
**REVIEW OF STATE AND FEDERAL MARINE PROTECTION
OF THE ECOLOGICAL RESOURCES
OF NANTUCKET SOUND**



**CENTER FOR COASTAL STUDIES
JANUARY 28, 2003**



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**COVER: SOCIALIZING GRAY SEALS (*HALICHOERUS GRYPUS*) ON A CAPE COD BEACH
PHOTO – OWEN NICHOLS, CCS © 2002**

i. Executive Summary

On October 22, 2002, the Center for Coastal Studies (CCS) was contacted by U.S. Representative William Delahunt (MA-10th District) to provide a review of the existing literature pertaining to the biological resources and environmental protection of the waters of Nantucket Sound. In response to this request, CCS has prepared the following document, detailing the biological significance of the species contained therein, as well as a review of pertinent existing and proposed state and federal protection of these waters. The purpose of this review is to gather existing facts regarding the biodiversity and ecological significance of the region and to highlight areas where additional study may be necessary.

Nantucket Sound contains significant ecological, commercial and recreational resources that have been at the heart of several past nominations for enhanced environmental protection and conservation policies within the region. The biological diversity and unique habitat areas of Nantucket Sound led the Commonwealth of Massachusetts to nominate the area for National Marine Sanctuary status in a 1980. The resources of Nantucket Sound were again deemed worthy of consideration for National Marine Sanctuary status by the resource evaluation committee appointed by the National Marine Sanctuary Program in 1983. These resources are equally significant today. Nantucket Sound is a recognized habitat for many state and federally protected species, including roseate terns, piping plovers, leatherback sea turtles, loggerhead sea turtles, Kemp's Ridley sea turtles, and grey seals.

Our review uncovered several localized studies and species-specific biological surveys throughout published literature, unpublished reports and on-going data collection. While of intrinsic value, these studies have not addressed management mechanisms for integrating and coordinating environmental management for resident or migratory species that rely on the Sound. As a result, much of the available information considers only pieces of an ecological whole, resulting in fragmented understanding of dynamic ecosystem processes and species interactions.

Current management focuses upon ecologically arbitrary divisions of a contiguous coastal resource resulting from overlapping state and federal jurisdiction of these waters. Past state and federal nominations to protect these waters as a national marine sanctuary suggest the inherent ecological, commercial, and recreational values of Nantucket Sound. CCS recommends a multi-disciplinary taskforce study of the Nantucket Sound biogeographical region to assess the existing habitat, species utilizations, and commercial and recreational values of the area in order to facilitate consistent environmental management and conservation of protected marine resources. The existing data collected by state, federal, and private agencies will greatly facilitate such a study by providing a base for designing a broad study of the entire system. Development of comprehensive ecosystem management begins with thorough, scientific evaluation of the resources and processes of the entire system designed to support a unified environmental policy for the continued use, study and protection of this valuable coastal resource.

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1.0 Introduction

The Center for Coastal Studies (CCS) is a non-profit research, education and conservation organization with over 25 years of service on a variety of coastal and marine issues. On October 22, 2002, CCS received a written request from U.S. Representative William Delahunt to provide a review of the existing literature pertaining to the biological resources and environmental protection of the waters of Nantucket Sound. Of particular interest in this regard were past attempts to gain marine sanctuary status for the waters of Nantucket Sound, as well as an overview of present ecological significance of the region.

The initial efforts to classify the waters of Nantucket Sound as a marine sanctuary were undertaken by the state Legislature with the passage in 1970 of the Massachusetts Ocean Sanctuaries Act. This legislative action authorized the creation of five ocean sanctuaries, with Nantucket Sound explicitly included within the Cape and Islands Ocean Sanctuary. Subsequent jurisdictional disputes culminated with federal jurisdiction over the central waters of Nantucket Sound, and a “hole-in-the-doughnut” scenario of unprotected federal waters nearly completely surrounded by protected state waters. To resolve the dilemma of dual management, the Commonwealth in 1980 advanced a proposal to designate Nantucket Sound as a National Marine Sanctuary. In 1983, Nantucket Sound was placed on the Site Evaluation List for National Marine Sanctuary status by a resource evaluation committee appointed by the National Marine Sanctuary Program. To date, however, Nantucket Sound remains a multi-jurisdictional region, with state jurisdiction over the state ocean sanctuary waters and federal jurisdiction over the central, “hole-in-the-doughnut” portion of the Sound.

CCS has completed a preliminary review of available literature pertaining to the marine resources of Nantucket Sound. This review serves to document published and unpublished data regarding marine and coastal resources of the area, and to

highlight areas where further and/or more intensive studies may be needed to fully evaluate the current status of this system. In preparing this review, it has become apparent that the jurisdictional boundaries that regulate management and research activities are incompatible with a holistic, ecosystem-based approach to managing the resources within and relying upon the dynamic and non-fragmented ecosystem of the Nantucket Sound region.

The Commonwealth has demonstrated a will to protect and conserve the resources of Nantucket Sound since its initial attempt to classify those waters as an ocean sanctuary. In 1980, the Commonwealth presented a compelling argument for federal recognition of those resources by nominating Nantucket Sound for National Marine Sanctuary status. The National Marine Sanctuary Program's site selection committee acknowledged and confirmed the Commonwealth's interest in protecting Nantucket Sound in its 1983 Final Report.

The Nantucket Sound region is unquestionably a healthy and productive ecosystem. However, the complexities of the jurisdictional arrangement have needlessly complicated scientists' and managers' ability to fully assess the ecological significance of the region and many of its marine species. Therefore, CCS concurs with the Commonwealth's 1980 recommendation that Nantucket Sound be managed as a single ecological unit so as to ensure that the entire region receive the level of environmental protection afforded to those portions of the Sound within the Cape and Islands Ocean Sanctuary.

2.0 Geography of Nantucket Sound

Nantucket Sound includes 163 square nautical miles of water and seabed between Cape Cod, Vineyard Sound, the islands of Martha's Vineyard and Nantucket extending seaward beyond Monomoy and Nantucket Islands. An approximate latitudinal boundary spans from 41° 12' N to 41° 40' N, while the longitudinal boundary spans approximately from 69° 55' W to 70° 36' W.

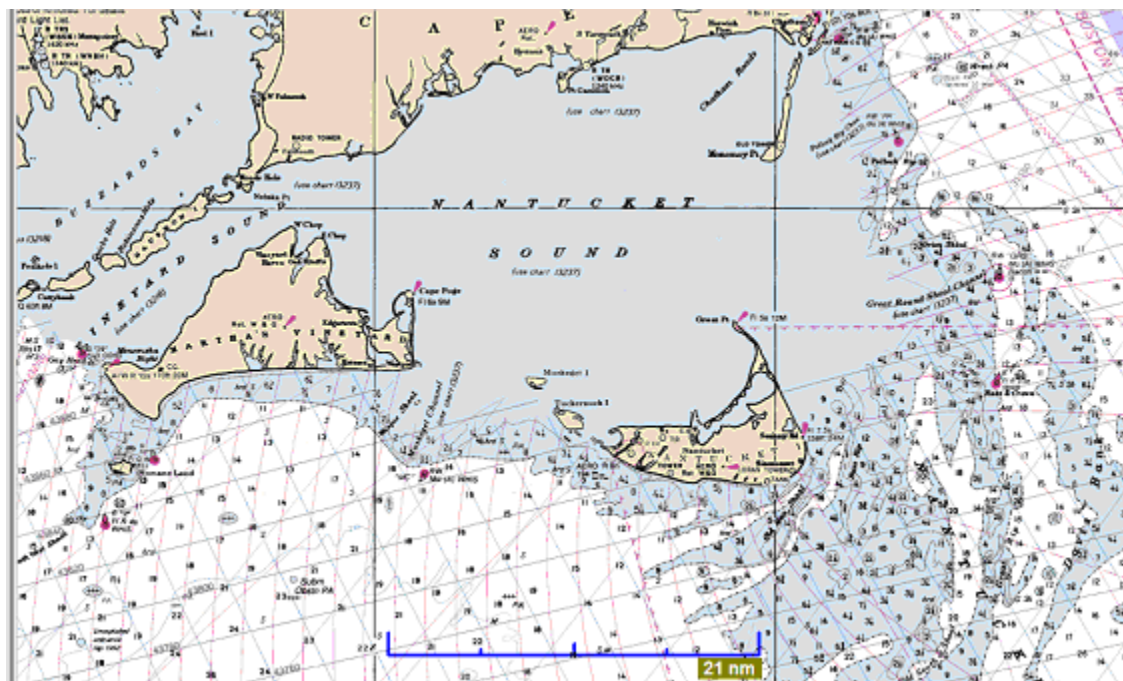


Figure 1 -- Nantucket Sound (from NOAA Chart 13200)

Nantucket Sound borders shallow shoal waters of the Atlantic Shelf to the east, deeper Atlantic Shelf waters to the south, Vineyard Sound to the west and Cape Cod to the North. The submerged land within 3 miles from mean low water is within the boundaries of the Cape and Islands Ocean Sanctuary. Waquoit Bay National Estuarine Research Reserve (NERR) borders Nantucket Sound on the northern shore. Monomoy National Wildlife Refuge comprises the northeastern terrestrial boundary of the Sound.

Nantucket Sound is situated at a confluence of the cold Labrador currents and the warm Gulf Stream. This creates a unique coastal habitat representing the southern range for Northern Atlantic species and the northern range for Mid-Atlantic species. The transitional ecology of the region is consistent with both the biogeographic location and the transitional geology of the glacially deposited sediments that form Nantucket Sound. Nantucket Sound is characterized by an extreme richness of biological diversity, containing habitats that range from open sea to salt marshes. The complex networks of habitat utilization and species competition within the Sound remains an area for significant scientific research.

The largest of the many shoals within Nantucket Sound is Horseshoe Shoal. Horseshoe Shoal covers approximately 35 square miles with depths averaging between 13 and 40 feet. The major navigational channel in Nantucket Sound is Main Channel, adjacent to the southern edge of Horseshoe Shoal. Nantucket Sound is subject to changes in the physical dynamics of its many shoals, with fluctuations caused by regional climatological and oceanographic phenomena.

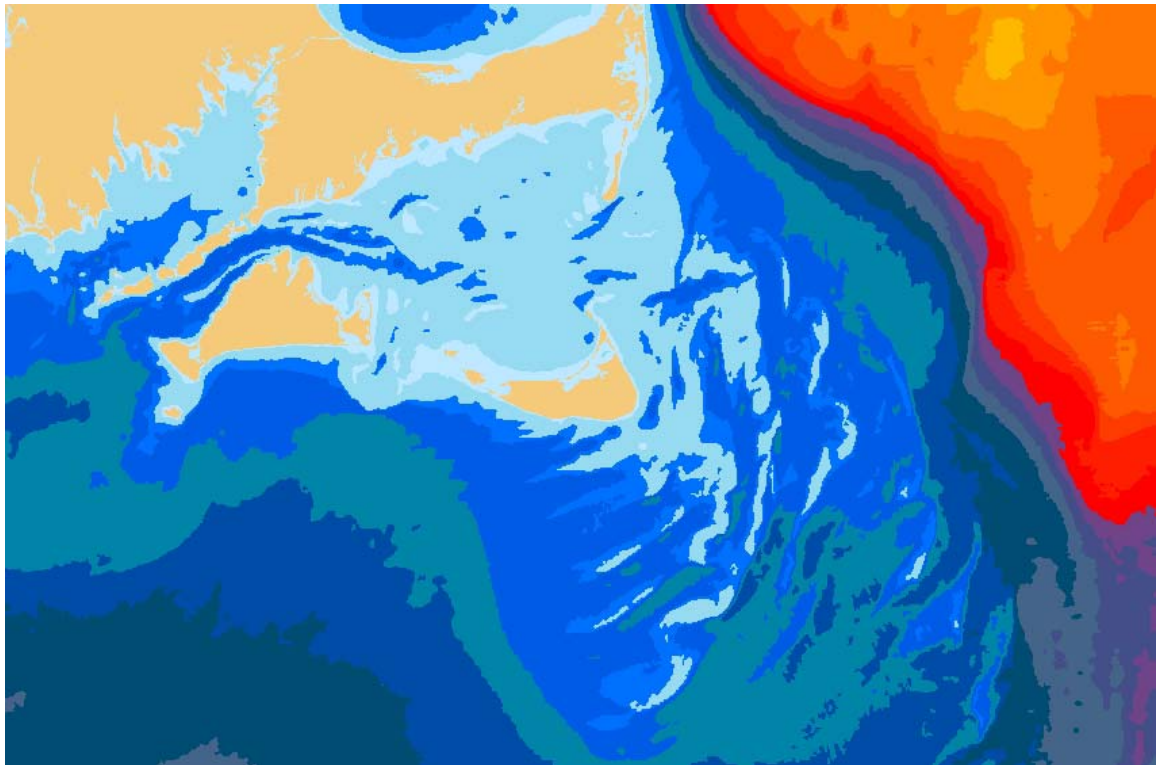


Figure 2 -- Bathymetry of Nantucket Sound and Nantucket Shoals

3.0 Overview of State and Federal Marine Protected Areas

3.1 Massachusetts Oceans Sanctuaries

The Massachusetts Oceans Sanctuary Act (M.G.L. c. 132A, §§ 13-16, 18) attempts to *protect the ecology or the appearance of the ocean, the seabed and subsoil from any exploitation, development or activity that would seriously alter or endanger those resources* (M.G.L. c. 132A, §§ 12A, 321 CMR Section 5.00). This statute does not regulate fisheries or living resource extraction, but does regulate non-renewable resource development, discharging, marine construction,

and shoreline alteration. Proposal for construction, development, or alteration of these waters are regulated through the Massachusetts Department of Environmental Management and Massachusetts Office of Coastal Zone Management. These sanctuaries extend three (3) miles from the state's coast. However, in the case of the Cape Cod Bay Ocean Sanctuary this limit was extended to envelop the entirety of the Bay.

3.2 National Marine Sanctuary System

The National Marine Sanctuary system was established to *identify, manage, and conserve areas of the marine environment that are nationally significant due to conservation, recreational, ecological, historical, scientific, educational, cultural, archaeological or aesthetic qualities* (National Marine Sanctuaries Act, 16 USC Section 1431). The regulations for National Marine Sanctuaries are sanctuary-specific and intended to provide selected areas comprehensive protection of the marine resources contained therein. The National Marine Sanctuary Program is administered by the National Ocean Service of the National Oceanic and Atmospheric Administration (NOAA).

3.2.1 Nomination Criteria and History

National Marine Sanctuaries can be designated in two ways: administratively, through the actions of the Secretary of Commerce; and legislatively, through an act of Congress. Prior to September 7, 1982 any person could recommend a site for consideration. Subsequent to 1982, NOAA's National Marine Sanctuaries Program contracted with Chelsea International Corporation of Washington D.C. to prepare a Site Evaluation List from which future marine sanctuaries might be chosen. From the Site Evaluation List, active candidates for sanctuary designation are chosen for their conservation, ecological, recreational or aesthetic values. Sanctuary designation requires the Secretary of Commerce to publish a notice of intent in the *Federal Register* informing the public of NOAA's intention to consider an area for sanctuary designation. A draft environmental impact statement on the proposed designation, the draft management plan, and draft regulations are prepared. This draft environmental impact statement (DEIS) must

include a resource assessment report and maps which depict the boundaries of the area.

During the review period the proposal goes before the House Committee on Resources and the Senate Committee on Commerce, Science and Transportation. Finally, the Secretary must publish a notice to designate a national marine sanctuary in the *Federal Register* and include final regulations. Another 45-days of Congressional review must elapse before a sanctuary is designated.

Sanctuaries are managed according to site-specific management plans prepared by the National Oceanic and Atmospheric Administration's (NOAA), with multiple opportunities for public comments. The philosophy behind National Marine Sanctuary management is what NOAA calls an “*ecosystem approach to marine environmental protection*.” While sanctuary management plans are site-specific, sanctuary regulations generally prohibit discharging materials into the protected area, alteration of the seabed, disturbance of cultural resources, and oil, gas and mineral production (with a grandfather clause for preexisting operations).

4.0 Marine Protection in Nantucket Sound

Nantucket Sound is a multi-jurisdictional biogeographical region. The Commonwealth of Massachusetts is responsible for management of the waters and sea floor of the Cape and Islands Ocean Sanctuary, including all submerged lands within 3 miles of the low water line (Appendix A, Table 1). Meanwhile, the federal government has jurisdiction over all waters and sea floor more than 3 miles from the Massachusetts coastline (Appendix A, Table 2). Because the portions of the Cape and Islands surrounding the Sound are some 25-30 nautical miles apart in some areas, the 3-mile envelope of the state-protected sanctuary excludes a significant portion of the interior of the Sound. The result is that this one, contiguous ecosystem is owned and managed by two distinct entities without a formal, unified management strategy.

There have been both state and federal efforts to integrate management of Nantucket Sound under various marine protected area designations. While the issue of jurisdictional boundaries in Nantucket Sound is essentially a political issue, management of the marine resources of the Sound is best achieved through an ecosystem-based approach to managing the biogeographical region. The fact that both the Commonwealth of Massachusetts and the U.S. government have proposed Nantucket Sound for National Marine Sanctuary status (described in Section 4.2, below) suggests that there is a general consensus regarding the level of ecological richness and environmental integrity of the Nantucket Sound region.

4.1 Cape and Islands Ocean Sanctuary

When Massachusetts passed the Ocean Sanctuaries Act (M.G.L. c. 132A, §§ 13-16, 18), in 1970, this action authorized the creation and maintenance of five (5) Ocean Sanctuaries. The Ocean Sanctuaries are managed by the Massachusetts Executive Office of Environmental Affairs (EOEA), with management activities carried out by several other state agencies, including 1) the Department of Environmental Management, 2) the Division of Marine Fisheries, 3) the Department of Environmental Protection, 4) the Office of Coastal Zone Management.

The Massachusetts Ocean Sanctuaries Act obliges the Department of Environmental Management (DEM) to protect the sanctuaries from any development or activity that would damage the ecology or aesthetics of the area. Specifically prohibited within Massachusetts Ocean Sanctuaries are the construction of physical structures on the seabed, the building of offshore or floating power plants, the drilling through or removal of mineral resources, gases or oils. Also banned are dumping of wastes and incineration of private or commercial wastes by any ship moored or floating within a sanctuary.

The Cape and Islands Ocean Sanctuary is defined in M.G.L c. 132A §§ 13:

The Cape and Islands Ocean Sanctuary is bounded and described as follows:
Beginning at a point on the mean low-water line at the southernmost point of Monomoy Point; thence due south to a point in the Atlantic Ocean three miles due south (180 Degrees True) of the mean low-water line at the southernmost point of Monomoy Point; thence due east (90 Degrees True) to the Exterior Line

of the Boundary of the Commonwealth as established on the aforementioned Marine Boundary Map; thence in a generally southerly and then westerly direction along said Exterior Line to the point of intersection with the extension of the lateral boundary of Rhode Island and Massachusetts; thence northerly along said lateral boundary to the mean low-water line near Quicksand Point; thence following the mean low-water line around Buzzards Bay, the Cape Cod Canal to the Bourne-Sandwich town boundary, and the southern portion of Cape Cod to the point of intersection in Pleasant Bay with the western boundary of the Cape Cod National Seashore; thence southerly along said boundary; thence by the shortest distance to the mean low-water line of Monomoy Island; thence to the point beginning by following the mean low-water line of the western side of Monomoy Island; and meaning and intending to include the area seaward of the mean low-water lines of Nantucket, Martha's Vineyard, Elizabeth and other islands; and *meaning and intending to include the following bodies of water: Nantucket Sound, Vineyard Sound, Buzzards Bay, the Cape Cod Canal, Pleasant Bay, and portions of the Atlantic Ocean.* [emphasis added]

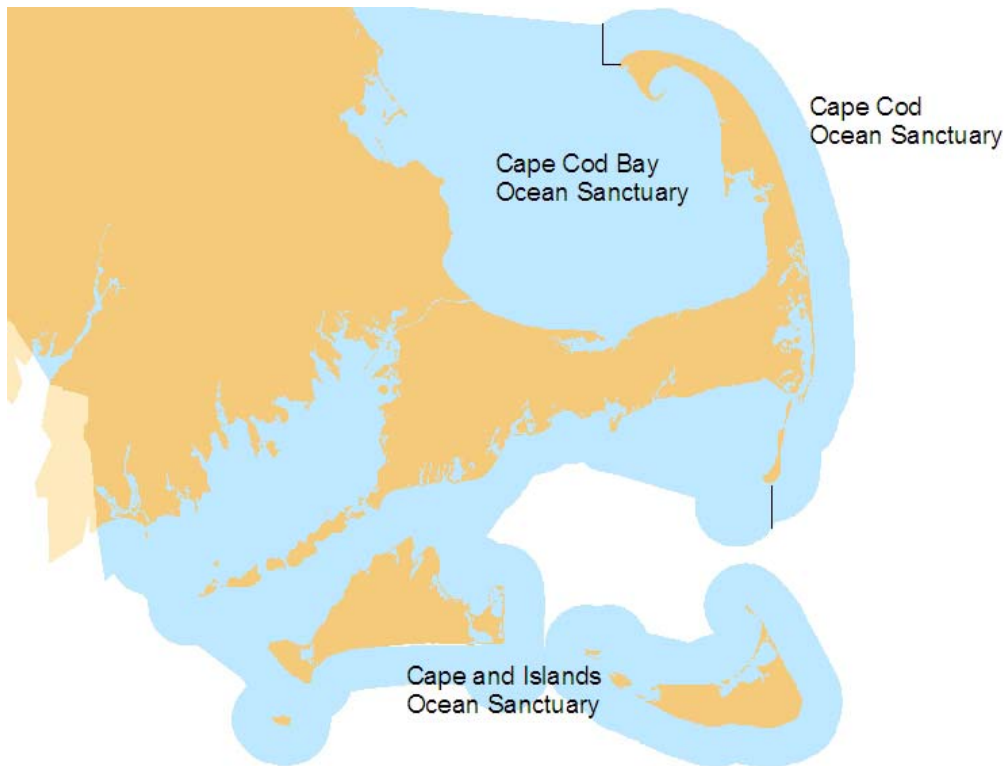


Figure 3 -- Massachusetts Ocean Sanctuaries

The Massachusetts Legislature made clear its intention to include the entirety of Nantucket Sound in the Cape and Islands Ocean Sanctuary. Later nominations for

National Marine Sanctuary status for Nantucket Sound (see Section 4.2), demonstrate that the Commonwealth has had a long-standing interest in promoting an integrated system for managing the Sounds resources. In fact, a major rationale for the Commonwealth's 1980 nomination was to gain equal protection for the both state and federal waters, as well as to combine management authority in a unique and relatively holistic way.

4.2.1 National Marine Sanctuary Nominations for Nantucket Sound

4.2.2 1980 Nomination

In 1980, the Massachusetts Secretary of Environmental Affairs and the Attorney General nominated Nantucket Sound for National Marine Sanctuary status pursuant to Title III of the Marine Protection, Research and Sanctuaries Act of 1972 (16 U.S.C. 32 §§1431-1445, also known as the National Marine Sanctuaries Act). The National Marine Sanctuaries Act authorizes the Secretary of Commerce to designate and manage areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or aesthetic qualities. The primary objective of this law is to protect marine resources, such as unique habitats. The Act also directs the Secretary to facilitate all public and private uses of Sanctuary resources that are compatible with the primary objective of resource protection.

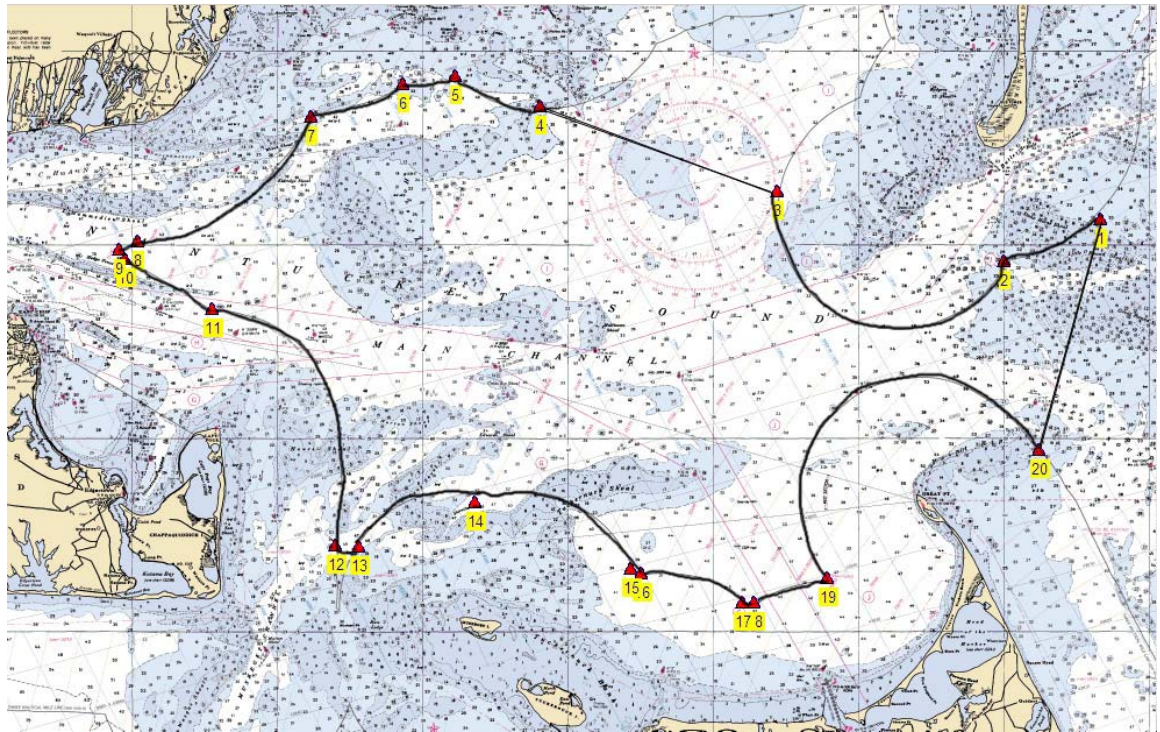


Figure 4 -- Proposed Boundary for Nantucket Sound National Marine Sanctuary in 1980 Nomination

The 1980 Nantucket Sound nomination was an attempt by the Commonwealth to secure protection for the portion of the Sound not within the Cape and Islands Ocean Sanctuary. This comprehensive nomination compiled available documentation demonstrating a host of ecologically and economically significant marine resources within this area, including finfish, shellfish, marine mammals, reptiles, birds, and rare and endangered marine plants. The 1980 nomination pointed to the need for additional research into the presence of cultural resources, fisheries, sea birds and marine mammals within Nantucket Sound. The central waters of Nantucket Sound were nominated “for their value as a habitat area, species area, unique area and a recreational and aesthetic area.” (EOEA 1980 Nomination p. 5)

The Commonwealth’s 1980 nomination pointed to the significant amount of conservation and recreation areas in the region of Nantucket Sound. The large extent of protected land and wetlands surrounding Nantucket Sound likely serves as habitat for the rich variety of species using the Sound. The Commonwealth’s

nomination also advocated protection of the important educational, historic and cultural values of the numerous shipwrecks scattered throughout the Sound.

Under the 1980 nomination, NOAA would have ultimate responsibility for the overall management of the proposed Sanctuary, while EOEA would be responsible for daily on-site management operations. The 1980 nomination was designed at increasing the level of integrative management, by improving the federal consistency with the Massachusetts Ocean Sanctuaries Act. According to the Commonwealth's nomination:

The absence of marine sanctuary protection for the federal waters in the center of the Sound would negate efforts by the Commonwealth of Massachusetts to insure the environmental protection of the marine resources of this important water body through its Ocean Sanctuaries Program. Nantucket Sound must have a coordinated management regime... if the ecological, recreational, historic and aesthetic resources of the Sound are to be adequately protected.

This nomination specified a holistic approach for management of the Sound, but implementation may have been complex due to the overlapping responsibilities under the proposed management arrangement. It is not clear whether this complexity affected its consideration by NOAA. No action was taken with respect to this nomination because NOAA did not have a program plan for the sanctuary system in place until 1983. As a result, the nomination was neither administratively accepted nor declined – in fact we found no record that the nomination had been formally acknowledged by the program until its mention in the later 1983 nomination, described below.

4.2.3 1983 Nomination

On August 4, 1983, Nantucket Sound, and a larger region including Nantucket Shoals and Oceanographer Canyon, were selected for the Site Evaluation List published in the *Federal Register* (Vol. 48, No. 151). Three other sites from the North Atlantic region were placed on the Site Evaluation list along with the proposed Nantucket Sound site. Of these sites, Stellwagen Bank was selected for sanctuary designation.

According to the National Marine Sanctuary Site Evaluations Recommendation and Final Reports (Chelsea International Corporation 1983):

The North Atlantic region contains two distinct biogeographic regimes...These two regimes meet in the area south of Cape Cod, and the transition area itself is as important as the two major regimes.

Nantucket Sound is clearly a unique transitional area supporting significant biological productivity and diversity. In reviewing the Nantucket Sound proposal, the resource evaluation committee recognized the obstacles inherent in managing multi-jurisdictional areas and the need to incorporate ecosystem boundaries into less pliable management boundaries. The large “swath” included in the several Nantucket Sound proposals was considered a general “study area boundary” owing to the lack of ecosystem-focused research in the region.

Despite a clear representation of the ecological, economic, and aesthetic values contained in Nantucket Sound, the area was not selected for inclusion in the marine sanctuary program. Several governmental and private agencies commented on behalf of Nantucket Sound, citing the ecological significance of the area. Such agencies include the Massachusetts Marine Fisheries Commission, the Cape Cod Museum of Natural History, the Massachusetts Division of Fisheries and Wildlife, and the Humane Society of the United States, among others.

5.0 Review of Jurisdictional History of Nantucket Sound

As a component of the 1980 nomination, the Commonwealth of Massachusetts referenced case law that might aid in the conclusion that the Sound was of particular ecological significance, linked to the ecological continuity between state and federally owned portions of these waters. Under statute (43 U.S.C. 29 §§1301, 1311) and case law (*United States v. Maine*, 423 U.S. 1 (1975)), states have jurisdiction over all submerged lands within the 3-geographical mile zone, and the U.S. has title to the seabed more than 3-miles from shore. This is the

jurisdictional delineation that is currently recognized in Nantucket Sound. This jurisdiction is in no way reflective of larger ecosystem boundaries, which are the increasing focus of integrated coastal zone management regimes.

The present multi-jurisdictional status of Nantucket Sound is a result of the federal effort to quiet title to the seabed along the Atlantic coast (*United States v. Maine et al.*, 475 U.S. 89 (1986)). Several states took exception to sections of the 1986 Special Master's Report on delimitation of the jurisdictional boundaries. One such exception was made by Massachusetts regarding the status of Nantucket Sound (*Massachusetts Boundary Case*, 475 U.S. 89, 94 n.9). The Commonwealth's argument has its roots in the American interpretation of English common law. Under common law, "county waters" were defined by an ambiguous line-of-sight test, which was presumed to have been met for purposes of the proceeding. The Commonwealth's case rested on the position that "ancient title" was conferred to the succeeding local jurisdiction by the English Crown in the Treaty of Paris, which ended the Revolutionary War. Furthermore, the Commonwealth argued that the United Nations' Convention of the Territorial Seas and Contiguous Zone ("Convention" 15 U.S.T. 1607, T.I.A.S. No. 5639 (1958)), provides for "historic bays." The U.S. argued that the United Nations report entitled "Juridical Regime of Historic Waters, Including Historic Bays (U.N. Doc. A/CN.4/143 (1962)) presented a 3-part definition of a historic bay including: 1) exercise of authority over the area, 2) with continuity of authority, and 3) acquiescence of foreign nations - the maritime equivalent of title acquired by adverse possession - which was not met by the Commonwealth with respect to Nantucket Sound. The term "ancient title" is not defined in the Convention, but according the U.N. report "to base the title on occupation is to base it on a clear and original title which is fortified by long usage."

The Report of the Special Master in the *Massachusetts Boundary Case* concluded that Nantucket Sound had an historic role in the development the colonial economy of Nantucket and Martha's Vineyard. However, the United States Supreme Court ruled that "the Commonwealth did not effectively "occupy" Nantucket Sound so as to obtain "clear original title" and fortify that title "by long

usage” before the seas were recognized to be free. The Supreme Court wrote that “Unless we are to believe that the self-interested endeavors of every seafaring community suffice to establish ‘ancient title’ to the waters containing the fisheries and resources it exploits, without regard to the continuity of usage or international acquiescence necessary to establish ‘historic title’, solely because exploitation pre-dated the freedom of the seas, then the Commonwealth’s claim cannot be recognized.”

The Nantucket Sound jurisdictional boundaries delineated by the U.S. Supreme Court (475 U.S. 89, 94) have produced an “enclave” of federally owned waters partially surrounded by state waters. No distance between mainland and/or the fringe islands exceeds 10 geographical miles. At the widest reach, between Monomoy and Great Point, the eastern entrance to Nantucket sound is 9.2 miles. Given the 3-mile state boundary, enclosing the embayment would require a straight line only 3.2 miles long. The western entrance to Nantucket Sound leads directly from Vineyard Sound, which, as mentioned, is within state jurisdiction. Beyond Vineyard Sound are either state waters (Buzzards Bay) or high seas, such that Nantucket Sound communicates vessels from high seas through state waters to high seas. Nantucket Sound meets the definition of inland waters as set forth by the U.S. in 1930.

6.0 Marine Resources of Nantucket Sound

Nantucket Sound possesses significant marine habitat for a diversity of ecologically and economically important species. Directly adjacent to the deeper waters of the Great South Channel, the Sound has particular significance for several federally-protected species including the gray seal (*Halichoerus grypus*), roseate tern (*Sterna dougallii*), piping plovers (*Charadrius melodus*), leatherback sea turtle (*Dermochelys coriacea*), Atlantic Ridley sea turtle (*Lepidochelys kempi*) and a variety of commercially and recreationally valuable fisheries. Despite this, there has been insufficient scientific study of the area to assess the status of these habitats or the living marine resources of the Sound. The following sections

highlight the dominant, economically significant, or conspicuous species presently inhabiting the region.

6.1.1 Marine Mammals

The waters of Nantucket Sound provide habitat potential for several species of seals and porpoises, including the gray seal, harbor seal, and harbor porpoise. Once hunted to the edge of extinction within the Gulf of Maine, harbor and gray seal populations are once again on the rise within this region. These waters are of particularly significant to gray seals which have a well-documented and growing breeding colony in Nantucket Sound, representing the southern-most breeding colony in the world, and the only known breeding colony in the United States. The breeding population at Muskeget Island rose from a maximum of 13 in the 1970's to over 1,500 in the 1990's. This rise can be attributed to increasing environmental awareness and their protection under the Marine Mammal Protection Act.

The gray seal is listed as “special concern” species on the Massachusetts [List of Endangered, Threatened and Special Concern Species](#) (321 CMR 10.60). While the species is not endangered globally, other North Atlantic grey seal populations are listed under the World Conservation Union (IUCN) Red List. The status of the gray seal population and the level of human-caused mortality and serious injury in U.S. waters is unknown, but populations are believed to be increasing.



Figure 6 -- Gray seal (*Halichoerus grypus*) spotted in the Sound. (CCS © 2002)

The Western North Atlantic gray seal population is divided into two non-interbreeding communities, with 93% of the southern community located within Nantucket Sound. This division of breeding communities renders the Nantucket Sound habitat essential to the sustenance of this population. Additionally, this dichotomy provides a fertile area of study into intra-species genetics and population studies significant to this and other marine and terrestrial mammal species. With respect to the genetic uniqueness of this population, the gray seals' dependence on the waters of Nantucket Sound strongly support protection of these and adjacent waters employing an ecosystem approach to management.

In contrast to the literature pertaining to gray seals, our review of the limited number of scientific surveys of the Sound has revealed a scarcity of cetacean sightings within this specific body of water. These limited findings may be explained in part by the shallow depth of the region, but may also be linked to the minimal, if any, systemic observation of the area. As an example, CCS has frequently observed cetaceans within equally shallow water in and around

Provincetown, Massachusetts, as species may follow food sources migrating from more suitable deepwater habitats. Similarly, waters directly adjacent to Nantucket Sound have been shown to be of particular significance to a host of marine mammals, linked to major migratory routes for several species. While the predominantly shallow waters of the Sound may limit the direct habitat potential for charismatic marine mammal species, the shoal waters are of keystone significance to essential food species that drive the larger marine ecosystem.

To better assess the significance of the region, CCS is coordinating efforts to perform an aerial survey of Nantucket Sound and adjacent waters to specifically address the lack of quantitative study. Specifically, Endangered North Atlantic right whales (*Eubalaena glacialis*) are known to congregate seasonally in the Great South Channel and Cape Cod Bay, and have been reported in Vineyard Sound, Buzzards Bay and Cape Cod Canal. In fact, there have been three (3) sightings of right whales in Nantucket Sound since 1959. Adjacent to a significant migratory passage for a diversity of whale species, sightings of humpbacks, pilot whales, and finback whales have also been reported within the Sound. Had regular surveys been conducted historically in the Sound, the potential exists for more definitive evidence of cetacean utilization of this habitat.

6.2 Avian Species

The Nantucket Sound eco-region contains pristine estuaries, extensive shoals and long stretches of undeveloped coastline. Vast numbers of seabirds and waterfowl congregate to utilize near-shore shoals to feed and rest, especially during the winter season. The region includes parts of the largest winter habitat for waterfowl on the east coast of the United States. The Monomoy National Wildlife Refuge exemplifies the diversity and productivity of the Nantucket Sound region's avian habitat. Protected waters, shoals, tidal flats, salt marshes, dunes and beaches combine to create one of the most significant bird habitats in New England. The extensive conservation acreage adjacent to Nantucket Sound allows many terrestrial species to utilize distinct habitat niches in the region. The abundance and diversity of avian species within the Nantucket Sound eco-region

warrant considerable future research before spatial and temporal scales of utilization are comprehensively understood.

Located within the Atlantic Flyway, Nantucket Sound possesses great habitat significance for a host of avian species, providing breeding, nesting resting and foraging habitat. As detailed in available documentation on Nantucket Sound, common eiders (*Somateria mollissima*), black scoters (*Melavitta nigra*) and surf scoters (*M. perspicillata*) congregate in the fall and winter within the shoal waters in the hundreds of thousands, while various species of terns are abundant in the coastal zone including the common tern (*Sterna hirundo*), least tern, (*S. albifrons*), roseate tern (*S. dougallii*) and arctic tern (*S. paradisaea*). The roseate tern is classified as an endangered species. The coast of Nantucket Sound is breeding habitat for the piping plover (*Charadrius melodus*), a threatened species.



Figure 6 – Common Eiders (*Somateria mollissima*) socializing. (CCS © 2002)

While a variety of public and private organizations frequently observe avian species within this region, no formal survey of species diversity, habitat utilization, or breeding success has been reported for Nantucket Sound.

Assessment of actual habitat value and ecosystem services provided by this region will be an important facet of evaluating the ecological significance of the Sound.

6.3.1 Fisheries

Of particular significance within Nantucket Sound is the economic and recreational value of finfisheries and shellfisheries. Massachusetts Division of Marine Fisheries trawl surveys conducted over the last 25 years revealed approximately 80 species of finfish and shellfish within the Sound. While these data are valuable, the survey provides only a descriptive evaluation of the status of the system, suggesting that further scientific analysis should be completed. Much of the fisheries diversity has been maintained in Nantucket Sound; however, trawl survey data has not been fully analyzed by CCS scientists for trends in species abundance and ecological significance. Regardless of the present diversity, the exceptional waters of the Sound remain a significant habitat for spawning and nursery grounds for a host of economically significant species. In fact, these waters have been classified Class SA (Coastal and Marine Classes) under the 314 CMR 4.00 Massachusetts Surface Water Quality Standards. This designation represents the highest standard for coastal marine waters, cited for the protection and propagation of fish, shellfish and other marine life.

Nantucket Sound is the most significant horseshoe crab (*Limulus polyphemus*) habitat in the state, and among the most undisturbed spawning habitat remaining on the east coast. Juvenile and adult horseshoe crabs burrow in sandy shoals and muddy seabed, with adults migrating to beaches to spawn. Horseshoe crab spawning events are thought to be critically important to the avian species using the Atlantic Flyway during migration. Horseshoe crab eggs are a major food resource for birds, and reductions in breeding success by horseshoe crabs are thought to play a role in reductions in migratory shorebird populations. The link between horseshoe crab spawning success and avian populations has been documented in other estuaries, but this dynamic remains to be investigated in Nantucket Sound.

From the literature reviewed, it is clear to CCS that Nantucket Sound possesses significant habitat for a diversity of commercially and recreationally important fish, marine mammal and avian species. As compelling as these data are, it is equally clear that further study should be completed to provide a timely and accurate representation of the present coastal and marine resources of the Sound. Furthermore, future study should consider individual species counts within a larger, ecosystem concept. The purely descriptive reports of the past should be replaced by estimates of diversity, species interactions, sustainability, and ecosystem health or stability to more accurately portray the present and future of this ecosystem – towards developing suitable management strategies.

7.0 Summary

Presently, Nantucket Sound is managed by several different state and federal agencies, as described above. The result of these ecologically arbitrary divisions of a contiguous marine ecosystem is that managers are unable to gain a comprehensive understanding of the spatial and temporal ecosystem dynamics and marine resources. Individual private and governmental agencies focus upon isolated components of a complex and diverse ecosystem. Increasingly, ecologists, environmental managers, and regulatory agencies have recognized the value of ecosystem-scale strategies for the protection of natural resources. Fragmented management polygons have been shown to lead to increased edge effects, compartmentalization of species and/or habitats, and discrepancies in policies and management arrangements. Within a marine environment, fragmentation can hinder comprehensive assessment of marine resources and evaluation of recreational uses or anthropogenic impacts on the biogeographical region.

7.1 Future Scientific Assessment

Our review of existing literature demonstrates that ecosystem-scale studies with directed management strategies are limited to date. Finite studies of portions of

the resource or studies directed at one species or group of species results in a fragmented understanding of the system as a whole and only speculative estimates of ecosystem processes. While all reports suggest the region is relatively healthy, ecologically rich, and economically valuable, CCS concludes that a comprehensive study of the system as an ecological unit is required to confirm and understand these findings on an ecosystem-scale before broad management decisions can be made. Given this approach, subsequent management strategies should be designed for one contiguous ecological unit, rather than for finite management polygons. This peer-reviewed assessment protocol must be developed both to establish a baseline and to serve as a template for future, ongoing study of these waters. Establishing these protocols would insure that informed management strategies be developed, and their efficacy fully evaluated, to promote continued sustainable use of this important ecosystem.

A comprehensive ecological assessment of the Nantucket Sound biogeographical area would require a multi-disciplinary research team to develop a system-wide understanding of 1) physical oceanographic and geological processes 2) marine and benthic community structure and ecology 3) fisheries 4) marine mammal and reptile habitat and 5) avian habitat. Each of these broad research areas contains crucial skill sets from which to use the existing literature, rapid assessment surveys and other research tools to develop an understanding of the marine environment. A reasonably comprehensive ecological assessment of Nantucket Sound, as discussed above, could be achieved within roughly one year. Such an assessment would naturally include an ecosystem mapping component.

While existing literature addresses many of the physical and geologic processes in Nantucket Sound, a comprehensive review of the region should focus on patterns of marine habitat available within the dynamic shoal environments. Submerged aquatic vegetation, including eel grass (*Vallisneria spiralis*), provides essential habitat for juvenile fish and shellfish, and a benthic survey of Nantucket Sound should be part of a comprehensive ecosystem study. Fisheries have been regularly surveyed in Nantucket Sound such that this area of research should be relatively rich in data. Analysis in this area should specifically address ecological

implications of shellfish and finfish dynamics. There is significant on-going marine mammal research in the Nantucket Sound region, and this information should clearly be included in a comprehensive study. As noted, the Nantucket Sound region has exceptional habitat for an abundant mix of avian species, however, there is insufficient data on community patterns, habitat pressures, and population dynamics affecting this region.

7.2 Recommendations and Conclusions

Within Nantucket Sound and adjacent waters, the development of an ecosystem-scale, scientifically based management strategy requires a formal and integrated examination of the existing and projected marine resources, ecosystem services, anthropogenic uses, and impacts. Having been managed in a fragmented manner has led to a sparse and disjointed understanding of the resources within these waters, further supporting the need for a unified management strategy.

Based on the results of a preliminary investigation, CCS supports the notion of state and federal coordination to manage these waters, using one, mutually acceptable management strategy that promotes the exchange of data between management groups. While the most direct means of achieving an ecosystem approach to management would be for the entirety of the Sound to be managed by one entity, such an agreement may be difficult to establish. The 1980 nomination by EOE and the Attorney General of Nantucket Sound as a marine sanctuary outlined a novel, holistic approach to provide a united management regime for the Sound. However, the specific mechanics of implementation and maintenance under joint jurisdiction may have required further review. The proposed management and ultimate responsibility of the resulting sanctuary would reside with two separate entities, not meeting today's standards for national marine sanctuary and potentially complicating management processes. Regardless of its merits or shortcomings, no action was taken with respect to this nomination because NOAA did not have a program plan for the sanctuary system in place until 1983.

The fact that the state Legislature, the Executive Office of Environmental Affairs, the state Attorney General, and the National Marine Sanctuary resource evaluation committee have found that Nantucket Sound warrants increased environmental protection, possibly including sanctuary status, demonstrates a general consensus regarding the ecological, economic, recreational and aesthetic importance of that region. CCS found no evidence to support the position that the ecological significance of the Nantucket Sound region has been diminished since those proposals were made. Nantucket Sound remains a pristine and tremendously productive ecosystem worthy of environmental conservation and protection.

Despite past nominations' failure to gain national marine sanctuary status, experience shows that such a cooperative management arrangement may be achieved, as evidenced by the Channel Island National Marine Sanctuary in California and the Hawaiian Islands Humpback Whale National Marine Sanctuary. By defining bio-regions, these sanctuaries established management polygons based on scientific determination of contiguous marine ecosystems or functional habitat units that best served to protect, study and manage waters on an ecosystem-scale. This type of determination is very much aligned with NOAA's fundamental management philosophy for the sanctuary program that pledges "*an ecosystem approach to marine environmental protection.*" Given the new paradigm of broad-based, ecosystem-scale management in science and environment policy, CCS recommends that future management of the marine and coastal resources of Nantucket Sound begin with comprehensive ecological study. Once such a study is completed, a more thorough and effective management strategy can be developed to guide appropriate management and policy decisions for this important coastal resource.

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Appendix A

Table 1: Massachusetts Laws and Regulations

Resource/Issue	Applicable Legislation	Regulations	Agencies
Areas of Critical Environmental Concern	MGL c. 21A §2(7); St. 1974, c. 806 s. 40(e)	301 CMR 12.00	DEM
Coastal Development or Use	MGL c. 91; MGL c. 6A § 2-7 MGL c. 21A, s. 4A	310 CMR 9.00	DEP
		301 CMR 20.00-24.00	CZM
Dredging and Filling	MGL c. 21 § 26-35	310 CMR 9.00	DEP
Emergency Response/ Spill Reporting	MGL c. 21E (State Superfund Law)	310 CMR 40.0000 (Mass. Contingency Plan)	DEP
Endangered Species (Natural Heritage Program)	MGL c. 131 s. 23	321 CMR 10.00	DFW
Environmental Notification Forms/Impact Reports	MGL c. 30 §61-62H (Mass. Environmental Policy Act [MEPA])	301 CMR 11.00	EOEC
Historic Preservation	MGL c. 9 §26-27C	950 CMR 71.00	MHC
Marine Fisheries	MGL c. 130	322 CMR 1.00-12.00	DFW
Ocean Sanctuaries Act	M.G.L. c. 132A, §§ 13-16, 18	302 CMR 3.00	DEM
Scenic/ Recreational Rivers Orders	MGL c. 21A, s. 2(28)	302 CMR 3.00	DEM
Water Pollution Control	MGL c. 21 § 26-53 (Mass. Clean Waters Act)	257CMR 2.00 310 CMR 41.00 314 CMR 1.00 - 15.00 314 CMR 4.00 314 CMR 9.00	DEP
Waterways Licensing	MGL c. 91 (Public Waterfront Act)	310 CMR 9.00	DEP
Wetlands	MGL c. 131 s. 40 (Wetlands Protection Act)	310 CMR 10.00	DEP CCC

Key: CCC= Cape Cod Commission; CZM= Office of Coastal Zone Management; DEM= Dept. of Environmental Management; DEP= Dept. of Environmental Protection; DFW=Dept. of Fish and Wildlife and Environmental Law Enforcement; MHC= Mass. Historical Commission

Appendix A

Table 2: Applicable Federal Laws

Resource/Issue	Applicable Legislation	Agencies
Atlantic Coastal Fisheries Cooperative Management Act	16 U.S.C. §§ 5101-5108	NOAA Atlantic States Marine Fisheries Commission
Coastal Zone Management Act	16 U.S.C. §§ 1451-1465	NOAA NERR CZM
Endangered Species Act	16 U.S.C. §§ 1531-1544	NOAA EOEA
Estuarine Areas Act	16 U.S.C. §§ 1221-1226	NOAA
Federal Water Pollution Control Act (Clean Water Act)	33 U.S.C. §§ 1251-1387	EPA
Magnuson-Stevens Fishery Conservation and Management Act	16 U.S.C. 1801-1882	NOAA
Marine Mammal Protection Act	16 U.S.C. §§ 1361-1421h	NOAA
Marine Protection, Research, and Sanctuaries Act (Marine Sanctuaries Act)	16 U.S.C. §§ 1431-1445a	NOAA
Migratory Bird Conservation Act	16 U.S.C. §§ 715-715r	Migratory Bird Conservation Commission
National Environmental Policy Act (NEPA)	42 U.S.C. §§ 4321-4347	Council on Environmental Quality Office of Environmental Quality
National Wildlife Refuge System Administration Act	16 U.S.C. §§ 668dd-668ee	FWS
Outer Continental Shelf Lands Act	43 U.S.C. §§ 1331-1356	DOI CZM

Key: CZM=Massachusetts CZM; DOI= Dept. of Interior; EPA= Environmental Protection Agency; FWS= U.S. Fish and Wildlife Service; NERR= National Estuarine Research Reserve; NOAA= National Oceanic and Atmospheric Administration