United States Department of the Interior

FISH AND WILDLIFE SERVICE

Eastern Massachusetts National Wildlife Refuge Complex
73 Weir Hill Road
Sudbury, MA 01776

January 31, 2019

Permits, Conservation, and Education Division
National Marine Fisheries Service (NMFS)
Office of Protected Resources
1315 East-West Highway Silver Spring, MD 20910

Dear Permits, Conservation, and Education Division:

Please find the attached request for an incidental take authorization under section 101(a)(5) of the Marine Mammal Protection Act of 1972, as amended, for the take of marine mammals incidental to conducting biological tasks for refuge purposes at Monomoy National Wildlife Refuge (NWR; Refuge), Nantucket NWR, and Nomans Land Island NWR in Massachusetts. These three refuges are managed through the Eastern Massachusetts National Wildlife Refuge Complex as part of the National Wildlife Refuge System of the U.S. Fish and Wildlife Service.

Refuge Complex staff census and monitor the presence and productivity of breeding and migrating shorebirds, and other priority species (including seals), using the beaches of Monomoy, Nantucket, and Nomans Land Island NWRs year round. All of the breeding and migrating shorebird activity occurs from 1 March – 30 November. Protection of seal haul out and pupping shorelines occurs year round, depending on the site. Monitoring activities of birds occur daily (on Monomoy and Nantucket) from April – August and is necessary to document the productivity (number of chicks fledged per pair) and population of our protected shorebird and seabird species. Monomoy NWR also participates in several less frequent, but equally important high priority conservation tasks to monitor for threatened and endangered species. These activities include censusing northeastern beach tiger beetles and participating in a red knot migration study during southward migration. Additionally, both Monomoy and Nantucket NWRs serve as vital staging grounds for migrating roseate terns and resighting and staging counts can sometimes interfere with pinniped behavior. Biological monitoring at Nomans Land Island NWR is less frequent, but is likely to occur on approximately 20 days between 1 March and 30 November in 2019.

Refuge Complex activities have the potential to cause Level B harassment to gray and harbor seals using the same beaches as haul out sites. We are requesting an Incidental Harassment

Authorization for the entire year, from April 1, 2019 through March 31, 2020, though we only expect to be undertaking activities related to protecting seal areas (posting signage for example) from December 1 – March 31. Every effort will be made to avoid disturbing pinnipeds when possible and will not result in serious injury or death.

All monitoring will be conducted by Refuge staff and volunteers. Please feel free to contact Stephanie Koch, Wildlife Biologist, at Stephanie_Koch@fws.gov for issues or any other questions you may have regarding this application.

Linh Phu
Project Leader
Eastern Massachusetts NWR Complex
U.S. Fish and Wildlife Service

Request for Marine Mammal Protection Act Incidental Harassment Authorization

Seabird and Shorebird Monitoring and Research at the Eastern Massachusetts National Wildlife Refuge Complex, Massachusetts

Submitted by:

Eastern Massachusetts National Wildlife Refuge Complex 73 Weir Hill Road
Sudbury, MA 01776

Submitted to:

Permits, Conservation, and Education Division National Marine Fisheries Service (NMFS) Office of Protected Resources
1315 East-West Highway Silver Spring, Maryland 20910-3226

January 31, 2019

Section 1: A detailed description of the specific activity or class of activities that can be expected to result in incidental taking of marine mammals.

The Eastern Massachusetts National Wildlife Refuge (NWR; Refuge) Complex is made up of eight refuges, including its three coastal refuges: Monomoy NWR, Nantucket NWR, and Nomans NWR. Although Monomoy NWR consists of three managed barrier islands, pinnipeds are only disturbed while carrying out biological activities on the Atlantic side of South Monomoy Island where gray seals primarily haul out. Therefore, activities mentioned at Monomoy NWR will only refer to South Monomoy Island. While biological tasks performed at these three refuges differ in some regard, all activities are necessary to carry out high priority conservation work for threatened and endangered species.

<u>Shorebird and Seabird Nest Monitoring and Research</u>

Monomoy NWR

On January 10, 1986, the Service listed the Atlantic Coast population of piping plovers as threatened under the provisions of the U.S. Endangered Species Act of 1973. Currently, Monomoy NWR serves as a nesting site for 8% of the breeding piping plover pairs in Massachusetts. Therefore, management and protection of the piping plover is one of the priority programs for the refuge. Many other avian species benefit from piping plover management, including the state-listed species of concern least tern and American oystercatcher. Monomoy NWR has a great responsibility to follow the guidelines provided for management in the revised 1996 recovery plan for the species (USFWS 1996). The primary objective of the recovery program is to remove the Atlantic Coast piping plover population from the List of Endangered and Threatened Wildlife and Plants by: (1) achieving well-distributed increases in numbers and productivity of breeding pairs, and (2) providing for long-term protection of breeding and wintering plovers and their habitat. Actions needed to achieve these objectives include: (1) manage breeding piping plovers and habitat to maximize survival and productivity, (2) monitor and manage wintering and migration areas to maximize survival and recruitment into the breeding population, (3) undertake scientific investigations that will facilitate recovery efforts, (4) develop and implement public information and education programs, and (5) review progress towards recovery annually and revise recovery efforts as appropriate (USFWS 1996).

The piping plover recovery efforts at the Refuge Complex correspond closely to management recommendations in the Piping Plover Recovery Plan. In order to monitor the productivity (number of chicks fledged per pair) of piping plovers at Monomoy NWR, it is necessary to identify suitable nesting habitat for the species. The most recent five-year review of the recovery plan stresses the importance of wide, flat, sparsely-vegetated barrier beach habitats in the recovery of the Atlantic Coast population (USFWS 2009). At Monomoy, piping plovers generally select areas that are sandy with some cobble on the beach face and occasionally nest in dense vegetation or behind primary dunes. The same can be said for least terns and American

oystercatcher pairs which also nest on South Monomoy Island. These nesting areas are adjacent to known gray seal haul-out sites.

Piping plovers begin returning to their Atlantic Coast nesting beaches in mid-March. The first nest is generally laid in mid-April and eggs will continue to be present on the beach until late July. During this time, nests are located by looking for a number of signs; continuous presence of adult birds, courtship and territorial behavior in a certain area, large concentrations of tracks, and scrapes. Methods for finding nests include waiting for a disturbed bird to return to its nest or covering probable nesting areas by searching the ground for signs of nests and zig-zagging the whole area to make sure the entire habitat is covered. Methods for finding nests can sometimes lead to seal disturbance. Nests are visited 4-5 times a week and confirmation of adult presence and incubation is confirmed at a distance when possible to prevent disturbance. Nests hatch after 28 days of incubation and chicks will remain with one or both parents until they fledge at 25 days of age. Depending on the date of hatching, flightless chicks may be present on refuge beaches from mid-May until late August. Chicks are monitored until fledge and may move hundreds of yards from the nest site to feed. The diet of piping plovers consists of invertebrates such as marine worms, fly larvae, beetles, and crustaceans (USFWS 1994a). Feeding areas include intertidal areas along the ocean and sounds sides of South Monomoy Island as well as washover areas.

Similar activities are performed when staff are nest searching for and monitoring American oystercatchers nests and broods. No American oystercatcher pairs nested near seal haul out sites in 2018, but have nested on the ocean side of South Monomoy Island in previous years. In 2001, the American oystercatcher was warranted special attention from the U.S. Shorebird Conservation Plan after the population severely declined to under 11,000 individuals. Monomoy NWR has the largest concentration of nesting American oystercatchers on Cape Cod and nesting success at our site is important to the survival of the species. The nesting season occurs from the end of April until mid-August. Monomoy NWR also serves as an important staging site for resting migrants, and bands are often read and reported to the American Oystercatcher Working Group. Staging American oystercatcher will sometimes roost near seal haul-out sites.

Least terns nest in small groups around South Monomoy Island. Productivity is not measured throughout the season, but nesting pairs are censused during a 2-3 day period in mid-June. Least terns are censused using the line-sweep method throughout the extent of the nesting colonies and checked by staff weekly to gauge productivity.

Staff installs symbolic fencing (sign posts with “area closed” and “beach closed” informational signs) around nest sites of piping plovers, American oystercatchers, and least terns to inform the public about the bird’s presence and protect critical habitat from human disturbance. These areas are adjacent to known seal haul-out sites and are regularly monitored throughout the season.

Nantucket NWR
Similar biological activities are carried out on Nantucket NWR. Piping plover, least tern, and American oystercatcher are known species to use Nantucket NWR and nearby lands for nesting from the middle of April until late-August. Beach nesting birds are monitored following similar methods and protocols as Monomoy NWR and areas of nesting are posted with closed signs. Refer to Section 2 and Attachment 2 for further clarification on seal haul-out locations. Signs are placed at least 150 feet from known seal haul-out areas on Nantucket NWR, which predominately occurs at the north tip of the Refuge. These posts help protect those areas from public disturbance. Nesting beach birds generally do not nest within the closed area for seals, but instead nest adjacent to the haul-outs. If need be, staff will briefly enter the closed area to check nests. If that's not the case, staff stays outside of the closed area, greater than 150 feet from seal haul-outs. Seabirds and shorebirds do not nest on the Refuge every year, but did nest on the Refuge during the last 3 years.

Nomans Land Island NWR
Nomans NWR is closed to the public. In recent years, it has only been visited 1-5 times a year by refuge staff for seabird and shorebird monitoring (but please see additional sections below regarding an increased monitoring effort at this site). During these visits the presence of shorebirds and seabirds are noted for record. Shorebirds and seabirds are inventoried by scoping suitable nesting and feeding habitat on the island. The greatest potential for disturbance occurs in safe boat landing zones, because these areas often overlap with hauled out seals. Every precautionary measure is taken to reduce disturbance to seals on Nomans Land Island NWR, but staff will land a boat or walk within 150 feet of seal haul-outs if safety reasons prevail. Refer to Section 2 and Attachment 3 for further clarification on seal-out locations, and Section 7 for further information on the difficulty of landing and traveling around Nomans Land NWR. A 25 foot Parker is usually used to travel to and from the Refuge.

<u>Roseate Tern Staging Counts and Resighting</u>
Monomoy NWR
On November 2, 1987, the Service listed the northeastern breeding population of the roseate terns as federally endangered. Monomoy NWR serves as an important nesting and staging site for the species. Monomoy NWR has a great responsibility to follow the guidelines provided for management in the Roseate Tern Recovery Plan for the Northeast population (USFWS 1998). The primary objective of the roseate tern recovery program is to promote an increase in breeding population size, distribution and productivity so as to warrant reclassification to threatened status and eventual delisting. Actions needed to attain this objective include: (1) oversee breeding roseate terns and their habitat to help increase survival and productivity including the physical maintenance, expansion and enhancement of nesting habitat, (2) develop a management plan for monitoring wintering and migration areas, (3) secure unprotected sites through acquisition and easements, (4) develop outreach materials and implement education programs, (5) conduct scientific investigations that will facilitate recovery efforts, (6) review progress of recovery annually and revise recovery

efforts as needed (USFWS 1998).

While breeding roseate terns prefer nesting habitat far from seal haul out sites, migrating terns use areas adjacent to the beach edge. The Cape and Islands as a whole serves as an important staging ground for common and roseate terns. In fact, the entire northeast population of roseate terns stage on the Cape and Islands prior to migrating to Central and South America. We conduct staging tern counts to document the importance of Monomoy NWR relative to other sites and to record changes in use over time by gathering baseline data on the numbers of roseate terns staging on the Refuge and adjacent beaches as well as the causes and duration of disturbances to staging terns. This is in compliance with the recovery plan to conduct scientific investigations that will facilitate recovery efforts (USFWS 1998).

In August and July, staff traverse areas of suitable staging habitat, including sand flats and open sand beaches, and make quick estimates of the number of staging terns. The terns are counted using binoculars and spotting scopes from a distance that does not disturb the birds. Color bands, field readable bands, and any tagged or banded birds are identified for reporting purposes. Observations on behavior and disturbance are also documented. Depending on the size of the flock, these surveys can last anywhere between one to three hours.

Nantucket NWR
Staging tern counts are carried out on Nantucket NWR following similar methods and protocols mentioned for Monomoy.

Nomans Land Island NWR
Staging tern counts are not performed on Nomans NWR.

<u>Red Knot Stopover Study</u>
Monomoy NWR and Nearby Beaches in Chatham, Orleans, and Eastham
On December 11, 2014, the Service listed the *rufa* subspecies of the red knot as federally threatened under the Endangered Species Act. As noted in the State of the Birds 2014 report, the knot's status is representative of the steep declines represented in shorebirds that migrate long distances (NABCI 2014). Threats to shorebirds have become more diverse and widespread in recent decades, requiring coordinated conservation efforts across their vast ranges. Protection of breeding, migration, and wintering habitat is critical to this species' recovery (Niles et al. 2008).

Southeastern Massachusetts, Monomoy NWR and surrounding beaches in Chatham, Orleans, and Eastham in particular, likely provide one of the most important areas for adult and juvenile red knots during their southward migration (Koch and Paton 2009, Harrington et al. 2010a, Harrington et al. 2010b). Research has shown that this region supports red knots bound for different winter destinations, including red knots wintering as far south as Patagonia (Harrington et al. 2010b). While

we are beginning to learn more about migration, stopover, and wintering sites of adults, currently there is little information on migration routes, and no information on wintering sites of juvenile red knots (Niles et al 2008). Knowledge of migration and wintering sites would allow researchers to assess habitat condition, work toward minimizing disturbance and other limiting factors, and better understand first-year survival (USFWS 2015). As a result, Monomoy NWR has continued working with partners and began placing geolocators on juvenile red knots migrating through this area in 2011. Efforts have since moved to outfitting nanotags on birds. Research and trapping is in collaboration with Larry Niles of Conserve Wildlife Foundation of New Jersey and L.J. Niles Associations, LLC**.**

There are two groups of red knots that pass through Monomoy NWR during the fall migration; the short-distance migrants and the long-distance migrants (Harrington 2010b). In order to gather migration information from both groups of knots, Complex staff, in collaboration with Conserve Wildlife Foundation of New Jersey, traps and tag red knots during several 8-10 day trapping windows in August and September. Research involves recon at multiple known red knot staging areas, including the ocean side of South Monomoy Island. If an area is found to have high numbers of staging red knots, efforts to trap in that area will occur during a one or two day period for 6-12 hours per day. Trapping involves the use of 1-4 cannon nets and assistance of up to 15 people. Cannon nets are large nets launched by metal projectiles set off by gunpowder, and are used to capture a large number of birds in a single event. The cannons are louder than a shotgun and have the potential to disturb seals nearby, although trapping generally does not occur when and where seals are hauled-out. Trapping occurs closer to high tide when most shorebirds are roosting and when seals are out feeding. If red knots and other shorebirds are in close proximity (<150 feet) to a seal haul-out, we do not trap at that site.

The ocean side of South Monomoy Island, where seals are found, is one potential trapping site for this research, but other potential trapping areas may overlap with seal haul-out sites as well. These sites include nearby beaches at the Cape Cod National Seashore (CACO) in Chatham, Orleans, and Eastham. The work carried out at CACO is done so in collaboration with the National Park Service (NPS) and the biological staff present at CACO. These areas are generally not trapped on if seals are present though, because red knots will not be present at the same time in the exact areas. The risk for personnel disturbing seals during this process is very low, but still exists if seals are nearby, and cannon nets are fired. Red knot trapping sites are chosen based on red knot behavioral and biological factors, and environmental considerations including weather. Although the potential to trap on sites outside of the mentioned beaches is low, the Red Knot Stopover Study is dependent on trappable locations where red knots are present. Knowing this, other CACO sites with known seal haul-outs might be considered and are mentioned in Section 2.

Shorebird trapping does not occur on Nantucket NWR or Nomans Land Island NWR.

Northeastern Beach Tiger Beetle Census

Monomoy NWR

In August of 1990, the Service listed the northeastern beach tiger beetle as threatened. Currently northeastern beach tiger beetle can be found at only two sites north of the Chesapeake Bay in Massachusetts: one on the south shore of Martha's Vineyard and one on South Monomoy Island and Nauset/South Beach in Chatham, MA (USFWS 1994b, USFWS 2015). Searches on Monomoy in the 1980s failed to locate the northeastern beach tiger beetle, but the structure of the habitat seemed favorable, making Monomoy the leading candidate as an introduction site. The first beetle larvae transplant occurred in May 2000. Since 2004, tiger beetle larvae have not been transferred to Monomoy (USFWS 2015). However, through continued adult tiger beetle monitoring, the annual presence of tiger beetles has been documented on the refuge. Annual monitoring confirms successful survival and production of tiger beetles through all stages of life, and gives a firm indication of a new self-sustaining population at Monomoy NWR.

Northeastern beach tiger beetle live their entire life on the beach, and prefer medium to medium-coarse sand. Adults occur on the beach from June through September and often congregate around the water's edge on warm days (USFWS 2011). On Monomoy NWR, the population occurs in habitat on the Atlantic side of South Monomoy Island on the water's edge and in the wrack line. Several index counts of the tiger beetle population are completed by refuge staff during July and August each year. Counts are conducted by slowly walking the water's edge at a width of 2-3 people across and tallying adults seen on the surface of the beach until the extent of suitable habitat is covered.

Northeastern beach tiger beetle surveys are not conducted on Nantucket NWR or Nomans Land Island NWR.

Coastal Shoreline Change Survey

Monomoy NWR

Since 2011, Monomoy has participated in a long-term coastal shoreline monitoring project in collaboration with Rutgers's University and the National Park Service protocol. The annual shoreline surveys are conducted twice a year to gain a finer understanding of the rate of shoreline change and to provide baseline information for sea level rise. Two one-day surveys are conducted at most sites, one in the spring and one in the fall. Surveys are only conducted in the fall at Monomoy NWR, typically between September and November, consequent to the large number of seals using the area in the spring. To document accurate data on shoreline change, a handheld Trimble device is used to GPS the neap high tide swash line around the ocean-facing extent of South Monomoy Island by walking the beach at a normal pace. The survey takes approximately one day to complete.

Shoreline surveys are not conducted on Nantucket NWR or Nomans Land Island NWR.

New England Cottontail Reintroduction

Nomans Land Island NWR

Beginning in 2019, we expect to spend an average of 20 days on the island each year as we initiate a New England cottontail reintroduction project. Most of the cottontail work will take place in the island interior (not the shorelines), and will not cause disturbance to seals, however, there will be more trips to and from the island, which could result in slightly more disturbance to seals on the shoreline as the boat approaches the island. We expect the 20 days to occur over approximately 12 trips during the spring, summer, and fall.

Protection of Seal Haul Out Areas

Nantucket NWR

At Nantucket NWR we maintain a year round closure for seals on the north tip of the property. We use metal and woodens signs, rope or twine, and informational signs to keep vehicles and pedestrians out of these areas. The perimeter of the closed areas sometimes needs to be moved (as seals move) or replaced (as signs are vandalized or lost in coastal storms).

Haul out sites are not protected with physical closures due to the difficulty in accessing the habitats at both Monomoy NWR and Nomans Land Island NWR. Nomans Land Island NWR is also closed to the public year round.

Section 2: The date and duration of such activity and the specified geographical region where it will occur.

Due to scheduling, time, tide constraints, and favorable weather/ocean conditions, the exact survey dates and durations are variable. The durations of activities marked in Table 1 and 2 do not reflect the durations of seal disturbance, but rather are estimates of the total time spent on the activities. Duration and frequency of seal disturbance is actually much less because not every activity event results in the disturbance of seals, and when disturbance may occur, it is very short in duration. Further details on activity durations are described in Section 1. The three main activity sites are National Wildlife Refuges managed by the U.S. Fish and Wildlife Service and are islands located off the coast of Cape Cod, Massachusetts. Disturbance to seals may occur during trapping events for the Red Knot Stopover Study at sites located on Cape Cod National Seashore managed by the National Park Service. Main haul-out sites at CACO occur in Chatham, Eastham, Wellfleet, and Truro, although red knot trapping has historically occurred in Chatham, Eastham, and Orleans.

Activity Sites

Monomoy NWR (41.590348, -69.987432): This site refers to the Atlantic side of South Monomoy Island at Monomoy NWR. Seals use most of the ocean-facing beach of this island as a haul-out site. See Attachment 1.

Nantucket NWR (N 41.391754, W -70.050568): This site refers to Nantucket NWR located on the northeast tip of Nantucket Island. The point itself is the primary haul-out site for this location. See

Attachment 2.

Nomans NWR (N 41.264267, W -70.812228): This site refers to Nomans Land Island NWR located off the coast of Martha's Vineyard. Seals here haul-out on the northeast peninsula, and sporadically along the northern shoreline. The rocks around the island are sometimes utilized as well. See Attachment 3.

Table 1. Site location and duration of activities at risk of disturbing gray seals haul-outs on National Wildlife Refuge activity sites.

		Site Location & Duration		
Activity	**Time of Year**	**Monomoy NWR**	**Nantucket NWR**	**Nomans NWR**
Shorebird and Seabird Monitoring & Research	April-August	17 weeks 2 days/ week 6-8 hours/day	17 weeks* 2 days/week <1 hour/day	1-5 days/year ~1 hour/day
Roseate Tern Staging Counts & Resighting	mid July- September	3 weeks 1-2days/week 1-3hours/day	6-8 weeks 2 days/week 1-3 hours/day	N/A
Red Knot Stopover Study	August- October	Two trapping windows 5-10 days in combination with CACO beaches 6-12 hours/day	N/A	N/A
Northeastern Beach Tiger Beetle Census	July- September	1-3 days/year 6-8 hours/day	N/A	N/A
Coastal Shoreline Change Survey	September-October	Once/year 8 hour day	N/A	N/A
New England Cottontail Introduction	March /April – November	N/A	N/A	20 days/year ~1 hour/day
Protection of Seal Haul Out Areas	April – March	N/A	10x / year 60 hours total	N/A

*Shorebird and seabird monitoring and research on Nantucket is contingent on the presence of nesting beach birds.

Section 3: The species and numbers of marine mammals likely to be found within the activity area.

Gray seal (*Halichoerus grypus atlantica*) and harbor seal (*Phoca vitulina concolor*) are found within the activity areas. Official counts of gray seal adults have not been conducted since the late nineties, so an exact population estimate is unknown. Since the population is always changing and is relatively plastic, it is difficult to narrow down how many individuals use Refuge lands and waters, but it is certainly in the thousands at Monomoy NWR (USFWS 2015). Numbers of gray seals below (Table 2) reflect approximate annual ranges based on 2015 National Oceanic and Atmospheric

Administration (NOAA) unpublished data for Monomoy NWR and U.S. Fish and Wildlife (USFWS) staff field observation estimates for Nantucket and Nomans Land Island NWRs. Table 3 reflects seal counts determined from aerial photography and represents the maximum number of seals seen at one time during the given month at Monomoy NWR (B. Josephson, NOAA, personal communication).

It is unknown how many harbor seals are found at the activity sites. Harbor seals are mainly winter residents with numbers tapering off in the summer. Harbor seals mix with gray seal haul- outs, which staff estimates are comprised of 5% or less harbor seals based on field observations. Activities are not conducted at the activity sites from late fall to late winter.

Monomoy NWR

Gray seal abundance varies throughout the year, with the highest numbers occurring during the pupping and molting season. In early spring, numbers may be as high as 18,000 individuals, tapering to 900 animals in the summer, and then increasing to over 1,000 seals in the fall. Since harbor seals are predominately winter residents, gray seal haul-outs are comprised of an estimated 50 harbor seals during the fall and winter, if any. Harbor seal estimates are based on USFWS staff field observations.

Table 2. Raw count of the maximum number of individual gray seals using Monomoy NWR lands and surrounding waters in 2015 based on NOAA unpublished data (B. Josephson, NOAA, personal communication).

Gray Seals	
Month	**Raw Count**
January	4435
February	6047
March	16764
April	18098
May	19166
June	8764
July	978
August	1206
September	658
October	1113
November	2379
December	not calculated

Nantucket NWR

Gray seal abundance on Nantucket NWR varies throughout the year. Summer months boast a haul-out of ~100 individuals, which increases to about 500 or more seals during the winter and very early spring. An estimate of 5-25 harbor seals can be found mixed in with gray seal haul-outs during this time, with significantly less, if any, occurring during the summer months. These ground observation estimates are provided by USFWS staff that work at Nantucket NWR.

Nomans NWR

Little is known about gray seal abundance on Nomans Land Island NWR. Staff estimates an abundance of less than 100 individuals during the summer based on ground observations, but we expect over 1000 animals use the shorelines and nearshore waters in the winter and early spring. Since harbor seals are known winter residents, no information is known on harbor seal abundance at this site. Nomans Land Island NWR is not often visited during the fall and winter by USFWS staff, and is closed to the public all year round.

Section 4: A description of the status and distribution, including seasonal distribution, of the affected species or stocks of marine mammals likely to be affected by such activities.

Gray Seal

There are three major populations of gray seals found in the world; eastern Canada, northwestern Europe and the Baltic Sea. The gray seals that surround Monomoy, Nantucket, and Nomans Land Island NWRs are included in the western North Atlantic Stock, which ranges from New York to Labrador.

Gray seals are a Massachusetts species of special concern and use the refuges for hauling out and breeding. In fact, Monomoy NWR is the largest haul-out site for gray seals on the U.S. Atlantic seaboard, and one of only two consistent sites in Massachusetts where gray seals pup (USFWS 2015). Gray seals are known to use Monomoy NWR and Nantucket NWR land and water year round, with higher numbers accumulating during the winter and spring when pupping and molting occur. While gray seal pupping grounds are historically further north on Sable Island in Nova Scotia and in the Gulf of St. Lawrence in Canada, there has been a year-round breeding population on Cape Cod and the islands since the late 1990s (Waring et al. 2016, USFWS 2015).

Monomoy NWR and Muskeget Island (west of Nantucket) are two of only a few sites where gray seals consistently pup in Massachusetts. Gray seals start to group up in fall and pupping generally occurs from mid-December to early February (USFWS 2015). Gray seal pupping on Monomoy NWR was limited in the past but has been increasing rapidly in recent years. Unpublished data from the Massachusetts Institute of Technology suggests that the 2016 breeding season produced between 700 to 1000 pups on Monomoy NWR (W. Puryear, MIT, personal communication). By early spring, upwards of 18,000 gray seals can be found hauled-out on Monomoy NWR (B. Josephson, NOAA, personal communication). While many of these seals use Monomoy NWR for breeding, others make their way to the refuge to molt. By late spring, gray seal abundance continues to taper until the fall (Table 3).

Gray seal pupping information for Nantucket NWR and Nomans Land Island NWR is limited, but evidence suggests that a small number of pups are born at each site in recent years. Similar trends in distribution at Monomoy NWR occur at Nomans Land Island and Nantucket NWRs, but in

significantly less numbers. Gray seals are most abundant at the activity sites from late fall until spring, and less frequent during the summer months when most activity is occurring. Although, there is uncertainty regarding seal use of Nomans Land Island NWR during the fall and winter since the refuge is not frequently visited by staff.

Current estimates of the total western North Atlantic gray seal population are not available, although portions of stock have been calculated for select time periods. Models estimate that the total minimum Canadian gray seal population is at 505,000 individuals (Waring et al. 2016). Present data are insufficient to calculate the minimum population estimate for U.S. waters. The most recent maximum count of gray seals in U.S. waters estimated 15,756 seals in Southeastern Massachusetts coastal waters in March 2011 (Waring et al. 2016). Current population trends show that gray seal abundance is likely increasing in the U.S. Atlantic Exclusive Economic Zone (Waring et al. 2016). Although the rate of increase is unknown, surveys conducted since their arrival in the 1980s indicate a steady increase in abundance in both Maine and Massachusetts, likely due to both natural increases and immigration (Waring et al. 2016). There are no published estimates for the number of gray seals on Monomoy NWR, however National Marine Fisheries Service surveys suggest that the number of pups on the refuge has increased from tens to hundreds in recent years. Gray seals are not listed under the Endangered Species Act and the western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. Regardless, gray seals are protected by the Marine Mammal Protection Act and the Service has an affirmative responsibility to protect seals when they are on refuge lands and in refuge waters (Waring et al. 2016, USFWS 2015).

See Section 3 for further information on gray seal seasonal distribution at each activity site.

Harbor Seal

Harbor seals found on Cape Cod are included in the Western North Atlantic Stock, which ranges from the Canadian Arctic to New York, and occasionally to the Carolinas. Due to imprecise abundance estimates and long survey intervals, current population trends have not been conducted for this stock and it is unknown how many harbor seals are found at the activity sites. Based on available counts along the Maine coast in 2012, the minimum population estimate is 66,884 (Waring et al. 2016).

Harbor seals generally start arriving to the Refuge Complex waters in early September and remain until late March (Waring et al. 2016, USFWS 2015). Numbers of these seals increase slowly through this time period and then quickly drop off in March as they make their northward movement from southern New England to Maine and eastern Canada, where they breed in mid-May (Waring et al. 2016, USFWS 2015). Though harbor seals are still present, their numbers are not as high as in the past (USFWS 2015). Gray seals seem to be displacing harbor seals to some extent, but the two species will haul out together, with gray seals occupying the upper beach and harbor seals staying closer to the water (Waring 2010, NOAA, personal communication). Harbor seals are not listed

under the Endangered Species Act and the Western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. Regardless, harbor seals are protected by the Marine Mammal Protection Act and the Service has an affirmative responsibility to protect seals when they are on refuge lands and in refuge waters (Waring et al. 2016, USFWS 2015).

Section 5: The type of incidental taking authorization that is being requested and the method of incidental taking.

Level B harassment is being requested for an Incidental Harassment Authorization. Research activities may result in the temporary disturbance (harassment) of mixed gray seal and harbor seal haul-outs by the presence of researchers conducting biological tasks. Seal haul-outs on the Cape and Islands are primarily composed of gray seals, with few harbor seals present during the fall and winter. We do not expect any death or serious injury to seals as a result of the proposed activities and take precautionary measures to avoid disturbance when possible.

Section 6: By age, sex, and reproductive condition, the number of marine mammals that may be taken by each type of taking identified in Section 5, and the number of times such takings by each type of taking are likely to occur.

Gray Seal

Little information is known about gray seal reproductive condition and their use of the activity sites for pupping. Newborn pups are not disturbed, as research and monitoring activities are not performed during the gray seal breeding season. Refer to Section 4 for further information on pupping.

Similarly, information on sex and age distribution is unknown as official research has not been conducted to address these questions. General observation from USFWS staff suggests mixed age and sex gray seal haul-outs (K. Iaquinto, USFWS, personal communication). For reasons mentioned, Table 3 reflects a mix of ages with both sexes combined.

Table 3. Estimated number of gray seal takes per activity at Monomoy, Nantucket, and Nomans Land Island NWRs based on NOAA unpublished data (Table 3) and USFWS field observations. Numbers included both males and females across all ages.

Activity	No. takes per event	No. events per activity	Total takes
Shorebird and Seabird Monitoring & Research	1000 (Monomoy) 50 (Nantucket) 10 (Nomans)	34 (Monomoy) 8 (Nantucket) 3 (Nomans)	34430
Roseate Tern Staging Counts & Resighting	10 (Monomoy) 10 (Nantucket)	6 (Monomoy) 4 (Nantucket)	100
Red Knot Stopover Study	250 (Monomoy) 150 (CACO)	5 (Monomoy) 5 (CACO)	2000
Northeastern Beach Tiger Beetle Census	750 (Monomoy)	3 (Monomoy)	2250

Coastal Shoreline Change Survey	500 (Monomoy)	1 (Monomoy)	500
New England Cottontail Introduction	10 (Nomans)	20 (Nomans)	200
Seal Haul Out Protection	25 (Nomans)	250 (Nomans)	250
Total takes			**39,730**

The greatest disturbance is expected to occur during the beach nesting bird breeding season from April-August, and mainly affects gray seals. Table 4 reflects conservative numbers, likely to be over-estimates, of the number of gray seals likely to be impacted by each activity event. Please note that take estimates were based on NOAA unpublished data (Table 2) and USFWS field observations. While the average number of gray seals present [in regards to Monomoy] from April until August is greater than what is reflected in Table 4, not every hauled-out seal on the beach is impacted from each activity and not all seals are impacted from every activity event. This is especially true for Monomoy NWR because the seal haul-out stretches across 4+ miles of beach, whereas the haul-outs on Nomans Land NWR and Nantucket NWR are more compact at a central location. These thoughts were taken into consideration when estimating seal take.

For shorebird and seabird monitoring and research on Monomoy, an average take of 1,000 gray seals was estimated based on Table 3 and field observations from staff working on South Monomoy Island. Seals on this island will haul out in groups along the Atlantic shoreline (Attachment 1). Although gray seals will haul out daily on South Monomoy, they won't always be present in the same location every day and will haul out during different times of the day in accordance with the tide. Staff faces the most difficulty avoiding seals along the narrow shoreline sections of the island at the south end of South Monomoy Island (Attachment 1). Seal haul-outs at the north end of the island can be readily avoided given the width of the beach and the availability of preferred nesting beach bird habitat located closer to the dunes (Attachment 1). While the average number of seals hauled-out on South Monomoy Island between April and August is 9000, an average of 1000 individuals [at any given time] better describes the number of seals staff comes into contact with (Table 2). Staff monitors nesting beach birds along the 4+ mile Atlantic shoreline of South Monomoy 5-6 days a week (Table 1). It is important to note that the entire extent of the shoreline is not monitored every day. Staff monitors as many areas as time allows, although there are some days when the north or south end of the island are not visited. And when seal haul-out areas are visited, staff does not always disturb the seals. Knowing this and keeping in mind the 17 week nesting season, staff estimates that seals are disturbed during shorebird and seabird monitoring twice a week (Table 1 & 3). This equates to 34 events of disturbance (Table 3). The same ideology and number of events was applied to Nantucket as well for this activity (Table 3). Nomans Land NWR is only visit twice a year during the spring and summer, and the number of takes per event is based on observations of staff visiting the island (Table 1).

The number of takes per roseate tern staging count and resighting event was estimated based on staff observations from previous surveys. It's rare if seals are disturbed during this event, as roseate terns generally prefer to roost on flats or open sand, while the seals prefer to haul-out on the shoreline of South Monomoy and Nantucket. However, disturbance is possible if roseate terns roost adjacent to the northern end of the haul-out area on South Monomoy Island or the haul-out on Nantucket (Attachment 1 & 2). The number of resighting events is based on previous year's survey efforts (Table 1).

The number of seal takes provided for the red knot stopover study in Table 4 were derived from previous year's efforts and staff observation. Trapping does not always occur on South Monomoy Island, and in fact did not occur there in 2017. Trapping locations are chosen based on reconnaissance efforts conducted to locate red knot roosts. When trapping is conducted on South Monomoy Island, the cannon nets are set in one location along the Atlantic shoreline and are not moved for the remainder of the trapping effort. Therefore, only the haul-outs closest to the trapping site may be affected, which staff estimates to be around 250 seals (Table 3). The number of events per red knot trapping activity reflects previous year's efforts (Table 1 & 3). Trapping does not occur if a seal haul-out is located within 150 feet of a red knot roost.

The number of takes estimated for Northeastern beach tiger beetle census in Table 4 is based on staff observation. This activity usually takes two to three days to conduct and results in some seal disturbance (Table 1 & 3). The number of takes provided for the coastal shoreline change survey is based on unpublished data from NOAA for the month of October (Table 2). Monomoy no longer conducts shoreline survey in the spring when seal haul-outs are at their biggest, therefore only one survey is conducted in the fall.

Harbor Seal

Peak pupping for harbor seals is in June and occurs elsewhere, mainly on the coasts of Maine and maritime Canada. A study in 2001 revealed that the seals migrating to New England waters include juveniles, sub-adults, and adults (Gilbert et al. 2005; Waring et al. 2006). Data on harbor seal sex and age distribution is still insufficient to report. Harbor seals are only noted in gray seal haul-outs if they are spotted by USFWS staff or researchers. It is unclear as to how many harbor seal takes occur since the seals are mainly present during the off season when research and monitoring is limited. However, staff estimates that gray seal haul-outs during the summer are comprised of 5% or less harbor seals based on field observations, as harbor seals are not always seen mixed in with every gray seal haul-out. To add, harbor seal numbers taper during the summer time when the highest level of seal disturbance occurs. We are requesting 1,964 harbor seal takes. This count is based on an estimate that seal haul outs contain 5% harbor seals and 95% gray seals in mixed flocks.

Total takes equal 41,694 of both species combined for all activities.

Section 7: The anticipated impact of the activity to the species or stock of marine mammal.

We anticipate potential temporary disturbance or flushing of individuals or groups of hauled-out pinnipeds as a result of our activities. For activities at Nantucket NWR, seals are only disturbed on average two times a week for 5-10 minutes if signage needs to be replaced, nests need to be checked, or if a member of the public is seen approaching the seals. Usually only small subsets of seals are disturbed. The haul-outs on Nomans Land Island NWR are only temporarily disturbed if they are resting near a safe boat landing area or if there is no other way around them along the narrow shoreline which is sometimes flanked by unpassable cliffs. Disturbance on Nomans Land Island NWR does not always occur during the 1-3 visits staff makes to the island, and if it does occur, will last 5-10 minutes.

Most of the Refuge Complex's disturbance to seals occurs at Monomoy NWR when conducting shorebird and seabird monitoring and research. Temporary disturbance during this activity will disturb seals an average of two times a week for 10-15 minutes. For activities of long duration, such as shoreline survey and Northeastern beach tiger beetle census, there is a higher probability of disturbing seals, but still a low relative impact to individuals and haul-outs. The long duration activities mentioned do not require personnel to linger at haul-out sites, but instead only walk by as they move along the beach, resulting in a 5-10 minute disturbance to individuals or haul-outs.

It is important to note that the majority of research and monitoring activities occur during the time of year when less seals are using the land and surrounding water of the activity sites. Most of the activities performed at the activity sites are not likely to disturb seals or disturb the maximum number of seals mentioned in Table 2 and Section 6. This is especially true for roseate tern staging counts and resighting at Monomoy NWR, which did not impact any marine mammals last year. That said, haul-outs have been known to occur adjacent to the activity sites and the potential to impact pinnipeds is therefore present. Activities do not occur when the seals are molting or pupping. Even so, gray seal breeding does not occur at Nantucket NWR and is extremely limited on Nomans Land Island NWR with very few pups born (S. Wood, NOAA, personal communication). Monomoy is one of two main breeding sites for gray seals in Massachusetts, but activities do not occur until months after the breeding season ends. Harbor seals do not breed in Massachusetts and are mainly winter visitors. Refer to Section 4 for more information about gray seal and harbor seal pupping. Disturbances will have only short-term effects on the individuals affected. No long-term effects on disturbed seals are expected as they remain close to shore following a flushing event, and then return to haul-out after the staff member has left the area. Every effort is made to avoid disturbing seals, including posting the haul-out areas with closed signs on Nantucket NWR and walking high up on the dunes at Monomoy NWR.

Present data are insufficient to calculate the total western North Atlantic gray seal population; however estimates of portions of the stock are available. Models predict that the total minimum Canadian gray seal population to be 331,000 individuals. Present data are insufficient to calculate population estimates of gray seals using U.S. waters, although gray seal abundance is likely increasing in the U.S. Atlantic Exclusive Economic Zone (Waring et al. 2016). The minimum population estimate of the western North Atlantic stock of harbor seals is 66, 884 individuals. Keeping this in mind, only ~100 gray seals and less than 25 harbor seals can be seen at any given time during the summer at Nantucket NWR and Nomans Land Island NWR. These numbers are very small compared to the western North Atlantic stock of harbor seals and the Canadian gray seal population alone. Although Monomoy NWR serves as a haul-out site for an arguable large portion of the gray seal population, the large numbers mentioned in Table 3 [for April and May] are only present at Monomoy NWR during the first month of activity events. After this time, gray seals numbers significantly taper to less individuals (Table 2). Less than 50 harbor seals can be seen at one time at Monomoy NWR during the summer months, a small number compared the minimum population estimate. Refer to Section 3 and 4 for more information about gray seal and harbor seal distribution. For reasons mentioned, the impact on gray seals and harbor seals is considered negligible.

We do not anticipate death, injury, or reduction in reproductive fitness of any marine mammal species or stocks. Temporary disturbance should not result in negative impacts to marine mammals, and every effort will be made to minimize potential harassment.

Section 8: The anticipated impact of the activity on the availability of the species or stocks of marine mammals for subsistence uses.

There is no impact on subsistence availability as activities will not take place in an area where subsistence hunting occurs.

Section 9: The anticipated impact of the activity upon the habitat of the marine mammal populations and the likelihood of restoration of the affected habitat.

There is no anticipated negative impact on marine mammal habitat. On Nantucket NWR, signs are posted on galvanized steel u-posts to protect the entire extent of areas utilized by seal haul- outs. Similar signage is used to denote bird nesting areas, and sometimes these areas overlap. Signs to protect seal haul-outs are generally present year round, depending on staffing, but are moved several times a year as seal numbers and haul-out locations shift. Placement of these signs actually provide a net benefit, as the signs inform the public to keep a respectable distance from hauled-out seals and reduce human disturbance. Staff has also not noticed a change in seal behavior, including avoidance behavior or abandonment from posts being present. Seal haul-out areas are not posted on Monomoy or Nomans Land Island NWRs.

Section 10: The anticipated impact of the loss or modification of the habitat on the marine mammal populations involved.

There is no anticipated loss or modification of marine mammal habitat.

Section 11: The availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks, their habitat, and their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance.

In order to reduce the impact of research and monitoring activities on affected marine mammal species, USFWS staff plans to minimize take by avoiding pinnipeds when possible during the outlined activities. Disturbance to hauled-out marine mammals will be minimized as follows:

- Researchers and USFWS staff will maintain the minimum legal distance of 150 feet or greater, unless it is absolutely necessary to flush a pinniped in order to continue conducting high priority conservation work (i.e., properly and effectively monitoring piping plover nests located on the narrow sections of beach at the south end of South Monomoy Island, surveying the shoreline for northeastern beach tiger beetles, etc.).

- Monitoring and research efforts are conducted as far away as practicable. When disturbance is unavoidable, staff will work quickly and efficiently to minimize the length of disturbance. Researchers and staff will do so by proceeding in a slow and controlled manner, which allows for the seals to slowly flush into the water. Staff will also maintain a quiet working atmosphere, avoiding loud noises, and using hushed voices in the presence of hauled-out pinnipeds. Pathways of approach to the desired study or nesting site will be chosen to minimize seal disturbance if an activity event may result in the disturbance of seals.

- Disturbance is deemed unavoidable if high priority conservation work is inhibited by trying to avoid seals (i.e., if a previously located piping plover nest and associated adults cannot be viewed using binoculars or scope, staff has to investigate the situation further by getting closer to the nest site and potentially disturbing nearby seals). Seals are not purposely flushed, but instead are disturbed as a consequence of performing an activity. If seals are flushed, they are flushed by the presence of staff walking too close to them. Disturbance events are infrequent, with less takes occurring during the busiest time of year when less seals are present on the beaches. Refer to section 6 on how often disturbance occurs.

- Researchers, USFWS staff and volunteers will be properly informed about the Marine

Mammal Protection Act and the take of pinnipeds, and will educate the public on the importance of not disturbing marine mammals, when applicable. Staff at Nantucket NWR will remain present on the beaches utilized by pinnipeds to prevent anthropogenic disturbance during times of high public use (late spring-early fall). Staff at Monomoy NWR will also be present on beaches utilized by seals during the same time of year, and will inform the public to keep a distance from haul-outs if an issue is noticed.

- Public closures are also in place to protect seal haul-outs. There is no public access to Nomans Land Island NWR, and haul-out sites are denoted with signage on Nantucket NWR for much of the year. Signs on Nantucket NWR are periodically moved as seal numbers and haul-out locations shift. Every precaution is taken to not disturb the seals and signs are moved during periods of low public traffic to help decrease disturbance and public involvement.

- The presence/proximity of seal haul-outs and the loud sound created by the firing of cannon nets are taken into consideration when selecting trapping sites for the Red Knot Stopover Study. Trapping sites are decided based on the presence of red knots, the number of juveniles located within roosts, and the observation of birds with attached geolocators and flags. Sites are not trapped on if there is a strong possibility of disturbing seals (i.e., there's a seal haul-out at the trapping site). The Red Knot Stopover Study occurs during the time of year (July-Sept) when the least number of seals are present at the activity sites (Section 3).

- When possible, seals will not be flushed by USFWS staff if offshore predators (ie. sharks) are seen in the surrounding waters.

- At Nomans Land NWR where boat operations potentially disturb seals, staff will conduct a slow and controlled approach to the island as far away as possible from haul-outs to prevent or minimize stampeding.

- Staff will avoid or proceed cautiously when operating boats in the direct path of swimming seals that may be present in the area.

It is important to note that the majority of research and monitoring activities occur during the time of year when less seals are using the land and surrounding water of the activity sites. These activities also do not occur when the seals are molting or pupping. Seals are flushed by the presence of researchers and staff walking by haul-outs while performing high priority conservation work. When seals are disturbed they are only disturbed for a short period of time and remain close to shore. Seals are not physically touched during any of the activities.

Section 12: Where the proposed activity would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses, you must submit either a plan of cooperation (POC) or

information that identifies what measures have been taken and/or will be taken to minimize any adverse effects on the availability of marine mammals for subsistence uses.

Not applicable. No activities will take place in or near subsistence hunting areas, nor will they affect the availability of species or stocks for subsistence use.

Section 13: The suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species, the level of taking or impacts on populations of marine mammals that are expected to be present while conducting activities and suggested means of minimizing burdens by coordinating such reporting requirements with other schemes already applicable to persons conducting such activity. Monitoring plans should include a description of the survey techniques that would be used to determine the movement and activity of marine mammals near the activity site(s) including migration and other habitat uses, such as feeding.

USFWS staff will monitor seals as activity events are being conducted in the presence of seals. Species and numbers, broken down by age and sex if possible, of any marine mammal subject to incidental take, along with the date, location, and start and end time of the event, will be recorded for report. Behavior of seals will be recorded on a three point scale (1=reaction not considered harassment, 2=moving 1-3 meters or a behavior considered harassment, 3=flushing greater than 3 meters). USFWS staff will report all observations of sick, injured, or entangled marine mammals on Monomoy NWR to the International Fund for Animal Welfare (IFAW) marine mammal rescue team, and will report to NOAA if injured seals are found at Nantucket NWR and Nomans Land Island NWR. We will also report any tagged or marked marine mammal to the appropriate research organization or federal agency, and record any rare or unusual species of marine mammal. Photographs will be taken when possible. This information will be incorporated into a report for NMFS at the end of the season. The Refuge Complex will also coordinate with any university, state, or federal researchers to attain additional data or observations that may be useful for monitoring marine mammal usage at the activity sites.

Section 14: Suggested means of learning of, encouraging, and coordinating research opportunities, plans, and activities relating to reducing such incidental taking and evaluating its effects.

The Refuge Complex currently coordinates with several universities and federal agencies, including Cummings School of Veterinary Medicine at Tufts University and NOAA, to conduct research on gray seal pupping on Monomoy NWR. This study hopes to address gray seal population size and expand on gray seal health studies (Dawicki 2016). Activities are reduced or are not performed if harassment of seals takes precedent. This is true when addressing shorebird project and shoreline survey, which are reduced or not performed if large seal haul-outs are present.

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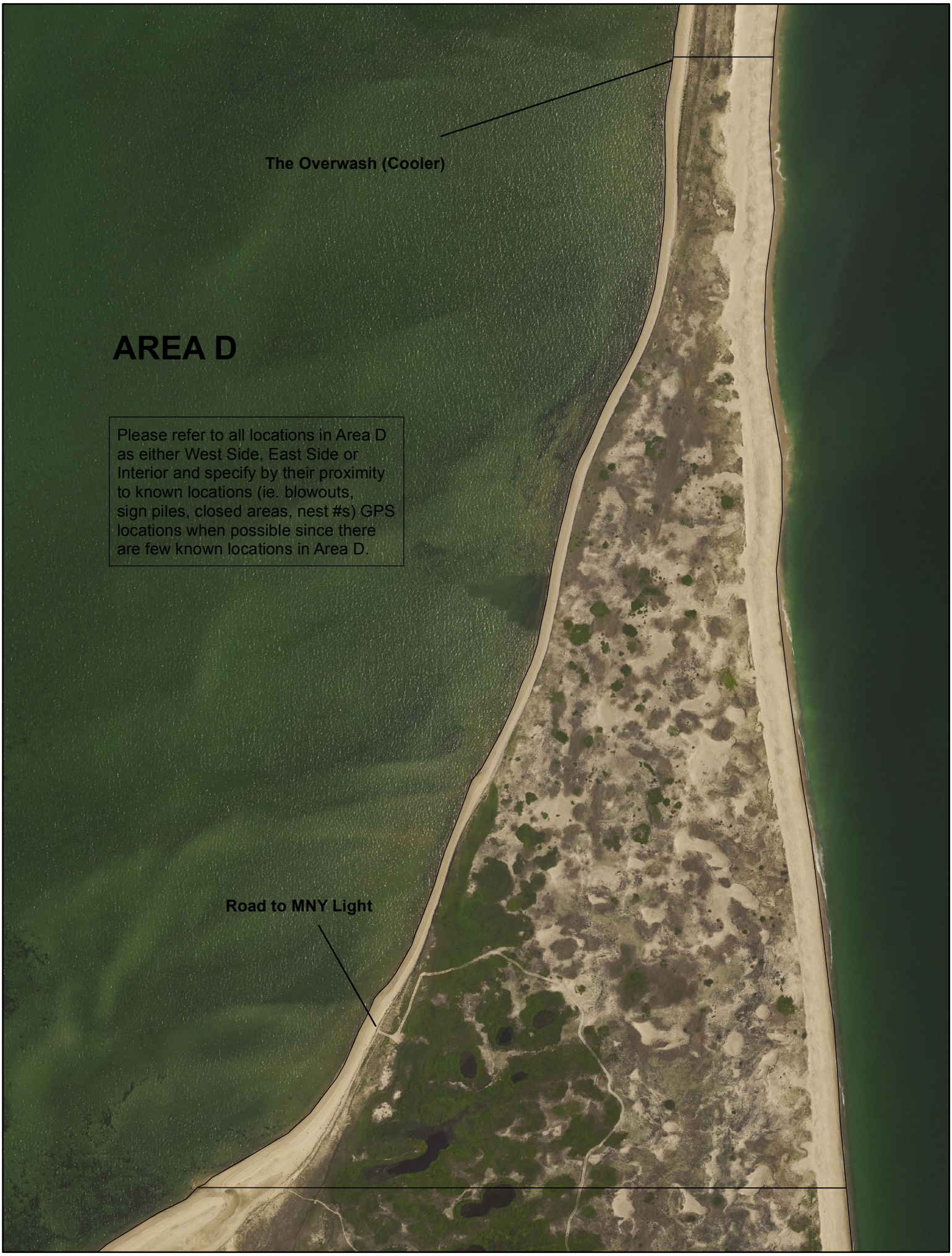
AREA A
North Tip
E Colony Trail
Main Colony
Boat Landing
Camp
Camp Trail
East Beach - Camp
South of Boat Landing
Hospital Pond Marsh
Plover Beach
Hospital Pond Inlet


Tinimoy
Hospital Pond Inlet
Refer to all areas on the West Beach of Area B as West Beach and specify by proximity to known locations (ie. the tracks were seen in Area B on W Beach between the HP Inlet and the 1st Corner).
Hospital Pond
Plover Beach
Boundary with South
First Corner
New Dune
Connection

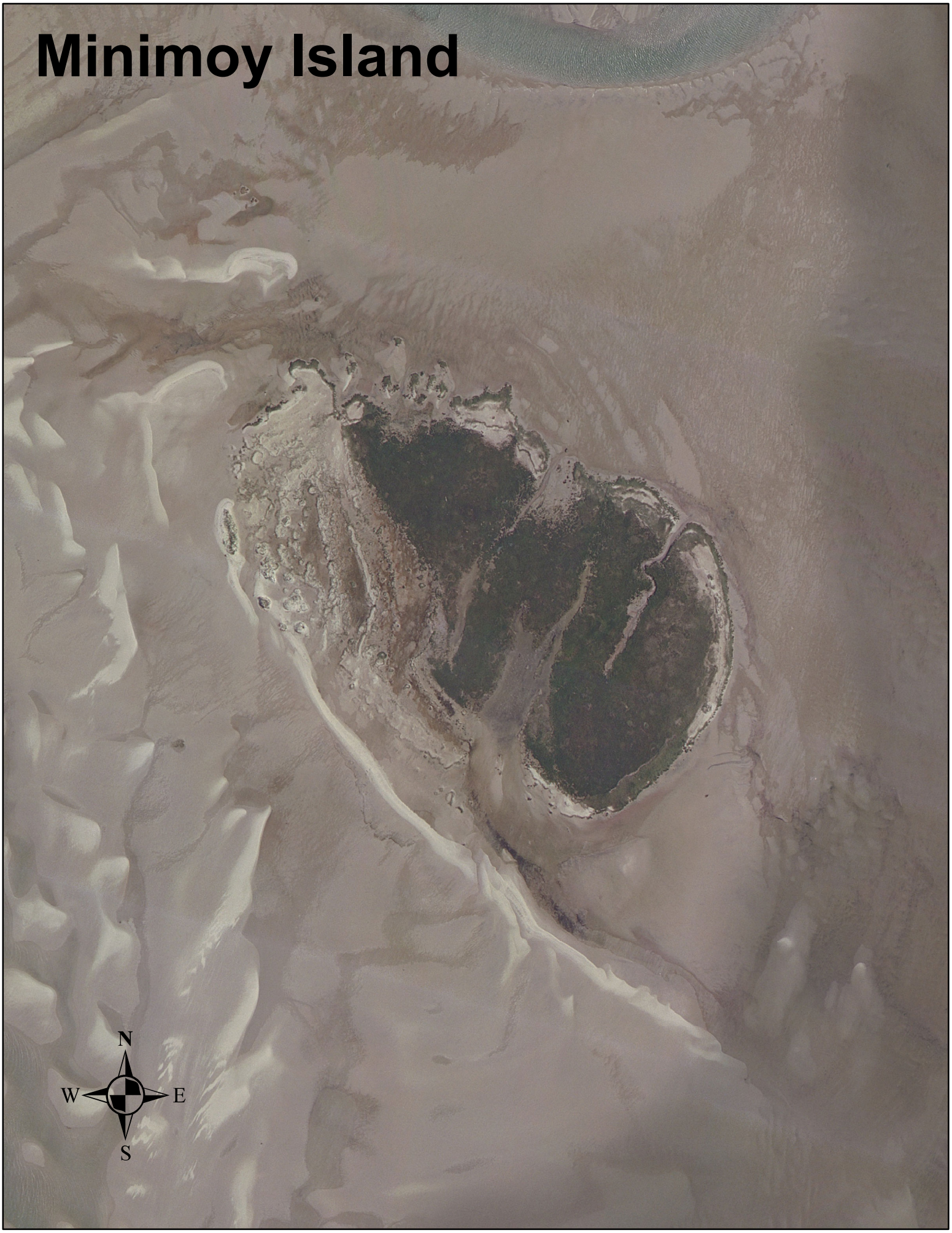

AREA C
Beetle Overwash
Please refer to all locations in Area C as either West Side, East Side or Interior and specify by their proximity to known locations (ie. Coyote tracks were located in Area C on the east side north of the beetle overwash)
The Big Stick
The Overwash (Cooler)


The Overwash (Cooler)
AREA D
Please refer to all locations in Area D as either West Side, East Side or Interior and specify by their proximity to known locations (ie. blowouts, sign piles, closed areas, nest #s) GPS locations when possible since there are few known locations in Area D.
Road to MNY Light

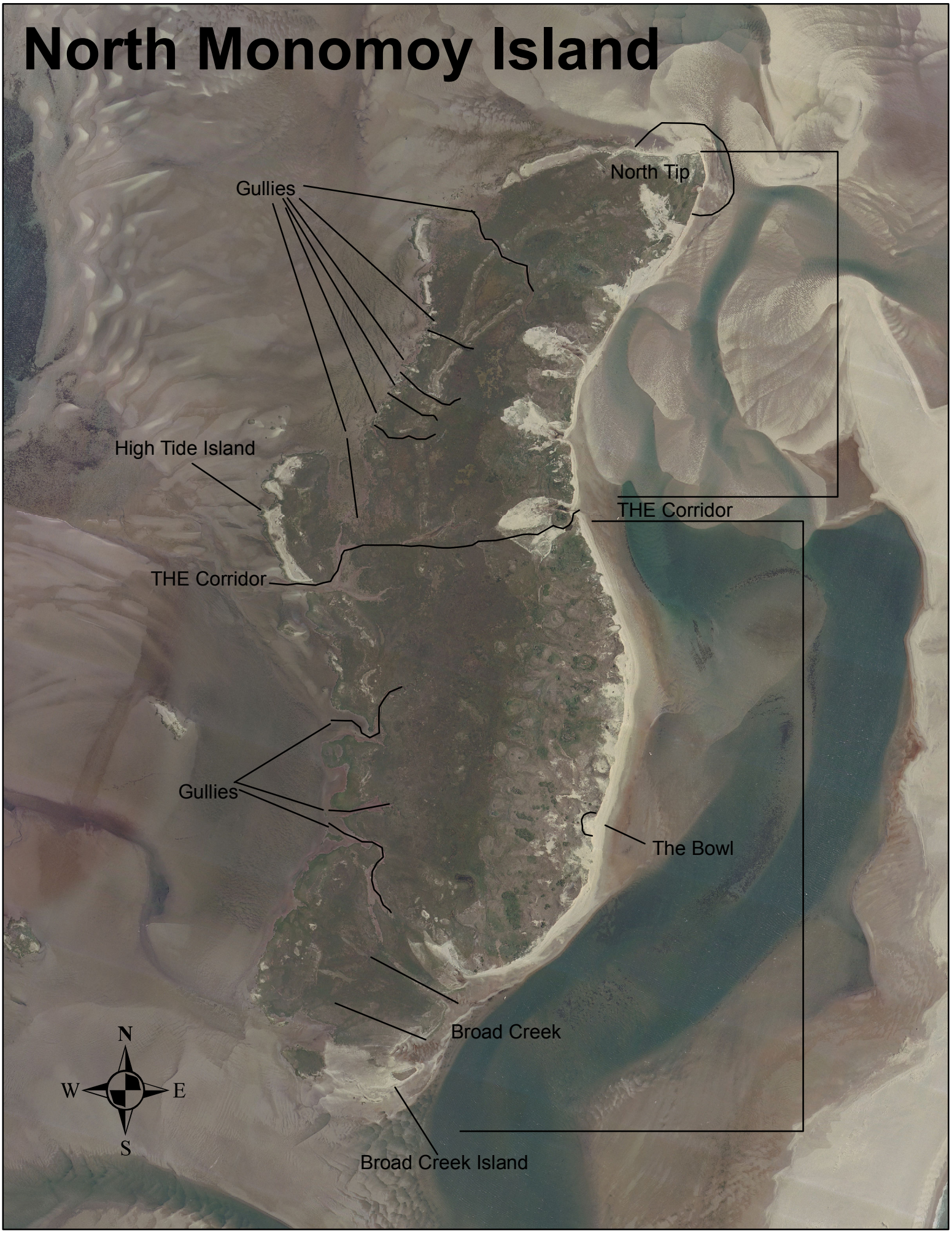

AREA E
LH West Beach
West LH Path
Road to MNY Light
Old PH Inlet
Please refer to all locations in Area E as either West Side, East Side or Interior and specify by their proximity to known locations (ie. MNY Light, Day Markers or overwash areas)
MNY Light
East LH Path
Powder Hole Trail
Powder Hole
New PH Inlet
PH Overwash Area
SE Day Marker
SW Day Marker
Little Station Pond
Big Station Pond


Little Station Pond
SW Day Marker
Big Station Pond
SE Day Marker
AREA F
Please refer to all locations in Area F by their proximity to known locations (ie. Day Markers, nest, or lights) GPS locations when possible since there are few known locations in Area F.
Second Light
First Light

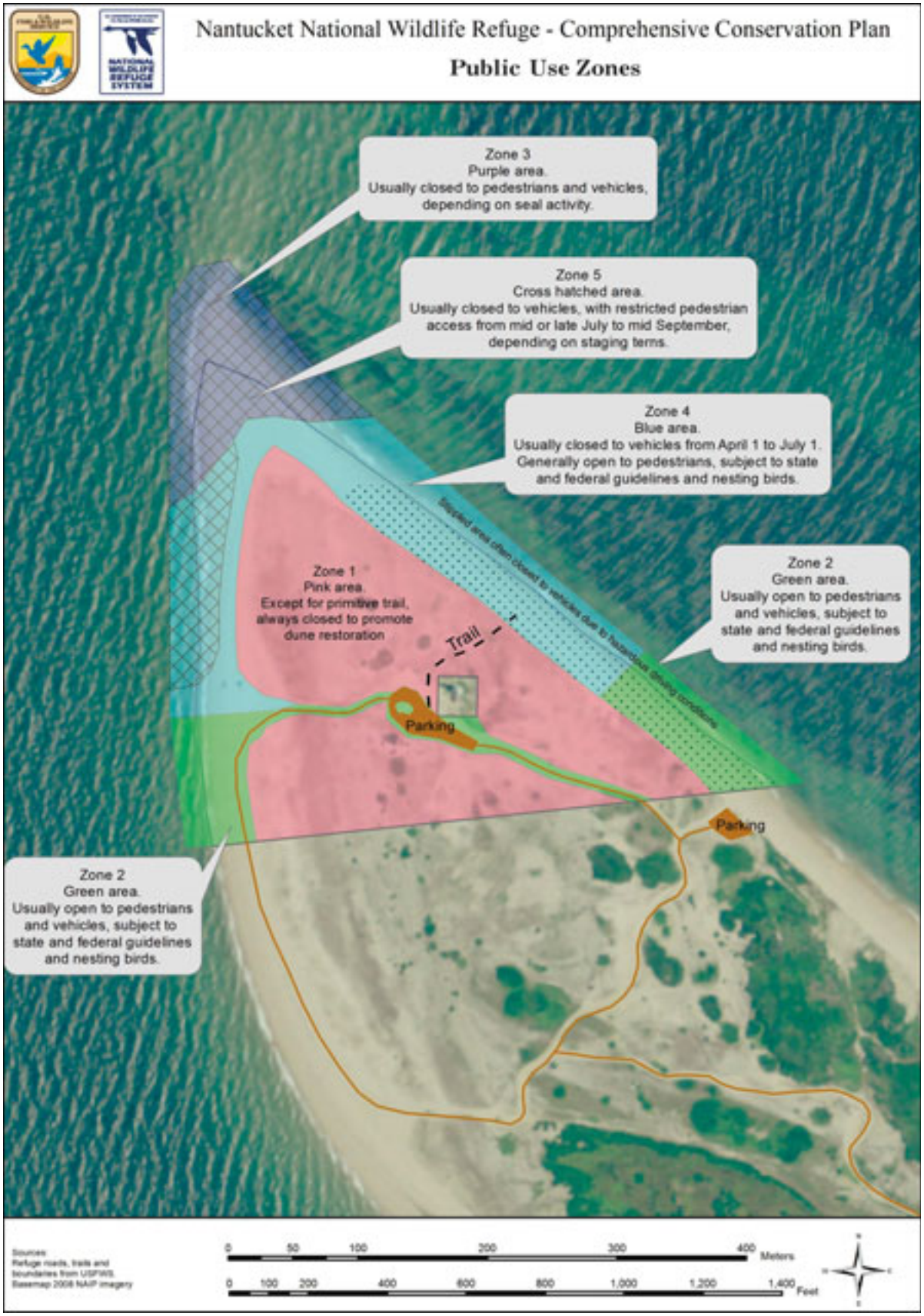
Minimoy Island



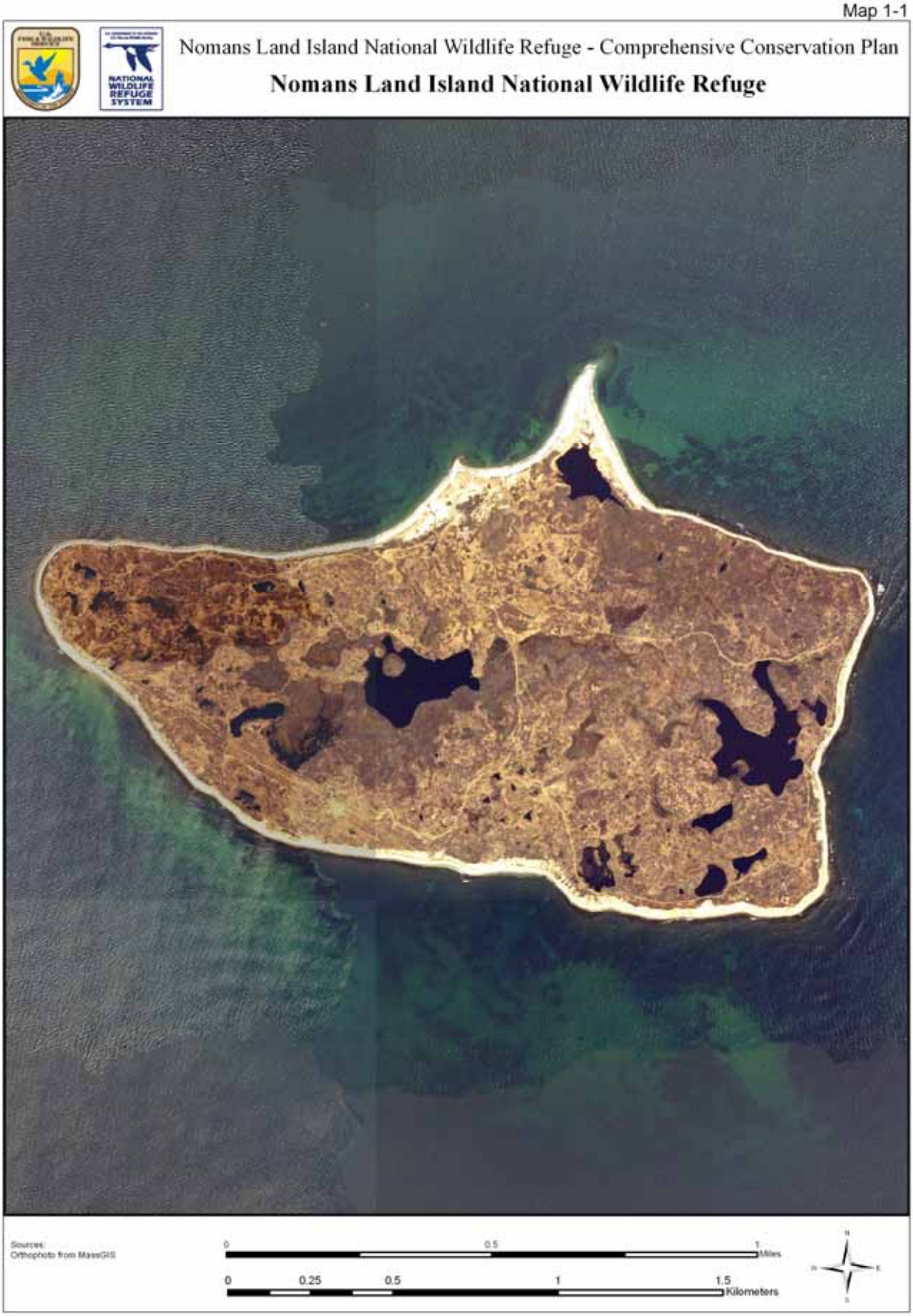
North Monomoy Island



Map 4-1. Public Use Zones



Map 1-1


Nomans Land Island National Wildlife Refuge - Comprehensive Conservation Plan
Nomans Land Island National Wildlife Refuge
NATIONAL WILDLIFE REFUGE SYSTEM
Sources:
Orthophoto from MassGIS
0
0.5
1
Miles
0
0.25
0.5
1
1.5
Kilometers