

Appendix A: Birds

Common Tern

Sterna hirundo

Federal Listing	N/A
State Listing	T
Global Rank	G5
State Rank	S2
Regional Status	Very High



Photo by Jessica Carloni

Justification (Reason for Concern in NH)

The common tern is a species of regional concern and is designated as threatened in New Hampshire. In the Northeast, common tern success is necessary for the recolonization of roseate terns. The common tern colony on Seavey Island should be maintained to successfully manage roseate terns. Managing for common terns will also address the needs of other coastal island species including Arctic Tern, common eider, black guillemot, and purple sandpiper. Efforts to restore the northeastern common tern population began in the 1970s but have been more organized since 1984, when the Gulf of Maine Tern Working Group was formed. Although common tern restoration efforts have been successful in increasing the number of breeding pairs, the number of islands that support tern colonies remains low. After near extirpation in the late 1800s from mass killings for feathers to decorate women's hats, the Gulf of Maine now supports over 20,000 pairs of common terns at 47 sites (Drury 1973, 1974, Kress and Hall 2004). However, 75% of the population nests on 13 islands, leaving them vulnerable to predation, oil spills, and catastrophic weather (Kress and Hall 2004). The primary limiting factor for common terns is the loss of nesting sites and predation that led to concentrated colonies in a small number of suitable sites (Kress and Hall 2004, Nisbet 2002). Gull populations took over many of the offshore islands that had supported terns, and other habitats were lost to erosion. This resulted in common terns nesting at marginal inshore islands where the habitat quality was low and the risk of predation was high. Regionally, the species is in jeopardy due to predation and loss of suitable nesting habitat. In the northeastern United States, gulls, great horned owls, black crowned night heron, coyote, mink, and rats eat eggs, chicks, and adults. Reduced prey abundance, competition for nest sites, contaminants, human disturbance, inclement weather, and insufficient funds to protect colonies also contribute (Nisbet 2002). Little is known about factors affecting the population on its wintering grounds (Kress and Hall 2004, Nisbet 2002). Common tern nesting is required for successful recolonization of roseate terns in the Northeast. The Seavey Island roseate tern colony largely depends on the protection and success of the common tern colony. Greater than 85% of the entire northeastern population of roseate terns currently nests on four islands from Buzzard's Bay to Long Island, New York, making the entire population vulnerable.

Distribution

Historically, common terns bred on several islands at the Isles of Shoals. Anecdotal evidence suggests that common terns nested in high numbers at Duck Island in the mid-1880s (Borrer and Holmes 1990). Jackson and Allen (1931) noted that common terns bred on Lunging Island as early as 1922 and the colony grew rapidly to 1,000 pairs by 1928. Jackson (1947) estimated that 1,500 to 2,000 pairs continued to nest there until 1938, and smaller numbers persisted at this site until the late 1940s. This site was abandoned before 1955 (Taber 1955), apparently because of displacement by herring gulls (Drury 1973, Erwin 1979). Herring and great black-backed gulls continue to nest at this

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location. F.B. White (1929) discovered a common tern colony on the mainland coast in Seabrook near the bridge over the Hampton Harbor Inlet. This colony, which fluctuated in size during the 9 years White observed it, apparently peaked in 1929 with at least 118 nests (White 1929). The year of its abandonment is unknown, but existing records indicate the presence of a single nest with eggs in 1953.

Several islands in the Great Bay estuary, including Nannie, Hen, Goat, and the two Footman Islands, have supported nesting terns in recent decades. These colonies apparently peaked around 1970 with approximately 12 pairs on the Footman Islands and 30-40 pairs on Nannie Island (Art Borrer, personal communication). Hen Island has supported 1 to 20 pairs of common terns from 1989 to 2014. The Footman Islands have sporadically supported small numbers of nesting pairs in the last 30 years. Nannie Island has not had any documented breeding in recent years. All of these inshore islands have been subjected to significant predator pressures as well as human disturbance. Tern nesting activity on the salt marshes of the Hampton Harbor estuary dates back to at least 1964. Approximately 50 pairs nested in the salt marsh in the 1970s and 1980s. These numbers have continued to decline and fewer than 25 pairs remain. Heavy predation and flooding have caused very low productivity in most years. This population is unlikely to survive under current conditions. Although the year of origin for the Back Channel colony is unknown, New Castle residents recall tern activity dating back at least 50 years. Past nesting has occurred on Pest and Leach's Islands as well as on 3 small islands known as the Back Channel Islands. Numbers fluctuated from 15 to 20 pairs in the early 1960s to only 1 pair in 1971, and back up to 44 pairs in 1982 (Foss 1982). This colony continued to decline through the 1980s and early 1990s due to predation and disturbance. This site was abandoned in 1998 after the Seavey Island colony was established.

In 1997, NHFG and the New Hampshire Audubon (NHA) began a project to restore terns to the Isles of Shoals. They worked with the New Hampshire Coastal Program, the Department of Resources and Economic Development (DRED) Parks Division, Wildlife Services of the USDA, Shoals Marine Laboratory, Isles of Shoals Steamship Company, the Gulf of Maine Seabird Working Group (GOMSWG) and the United States Fish and Wildlife Service (USFWS) to complete the first year of this project using nonlethal means of gull control, along with decoys and sound to attract breeding terns back to the Isles of Shoals. In 1997, a small colony of six pairs raised and fledged six young at this site. This colony has continued to show significant growth, with breeding pairs climbing from 6 pairs in 1997 to 2873 pairs in 2014 (figure 1). Regionally, the distribution of the common tern is unchanged since the first records in 1870 (Nisbet 2002), although the numbers have fluctuated widely. Common terns nest from North Carolina to Newfoundland and west through the Great Lakes into northwestern Canada (Kress and Hall 2004). Currently, the estimated number of nesting pairs in this entire region is 82,000 (Nisbet 2002).

In New Hampshire, 99% of common terns currently nest on Seavey Island, Isles of Shoals. Seavey Island is part of a cluster of islands known as the Isles of Shoals (see Coastal Islands profile). The Shoals are located approximately 9 km from Rye Beach and 13 km from the mouth of the Piscataqua River (figure 1). Seavey Island is approximately 1.5 hectares in size, with rugged granite outcroppings pocketed with herbaceous vegetation. Seavey Island is connected to White Island by a cobble tombolo at low tide. The predominant plant species found in the Seavey Island nesting areas include grasses, yarrow (*Achillea millefolium*), seaside goldenrod (*Solidago sempervirens*), black mustard (*Brassica nigra*) and dodder (*Cuscuta groenovii*) (De Luca et al. 1998).

Other nesting sites in New Hampshire include the rocky islands at the Isles of Shoals, small inshore islands in Great and Little Bays and along the Piscataqua River, and the extensive thatched areas in the Hampton-Seabrook salt marshes. In the salt marsh, they build shallow nests atop the mats of dead thatch. On Seavey Island and the tern islands in Great Bay they create shallow grass and stick cups atop the rock and/or vegetation.

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Habitat

Common terns nest on rocky islands, barrier islands, and salt marshes that are close to feeding areas and that provide protection from predators. Common terns nest in the open, on bare ground, or on vegetation, and rarely under cover (but often adjacent to vegetation) (Kress and Hall 2004). On average, nest sites have more than 90% visibility from above (Burger and Gochfeld 1988). A preliminary study of nest site parameters for the New Hampshire Seavey Island colony in 1998 showed that 54% of the nests were located at the rock-vegetation interface, 24% were located on rock and 22% were located in the vegetation.

Common terns feed primarily on juvenile marine fish, but will also eat aquatic and terrestrial invertebrates (Hall 1999, De Luca et al. 1998-2002). Foraging success depends on the abundance and depth of the prey, tidal height, wind speed, and sea surface conditions (Hall 1999). Common terns have a broader diet than roseate and arctic terns and seem to adapt to changing prey availability more readily (Safina et al. 1990). At Seavey Island, Isles of Shoals, feeding data collected from 1998 to 2014 identified more than 30 food items. Juvenile white hake (*Urophycis tenuis*) was the dominant prey delivered to chicks, totaling 39% of all feedings with the exception of 2001, 2009, 2010 and 2012, when Atlantic herring (*Clupea harengus*) was delivered to chicks with the highest frequency. Other prey items include: sandlance (*Ammodytes americanus*), butterfish (*Peprilus triacanthus*), bluefish (*Pomatomus saltatrix*), and euphasiids and insects.

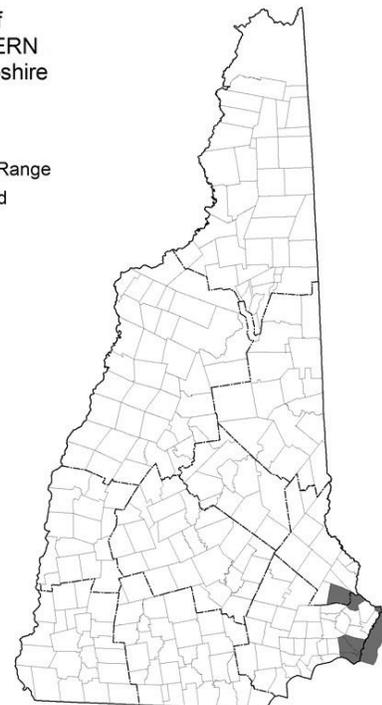
Although no formal study of foraging locations has been conducted, the rate and timing of observed feedings highlight the importance of the waters that immediately surround the Isles of Shoals. Foraging has also been consistently observed in the Hampton and Seabrook harbors, Rye Harbor, and at the mouth of the Piscataqua River.

NH Wildlife Action Plan Habitats

- Coastal Islands
- Salt Marshes

Distribution of
COMMON TERN
in New Hampshire

■ Current Range
▨ Localized



Distribution Map

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Current Species and Habitat Condition in New Hampshire

Productivity on Seavey Island has fluctuated from a high of 1.71 chicks per pair in 1999 to a low 0.47 chicks per pair in 2006 (table 1). Smaller clutch sizes in 2003 and 2004 may have resulted from cool weather and rough seas. It will be important to follow productivity trends and address low productivity if it persists.

The Isles of Shoals population is home to all of New Hampshire's roseate and Arctic terns, and to more than 98% of common terns. This concentration at one site in New Hampshire makes this population very vulnerable to any form of disturbance or catastrophic event. The potential for tern recolonization at any of the identified conservation units outside the Isles of Shoals is low. Predation, disturbance, and the attendant issues of marginal habitat significantly threaten inshore colonies of terns.

Common terns have not nested on any other islands at the Isles of Shoals since the late 1940s. Anecdotal evidence from Duck Island makes the possibility of common and roseate tern breeding high, with numbers of terns described in the "thousands". Both Lunging and Duck Island are potential tern breeding habitat but currently support large herring and great black-backed gull colonies. In 2004, common tern colonies were confirmed at two remaining "mainland" sites—Hen Island in Newington and the Hampton salt marsh. The only nesting site with confirmed productivity was at Hen Island in Little Bay. This colony has had approximately 12 pairs since the early 1990s. Productivity has varied but averaged about 1 chick per pair for most years. Although a few birds still attempt to nest in the Hampton salt marsh, they fledge few chicks. Encroachment, predation, human disturbance, and flooding all threaten the salt marsh terns.

Population Management Status

The Seavey Island tern nesting colony is intensively managed. Biologists live on the island during the breeding season to control predators, monitor the productivity of the colony, and implement public outreach. Seavey Island is also posted from 1 May to 1 September to minimize disturbance. Common terns were re-colonized at this site using techniques that included nonlethal gull control and tern attraction techniques. Nonlethal gull control at Seavey Island included the presence of a dog during the latter half of April, pyrotechnics, regular circumnavigation of the island beginning 30 minutes before sunrise and continuing until 30 minutes after sunrise, and the placement of a large rock in any gull nest cups (NHA and NHFG unpublished reports 1997-2014). Tern attraction techniques included the placement of decoys in suitable habitat along with the broadcast of tern colony sounds (Kress 1983). Six common terns nested at this site in the first year of restoration efforts (1997).

Resident tern biologists are able to continue active gull control through the breeding season. Specialist predatory gulls can be removed from the island. Gull control data clearly show that changes in the intensity of direct intervention can affect the success of the colony. Although it is difficult to land on Seavey Island, the summer months allow for increased boat traffic and visitation to the Isles of Shoals. Tern biologists act as stewards and can help regulate any visitation. Educational visits from Shoals Marine Lab, Star Island, and various other conservation organizations foster the conservation of this seabird colony.

There has not been any systematic identification or monitoring of critical foraging resources for the common tern. It is important to understand variation in prey use and the effects on breeding success. In addition, little is known of staging area usage before and after breeding season.

Regulatory Protection (for explanations, see Appendix I)

- Endangered Species Conservation Act (RSA 212-A)

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- Migratory Bird Treaty Act (1918)

Quality of Habitat

Nest parameters on Seavey Island were recorded in 1998 to develop habitat and vegetation profiles for common tern nest sites on Seavey Island. Ongoing studies will evaluate the capacity of the island to support more nesting pairs and to document habitat changes, leading to more effective habitat and vegetation management.

The quality of foraging habitat and prey availability near Seavey Island is largely unknown. Foraging studies will determine how prey availability and foraging effort affect productivity. The productivity level of the Seavey Island colony in 2014 (0.78 chicks per nest) was below the level considered productive in the Northeast (more than 1.1 chicks per nest). There was significant disturbance to the colony by a juvenile peregrine falcon and decreases in productivity will have to be analyzed further. The 2 other historic nesting sites for common terns at the Isles of Shoals are Duck Island and Lunging Island. These islands have good potential for tern nesting, yet each support large numbers of nesting gulls. The presence of raccoons and gulls make tern nesting impractical on Smuttynose Island, though the island once hosted one of the largest gull populations at the Isles of Shoals. Appledore Island is unsuitable for terns because of large populations of gulls, rats, muskrats, raccoon, and humans.

The Hen Island tern colony in Great Bay, which has averaged 12 pairs since 1989, has been disrupted by rats, Canada geese, great horned owl, and humans. A small but persistent tern colony remains in the Hampton salt marsh, though it has been plagued by flooding, predation and human disturbance. Efforts to protect this habitat may improve the potential for nesting.

Habitat Protection Status

- White and Seavey Islands have been managed by the Department of Resources and Economic Development (DRED)-Parks and Recreation Division as part of Odiorne State Park since 1993. A Memorandum of Agreement on tern restoration exists between DRED – Parks Division and NHFG. 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 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).
- There is no protection at privately owned Lunging Island beyond current shoreline and wetland regulations.
- Smuttynose Island is privately owned but was protected in August 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).
- The Town of Newington owns Hen Island. Since the early 1990s, the town has worked with NHFG and NHA to close the island during the breeding season. The proximity of the island to the mainland has subjected Hen Island terns to disruption by rats, Canada geese, great horned owl, and humans.

Habitat Management Status

Seavey Island is managed for terns through the NHFG and NHA Tern Restoration partnership. Restoration efforts between 1997 and 2004 focused on eliminating gull nesting and controlling predation, which allowed some re-colonization by common terns. There has been a gradual shift in the Seavey Island vegetation from yarrow and seaside goldenrod to tall dense grasses. Although the height of the grass makes the habitat more suitable for roseate terns, the density can cause problems for movement of adults and chicks. In 2005, approximately 100 feet of boardwalk was laid through

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the grassy area to give more structure and opening to the nesting habitat, and to allow biologists access to this part of the island.

It will be important to continue the common tern nest site analysis to evaluate habitat suitability, and to have baseline data from which to make management decisions regarding habitat improvement.

Other islands identified in 'Relative Quality of Habitat Patches' as having the potential for tern recolonization need to have baseline habitat assessments. If determined to be suitable for restoration efforts, a habitat restoration plan would need to be developed and implemented.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a "medium" or "high" score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

Mortality from predator overpopulation (Threat Rank: High)

Herring gulls and great black-backed gulls are major predators on terns and other small seabirds. The protection of all seabirds, changes in human land use along coastal islands, the fishing industry, and the use of open landfills caused gull populations to exponentially increase in the twentieth century (figure 2). Gulls prey on tern eggs and chicks and displace them from prime nesting habitats (Foss 1994). Gulls were partly to blame for the extirpation of roseate terns from New Hampshire, but initiation of active gull control on Seavey Island has allowed for the recolonization of this species. Nearshore tern colonies are vulnerable to predators such as rats, raccoons, skunk, and fox. Increased development and human use of coastal areas has allowed for an abundance of potential tern predators (USFWS 1998, Kress and Hall 2004). Great horned owl and black-crowned night heron will fly many kilometers to feed on tern chicks and adults. Other avian predators seen at Seavey Island include peregrine falcon, northern harrier, snowy owl, and cattle egret. With 99% of the common terns and 100% of the roseate terns in New Hampshire nesting at Seavey Island this species is vulnerable to predation.

More effective control of municipal and fishing wastes is helping to control gull populations. However, the New Hampshire seacoast still has a large open landfill located in Rochester, about 46 kilometers from the Isles of Shoals. This landfill supports large numbers of gulls during the winter. The Isles of Shoals remains an active fishing area, and there is evidence that discarded lobster bait and other fishing wastes subsidize local gull populations (Goodale 2000). Lack of gull control has been shown to sharply increase predation and disturbance of nesting terns (Donehower 2003). Although non-lethal gull control has successfully removed nesting gulls from Seavey Island, gull predation continues at this site and is particularly intense during the fledging period.

Nocturnal predators such as the great horned owl and black-crowned night herons prey on terns and may cause colony desertion (Nisbet 1999). A great horned owl killed significant numbers of roseate adults in the 2 largest roseate colonies in Buzzard's Bay, Massachusetts. Black-crowned night heron predation has been documented on Stratton Island, Maine and on Falkner Island, Connecticut. The Stratton Island colony grew from 1 pair in 1995 to 127 pairs in 2001 after black-crowned night herons were controlled. The Falkner Island population fell from 135 pairs in 1997 to 37 pairs in 2004 after black-crowned night heron appeared.

Since 2000, mink have invaded 5 common and roseate tern colonies, resulting in dramatic loss of common and roseate terns and the abandonment of tern colonies from Ship Island, Stratton Island, and Jenny Island. Mink killed every roseate chick on Brothers Island (Canada) in 2 consecutive years.

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Boats have brought predators (rats and raccoons) to Star, Smuttynose, and Appledore Islands in the Isles of Shoal, causing widespread nesting failure.

Species impacts from competition (with gulls for nesting islands) (Threat Rank: High)

Gulls displace terns from prime nesting habitats (Foss 1994). Gulls continue to nest on all the other islands at the Isles of Shoals, making them unsuitable for terns.

Duck and Lunging Islands were noted to support high numbers of breeding terns in the mid-1800 and 1900s (Jackson 1947, Borrer and Holmes 1990), but Lunging Island was abandoned because of displacement by herring gulls (Drury 1973, Erwin 1979). The presence of open landfills and lobster and other fishery waste have also contributed to growing gull populations in seacoast NH (Goodale 2000) and other coastal areas (Kadlec and Drury 1968, Drury 1973, Nisbet 1978, Oro et al. 1995, Chapdelaine and Rail 1997). The near extirpation of terns caused by the gathering of birds for the feather trade provided gulls with more nesting habitat leading to an increase in large gulls (herring (*Larus argentatus*) and great black-backed gulls (*Larus marinus*)) (Brown and Nettleship 1984, Buckley and Buckley 1984) which prey on tern eggs and young (Nisbet 2002).

Mortality and habitat degradation from oil spills (Threat Rank: High)

Portsmouth Harbor services large passenger and container ships presenting the possibility of an oil spill occurring near the Isles of Shoals where common terns nest or within the Piscataqua River where they forage. Common terns could also be affected by oil spills during migration or on their wintering grounds.

Seabirds are particularly susceptible to both internal and external oil exposure after oil spills at sea (Leighton 1993), and their foraging habits, preening behavior, and resting requirements lead to frequent contact with surface oil (Haney et al. 2014). Mortality occurs as a consequence of spills of petroleum oils. Birds are affected by oil in the following ways: external contamination of feathers, contamination of eggs which are lethal to the embryo in very small doses, and ingestion of oil while preening. Oils on feathers is the single most devastating effect of oil on birds as the feathers lose their water repellency, insulation, and flight capabilities. Death results from combinations of hypothermia, starvation, and drowning (Leighton 1993).

Disturbance from restoration and maintenance of lighthouse and associated buildings (Threat Rank: Medium)

A historic lighthouse and other buildings on White Island require maintenance. Heavy machinery could disturb nesting terns. Increased human traffic to conduct maintenance could also disturb terns and or cause accidental egg damage.

Current mitigation tactics include timing construction when terns are absent from the island and if the maintenance is absolutely necessary when terns are present, the bird's response would be

Species impacts from sea level rise and altered food chains (Threat Rank: Medium)

Climate change will likely warm sea surface temperatures and oceanic circulation, leading to changes in nutrient cycling and marine productivity (Tyrell 2005). Many other activities threaten coastal marine habitat in the Gulf of Maine (for a review, see Tyrell (2005)). There is some indication that primary productivity patterns in the GOM have shifted in both magnitude and phenology (NEFSC 2013) which would have harmful effects on all trophic levels in the system. Mills et al. (2013)

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reported that 2012 was the largest, most intense warming event in the Northwest Atlantic in 30 years and was distinctly evident in the GOM where the 2012 sea surface temperature (SST) anomaly was 2°C above the 1982–2011 average, and over a degree warmer than the next highest anomaly. This level of warming is close to the mean SST change projected to occur near the end of the century (Meehl et al. 2007). These changes presumably have important impacts on the foraging ecology and ultimately success of terns nesting at White and Seavey Islands.

In 2011 on Petit Manan Island, Maine, common terns delivered 40% butterfish (*Poronotus triacanthus*) to their chicks versus 10% herring, one of the preferred prey species; butterfish is a deep bodied fish difficult for chicks to consume. This pattern has been observed recently at other regional breeding sites and is reversed from typical years when herring was the dominate fish in chick diets (Steeves 2011). In 2012 when water-temperature was the warmest on record in the Gulf of Maine in the last 30 years (Mills et al. 2013), Atlantic puffins (*Fratercula arctica*) at Petit Manan Island fed their chicks significantly larger butterfish than in previous years, perhaps signaling a response to an earlier phenology of ecosystem processes, and subsequently, more advanced spring butterfish growth (National Audubon Society 2012).

Habitat conversion and species disturbance from wind tower and turbine development (Threat Rank: Medium)

Habitat may be converted around the Isles of Shoals for a potential wind turbine site. The construction would disturb terns nesting on White and Seavey Island and may cause movement issues around the turbines. Wind turbines located in their migratory routes could also pose a threat.

Wind farms can be fatal to birds through direct contact with towers or blades (Drewitt and Langston 2006, Arnett et al. 2008). Breeding site selection can also be affected (Pearce-Higgins et al. 2009, Douglas et al. 2011), as well as flight routes (Desholm and Kahlert 2005, Larsen and Guillemette 2007), and foraging behavior (Larsen and Madsen 2000). Offshore wind farms can affect sedimentation patterns and prey species composition (Percival 2001) and may act as a barrier to seasonal and local migrations (Exo et al. 2003). Currently no wind development projects are proposed for the Isles of Shoals where common terns nest; however Cape Wind is attempting to build a wind farm off the coast of Cape Cod, Massachusetts.

Species impacts from reduced prey availability due to overfishing (Threat Rank: Medium)

According to the United Nations Food and Agriculture Organization, more than 70% of the worldwide marine fish stocks are either fully exploited or depleted (FAO Report 2004). In the North Atlantic, the American Fisheries Society has identified 82 species at risk of extinction including Atlantic salmon, Atlantic halibut, and a number of species of sharks, skates, sturgeons, and groupers. Fishing can change the abundance of exploited species and degrade marine habitat (e.g., trawling) (Collie et al. 1997). Point and non-point source runoff from agricultural and developed coastal areas can negatively impact estuarine and sub-tidal areas that support food webs in coastal and offshore waters.

Changes in prey availability affect the growth and survival of chicks and the condition of adults (Safina et al. 1988, Nisbet et al. 1995). Prey availability may also impact the size and distribution of colony sites (Nisbet 1999). However, the correlation of reduced prey availability and common and roseate tern productivity has not been firmly established. Other seabirds, including terns, have shown very significant impacts from changes in prey availability. In Britain, breeding failure and diminished adult survival in Arctic terns was linked to changes in fish prey availability due to commercial fisheries

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activities (Suddaby and Ratcliffe 1997 in Kress and Hall 2004). In 2004, disappearance of sand eels devastated Scottish seabird colonies; 1,200 guillemot nests on the isle of Shetland failed completely, 24,000 Arctic tern nests were almost entirely empty, and the world's largest colony of great skuas produced only a few chicks. Scientists believe that the sand eels are disappearing because the cold-water plankton that these fish depend on no longer flourishes in these coastal areas. The North Sea has warmed 3.6°F over the last 20 years, shifting the phytoplankton blooms northward or earlier in the season (Schulman 2005).

Disturbance from recreation and tourism (Threat Rank: Medium)

Nearly one-third of the population in the United States (over 75 million people) and Canada (over 9 million people) live within a day's drive of the Gulf of Maine. Vast areas of coastal and offshore marine habitat have been lost or degraded in the last three centuries. The northeastern common tern population is restricted to a small number of islands and many historic nesting islands been lost to erosion or are occupied by gulls. Degradation and disturbance in these areas would all have a negative impact on common tern success. Little is known of critical habitat (foraging, staging, and wintering habitat) of common or roseate terns. Nisbet (2002) cites the need for increased research into winter habitat where it is believed the highest mortality occurs.

Critical habitats for common terns and roseate terns should be identified and protected. Seavey Island is important because most of New Hampshire's common terns and all of its roseate terns nest there. Yet scientists do not know basic information such as the location of foraging or staging areas. The 2 known staging areas in the Northeast are in highly developed areas of the coast and may be vulnerable (Casco Bay, Maine and South Beach, Massachusetts).

List of Lower Ranking Threats:

Species impacts from mercury toxicity
Mortality from various diseases (cholera, botulism, salmonella) Mortality
from unregulated take on winter grounds
Habitat degradation from aquaculture contamination
Habitat conversion due to development

Actions to benefit this Species or Habitat in NH

Manage and monitor the Seavey Island colony, Restoration and Management

Primary Threat Addressed: Mortality from predator overpopulation

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases

Objective:

The objective of continued intensive management at Seavey Island is to increase and secure both the common and roseate tern populations.

General Strategy:

Political Location:

Watershed Location:

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Manage and monitor the Seavey Island colony, Restoration and Management

Primary Threat Addressed: Species impacts from competition (with gulls for nesting islands)

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases

Objective:

The objective of continued intensive management at Seavey Island is to increase and secure both the common and roseate tern populations.

General Strategy:

Resident biologists act as stewards for the Seavey tern colony and can enforce the closure of this island during the breeding season, as well as providing annual population and productivity estimates. Active management occurs annually during the breeding season from 21 April to 31 August. Active management through the breeding season allows for an immediate response or change in response to all the threats identified above (predation, human disturbance, disease and oil spill). Although there are no established recovery criteria for common terns in the northeast region, a productivity rate in the range of 1.1–1.8 chicks per nest is considered adequate to sustain population growth. The primary objective of the Northeast region roseate tern recovery program is to promote an increase in breeding population size, distribution, and productivity to warrant reclassification to threatened status and eventual delisting. The criteria for recovery include a minimum of 6 large colonies (> 200 pairs) with high productivity (at least 1.0 fledged young/nest) for 5 consecutive years. Successful management and monitoring at Seavey Island would maintain productivity of the common tern colony and expand the roseate population to the level cited above and maintain this level for at least 5 years. Implementation will require the cooperation of the two major partners in the Tern Restoration Project (NHFG and NHA) as well as other cooperators and supporters including the USFWS, DRED, USDA – Wildlife Services, NHCP, Shoals Marine Lab, Roseate Tern Recovery Team (TRRT) and GOMSWG. Collaboration will occur with state and federal partners working with terns in other northeastern states including Maine, Massachusetts, Connecticut and New York, as well as with international partners in Canada. Important guidance for establishing monitoring protocols will be provided by the New Hampshire Tern Management Team along with the methodologies outlined by the Roseate Tern Recovery Plan and the Tern Management Handbook.

Political Location:

Watershed Location:

Develop predator management plan, Restoration and Management

Primary Threat Addressed: Mortality from predator overpopulation

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases

Objective:

The objective of continued and more effective management of predator concentrations is to increase and secure common and roseate tern populations, while minimizing mortality and movement.

General Strategy:

A proactive management plan should exist to better respond to predation from a suite of predators including gulls, great horned owl, black-crowned night heron, and mammalian predators such as mink, raccoons, and rats. Minimizing predator impacts will help.

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Political Location:

Watershed Location:

Identify and protect important staging and foraging areas for common and roseate terns, Habitat Protection

Primary Threat Addressed: Mortality from predation (mammals, snowy owls, peregrine falcon)

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases

Objective:

The objective of identifying and protecting tern foraging and staging areas is to maintain breeding colonies and minimize mortality.

General Strategy:

The productivity of the Seavey Island common and roseate terns will be monitored annually using established methods outlined in the Roseate Tern Recovery Plan, The Tern Management Handbook and through the regional roseate tern metapopulation study (Nisbet 1990). An all island census will also be conducted annually during the census window of June 12-20 as established by the regional tern working group (GOMSWG). Downward trends in either colony census numbers or productivity estimates need to be addressed immediately. The desired ecological response to protection of foraging and staging areas is to increase the likelihood that common and roseate terns will successfully breed, reach target levels of productivity, and increase in population numbers on Seavey Island. Successful management will be indicated by a positive growth rate and the achievement of recovery objectives (US-FWS Roseate Recovery Plan). Coordination with land protection specialists from local, state and federal agencies to maximize the potential for successful protection of identified foraging and staging areas. The protection of these habitats may require the innovative protection strategies such as those outlined in the GOMC Marine Protected Areas Project. Federal and state partners from the NHCP, the Coastal Islands Wildlife Refuge, the Great Bay Refuge, and the Great Bay National Estuarine Research Reserve would be important partners. It is likely that areas will be identified across state boundaries and necessitates coordination with Maine and/or Massachusetts partners.

Political Location:

Watershed Location:

Develop regional partnerships, Restoration and Management

Primary Threat Addressed: Mortality and habitat degradation from oil spills

Specific Threat (IUCN Threat Levels): Pollution / Industrial & military effluents / Oil spills

Objective:

The Tern Restoration Project will benefit from collaboration with other organizations that are focused on resource conservation and management in the Gulf of Maine.

General Strategy:

NHCP provides the leadership in coordinating local communities, state and federal agencies in the planning and policy issues needed to balance the preservation of New Hampshire's natural resources with the social and economic needs of the coastal region. The Gulf of Maine Council brings together partners from Massachusetts, New Hampshire, Maine, and the Canadian provinces of New Brunswick and Nova Scotia (www.gulfofmaine.org). The Gulf of Maine Habitat Conservation Subcommittee is

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working with partners in the region to develop and advance marine habitat conservation strategies.

Political Location:

Watershed Location:

Monitor prey availability during the tern nesting season and protect land for nesting habitat

Primary Threat Addressed: Species impacts from reduced prey availability due to overfishing

Specific Threat (IUCN Threat Levels): Biological resource use / Fishing & harvesting aquatic resources / Unintentional effects: large scale (species being assessed is not the target) [harvest]

Objective:

Further research is needed to assess the role of commercial fisheries on prey availability for seabird colonies.

General Strategy:

It is important to support research and policies that help to reduce negative impacts on nursery areas for prey items such as herring, hake and other fish stocks that are important food for seabirds. Some of the key partners could coordinate with the NHFG Department Marine Resources Division and the Shoals Marine Laboratory to monitor prey availability. An established monitoring program coupled with the chick provisioning studies taking place on Seavey Island would allow seabird biologists and fisheries managers to collaborate on actions that could benefit seabird restoration.

Political Location:

Watershed Location:

Strengthen and expand outreach efforts on seabird conservation

Primary Threat Addressed: Disturbance from recreation and tourism

Specific Threat (IUCN Threat Levels): Human intrusions & disturbance

Objective:

Improve public outreach and education on seabird restoration issues in New Hampshire and the Gulf of Maine

General Strategy:

The development of classroom curriculum and teacher resources will capture an important audience. A tern restoration web page will foster stewardship, increased understanding and appreciation for seabird conservation issues. A web page addition would reach a large, broad audience and expand educational opportunities manifold. These efforts lay the groundwork for increased awareness and understanding of coastal issues that impact seabird islands, and promote stewardship for coastal resources. Improve public outreach and education on seabird restoration issues in New Hampshire and the Gulf of Maine through the following mediums: • Further develop and implement outreach and education to Isles of Shoals users including the Shoals Marine Lab, Star Island, Seacoast Science Center, and island visitors • Further develop and implement an outreach program and educational materials for passengers aboard charter vessels in and around the Isles of Shoals including the Uncle Oscar, ISSCO ferry and the Granite State • Develop a tern restoration presentation and curriculum to be included in the coastal ecology unit presented to middle and high school students aboard the Granite State • Further develop and implement a teacher workshop that highlights the tern

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restoration project and seabird conservation issues • Develop a seabird conservation curriculum that can be used in classroom presentations. Use roseate terns as an example of a successful restoration model • Create a Tern Restoration/Seabird Conservation Page with live streaming tern video from Seavey Island on the NHA/NHFG Web pages.

Political Location:

Watershed Location:

Threat Assessment and Condition Research

Objective:

Conduct threat assessment and condition assessment research for common terns in New Hampshire.

General Strategy:

Threats to common terns and their breeding habitat are well documented in management and conservation plans. The threat posed by reduced prey availability still needs research and monitoring to determine the correlation with tern productivity. Direct threats to foraging and staging areas are unclear until these areas have been identified. Threat assessment research should consider the following: Assess the effects of tern predators and evaluate means of controlling those species in different critical habitats and at different times of the year; determine laughing gull impacts on common and roseate tern nesting success; assess and monitor the effects of aquaculture, fishing practices, and other stressors on terns, tern predators, and habitats; identify and protect (if feasible) critical habitats such as foraging, staging, and wintering areas; and identify seasonal and spatial variation in prey (composition and abundance) and potential effects on colony productivity.

Political Location:

Statewide

Watershed Location:

Statewide

Monitor the common tern population

Objective:

Continue to monitor and further assess common tern populations in New Hampshire.

General Strategy:

Monitoring research should include continued intensive monitoring of common terns on Seavey Island, using established methods as outlined by the GOMSWG and the Roseate Tern Recovery Plan to determine productivity; and continued monitoring of the mainland colonies to assess condition and the potential for protection. Further assessment may include conducting habitat assessments at the other historic Isles of Shoals islands; identifying and characterizing preferred foraging habitat and evaluating vulnerability of principal foraging sites to human disturbance; assessing seasonal prey availability and how it relates to tern productivity; assessing potential effects of an oil spill near Seavey Island; identifying the location and use of staging and roosting areas for common and roseate terns; determining if pre-migratory staging areas constitute a vulnerable population bottleneck; and identifying important wintering areas.

Political Location:

Statewide

Watershed Location:

Statewide

References, Data Sources and Authors

Data Sources

Basic natural history information in this profile was largely gathered from the literature cited. Information on habitat and distribution was gathered from scientific literature, recovery conservation plans, technical field reports, published literature, NHA and NHFG Seavey Island data, New Hampshire Bird Records data, Gulf of Maine Seabird Working Group (GOMSWG) and Roseate Tern Recovery Team (RTRT) discussion and minutes. Information on habitat and distribution was gathered from scientific literature, recovery conservation plans, technical field reports, published literature, NHA and NHFG data, GOMSWG and Roseate Tern Recovery Team (RTRT) discussion and minutes.

Data Quality

Common terns have been followed closely since the formation of the Gulf of Maine Tern Working Group in 1984. Regionally, common tern breeding colonies have been managed and intensively monitored for more than 20 years. The Seavey Island common tern population has been intensively studied since recolonization in 1997. In New Hampshire, all current and recently occupied tern-nesting sites are surveyed annually during June. Historical habitat at the Isles of Shoals was surveyed in 1977, 1985 and 1995, and an all-island census on White and Seavey Islands has been conducted annually since 2005. Habitat parameters were identified at common tern nests on Seavey Island in 1998. This pilot study produced baseline data for the development of habitat and vegetation profiles of common tern nest sites. The update and continuation of this study, along with the generation of vegetation profiles, will help in the development of a habitat management plan. Common tern foraging habitat is largely unknown in New Hampshire, though sightings between 1998 and 2001 suggest that common terns forage close to Seavey Island. It will be important to identify critical foraging areas for this species and to explore staging areas in nearby waters. Little is known about common tern migration and wintering habitat. Large winter concentrations have been identified in Suriname, Trinidad, Brazil, and Argentina (Hays et al. 1997, 1999). It is important to identify and assess common tern wintering habitat. Census and productivity surveys have been conducted since common terns began nesting in 1997. Chick provisioning data was collected from 1998 to 2014, and baseline habitat data for common tern nesting sites was collected in 1998. The habitat on Lunging and Duck Island needs to be evaluated through nest censuses and a vegetation/habitat profiles.

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