This document contains overall and specific condition of the Center for the Inland Bays from the National Estuary Program Coastal Condition Report. The entire report can be downloaded from ***http://www.epa.gov/owow/oceans/nepccr/index.html***

National Estuary Program Coastal Condition Report

Chapter 3: Northeast National Estuary Program Coastal Condition, Center for the Inland Bays

June 2007

Center for the Inland Bays

www.inlandbays.org

Background

The Delaware Inland Bays are located in southeastern Sussex County, DE, and are composed of three estuaries: Rehoboth Bay, Indian River Bay, and Little Assawoman Bay, which combine to form the smallest of the 28 NEP estuarine systems (DNREC, 2000). Rehoboth Bay is the most northerly of the three bays and adjoins Indian River Bay, which discharges via Indian River Inlet into the Atlantic Ocean. Connected to Indian River Bay via the Assawoman Canal, Little Assawoman Bay is located further south and discharges into Assawoman Bay. The source of the majority of the freshwater input to the Bays is groundwater seepage. In the Rehoboth and Indian River bays, 80% of the freshwater inputs originate from groundwater discharging to the Bays directly or indirectly though the Bays' tributaries. The major tributaries to the Bays include Indian River, Pepper Creek, Herring Creek, Love Creek, and Dirickson Creek (DNREC, 2001).

The Center for the Inland Bays (CIB) was established as part of the NEP in 1994 under the auspices of the *Inland Bays Watershed Enhancement Act* (Title 7, Chapter 76). The mission of the CIB is to promote the wise use and enhancement of the Inland Bays, their tributaries, and the Inland Bays' watershed. The Bays have an average depth ranging from 3 to 8 feet and are poorly flushed by tidal movement; thus, they are especially sensitive to environmental changes (DNREC, 2001).

Fluctuations in water temperature, changes in salinity, and increases in pollutant levels can have dramatic effects on water quality and on the entire ecosystem of the Bays.

The Delaware Inland Bays are an important agricultural area and a popular tourist destination. In 2002, one-third of the watershed was devoted to agricultural uses (CIB, 2004). Approximately 70 million chickens are produced annually in the watershed, creating more than 90 tons of manure (DNREC, 2000; CIB, 2002). Recreation and tourism are also common in the Inland Bays and contribute approximately $250 million annually to the local economy. On summer weekends, the area's population can increase by more than 200% (DNREC, 2000). Boating is a popular activity, and it is estimated that 21,000 boaters use the Bays annually. The potential for illegal sewage discharge from these boats has led to the closure of some of the Bays' shellfish beds (DNREC, 2001).

Environmental Concerns

Water quality impairment and its effects on the estuarine ecosystem are a significant concern in the Delaware Inland Bays. Runoff from CAFOs, leaking or malfunctioning septic systems, and discharges from municipal treatment facilities can all lead to increases in nutrients and releases of fecal coliform bacteria to the Bays. Almost 70% of the streams entering the Bays are impaired, both from a water quality and habitat standpoint. Most of this impairment has occurred due to stream channelization and ditching to improve drainage. The ecology of the Bays has changed in the past 40 years, from a clear water system that supported seagrass, bay scallops, and a variety of other shellfish, finfish, and waterfowl to a murky water system that no longer supports a healthy ecology. Instead, this system enables HABs, nuisance seaweed blooms, and oxygen-depletion episodes, while suppressing bay grasses, bay scallops, and the variety and abundance of other shellfish, finfish, and waterfowl noted in earlier years (CIB, 2002).

Population Pressures

The population of the NOAA-designated coastal county (Sussex) coincident with the CIB study area increased by 114% during a 40-year period, from 0.07 million people in 1960 to almost 0.16 million people in 2000 (Figure 3-92) (U.S. Census Bureau, 1991; 2001). This rate of population growth for the CIB study area is almost five times the population growth rate of 24% for the collective NEP-coincident coastal counties of the Northeast Coast region. In 2000, the population density of this one coastal county was 166 persons/mi^2, about six times lower than the density of 1,055 persons/mi^2 for the collective NEP-coincident coastal counties of the Northeast Coast region (U.S. Census Bureau, 2001). Population pressures for this study area are high, especially during the summer months, because this area and its beaches and bays serve as a major recreational center for the Washington, D.C., and Philadelphia metropolitan areas.

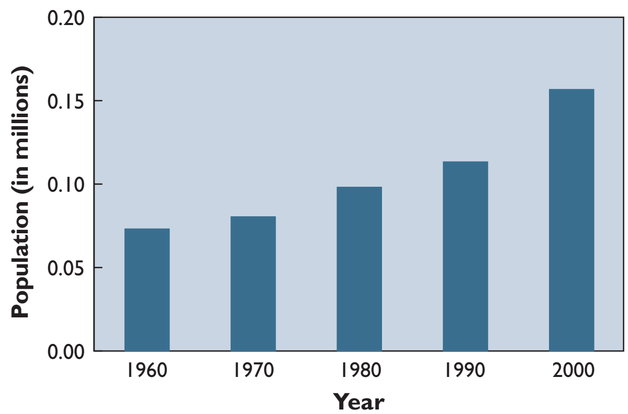

Figure 3-92. Population of NOAA-designated coastal county of the CIB study area, 1960–2000 (U.S. Census Bureau, 1991; 2001).

NCA Indices of Estuarine Condition—Delaware Inland Bays

The overall condition of the Delaware Inland Bays is rated fair based on the four indices of estuarine condition used by the NCA (Figure 3-93). The water quality index for the Delaware Inland Bays is rated fair, the sediment quality and benthic indices are rated poor, and the fish tissue contaminants index is rated good. Figure 3-94 provides a summary of the percentage of estuarine area rated good, fair, poor, or missing for each parameter considered. This assessment is based on data from 30 NCA stations sampled in the CIB estuarine area in 2000 and 2001. Please refer to Tables 1-24, 1-25, and 1-26 (Chapter 1) for a summary of the criteria used to develop the rating for each index and component indicator.

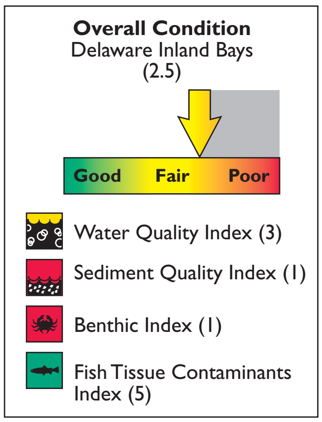

Figure 3-93. The overall condition of the CIB estuarine area is fair (U.S. EPA/NCA).

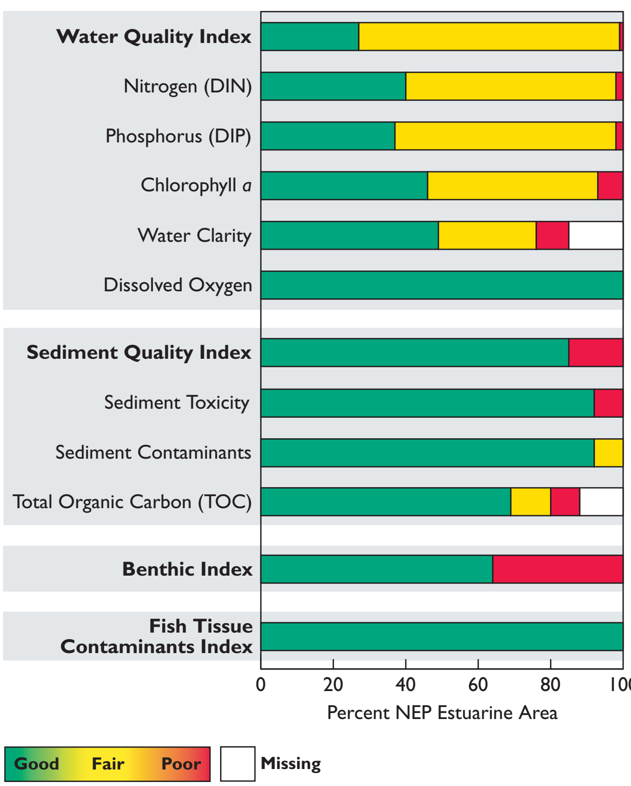

Figure 3-94. Percentage of NEP estuarine area achieving each rating for all indices and component indicators — Delaware Inland Bays (U.S. EPA/NCA).

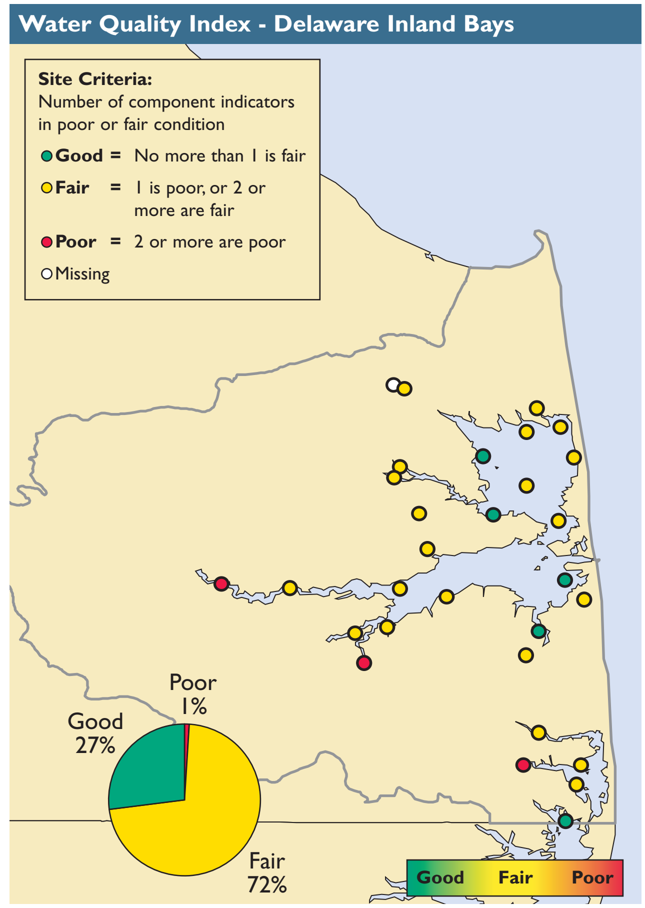

Figure 3-95. Water quality index data for the Delaware Inland Bays, 2000–2001 (U.S. EPA/NCA).

Water Quality Index

Based on the NCA survey results, the water quality index for the Delaware Inland Bays is rated fair, with 72% of the estuarine area rated fair for water quality (Figure 3-95). This index was developed using NCA data on five component indicators: DIN, DIP, chlorophyll *a*, water clarity, and dissolved oxygen. Elevated concentrations of DIN, DIP, and chlorophyll *a* were measured in about 60% of the Bays. Diminished water clarity was evident in 36% of the Bays—a typical measurement for the southern estuaries of the Northeast Coast region. Dissolved oxygen concentrations in bottom waters were greater than 5 mg/L at all locations sampled during the study period.

Dissolved Nitrogen and Phosphorus | The Delaware Inland Bays are rated fair for DIN concentrations, with 40% of the estuarine area rated good, 58% of the area rated fair, and 2% of the area rated poor. The Delaware Inland Bays are also rated fair for DIP concentrations, with 37% of the estuarine area rated good for this component indicator, 61% of area rated fair, and 2% of the area rated poor.

Chlorophyll a | The Delaware Inland Bays are rated fair for chlorophyll *a* concentrations. Forty-six percent of the estuarine area was rated good for chlorophyll *a* concentrations, 47% was rated fair, and 6% of the area was rated poor.

Water Clarity | Water clarity in the Delaware Inland Bays is rated good. Forty-nine percent of the estuarine area was rated good for this component indicator, 27% of the area was rated fair, and 9% of the area was rated poor. NCA data on water clarity were unavailable for 15% of the CIB estuarine area.

For the purposes of this report, water clarity in the Delaware Inland Bays was rated poor at a sampling site if light penetration at 1 meter was less than 10% of surface illumination. These criteria are used for estuaries with normal turbidity and are applied to most U.S. estuaries. In some areas of the country, more stringent criteria are applied to support extensive SAV beds or active SAV restoration programs. Water clarity in these regions is rated poor at a sampling site if light penetration at 1 meter is less than 20% of surface illumination.

Although the more stringent water clarity criteria were not applied when rating the Delaware Inland Bays in this report, SAV restoration efforts are underway in this estuarine system; thus, these more stringent criteria could be applicable to the Bays. If these criteria had been applied, water clarity in the Bays would have been rated poor, with 36% of the estuarine area rated poor (see table below).

Rating	Current Criteria (% area)	More Stringent Criteria (% area)
Good	49	40
Fair	27	8
Poor	9	36
Missing	15	15

Dissolved Oxygen | The Delaware Inland Bays are rated good for dissolved oxygen concentrations, with 100% of the estuarine area rated good for this component indicator.

Sediment Quality Index

The sediment quality index for the Delaware Inland Bays is rated poor (Figure 3-96). Fifteen percent of the estuarine area was rated poor, and less than 1% of the area was rated fair. This index was developed using NCA data on three component indicators: sediment toxicity, sediment contaminants, and sediment TOC. Sediments were toxic to amphipods at one NCA site; however, the extent of sediment contamination was relatively insignificant (8% rated fair). Moderate and high concentrations of TOC were measured in 19% of the Bays, largely in the tributaries.

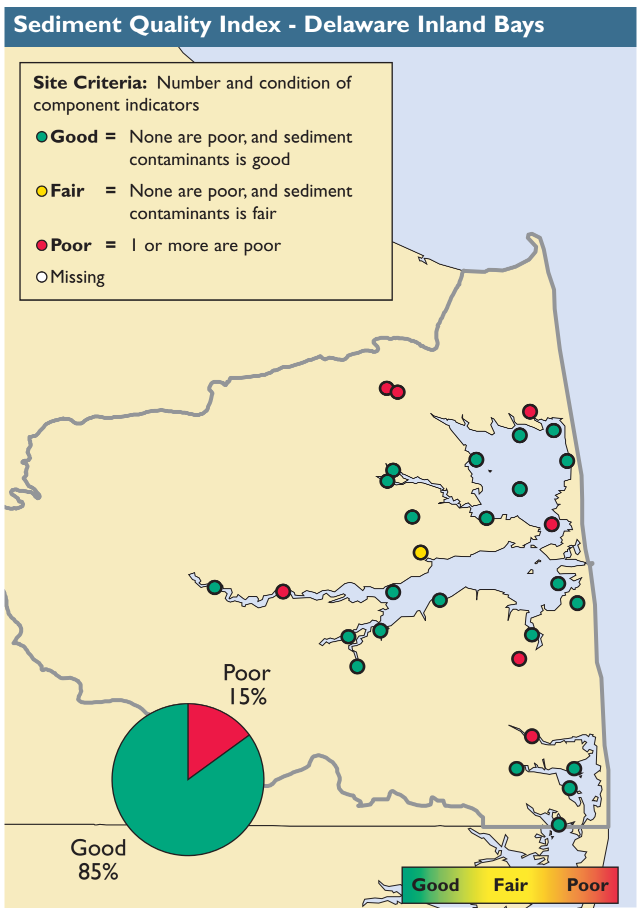

Figure 3-96. Sediment quality index data for the Delaware Inlands Bays, 2000–2001 (U.S. EPA/NCA).

Sediment Toxicity | The Delaware Inland Bays are rated poor for sediment toxicity, with 7% of the estuarine area rated poor for this component indicator.

Sediment Contaminants | The Delaware Inland Bays are rated good for sediment contaminant concentrations. None of the estuarine area was rated poor for this component indicator, and 8% of the estuarine area was rated fair.

Total Organic Carbon | The Delaware Inland Bays are rated good for sediment TOC. Sixty-nine percent of the estuarine area was rated good for this component indicator, and 11% of the area was rated fair. Only 8% of the area was rated poor for sediment TOC, and NCA data on TOC concentrations were unavailable for 12% of the CIB estuarine area.

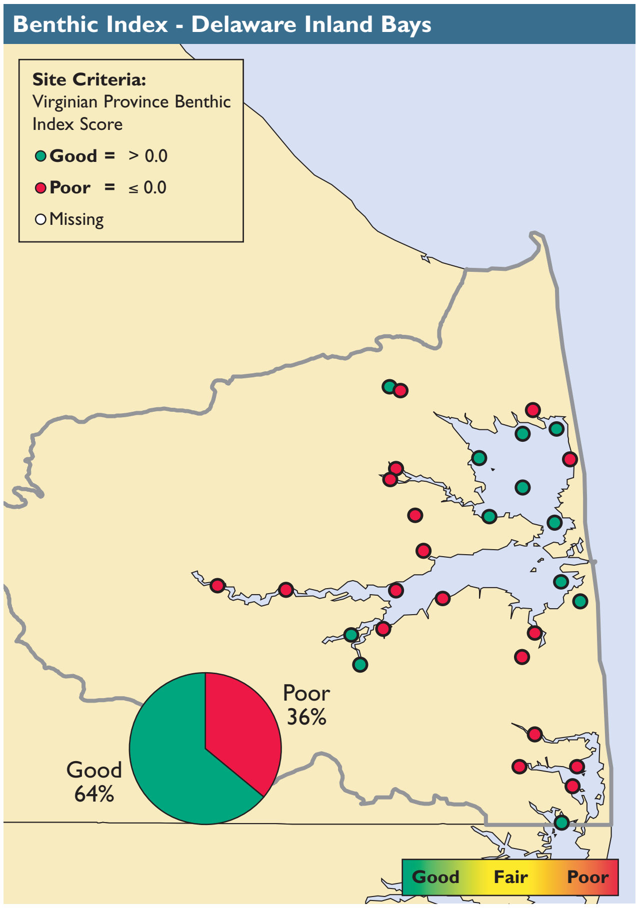

Figure 3-97. Benthic index data for the Delaware Inland Bays, 2000–2001 (U.S. EPA/NCA).

Benthic Index

The benthic condition rating for the Delaware Inland Bays is poor, as evaluated by the Virginian Province Benthic Index (Figure 3-97). More than a third of the estuarine area had index scores that indicated an unsatisfactory degree of benthic diversity, with most of the sites designated as impaired located in tributaries of the Bays.

Fish Tissue Contaminants Index

Based on NCA survey results, the fish tissue contaminants index for the Delaware Inland Bays is rated good. Only four fish samples were analyzed for chemical contaminants (Figure 3-98); however, none contained chemical contaminant concentrations that exceeded the EPA Advisory Guidance values for fish consumption.

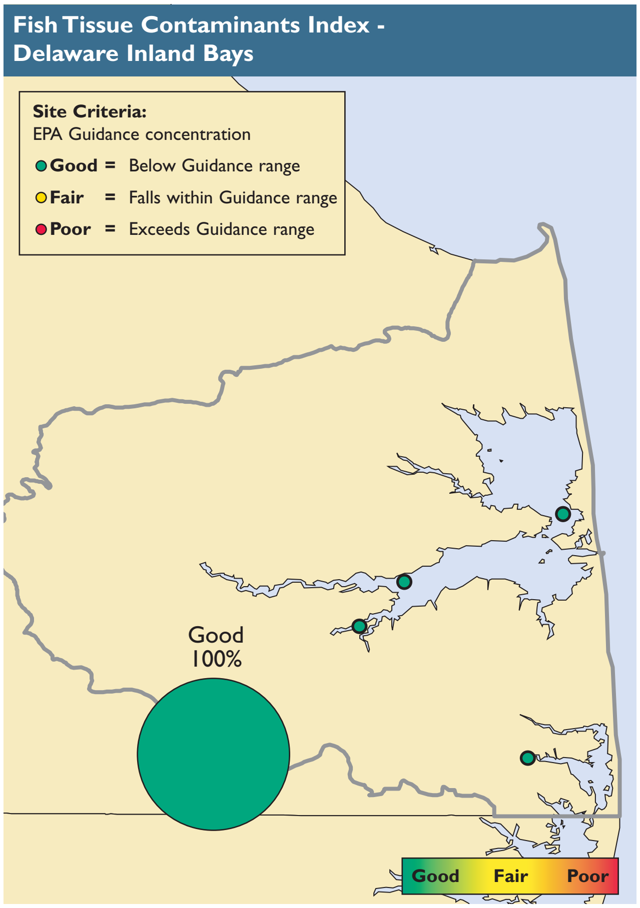

Figure 3-98. Fish tissue contaminants index data for the Delaware Inland Bays, 2000–2001 (U.S. EPA/NCA).

Center for the Inland Bays

HIGHLIGHT

Delaware Inland Bays Tributary Action Team

Eutrophication due to nutrient over-enrichment is a priority problem for Delaware's Inland Bays. Overall, the Inland Bays are highly eutrophic, with an increasing trend towards nutrient enrichment experienced during the past 40 years (CIB, 2002). These eutrophic conditions have led to nuisance algal blooms, fish kills, large variations in dissolved oxygen levels, loss of SAV, and an increase in HABs or harmful phytoplankton blooms. Some of these blooms have been composed of organisms, such as *Pfiesteria* and *Chattonella*, which are potentially toxic.

Because of degraded water quality conditions resulting primarily from eutrophication, the Inland Bays are identified as impaired waters on Delaware's 1996 303(d) list and require the application of TMDLs. In December 1998, the Delaware Department of Natural Resources and Environmental Control (DNREC) promulgated TMDLs for the Indian River, Indian River Bay, and Rehoboth Bay, which called for non-point source nutrient load reductions as high as 85% for nitrogen and 65% for phosphorus. The Delaware DNREC also called for the elimination of all point-source discharges to the Inland Bays (DNREC, 1998).

During the autumn of 1998, the CIB initiated a Tributary Strategy Program in which local stakeholders (e.g., industry, agriculture, municipalities, real estate businesses, golf courses, citizens) from each of the Inland Bays sub-watersheds (e.g., Rehoboth, Indian River, and Little Assawoman bays) were organized into an Inland Bays Tributary Action Team (TAT). The TAT created a body responsible for providing guidance and direction to the CIB in its mission to reduce nutrient contributions and restore habitat in the Delaware Inland Bays (CIB, 2005).

Since January 1999, the TAT has been involved in a coordinated effort with the Delaware DNREC to develop pollution-control strategies to meet the required TMDLs for nitrogen and phosphorus in the Bays. To accomplish this goal, a public engagement model, *Public Talk – Real Choices*, was developed and applied to this program by the University of Delaware's Cooperative Extension Agency, which co-facilitated the process with the university's Sea Grant Marine Advisory Service (CIB, 2005).

An Inland Bays' resident attempting to remove the nuisance macroalgae *Ulva* (sea lettuce) from shoreline property (James Alderman).

The purpose of *Public Talk – Real Choices* was to move formulation and creation of a major public policy decision from a state agency (DNREC) to the public for deliberation and dialogue. Using deliberative dialogue as its core, *Public Talk* went further by engaging the public in learning about the issues, framing issues for deliberation, weighing the costs and consequences of choices, coming to public judgment, and making decisions. This was not a model that engaged a small group to simply make recommendations to a state agency that would subsequently "sell" the policies to the public via public workshops and public hearings (CIB, 2005). Instead, the TAT published the issue book *Saving Our Bays: Our Challenge – Our Choice* (CIB, 2000) and distributed more than 20,000 copies within the watershed (University of Delaware, 2000). The TAT also hosted seven public forums in the watershed to educate residents and visitors about the choices under consideration and to receive input concerning the development of pollution-control strategies for the Bays.

Ultimately, the Inland Bays TAT offered three sets of pollution-control strategy recommendations to the Delaware DNREC for review and consideration. Based on these recommendations, the DNREC has proposed to promulgate a pollution-control strategy for each of the Inland Bays (DNREC, 2006). Elements of this strategy are both voluntary and regulatory in nature and are designed to reduce nutrient loadings from current and future land practices. This combination of actions will lead to the achievement of the TMDLs.

Scientific literature and experts in the pertinent fields were consulted and assisted the Delaware DNREC in estimating the nutrient reductions that would be achieved through promulgation of this pollution-control strategy. In addition, the strategy reviews the various costs associated with the recommended actions and, where appropriate, recommends funding mechanisms and implementation schedules while identifying responsible parties. Finally, the strategy reviews the agencies and programs charged with implementing elements of the strategy.

The success of the Inland Bays TAT has prompted the organization of other similar teams throughout the state. In fact, pollution-control strategies are now being formulated by teams representing the watersheds for the Murderkill, Broadkill, Appoquinimink, and Nanticoke rivers.

Center for the Inland Bays Indicators of Estuarine Condition

The Inland Bays Scientific and Technical Advisory Committee (STAC) is a working group that formed the Inland Bays Indicators Subcommittee in 2001. This subcommittee developed a preliminary list of environmental indicators that were selected for several purposes, including the following:

- Communicating the health of the Delaware Inland Bays and its rivers to public audiences
- Evaluating progress in the CIB restoration effort
- Monitoring environmental conditions and responses to restoration efforts
- Providing information needed to establish restoration goals
- Regularly informing and involving the public in the achievement of restoration goals
- Making detailed information and reference data for these indicators available upon request so that others may participate in tracking indicator progress.

These indicators were characterized by their position in a hierarchy, ranging from Level 1 indicators, which are used to measure administrative actions such as issuing permits, to Level 6 indicators, which are indirect or direct measures of ecological or human health (Table 3-5). All of the information captured by this continuum has value for stakeholders and policymakers. Although the indicators toward the higher end of the continuum (Levels 4 through 6) portray a clearer, more direct image of the environmental condition of the Bays, indicators at the lower levels (Levels 1 through 3) are needed to establish a link between the actions taken and the effects observed (CIB, 2002).

Table 3-5. Indicators Recommended by the Scientific and Technical Advisory Committee (CIB, 2002)

Level 1. Actions by EPA/State/Local Regulatory Agencies
a. Septic tank conversions to central sewer system
b. Acquisition of land for parks and open spaces
c. Establishment of Nutrient Management Programs
Level 2. Responses of the Regulated and Non-regulated Community (To be developed later pending specific data collection)
a. Animal waste conversion projects
1. Pelletized fertilizer
2. Fuel
Level 3. Changes in Discharge/Emission Quantities
a. Removal of direct discharges or reductions in load to the Delaware Inland Bays
Level 4. Changes in Ambient Conditions
a. Nutrient pollution
1. Nitrogen
2. Phosphorus
3. Chlorophyll *a*
4. Water clarity
a. Sneaker Index
b. Secchi depth
5. Dissolved oxygen
Level 5. Changes in Uptake and/or Assimilation
a. Shellfish-growing area closures
Level 6. Changes in Health, Ecology, or Other Effects
a. Bay grasses (SAV)
1. Acres
2. Density
3. Changes
4. Biofouling
b. Shellfish – Hard clam landings
c. Fish – Recreational fishing indicator
d. Habitat restoration efforts – SAV
e. Land-use issues
1. Population growth
2. Deforestation
3. Nutrient loading by various land uses

Water and Sediment Quality

The CIB uses the measurements of several water quality parameters (nitrogen, phosphorus, chlorophyll *a*, water clarity, and dissolved oxygen) as indicators of the Bays' pollution levels and as a method for detecting changes in ambient conditions within the Bays. Figure 3-99 compares the Delaware DNREC's water quality goal and the mean value measured during the 1990s for several of these parameters. These data show that all four waterbodies did not achieve the desired goal for DIP concentrations during the 1990s and that the ability to meet other goals varied by waterbody. This analysis indicates that Little Assawoman and Indian River bays are more eutrophic than Rehoboth Bay (CIB, 2002).

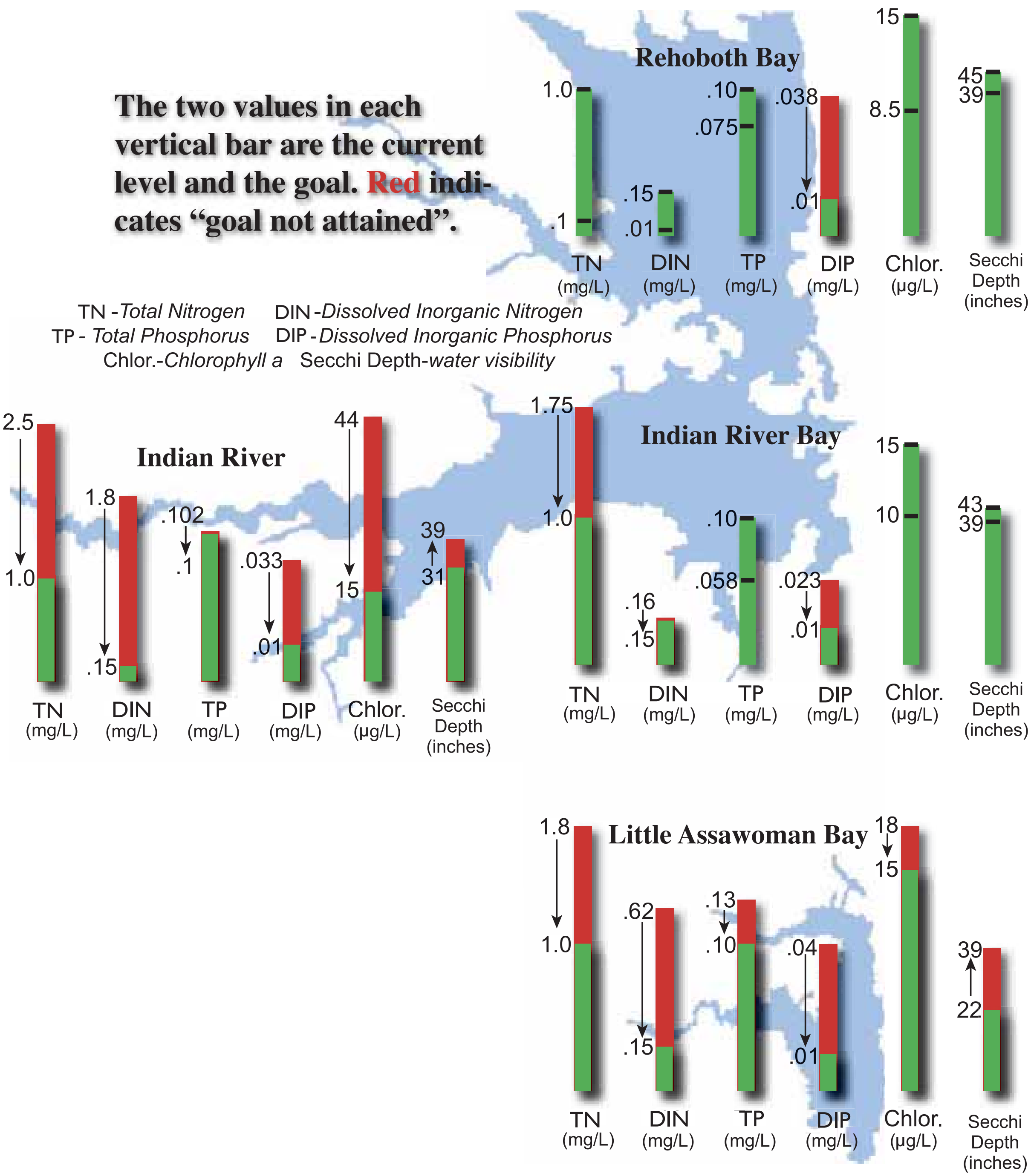

Figure 3-99. Water quality parameters as compared to water quality goals for the Delaware Inland Bays for the 1990s (CIB, 2004)

Nutrient loads entering the Delaware Inland Bays come from non-point, point, and atmospheric sources; however, the majority of the nutrient loadings to the Bays are derived from non-point sources. The Delaware DNREC estimated that almost 4,500 pounds of nitrogen and 163 pounds of phosphorus enter the Bays each day from non-point sources, such as septic systems, stormwater runoff, and agricultural activities (CIB, 2002). Direct discharges from point sources contribute less than 4% of the Bays' nitrogen loading (DNREC, 2000). Between 1990 and 2000, direct discharges of nitrogen increased by 32% to 710 pounds per day. Point-source releases of phosphorus also increased by 6% to 72 pounds per day (CIB, 2004). Nitrogen loading to the Bays from atmospheric deposition is estimated to range up to 25% of the total nitrogen load (DNREC, 2000).

The Sneaker Index has been collected in the Delaware Inland Bays since 2001. This surrogate measure for water clarity is calculated every year as the water depth at which Delaware's current governor can no longer see a pair of white tennis shoes while standing in the Bays. This method has proven to be a good way to raise public awareness about water clarity in the Bays. Submerged sneaker visibility has ranged from a maximum of 51 inches in 2001 to a minimum of 39 inches in 2002. In 2004, the Sneaker Index was 44 inches (CIB, 2004).

The CIB also measures levels of total coliform bacteria in the waters of Rehoboth Bay and Indian River Bay as an indicator of the potential for pathogen-contaminated shellfish to introduce illness to human populations. The DNREC uses coliform bacteria measurements to determine if local shellfish beds are safe for harvesting (CIB, 2004).

Habitat Quality

SAV is considered a good ecological indicator because ambient water quality conditions are generally considered to be good if healthy and reproducing SAV are abundant. The highest concentration and greatest diversity of SAV in the Bays is located in the Bay's freshwater tributaries (CIB, 2002). In the tidal portions of the Bays, eelgrass, a widely valued seagrass, is considered a particularly important indicator of water quality. Historically, the amount of eelgrass declined as nutrient loads to the Bays increased, and by the early 1970s, eelgrass and most of the other SAV species had almost completely died out in the tidal portions of the Bays (CIB, 2004). Currently, the majority of the Bays' estuarine area will not support eelgrass; however, restoration efforts have reintroduced eelgrass to the Indian River Inlet (DNREC, 2000; CIB, 2004). Where water quality is sufficient to support vigorous plant growth, the restored eelgrass beds are reproducing (DNREC, 2000).

The CIB uses changes in the region's land use to help characterize the changing landscape of the Bays. Aerial photography is used to determine the extent of each land-use category in the Inland Bays watershed. In 2002, agriculture, forest, urban, and wetlands were the top four land-use classes in the watershed (Figure 3-100), and overall, the watershed is becoming more urbanized. Between 1992 and 2002, urban lands increased by 8,940 acres, or 34%. During the same time period, forested, agricultural, and barren land acreage declined (CIB, 2004).

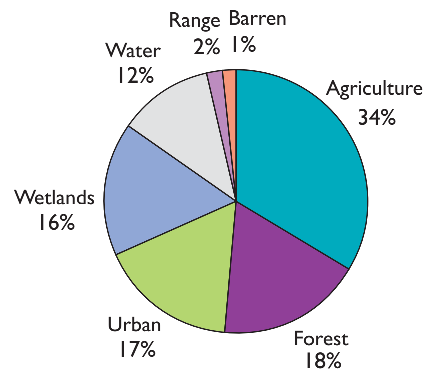

Figure 3-100. Delaware Inland Bays land use in 2002 (CIB, 2004).

Wetlands are an important type of habitat because they filter nutrients, trap sediments, control flooding, and support diverse plant and animal communities. Since 1780, Delaware has lost an estimated 54% of its wetlands (DNREC, 2000), and between 1982 and 1992, 92% of the 297 acres of wetlands lost in the Delaware Inland Bays area were freshwater vegetated wetlands. Agriculture, residential development, and pond construction were the primary causes for this loss (DNREC, 2001). In the Delaware Inland Bays watershed, the rate of wetlands loss has decreased in recent years, with wetlands acreage increasing slightly between 1992 and 2002 (DNREC, 2001; CIB, 2004).

Macroalgae (seaweeds) in the Delaware Inland Bays provide preferred habitat for blue crabs and a variety of fish. The monitoring of macroalgae (seaweeds) habitat in the Bays is important because macroalgae are a sensitive habitat type. As nutrient levels in the water increase, macroalgae density increases, which can result in diminished habitat quality, HABs, low dissolved oxygen levels, and the mortality of fish and benthic organisms. For example, thick mats of macroalgae formed in parts of Indian River Bay in 1998, impacting more than 8 acres and killing an estimated 100,000 clams. Rehoboth Bay has the greatest amount of macroalgae of the Delaware Inland Bays (DNREC, 2001).

Living Resources

Hard clams were chosen as a CIB indicator because they are the most important commercial fishery and one of the most abundant benthic species in the Delaware Inland Bays (CIB, 2004). Hard clams began to colonize extensive areas of Rehoboth and Indian River bays in the 1940s, and the majority of current habitat in the Bays is suitable for hard clams (DNREC, 2001). Hard clam landings peaked in the 1950s and 1960s and have been increasing in recent years, including increases from about 300,000 to more than 3.5 million clams between 1987 and 2003 (DNREC, 2001; CIB, 2004). Overall, the CPUE is stable, and the increase in clam landings is primarily due to a corresponding increase in the amount of effort expended to catch the clams. In recent years, a large percentage of each catch has been composed of clams that are in the smallest size category, which indicates the presence of more young clams in the Bays. The CIB suspects that improved water quality is the likely cause of the increased number of young clams (CIB, 2002; 2004).

Beach-nesting birds and the tiger beetle are considered to be good indicators of the ecological integrity of beach and dune communities in the Bays. The piping plover, least tern, common tern, black skimmer, and American oystercatcher are the five beach-nesting bird species that are tied to the Bays' beach and dune habitat. In the 1960s, these birds resided in the area in good numbers, and small numbers of least terns, common terns, and American oystercatchers continue to nest in the area, although common tern nesting efforts are sporadic. Piping plovers nest annually in the study area; however, the population has declined in recent years and nest productivity is low, primarily due to predation. Black skimmers have not nested in the Delaware Inland Bays since 1990, and the tiger beetle has only been recorded in Cape Henlopen State Park (DNREC, 2000; 2001).

Recreational fishing in the Delaware Inland Bays is a popular pastime, and sea trout, summer flounder, striped bass, and bluefish are commonly caught in the Bays. Recreational fishing trips and landings are seen as good indicators because the success of the recreational fisherman is linked to the ability of the Bays to support viable fish populations. Between 1988 and 2002, the number of fishing trips per year has followed an overall increasing trend. At the same time, the number of fish caught per trip has remained relatively constant. This indicates that the Bays are capable of sustaining the current level of recreational fishing (CIB, 2004).

Environmental Stressors

The centralization of sewers is used as an indicator of progress made by government action to decrease non-point source pollution to the Bays. The watershed's existing 16,000 septic systems discharge nutrients to the groundwater, which transports the nutrients to the Bays and tributaries. It is estimated that almost 1,000 pounds of nitrogen and up to 40 pounds of phosphorus are discharged on a daily basis to the Bays from existing and recently removed septic systems. Since 1993, more than 13,000 septic systems have been replaced with centralized public sewer systems (CIB, 2002; 2004)

The CIB uses population growth as a good indicator of overall environmental stress on the Bays and the watershed. Between 1990 and 2000, the population of Sussex County increased by more than 38%. The area of the county with the greatest population growth was located along the Atlantic Coast portion of the Delaware Inland Bays watershed, where the population increased by 59% (U.S. Census Bureau 1991; 2001). Population growth in this area is expected to continue. By 2020, the population of Sussex County as a whole is expected to reach 180,000 people, and much of this population will be concentrated in the watershed (CIB, 2004).

Current Projects, Accomplishments, and Future Goals

The establishment of the CIB was the culmination of more than 20 years of active public participation and investigation into the decline of the Delaware Inland Bays and remedies for the restoration and preservation of the watershed. The CIB was designed to accomplish several specific goals:

- Sponsor and support educational activities, restoration efforts, and land-acquisition programs that lead to the present and future preservation and enhancement of the watershed
- Build, maintain, and foster the partnership among the general public, private sector, and local, state, and federal governments; this partnership is essential for establishing and sustaining the policy, programs, and political will to preserve and restore the resources of the watershed
- Serve as a forum where Inland Bays watershed issues may be analyzed and considered for the purpose of providing responsible officials and the public with a basis for making informed decisions concerning the management of the resources of the watershed.

Some of the CIB's ongoing projects and major accomplishments in the Delaware Inland Bays' watershed include the following:

- In August of 2004, the CIB began a large-scale scientific research project to determine the ecological health of the area's freshwater wetlands.
- Since 1994, the CIB has awarded more than $1 million to support research, outreach, and demonstration projects. These projects have included evaluating HABs, enhancing the restoration of shellfish stocks, and raising water quality awareness in middle school students.
- More than 100,000 eastern oysters were raised during 2003 by volunteer oyster gardeners as part of the CIB's Shellfish Gardening Project, which was designed as a pilot program to restore oysters to the Inland Bays. These oysters were later planted on a constructed oyster reef in Indian River Bay. Since 2001, the CIB has planted more than 1.5 million oysters on this reef (CIB, 2005).

Conclusion

The Delaware Inland Bays combine to form the smallest of the 28 NEP estuarine systems. These Bays are shallow and poorly flushed by tidal movement, and as such, are especially sensitive to environmental changes. The overall condition of Delaware Inland Bays is rated fair based on the four indices of estuarine condition used by the NCA. The CIB has developed a suite of indicators used to measure a variety of elements—from administrative actions, such as issuing permits, to those elements that are indirect or direct measures of ecological or human health. These indicators should provide a comprehensive picture of the environmental and human components of the system over time.