as clearly native or nonindigenous), including, to the extent possible, probable pathway.
 - Species that have not yet been identified in Wyoming’s waters, but have the potential of finding their way into the State’s waters and the pathways of concern.
 - Any evaluations of the economic and ecological costs and benefits of proposed actions. The Task Force recommends using ecological risk assessment principles to understand and group ANS problems.

Response: The information requested in the comment was provided, if known. Cryptogenic species information was not known and therefore not included.

- **Goals (Page 14)** – The goal listed in this section is a solid goal that reflects the intent of the Non-indigenous Aquatic Nuisance Prevention and Control Act. However, this goal does not match the goals and/or actions listed in the Executive Summary.
 - This section could also be improved by indicating how the goal(s) of the plan contribute to the accomplishment of ANSTF, Fish and Wildlife Service, NOAA Fisheries, or other relevant Federal program long-term outcome goals.”

Response: The plan was revised so all goals are consistent and a bullet was added relating to federal goals.

- **Existing Authorities and Programs (Page 14)** – This section adequately describes the existing Federal and State authorities pertaining to AIS. However, the following information from the Guidance is missing:
 - Despite references in both the Executive Summary and Priorities for Action, the plan contains very little information on existing AIS program activities in Wyoming.
 - The identification of gaps in those authorities or implementing regulations is extremely brief, consisting of two bullets with very little detail instead of a concise treatment of the subject matter in its own right.

Response: The plan was revised to include greater detail on existing program and authorities at the state and federal levels.

- **Objectives, Strategies, Action and Cost Estimates (Page 15)** – The Objectives and Strategies section of the Wyoming plan outlines the basic objectives and strategies of the plan, however, it fails to provide any detail at the task level or provide cost estimates for these actions. The actions are mentioned in the implementation table, but enough details are not provided in the table or in the corresponding section of the plan itself. As per the Guidance document this section should include:

- **Actions** - Each strategy should include Actions that describe the specific work or task that will be performed to implement a strategy. Short statements detailing the work required and organizations involved and their respective roles should be prepared for each action. The expected result should be described.
 - For each action, the names of the implementing and funding organizations and their roles should be specified.
 - If necessary, include information about the problems and concerns being addressed to indicate why a particular strategy or set of actions is appropriate.
 - In the event that the authority to undertake the necessary action does not exist, an objective and related strategies and actions may be required to attain the authority to pursue the actions necessary to achieve the goal.
 - The plan should also disclose the consensus reached among organizations to apportion activities and work collaboratively on addressing ANS problems.
 - The roles and responsibilities of each participating organization need to be clearly defined and lead organizations need to be identified.
- **Cost Estimates** - The basis for the cost estimates (i.e., salary of two field biologists 1/3 of the year, plus equipment and travel costs) should be presented here if that information is available. The estimated contribution of each organization and the total cost for each action should be shown in the implementation table.

Response: This section has been expanded to include lead agencies on the tasks and cost estimates for each action.

- **Priorities for Action (Page 22)** – The Wyoming Plan details four categories of priorities upon which it will focus its efforts but the section is missing a few other pieces of information. As per the Guidance document this section should include:
 - The plan should discuss the rationale for focusing on certain species, pathways, economic and ecological impacts, or other problems/concerns and not others.
 - It should be explicit about which problems and concerns are to be addressed in this iteration of the plan and why they were included at this time while others were not.

Response: This section has been revised as suggested.

- **Implementation Table (Page 23)** – The implementation table has all the required components and matches up with the Objectives and Strategies section. However, the table only goes out three years (instead of 5 in the guidance) and there are no funding or FTE estimates in the FY12 or FY13 columns. Is Wyoming using the option for developing a short-term action plan (not less than 2 years) instead of a full 5-year planning period? If so, then more details are needed on an implementation strategy as detailed in the Guidance.
 - Note: Since this is a preliminary draft of the WY plan, I don't necessarily expect to see a complete implementation table yet, but hopefully those missing columns will be filled out by the time the plan is submitted for final approval.

Response: This section has been revised to include anticipated funding and FTE needs for FY12-FY13.

- **Program Monitoring and Evaluation (Page 29)** – The Wyoming Plan handles program monitoring and evaluation through a three part strategy of oversight, evaluation, and dissemination. However, for these actions, it is unclear exactly what the measurable performance measure will be and what the thresholds for success versus failure will be. The Guidance document includes the following information on program monitoring and evaluation, most of which is not covered in the Wyoming Plan:
 - Include in this discussion the performance measures that will be used to assess the effectiveness of management actions. For instance, on an annual basis this might include:
 - Whether or not objectives are achieved;
 - Rate of spread along a river reach or coastline;
 - Change in total acreage of habitat occupied by the ANS or the displaced native species;
 - Changes in abundance of an invader and directly or indirectly impacted species;
 - Changes to Federal and State T&E and extinct species lists due to ANS.
 - It is recognized that unforeseen factors may impact the progress of remedying a problem, and this would be evident through program monitoring and evaluation. The discussion should address how other physical, chemical and biological stressors are impacting the effectiveness of management actions and the success of objectives.
 - Describe the process that will be used to accumulate information about results (outcomes and outputs), compare them against planned results, evaluate effectiveness of efforts, and provide feedback. Monitoring and evaluation actions should be included as multiple line items in the Implementation Table.”

Response: This section has been revised as suggested.

- Appendices
 - Appendix C – Section 1202 of the National Invasive Species Act - is not something you are required to include in your plan, but it is also not something you need to delete either. It is perfectly acceptable to include Section 1202 if you prefer.

Response: This section has been omitted for brevity.

Specific Comments (content and typographical)

Response: All typographical and content comments have been addressed.

- Page 1, Executive Summary – This section is confusing because some of the information does not match information anywhere else in the document:
 - The purpose in the first paragraph does not match the purpose cited later in the section on Priorities for Action.
 - The list of goals (#’s 1-4) do not match the information in the Goals section (page 14) or anything elsewhere else in the document.

- The 4 actions are labeled as goals and also do not match the information in the Goals section (page 14) or anything elsewhere in the document.
 - Please note that I am not saying anything about the quality of the purpose or the goals or actions. It is just confusing to see a goal that isn't mentioned anywhere else in the document or a purpose that doesn't match a purpose stated later in the document.
- Page 2, Executive Summary – Some more details (background) on the FY 11 \$1.5 Million appropriation for AIS would be helpful.
- Page 4, Figure 1 – This map should be expanded to fill a full page with additional details added that reflect the discussion of the geographic scope of Wyoming and the plan as per the suggestion earlier in these comments.
- Page 5 – Problem Definitions and Ranking – Some more details on the Wyoming Department of Agriculture and their work with invasive aquatic plants mentioned here (saltcedar and purple loosestrife) would help the reader understand why they are not included in the WY AIS Plan.
- Page 5 – Problem Definitions and Ranking – For most of the species descriptions, the common name needs to be separated from the scientific name by a comma or perhaps parentheses.
- Page 5 – Problem Definitions and Ranking – The end of the 2nd paragraph states “*the most significant pathways for AIS to spread into and within Wyoming are through illegal introduction or transport on trailered watercraft.*” This is the type of discussion that would benefit from some additional details as mentioned earlier in these comments.
- Page 6 – Figure 2 – Although I am not a mussel expert, it looks to me as if the zebra mussel is labeled as a quagga mussel and vice versa.
- Page 6 – Rusty Crayfish – This paragraph states “*In 2006 and 2007, the rusty crayfish were successfully eradicated.*” This is a significant accomplishment and should be explained in greater detail. Successful eradications are so rare you should definitely give this some more attention in the document.
- Page 7 – Asian carp entry – Consider breaking the Asian carp entry into more than one paragraph for easier reading.
- Page 8 – VHS entry – I seem to remember that the theory on how VHS was introduced may have changed. I am not sure they think it was ballast water anymore.
- Page 9 – Priority Class 2 – In the description of this category, it states that “Management techniques are largely ineffective for these species.” However, the next sentence states that “management for these species will focus on ... control of population size ...” This is confusing because, from my experience, “management techniques” are often things that do control population size. Perhaps some clarification is needed here?

- Page 14 – Existing Authorities and Program
 - The word Program in the heading needs an “s.”
 - The acronyms should be spelled out the first time despite the use of the list of acronyms.
 - This section seems much too short. While I am not looking for an exhaustive thesis on the subject, I do have the following comments:
 - The State info could be more detailed;
 - The Federal info is non-existent; and
 - The information on WY programs and existing activities needs to be more detailed. There have been several places in the document where other AIS activities have been referenced without giving any detail.

- Page 15 – Problems 1A through 6A – Since there is only one problem listed under each Objective, the problems do not need to be labeled. I recommend removing the numbers, expanding upon each problem with a little more detail, and fitting them into the section on Problem Definitions and Ranking. This would improve the flow of the document and remove an unnecessary level of numbering from the Objectives, Strategies, and Actions.

- Page 16 – Task 1A2e – The three activities described in this Task seem as if they could be separate tasks. Consider breaking them into three separate tasks.

- Page 18 – Task 3A2b – The word “stakeholder” needs an s.

- Page 19 – Task 4A2a – This Task reads: “Continue current control programs for state noxious weeds.” This is one of the areas where additional information on existing programs would be beneficial (see earlier comment above). In addition, if you are referring to programs for terrestrial weeds, then this Task isn’t necessary.

- Page 20 – Objective 5 – It is very disappointing to see an entire Objective on education and see no references at all to the Aquatic Nuisance Species Task Force’s National Public Awareness Campaigns: Stop Aquatic Hitchhikers! and Habitattitude. These campaigns have already developed brands and materials that can be used by participants and go a long way towards saving limited resources and spreading a consistent National message. Recommend adding appropriate Tasks to utilize these campaigns.

- Page 22 – Priorities for Action –
 - The purpose on this page does not match the purpose in the Executive Summary.
 - The definitions for the Priority Classes should be repeated in this section.
 - It does not explain exactly why the focus shall be on Priority 1 and 2 species.
 - What about priorities beyond specific species? Are there specific pathways, research needs, problems, etc that could be considered priorities as well?

- Page 30 – Glossary – In the definition for accidental introduction I think the word “purposeful” needs to be changed to “purpose.”

- Page 32 – Literature Cited – The following reference does not seem to be cited within the document: Cao, L. 2009b. Curly pondweed *Potamogeton crispus* fact sheet. USGS nonindigenous aquatic species database. Gainesville, FL.
- Page 34 – Appendix A – The list of nonindigenous species states that “*Not all species in this list are AIS. It also contains species that would not currently classify as AIS due to their beneficial nature in selected waters...*” This implies that while all the species might not be AIS, they are all supposed to be aquatic. If that is the case, then some plant species should be considered for removal as they are not considered aquatic. The following plant species should be considered for removal due to their wetland indicator status and their life histories:
 - birdfoot trefoil (*Lotus corniculata*) – a facultative upland plant
 - field sow thistle (*Sonchus arvensis*) – a facultative to facultative upland plant
 - smooth field sow thistle (*Sonchus arvensis uliginosus*).
 - Recommend reviewing the plant list carefully to be sure that all of the plants listed are definitely aquatic.
- Page 36 – Appendix B – Are there other contacts to b

2) From Paul Zaicek, Florida Department of Agriculture (representing National Association of State Aquaculture Coordinators)

Thank you on behalf of the National Association of State Aquaculture Coordinators (NASAC) for the opportunity to comment on the Wyoming plan. The plan is well-written, straightforward and includes very good maps and graphics. I believe it is a rare instance for the Task Force to read a state plan that has a single author. It is abundantly evident that Ms. Bear has thoroughly researched preparing a state plan and put together a sound document.

Specific to the plan, our comments are:

The Aquatic Nuisance Species Task Force has created a variety of products and programs that Wyoming may wish to consider citing and including in their plan. Specifically these are:

- Several national management plans for a variety of invasive species that the state could utilize to its benefit that can be found here, <http://www.anstaskforce.gov/control.php>, as well as the recently completed Quagga-Zebra Mussel Action Plan for Western U.S. Waters (http://www.anstaskforce.gov/QZAP/QZAP_FINAL_Feb2010.pdf).
- A website to the HACCP risk management process that Ms. Bear mentioned in the plan: <http://www.anstaskforce.gov/haccp.php>.
- Public education programs that Wyoming can immediately join and support that can be found here: <http://www.anstaskforce.gov/education.php>. Notably, Wyoming Game and Fish Department is already listed as a Protect Your Waters member.
- A risk analysis methodology: http://www.anstaskforce.gov/Documents/ANSTF_Risk_Analysis.pdf

- A pathway risk analysis and prioritization guide:
http://www.anstaskforce.gov/Documents/Pathways_Training_and_Implementation_Guide_Jan_2007.pdf

Response: This section has been revised to include information suggested above.

In reference to the Objectives and Strategic Actions identified in the plan, Wyoming may wish to:

2A3b – Reconsider an approved list or white list approach to limiting nonnative species importation, for any particular “group” of species (vertebrates, plants, invertebrates, etc.) a relatively small proportion may prove to be invasive (causing significant economic, ecological or human health effects). Sometimes called the “rule of tens,” this very rough approximation can be surprisingly accurate given the considerable biological uncertainty, disagreement amongst scientists, and location involved. The rule of tens is simply that of any particular group of imported species, 10% may be introduced to the wild, and of those introduced plants 10% may become established and of those established species, 10% may become a pest. The rule of tens is approximate and may range from 5% to 20% at any particular step.

As examples of the burden that can be created for a public agency to enforce and for the public to accept a white list:

- Texas proposed in December 2009 a white list approach to allowing the importation and ownership of aquatic plants in lieu of their current prohibited list of 11 species and one genus. Texas aquatic plant producers identified 730 nonnative aquatic plants in-trade with an additional 1,800 varieties of water lilies. The Texas agency has proposed in June an initial list of 262 plants. At the moment there is considerable controversy about the respective lists before a final list is supposed to be released in December of this year.
- There is an estimated 600 to 800 freshwater aquarium species (not including plants) and 1,500 fish species, 200 coral species, and 500 invertebrate species (excluding coral) in the marine aquarium hobby trade.

Response: This section has been revised to include use on invasiveness potential to consider prohibiting only species with highest risk of harm instead of an all-inclusive list.

3A2 - Adopt a National Incident Management System (AKA Incident Command System) approach to rapid response as is exemplified a plan developed by the Mid-Atlantic Regional Panel (<http://www.midatlanticpanel.org/resources/documents/MarylandPlanFinal.pdf>) as well as a strategy focused upon agency NIMS training.

Response: This strategy is now considered in this task.

3) From Mike Ielmini, National Invasive Species Program Coordinator and ANSTF Agency Representative, U.S. Forest Service:

Overall, the plan does provide an excellent set of objectives, goals, and actions to address AIS across Wyoming. They note the importance of coordination and collaboration, and seem

to span the full spectrum of species threats to the waters of Wyoming. They also note the importance of interstate issues and describe that well and some of the actions to address those issues. They highlight the watersheds at risk well. Additionally, the plan does touch on the Research component of the AIS issue, and has identified several broad research needs. Generally it is well done and we should offer our support to move it forward for approval with the following suggestions/comments:

1. The plan does acknowledge the need for coordination with federal agencies, and does a fairly good job of describing the State authorities for AIS management under this proposed plan. However, the plan needs to also expand and articulate key authorities which support the federal partners in AIS work and make the connection to the roles and responsibilities the federal agencies have to help meet the plan's goal against AIS, particularly agencies such as USFS, NPS, USFWS, BOR, DOE, COE, NRCS, DoD and APHIS. For example, work to survey, detect, prevent, and control AIS on waters within the federal landbase in Wyoming will be critical to achieving success in this plan...and WY does not have capacity to handle that without the federal partners covering that ball using their own existing federal authorities and policies. Wyoming needs to elevate the role of the Fed's overall across this plan, not just the part related to USFWS funding through ANSTF.

Response: More thorough information on federal agency roles is now included in the existing authorizes section of the plan.

2. Budget/cost figures projected in the tables seem to typically show '0' (zero). It would be more effective if they would include a more tangible figure for each of those planned costs/program items. I'd suggest adding numbers to reflect what has been done in the past budget years, even if the plan hadn't been in place yet. Overall this document could be the foundation on which they build budget justifications in the future, so their projections should reflect actual expected needs.

Response: Budget figured for FY09 will remain zero as no funds were available for AIS activities at that time. Figures from FY10-FY11 reflect the legislative appropriation. Figures for FY12-FY13 have been added to reflect needed funding and personnel.

4) Comments from Susan Pasko, Aquatic Invasive Species Analyst, NOAA

Note: Ms. Pasko made her comments from within Adobe Acrobat. The following information are the highlights in her words, but for the complete information one must look at the accompanying PDF document.

Here are my comments on the Wyoming plan. I have made several mark-ups throughout the document, but here are the highlights:

Overall the plan covers all the main areas: prevention, EDRR, control, education, legislation, and funding. Also, the objectives established by the plan seem feasible and able to progress over the next several years. The plan also appears to have a flexible nature, such that it can be expanded to new threats and pathways.

However, the tasks listed under the objectives seems very broad. The state will be given 1.5 million dollars in FY 11 to implement this plan, thus they should be able to provide more details as to how this money will be spent. Many of tasks could be broken down into specific action items which designate target audience, specific pathways addressed, materials used, how/where data will be coordinated, conferences / workshops to be developed, use of any existing educational programs or national campaigns, etc. Also, within the implementation table, they list "various" for several categories, as numerous interested groups - have they identified any potential players or discussed the roles they might play in implementing the plan?

Response: Tasks have been developed further to be more specific and include lead agency information.

Also the plan is very focused on zebra / quagga mussel prevention, with little mention of other AIS. For example - only one species is listed for each species classes 3 and 4. Invasive mussels may be a top priority for the state - but this should not be the primary focus of the plan! By doing so they are ignoring several other AIS and their pathways. The plan should be drafted in a more general manner and, if needed, they should construct a supplementary Quagga / Zebra plan for the state.

Response: The plan addresses various AIS and pathways, and is not focused on zebra/quagga mussels. However, as explained in the priorities for action section invasive mussels pose the greatest threat to Wyoming waters and will remain a top priority of the plan.

Numerous task are associated with coordination of agencies; but no mention of establishing a State Council? Is this something they have considered?

Response: A council was considered but deemed not necessary at this time. A council will be formed in the future if need dictates.

Finally - they need to double check the correct captions are matched up with the pictures. For, example I am fairly certain the captions of the quagga / zebra mussels are reversed.

Response: This caption has been corrected.