



This document contains overall and specific condition of the Barataria-Terrebonne National Estuary Program 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

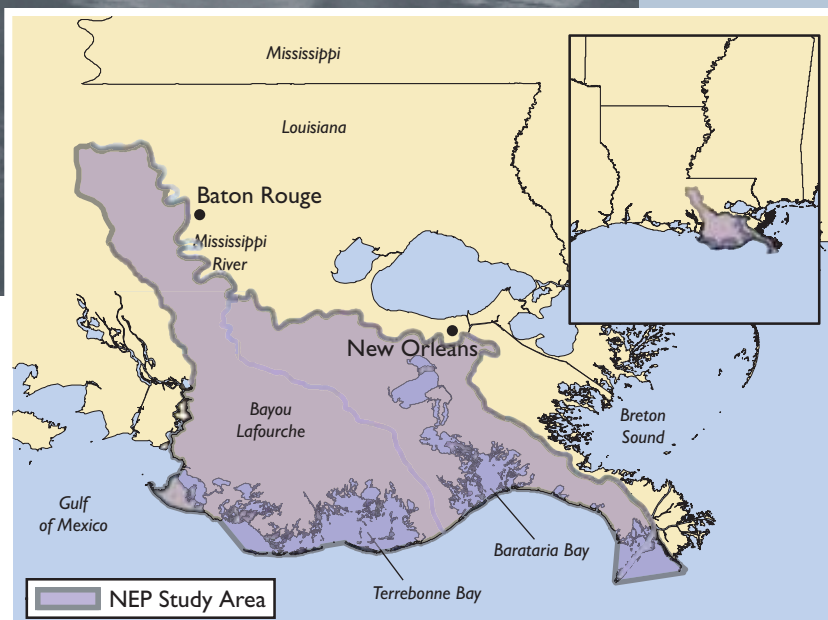
Chapter 5: Gulf of Mexico National Estuary Program Coastal Condition, Barataria-Terrebonne National Estuary Program

June 2007

Barataria-Terrebonne National Estuary Program



www.btnep.org



Background

The study area of the Barataria-Terrebonne National Estuary Program (BTNEP) is located between the Mississippi and Atchafalaya rivers in southern Louisiana and covers approximately 6,500 mi² (Caffey and Breaux, 2000). Bayou Lafourche separates this area into two basins: Barataria Basin to the east and Terrebonne Basin to the west. The integration of salt water and fresh water begins offshore, where water, sediment, nutrients, and pollutants from the Mississippi River mix with the salt water of the Gulf of Mexico. Approximately 735 species of birds, finfish, shellfish, reptiles,

amphibians, and mammals spend all or part of their life cycle in the estuary, with several of these species categorized as either threatened or endangered (BTNEP, 2005).

Significant industrial and municipal effluents enter the Mississippi River between Baton Rouge and New Orleans, contributing to nutrient and contaminant loadings in the estuary system. Several natural and man-made waterways transect the estuary system, including the Gulf Intracoastal Waterway and the Barataria Waterway. Open water and wetlands are the predominant land-use classifications in the region and have been

increasing in area since 1956 (Figure 5-43). More than three quarters of the BTNEP study area (3.2 million acres) is classified as open water or wetlands, leaving approximately one million acres for urban and agricultural uses (Moore and Rivers, 1996).

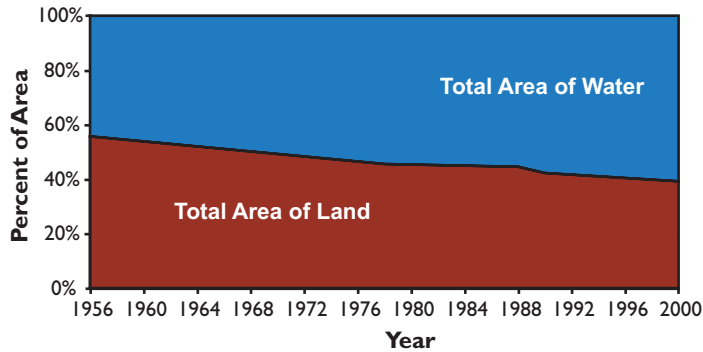


Figure 5-43. Change in the total area of water in the BTNEP estuarine area between 1956 and 2000 (BTNEP, 2002).

Environmental Concerns

The priority issues affecting the BTNEP study area include habitat loss, hydrological modification, reduced sediment flows (reduction in sediment inputs), eutrophication, pathogen contamination from untreated sewage and stormwater discharges, toxic substances, and declines in living resources (Battelle, 2003). Sediment loss (depletion), in conjunction with the subsidence (sinking) of marshes, is the most significant problem in the Barataria-Terrebonne Estuarine Complex. The construction of levees to protect human communities from floods has eliminated vital inputs of fresh water and sediments from reaching the estuaries; these inputs are needed to keep the marshes above water. Sea-level rise, erosion, canal dredging, and the construction of navigation and oil-exploration channels further contribute to this problem. The impacts of hydrological modifications in the BTNEP study area are numerous; man-made canals create paths for waters of higher salinity to intrude inland, destroying freshwater plants and forcing animals either to adapt or to relocate. Each year, about 15 mi² of wetlands in the study area are lost, and a half-acre of the Complex's coastal wetlands turns to open water every 15 minutes (BTNEP, 2002; Focazio, 2006b). Because this coastal marsh habitat provides a considerable buffer from the flooding,

storms, and hurricanes that threaten the Louisiana coastline, this loss of habitat is detrimental to the health of fish and wildlife populations and to human development. Many species that depend on habitat in the Barataria-Terrebonne Estuarine Complex are either threatened or endangered, including the American bald eagle, brown pelican, piping plover, least tern, Louisiana black bear, and American alligator.

Population Pressures

The population of the 16 NOAA-designated coastal parishes coincident with the BTNEP study area increased by 28% during a 40-year period, from 1.3 million people in 1960 to 1.6 million people in 2000 (Figure 5-44) (U.S. Census Bureau, 1991; 2001). This rate of population growth for the BTNEP study area was the lowest growth rate of any of the Gulf Coast NEPs and constitutes less than one-fourth of the population growth rate of 133.3% for the collective NEP-coincident coastal counties of the Gulf Coast region. In addition, the population density of the BTNEP study area in 2000 was 184 persons/mi², the second-lowest density of the Gulf Coast NEPs and about one-third less than the population density of the region's collective NEP-coincident counties (287 persons/mi²) (U.S. Census Bureau, 2001). Development and population pressures are moderate in this study area, which serves as a major center for commercial fishing and shellfish, the petrochemical industry, and recreational activities.

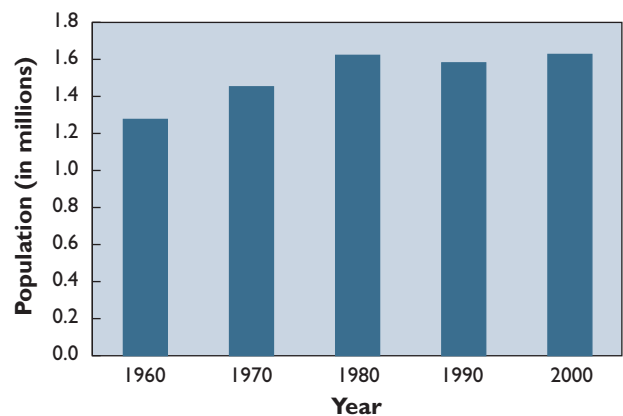


Figure 5-44. Population of NOAA-designated counties of the BTNEP study area, 1960–2000 (U.S. Census Bureau, 1991; 2001).

NCA Indices of Estuarine Condition—Barataria-Terrebonne Estuarine Complex

The overall condition of the Barataria-Terrebonne Estuarine Complex is rated fair based on the four indices of estuarine condition used by the NCA (Figure 5-45). The water quality, sediment quality, and benthic indices are rated fair, and the fish tissue contaminants index is rated poor. Figure 5-46 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 collected by the State of Louisiana and the NCA from 25 stations sampled in the BTNEP 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.

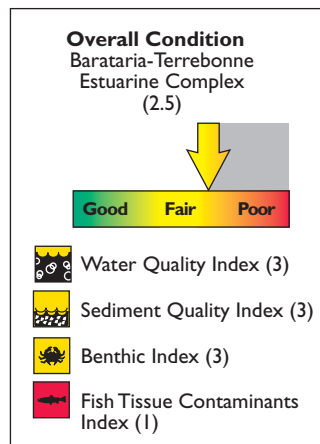


Figure 5-45. The overall condition of the BTNEP estuarine area is fair (U.S. EPA/NCA).

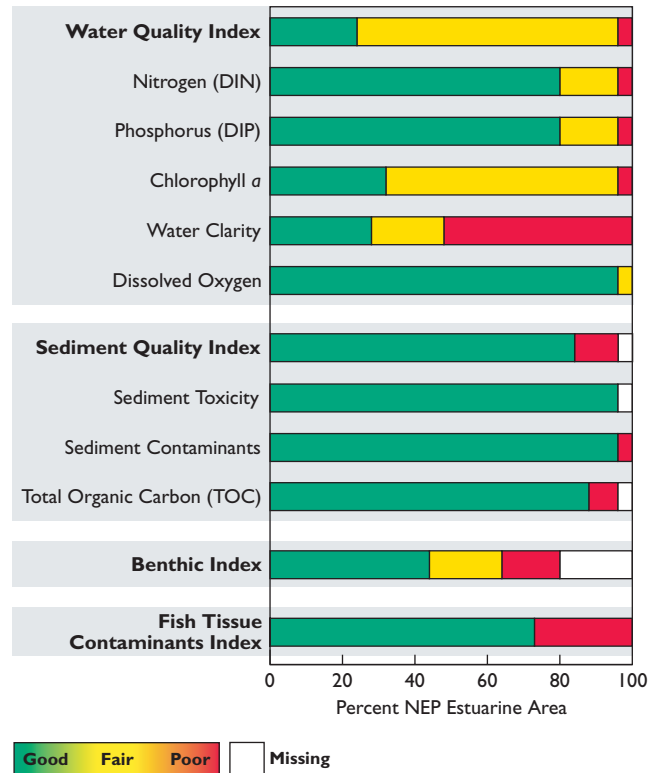


Figure 5-46. Percentage of NEP estuarine area achieving each rating for all indices and component indicators — Barataria-Terrebonne Estuarine Complex (U.S. EPA/NCA).



Water Quality Index

Based on NCA survey results, the water quality index for the Barataria-Terrebonne Estuarine Complex is rated fair (Figure 5-47). This water quality index was developed using NCA data on five component indicators: DIN, DIP, chlorophyll *a*, water clarity, and dissolved oxygen. In NOAA's Estuarine Eutrophication Survey, Barataria Bay was listed as having high to hypereutrophic chlorophyll *a* concentrations and high DIN and DIP concentrations (NOAA, 1997). In the same report, the Terrebonne and Timbalier bays were listed as having high chlorophyll *a* and DIP concentrations and moderate DIN concentrations.

Dissolved Nitrogen and Phosphorus | DIN and DIP concentrations in the BTNEP estuarine area are rated good. For both component indicators, 4% of the estuarine area was rated poor, 16% of the area was rated fair, and 80% of the area was rated good.

Chlorophyll *a* | Chlorophyll *a* concentrations in the Barataria-Terrebonne Estuarine Complex are rated fair. Although only 4% of the estuarine area was rated poor for chlorophyll *a* concentrations, 64% of the area was rated fair, and 32% of the area was rated good.

Water Clarity | Water clarity in the BTNEP estuarine area is rated poor. Expectations for water clarity are low due to high river flow and naturally high turbidity for these estuaries. Water clarity was rated poor at a sampling site if light penetration at 1 meter was less than 5% of surface illumination. Fifty-two percent of the estuarine area was rated poor for water clarity, 20% of the area was rated fair, and 28% of the area was rated good.

Dissolved Oxygen | Dissolved oxygen conditions in the BTNEP estuarine area are rated good. NCA estimates show that none of the estuarine area was rated poor for this component indicator, 4% of the estuarine area was rated fair, and 96% of the area was rated good.

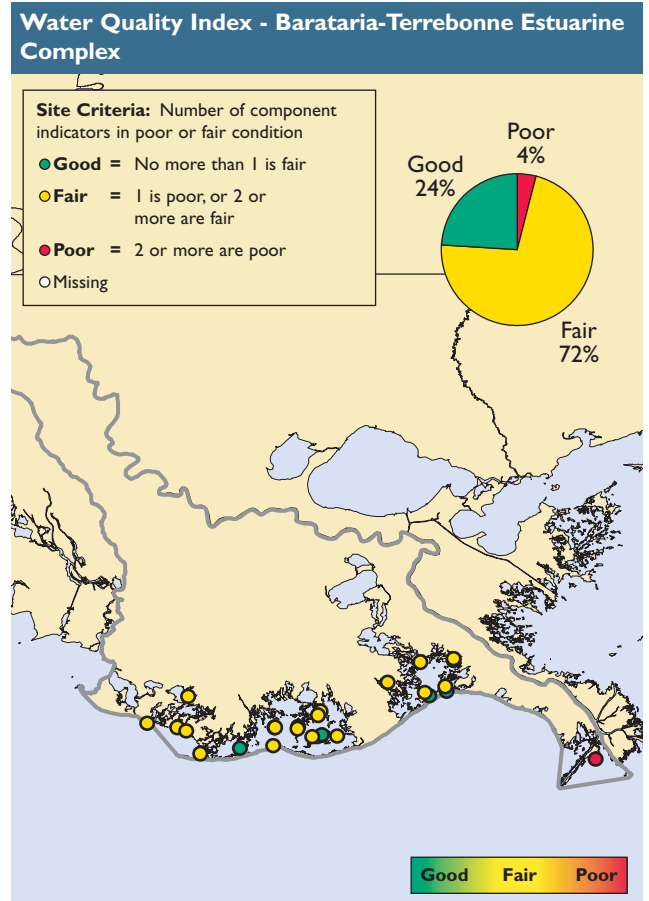


Figure 5-47. Water quality index data for the Barataria-Terrebonne Estuarine Complex, 2000–2001 (U.S. EPA/NCA).



© BTNEP



Sediment Quality Index

The sediment quality index for the Barataria-Terrebonne Estuarine Complex is rated fair. This index was developed using NCA data on three component indicators: sediment toxicity, sediment contaminants, and sediment TOC. Although all three component indicators received good ratings for the Barataria-Terrebonne Estuarine Complex, the index is rated fair because greater than 5% of the estuarine area was rated poor for sediment quality (Figure 5-48).

Sediment Toxicity | Sediment toxicity is rated good for the BTNEP estuarine area because none of the area was rated poor for this component indicator.

Sediment Contaminants | Only 4% of the BTNEP estuarine area was rated poor for sediment contaminant concentrations; therefore, the Complex is rated good for this component indicator.

Total Organic Carbon | Sediment TOC is rated good for the BTNEP estuarine area. Eighty-eight percent of the estuarine area was rated good for this component indicator, and only 8% of the area was rated poor. NCA data on TOC concentrations were unavailable for 4% of the BTNEP estuarine area.

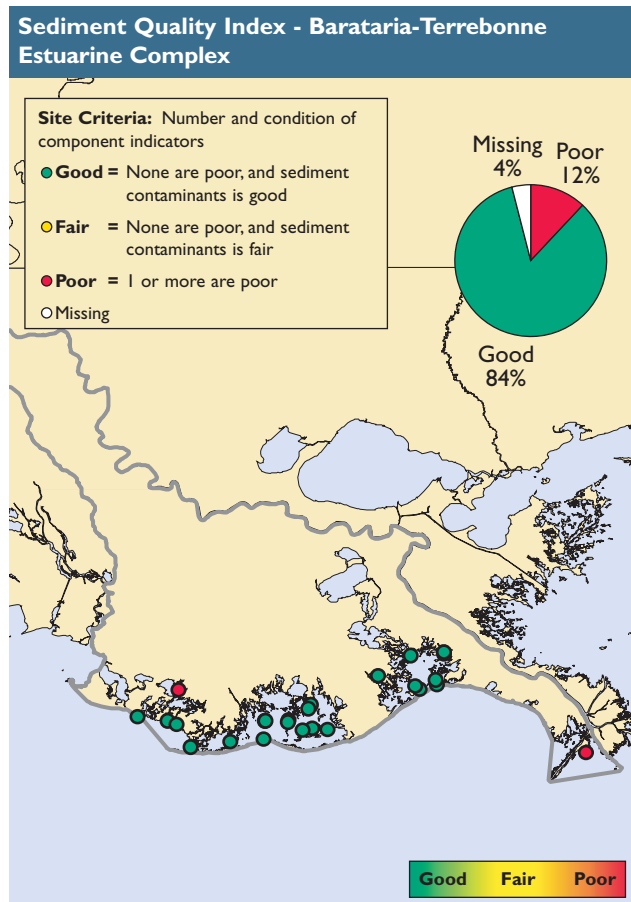


Figure 5-48. Sediment quality index data for the Barataria-Terrebonne Estuarine Complex, 2000–2001 (U.S. EPA/NCA).



Eroding marsh peninsula between Bayous Perot and Rigolettes, Barataria Basin (Dr. Terry McTigue, NOAA, NOS, ORR).



Benthic Index

Based on NCA survey data and the Gulf Coast Benthic Index, the condition of benthic invertebrate communities in the Barataria-Terrebonne Estuarine Complex is rated fair. Benthic condition index estimates indicate that 16% of the area had degraded benthic resources, and NCA data on benthic condition were unavailable for 20% of the BTNEP estuarine area (Figure 5-49).



Fish Tissue Contaminants Index

The fish tissue contaminants index for the Barataria-Terrebonne Estuarine Complex is rated poor. Figure 5-50 shows that 27% of all stations sampled where fish were caught exceeded the EPA Advisory Guidance values used in this assessment and were rated poor.

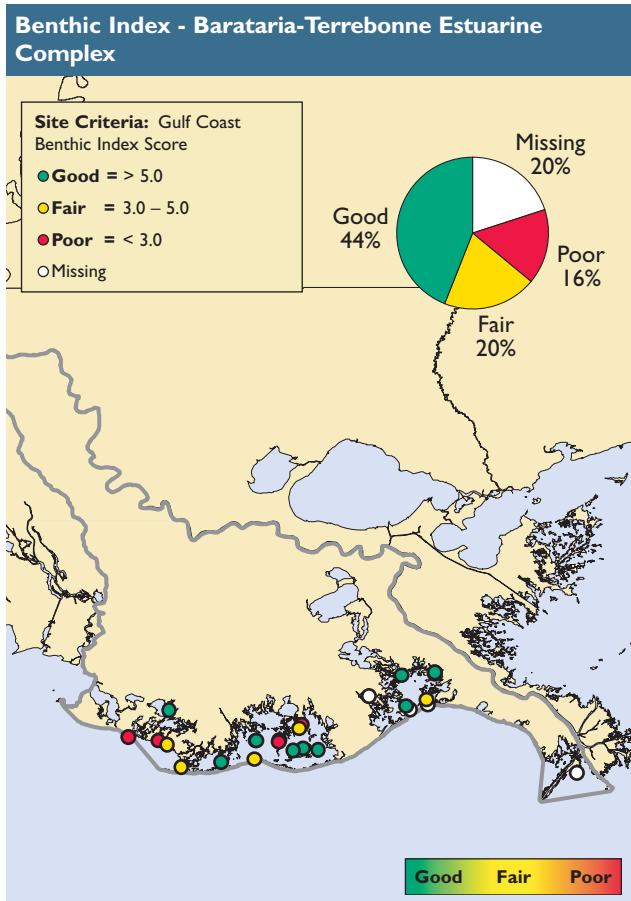


Figure 5-49. Benthic index data for the Barataria-Terrebonne Estuarine Complex, 2000–2001 (U.S. EPA/NCA).

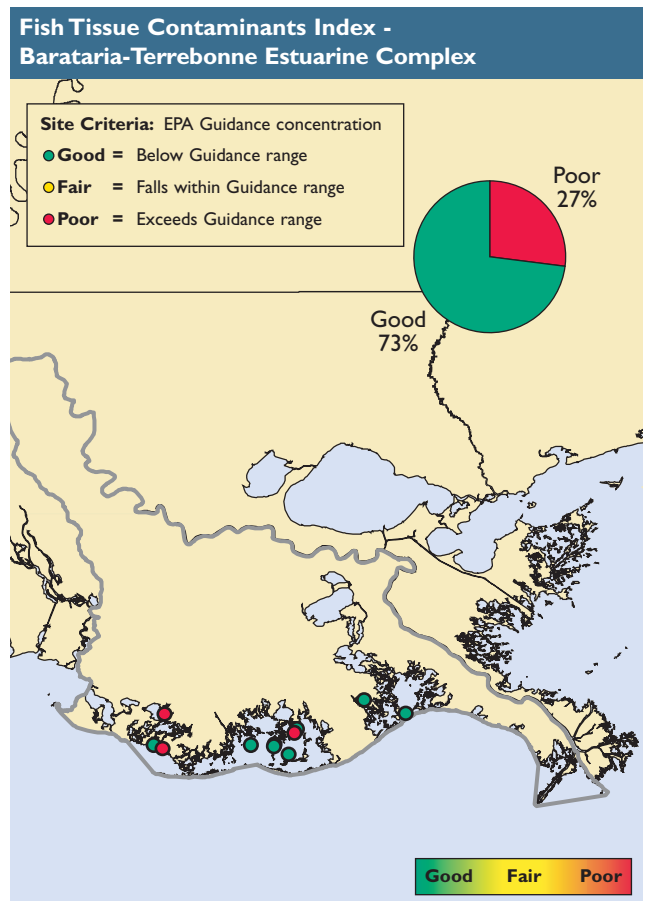


Figure 5-50. Fish tissue contaminants index data for the Barataria-Terrebonne Estuarine Complex, 2000–2001 (U.S. EPA/NCA).



HIGHLIGHT

Maritime Forest Ridge and Marsh Restoration at Port Fourchon, Louisiana

The Maritime Forest Ridge and Marsh Restoration (MFRMR) at Port Fourchon, LA, is a vital migratory bird habitat-restoration project that is intended to serve as an example for similar coastal ridge restoration work and to provide useful scientific data for future coastal restoration projects. To achieve these goals, the BTNEP has offered its assistance in many capacities. For example, the BTNEP and its Migratory Bird Action Plan Team worked as liaisons between the bird-watching community and the Greater Lafourche Port Commission to encourage the project. The BTNEP has also served as a liaison between the Greater Lafourche Port Commission and various federal and state agencies during the permitting process.

The project’s vision includes plans to restore a historic maritime forest ridge that has eroded and subsided since the 1950s; vegetate the ridge with woody plant species that provide excellent habitat for migratory birds; and eventually add boardwalks, trails, and an interpretive center.

More than 60 acres each of salt marsh and maritime forest ridge have been created. The construction phase of this project involved grading the land to transform a linear mound into a sloped ridge habitat, with a elevation gradient ranging from marsh elevation at 1.6 feet above sea level in the tidal zone to 8 feet above sea level at the peak of the ridge. Future phases of the MFRMR project development include plans to extend the project area linearly by several thousand feet over the next few years. Funding for the initial conceptualization and construction phase came from several sources, including \$100,000 of direct project support from the Louisiana Department of Natural Resources (LDNR); a \$100,000 grant from the Shell Oil Company; and \$45,000 in project support from various project partners (Personal communication, Blanchard, 2005). The partners for this phase of the project listed below.

Partners for Restoring the Historic Maritime Forest Ridge

Barataria-Terrebonne National Estuary Program	Barataria-Terrebonne Estuary Foundation
Greater LaFourche Port Commission	Gulf of Mexico Foundation
Gulf of Mexico Program	The Louisiana Nature Conservancy
Louisiana Department of Natural Resources	Natural Resource Conservation Service
National Oceanic and Atmospheric Administration	Orleans Audubon
Shell Oil Company	Terrebonne Bird Club

Now that this phase of the MFRMR project is nearing completion, the BTNEP is working closely with another group of partners (e.g., NOAA, the Gulf of Mexico Partners) to vegetate and monitor the MFRMR project area. The newly formed BTNEP Volunteer Program has hosted three volunteer planting events at the MFRMR project area. These events involved more than 150 volunteers who planted nearly 11,000 plants (Personal communication, Blanchard, 2005). Because of the logistics involved in transporting people and plants to the MFRMR site, project partners were needed to ferry materials and volunteers to the site by boat, as well as to provide lunches, drinks, and T-shirts to the volunteers. Partners who contributed to the volunteer efforts on the ridge include the BTNEP, Barataria-Terrebonne Estuary Foundation, Greater Lafourche Port Commission, USDA NRCS Plant Materials Center, ES&H Environmental Safety Consulting, Inc., Louisiana Department of Wildlife and Fisheries (LDWF), and Lafourche Parish Coastal Zone Management (CZM). Groups that volunteered their efforts for the different planting events on the ridge include the Lockport Middle School, Bayou Lafourche Marine Institute, Boy Scouts of America, Shell Oil Company Summer Interns, and University of New

Orleans PIES Camp students. The efforts of these volunteers are important because the vegetation helps to stabilize the shoreline and slopes of this restored habitat against hurricanes. A future large-scale volunteer effort is also planned, where volunteers will plant woody trees and shrubs on the crown of the ridge.

The BTNEP recognizes that any efforts to restore the rapidly vanishing coastal lands of south Louisiana not only require sound scientific footing, but also the full support and involvement of the citizens who live, work, and play in the lands and waterways of coastal Louisiana. By engaging residents through volunteerism, the BTNEP not only forges new community partnerships and fosters public support for coastal restoration, but it also puts a face on the efforts to save this landscape by allowing citizen volunteers to work shoulder-to-shoulder with the biologists, geologists, engineers, and other scientists who work on the immense problems faced by the coastal Louisiana region. Additional information about the MFRMR and other restoration projects in the BTNEP study area is available by contacting the BTNEP or by visiting the program's Web site at: <http://www.btnep.org>.



BTNEP volunteers plant marsh plants to restore vegetation to the ridge site (BTNEP).

Barataria-Terrebonne National Estuary Program Indicators of Estuarine Condition

Water and Sediment Quality

The following water and sediment quality indicators are used by the BTNEP to assess estuarine condition:

- Eutrophic conditions and nutrient levels
- Hypoxia (i.e., area of dead zone)
- Pathogens (e.g., fecal coliform at swimming and shellfish-harvesting areas)
- Levels of toxic substances in water and sediment
- Oyster bed closures.

Eutrophic conditions and nutrient levels in the Barataria-Terrebonne Estuarine Complex are monitored at a series of 15 sites within the region, and trend studies show that all sites have been classified as having either medium or high nutrient conditions under EPA/NOAA's guidelines for evaluating nutrient concentrations. Measurements of chlorophyll *a* levels during the past 20 years provide strong evidence that eutrophication is occurring in this system because many sites show an increase in chlorophyll *a* concentrations over time (Rabalais et al., 1995).

The extent of mid-summer hypoxia (dissolved oxygen levels below 2.0 mg/L) in bottom waters often affects up to 8,000 mi² of the Louisiana and Texas continental shelf and has been associated with large fish kills in the Barataria-Terrebonne Estuarine Complex (Battelle, 2003). Hypoxic events are good indicators for monitoring nutrient pollution loads associated with wastewater treatment and agricultural runoff. Over time, nearshore bottom dissolved oxygen concentrations have typically varied from 4 to 8 mg/L in the Complex, with sampling results indicating that persistent hypoxia tends to occur from mid-May to mid-September (Rabalais et al., 1995). Overall, data on dissolved oxygen in bottom waters are limited, but research has shown that hypoxic conditions (area of dead zone) in the Complex are most likely to occur in poorly flushed areas, deeper channels, and areas receiving organic loading from sewage or other wastewater outfalls.

Pathogens from sewage pollution in the Complex are associated with illnesses in humans who swim in contaminated waters or who eat contaminated oysters. To help reduce the consumption of pathogen-contaminated oysters, the Louisiana Department of Health and Hospitals Molluscan Shellfish Program monitors fecal coliform bacteria levels in surface waters on a monthly basis in the oyster bed areas of the Barataria-Terrebonne Estuarine Complex (Battelle, 2003). Fecal coliform in the Complex comes from a variety of sources, including poorly functioning on-site septic systems, pasture land runoff, and waste from marsh animals, nutria, and waterfowl.

The presence of toxic substances in BTNEP waters can be measured by testing the surface water and sediment or by testing the fish that feed in these waters. Atrazine is a concern in the surface waters of the BTNEP study area and is measured through the direct testing of these waters. Concentrations of atrazine in the surface waters of the Upper Terrebonne basin have exceeded the EPA maximum contaminant level (MCL) of 3 ppb for drinking water (Battelle, 2003). Copper, lead, arsenic, chromium, and cadmium concentrations have declined since the 1980s, whereas mercury levels have remained fairly constant. Although contamination is fairly widespread in scope, the areas of most concern are on the periphery of the Complex, such as Oyster Bayou and Tiger Pass. Other contaminants have been detected in fish or shellfish, which accumulate toxic substances from the food they eat and from the surrounding water and sediments. Toxics detected in fish and crustaceans of the Barataria-Terrebonne Estuarine Complex include pesticides, metals, volatile organic compounds (VOCs), and PCBs (Rabalais et al., 1995).

Habitat Quality

The LDNR, NRCS, and other programs collectively monitor the number of acres of salt marshes and oligohaline (low salinity) habitat that have been restored in the BTNEP study area since 1986; however, the data needed to make actual assessments of habitat quality and functionality on a Complex-wide basis do not yet exist (Battelle, 2003). A large number of data sets specific to individual restoration projects are available, but these data sets can not be readily combined to

report on status and trends for habitat restoration across the entire Barataria-Terrebonne Estuarine Complex. The Louisiana Coastwide Reference Monitoring System has been proposed to help make large restoration efforts a possibility. This effort requires collecting estuary-wide information, including land/water ratios; vegetation composition and cover; frequency of flooding; salinity; and sedimentation and erosion.

Living Resources

The following list of indicators is used by the BTNEP to measure changes in living resources:

- Endangered or threatened species (e.g., abundance and nesting success of brown pelican and American bald eagle)
- Waterfowl (e.g., abundance of mottled duck)
- Density of alligator nests
- Invasive species (e.g., acres of marsh damaged by invasive nutria)
- Number of fish consumption advisories and mercury levels in fish tissue.

Both the bald eagle and the brown pelican populations show signs of recovery following near extinction in the area due to reproductive failures associated with pesticide exposures. Today, Louisiana's brown pelicans occur throughout their historic range, and this reintroduction program is a success story in Louisiana's conservation efforts. The number of successful nests in the Barataria-Terrebonne Estuarine Complex has risen from 675 in 1990 to more than 6,500 in 2001 (BTNEP, 2002). Bald eagles are monitored for the number of successful nests, active nests, and fledglings produced (Battelle, 2003).

Status and trend reports indicate that 35 species of waterfowl have been reported in the Complex, which is of international significance as a wintering ground for migratory waterfowl species. Drought, marsh loss, commercial development, and predation all affect the Complex's duck population on an annual basis and can provide information about degradation or loss of habitat (Condrey et al., 1995). The Audubon Society's Christmas bird count is another indicator used by the BTNEP, and monitoring the abundance of shorebird species has been suggested as a priority indicator need.

The density of alligator nests in the Barataria-Terrebonne Estuarine Complex is directly indicative of population size and indirectly indicative of the abundance of fresh marsh habitats. The LDWF has been conducting an annual nest survey since 1991 to establish quotas, measure abundance, and assess productivity. The number of alligator nests is often affected by drought conditions and salinity levels (Battelle, 2003).

The growth of invasive species and the resultant damage they cause is another priority concern of the BTNEP. Among the most serious invasive species found in the Barataria-Terrebonne Estuarine Complex are water hyacinth, water spangle, Eurasian watermilfoil, *Hydrilla*, alligatorweed, Chinese tallow tree, and zebra mussel. The LDWF spends about \$1.5 million annually on non-native aquatic plant control (BTNEP, 2002) and also collects data on the damage caused by nutria herbivory using periodic aerial surveys over brackish marsh areas (Figure 5-51). Nutria are a concern because they damage agricultural crops and irrigation dikes and consume the roots of marsh plants, thereby accelerating land loss. Damage and control costs for zebra mussels is also a good indicator of the magnitude of this invasive species problem.

The number of fish consumption advisories issued in the Barataria-Terrebonne Estuarine Complex is an indicator of the overall human health risk associated with toxic contaminants in seafood. Fish sampling is conducted by the Louisiana Department of Environmental Quality near facilities that have experienced chemical spills or demonstrated poor waste management practices. There are no waterbody-specific fish consumption advisories within the BTNEP study area; however, Louisiana has issued a statewide mercury advisory for king mackerel in all coastal waters, which includes BTNEP estuarine waters (U.S. EPA, 2005a).

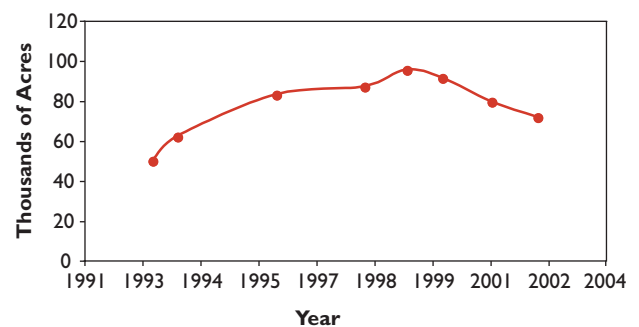


Figure 5-51. Estimated acreage damaged by nutria herbivory (BTNEP, 2002).

Environmental Stressors

In coastal Louisiana, more than 160,000 registered recreational vessels share the water with thousands of commercial vessels. Dumping sewage overboard can contaminate surface waters, sediments, and fishery stock with pathogens and was the suspected cause of at least two outbreaks of illness due to the consumption of contaminated oysters in the 1990s. To reduce instances of overboard dumping, many marinas offer boat pump-out stations for the collection of sewage from recreational and commercial vehicles. The cumulative number of boat pump-out stations in the Barataria-Terrebonne Estuarine Complex is another indicator tracked by the LDWF, and the number of stations has risen considerably at both commercial and recreational marinas since the early 1990s. The availability of these stations is critical to reducing overboard discharge of sewage to swimming and oyster-growing areas in the region and to controlling outbreaks of gastroenteritis that have been associated with Norwalk viruses and site closures since 1982 (Battelle, 2003).

Current Projects, Accomplishments, and Future Goals

The BTNEP has produced videos, posters, brochures, booklets, and presentations and has made them available to teachers and other educators through their Web site. Materials are available for kindergarten through 12th grade and feature a range of media, including coloring books, videos, slides, and posters. The BTNEP has also created Action Plan Teams to implement its CCMP, *The Estuary Compact: A Public Promise to Work Together to Save the Barataria and Terrebonne Basins* (Moore and Rivers, 1996), in each of five different areas: Water Quality, Habitat, Living Resources, Cultural Heritage, and Economic Development. The BTNEP is actively implementing a large habitat-restoration program, which includes numerous projects to rebuild wetlands, ridges, barrier islands, and other habitats, such as the following:

- **Point Aux Chenes stormwater redirection** – This pilot-scale restoration project is diverting stormwater discharge into the Point Aux Chenes

wetlands. These discharges are expected to reduce salinity, stimulate the growth of emergent vegetation, and encourage sedimentation in the wetland.

- **SAV research** – The BTNEP is working to assess the habitat value and to develop new methods for restoring various SAV throughout the Complex.
- **Invasive species workshops** – These workshops educate the public about which invasive species have infiltrated the BTNEP study area, how these species impact the region's ecosystem, and what steps government agencies and individuals need to take to combat these invasive species.

Conclusion

The data from the NCA suggest that the overall condition of the BTNEP study area is rated fair and that water quality is rated fair. Water quality indicators used by the BTNEP show that eutrophication is a continuing concern across the Complex and will require ongoing monitoring of nutrient and dissolved oxygen concentrations. In addition, the monitoring of chlorophyll *a* levels helps provide the more conclusive data needed to support future analyses of eutrophic conditions. Although the NCA's dissolved oxygen measurements show that none of the Complex's bottom water areas exhibited hypoxia, these measurements were made during a relatively short time period and provide only a snapshot of the summer dissolved oxygen concentrations. The BTNEP's partner agencies conduct monitoring on a year-round basis rather than during a single summer-sampling period, as is used by the NCA. The more intensive year-round monitoring allows researchers to evaluate more subtle changes and trends that may only be discernable when comparing data over a more extensive period of time. For example, NCA sampling may not have occurred during one of the periods of hypoxia that often occur in the Complex during late summer; however, these hypoxic events are sometimes detected when more frequent monitoring intervals are used by the BTNEP. The BTNEP's indicators also demonstrate that pathogens are an issue within the estuarine system. Sediment quality tests have provided limited information, but indicate contamination around discharge areas in the estuary basin.