Pre-Development Assessment of Avian Species for the Proposed Long Island – New York City Offshore Wind Project Area

Final Report 10-22
Task 3b
October 2010

New York State
Energy Research and
Development Authority

The New York State Energy Research and Development Authority (NYSERDA) is a public benefit corporation created in 1975 by the New York State Legislature.

NYSERDA derives its revenues from an annual assessment levied against sales by New York's electric and gas utilities, from public benefit charges paid by New York rate payers, from voluntary annual contributions by the New York Power Authority and the Long Island Power Authority, and from limited corporate funds.

NYSERDA works with businesses, schools, and municipalities to identify existing technologies and equipment to reduce their energy costs. Its responsibilities include:

- Conducting a multifaceted energy and environmental research and development program to meet New York State's diverse economic needs.
- The **New York Energy $mart**SM program provides energy efficiency services, including those directed at the low-income sector, research and development, and environmental protection activities.
- Making energy more affordable for residential and low-income households.
- Helping industries, schools, hospitals, municipalities, not-for-profits, and the residential sector, implement energy-efficiency measures. NYSERDA research projects help the State's businesses and municipalities with their energy and environmental problems.
- Providing objective, credible, and useful energy analysis and planning to guide decisions made by major energy stakeholders in the private and public sectors.
- Since 1990, NYSERDA has developed and brought into use successful innovative, energy-efficient, and environmentally beneficial products, processes, and services.
- Managing the Western New York Nuclear Service Center at West Valley, including: overseeing the State's interests and share of costs at the West Valley Demonstration Project, a federal/State radioactive waste clean-up effort, and managing wastes and maintaining facilities at the shut-down State-Licensed Disposal Area.
- Coordinating the State's activities on energy emergencies and nuclear regulatory matters, and monitoring low-level radioactive waste generation and management in the State.
- Financing energy-related projects, reducing costs for ratepayers.

For more information, contact the Communications unit, NYSERDA, 17 Columbia Circle, Albany, New York 12203-6399; toll-free 1-866-NYSERDA, locally (518) 862-1090, ext. 3250; or on the web at www.nyserda.org

Pre-Development Assessment of Avian Species for the Proposed Long Island – New York City Offshore Wind Project Area

Final Report

Prepared for the

New York State Energy Research and Development Authority

Albany, NY
www.nyserda.org

Jacques Roeth
Project Manager

Prepared by

AWS Truepower LLC

Bruce Bailey, PhD
Project Manager

and

GEO-Marine, Inc

NYSERDA
Report 10-22
Task 3b

NYSERDA 9998-03

October 2010

NOTICE

This report was prepared by AWS Truepower, LLC and Energy & Environmental Analysts, Inc. (EEA) in the course of performing work contracted for and sponsored by the New York State Energy Research and Development Authority (hereafter “NYSERDA"). The opinions expressed in this report do not necessarily reflect those of NYSERDA or the State of New York, and reference to any specific product, service, process, or method does not constitute an implied or expressed recommendation or endorsement of it. Further, NYSERDA, the State of New York, and the contractor make no warranties or representations, expressed or implied, as to the fitness for particular purpose or merchantability of any product, apparatus, or service, or the usefulness, completeness, or accuracy of any processes, methods, or other information contained, described, disclosed, or referred to in this report. NYSERDA, the State of New York, and the contractor make no representation that the use of any product, apparatus, process, method, or other information will not infringe privately owned rights and will assume no liability for any loss, injury, or damage resulting from, or occurring in connection with, the use of information contained, described, disclosed, or referred to in this report.

ACKNOWLEDGEMENTS – This report was a collaborative effort written by EEA and AWS Truepower. Contributing authors/editors from AWS Truepower were Bruce Bailey, PhD and Peter Johnson.

ABSTRACT AND KEY WORDS

This report presents the results of a pre-development assessment study of the birds that may be in the vicinity of a proposed 700 MW offshore wind energy project in the Atlantic Ocean located approximately 14 nautical miles (16 statute miles) southeast of Long Island. The information compiled by this study is intended to provide the Long Island – New York City Offshore Wind Collaborative, a coalition of utilities, State and New York City agencies, and other interested parties, with a baseline of knowledge to facilitate future project planning, siting and measurement activities. The assessment includes a review of the avian species that may be found in the New York Bight. The study analyzes the potential impacts of development of the proposed project to unlisted, threatened, endangered, and species of concern during the construction phase and the operational phase of the wind project. Avian risk assessment methodologies are discussed. A review of the existing data indicated that development in the proposed project area may be feasible; however, the collection of site specific environmental data as designated by government agencies will be required to confidently determine the proposed project's potential impact on avian species.

KEY WORDS – offshore wind energy, New York Bight, avian risk assessment, birds, NYSERDA, AWS Truepower, EEA, Inc.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SUMMARY

This report presents the results of a pre-development assessment study of bird use in the vicinity of, and potential bird impacts from, a proposed offshore wind energy project in the Atlantic Ocean southeast of Rockaway Peninsula, Long Island. The information compiled by this study is intended to provide the Long Island – New York City Offshore Wind Collaborative, which is a coalition of utilities, State and New York City agencies, and other interested parties with a baseline of knowledge to facilitate future project planning, siting and measurement activities. The offshore wind facility, which would be developed and operated by one or more developers selected as part of a formal solicitation process by the Collaborative, is envisioned to be located within a 65,000 acre (263 km^2) area approximately 14 nautical miles (16 statute miles) southeast of Rockaway Peninsula, Long Island. This area could support up to 700 MW of nameplate wind capacity, although an initial phase could be as small as 350 MW.

This report provides an overview of avian (bird) species in the New York Bight region and evaluates the potential impacts of offshore wind development on these species in the proposed project area. The New York Bight extends from Cape May, New Jersey to Montauk Point, New York and encompasses the project area. Topics addressed include required regulatory approvals, an overview of species in the New York Bight, a summary of construction impacts and impacts during the wind project's lifetime, and a discussion of assessment methodologies. The report also evaluates the risk of development to bird species likely to inhabit the project area.

The abundance, range, feeding habits, and flight characteristics are described for avian species that may use the project area. These species were categorized according to groupings such as seaducks, loons, grebes, shearwaters and petrels, gannets, wading birds, raptors, shorebirds, gulls and terns, alcids and landbirds. Separate discussions are provided for unlisted species, as well as for threatened, endangered and species of concern, which include piping plover, roseate tern, common tern, least tern, listed diurnal raptors, and common loon. The proposed project will be required to conform with specific regulations relating to avian species protection, including the Endangered Species Act (ESA), the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Offshore and nearshore construction impacts to birds may include noise, collision risk, and displacement from foraging areas. Potential impacts during the lifetime of the proposed project include barrier effect (blocking of flight patterns), habitat loss, and the possibility of collisions. Conclusions are derived from studies conducted at European offshore wind projects as well as at onshore wind projects within the United States and Europe. Although data is limited, possible impacts from project decommissioning are discussed. Positive impacts of development to avian species include the creation of artificial reef habitats around the turbine foundations, which may increase the availability of food sources for birds in the area.

Mitigation measures will likely be employed during the construction and operational phase of the proposed project to minimize avian impacts. Construction-related mitigation measures may include (i) identifying important avian areas through surveys of coastal and offshore areas to avoid siting facilities and cable paths in or near these areas, and (ii) timing construction to avoid periods when marine and coastal birds are in the area. Operation-related mitigation measures may include (i) avoiding areas of known important or high bird use, (ii) reducing the operation of turbines during peak migration periods, and (iii) the use of anti-perching devices on towers.

A discussion on assessment methodologies outlines and provides brief descriptions of the various techniques used for monitoring birds and their interactions with wind turbines, including radio telemetry, acoustic monitoring, aerial surveys, anti-perching devices, thermal imaging, visual surveys and radar studies. Employing these assessment methodologies would provide additional data to better define the avian resources in the New York Bight region, further minimizing the risk of unforeseen impacts to avian species.

Based on available information, the project area does not present any obvious barriers or other fatal flaws for the development of an offshore wind project with regards to avian impacts; however, the current body of knowledge regarding avian species use of the proposed project area is limited. Additional field studies and data collection will likely be required by governing agencies as part of the environmental impact statement review process to further define how offshore wind project development in the New York Bight region might affect local and migrating avian species. The assessment methodologies described in this report may be among those employed during the environmental review process. Baseline data collection will likely be necessary to determine local avian species, numbers, distribution, and movements in order to further assess the potential impacts of project development on avian species. Also, general information on the effects of offshore wind projects on pelagic birds may require further study, as current information is limited. Regulatory agencies will define the extent and scope of the studies that will be necessary.

Section 1

1. INTRODUCTION

The Long Island – New York City Offshore Wind Collaborative (the "Collaborative"), a coalition of utilities, State and New York City agencies, is seeking to obtain power from a future offshore wind energy facility located in the Atlantic Ocean. The offshore wind facility, which would be developed and operated by one or more developers selected as part of a formal solicitation process, is envisioned to be located within a 65,000 acre area approximately 14 nautical miles (16 statute miles)[1] southeast of Rockaway Peninsula, Long Island. The proposed project area could support up to 700 MW of nameplate wind capacity, although an initial phase could be as small as 350 MW.

The New York State Energy Research and Development Authority (NYSERDA) engaged AWS Truepower (AWST) and its subcontractors to conduct pre-development assessment studies of the physical and environmental qualities of the proposed project area and its surroundings. A preliminary review of these qualities is critical in the initial planning stages to determine the existence and nature of any perceived barriers, conflicts, or other fatal flaws that could preclude development of the proposed project. Prior experiences both onshore and offshore have established that impacts to local bird species are a significant environmental consideration for wind projects. Using existing data, this report characterizes the avian species that may be found in the New York Bight region (extending from Cape May, New Jersey to Montauk Point, New York) and potential impacts of development. This information is intended to provide interested parties with a baseline of knowledge to facilitate future project planning, siting and measurement activities.

Because limited data is available, uncertainty exists regarding the impacts of offshore wind energy to birds. Species affected by offshore wind development differ from species that are traditionally affected by land-based projects. Seabird distribution is not well known for much of the Atlantic coast and avian data from offshore wind projects is limited; thus the importance of carefully-designed studies is critical for offshore wind project siting in order to minimize ecological risks to avian species in the marine environment.

In order to better characterize avian use in the proposed project area, a review of existing data was conducted to determine potential impacts to birds in the New York Bight region. The assessment relied on available resources and literature to determine bird species that may inhabit the proposed project area. The possible impacts of offshore wind development were evaluated based on habitat use and species behavior, and focused on both impacts from construction activities (i.e., for turbines, foundations, cabling, and substations) and impacts during the project's lifetime (i.e., barrier effect, habitat loss, collisions). Results from avian studies at European offshore wind projects are summarized, as some of these results may be relevant to a project developed in the New York Bight. Assessment methodologies that may be useful in

[1] A nautical mile equals 1.15 statute miles.

further characterizing avian use in the proposed project area are described. Overall, the review provides a preliminary assessment of potential impacts to offshore wind development in the New York Bight.

Section 2

2. PROJECT DESCRIPTION

In support of the Collaborative's planning efforts, the New York State Energy Research and Development Authority (NYSERDA) engaged AWS Truepower (AWST) and its subcontractors to conduct pre-development assessment studies of the physical and environmental qualities of the proposed project area and its surroundings.

The avian risk assessment focused on the proposed offshore project area and the landfall area for the transmission line on the Rockaway Peninsula, Long Island. The 350 to 700 MW offshore wind project is envisioned to be located within a 65,000 acre area approximately 14 nautical miles southeast of Rockaway Peninsula and between the Ambrose-to-Nantucket and Hudson Canyon-to-Ambrose shipping lanes. Water depths in the project area range from 70 to 120 ft.

The Long Island Power Authority's (LIPA) Rockaway Substation in Far Rockaway and Con Edison's North Queens Substation have been identified as likely points of interconnection for the first 350 MW phase of the project. If the project is expanded to 700 MW, a second transmission line may be built and connected to a new substation in eastern Queens, New York. These areas were evaluated for potential impacts of development to local bird populations.

Specific project details, including the size of turbines, foundation type, and the turbine array layout have not yet been established. Offshore wind turbines typically have a hub height of 60 to 90 meters and blade lengths between 40 and 60 meters. A typical wind turbine is depicted in Figure 2. Turbines may be placed between one-third to two-thirds of a mile apart. Specific project details are dependent on a variety of environmental factors, and will be decided upon as the project moves closer to the construction phase.

Section 3

3. REGULATORY APPROVALS

3.1. MINERAL MANAGEMENT SERVICE APPROVAL

The proposed project will be located in federal waters and will require an environmental impact assessment (EIS) under the National Environmental Policy Act (NEPA). Additional federal environmental review is required under the Federal Energy Policy Act of 2005 that directed the U.S. Department of Interior's Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEM, formerly Mineral Management Service [MMS]) to establish the Outer Continental Shelf (OCS) Alternative Energy and Alternate Use program.

In October 2007 the BOEM (then MMS) released a Programmatic Environmental Impact Statement (PEIS) to establish and apply the requirements of NEPA and examine the potential environmental effects of alternative energy development (including wind) on the OCS. Three OCS regions were analyzed for potential alternative development in the PEIS. The current study area is located in the North-Atlantic subdivision of the Atlantic region, ranging from Maine to the southern portion of the New Jersey coast (see Figure 3).

The PEIS provides a framework to assess the broad, regional environmental issues that will require consideration in order to proceed with development. This framework includes Best Management Practices (BMPs) that may be adopted as mitigation measures by the Alternative Energy and Alternate Use Program in order to facilitate future preparation of site-specific NEPA documents. Policies affecting potential avian impacts include:

- *"The lessee shall evaluate avian use of the project area and design the project to minimize or mitigate the potential for bird strikes and habitat loss. The amount and extent of ecological baseline data required will be determined on a project-by- project basis.*
- *Lessees shall take measures to reduce perching opportunities*
- *Lessees shall locate cable landfalls and onshore facilities so as to avoid impacts to known nesting beaches.*
- *Wind turbine rotors should not come within 30 m (100 ft) of the ocean surface to minimize impacts to water birds.*
- *Lessees shall comply with Federal Aviation Administration (FAA) and United States Coast Guard (USCG) requirements for lighting while using lighting technology (e.g. low-intensity strobe lights) that minimizes impacts to avian species"* (MMS PEIS, 2007).

In addition to the development of these policies by the BOEM, offshore wind energy will involve additional State and/or federal environmental review. Avian resources that may occur in the project area are protected under the following measures:

3.2. ENDANGERED SPECIES ACT

The Endangered Species Act (ESA) was passed in 1973 and is administered by the US Fish and Wildlife Service (USFWS). It provides for criminal prosecution for the taking of a federally listed species. According to the ESA, “the term take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” In the event a proposed project may result in the take of a listed species, the reviewing federal agency is required under Section 7 of the Act to consult with the USFWS. In addition, the Fish and Wildlife Conservation Act of 1988 as amended requires the USFWS to monitor and assess migratory non-game birds, determine the effects of human activities, and “identify species, subspecies, and populations of migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA.” The list is primarily derived from the assessment scores from three major bird conservation plans: Partners in Flight North American Landbird Conservation Plan, the United States Shorebird Conservation Plan, and the North American Waterbird Conservation Plan. (USFWS, 2008).

While the bird species included in the Birds of Conservation Concern are priorities for conservation action, the list is not intended to be the determining factor as to whether a species warrant consideration for ESA listing. The goal is to prevent the need for additional ESA bird listings by implementing proactive management and conservation actions. By focusing attention on high priority species and promoting the study and protection of habitats and critical ecological communities, the development of avian populations will be further sustained.

3.3. MIGRATORY BIRD TREATY ACT AND BALD AND GOLDEN EAGLE PROTECTION ACT

Unlike the ESA, the Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA) are liability statutes administered by the USFWS and do not require a consultation process. Under the MBTA activities that take migratory birds such as hunting, are permitted, however there is no provision for incidental take. Federal guidelines for the siting of wind energy projects in the offshore environment are currently under development. Interim guidelines for the development of land-based wind projects have been developed by the USFWS. Federal agencies will play a role in regulating unlisted species: in an effort to further enhance the conservation of migratory birds, executive order 13186 Responsibilities of Federal Agencies to Protect Migratory Birds was implemented in 2001. This executive order requires every federal agency whose actions are likely to negatively impact migratory bird populations to enter into a Memorandum of Understanding (MOU) with the USFWS. The MOU outlines how the agency will avoid or minimize impacts to migratory birds and promotes the incorporation of migratory bird conservation into agency planning. The latter includes considering impacts to migratory birds while conducting a NEPA analysis and reporting annually on the level of take that is occurring.

Section 4

4. AVIAN SPECIES IN THE PROJECT AREA

Species that have been known to use the offshore areas of the New York Bight may be found in the proposed project area. The New York Bight is the triangular expanse of shallow ocean between Long Island and the New Jersey Coast (see Figure 4). The New York Bight is a smaller area within the much larger Mid-Atlantic Bight that extends from Cape Cod, Massachusetts southward to Cape Hatteras, North Carolina (USGS, 2003). Seabird species that use the New York Bight include pelagic birds such as shearwaters, petrels, fulmars, gannets, phalaropes, skuas, kittiwakes, gulls, jaegers and auks that are generally found over three miles offshore (USFWS, 1996). Pelagic species use open ocean waters rather than waters directly adjacent to land or inland. These species spend most of their lives on the open waters, coming to land only to breed. Generally, seabirds are long-lived birds with high survival rates but low reproduction rates, increasing mortality effects.

Published survey data for the immediate proposed project area and surrounding area is very limited. Most of the published survey data is not extensive enough to fully describe the use of the New York Bight and the project area by seabirds. The data resources are scattered and distributed over many years. Baseline studies may be necessary to determine avian use of project area waters and to assess potential impacts of development. The extent of these studies will be determined by regulatory agencies.

Table 1 indicates species of seabirds that the USFWS lists as using the New York Bight. Figure 5 shows the density of pelagic birds observed by season in the New York Bight based on 1980-1988 data from the National Marine Fisheries Service (NMFS) systematic seabird survey database. In the summer, when many species are located at breeding grounds outside the New York Bight waters, the relative density and diversity of species is lower. Concentrations of birds occur in the vicinity of the Hudson Shelf Valley and Hudson Canyon off the south shore of Long Island and south and east of Montauk Point (see Figure 4). Nutrient rich waters from the Hudson-Raritan Estuary and the coastal bays may concentrate food resources for pelagic bird species. In summer, shearwaters and storm-petrels are most abundant. Locally nesting gulls and terns may also feed in nearshore waters of the Bight (USFWS, 1996). During the spring and fall, higher densities of seabirds can be observed. Species migrating through the New York Bight in the fall and spring are similar and include shearwaters, petrel, gannets, phalaropes, and jaegers. In the spring highest densities of seabirds occur on the OCS near the shelf break particularly in the vicinity of Block Canyon. During the late winter and early spring the waters are will mixed, and fish and invertebrates associated with the upwelling of nutrient-rich waters along the shelf break provide an abundant food source for pelagic birds. In the fall, the highest densities of seabirds are observed south and east of Montauk Point (which is approximately 115 miles northeast of the project area), along the south shore of Long Island, in the Apex of the Bight and off the mouth of Delaware Bay (USFWS, 1996). In the winter, moderate densities of birds can be found over the entire continental shelf with concentrations in similar locations as in the fall. Higher concentrations are off Delaware Bay and along the shelf edge. During the winter the offshore waters are dominated by kittiwakes, skuas, gannets, and auks (USFWS, 1996).

4.1. UNLISTED SPECIES

The following avian species have been listed by the USFWS as using New York Bight area waters. Individual accounts are given for species that are most likely to migrate through/and or exploit pelagic habitat. Other accounts are for species groups (i.e., raptors, landbirds) that may migrate through the study area but do not typically use offshore waters for foraging. Threatened and endangered species are covered in greater detail in section 4.2. Information for species accounts was obtained primarily from the following sources: Birds of North America Online, Bulls Birds of New York State, FWS Species Groups of Special Interest, and the Water Bird Conservation Plan Mid-Atlantic/New England/Maritime Region species profiles. Individual references for species accounts from Birds of North America Online can be found in the references. Table 2 summarizes the avian species that may use the waters of Long Island and the New York Bight. The table includes a larger number of species, as it details some of the birds that may be less common in pelagic waters of the project area.

4.1.1. Seaducks

Seaducks are abundant in Long Island waters during migration and as winter residents. Scoter species using nearshore waters number in the thousands. Other species including eiders and long-tailed ducks are also abundant. Generally, in the winter, the densest concentration of seaducks are in the waters surrounding Montauk, extending to about 10 miles west of Montauk to within about a mile of shore (Kerlinger, 2002). In recent years, significant numbers of scoters were also counted off the south shore barrier beaches in Nassau County during Christmas Bird Counts. Wintering scoters are usually concentrated closer to shore (within 2 km), while eiders and long-tailed ducks can be found further offshore. Foraging and roosting flights of seaduck species are low over the surface and can occur at night. Foraging flight heights are usually less than 30 m above the surface while roosting flights can be variable and occur at altitudes of about 20 to 200 m above the surface. Migration flights of seaducks are mostly along the coast, with most birds flying at very low altitudes over water (less than 31 m). Hundreds of thousands of scoters may pass Long Island in the autumn (Kerlinger, 2002). Other seaduck species, including common goldeneye, bufflehead, common merganser, red-breasted merganser, harlequin duck and greater scaup are more likely to use the inshore and coastal areas of Long Island.

Common Eider (*Somateria mollissima*) is a common and often abundant winter visitor off Long Island, with most numbers concentrated in the Montauk area. Migration over water is usually along coastlines with low flight heights (less than 31 m above the surface). Along the Atlantic Coast, spring migration of wintering birds has been recorded through May 14 in New York. Fall migration is more protracted than spring migration, and southward movement along the Atlantic is rare before mid-November in New York.

In winter, the common eider prefers areas where sea swells break directly against rocks and areas where wave action results in a relatively extensive tidal zone. Birds often rest during high tides, preferring to feed during ebb and lower tidal cycles. They feed over rocky substrates (surfaces) varying from cobbles and boulders to bedrock. Eiders feed by diving and picking food from bottom (epibenthos). Diving depth is generally less than 10 m. They usually feed in groups (up to thousands) but occasionally alone. Hunting of eiders especially in the Atlantic Flyway has increased recently, as other waterfowl seasons (notably black ducks) have become more restrictive; however, current hunter harvest levels are poorly measured.

Surf Scoter (*Melanitta perspicillata*) is a common to abundant migrant and winter visitant. It breeds and winters exclusively in North America. In winter it frequents shallow marine coastal waters less than 10 m deep, usually over substrates of pebbles and sand. Coastal and pelagic surveys indicate that vast majority of surf scoters wintering on Canadian Pacific Coast occur within 1-km of land. Little is known of wintering habitat preferences of surf scoters on the East Coast. Blue mussels (*Mytilus edulis*) are an important part of diet in marine habitats outside of breeding season. Surf scoters fly low over water in daily movements, but reach considerable heights during migration. On average (1961–1993), conservative hunting surveys report that approximately 18,000 individuals are killed each year in the U.S.

White-winged Scoter (*Melanitta fusca*) breeds from Alaska through western Canada with low numbers in eastern Canada. In winter, it appears that about 70 percent of the Atlantic white-winged scoter population frequents the area between Long Island Sound and Chesapeake Bay. An abundant migrant and winter visitant on the coast, it is generally the most numerous of the scoters in New York. It is chiefly a bottom feeder on aquatic and marine mollusks (especially bivalves, such as mussels), crustaceans, and insects. In winter it mostly feeds along the coast just beyond the wave break zone, within approximately 1.6 km of shore. White-winged scoters are among the most vulnerable sea birds to oil spills because the species often is present in high densities along oil transportation routes. Extensive oil spills may eliminate entire wintering populations. Long-term disruption of food supplies could also have serious effects on populations.

Black Scoter (*Melanitta nigra*) breeds in North America in Alaska and locally in central and eastern Canada to Newfoundland. It is also an abundant migrant and winter visitant along the coast of New York. Its preferred habitat during winter is not well known. In Newfoundland, black scoters are found in waters with cobbles and bedrock ledges, habitats similar to those used by the harlequin duck (*Histrionicus histrionicus*), but further offshore. Along New Hampshire and Massachusetts coasts, black scoters prefer sandy beaches to rocky headlands. In the marine environment, they feed in open waters near shore or over undersea ledges, usually in waters less than 10 m deep on mollusks and crustaceans. They sometimes fly in lines just over the surface of marine waters.

Long-tailed Duck (*Clangula hyemalis*) breed in extensive portions of subarctic and arctic areas of Alaska and northern Canada. It is a common to very abundant visitor along coastal New York. In winter it is generally coastal, but can also be found offshore. In marine wintering areas, it commonly feeds on epibenthic crustaceans, especially amphipods, mysids, and isopods which are all small marine organisms. Bivalves, gastropods (such as snails), fish, and fish eggs are also important food items in some areas. The long-tailed duck can dive up to 60 m (198 ft) to pick food items off the sea floor or to consume food within the water column.

Other seaduck species, including common goldeneye, bufflehead, common merganser, red-breasted merganser, harlequin duck and greater scaup, are more likely to use the inshore and coastal areas of Long Island.

4.1.2. Loons

Common Loon (*Gavia immer*) and **Red-throated Loon (*Gavia stellata*)** are large mainly fish-eating, foot propelled diving birds that inhabit fresh and saltwater locations. They dive from the surface and are capable of reaching depths of about 75 m. Loons are highly migratory, most requiring a long run to become airborne from both land and water. Red- throated loon is common to locally abundant off Montauk in winter. It uses bays, seacoasts, estuaries and inner continental shelf waters to greater than 40 miles offshore. Marine feeding is close to shore during windy, rough conditions, and further offshore when calm. The common loon is listed as a species of special concern in New York State. The common loon uses waters off Long Island for migration and wintering. Large numbers of common loons can sometimes be seen in coastal salt waters, especially after a severe interior freeze.

4.1.3. Grebes

Red-necked Grebe (*Podiceps grisegena*) distribution and the size of wintering populations is not well known. In severe winters, irruptions (incursion of birds that do not normally occur in an area) of red-necked grebes into inland and coastal areas south and east of the Great Lakes following freeze-up of the Great Lakes suggest that numbers may range from hundreds to a few thousand individuals. Non-breeding birds usually arrive by early March on the coast. They are highly sea-based in winter, using estuarine and coastal waters. Red-necked grebes winter along the Atlantic Coast from Newfoundland to North Carolina, but are most prevalent in Nova Scotia and New Brunswick to Long Island, where they can be found well offshore. Red-necked grebe are visual predators, taking prey anywhere from just above the water surface to the bottom of the water column. In salt water environments, they consume fish, crustaceans and polychetes (marine worms). Outside of migration period, they rarely fly, requiring long running taxis on water to become airborne. Overland flights are nocturnal with diurnal flights over water and along coasts. Diurnal overwater flights are low (mostly within 5-to-10 m) over water’s surface.

Horned Grebe (*Podiceps auritus*) is a common to abundant migrant and winter visitor along the coast. It is mostly found inshore and generally forages in shallow to moderately deep waters (less than 6 m). Still, in the south Baltic Sea area, large concentrations can be found on open sea (10 to 20 m depth) far from land (these wintering populations are seldom detected, except by aerial and ship-based survey methods). In winter, horned grebes sometimes forage in flocks numbering up to 200. During winter they tend to prey on benthic species rather than midwater species (such as small fish). It appears that the horned grebe migrates over a broad front in the interior of the continent without following any route.

4.1.4. Shearwaters and Petrels

Shearwaters and petrels are in the family *Procellariidae* (tube-nosed swimmers). They are present in waters off Long Island from May to November and are rarely seen from the coast, being found in offshore waters five miles or more from land in most cases. Shearwaters and petrels are known to fly low, usually within 10 m of the surface.

Northern Fulmar (*Fulmaris glacialis*) breeds in the Americas from the Bering Sea and Aleutians east to Baffin Island, Greenland and from Iceland south to Newfoundland. It is common to abundant offshore in New York Bight waters where a wintering population is present in most years. It is an active ship follower, feeding on offal (fish remains) discarded from fishing vessels. It also feeds on a wide variety of fish and macrozooplankton from waters at or near the surface. It hunts by swimming or plunging at the surface of the water and can dive to a depth of approximately three m. Flight over the ocean consists of alternating glides and stiff-winged flapping, with birds rarely rising more than a few meters above wave crests.

Cory's Shearwater (*Calonectris diomedea*) breeds in the eastern north Atlantic and Mediterranean and ranges west to the Atlantic coast of North America during the summer and fall. It disperses westward into the Atlantic after a late-summer breeding season, and may occur in large numbers in New York waters. It is more common off eastern Long Island, and is usually much less common westward.

Greater Shearwater (*Puffinus gravis*) breeds in the southern hemisphere and can be seen in New York bight waters in large numbers from May through November. This species is attracted to chumming by fishermen (the act of luring fish by throwing bait overboard) and can be seen following boats. They are often seen with gulls and can be found sitting on the water in groups of 50-to-100 birds. The greater shearwater flies low, usually within approximately 10 meters of the surface, and forages by picking up food from the surface and making shallow dives. Large concentrations of this species can be found off the coast of Long Island in the summer months.

Sooty Shearwater (*Puffinus griseus*) also breeds in the southern hemisphere. Its flight and foraging behavior is similar to that of other shearwaters. Like the Cory's and greater shearwaters, large numbers of sooty shearwaters can be found off the coast of Long Island during spring and early summer.

Manx Shearwater (*Puffinus puffinus*) migrate through the New York Bight in the summer and fall. It has a mostly northerly breeding range with a small recently established population in North America. Presumed juvenile non-breeders occur in slope and shelf waters[2] off North Mid-Atlantic states and Georges Bank during spring, with distributions expanding onto shelf waters throughout summer. Only small numbers would be expected to be found off the coast of Long Island. Away from breeding colonies, their habitat is entirely aerial and marine. Along the northeast coast, this species shows a preference for shallower continental shelf waters off southern New England, especially the waters of Georges and Stellwagen banks. In the North East Atlantic, Manx shearwater feed mostly during the day on small fish including herring and anchovy species. They make shallow brief dives to depths of less than three m. Populations of this species are generally considered stable or slowly increasing.

Audubon's Shearwater (*Puffinus iberminieri*) is a pantropical breeder. It is a fairly common visitant to offshore waters From June-September. The species is probably most abundant during periods when water temperatures are at their warmest, and is often encountered on pelagic birding trips.

Wilson's Storm Petrel (*Oceanites oceanicus*) breeds in the southern hemisphere and spend much of its non-breeding time in the North Atlantic, including the New York Bight. The main movement off New England coasts is between April and May. They can be found in New York Bight waters from May to September. It is strictly pelagic outside of its breeding season. Storm petrels feed in areas that are rich with zooplankton, pecking on organisms while hovering over the surface of the water, and sometimes resting briefly on the water. Wilson's storm petrel is not known to dive. This species is probably one of the most abundant pelagic species in Long Island waters, with thousands of individuals using offshore areas in the summer. Wilson's storm petrel is often found in groups feeding or resting on the surface of the water, and is known to follow ships.

Leach's Storm Petrel (*Oceanodrama leucorhoa*) breeds in the North Atlantic and migrates through the New York bight in the summer and fall. The species is found in Long Island waters much less frequently than Wilson's storm-petrel. It is known to forage at night.

[2] The continental shelf is the extension of the land masses surrounding the continents. The slope is where the shelf waters drop off into the deepest parts of the ocean.

4.1.5. Gannets

Northern Gannet (*Morus bassanus*) is a common to very abundant migrant off Long Island and a common winter resident off the New Jersey coast. Northern gannets can be seen anywhere along the south coast of Long Island and are abundant at Montauk mid-fall through early winter when thousands can be observed feeding off the point. Maximum numbers include 10,000 off of Montauk in November 1991 and 3600 in Block Canyon in March of 1979. As a breeding bird, the northern gannet is confined to the continental-shelf waters on both sides of the North Atlantic. In North America, there are only six well-established colonies: three in the Gulf of St. Lawrence, Québec and three in the North Atlantic off the coast of Newfoundland. In autumn, all age classes move southward along the Atlantic Coast. Southward movement to New England coastal waters begins with the departure of juveniles from late September through early October, after which large numbers can be found off Georges Bank and its adjacent shelf waters. Peak northward migration of adults and sub-adults off the coasts of New Jersey and New York occurs in early March through early April, and movement of immature birds occurs between late April and mid-May. Post-breeding northern gannets migrate largely over the waters of the continental shelf and along the continental slope, coming to land only to pursue shoals of fish or during unusual weather conditions.

Northern gannets are opportunistic generalist predators, feeding diurnally on pelagic prey. Their primary foraging strategy is plunge-diving from a height of 10 to 40 m. They generally forage communally in large flocks of up to 1,000 over shoals of prey fish. They may also scavenge from fishing boats and take fish from fishing nets near the surface. Northern gannets often feed in association with cetaceans (such as whales and dolphins) and large predatory fish species such as bluefish (*Pomatomus saltatrix*), which herd fish shoals into concentrations near the surface. Northern gannets typically fly 10 to 40 m above the water, occasionally flying lower over waves. They are also known to fly and soar at considerable altitudes (greater than 40 m). During non-breeding seasons, northern gannets remain continuously at sea, roosting on the water.

4.1.6. Wading Birds

Long Island provides nesting habitat for nine species of long-legged waders, including the glossy ibis, snowy egret, black-crowned night heron, and great egret, which are some of the most common species in the area. Fewer numbers of little blue heron, green-backed heron, tricolored herons, yellow-crowned night herons and cattle egret are also present. These birds typically nest in shrubs or trees on salt marshes or dredged material islands (NYSDOS, 1998). The NYSDEC Long Island Colonial Waterbird Surveys provide data on the numbers of nesting birds at survey sites located throughout Long Island. Wading birds forage in a wide variety of shallow water aquatic habitats. They do not fly offshore except during migration.

Long Island nesting birds are not likely to use the areas off the coast of Long Island during migration. Birds that are found over open ocean during migration would generally be over 500 feet above the water's surface; however, if faced with headwinds, they are known to fly very low, often below 500 feet (Kerlinger, 2002).

4.1.7. Raptors

Thousands of raptors migrate along the barrier beaches in the fall, the most numerous being falcons, which are more likely to cross open water than other hawk species (Kerlinger, 2001). Raptors migrate during the day, usually along the shoreline, flying at various altitudes depending on wind direction and speed. Flight height can often be at rotor height for migrating hawks. Falcons, ospreys (*Pandion haliaetus*) and northern harriers (*Circus cyaneus*) regularly make water crossings of ten miles or more, and falcons are known to fly directly from Fire Island Inlet to the central New Jersey coast (Kerlinger, 2001). Kerlinger *et. al.* (1983) documented records of hawks seen offshore in the North Atlantic during pelagic bird surveys. Kerlinger (1985) also studied water crossings by hawks at Cape May Point, NJ and Whitefish Point, Michigan, finding that merlins (*Falco columbarius*), American kestrels (*Falco sparverius*), sharp-shinned hawks (*Accipiter striatus*) and rough-legged hawks (*Buteo lagopus*) only sometimes crossed, while peregrine falcons (*Falco peregrinus*), northern harriers and ospreys usually made crossings. Rogers and Leatherwood (1981) documented an osprey and peregrine falcon hunting far out at sea. The falcon used the ship's yardarm as a perch for hunting leach's storm petrels. The Fire Island Raptor Enumerators (FIRE) is a hawk watch located in Suffolk County near the Fire Island Inlet. The watch has recorded fall migrating diurnal raptors for over 25 years. Raptor counts at this location are dominated by falcon species (kestrels and merlins), and the watch has recorded high numbers of peregrine falcons. Table 3 shows count numbers of raptors flying over the watch area from 2000 to 2009. Hawks counted during fall migration are heading south to wintering grounds.

4.1.8. Shorebirds

Thirty species of migratory shorebirds use the marine estuaries, freshwater habitats, and adjacent uplands of Long Island's south shore. Shorebird uses of the area include breeding, summering, wintering, and staging areas during spring and fall migration (NYSDOS, 1998). Except for phalaropes, migratory shorebirds do not use offshore waters for foraging, and have a strong affinity for beaches, tidal flats, and wetlands. Shorebirds concentrate in stopover areas that have abundant food resources to accumulate energy reserves for sustaining long distance migratory flights. Shorebirds make extensive use of south shore estuaries. The Jamaica Bay area is one of the most important migratory shorebird stopover sites in the region, with hundreds of thousands of shorebirds using the area during spring and fall migrations (NYSDOS, 1998). Breezy Point (on the western tip of the Rockaway Barrier Beach) supports some of the highest concentrations of beach nesting birds in New York State, including a small number of roseate terns in the 1990s (NYSDOS, 1992). The South Shore Estuary Reserve western bays complex is also an important shorebird area. Six species of shorebirds have nested within the area, including the piping plover, American oyster catcher, willet, American woodcock, spotted sandpiper, and killdeer (NYSDOS, 1998). Shorebirds migrate annually between the Arctic and South America, moving through the estuaries. Spring migration through the New York Bight area begins in late winter, peaking in May and lasting through June. The fall southward migration begins in late June, peaking in July and August, with most species migrating over the Atlantic (NYSDOS, 1998). The altitude of shorebird migration over the western Atlantic and coastal areas is generally higher than songbirds (most nocturnal landbird migrants fly between 300 to 2000 ft above sea level), although lower elevation flights over the water may occur during the daytime. Birds engaged in longer distance migratory flights will mostly be above 1,000 ft (Kerlinger, 2001). Two species of shorebirds, the red-necked and red phalaropes, forage in pelagic waters.

Red-necked Phalarope (*Phalaropus lobatus*) migrates through the offshore waters of the New York Bight in spring and fall. Migration is mainly pelagic but also inshore. The bird's presence at Atlantic coastal and offshore sites on Long Island, NY occurs between late April and late May. Fall migration is more protracted and conspicuous (or at least better documented) than spring movement. Spring migration is conducted more rapidly and possibly farther inshore. When at sea during migration, the species is associated with continental shelf-breaks, fronts, upwellings, and other oceanographic features that concentrate submerged prey near the surface. Very little is known about the red-necked phalarope's wintering biology at sea.

Red Phalarope (*Phalaropus fulicaria*) is the most pelagic of the phalarope species, spending up to eleven months in marine habitats. Its migratory routes and wintering habitats are entirely pelagic. It breeds in the Arctic, migrating through the offshore waters of the New York Bight in the spring and fall. It is more likely to be seen in the mid-Atlantic Bight than north in the New York Bight region, and is more prevalent well offshore along the shelf-break, over Georges Bank and the Scotian Shelf, and into Canadian arctic waters.

4.1.9. Jaegers, Gulls, and Terns

Numerous gull and tern species may use the coastal, nearshore and pelagic waters of Long Island. Herring, greater black-backed gulls, and laughing gulls breed on Long Island. Additional gull species that may use the Long Island waters include the ring-billed gull, Bonaparte's gull, and black-legged kittiwake. These species migrate into the area in the fall, and many forage in offshore waters during the winter. Five species of terns breed on Long Island. The least tern and common tern are state listed, and the roseate tern is federally listed. These species and are covered in greater detail in section 4.2. Gull bill terns are found in small numbers on Long Island. Most are likely to be found foraging near shore. Forster's terns are also found on Long Island. Although this species can be found in offshore waters, most are likely to forage closer to shore. Pomarine and parasitic jaeger are pelagic species and are typically found far offshore.

<u>Black-legged Kittiwake (*Rissa tridactyla*)</u> is a pelagic species that can be abundant in late fall and winter and can be found off the eastern U.S. coast from late November to March. It is known to wander widely at sea outside of breeding season, and protracted movements imply continued foraging during migratory periods. In eastern North America, it is distributed widely along banks and shelf edges, but is also seen in deeper waters. Black-legged kittiwake feed at the ocean surface on fish and macrozooplankton, mostly in daylight. They also feed at night, foraging over deep ocean waters where prey approach the surface in darkness. They often feed in association with larger gulls (*Larus* species), alcids, terns, or cormorants. They are highly maneuverable in flight.

<u>Bonaparte's Gull (*Chroicocephalus philadelphia*)</u> is a common to very abundant migrant and winter visitor. They feed on small fish, euphausids, amphipods, and insects. In winter, they are more pelagic than most other gull species and often feed up to 20 km offshore, feeding along tidal rips, tidal convergences, and upwellings where food is concentrated. They feed by plunge-diving from air to water, aerial dipping (taking food from the surface in flight), surface-seizing (sitting on water and taking food from surface), surface-dipping (swimming and then dipping to pick up items below the surface), and jump-plunging (swimming, then jumping upward and diving underwater). In contrast to many species of gulls, they often forage in groups over fish schools, where bird density is dependent to prey density. They are also known to forage with other species of gulls, such as herring and ring-billed gulls.

<u>Laughing Gull (*Leucophaeus atricilla*)</u> is a local breeder in western Long Island, and a large breeding colony exists in the Jamaica Bay area. They migrate south in winter, but can be fairly common in the Long Island area into December. They normally feed along the coast at the edge of water and will go inland during high winds. Laughing gulls roost on inland lakes, bays, estuaries, and impoundments, as well as on the open ocean. The east coast population migrates along the coast in spring and fall, but individuals may scatter inland. Before migration in September and October, they may form large flocks and sit on ocean waters or beaches.

Herring Gull (*Larus argentatus*) is a year-round resident on the east coast of North America that is found from Newfoundland to North Carolina. Winter distribution and abundance shows a strong association with open fresh or salt water. The herring gull is continuously distributed along all of the Atlantic. Offshore movement is related to foraging conditions, and in March many adults build reserves for breeding season. As a species, herring gulls are generalists, preying on many food items including pelagic and intertidal marine invertebrates, fishes, insects, other and other seabirds (adults, eggs, and young). They are opportunistic scavengers of fish, carrion and human refuse. Herring gulls often feed on by-catch or discards from the stern of fishing vessels by surface-dipping or landing and grabbing. At sea, they forage in large, widely-scattered groups that coalesce quickly through rapid recruitment once a prey concentrations is found. They often follow foraging humpback whales or groups of dolphins, hovering over feeding groups and grabbing fish, squid, and zooplankton concentrated at the surface by mammals, diving birds, or large predatory fishes swimming underneath.

Great Black-Backed Gull (*Larus marinus*) is common in the northeastern U.S. and is present throughout the coast. In the U.S., it breeds along the immediate coast (particularly on offshore islands) in all states from Maine to southern New Jersey. Most local birds breed on southern and eastern shores on Long Island. Adults and immatures can be found at sea near Georges Bank and throughout the Gulf of Maine in the winter. Although the great black-backed gull is an opportunistic feeder, most individuals live primarily on natural prey such as marine fishes and invertebrates. It cannot dive below one to two meters and feeds on prey at or very near the surface. At sea, great black-backed gulls forage in widely scattered groups; congregating around submarine features (mounts, sandbanks, local upwellings) where concentrations of prey are prevalent. In the Georges Bank area, adults and juveniles often forage in pairs. Great black-backed gulls are known to follow large predatory fishes that are foraging, hovering over feeding groups and grabbing fish or squid concentrated at surface. They also capture schooling fish and bycatch (non-target or undersized fish) discarded from stern of fishing vessels by surface-dipping or by landing and grabbing.

Pomarine Jaeger (*Stercorarius pomarinus*) is a regular pelagic migrant off Long Island and is fairly common in the fall. Over the continental shelf off northeast U.S., they are most numerous during late April, May, and especially in October over Georges Bank, where they regularly occur in small numbers. Pomarine Jaegers migrate singly or in small groups. Migrants typically fly into headwinds up to about 10 m/s, but settle on the water in higher winds or when visibility is poor. Over mid-ocean waters, migrants can continue to fly in storms with winds of 40 to 45 m/s, making slow headway and using wave troughs for shelter, and occasionally rising 30 to 50 m above the waves. In good weather, pomarine jaegers often fly over 10 m above the water's surface, following straight paths. Migrants far from shore in the North Atlantic are rarely observed feeding. During winter, individuals often congregate around fishing vessels or other ships, mostly to forage for refuse, but also to steal from other species.

Parasitic Jaeger (*Stercorarius parasiticus*) is an uncommon spring and fall pelagic migrant off Long Island and is seen more often from shore than other jaeger species. On pelagic trips, parasitic jaegers can be seen in low numbers (usually from one to three individuals) from late May to mid-June and from mid-August to early October. In a headwind, migrants fly close to the surface of the water, flapping steadily, and sometimes rising to bank above the crests of waves; otherwise, they often take a straight course eight to ten meters above the water. During migration and in winter, they feed by swooping and plucking scraps from the surface behind boats, by preying on crustaceans taken on foot in tidal flats, or by preying on small birds chased in flight. The feeding strategy of the parasitic jaeger relies mostly on kleptoparasitism, stealing most of their food from other seabirds.

4.1.10. Alcids

Alcids are oceanic birds that only come to land to nest. They generally fly close to the water's surface. They are present in New York Bight waters in the winter. The most common alcids that would be expected in the project area are the dovekie and razorbill.

Dovekie (*Alle alle*) may be a very common to abundant inhabitant of offshore waters in mid to late winter, usually being found more than five miles from land. Dovekies breed predominantly in high arctic regions, particularly Greenland, with a few small breeding assemblages in northeastern Canada and the Bering Sea. Dovekies often are observed out of range along the east coast of North America. In winter, their distributions are associated with planktonic prey and sea ice. Concentrations are reported near shelf edges, particularly in the south Grand Banks, Gulf of Maine, and northern and eastern edges of Georges Bank, with a few venturing to Long Island. Dovekies are highly vulnerable to oil discharges from vessels (which are illegal), as well as oil spills. Large numbers of dovekies have been reported as being attracted to illuminated offshore oil platforms. Many are caught in fishing nets.

Razorbill (*Alca torda*) is the most common alcid in offshore Long Island waters with many found in the waters more than five miles off the south shore of Long Island. They are present mostly from November through March (Kerlinger, 2001). Razorbills breed in boreal and low-arctic Atlantic waters where sea-surface temperatures are less than 15°C. The center of the North American breeding range is in low-arctic waters of southern Labrador and the lower north shore of the Gulf of St. Lawrence, Quebec. Most razorbills from North American colonies spend winters south of their breeding range in ice-free coastal waters, with large numbers frequenting shoal areas in the outer Bay of Fundy and Gulf of Maine. Razorbills are wing-propelled pursuit divers. They mainly feed on schooling fish: predominantly herring in boreal waters and sandlance and capelin in low-arctic waters. Crustaceans and polychetes are also important in adult diets. The razorbill is considered to be one of the most vulnerable seabird species to oil pollution. Additionally, large numbers of Razorbills die after becoming entangled in fishing gear.

Other alcid species, including the common murre (*Uria aalge*), thick-billed murre (*Uria lomvia*), and Atlantic puffin (*Fratercula arctica*), are uncommon to rare visitors in Long Island waters.

4.1.11. Passerines

Passerines, sometimes known as perching birds, include more than half of all bird species. Neotropical songbirds that spend approximately eight months of the year wintering in Central and South America and spend the remaining months on breeding grounds in North America's temperate latitudes. In the northern hemisphere, peak long-distant migratory movements of neotropical and regional migrant passerines are in the spring and fall. The majority of passerines travel at night, beginning within half an hour after sunset

(Richardson, 2000). Migration altitudes are highly variable, but most nocturnal migrants fly well above turbine height. Nevertheless, inclement weather (rain and fog) can cause birds to fly heights lower than usual (Richardson, 2000, Huppop *e.t al*.2006). The number of migrants is reduced when visibility is impaired by fog or rain; however some birds do fly under these conditions, especially if conditions were previously more favorable when the birds took flight (Richardson, 2000). Songbirds and other terrestrial species do not forage over the ocean. Millions of passerines and other landbirds migrate through the Long Island area in the fall. These birds also migrate through the area in the spring, although in lower numbers (Kerlinger and Curry, 2002). Passerines migrating through the area typically fly at altitudes far above rotor heights at typical flight altitudes between 300 and 2000 ft above sea level (Kerlinger, 1995; Kerlinger and Curry, 2002).

4.1.12. Bats

Although not an avian species, bats are an aerial mammalian species that warrants environmental consideration with respect to wind project operation. Bats are not generally associated with marine habitats; however saltwater crossings have been documented for migratory tree bats. Although studies have not been conducted to track migration patterns of bats along the east coast, it is possible that certain species of migratory bats follow migration corridors along the Atlantic coast in a manner similar to those followed by migratory birds (MMS FEIS, 2009). Historic observations of marine habitats are limited and generally outdated, but silver-haired bats, eastern red bats, and hoary bats have occasionally been observed on ships at sea and offshore islands, such as Bermuda. These observations confirm that these bat species are able to travel long distances over water (Cryan, 2003). Long distance migratory bats travel south to winter ranges in the southern U.S. between August and early October and return during April and May (MMS, 2009). There is little known about the migratory movements of bats within the proposed project area. Further study may be necessary in order to fully understand potential impacts. Regulatory agencies will determine the level of study that may be required to investigate potential use of project area waters by migrating bats.

4.2. THREATENED, ENDANGERED, AND SPECIES OF CONCERN

Table 4 lists avian species that may be present in New York State that have been listed by the USFWS as endangered or threatened and species listed by the NYSDEC as endangered, threatened and species of special concern. In addition the table indicates the habitat use of the project area for migrating and/or foraging by the listed species. The USFWS lists the roseate tern as endangered and the piping plover in the Atlantic Coast region as threatened. NYSDEC lists ten species as endangered, ten species as threatened, and 19 species as special concern. Eskimo curlew listed as endangered in New York State may possibly be extinct, as it has not been recorded with certainty since the early 1980s and none have been confirmed in South American wintering grounds since 1939. Species accounts are included in this section for federally listed species as well as state listed waterbird species that may use the project area. Individual species accounts are provided for the piping plover, roseate tern, common tern, least tern, and common loon. Raptors are covered as a group. Potential impacts are discussed in section 8.2.

4.2.1. Piping Plover

Piping Plover (*Charadius melodus*) is a shorebird species occurring only in the western hemisphere. Three breeding populations are recognized by the USFWS, with the Great Lakes population designated as endangered and the Northern Plains and Atlantic Coast populations designated as threatened (USFWS, 1996). Adult plovers generally appear in the Long Island area between mid-March and mid-April (NYSDOS, 1991). These species are most vulnerable to disruption during the arrival and courtship period, and any disturbance may cause them to abandon the area. Still, once eggs are laid, adults show a strong loyalty to their nests and are unlikely to abandon the site unless the disturbance is severe. Nest sites are characterized by open sand, gravel or shell covered substrate above the high water mark. Piping plover nests are shallow depressions in the sand. They are solitary nesters with breeding territories ranging in size from 0.1 to 1.7 acres. On Long Island, plover nests with eggs may be found from late April to late June. Incubation lasts about 27 to 32 days and is shared by both sexes. Piping plover young fledge in about 25-35 days (NYSDOS, 1991). Feeding territories are maintained throughout the breeding season and are usually adjacent to breeding territories in the intertidal beach zone with small crustaceans, mollusks, marine worms, insects, and other invertebrates as the main food source (Elliot-Smith *et. al*. 2004). Piping plovers are able to fly 28-35 days after hatching. By late August and early September, piping plovers leave their northern breeding grounds for wintering areas (NYSDOS, 1991). There have been no reported sightings of piping plovers in mid or long distance flight anywhere along the Atlantic coast (MMS FEIS Appendix G, 2008). Migrants along the Atlantic Coast are presumed to follow a narrow path along the coast. Sightings away from inland and offshore outer beaches during migration are rare (USFWS, 1996).

The NYSDEC Long Island Colonial Waterbird and Piping Plover Survey is a continuing monitoring effort of Long Island area birds. Approximately 65 sites are surveyed annually. The survey began in 1983 when only least terns and piping plover were monitored. Since 1995, common terns, least terns, roseate terns, Forster’s terns, gull-billed terns, black skimmers, and plovers have been surveyed annually. Other waterbird species, including gulls, herons and egret species, are also surveyed. These surveys are conducted through a coordinated effort of conservation groups, local governments and volunteers. The purpose of the survey is to determine the number of breeding adults of each species present during the survey period week (NYSDEC, 2002). Each year the USFWS Long Island field office assists the NYSDEC Long Island Colonial Waterbird and Piping Plover Survey in matters related to piping plover and roseate tern. These efforts include coordinating with public and private partners for equipment provisions and technical assistance.

Figure 6 shows active Long Island Colonial Waterbird and Piping Plover survey areas located along the barrier beaches near the Rockaway Substation, as well as survey areas in the Jamaica Bay complex. Table 5 lists the numbers of piping plovers as well as least, common and roseate terns at these sites from 2000 through 2008. Active sites closest to the Rockaway Substation include Arverne by the Sea, Far Rockaway, and the Long Beach Island and Atlantic survey areas.

4.2.2. **Roseate Tern**

The U.S. Department of Interior lists the northeastern population of roseate tern (*Sterna dougallii*) as endangered and the Caribbean population as threatened. Roseate terns generally appear at their Long Island breeding grounds in late April to mid-May (USFWS, 1988). On Long Island, roseate tern colonies are within common tern colonies; however, roseate tern show a preference for specific micro-habitats within the main colony, where discrete sub-colonies are set up. Successful colonies are almost always on islands (NYSDOS, 1991). There are two types of micro-habitats on Long Island. The first is sandy islands or barrier beaches vegetated with beach grass and herbaceous plants (plants that die down during the winter). The second is rocky clay islands with a thin layer of soil and grassy and herbaceous plants. The only place on Long Island that fits this second type of micro-habitat is Great Gull Island (NYSDOS, 1991).

Optimal habitat for the roseate tern should be eighty percent covered by herbaceous plants about 30 inches tall. As with plovers and least and common terns, roseate terns are most vulnerable to disruption during courtship and pair formation. Roseate tern nest sites are usually selected one-to-four days before egg-laying. They require cover for nesting, usually accomplished by locating simple nests beneath a clump of grass, a plant, or another object that would provide shelter (NYSDOS, 1991).Roseate tern chicks remain in their nests for several days after hatching, and are fed by parents for several weeks after fledging. Roseate terns leave Long Island in early September (NYSDOS, 1991). In New York, the species breeds only at a few Long Island Colonies, the largest of which is on Great Gull Island (Figure 7). Located off the northeastern tip of Long Island, this colony is over 100 miles from the proposed project area. Breeding pairs at this location have numbered in the thousands over the last five years (Table 6).

The roseate tern is a specialized plunge diver, feeding on small schooling marine fish, and northeastern roseate terns feed mostly on American sand lance (*Ammodytes americanus*), clupeids (such as Atlantic herring, mackerel, and small bluefish), and anchovies. The roseate tern usually forages over reefs, sandbars, or tide rips, or in association with predatory fish that force smaller fish to the surface. It often feeds in association with other tern species. Adapted for fast flight and relatively deep diving, the roseate tern often submerges completely when diving for fish. The roseate tern’s foraging range depends on local fish availability, which in turn is influenced by bottom topography and occurrence of predatory fish. Northeastern breeders may fly 30 km to feed. Compared with common terns, roseates on Long Island forage over shallower water closer to shore (mean depth of seven meters). Foraging areas are mainly in inlets, and less often over schools of predatory fish. Still, roseates may feed farther from the colony than common terns. On Long Island, bluefish competed with other tern species (including roseates) for small fish, but also drove fish to surface, increasing the availability for terns. At Bird Island in Massachusetts, roseates fed mainly over three small sandbars, but also over tide rips up to 30 km from colony. At Falkner Island in Connecticut, roseate terns traveled at least 25 km to sandbars off the northern shore of Long Island. In the Caribbean, feeding is primarily over schools of predatory fish or along reef margins (Gochfeld *et.al*.1998). A foraging study of the northeastern population of roseate terns conducted by Rock *et. al*. (2007) used telemetry to determine that roseates nesting at Country Island, Nova Scotia sometimes foraged as far as 15.5 miles (25 km) from the colony. On average, they foraged much closer at 4.3 miles (7 km) from the colony, and foraging was especially prevalent in water depths of less than 16.5 ft (five meters). The authors concluded that critical foraging habitats for the roseate tern colony were shallow areas (less than five meters in depth) within 10 km of the colony, and recommended that these areas be protected (in MMS FEIS, 2009 appendix J).

An evaluation of flight altitudes of terns (both roseate and common) in Nantucket Sound was conducted for the Cape Wind project. Boat surveys in 2003 and 2004 observed more than 560 terns. Of these, ninety percent of the terns in flight were below the rotor-swept zone (swept zone between 23 and 134 m above the water's surface). Aerial surveys of over 900 terns (both species) in 2002 and 2003 found that 94 percent were at altitudes below the rotor-swept zone (MMS FEIS, 2009 Appendix J).

Roseate terns migrate mainly offshore. Small numbers are seen on coastal beaches and inlets between wintering and breeding areas. Northeastern individuals are long-distance migrants, traveling mainly over the ocean. Staging birds have been reported in large flocks. Terns have been reported at inlets and islands from Long Island to Maine in August and September. There are few direct observations of migrating North American individuals, as these terns are long-distance migrants that travel mainly over the ocean to the West Indies and South America. Factors influencing migratory movements are not known. Juveniles and adults disperse in family parties throughout their breeding range in late July and August. Most one-year olds remain in winter quarters during boreal summer (Gochfeld *et. al.*,1998).

4.2.3. Common Tern

Common tern (*Sterna hirundo*) is listed as threatened by New York State. Common terns occur throughout the northern hemisphere with the exception of the North American Pacific coast. They are Long Island's most abundant tern species. Common terns return to Long Island breeding grounds in early May. Nests with eggs can be found by the middle of May (NYSDOS, 1991). They are most vulnerable to disruption during arrival, courtship and pair formation, and as with piping plover, they show a strong loyalty to their nests once eggs are laid. Common tern essentially use the same nesting habitat as piping plovers: sand or sand-cobble beaches located along ocean shores, bays, and inlets between the high tide line and area of dune formation. On Long Island, common tern colonies also occur on salt marsh islands and open elevated areas interspersed within an expanse of salt marsh. Unlike piping plover chicks, common tern chicks remain in their nests for about three days after hatching and are fed by their parents until several weeks after fledging. Most common terns leave Long Island in September but some may remain until early October (NYSDOS, 1991). Figure 6 and Table 5 provide the location and numbers of common terns recorded by the NYSDEC Long Island Colonial Waterbird and Piping Plover Survey areas in the vicinity of the Rockaway Peninsula. Common terns may also nest at a number of coastal beaches in New Jersey.

In breeding areas, foraging birds use open waters within about 20 km of breeding sites, where fish availability is within 50 cm of surface (e.g., shallow coastal waters, bays, inlets, shoals, tide-rips, drift lines, salt marsh creeks, lakes, ponds, and rivers). On the Atlantic Coast, foraging is usually within a kilometer of the shore, although common terns have occasionally been recorded feeding over predatory fish in open water. There is little information available about the foraging of staging, migrating, or wintering birds. Near Cape Cod, Massachusetts, common terns feed in tidal inlets or between islands up to 20 km offshore, sometimes with marine mammals. Common tern often feed singly or in small groups, but in marine environments, flocks of over 1,000 birds sometimes congregate over schools of predatory fish that drive prey fish to the surface. A single diving bird can attract others from up to a kilometer away. On the Atlantic coast, common terns form mixed feeding aggregations with roseate or Arctic terns and sometimes with laughing gulls or other gulls. Common terns usually out-compete roseate terns for food in mixed groups. Aerial plunge-diving is the main method of food capture. Common terns are both generalists and opportunists, preying on over 55 different species of fish and over 35 invertebrate taxa in North America (Nisbet, 2002).

All North American populations of common terns are migratory, wintering mainly in South America or western Central America. There is no direct evidence of migration routes. Atlantic unit birds disperse throughout their breeding area in July and August, concentrating at staging sites from New Jersey to Southern Maine. Flocks of up to 10,000 have been reported around Cape Cod, Massachusetts. Common terns probably migrate directly south across the western North Atlantic from mid-August to mid-October. There is no evidence that birds migrating across the western North Atlantic feed in the open ocean (Nisbet, 2002).

4.2.4. Least Tern

Least tern (*Sternula antillarum*) is a widely distributed breeder in North America. It is listed as threatened in New York State. The species occurs only in the western hemisphere. The eastern subspecies includes all of Long Island's birds, and Long Island is their only nesting area in New York State. Least terns arrive on Long Island in early May, often returning to sites that have been used for several years. They nest on sandy ocean beaches and use the same nesting habitat as the piping plover and common tern. Colonies can range in size from two to 600 pairs. Least tern leave Long Island in early September (NYSDOS, 1991). Figure 6 and Table 5 provide the locations and numbers of least terns recorded at NYSDEC Long Island Colonial Waterbird and Piping Plover Survey areas in the vicinity of the Rockaways.

Least terns migrate in small, loose groups, feeding en route in shallow waters near land and resting on sandbars, beaches, pilings, and docks. During migration and post-breeding wandering, least terns have appeared in aquatic habitats through most of the U.S., primarily following major rivers and marine coasts. Least terns forage in a variety of shallow water habitats. On marine coasts, they feed primarily in bays, lagoons, estuaries, river and creek mouths, tidal marshes, lakes, and occasionally offshore. Least terns forage throughout the day, searching for prey while flying or hovering one to ten meters above water, then quickly plunging to the surface (Thompson *et. al.*, 1997).

4.2.5. <u>Diurnal Raptors</u>

A number of state-listed diurnal raptors may migrate through or close to the project area. Additionally, a number of raptor species are known to forage offshore. The peregrine falcon is listed as endangered in New York State. The northern harrier and bald eagle are listed as threatened. The osprey, Cooper's hawk, sharp-shinned hawk, northern goshawk and red-shouldered hawk are listed as species of special concern. Thousands of raptors migrate along the barrier beaches in the fall, the most numerous being falcons, which are more likely to cross open water than other hawk species. Falcons, ospreys and northern harriers regularly make water crossings of ten miles or more, and falcons are known to fly directly from Fire Island Inlet to the central New Jersey coast (Kerlinger, 2002). Peregrine falcons, and to a lesser extent, osprey are species that are most likely to forage in the project area. Raptors in the genus Accipiter (Cooper's hawk, sharp-shinned hawk, northern goshawk) do not forage offshore. Very few bald eagles and northern goshawk are counted at the FIRE hawk watch (FIRE Website). Red-shouldered hawks would not be expected to migrate through or in the vicinity of the project area. Further study may be necessary to determine use of the project area by migrating hawks.

4.2.6. <u>Common Loon</u>

Common Loon is listed as a species of special concern in New York State. They use waters off Long Island for migration and wintering. Spring migratory flights of common loon are generally between March and June, and fall flights are between September and December. Migratory flights are not completely known and require further study. Most East Coast flights are reported just offshore following the coastline, as well as over land; however, significant offshore flights have been mapped (McIntyre *et. al.*, 1997). Although wintering habitat is poorly defined, it is believed to be primarily coastal and marine, with the majority of individuals located inshore, over shoals, and in sheltered bays, inlets, and channels. Common loons are opportunistic foragers. Seasonal, spatial, and annual variability is due to shifting abundance of small fish (McIntyre *et. al.*, 1997).

4.3. SEABIRD STUDIES IN THE NEW YORK BIGHT AND SURROUNDING WATERS

Published survey data for the immediate proposed project area and surrounding area is limited. Seabird data resources are scattered and distributed among many years. Historic data, although important, may not portray current trends and distributions due to changes in climates and habitats. Although the project area has the potential to be used by a diversity of pelagic species, the proposed project's distance from the coast and distance from the continental shelf may limit the density of birds that are likely to be present in the area. Further study is necessary to determine the use of the study area by pelagic species and the abundance of birds throughout the year.

A number of data resources were used to define the diversity and density of species that may be present in the project area. A brief overview of this data is presented below. Density numbers may be skewed depending on the method of data collection. The data is limited and should not replace further investigation of the proposed project area. Before this project site can be judged suitable for wind energy generation and an acceptable environmental impact assessment completed, baseline studies of the project area will likely be undertaken to determine avian use. Baseline studies would determine the current distribution and usage of the project area by avian resources. These studies will be useful for assessing the potential impacts of the proposed project on species present in the project area.

The Ocean Biogeographic Information System (OBIS) Sea Map is a spatially referenced on-line database information system where marine mammal, seabird, and sea turtle data from across the globe can be accessed (OBIS Sea Map Website: http://seamap.env.duke.edu/). The data set accessed was part of the Programme Intégré de Recherches sur les Oiseaux Pélagiques (PIROP, English: Integrated Research Program on Pelagic Birds), which used vessel-based surveys to monitor pelagic seabirds. The data collection period covers all seasons from 1965 to 1992, with most surveys being conducted between late summers. The survey protocol originally consisted of unlimited width ten-minute transects, but was changed in 1984 to fixed-width strip transects;[3] thus, data from the PIROP database need to be interpreted as representing relative (not absolute) abundance. Figure 9 shows abundance of seabirds recorded over observation periods. The figure indicates that density of seabirds recorded within the vicinity of the project area was low, with most results falling in the one-to-three and three-to-ten observation bins. Table 8 shows the avian subset within the proposed project area based on the data from this study. Species recorded include the common loon, Wilson's storm petrel, northern gannet, double-crested cormorant, black-legged kittiwake, Bonaparte's gull, ring-billed gull, herring gull, great black-backed gull, glaucous gull, common tern, parasitic jaeger, and various scoters.

[3] Line transects are widely used as a sampling technique for estimating the size of wildlife populations. A fixed-width transect survey establishes a transect width, while an unlimited transect does not bound the transect width from which observations are recorded.

Table 9 includes data from a larger area that encapsulates the proposed project area, as shown in Figure 9. Seventeen additional species were observed in this area, including the Arctic tern, brant, black scoter, Cory's shearwater, great cormorant, greater shearwater, laughing gull, leach's storm petrel, lesser black-backed gull, long-tailed duck, pomarine jaeger, red-necked phalarope, red-throated loon, sooty shearwater, and thick-billed murre.

The New Jersey Department of Environmental Protection (NJDEP) contracted Geo-Marine Inc. to conduct baseline avian line transect surveys along the New Jersey coastline. The New Jersey study area is depicted in Figure 10. A line- transect method was used to obtain density estimates of seabirds. The surveys included small-boat surveys to document nearshore bird activity and shipboard surveys to capture offshore bird activity. The study area was located between Barnegat Bay and Hereford Inlet at distances up to 20 nautical miles off the New Jersey shore. The overall goal of the study was to provide spatial and temporal data on species using New Jersey offshore waters to assist with siting offshore wind energy projects. The study determined the abundance, distribution, and flight behavior, of bird species in the study area. Some of the data from the January to December 2008 Revised Interim Report is summarized in the following paragraphs.[4]

In order to quantify avian densities, a grid cell system was established over the study area. Individual grid cells were ranked according to the number of observations in the cell. Each grid cell was approximately ten kilometers by ten kilometers. The number of bird counted in each cell was divided by the cell area to yield the bird density. Cells were assigned a ranking from A to F based on density percentile. A represents the highest density (top 20 percent), E represents the lowest density, and F represents a density of zero. Grid cells depicted in red were designated as high density grid cells (see Figure 11).

The spatial locations of the high-density grid cells exhibit seasonal variability. Generally, the greatest density cells (A ranking) occurred within five miles from shore, and avian density decreased with increasing distance from shore. Figures 12 to 14 indicate that avian density appeared to be lowest in the winter (January through April) compared with spring and summer (May through July) and summer and fall (August- November).

Table 10 depicts the most abundant avian species within the New Jersey study area during the winter, spring, summer, and fall shipboard offshore transect surveys. The numbers recorded are avian observations within each 300 m by 300 m survey strip transect. For these observations, the ship was traveling at a speed of 7 knots or greater. Data in February was not reported because of limited availability. In January, 37 razorbills were recorded. The northern gannet was the most abundant species recorded in January, March

[4] The full reports from the NJDEP baseline studies can be found at the NJDEP Website (http://www.state.nj.us/dep/dsr/ocean-wind/).

and May. The herring gull was the second most abundant species in both March and May. In June, July, and August, Wilson's storm petrel was the most abundant species recorded, with the laughing gull and the common tern the next most abundant during these months. Along with northern gannet, these species comprised the majority of the sightings in the summer season. Scoter numbers were high in April and November.

Pelagic species are also recorded during pelagic seabird trips. Many of these trips frequent the Hudson Canyon. Although observations are often from areas much farther offshore than the project area, they provide some insight into species that may frequent project area waters. Pelagic birds regularly reported include the black-legged kittiwake, Wilson's storm petrel, northern gannet, parasitic jaeger, dovekie, common murre, razorbill, greater shearwater, Cory's shearwater, and Manx shearwater (The Kingbird Archive and Paulagics.com).

The Christmas Bird Count (CBC) is a bird census performed annually in the early winter by volunteer birdwatchers that provides data on bird populations across North America.. Although Christmas Bird Count data does not typically record species that cannot be seen from land, data from an offshore count in 1906 reported a long-tailed duck, six loon species, ten Bonaparte's gulls, two glaucous gulls, three black-legged kittiwakes, and twenty black-backed gulls in the Cholera Banks (Audubon CBC data).

Section 5

5. CONSTRUCTION IMPACTS

Construction activities associated with installing an offshore wind project may impact birds in the area. In the PEIS, the BOEM (then MMS) examined the potential avian impacts during the construction, operation and decommissioning stages of an offshore wind project, and established guidelines as a framework to assess the broad regional environmental issues that require consideration. The nature and magnitude of the impacts to marine and coastal birds will depend on the location of project components, the timing of project-related activities, and the nature and magnitude of the project-related activities (MMS PEIS, 2007).

Marine and coastal birds may be affected by the construction of offshore wind turbines, cable trenching, cable laying, and the construction of onshore and offshore substations. Construction in coastal areas may directly disturb coastal habitats. Construction will cause temporary displacement of birds due to increased human and vessel traffic, equipment presence, and noise related to pile driving. Most of these impacts will be short-term, lasting only until construction is completed. Disturbance of habitats in the proposed project area will be long-term.

5.1. OFFSHORE CONSTRUCTION IMPACTS

Pelagic avian species known to use the offshore waters of the New York Bight may be affected by offshore construction. Displacement of birds during construction activities is expected. It is likely that offshore pelagic species not typically subject to human activity (e.g., shearwaters, alcids, seaducks and loons) will avoid the area during construction. The presence of turbines under construction and large equipment (e.g., offshore cranes) could also cause a risk of collision. Avoidance during construction could result in changes to foraging or flight behavior. Other species, especially those that actively follow vessels to feed on offal (such as gulls and terns), may be attracted to the area during construction. Some species may not be significantly affected by construction activities.

Petersen (2005) found that service vessels and helicopters caused the displacement of some seabirds at operating offshore wind projects. Due to the fact that baseline studies at Horns Rev in Denmark recorded low and variable numbers of birds within the vicinity of the wind project, the ability to statistically detect significant changes in bird numbers was somewhat limited; however, these results imply that the presence of vessels during construction activities may also lead to the displacement of some avian species.

According to statistically significant results obtained by Christensen *et. al*., (2003) at the Horns Rev wind project, herring gulls may be attracted to construction activities. This species typically aggregates around ships in offshore habitats. Gulls may also have been attracted to perching opportunities on the erected platforms. Loons and alcids did not seem to avoid areas where there was construction activity (Christensen *et. al*., 2003).

In Europe, proposals for offshore development of wind projects have increased dramatically. In order to assess the possible impacts to seabirds, Garthe and Hüppop (2004) developed a species sensitivity index (SSI) by choosing nine factors derived from species attributes. These attributes were flight altitude, percentage of time flying, nocturnal flight activity, sensitivity to disturbance by ship and helicopter traffic, flexibility in habitat use, biogeographical population size, adult survival rate and European threat and conservation status. Each factor was scored on a 5 point scale from 1 (low vulnerability) to 5 (high vulnerability). Table 11 provides the results. White-winged scoter, black scoter, red-throated loon, common eider, red-necked grebe, common murre, and razorbill showed stronger escape/avoidance behavior to disturbances by ship and helicopter traffic. This may make these species more vulnerable to disturbances during construction activities. Gulls and terns showed a less significant avoidance behavior.

Although there are no current studies in the immediate project area regarding the diversity and abundance of seabirds, available data from offshore locations in the New York area indicate that a large number of birds may not congregate in the proposed project area at any one time. This would likely minimize construction impacts to most species. Fishing blog sites indicate that numbers of gulls and terns congregate in the Cholera Banks, which is part of the study area (Noreast Website); however, these species have shown less significant avoidance behaviors to ship disturbances.

5.2. NEARSHORE AND ONSHORE CONSTRUCTION IMPACTS

Cable trenching will result in turbidity (suspended sediment) from sediment plume, potentially temporarily displace food species; however, these impacts will be temporal and limited to the immediate area of trenching activity. Turbidity impacts will be affected by sediment type, as larger grain size sediment settles more rapidly than finer sediment. Specific cable trenching techniques, including jet plowing and horizontal directional drilling, will affect the amount of turbidity induced during cable installation.

Nearshore areas are used by numerous species of shorebirds and wading birds. These species may be temporarily displaced during construction activities. Impacts to these species could be minimized by scheduling construction outside of peak migration and foraging periods.

The location of the proposed project is off the Rockaway Peninsula southeast of Long Island. Proposed electrical infrastructure for the project includes a new transmission line from an onshore substation to an existing North Queens Substation and interconnection to the LIPA transmission system in the vicinity of the Rockaways. Construction of this infrastructure may impact terrestrial avian species in the region; however, specific impacts cannot be fully investigated until the location and extent of affected habitat is better known. Species that may be affected by these construction activities would primarily be habitat generalists and opportunistic species that typically inhabit urban settings. These species are able to adapt to a variety of habitat conditions and are generally more tolerant of frequent human disturbances.

Avian species located near the cable landing and the onshore substation are more likely to be impacted, and mitigation measures may be required. The U.S. Shorebird Conservation Plan indicates that significant areas for shorebirds in New York include the Long Island Atlantic coast and Jamaica Bay, and Jamaica Bay has also been designated as a globally important bird area. The cable landing may be installed near a portion of the barrier beach along the Rockaway Peninsula. This area may provide foraging and breeding habitats for numerous shorebirds and could result in loss or alteration of preferred coastal habitats. High-energy beach fronts are used for foraging and breeding. Potential impacts to the nesting areas of piping plovers and colonial waterbirds (such as least and common terns) may cause a concern. Most impacts will be temporary and can be mitigated by timing construction outside the breeding season of critical species. The NYSDEC no-work window for breeding colonial water birds is typically from March 31 to August 31. Potential impacts to barrier beach habitats are covered in more detail in section 8.2.

In a sister report, *Pre-Development Assessment of Natural Resources for the Proposed Long Island – New York City Offshore Wind Project Area*, potential landfall areas were reviewed. The least environmentally sensitive area for the cable landfall is south of the Rockaway Substation; however this area is adjacent to suitable habitat for nesting shorebirds, so coordination with regulatory will likely be necessary to reduce impacts. Mitigation may include no-work construction windows during the breeding season.

Mitigation measures recommended by the BOEM in the PEIS (2007) with regard to construction related activities include:

- Conducting surveys of coastal and offshore areas to identify important feeding, nesting, staging and wintering areas and to avoid siting facilities and cable paths in or near these areas.
- Timing major construction and noise-generating activities, such as pile driving and cable trenching, to avoid periods when marine and coastal birds are nesting near construction zones.
- Limiting the use of steady-burning bright lighting in order to reduce attraction of birds to construction and service vessels and thus further reduce potential for ingestion of or entanglement with accidental releases of solid debris from these ships.

Section 6

6. IMPACTS DURING PROJECT LIFETIME

Project lifetime impacts of the proposed wind project would affect pelagic species using offshore waters of the New York Bight. As large numbers of birds are not likely to congregate in the proposed project area at any one time, these impacts would be expected to be minimized. Baseline studies of the specific project area will help to establish avian use in the area before construction, allowing the magnitude of project lifetime impacts to be better understood. Some level of impact is expected if additional studies determine that the area is regularly used for foraging and migration.

Data from European studies on avian impacts during project lifetime can be extrapolated to the proposed project. European studies at offshore wind projects have focused mostly on waterbirds, and many are restricted to migrating waterbirds, which may behave differently than seabirds during local movements. Little information is available for pelagic species. Information on the effects of wind turbine noise on seabirds is also limited.

In their Literature Review of Offshore Wind Farms with Regard to Seabirds, Dierschke and Garthe (2006) summarize results of seabird studies conducted at existing offshore wind projects. Relevant results from coastal wind projects and other technical activities at sea were also taken into account in their review. The report offers a comprehensive basis for the assessment of the potential impacts on seabirds from wind projects (Dierschke and Garthe, 2006). According to the authors, wind projects generally pose a number of potential threats to birds, including:

- Barrier effects: effects due to avoidance of wind turbines and other offshore structures. These can include shifts in habitat use.
- Habitat loss: displacement due to disturbance by operating turbines or physical loss of habitat (i.e., modification of flora and fauna) due to structures placed offshore, and
- Fatalities: due to collisions with turbine blades.

6.1. BARRIER EFFECT

The placement of turbines in the offshore environment may create barriers to avian movement, causing deflection or avoidance of birds around turbine arrays. These deflections can cause effects on migrating birds and on birds moving between roosting/nesting and feeding sites. Avoidance can result in increased flight distance, increasing the birds' energy expenditure can possibly influence survival. As with other impacts, barrier effects are dependent on a range of factors, including species, type of bird movement (i.e., migratory vs. local movements), flight altitude, diel or diurnal movement, turbine spacing, and weather conditions.

Results of studies at the offshore wind projects at Nysted and Horns Rev in Denmark showed that most migrating birds generally avoided the wind projects, although avoidance effects were highly species–specific, making some species more susceptible to barrier effects than others. Most bird flocks (71 to 86 percent) at Horn Rev avoided the wind project at a distance of 1.5 to 2 km from the project. Changes in flight direction tended to occur closer to the wind project at night than during the day (Petersen *et. al.*, 2006). Species-specific results indicated that loons showed complete avoidance of the wind project area during the three-year post-construction period, despite being present prior to construction. Common scoters, absent from the area prior to construction, occurred in large numbers in the vicinity of the wind project but rarely within the turbine array. Long- tailed ducks showed significant reductions in density post-construction. Common murres and razorbills avoided the project area, staying within two-to-four kilometers away. Gannets also avoided the project area. Arctic and common terns showed indications of avoidance response in the wind project area, but increased use of the two kilometer zone around the wind project. Most gulls and terns showed neither an avoidance or attraction response. Black-backed gulls and herring gulls showed no sign of avoidance at all. Visual observations of terns entering wind projects showed that they did not pass beyond the second row of turbines; however, terns were found foraging on the outer edges of the wind project. Interestingly, gulls and cormorants recorded as resting on turbine platforms during normal operation were at turbines on the edges of the wind project. Alternatively, when turbine movement was stopped, these species were recorded on turbine platforms within the wind project (Petersen *et.al*., 2006).

In the Dierschke and Garthe (2006) literature review, the results of seabird studies conducted at existing offshore wind projects (mainly Utgrunden and Yttre Stengrund in Sweden and Tunø Knob, Horns Rev, and Nysted in Denmark) concentrated on seabirds regularly found in German waters. Information about flying seabirds is mostly limited to migrating birds. It was found that the red-throated loon, Arctic loon, gannet, common scoter, common murre, razorbill, white-wing scoter and black guillemot commonly fly detours around offshore wind projects instead of crossing through projects.

Dierschke and Garthe (2006) also summarized relevant results from European coastal wind projects. During a seven year study at Blyth Harbour in northeastern England, considerable numbers of cormorants, eiders, black-headed gulls, herring gulls and great black-backed gulls were present for at least a portion of the year. Cormorants regularly crossed the row of turbines, with ten percent flying within the range of the rotor plane. Eiders flew between the turbines during the first years of the study, but afterward only entered the area by swimming. Large gulls flew between the turbines. Anecdotal reports indicated that fulmars, black-headed gulls, kittiwakes, and sandwich terns also passed through the wind project. Two other coastal wind projects, Maasvlakte in the Netherlands and Zeebrugge Harbour in Belgium, are both located between the foraging and breeding grounds of gulls and terns. Turbine rows were regularly crossed by these birds at these projects, indicating that the turbines did not create a barrier effect for these species.

Speakman *et. al*. (2009) reviewed available estimates of flight energy demands on birds to model the flight energy expenditures of seabirds due to deviation around wind projects. The model found that avoidance of a single wind project is likely to be trivial for most species, even if birds travels 30 km off course. Nevertheless, if birds are required to make regular deviations around a project that is located between roosting and feeding sites or between nesting and feeding sites, daily energy demands would require birds to increase their daily foraging efforts. If prolonged, this situation could have a mortality impact. This indicates that consideration should be given to any potential impacts that development could have on the regular movements of seabirds, primarily between breeding and/or feeding areas (Speakman, *et. al.*, 2009).

Some species may become accustomed to turbines. Thus, impacts from barrier effects may not be permanent for all species, as habituation to the project may occur with time. Habituation effects at offshore facilities are not well understood, and studies are still pending; thus conclusions regarding the habituation of seabirds are premature. Presence and behavior of some species within existing offshore wind projects suggest that they became accustomed to the turbines. Instances of habituation have been observed at several small wind projects, including at Blyth Harbour, where turbine rows are regularly crossed by cormorants, ducks, gulls, and terns on flights between breeding colonies, roosts, and offshore foraging areas (Dierschke and Garthe, 2006). Peterson *et. al*. (2007) summarized avian survey data collected from January to April 2007 regarding habitat use by black scoter in and around the Horns Rev wind project. The data indicated that the black scoter may occur in high densities between newly constructed wind turbines at sea, but only a number of years after initial construction. The increased density of black scoters a few years after construction may have resulted from a change in food supply rather than a change in bird behavior. It was found that loons continued to avoid the wind project and the surrounding area (Peterson *et. al*. 2007).

6.2. HABITAT LOSS

The physical loss of habitat may result from offshore wind project development due to the permanent displacement and modification of flora and fauna in the region and the displacement of birds due to the disturbance of operating turbines. Bird displacement due to behavioral avoidance can represent effective habitat loss; that is, birds that actively avoid wind project areas are effectively displaced from the wind project waters. This loss will be relative to the size of the wind project and the location of suitable forage areas in the immediate vicinity. As offshore wind development becomes more widespread, the cumulative effect of effective lost habitat on impacted species should be considered. In addition to cumulative loss from other wind farm development, areas disturbed by other factors such as related cable routes, oil and gas platforms, and impacts from fishery and shipping can further reduce available habitat adding to the cumulative effect of habitat loss. Displacement will affect different species in different ways. The magnitude of impacts depends on the availability of suitable alternative feeding areas around the project area. Species with very specific habitat requirements will be more vulnerable to the effect of displacement than habitat generalists.

Offshore habitat loss results from the physical loss of feeding substrate under the foundation and anti-scour protection. Construction may impact benthic fauna, which may affect the availability of fish. Placement of new offshore structures may also result in substrate gain as well, leading to the creation of artificial reef communities. Preliminary results from operating wind projects in Europe confirmed the development of hard bottom communities; however, whether the presence of these communities increase seabird usage in the area is not conclusive. Habitat gain and loss will be relative to the prevalence of suitable forage areas in and around the project area. Habitat loss may occur as birds permanently or temporarily avoid the project area during operation (i.e., become displaced).

Studies at European wind projects have assessed the relative substrate loss from project development. Fox and Peterson (2006) found that foundations and scour protection usually covers less than two percent of the total project area; therefore, habitat loss from these structures is not considered substantial. Petersen *et. al.* (2007) concluded that physical habitat loss and gain due to the construction of the Nysted and Horns Rev wind projects was considered small since only one percent of the substrate in the project area was affected by foundations and scour protection. Initial results from Horns Rev indicated that sand lance, which is an important prey species for many seabirds, were not negatively affected by development (Dierschke and Garthe, 2006, Peterson *et. al,* 2006). As offshore wind development becomes more widespread, the cumulative effect of lost substrate on impacted species should be considered.

Species that may be at greater risk of the potential effects of habitat loss are species that have less flexibility in habitat use. Garthe and Huppop (2004) SSI rankings indicated that seaducks, loons, grebes, cormorant and alcids have less flexibility in habitat use, while gulls and terns are more flexible in habitat use (Table 11). Species in the project area with less flexibility in habitat use are likely to be the most impacted by project development.

According to the literature review by Dirschke and Garthe (2006), six out of 35 seabirds regularly living in German waters strongly avoid offshore wind projects, including the red-throated loon, Arctic loon, gannet, common scoter, common murre, and razorbill (Table 12). The long-tailed duck was still present in the project area, but was recorded in much lower numbers after construction. Seven species did not demonstrate obvious habitat displacement, and three gull species increased in numbers compared to the pre-construction data. Data for many other pelagic species, including grebes, fulmar, shearwater, and jaegers, is either limited or inconclusive (Dierschke and Garthe, 2006).

6.3. COLLISIONS

Erickson *et. al*, (2001) estimated 100 million to one billion birds are killed annually in the U.S. due to collisions with human-made obstacles, including vehicles, aircrafts, buildings and windows, power lines, communication towers , smokestacks and other structures. Data collected in the U.S. as of 2001 indicated an average of 2.19 avian fatalities per (onshore) wind turbine per year (Erickson *et. al*., 2001). A 2005 report estimated avian collision mortality from onshore wind projects from 0.63-7.70 birds/turbine/year (Erickson *et al*, 2005).

The PEIS cites bird collisions with turbines as an area of concern for offshore wind projects. In contrast to avian movements near onshore projects, many marine and coastal avian species exhibit flocking behavior and daily onshore and offshore movements, and many marine and coastal birds undergo migrations along the Atlantic coast. Direct mortality at wind projects can result from birds being struck by revolving blades or from flying into towers, nacelles, or associated structures. Collision risks are dependent on many factors. The greatest risk is in areas regularly used by large numbers of feeding or roosting birds or along migratory flyways and local flight paths. Establishing the risk for collisions at offshore wind projects is problematic. Methods developed to track onshore and coastal mortalities due to collisions rely heavily on ground searches for carcasses, which is not possible in the offshore environment.

Seabirds entering offshore wind projects can be considered at risk for collision (Dierschke and Garthe, 2006). The level of risk is influenced by species flight behavior: species that regularly fly within the rotor swept area are more susceptible to collisions, as are species with less flight maneuverability. Species that tend to avoid turbines will be at less risk of collision. The additive mortality risk to seabirds due to collisions with turbines in offshore locations is difficult to assess. Further investigation into the offshore behavior of migrating landbirds and raptors will be necessary to judge the potential risks to these species.

Desholm and Kahert (2005) tracked the spatial migration pattern of waterbirds by radar and found a substantial avoidance response by migrating waterbirds to a large offshore wind farm. Overall, less than 1% of the ducks and geese flew close enough to the turbines to be at any risk of collision (Figure 15). The final results of radar studies at offshore wind projects at Nysted and Horns Rev in Denmark, confirmed that many birds entering the wind project re-orientate themselves to fly between turbine rows, frequently equidistant between turbines, minimizing the risk of collision (Petersen *et. al*. (2006); thus, birds flying within turbine rows tend to take routes away from the areas of highest risk. There was also evidence that birds readjusted flight orientation after entering the project area in order to take the shortest exit route, further minimizing collision probability. More than 2,400 hours of Thermal Animal Detection System (TADS) monitoring was undertaken at the site. Results included eleven bird detections well away from the sweep area of the turbine blades, two passing bats, two passing objects (either small birds or bats), a moth, and the collision of one small bird. At Nysted, no bird species came even close to approaching a one-percent mortality rate, the rate necessary to require mitigation mechanisms in order to reduce impacts. The report indicated that similar results were likely at Horns Rev (Peterson, *et. al*., 2006).

Evidence of collision risk at offshore locations is difficult to obtain, since bird carcasses are difficult to collect in the offshore environment. Dierschke and Garthe (2006) summarized collision mortality for both coastal and offshore wind projects in Europe. Coastal wind project studied include Blyth Harbour in northeastern England, Maasvlakte and Lely in the Netherlands, Zeebrugge Harbour in Belgium. Offshore wind projects studied include Utgrunden and Ytrre Stengrund in Sweden and Tuno Know, Horn Rev and Nysted in Denmark. It was found that seabirds tend to avoid collisions, either by flying detours around wind projects and turbines, or by employing flight manipulations to avoid collisions. Still, in poor visibility, migrating birds reacted to turbines to a lesser degree and at closer distances than in favorable weather conditions and during daylight.

Studies at coastal wind projects recorded 13 seabird species as casualties, with gulls being especially vulnerable to collisions (Dierschke and Garthe 2006; see Table 12). Casualties included common eiders, red-throated loons, northern fulmars, great cormorants, black-legged kittiwakes, black-headed gulls, mew gulls, herring gulls, lesser black-backed gulls, great black-backed gulls, common terns and common murres. Information about the circumstances when casualties occurred was not available at most wind projects. Some of the wind projects in the study were located between both migration routes and flights to night roosts. As a result, some of the casualties were birds from local breeding populations that were struck during foraging flights and flights to and from roosts. At one of the coastal wind projects, the annual collision rate was higher along a turbine row, perpendicular to the main flight direction of birds (Dierschke and Garthe 2006). This implies that collision risks could be mitigated somewhat by orienting turbine rows in the same direction as the primary flight direction of birds. This mitigation strategy was suggested by Huppop *et al* (2006), who recommended aligning turbine rows parallel to the main direction of flight as well as providing open migration corridors several kilometers in width between projects. Drewitt *et al* (2006) also suggested that collisions could be mitigated by adopting best-practice measures, such as grouping turbines to avoid alignment perpendicular to main flight paths and providing flight corridors between clusters of turbines aligned with main flight trajectories for large wind projects.

Huppop *et. al*. (2006) studied year-round bird migration over the North Sea using radar, thermal imaging, and visual and acoustic observations. Illuminated structures (inland, on the coast, and at sea) are known to attract birds, increasing the number of collisions with these structures. This has been noted for over a century on almost every continent. During adverse weather, the effect may be even more pronounced at sea than on land, as there are no suitable resting places for terrestrial birds. Erickson *et. al*. (2001) suggested that lighting is the single most critical attractant leading to collisions with tall structures. It was also noted that artificial lights at night attract migrating birds, particularly during inclement weather when birds can become disoriented. Therefore, collisions with wind turbines are more likely when nocturnal migrants meet unfavorable weather conditions during their journey. Russell (2005) reviewed interactions of migrating birds and offshore oil and gas platforms in the northern Gulf of Mexico and found that migrants sometimes arrived at certain platforms shortly after midnight and proceeded to circle the platforms for variable periods ranging from minutes to hours. The circulations tended to occur on overcast nights when birds were attracted to platform lights. It was believed that the birds were attracted to the cone of light surrounding the platform and were reluctant to leave, as their visual cues with the horizon were lost. Russell (2005) also found that collisions with platforms were more common in the fall, since nightfall occurred earlier in the evening in that season.

Although lighting on tall, man-made structures may increase the risk of collisions (especially during inclement weather), emerging data from existing onshore wind projects in the United States suggest that FAA-required lighting on wind turbines does not increase the risk of avian collisions. Available studies do not indicate a significant trend between mortality at lit turbines compared to unlit turbines (MMS FEIS Appendix N, 2009).

Nevertheless, lighting guidelines can be developed to minimize avian impacts. In a 2008 Avian Risk Assessment for the Great Lakes Energy Center, Guarnaccia and Kerlinger recommend the following construction guideline with regard to lighting:

> *"Lighting of turbines and other infrastructure should be minimal to reduce the potential for attraction of night migrating songbirds and similar species. Federal Aviation Administration (FAA) night obstruction lighting should be only flashing beacons (L-864 red or white strobe (or LED), or red flashing L-810 with the longest permissible off cycle. Steady burning (L-810) red FAA lights should not be used, although if turbines exceed 152 m (500 feet), the FAA may recommend them. Sodium vapor lamps and spotlights should not be used at any facility (e.g. lay-down areas or substations) at night except when emergency maintenance is needed. If steady burning lights are needed for maintenance purposes, the use of green or blue lights should be investigated as a means of minimizing bird attraction. Navigations lights (steady red and green, located near the water level) will likely be required, but these have not been demonstrated to attract migrating birds."* (Guarnacciaand Kerlinger, 2008)

The BOEM (then MMS) and Cape Wind Associates developed a framework for the Avian and Bat Monitoring Plan for the Cape Wind project. Proposed mitigation measures are based on information from the USFWS guidelines on lighting for communication towers and other land-based tall structures. These guidelines were considered to be adequate in addressing lighting issues at the proposed Cape Wind project; thus, the BOEM did not require monitoring to determine the effects of lighting on avian species for the proposed project. The guidelines are presented as follows:

"As allowed by the FAA and USCG, lighting of the wind power turbines and associated structures should:

- *Include the minimum amount of pilot warning and obstruction avoidance lighting*
- *Use only white (preferable) or red strobe lights at night, and these should be the minimum number, minimum intensity, and minimum number of flashes per minute*
- *Flashes should be synchronous among structures*
- *Never use solid red or pulsating red lights at night*
- *Never use large-scale continuous illumination*
- *Leave lights on only when necessary and downshield when possible, including onshore security and equipment lighting.*
- *As allowed bys the FAA and USCG, lighting of any support vessels should minimize use of high-density work lights." (MMS FEIS Appendix N, 2009)*

Mitigation measures in the PEIS (2007) regarding operation-related activities include the following recommendations:

- *"Avoid locating facilities in or near areas of known important or high bird use (e.g., foraging and overwintering areas, rookery sites, migratory, staging, or resting areas)."*
- *"Reduce or stop operation of turbines that are located directly in migration paths during peak migration periods."*
- *"Avoid the use of bright lights to reduce the attractiveness of towers to birds. Use low-intensity strobe lights instead of more commonly-used medium-intensity red incandescent blinking lights when complying with Federal Aviation Administration (FAA) lighting guidelines. Low intensity strobe lights may be less attractive to night migrants."*
- *"Because many marine birds fly close to the water surface, turbine blades should not come within 30 m (98 ft) of the ocean surface."*
- *"To increase visibility of moving rotors, paint the distal portion of each blade to sharply contrast with the remaining portions of the rotor."*
- *"Use anti-perching devices to reduce the attractiveness of towers to birds."*

Section 7

7. IMPACTS DURING PROJECT DECOMMISSIONING

The dismantling and removal of infrastructure from wind projects and the transport of these structures for disposal or re-use could impact bird species in the area and species that have become habituated to using the platform structures. The PEIS indicates that "the MMS (now BOEM) has established guidelines for explosive platform removals. These guidelines require structure removal-specific plans to protect marine life and the environment and specify procedures and mitigation measures to be taken to minimize potential impacts." Cutting, rather than the use of explosives is preferred for platform removal (MMS PEIS, 2007). BOEM review of proposed removal projects includes consultation with NMFS and USFWS to ensure listed species will not be impacted by removal (MMS PEIS, 2007). Currently, no impact studies have been conducted documenting potential avian impacts associated with the decommissioning of offshore wind turbines.

Section 8

8. IMPACT ASSESSMENT FOR PROJECT AREA BIRDS

Previous sections listed avian species that may use the New York Bight and discussed general impacts to birds related to offshore development in Europe. This section applies these impacts to specific species that may use project area waters. Potential impacts were determined by assessing preferred habitat and species behavior along with information accumulated from European and U.S. studies. Risk assessment is difficult to determine for most of the species groups with regard to the proposed project because information on avian use of the project area is limited.

8.1. IMPACTS TO UNLISTED SPECIES

Large concentrations of wintering seaducks particularly eider and scoter species are found in Long Island waters in the winter. Although winter habitat preferences are typically coastal, seaducks may use the proposed project area. Long-tailed ducks may also be found using offshore waters. European studies have shown that migrating scoters and eiders avoid wind projects (Dierschke and Garthe 2006; Petersen *et. al.,* 2006). This avoidance behavior would minimize risk of collision with these species if they migrate through the project area. Studies of long-tailed ducks at European wind projects found that foraging ducks remained after construction, but numbers may have been reduced (Dierschke and Garthe, 2006). Displacement of the long-tailed duck may occur due to service boats. Since the heaviest concentrations of both migrating and foraging seaducks are likely to occur in waters closer to shore, the risk of impacts to seaducks from the proposed project may be minimized.

Red-throated (unlisted) and common loon (species of special concern) may use project area waters. Results from European studies suggest that red-throated loons strictly avoid swimming or flying within wind projects (Dierschke and Garthe 2006; Petersen *et. al.*, 2006). Impacts to red-throated loons will depend on their level of use of the proposed project area. Red-throated loons may have less flexibility in habitat and may be impacted if they are displaced from project area waters. The behavior and presence of common loons in New York Bight waters is not well known and requires further study in order to determine potential impacts.

Pelagic Birds such as gannets, storm petrels, shearwaters, and alcids use waters of the New York Bight and may be found in the project area. There is considerable uncertainty in evaluating the risk of project development on these species. The distribution and density of seabirds in offshore waters is not uniform, and is influenced by a number of factors (e.g., season, forage opportunities, migration patterns, concentration areas, etc.). Seabirds preferentially associate with physical features, such as fronts, thermal domes, topography, surface currents, and water masses. Habitat preferences are species specific. Because the species-to-habitat relationship reflects species-to-prey relationships, habitat by species can vary from year to year (Balance, 2007). Gannets will likely use project area waters. Although European studies suggest that gannets may avoid wind projects (Dierschke and Garthe, 2006, Petersen *et. al.,* 2006), further study is needed. Because gannets feed by plunge diving, they may be at greater risk of collision with turbines due to their foraging strategy. Alcids, including razorbills and dovekies may use project waters. European studies have shown that a number of alcid species (guillemots and razorbills) avoid wind projects (Dierschke and Garthe 2006; Petersen *et. al.,* 2006). Collision impacts would be mitigated for species that actively avoid turbine arrays. Still, alcids may have less flexibility in habitat use and may be impacted if displaced from project area waters. There is little information on impacts of wind projects to other pelagic species such as jaegers, storm petrels, skuas, and phalaropes. Further study is necessary to determine behavior with respect to wind projects and the use of project area waters.

Thousands of diurnal raptors migrate along the south shore of Long Island in the fall, and some of these raptors, especially falcons, may pass over project area waters. Most migrating raptors do not forage in offshore waters, and are likely to pass over the project area above turbine height. Peregrine falcons and ospreys may forage offshore, putting them at greater risk of collision. Anti-perching devices may mitigate perching concerns on turbines, minimizing the potential collision risk to these species. The use of project area waters by migrating raptors will require more research in order to fully determine potential impacts to this group.

Migrating shorebirds may pass over project area waters. Most will be engaged in active migration at higher altitudes above turbine height, minimizing potential impacts. Nearshore impacts due to construction and cable trenching can be mitigated by limiting construction outside active breeding seasons as well as during times when foraging shorebirds are known to concentrate in coastal areas.

Gulls and terns are known to use project area waters. Studies from Europe indicate that most gulls and terns do not avoid wind projects (Dierschke and Garthe, 2006). As a result, some collision risk can be expected; however, these species are also known to have high flight maneuverability and can often avoid collisions. Kittiwakes are also likely to be found in project area waters. European studies indicate that this species does not seem to avoid wind projects (Dierschke and Garthe, 2006). Listed species of terns include the roseate tern, common tern and least tern, which are discussed in more detail in section 8.2. Use and behavior of tern species in project area waters is not well known. Nearshore impacts to nesting terns and gulls can be mitigated by limiting construction outside active breeding seasons.

Potential impacts to migrating passerines will be limited to migration periods in the spring and fall, with most migration at altitudes above turbine height. Nevertheless, a number of studies on migrating birds' flight altitudes found that flight altitudes tended to be lower offshore than on the coast or inland. Adverse weather conditions can lead to even greater reductions of flight altitudes at sea (Richardson, 2000, Huppop *et. al*. 2006). Other studies indicate that many collisions with tall structures are due to passerine attraction to lighting (Erickson *et. al*. 2001); however, lighting mitigation required in an approved BOEM lease is believed to adequately address impacts to avian species from this concern, and emerging data from existing onshore wind projects in the U.S. indicate that FAA required lighting on wind turbines does not increase avian risk of collision (MMS FEIS Appendix N, 2009). Some collision risk can be expected if large numbers of passerines pass over project area waters. Further study may provide better understanding of migration patterns and the flight altitude of migrating passerine species over project area waters.

8.2. IMPACTS TO ENDANGERED, THREATENED, AND SPECIES OF CONCERN

Potential impacts to endangered, threatened, and species of concern are discussed in this section. Compliance with ESA regulations and coordination with USFWS is necessary to ensure that project activities are conducted in a manner that minimizes or avoids impacts to listed species and their habitats.

8.2.1. Piping Plover

The Atlantic coast populations of piping plover are designated by the federal government as threatened. The greatest risk of development to the piping plover would be land-based construction operations that may disturb habitats during cable installation, cable landing and connection to land-based substation(s). These impacts should be temporary, and can be mitigated by environmental no-work windows, restricting project activity during arrival, courtship and nesting. The NYSDEC no-work window for endangered and threatened birds is typically from March 31 to August 31. Figure 6 shows active Long Island Colonial Waterbird and Piping Plover Survey areas along the barrier beaches near the Rockaway Substation, as well as survey areas in the Jamaica Bay Complex. Table 5 lists the numbers of piping plovers observed at these sites from 2000-2008. Active sites closest to the Rockaway Substation include Arverne by the Sea, Far Rockaway, and Long Beach Island and Atlantic Survey areas.

In a 2009 Biological Opinion, the USFWS addressed the effects of all activities associated with the Cape Wind project to ESA-listed birds (i.e., lease, construct, operate, maintain, and decommission a wind energy project on Horseshoe Shoal in Nantucket Sound, Massachusetts). Collision risk for piping plovers was expected to be very low, with no more that 0.5 piping plover collisions per year. Barrier or displacement effects were found to be inconsequential, as the proposed project area is not a breeding or foraging habitat. No short term habitat loss was anticipated at Cape Wind, as the proposed submarine cable route is greater than 300 meters from piping plover nesting habitats and the submarine cable landfall is not near breeding piping plovers. Pre-construction, post-construction, and routine maintenance activities were not anticipated to cause adverse effects to breeding piping plovers (MMS FEIS, 2009 Appendix J).

8.2.2. Roseate Tern

The U.S. Department of Interior lists the northeastern population of roseate terns as endangered. The extent that roseate terns use the waters of the project area for foraging is unknown; however, roseates are not known to forage farther than 30 km from colonies (Gochfeld *et.al*.1998). Thus, the risk to breeding terns on Long Island may be limited to the few pairs known to colonize Long Island further west of the main breeding colonies that are located in eastern Long Island. Figure 7 shows the NYSDEC Long Island Colonial Waterbird Survey areas where roseate terns have been recorded. In New York, the species breeds only at a few Long Island colonies, the largest of which is on Great Gull Island owned by the American Museum of Natural History. This island is located off the northeastern tip of Long Island, which is approximately 160 km from the project area. Breeding pairs at this location have numbered in the thousands over the last five years. Numbers at other survey areas indicate only a few breeding pairs (Table 6). In 2008 Goose Flat was the only western Long Island area with roseate terns present, with only two pair reported.

In the 2009 Biological Opinion for the Cape Wind application, the USFWS estimated four to five roseate terns collisions per year. The USFWS determined that the amount of habitat loss will be insignificant compared to the total acreage of Nantucket Sound and large amount of tern foraging habitat available, and that cable placement was not likely to adversely affect species foraging or staging. The USFWS also concluded that the Cape Wind project was not likely cause adverse barrier effects for commuting roseate terns, and was not likely to displace roseate terns from foraging habitats. It was determined that pre- and post-construction activities were not expected to significantly alter roseate tern behavior, as the effects of such activities were expected to be localized and of short duration (MMS FEIS, 2009 Appendix J).

Regarding the impacts of the Cape Wind project on piping plovers and roseate terns, the USFWS's overall conclusion was that the project was not likely to "jeopardize the continued existence of" these species. "Jeopardize the continued existence of" is defined as "to engage in an action that would be expected, directly or indirectly to reduce appreciably the likelihood of both survival and recovery of a listed species in the wild by appreciably reducing the reproduction, numbers, and distribution of that species" (MMS FEIS, 2009 Appendix J).

There have been no studies documenting the use of the proposed project area waters by piping plovers and roseate terns; however, if use by these species is comparable to that in Cape Wind's project area waters, it is possible that the USFWS may draw a similar conclusion for the Collaborative's proposed project. Further study is necessary to determine the use of project area waters by piping plovers and roseate terns.

8.2.3. Common Tern

The common tern is listed as threatened in New York State. Potential impacts to common tern could occur during land-based construction operations that may disturb habitat during cable installation, cable landing and connection to land-based substation(s). Impacts to nesting birds can be mitigated by siting the cable landing away from known breeding areas and restricting project activity from occurring during arrival, courtship, and nesting. The NYSDEC no-work window for endangered and threatened birds is typically March 31 to August 31. Figure 6 and Table 5 provide the locations and numbers of common terns recorded by the NYSDEC Long Island Colonial Waterbird and Piping Plover Survey areas in the vicinity of the Rockaway Peninsula. Common terns may also nest at a number of coastal beaches in New Jersey. Impacts to foraging common terns are likely to be similar to impacts described for roseate tern; however the numbers of common terns that nest in western areas of Long Island is much greater than the number of roseate terns. As a result, a greater number of common terns may use project area waters. Further study is necessary to determine the use of project area waters by common terns.

8.2.4. Least Tern

Impacts to foraging least terns are likely to be similar to impacts described for other tern species; however, least tern are less likely to forage far offshore, limiting potential impacts. Impacts to nesting least terns can be mitigated by siting the cable landing away from known breeding areas and restricting project activity from occurring during arrival, courtship and nesting periods. Figure 6 and Table 5 provide the locations and numbers of least tern recorded by the NYSDEC Long Island Colonial Waterbird and Piping Plover Survey areas in the vicinity of the Rockaways.

8.2.5. Diurnal Raptors

Peregrine falcons, and to a lesser extent, ospreys, are the raptor species most likely to forage in the project area. It is anticipated that anti-perching devices will mitigate perching concerns on turbines and minimize the potential collision risks for these species. Raptors in the genus Accipiter (Cooper's hawk, sharp-shinned hawk, northern goshawk) do not forage offshore. The impacts to bald eagles and northern goshawk would be expected to be negligible, as very few are likely to migrate through or in the vicinity of the project area. Very few eagles and goshawks are counted at the FIRE hawk watch. Red-shouldered hawks would not be expected to migrate through or in the vicinity of the project area.

8.2.6. Common Loon

The likelihood that common loons will be impacted by barrier effects, avoidance, and collision risk due to project development is not well known. In addition, migration and wintering habitats of common loons are not well understood. This species requires further study in order to assess potential impacts.

8.2.7. Passerines

Until the location of land-based transmission lines and substation(s) are better defined, impacts to endangered and threatened bird species using terrestrial and upland habitats cannot be fully investigated. Figure 8 illustrates the breeding bird blocks for the Rockaway area. Table 7 lists the federally and New York State endangered, threatened, and species of concern, along with the breeding status of species within project area blocks.

Section 9

9. AVIAN ASSESSMENT METHODOLOGIES

9.1. BASELINE ASSESSMENT METHODOLOGIES TO DETERMINE PROJECT AREA USE

Assessing the potential impacts to seabirds requires baseline studies to determine the use of the project and surrounding areas by both migrating and foraging birds. As no offshore wind projects have been developed in the U.S. to date, avian assessment requirements and methodologies are not yet firmly established. The PEIS provides a framework to assess the broad, regional environmental issues that will require consideration in order to proceed with offshore wind development. This includes Best Management Practices (BMPs) that may be adopted as mitigation measures in order to facilitate future preparation of site-specific NEPA documents. The policy for baseline avian impact studies is as follows:

> "The Lessee shall evaluate avian use of the project area and design the project to minimize or mitigate the potential for bird strikes and habitat loss. The amount and extent of ecological baseline data required will be determined on a project-by- project basis" (MMS PEIS, 2007).

The following sections provide an overview of some of the baseline data methods and impact assessment methodologies for determining avian use of proposed wind project areas. Baseline studies and impact assessments will be important for determining impacts to avian species as offshore wind development moves forward in the U.S.

Many European countries have established minimum requirements for environmental assessments. including the need to identify key areas of concern and establish research projects that quantify effects. These activities require recommendations for pre- and post-construction control impact studies that: (1) determine bird distribution and density using transect surveys, (2) detect movements (including flight height) of local foraging birds and long distant migrants (both day and night) using a combination of visual observations, radar and flight call recordings, and (3) study collision risk and mortality using infra-red technologies (Langston and Pullen, 2003).

In order for comparable assessments to be carried out at different wind project sites in Europe, Camphuysen *et. al*. (2004) published ship-based and aerial sampling methods for marine birds and guidance on their applicability to offshore wind projects. The report serves as a guidance document, providing detailed recommendations for methodology of both ship-based and aerial surveys in order to establish common standards for offshore marine bird surveys. The research objective goals were to determine:

- Seabird distribution patterns
- Seabird abundance
- Migratory pathways

- Foraging areas
- Factors explaining seabird distributions and abundance
- Variability in spatial and temporal patterns (seasonal, diurnal, spatial)
- Evaluation of collision risks (Camphuysen *et. al*., 2004)

In *A Review of Assessment Methodologies for Offshore Wind projects*, Maclean *et. al.* (2009) reviewed environmental assessments conducted for offshore wind projects in Europe. In this report, Maclean *et. al.* studied the extent to which the recommendations made by Camphuysen *et. al*. (2004) were followed. For almost all assessments reviewed by Maclean *et. al.*, both boat-based and aerial surveys were conducted over a minimum of two years. Boat-based surveys were usually carried out monthly throughout the year, and aerial surveys were typically conducted at least four times during the winter. In many cases, aerial surveys were also carried out during key migration periods or during the summer months if avian use was expected to be abundant outside winter months (Camphuysen *et. al*. 2004).

In determining the frequency and timing of surveys, Maclean *et. al.* (2004) recommended four factors for consideration, which are: (1) surveys need to capture seasonal peaks in abundance so that precautionary assessments of displacement and disturbance can be assessed, (2) surveys need to have been conducted frequently enough to allow precise estimates of mean numbers because this is required for collision risk modeling, (3) there is a need to determine seasonal patterns of use, and (4) surveys need to span a sufficient period of the year to ensure that unbiased estimates of mean numbers can be calculated. In conclusion, the authors recommended the following (Maclean *et.al*., 2004):

- For the purpose of collision risk modeling, both boat based and aerial surveys should be conducted throughout the year, irrespective of whether key features are most abundant at key times of the year. This is necessary to ensure that mean densities can be correctly calculated and to determine whether any features thought not to be key are present.
- At least twelve boat surveys and eight aerial surveys should be conducted within the year. Numbers should be tested to determine if additional surveys are required to allow a precise estimate of mean numbers.
- Although surveys should be conducted throughout the year, aerial surveys in particular should be conducted more frequently at times when peak abundance of key features are expected. The authors outline the statistical methods required to correct for this bias in detail in their review (Maclean *et. al*., 2007).

In the U.S., impact assessment methodologies to nocturnally active birds and bats were presented by Kunz *et. al.* (2007). Although this document is not specific to offshore wind, it provides a guideline of evaluation methods to be implemented at proposed wind development sites. These consist of both simple visual methods and methods that rely on high-quality equipment, including moon watching, ceilometer, night vision, thermal infrared imaging cameras, Next-Generation Radar (NEXRAD), Marine (X-band) radar, tracking radar, audio tracking, ultrasound microphones for bats, and radiotracking.

Baseline avian studies for offshore wind projects have been conducted in the northeastern U.S., including studies for the New Jersey Department of Environmental Protection and for the proposed Cape Wind project. Sampling protocol and avian survey protocol for the New Jersey Baseline Studies was conducted by Geo-Marine, Inc. This protocol was developed using some of the methods in Camphuysen (2004) and in Gould and Forsell (1989) (NJDEP EBS Interim Report, 2009). For the Cape Wind project, the applicant and the Massachusetts Audubon Society conducted studies to characterize the use of the project area and surrounding waters. Cape Wind Associates and the Massachusetts Audubon Society conducted baseline avian surveys over a five-year period in order to develop an estimate of relative abundance and distribution of birds in the proposed project area. The surveys included boat and aerial work during all seasons. From 2002 to 2006, Cape Wind Associates conducted 51 total aerial surveys and 48 boat surveys, while the Massachusetts Audubon Society conducted 81 aerial and 41 boat surveys (MMS, FEIS, 2009).

9.2. AVIAN IMPACT ASSESSMENT METHODOLOGY

A specific monitoring plan to determine project impacts will likely be determined by government agencies during the IES process. The PEIS proposed BMPs include pre-construction planning such that the “lessees shall develop a monitoring program to ensure that environmental conditions are monitored during construction, operation and decommissioning phases. The monitoring program requirements, including adaptive management strategies, shall be established at the project level to ensure that potential adverse impacts are mitigated.” (MMS PEIS, 2007) This section describes methodologies that may be employed in an avian monitoring campaign.

The BOEM (then MMS) and Cape Wind Associates developed a *Framework for Avian and Bat Monitoring Plan* for the Cape Wind Energy Project (MMS, FEIS Appendix N, 2009) that outlines methods and requirements for gathering data and evaluating potential impacts from the proposed project. The framework was developed in cooperation with the BOEM, the applicant, and USFWS. It was developed as part of the Cape Wind Final EIS. Coordination and input from the USFWS is expected to continue as the plan is implemented to improve and adjust the plan as the project progresses. The following is a summary of the objectives and existing monitoring techniques reviewed in this document. Although the project areas and affected species will differ between the Cape Wind Energy Project and the proposed project, the monitoring program and methods outlined in the framework provide insight into avian assessment methodologies that may be used as the development of offshore wind projects in the U.S. moves forward.

The objectives of the Cape Wind avian monitoring plan was to gather and summarize existing information on monitoring techniques and the effectiveness of these techniques in evaluating pre and post-construction monitoring requirements for the proposed project. It was ultimately determined that a combination of radio telemetry, acoustic monitoring, aerial surveys, anti-perching devices and monitoring, and Thermal Animal Detection Systems (TADS) or similar systems would be the most effective techniques to determine impacts associated with developing the proposed project (MMS Appendix N, 2009). The strategies from the plan are summarized below.

9.2.1. Radio Telemetry

Telemetry surveys can provide species-specific information on movement and patterns of species within a proposed project area. For the Cape Wind project, radio tracking of semipalmated plovers and common terns as surrogates for roseate terns will be used to determine their movements in relation to the project area. Twenty five common terns, as surrogates for roseate terns, will be captured, tagged with radio transmitters, and located at least 12 times between July 1 and August 31 to determine their movements and proximity to the project area during staging and prior to fall migration in late August. The pre-construction assessment would be compared to the post-construction assessment to assess any changes in tern use of the project area. If the tracking proves to be effective and safe for the birds, radio transmitters will be attached to adult roseate terns and piping plover as approved by USFWS (MMS, FEIS Appendix N, 2009).

9.2.2. Avian Acoustic Monitoring

Acoustic monitoring of birds involved the use of microphones to identify nocturnal migrants and species that are present in a project area. Approaches are being tested to convert call counts to passage rates, which may allow for estimation of flight heights for different species in the offshore environment (Farnsworth and Russell, 2007). For the monitoring plan for the Cape Wind project, acoustic microphones will be placed on ten monopiles or the offshore substation platform from May through October to continuously record flight calls of birds over or near the project. The microphones will also monitor at these locations three days per month from November through April to determine the incidence of birds in the vicinity of the proposed project during this period (MMS, FEIS Appendix N, 2009).

9.2.3. Aerial Surveys

Aerial surveys can assist in determining overall bird abundance and distribution at a proposed project site. In the Cape Wind monitoring plan, aerial surveys monitoring the abundance and spatial distribution of avian species will be conducted using the same methodology employed during pre-construction surveys. Aerial surveys will be conducted at an altitude of 250 ft (76 m) in a float plane or equivalent type of aircraft, maintaining air speed of approximately 100 miles per hour (90 knots). Birds will be identified along transects during different times of day and during different tide conditions at times when wave heights are no greater than two feet (sea state classification of 3) (MMS, FEIS Appendix N, 2009).

9.2.4. Anti-Perching Devices and Monitoring

Wind turbine generators and offshore substation platform present perching concerns for some bird species. Some birds may use various perches around the edges of the platform as vantage points from which to watch for prey, thereby increasing their risk of collision. Numerous species of birds are likely to use any suitable flat surface as places to rest during the day and for roosting at night. Other species, such as terns, may initiate high courtship flights from wind turbines, putting them at risk for collisions. Anti perching deterrents may consist of a fence to prevent access from the side and wires to restrict visibility from the deck of the platform. Other deterrents may include wire types, nets, spikes, coils, visual devices, water sprays, decoys and audio devices, including compressed air cannons (MMS, FEIS Appendix N, 2009).

The Cape Wind monitoring plan requires that each wind turbine and the offshore substation platform be equipped with avian deterrent systems to discourage terns and other avian species from perching on the railings and deck areas. Cameras may be used on some turbines to monitor the effectiveness of the anti perching devices. Video cameras would be set up on up to six turbine monopoles to monitor the effectiveness of the existing perching deterrents. In addition, field biologists will monitor tern presence in the project area to determine avoidance or attraction (MMS, FEIS Appendix N, 2009).

9.2.5. Thermal Imaging Cameras

Thermal imaging cameras detect heat emitted from and reflected off of objects (Arnett et al. 2005), and can be used to observe avian behavior in the vicinity of wind project during nighttime and inclement weather. In Cape Wind's monitoring plan, Thermal Animal Detection Systems (TADS) will be positioned near the base of the wind turbine monopile to monitor avian collisions. Each thermal imaging camera is connected to a data logging device at the turbine. Computers are loaded with thermal trigger software with operator designed settings and are adjusted to eliminate non-avian targets so data collection is limited to times when a target passes within the camera's field of view. A key benefit of the TADS and similar systems is that thermal imaging cameras are capable of detecting birds in total darkness as well as during conditions of clouds and fog, and with proper set-up may be capable of recording birds within the rotor-swept zone. However, the usefulness of TADS for species identification can be limited when the distance between the camera and the bird is great (MMS, FEIS Appendix N, 2009).

9.2.6. Other Methods

Other methods for evaluating potential impacts from the proposed project were considered, but not selected as part of the Cape Wind monitoring plan. These include monitoring of the effects of lighting on avian species, visual surveys (except to ground-truth another technique), and radar surveys (MMS, FEIS Appendix N, 2009). A brief description of these methods and why they were not chosen for the Cape Wind Avian and Bat Monitoring Plan follows.

9.2.6.1. Monitoring of the Effects of Lighting. Mitigation measures from the USFWS guidelines for lighting of communication towers and other land-based tall structures were considered to be adequate in addressing lighting issues at the proposed Cape Wind project; thus, the BOEM did not require monitoring of lighting effects on avian species at the Cape Wind project. These mitigation guidelines are presented in section 6.3.

9.2.6.2. Visual Surveys. Daytime visual surveys conducted from boats, the offshore substation platform, and from planes during breeding and migration periods are useful for determining changes in bird behavior, abundance and distribution in response to wind turbines; however these surveys are limited because they cannot assess avian impacts during night time and inclement weather. In addition, information such as flight altitude is often difficult to assess through visual surveys. As a result, visual surveys were included in the avian monitoring plan only to supplement or ground truth other techniques included in the monitoring plan (i.e. radio telemetry) or when they could provide large scale general information on avian use of the project area . (MMS, FEIS Appendix N, 2009).

9.2.6.3. Radar Studies. Radar studies provide information regarding the use of airspace during the day and night over proposed project areas, and can be used to document avoidance behavior of migrating birds approaching wind turbine arrays; however the usefulness of radar tracking can be limited during periods of heavy rain or inclement weather, and may not provide species specific information unless correlated with visual surveys. Therefore, radar studies do not always provide specific enough information for assessing potential impacts to focus species (MMS, FEIS Appendix N, 2009).

Section 10

10. CONCLUSIONS

This report provided an overview of avian species in the New York Bight region and evaluated the potential construction and operating impacts of a proposed offshore wind energy project on these species in the identified project area. Topics addressed include required regulatory approvals, an overview of species in the New York Bight, a summary of construction impacts and impacts during the wind project's lifetime, and a discussion of assessment methodologies. The report also evaluates the risk of development to bird species likely to inhabit the project area. The anticipated impacts to birds in the region are partially based on impacts observed from research at European offshore wind projects.

Avian density generally decreases with increasing distance from shore. As large numbers of birds are not expected to congregate offshore at any one time, avian impacts would be expected to be minimized. Pelagic species that may be present in New York Bight waters include shearwaters, petrels, fulmars, gannets, kittiwakes and alcids. The area may also be used by numerous avian species during migration. A number of endangered, threatened, and species of concern use the project area waters or migrate through the area. Federally threatened and endangered species that may use the project area include the roseate tern and piping plover.

Construction activities for the proposed project may impact avian species near the shore and farther offshore. Nearshore construction impacts may be incurred by cable landing and by the construction of onshore substation(s). In order to mitigate the risk to local avian populations, construction could be scheduled outside of primary breeding periods. Careful siting of the location for cable landing and onshore substation(s) will be necessary to avoid disrupting critical avian habitats nearshore. Offshore construction impacts will be temporary, and will mostly affect species that are known to show avoidance behavior to human disturbance.

Impacts to avian species during the project lifetime include barrier effects due to avoidance of wind turbines, habitat loss due to turbine operation and/or the physical presence of the structures, and fatalities due to collisions. European studies have found that certain species of seabirds (such as migrating seaducks) avoid wind projects, while others are less likely to display avoidance behavior. Barrier effects may not be permanent for all species, as recent European studies suggest that some species may begin to become habituated to the presence of wind turbines a number of years after construction and re-enter the project waters. The significance of habitat loss resulting from the proposed project will depend on the species and number of birds using the project area, as well as the availability of alternative habitats nearby. Although most offshore wind projects have recorded few collisions to date, some difficulty exists in assessing bird fatalities from collisions at offshore wind projects, since assessment methods rely heavily on ground searches for carcasses. Additionally, no offshore wind projects have been decommissioned to date, so potential avian impacts resulting from decommissioning activities are uncertain.

Mitigation measures will likely be employed during the construction and operational phase of the proposed project to minimize avian impacts. Construction-related mitigation measures may include (i) identifying important avian areas through surveys of coastal and offshore areas to avoid siting facilities and cable paths in or near these areas, and (ii) timing construction to avoid periods when marine and coastal birds are in the area. Operation-related mitigation measures may include (i) avoiding areas of known important or high bird use, (ii) reducing the operation of turbines during peak migration periods, and (iii) the use of anti-perching devices on towers.

As the first step in the siting process, this assessment was meant to identify any obvious fatal flaws to development resulting from avian species in the area based on existing data. The assessment did not identify any fatal flaws; however, avian species in the area are sensitive and should be carefully considered when siting and constructing the project.

Although the data reviewed and summarized for this report is representative of known avian species in the vicinity of the project area, further data collection and analysis will likely be required by government agencies in order to obtain development approval, as the current body of knowledge regarding avian species use of the proposed project area is limited. For most species, avian use in the proposed project area will require additional study in order to further assess potential impacts. Also, general information on the effects of offshore wind projects on pelagic birds may require further study, as current information is limited. As offshore wind energy projects in the U.S. progress, baseline and monitoring studies will provide a better understanding of avian impacts and effective mitigation measures.

As the project progresses, it is expected an Environmental Impact Study (EIS) will be conducted, which will explore the impact of project development in much greater depth. The collection of site specific field data will likely be required by government agencies as part of the EIS review process in order to better characterize the species that may be affected by project development. Baseline data collection will likely be necessary to determine local avian species, numbers, distribution, and movements in order to further assess the potential impacts of project development on avian species. Assessment methodologies may include aerial and boat surveys, radio telemetry, avian acoustic monitoring, thermal imaging cameras, and radar studies. The extent of baseline and follow-on studies will be determined during coordination with regulatory agencies.

Section 11

11. REFERENCES

Allison, T.D, Jedrey E. & Perkins, S. 2008 Avian Issues for Offshore Wind Development In Marine Technology Society Journal. Volume 42, Number 2.

Arnett, E.B., editor. 2005. Relationships between Bats and Wind Turbines in Pennsylvania and West Virginia. An assessment of Fatality Search Protocols, Patterns of Fatality and Behavioral Interactions with Wind Turbines. In MMS FEIS 2009 Appendix N.

Atlantic Sea Island Group. 2007. Deepwater Port License Application. Submitted to the US Coast Guard. May 2007.

Audubon CBC data. Retrieved from Website: http://www.audubon.org/bird/cbc/hr/index.html.

Avian Risk Assessment for Great lakes Wind Energy Center, Cuyahoga County, OH. Retrieved June 2010 from Website http://development.cuyahogacounty.us/pdf_development/en-US/GLWEC_AvianRiskAssmnt_011309.pdf.

Bass Fisherman.com Topic: Cholera Banks. Retrieved June 2010 from Website http://discuss.bayfisherman.com/board/index.php?board=4;action=display;threadid=6.

Brown, Patrick W. and Leigh H. Fredrickson. 1997. White-winged Scoter (*Melanitta fusca*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/274.

Bordage, Daniel and Jean-Pierre L. Savard. 1995. Black Scoter (*Melanitta nigra*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/177.

Camphuysen, C.J., Fox A.D., Leopold. M.F. and Petersen, I.K. (2004) Toward standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the U.K. A Comparison of Ship and Aerial Sampling Methods for Marine Birds, and Their Applicability to Offshore Wind Farm Assessments. Koninkljk Nederlands Isnsitut voor Onderzoek der Zee Report commissioned by COWRIE.

Clark, K. and Niles,L.J. U.S. Shorebird Conservation Plan Northern Atlantic Regional Shorebird Plan. Version I prepared by NJ Division of Fish and Wildlife and Members of the Northern Atlantic Shorebird Habitat Workshop.

Comprehensive Wildlife Conservation Strategy (CWCS) Plan. Retrieved from NYSDEC Website http://www.dec.ny.gov/animals/30483.html.

Con Edison and Long Island Power Authority. 2009. Joint Con Edison – LIPA Off-Shore Wind Power Integration Project Feasibility Assessment. Draft. March 20, 2009.

Cooper, B., A Stickney, T.J. Mabee. 2004 A Radar Study of Nocturnal Bird Migration at the Proposed Chautauqua wind Energy Facility, New York, Fall 2003 Prepared for Chautauqua Windpower LLC.

Cryan, P.M. 2003. Seasonal distribution of migratory tree bats *(Lassiurus* and *Lasioncycteris*) in North America, Journal of Mammalogy 84:579-93.

Department of Interior. Retrieved from Website http://www.doi.gov/.

Dierschke, V. & S Garthe. 2006. Literature Review of Offshore Wind Farms with regard to Seabirds in Zucco C Wende W., Merck T, Köchling I., and Köppel J (eds.), (2006) Ecological Research on Offshore Wind Farms: International Exchange of Experiences,Part B: Literature Review of Ecological Impacts, BfN-Skripten 186.

Drewitt. A.L. & Langston, R.H. 2006 Assessing the impacts of wind farms on birds. Ibis (2006), 148, 29-42.

Endangered Species Act of 1973, Public Law 93-205, approve Dec.28, 1973,87 Stat.884 As amended Through Public Law 107-136, Jan. 24, 2002

ESS Group, Hatch, J. &Kerlinger, P. 2004. Appendix 5.7-H Evaluation of the Roseate Tern and Piping Plover for the Cape Wind Project Nantucket Sound.

Ess Group, Inc. 2007. Cape Wind Energy Project-Final Environmental Impact Report (FEIR) EOEA # 12643, Development of Regional Imapct #JR#20084. Volume 1-3. Prepared for Cacpe Wind Associates, L.L.C., Boston, Mass.

ESS Group, Inc, 2008 Cape Wind Draft Avian Monitoring and Reporting Plan. Prepared for Cape Wind LLC Associates.

Erickson, W.P., G.D. Johnson, M.D. Strickland, D.P Young Jr, K.J Sernka and R.Good. 2001 Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States. National Wind Coordinating committee (NWCC) Resource Document.

Erickson, W.P., G. Johnson, and D. Young Jr. 2005. A Summary and Comparison of Bird Mortality from Anthropogenic Causes with an Emphasis on Collisions. USDA Forest Service General Technical Report PSW-GTR-191.

Exo, K.M, Huppop, O. & Garthe, S. 2003 Birds and offshore wind farms: a hot topic in marine ecology. Wader Study GroupBulletin 100: 50-53.

Farnsworth, A. and Clark, C.W. 2007. Monitoring flight calls of migrating birds from an oil platform in the northern Gulf of Mexico. J Field Ornithology 78(3): 279-289 in Cape Wind Energy Project FEIS, 2009 Appendix N Framework for the Avian and Bat Monitoring Plan.

Farnsworth, A. and Russell, R.W, 2007. Monitoring flight calls of migrating birds from an oil platform in the northern gulf of Mexico. J. Field Ornithology 78(3):279-289. In MMS FEIS 2009 Appendix N.

Fire Island 2008 Daily Summary. Retrieved June 2010 from Audubon Website http://battaly.com/fire/counts/2008.htm.

Fox, A.D. & Petersen, I.K. 2006. Assessing the degree of habitat loss to marine birds from the development of offshore wind farms. Waterbirds around the world. Eds G.C. Boere, C.A Galbraith & D.A Stroud. The Stationery Office, Edinburgh UK pp 801-804.

Garthe S. & Huppop O. 2004. Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index. Journal of applied Ecology 2004 41, 724-734.

Gill Jr., Robert E., Pablo Canevari and Eve H. Iversen. 1998. Eskimo Curlew (*Numenius borealis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online.

GMI (Geo-Marine Inc) 2009. Ocean/Wind Power Ecological Baseline Studies January- December 2008 prepared for New Jersey Department of Environmental Protection.

Gochfeld, Michael, Joanna Burger and Ian C. Nisbet. 1998. Roseate Tern (*Sterna dougallii*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online.

Good, Thomas P. 1998. Great Black-backed Gull (*Larus marinus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online.

Goudie, R. Ian, Gregory J. Robertson and Austin Reed. 2000. Common Eider (*Somateria mollissima*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online.

Guarnaccia, J. and P Kerlinger. 2007. Feasibility Study of Potential Avian Risk from Wind Energy Development, Western Ohio Lakeshore Region Lucas, Ottawa, Sandusky, Erie, and Lorain Counties, Ohio. Prepared for AWS Truewind, LLC.

Guarnaccia, J. and P Kerlinger. 2008. Avian Risk Assessment Great Lakes Wind Energy Center Cuyahoga County, Ohio Report prepared for juwi GmbH/JW Great Lakes Wind LLC.

Hatch, Scott A. and David N. Nettleship. 1998. Northern Fulmar (*Fulmarus glacialis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online.

Hatch, Scott A., Gregory J. Robertson and Pat Herron Baird. 2009. Black-legged Kittiwake (*Rissa tridactyla*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online.

Heath, Shane R., Erica H. Dunn and David J. Agro. 2009. Black Tern (Chlidonias niger), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online.

Historical Results from Christmas Bird Count. Retrieved June 2010 from Audubon Website http://www.audubon.org/bird/cbc/hr/index.html.

Huppop O. Dierschke J., Exo K., Fredrich E. & R. Hill. 2006. Bird migration studies and potential collision risk with offshore wind turbines. Ibis 148, 90-109.

Huettmann, F. & J.W. Chardine. PIROP (Programme Integre de recherché sur les oiseaux pelaguiques) Northwest Atlantic 1965-1992. Canadian Wildlife Service. Sackville, New Brunswick, CAN. Last Modified April 4, 2008.

Huntington, Charles E., G. Ronald, Butler and Robert A. Mauck. 1996. Leach's Storm-Petrel (Oceanodroma leucorhoa), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online.

Huppop, O., J.Dierschke, , K. Exo, E. Fredrich, & R. Hill 2006 Bird migration studies and potential collision risk with offshore wind turbines. Ibis 148 90-109.

Kerlinger P., J.D. Cherry, K.D. Powers 1983. Records of Migrant Hawks form the North Atlantic Ocean. The Auk, Vol 100 No. 2 pp488-490.

Kerlinger, P. 1995. How Birds Migrate. Stackpole Book, Mechanicsburg, PA.

Kerlinger P. and R. Curry. 2001. Avian Issues and Potential Impacts Associated With Wind Power Development in the Nearshore Waters of Long Island, New York. Prepared for Bruce Bailey AWS Scientific.

Kerlinger P. and R. Curry. 2002 Desktop Avian Risk Assessment for the Long Island Power Authority Offshore Wind Energy Project. Prepared for AWS Scientific Inc and LIPA

Kerlinger, P. Hatch, J. 2001. Appendix 5.7-A Preliminary Avian Risk Assessment for the Cape Wind Energy Project. Prepared for Cape Wind Associates L.L.C.

King, S I., Maclean, T. Norman, and Prior A, (2009) Developing Guidance on Ornithological Cumulatvie Impact Assessment for Offshore Wind Farm Developers. Report Commissioned by Cowrie Ltd.

The Kingbird Archive of NYSOA's Quarterly Journal. New York State Ornithological Association. Retrieved June 2010 from NYSOA Website http://www.nybirds.org/KBsearch.htm.

Kingsley, and A.,B.Whittam, 2005. Wind Turbines and Birds A Background Review for Environmental Assessment. Prepared of Environment Cananda/Canadian wildlife Service.

Kunz, T.H. Arnett, E.B., Cooper B.M. Erickson W.P., Larkin, R.P. Mabee, T. Morrison, M.L., Strickland, M.D. Szewczak, J.M. 2007. Assessing Impacts of Wind Energy Development on Nocturnally Active Birds and Bats: A Guidance Document. Journal of Wildlife Mangement 71(8):2449-2486.

Langston, R.W.H. &. Pullen, J.D. 2003. Windfarms and Birds: An analysis of the effects of windfarms on birds, and guidelines on environmental assessment criteria and site selection issues. Report T-PVs/Inf (2003) by Birdlife International to the Council of Europe, Bern Convention on the Conservation of European Wildlife and Natural Habitats.

Lavers, Jennifer, Mark Hipfner, Gilles Chapdelaine and J. Mark Hipfner. 2009. Razorbill (*Alca torda*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/635.

Lee, David S. and J. Christopher Haney. 1996. Manx Shearwater (Puffinus puffinus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online.

Levine, E. Ed 1998 Bull's Birds of New York State. Cornell University Press, Ithaca, NY.

Lilley, M.B. & Firestone, J. 2008. Wind Power, Wildlife, and the Migratory Bird Treaty Act: A Way Forward.

Maclean, I.M.D, Wright, L.J.,Showler, D.A. and Rehfisch, M.M. 2009. A Review of Assessment Methodologies for Offshore Windfarms. British Trust for Ornithology Report Commissioned by Cowrie Ltd.

Marine Zones. Retrieved June 2010 from USFWS Conservation Library Website http://library.fws.gov/pubs5/web_link/text/marizone.htm#Continental%20Shelf%20Zone.

McIntyre, Judith W. and Jack F. Barr. 1997. Common Loon (*Gavia immer*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online.

Mellor, M.T. Craig,D.,Baillie, and P. Woolaghan.2007 Trial high definition video survey of seabirds COWRIE HIDEF-05-07. United Kingdom: Collaborative Offshore Wind Research into the Environment.

Mowbray, Thomas B. 2002. Northern Gannet (*Morus bassanus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online.

MMS, 2006 Technology White Paper on Wind Energy Potential on the U.S. Outer Continental Shelf.

MMS, 2007. Programmatic Environmental Impact Statement (PEIS) for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf.

MMS 2009. Cape Wind Energy Project. Final Environmental Impact Statement.

MMS Cape Wind Energy Project FEIS January 2009.Appendix G, Biological Assessment.

MMS, Cape Wind Energy Project FEIS January 2009. Appendix J, FWS and NOAA Fisheries Biological Opinions.

MMS Cape Wind Energy Project FEIS, January 2009. Appendix N Framework for the Avian and Bat Monitoring Plan.

MMS, 2010 Cape Wind Energy Project environmental Assessment April 28, 2010 OCS EIS/EA MMS 2010-011.

Montevecchi, William A. and Iain J. Stenhouse. 2002. Dovekie (*Alle alle*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/701.

Morrison, M.L. 2006. Bird Movements and Behaviors in the Gulf Coast Region: Relation to Potential Wind Energy Developments NREL/SR 500- 39572.

Mowbray, Thomas B. 2002. Northern Gannet (*Morus bassanus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/693.

New York City's Physical Environment. Retrieved June 2010 from USGS Website http://3dparks.wr.usgs.gov/nyc/common/introduction.htm.

NJDEP, 2009. New Jersey Department of Environmental Protection Baseline Studies July-September Quarterly Report. Geo-Marine Inc.

NJDEP, 2009. New Jersey Department of Environmental Protection Baseline Studies April-June Quarterly Report. Geo-Marine Inc.

NJDEP, 2009. New Jersey Department of Environmental Protection Baseline Studies December2008-March 2009 Quarterly Report. Geo-Marine Inc.

NJDEP, 2009 New Jersey Department of Environmental Protection Baseline Studies January-December 2008 Revised Interim Report Geo-Marine Inc.

NJDEP, 2010. New Jersey Department of Environmental Protection Baseline Studies October-December Quarterly Report. Geo-Marine Inc.

NJDEP EBS Interim Report, 2009. appendix A-1 Avian Observer Packet-Version 1.

NYSDEC, 2002. 1998-1999 Long Island Colonial Waterbird and Piping Plover Survey.

NYSDEC. 2000-2008 Long Island Colonial Waterbird and Piping Plover Survey.

New York State Department of State, Division of Coastal Resources and Waterfront Revitalization and the Nature Conservancy. 1991. Draft Long Island's Beach-Nesting Shorebird Habitat: Protection and Management of a Valuable Resource.

NYSDOS, 1992. Significant Habitats and Habitat Complexes of the New York Bight Watershed Jamaica Bay and Breezy Point complex#16.

NYSDOS, 1998. Technical Report Series, Shorebirds. Prepared for the South Shore Estuary Reserve Council.

Nisbet, Ian C. 2002. Common Tern (*Sterna hirundo*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/618.

Northeast Roseate Recovery Team, 1998. Roseate Tern *Sterna dougallii* Northeastern Population Recovery Plan.

Offshore Wind Power. Retrieved June 2010 from Danish Energy Agency Website http://www.ens.dk/EN-US/SUPPLY/RENEWABLE-ENERGY/WINDPOWER/OFFSHORE-WIND-POWER/Sider/Forside.aspx.

One-Hundred Tenth Christmas Bird Count: Citizen Science in Action (12/14/2009-01/05/2010). Retrieved June 2010 from Audubon Website http://www.audubon.org/Bird/cbc/.

Partners in flight Website http://www.partnersinflight.org/pubs/pifnews/oct2001.HTM

Percival, S.M. 2001 Assessment of the Effects of Offshore Wind Farms on Birds. Ecology Consulting.

Percival S.M. 2003 Birds and Wind Farms in Ireland: A Review of Potential Issues and Impact Assessment. Ecology Consulting.

Peterson Ib K., Christensen, T.K ,Kahlert J , Desholm M, Fox A.D. 2006. Final results of bird studies at the offshore wind farms at Nysted and Horns Rev, Denmark NERI Report Commissioned by DONG energy and Vattenfall AIS.

Pierotti, R. J. and T. P. Good. 1994. Herring Gull (*Larus argentatus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/124.

Powers, K.P. 1983. Pelagic Distribution of Marine Birds off the Northeastern United States. NOAA Technical Memorandum NMFS-F/NEC-27.U.S. Department of Commerce, NMFS In Sullivan J.K. 1991.

Read, A.J., Halpin, P.N., Crowder, L.B., Best, B.D., Fujioka, E.(Editors). 2010. OBIS-SEAMAP: mapping marine mammals, birds and turtles. World Wide Web electronic publication. http://seamap.env.duke.edu, Accessed on March 04, 2010.

Richardson, W.J. 2000. Bird Migration and Wind Turbines: Migration Timing, Flight Behavior, and Collision Risk. LGL. Ltd Environmental Research Associates.

Rock, C.K., M.L. Leonard, and A.W. Boyne. 2007. Foraging Habitat and Chick Diets of Roseate Tern, *Sterna dougallii*, Breeding on Country Island Nova Scotia Avian Conservation and Ecology 2(1):4.

Rubega, Margaret A., Douglas Schamel and Diane M. Tracy. 2000. Red-necked Phalarope (*Phalaropus lobatus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/538.

Robertson, Gregory J. and Jean-Pierre L. Savard. 2002. Long-tailed Duck (*Clangula hyemalis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/651.

Russell, R.W., 2005. Interactions Between Migrating Birds and Offshore Oil and Gas Platforms in the Northern Gulf of Mexico: Final Report. U.S. Dept of Interior, MMS Gulf of Mexico OCS Region. OCS Study MMS 2005-009.348 pp.

Tony Salerno. Summer Blues: Bank on Action. Retrieved June 2010 from Noreast.com Websitehttp://www.noreast.com/IssuePage.cfm?issue=1612&Directory=%5CFeatures%5C&mFile=Summertime.htm.

Savard, Jean-Pierre L., Daniel Bordage and Austin Reed. 1998. Surf Scoter (*Melanitta perspicillata*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online.

Speakman J., H Gray, L Furness (2009) University of Aberdeen report on effects of offshore wind farms on the energy demands on seabirds (October 2009). Institute of Biological and Environmental Sciences, University of Aberdeen Scotland, UK.

Stedman, Stephen J. 2000. Horned Grebe (*Podiceps auritus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online:
Stout, Bonnie E. and Gary L. Nuechterlein. 1999. Red-necked Grebe (*Podiceps grisegena*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online.

The State of the Birds Report 2010 Report on Climate Change.

Sullivan J.K. 1991. Fish and Wildlife Populations and Habitat Status and Trends in the New York Bight. A Report to the Habitat Work Group for the New York Bight Restoration Plan.

Thompson, Bruce C., Jerome A. Jackson, Joannna Burger, Laura A. Hill, Eileen M. Kirsch and Jonathan L. Atwood. 1997. Least Tern (*Sterna antillarum*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online.

Tracy, Diane M., Douglas Schamel and James Dale. 2002. Red Phalarope (*Phalaropus fulicarius*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/698.

U.S. Department of Interior Website http://www.doi.gov/.

USDOI, 2005 Letter to Richard Polo USACE NY District.

USFWS, 1996 Piping Plover (*Charadrius melodus*) Atlantic Coast Population Revised Recovery Plan. Prepared by the Atlantic Coast Piping Plover Recovery Team for the USFWS Region 5.

USFWS, 1996 Significant Habitats and Habitat Complexes of the New York Bight Watershed Southern New England-New York Bight Coastal Ecosystem Program, Charlestown, Rhode Island, completed November, 1996, Published November, 1997

USFWS, 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory bird Management, Arlington, Virginia

USGS, 2003 Geology of the New York City Region. http://3dparks.wr.usgs.gov/nyc/common/introduction.htm.

Waterbird Conservation Plan for the Mid-Atlantic/New England/Maritimes Region, Appendix 2. Retrieved from Website http://www.waterbirdconservation.org/pdfs/regional/manem_appendix_2.pdf.

Waterbird Conservation for the Americas – Mid-Atlantic/New England/Maritimes. Retrieved from Website http://www.fws.gov/birds/WATERBIRDS/MANEM/INDEX.HTML.

West End Hot Spot The Cholera Banks (August 2, 2009). Retrieved June 2010 from Examiner.com Website http://www.examiner.com/x-13132-NY-Fishing-Examiner~y2009m8d2-West-end-hot-spot-the-Cholera-Banks.

White, Clayton M., Nancy J. Clum, Tom J. Cade and W. Grainger Hunt. 2002. Peregrine Falcon (*Falco peregrinus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/660.

Wiley, R. Haven and David S. Lee. 1999. Parasitic Jaeger (*Stercorarius parasiticus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/445.

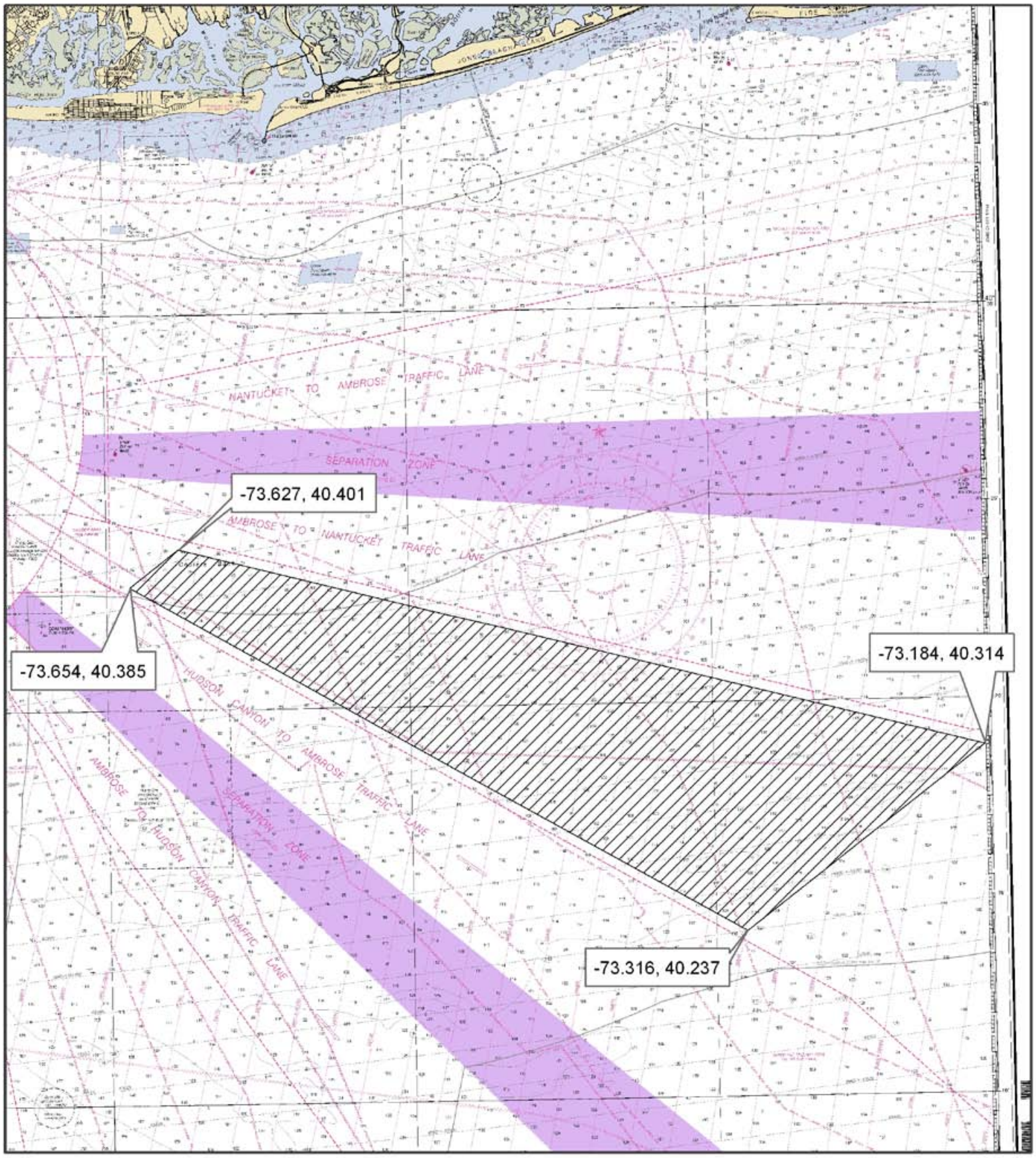
Winkelman, J.E. 1992a&b Impact of the Sep wind park near Oosterbierum the Netherlands on birds 1&2 in Percival S.M. 2001 Assessment of the Effects of Offshore wind Farms on Birds ETSU W/13/00565/REP.

Zucco C Wende W., Merck T, Köchling I., and Köppel J (eds.), (2006) Ecological Research on Offshore Wind Farms: International Exchange of Experiences,Part B: Literature Review of Ecological Impacts, BfN-Skripten 186.

APPENDIX F

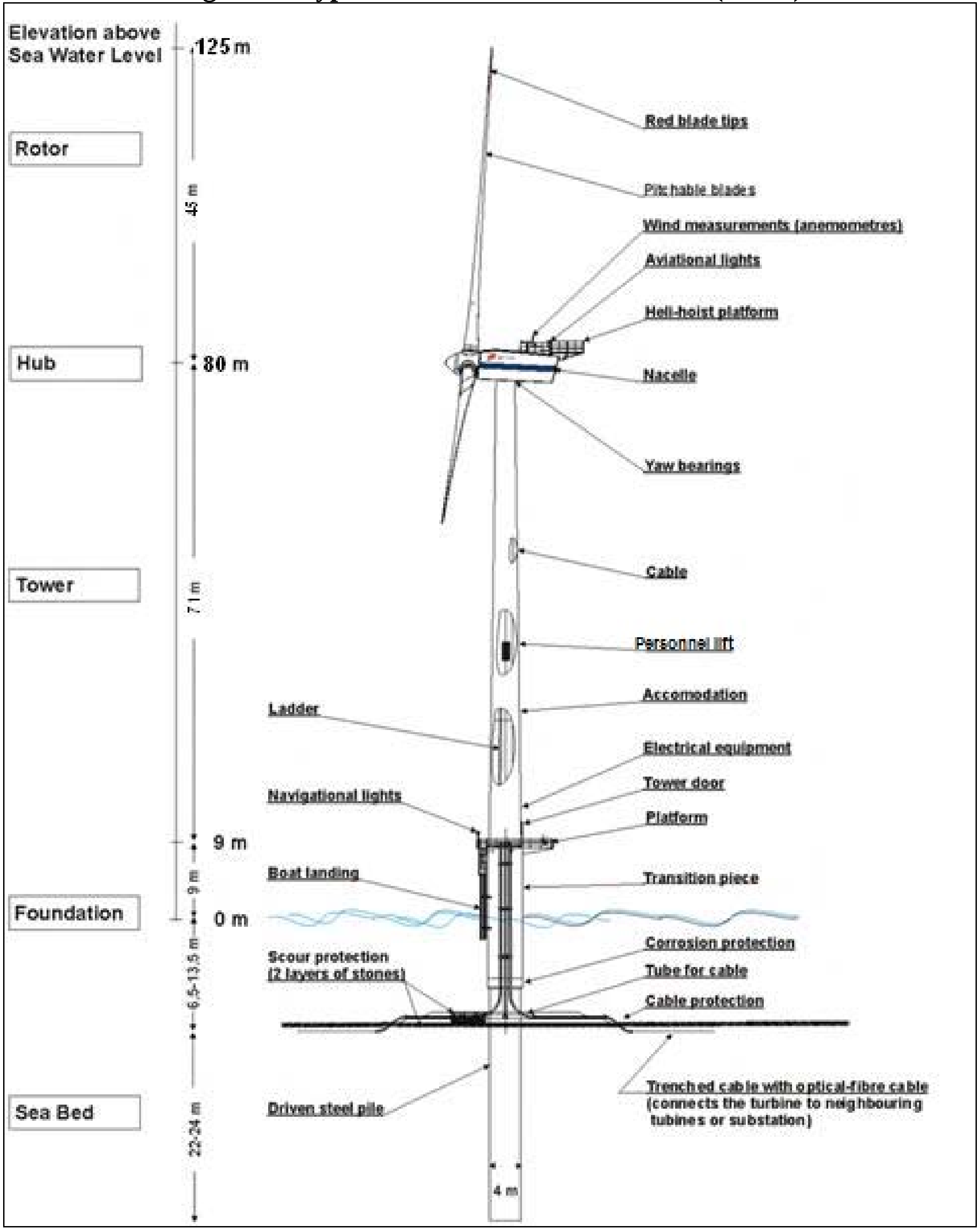
FIGURES

Figure 1: Proposed Project Area for the Long Island – New York City Offshore Wind Collaborative



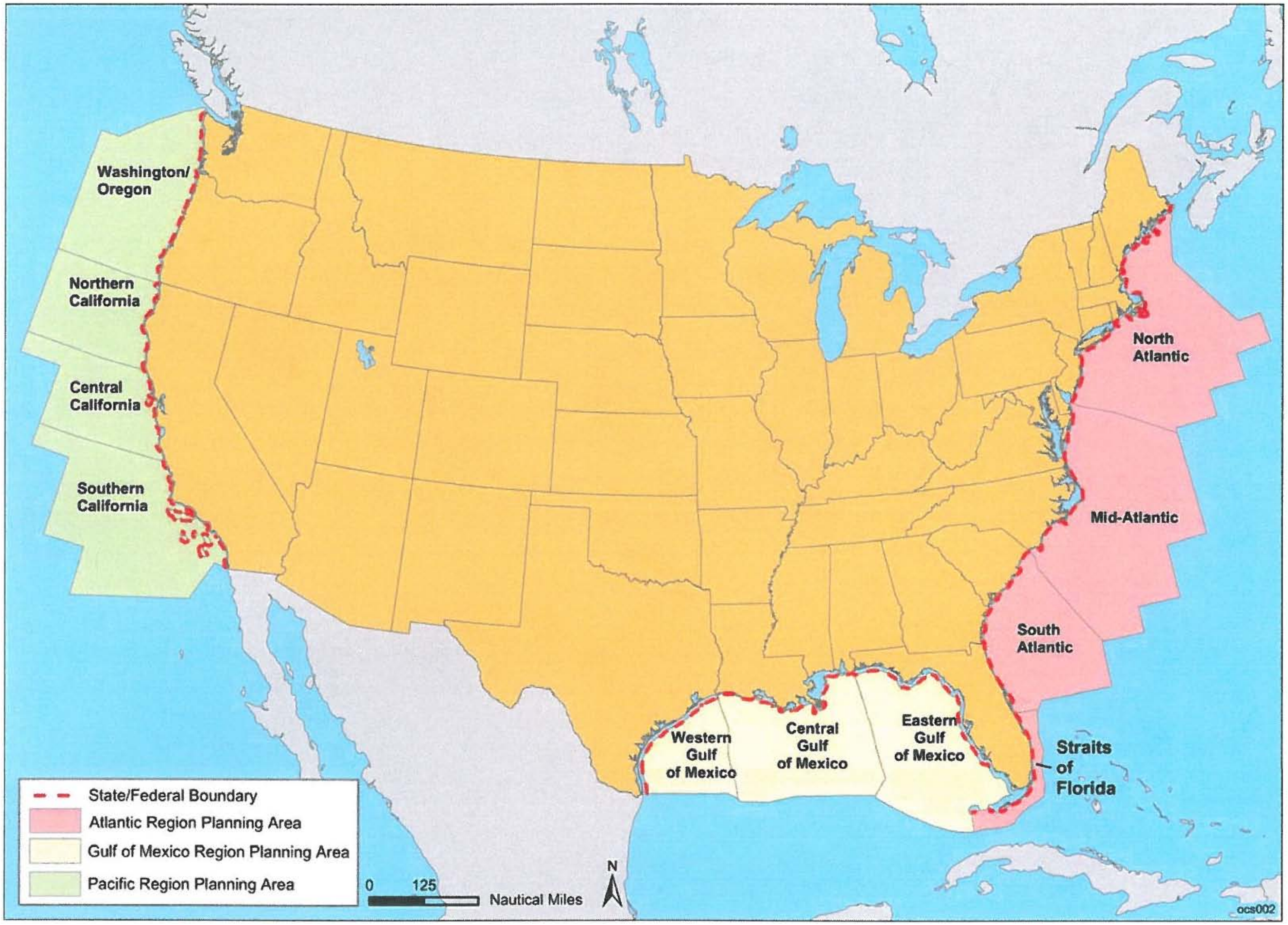
Source: AWS Truewind

Figure 2: Typical Wind Turbine Generator (WTG)



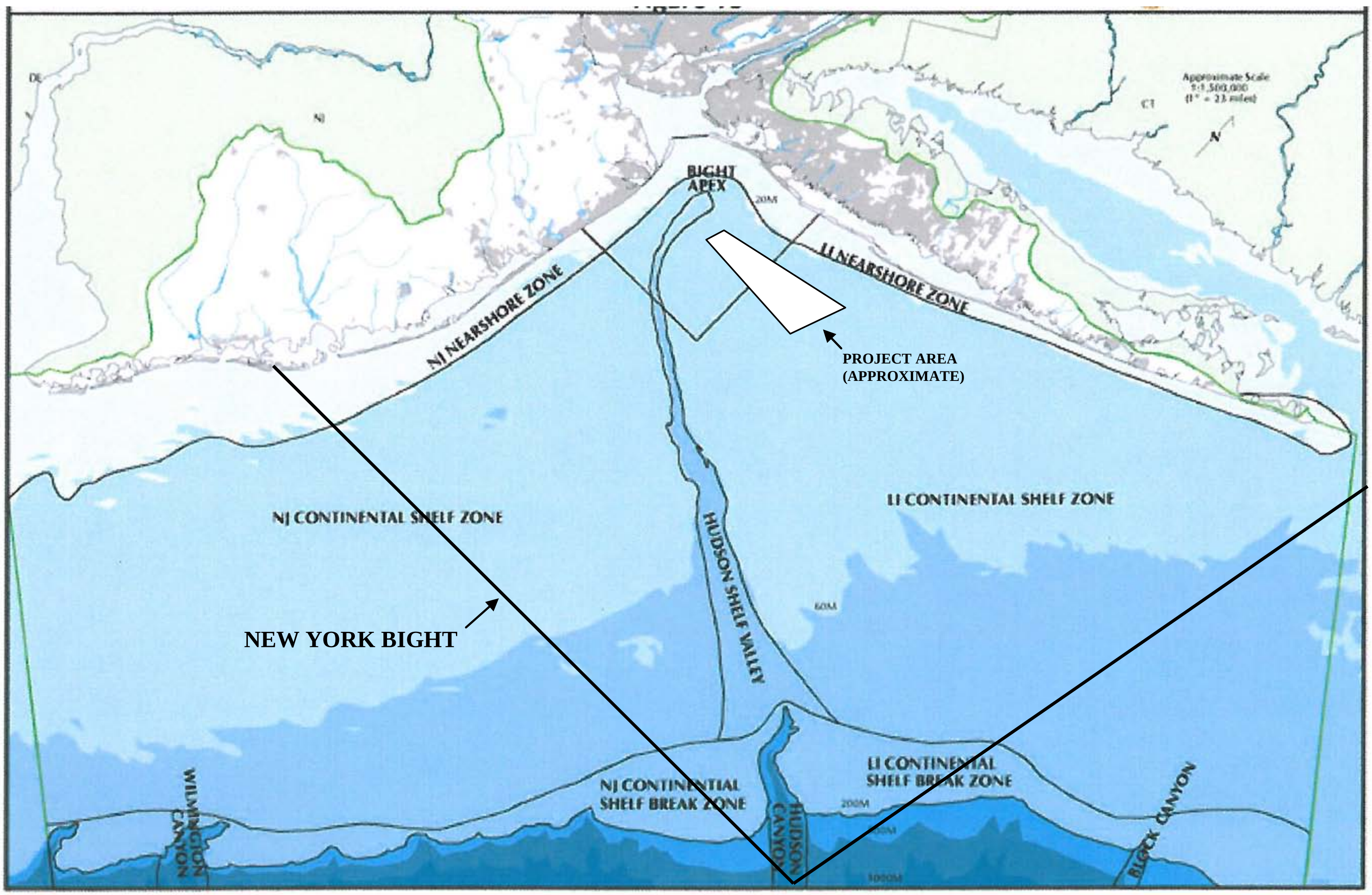
Source: Modified from the Horns Rev wind project, Vattenfall AB.

Figure 3: Regional Planning Areas on the Outer Continental Shelf



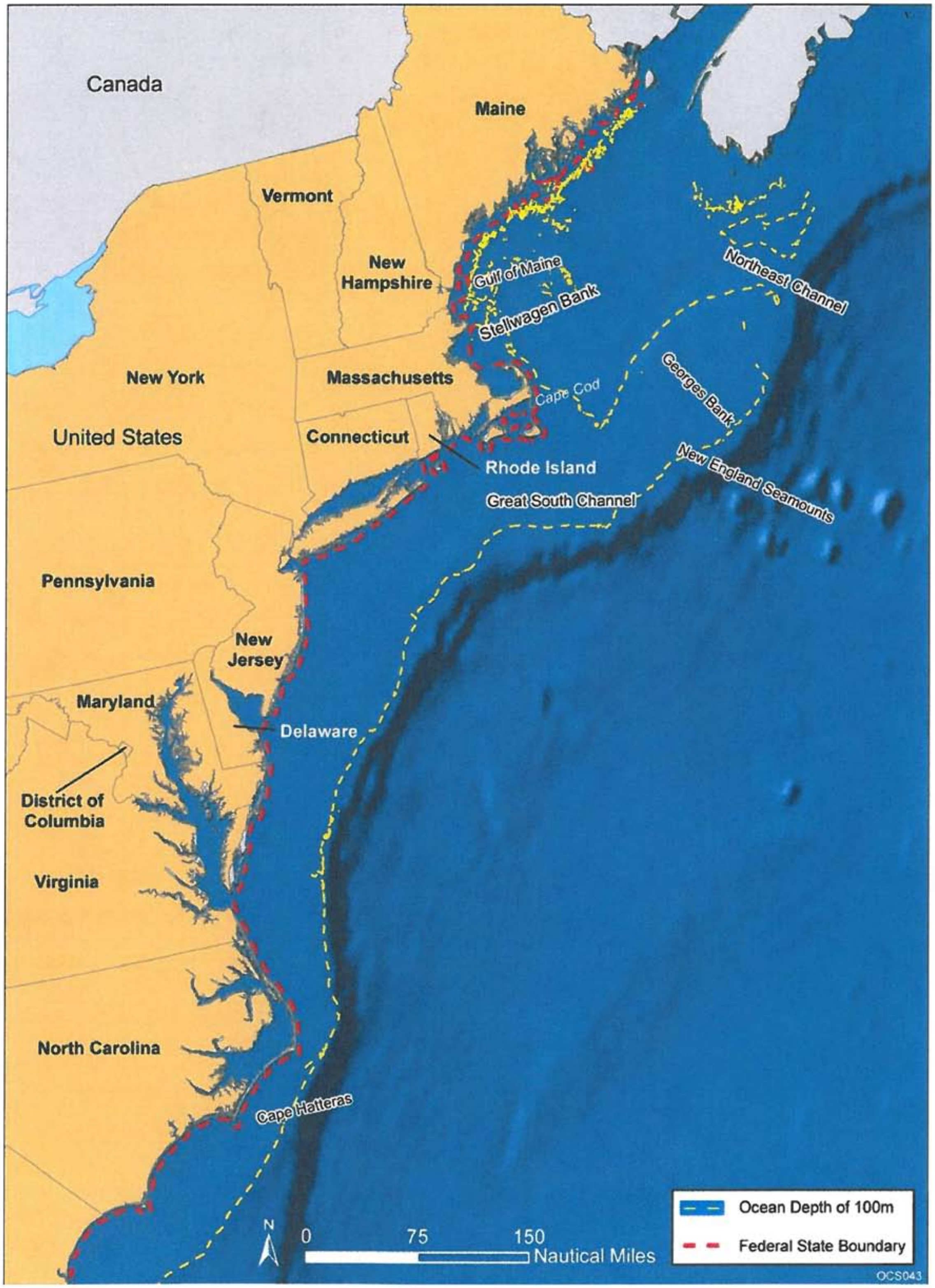
Source: MMS, 2007

Figure 4: Marine Zones of the New York Bight and Physiographic Features of the North Atlantic Region



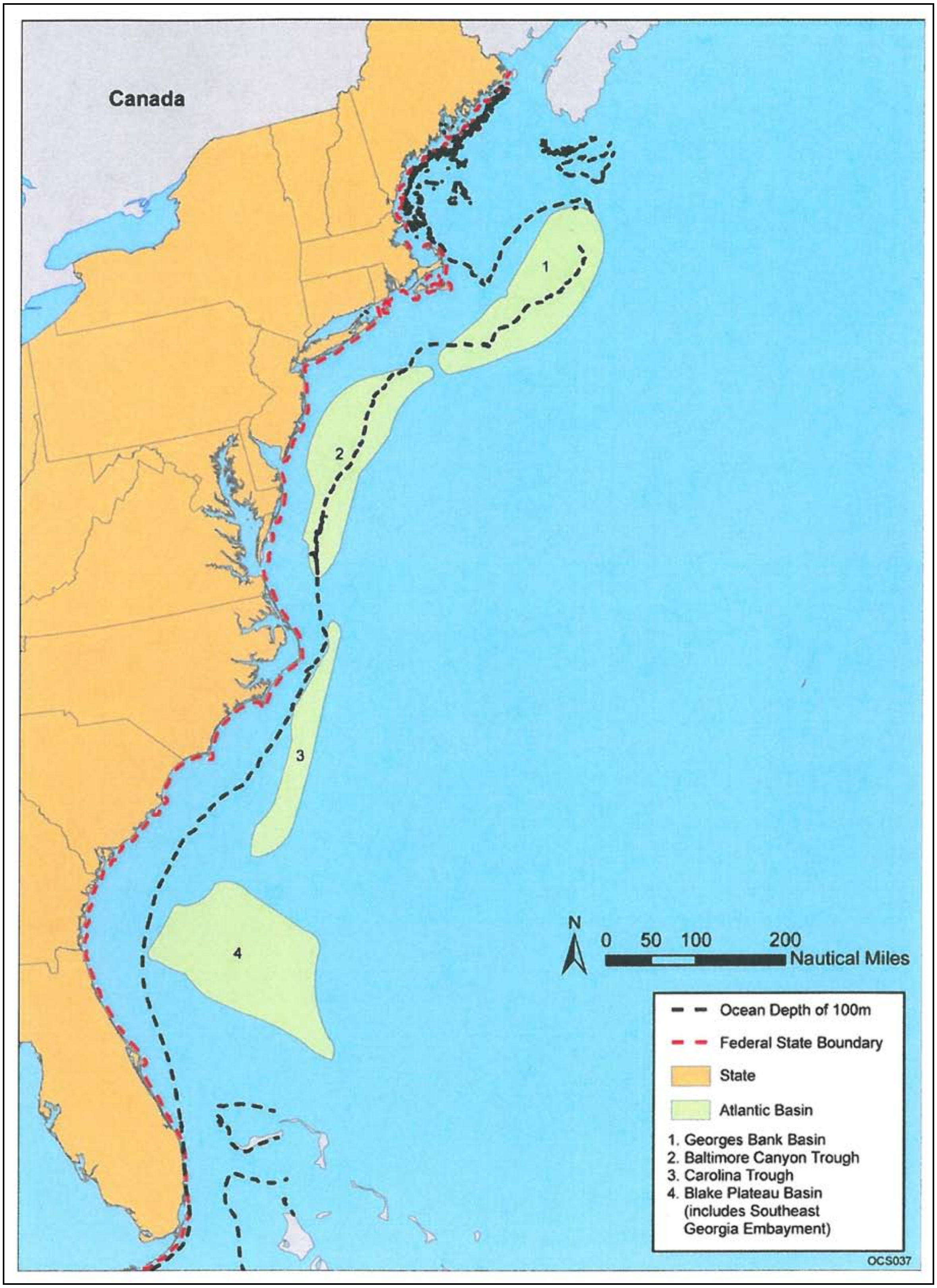
Sources: (Top) http://library.fws.gov/pubs5/web_link/images/fig18b.jpg; (Bottom) MMS PEIS, 2007

Figure 4: Marine Zones of the New York Bight and Physiographic Features of the North Atlantic Region



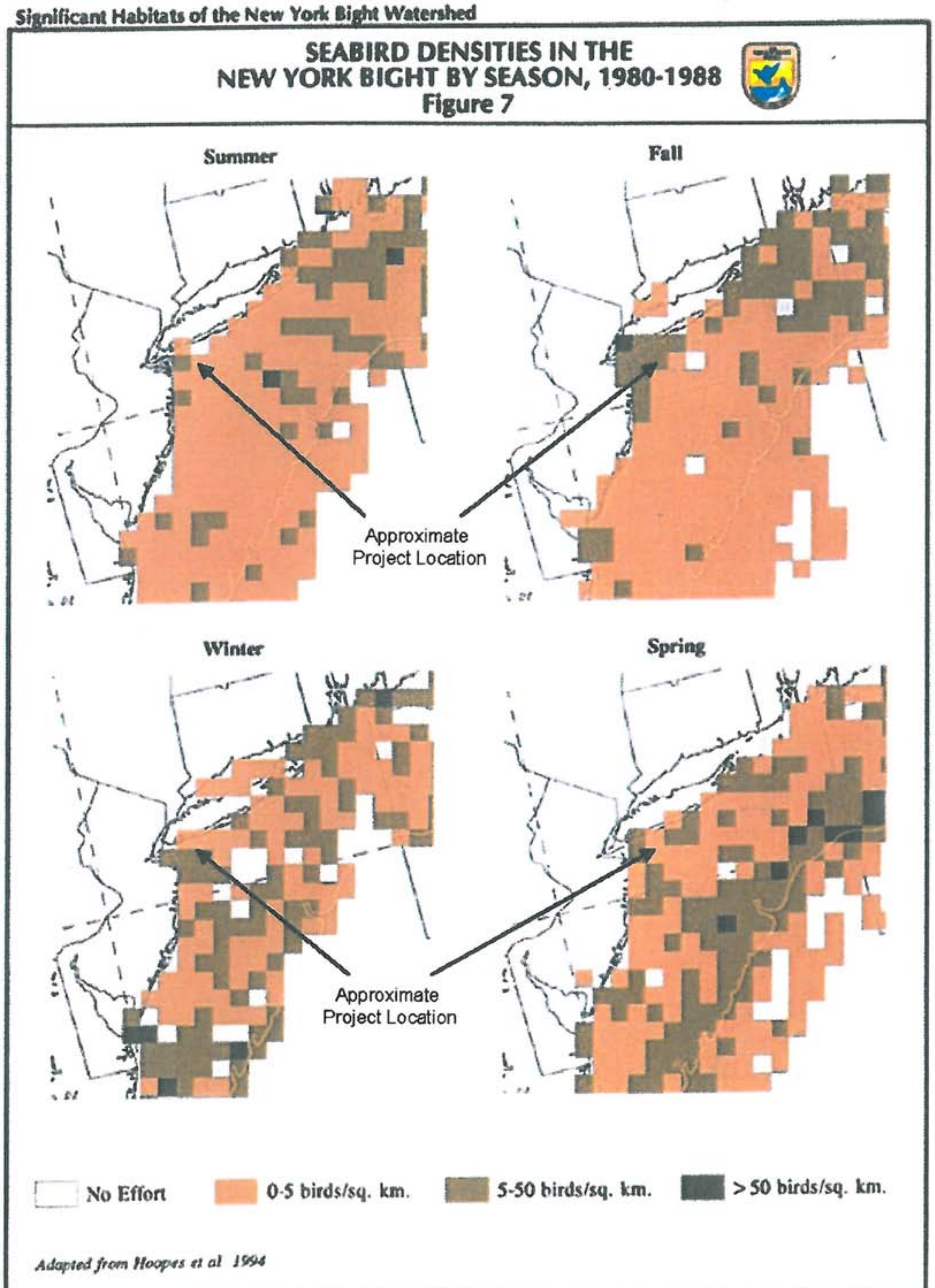
Sources: (Top) http://library.fws.gov/pubs5/web_link/images/fig18b.jpg; (Bottom) MMS PEIS, 2007

Figure 4: Marine Zones of the New York Bight and Physiographic Features of the North Atlantic Region



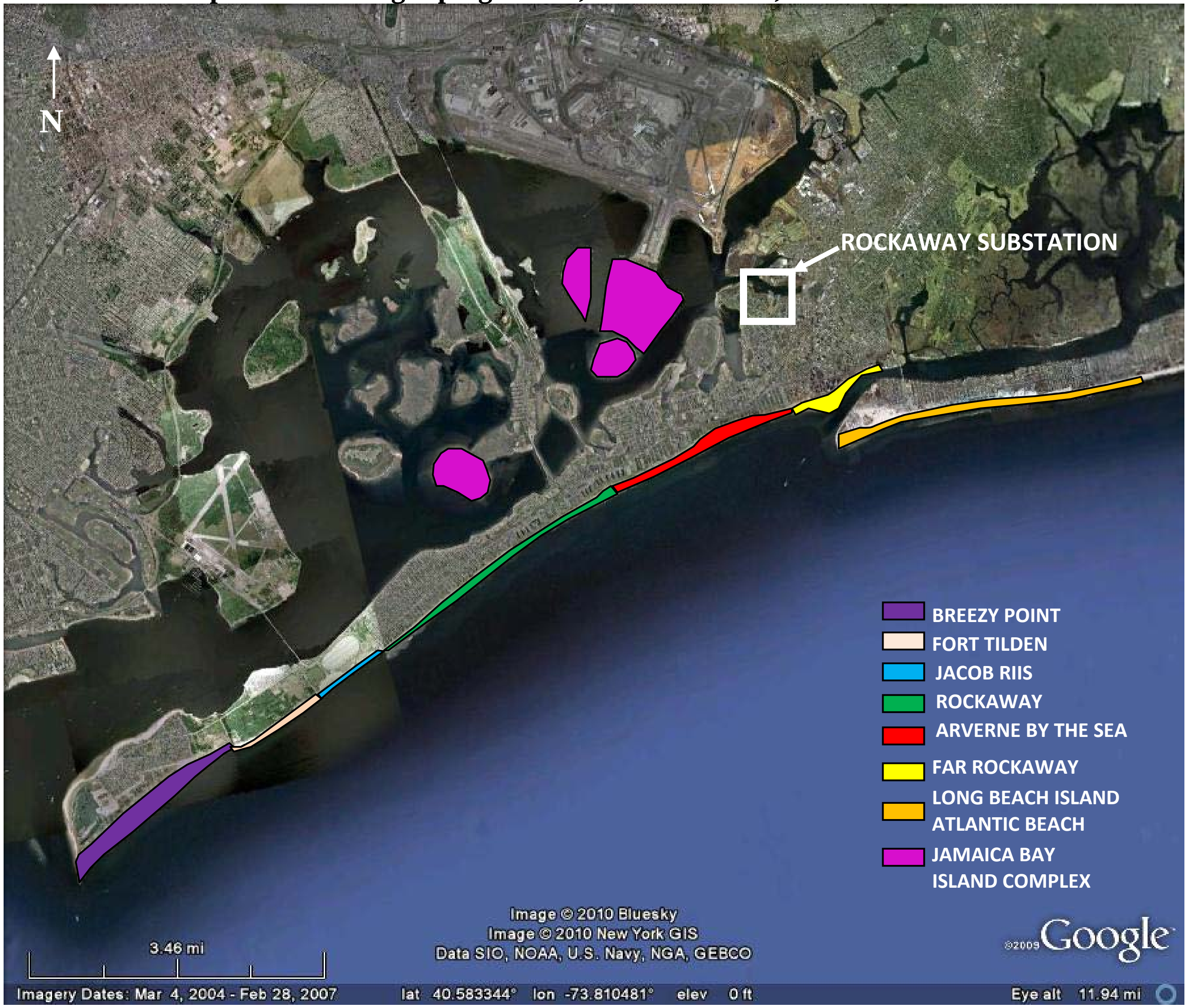
Sources: (Top) http://library.fws.gov/pubs5/web_link/images/fig18b.jpg; (Bottom) MMS PEIS, 2007

Figure 5: Density of Pelagic Birds Observed by Season in the New York Bight



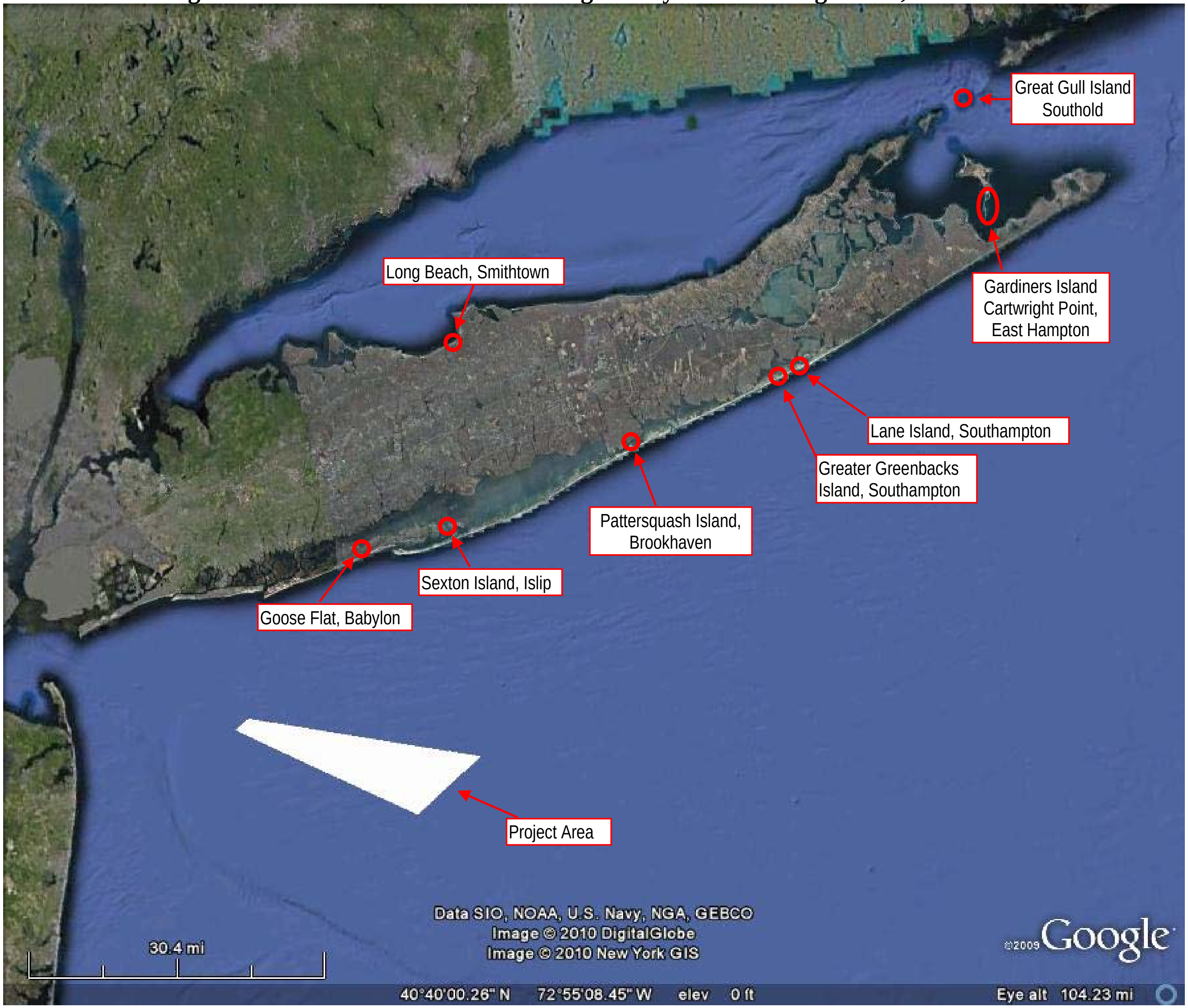
Source: USFWS Selected Seabirds of the New York Bight:
http://library.fws.gov/pubs5/web_link/tables/int_pbrd.htm
In: Volume3, Part 1 Deepwater Port License Application

Figure 6: Active Long Island Colonial Waterbird & Piping Plover Survey Sites for State-listed Species including Piping Plover, Common Tern, Least Tern and/or Roseate Tern



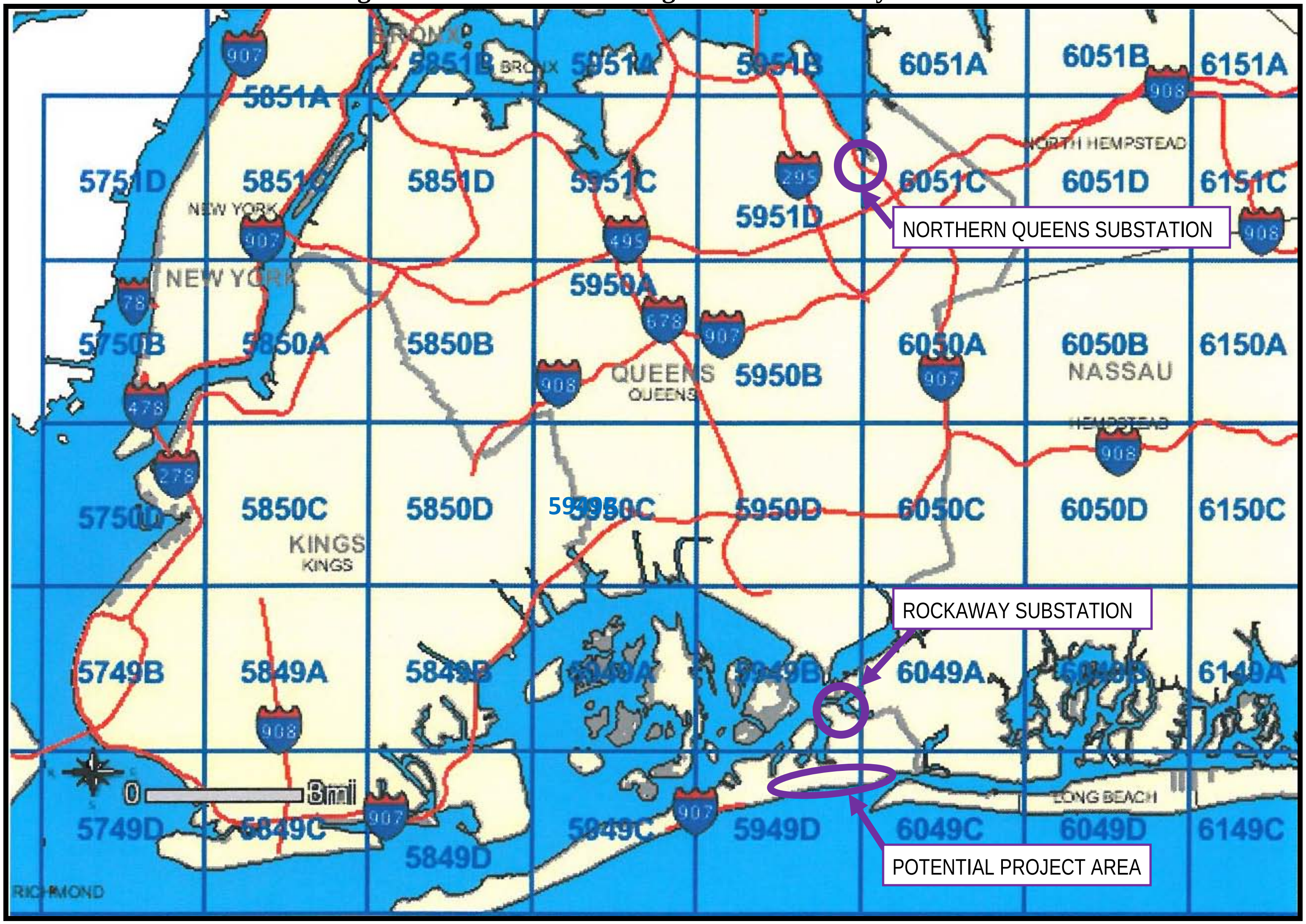
Source: NYSDEC, 2002

Figure 7: Active Roseate Tern Breeding Survey Sites on Long Island, New York



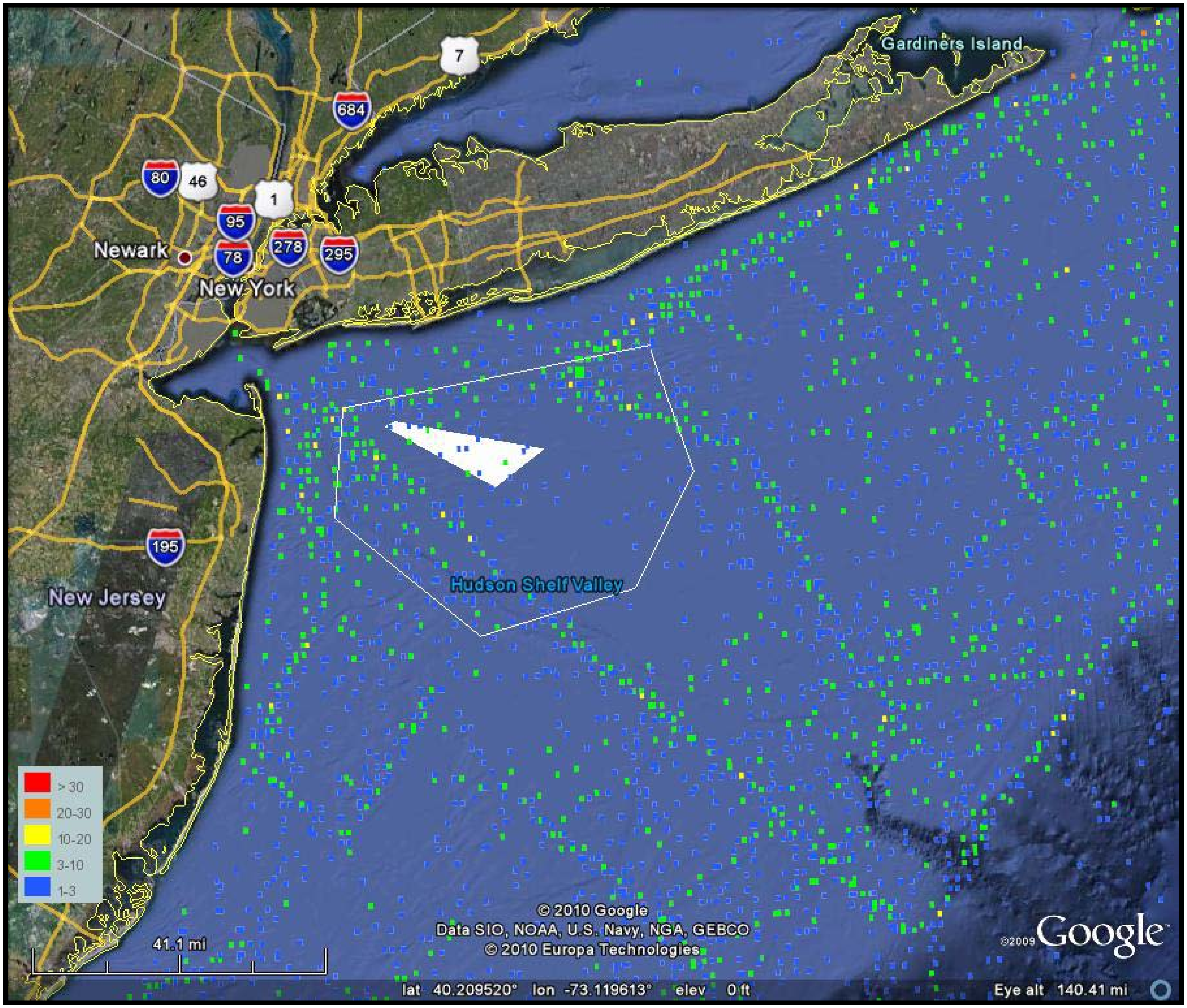
Source: NYSDEC, 2002

Figure 8: New York Breeding Bird Atlas Survey Blocks



Source: New York Department of Environmental Conservation New York Breeding Bird Atlas 2000 @ http://www.dec.ny.gov/imsmaps/bbatlas/viewer.htm

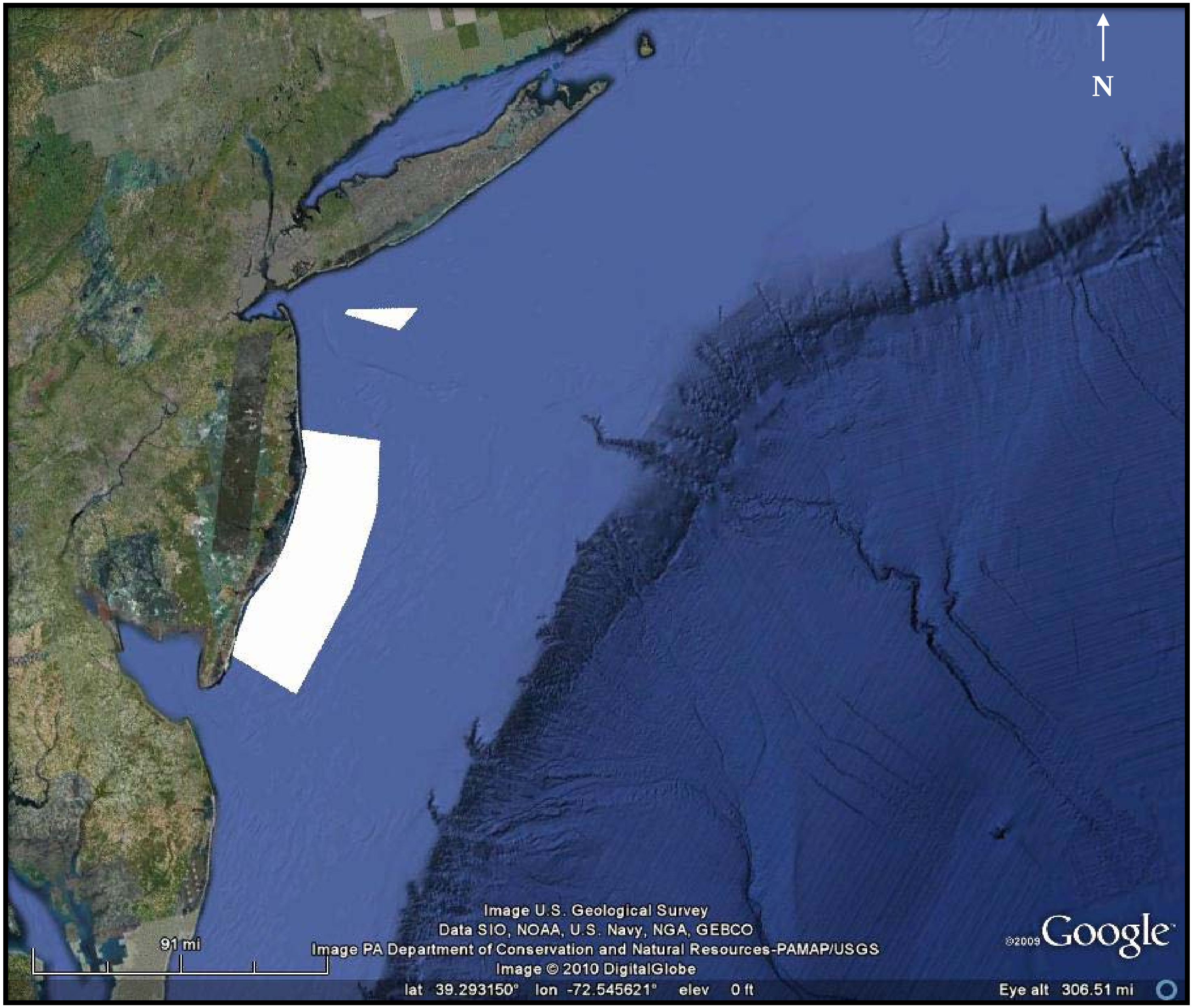
Figure 9: OBIS–SeaMap Avian Species Abundance from PIROP Northwest Atlantic Dataset



Source: OBIS Seamap @ http://seamap.env.duke.edu/

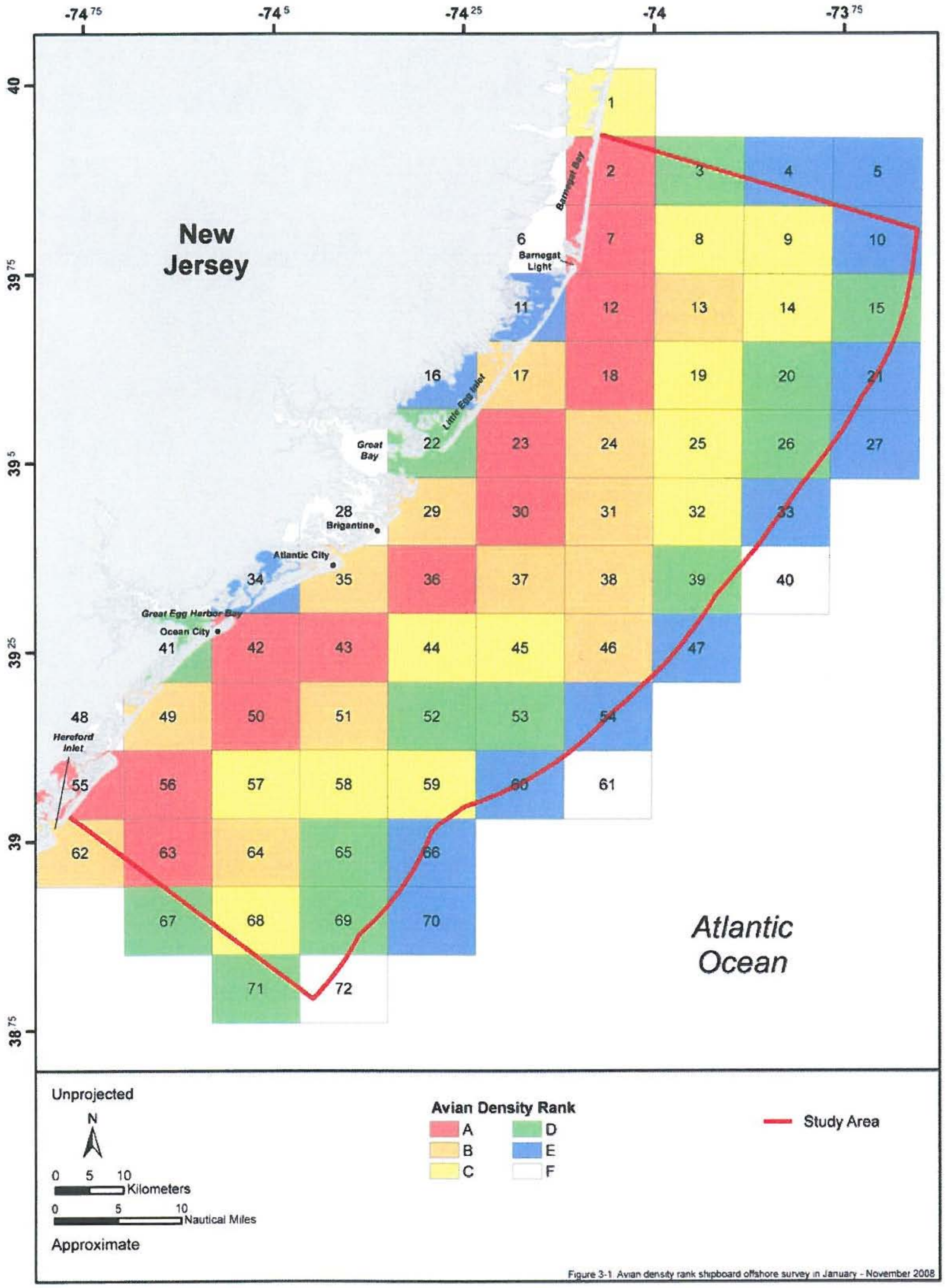
Note: Legend color blocks refer to total number of avian observations made during the boat survey at a particular latitude-longitude coordinate. Data from 1965-1992

Figure 10: Proposed Project Area in Relation to NJDEP Baseline Study Project Area



Source NJDEP, 2008

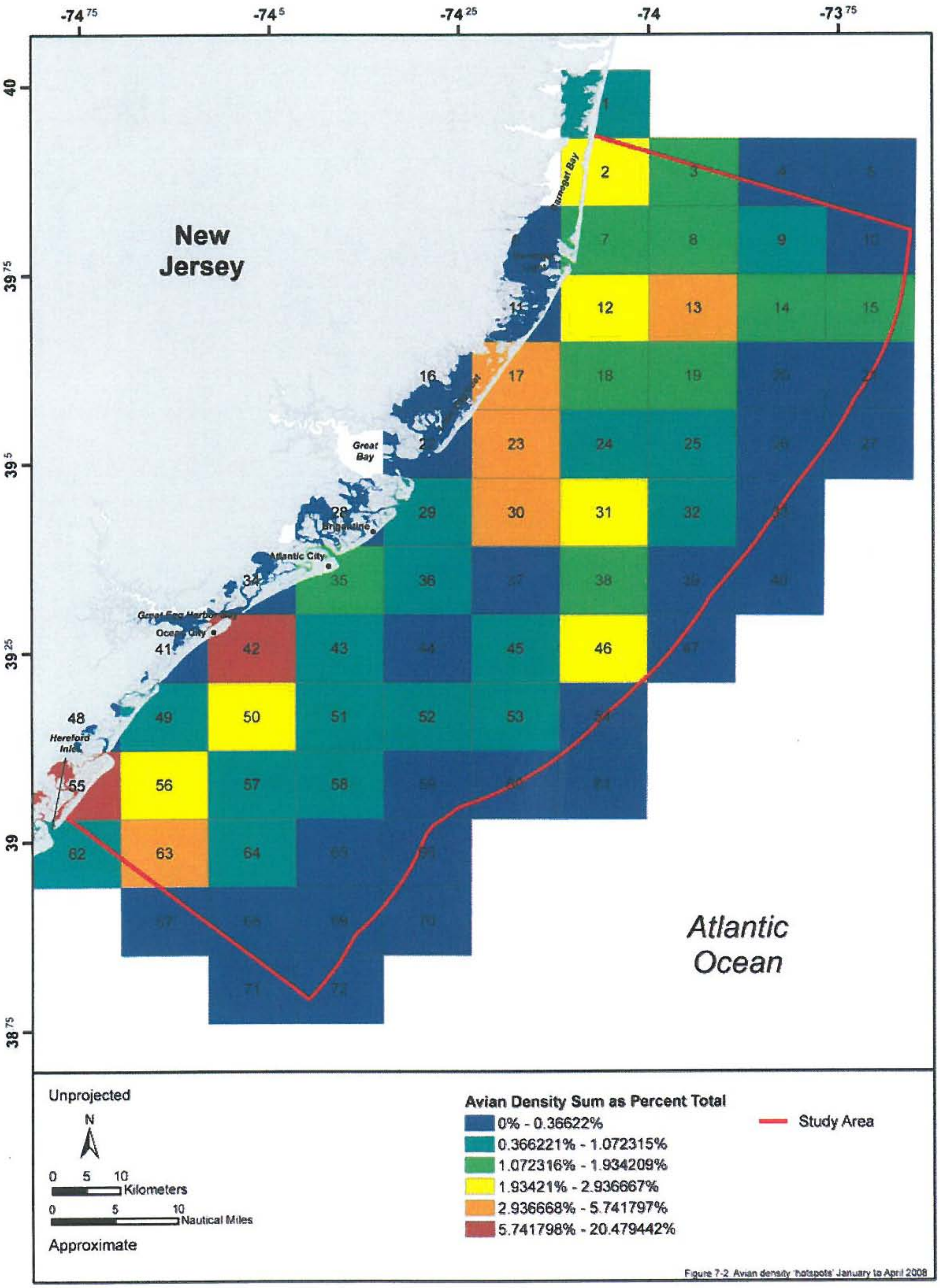
Figure 11: Cumulative Avian Density Grids from NJDEP Baseline Studies Shipboard Offshore Surveys from January through November 2008



Source: New Jersey Department of Environmental Protection Baseline Studies January-December 2008 Revised Interim Report

Note : excludes February, Cell size is ~6 mi.^{2}.

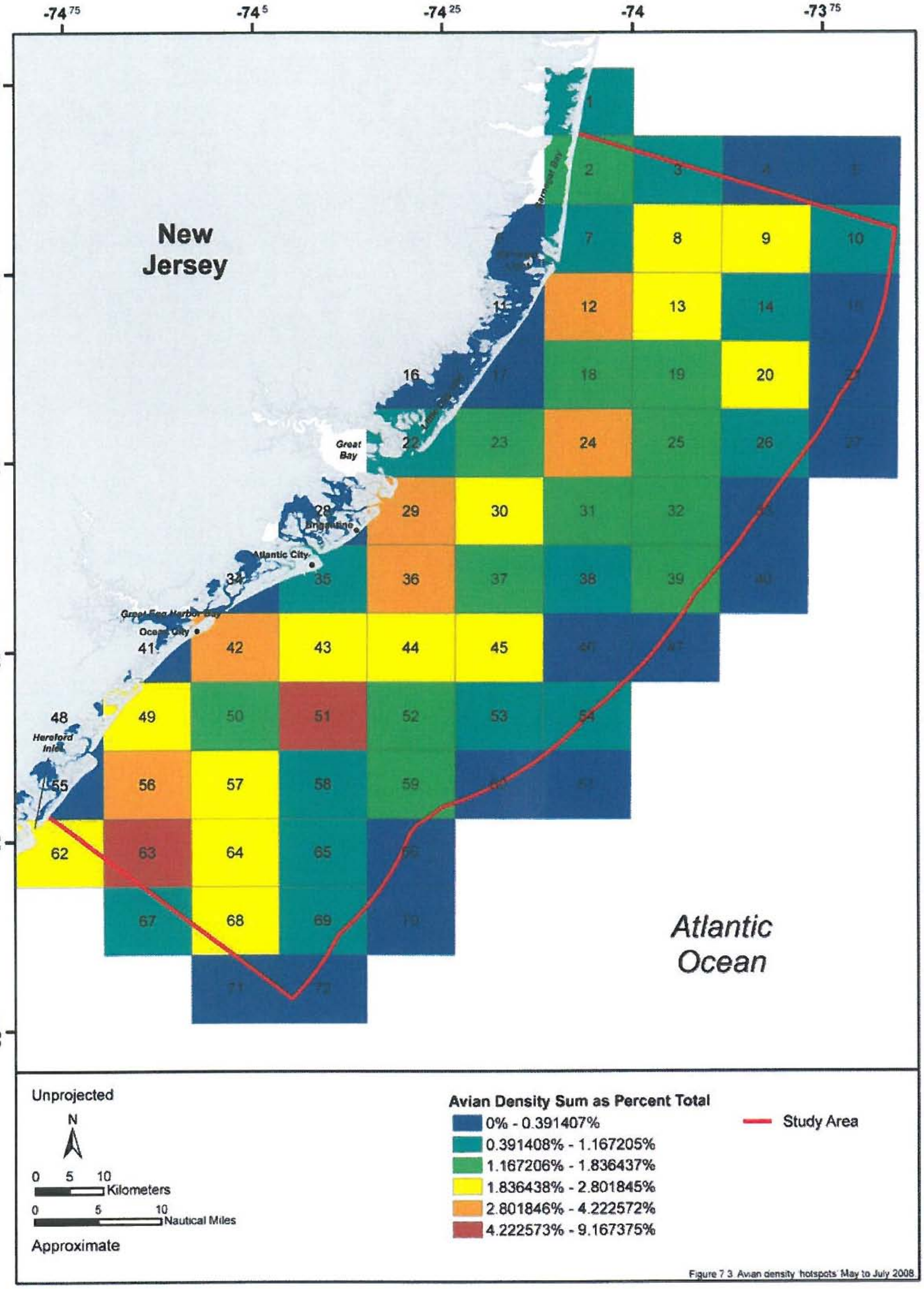
Figure 12: Winter Avian Density Grids from NJDEP Baseline Study Shipboard Offshore Surveys from January through April 2008



Source: New Jersey Department of Environmental Protection Baseline Studies January-December 2008 Revised Interim Report

Note: Cell size is ~6 mi.^{2}.

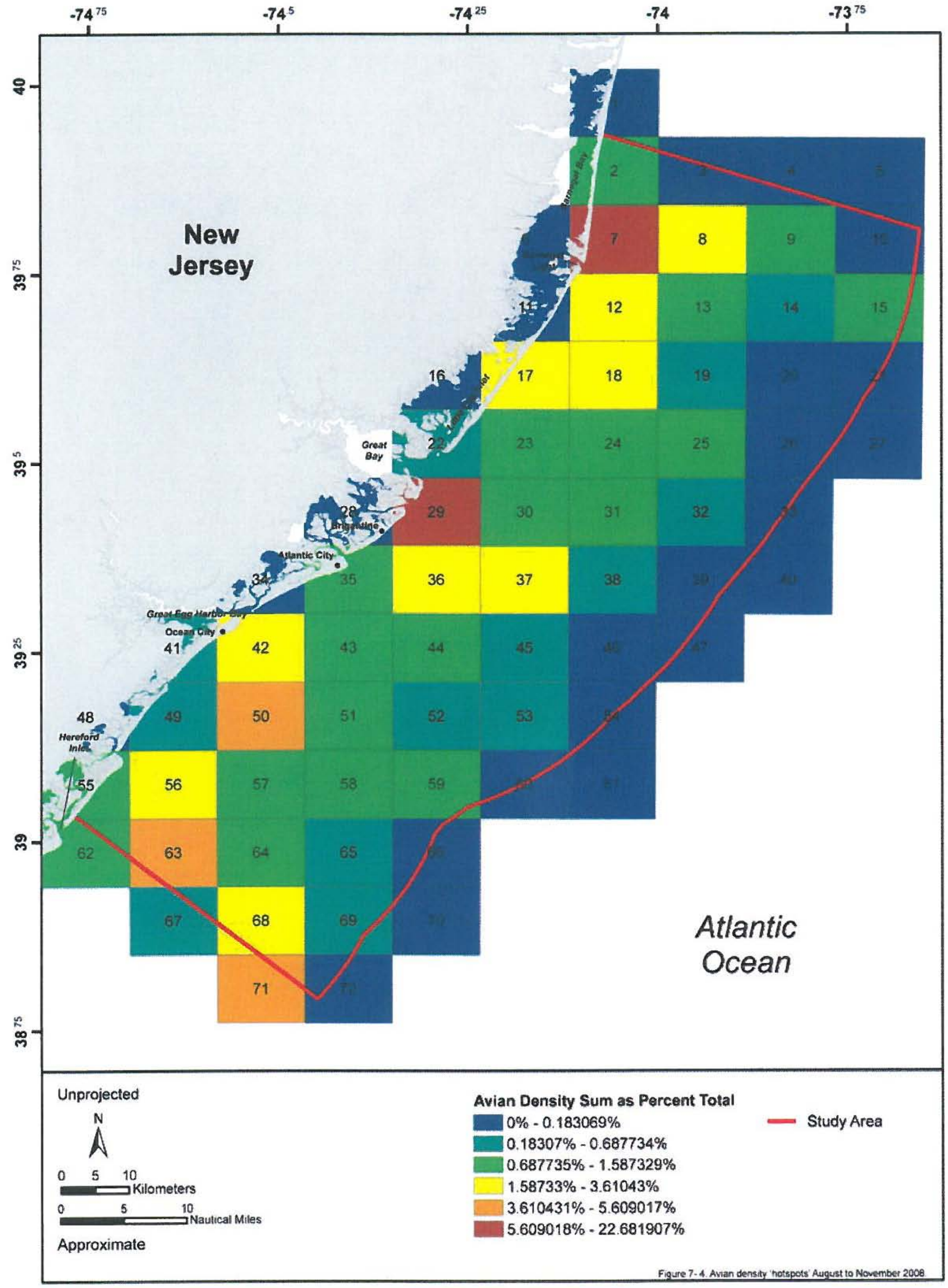
Figure 13: Spring/Summer Avian Density Grids from NJDEP Baseline Study Shipboard Offshore Surveys from May through July 2008



Source: New Jersey Department of Environmental Protection Baseline Studies January-December 2008 Revised Interim Report

Note: Cell size is ~6 mi.^{2}

Figure 14: Summer/Fall Avian Density Grids from NJDEP Baseline Studies Shipboard Offshore Surveys from August through November 2008



Source: New Jersey Department of Environmental Protection Baseline Studies January-December 2008 Revised Interim Report

Note: Cell size is ~6 mi.^{2}.

Figure 15: Flight Trajectories During Initial Operation of Wind Turbines.

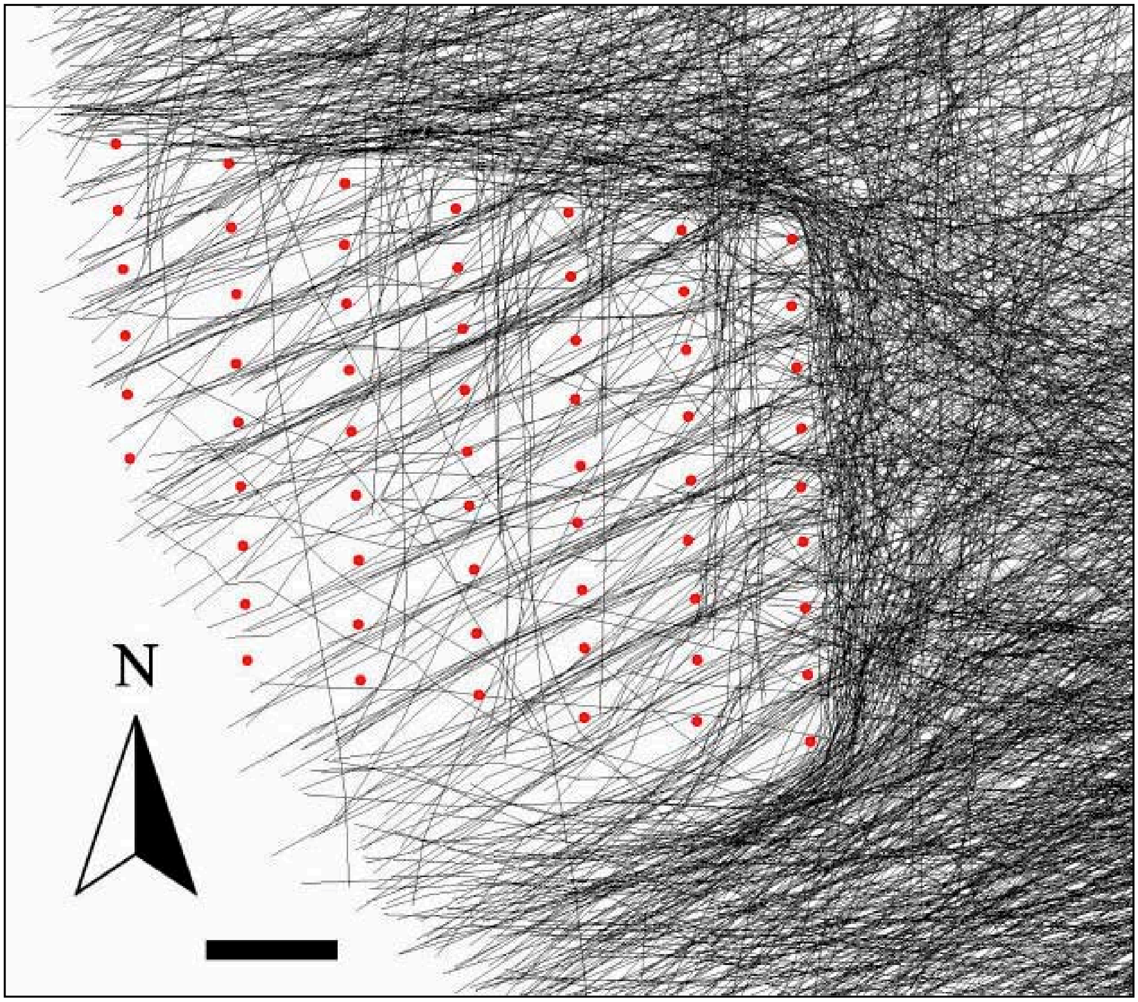


Figure 15 shows the westerly oriented flight trajectories during the initial operation of the wind turbines. Black lines indicate migrating waterbird flocks; red dots indicate wind turbines.

Scale bar = 1000 m.

Source: Desholm M. and J Kahlert Avian collision risk at an offshore wind farm. Biol Lett. 2005 September 22; 1(3): 296–298. Published online 2005 June 9. doi: 10.1098/rsbl.2005.0336. Copyright © 2005 The Royal Society.

APPENDIX T

TABLES

Table 1: Selected Seabirds of the New York Bight

Scientific Name	Common Name	Seasonal Use	Distribution
Gaviiformes (Loons)			
Gavia immer	Common Loon	M/W	coastal/pelagic/bays
Gavia stellata	Red-throated Loon	M/W	coastal/pelagic/bays
Podicipediformes (Grebes)			
Podiceps auritus	Horned grebe	M/W	coastal/bays
Podiceps grisegena	Red-necked Grebe	M/W	coastal/bays
Procellariiformes (Tube-nosed Swimmers)			
Calonectris diomedea	Cory's Shearwater	S/W	pelagic
Fulmarus glacialis	Northern Fulmar	M/W	pelagic
Oceanites oceanicus	Wilson's Storm-petrel	S/M	pelagic
Oceanodroma leucorhoa	Leach's Storm-petrel	S/M	pelagic
Puffinus gravis	Greater Shearwater	S/M	pelagic
Puffinus griseus	Sooty shearwater	S/M	pelagic
Puffinus puffinus	Manx Shearwater	S/M	pelagic
Pelecaniformes (Totipalmate Swimmers)			
Sula bassanus	Northern Gannet	M/W	pelagic/coastal
Anseriformes (Waterfowl) **Mergini (Eiders, Scoters Mergansers and Allies)**			
Clangula hyemalis	Oldsquaw	M/W	coastal/bays
Histrionicus histrionicus	Harlequin Duck	W	coastal
Melanitta nigra	Black Scoter	M/W	coastal/bays
Melanitta perspicillata	Surf Scoter	M/W	coastal
Mergus serrator	Red-breasted Merganser	M/W	coastal/bays
Somateria mollissima	Common Eider	M/W	coastal/bays
Somateria spectabilis	King Eider	W	coastal
Charadriiformes (Shorebirds, Gulls and Alcids) **Scolopacidae (Sandpipers and Allies)**			
Phalaropus fulicaria	Red Phalarope	M	pelagic
Phalaropus lobatus	Red-Necked Phalarope	M	pelagic
Laridae (Skuas, Gulls, Terns and Skimmers)			
Catharacta skua	Great Skua	M/W	pelagic
Larus argentatus	Herring Gull	B/M/W	bays/coastal/pelagic
Larus marinus	Great Black-backed Gull	B/M/W	bays/coastal/pelagic
Rissa tridactyla	Black-legged Kittiwake	M/W	pelagic
Stercoratrius parasiticus	Parasitic Jaeger	M	pelagic
Stercoratrius pomarinus	Pomarine Jaeger	M	pelagic
Alcidae (Auks)			
Alca torda	Razorbill	W	pelagic
Alle alle	Dovekie	W	pelagic
Uria lomvia	Thick-billed Murre	W	pelagic

B=Breeding M=Migrant W=Winter S=Summering
Distribution: primary distribution of species in the New York Bight; multiple distributions are in declining order of use; bays = enclosed or semi-enclosed coastal bays, coastal = the nearshore waters of the New York Bight within sight of land, pelagic = offshore waters of the New York Bight out of sight of land.
Source: USFWS Selected Seabirds of the New York Bight:
http://library.fws.gov/pubs5/web_link/tables/int_pbrd.htm

Table 2. Summary of Avian Species that may Utilize New York Bight Waters

Species	WCP Ranking	NY & NJ State Status	Distribution Habitats & Behavior	Seasonal Occurrence	Regional Threats/Limiting Factors	Comments
Common Eider *Somateria mollissima*	--	--	Marine coasts	Migratory, Wintering	Chronic oil contamination, hunting, habitat degradation	Most flight within 0-5 meters Known avoidance behavior to wind farms during migration
Har equin Duck *Histrionicus historionicus*	--	--	Coastal in wintering areas	Wintering	Onshore habitat degradation	Found along coasts often near jetties and natural rocky areas. Not very abundant in LI waters
White-Winged Scoter *Melanitta fusca*	--	--	Winter in large bays and estuaries, coastal	Migratory, Wintering	Hunting, susceptible to marine pollutants and oil spills	Most flight within 0-5 meters of sfc. Most activity closer to shore. Known avoidance of wind farms.
Surf Scoter *Melanitta perspicillata*	--	--	Shallow coastal in winter but some offshore	Migratory, Wintering	Hunting, susceptible to marine pollutants	Most flight within 0-5 meters of sfc. Most activity close to shore. Known avoidance of wind farms.
Black Scoter *Melanitta nigra*	--	--		Migratory, Wintering	Hunting, susceptible to marine pollutants	Most flight within 0-5 meters of sfc. Most activity close to shore.
Long-tailed Duck *Clangula hyemalis*	--	--	Primarily coastal marine waters in winter	Migratory, Wintering	--	Most flight between 0-10 m. Roosting flights can be between 7-50 m. Generally coastal but can be found offshore. Known wind farm avoidance
Red-breasted Merganser *Mergus serrator*	--	--	In winter coastal estuaries and bays	Migratory, Wintering	--	Most found inshore but can be found further offshore. May be attracted to wind farm areas due to increased fish availablity
Red-throated Loon *Gavia stellata*	High	S2 – Imperiled	Bays, Estuaries, Seacoasts, Inner Continental Shelf	Migratory, Wintering (Sept-Feb)	Fish net/line entanglement, oil spills, environmental pollutants, impact/ collision with turbine, wire or other stationary structures	Most flight 5-10 m above sfc May be found nearshore and offshore. Known avoidance behavior to wind farms
Common Loon *Gavia immer*	Moderate	NY – Special Concern S3 – Vulnerable S4 – Apparently Secure	Bays. Marshes, Lakes/Rivers, Islands, Seacoasts, Open Water	Migratory, Wintering (Sept-Feb)	Habitat loss due to shoreline development, fish net entanglement, environmental pollutants	Most flight 5-10 m above sfc Most known activity closer to shore. Migratory and offshore use needs further study

Species	WCP Ranking	NY & NJ State Status	Distribution Habitats & Behavior	Seasonal Occurrence	Regional Threats/Limiting Factors	Comments
Horned Grebe *Podiceps auritus*	High	--	Estuaries, Seacoasts, Inland Waterbodies	Migratory, Wintering (Sept-Feb)	Oil spills, disease, predation	Mostly found in near shore waters
Red-necked Grebe *Podiceps grisegena*	Moderate	--	Bays, Estuaries, Seacoasts, Shallow Open Water	Migratory, Wintering (Sept-Feb)	Chemical pollutants, botulism, oil spills, gill net entanglement, hunting	Most flight within 5-10 m of sfc. Mostly found in near shore waters
Northern Fulmar *Fulmarus glacialis*	Moderate	--	Pelagic (rarely >60 miles offshore)	Migratory, Wintering (March-Feb)	Oil spills, environmental pollutants, fish net entanglement, reduction in commercial fishing activities, climate change	Most flight within 0-5 m of sfc. Common to abundant in offshore NY bight waters.
Cory's Shearwater *Calonectris diomedea*	Moderate	--	Pelagic	Migratory, Summering (May-Nov)	--	Generally fly low within 10 m of sfc. May occur in large numbers in offshore areas
Greater Shearwater *Puffinus gravis*	High	--	Pelagic	Migratory, Summering (May-Nov, June/July Peak)	Oil spills, fisheries	Generally fly low within 10 m of sfc. Can be found in large numbers in offshore areas
Sooty Shearwater *Puffinus griseus*	Moderate	--	Pelagic	Migratory, Summering (June-Nov)	Oil spills, environmental pollutants, gill net entanglement	Most flight within 0-5 m of sfc. Common to abundant off L I coast
Manx Shearwater *Puffinus puffinus*	Moderate	--	Pelagic, Coastal Inshore	Migratory, Summering (Feb-Oct)	Environmental pollutants, over fishing, climate change	Generally fly low within 10 m of sfc Not abundant in L I waters
Audubon's Shearwater *Puffinus Iherminieri*	High	--	Pelagic	Wintering (Apr-Nov)	Unknown	Most flight low over sfc. Most abundant when water temperature is at its warmest
Wilson's Storm-petrel *Oceanites oceanicus*	Low	--	Pelagic	Migratory, Summering (April-Sept)	Environmental pollutants, climate change	Most flight within 0-5 meters of sfc. Can occur in large numbers in offshore areas in summer.
Leach's Storm-petrel *Oceanodroma leucorhoa*	Low	--	Pelagic (forages within 130 miles of land but uncommon within 30 miles), Islands (breeding)	Migratory, Summering (April-Oct)	Habitat degradation due to introduced predators, predation, environmental pollutants, oil spill, human disturbance	Most flight within 0-5 meters of sfc. Less common in LI waters than Wilson's Storm Petrel
Northern Gannet *Sula bassanus*	Low	--	Pelagic (forages intensely <40 miles off shore	Migratory, Wintering (Sept-Feb)	Introduced predators, net/line entanglement, environmental pollutants, climate change	Most flight within 10-20 m Known avoidance behavior to wind farms

Species	**WCP Ranking**	**NY & NJ State Status**	**Distribution Habitats & Behavior**	**Seasonal Occurrence**	**Regional Threats/Limiting Factors**	**Comments**
Brown Pelican *Pelecanus occidentalis*	Moderate	--	Coastal, Estuaries, Ponds, Open Water (<50 miles offshore)	Breeding, Migratory, Wintering	Habitat degradation, nest/roost site disturbance and flooding, environmental pollutants	Uncommon visitor in summers in coastal areas
Double-crested Cormorant *Phalacrocorax auritus*	Low	S3 – Vulnerable	Seacoasts, Shallow Open Water (<20 miles offshore)	Wintering (Sept-April)	Environmental pollutants, predation, lethal control of adults	Flight often within rotor height, Forage in more inshore areas, Known to habituate
Great Cormorant *Phalacrocorax carbo*	Moderate	--	Seacoasts, Cliffs, Lakes/Rivers	Wintering (Sept-Feb)	Human disturbance, food shortage	Most activity closer to shore
Osprey *Pandion haliaetus*	--	NY – Special Concern	--	Breeding Migratory	--	May migrate through project area. May forage offshore.
Northern Harrier *Circus cyaneus*	--	NY - Threatened	--	Breeding Migratory	--	May migrate through project area.
Peregrine Falcon *Falco peregrinus*	--	NY –Endangered	--	Migratory Breeding	--	May migrate through project area. May forage offshore
Piping Plover *Charadius melodus*		NY –Endangered Fed-Threatened	Open Sandy Beaches	Breeding (Apr-Aug)		Migratory movements in Long Island area not well known
Red-necked Phalarope *Phalaropus lobatus*	--	--	Pelagic shelf breaks	Migratory	--	Utilizes offshore waters
Red Phalarope *Phalaropus fulicaria*	--	--	Mostly pelagic, shelf breaks, but some inshore	Migratory	--	Utilizes offshore waters
Black-legged Kittiwake *Stercorarius parasiticus*	Low	--	Pelagic, Seacoasts, Bays, Estuaries, Islands, Cliffs (6 miles or more offshore)	Migratory, Wintering (Sept-Feb)	Over fishing, Oil spill	Most flight within 5-10 m of sfc. Can be abundant in offshore waters. Will enter wind farm areas, may be vulnerable to collsions
Bonaparte's Gull *Chroicocephalus philadelphia*	Moderate	--	Bays, Seacoasts, Estuaries, Marshes, Lakes/Rivers, Pelagic (<15 miles offshore)	Wintering (Sept-April)	Near shore threats, oil spill Sensitive to human disturbance at nest sites	Can be found in offshore waters
Laughing Gull *Leucophaeus atricilla*	Low	S1 – Critically Imperiled	Bays, Seacoasts, Estuaries, Islands	Breeding (March-Aug)	Habitat loss and degradation due to coastal development, predation, environmental pollutants, aircraft collisions, rack deposits, climate change	Can be found in offshore waters
Ring-billed Gull *Larus delawarensis*	Low	S4 – Apparently Secure	Bays, Seacoasts, Estuaries, Fields, Lakes/Rivers	Migratory, Wintering (Sept-Feb)	Habitat degradation and loss due to erosion and flooding, nest site disturbance, environmental pollutants	Most common in inshore areas, however, can be found in offshore waters

Species	WCP Ranking	NY & NJ State Status	Distribution Habitats & Behavior	Seasonal Occurrence	Regional Threats/Limiting Factors	Comments
Herring Gull *Larus Argentatus*	Low	S5 – Secure / Abundant	Bays, Estuaries, Seacoasts, Cliffs, Intertidal/Subtidal (<20 miles offshore)	Breeding, Migratory, Wintering (All Year)	Habitat loss, disturbance & predation at nesting colonies, oil spills, environmental pollutants, over fishing, climate change	Can be found offshore. Known to fly at rotor height Often associated with fishing vessels
Lesser Black-backed Gull *Larus Fuscus*	Moderate	--	Bays, Estuaries, Tundra, Lakes/Rivers, Rocky or Sandy Coast	Migratory, Wintering (Sept-March)	Environmental pollutants	Most flight 20-50 m of sfc. Not abundant in area
Glaucous Gull *Larus hyperboreus*	Low	--	Coastal, Pelagic, Inland Waterbodies, Intertidal, Cliffs	Wintering (Dec-April)	Oil spill, environmental pollutants	Can be found offshore, not abundant in area
Great Black-backed Gull *Larus marinus*	Low	S3 – Vulnerable	Seacoasts, Islands, Inland Waterbodies, Intertidal/Subtidal (<60 miles offshore, intensely <15 miles)	Breeding, Migratory, Wintering (All Year)	Human disturbance during breeding, aircraft collision, oil spills	Can be found offshore. Known to fly at rotor height
Least Tern *Sternula antillarum*	High	NY – Threatened S3 – Vulnerable NJ – Threatened	Bays, Estuaries, Coastal, Rivers/Lakes, Beaches, Shallow Open Water	Breeding, Migratory (May-Sept)	Habitat degradation and loss due to human disturbance and vegetation encroachment, introduced predators, climate change	Usually do not forage far offshore
Black Tern *Chlidonias niger*	Moderate	NY –Endangered S2 – Imperiled	Bays, Estuaries, Seacoasts, Rivers/Lakes, Freshwater Marshes	Migratory	Habitat alteration/degradation, increasing water levels, decline in water quality, predation	Local birders report sightings off Long Island coast usually in August and September
Roseate Tern *Sterna dougallii*	High	NY –Endangered S1 – Critically Imperiled NJ – Endangered Fed- Endangered	Bays, Estuaries, Seacoasts, Islands, Offshore Waters	Breeding, Migratory (May-Aug)	Habitat loss due to erosion, development and disturbance; predation, competition, oil spills, hunting, effects of wind farm development of concern	May forage in offshore waters of project area
Common Tern *Sterna hirundo*	Low	NY – Threatened S3 – Vulnerable NJ – Special Concern	Bays, Estuaries, Seacoasts, Beaches, Sandbars, Islands	Breeding (March-Aug)	Human disturbance, predations, competition, environmental pollutants, climate change	Most flight 5-10 m from sfc. May forage in offshore waters. Some avoidance response, but will enter wind farm areas also increase in use of area outside wind farms
Forster's Tern *Sterna forsteri*	Moderate	S3 – Vulnerable	Bays, Estuaries, Marshes, Seacoasts, Rivers/Lakes	Breeding (Apr-Aug)	Reduction in habitat, rising sea level, predation, disturbance/vandalism, collision with vehicles while foraging	Most foraging closer to shore
Royal Tern *Thalasseus maximus*	Moderate		Open Sandy Beaches, Seacoasts, Estuaries	Migratory	Human encroachment, predation, wind farm development	Tend to forage close to shore

Species	WCP Ranking	NY & NJ State Status	Distribution Habitats & Behavior	Seasonal Occurrence	Regional Threats/Limiting Factors	Comments
Black Skimmer *Rynchops niger*	High Concern	NY – Special Concern S1 – Critically Imperiled	Bays, Estuaries, Islands, Sandy Beaches, Shell Banks, Mudflats, Rivers	Breeding (March-Aug)	Human disturbance, sea level rise – flooding of nests, predation, concentrated breeding sites	Nest on Long Island. Forage near beaches, bays and calm inshore waters. Do not forage offshore. Generally fly low above sfc.
Great Skua *Catharacta skua*	Moderate	--	Pelagic	Migratory, Wintering (Nov-March)	Environmental pollutants	Most flight 10-20 m from sfc Not abundant in study area
Pomarine Jaeger *Stercorarius pomarinus*	Low	--	Pelagic	Migratory (March-Feb)	Environmental pollutants, reduction in commercial fishery activities, climate change	--
Parasitic Jaeger *Stercorarius parasiticus*	Low	--	Pelagic, Seacoasts, Inland Coasts	Migratory (May-Oct)	Environmental pollutants	Most flight 10-20 m from sfc Not abundant in study area
Long-tailed Jaeger *Stercorarius longicaudus*	Low	--	Pelagic <20 miles offshore, Seacoasts, Inland Waterbodies	Migratory (Nov-April)	Environmental pollutants	Rare in study area
Dovekie *Alle alle*	Moderate	--	Pelagic, Seacoasts	Wintering (Dec-May)	Rough seas, failing plankton supply, climate change	Most flight 0-5 meters of surface
Common Murre *Uria aalge*	Moderate	--	Pelagic, Cliffs, Rocky Seacoasts (30-90 miles offshore)	Wintering (Sept-Feb)	Human disturbance, gill net entanglement, oil spills, predation, environmental pollutants, climate change	Most flight 0-5 meters of surface. Known avoidance to wind farms. Rare in study area
Thick-billed Murre *Uria lomvia*	Moderate	--	Pelagic, Cliffs, Seacoasts (<100 miles offshore)	Wintering (March-Feb)	Introduced predators, competition, oil spills, environmental pollutants, climate change	Most flight 0-5 meters of surface Rare in study area
Razorbill *Alca torda*	Moderate	--	Pelagic, Cliffs, Islands, Rocky Shores	Wintering (Sept-Feb)	Introduced predators, competition, oil spill, environmental pollutants, gill net entanglement, climate change	Shown to avoid wind farm area and 2 km zone around. Most flight 0-5 meters of surface

Environmental pollutants = chemical contaminants, pesticides (chlorinated hydrocarbons), mercury, PCBs, organochlorines
BCR Bird Conservation Rank from Waterbird Conservation Plan for Mid-Atlantic/ New England/ Maritime Region is based on continental and regional population importance
Waterbird Conservation Plan for the Mid-Atlantic/New England/Maritime Region Species Profiles
The Birds of North America Online
Sea Duck Joint Venture
Flight heights and disturbance response to wind farms from European and U.S. offshore wind studies

TABLE 3: FIRE Fall Hawk Migration Survey Results

Common Name	Scientific Name	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Black Vulture	*Coragyps atratus*	-	-	-	-	0	-	-	-	0	0
Turkey Vulture	*Cathartes aura*	-	-	-	-	0	-	1	-	2	0
Osprey	*Pandion haliaetus*	325	381	287	345	219	246	152	417	501	264
Bald Eagle	*Haliaeetus leucocephalus*	4	3	1	2	6	2	5	6	2	1
Northern Harrier	*Circus cyaneus*	208	208	169	328	181	129	298	434	188	181
Sharp-shinned Hawk	*Accipiter striatus*	273	513	355	314	277	319	427	313	279	291
Cooper's Hawk	*Accipiter cooperii*	8	27	22	23	20	37	48	41	49	47
Northern Goshawk	*Accipiter gentilis*	5	5	1	1	4	2	1	0	0	1
Red-shouldered Hawk	*Buteo lineatus*	1	1	0	0	0	0	0	0	0	0
Broad-winged Hawk	*Buteo platypterus*	0	0	0	0	1	1	0	0	0	0
Red-tailed Hawk	*Buteo jamaicensis*	1	0	3	1	1	1	2	0	1	1
Rough-legged Hawk	*Buteo lagopus*	1	0	0	0	0	0	0	0	0	0
Golden Eagle	*Aquila chrysaetos*	0	0	0	0	0	0	0	0	0	0
American Kestrel	*Falco sparverius*	1222	883	1112	627	928	602	744	731	667	518
Merlin	*Falco columbarius*	888	1340	1440	1228	1190	1334	1684	1493	1240	1291
Peregrine Falcon	*Falco peregrinus*	148	178	139	146	112	135	179	237	315	290
Unknown Raptor		32	21	13	6	13	11	12	8	12	8
TH		3116	3560	3542	3021	-	2819	3553	3680	3256	2893

Source: Survey data compiled by Drew Panko and posted by Trudy Battaly at Fire Island Raptor Enumerators (FIRE) www.battaly.com

Table 4: Endangered, Threatened, and Species of Concern

The following species meet one or both of the criteria specified in section 182.2(g) of 6NYCRR Part 182 and which are found, have been found, or may be expected to be found in New York State.

ENDANGERED		
Common Name	Scientific Name	Habitat Suitability of Project Area
Spruce Grouse	*Falcipennis canadensis*	--
[3]Golden Eagle	*Aquila chrysaetos*	--
Peregrine Falcon	*Falco peregrinus*	May migrate and forage offshore
Black Rail	*Laterallus jamaicensis*	--
[1,2,4]Piping Plover	*Charadrius melodus*	Migratory (?)
[1,3]Eskimo Curlew	*Numenius borealis*	--
[1]Roseate Tern	*Sterna dougallii dougallii*	May utilize project area
Black Tern	*Chlidonias niger*	--
Short-eared Owl	*Asio flammeus*	--
Loggerhead Shrike	*Lanius ludovicianus*	--

[1]Currently listed as "endangered" by the U. S. Department of the Interior.
[2]Currently listed as "threatened" by the U. S. Department of the Interior.
[3]Species is extirpated from New York State.
[4]Piping Plover is listed as federally endangered in the Great Lakes Region, and as federally threatened in the Atlantic Coastal Region.
--Indicates species not likely to use project area

Source: NYSDEC. 2007. List of Endangered, Threatened and Special Concern Fish & Wildlife Species of New York State. New York State Department of Environmental Conservation. Last accessed on March 30 2010 at http://www.dec.ny.gov/animals/7494.html.

Table 4: (Continued)

The following threatened species meet one or both of the criteria specified in section 182.2(h) of 6NYCRR Part 182 and which are found, have been found, or may be expected to be found in New York.

THREATENED		
Common Name	Scientific Name	Habitat Suitability of Project Area
Pied-billed Grebe	*Podilymbus podiceps*	Migratory
Least Bittern	*Ixobrychus exilis*	Migratory
Bald Eagle	*Haliaeetus leucocephalus*	--
Northern Harrier	*Circus cyaneus*	Migratory
King Rail	*Rallus elegans*	--
Upland Sandpiper	*Bartramia longicauda*	Migratory
Common Tern	*Sterna hirundo*	May use project area
Least Tern	*Sterna antillarum*	May use project area
Sedge Wren	*Cistothorus platensis*	--
Henslow's Sparrow	*Ammodramus henslowii*	--

Source: NYSDEC. 2007. List of Endangered, Threatened and Special Concern Fish & Wildlife Species of New York State. New York State Department of Environmental Conservation. Last accessed on March 30 2010 at http://www.dec.ny.gov/animals/7494.html.

Table 4: (Continued)

The following are designated as species of special concern as defined in Section 182.2(i) of 6NYCRR Part 182. Species of special concern warrant attention and consideration but current information, collected by the department, does not justify listing these species as either endangered or threatened

SPECIAL CONCERN		
Common Name	Scientific Name	Habitat Suitability of Project Area
Common Loon	*Gavia immer*	May use project area
American Bittern	*Botaurus lentiginosus*	Migratory
Osprey	*Pandion haliaetus*	May use project area
Sharp-shinned Hawk	*Accipiter striatus*	Migratory (?)
Cooper's Hawk	*Accipiter cooperii*	Migratory (?)
Northern Goshawk	*Accipiter gentilis*	--
Red-shouldered Hawk	*Buteo lineatus*	--
Black Skimmer	*Rynchops niger*	Migratory
Common Nighthawk	*Chordeiles minor*	Migratory
Whip-poor-will	*Caprimulgus vociferus*	--
Red-headed Woodpecker	*Melanerpes erythrocephalus*	--
Horned Lark	*Eremophila alpestris*	Migratory
Bicknell's Thrush	*Catharus bicknelli*	Migratory
Golden-winged Warbler	*Vermivora chrysoptera*	Migratory
Cerulean Warbler	*Dendroica cerulea*	Migratory
Yellow-breasted Chat	*Icteria virens*	--
Vesper Sparrow	*Pooecetes gramineus*	--
Grasshopper Sparrow	*Ammodramus savannarum*	--
Seaside Sparrow	*Ammodramus maritimus*	Migratory

Source: NYSDEC. 2007. List of Endangered, Threatened and Special Concern Fish & Wildlife Species of New York State. New York State Department of Environmental Conservation. Last accessed on March 30 2010 at http://www.dec.ny.gov/animals/7494.html.

Table 5: Results of Avian Pair Presence for State-listed Species during NYSDEC's Long Island Colonial Waterbird and Piping Plover Survey

Year	Breezy Point	Fort Tilden	Jacob Riis	Rockaway	Arverne-by-the-Sea	Far Rockaway	Long Beach Island Atlantic
2008	PIPL – 30 COTE – 2850 LETE – 353 RSTE – 0 BLSK – 137	PIPL – 0	PIPL – 4 LETE – 0	PIPL – 0 LETE – 0	PIPL – 15 COTE – 0 LETE – 88	PIPL – 3 LETE – 0	PIPL – 6 COTE – 355 LETE – 263 BLSK – 90
2007	PIPL – 36 COTE – 2550 LETE – 299 RSTE – 0 BLSK – 189	PIPL – 0 LETE – 0	PIPL – 1 LETE – 0	PIPL – 0 LETE – 0	PIPL – 21 COTE – 0 LETE – 18	PIPL – 4 LETE – 0	PIPL – 7 COTE – 344 LETE – 333 BLSK – 90
2006	PIPL – 30 COTE – 3551 LETE – 401 RSTE – 0 BLSK – 225	PIPL – 0 LETE – 0	PIPL – 2	COTE – 0	PIPL – 14 COTE – 2 LETE – 126	PIPL – 2 LETE – 0	PIPL – 5
2005	PIPL – 26 COTE – 2223 LETE – 392 RSTE – 0 BLSK – 215	PIPL – 0 LETE – 0	PIPL – 3 LETE – 0	PIPL – 0 LETE – 0	PIPL – 14 COTE – 3 LETE – 97	PIPL – 0 LETE – 0	PIPL – 10 COTE – 0 LETE – 69 BLSK – 21
2004	PIPL – 26 COTE – 2991 LETE – 135 RSTE – 0 BLSK – 168	LETE – 0	PIPL – 2 LETE – 0		PIPL – 21 COTE – 1 LETE – 84		PIPL – 6 COTE – 0 LETE – 29 BLSK – 8
2003	PIPL – 25 COTE – 2141 LETE – 147 RSTE – 0 BLSK – 118	PIPL – 1 LETE – 0	PIPL – 1 LETE – 0		PIPL – 15 COTE – 1 LETE – 93	PIPL – 2 LETE – 0	PIPL – 7 COTE – 28 LETE – 35 BLSK – 5
2002	PIPL – 19 COTE – 1425 LETE – 289 RSTE – 0 BLSK – 199	PIPL – 0 LETE – 0	PIPL – 2 LETE – 0	PIPL – 0 LETE – 0	PIPL – 14 COTE – 1 LETE – 80	PIPL – 1 LETE – 0	PIPL – 5 COTE – 13 LETE – 25 BLSK – 28
2001	PIPL– 17 COTE – 1581 LETE – 191 RSTE – 0 BLSK – 353	LETE – 0	PIPL– 2 LETE – 0	LETE – 0	PIPL– 14 COTE – 2 LETE – 270	PIPL– 1 LETE – 0	PIPL– 6 COTE – 74 LETE – 0 BLSK – 25
2000	PIPL– 18	PIPL – 1	PIPL – 0	PIPL – 0	PIPL– 11	PIPL– 1	PIPL – 7

PIPL = Piping Plover, COTE = Common Tern, LETE = Least Tern, RSTE = Roseate Tern, BLSK = Black Skimmer

Source: NYSDEC. Long Island Colonial Waterbird and Piping Plover Survey. New York State Department of Environmental Conservation Division of Fish, Wildlife and Marine Resources.

Table 5 (Continued)

Year	Little Egg Marsh	Silver Hole Marsh	Jo Co Marsh	East High Meadow
2008		COTE – 0	COTE – 27	COTE – 50
2007	COTE – 11			
2006				
2005				
2004				
2003				
2002		COTE – 10	COTE – 140	COTE – 110
2001				
2000				

COTE = Common Tern

Source: NYSDEC. Long Island Colonial Waterbird and Piping Plover Survey. New York State Department of Environmental Conservation Division of Fish, Wildlife and Marine Resources.

Table 6: Results of Avian Pair Presence for Roseate Tern during NYSDEC's Long Island Colonial Waterbird and Piping Plover Survey

Year	Goose Flat	Sexton Beach	Long Beach	Pattersquash Island	Greater Greenbacks Island Cartwright Pt	Lanes Island	Gardiners Island	Great Gull Island
2008	2						27	1288
2007	1				1	1	193	1636
2006	25		1		2		80	1222
2005	11	2		2		2	80	1195
2004	11					4	322	1352

Source: NYSDEC. Long Island Colonial Waterbird and Piping Plover Survey. New York State Department of Environmental Conservation Division of Fish, Wildlife and Marine Resources.

Table 7: New York State-listed Breeding Bird Species Recorded within Atlas Survey Blocks Covering Key Substations and Potential Project Areas

Common Name	Scientific Name	NY Legal Status	Rockaway Substation		Northern Queens Substation		Potential Project Area	
			Block 5949B	Block 6049A	Block 5951D	Block 6051C	Block 5949D	Block 6049C
Osprey	*Pandion haliaetus*	Special Concern	CO	PO		CO		CO
Northern Harrier	*Circus syaneus*	Threatened	CO	CO				PO
Piping Plover	*Charadrius melodus*	Endangered	CO				CO	CO
Upland Sandpiper	*Bartramia longicauda*	Threatened	CO	CO				
Least Tern	*Sternula antillarum*	Threatened					CO	CO
Common Tern	*Sterna hirundo*	Threatened	CO				CO	CO
Black Skimmer	*Rynchops niger*	Special Concern	CO				CO	CO
Short-eared Owl	*Asio flammeus*	Endangered	CO	CO				
Common Nighthawk	*Chordeiles minor*	Special Concern			PR			
Horned Lark	*Eremophila alpestris*	Special Concern	CO				PR	CO
Grasshopper Sparrow	*Ammodramus savannarum*	Special Concern	CO	CO	PR			
Seaside Sparrow	*Ammodramus maritimus*	Special Concern	PR			PR		PR

CO = Confirmed Breeding PR = Probable Breeding PO = Possible Breeding
Potential Project Area = Far Rockaway and Arverne by the Sea shoreline
Source: The Second Atlas of Breeding Birds in New York State http://www.dec.ny.gov/animals/7312.html

Table 8: PIROP Avian Subset within Proposed Project Area

Common Name	Scientific Name	Combined Total of Observations for All Survey Dates	Number of Dates That Observations Were Made (of 78 survey dates)	Survey Date Range of Observations
Scoters	*Melanitta*	8	2	March 1982-1983
Common Loon	*Gavia immer*	4	3	Oct-March 1982-1984
Wilson's Storm-Petrel	*Oceanites oceanicus*	2	1	Jul-1983
Northern Gannet	*Morus bassanus*	20	8	Nov-March 1982-1987
Double-crested Cormorant	*Phalacrocorax auritus*	2	1	Sep-1988
Black-legged Kittiwake	*Rissa tridactyla*	189	6	Sept-Feb 1982-1987
Bonaparte's Gull	*Chroicocephalus philadelphia*	11	2	March 1982-1986
Ring-billed Gull	*Larus delawarensis*	5	3	Nov-March 1982-1986
Herring Gull	*Larus argentatus*	91	20	Feb-Nov 1981-1988
Glaucous Gull	*Larus hyperboreus*	1	1	Mar-1984
Great Black-backed Gull	*Larus marinus*	28	13	Sept-May 1982-1987
Common Tern	*Sterna hirundo*	18	3	May-Oct 1983-1988
Parasitic Jaeger	*Stercorarius parasiticus*	1	1	Sep-1986

* Survey dates per year: 1980-5, 1981-9, 1982-9, 1983-11, 1984-12, 1985-10, 1986-7, 1987-9, 1988-5
Source: OBIS SEAMAP http://seamap.env.duke.edu/

Table 9: PIROP Avian Subset within Proposed Project Vicinity

Common Name	Scientific Name	Total # of Observations	Total # of Dates Observations Made (of 78 survey dates)
Brant	*Branta bernicla*	50	1
Black Scoter	*Melanitta nigra*	16	2
Long-tailed Duck	*Clangula hyemalis*	60	1
Red-throated Loon	*Gavia stellata*	4	3
Common Loon	*Gavia immer*	51	17
Northern Fulmar	*Fulmarus glacialis*	1	1
Cory's Shearwater	*Calonectris diomedea*	66	7
Greater Shearwater	*Puffinus gravis*	133	6
Sooty Shearwater	*Puffinus griseus*	15	5
Wilson's Storm-Petrel	*Oceanites oceanicus*	294	18
Leach's Storm-Petrel	*Oceanodroma leucorhoa*	50	3
Northern Gannet	*Morus bassanus*	475	--
Double-crested Cormorant	*Phalacrocorax auritus*	20	4
Great Cormorant	*Phalacrocorax carbo*	40	1
Red-necked Phalarope	*Phalaropus lobatus*	1	1
Red Phalarope	*Phalaropus fulicaria*	2	1
Black-legged Kittiwake	*Rissa tridactyla*	565	23
Bonaparte's Gull	*Larus philadelphia*	48	5
Laughing Gull	*Larus atricilla*	99	22
Ring-billed Gull	*Larus delawarensis*	51	37
Herring Gull	*Larus argentatus*	1323	62
Lesser Black-backed Gull	*Larus fuscus*	2	2
Glaucous Gull	*Larus hyperboreus*	1	1
Great Black-backed Gull	*Larus marinus*	437	44
Common Tern	*Sterna hirundo*	73	19
Arctic Tern	*Sterna paradisaea*	3	1
Pomarine Jaeger	*Stercorarius pomarinus*	2	2
Parasitic Jaeger	*Stercorarius parasiticus*	1	1
Thick-billed Murre	*Uria lomvia*	100	1

Source: OBIS SEAMAP http://seamap.env.duke.edu/

Table 10: The Top Five (5) Most Abundant Avian Species Observed per month During the NJDEP Baseline Studies Shipboard Offshore Transect Surveys of 2008

Common Name	Number	Abundance
January 2008		
Northern Gannet	776	1.55
Red-throated Loon	118	0.24
Common Loon	83	0.17
Herring Gull	71	0.14
Black Scoter	63	0.13
Total	1,111	2.23
March 2008		
Northern Gannet	1,497	1.81
Herring Gull	466	0.56
Long-tailed Duck	306	0.37
Red-throated Loon	180	0.22
Black Scoter	142	0.17
Total	2,591	3.13
April 2008		
Surf Scoter	1,297	1.80
Northern Gannet	809	1.12
Black Scoter	335	0.46
Scoter, dark-winged	204	0.28
Herring Gull	160	0.22
Total	2,805	3.88
May 2008		
Northern Gannet	531	0.96
Herring Gull	197	0.36
Common Loon	161	0.29
Common Tern	151	0.27
Black Scoter	141	0.25
Total	1,181	2.13
June 2008		
Wilson’s Storm-petrel	338	0.41
Common Tern	182	0.22
Laughing Gull	174	0.21
Northern Gannet	132	0.16
Cory’s Shearwater	57	0.07
Total	883	1.07
July 2008		
Wilson’s Storm-petrel	364	0.53
Laughing Gull	283	0.41
Common Tern	245	0.36
Cory’s Shearwater	42	0.06
Northern Gannet	24	0.03
Total	958	1.39
August 2008		
Wilson’s Storm-petrel	1,245	1.55
Laughing Gull	514	0.64
Common Tern	510	0.63
Great Black-backed Gull	56	0.07
Purple Martin	47	0.06
Total	2,375	2.95
September 2008		
Common Tern	301	0.36
Laughing Gull	268	0.32
Great Black-backed Gull	203	0.24
Tern, small	78	0.09
Herring Gull	36	0.04
Total	886	1.05
October 2008		
Double-crested Cormorant	962	1.16
Laughing Gull	575	0.69
Forster’s Tern	399	0.48
Northern Gannet	281	0.34
Herring Gull	127	0.15
Total	2,344	2.82
November 2008		
Surf Scoter	2,101	3.85
Laughing Gull	1,323	2.43
Northern Gannet	1,065	1.95
Black Scoter	1,062	1.95
Scoter, dark-winged	510	0.94
Total	6,061	11.12

Source: NJDEP Baseline Studies January-December 2008 Revised Interim Report

Table 11: Scores of Nine Vulnerability Factors and Resulting Species Sensitivity Index (SSI) values for Selected Seabird Species

Avian Species	Flight maneuver-ability	Flight altitude	% flying	Nocturnal flight activity	Disturbance by ship and helicopter traffic	Habitat use flexibility	Biogeo-graphical populatio n size	Adult survival rate	European threat and conservati on status	SSI
Black-throated Diver	5	2	3	1	4	4	4	3	5	44:0
Red-throated Diver	5	2	2	1	4	4	5	3	5	43:3
White-winged Scoter	3	1	2	3	5	4	3	2	3	27:0
Great Cormorant	4	1	4	1	4	3	4	3	1	23:3
Common Eider	4	1	2	3	3	4	2	4	1	20:4
Red-necked Grebe	4	2	1	1	3	5	5	1	1	18:7
Great Black-backed Gull	2	3	2	3	2	2	4	5	2	18:3
Black Tern	1	1	4	1	2	3	4	4	4	17:5
Black Scoter	3	1	2	3	5	4	2	2	1	16:9
Northern Gannet	3	3	3	2	2	1	4	5	3	16:5
Razorbill	4	1	1	1	3	3	2	5	2	15:8
Common Tern	1	2	5	1	2	3	3	4	1	15:0
Lesser Black-backed Gull	1	4	2	3	2	1	4	5	2	13:8
Arctic Tern	1	1	5	1	2	3	3	4	1	13:3
Little Gull	1	1	3	2	1	3	5	2	4	12:8
Great Skua	1	3	4	1	1	2	5	4	2	12:4
Common Murre	4	1	1	2	3	3	1	4	1	12:0
Mew Gull	1	3	2	3	2	2	2	2	4	12:0
Herring Gull	2	4	2	3	2	1	2	5	1	11:0
Parasitic Jaeger	1	3	5	1	1	2	4	3	1	10:0
Black-headed Gull	1	5	1	2	2	2	1	3	1	7:5
Black-legged kittiwake	1	2	3	3	2	2	1	3	1	7:5
Northern Fulmar	3	1	2	4	1	1	1	5	1	5:8

Source: Garthe, S. and O. Huppop (2004)

* White-winged Scoter = Velvet Scoter, Black Scoter = Common Scoter, Red-throated Loon = Red-throated Diver, Parasitic Jaeger = Arctic Skua, Common Murre = Common Guillemot

-Flight maneuverability Species ranked form very high (1) to low (5)

-Flight altitude 1, 0-5 m; 2, 5-10 m; 3, 10-20 m; 4, 20-50 m; 5, 50-100 m; 6,>100 m Flight heights were further adjusted for those species that fly at different heights greater than 50% of time.

-Percentage of time flying 1 if 0-20% of individuals in the transect were flying; 2 if 21-40 %; 3 if 41-60 %; 4 if 61-80 % and 5 if 81- 100 %

-Nocturnal flight activity was classified subjectively from 1- hardly any flight activity at night to 5- much flight activity at night

-Disturbance by ship and helicopter traffic- scored subjectively from 1- hardly any escape /avoidance behavior and/or none/very low fleeing distance to 5- strong escape/avoidance behavior and/or large fleeing distance

-Flexibility in habitat use based from 1- very flexible in habitat use to 5- reliant on specific habitat characteristics. Based on published data as in Garthe (1997) and Skow & Prins (2001) and unpublished data

-Biographical population size- factor scored according to the respective biogeographical population size of each species form 1- population size exceeding 3 million individuals; 2- for > 1 million up to 3 million; 3 for >500,00 up to 1 million; 4- for>100,000 up to 500,000; 5- for less than 100,000

-Adult survival rate score of 1 annual survival rate ≤0.75; score of 2, >0.75- 0.80; score of 3, >0.80-0.85; score of 4, >0.85-0.95; score of 5, >0.90.

Table 12: Summary of the Effects of Offshore Wind Farms on Seabirds

Common Name	Scientific Name	Habitat Loss	Barrier Effect	Fatal Collisions
Common Eider	*Somateria mollissima*	+	0*	00
White-winged Scoter	*Melanitta fusca*	?	00	?
Black Scoter	*Melanitta nigra*	00	00	?
Long-tailed Duck	*Clangula hyemalis*	0	+	?
Red-breasted Merganser	*Mergus serrator*	+	+	?
Red-throated Loon	*Gavia stellata*	00	00*	0
Horned Grebe	*Podiceps auritus*	?	?	?
Red-necked Grebe	*Podiceps grisegena*	?	+	?
Northern Fulmar	*Fulmarus glacialis*	?	0	0
Sooty Shearwater	*Puffinus griseus*	?	?	?
Northern Gannet	*Sula bassanus*	00	00	?
Great Cormorant	*Phalacrocorax carbo*	+	0*	0
Black-legged Kittiwake	*Stercorarius parasiticus*	+	+	0
Black-headed Gull	*Chroicephalus ridibundus*	?	+*	0
Little Gull	*Hydrocoloeus minutus*	++	+	?
Mew Gull	*Larus canus*	?	+*	0
Herring Gull	*Larus Argentatus*	++	+*	0
Lesser Black-backed Gull	*Larus Fuscus*	?	+*	0
Great Black-backed Gull	*Larus marinus*	++	+*	0
Common Tern	*Sterna hirundo*	+	+*	0
Arctic Tern	*Sterna paradisaea*	+	+	?
Great Skua	*Catharacta skua*	?	?	?
Pomarine Jaeger	*Stercorarius pomarinus*	?	?	?
Parasitic Jaeger	*Stercorarius parasiticus*	+	+	?
Common Murre	*Uria aalge*	00	00	0
Razorbill	*Alca torda*	00	00	?
Black Guillemot	*Cepphus grylle*	?	00	?

Source: Dieschke and Garthe 2006

Habitat Loss: 00 = strong avoidance, 0 = reducing numbers, + = occurring with no or only few effects, ++ = increased numbers, ? = little or no data to draw conclusion

Barrier Effect: 00 = strong avoidance, 0 = detours occurring, + = commonly flying through wind farms, * = includes information from coastal wind farms, ? = little or no data to draw conclusion

Fatal Collisions: 00 = casualties recorded at offshore and coastal wind farms, 0 = casualties recorded as coastal wind farms, ? = little or no data to draw conclusion

For information on other
NYSERDA reports, contact:

New York State Energy Research
and Development Authority
17 Columbia Circle
Albany, New York 12203-6399

toll free: 1 (866) NYSERDA
local: (518) 862-1090
fax: (518) 862-1091

info@nyserda.org
www.nyserda.org

Pre-Development Assessment of Avian Species for the Proposed Long Island – New York City Offshore Wind Project Area

Final Report 10-22 Task 3b