HABITAT PROFILE

Coastal Islands

Associated Species: roseate tern (Sterna dougallii dougallii), common tern (Sterna hirundo), Arctic tern (Sterna paradisaea), black guillemot (Cepphus grylle), purple sandpiper (Calidris maritima)
Global Rank: Not Ranked
State Rank: Not Ranked
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Element 1: Distribution and Habitat

1.1 Habitat Description

Off the New Hampshire coast, islands are exposed to and battered by the maritime environment. Natural disturbances such as severe storms affect the rocky intertidal zones by causing mechanical weathering, disrupting succession, and influencing local levels of species diversity (Sousa 1979). Coastal islands have rocky shores, are usually remote, undisturbed, and free of predators (Percy 1997). Coastal islands are vegetated by grasses, herbaceous plants, and shrub thickets that grow among rocky outcrops, and have few to no trees (Nichols 2004). Historical accounts of the Isles of Shoals describe the islands as rocky and barren, and overgrown by grasses, herbaceous plants, and dense shrubs (Borror and Holmes 1990). The rocky intertidal areas are dominated by blue-green algae, lichens (Nichols 2004), and various mollusks and gastropods. The vegetation on mainland islands closely reflects the upland and wetland communities that are typical of the mainland near that island (B. Nichols, NHNHB, personal communication.).

1.2 Justification

Many species of colonial seabirds, water birds, waterfowl, shorebirds, and marine mammals use coastal islands as breeding grounds (DeGraaf and Yamasaki 2001, Kushlan et al. 2002). The Isles of Shoals group serves as a major premigratory staging area and migratory stopover for many Neotropical birds and provides wintering habitat for land birds (Borror and Holmes 1990). Numerous species of invertebrates (amphipod crustaceans, periwinkles, barnacles, mussels) and rockweeds reside in the rocky intertidal areas.

Several of these islands were home to large breeding colonies of terns (*Sterna* sp.), but a loss of habitat and an increase in numbers of herring gull (*Larus argentatus*) and great black-backed gulls (*Larus marinus*) preying on and displacing the terns resulted in their decline (USFWS 1998). Since 1997, Seavey Island has been the site of an intense tern restoration project. Efforts to restore breeding colonies of the federally endangered roseate tern (*Sterna dougallii dougallii*), state endangered common tern (*Sterna hirundo*), and state threatened Arctic tern (*Sterna paradisaea*) have been successful through gull control measures before and during the tern breeding seasons (NHFG 2004). Islands increase the productivity of waters by agitating currents, sediments, and nutrients, and increase the amount of shoreline available for use by plant and animal species (Percy 1997).

1.3 Protection and Regulatory Status

Islands that serve as breeding grounds for federal and state listed species are protected through the Endangered Species Act and the State Endangered Species Act respectively. Marine mammals are protected under the Marine Mammal Protection Act. Islands located in Great Bay National Wildlife Refuge are protected under the National Wildlife Refuge System, along with the Great Bay National Estuarine Research Reserve (Short 1992). Various laws and agreements exist that protect marine waters such as the Clean Water Act, the MARPOL Act, the Rivers and Harbors Act, Marine Mammal Protection Act, and the Marine Protection, Research, and Sanctuaries Act (Boesch et al. 2001).

1.4 Population and Habitat Distribution

Within the Gulf of Maine watershed, New Hampshire has 40-60 coastal islands that are all located in the southeast corner of the state (USGS 2001). They occur in four main waterbodies: Little Bay, Great Bay, Portsmouth Harbor, and the Atlantic Ocean. Offshore islands include the Isles of Shoals group located roughly 10 miles off the coast of New Hampshire. Mainland islands are scattered throughout Portsmouth harbor, the Piscataqua River and its tributaries, and Little and Great bays in Great Bay National Wildlife Refuge.

1.5 Town Distribution Map

See attached.

1.6 Habitat Map

GRANIT was accessed to identify coastal islands. Very small islands were grouped to their nearest adjacent neighboring island. In total, 96 polygons were grouped into 48 islands,

1.7 Sources of Information

Information on habitat and distribution of coastal islands in New Hampshire was taken from the New Hampshire natural communities guide, scientific literature, conservation plans, field guides, databases, and technical reports.

1.8 Extent and Quality of Data

There is no defined coastal island natural community type in New Hampshire. However, the presence of Shoals Marine Lab has led to extensive research on the Isles of Shoals. Changes in bird species composition and abundance have periodically been documented (Borror and Holmes 1990). Other smaller islands have been surveyed irregularly to determine presence of nesting common terns. An ongoing island ownership debate between New Hampshire and Maine has added to the uncertainty of the number of coastal islands that are under New Hampshire jurisdiction.

1.9 Distribution Research

A formal assessment and classification of New Hampshire coastal island natural communities and intertidal communities is needed.

Element 2: Species/Habitat Condition

2.1 Scale

The 48 islands were clustered into 15 conservation units based on geographic location.

2.2 Relative Health of Populations

The Isles of Shoals have been identified as key habitats for nesting and migrating birds. The islands also serve as haul-outs for harbor and other seal species. Historical habitats for nesting colonial birds include unnamed islands of Back Channel/New Castle, Colony Cove and Hen Island in Little Bay, and Footman and Nannie islands in Great Bay (New Hampshire Audubon Society unpublished data). Little is known about the health of other islands due to their remoteness or small size.

2.3 Population Management Status

N/A

2.4 Relative Quality of Habitat Patches

The 9 islands (4 of which are in New Hampshire) that comprise the Isles of Shoals provide the highest quality of coastal habitat. Nevertheless, large colonies of herring and great black-backed gulls that were established between 1950 and 1970 have reduced habitat values for other species. Gull management on White and Seavey Islands has restored their function as tern nesting areas. The islands in the Portsmouth Harbor and Great Bay have more limited habitat value because of their small size and proximity to the mainland.

2.5 Habitat Patch Protection Status

- The Isles of Shoals have varying degrees of protection. White and Seavey Islands have been under the ownership of the DRED Parks Division as part of Odiorne State Park since 1993 (Appledore Engineering 1999). Seavey Island was deeded to the State of New Hampshire after the White Island Lighthouse was automated in 1987. A Memorandum of Agreement between DRED Parks Division and NHFG exists relative to tern restoration. Seavey Island is managed by NHFG as an endangered species nesting area and is afforded both state and federal protection under endangered species law.
- The Star Island Corporation privately owns Appledore and Star Island, and both are open to the public through various touring companies.
- The Coastal Islands National Wildlife Refuge purchased Duck Island in July 2003. This island will be managed for its wildlife resources, protected as a seabird colony, posted for closure during the breeding season, and evaluated for habitat management and restoration (B. Benedict, USFWS, personal communication).
- Lunging, Malaga, and Cedar Islands are privately owned. There is no protection status at these islands beyond current shoreline and wetland regulations.
- Smuttynose Island is privately owned but was protected in August of 2001 by a conservation easement held by the Coastal Islands National Wildlife Refuge. This conservation easement allows the refuge to manage the site for wildlife resources (B. Benedict, USFWS, personal communication).
- Hen Island is owned by the Town of Newington. Since the early 1990s, the town has worked with NHFG and ASNH to post signs to close the island during the breeding season. The area is used only by town residents, and they have acted as stewards for this colony. The proximity of the island to the mainland leaves the terns vulnerable to predation and the Hen Island tern colony has been disrupted by rats, Canada geese, great horned owl, and human disturbance.
- Islands in Great Bay National Wildlife Refuge have protection under the National Wildlife Refuge System and the Great Bay National Estuarine Research Reserve.
- The protection status of islands in Portsmouth Harbor and Piscataqua Rivers is unknown.

2.6 Habitat Management Status

A management program for Great Bay has been established by the Great Bay National Estuarine Research Reserve, the National Oceanic and Atmospheric Administration, and the Marine Division of the New Hampshire Fish and Game Department, whose goal is to preserve the estuarine resources for research and education. There is no organization for management of Little Bay or Piscataqua River. An MOA between the DRED and NHFG exists relative to tern restoration on White and Seavey Islands. The Marine Fisheries Division of NHFG has authority over management activities of coastal natural resources. Various governmental and nongovernmental programs collaborate (e.g., Gulf of Maine Council on the Marine Environment and Gulf of Maine Seabird Working Group) work to protect and restore coastal island habitats.

2.7 Sources of Information

Habitat maps were examined to identify key habitats. Information on protection and management status was found in management and conservation plans.

2.8 Extent and Quality of Data

Numerous studies have been conducted and published on the flora and fauna of the Isle of Shoals and the surrounding marine environment. Currently, the University of New Hampshire Jackson Estuarine Laboratory conducts long term monitoring of the health of the Great Bay estuary and Portsmouth Harbor. Due to their remoteness or small size, little is known about the relative condition of mainland coastal island habitat.

2.9 Condition Assessment Research

A formal assessment and classification of New Hampshire coastal island natural communities and intertidal communities is needed. Mainland island vegetation and wildlife use needs to be assessed to define priority habitats.

Element 3: Species and Habitat Threat Assessment

3.1.1 Non-Point Source Pollution, Mercury

(A) Exposure Pathway
Moderate forms of atmospheric pollution are widespread among coastal environments. Chemicals in the environment from industrial and municipal discharges, atmospheric deposition, and polluted runoff can accumulate in marine sediments at harmful levels and, accumulate in aquatic plants, invertebrates, fish, and mammals (Beckvar 1996). Accumulation of contaminated sediment in prey species may be transferred to higher trophic levels.

Once mercury is converted to methylmercury, it can be consumed by organisms. Methylmercury can then both accumulate and increase in concentration as it moves up the food chain. Seabirds are at risk for high levels of mercury as they feed relatively high on the ocean's food chain (Evers 2005).

(B) Evidence
The two basic routes of exposure are transport of dissolved contaminants through porous tissue and ingestion of contaminated prey or sediment particles. Metals are easily absorbed into the tissue of aquatic organisms and are not easily eliminated. Mercury has the highest potential of being biomagnified and transferred along the intertidal food chain (Blackmore and Wang 2004, Marsden and Rainbow 2004). Marine mammal tissues have some of the highest concentrations of mercury found in all marine organisms (Beckvar 1996).

Mercury Connections, a report that summarizes the findings of mercury patterns in northeastern North America, identified nine areas where mercury concentrations were significantly elevated in fish and wildlife. These locations were identified as "biological hotspots" where high levels of methylmercury pose an ecological risk (Evers 2005). The lower Merrimack River watershed that borders New Hampshire and Massachusetts was identified: Seavey Island is in close proximity to the outflow of this river. Mercury has been shown to have negative effects on individual seabirds, as well as the overall populations, through changes in reproduction, behavior, and physiology that result in lowered productivity and survival.

3.1.2 Recreation

(A) Exposure Pathway
An increase in recreational activities near or on coastal islands can cause nesting species to abandon nests causing eggs or chicks to become vulnerable to predators, or prevent species from returning to suitable nesting sites. Carelessly walking across islands could result in trampling of vegetation or destruction of bird nests. Pets may destroy nests and frighten nesting birds, resulting in nest abandonment.

The lighthouse renovations scheduled to take place on White Island in 2005 – 2006 will bring many more visitors to White and Seavey Islands. Preservation of the White Island Light Station is being supported, in part, by a grant under the Save America's Treasures program which stipulates that visitation to the island be permitted for a minimum number of days each year. The potential exists for an increased number of island visitors after the renovation is complete.

(B) Evidence
Boaters have been seen dumping garbage into the ocean, which eventually washes up onto island shores. Remains of illegal campfires have been found on White Island, Isles of Shoals, adjacent to the tern colony on Seavey Island. Vandalism on Higgins Beach, Maine resulted in a complete least tern (*Sterna antillarum*) colony failure (Kress and Hall 2004). Offshore boating activities (whale watching, fishing, tour boats) can cause species to be flushed from the islands causing them to use up energy (USFWS 1994). Studies that investigated the effects of recreation and trampling on rocky intertidal zones showed that species occupying these areas are under intense pressure and their populations fluctuate based on the intensity of the disturbance (Keough and Quinn 1998, Aleesa et al. 2003).

Beyond the direct impact that taking terns on the wintering grounds has on the survival of this species, it is harder to correlate human disturbance with common and roseate tern productivity. Impacts from the intermittent disturbance of recreation and tourism are likely to cause some negative impacts to common tern productivity, but are unlikely to result in permanent disruption to nesting. Human disturbance at the inland colonies in New Hampshire has been known to cause abandonment in the past. Both Hen Island and the Hampton salt marsh colonies suffer negative impacts from human intrusion.

3.1.3 Climate Change

(A) Exposure Pathway
The melting of glacial ice and thermal expansion of ocean water is the main pathway for sea level rise (Gulf of Maine Council Habitat Restoration Subcommittee 2004). Low elevation habitats are important for nesting and loafing for seabirds and marine mammals and will be flooded by rising sea levels or overwashed more frequently by storm surges (Gulf of Maine Council Habitat Restoration Subcommittee 2004). These changes affect habitat availability and the timing of nesting and migration (Kushlan et al. 2002).

(B) Evidence
Sea levels are rising along mainland and island shores due to rising temperatures (Kushlan et al. 2002). Air temperatures are expected to rise 1.4 - 5.8 ° C in the twenty-first century (Church et al. 2001). Along much of the United States coast, the sea level is rising 2.5-3.0 mm/yr, and global warming, resulting from an increase in carbon dioxide and other gasses in the atmosphere, could raise the sea level 15 cm by 2050 and 34 cm by 2100, and increase storm frequency (Titus and Narayanan 1995, Titus 1990). According to Titus (1990), barrier islands respond to a rise in sea level by either washing over landward and remaining intact or breaking up and drowning in place.

3.1.4 Oil Spills

(A) Exposure Pathway
Oil can enter marine waters because of platform construction, drilling, shipping and spillage, and low-level seepage from surface runoff or subsurface sources (Boesch et al. 2001). Species can become coated in oil, resulting in direct mortality or reduced reproductive success, food can become contaminated, toxins can build up in upper trophic feeders, and oil can coat the shores resulting in habitat degradation (Kushlan et al. 2002).
Because coastal rocky shores are exposed to continuous wave action, any oil that is deposited is rapidly removed, however, contaminated waters that wash over tide pools could result in direct mortality of their inhabitants and heavy oil might remain on rocks over the high tide line. Any impacts usually do not last long except where heavy concentrations of light oil come ashore quickly (New Hampshire Estuaries Program and NHDES 2004).

(B) Evidence
The harmful effect of oil on birds has been well documented, both through contamination from chronic oil pollution and from major oil spills (Chardine 1990). Externally, even a small amount of oil contamination can destroy the weatherproofing and insulating properties of the plumage. This in turn can cause hypothermia and inability to fly, stay afloat, and forage. Internally, the ingestion of oil can be equally life threatening. Direct toxic effects on the gastrointestinal tract, pancreas, and liver have all been documented (Pierce 1991). Johnston (1984) has summarized various studies and reports regarding effects of oil spills on marine species and habitats:

- Plants, mollusks, and other invertebrates that are attached to rocks are initially impacted but quickly recover
- Birds suffer the greatest impacts, resulting in rapid death if they are coated in heavy oil and do not receive immediate assistance
- Internal organs are affected through ingestion of oil through preening, and oiled birds transfer oil to eggs causing a reduction in egg permeability and reduced productivity
- Marine mammals are not at great risk when encountering oil since it is usually washed off when diving, but when they come into contact with oil-coated shorelines, serious and possible life-threatening skin irritations occur
- Oil on rocks can last for as long as 8 years, particularly if the coated rock has been dried and warmed by the sun.

During a 1996 spill, the Hen Island tern colony in Little Bay was oiled as the birds were incubating eggs. Perhaps as disruptive was that the island was used to anchor containment booms and serve as point for cleanup activity. In addition to the direct disturbance, data from the New Hampshire Gulfwatch monitoring program documented high levels of polycyclic aromatic hydrocarbons in mussels immediately following the spill followed by a gradual recovery to baseline levels within 2 years (GOMC 2003).

Bird and Ram Islands, which support close to 50% of the northeastern roseate population, were especially affected by a 2003 spill. Ram Island was the most heavily oiled of the affected islands. According to Carolyn Mostello of the Massachusetts Division of Fisheries and Wildlife there were more than 20 birds found dead on Ram Island immediately following the spill and many more birds, including terns, were oiled to varying degrees. To limit further oiling of terns and their eggs, hazing was initiated on Ram to keep the birds off island.

3.1.5 Aquaculture

(A) Exposure Pathway

Marine aquaculture spreads over 26,000 hectares (100 mi^2) of marine waters and accounts for 1/3 of global seafood farming by weight (Goldburg et al. 2001). The production of marine finfish and shellfish has been the fastest growing portion of aquaculture (Goldburg et al. 2001). Aquaculture facilities attract seabirds that take advantage of new food sources. Distressed farmers may result to harassment and legal or illegal killing of these species to protect their stock (Kushlan et al. 2002, Goldburg et al. 2001). Fish can escape and harm wild populations by way of competition, interbreeding, spread diseases and parasites, and cause the displacement or extinction of native populations (Goldburg et al. 2001). Some aquaculture practices use wild fish as feed and can indirectly affect marine environments thousands of miles away (Goldburg et al. 2001). Aquaculture also contributes to nutrient pollution, primarily nitrogen pollution (through uneaten food and waste discharge), which can lead to eutrophication (Boesch et al. 2001, Goldburg et al. 2001).

(B) Evidence

In the southeastern United States, 108,000 waterbirds that feed at aquaculture sites were legally destroyed between 1987 and 1995 and more were probably illegally destroyed, which increases the impact of aquaculture-related mortality (Kushlan et al. 2002, Goldburg et al. 2001). Escapes of native species that are farmed can harm wild populations, especially when genetic differences exist between the farmed and wild populations (Goldburg et al. 2001). In Maine, a storm in 2000 resulted in the escape of 100,000 farmed Atlantic salmon of European origin (Goldburg et al. 2001).

Farmed mollusks, which are grown on the bottoms of bays along the East Coast, are sometimes harvested by dredging that can alter the bottom habitat and reduce biodiversity (Goldburg et al. 2001).
Organic wastes from aquaculture contribute to 80% of nitrogen released into the marine system (Goldburg et al. 2001). One finfish and shellfish aquaculture site in New Hampshire is less than 2 km south of White and Seavey Island. Two oyster aquaculture sites exist near Adams and Durham Points in Little Bay.

3.1.6 Energy and Communication Infrastructure

(A) Exposure Pathway

Three types of impacts to birds that may occur at offshore wind turbine facilities are short term disturbance and displacement during construction, long-term disturbance and displacement resulting from the presence of turbines and other structures, and mortality resulting from collision with moving turbine rotors (Kerlinger and Curry 2002). Waters may be disturbed and sediment released into the water column (Kerlinger and Curry 2002).

(B) Evidence

Few studies exist regarding impacts of offshore wind turbine facilities on birds. In the Netherlands and the United Kingdom, bird fatalities resulting from collision with turbines have been low to moderate (Kerlinger and Curry 2002). Other studies reveal that birds generally avoid sites within 100-200 m of the turbines (Kerlinger and Curry 2002). In some coastal situations, studies have observed water and shorebirds flying around turbines and not foraging beneath them (Kerlinger and Curry 2002). Even though the footprint of the wind turbine structure can take up a small fraction of the project area, disturbance and displacement of birds has been known to occur (Kerlinger and Curry 2002).

3.2 Sources of Information

Information regarding threats was taken from peer-reviewed scientific studies, field observations, and technical reports from state and federal environmental agencies, and reports from non-governmental environmental organizations. Threats were compiled and ranked internally, and sent out for expert review. Known contamination sources, heliports, staging areas, recreational fishing, marinas, and aquaculture locations were provided by NHDES. Airport locations were provided by NHDOT.

3.3 Extent and Quality of Data

There is a vast amount of data pertaining to predator overpopulation, atmospheric deposition, recreation and tourism, climate change, aquaculture, and oil spills being major threats to marine environments, primarily resulting from scientific research studies and federal environmental agency programs. Little is known about the risks of offshore wind turbines. To date, there are few "best industry practices" for preventing and/or mitigating impacts to birds at wind power facilities (Kerlinger and Curry 2002).

3.4 Threat Assessment Research

- Better linkage of biological response to contaminants with exposure and dose (Luoma 1999) and evaluation of wildlife bioindicators for New Hampshire are priority research topics.
- Intense monitoring and reporting of recreational usage of coastal islands are needed to assess impacts and recreational tour boat effects on coastal island species (Kress and Hall 2004).
- Continue to monitor changes in sea level resulting from changes in air temperature. Study the effects of short and long-term climate change on ocean habitats and species (Kushlan et al. 2002).
- Long-term assessments and biodiversity surveys of coastal islands before and after oil spills to determine effects.
- Develop improvements to aquaculture facilities such as escape-proof pens, non-lethal predator control, and effluent treatment systems (Goldburg et al. 2001).
- Monitor legal/illegal seabird take.
- Studies showing how offshore wind turbines affect birds need to be conducted and should be designed to provide necessary information to assess risk, including flight patterns, frequency of use of the site, and seasonal population sizes (Kerlinger and Curry 2002).

Element 4: Conservation Actions

4.1.1 Advise Interagency Risk Assessment Team on climate change risks to marine wildlife

(see interagency regulation and policy strategy)

(A) Direct threats addressed: Predation and Herbivory, Non-Point Source Pollution (Chemical Contaminants)

(B) Justification
Evidence in the North Sea has shown that the warming of the ocean waters can have a drastic impact on the availability of seabird food resources. In 2004, the majority of the seabird nests along the coast of Scotland produced no chicks. Scientists believe that the shift in phytoplankton to colder waters caused a massive decline in the preferred seabird food. It will be important to collect adequate data in the Gulf of Maine to document changes in water temperature and food availability.

4.1.2 Coordinate with Oil Spill response team to update the oil spill response in proximity to Isles of Shoals including the purchase of survey and hazing equipment. Document habitat quality and food resources prior to spill to serve as baseline for assessing effects of spills.

(A) Direct Threats Affected: Oil spills, Habitat Loss, Predation and Herbivory

(B) Justification
With 99% of the common tern and 100% of the roseate tern population in New Hampshire nesting on Seavey Island it is critical to minimize the impacts

of a catastrophic event such as an oil spill. Through careful planning, the purchase of equipment, and enforcement of safe shipping and operational procedures, an oil spill may be more easily contained.

- Oil spill response planning will allow for more immediate and appropriate response to an oil spill in close proximity to the Seavey Island seabird colony. The purchase of appropriate equipment to contain and clean up an oil spill at this location will improve the chances for minimal impact to the colony.
- Oil spill response planning that is specific to the Isles of Shoals and seabird nesting areas will help to protect the Seavey Island colony.
- Oil spill response planning should be ongoing and year round. Plans should include breeding and non-breeding periods. Purchase of equipment is an immediate need.
- Baseline documentation of the habitat quality and available food resources will be important in assessing the impacts of an oil spill, responding to impacts, and improving the outcome of any future spill response.

(G) Implementation
Implementation of improved oil spill response to the waters surrounding the Isles of Shoals will require the collaboration and cooperation of Tern Restoration Project personnel from NHFG and ASNH with the Oil Spill Response team to ensure that information on tern nesting and habitat usage is incorporated into the plan. Purchase of the proper equipment to deal with an oil spill near Seavey Island will require dedicated funds. Baseline data collection will need coordination and input from all partners.

4.1.3 Coastal Predator Overpopulation Management Plan, Population Management

(see predation and herbivory strategy)

4.1.4 Protect Lunging Island as seabird nesting habitat by approaching landowners with land protection options including conservation easement, conservation tax abatements and incentives, fee acquisition or voluntary agreements, Habitat Protection

(A) Direct Threats Addressed: Habitat Loss

(B) Justification
Lunging Island provided the most important documented historical habitat for terns in New Hampshire. The future protection of this site is important to prevent any further habitat losses and for the expansion of tern nesting habitat at the Isles of Shoals.

4.1.5 Coordinate with the Coastal Islands Refuge in the protection of Duck and Smuttynose Islands as seabird nesting habitat, Habitat Protection

(A) Direct Threats Addressed: Habitat Loss

(B) Justification
Duck and Smuttynose Islands are both protected under the National Wildlife Refuge System as seabird nesting habitat. It is important to coordinate and support protection at these sites.

4.1.6 Endorse Research on Aquaculture Impacts Effluent guidelines, improved state oversight including wastewater discharges, and introduction of new species. Develop voluntary guidelines.

Element 5: References

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5.2 Data Sources

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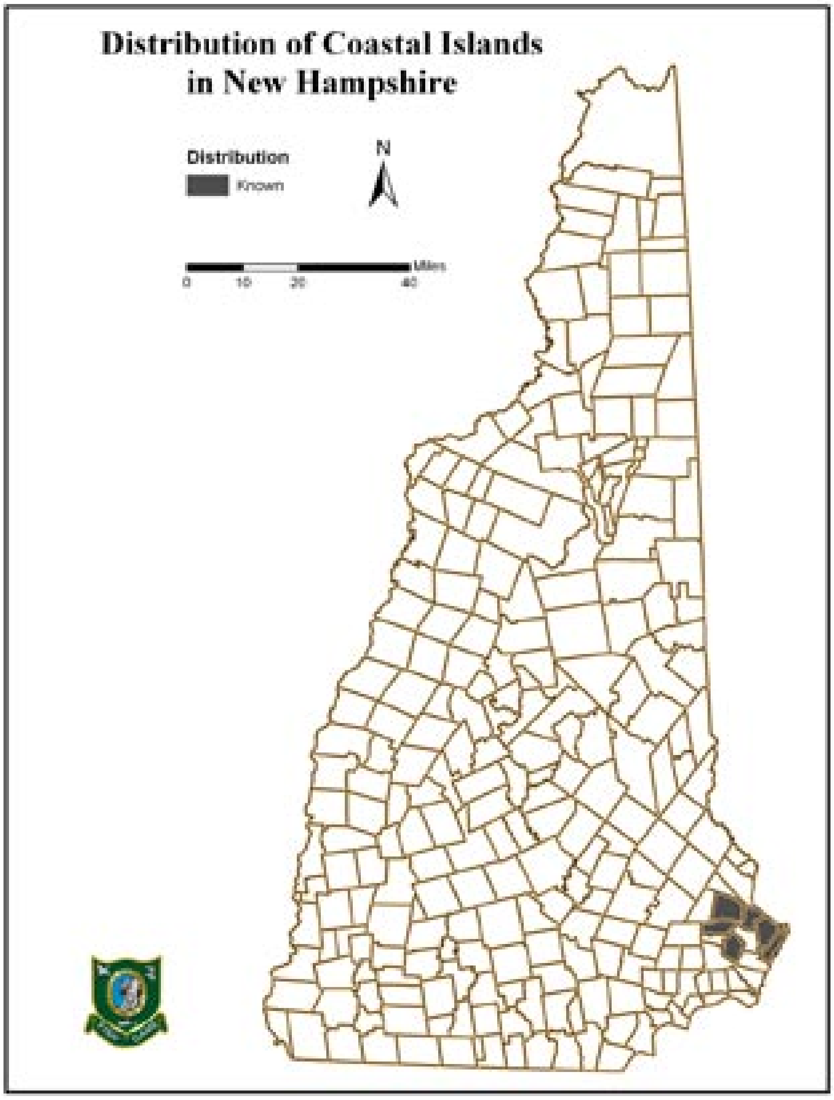

Distribution of Coastal Islands in New Hampshire
Distribution
Known
N
Miles
0
10
20
40