



This document contains overall and specific condition of the Buzzards Bay 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 3: Northeast National Estuary Program Coastal Condition, Buzzards Bay National Estuary Program

June 2007

Buzzards Bay National Estuary Program



www.buzzardsbay.org



Background

Buzzards Bay is a moderately large estuary located between the western part of Cape Cod and the Elizabeth Islands in Massachusetts. The Bay is approximately 269 mi² in size and 28 miles long, averages about 8 miles wide, and has an average depth of 36 feet (NOAA, 1985; BB NEP, 2005). The coastline stretches over 280 miles and includes inner harbors, the bayward-facing portions of the Elizabeth Islands, the portions of the Cape Cod Canal that are in the watershed, and 11 miles of public beaches that lure thousands of

tourists from Massachusetts and neighboring states (BB NEP, 1992). In addition, the world-renowned Woods Hole Oceanographic Institution and the Marine Biological Laboratory are located near a passage to Buzzards Bay.

Buzzards Bay exchanges water with Rhode Island Sound to the southwest, with Vineyard Sound through the Elizabeth Islands, and with Cape Cod Bay via the Cape Cod Canal at the northern end. A number of tributaries provide freshwater flows to the Bay, including the Agawam, Wankinco, Wewantic, Mattapoissett, Acushnet,

Paskamanset, and Westport rivers. Buzzards Bay is rich in shellfish resources and has a \$4 million annual shellfish industry, representing 25% of Massachusetts' annual fisheries total. Shellfish species harvested in Buzzards Bay include soft shell clams, quahogs, scallops, oysters, and lobster. Shellfish-harvesting is a popular pastime for many tourists, and more than 500 commercial permits and 12,800 recreational permits are sold annually (BB NEP, 2005).

The Buzzards Bay coastline features a wealth of habitats, including salt marshes, tidal flats, barrier beaches, eelgrass beds, and subtidal zones. The Buzzards Bay National Estuary Program (BB NEP) is an advisory and planning unit of the Massachusetts CZM and receives funding from EPA as part of the NEP.

Environmental Concerns

The most significant threats to Buzzards Bay and its watershed include toxic contamination of the ecosystem, closures of shellfish beds due to bacterial contamination, non-point source pollution, habitat loss, and nitrogen loading and resulting coastal eutrophication. In general, environmental degradation from pollutant inputs is localized in the more than 30 embayments along the periphery of Buzzards Bay, whereas water and habitat quality in the central Bay are very good (CBB, 2003).

Population Pressures

The population of the 4 NOAA-designated coastal counties (Barnstable, Bristol, Dukes, and Plymouth) coincident with the BB NEP study area increased by 72% during a 40-year period, from 0.72 million people in 1960 to about 1.24 million people in 2000 (Figure 3-34) (U.S. Census Bureau, 1991; 2001). This rate of population growth for the BB NEP study area is almost three 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 the BB NEP's 4 coastal counties was 726 persons/mi², slightly lower than the population density of 1,055 persons/mi² for the collective NEP-coincident coastal counties of the Northeast Coast region (U.S. Census Bureau, 2001).

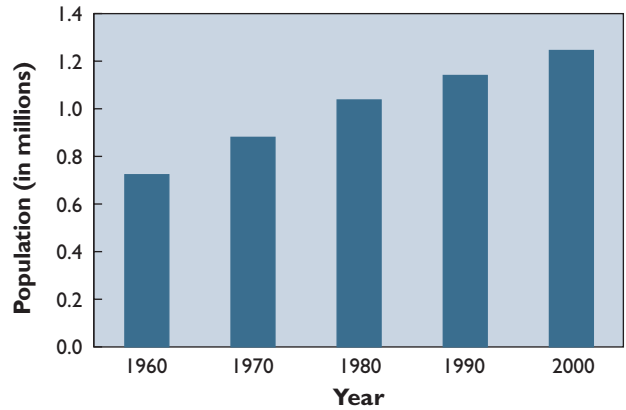


Figure 3-34. Population of NOAA-designated coastal counties of the BB NEP study area, 1960–2000 (U.S. Census Bureau, 1991; 2001).

NCA Indices of Estuarine Condition—Buzzards Bay

The overall condition of Buzzards Bay is rated fair based on the four indices of estuarine condition used by the NCA (Figure 3-35). The water quality index for Buzzards Bay is rated good, the sediment quality index is rated fair, the benthic index is rated good to fair, and the fish tissue contaminants index is rated poor. Figure 3-36 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 sites sampled in the BB NEP 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.

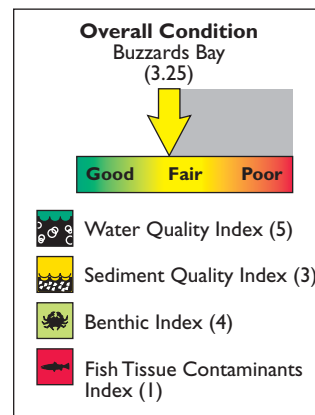


Figure 3-35. The overall condition of the BB NEP estuarine area is fair (U.S. EPA/NCA).

Buzzards Bay National Estuary Program

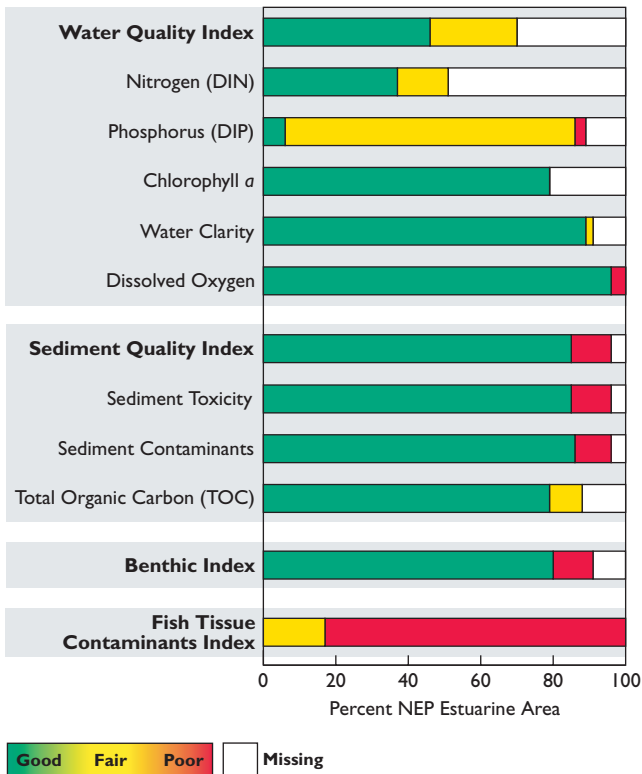


Figure 3-36. Percentage of estuarine area achieving each rating for all indices and component indicators — Buzzards Bay (U.S. EPA/NCA).



Water Quality Index

Based on the NCA survey results, the water quality index for Buzzards Bay is rated good, although water quality data were unavailable for nearly a third of the estuary (Figure 3-37). This index was developed using NCA data on five component indicators: DIN, DIP, chlorophyll *a*, water clarity, and dissolved oxygen. Fourteen percent of Buzzards Bay had moderate DIN values, but DIN measurements were not available for almost half of the Bay. Nearly the entire Bay displayed moderately high DIP levels—not an unusual finding in Northeast Coast estuarine waters. Chlorophyll *a* concentrations were uniformly low for Buzzards Bay. Water clarity was satisfactory everywhere in Buzzards Bay, and there was only one incidence of oxygen depletion.

Dissolved Nitrogen and Phosphorus | The DIN concentrations rating for Buzzards Bay is good, with 37% of the estuarine area rated good and 14% of the area rated fair for this component indicator. None of the estuarine area was rated poor for DIN; however, DIN concentrations were not assessed in 49% of the BB NEP estuarine area. DIP concentrations in Buzzards Bay were rated fair, with 6% of the estuarine area rated good for DIP and 80% of the area rated fair. Three percent of the estuarine area was rated poor for this component indicator, and NCA data on DIP concentrations were unavailable for 11% of the BB NEP estuarine area.

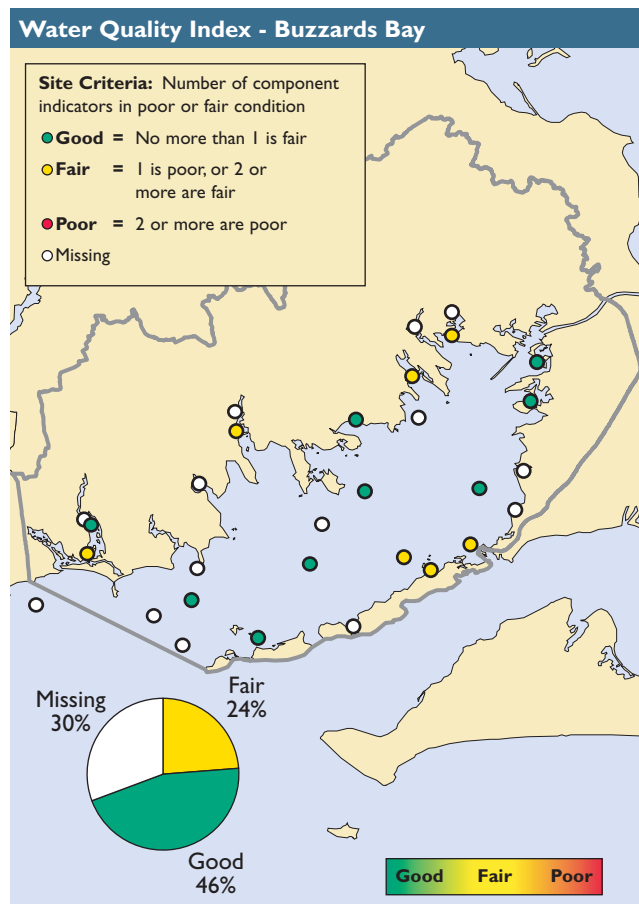


Figure 3-37. Water quality index data for Buzzards Bay, 2000–2001 (U.S. EPA/NCA).

Chlorophyll *a* | Buzzards Bay is rated good for chlorophyll *a* concentrations. Seventy-nine percent of the estuarine area was rated good for chlorophyll *a* concentrations, and none of the area was rated poor or fair; however, NCA data on chlorophyll *a* concentrations were unavailable for 21% of the BB NEP estuarine area.

Water Clarity | Buzzards Bay is rated good for water clarity. Water clarity was rated poor at a sampling station if light penetration at 1 meter was less than 10% of surface illumination. Eighty-nine percent of the Buzzards Bay estuarine area was rated good for water clarity, 2% was rated fair, and none of the area was rated poor. NCA data on water clarity were unavailable for 9% of the BB NEP estuarine area.

Dissolved Oxygen | Buzzards Bay is rated good for dissolved oxygen concentrations. Ninety-six percent of the estuarine area was rated good for dissolved oxygen concentrations, and only 4% of the estuarine area was rated poor.



Sediment Quality Index

The sediment quality index for Buzzards Bay is rated fair, with 11% of the estuarine area rated poor and less than 1% of the area rated fair for sediment quality condition (Figure 3-38). There were relatively few indications of sediment contamination in Buzzards Bay. Sediments proved to be toxic to amphipods at four sites (11% by area), including one contaminated site, and there were no indications of high TOC concentrations.

Sediment Toxicity | Buzzards Bay is rated poor for sediment toxicity. Eleven percent of the Buzzards Bay estuarine area was rated poor for sediment toxicity, and NCA data on this component indicator were unavailable for 4% of the BB NEP estuarine area.

Sediment Contaminants | Buzzards Bay is rated fair for sediment contaminant concentrations. Approximately 10% of the estuarine area was rated poor for this component indicator, and 86% of the area was rated good.

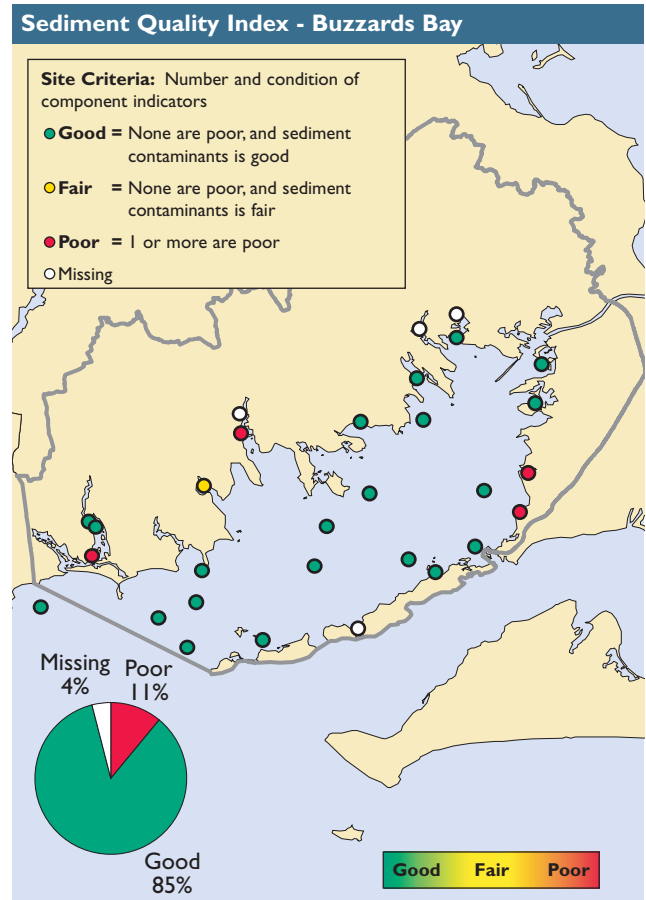


Figure 3-38. Sediment quality index data for Buzzards Bay, 2000–2001 (U.S. EPA/NCA).

Total Organic Carbon | Buzzards Bay is rated good for sediment TOC. Seventy-nine percent of the estuarine area was rated good for TOC concentrations, 9% of the area was rated fair, and none of the area was rated poor. NCA data on TOC concentrations were unavailable for 12% of the BB NEP estuarine area.



Benthic Index

The benthic condition rating for Buzzards Bay is good to fair, as evaluated by the Virginian Province Benthic Index (Figure 3-39). Eighty percent of the estuarine area was rated good for benthic condition, and 11% of the area was rated poor. Only one Buzzards Bay site designated as impaired for benthic condition also had an impaired rating for sediment contamination.

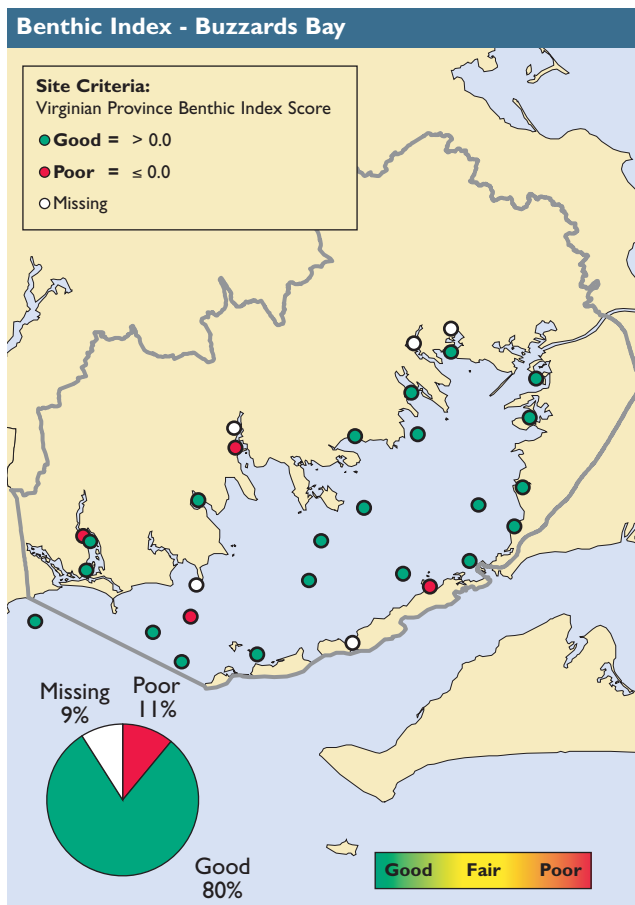


Figure 3-39. Benthic index data for Buzzards Bay, 2000–2001 (U.S. EPA/NCA).



Fish Tissue Contaminants Index

Based on the NCA survey data collected in 2000–2001, the fish tissue contaminants index for Buzzards Bay is rated poor. Eighty-three percent of fish samples analyzed exceeded EPA Advisory Guidance values for at least one contaminant and were rated poor for this index (Figure 3-40).

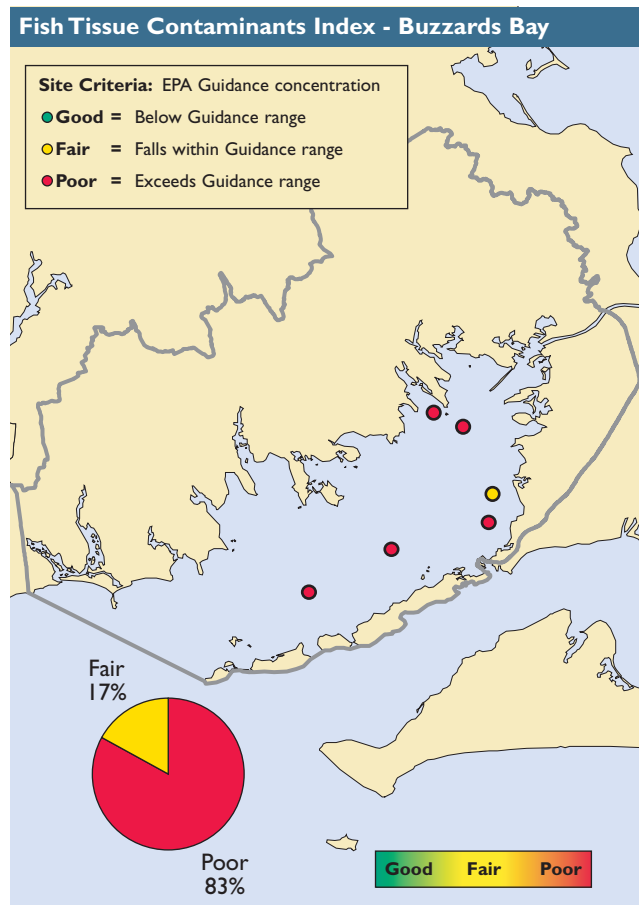


Figure 3-40. Fish tissue contaminants index data for Buzzards Bay, 2000–2001 (U.S. EPA/NCA).

Buzzards Bay National Estuary Program Indicators of Estuarine Condition

To assess environmental results for improving habitat, living resources, and water quality, the BB NEP relies on direct measures of water quality and acres of shellfish-harvesting closures. For other environmental assessments, the BB NEP relies on documentation of human behavioral impacts (e.g., number of gallons pumped at boat pump-out facilities). The following specific indicator measures are used by the BB NEP to evaluate environmental conditions in Buzzards Bay.

Water and Sediment Quality

In order to encompass the many different water quality measurements monitored by the BB NEP, the program created a eutrophication index, the Buzzards Bay Health Index, to score each cove and harbor on a scale of 0 to 100. The BB NEP uses this index as a compilation of five individual indicators: dissolved oxygen, DIN, total organic nitrogen, chlorophyll *a*, and Secchi disk depth. Dissolved oxygen measures used by the program are an average of the lowest 20% of readings collected by a citizens' water quality monitoring group, The Coalition for Buzzards Bay (CBB). Each embayment (harbors and coves) within the Buzzards Bay watershed has its own suite of nutrient sources and potential management solutions. Embayments with scores less than 35 are labeled eutrophic, whereas those with scores of 35 to 65 are designated as fair. Those embayments with scores greater than 65 are labeled good to excellent. Water quality measurements are collected by CBB, with roughly 10 to 15 samples collected at 2 to 4 sites at each of 30 different Buzzards Bay embayments (Costa et al., 1999). Central Buzzards Bay, which exhibits excellent water quality, has scored close to 100 on the Buzzards Bay Health Index, whereas the Nasketucket River, Agawam River, Eel Pond, and Westport River exhibited the lowest scores of any areas within the watershed between 1997 and 2003. In contrast, Quissett Harbor, Aucoot Cove, and Penikese Island received excellent scores (between 90 and 100) for their water quality (CBB, 2003).

The number of shellfish-harvesting closures is a good indicator of bacterial contamination problems in Buzzards Bay. Shellfish-harvesting closures reached their peak in 1990, when more than 16,500 acres were closed to harvesting due to bacteria contamination. In 2003, almost 41% (roughly 9,300 acres) of the 23,000 acres of Buzzards Bay's most productive nearshore shellfishing areas were closed to harvesting (CBB, 2003). The Massachusetts Division of Marine Fisheries (DMF) and the MDPH test surface waters or shellfish to track bacteria contamination, and the BB NEP creates a thumbnail sketch of the change in number of acres of shellfish beds closed over time, using data collected on July 1 of each year.

Habitat Quality

The widespread distribution of eelgrass in Buzzards Bay and its sensitivity to pollution make it an ideal indicator species for changes in water quality and for tracking overall ecosystem health. For these reasons, the BB NEP funded a study of eelgrass distribution in Buzzards Bay (Figure 3-41) that was based on historical aerial photographs, field surveys, and sediment cores. The ratio of existing eelgrass habitat area to potential eelgrass habitat area has been evaluated, and although there is considerable variability in response among the embayments, a clear trend overall of declining eelgrass coverage with increased nitrogen loadings was observed. Additionally, the decline in the catch of bay scallops in Waquoit Bay (Cape Cod Lagoon) has coincided with declines in eelgrass (BB NEP, 2005).

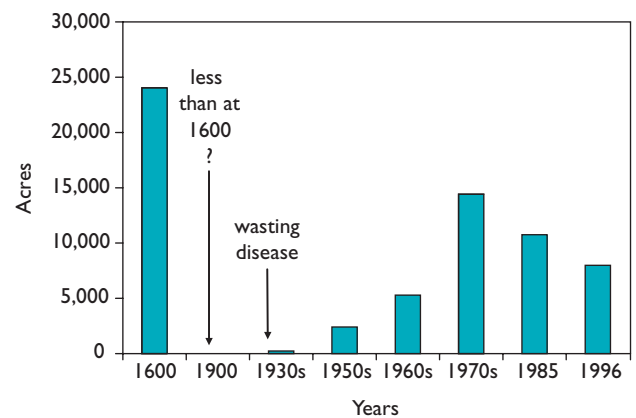


Figure 3-41. Eelgrass abundance measured by the BB NEP (BB NEP, 2005).

HIGHLIGHT

Protecting the Endangered Roseate Tern

Roseate terns (*Sterna dougallii*) are a federally endangered species recognized under the Migratory Bird Treaty Act. These birds breed in North America on the coasts and islands of the Atlantic Ocean, winter along the northern coast of South America, and nest in association with other tern species, such as the common tern. Although the population of roseate terns in northeastern North America has increased slowly since 1987, more than 90% of this species' population is concentrated in five predator-controlled sites in the United States. The largest North American colony of this species is found in Buzzards Bay, with half of North America's breeding pairs found on two of the Bay's tiny islands (Bird Island and Ram Island) (see bar graph). Roseate terns returned to Ram Island in the 1990s after a 20-year absence, and the island now hosts more breeding pairs than Bird Island.

The Massachusetts Division of Fisheries and Wildlife (MassWildlife) reports on the numbers of roseate tern nests by individual island. The New Bedford Superfund trustees have awarded more than a million dollars to protect and preserve tern habitat on Bird Island through beach replenishment and restoration, while Penikese Island, located near the southern tip of the Elizabeth Island chain, is the focus of new efforts to expand roseate tern habitat onto additional islands in the estuary.

A century ago, roseate terns were a favorite target of hunters selling feathers to the millinery industry and egg collectors. Human exploitation (trapping for

market) of the roseate tern on its South American wintering grounds, where no public protection is offered, is currently the main limiting factor for the species. Predation at breeding colonies by gulls, crows, marsh hawks, short-eared owls, and other wildlife poses a constant threat and seems to be the main reason for the selection of islands and inlets as nesting sites. Other concerns include competition for nest sites from other species (e.g., larger gulls) and the reproductive effects (e.g., thinning of eggshells, premature breakage of eggs, reduced reproductive success) of toxic chemicals that pass through the food chain. In addition, a shortage of males may limit the productivity of roseate terns at some colonies in northeastern North America, where 20% of breeding females do not find mates.

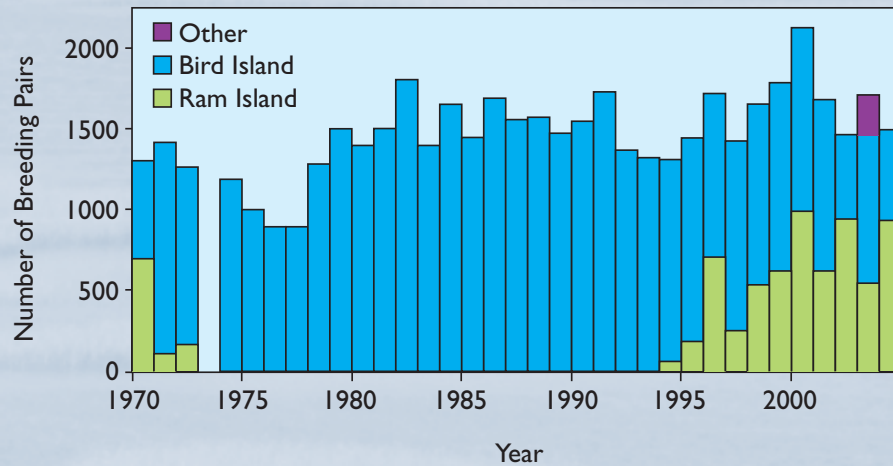


Roseate tern (Ted DEo n. <http://www.geocities.com/teddeon509/gallery.html>)

As a result of an oil spill in April 2003 that severely affected Ram Island, “hazing” operations using cannons and lights were put into effect to discourage the arrival and nesting of birds to the island until the oil was cleaned up. Some breeding pairs delayed nesting on Ram Island because of the cleanup activities, whereas other pairs nested on Penikese Island. One account of the impact included an estimate that at least 350 roseate tern chicks had been lost because of the delayed nesting; this number represents roughly 10% of annual chick

production for the species. The impact to roseate terns and other species and habitat from the spill is being addressed through the Natural Resource Damage Assessment (NRDA) process. Separate from the NRDA process, a \$10 million criminal settlement was finalized in November 2004.

Additional information about roseate terns in Buzzards Bay is available at <http://www.buzzardsbay.org/roseates.htm>.



Buzzards Bay roseate tern breeding pairs (Data courtesy of Brad Blodget and Carolyn Mostello, former and current State Ornithologist, MassWildlife).

Acres of forest cover serve as a useful indicator of the ability of the Buzzards Bay system to support healthy ecosystems. Forest growth along streambanks is critical for maintaining freshwater quality, filtering nitrogen and sediments, stabilizing erodible soils, and providing fish and wildlife habitat. A target threshold suggested for forest cover is approximately 70%, based on observations in similar coastal watersheds. Forest cover in the Bay watershed has increased since 1850 as pastures and farm fields were abandoned; however, about 23,000 acres (13%) of forests have been lost since 1973, primarily due to residential and commercial development. In 2003, more than half the Buzzards Bay watershed was covered by forests (CBB, 2003).

The BB NEP also uses the acreage of protected open space in the watershed as a useful indicator of potential habitat area. Open space areas that are critical for protection include coastal and freshwater wetlands, river and stream corridors, and watersheds to nitrogen-sensitive embayments and public drinking water supplies. More than 50,000 acres (or 20% of the total land area) in the Buzzards Bay watershed, from Fall River to Falmouth, is permanently protected open space (BB NEP, 2005).

Although it is not currently assessed, the number of anadromous (migratory) fish runs restored in the Bay will be used as an indicator by the BB NEP in the future. Populations of anadromous fish species such as the alewife and blueback herring have declined dramatically in Buzzards Bay during the past century. Not only are these two species part of an important commercial fishery, they are also an important forage food for other fish, whales, and coastal birds, such as the roseate tern (BBP NEP, 1999).

Living Resources

River herring populations are an important natural resource in Buzzards Bay, and their numbers have declined over time to a fraction of their historic levels. Currently, only the Mattapoissett and Sippican rivers are surveyed for river herring on a routine basis using electronic counters. In an effort to help restore the river herring population, the BB NEP has assisted with the removal of fish passage obstructions and the construction or repair of fish ladders (BB NEP, 2005). In addition, alewives and blueback herring populations have

decreased dramatically in the Bay, whereas populations of shad, sturgeon, and Atlantic salmon have been eliminated (CBB, 2003).

The bay scallop population in Buzzards Bay is under close study by the Massachusetts DMF because pollution and declines in eelgrass bed coverage have hindered scallop colonization. Scallop populations in the Bay have declined dramatically during the past 30 years (CBB, 2003); therefore, the BB NEP is supporting physical restoration efforts to stimulate eelgrass and scallop recovery in areas of the Bay with good water clarity.

Environmental Stressors

Measurements of human activity (e.g., population growth rates, number of marine vessels in the Bay) can also be used as indicators of estuarine condition. Like most coastal areas, the Buzzards Bay watershed continues to lose open land to development. The 2000 U.S. Census confirmed that the Buzzards Bay watershed remains a fast-growing area. Although the City of New Bedford experienced a population decline, population growth averaged 8.8% during the last decade among other towns in the watershed (U.S. Census Bureau, 2001). More than 236,000 people live in the Buzzard Bay watershed, and nearly 20,000 marine vessels pass through the Bay annually (Martin et al., 1996).

Current Projects, Accomplishments, and Future Goals

Some of the major environmental accomplishments of the BB NEP include the following:

- The number of acres of shellfish beds closed because of bacterial contamination has declined nearly 25% since the *Buzzards Bay Comprehensive Conservation and Management Plan* was completed in 1991 (BB NEP, 1992; BBP NEP, 1999; CBB, 2003).
- The BB NEP assisted in the construction of a test center to evaluate and promote advanced septic treatment solutions for use in watersheds where limits have been established on the discharge of nitrogen, and the designation of Buzzards Bay as a No-Discharge Area has helped to reduce bacteria inputs to the Bay from vessel traffic.

- In 1989, the BB NEP gave \$35,000 in grants to the City of New Bedford and the Barnstable County Health Department to upgrade their laboratories and to pay for the analysis of extra samples collected by the Massachusetts DMF. DMF staff also trained local officials to assist with the sanitary surveys in their communities (BBP NEP, 1999).
- CBB has created a nature trail for local schools, organized beach cleanups, and promoted bilingual stenciling of storm drains that discharge directly into Buzzards Bay.
- The BB NEP has developed two atlases to assist with wetland-restoration efforts. One atlas identifies 172 tidally restricted salt marshes and will be helpful in efforts to remove tidal restrictions and to improve and restore wetland health (Costa et al., 2002). The development of this atlas has already led to the restoration of 10 of these sites (Personal communication, Costa, 2006). The second atlas identifies filled and impaired wetlands on public and conservation lands and is used to identify wetland-restoration sites to meet mitigation requirements from other programs (Rockwell et al., 2004; Rockwell and Williams, 2005).
- The BB NEP recently completed an \$85,000 grant entitled *Managing Nitrogen Sensitive Embayments through Land Conservation* for work in the Slocums River and Onset Bay (Wareham) watersheds. The Massachusetts Environmental Trust provided \$29,000 in matching funds to this project.
- Nitrogen-analysis work begun in the mid-1990s by the BB NEP for West Falmouth Harbor led to the construction of a tertiary WWTP in 2005 that is designed to reduce nitrogen inputs to the harbor (BB NEP, 2005).
- New Bedford assessed its open space needs and incorporated a Greenway Plan for the city.
- Ongoing cleanup of New Bedford Harbor sediments represents one of the most promising restoration efforts in the Buzzards Bay watershed.
- The BB NEP Web site was used by state and federal agencies to disseminate information about the impacts of the 2003 oil spill in the Bay and about ongoing cleanup activities. The BB NEP also conducted an analysis of the volume of oil spilled during the accident, and this analysis contributed to the 98,000-gallon estimate adopted by state and federal agencies. The BB NEP continues to assist federal agencies in the NRDA efforts related to the 2003 oil spill and in the identification of potential restoration sites (BB NEP, 2005).
- In 2003, the BB NEP completed an atlas of stormwater discharges and stormwater drainage networks discharging to Buzzards Bay (Costa and Bisette, 2003). This atlas has helped municipalities achieve the mapping requirements for Phase II National Pollution Discharge Elimination System (NPDES) stormwater permits and identify problem discharges that contribute to shellfish bed closures. In partnership with a vocational high school and a non-profit composed of municipal officials, this effort expanded inland during 2005 to map all known discharges to wetlands located in the watershed. An updated stormwater atlas will be published in 2006 (BB NEP, 2005).
- Since 1992, the BB NEP has awarded millions of dollars in federal and state funds through their ongoing municipal mini-grant program to assist area municipalities and non-profits with the implementation of recommendations contained in the BB NEP CCMP. These mini-grants have helped leverage other funds. The BB NEP also assists municipalities in developing successful grant applications to other programs (BB NEP, 2005).

Conclusion

The Buzzards Bay estuarine area is rated fair for overall condition based on the NCA's four indices of estuarine condition. The BB NEP findings show that the four most significant environmental challenges facing the Buzzards Bay estuarine area are toxic contamination and oil spills, nitrogen loading and the effects of eutrophication, natural habitat loss, and bacterial contamination of Bay waters and shellfish-harvesting areas. The Buzzards Bay Health Index is used to evaluate water quality changes, with a scoring system based on oxygen depletion, excess nutrient levels, transparency, and algal blooms. Some of the key habitat indicators used to monitor environmental changes in Buzzards

Bay include acres of eelgrass bed coverage, forest coverage, and the amount of protected open space. In addition, populations of several wildlife species are used as primary indicators of environmental quality, including the river herring and bay scallop. Populations of these species have decreased due to human activities in the watershed. New Bedford Harbor remains one area of special concern for the BB NEP, but substantial progress has been made in the remediation of contaminated sediments. Buzzards Bay has avoided many estuary-wide problems that plague other watersheds around the country, but land-use practices and the growing local population have impacted natural resources in the 32 small embayments in the Buzzards Bay area.



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