Chapter 6
Coastal and Estuarine Waters

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Photo by Mike Morrison

Overview

Land development activities in coastal watersheds are creating uncontrolled stormwater runoff and increasing the danger to scarce and environmentally sensitive resources. Rising nutrient and bacteria levels threaten the natural and human environment while head-of-tide dams block fish migration. Troubling declines in seagrass beds in Great Bay may signal that a point of no return could lie ahead. Much depends on reversing these trends, and time is of the essence.

6.1 Occurrence and Significance

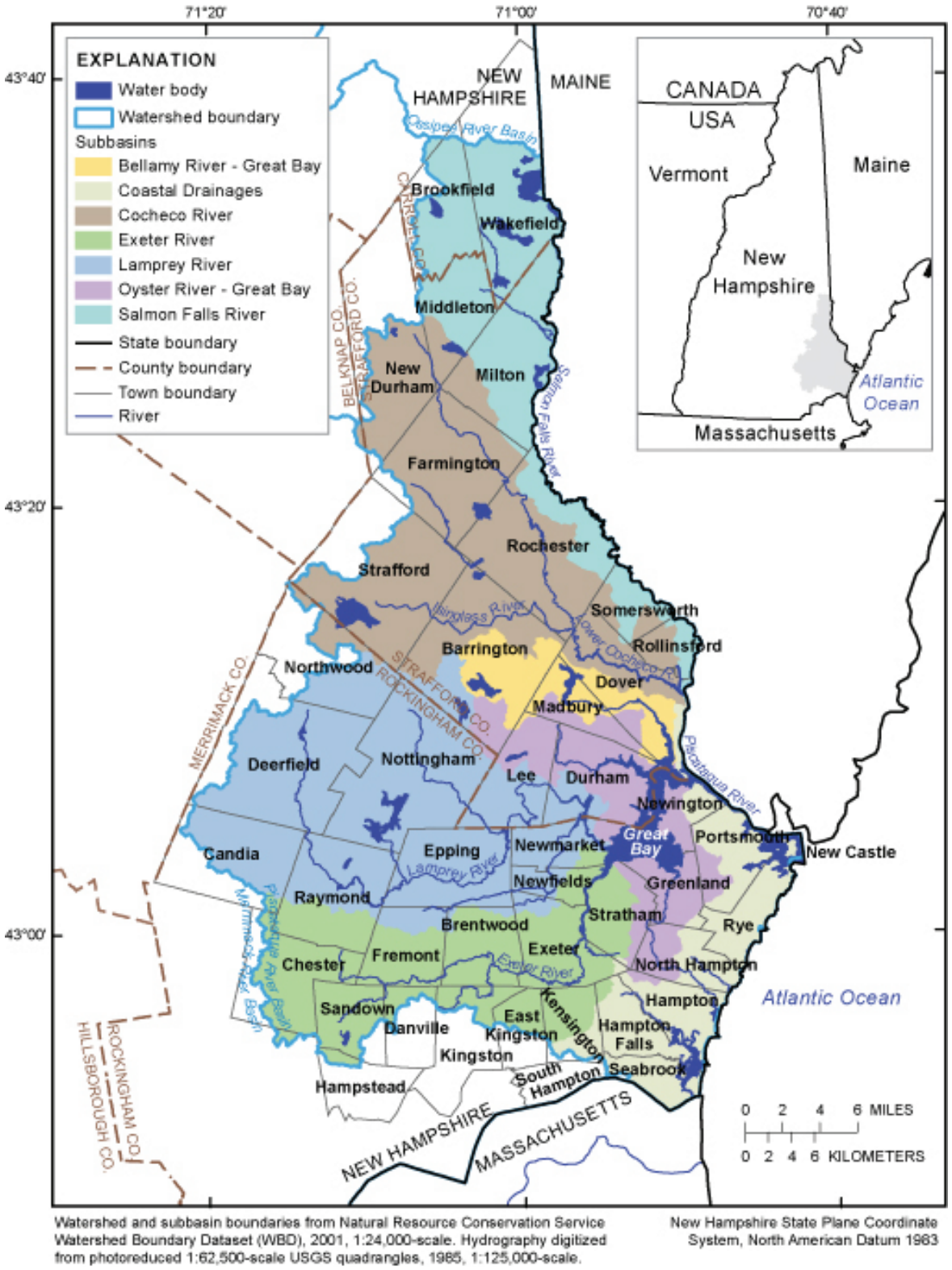
Although New Hampshire has just over 18 miles of Atlantic coastline, the state's two major estuaries, Great Bay Estuary and Hampton-Seabrook Harbor, have nearly 220 miles of estuarine shoreline. These two estuaries differ in geology, hydrology and history, but both are valued for their beauty and rich array of natural resources that, along with Rye Harbor and Little Harbor, provide numerous commercial and recreational opportunities. New Hampshire's coasts and estuaries can be categorized into three parts: Hampton-Seabrook Estuary, Great Bay and its tributary rivers, and the ocean coast line. The coastal zone also can be divided into several different watersheds (Figure 6-1). Because these land areas contribute water to fragile estuarine resources, issues regarding estuarine and coastal water quality involve communities in these upstream watersheds.

Individual Seacoast communities tend to have the highest percentage of impervious surfaces relative to other New Hampshire communities due to the dense population and development in the southeastern region of the state.

Although the coastal watersheds of New Hampshire represent only 9 percent of the state, these areas provide essential habitat for more than 130 rare species, including many that occur nowhere else in New Hampshire (Zankel et al., 2006). There are also 1,800 miles of rivers and streams ranging from cold brook trout headwaters in the upper watershed to large, meandering tidal rivers near the coast. In addition to the habitat value of this area, it is also the fastest growing area of New Hampshire and is significant tourist destination.

6.1.1 Great Bay Estuary

Great Bay Estuary, the state's largest estuary, is a tidally dominated system with a water surface area of approximately 13,500 acres, or 21 square miles, including Little Bay and the Piscataqua River. Approximately three-quarters of the estuary's 1,023 square mile watershed is located within New Hampshire; the rest is in Maine. Several New Hampshire communities border Great Bay Estuary, which has more than 144 miles of shoreline made up of steep wooded banks with rock outcroppings, cobble and shale beaches, and fringing salt marsh. As shown in Figure 6-1, the estuary's tributaries include the Isinglass, Cocheco, Salmon Falls, Oyster, Exeter, and Lamprey rivers. The phase of the tide lags significantly as one moves from the ocean up the estuary, with slack



Watershed and subbasin boundaries from Natural Resource Conservation Service Watershed Boundary Dataset (WBD), 2001, 1:24,000-scale. Hydrography digitized from photoreduced 1:62,500-scale USGS quadrangles, 1985, 1:125,000-scale.

New Hampshire State Plane Coordinate System, North American Datum 1983

Figure 6-1. New Hampshire's coastal zone watersheds. New Hampshire's coastal watershed consists of a large network of streams, rivers and estuaries. *Source: U.S. Geological Survey, 2008.*

tides as much as 2.5 hours later in the Squamscott River than at the mouth of Portsmouth Harbor (New Hampshire Estuaries Project [NHEP], 2007). It can take up to 39 tidal cycles, or 20 days, for water from Great Bay to migrate to the open ocean (Bilgili et al., 2005).

6.1.2 Hampton-Seabrook Harbor

Hampton-Seabrook Harbor is a smaller bar-built estuary that formed as sandbars built up along the coastline. It is situated behind barrier beaches and surrounded by over 5,000 acres of salt marsh. In New Hampshire this estuary has approximately 72 miles of tidal shoreline (Jones, 2000) and covers approximately 1152 acres at high tide (NHEP, 2007). Sandy beaches, with some of the last remaining sand dunes in coastal New Hampshire, are a popular tourist attraction adjacent to and within the estuary. The Hampton-Seabrook Harbor also serves as a popular clamming destination and has the most productive clam flats in the state.

6.1.3 The Ocean Coast Line

Dominated by barrier beaches, dunes and maritime forests, the ocean coast line is where European settlers first arrived in New Hampshire. From the productive salt hay fields to the cod drying racks on the Isles of Shoals, to the protected inlets and natural jetties, the seacoast has always been special to the people of the state. Today, 78 percent of New Hampshire's coastal sand beaches are preserved for public use in state parks. Route 1A is a scenic byway traveled by thousands of tourists and New Hampshire's history is told at places such as Odiorne State Park and the Wentworth Coolidge Mansion.

6.2 Issues

6.2.1 Climate Change Expected to Hit the Coast Hard

The defining characteristic of New Hampshire's coast and estuaries is the tide. One of the unique issues that the coast faces is flooding, aggravated by tidal inundation and storm surges. The Patriot's Day storm of 2007 was a spectacular example of coastal flooding that occurred because of a strong Nor'easter combined with astronomical high tides. The offshore waves during the peak of the storm were more than 30 feet high (NOAA, 2007).

A recent study through the National Oceanic and Atmospheric Administration (NOAA) identified 96 major coastal inundation or storm surge events in New Hampshire and Maine between 1914 and 2007, and 37 between 1980 and 2007 (Cannon, 2007). This study revealed a number of facts about the way storm surges occur on New Hampshire's coast.

- Eighty-three percent of storms happen in the colder months of October through March.
- Tidal flooding, although relatively infrequent, tends to cluster with two or more events in a single year.
- While most flooding occurs with high tides (above 12 feet), many happen at lower tides due to wind, wave, and tidal water "piling."

- Storm surge can be very difficult to predict due to the complex shape of New Hampshire's coast and variable meteorological data.

With current and projected climate trends, the associated rise in sea level is expected to exacerbate tidal flooding in the future. For the period of 1921 to 1999, sea level as measured in Boston rose at a rate of at 2.65 millimeters per year (Kirshen et al., 2008), or about 10.4 inches per century. The Intergovernmental Panel on Climate Change projects that by the year 2050 global sea levels will rise between 7 and 14 inches under a lower greenhouse gas emissions scenario and between 10 and 23 inches under a higher emissions scenario (Figure 6-2). With this magnitude of sea level rise, a storm surge that now occurs only once every 100 years will instead occur once every two to 15 years (Ward & Adams, 2001; Kirshen et al., 2007).

Sea level rise may also cause a large increase in the area of land susceptible to flooding. A two-foot rise in sea level by the end of this century is likely to increase the amount of New Hampshire seacoast land at risk for the 10-year and 100-year tidal floods by 34 percent and 100 percent, respectively (Ward & Adams, 2001).

In addition to raising sea level and increasing storm surges, climate change is also expected to increase the frequency and severity of intense rainstorms and corresponding flooding, conditions which the current drainage infrastructure (culverts, etc.) is not designed to handle (see Chapter 10 – Stormwater). In addition to damaging infrastructure and private property, disrupting transportation, and creating health hazards, large coastal floods can have significant ecological impacts. Large volumes of water from tributary rivers can cause salinity levels in estuaries to plummet. Depending on the timing, length, and severity of such an event, a great many seacoast species could be impacted. For example, lobsters may migrate out of the estuary and juvenile lobster and other fish may be injured or killed.

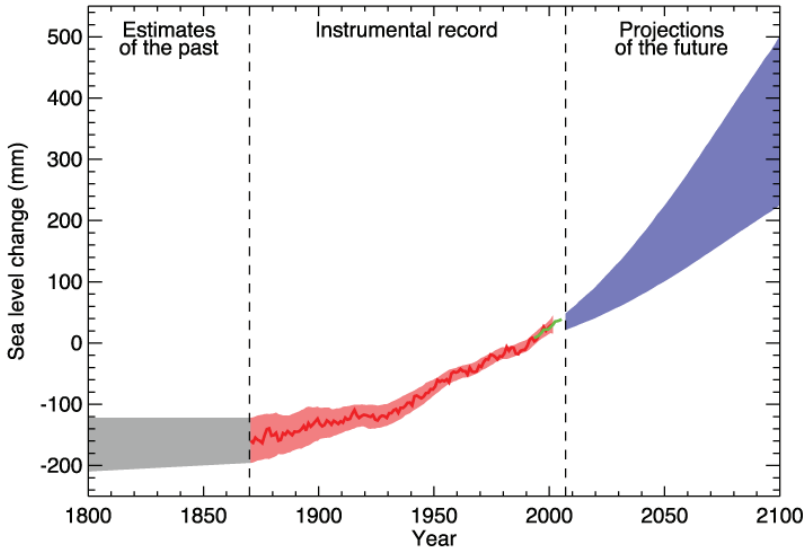


Figure 6-2. Past and projected global average sea level. The gray shaded area shows the estimates of sea level change from 1800 to 1870 when measurements are not available. The red line is a reconstruction of sea level change measured by tide gauges with the surrounding shaded area depicting the uncertainty. The green line shows sea level change as measured by satellite. The purple shaded area represents the range of model projections for a medium emissions growth scenario. ***Source: Intergovernmental Panel on Climate Change, 2007; U.S. Environmental Protection Agency, 2007.***

6.2.2 Growth in Water Demand

Seventy-three percent of New Hampshire's population growth in the next 20 years will be concentrated in the four southeastern counties, which make up about one-third of the state's land base (OEP, 2006). The population of the seacoast counties, Rockingham and Strafford, has increased rapidly in recent decades (Figure 6-3). Predicted growth is likely to further strain

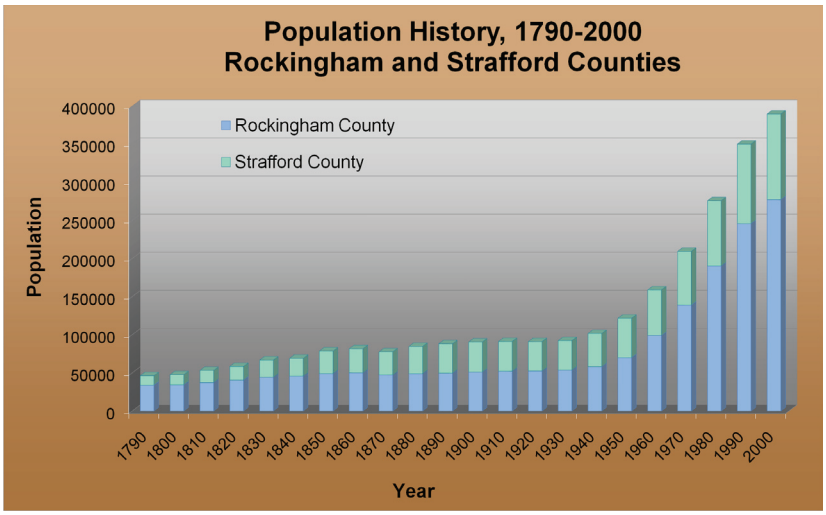


Figure 6-3. Population of New Hampshire's coastal counties. *Source: Zankel et al., 2006.*

seacoast water supply systems that are already having difficulty locating new sources. The seacoast contains 84 public water supply systems, which include over 300 individual wellheads or surface intakes. These systems serve more than 172,000 people. By 2025 demand for water in the Seacoast Region of New Hampshire is expected to grow by more than 50 percent. In the past five years, water use was estimated at 26.3 million gallons per day. By 2025 the demand may be more than 40 million gallons per day (Horn et al., 2008).

6.2.3 Land Use Development Activities Threaten Sensitive Estuaries

Although most New Hampshire communities review individual development proposals with a view to managing the impacts associated with stormwater, the cumulative impact of land use changes driven by economic and population growth is not addressed adequately on a watershed level. In 2005 8 percent of the coastal watershed was covered by impervious surfaces (roofs, streets, sidewalks and parking lots), compared to 4.7 percent in 1990, almost doubling the impervious coverage in 15 years (Justice & Rubin, 2006; NHEP, 2006b). As described in Chapter 1 – Introduction and Overview and Chapter 10 – Stormwater, the cumulative effects of impervious surfaces on water resources can be significant.

Nutrient Load from the Watershed Is Increasing

Plant nutrients, primarily phosphorus and nitrogen in the context of aquatic ecosystems, are naturally occurring substances in water; however, they do not originate from natural sources alone. Landscape change, fertilizer use, air pollution, and wastewater disposal all contribute nutrients. The great concern in salt water systems is excessive nitrogen, which can cause algal blooms, decrease water clarity, and deplete essential dissolved oxygen. The primary areas of concern in New Hampshire tidal waters are Great Bay, Little Bay, and their tributary rivers. Water travels more slowly through these areas than in areas near the coastal shore, allowing ample time for the ecosystem to be impacted by excess nutrients.

An analysis of several sets of historical data show that dissolved inorganic nitrogen concentrations have increased by 59 percent in the past 25 years in Great Bay (NHEP, 2006a). The majority of nitrogen reaching Great Bay, 62 percent, originates from nonpoint sources via tributaries (Figure 6-4). Stormwater pollution contributes nutrients to these tributaries, indicating that nutrient pollution in the coastal zone occurs on the watershed scale and must be addressed in communities and locations upstream of the estuaries. Wastewater treatment facilities contribute the second largest amount of nitrogen reaching Great Bay at 19 percent (NHEP, 2006a).

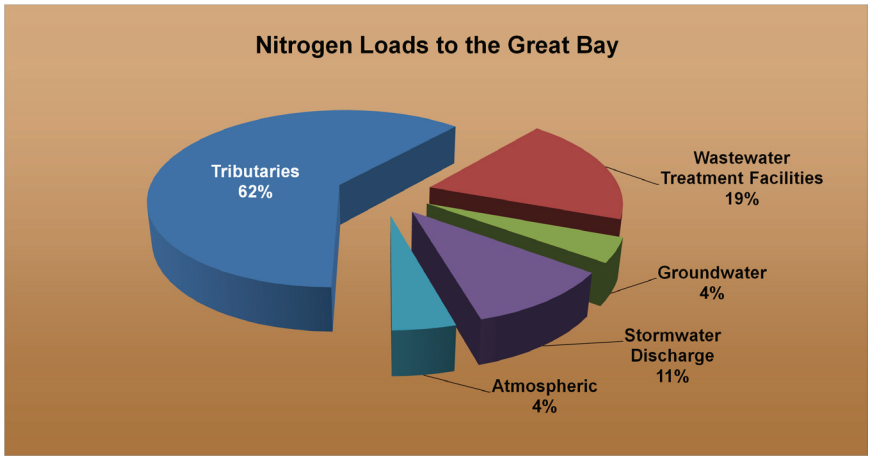


Figure 6-4. A large portion of the total nitrogen load to Great Bay is carried by tributaries from upstream locations. It is likely that nonpoint sources of stormwater pollution are significant contributors to this pollution. These nutrients are a common cause of nuisance algal blooms and possibly low dissolved oxygen problems. *Data Source: NHEP, 2006a.*

Excess Nutrients May Be Linked to Other Water Quality Declines

Dissolved oxygen is essential for aquatic habitats because prolonged periods of low levels can be severely detrimental to an ecosystem. Low dissolved oxygen concentrations are evident in the tidal tributaries where levels consistently fail to meet state water quality standards. Although the direct cause is unknown, excessive nutrient levels can increase the demand for dissolved oxygen. As algae and other organisms grow and reproduce in response to the nutrients, they deplete the oxygen in the water. Nonpoint source pollution and discharges from wastewater treatment facilities are both possible causes of algal blooms and, consequently, low dissolved oxygen levels.

There have also been declines in eelgrass coverage, which may signify declining water quality (Figure 6-5). Eelgrass is a type of seagrass essential to the ecology of estuaries because it filters water, stabilizes sediments, provides food for wintering waterfowl, and furnishes habitat for juvenile fish and shellfish. Eelgrass is especially sensitive to water clarity and, in turn, helps to improve clarity by preventing erosion and filtering particulates. There have been rapid, temporary drops in eelgrass stands due to wasting disease events in the past; however, a consistent, decreasing trend in eelgrass, unrelated to wasting disease, is also evident in New Hampshire estuaries. Recent surveys have shown that eelgrass has completely disappeared from the estuarine portions of the Squamscott, Lamprey, Oyster, and Bellamy rivers. Following these surveys, DES designated much of Great Bay Estuary as “threatened” or “impaired” due to the significant eelgrass declines (NHDES, 2008a). The coverage of eelgrass in Great Bay declined by 17 percent between 1996 and 2004 (NHEP, 2006b). This trend cannot be linked directly to the water quality in Great Bay, though increases in sediment concentrations have been observed. The changes in eelgrass strongly suggest that New Hampshire’s estuaries may be on the verge of entering a danger zone from which there may be no recovery.

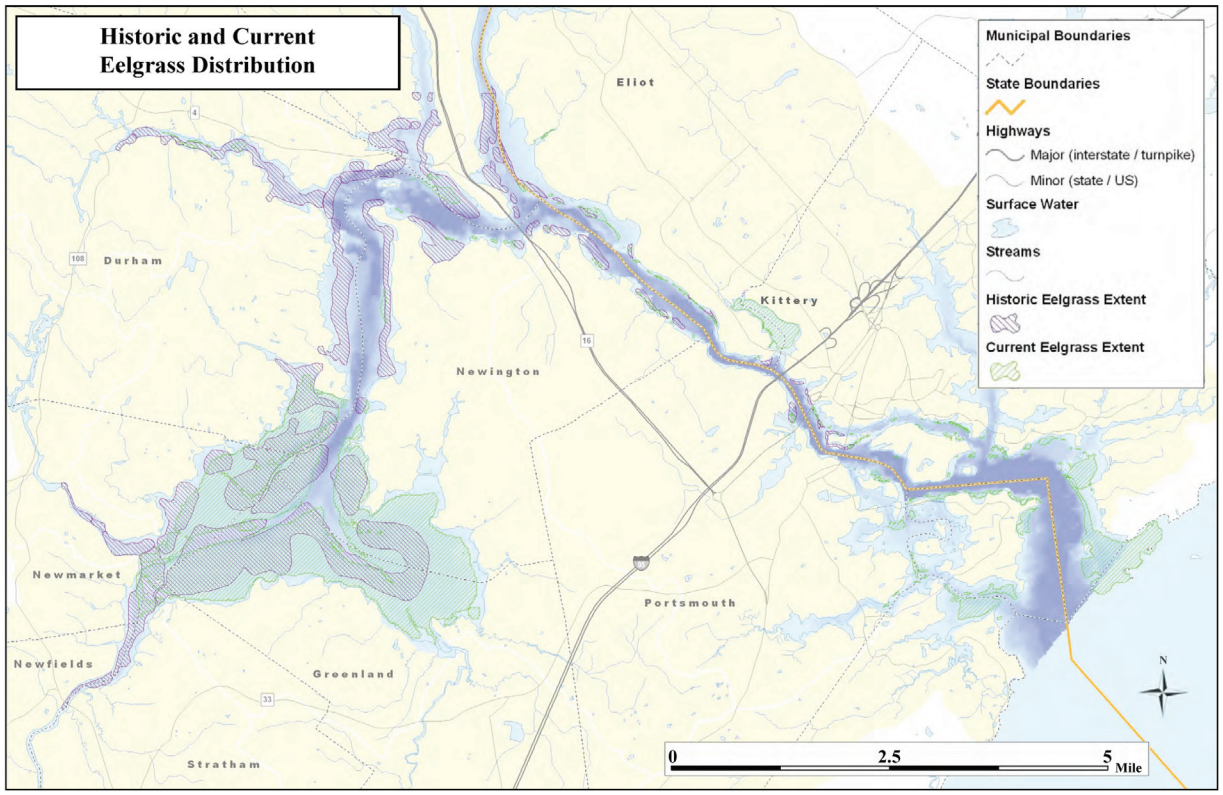


Figure 6-5. The extent of eelgrass habitat has decreased significantly since the maximum area, recorded in 1996. This change likely indicates broad scale water quality issues involving suspended sediments (cloudy water) and nutrient pollution that affect the coastal zone on the watershed scale. *Source: Odell et al., 2006.*

Water Quality and Shellfish Abundance in Great Bay Are Declining Together

It is estimated that the historic (colonial) shellfish populations in Great Bay were capable of filtering a volume of water equivalent to the entire bay in less than four days. "The current oyster population may be capable of filtering a volume of water equivalent to the entire estuary in about 137 days" (Odell et al., 2006, p. 31). At the same time, sediment inputs to the Great Bay system are increasing. Concentrations of total suspended solids (TSS) in Great Bay increased from an average value of 8.8 mg/L to 15.9 mg/L (an 81 percent increase) between 1976-1981 and 1999-2004. Between 1994 and 2004 TSS increased by approximately 20 percent at three major tributaries over a period when annual river flows went down. Sediment yield nearly doubled in that time period for the Oyster River (NHEP, 2006b).

Taken together, these two trends are worrisome. Inputs of sediment are increasing at exactly the same time the natural buffering capacity is decreasing. Beginning around 1995, oyster populations became greatly impacted by the parasites Dermo and MSX. As the Great Bay Estuary Restoration Compendium points out, "The current poor status of oysters in Great Bay is attributed to multiple factors, including accumulation of fine sediments, mortality due to MSX, removal of shell and lack of preferred substrate for settlement, and poor recruitment. (Odell et al., 2006, p. 27).

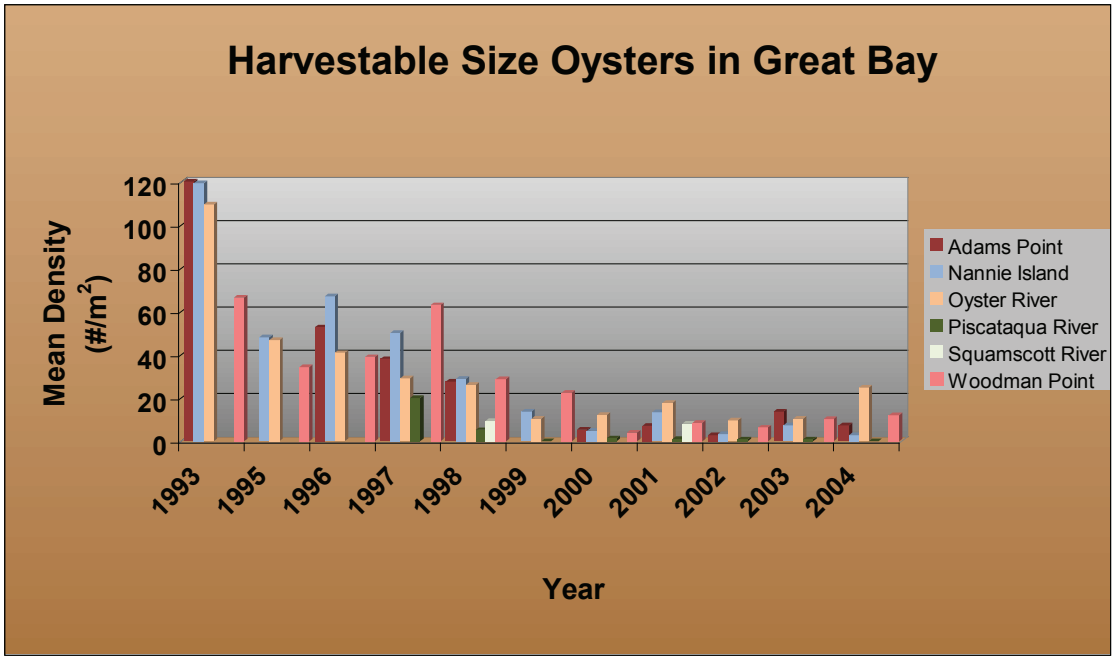


Figure 6-6. Harvestable size oysters by year in New Hampshire's Great Bay. ***Source: NHEP, 2005.***

Thus, the lack of shellfish (Figure 6-6) may be exacerbating the impacts of upland development within the Great Bay watershed, which, through increased turbidity, is a significant factor limiting light penetration to eelgrass and other underwater habitats.

6.2.4 Bacterial Contamination from Wet Weather Sources Continues to Impact Coastal Resources

Fecal coliform bacteria in water may indicate the presence of sewage contamination and, consequently, disease-causing microorganisms. A majority of shellfish harvesting areas, 53 percent, are currently closed due to the measured or potential presence of fecal coliform bacteria. These areas are either near major pollution sources, in areas where high bacterial levels are consistently measured, or unclassified because their potential contamination level is uncertain (Figure 6-7). The areas that are open for harvest, the remaining 47 percent, can also be intermittently closed if conditions for bacterial contamination exist (NHDES, 2008b).

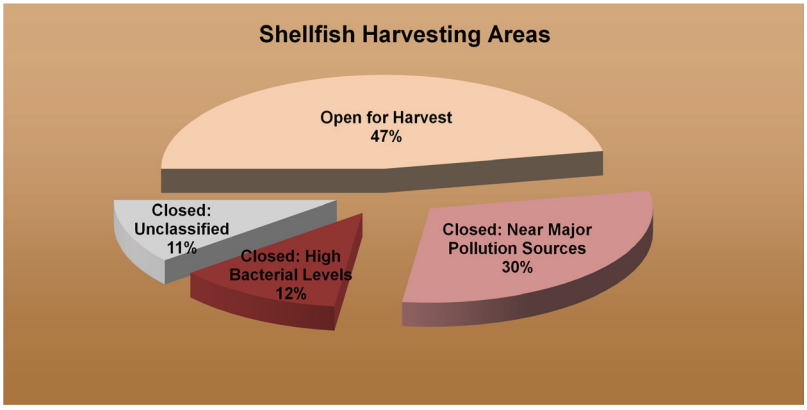


Figure 6-7. Over 50 percent of shellfish harvesting areas are closed, and a majority are due to evidence of or nearby pollution sources. ***Source: NHDES, 2008b.***

Over the past 20 years, bacteria sampling has been conducted intensively in the Great Bay system. The bacteria concentrations in Great Bay have decreased by 73 percent over the past 16 years, but the trend has slowed recently (NHEP, 2006b). Up-

grades to wastewater treatment facilities and stormwater management projects funded by the New Hampshire Estuaries Project are likely major contributors to the decreasing trend. However, this conclusion is based on only two of the seven tributaries to the Great Bay Estuary and only four data-collecting stations. The observed trend may have been driven by large decreases in the late 1980s and early 1990s, with smaller changes occurring in the past decade. Alternatively, continued land development in the coastal watershed may be counteracting the ongoing pollution control efforts (NHEP, 2006a).

Wet weather bacteria counts are usually much greater than those found during dry weather. Sources of bacteria in stormwater samples often include wastes from pets, waterfowl, malfunctioning septic systems or sewer overflows, and a multitude of other potential sources. These nonpoint sources of pollution are usually linked to impervious surfaces carrying untreated stormwater directly towards surface waters and the absence of stormwater management practices to improve water quality. Combined sewer overflows are also sources of wet weather bacteria.

6.2.5 Head-of-Tide Dams Harm Fish Populations

The obstacles to upstream fish migration created by dams can harm fish populations by fragmenting populations and habitats and preventing reproduction. Several dams in New Hampshire's coastal zone impound water just above the head-of-tide, the location farthest upstream affected by tidal changes. The bodies of water created above dams often have decreased dissolved oxygen levels, which also limit fish populations and adequate habitat for aquatic species.

These head-of-tide dams especially impact populations of anadromous fish species, those that depend on both fresh and salt water ecosystems for habitat. Adult anadromous fish swim upstream to spawn in freshwater habitats. Largely due to dams, anadromous fish populations and the extent of area they inhabit have decreased significantly in New Hampshire. The map in Figure 6-8 shows the current extent of alewife populations and the estimated historical extent of the coastal watershed streams that these fish inhabited. Alewife is just one species among several that require access to upstream freshwater habitats from the marine coast including Blueback herring, American shad, American eel, Atlantic salmon, Rainbow smelt and Atlantic sturgeon. All of these fish species are important to the overall health of the Gulf of Maine ecosystem, providing forage for many commercially harvested fish.

6.2.6 Boat Access and Moorings Present Ecological and Water Quality Issues

The increasing presence of boats on coastal waters, while a source of recreational value for New Hampshire residents and visitors, also damages eelgrass beds and endangers shellfish harvesting areas. Increased mooring permits may also affect water quality and habitat through fuel or oil contamination, sewage contamination, and the direct physical damage caused by the moorings themselves. The risk of boat sewage contamination is becoming a particular threat to shellfish harvesting. The number of mooring permits in the Great Bay Estuary has grown from 475 in 1990 to approximately 650 today.

Most of the 5,400 acres of estuarine shellfish waters are already subject to intermittent bacterial pollution and temporary closures, largely from wet weather sources of pollution such as stormwater runoff. Mooring fields are also beginning to encroach on recreational oyster beds, as a new

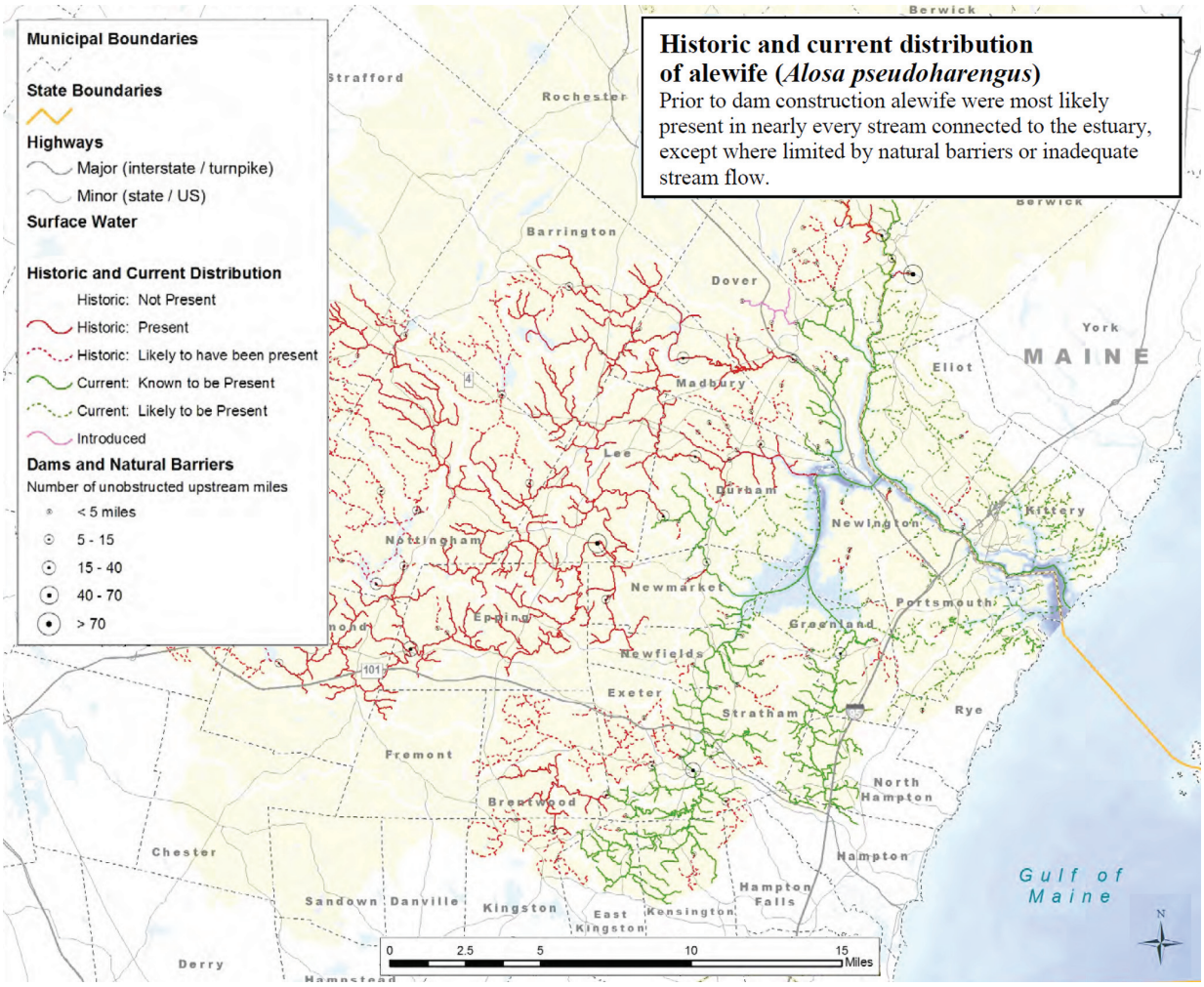


Figure 6-8. Dams placed at the head-of-tide, or the farthest point upstream of the coast affected by tidal changes, limit the movement of several species of fish that depend on both fresh and salt water habitats. Alewife, for example, are found today (green) in a much smaller network of streams than expected historically (red). Atlantic salmon, as another example, are no longer found anywhere in the stream network in the Great Bay watershed. *Source: Odell et al., 2006.*

mooring field was established in 2004 just south of Adams Point, adjacent to a major oyster bed. Although the recent "No Discharge" designation for all New Hampshire waters will help reduce the risk of contamination by sewage, balancing competing uses in the coast remains an ongoing challenge.

6.3 Current Management and Protection

A tremendous amount of work has been done for New Hampshire's coast and estuaries by the municipalities, federal government, and New Hampshire state government. Efforts by non-governmental organizations, the University of New Hampshire, and hundreds of volunteers have also helped immensely. All these agencies and organizations working together make the seacoast one of the best studied and monitored places in New Hampshire.

6.3.1 New Hampshire Coastal Program

The New Hampshire Coastal Program, administered by DES, is one of 34 federally approved coastal programs authorized under the Coastal Zone Management Act. Its mission is to balance the preservation of coastal resources with the social and economic needs of this and succeeding generations. The Coastal Program creates and sustains partnerships with local, state, and federal agencies as well as businesses and nonprofit groups to complete planning, restoration, and education projects. In 2007 the Coastal Program celebrated 25 years of bringing together people, talent, and resources for the coast.

In 1972 Congress passed the Coastal Zone Management Act (CZMA) in recognition of the importance of the nation's coastal resources. The Coastal Program gained federal approval in 1982. Section 307 of the CZMA, known as the federal consistency provision, provides a mechanism for states to manage coastal uses and resources and to facilitate cooperation and coordination with federal agencies. The review process ensures that federal activities affecting any land or water use, or natural resource in New Hampshire's coastal zone will be conducted in a manner consistent with the Coastal Program's enforceable policies. The Coastal Program has a restoration program which is dedicated to working on degraded salt marshes and rivers, and to address the problems associated with invasive species. The Coastal Program has distributed more than $12 million in grants over its history and actively supports the Strafford and Rockingham regional planning commissions with funding on an annual basis.

6.3.2 Coastal Nonpoint Pollution Control Program

The Coastal Program developed and oversees the implementation of the state's Coastal Nonpoint Pollution Control Program (CNPCP). The CNPCP was created to augment EPA's Section 319 (nonpoint source pollution) program with specific focus on enforceable policies in the coastal watershed. Activities for the program include coordination of state and local organizations and agencies, technical assistance, monitoring, and public education. The focus of the CNPCP in New Hampshire has been on bacterial contamination, biomonitoring, and municipal activities.

6.3.3 Coastal and Estuarine Land Conservation Program

As undeveloped land becomes increasingly rare, seacoast towns look to the federal Coastal and Estuarine Land Conservation Program (CELCP) to fund local land protection efforts. CELCP, a tremendously competitive program where states vie for space on a national priority list, aims to protect coastal lands with significant ecological value. CELCP requires a one-to-one match for all projects.

6.3.4 Public Beach Program

DES has operated a Public Beach Inspection Program, or Beach Program, for over 20 years. Fifteen coastal and estuarine beaches are inspected and monitored for the presence of fecal bacteria on a weekly or bi-weekly basis during the swimming season.

6.3.5 Dredge Management Task Force

The New Hampshire Dredge Management Task Force (DMTF) is an interagency work group formed in 1993 to review existing and proposed dredging projects and to develop policies, rules, and guidelines for dredging activities in New Hampshire's coastal waters. The DMTF provides technical and regulatory expertise to ensure that dredging projects are conducted in a manner consistent with state and federal rules and regulations.

6.3.6 Natural Resources Outreach Coalition

The Natural Resources Outreach Coalition (NROC) is a collaboration of 10 state, regional, and non-profit organizations that provides natural resources planning assistance to communities in New Hampshire's coastal watersheds. NROC provides guidance and technical assistance to help communities deal with the impacts of economic and population growth on natural resources. Over a period of a year or more, the NROC team meets with municipal officials and interested community members to focus their natural resource protection goals, develop an implementation strategy, and locate the technical and financial assistance needed to accomplish goals.

6.3.7 New Hampshire Estuaries Project

The New Hampshire Estuaries Project is part of EPA's National Estuary Program, which is a joint local, state, and federal program established under the Clean Water Act with the goal of protecting and enhancing nationally significant estuarine resources. The NHEP receives its funding from the EPA and is administered by the University of New Hampshire. Approved in 2001 and updated in 2005, the NHEP Comprehensive Conservation and Management Plan is an approach to protect and enhance the state's estuaries. Spanning three years, the collaborative process to develop the watershed plan involved the work of researchers, planners, resource managers, concerned individuals, and other coastal stakeholders. The resulting plan describes actions to be undertaken throughout New Hampshire's coastal watershed to achieve and sustain healthy estuarine systems. The Management Plan identifies priority actions in five areas: 1) water quality; 2) land use, development, and habitat protection; 3) shellfish resources; 4) habitat restoration; and 5) public outreach and education.

6.3.8 Great Bay National Estuarine Research Reserve

Great Bay National Estuarine Research Reserve is part of a national network of protected areas established for long-term research, education and stewardship. This partnership program between NOAA and the coastal states protects more than one million acres of estuarine land and water. These areas provide essential habitat for wildlife, serve as living laboratories for scientists, and offer educational opportunities for students, teachers and the public.

6.3.9 Great Bay Resource Protection Partnership

The Great Bay Resource Protection Partnership was formed in 1994 to identify and protect significant habitat areas in the Great Bay region. This successful partnership is comprised of statewide, regional and local non-profit conservation organizations, municipalities, and state and federal agencies. As of September 2008 the GBRPP has protected 5,837 acres of critical habitat around Great Bay (GBRPP, 2008). Local communities and other organizations have protected an additional 3,020 acres that the GBRPP has been able to use as a match to leverage federal funding.

6.3.10 New Hampshire Corporate Wetlands Restoration Partnership

The goal of the New Hampshire Corporate Wetlands Restoration Partnership is to facilitate corporate interest, involvement and support for the state's aquatic resources. Funds collected by the NHCWRP are used to restore coastal and freshwater wetlands and rivers degraded by human activities such as fill, pollution, or changes in water flow. The program has been adopted by the federal government as a national initiative (Corporate Wetlands Restoration Partnership, n.d.).

6.3.11 Volunteer Programs

There are numerous volunteer monitoring and cleanup programs in the seacoast watershed. These include not only the Volunteer River Assessment Programs, as in other watersheds, but also four volunteer river biomonitoring assessment groups, the Great Bay Coastwatch, Marsh Monitors, and Blue Ocean Society monthly beach cleanup teams.

6.3.12 No Discharge Program

New Hampshire's coastal waters were designated as a "No Discharge Area" in 2005, prohibiting the discharge of treated and untreated boat sewage. Federal law additionally prohibits the discharge of untreated sewage from vessels within all navigable waters of the United States, which include territorial seas within three miles of shore.

6.3.13 Land Conservation Plan for New Hampshire's Coastal Watersheds

The Coastal Program and NHEP recently teamed up with The Nature Conservancy, the Society for the Protection of New Hampshire Forests, and the Rockingham and Strafford regional planning commissions to create a Land Conservation Plan for New Hampshire's Coastal Watersheds. This plan identifies the 70 most ecologically significant areas of the watershed. Those 70 priority areas contain some 190,000 acres of undeveloped land in the 42 towns of the watershed (Figure 6-9). Approximately 40,000 acres have already been protected (Zankel et al., 2006).

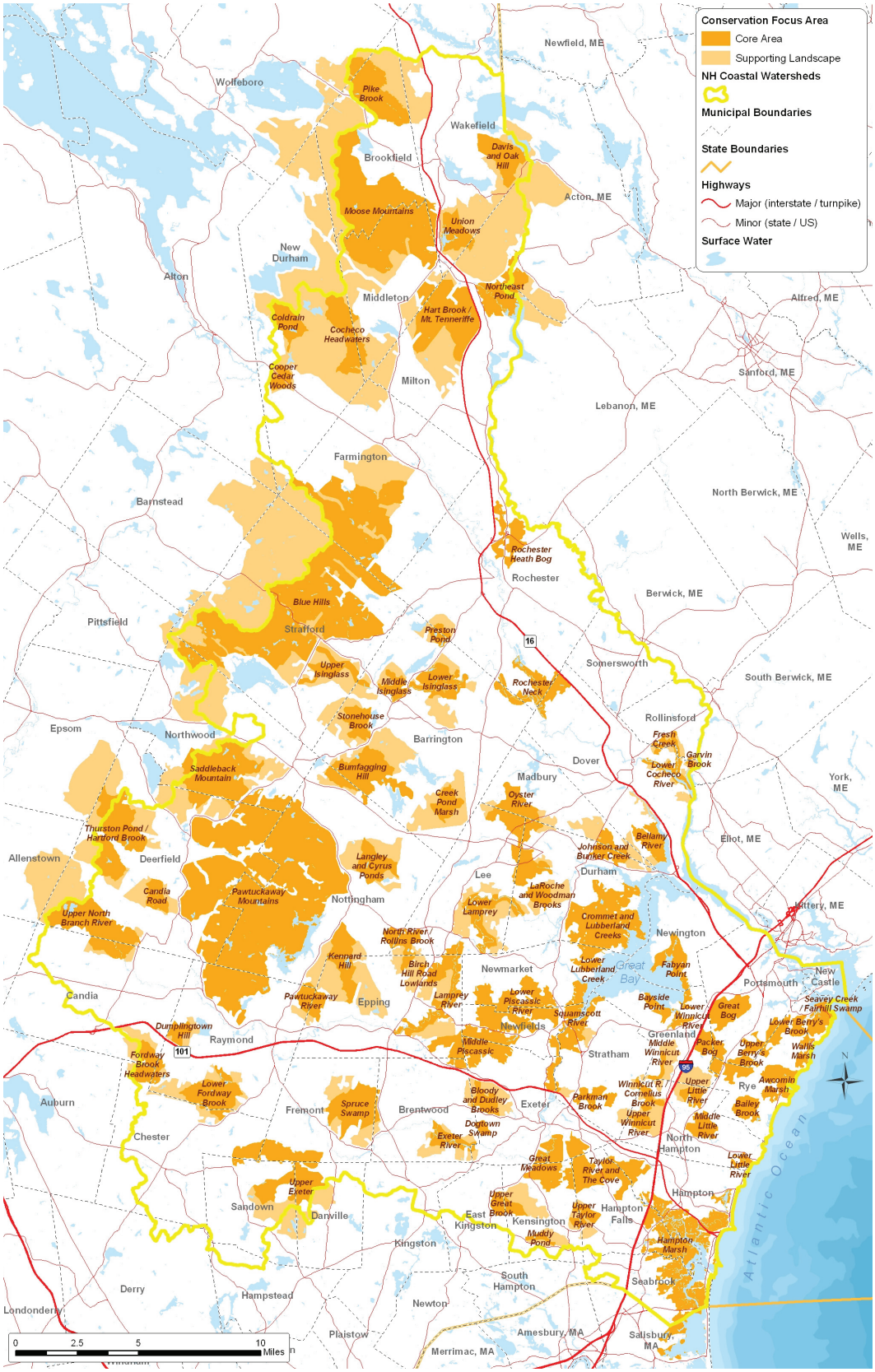


Figure 6-9. Conservation focus areas and supporting landscapes in the coastal watershed. ***Source: Zankel et al., 2006.***

6.4 Stakeholder Recommendations

This section contains key recommendations that have been developed in concert with a group of volunteer stakeholders that have reviewed and contributed to this chapter.

6.4.1 Develop a Strategy to Adapt to the Impacts of Climate Change

In light of the extensive impacts coastal areas are expected to experience as a result of climate change, an adaptation strategy for this area is a priority.

6.4.2 Reduce Nutrient and Sediment Loads to the Estuaries

Current nutrient loading to coastal waters is creating serious issues with water quality that must be addressed if the estuaries are to be preserved. Much of the loading likely results from increasing stormwater runoff, which results from the pace, pattern, and method of development, and from wastewater treatment facilities, which are increasingly stressed as a result of population growth. Large tracts of forests and farmlands are being converted to sprawling residential and commercial land uses with more compacted lawns, roads, and parking lots and greater runoff. The construction process itself often produces significant uncontrolled sediment loads to downstream waters. While population growth may be inevitable, the increases in total runoff and sediment loads do not have to be because runoff can be handled onsite much more effectively than at present. Changes to DES's Alteration of Terrain regulations, discussed in Chapter 10 – Stormwater, will help substantially, but significant progress must be made before the hydrology of new development resembles pre-development conditions. Additionally, the existing developed landscape should be retrofitted for stormwater runoff treatment where feasible.

6.4.3 Limit Boat Moorings

To protect sensitive coral reefs, some countries limit the number and location of boat moorings since these have been repeatedly shown to disrupt and even destroy otherwise intact reefs. While New Hampshire does not have reefs, the estuary habitats along New Hampshire's coasts are nearly as sensitive to moorings and disruptions that may include damage from anchors, sewage dumping, and propeller disturbance. Existing moorings have already encroached on valuable shellfish habitat, and new moorings increase the encroachment. The best locations and carrying capacity of moorings in New Hampshire's estuaries along with potential limits on boat access should be evaluated to protect these resources.

6.4.4 Make Removal of Head-of-Tide Dams a Priority

As discussed in Chapter 11 – Dams, New Hampshire has a dam removal program. Because head-of-tide dams are in the most sensitive locations possible for fish passage, any of these dams that could be removed should be a priority and the others should receive additional attention for fish passage as they are upgraded or repaired.

6.4.5 Expand Shellfish Resources and Harvesting Opportunities Through Improved Management of Estuarine Areas

There continues to be great interest in opening more shellfish harvesting areas either by gathering more environmental quality data to determine whether additional areas can be classified as safe, or by pursuing studies to investigate and remediate pollution sources and improve the management of the shellfish areas. Significant effort and investment are also needed in restoring large self-sustaining shellfish populations. Healthy native oyster populations, for example, will not only improve harvest opportunities, but also enhance water quality since oysters filter large volumes of water.

When DES began classifying shellfish waters in 2000, New Hampshire did not have a coordinated program to implement the National Shellfish Sanitation Program; thus, interstate sale of commercially grown shellfish was not possible. In February 2002 New Hampshire was officially recognized as a shellfish producing state by the U.S. Food and Drug Administration. New opportunities to harvest shellfish have been realized not only by opening new areas but also by improved management. Most estuarine areas open for harvest still require temporary closures due to high bacteria levels associated with rainfall, season or other factors. Augmented monitoring to develop information to support more accurate classifications has led to more opportunities for shellfish harvesting. Continued expansion of monitoring and better management will expand the available economic shellfish harvesting opportunities.

6.4.6 Support Land Conservation and Stormwater Best Management Practices to Help Reverse Trends in Coastal and Estuarine Degradation

In some ways the seacoast is a model for land protection. Currently 54,622 acres in the coastal watershed are protected, which amounts to 10.7 percent of the land area. An additional 21,790 acres of watershed land need to be protected in order to achieve the NHEP goal of protecting 15 percent of the watershed area by 2010 (NHEP, 2006b). However, the Land Conservation Plan for New Hampshire's Seacoast Watersheds has identified 190,000 acres of land that make up the core ecologically important areas (Zankel et al., 2006). Achieving this goal will require a substantial increase in the rate of land protection. More importantly, land protection efforts must be targeted to maintain natural buffers on the streams and rivers that feed estuaries and to protect water quality, as guided by the plan.

Although conserving land in its natural state does help to lessen stormwater impacts downstream, it does not directly alleviate the sources of stormwater pollution already present. In addition to conserving coastal lands, stormwater best management practices must be implemented to alleviate problematic pollution from existing development, and low impact development site design (see Chapter 10 – Stormwater) must be employed for new development in the seacoast watershed.

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