Avian and Bat Risk Assessment

South Fork Wind Farm and South Fork Export Cable

Prepared for:
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NOTE TO READER

This document provides a comprehensive assessment of potential direct and indirect seasonal risks to birds and bats during the construction, operation, and decommissioning phases of the South Fork Wind Farm (SFWF) and the South Fork Export Cable (SFEC). Project elements include the offshore components of the SFWF located on the Atlantic Outer Continental Shelf, as well as both offshore and onshore components of the SFEC that will interconnect with the Long Island Power Authority transmission system on Long Island, New York. A detailed description of the Project area and Project description is available in Section 1.0.

Many of the described bird groups and bats that seasonally reside in or migrate through the Project area are known to occupy one or more of the defined Project areas during each of the proposed Project phases. By necessity, the reader will encounter certain repetition in the bird and bat responses to risk conditions where there is overlap between impacts anticipated at the SFWF and SFEC or impacts among different project phases. To help reduce or eliminate some redundancies throughout the document, the avian and bat conditions--as they apply to risk--are described in a separate section at the beginning of the document. Avoidance and minimization measures that are part of the design and operation of the Project are described in one section at the end of the main document. Note that for each type of direct or indirect effect for the different project phases, the sections are organized as follows:

SFWF

Birds

Bats

SFEC

Birds

Bats

Each section includes an assessment of risk to bird and bat species groups, and to listed species specifically. Bird groups susceptible to similar risks due to their use of and behaviors at the SFWF and SFEC are grouped for the discussions of impacts to further limit redundancies. Readers are encouraged to utilize the Table of Contents as a reference to descriptions of potential concerns and specific issues.

Appendix A includes a more detailed description of the existing conditions of the affected environment. Appendix B provides a summary of what is known regarding impacts to birds and bats from existing manmade strucures in the offshore environment (including wind facilities, primarily in Europe).

Executive Summary

The South Fork Wind Farm (SFWF), as proposed by Deepwater Wind South Fork LLC (DWSF), will consist of the design, construction, operation, maintenance, and decommissioning of an up to 15 wind turbine generators (WTGs) on the Atlantic Outer Continental Shelf (OCS), as well as both the offshore and onshore components of an electrical energy export cable (South Fork Export Cable; SFEC) that will interconnect with the Long Island Power Authority (LIPA) transmission system on Long Island, New York. SFWF and SFEC are collectively referred to as the “Project”.

The purpose of this risk assessment is to 1) evaluate the potential for, and level of, risk to birds and bats that may result from construction, operation, and decommissioning of the SFWF and SFEC; 2) identify species most at risk of impact, with particular consideration for species listed as threatened or endangered under the federal Endangered Species Act (ESA) and New York State listed species; 3) identify periods—seasonal and daily—when species are most at risk; and 4) to identify the Project’s avoidance and minimization measures to minimize risks, as possible. Federally or state-listed species that are of special interest in this risk assessment include the federally listed roseate tern (*Sterna dougallii*), rufa red knot (*Calidris canutus rufa*), piping plover (*Charadrius melodus*), and northern long-eared bat (*Myotis septentrionalis*), as well as the state-listed least tern (*Sternula antillarum*) and common tern (*Sterna hirundo*). Note that essentially all birds discussed in this risk assessment are afforded protection under the Migratory Bird Treaty Act (MBTA; 50 CFR 10.13).

This risk assessment will inform the Project’s Construction and Operations Plan (COP), which will be reviewed by the Bureau of Ocean Energy Management (BOEM). BOEM recognizes that there are impact producing factors (IPF) associated with the construction, operation, and decommissioning of offshore renewable energy projects. At the SFWF and SFEC, these IPF include visible structures, lighting, sediment suspension and deposition, seafloor and land disturbance, discharges and releases, trash and debris, noise, and traffic that may result in effects to birds and bats during construction, operation, and maintenance, and decommissioning of the Project. Activities associated with construction and decommissioning are very similar and the impacts for these two project phases are considered together.

There are also both direct and indirect effects potentially associated with each phase of the Project, at both the SFWF and SFEC. Direct effects may result from habitat loss and/or habitat modification during construction, disturbances from vessels, noise during construction and maintenance activities, and collision risk during construction and operation. Indirect effects may include the displacement or attraction to visible structures, barrier effects representing increased energy expenditure while traveling around or avoiding visible structures, mortality or injuryassociated with potential releases or discharges of petroleum-based fluids or other contaminants, and mortality or injury from accidental disposal of trash or debris.

There are key factors that contribute to potential bird and bat risk, including abundance and seasonal use, behaviors, flight heights, changes in foraging habitat, increased perching/roosting habitat, weather/visibility, and effects of lighting. These key factors were summarized for both birds and bats for the assessment of risk and are the driving elements behind the measures that DWSF has incorporated into the Project's plan to avoid and minimize impacts.

Summary of Construction/Decommissioning Impacts at SFWF, SFEC, and SFEC – Onshore

Negligible to minor impacts associated with collision risk for birds during construction and decommissioning may occur, depending on the species and number of individuals involved in potential collision events. Birds are susceptible to collision with both moving and stationary man-made structures extending above the surface of the water, particularly at night and/or during other periods of low visibility (e.g., rain or fog). Brightly illuminated structures offshore such as research platforms pose a risk to birds migrating at night particularly during rain or fog when birds can become disoriented by sources of artificial light. While nocturnal migrant passerines are known to be most prone to collision with man-made structures, among those species that may be at risk of collision include federally or state-listed species: roseate tern, rufa red knot, piping plover, least tern, and common tern. While collision risk for these species of concern is considered low, the loss of one or a few individuals to these populations already at risk could represent a **minor** impact. Other bird groups with relatively stable populations may generally be at risk of **negligible to minor** collision related impacts, depending on the time of year and number of individuals involved. Bats are **not expected to be at risk** of collision with stationary structures during construction. Lighting during construction activities will be limited to the minimum required for safety during construction activities to minimize impacts.

Due to the temporary nature of construction and decommissioning activities, only **negligible** impacts associated with the direct effect of habitat loss or modification due to seafloor/land disturbance are anticipated. Sediment suspension and deposition will be minimized during turbine foundation and submarine cable installation. There will be **no impacts** to nesting areas at beaches as installation for the SFEC will occur under the beach. The need for time of year restrictions for beach work and tree-clearing activities at onshore components will be determined in consultation with the agencies.

Negligible or minor impacts to birds and bats due to disturbances associated with noise and vessel traffic are expected during construction and decommissioning activities. These impacts will be temporary and similar to those observed with normal non-project related vessel traffic.

Potential indirect effects such as contaminant discharges or releases, or accidental disposal of trash or debris during construction and decommissioning would be expected to result in **negligible** impacts due to the preemptive implementation of best management practices to prevent such incidents.

Summary of Operations Impacts at SFWF, SFEC, and SFEC – Onshore

The primary direct effect for birds and bats during operations is collision risk with WTGs at the SFWF due to visible structures and lighting. Species most at risk of collision are those that more frequently occur in the rotor-swept zone (RSZ) and those that may travel through the SFWF at night and/or periods of inclement weather. Impacts associated with risk of collision are anticipated to be **negligible to minor** and would be dependent on species type and the number of individuals involved. Federally and state-listed species are among birds and bats that may be susceptible to minor impacts associated with collision risk, including roseate tern, rufa red knot, piping plover, northern long-eared bat, least tern, and common tern. While these species are not expected to frequent the SFWF, individuals in general may cross the area at most twice per year during migration. The loss of one or a few individuals, over the life of the SFWF, for a population already at risk would represent an adverse impact; however, it would not represent an impact that that these populations could not recover from. Other bird and bat groups with relatively stable populations may generally be at risk of **negligible to minor** collision related impacts, depending on the time of year and number of individuals involved.

Direct effects during operation could also include temporary disturbances associated with traffic or noise during maintenance activities. These disturbances would be temporary and **negligible to minor** and similar to those observed with normal vessel traffic.

Indirect operational impacts may pose **negligible to minor** impacts to birds and bats, depending on type of impact (displacement, attraction, barrier effect, or discharge/release). Displacement and barrier effects are expected to generally result in **negligible to minor** impacts to most species that seasonally occur in the SFWF. The level of impact of a contaminant spill or release would be dependent on the type, size, and location of the spill. Federally and state-listed birds are among species that may be impacted after a spill or release. However, any potential spill-related impacts are expected to be mitigated by a series of avoidance and minimization measures and preemptive implementation of best management practices during operation of the SFWF and SFEC; therefore impacts associated with discharges/releases are expected to be **negligible** for birds (with no impacts to bats). Trash and debris will be strictly managed and properly disposed of according to state and federal laws; therefore impacts associated with trash or debris are expected to result in **negligible** impacts to birds (and no impacts to bats).

Overall Summary of Risk

There may be negligible to minor impacts from direct or indirect effects during construction or operation of the SFWF or SFEC, no moderate or major impacts are anticipated.

Species most vulnerable to impacts primarily include populations already at risk, such as those species listed as endangered or threatened at either a federal or state level. However, occurrences of listed species within the SFWF are expected to be rare and largely limited to migration periods (March through May and July through October). Risk of collision is greatest at night, particularly during periods of inclement weather, but also during daytime periods of limited visibility. Use of the minimal amount of required safety lighting, and contaminant spill prevention and response plans will minimize impacts at the SFWF and SFEC. Risk of barrier effects or avoidance is low for listed species due to their low use of the SFWF area. Furthermore, species that travel long distances during migration have been found to be less affected by slight increases in flight distances around man-made facilities due to their ability to travel such long distances. If necessary, time of year construction activity restrictions may mitigate impacts to listed species at the SFEC sea-to-shore transition and at other onshore project components.

Table E-1 describes the type (direct or indirect) and likelihood of risk (yes, no, potential) and period of greatest risk for bird and bat groups and species of interest.

Table E-1. Type and level of risk and period of greatest risk for bird and bat groups and species of interest at the SFWF and SFEC.

	ROTE		PIPL		REKN		LETE		COTE		Night Migrants		Seabirds		Waterfowl		Waterbirds		Shorebirds		Landbirds		Migrating Bats		Non-M Bats		NLEB	
	C/D	OPS	C/D	OPS	C/D	OPS	C/D	OPS	C/D	OPS	C/D	OPS	C/D	OPS	C/D	OPS	C/D	OPS	C/D	OPS	C/D	OPS	C/D	OPS	C/D	OPS	C/D	OPS
SFWF																												
Night Migration																												
Direct	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Indirect	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Daytime Activity																												
Direct	Y	Y	N	N	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N	P	P	N	N	N	N
Indirect	Y	Y	N	N	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N	P	P	N	N	N	N
Nesting																												
Direct	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Indirect	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Foraging																												
Direct	Y	Y	N	N	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y	P	P	P	P	N	N	P	P	P	P	P	P
Indirect	Y	Y	N	N	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y	P	P	P	P	N	N	P	P	P	P	P	P
Overwintering																												
Direct	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N
Indirect	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N
SFEC OCS																												
Night Migration																												
Direct	P	N	P	N	P	N	P	N	P	N	Y	N	P	N	P	N	P	N	P	N	N	N	P	N	N	N	N	N
Indirect	P	N	P	N	P	N	P	N	P	N	Y	N	P	N	P	N	P	N	P	N	N	N	P	N	N	N	N	N
Daytime Activity																												
Direct	N	N	N	N	N	N	N	N	N	N	N	N	P	N	N	N	P	N	P	N	P	N	P	N	N	N	N	N
Indirect	N	N	N	N	N	N	N	N	N	N	N	N	P	N	N	N	P	N	P	N	P	N	P	N	N	N	N	N
Nesting																												
Direct	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Indirect	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Foraging																												
Direct	P	N	N	N	N	N	P	N	P	N	N	N	P	N	P	N	P	N	P	N	N	N	N	N	N	N	N	N
Indirect	P	N	N	N	N	N	P	N	P	N	N	N	P	N	P	N	P	N	P	N	N	N	N	N	N	N	N	N
Overwintering																												
Direct	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N	N	N	N	N	N	N	N
Indirect	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N	N	N	N	N	N	N	N
SFEC NYS/Onshore																												
Night Migration																												
Direct	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Indirect	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Daytime Activity																												
Direct	Y	N	Y	N	Y	N	Y	N	Y	N	N	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N
Indirect	Y	N	Y	N	Y	N	Y	N	Y	N	N	N	Y	N	Y	N	Y	N	Y	N	P	N	P	N	P	N	P	N
Nesting																												
Direct	P	N	P	N	P	N	P	N	P	N	N	N	P	N	N	N	N	N	P	P	P	N	P	N	P	N	P	N
Indirect	P	N	P	N	P	N	P	N	P	N	N	N	P	N	N	N	N	N	P	P	P	N	P	N	P	N	P	N
Foraging																												
Direct	P	P	P	N	P	N	P	P	P	P	N	N	P	N	P	N	P	N	P	P	P	N	P	N	P	N	P	N
Indirect	P	P	P	N	P	N	P	P	P	P	N	N	P	N	P	N	P	N	P	P	P	N	P	N	P	N	P	N
Overwintering																												
Direct	N	N	N	N	N	N	N	N	N	N	N	N	P	N	P	N	N	N	N	N	N	N	N	N	N	N	N	N
Indirect	N	N	N	N	N	N	N	N	N	N	N	N	P	N	P	N	N	N	N	N	N	N	N	N	N	N	N	N

ROTE = roseate tern (federally and state endangered), PIPL = piping plover (federally threatened and state endangered), REKN = red knot (federally threatened), LETE = least tern (state-threatened), COTE = common tern (state-threatened), NLEB = northern long-eared bat (federally and state threatened)

C/D = construction and decommissioning, OPS = operations

Y = yes, P = potential, N = no.

1.0 INTRODUCTION AND PROJECT DESCRIPTION

This risk assessment addresses the South Fork Wind Farm (SFWF) and the associated South Fork Export Cable (SFEC) proposed by Deepwater Wind South Fork (DWSF). The SFWF would consist of the construction, operation and maintenance, and decommissioning of an up to 15 wind turbine generators (WTGs) on the Atlantic Outer Continental Shelf (OCS[1]), as well as the SFEC, including both the offshore and onshore components of an electrical energy export cable that will interconnect with the Long Island Power Authority (LIPA) transmission system on Long Island, New York (Figure 1-1). The proposed SFWF is approximately 30.6 kilometers [km] (19 miles [mi]) east-southeast of Block Island, Rhode Island, and approximately 56.3 km (35 mi) east of Montauk Point, New York. SFWF and SFEC are collectively referred to as the "Project".

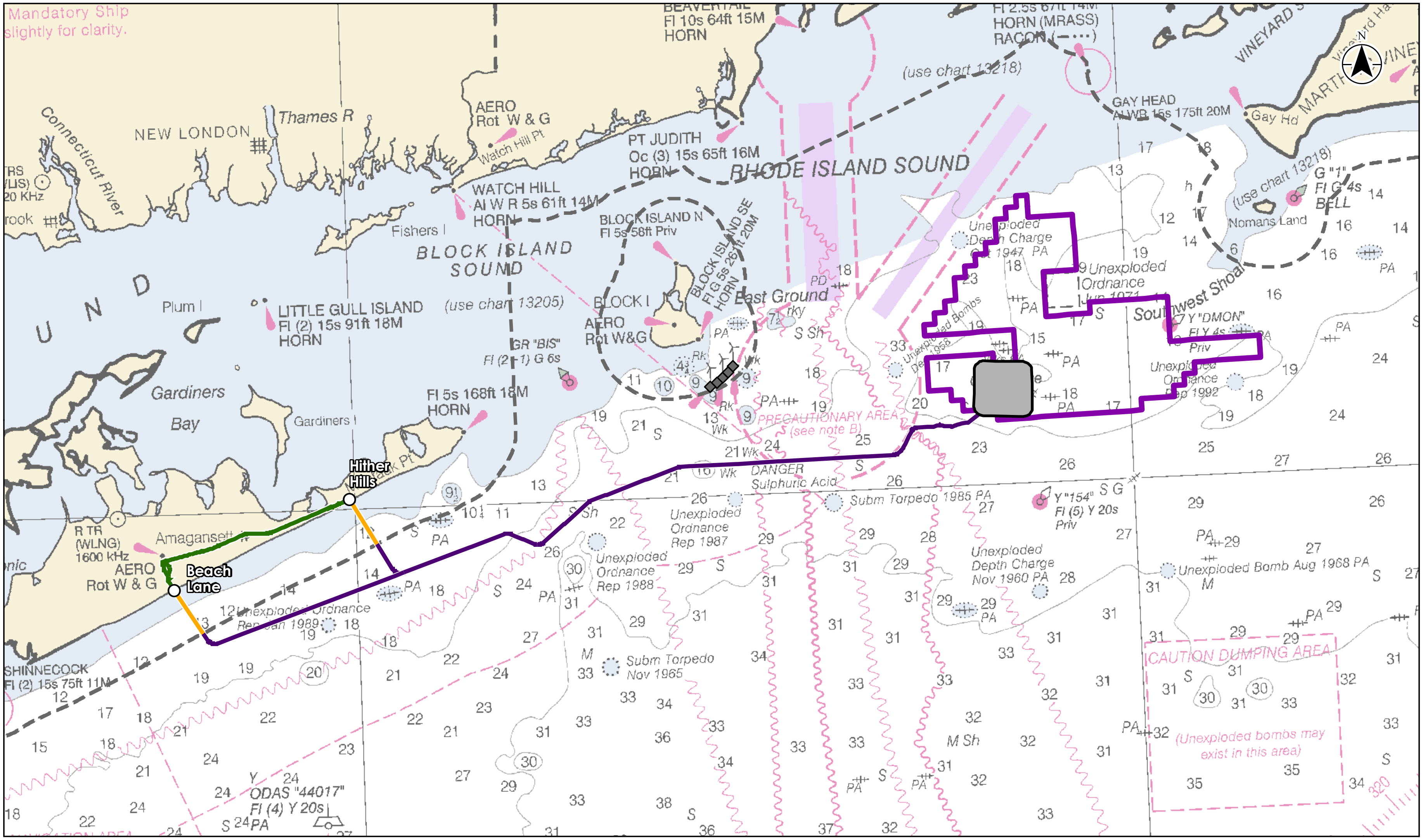
The proposed SFWF would consist of wind turbine generators (turbines, WTGs), inter-array cables, and an offshore substation, including:

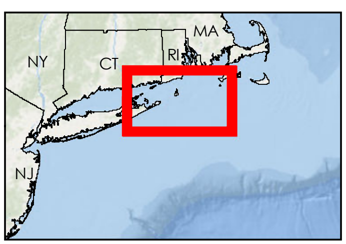
- Up to 15 WTGs mounted on foundations. The WTGs under consideration are 12 MW, with a maximum rotor-swept height of 262 m (860 feet) (MSL);
- Approximately 42 km (26 mi) of inter-array cables connecting WTGs to an offshore substation. The inter-array cable would either be a 34.5 kilovolt (kV) or 66 kV 3-phase AC cable; and
- An offshore substation constructed on similar foundations as the WTGs containing switch gear and a step-up transformer for transmission to the mainland, and helicopter landing pad.

The proposed SFEC will be located offshore, in both federal waters and New York state territorial waters, and onshore in East Hampton, New York. The landfall location for SFEC will be on the south shore of Long Island, either at Beach Lane or Hither Hills (both in East Hampton). The SFEC includes the export cable segments extending from the offshore substation to the onshore landing site to a new interconnection facility, including:

- SFEC – OCS: the segment of the export cable in federal waters on the OCS from the offshore substation to the boundary of NY state territorial waters;
- SFEC – NYS: the segment of the export cable from the boundary of NY state waters to a sea-to-shore transition in East Hampton; and
- SFEC – Onshore: the segment of the export cable from the sea-to-shore transition to the SFEC – Interconnection Facility where the SFEC will interconnect with the LIPA system in East Hampton on Long Island, Suffolk County, New York.

[1] The OCS is defined by the Bureau of Ocean Energy Management (BOEM) as "3 International Nautical Miles (International Nautical Miles = 6076.10333 feet) seaward of the baseline from which the breadth of the territorial sea is measured".





Legend

- SFWF
- SFEC - OCS
- SFEC - NYS
- SFEC - Onshore
- Landing Site
- Block Island Wind Farm
- Submerged Lands Act Boundary
- Lease Area OCS-A 0486

0 10 Miles

1 inch = 10 miles (At original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 18N
2. Study area footprints provided by Bureau of Ocean Energy Management (BOEM).
3. Base map: ESRI World Topographic Map web mapping service.

Stantec

Project Location
Long Island, New York

195601308
Prepared by GAC on 2018-02-07
Technical Review by JLC on 2018-02-12
Independent Review by BR on 2018-02-13

Client/Project
CH2M HILL, Inc.
Deepwater South Fork COP Support

Figure No.
1-1

Title
Project Location Map

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The SFWF Operations and Maintenance (O&M) facility will be in a port either in Montauk in East Hampton, New York, or at Quonset Point in North Kingstown, Rhode Island. Several port facilities located in New York, Rhode Island, Massachusetts, and Connecticut will be considered for offshore construction, staging and fabrication, as well as for crew transfer and logistics support.

1.1 CONSTRUCTION ACTIVITIES

Construction of the SFWF is anticipated to be completed in the following general sequence:

- Mobilization of vessels and transportation of materials.
- Transportation of turbine foundations[2] to the WTG installation site.
- Installation of foundations.
- Installation of the offshore substation.
- Installation of the inter-array cable.
- Installation of the WTGs.

Installation of the SFEC – OCS and SFEC – NYS will include:

- Installation of the submarine cable will be via a simultaneous cut and lay process using a self-propelled mechanical and hydro-jet trenching plow that will cut a trench along the seafloor and simultaneously entrench the cable in a single pass.
- The target burial depth of the cable is 2 m (4–6 feet), with a maximum trench depth of 3.05 m (10 feet) and trench width of 0.91 m (3 feet); the cable width will be 0.23 – 0.30 m (0.75 – 1.0 feet). Cable plowing and laying will occur from the sea-to-shore transition to the offshore substation.
- The burial method for the SFEC is dependent on suitable seabed conditions and sediments along the cable route. Other methods of cable protection may be employed in areas where seabed conditions might not allow for cable burial, such as additional cable armoring, articulated concrete mattresses, or rock placement.
- Cable plow technology and burial speed will depend on final cable type and seabed conditions, but is expected to achieve between 0.1 and 0.75 km/hour [hr] (0.1–0.5 mi/hr).

Installation for the SFEC – Onshore is anticipated to be completed in the general sequence described below and without need for any new overhead transmission lines. Descriptions are provided for the two landfall locations under consideration: Beach Lane and Hither Hills (both in East Hampton, Long Island).

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[2] Three foundation types under consideration include: 1) Jacket: one steel, lattice superstructure per WTG secured to the sea floor by four smaller, steel piles; 2) Monopile: one, large, steel monopile per WTG embedded into the sea floor; or 3) Gravity Base Structure (GBS): one large, pre-cast concrete, ballasted base per WTG resting on the sea floor. DWSF will select the type of foundation based on detailed engineering and design and site-specific physical data. Each foundation type has a different installation procedure.

Beach Lane Landing Site

- Offshore and onshore cables will be spliced together so the cable can be routed to the SFEC – Interconnection Facility by an underground electrical duct bank (the duct bank will run along the entire underground route onshore). The area where these installation activities would occur is described as the sea-to-shore transition and includes a new underground transition vault (in which the onshore and offshore cables will be spliced together) in interior portions of land, cable installed under the beach and intertidal water, and a temporary cofferdam located offshore beyond the intertidal zone.
- Horizontal Directional Drilling (HDD) will be used to install the submarine cable from a new transition vault in a manhole located onshore in the roadway approximately 243 m (800 feet) onshore from the Mean High Water Line (MHWL) to a point approximately 533 m (1,750 feet) from the MHWL, where a temporary cofferdam may be installed The entrance point will be in interior land areas, the cable will be installed under the beach (sea-to-shore), and the exit point will be offshore beyond the intertidal zone.
- Excavation for a new underground duct bank will occur within the right of way of roads and Long Island Railroad (LIRR).
- Installation of SFEC – Interconnection Facility components. An area of woodlot, up to approximately 0.96-hectare (2.38-acre), will be cleared for construction of the SFEC – Interconnection Facility.

Hither Hills Landing Site

- The offshore and onshore cables will be spliced together so the cable can be routed to the SFEC – Interconnection Facility by an underground electrical duct bank. The area where these installation activities would occur is described as the sea-to-shore transition. The sea-to-shore transition would include a new underground transition vault in interior portions of land, cable installed under the beach and intertidal water, and a temporary cofferdam located offshore beyond the intertidal zone.
- HDD will be used to install the submarine cable from a new transition vault in a manhole located onshore in a parking lot located approximately 198 m (650 feet) from the MHWL to a point approximately 579 m (1,900 feet) from the MHWL, where a temporary cofferdam may be installed. The entrance point will be in interior portions of land, the cable will be installed under the beach (sea-to-shore), and the exit point will be offshore beyond the intertidal zone.
- Excavation for a new underground duct bank will occur within right of way of Hither Hills State Park, roads, and LIRR.

  Installation of SFEC – Interconnection Facility components. An area of woodlot, approximately 0.96-hectare (2.38-acre), will be cleared for construction of the SFEC – Interconnection Facility.

1.2 OPERATIONS AND MAINTENANCE ACTIVITIES

It is anticipated that each WTG will require approximately one week of planned maintenance and approximately one week of unplanned maintenance per year. Planned maintenance is scheduled during low-wind, summer periods of the year. Unplanned maintenance scheduling will be in response to turbine issues that cannot be resolved remotely. A Crew Transfer Vessel will travel out to WTGs requiring maintenance.

The inter-array cable has no maintenance needs unless a fault or failure occurs. Cable failures are only anticipated as a result of damage from outside influences, such as boat anchors.

1.3 DECOMMISSIONING ACTIVITIES

Decommissioning of the facility will follow similar steps to construction; however, the process will generally occur in reverse order.

2.0 RISK ASSESSMENT

2.1 ASSESSMENT GOALS AND OBJECTIVES

The purpose of this risk assessment is to 1) evaluate the potential for, and level of, risk to birds and bats that may result from construction, operation, and decommissioning of the SFWF and SFEC, 2) identify the species most at risk of impact, with particular consideration for species listed as threatened or endangered under the federal Endangered Species Act (ESA) and New York State listed species (Table 2-1), 3) identify seasonal and daily periods when species are most at risk, and 4) to identify the Project's avoidance and minimization measures to avoid or reduce risks, as possible.

Of particular interest to this assessment are federally and state-listed species including the federally endangered roseate tern (*Sterna dougallii*); the federally threatened rufa red knot (*Calidris canutus rufa*), piping plover (*Charadrius melodus*), and northern long-eared bat (*Myotis septentrionalis*); and the New York State threatened least tern (*Sternula antillarum*) and common tern (*Sterna hirundo*) (note piping plover and roseate tern are also state-listed endangered, and northern long-eared bat are also state-listed threatened).

2.2 APPLICABLE REGULATIONS

Under CFR 30 CFR 585.626(a)(3), applicants for federal projects are required to characterize avian resources in a Lease Area through development and submittal of a Construction and Operations Plan (COP). This Risk Assessment and the Technical Report (Appendix A) will inform the Project's COP, which will be reviewed by the Bureau of Ocean Energy Management (BOEM). BOEM will be the lead federal agency during the review of the SFWF under the National Environmental Policy Act (NEPA) (42 USC 4321 *et seq*.) for environmental effects and benefits. Section 7 of the Endangered Species Act (ESA) of 1973 (16 U.S.C. § 1531 et seq.) is the mechanism by which federal agencies ensure the actions they take, including those they fund or authorize, do not jeopardize the existence of any listed species. Federal agencies must consult with the US Fish and Wildlife Service (USFWS) to assess how proposed actions may harm federally endangered or threatened species and/or their designated critical habitat. Biological assessments, or some other form of analysis, are typically prepared for projects requiring federal actions that may affect listed species. If a proposed activity is determined likely to have a significant adverse effect on a federally listed species, then the acting agency, along with the project proponent, must either work with the USFWS to find ways to eliminate the potential for adverse effects or initiate formal consultation whereby the USFWS prepares a Biological Opinion and Incidental Take Statement. Mitigation is often required to compensate take of listed species.

BOEM is required to protect the environment and natural resources of the OCS under the Outer Continental Shelf Lands Act (43 USC § 1337). BOEM has a Memorandum of Understanding (MOU) with USFWS, established in 2009 (Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds), to assess potential impacts to wildlife and implement mitigation measures, if needed, for offshore renewable energy projects. Native migratory birds are afforded protection under the federal Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755) and eagles are further protected under the federal Bald and Golden Eagle Protection Act (BEGPA; 16 U.S.C. 668-668c) of 1940.

The New York Public Service Commission (PSC) will lead the review of the SFEC – NYS and SFEC – Onshore in the State of New York under Article VII of The New York Public Service Law, which will include review under Section 401 of the Clean Water Act (CWA). Multiple federal and state governmental authorities will be cooperating or consulting agencies during the permitting process. The federal and state regulations that are relevant to the assessment of risk for birds and bats are described in Table 2-1.

Table 2-1. Federal and state regulations and definitions applicable to the SFWF and SFEC.

Applicable regulations and definitions			Applicable species in SFWF and SFEC
Migratory Bird Treaty Act (MBTA), 1918	over 800 species protected, as listed under Title 50, section 10.13, of the Code of Federal Regulations (50 CFR 10.13)	Illegal to "pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect"	generally all species of bird that may occur in SFWF and SFEC areas
Endangered Species Act (ESA; 16 U.S.C. 1531 et seq.), 1973	1,930 species of US and US waters listed	Section 7 of the ESA specifies that Federal Agencies (e.g., BOEM) consult with the Secretary of Commerce (via National Marine Fisheries Service (NMFS) and/or Interior (via USFWS) to determine that any "agency action is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of an endangered or threatened species' critical habitat"	federally endangered: roseate tern; federally threatened: piping plover, red knot, and northern long-eared bat
Bald and Golden Eagle Protection Act (BEGPA), 1940	16 U.S.C. 668-668c	prohibits "taking" of eagles (their parts, nests, or eggs) without a permit from the Sectretary of the Interior	state endangered: golden eagle; state threatened: bald eagle
Environmental Conservation Law of New York, Section 11-0535 and 6 NYCRR (New York Code of Rules and Regulations) Part 182, 1999	state endangered species: section 182.2(g) of 6NYCRR Part 182; state threatened species: section 182.2(h); and state special concern: section 182.2(i)	Prohibited is the "taking, importation, transportation, possession or sale of any endangered or threatened species of fish, shellfish, crustacea or wildlife, or hides or other parts thereof, or the sale or possession with intent to sell any article made in whole or in part from the skin, hide or other parts of any endangered or threatened species of fish, shellfish, crustacea or wildlife is prohibited, except under license or permit from the department"	state endangered: piping plover and roseate tern; state threatened: common tern, least tern, and northern long-eared bat; state special concern: eastern small-footed bat
BOEM/MMS Memorandum of Understanding (MOU) with USFWS, 2009	BOEM follows National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321-4347) process to asssess impacts to migratory birds and their habitats	"potential impacts be thoroughly assessed and that mitigation measures be considered and implemented as appropriate"	all birds/bats

2.3 RISK ASSESSMENT APPROACH

This risk assessment takes a weight-of-evidence approach, drawing from the most current and relevant literature, biological and ecological information, and empirical data collected at the BIWF and proposed offshore wind projects in the region, as well as offshore wind projects in Europe. The analysis is largely qualitative due to the developing nature of the U.S. offshore wind industry and very limited availability of post-construction monitoring data. There are inherent data gaps associated with the information available for this risk assessment due to the limitations of available technologies to investigate impacts to birds and bats in the offshore environment. For example, ship-based survey results represent diurnal avian activity only as these visual observation surveys cannot sample nocturnal periods, and these types of surveys are typically conducted under fair conditions with decent visibility and relatively low wind speeds. Consequently, data collected during these types of surveys do not represent the variable bird behaviors that may occur during all weather conditions or times of day (Viet et al., 2017). Additionally, there is currently no way to confirm carcass counts offshore and the available methods to estimate fatality rates – including shoreline based beached-bird surveys and remote sensing technologies such as radar and thermal cameras – have limitations. While there is a growing information base from European offshore wind projects, available studies have primarily focused on displacement or barrier effects rather than collision mortality, given the current limited ability to detect and record collision events at sea (Hill et al., 2014; Huppop et al, in press; Molis et al, under review).

There is some uncertainty surrounding listed species use of the SFWF. While piping plover, roseate tern, least tern, and common tern have the potential to occur in the SFWF area during migration, little information is available regarding the weather conditions when they may occur or their potential flight heights when far offshore. Similarly, little is known regarding the height of flight at which bats may migrate far offshore under a range of weather conditions. Finally, there is limited information regarding species-specific turbine avoidance behaviors, particularly in the offshore environment, and even the data from European offshore wind projects is limited.

This analysis considers applicable avoidance and minimization measures that will be in place during construction/decommissioning and operation of the SFWF and SFEC in the assessment of level of risk for each type of impact. Because this risk assessment will be used to inform the COP for BOEM's review of the Project, BOEM's standard impact producing factors (IPF) are used, as described in the following sections.

2.4 IMPACT PRODUCING FACTORS

BOEM considers the IPF outlined in Table 2-2 during reviews of offshore renewable energy projects. Table 2-2 indicates which IPF are relevant to birds and bats during construction, operation, and/or decommissioning of the SFWF and SFEC, the type of impact, and whether those IPFs may have direct or indirect impacts on birds and bats. Those IPFs with no effect to birds and bats, including electromagnetic field, air emissions, and trash/debris, are excluded from this risk assessment because they have no mechanism to impact birds and bats.

Table 2-2. Impact producing factors and type of associated impact resulting from construction/decommissioning and operation of the SFWF and SFEC and anticipated level of impact to birds and bats.

Impact Producing Factor	Type of Impact (Direct or Indirect)	Potential level of impact[1]	
		Birds	Bats
Seafloor and Land Disturbance	Direct habitat loss/modification	NEG	NEG-MIN
Sediment Suspension and Deposition	Direct habitat loss/modification	NEG	NONE
Noise	Indirect displacement	NEG-MIN	NEG
Electromagnetic Fields (EMF)	Indirect injury/mortality	NONE	NONE
Discharges and Releases	Indirect mortality/decreased breeding success	NEG	NONE
Trash and Debris	Indirect injury/mortality	NEG	NONE
Traffic	Indirect displacement/attraction	NEG-MIN	NEG-MIN
Air Emissions	Indirect injury/mortality	NONE	NONE
Visible Structures	Direct collision risk; indirect barrier effect or attraction	NEG-MIN	NEG-MIN
Lighting	Direct collision risk; indirect barrier effect or attraction	NEG-MIN	NEG-MIN
1 NONE: no impact; NEG: negligible; MIN: minor; MOD: moderate; MAJ: major.			

These IPFs would have variable impacts on different species groups of birds and bats. As such, potential risks are considered separately for the different species groups, with a specific focus on rare or listed species. Bird and bat groups susceptible to similar risks due to their use and behaviors at the SFWF and SFEC are grouped for the discussion of impacts. Types of risks to birds and bats at the SFWF compared to the SFEC will vary and are therefore discussed separately.

2.5 TYPES OF EFFECTS

There is potential for both direct and indirect effects associated with the construction/ decommissioning and operation of the SFWF and SFEC:

- Direct effects are those expected to occur at the same location and within the same timeframe as the project activity. Direct effects include habitat loss and/or habitat modification during construction and decommissioning and may be a result of disturbances from vessels and noise during construction and maintenance. Direct effects also include potential collision events during construction and operation. Direct effects such as collision mortality in the offshore environment are difficult to investigate.
- Indirect effects are those that may occur after the project activity and may result in impacts to a different or larger area than the location of the project activity. Indirect effects may include the presence of visible structures resulting in displacement or attraction, or barrier effects representing increased energy expenditure while traveling around or avoiding visible structures. An additional indirect effect may include potential discharges or releases of petroleum-based fluids or other contaminants. Indirect effects can be complicated and difficult to measure due to other non-project related influences and can vary among species.

2.6 IMPACT EFFECT LEVELS

Impacts may be short-term (temporary) or long-term (reoccurring or permanent). Direct and indirect effects may result in the following levels of impacts for birds and bats:

- No impact – no existing mechanism for effect.
- Negligible impact – if perceptible, would not be measurable.
- Minor – if adverse, would be perceptible but, in context, would be avoidable with proper mitigation and if impacts are measurable, the affected system would be expected to recover completely without mitigation once the impact is eliminated.
- Moderate – if adverse, would be measurable but not threaten the viability of the affected system and would be expected to absorb the change/impact if proper mitigation or remedial action is implemented.
- Major – if adverse, would be measurable but not within the capacity of the affected system to absorb the change, and without major mitigation, could be severe and long lasting.

2.7 KEY RISK FACTORS

The following key factors influence risks to birds and bats at the SFWF and SFEC. In the list below, a description of how these factors influence risk and the location of where a detailed discussion of each key factor can be found within this document (Section 2.2, Avian and Bat Existing Conditions and/or Appendix B, Literature Summary) is provided.

- Key Factor 1: Seasonal Abundance and Species Use – relates to timing and frequency of occurrence, and periods when risk exists (Section 2.2)
- Key Factor 2: Behaviors – influences frequency of occurrence and level of risk of activities in the rotor-swept zone (RSZ) (Section 2.2; Appendix B)
- Key Factor 3: Flight Height – influences occurrence in RSZ (Section 2.2; Appendix B)
- Key Factor 4: Risk of Collision – likelihood of collision events (Appendix B)
- Key Factor 5: Changes to Foraging and Perching/Roosting Habitat – influences frequency of occurrence and activity in RSZ (Appendix B)
- Key Factor 6: Weather – influences likelihood of collision events (Appendix B)
- Key Factor 7: Visibility and Lighting – influences likelihood of collision events (Appendix B)

Note that Appendix B includes additional information for birds regarding disturbance, displacement/avoidance and barrier effect.

2.8 AVIAN AND BAT EXISTING CONDITIONS

Appendix A, the Technical Report, provides a detailed characterization of the bird and bat ecological community associated with the SFWF and SFEC. Those biological and empirical data that relate to the key factors that are applicable to the assessment of risk, including seasonal abundance, use, and behaviors, are summarized below.

2.8.1 Avian Community Characterization

For birds, empirical data most relevant to this assessment were collected during the Rhode Island Ocean Special Area Management Plan (OSAMP) surveys from 2009 to 2012 (Paton et al., 2010; Winiarski et al., 2012); regional telemetry data from recent studies focusing on threatened and endangered species (Loring et al., 2017a; Loring et al., 2017b); pre-construction visual observation surveys conducted for the Block Island Wind Farm (BIWF; Tetra Tech and DeTect, 2012); and preliminary results from the first year of post-construction monitoring surveys at the BIWF (Stantec, in prep). The regional studies considered most relevant to the assessment of risk at the SFWF and SFEC are summarized in Table 2-3 and Figure 2-1 and are referenced throughout the following sections. Also considered were recent nesting data for listed shorebird and tern species on Long Island (Town of East Hampton, 2017; K.Gaidasz, NYSDEC, per comm.) (Figure 2-2).

The groups of birds that are likely to occur in the SFWF and SFEC include:

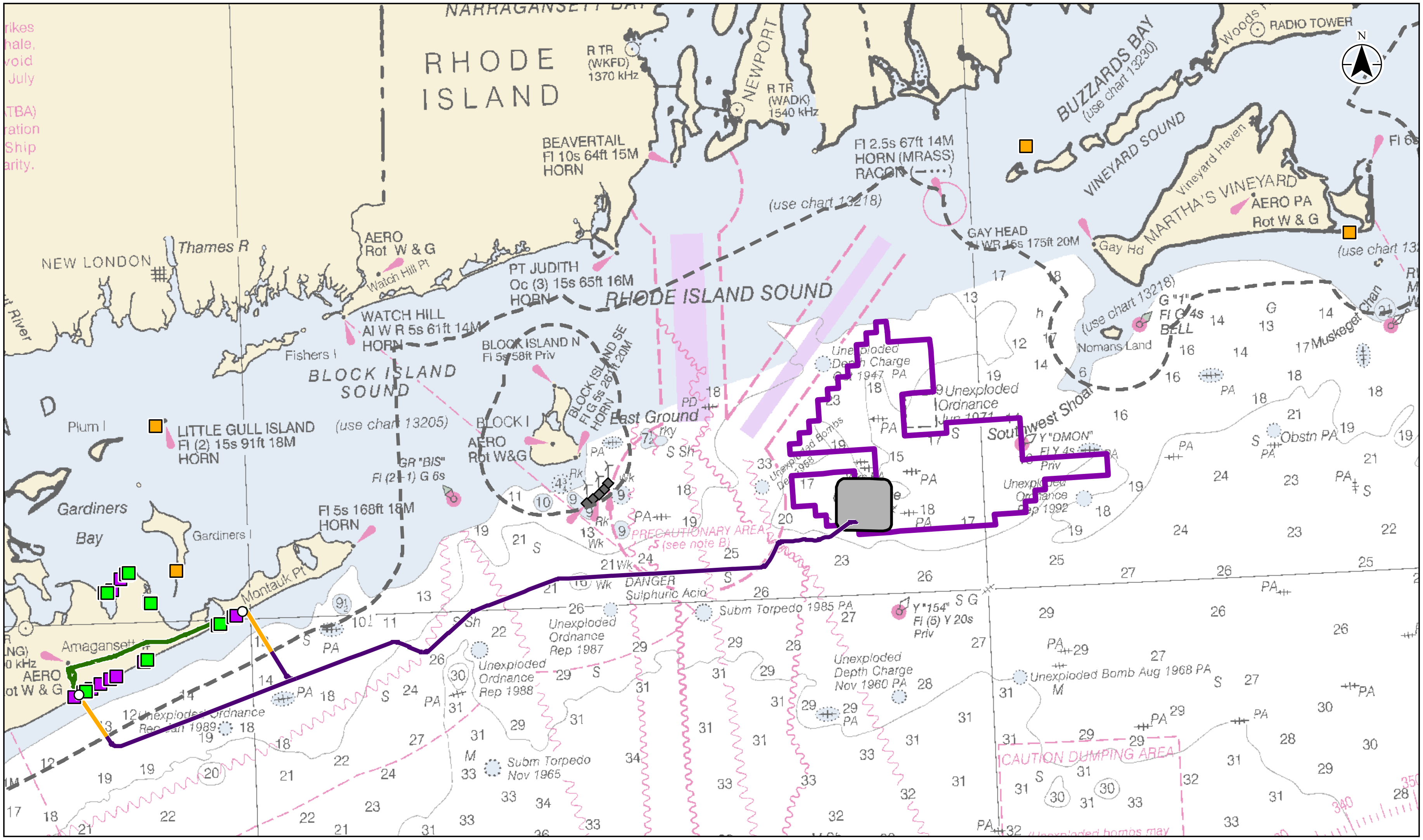
- Waterbirds – loons and cormorants

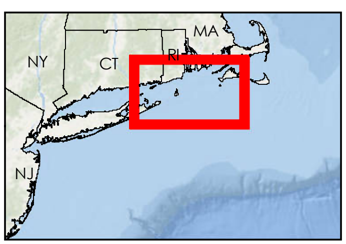
- Seabirds – shearwaters, fulmars, storm-petrels, gannets, jaegers, gulls, kittiwakes, terns, and alcids
- Waterfowl – seaducks and diving ducks
- Shorebirds – primarily plovers, sandpipers, and phalaropes
- Landbirds – passerines and raptors

For simplicity sake, biological information as it relates to risk is generally summarized by bird group except in the case of listed species, which are discussed separately.

Table 2-3. Descriptions of relevant regional avian surveys.

Study	Dates	Reference(s)
Rhode Island Ocean Special Area Management Plan (OSAMP)	2009 to 2012	Paton et al., 2010; Winiarski et al., 2012
OSAMP offshore ship-based surveys (grid and line) and land-based sea watches	grid surveys: February to May 2009 and June 2009 to March 2010; line surveys: July and August 2009; land-based: January 2009 to February 2010	Paton et al., 2010
OSAMP offshore aerial transect surveys	November 2009 to March 2010	Paton et al., 2010
OSAMP offshore aerial transect surveys	October 2010 to July 2012	Winiarski et al., 2012
Block Island Wind Farm beached-bird survey	June 2015 to July 2017	Tetra Tech, 2017
Block Island radar survey from Southeast Lighthouse	February 2009 to September 2011	Tetra Tech and DeTect, 2012
Block Island offshore aerial high definition videography survey	August 2009 to April 2010	Tetra Tech and DeTect, 2012
Block Island offshore ship-based avian transect surveys	July 2009 to June 2010, and August through September 2011	Tetra Tech and Detect, 2012
Block Island post-construction offshore ship-based avian transect surveys	January 2016 to December 2017	Stantec, in prep
BOEM tern and plover telemetry study	summer and fall 2016	Loring et al., 2017a
BOEM red knot telemetry study	summer and fall 2016	Loring et al., 2017b





Legend

Nesting Locations

- Least Tern
- Piping Plover
- Roseate Tern
- Landing Site
- Block Island Wind Farm
- SFWF
- SFEC - OCS
- SFEC - NYS
- SFEC - Onshore
- Submerged Lands Act Boundary
- Lease Area OCS-A 0486

0 10 Miles

1 inch = 11 miles (At original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 18N
2. Study area footprints provided by Bureau of Ocean Energy Management (BOEM).
3. Base map: West Quoddy Head to New York NOAA Nautical Chart.

Project Location 195601308
Long Island, New York
Prepared by GAC on 2018-02-12
Technical Review by JLC on 2018-02-13
Independent Review by BR on 2018-02-14

Client/Project
CH2M HILL, Inc.
Deepwater South Fork COP Support

Figure No.
2-1

Title
Town of East Hampton 2017 active nesting locations of piping plover and least terns, and closest major roseate tern nesting colonies to SFWF

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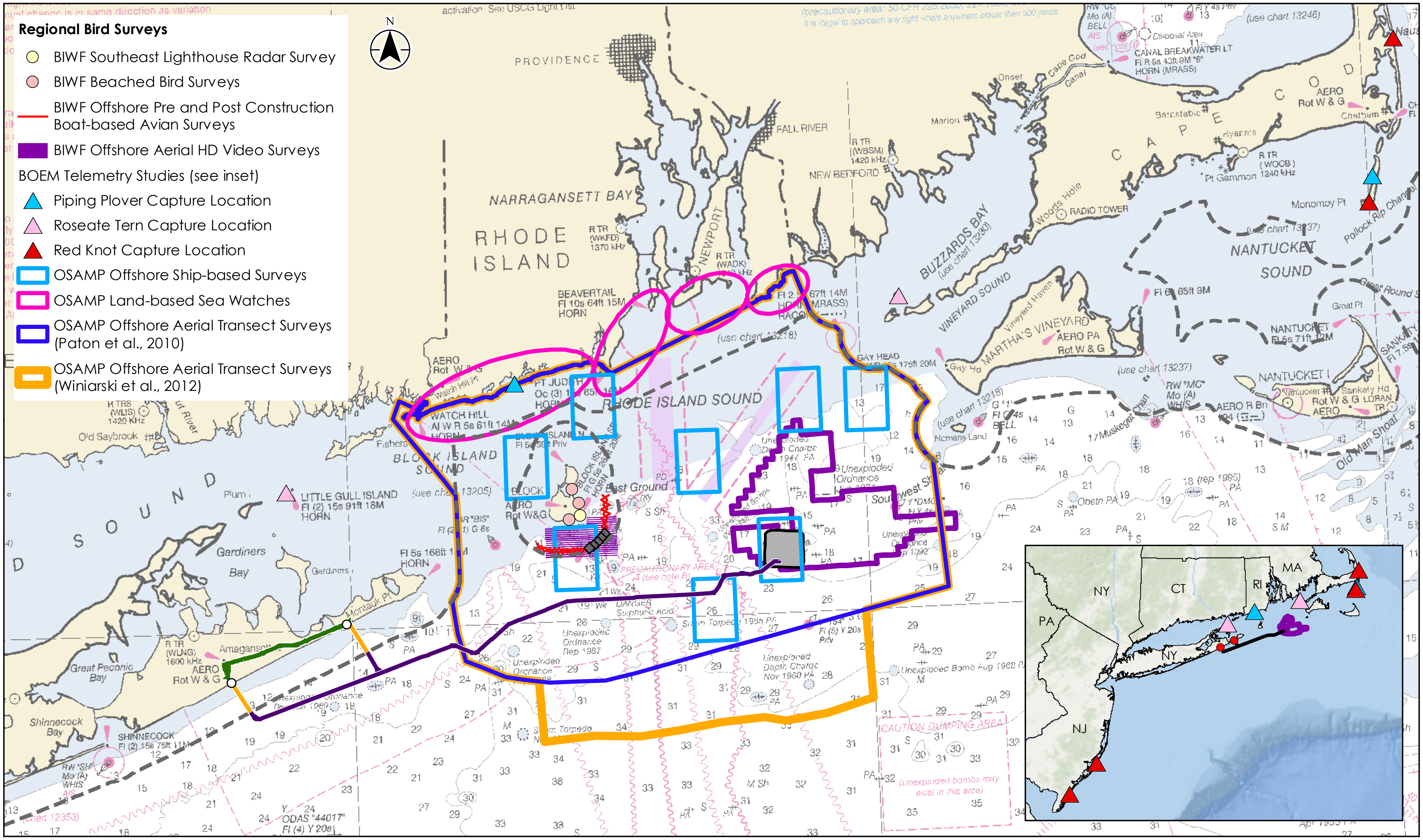

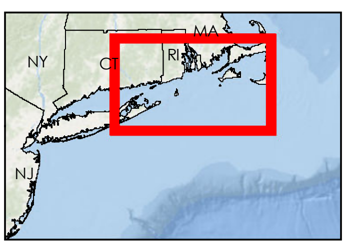

Legend

- SFWF
- SFEC - OCS
- SFEC - NYS
- SFEC - Onshore
- Landing Site
- Block Island Wind Farm
- Submerged Lands Act Boundary
- Lease Area OCS-A 0486

0 15 Miles

1 inch = 15 miles (At original document size of 8.5x11)

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Study area footprints provided by Bureau of Ocean Energy Management (BOEM).
3. Base map: West Quoddy Head to New York NOAA Nautical Chart.

Stantec

Project Location
Long Island, New York

195601308

Prepared by GAC on 2018-02-14
Technical Review by JLC on 2018-02-15
Independent Review by BR on 2018-02-15

Client/Project
CH2M HILL, Inc.
Deepwater South Fork COP Support

Figure No.
2-2

Title
Locations of Relevant Regional Bird Surveys

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2.8.1.1 Key Factor 1: Avian Seasonal Abundance and Species Use

***Avian Seasonal Abundance and Species Use:* SFWF and SFEC – OCS**

The Technical Report (Appendix A) includes heat maps showing the seasonal distribution and relative abundance of 16 species of marine birds that commonly occur in the region of the SFWF and SFEC −OCS. These figures are based on modeled data from surveys conducted in the Atlantic (O'Connell et al., 2009; O'Connell et al., 2011; Kinlan et al., 2016).

In the OSAMP study area, researchers conducted ship-based line transect surveys of 8 grids from February to May 2009 and June 2009 to March 2010, nearshore ship-based line transect surveys in July and August 2009, and land-based sea watches from January 2009 to February 2010 (Figure 2-1; Paton et al., 2010). Of 56 species detected during the ship-based surveys, herring gull, Wilson's storm-petrel, and northern gannet (*Morus bassanus*) were among the most frequently detected (Paton et al., 2010). Wilson's storm petrels and shearwaters have globally large populations. Paton et al., (2010) estimated that potentially tens of thousands of Wilson's storm-petrels and tens of thousands shearwaters may occur in the OSAMP study area every summer. Relatively few phalaropes were detected during the ship-based surveys (Paton et al., 2010); however, phalaropes can sometimes occur in large concentrations offshore during migration (in flocks of up to 10,000 individuals) (Rubega et al., 2000).

Paton et al., (2010) also conducted 10 aerial transect surveys between November 2009 and February 2010. Of 17 observed species, common eider (*Somateria mollissima*), unidentified gull, and northern gannet were most frequently detected (Paton et al., 2010). Table 2-4 includes Paton et. al.'s (2010) estimated daily abundance of the most commonly observed species during the peak season of occurrence within the offshore OSAMP study area, as well as applicable data from a pre-construction radar study conducted at the Southeast Lighthouse on Block Island by Tetra Tech and DeTect (2012) from February 2009 to September 2011. The species or species groups included represent those that may occur most commonly in the SFWF.

Table 2-4. Species expected to most commonly occur in the SFWF and SFEC OCS based on estimated abundance and peak season of occurrence during offshore studies.

Group/Representative Species[1]	Estimated Daily Abundance during Peak Season of Occurrence in Offshore OSAMP Study Area (95% CI)	
Waterbirds		
common loon	2,901 (2535-3321)	winter
red-throated loon	190 observed*	winter
Seabirds		
herring gull	7,332 (6,000-8,961)	fall
great black-backed gull	2,680 (2366-3036)	fall
black-legged kittiwake	291 (548-707)	winter
common murre	623 (548-707)	winter
razorbill	1,390 (996-1,940)	winter
dovekie	5,771 (4,222-7,888)	winter
Wilson's storm-petrel	16,335 (10,879-24,527)	summer
Cory's shearwater	2,643 (1979-3530)	late summer/early fall
greater shearwater	3,350 (3005-3712)	late summer/early fall
northern gannet	4,474 (3688-5187)	fall and winter
Waterfowl		
common eider	518 observed*	winter
black scoter	313 observed*	winter
surf scoter	563 observed*	winter
white-winged scoter	682 observed*	winter
unid. scoter	1,542 observed*	winter
Shorebirds		
red-necked phalarope (and unid. phalarope)	26 observed*	late summer/early fall
Nocturnal Migrants		
passerines (predominantly)	33.0-119.5 targets/km/hr**	spring and fall
*No daily abundance estimate available, number represents cumulative total observed during surveys.		
**Offshore average nightly passage rate for all years combined for spring and fall from Block Island radar survey (Tetra Tech and Detect 2012).		

Additional surveys conducted for the OSAMP included aerial transect surveys from October 2010 to July 2012 (Figure 2-1; Winiarski et al., 2012). Transects crossed nearshore, island, and offshore locations. The aerial surveys found similar results to the ship-based OSAMP surveys: the species most commonly observed included herring gull, great black-backed gull (*Larus marinus*), and scoter species (Winiarski et al., 2012).

Tetra Tech and Detect (2012) conducted pre-construction boat-based transect surveys at BIWF from July 2009 to June 2010, and again from August 2011 to September 2011. Observers documented 32 bird species for all surveys combined. The most commonly detected species included black scoter (*Melanitta Americana*; n = 948), northern gannet (n = 865), unidentified *Laurus* gull (n = 828), white-winged scoter (*Melanitta deglandi*; n = 693), and common loon (*Gavia immer*; n = 552). Of the total 6,971 birds recorded, terns accounted for 1.5 percent (n = 102) and shorebirds accounted for 0.19 percent (n = 13) of observations.

Tetra Tech and Detect (2012) also conducted an offshore aerial high definition videography survey in 2009 and 2010 (Figure 2-1). Unidentified duck was the most commonly detected group (particularly in February), followed by unidentified *Laurus* gull (particularly in April), unidentified bird (particularly in April), unidentified loon (particularly in March), and northern gannet (particularly in April) (Tetra Tech and Detect, 2012). Highest counts of all bird species combined were in February (Tetra Tech and Detect, 2012).

Passerines are one of the most abundant bird groups in North America; however, passerines are expected to primarily cross the OCS during night migration and will typically fly at great heights (Willmott et al., 2013). Tetra Tech and Detect (2012) conducted a radar survey from February 2009 to September 2011 from the Southeast Lighthouse on Block Island. The radar system sampled bird and bat targets out to 5.6 km (3 nm) from the island; using different radar settings, they sampled target activity onshore, nearshore, and offshore. Coastal and island-based radar surveys revealed that passerines migrate on a broad-front and primarily occur offshore during night migration (TetraTech and Detect, 2012).

Some species of raptors, including peregrine falcon (*Falco peregrinus*), may occur over the OCS during migration; however, most species typically avoid crossing large bodies of water during migration. Peregrine falcons can fly hundreds of kilometers offshore during migration (Williams et al., 2015). Bald eagles and ospreys (*Pandion haliaetus*) will migrate along the Atlantic coast; however, rare flights over the OCS may occur.

Table 2-5 outlines the peak seasons of occurrence of the species expected to most commonly occur in the SFWF. During Tetra Tech and Detect's (2012) radar study, the highest passage rates were recorded onshore during nights in the fall and summer, nearshore during nights in the fall, and offshore during dawn in late winter. Tetra Tech and DeTect (2012) found that target activity varied by season and daytime/nighttime period. Waterbirds such as loons, and waterfowl including red-breasted mergansers, scoters, and eiders, and seabirds such as alcids could occur in relatively large numbers in the SFWF and SFEC OCS in the winter (Table 2-4). Researchers concluded that the OSAMP study area provides critical wintering habitat for common loon, with 54 percent of the Northeast breeding population estimated to occur in the area during winter (Paton et al., 2010). Other seabirds such as shearwaters, fulmars, storm-petrels, gannets, and jaegers typically occur in the SFWF area in late-summer and fall during dispersal periods. Two species of shorebird may stage in the SFWF during fall migration and winter, red-necked phalarope (*Phalaropus lobatus*) and red phalarope (*Phalaropus fulicarius*). Other species of shorebirds and landbirds may occur over the SFWF while migrating in the spring and fall.

Table 2-5. Seasonal timing of occurrence of species that may occur in the SFWF and SFEC OCS.

Group/Representative Species	Peak Season(s) of Potential Occurrence
Waterbirds	
common loon	winter
red-throated loon	winter
Seabirds	
herring gull	fall
great black-backed gull	fall
black-legged kittiwake	winter
common murre	winter
razorbill	winter
dovekie	winter
Wilson's storm-petrel	summer
greater shearwater	late summer/early fall
Cory's shearwater	late summer/early fall
northern gannet	fall and winter
common tern	summer/mainly post-breeding
roseate tern	summer/mainly post-breeding
least tern	summer/mainly post-breeding
Waterfowl	
common eider	winter
black scoter	winter
surf scoter	winter
white-winged scoter	winter
Shorebirds	
red-necked phalarope	late summer/early fall
red phalarope	late summer/early fall
piping plover	rarely during migration (up to twice per year per individual)
red knot	potentially during migration (up to twice per year per individual)
Nocturnal Migrants	
passerines	spring and fall migration (up to twice per year per individual)

[1] This list does not include all species that may occur in the SFWF, rather the species expected to most commonly occur as well as species of interest (roseate tern, piping plover, red knot, least tern and common tern).

[2] Designates federally or state-listed species.

Avian Listed Species *Occurrence: SFWF and SFEC – OCS*

Terns are potentially present in the region from late spring through early fall; however, terns were only detected in the offshore OSAMP study areas in summer, mainly during the post-breeding period (Paton et al., 2010). There were 81 terns (mostly common terns) observed in the ship-based OSAMP survey, including 8 roseate terns. Roseate terns were seen on three ship-based line transect grids in Block Island Sound, no roseate terns were detected on grids in Rhode Island Sound or within the Inner Continental Shelf during ship-based surveys (Paton et al., 2010). During the OSAMP ship-based surveys, roseate terns were only detected in Block Island Sound during mid-July to late August 2009 (Paton et al., 2010). The authors concluded that these species were relatively uncommon in the ocean OSAMP study areas and were only observed during the post-breeding period. There were no roseate terns confirmed during the OSAMP aerial surveys however the authors note that this type of survey does not often allow for identifying terns to the species level and was not designed to detect individuals or small flocks of relatively small birds (Winiarski et al., 2012). Roseate terns are known to forage as far as 24–48 km (15–30 mi) from breeding colonies; however, they are generally expected to remain within a range of 7 km (4 mi) (Burger et al., 2011). They also overwinter in Brazil so Northeast birds are expected to cross the OCS at some point during migration. While there are few coastal records of roseate terns during migration, there have been offshore records of what were assumed to be migrating birds during pelagic bird tours (Burger et al., 2011). Least terns were among the species of terns observed during the OSAMP aerial surveys from October 2010 to July 2012; terns in general were most abundant during summer surveys and occurred throughout the study area (Winiarski et al., 2012). Least tern (n = 1) was detected during Tetra Tech and DeTect's (2012) pre-construction boat-based surveys at Block Island. The OSAMP researchers noted that terns were relatively abundant during the spring and summer aerial surveys in both the nearshore and offshore environments. It is likely that a small percentage of those individuals detected were roseate terns. Least terns are thought to migrate along the coast but are also known to cross bodies of water; Atlantic Coast least terns will cross the ocean to get to the Caribbean Islands (Thompson et al., 1997), so the potential exists for crossings of SFWF. Roseate terns, common terns, and least terns are expected to occur infrequently over SFWF during the summer and may also cross the SFWF during spring and fall migration. Although there are no known staging areas that funnel migrating terns over the SFWF, the potential exists for terns to cross SFWF while departing staging grounds or when arriving at breeding areas in the spring. Data from immersion sensors indicated both common and roseate terns tagged with geolocators departing for migration from Cape Cod flew mostly during the night and stopped to feed at times during the day, and both species were observed resting on the water during the day and at night during migration (Nisbet et al., 2014, 2017a).

During the Tetra Tech and Detect (2012) pre-construction boat-based transect surveys at BIWF, least tern (n = 1) and common tern (n = 65) were detected but no other species of concern (e.g., piping plover, roseate tern, or red knot) were observed.

In June 2016, Loring et al. (2017a) radio-tagged 123 common and roseate terns on nesting islands including Great Gull Island, New York and Bird and Penikese Islands in Buzzards Bay, Massachusetts. The authors tracked terns to pre-migration staging areas after breeding until mid-September via automated telemetry tracking stations at 21 land-based and 1 boat-based towers from southern New England to New York. Common terns began departing Bird Island in mid-June and Great Gull Island in mid-July before relocating to staging areas. Based on tracking station detections, common terns moved between coastal locations. During the same study, Loring et al. (2017a) found roseate terns began departing Bird Island in mid-June and Great Gull Island in early-July. Roseate tern movements were also between shores and islands of Massachusetts, Rhode Island, and New York. Some flights between eastern Long Island (Gardiners Island/Cartwright Point) and locations in Nantucket Sound crossed areas of Block Island Sound (Loring et al., 2017a). Great Gull Island terns (both roseate and common) primarily frequented sites west of Buzzards Bay, and birds tagged in Buzzards Bay remained around Cape Cod.

There is potential for piping plover and red knot to cross SFWF during migration as both species disperse to their wintering grounds during August and September and return to breeding locations during March and April. Researchers observed 25 individuals of 6 species of shorebirds (and 2 unidentified shorebird groups) during the ship-based surveys within the OSAMP. No federally threatened piping plover were observed during the ship-based surveys (Paton et al., 2010) or during the OSAMP aerial surveys. However, the authors acknowledge these types of surveys did not allow for identifying shorebirds to the species level and were not designed to detect individuals or small flocks of small birds (Winiarski et al., 2012).

Piping plover foraging and breeding locations are land-based (Burger et al., 2011) and include locations on Long Island and rarely on Block Island. The OSAMP researchers indicated piping plovers generally remain along coastal beaches, with the possible exception of migratory periods (Paton et al., 2010). The majority of Atlantic Coast piping plover migratory movements are believed to take place along the outer beaches of the Atlantic coastline, with most movements thought to occur along a narrow flight corridor because offshore and inland observations are rare (USFWS, 1996). Piping plover have been observed in Bermuda, so they are capable of migrating offshore, or they may get blown off course during inclement weather (Burger et al., 2011). Available pelagic bird tour long-term datasets from locations in the north and central OCS documented shorebirds but no piping plovers were observed 3 miles or greater from shore (Burger et al., 2011). Recent telemetry data suggest piping plover migration is not always restricted to coastal locations and some individuals will occur offshore. Crossings of the OCS are possible but expected to be broad-front, with individuals making up to 2 crossings per year (Gordon, 2011). A 2016 telemetry study tagged 50 piping plovers from Massachusetts and Rhode Island; 29 of these individuals retained their transmitters through the time of dispersal from their breeding areas. The median departure date for these 29 individuals was July 23. Of those piping plovers tagged at Rhode Island locations, 56 percent took an offshore route through Block Island Sound, departing between Montauk and Block Island, and 44 percent departed via a coastal route through Long Island Sound. Of those piping plovers tagged at Massachusetts locations, 70 percent headed south through eastern Nantucket Sound and south over Nantucket Sound, 23 percent headed west from Monomoy Island traveling across Nantucket

Sound, Rhode Island Sound, and Block Island Sound before heading southwest through Long Island Sound (Loring et al., 2017a).

The federally threatened red knot was not among the six species of shorebirds observed during ship-based surveys within the OSAMP. They were not observed in any of the OSAMP study areas in 2009 to 2010, nor were they confirmed during the OSAMP aerial surveys from 2010 to 2012 (Paton et al., 2010; Winiarski et al., 2012). Red knots are known to stop over in New York during north and southbound migrations (Baker et al., 2013). Red knots are one of the longest distance travelers and migrate thousands of kilometers between stopover locations (Baker et al., 2013). The red knot migration is suspected to largely be non-coastal, with widely spaced migration stopover locations (Gordon, 2011). Their flights over the OCS are believed to be broad-front, with potential concentrations south of Cape Cod in fall and south of Delaware Bay in spring (Gordon, 2011). Geolocators were attached to red knots in Delaware Bay, New Jersey and the Monomoy Refuge, Massachusetts in 2009. While most of the Delaware Bay birds were long-distance migrants, some of the Monomoy birds stopped over and/or over-wintered at locations along the Atlantic Coast (Berger et al., 2012). Some individuals were detected at locations over the OCS 2–6 times over the course of a year. The researchers suggested that migrants may be at risk of collision with WTGs located in the OCS when ascending or descending to/from stopover or over-wintering sites, or if taken off course during inclement weather (Berger et al., 2012). In 2016, there were 99 red knots tagged on Cape Cod, of which 85 individuals had valid detections at telemetry stations located from Cape Cod to Cape Hatteras. Of these 85 birds, migratory departures for 40 individuals leaving Nantucket Sound were detected at various stations. Of these 40 birds, 32 were last detected in Nantucket Sound departing in a southeasterly direction (Loring et al., 2017b). The remaining 8 birds were detected over the mid-Atlantic with flight trajectories toward Long Island or directly across the Atlantic toward Virginia.

Avian Species Abundance and Species Use: SFEC − Onshore and Sea-to-Shore Transition

A variety of landbirds including passerines and raptors that occur in terrestrial habitats on Long Island in the East Hampton area. Many species may breed or stopover in woodland habitats on Long Island during migration. There will be a relatively small area of woodland cleared (less than 0.96-hectare [2.38-acres]) for development of the SFEC - Interconnection Facility. Otherwise, the SFEC − Onshore upland components will largely occur in already developed areas with limited avian use. Therefore, this discussion largely focuses on the SFEC − Onshore shoreland and sea-to-shore areas.

Common species of shorebird that may breed on Long Island include American oystercatcher (*Haematopus palliates*), killdeer (*Charadrius vociferous*), and willet (*Tringa semipalmata*) (Appendix A). There are many species of migratory shorebird that may occur on eastern Long Island during spring or fall migration, including the federally threatened rufa red knot. Several species of shorebird may also overwinter on Long Island including sanderling (*Calidris alba*), dunlin (*Calidris alpine*), and purple sandpiper (*Calidris maritima*).

Avian Listed Species Occurrence: SFEC – Onshore and Sea-to-Shore Transition

The New York Natural Heritage Program indicated breeding records for piping plover at Napeague Beach and Napeague State Park, and near the Hither Hills and Beach Lane landing sites; however, the project is outside of critical habitat designated for this species (NYSDEC, 2017). There are breeding records of least terns in the vicinity of Napeague Beach, and near the Hither Hills and Beach Lane landing sites (NYSDEC, 2017). The Town of East Hampton monitors piping plovers and least terns during the breeding season on the south shore and in the bays and harbors at the eastern end of Long Island (Town of East Hampton, 2015a; Town of East Hampton, 2015b; Town of East Hampton, 2017).

Piping plover are present in the region between March and September and use sandy shorelines and barrier islands for nesting. In 2017, there were 35 pairs of piping plover nesting on the beaches of East Hampton at 12 active nesting sites (Town of East Hampton, 2017) (Figure 2-1). The closest active nesting territories in 2017 to the Beach Lane landing site were on Wainscott Pond (1 pair) and Georgica Pond and Georgica Beach (6 pairs) (Town of East Hampton, 2017). These locations abut the Beach Lane landing site (Figure 2-1). In 2017, there were 6 pairs of piping plover at Napeague Beach, adjacent to the Hither Hills State Park landing site (1.6 km [1 mi]) (Town of East Hampton, 2017). The shoreline of Hither Hills State Park also hosts nesting piping plovers (K. Gaidasz, NYSDEC, pers. comm.) (Figure 2-1).

Least terns are present in the region between April and September. On Long Island, least terns nest on peninsulas, barrier islands, and sandy shorelines on bays and the coast, often in proximity to piping plover (MacLean et al., 1991, as cited by Thompson et al., 1997; Town of East Hampton, 2015a; Town of East Hampton, 2015b; Town of East Hampton, 2017). In 2017, there were an estimated 125 breeding pairs of least terns among 6 different sites in the Town of East Hampton. The closest nesting location to the Beach Lane landing site is Georgica Pond where in 2017 there were 60 pairs (Town of East Hampton, 2017). In 2017, Napeague Beach hosted 6 pairs of least terns in 2017 (Town of East Hampton, 2017). The shoreline of Hither Hills State Park also hosts nesting least terns (K. Gaidasz, NYSDEC, pers. comm.) (Figure 2-1).

Roseate and common terns are present in the region from April to October. Common and roseate terns breed in the vicinity of eastern Long Island on adjacent coastal habitats and islands (Figure 2-2; Appendix A). The largest active roseate tern breeding colony is Great Gull Island (>1,500 pairs; USFWS 2010) located north of Long Island, approximately 72 km (45 mi) west-northwest from SFWF (Figure 2-1). The closest active colony locations to the SFWF include Gardiner's Island/Cartwright Point east of Long Island (71 km [44 mi]), and Penikese Island (24 km [15 mi]) and Norton Point (37 km [23 mi]) off of Massachusetts (USFWS, 2010) (Figure 2-2). Great Gull Island and three colonies in Buzzard's Bay support approximately 90 percent of the northeast breeding population (Loring et al., 2017a).

During migration, large concentrations of rufa red knots can occur on the south shore of Long Island in spring (April and May) and late summer-fall (July through October). Preliminary results from BOEM's telemetry study detected birds flying in the vicinity of Long Island's south shore (Loring et al., 2017b).

The state threatened northern harrier (*Circus cyaneus*) is known to breed at locations across Long Island, with breeding records in the vicinity of the onshore portions of the project, including Napeague State Park, Hither Hills State Park, Napeague Harbor (NYSDEC, 2017; K. Gaidasz, NYSDEC, pers. comm.). Their breeding period extends from April through September, with nesting habitat in marshes, meadows, and grasslands with low, thick vegetation (Smith et al., 2011).

There are no known bald eagle nests in the direct vicinity of the landing site locations and suitable bald eagle habitat on Long Island is limited.

2.8.1.2 Key Factor 2: Avian Behaviors

Avian Behaviors: SFWF and SFEC – OCS

Species that seasonally occur at the SFWF and SFEC OCS use the offshore environment to forage, commute, rest and/or roost overnight, or may cross the area during migration. Waterbirds, seabirds, seaducks and limited species of shorebirds (phalaropes) are the groups that spend relatively more time offshore as they may seasonally forage and/or stage in offshore habitat. These bird groups are known to forage at the water's surface or dive for prey types that include small fish, mollusks, crustaceans, and plankton (larval fish, krill, and jellyfish). Seabirds in general forage in areas with predictable food supplies, typically where currents meet or other locations with turbulence where prey is brought to the surface (Gaston, 2004). While some groups such as jaegers and gulls forage at the water's surface, others like thick-billed murre (*Uria lomvia*) and dovekie (*Alle alle*) will dive to substantial depths in pursuit of prey (Table 2-3). When out to sea, many seabirds will occur in groups with other feeding seabirds (Wiley and Lee, 2000). Table 2-3 summarizes the foraging behaviors of representative species from each type of bird group that may seasonally occur or stopover in the SFWF.

Seaducks including common eider, black scoter, surf scoter and white-winged scoter were relatively abundant during ship-based surveys. While many seaducks were observed closer to shore during the day, the authors indicated that night time roosting locations of seaducks in the Ocean OSAMP area are unknown. However, they observed seaducks traveling offshore daily just before or after dusk to roost in deeper waters (1–5 km [0.6–3.1 mi] offshore) (Payton et al., 2010).

Table 2-6. Foraging behaviors of bird groups that may seasonally occur within the SFWF and SFEC.

Group/Representative Species[1]	Season of Occurrence	Foraging Behavior (specific to when may occur in SFWF or SFEC)	Water Depth	Reference
Waterbirds				
common loon	fall/winter	Finds prey by peering into water while swimming; also by searching and probing around vegetation and objects in water column and on bottom while swimming underwater, solitary and group foraging on wintering grounds	Relatively shallow	Evers et al. 2010
red-throated loon	fall/winter	Searches for prey by peering from surface or hunting underwater	Relatively shallow	Barr et al. 2000
double-crested cormorant	summer/fall	Dives from surface and pursues prey underwater	Shallow open water (< 10 m deep) and close to shore (< 5 km away); deepest dive recorded at 25.8 m	Dorr et al. 2014
great cormorant	summer/fall	Dives from surface and pursues prey underwater	Maximum depth 32 m	Hatch et al. 2000
Seabirds				
common tern	summer	Diving from the air (plunge diving)	50 cm below the surface	Nisbet et al. 2017a
rosteate tern	summer	Aerial plunge-diving	Submerges briefly	Nisbet et al. 2014
herring gull	year-round	Follow fishing boats or lobster boats to feed on discarded by-catch, also congregate around submarine features such as sandbanks, local upwellings, or tide rips	Shallow plunge-dives for sinking items, or sits on the water waiting for scraps to float by	Nisbet et al. 2017b
black-legged kittiwake	winter	Feeds at surface, often in flocks using surface-plunging, surface-seizing, and surface-dipping. Occasionally steals food from conspecifics. Occasionally feeds on waste from sea-going ships	Surface feeder. In plunge dives (from 1-6 m above the water), may reach depths of 0.5 to 1.0 m, often submerging 1 to 2 seconds	Hatch et al. 2009
parasitic jaeger	spring/summer/fall	Kleptoparasitism	Surface	Wiley and Lee 1999
pomarine jaeger	spring/summer/fall	Migrants rarely observed feeding but on wintering grounds often congregates around fishing vessels or other ships, mostly to forage on scraps but also to steal from other species	Surface	Wiley and Lee 2000
thick-billed murre	winter	Dives with rapid descent and ascent separated by a flat bottom period lasting 30-75 seconds	As deep as 210 m, but generally 7-33 m	Gaston and Hipfner 2000
razorbill	winter	Generally fairly shallow waters offering predictable feeding conditions (often at fronts, upwellings), often feed nearshore	Capable of diving to >100 m but generally not greater than 20-30 m	Lavers et al. 2009
dovekie	winter	Bounce dives and ascending underwater flights to pursue prey	Diving as deep as 30 m	Montevecchi and Stenhouse 2002
Leach's storm-petrel	summer	Feeds by pecking at individual organisms while hovering over surface, occasionally pattering on surface, as Wilson's Storm-Petrel commonly does, or sitting on water. Will use smell to locate food.	Surface feeder	Huntington et al. 1996
Manx shearwater	spring/summer/fall	Mostly 1-2 m above and on sea surface. Dives both from sea surface and from air. Many aerial plunges are from <1.5 m, after which shearwaters sit and subsequently dive from sea surface.	Makes brief, shallow surface dives, probably to depths of <3 m	Lee and Haney 1996
northern gannet	winter/spring/fall	Plunge-diving. In presence of shoaling fish, flies up-wind with bill pointing slightly downward and, from a height of 10–40 m, tips steeply, or gradually, into a vertical or slightly angled gravity-plunge, penetrates water at speeds >100 km/h. Also feeds on scraps near fishing vessels	Depth of dive 3–5 m; occasionally descends to 12–15 m by swimming; most submergences last 5–7 seconds, and occasionally as long as 30 seconds	Mowbray 2002
Waterfowl				
common eider	winter/spring/fall	Winter shoal marine waters (<20 m) in outer coastal areas. Feeds by diving and "picking" food from bottom. In winter, often forages in large flocks (can be >1,000 individuals)	Typically forage in water depths less than 10 m. Dives average <60 seconds but can be considerably longer (up to 131 seconds	USGS 2001; Goudie et al. 2000
white-winged scoter	winter/spring/fall	On winter areas feeding sites 5-20 m deep, usually <5 m	Typically forage in water depths less than 10 m, dive for prey on or near bottom	USGS 2001; Brown and Fredrickson 1997
red-breasted merganser	winter/spring/fall	Individuals feed from water surface and by diving to various depths. Also cooperative herding	Shallow diving in water <2-5 m deep	Craik et al. 2015
Shorebirds				
red-necked phalarope	spring/fall	Visual forager, pecking prey from water. Normally pecks at, or just below, surface, rarely, submerges head and neck; top-like spinning on surface of water to create upwellings	Surface	Rubega et al. 2000
1 Not all species that could occur in the area are included, rather a sample of representative species.				

Avian Behaviors: SFEC – Onshore and Sea-to-Shore Transition

Shorebirds will forage in the intertidal zones of beaches for invertebrates, small crustaceans, bivalve mollusks, small polychaete worms, insects, and talitrid amphipods (Macwhirter et al., 2002). Terns and related species will forage over shallow waters and sandspits near shore for small prey fish (Nisbet et al., 2017a). Northern harrier and peregrine falcon may also hunt along the shoreline for avian prey.

2.8.1.3 Key Factor 3: Avian Flight Heights

The following discussion of flight heights focuses on flight height information available for the SFWF where WTGs and other above water structures may pose a risk of collision; the SFEC components will be buried beneath the seabed and there will be no above ground electrical lines associated with onshore components.

For the purposes of this risk assessment the RSZ of the WTG model under consideration is approximately 25–262 m (82–860 feet) above sea level (asl).

Flight height varies by species and by behavior (foraging, commuting, or migrating) and is also influenced by weather. Seabirds such as jaegers and terns typically fly or dive from heights just above the water's surface (Nisbet et al., 2017a; Lee and Haney, 1996). Roseate terns are known to forage at very low heights between 1–12 m (3–39 feet) above sea level (asl) (Gochfeld et al., 1998). Some seabirds like northern gannets commute and dive for food from relatively greater heights (approximately 10–40 m (33–131 feet) asl; Mowbray, 2002). Seaducks (such as scoters and eiders) and waterbirds (such as loons or cormorants) dive from the water's surface to forage (Evers et al., 2010; Goudie et al., 2000). Table 2-7 below summarizes the percent of observations of common species in the offshore environment by flight height categories as seen during the OSAMP ship-based surveys.

Table 2-7. Percent of observations of common species by flight height category as observed during ship-based surveys in the Ocean OSAMP Study Area.

Group/Representative Species	Percent of Observations of Common Species in the Ocean SAMP by Flight Height Category (Meters)					Number of Observations
	0	<10	10-25	25-125	>125	
Waterbirds						
common loon	81.8	7.9	4.5	5.1	0.7	292
red-throated loon	5.7	30.2	35.8	21.7	6.6	106
Seabirds						
herring gull	7.6	64.7	13.9	12.8	1.0	1652
great black-backed gull	15.8	67.3	8.1	8.0	0.8	1001
black-legged kittiwake	9.1	32.7	47.3	10.9	0.0	55
common murre	55.0	45.0	0.0	0.0	0.0	131
razorbill	41.9	58.1	0.0	0.0	0.0	93

Group/Representative Species	Percent of Observations of Common Species in the Ocean SAMP by Flight Height Category (Meters)					Number of Observations
	0	<10	10-25	25-125	>125	
dovekie	77.6	22.4	0.0	0.0	0.0	125
Wilson's storm-petrel	49.8	50.2	0.0	0.0	0.0	1511
greater shearwater	9.6	90.4	0.0	0.0	0.0	239
Cory's shearwater	21.7	78.3	0.0	0.0	0.0	520
northern gannet	9.0	46.1	38.1	6.7	0.2	1278
Waterfowl						
common eider	8.8	90.8	0.3	0.0	0.0	294
black scoter	0.0	92.4	7.6	0.0	0.0	277
surf scoter	0.0	9.6	90.4	0.0	0.0	209
white-winged scoter	2.5	70.2	27.3	0.0	0.0	161
Shorebirds						
red-necked phalarope	95.8	4.2	0.0	0.0	0.0	24

Of the 54 species and 8,927 observations of birds seen during ship-based surveys in the OSAMP, the majority (57.6%) were observed in the < 10 m asl flight height category, followed by 21.5 percent observed in the 0 m, and 14.6 percent in the 10–25 m asl categories (Paton et al., 2010). Only 5.5 percent and 0.8 percent of birds were observed in the 25–125 m and > 125 m flight height asl categories, respectively.

Tetra Tech and Detect (2012) conducted pre-construction boat-based transect surveys in the BIWF area from July 2009 to June 2010, and August 2011 to September 2011 (Table 2-10). Stantec conducted the first year of post-construction boat-based transect surveys at BIWF from January to December 2017 (Stantec, in prep). Most birds both pre- (73%) and post-construction (68%) were observed in the < 10 m (33 feet) category, followed by the 10–25 m (33–82 feet) categories (20% pre- and 27% post-construction) (Stantec, in prep). Note these data do not include those birds sitting on the water. Mean flight height per species group per segment grouping was generally comparable between pre- and post-construction surveys; however, northern gannet and gull mean flight height was notably higher within the turbine area segments (segments 8 to 14 [within 2 km (1.2 mi) of the WTGs]), but also appeared higher in reference segments 15 to 25 (Figure 2-3).

Table 2-8. Percent of observations by flight height category as observed during pre-construction ship-based avian transect surveys for the Block Island Wind Farm.

Species	Total (n)	Flight Height Category				
		<10m	10–25m	26–125m	126–200m	>200m
Loons						
Common Loon	224	30%	67%	3%	0%	0%
Red-throated Loon	16	69%	31%	0%	0%	0%

Species	Total (n)	Flight Height Category				
		<10m	10–25m	26–125m	126–200m	>200m
Shearwaters						
Manx Shearwater	18	100%	0%	0%	0%	0%
Audubon's Shearwater	16	100%	0%	0%	0%	0%
Greater Shearwater	77	92%	8%	0%	0%	0%
Sooty Shearwater	29	100%	0%	0%	0%	0%
Cory's Shearwater	29	100%	0%	0%	0%	0%
Unidentified Shearwater	26	92%	8%	0%	0%	0%
Storm-petrels						
Wilson's Storm-petrel	102	99%	1%	0%	0%	0%
Unidentified Storm-petrel	12	100%	0%	0%	0%	0%
Gannet						
Northern Gannet	799	78%	20%	1%	0%	0%
Cormorants						
Double-crested Cormorant	35	6%	9%	86%	0%	0%
Great Cormorant	9	100%	0%	0%	0%	0%
Unidentified Cormorant	44	2%	98%	0%	0%	0%
Ducks						
Common Eider	198	100%	0%	0%	0%	0%
Long-tailed Duck	6	83%	17%	0%	0%	0%
White-winged Scoter	393	100%	0%	0%	0%	0%
Surf Scoter	28	100%	0%	0%	0%	0%
Black Scoter	936	97%	3%	0%	0%	0%
Unidentified Scoter	382	70%	30%	0%	0%	0%
Red-breasted Merganser	15	100%	0%	0%	0%	0%
Unidentified Duck	353	48%	31%	21%	0%	0%
Shorebirds						
Sanderling	5	100%	0%	0%	0%	0%
Unidentified Shorebird	8	50%	50%	0%	0%	0%
Gulls						
Bonaparte's Gull	1	100%	0%	0%	0%	0%
Laughing Gull	15	87%	0%	13%	0%	0%
Ring-billed Gull	14	21%	36%	43%	0%	0%
Herring Gull	428	36%	40%	23%	0%	0%
Great Black-backed Gull	395	42%	42%	16%	1%	0%
Unidentified Gull	788	65%	19%	14%	2%	0%
Black-legged Kittiwake	13	100%	0%	0%	0%	0%
Terns						

Species	Total (n)	Flight Height Category				
		<10m	10–25m	26–125m	126–200m	>200m
Common Tern	65	29%	68%	3%	0%	0%
Forster's Tern	1	100%	0%	0%	0%	0%
Least Tern	1	0%	100%	0%	0%	0%
Unidentified Tern	35	60%	37%	3%	0%	0%
Alcids						
Razorbill	116	100%	0%	0%	0%	0%
Thick-billed Murre	9	100%	0%	0%	0%	0%
Unidentified Murre	75	100%	0%	0%	0%	0%
Dovekie	20	100%	0%	0%	0%	0%
Black Guillemot	1	100%	0%	0%	0%	0%
Unidentified Alcid	88	100%	0%	0%	0%	0%
Passerines						
Bank Swallow	2	0%	100%	0%	0%	0%
Unidentified Swallow	5	80%	20%	0%	0%	0%
Unidentified						
Unidentified Bird	24	96%	4%	0%	0%	0%
Overall	**5856**	**73%**	**20%**	**7%**	**0%**	**0%**

Table 2-9. Percent of observations by flight height category as observed during post-construction ship-based avian transect surveys for the Block Island Wind Farm.

Species	Total (n)	Flight Height Category				
		<10m	10–25m	26–125m	126–200m	>200m
Loons						
Common Loon	21	67%	14%	19%	0%	0%
Red-throated Loon	14	43%	57%	0%	0%	0%
Unidentified Loon	2	0%	0%	50%	50%	0%
Shearwaters						
Greater Shearwater	65	97%	3%	0%	0%	0%
Sooty Shearwater	4	100%	0%	0%	0%	0%
Cory's Shearwater	134	100%	0%	0%	0%	0%
Unidentified Shearwater	505	100%	0%	0%	0%	0%
Storm-petrels						
Wilson's Storm-petrel	120	75%	25%	0%	0%	0%
Gannet						
Northern Gannet	75	43%	48%	9%	0%	0%
Cormorants						
Great Cormorant	2	100%	0%	0%	0%	0%

Species	Total (n)	Flight Height Category				
		<10m	10–25m	26–125m	126–200m	>200m
Ducks						
Common Eider	78	72%	28%	0%	0%	0%
Long-tailed Duck	7	71%	29%	0%	0%	0%
White-winged Scoter	76	66%	34%	0%	0%	0%
Surf Scoter	12	50%	50%	0%	0%	0%
Black Scoter	1064	61%	39%	0%	0%	0%
Unidentified Scoter	2	100%	0%	0%	0%	0%
Red-breasted Merganser	3	100%	0%	0%	0%	0%
Jaegers						
Unidentified Jaeger	1	0%	100%	0%	0%	0%
Gulls						
Bonaparte's Gull	1	0%	100%	0%	0%	0%
Herring Gull	258	41%	37%	21%	0%	0%
Great Black-backed Gull	157	32%	38%	30%	0%	1%
Unidentified Gull	8	0%	0%	0%	0%	100%
Terns						
Common Tern	5	40%	60%	0%	0%	0%
Alcids						
Razorbill	4	100%	0%	0%	0%	0%
Common Murre	0	0%	0%	0%	0%	0%
Unidentified Murre	2	50%	50%	0%	0%	0%
Passerines						
Barn Swallow	2	100%	0%	0%	0%	0%
Unidentified						
Unidentified Bird	1	100%	0%	0%	0%	0%
Overall	**2623**	**68%**	**27%**	**4%**	**0%**	**0%**

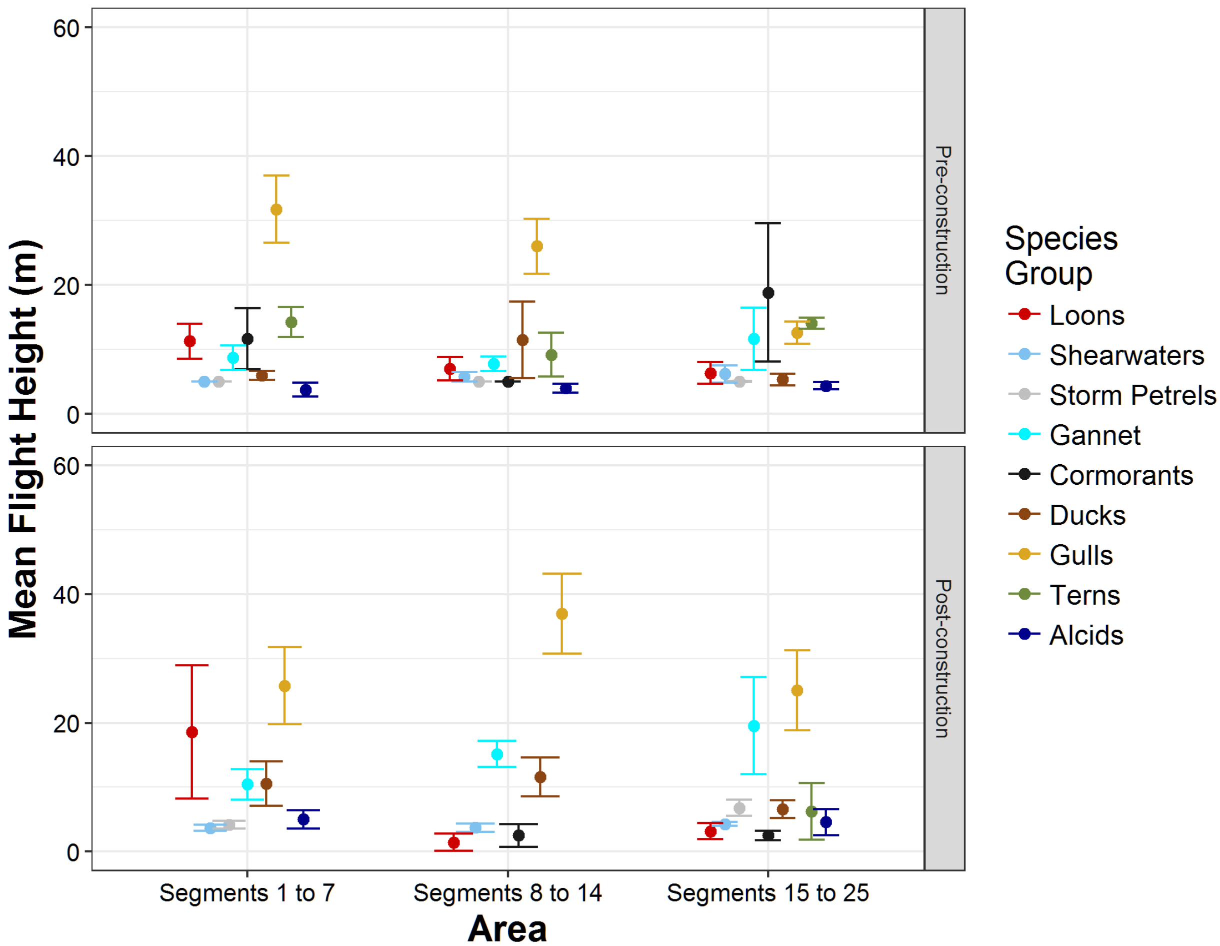


Figure 2-3. Mean flight height by survey segment grouping during pre-and post-construction ship-based avian surveys at the Block Island Wind Farm (note segments 8 to 14 represent the turbine area).

Boat-based visual surveys represent daytime bird observations and flight behaviors. The most applicable nighttime flight height information is the BIWF pre-construction radar survey (Tetra Tech and Detect, 2012). This survey also provided daytime flight height information. Note that only the nearshore and offshore flight heights are summarized below:

- For all seasons and all daytime/nighttime periods combined, the overall mean flight height nearshore was 234.6 m (769.7 feet) compared to 94.9 (311.4 feet) asl offshore.
- Overall mean target flight height was lowest during the night (87.2 m [286.1 feet] asl), and greatest during the day (99.2 m [325.5 feet] asl) offshore.

While passage rates were generally comparable for the nearshore and offshore radar datasets (though slightly higher nearshore), nearshore flight heights were greater overall than offshore flight heights (Tetra Tech and Detect, 2012); however, it is likely that using s-band radar from

Block Island presents limitations in detecting small, high-flying birds offshore and the data are heavily biased toward larger bodied targets. This system is limited in terms of its ability to detect smaller targets (i.e., smaller bodied birds such as passerines and bats), especially at the ~4-mile offshore distance of the BIWF WTGs.

Avian Flight Heights: Listed Species

The OSAMP ship-based surveys indicate both common and roseate terns fly at heights within the proposed RSZ during summer commuting flights: 11.5 percent and 12.5 percent of common and roseate terns, respectively, occurred within the 25–125 m (82–410 feet) flight height asl category. Neither species (nor unidentified terns) were observed greater than 125 m (410 feet) asl. The average foraging height of roseate terns is 4.4 m (1–6 m), and they do not typically forage at heights greater than 12 m (39 feet) when foraging. During breeding period, most common and roseate terns commute at heights below 21 m (69 feet) but sometimes up to 50 m (164 feet) (Burger et al., 2011). Least terns were not detected during the OSAMP offshore ship-based surveys; however, during land-based sea watches for the OSAMP, 56.1 percent of least terns were observed < 10 m (33 feet), 39 percent were observed between 10 and 25 m (33–82 feet), and 4.9 percent were observed between 25 and 125 m (82– 410 feet) asl (Paton et al., 2010).

There are no flight height data available for piping plover from the ship-based OSAMP surveys and behavioral data are mainly only available from birds on breeding territories. While less applicable to the offshore environment, land-based sea watches conducted for the OSAMP observed 9 piping plovers; 0.3 percent of surveys documented piping plover flights over water. Of 6 piping plover observations for which flight height data were available, 100 percent were observed < 10 m (33 feet) asl. Other species of shorebird are known to migrate at heights of thousands of meters, including red-neck phalaropes, which are known to migrate at heights above 3,000 m (Rubega et al., 2000). Migratory flight height data remain lacking however for piping plover (Gordon, 2011). They are not assumed to travel in large flocks like some other species of shorebird; a typical flock size of piping plover observed departing for migration was 3–6 individuals (Elliott-Smith and Haig, 2004).

During the Loring et al. (2017b) nanotag study, researchers were able to use detection data to model an estimate of flight altitude for 1 migratory red knot as it flew across Nantucket Sound. The bird's flight was well above the height of the RSZ, ranging from 650–820 m (2,133–2,690 feet) asl (Loring et al., 2017b).

2.8.2 Bat Community Characterization

For bats, empirical data most relevant to this assessment include regional bat acoustic studies conducted from coastal, island, vessel, or offshore structure locations (Stantec, 2016a; Pelletier et al., 2013; Smith and McWilliams, 2012; Tetra Tech and DeTect, 2012; and Stantec, 2016b; Stantec, in prep) and regional telemetry data from recent studies focusing on listed species (Dowling et al., 2017). The regional studies considered most relevant to the assessment of risk at the SFWF and SFEC are summarized in Table 2-10 and Figure 2-4 and referenced throughout the following section.

Species of bats that may occur in the SFWF and SFEC project areas include both long-distance migrants and 'non-migrant'/cave-dwelling bats.

Long-distance migrants include:

- hoary bat (*Lasiurus cinereus*)
- eastern red bat (*Lasiurus borealis)* and
- silver-haired bat (*Lasionycteris noctivagans*)

Non-migrants/cave dwelling bats include:

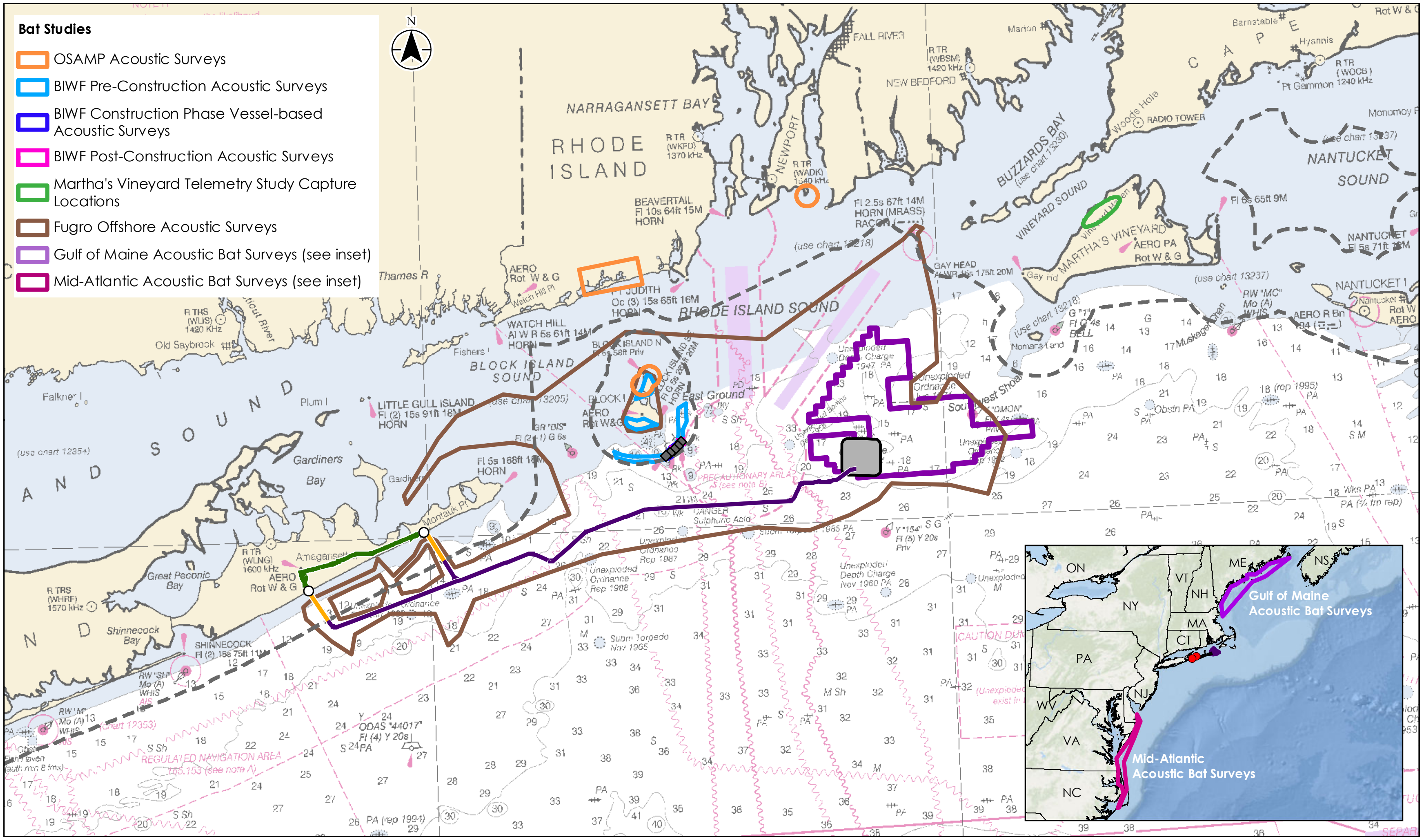
- northern long-eared bat (*Myotis septentrionalis*)
- little brown bat (*Myotis lucifugus*)
- eastern small-footed bat (*Myotis leibii*)
- big brown bat (*Eptesicus fuscus)* and
- tri-colored bat (*Perimyotis subflavus*)

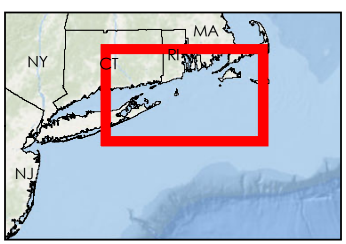
The northern long-eared bat is of particular interest to this risk assessment as it is both federally and state-listed as threatened.

Table 2-10. Descriptions of relevant regional bat surveys.

Study	Dates	Reference(s)
Acoustic Bat Survey, Gulf of Maine, mid-Atlantic, and Great Lakes Locations	2009 to 2014	Stantec, 2016a
Gulf of Maine to Massachusetts acoustic bat survey	late summer/fall 2009; late-summer/fall 2010; and 2011	Pelletier et al., 2013
Coastal and Island Acoustic Bat Survey for the OSAMP, Rhode Island and Block Island Locations	September 8 to November 9, 2010 and September 8 to November 12, 2011	Smith and McWilliams, 2012
Pre-construction Passive and Active Offshore Acoustic Bat Survey, Block Island Wind Farm	2009 and 2011	Tetra Tech and DeTect, 2012
Construction Phase Vessel-Based Acoustic Survey, Block Island Wind Farm	early to mid-August, 2016	Stantec, 2016b

Study	Dates	Reference(s)
Post-Construction Acoustic Survey, Block Island Wind Farm	August 3, 2017 to January 9, 2018	Stantec, in prep1
Fugro Acoustic Survey, South Fork Wind Farm	July 14 to November 15, 2017	Stantec, in prep2
Martha's Vineyard Telemetry Study	late-summer and early fall, 2016	Dowling et al., 2017





Legend

- SFWF Work Area
- SFEC - OCS
- SFEC - NYS
- SFEC - Onshore
- Landing Site
- Block Island Wind Farm
- Lease Area
- Submerged Lands Act Boundary

0 15 Miles

1 inch = 15 miles (At original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 18N
2. Study area footprints provided by Bureau of Ocean Energy Management (BOEM).
3. Base map: West Quoddy Head to New York NOAA Nautical Chart.

Stantec

Project Location 195601308
Long Island, New York

Prepared by GAC on 2018-02-15
Technical Review by JLC on 2018-02-16
Independent Review by BR on 2018-02-16

Client/Project
CH2M HILL, Inc.
Deepwater South Fork COP Support

Figure No.
2-4

Title
Locations of Relevant Regional Bat Surveys

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2.8.2.1 Key Factor 1: Bat Abundance and Seasonal Use

***Bat Seasonal Abundance and Species Use:* SFWF and SFEC – OCS**

Bats are known to occur over offshore environments, mainly during late summer and fall migration, but also during spring migration and summer (Pelletier et al., 2013; Stantec, 2016a; Stantec, in prep). Bats would be expected to primarily occur in the airspace of the SFWF and SFEC OCS (at a range of heights extending from just above the water's surface to above the RSZ) while migrating, commuting, or foraging. While bats are expected to primarily forage on insects, there is also some evidence bats may occasionally take crustaceans from the water's surface (Ahlén et al., 2007; Ahlén et al., 2009).

Stantec conducted an acoustic bat study from 2009 to 2014 at coastal and offshore locations in the Gulf of Maine, mid-Atlantic, and Great Lakes regions (Figure 2-4). Seasonal patterns were observed across these regions, with activity peaking in late summer and early fall (Stantec, 2016a). Bats were not detected for extended periods at some remote offshore sites during mid-summer: one remote offshore detector reported 126 consecutive nights from early April to early August without bat activity, and 12 datasets showed over 40 consecutive nights without bat activity during the summer (Stantec, 2016a). Species differed in seasonal activity patterns across the regions sampled: eastern red bat activity levels peaked between July and October; hoary bat activity peaked in mid-August; silver-haired bat activity peaked early September; *Myotis* species were either active throughout the season at island sites that appeared to have a resident population, or otherwise occurred irregularly during the fall migration period (Stantec, 2016a).

A late summer/fall 2009 acoustic study by Stantec at 2 coastal and 10 offshore islands in the Gulf of Maine (Figure 2-4) documented bat activity with at least one site, located approximately 33 km (21 mi) offshore of Mount Desert Island, recording bat activity as late as November 11, 2009 (Pelletier et al., 2013).

As part of the OSAMP research, Smith and McWilliams (2012) conducted acoustic monitoring at 6 sites on the Rhode Island coast and 2 sites on Block Island (Figure 2-4). Detectors operated in fall 2010 and fall 2011, between early September to early November. Most bat activity occurred in September to early October.

Pre-construction surveys at BIWF included passive and active offshore acoustic monitoring in spring, summer 2009 and 2010. For passive monitoring, a detector was mounted on a buoy located 5.5 km (3 mi) off the south coast of Block Island (Figure 2-4), and operated from October to early November 2009, and April through mid-October 2010. No bat passes were recorded in fall 2009 and 16 bat passes were recorded on three nights in 2010 (2 nights in June and 1 night in July) (Tetra Tech and Detect, 2012). Active vessel-based, pre-construction monitoring was conducted along transects in the BIWF (Figure 2-4) on 1 night in July, 2 nights in August, and 1 night in September 2009 and 1 night in September 2011. Only one call sequence was recorded on one night in August (Tetra Tech and Detect, 2012).

Construction phase vessel-based acoustic monitoring was completed on vessels supporting BIWF WTG installation (Figure 2-4) from early to mid-August 2016. Bat passes were recorded on 29 of the 54 detector-nights (54%) within the project area during the study; one night (August 17) recorded 65 percent of all passes recorded (Stantec, 2016b). There were 1,546 bat passes recorded while the vessels were in the project area. In comparison, when one of these vessels was at port in Providence, a total of 2,310 passes were recorded, most of which (93%; n = 2,143) were recorded on a single night (August 5) (Stantec, 2016b).

A post-construction bat acoustic study was conducted at the BIWF from August 3, 2017 to January 9, 2018 with 2 detectors mounted on each of the deck platforms of WTG 1 and WTG 3 (Figure 2-5). The WTG 1 detectors recorded 431 bat passes for a rate of 2.7 passes per detector night, and the WTG 3 detectors recorded 680 passes for a rate of 4.3 passes per detector night (Stantec, in prep). At WTG 1, monthly detection rates were highest in August (9.3 passes per detector night; Figure 2-5); however, the night with the highest number of recorded bat passes at WTG 1 was September 16, 2017 (n = 81 bat passes). At WTG 3, monthly detection rates were highest in September (13.8 passes/detector night; Figure 2-5) and the night with the highest number of recorded bat passes was also September 16 (n = 273). No bat passes were recorded at either WTG from November through January (Figure 2-5; Stantec, in prep).

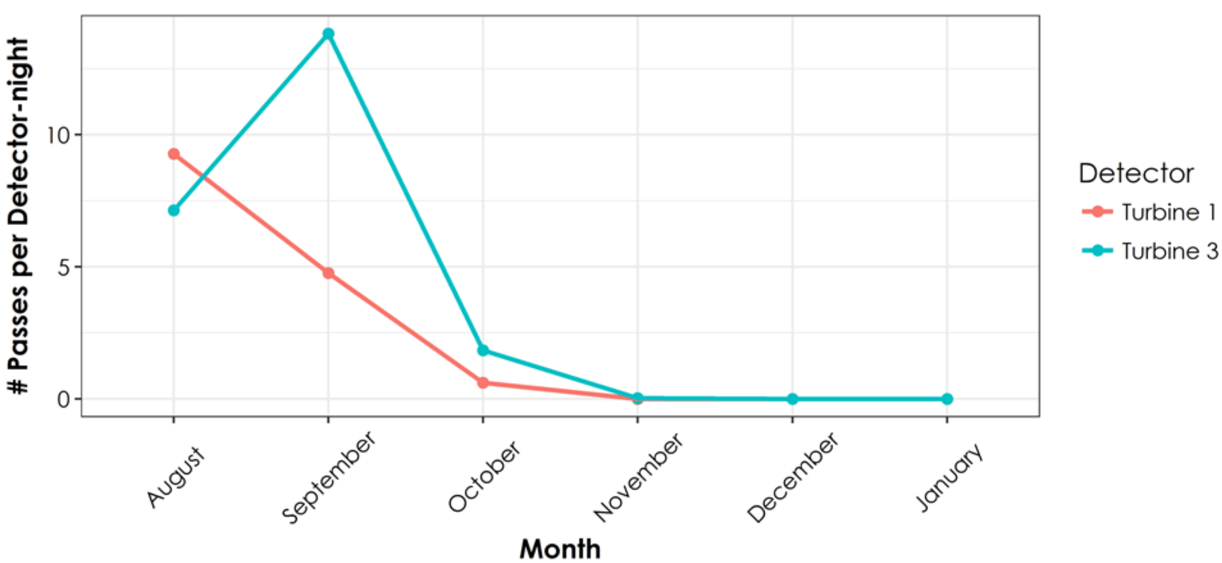

Figure 2-5. Monthly bat activity rates by detector during post-construction bat acoustic surveys at the Block Island Wind Farm, August 2017 – January 2018.

In addition to the turbine-based post-construction acoustic studies, 2 acoustic bat detectors were deployed on the railing of the Fugro Enterprise vessel from July 14 to November 15, 2017 while the vessel traveled from New Bedford, Massachusetts to the northeast end of Long Island, around the BIWF, and around the SFWF (Figure 2-6). This analysis includes only "offshore" recorded data, i.e. when the vessel was 24 km (15 mi) beyond New Bedford harbor. A total of 911 bat calls were recorded for a rate of 7.3 passes per detector-night. The highest monthly detection rate was recorded in August (17.2 passes per detector-night), few bat passes were recorded in July. The night with the highest number of recorded bat passes was August 16 (n = 190) (Stantec, in prep).

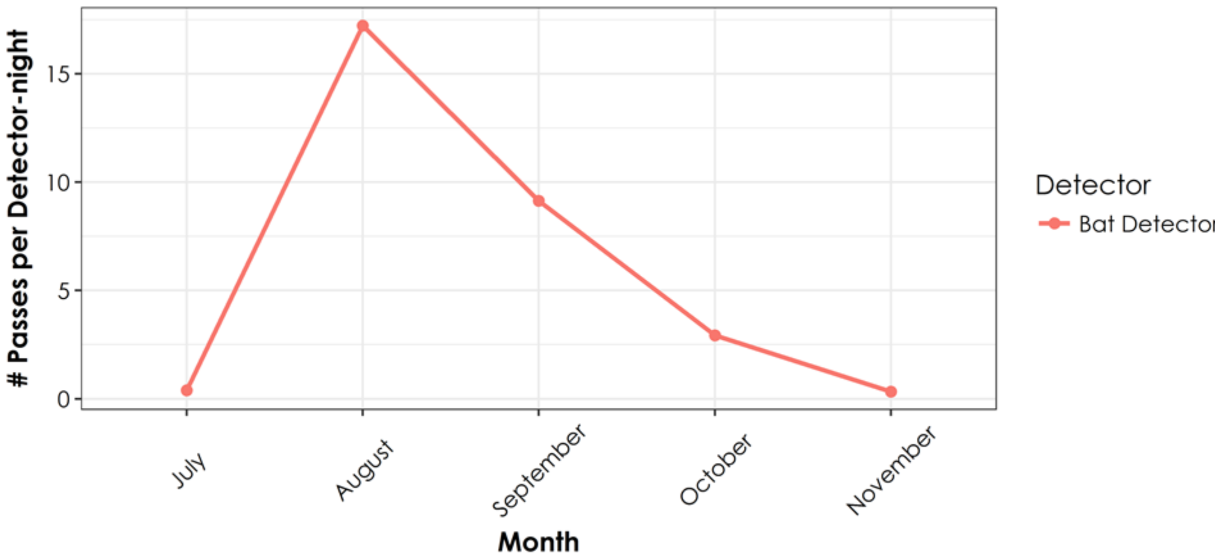

Figure 2-6. Monthly bat activity detected during the Fugro Enterprise Vessel bat acoustic survey, 2017.

Stantec's 2009 to 2014 acoustic study at coastal and offshore locations in the Gulf of Maine, mid-Atlantic, and Great Lakes regions, found eastern red bats were the most commonly detected species at offshore structures, comprising 90 percent of passes that were identifiable to species. Silver-haired bats and hoary bats accounted for small percentages of overall activity but were widespread (occurring at 89% and 95% of sites, respectively). Although *Myotis* were more numerous at sites on or near the coast, they were also detected at remote offshore locations. Detections of *Myotis* species significantly declined however at most sites in the Gulf of Maine region after 2011, likely due to declines resulting from White Nose Syndrome (Stantec, 2016a). Big brown bats represented a large proportion of bat activity along the coast and on islands but were not often detected offshore. Tri-colored bats were detected least frequently and only at approximately half of the survey locations (Stantec, 2016a).

Smith and McWilliams (2012) indicated eastern red bat and silver-haired bat were the most frequently detected bats at locations sampled in both 2010 and 2011. The authors indicated that big brown bats and tri-colored bats were also commonly detected, while *Myotis* were relatively rare at all sites (Smith and McWilliams, 2012).

Passive offshore pre-construction acoustic surveys for BIWF resulted in 16 call sequences; 2 were hoary bats, 3 were silver-haired bats, and the other calls were classified as high frequency unknown (Tetra Tech and Detect, 2012). Active pre-construction transect surveys resulted in a single silver-haired bat recording (Tetra Tech and Detect, 2012).

A total of 1,546 bat passes were recorded during a construction phase, vessel-based acoustic survey at BIWF (note that data recorded when vessels were outside BIWF were not included in this summary); of 1,307 passes that could be classified to species, 90 percent (n = 1,180) were eastern red bat, 9 percent (n = 112) were hoary bat, 1 percent was silver-haired bat (n = 14), and 1 call was classified as a big brown bat. There were no *Myotis* passes identified (Stantec, 2016b).

Of those bat passes recorded during the BIWF post-construction survey, the majority were eastern red bat (52%; n = 573); however, silver-haired bat (28%; n = 316), hoary bat (12%; n = 129), big brown bat (3%; n = 33), tri-colored bat (3%; n = 33), and little brown bat (0.2%; n = 2) were also recorded (Figure 2-7). There were no northern long-eared bat calls detected (Stantec, in prep).

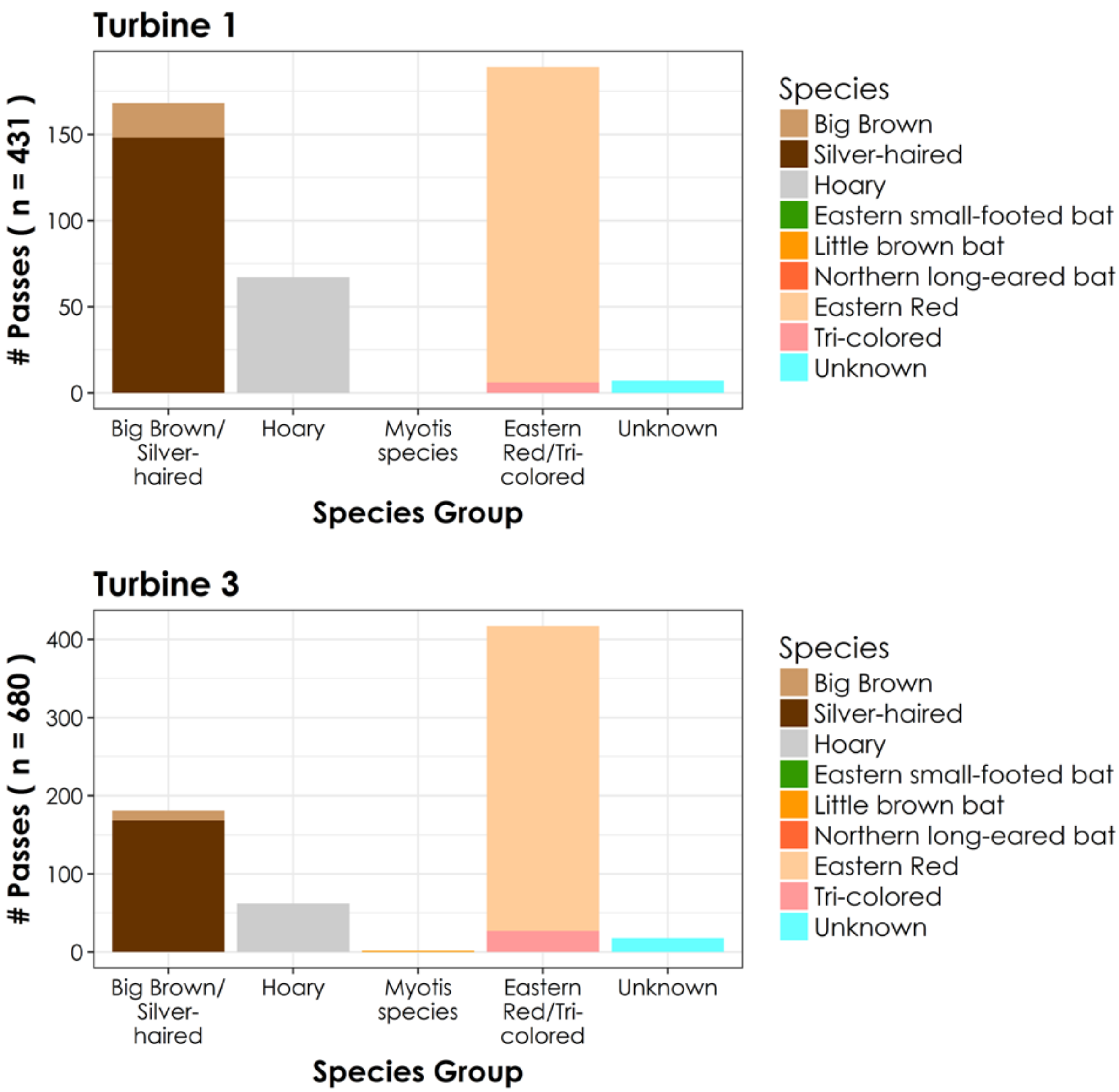

Figure 2-7. Species composition of bat activity detected at WTG 1 (top) and WTG 3 (bottom) during bat acoustic surveys at the Block Island Wind Farm, August 2017 – January 2018.

Of 896 passes identified to species during the Fugro Enterprise bat acoustic survey, eastern red bats accounted for the majority of passes (69.2%; n = 620), followed by silver-haired bats (12.9%; n = 116); other recorded passes that could be identified to species represented less than 5 percent of all passes: big brown bat (n = 44), northern long-eared bat (n = 34), little brown bat (n = 31), tri-colored bat (n = 31), hoary bat (n = 19), and eastern small-footed bat (n = 1) (Stantec, in prep; Figure 2-8). Species groups detected in the SFWF area included the red bat/tri-colored bat guild, big brown/silver-haired bat guild, hoary bat, northern long-eared bat, and unknown bat (Stantec, in prep). There was one northern long-eared bat call detected in the SFWF on August 6, 2017.

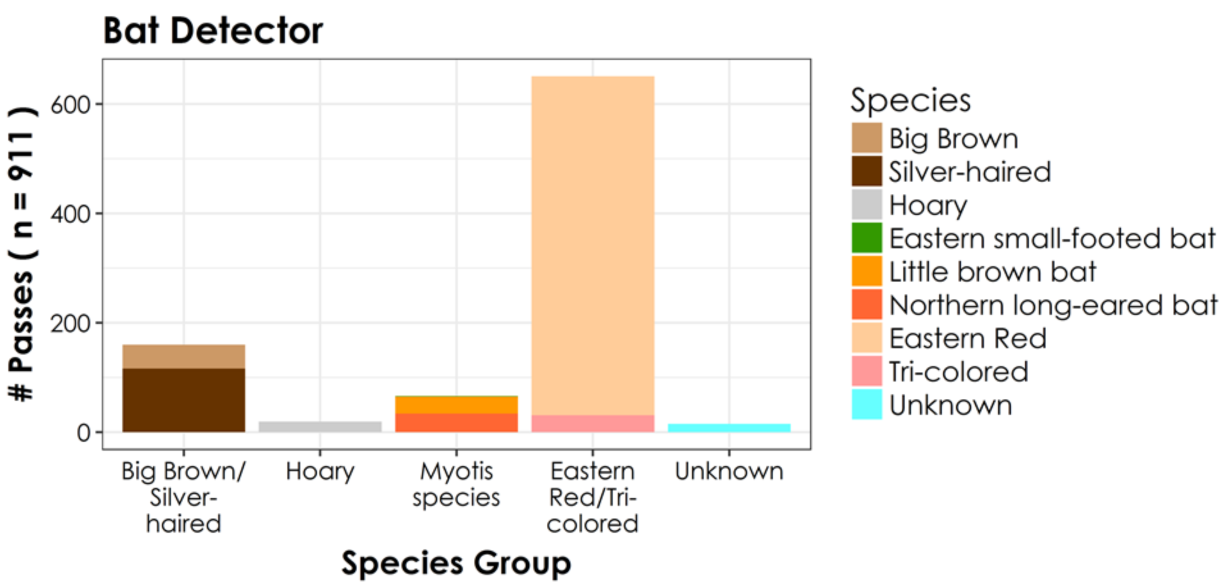

Figure 2-8. Species composition of bat activity detected during the Fugro Enterprise Vessel bat acoustic survey, 2017.

During late-summer and early fall of 2016, Dowling et al., (2017) tagged 4 different species of bats on Martha's Vineyard. In July, researchers tracked 4 northern long-eared bats, and tracked 1 northern long-eared bat in October; BioDiversity (as cited by Dowling et al., 2017) also tracked 3 additional northern long-eared bats in July and August, for a total of 8 northern long-eared bats tracked that year. For other species, researchers tracked 3 little brown bats, 2 big brown bats, and 3 eastern red bats. While little brown bats and eastern red bats were detected making offshore movements, northern long-eared bats made no offshore movements. Researchers noted there was a limited sample size of bats tracked and northern long-eared bats were not tracked in late-August when potential offshore movements may have occurred. Dowling et al. (2017) indicated it would be unlikely for northern long-eared bats to forage offshore during the maternity period from June to mid-July; during this period females are not believed to travel more than 2 km (1.2 mi) from roosts. Data suggest that northern long-eared bat may overwinter on Martha's Vineyard (acoustic detections were recorded throughout October and into mid-November and northern long-eared bat were detected in February), but it is unknown if other individuals occur offshore during migratory periods (Dowling et al., 2017).

Bat activity at both onshore and offshore locations is typically linked to specific weather conditions, with activity generally positively correlated with temperature and negatively correlated with wind speed. During the BIWF post-construction survey, 99 percent (n = 1,079) of bat passes (recorded during periods for which weather data was also available) occurred when wind speeds were < 5.0 m/s (11 mph) (Stantec, in prep). Three hundred and fifty-nine (33%) passes occurred when winds were calm, with much of that activity occurring on September 16, 2017 when wind speeds were 0.0 m/s for most of the night. Species group composition was generally consistent regardless of wind speed (Stantec, in prep). Bat activity had a positive relationship with warmer temperatures (91% of bat activity recorded when temperatures were ≥ 15.0°C [59°F]), with very little bat activity documented when temperatures were below 15.0°C (Stantec, in prep). During the Fugro bat acoustic survey, 82 percent (n = 736) of recorded bat passes for which corresponding weather data were available occurred when wind speeds were < 5.0 m/s and temperatures were ≥ 15.0°C; very little bat activity was recorded when temperatures were below 15.0°C (Stantec, in prep).

Bats are primarily active at night at onshore locations and presumably also at offshore locations, although long distance migrants may occasionally appear offshore in daytime periods during migration (Hatch et al., 2013; Stantec, 2016a). Stantec (2016a) indicated bat activity peaked during the first hour after sunset and then declined for the remainder of the night. During the BIWF post-construction survey, bat activity peaked during hour 9 after sunset at WTG 3, and at WTG 1, activity peaked between hours 1 and 4 after sunset, with a second peak during hour 8 after sunset (Stantec, in prep). During the Fugro bat acoustic survey, bat activity peaked between hours 1 and 5 after sunset. At some study sites in the Gulf of Maine, daytime bat activity represented an unexpectedly high percentage of total activity: between 10.9 and 13.9 percent of bat activity at those sites was detected between sunrise and sunset (Stantec, 2016a).

***Bat Seasonal Abundance and Species Use:* SFEC − Onshore**

Bats use a variety of terrestrial environments on Long Island for foraging and roosting during summer breeding and migration periods. The site of the proposed SFEC - Interconnection Facility occurs in wooded habitat, which likely provides suitable bat habitat. While other onshore project components occur in already developed areas, there is the potential for bats to use other types of habitats in the surrounding area.

NYDEC 2017 acoustic surveys did not identify northern long-eared bat within 2.4 km (1.5 miles) of the Beach Lane landing site; there have however been positive identifications for this species within 2.4 km miles of the Hither Hills landing site (K. Jennings and K. Gaidasz, NYSDEC, pers. comm.).

2.8.2.2 Key Factor 2: Bat Behaviors

This discussion of behavior focuses on information applicable to the SFWF where may pose a risk of collision; the SFEC components will be buried beneath the seabed and there will be no above ground electrical lines associated with onshore components.

The attraction of bats to tall anthropogenic structures has been well documented (Jameson and Willis, 2014; Cryan and Barclay, 2009; Cryan et. al., 2014). The remote nature of offshore WTGs may further enhance that attraction as potential roosting structures during migration. During installation of WTGs at the BIWF, crew members from the construction vessels provided multiple reports of bats roosting on the construction vessels during the day (Stantec, 2016b).

2.8.2.3 Key Factor 3: Bat Flight Heights

This discussion of flight height focuses on flight height information available for the SFWF and SFEC – OCS where WTGs and other above water structures may pose a risk of collision.

There is limited information regarding bat flight heights in the OCS (refer to Appendix B for a summary of flight height information of bats from offshore locations in Europe). Virtually all acoustic studies conducted to date in the region have been conducted at locations below the proposed RSZ of the WTGs. Over the OCS, bat flight heights would likely depend on weather conditions and individual bat activity (e.g., if actively migrating or foraging). During Biodiversity Research Institute's mid-Atlantic offshore baseline survey project, researchers documented 17 bats offshore (mostly eastern red bats) either during boat-based or high-resolution video aerial surveys. Bats were detected 16–70 km (10–43 mi) offshore. All bats were seen migrating during the day during good weather conditions, and most bats seen during video aerial surveys were flying several hundred meters above sea level (Hatch et al., 2013, as cited by Williams et al., 2015).

2.9 CONSTRUCTION IMPACTS

2.9.1 Direct Effects

2.9.1.1 Habitat Loss and Modification

SFWF

<u>Birds</u>

A potential direct effect to birds during construction of the SFWF is habitat loss or modification. Construction activities will result in temporary disturbances to the seafloor, resulting in short-term changes in sediment suspension or deposition. While construction of the SFWF will not result in the loss of breeding habitat for any bird species, there could be impacts to foraging or staging (i.e., resting) habitats of species within the SFWF area.

Waterbirds, seabirds, waterfowl (seaducks) and limited species of shorebirds (e.g., red-necked phalarope [*Phalaropus lobatus*] and red phalarope [*Phalaropus fulicarius*]) foraging or staging in the area may be susceptible to impacts to habitat during construction. For other shorebirds and landbirds, there would be **no impacts** associated with modifications to the seafloor during construction due to their lack of use of that habitat. Listed tern species such as roseate, common, and least terns are among species that could use the area to forage; it is unlikely these species would occur in the area during the breeding period but may occur in the area during pre-migratory staging or migratory periods.

Turbine foundations will be installed into the seabed in waters that are approximately 31–38 m (102–125 feet) deep. Vibrations from pile-driving to install jacket or monopole foundations will temporarily increase local noise levels by emitting high intensity acoustic pulses (Kragefky, 2014). This noise may startle prey fish and cause them to flee as observed with other noise sources such as approaching vessels (Kragefky, 2014). Increases in turbidity from this activity are likely to be limited, especially in coarser-grained substrates, but could also temporarily impede prey fish foraging and navigation in disturbed areas (Jarvis, 2005). These effects could briefly interrupt foraging opportunities for local fish and birds. Alternatively, these same disturbances may stir up small benthic organisms causing prey fish and birds to forage in the area. Nedwell et al. (2004, as cited by Gill, 2005) suggest construction activities may affect fish and benthic communities out to distances of 100 m (328 feet) from the source; however, based on the hearing sensitivities of some fish (i.e., herring and cod), noise from activities such as pile driving may be detected by some species of fish out to distances of 80 km (50 mi) or more.

Impacts to foraging habitat are anticipated to be minimal as construction activities would be temporary and localized. Jack-up barge(s) with a crane will be used to install the foundations. Pile driving will be used to fix the foundation structures into the seabed; foundations will not be hammered simultaneously. Duration of pile driving is anticipated to be 48 hours per jacket (unless the pre-piled scenario is used which is expected to take 3 to 4 days of work time per foundation). The hollow foundations are expected to trap most sediment displaced during pile driving. Given the relatively small footprint of the SFWF and the abundance of alternative foraging locations, **negligible** impacts to foraging waterbirds, waterfowl, seabirds, and phalaropes are anticipated during the construction period. Further, pile driving activities will not occur at the SFWF from November 1 – April 30; as a result, impacts from pile driving to overwintering birds will be avoided. Impacts to the substrate and associated impediment or attraction of prey, and potentially foraging seabirds, are expected to be minor, and requiring only a short-term recovery period. Therefore, only **negligible** impacts associated with seafloor disturbance or sediment suspension and deposition are anticipated for birds foraging in the area.

There would be similar disturbances to the seafloor during installation of the inter-array cables connecting the WTGs to the offshore substation. Vibrations from jet plowing for cable trenching could startle and temporarily displace prey fish. Increases in turbidity from this activity could also temporarily impede fish foraging and navigation in disturbed areas (Jarvis, 2005), and in turn influence foraging opportunities for seabirds. Alternatively, sediment disturbances during installation may stir up small benthic organisms, attracting bird prey species to the area to forage, which could attract foraging seabirds.

A particle sediment study was conducted in June 2016 using visual and video monitoring and photography during the BIWF submarine cable installation. Turbidity profiles at construction test and control sites were found to be comparable (James et al., 2017). Most sediments were believed to be contained in the overspill levee because there were no sediment plumes observed extending beyond the direct vicinity of the equipment (James et al., 2017). Because similar technologies used at BIWF will be used to install the SFWF inter-array cable, any construction effects are expected to be similarly temporary, localized, and negligible. Sediment suspended during submarine cable installation is expected to be localized and to quickly resettle (e.g., within minutes or up to a few hours). Jet plow embedment or mechanical plow technologies would allow for simultaneous plowing and cable-laying to minimize impacts; compared to open cut dredging or trenching, these methods will minimize sediment disturbance and alteration and reduce associated turbidity. Impacts associated with displacement or attraction of prey, and potential attraction of foraging waterbirds, waterfowl, seabirds, and phalaropes during installation are anticipated to be negligible and temporary, with natural benthic substrate and prey fish communities expected to relatively quickly return to normal. Given the relatively narrow width of the inter-array cable trench plowed during construction compared to the large areas of alternative foraging habitat, **negligible** foraging habitat loss or modification is anticipated during installation of the inter-array cable for these bird groups. As relatively low numbers of other species of shorebirds and landbirds would be expected to occur in the airspace of the SFWF area during construction, there are **no impacts** to other shorebirds or landbirds associated with disturbances to the seafloor, or resulting sediment suspension and deposition at the SFWF.

Bats

There are **no impacts** to bats associated with disturbances to the seafloor, resulting from sediment suspension and deposition.

SFEC

Birds

A potential direct effect to birds during construction activities for the SFEC – OCS and SFEC – NYS is habitat loss or modification. Construction activities will result in disturbances to the seafloor, resulting in sediment suspension and deposition. While construction of the SFEC – OCS and SFEC – NYS will not result in the loss of breeding habitat for any bird species (as no breeding habitat occurs in these areas), there could be impacts to foraging and staging habitats for the species that may occur in the area. Waterbirds, seabirds, waterfowl (seaducks), and limited shorebird species (e.g., red-necked phalarope and red phalarope) staging or foraging in the area may be susceptible to impacts to habitat during installation of the submarine portion of the SFEC. There will be **no impacts** to other shorebirds or landbirds expected due to installation of the SFEC – OCS or SFEC – NYS.

The effects during installation activities are expected to be like those discussed above for the SFWF inter-array cable, resulting in temporary, localized, and **negligible** risks to waterbirds, seabirds, waterfowl, and phalaropes. Given the relatively narrow width of the cable trench plowed during construction compared to the large areas of alternative foraging and resting habitat, **negligible** habitat loss or modification is anticipated during cable installation.

Along the route of the SFEC – Onshore, in East Hampton, New York, are potential temporary construction-related risks to breeding shorebirds and some seabirds (e.g., terns), including potential impacts to the federally threatened and New York endangered piping plover and the New York state threatened least tern. IPFs including seafloor/land disturbance, and sediment suspension and deposition could briefly impact foraging habitat for nesting or staging shorebirds or seabirds. Prey fish could become startled and temporarily flee the area. In the intertidal zone, invertebrates, small crustaceans, mollusks, and other benthic shorebird prey sources could become temporarily covered by sediment released during the installation process. Nesting and staging birds are particularly at risk of impacts to their habitats due to high energetic demands during these sensitive periods. These risks however are anticipated to be only temporary, short-lived, and spatially contained to immediately adjacent areas.

Cable transition from sea-to-shore will be completed using HDD from a new transition vault located within a public road, under the beach, to an exit point offshore. Since the sea-to-shore transition would be installed via HDD that would begin within a public road and end approximately 530 to 580 m (~1700 to 1900 feet) offshore from the MHWL, installation of the SFEC is not expected to result in any long-term change in coastal erosion, the inter-tidal community structure, prey availability, or natural sediment deposition processes. Horizontal drilling will minimize potential construction impacts on the inter-tidal community within the vicinity of the landfall site. Any increase in turbidity and potential relocation of sandy sediments would be temporary, localized, and negligible, resulting in no lasting physical changes to coastal areas or beaches. The temporary cofferdam will be removed after commencement of installation of the SFEC – NYS. The excavated sediments placed in the immediate vicinity of the cofferdam will be allowed to disperse naturally. As such, risk of impacts to foraging habitat of breeding shorebirds or staging shorebirds or seabirds associated with changes in inter-tidal habitat during installation of the SFEC are anticipated to be temporary, localized, and **negligible**.

It is possible that workspaces would be required on the beach to support the assemblage of equipment (e.g., the cofferdam and conduit pipe) and for personnel vehicles; however, these activities are not expected to occur during the nesting period and would not result in long-term loss or modification of beach habitat.

Except for the SFEC - Interconnection Facility to be located adjacent to the existing East Hampton substation, all components of the SFEC – Onshore will be set within a new underground duct bank in developed areas along existing ROWs, thus resulting in **no impacts** associated with habitat modification/loss or disturbances to landbirds. An approximately 0.96-hectare (2.38-acres) area consisting of woodland habitat will be cleared for construction of the SFEC – Onshore Substation, and there may be a small amount of additional clearing along railroad ROWs for the SFEC − Onshore. See Section 3.0 for time of year restrictions for tree-clearing activities; while these restrictions target mitigating impacts to roosting bats, they would also mitigate impacts to nesting landbirds. There will be **negligible** impacts to landbirds associated with development of the SFEC – Onshore Substation.

Bats

Bats are expected to seasonally occur in areas of the SFEC – OCS and SFEC – NYS while migrating, commuting, or foraging but will be unaffected by seafloor disturbances during installation of the SFEC – OCS or SFEC – NYS.

As noted, installation of the SFEC – Onshore and construction of the SFEC – Onshore Substation will result in temporary and negligible land disturbances. Since the SFEC – Onshore is within existing ROWs (primarily existing roads), **no impacts** to bats are expected from installation of the SFEC – Onshore. **Negligible to minor** impacts are expected from construction of the SFEC – Onshore Substation given these activities will occur in already developed areas and only a relatively small area will be cleared for the substation, with minimal additional vegetation clearing along railroad ROWs for the SFEC – Onshore. See Section 3.0 for time of year restrictions for tree-clearing activities to mitigate impacts to roosting bats.

Summary of Habitat Loss/Modification Impacts (Construction and Installation of SFWF and SFEC)

DWSF has committed to several measures during construction to reduce impacts associated with habitat loss or modification, as described in Section 3.0. These measures, in conjunction with the temporary nature of scheduled construction activities, will result in only **negligible to minor** impacts to local birds and bats and their habitat.

2.9.1.2 Collision Risk

SFWF

Birds

A potential direct effect to birds during construction includes risk of collision with above water structures including large equipment, temporary platforms, barges, and WTGs. Collision risk is a direct effect that could result in mortality or injury. IPFs associated with collision risk during construction include the physical presence of large above water structures, lighting, and visibility (Table 2-2).

Waterbirds, waterfowl, seabirds, shorebirds and landbirds may be at risk of collision with tall structures located on an otherwise open and flat landscape during construction. Federally and state listed species including roseate tern, piping plover, red knot, least tern, and common tern are among those that are at risk of collision. Risk of collision at the SFWF is considered more of an issue during operations so it is discussed in more detail in Section 2.4.1. The level of risk is dependent on species behaviors, abundance, and timing of occurrence in the area, as outlined in Section 2.2.1. Bird collisions with tall, manmade structures may occur during the day while birds forage or commute, or at night when birds migrate or make short-distance flights. Since many birds can visually detect structures and avoid them during the day during periods of good visibility, this discussion focuses mainly on collision risk at night and during migration when large numbers of birds may move through the area. The periods of greatest risk of night time migration collision are in the spring (March through May) and fall (mid-August through October), particularly during periods of reduced visibility such as fog or rain.

The presence of illuminated lift barges during construction will present collision risk to migratory birds at night, particularly during periods of rain or fog. However, limited or no construction activities will be conducted during periods of poor weather, i.e., rain, fog, or low cloud conditions. Available information indicates that most migrants typically travel on clear nights and at great heights over land, above the height of the proposed WTGs (Gauthreaux, 1991; Richardson, 1998; Huppop et al., in press). With risk minimization measures in effect (as described in Section 3.0), impacts associated with collision risk for birds during construction are expected to be temporary and generally **negligible to minor**. However, in the unlikely case of a large-scale collision event, the impact could be more severe depending on the species and number of individuals involved.

Bats

Risk of bat collision at the SFWF is considered primarily an issue during operations and so is discussed in more detail in Section 2.4.1. Increased risk of collision due to attraction to operating WTGs is discussed in Section 2.4.1; however, there are **no collision-related impacts** to bats anticipated during construction.

Summary of Collision Risk (Construction)

During construction, there is a potential risk of collision impacts for birds at the SFWF. The periods of greatest risk of collision are associated with periods of inclement weather during night time spring and fall migration (March through May, and mid-August through October). There is no collision risk associated with bats due to their ability to echolocate and detect stationary structures. There is no risk of collision for birds at the SFEC because large stationary equipment (e.g., lift barge) will not be used for cable installation. Generally **negligible to minor** impacts associated with collision risk during construction for birds are expected, and **no impacts** associated with collision for bats during construction is expected. Potential collision related impacts during construction will be minimized by measures described in Section 3.0.

2.9.1.3 Disturbances

SFWF

Birds

Direct effects to birds may temporarily result from traffic and noise during construction at the SFWF. These IPFs may pose a risk of disturbance to birds which could result in a temporary displacement from the area. Construction will also result in increased vessel activity. Transportation barges and material barges would transport the Project components and equipment to the SFWF Work Area. Additionally, small work and support vessels would make regular trips from ports during the construction period. These activities may temporarily flush waterbirds, waterfowl, seabirds, and phalaropes from local foraging or staging habitats but any disruptions would be localized and like other, non-project related boat activities that regularly occur in the area. Alternatively, as some groups of birds such as gulls may be attracted to vessel activity due to association with fishing boats and the potential foraging opportunities.

These types of effects already occur to some extent within and adjacent to the SFWF area due to existing non-project related boat activity, and the temporary increase of activity and disturbances during construction is likely to have **negligible to minor** and temporary effect on waterbirds, seabirds, seaducks, and phalaropes that may occasionally stage in the area. The species and number of birds displaced from (or attracted to) construction activities will be dependent on the time of year, and some species such as divers and seaducks are expected to be more sensitive to these types of impacts. Vessels will follow NOAA vessel speed restrictions to avoid strikes with marine mammals and turtles; this measure will also benefit marine birds by allowing birds more time to react to approaching vessels.

Other migratory shorebirds and landbirds that do not stopover in offshore habitats are only anticipated to occur infrequently in the airspace of the SFWF during migration; therefore, disturbance impacts associated with traffic and noise during construction are anticipated to have **no impact** to these bird groups.

Bats

As bats are only anticipated to occur infrequently in the airspace of the SFWF during migration, impacts associated with traffic and noise during construction are anticipated to have **no impact** to bats.

SFEC

Birds

Direct effects to birds may result from traffic and noise during installation of the SFEC – OCS and SFEC – NYS. These IPFs may pose risk of disturbance impacts to waterbirds, seabirds, seaducks, and phalaropes that occur in the OCS areas to forage or stage. Similar to the SFWF, there will be increased vessel activity during installation of the SFEC with multiple vessels (work vessel, fuel bunkering vessel, cable laying vessel, support tug, crew transfer and support vessels) making regular trips from ports. These activities may temporarily flush birds in the path of vessels, and alternatively, attract other groups of birds, as discussed in the previous section for the SFWF.

Since this type of disturbance already occurs to some extent within and adjacent to the SFEC – OCS and SFEC – NYS due to existing levels of boat traffic, the temporary increase of activity and disturbances during construction is likely to have only a **negligible to minor** effect on waterbirds, seabirds, seaducks, and those limited shorebird species that may stage in the area. The species and number of birds displaced from (or attracted to) construction activities will be dependent on the time of year, with some species such as divers and seaducks expected to be more sensitive to these types of impacts. Other migratory shorebirds and landbirds that do not stopover in offshore habitats are only anticipated to occur infrequently in the airspace of the

SFEC – OCS and SFEC – NYS and during migration; therefore, disturbance impacts associated with traffic and noise during construction are anticipated to have **no impact** to these bird groups.

There may be temporary disturbance impacts to breeding or staging shorebirds and some species of seabird including terns at the SFEC – Onshore, specifically effects associated with noise during HDD during the installation of the sea-to-shore transition. Breeding piping plovers and least terns, and staging red knots are among species that seasonally use the habitats on eastern Long Island. Sensitive periods include the piping plover breeding season from April through August (with some birds arriving as early as March and some late-nests not fledging until sometime in September), as well as shorebird migration periods in the spring (March and April) and fall (mid-July through September). HDD installation activities are expected to take 10 to 12 weeks and would occur 24 hours per day. Activities will only occur underground in the sea-to-shore transition area; however, noise from the operation of equipment associated with the HDD drilling and installation of the buried duct bank may temporarily flush birds including listed shorebird and tern species from adjacent habitats. Depending on the time of year of the activity, this could impact birds during sensitive staging periods when birds are under greater energy demands (see Section 3.0 for time of year restrictions for beach construction activities). While no noise disturbance impacts to nesting shorebirds are expected in the sea-to-shore transition due to time of year restrictions described in Section 3.0, there may be noise-related impacts to shorebirds during other seasons.

During drilling for the HDD there will be noise that could temporarily flush birds, if present during migration or winter. It is possible that workspaces would be required on the beach to support the assemblage of equipment (e.g., the cofferdam and conduit pipe) and for personnel vehicles; however, these activities are not expected to occur during the nesting period. Among sensitive species that may occur in the area during these activities are the federally threatened red knot; they may occur as migrants during construction periods. Beyond the above-mentioned activities, there will be no vessel activity or other large equipment close to shore 530 to 580 m (~1700 to 1900 feet) for installation of the SFEC – Onshore. Noise from drilling in the sea-to-shore transition area and activities at beach work areas could result in temporary impacts which would be short-term and localized; therefore, only **negligible** impacts to birds are expected from construction of the SFEC – Onshore.

There will be noise and traffic associated with construction of the SFEC – Onshore Substation. These effects could impact landbirds that use the terrestrial habitats of eastern Long Island. Noise and traffic related impacts are expected to have temporary and **negligible** impacts on landbirds because construction will occur in already developed areas, and impacts associated with construction of the SFEC – Onshore Substation will be similar to already existing sources of noise and traffic in the local area.

Bats

It is anticipated that SFEC – OCS and SFEC – NYS installation impacts, including traffic and noise, will have **no impact** on bats. Onshore, bats use a variety of terrestrial habitats in eastern Long

Island. There will be noise and traffic associated with construction of the SFEC – Onshore Substation. Since these activities will occur in already developed areas, there are **negligible** impacts to bats expected.

Summary of Disturbance Impacts (Construction SFWF and Installation of SFEC)

Construction related impacts to birds and bats are expected to be **negligible or minor**. DWSF will implement avoidance and minimization measures into the design of the SFWF and SFEC to minimize risk, as described in Section 3.0.

Summary of Direct Effects during Construction of SFWF and Installation of SFEC

Direct effects during construction activities will be temporary and generally **negligible to minor** impacts to birds or bats are expected. The level of potential impacts associated with the IPF during construction are summarized in Table 2-4 below.

Table 2-11. Direct impact producing factors and type of associated impact during construction of the SFWF and SFEC.

Impact Producing Factor	Type of Impact (Direct)	Potential level of impact[1]											
		Waterbirds	Seabirds	Waterfowl	Shorebirds	ROST	LETE	COTE	PIPL	REKN	Landbirds	Bats	NLEB
SFWF													
Sediment Suspension and Deposition	Habitat loss/modification	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NONE	NONE	NONE	NONE	NONE
Seafloor/Land Disturbance	Habitat loss/modification	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NONE	NONE	NONE	NONE	NONE
Lighting	Collision risk	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NONE	NONE
Visible Structures	Collision risk	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NONE	NONE
Traffic	Disturbance	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NONE	NONE	NONE	NONE	NONE
Noise	Disturbance	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NONE	NONE	NONE	NONE	NONE
SFEC OCS and NYS													
Sediment Suspension and Deposition	Habitat loss/modification	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NONE	NONE	NONE	NONE	NONE
Sea Floor/Land Disturbance	Habitat loss/modification	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NONE	NONE	NONE	NONE	NONE
Traffic	Disturbance	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NONE	NONE	NONE	NONE	NONE
Noise	Disturbance	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NONE	NONE	NONE	NONE	NONE
SFEC Onshore													
Sediment Suspension and Deposition	Habitat loss/modification	NONE	NEG	NONE	NEG	NEG	NEG	NEG	NEG	NEG	NONE	NONE	NONE
Sea Floor/Land Disturbance	Habitat loss/modification	NONE	NEG	NONE	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG-MIN
Traffic	Disturbance	NONE	NEG	NONE	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Noise	Disturbance	NONE	NEG	NONE	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1 NONE: no impact; NEG: negligible; MIN: minor; MOD: moderate; MAJ: major													
ROST = roseate tern, LETE = least tern, COTE = common tern, PIPL = piping plover, REKN = red knot, NLEB = northern long-eared bat													

2.9.2 Indirect Effects

2.9.2.1 Discharges and Releases

SFWF

<u>Birds</u>

An indirect effect due to the IPF of discharges or releases may occur during construction activities. There will be variable, but generally limited, amounts of lubrication, grease, oil, and cooling fluids present during construction of the WTGs. There may also be a small, temporary diesel generator at each WTG on the work deck of the foundations. If present, the generator would have a tank storing up to 50-gallons of diesel gas at any time.

Accidents during construction involving vessel collisions or unintended release or discharges of fuels, lubricants, and other liquid contaminants are possible. Depending on location, time of year, and spill size, different bird types have the potential to be impacted. Because terns and gulls forage at the water's surface, they are among those species of birds that are particularly vulnerable to discharges/releases such as oil spills (Jarvis, 2005). Similarly, because seaducks and waterfowl dive from the water's surface, they are also vulnerable. In addition, nesting birds can transfer oil to their eggs or young resulting in impacts to breeding success (Jarvis, 2005). If the feathers of birds become heavily coated with oil, birds can possibly lose their ability to waterproof, insulate, and their ability to fly. Mortality can result from heat loss, starvation, drowning, or if toxins are ingested (Jarvis, 2005).

Oil spills and other contaminant releases can potentially impact large areas if spills are not quickly contained. Although possible, a large discharge/release event is unlikely given the vessels are all regulated by the U.S. Coast Guard (USCG) and must abide by USCG-approved spill plans. In addition, SFWF will have an Oil Spill Response Plan that will be approved by the Bureau of Safety and Environmental Enforcement (BSEE). Further, due to the relatively limited amounts of fuels and liquid petroleum products, in conjunction with the extended distances between SFWF and the closest mainland or island shores, any potential for impacts to shorebirds are greatly reduced and expected to be **negligible**. At the SFEC sea-to-shore transition and onshore HDD work areas, drilling fluids will be managed within a contained system. An HDD Inadvertent Release Plan will minimize the potential risks associated with release of drilling fluids or a frac-out. Sanitary and other waste fluids from vessels will be properly managed in accordance with federal and state laws. Impacts to seabirds, waterbirds, and waterfowl that forage offshore at or below the water's surface could be greater, but still **negligible** because of the relatively small amount of fluids available for release during construction and the avoidance and minimization measures that will be in place to prevent such events, as described in Section 3.0. There are **no impacts** to landbirds due to discharges/releases anticipated.

Bats

Given that bats may occasionally feed off the surface of the water (Ahlén et al., 2007; Ahlén et al., 2009), there is the limited potential for bats to ingest prey from contaminated water should a spill or discharge occur. However, bats more typically capture aerial insect prey and are not expected to purposely travel great distances from the shoreline to forage on the ocean surface. Therefore, impacts from potential discharges/releases in the SFWF are expected to have **no impact** to bats.

SFEC

Birds and Bats

Indirect effects like those in the SFWF may occur at the SFEC – OCS during submarine cable installation. At the SFEC – NYS or sea-to-shore, shorebirds and terns may be at risk of reduced breeding success or mortality if a discharge/release of drilling fluid or another contaminant were to occur there. Nesting birds can also transfer oil to their eggs or young (Jarvis, 2005). Impacts would depend on the timing and location of an incident, the type and magnitude of fluid released, and number of birds present. Because of the avoidance and minimization measures that will be in place during construction activities, the event of a spill or discharge is unlikely and only **negligible to minor** impacts to waterbirds, waterfowl, seabirds, and shorebirds are expected. There are **no impacts** to landbirds anticipated from discharges or releases.

Because bats are typically expected to forage for insects above SFEC – NYS than take prey from the surface of the water, **no impact** to bats from discharges/releases at the SFEC – NYS or sea-to-shore transition are expected.

2.9.2.2 Trash and Debris

SFWF and SFEC

Birds

During construction activities at the SFWF and SFEC, trash and miscellaneous debris will be generated. Accidental disposals could result in bird ingestion or entanglement, which could ultimately result in mortality or injury. However, these materials would be strictly managed and disposed of according to state and federal laws. Additionally, all personnel working offshore will receive training on marine debris awareness. Impacts to birds from trash and debris are considered **negligible** because the likelihood of accidental disposals would largely be prevented.

Bats

There are no impacts to bats anticipated from trash and miscellaneous debris during construction of the SFWF and SFEC.

Summary of Indirect Effects (Construction of SFWF and SFEC)

Best management practices will be implemented to minimize the potential for accidental spills and releases of drilling fluids and other petroleum-based contaminants during construction in the onshore, nearshore, and offshore environments, as described in Section 3.0. Discharges/ releases or trash/debris during construction are expected to result in **negligible** impacts because of the design, engineering, and operational measures that will be in place to prevent such incidents.

Table 2-12. Indirect impact producing factors and type of associated impact during construction of the SFWF and SFEC.

Impact Producing Factor	Type of Impact (Indirect)	Potential level of impact[1]											
		Waterbirds	Seabirds	Waterfowl	Shorebirds	ROST	LETE	COTE	PIPL	REKN	Landbirds	Bats	NLEB
SFWF													
Discharges and Releases	Mortality/Decreased Breeding Success	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NONE	NONE	NONE
Trash and Debris	Mortality/Injury	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NONE	NONE	NONE
SFEC OCS and NYS													
Discharges and Releases	Mortality/Decreased Breeding Success	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NONE	NONE	NONE
Trash and Debris	Mortality/Injury	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NONE	NONE	NONE
SFEC Onshore													
Discharges and Releases	Mortality/Decreased Breeding Success	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NONE	NONE	NONE
Trash and Debris	Mortality/Injury	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NONE	NONE	NONE

1 NONE: no impact; NEG: negligible; MIN: minor; MOD: moderate; MAJ: major

ROST = roseate tern, LETE = least tern, COTE = common tern, PIPL = piping plover, REKN = red knot, NLEB = northern long-eared bat

2.10 OPERATIONS IMPACTS

2.10.1 Direct Effects

2.10.1.1 Collision Risk

SFWF

Birds

Collision with an operating WTG resulting in mortality or injury is a potential direct effect to birds during operation of SFWF. IPFs associated with collision risk include visible structures and lighting. Migrating birds are at particular risk of collision at night when they can become disoriented by lighting, particularly during adverse conditions such as rain or fog. Some birds may not collide with structures but, if disoriented by artificial light, they may die from exhaustion by continuously circling around the lit structures (Huppop et al., in press). When seasonally present, risk of collision would depend on bird abundance and distribution in relation to the SFWF, and ultimately frequency of occurrence in the WTG RSZ. Abundance and height of flight are the key factors most directly linked to frequency of occurrence in the RSZ (Willmott et al., 2013).

The proposed maximum rotor-swept height of the 12 MW WTGs under consideration is 262 m (860 feet), notably taller than most model WTGs currently operating in North America. The BIWF turbines are 6 MW with a maximum rotor-swept height of 180 m (600 feet). Limited available information from onshore wind farms in the US suggest that bird collision risk increases with increasing height of WTGs (Loss et al., 2013). However, statistical modeling using data describing the flight heights of 25 bird species (including waterbirds, waterfowl, and seabirds) from surveys at 32 proposed offshore wind farms in Europe, showed many birds fly within approximately 21 m (70 feet) of the sea surface (Johnston et al., 2014). These results demonstrate that use of larger turbines may reduce collision risk for marine birds (Johnston et al., 2014). However, taller turbines may pose more of a risk to high flying migrants including shorebirds and passerines.

There are other key factors that would influence risk of collision including bird use and behavior near operating WTGs, which would largely depend on the time of year. As discussed below, the increase of available substrate below the water's surface may attract prey including invertebrates and fish, while above water structures may provide perching opportunities for some species of birds, both of which could influence bird use and behaviors in the area. Weather and visibility are significant factors influencing risk of collision.

The submarine portion of the WTG foundations and scour protection methods (either rock armor or scour mats) will increase the available surface area underwater. This increase in surface area will provide substrate for biofouling by benthic invertebrates and may create habitat for bird prey fish. Fish may concentrate around WTG foundations in the SFWF as they have been documented congregating around floating or stationary structures in the marine environment (Kragefky, 2014). The SFWF foundations will likely create some level of a localized artificial reef effect, where fish may find shelter or food (Kragefky, 2014). Further, turbulence at WTGs may force prey items to the surface, providing potential foraging opportunities (Dierschke et al., 2016). The increase in prey may attract waterbirds, seabirds, waterfowl, and phalaropes to the area to forage. Certain foraging behaviors may put some bird groups at risk of collision with spinning blades. Birds that dive from the water's surface such as loons and seaducks while foraging would not be at risk of collision with spinning blades while foraging; however, seabirds such as terns or gannets could be at risk if diving from the air. Seabirds such as terns are agile fliers and have exhibited flight maneuverability around artificial structures such as lighthouses and ships; however, if foraging they may be focusing on prey below and not aware of spinning blades. Bird prey sources including mullusks and crustaceans are expected to increase over time immediately on and around the underwater turbine structures. The potential increase in prey fish around the SFWF WTG foundations is expected to be localized and minor, and may shift over time due to the dynamic nature of fish distributions offshore. Because of the relatively small footprint of the SFWF WTG foundations and the dynamic nature of food sources in the offshore environment, increased risk of collision due to attraction for foraging opportunities is expected to result in **negligible to minor** impacts to birds.

The foundation deck may provide perching opportunities for some species of waterbirds and seabirds that perch on natural and manmade structures in the marine environment (e.g., cormorants, gulls, terns). If flying toward spinning blades when taking off or landing on perches, these bird groups may be at increased risk of collision. The approach of vessels could cause perched birds to quickly depart the area. Fleeing behavior could increase the risk of collision with blades. Nocturnal migrating passerines may recognize the WTGs on the otherwise flat landscape offshore as a potential location to land if blown offshore during inclement weather. "Fall out" events are known to occur at islands offshore when nocturnal migrants are looking for a place to land when encountering adverse weather; these events can happen both onshore and offshore and often migrants become attracted or disoriented by artificial sources of light. Without places to land, some birds may expire from exhaustion into the ocean. The presence of offshore WTGs could result in increased collision risk if the birds encounter the blades while rapidly decreasing their height of flight; however, if birds avoid collision with the blades, some birds may find the WTG foundations and railings as a place to rest. Due to impact minimization measures discussed in Section 3.0, increased risk of collision due to attraction for perching opportunities is expected to result in **negligible to minor** impacts to birds.

Risk of collision for birds is greater during periods of rain or fog, and during low light conditions (i.e., at night or crepuscular periods) (Fox et al., 2006). The results of available onshore mortality studies indicate that many bird collisions with man-made structures take place during nighttime migration during inclement weather (Kerlinger, 2000). Presumably fog conditions during the day would increase risk for locally foraging and commuting birds as well. Huppop et al. (2006) suggests that risk of collision with man-made structures located offshore would also be elevated during periods of rain and fog. Artificial lighting in periods of rain and fog are known to disorient birds. Peterson et al. (2006) observed a substantial decrease in the volume of migrating waterbirds at a European offshore wind farm during inclement weather (Peterson et al., 2006).

The offshore substation and WTGs within the SFWF are required by the USCG to be lit at the foundation deck at night, and the offshore substation will also have safety lighting. The WTGs may require pulsing aviation lighting. Lighting may serve as an attractant to nighttime migrants, particularly during periods of fog. Certain types of light may pose more of a risk including sodium vapor lights and other types of flood lighting. Large-scale fatality events can result from attraction/disorientation due to artificial sources of light during inclement weather. Pulsing lights have been found to be less of an attraction than steady burning lights. It is possible that blinking aviation lighting on WTGs may help birds detect the presence of the nacelles (but not necessarily the blades) and may facilitate avoidance of encounters during periods of good visibility. It is suspected that natural sources of nighttime lighting (e.g., moonlight or starlight) may decrease the risk of bird collisions if their movements result in nighttime crossings of the SFWF during clear conditions. Increased risk of collision due to artificial lighting and attraction/disorientation of birds may result in **minor** impacts to birds. Nocturnal migrant passerines and some seabirds (e.g., alcids) are expected to be most vulnerable to attraction effects based on available information (Appendix B). However, due to impact minimization measures that will be in place during operations, impacts associated with lighting are expected to be minimized.

The potential level of collision risk during SFWF operation is dependent on the species and their behaviors. Impacts associated with mortality would depend on the population size, reproductive success rates, and annual survivorship of adults and juveniles. Willmott et al. (2013) developed a method of ranking bird group relative sensitivity to the impacts associated with potential collision with WTGs on the Atlantic OCS. Species that were ranked as being more susceptible to collision mortality included gulls, terns (including roseate terns), jaegers, phalaropes, cormorants, northern gannets, and scoters due to high occurrence in the OCS or population at risk, low macro avoidance rates and relatively high proportion of flights in the RSZ (Willmott et al., 2013). Species with the lowest vulnerability to collision risk included passerines that would only cross the OCS during migration and would typically fly above the RSZ. Many of the species with low collision sensitivities also had large global populations, making them less sensitive to mortality impacts (Willmott et al., 2013).

Roseate tern, least tern, and piping plover are among species sensitive to impacts (Willmott et al., 2013), due to their at-risk populations. Collision related impacts would have more of an adverse effect on these rare species; however, occurrences of these less common species at the SFWF are expected to be infrequent. A risk evaluation for wind facilities in the OCS by Burger et al. 2011 suggested that turbine collisions and population level effects for piping plover were unlikely; the authors suggested the risk of collision for roseate terns was not well understood, but the risk of population level effects was considered low; and, the risk of collision fatalities was considered unlikely for red knots, but if they were to occur they could have negative population effects (Burger et al., 2011).

While the likelihood of a collision for each of these sensitive species is generally considered low, the loss of one or a few individuals per year may represent a **minor** impact. Other bird groups, including waterfowl, with relatively stable populations and relatively minimal time spent in the RSZ may generally be at risk of **negligible or minor** collision related impacts, depending on the numbers of individuals involved in collision events. Nocturnal migrant passerines were classified as having potentially **minor** impacts because this group is known world-wide to be most commonly involved in collision events with man-made structures both onshore and offshore, and large-scale collision events during migration do have the potential to occur, if certain weather conditions coincide with periods of peak migratory movements.

Given available information and the key factors that contribute to risk of collision, the species or groups identified in Table 2-13 are considered most likely to be involved in collision events at the SFWF, or would be most at risk of collision-related impacts due to a population already at risk; note this table does not include all species that may be at risk of collision. Also listed are the periods of greatest collision risk for the species or group.

Table 2-13. Species level of collision risk based on key factors.

Species or Group	Applicable Key Risk Factor(s)	Relevant Information	Risk of Collision	Level of Potential Impact	Peak Period Risk
roseate tern[1]	behaviors and flight heights	conservation concern, commuting flight heights, migratory stopover behaviors (landing on water), offshore migration documented	low	minor	summer/mainly post-breeding
least tern[1]	behaviors and flight heights	conservation concern, thought to largely follow coast during migration but also known to cross bodies of water	low	minor	summer/mainly post-breeding, migration
common tern[1]	behaviors and flight heights	conservation concern, commuting flight heights, migratory stopover behaviors (landing on water), offshore migration documented	low	minor	summer/mainly post-breeding

Species or Group	Applicable Key Risk Factor(s)	Relevant Information	Risk of Collision	Level of Potential Impact	Peak Period Risk
piping plover[1]	behaviors and flight heights	conservation concern, unknown migratory flight heights; migration risk only, expected to occur less frequently offshore during migration	low	minor	spring and fall migration
red knot[1]	behaviors and flight heights	conservation concern	low	minor	spring and fall migration
northern gannet	abundance and use, behaviors and flight heights, effects of lighting	relatively high commuting flights	medium	minor	fall and winter
gulls and jaegers	abundance and use, behaviors and flight heights	low macro-avoidance of wind farms and flight heights in RSZ	medium	minor	gulls year round, jaegers spring/summer/fall
eiders and scoters	abundance and use, behaviors and flight heights	nighttime roosting offshore, crepuscular flights to and from roosts but high avoidance of wind farms decreases collision risk	low	minor	winter
loons	abundance and use, behaviors and flight heights	critical common loon winter habitat in the OSAMP study area, relatively high commuting flights, but high macro avoidance of wind farms decreases collision risk	low	minor	winter

Species or Group	Applicable Key Risk Factor(s)	Relevant Information	Risk of Collision	Level of Potential Impact	Peak Period Risk
shearwaters	abundance and use	one of the most abundant species groups in region, low flight heights decrease collision risk	medium	minor	late summer/early fall
Wilson's storm-petrel	abundance and use, effects of lighting	one of the most abundant species in the region; while its low flight heights decrease its risk of collision, attraction to light and potential nighttime feeding increase its risk	medium	minor	summer
phalaropes	abundance and use, effects of lighting	can occur in large flocks offshore during migration (flocks of thousands of individuals can be present at one time) and its attraction to artificial light during fog/rain increases collision risk	medium	minor	late summer/early fall
nocturnal migrant passerines	abundance and use, effects of lighting	one of the most abundant bird groups, its migratory flights expected to be primarily above the RSZ offshore, but attraction to artificial light and potential travel offshore in adverse weather could put them at risk	medium	minor	spring and fall migration

[1] Federally or state-listed species.

Combined with the key factors of abundance and flight behaviors, lighting and visible structures are the IPF that influence risk of collision. During periods with weather conducive to migration, flight heights of migrants are expected to be high and generally above the height of the WTGs. Periods of decreased visibility (i.e., at night or during inclement weather) are when risk of collision is greatest. There is a risk of artificial lighting associated with the SFWF in combination with adverse weather at night to result in large-scale collision events. The use of the minimum required USCG and aviation lighting will minimize impacts to migrating birds. When possible, shielding or angling lighting downward will minimize the attraction of birds. Collision avoidance rates, under good conditions, for most species are expected to be high based on available literature (93–100%; Appendix B), and some species' (e.g., loons and alcids) avoidance of wind farms in general minimizes their risk of collision.

Bats

A potential direct effect to bats during operations of the SFWF is collision with the WTGs resulting in mortality or injury. Bats are not only susceptible to collision with operational WTG blades but may also die as a result of barotrauma (lung damage), caused by a rapid decrease in air-pressure near moving turbine blades (Baerwald et al., 2008; Kunz et al., 2007). Offshore wind turbines may attract insects under certain weather conditions and during certain times of year. The presence of insects at WTGs may provide a food source for migrating bats, and some above water structures in the SFWF may provide roosting opportunities. While these features may result in some benefits to bats, they would also increase bat risk of collision. The IPFs associated with collision risk for bats during SFWF operations include visible structures and lighting. There are key factors that would influence the risk of collision including abundance and seasonal use and behaviors in the vicinity of operating turbines, and weather conditions when bats are in the vicinity of turbines.

The proposed maximum rotor-swept height of the 12 MW WTGs under consideration is 262 m (860 feet). There is limited and conflicting information available regarding the relationship between bat collision risk and increasing turbine size: Barclay et al. (2007) suggests there is a positive relationship with risk and increasing WTG height at onshore locations, while Thompson et al. (2017) suggests there is no relationship. There is limited information regarding bat flight heights offshore; however, recent digital video aerial surveys indicate that bats will travel at heights several hundred meters above sea level (Hatch et al., 2013); therefore, some bats migrating offshore may be at risk of collision with taller turbines.

While bats are presumably less abundant in offshore environments than onshore particularly during summer residency periods, possible attraction of insects to offshore wind facilities, or attraction of bats to tall structures on an otherwise flat landscape may influence bat activity and risk at offshore WTGs. The actual number of bats that may collide with turbines is unknown and currently there is no way to confirm bat fatalities at offshore WTGs. The level of mortality observed at onshore turbines is not necessarily transferable to offshore turbines due to different use and behaviors offshore. Due to a lack of bat carcasses reported during bird large-scale fatality events, bats do not appear to be susceptible to the same large-scale collision events that birds are vulnerable to with structures such as lighthouses, lightships, and oil or research platforms.

Light sources on the SFWF WTG decks and offshore substation may serve as an attractant to bats as they navigate, or bats may potentially be indirectly attracted if insect prey are drawn to the lighting. The WTGs may also be lit with aviation lighting; however, aviation lighting has not been found to influence bat collision risk at onshore facilities in North America (Arnett et al., 2008). DWSF will use the minimum safety lighting required at the SFWF. When possible, lights that are shielded and angled downward will minimize attraction of bats or their prey.

Based on the available information and the key factors that contribute to risk of collision, the level of risk of collision and the level of potential resulting impacts is outlined in Table 2-14. Data suggests that bats are more abundant at onshore locations compared to offshore locations. Bat collision-related impacts may result in minor impacts at the SFWF, with long-distance migratory bats considered to be most at risk. Additionally, several North American non-migratory bat species populations are in decline (notably the federally threatened northern long-eared bat). Given bats have low reproductive rates and require a high adult survivorship, those populations in decline are potentially vulnerable to impacts (Arnett et al., 2013). Despite an anticipated low collision risk, the level of impact to the listed northern long-eared bat is also considered minor (because they are a population already at risk.

Table 2-14. Level of collision risk based on key factors for bat species groups.

Species or Group	Most Applicable Key Risk Factor(s)	Relevant Information	Risk of Collision	Level of Potential Impact	Peak Period Risk
Listed species (northern long-eared bat)	seasonal occurrence, species use, increased foraging/roosting opportunities	low numbers expected in SFWF due to declines due to WNS	low	minor	late-summer, fall dispersal
Long-distance migrants (eastern red, hoary, silver-haired bat)	seasonal occurrence, species use, increased foraging/roosting opportunities	most abundant group detected by offshore acoustic surveys	medium	minor	late-summer, fall migration
'Non-migratory'/cave dwelling (Myotis sp., big brown, tri-colored bat)	seasonal occurrence, species use, increased foraging/roosting opportunities	relatively lower activity offshore detected offshore	low	minor	late-summer, fall dispersal

SFEC

Birds and Bats

Because the SFEC – OCS and SFEC – NYS will be buried under the seabed and there will be no overhead collection lines associated with the SFEC – Onshore, there are **no impacts** associated with collision risk for birds or bats at these project components. It is possible that during migration birds may be attracted to lighting at the Onshore Substation, and bats may be indirectly attracted to the area due to attraction of insect prey to lighting. However, the minimal safety lighting required will be used. Motion-activated lighting would serve as less of an attractant than steady burning lights. When possible, lighting will be shielded and angled downward to minimize attraction and the potential risk of collision with nearby structures. Lighting at the Onshore Substation is expected to result in **neglibible impacts** to birds and bats.

2.10.1.2 Disturbance

SFWF

Birds

Disturbances associated with intermittent vessel traffic during maintenance activities could present minor and temporary direct effects to waterbirds, waterfowl, seabirds, and phalaropes that may use the area for foraging or resting; these impacts would be similar to non-project related boat activity in the area. The relevant IPF include traffic and noise. Approaching maintenance vessels could flush some bird species from foraging or staging habitats. Loons and alcids are among bird types that are more sensitive to disturbances (Appendix B). The temporary increase of activity and disturbances during maintenance is likely to have only **negligible to minor** and short-term effect on birds in the area and use of the area is expected to continue shortly after the vessels depart. There are **no impacts** associated with disturbances during maintenance at the SFWF for other species of shorebird or landbirds expected.

Another source of noise could come from the operating WTGs, either from the spinning blades or from the generators. Vibrations from the generators may be audible under water. However, effects of turbine-generated noise have not been recognized as avian stressors at European and/or North America terrestrial or offshore wind farms to date. Wind and wave noise would be expected to washout or dampen noise from turbine generators. Noise from operating WTGs is expected to have **no impact** on birds.

Bats

Bats may be present in the offshore environment during maintenance activities. Boat activity and noise already occur to some extent within and adjacent to the SFWF area due to existing levels of vessel traffic. The temporary increase of activity and associated disturbances during maintenance activities is expected to have **no impact** on bats in SFWF. While hypotheses for why bats approach WTGs include curiosity about the structures and possible attraction to noise produced by operating WTGs, turbine-generated noise has not been identified in the literature as a possible stressor for bats and noise from operating WTGs is expected to have **no impact** on bats.

SFEC

Birds and Bats

There will be no maintenance during routine operation of the SFEC – OCS and SFEC – NYS; therefore, no impacts to birds or bats are expected from disturbances in the form of traffic or noise. The SFEC – Onshore is expected to require minimal maintenance which will be completed by a typical utility bucket truck style vehicle and would occur below ground in the onshore transition vault or in manholes. Therefore, **no impacts** to birds or bats are expected during maintenance of the SFEC – Onshore.

Summary of Direct Effects (Operation)

The primary potential direct impact during operation of the SFWF is risk of collision. Because the SFEC components (apart from the substation) will be buried, collision is not a risk at the SFEC. Collision risk at the SFWF would be long-term (for the life of the WTGs), and would vary depending on the season, weather, and the abundance and behaviors of species present. Species that occur most frequently in the WTG RSZ would be at greater risk of collision. Under periods of good visibility most collisions are expected to be avoided and infrequent collisions of common species would represent a **negligible to minor** impact. If a large-scale avian fatality event and/or the take of a listed species occurred, the impacts could be **minor** or possibly more severe depending on the number of individuals and species involved. While species such as roseate tern, piping plover, red knot and northern long-eared bat are expected to infrequently occur over the SFWF, the loss of a single individual of a listed species could represent a **minor** impact. Direct effects during operation could also include temporary disturbances associated with intermittent vessel traffic or noise during maintenance activities. Disturbances during maintenance would be temporary and **negligible to minor** impacts associated with these disturbances are expected, with disturbances similar to non-project related boat activity already occurring in the area. The level of potential direct effects associated with the IPF during operation are summarized in Table 2-15. Relevant mitigation measures are discussed in Section 3.0 below.

Table 2-15. Direct impact producing factors and type of associated impact during operation of the SFWF and SFEC.

Impact Producing Factor	Type of Impact (Direct)	Potential level of impact[1]											
		Waterbirds	Seabirds	Waterfowl	Shorebirds	ROST	LETE	COTE	PIPL	REKN	Landbirds	Bats	NLEB
SFWF													
Lighting	Collision risk	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN
Visible Structures	Collision risk	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN
Traffic	Disturbance	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NONE	NONE	NONE	NONE	NONE
Noise	Disturbance	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NONE	NONE	NONE	NONE	NONE
SFEC OCS and NYS													
NA	Collision risk	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
Traffic	Disturbance	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NONE	NONE	NONE	NEG-MIN	NEG-MIN
Noise	Disturbance	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NONE	NONE	NONE	NEG-MIN	NEG-MIN
SFEC Onshore													
NA	Collision risk	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
Traffic	Disturbance	NONE	NEG-MIN	NONE	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NONE	NEG	NEG
Noise	Disturbance	NONE	NEG-MIN	NONE	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NONE	NEG	NEG

1 NONE: no impact; NEG: negligible; MIN: minor; MOD: moderate; MAJ: major

ROST = roseate tern, LETE = least tern, COTE = common tern, PIPL = piping plover, REKN = red knot, NLEB = northern long-eared bat

2.10.2 Indirect Effects

2.10.2.1 Displacement or Attraction

SFWF

Birds

The presence and operation of the SFWF may result in displacement of waterbirds, waterfowl, seabirds, and phalaropes that use the area for foraging, resting, or nighttime roosting. Displacement results if a bird discontinues its use of foraging or staging habitat (see Section 2.4.2.2 for discussion of barrier effects which is applicable to migrating or commuting birds). Displacement can ultimately result in decreased survivorship if birds are unable to access preferred habitat. Displacement can result from birds avoiding visible and operating structures, vessel activity during maintenance, or from the physical loss or modification of habitat. Displacement impacts would be species specific and may change over time if birds become habituated to the presence of the turbines.

Based on the available information, bird species considered most at risk of displacement impacts include seaducks, loons, and some alcids due to restrictions in their prey sources and high macro avoidance rates. However, displacement impacts may be temporary if birds become habituated or are able to find favorable alternative food sources. Due to the dynamic availability and location of prey sources in the offshore environment and the relatively small footprint of the proposed SFWF compared to the surrounding area, it is likely that displacement impacts would be temporary and **negligible to minor** for those species that may forage, stage, or roost in the area. There are **no impacts** associated with displacement for species that may only cross the area during migration, including other species of shorebird and landbirds.

Bats

Bats have been observed to forage and migrate over offshore environments; however, based on available information they may be more likely to be attracted to the wind farm rather than displaced. They may investigate WTGs for potential roosting opportunities or may use the structures for navigational purposes while migrating. These behaviors may increase their risk of collision but there are **no impacts** associated with displacement anticipated for bats during operation of the SFWF.

SFEC

Birds and Bats

Because the SFEC – OCS, SFEC – NYS, and sea-to-shore transition will be buried beneath the seabed/shore, and the SFEC – Onshore will occur in already developed areas, there are **no impacts** anticipated for birds or bats due to displacement at these locations. It is possible that during migration birds may be attracted to lighting at the Onshore Substation, and bats may be indirectly attracted to the area due to attraction of insect prey to lighting. However, the minimal safety lighting required will be used. Motion activated lighting would serve as less of an attractant than steady burning lights. When possible, lighting will be shielded and angled downward to minimize impacts. Lighting at the Onshore Substation is expected to result in **neglibible impacts** to birds and bats.

***Summary of Displacement/Attraction Effects (Operation*)**

Displacement impacts can be complicated and difficult to detect, and impacts may not be immediately observable. Displacement impacts may only occur at the SFWF and are not expected at any portions of the SFEC. Due to the dynamic availability and location of prey sources in the offshore environment and the relatively small footprint of the SFWF, it is likely that displacement impacts would be **negligible or minor** for many bird species. Some species may habituate to the presence of WTGs, and some may be attracted for roosting or foraging opportunities. There are **no impacts** associated with displacement anticipated for bats during operation of the SFWF.

2.10.2.2 Barrier Effects

SFWF

<u>Birds</u>

During migration movements or while commuting, the presence of WTGs may result in barrier effects to birds if they make either small- or large-scale avoidance movements around individual WTGs or around the wind farm area in general. Barrier effects may ultimately result in increased energy expenditure and possibly impacts to fitness or survivorship (Fox et al., 2006). The level of associated impacts resulting from barrier effects would vary by species. These effects would depend on a species avoidance behavior and the increase in distance that birds may travel to avoid the structures.

Most bird species are expected to make minor changes to their flight trajectories (either horizontally or vertically) when approaching WTGs. These changes would represent negligible increases in energy expenditure. Therefore, **negligible** impacts associated with barrier effects are expected for many bird groups. Species that demonstrate macro avoidance behaviors such as waterbirds (e.g., loons) and seaducks, may make more large-scale avoidance maneuvers. But given the relatively small footprint of the SFWF, increases in distances traveled to avoid the SFWF are expected to result in **negligible** increases along a bird's migration path, likely far less than < 0.5% of the total distance traveled during a migration season. Potential impacts to listed species are discussed below.

Roseate tern and least tern crossings of the SFWF are expected to be infrequent and largely restricted to post-breeding or migratory periods. Terns are among bird groups that have demonstrated continued use of offshore wind farms, presumably without large increases in energy expenditure while avoiding encounters with WTGs. Micro avoidance behaviors are expected to result in minor changes to tern flight behavior and minimal increases in energy expenditure. Terns may cross the area during migration; however, their flight heights are expected to generally be above the RSZ. **Negligible** impacts associated with barrier effects to roseate terns are expected.

Piping plovers are expected to travel along the coast or nearshore coastal waters, as they migrate up or down the Atlantic Coast; piping plover may also more rarely cross areas of the OCS during migration. Therefore, the presence and operation of the SFWF is not expected to present a major barrier to the flight paths of migratory plovers. Shorebirds are among species that have shown micro avoidance behaviors when encountering wind farms. Therefore, **negligible** impacts associated with barrier effects to piping plover are expected.

Red knots may occur offshore during migration; however, their flight heights are expected to generally be well above the RSZ. Birds descending or ascending to stopover locations or those birds flying in inclement weather may occur at lower flight heights; however, less migration activity is expected during these conditions. **Negligible** impacts associated with barrier effects to red knots are expected.

Bats

Available data suggests bats may be somewhat attracted to WTGs offshore for foraging, roosting, or navigational purposes. If encountering the WTGs, migrating bats may need to make micro or macro avoidance changes to their flight paths to avoid collisions. These changes may result in increased migratory flight distances and possibly increased energy expenditure, or increased risk of collision when encountering spinning blades. Attraction to offshore WTGs could possibly increase bat risk of drowning as a result of exhaustion if drawn off course from more direct migratory paths. However, due to the small footprint of the SFWF, increased distances traveled along migratory flight paths are expected to be **negligible**.

SFEC

Birds and Bats

Because the SFEC – OCS, SFEC – NYS and SFEC – sea-to-shore transition will be buried under the seabed/shoreline, there will be **no impacts** to birds or bats associated with barrier effects at these project components. Further, the SFEC - Interconnection Facility will occur in an already developed area and any increases in flight paths to avoid this relatively small structure would result in **negligible** impacts to birds and bats.

Summary of Barrier Effects (Operation)

Birds may be at risk of barrier effects when migrating or commuting offshore; bats are more likely to be attracted to WTGs. If encountering the WTGs, birds and bats may need to make micro or macro avoidance maneuvers to avoid collisions with spinning blades or other above water structures. Due to the small footprint of the SFWF, associated impacts are expected to be **negligible**.

2.10.2.3 Discharges and Releases

SFWF

Birds

An indirect effect due to the IPF of discharges or releases may occur during operations and maintenance. Vessel collisions or storm damage to above water infrastructure could result in oil or other fluid discharges/releases. There will be variable, but generally limited, amounts of lubrication, grease, oil, and cooling fluids within the WTGs to support the operation of the WTG bearing, pitch and hydraulic systems as well as the WTG transformer. In addition, there will be lubrication oil for the gearbox of each WTG. Spills may result in the release of contaminants from vessels or from the WTGs. Impacts would depend on the location, time of year, and the size of a spill. Because terns and gulls forage at the water's surface, they are among those species of birds that are particularly vulnerable to oil spills (Jarvis, 2005). Because seaducks and waterfowl dive from the water's surface, they are also vulnerable. Nesting birds can transfer oil to their eggs resulting in impacts to breeding success (Jarvis, 2005). If the feathers of birds become heavily coated with oil, birds can potentially lose waterproofing, insulation, or the ability to fly. Potential impacts include mortality from heat loss, starvation, or drowning. Mortality can also result if toxins are ingested (Jarvis, 2005).

The event of a spill is unlikely, and impacts would largely depend on the location of the spill, the size, and the time of year. Due to the distance between the SFWF and the closest mainland or island shores, the potential for impacts to shorebirds, landbirds, and nesting birds are reduced. Impacts to seabirds, waterbirds, and waterfowl that forage offshore at or below the water's surface could be greater, but again would depend on the time of year. Impacts to these bird groups would depend on the timing and location of an incident and the number of birds present, but are expected to be **negligible** due to the avoidance and minimization measures that will be in place during maintenance activities.

Bats

At an offshore wind project in Europe, bats were observed feeding off the surface of the water potentially on crustaceans. If a spill or discharge occurred, there is the potential for bats to ingest prey from contaminated water. However, bats are typically expected to capture insect prey in flight; therefore, impacts from discharges/releases in the SFWF would be expected to have **no impact** to bats.

SFEC

Birds and Bats

There are **no impacts** to birds or bats anticipated with discharges/releases during operation at the SFEC – OCS, SFEC – NYS or SFEC – sea-to-shore transition since these components will be buried beneath the seabed and there will be no routine maintenance at these components.

2.10.2.4 Trash and Debris

SFWF and SFEC

Birds

During maintenance activities at the SFWF and SFEC, trash and miscellaneous debris will be generated. Accidental disposals could result in bird ingestion or entanglement, which could ultimately result in mortality or injury. However, these materials would be strictly managed and disposed of according to state and federal laws. Additionally, all personnel working offshore will receive training on marine debris awareness. Impacts to birds from accidental disposal of trash and debris are expected to be **negligible** due to the measures that will be in place to prevent such events.

Bats

There are no impacts to bats anticipated from trash and miscellaneous debris during maintenance activities at the SFWF and SFEC.

Summary of Indirect Effects (Operation)

Indirect impacts during operations may have **negligible to minor** impacts, depending on the type of impact (displacement, barrier effect, discharge/release, or trash/debris) (Table 2-16). There are a number of avoidance and minimization efforts that will be implemented to avoid or reduce indirect impacts at the SFWF and SFEC, as described in Section 3.0.

Table 2-16. Indirect impact producing factors and type of associated impact during operation of the SFWF and SFEC.

Impact Producing Factor	Type of Impact (Indirect)	Potential level of impact[1]											
		Waterbirds	Seabirds	Waterfowl	Shorebirds	ROST	LETE	COTE	PIPL	REKN	Landbirds	Bats	NLEB
SFWF													
Visible Structure/Lighting	Displacement	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Visible Structure/Lighting	Attraction	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN	NEG-MIN
Visible Structure/Lighting	Barrier Effect	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Discharges and Releases	Mortality/Decreased Breeding Success	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NONE	NONE	NONE
Trash and Debris	Mortality/Injury	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NONE	NONE	NONE
SFEC OCS and NYS													
NA	Displacement	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
NA	Attraction	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
NA	Barrier Effect	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
Discharges and Releases	Mortality/Decreased Breeding Success	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NONE	NONE	NONE
Trash and Debris	Mortality/Injury	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NONE	NONE	NONE
SFEC Onshore													
NA	Displacement	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
Visible Structure/Lighting	Attraction (Onshore Substation only)	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NEG-MIN	NEG-MIN	NEG-MIN
NA	Barrier Effect	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
Discharges and Releases	Mortality/Decreased Breeding Success	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
Trash and Debris	Mortality/Injury	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
1 NONE: no impact; NEG: negligible; MIN: minor; MOD: moderate; MAJ: major													
ROST = roseate tern, LETE = least tern, COTE = common tern, PIPL = piping plover, REKN = red knot, NLEB = northern long-eared bat													

2.11 DECOMMISSIONING IMPACTS

Decommissioning impacts are expected to be similar to those during construction, and would consist of primarily direct impacts due to habitat loss/modification, traffic, and noise. Since these impacts will be temporary, only **negligible** impacts are expected. In the very rare event of discharge or release due to an accident during decommissioning activities, potentially greater impacts could occur. However, given that decommissioning and spill response plans will be in place, only **negligible** impacts are expected.

3.0 AVOIDANCE AND MINIMIZATION MEASURES

3.1 SFWF

Several measures have been identified to avoid and/or minimize potential impacts for avian and bat species from construction, operations and decommissioning of the SFWF.

- The SFWF WTGs will be widely spaced, with at least 1.3 km (0.8 mi) between WTGs; this wide spacing will allow avian species to avoid individual WTGs and minimize risk of potential collsion.
- The location of SFWF, more than 18 miles (30 km, 16 nm) offshore, is sited away from coastal shallow areas and mudflats which are known to concentrate birds, particularly shorebirds and seaducks; this will reduce impacts associated with loss of habitat and collision risk.
- During operations, lighting on the WTGs, foundation decks, and offshore substation will use the minimum required for safety and by regulation; therefore, minimizing the potential for attraction, disorientation, or and possible collision of birds or bats at night.
- DWSF will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. Every vessel will have its own USCG-compliant spill prevention plan and the SFWF will have an Oil Spill and Prevention Plan (OSRP) in place to prevent the occurrence of spills or releases during construction. Accidental spill or release of oils or other hazardous materials will be managed through the OSRP.
- Trash and debris will be managed and properly disposed of according to state and federal regulations.
- Vessels will follow NOAA vessel speed restrictions to avoid strikes with marine mammals and turtles; this measure would also benefit marine birds by allowing birds more time to react to approaching vessels.

3.2 SFEC

Several measures have been identified to avoid and/or minimize potential impacts for avian and bat species from construction, operations and decommissioning of the SFEC.

SFEC Offshore

- DWSF will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. Every vessel will have its own USCG-compliant spill prevention plan and the SFWF will have an OSRP in place to prevent the occurrence of spills or releases during construction. Accidental spill or release of oils or other hazardous materials will be managed through the OSRP.

- Trash and debris will be managed and properly disposed of according to state and federal regulations.
- Vessels will follow NOAA vessel speed restrictions to avoid strikes with marine mammals and turtles; this measure would also benefit marine birds by allowing birds more time to react to approaching vessels.

SFEC NYS and Onshore

- The SEFC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone; thereby minimizing impacts to bird foraging habitat (e.g., covering up benthic prey sources).
- Drilling fluids will be managed within a contained system. An HDD Inadvertent Release Plan will minimize the potential risks associated with release of drilling fluids or a frac-out.
- The SFEC Onshore cable will be buried; therefore avoiding the risk to birds associated with overhead lines. The SFEC Onshore cable will also be located underground in previously disturbed areas, such as roadways and railroad ROW, therefore minimizing potential impacts to bat habitat from clearing.
- Installation of the SFWF inter-array cable and SFEC - Offshore will occur via a mechanical and hydro-jet plow. Compared to open cut dredging/trenching, this method will minimize sediment disturbance and alteration to benthic and fish habitat that may serve as prey sources for birds in the areas.
- During operations, the minimum lighting required by regulation and for safety will be used at the interconnection facility in an effort to minimize impacts associated with attraction/disorientation and possibly collision of birds at night, or the attraction of bat insect prey.
- A management plan for listed species will be prepared for SFEC Onshore. DWSF will work with NYSDEC and USFWS to determine the need for beach work restrictions from April 1 through August 31 to avoid potential disturbance impacts to listed species. The types of activities that may be restricted and the distances that should be maintained from listed species habitat during permissible activities will be determined in coordination with the agencies. DWSF will continue to coordinate with the NYSDEC and USFWS regarding the need for time of year restrictions for tree-clearing activities at onshore project components to avoid impacts to potentially occupied northern long-eared bat habitat.

4.0 CONCLUSIONS

There may be negligible to minor impacts from direct or indirect effects during construction or operation of the SFWF or SFEC, no moderate or major impacts are anticipated.

Species most vulnerable to impacts primarily include populations already at risk, such as those species listed as endangered or threatened at either a federal or state level. However, occurrences of listed species within the SFWF are expected to be rare and largely limited to migration periods (March through May and July through October). Risk of collision is greatest at night, particularly during periods of inclement weather, but also during daytime periods of limited visibility. Use of the minimal amount of required safety lighting and contaminant spill prevention and response plans will minimize impacts at the SFWF and SFEC. Risk of barrier effects or avoidance is low for listed species due to their low use of the SFWF area. Furthermore, species that travel long distances during migration have been found to be less affected by slight increases in flight distances around man-made facilities due to their ability to travel such long distances. If necessary, time of year construction activity restrictions may mitigate impacts to listed species at the SFEC sea-to-shore transition and at other onshore project components.

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Appendix A TECHNICAL REPORT

Avian and Bat Resources Technical Report

May 25, 2018

Prepared for:

Deepwater Wind South Fork, LLC

Prepared by:

Stantec Consulting Services Inc.
30 Park Drive
Topsham, ME 04086

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Acronyms and Abbreviations

BOEM	Bureau of Ocean Energy Management
ft	foot
ft^2	square foot
km	kilometer
km^2	square kilometer
m	meter
mi	mile
mi^2	square mile
NERACOOS	Northeastern Regional Association of Coastal and Ocean Observing Systems
NoID	unknown species
NYS	New York State
OCS	Outer Continental Shelf
RI Ocean SAMP	Rhode Island Ocean Special Area Management Plan
R/V	research vessel
SFEC	South Fork Export Cable
SFWF	South Fork Wind Farm
WTG	wind turbine generators

1.0 INTRODUCTION

This report characterizes existing avian and bat resources in the project area based on publicly available data from prior surveys and summarizes existing bird and bat data from historical and recent survey efforts conducted in the locales of proposed project components. The spatial scope of the affected environment for these resources includes the South Fork Wind Farm (SFWF), South Fork Export Cable (SFEC), including segments in federal waters on the Outer Continental Shelf (SFEC – OCS), and in New York State territorial waters (SFEC – NYS), and landing sites at Beach Lane and Hither Hills, both in East Hampton, New York, as well as proximal offshore, nearshore, and onshore areas relative to these project elements, i.e., the avian and bat resource study area (Study Area; Figure 1).

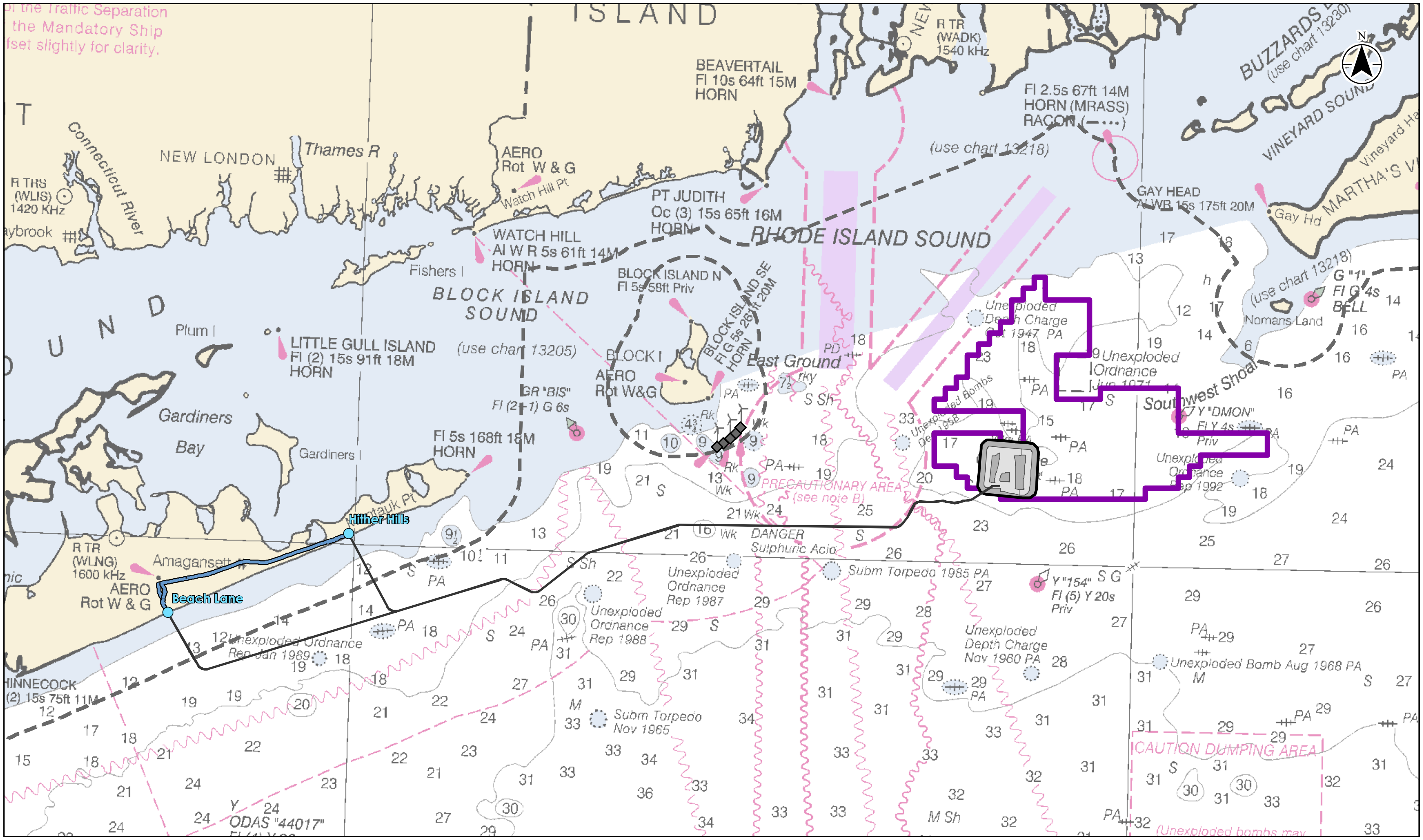
Objectives for this technical report include the following:

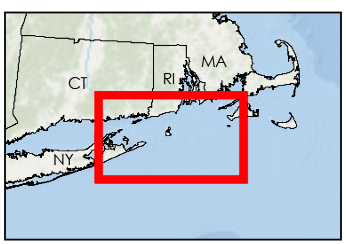
1. Describe bird and bat species composition during summer and winter residency and spring and fall migration periods for the SFWF, SFEC – OCS, and SFEC – NYS.
2. Identify spatial and temporal distribution patterns, including flight ecology, of avian and bat communities within the Study Area.
3. Identify and evaluate the spatial and temporal distribution of state and federal rare, threatened, and endangered species within the Study Area.
4. Provide supporting information for the affected environment, potential impacts, and mitigation measures sections of the project construction and operations plan.

1.1 PROJECT DESCRIPTION

The SFWF will be located in federal waters and include up to 15 wind turbine generators (WTG). The SFWF will also comprise turbine foundations, inter-array cable connecting turbines, and an offshore substation. The SFEC includes a submarine export cable located offshore (in both federal and New York state territorial waters), an underground export cable located onshore (in East Hampton, New York), and a new onshore substation (also located in East Hampton, New York).

The SFWF O&M facility will be in a port either in Montauk in East Hampton, New York or at Quonset Point in North Kingstown, Rhode Island. Several port facilities located in New York, Rhode Island, Massachusetts, or Connecticut will be considered for offshore construction, staging and fabrication, as well as for crew transfer and logistics support.





Legend

- SFWF Project Envelope
- SFWF Work Area
- Offshore Export Cable
- Onshore Export Cable
- Landing Site
- Block Island Wind Farm
- Submerged Lands Act Boundary
- Lease Area OCS-A 0486

0 10 Miles

1:633,600 (At original document size of 8.5x11)

Notes

1. Coordinate System: NAD 1983 UTM Zone 19N
2. Study area footprints provided by Bureau of Ocean Energy Management (BOEM).
3. Base map: ESRI World Topographic Map web mapping service.

Stantec

Project Location
Offshore Rhode Island

195601308
Prepared by GAC on 2018-02-07
Technical Review by JLC on 2018-02-12
Independent Review by BR on 2018-02-13

Client/Project
CH2M HILL, Inc.
Deepwater South Fork COP Support

Figure No.
1

Title
Project Location Map

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1.2 STUDY AREA DESCRIPTION

The SFWF project, with all its structural components, will be located across a broad expanse of the southern New England Atlantic Continental Shelf, just south of Rhode Island Sound and Block Island Sound, and within the New York Bight. As such, a variety of physical, chemical, and biological conditions occur that dictate the distribution and activity of birds and bats within the project area both seasonally and annually.

For birds, water depth is likely the primary physical feature affecting species distribution, as this physical habitat characteristic will limit where different species can successfully access food resources. However, other factors such as substrate, water temperature, salinity and currents all affect resource availability and, consequently, bird species distribution and abundance.

For bats, relating occurrence to certain physical features is harder to estimate. While known to be present, we are only beginning to understand the circumstances of when and where we would predict bats to occur offshore

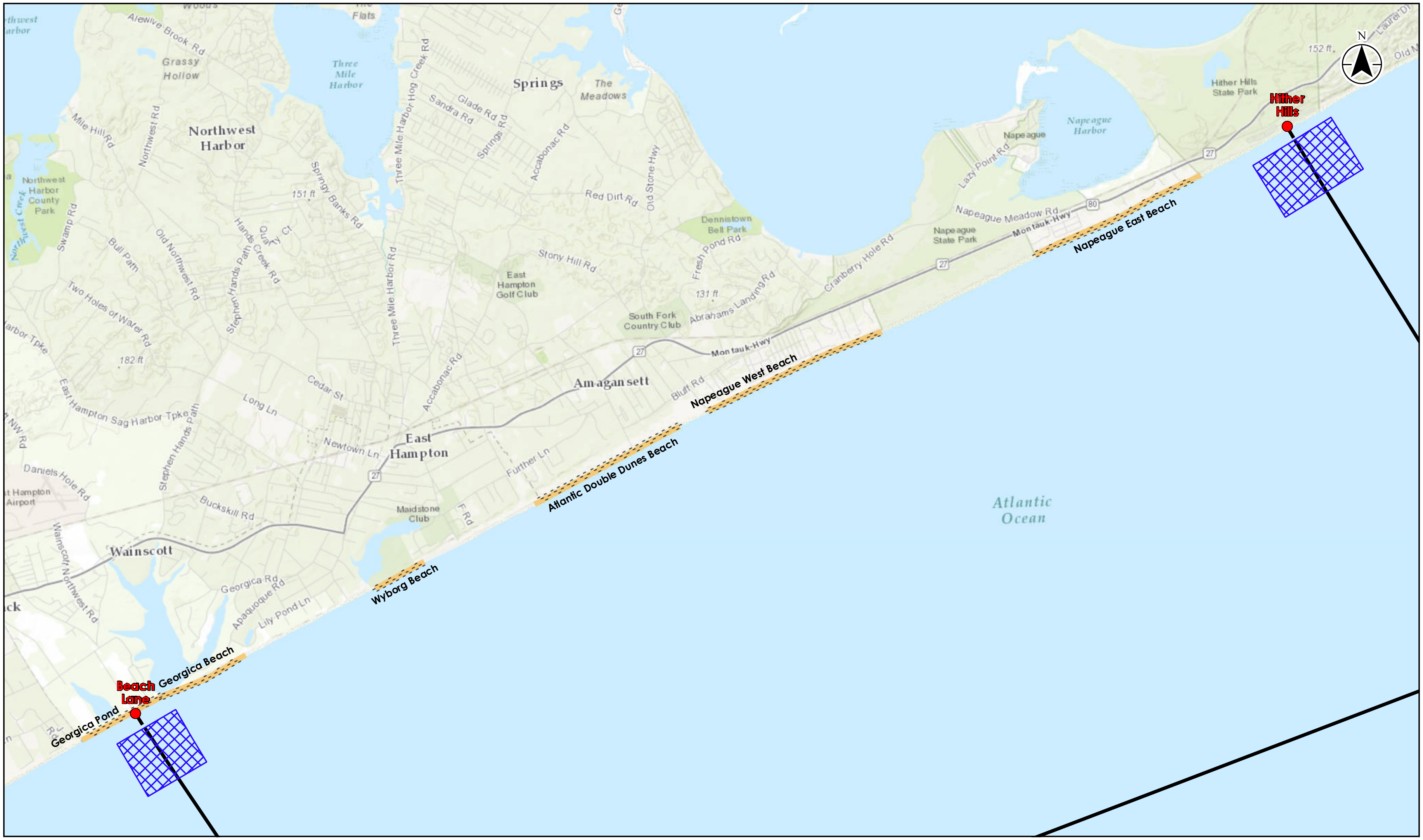
The SFWF is located in the temperate marine waters of the Outer Continental Shelf[1] immediately south of Rhode Island Sound at Cox Ledge (Figure 1). The SFWF project area, covering approximately 36.3 square kilometers ($km^{2;}$ [14.0 square miles (mi^2)]), is in federal waters located approximately 37 kilometers (km; [23 miles (mi)]) south of the mainland shoreline and 26 km (16 mi) east-southeast of Block Island, Rhode Island. Water depths in the SFWF area range from 30 to 40 meters (m [100–130 feet (ft)]). Based on a sediment profile and plan view imaging survey (Inspire, 2018), sediments in the SFWF are predominantly sand sheets and sand with mobile gravel with limited occurrences of patchy cobbles and boulders on sand. Submerged aquatic vegetation is lacking at these depths and the benthic community is described as soft sediment fauna, characterized by infaunal burrows, tubes, mobile epifauna, sand dollars, and fish feeding pits (Inspire, 2018).

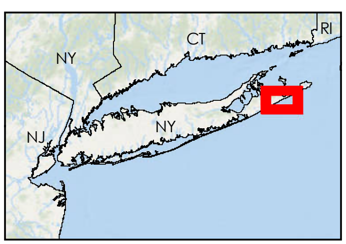
The proposed SFEC – OCS would run from the SFWF, west across Block Island Ridge, and make landfall at one of two sites on the south shore of Long Island (Figure 1). The SFEC – OCS occurs in deeper, offshore areas than the SFEC – NYS, crossing a broad expanse of the seafloor along its approximately 90-km (55-mi) length. Water depths are similar to those in the SFWF and predominantly range from 30 to 40 m (100–130 ft), though there are two areas that are 50 m (165 ft) deep east and west of Block Island.

Medium- and coarse-grained sands are the predominant sediments along SFEC – OCS (Inspire, 2018). The benthic community is of a similar composition as that of the SFWF, though variation is likely in areas of very coarse and fine sand found in the western half of the SFEC – OCS.

[1] In a geological context, the Continental Shelf is the gently sloping undersea plain between a continent and the deep ocean. The continental shelf is an extension of the continent's landmass under the ocean. In the context of the Outer Continental Shelf Lands Act, the Outer Continental Shelf comprises the submerged lands, subsoil, and seabed beginning 3 nautical miles off the coastline extending for at least 200 nautical miles to the edge of the Exclusive Economic Zone or possibly farther, depending on the location of the shelf.

The two SFEC – NYS options (Figure 2) occur in shallower water than the SFEC – OCS. Water depths are generally <30 m (100 ft), and substrate is predominately sand sheets (Inspire, 2018). Submerged aquatic vegetation may occur in some shallow water areas, though this may be limited nearshore due to wave energy effects.





Legend

- Landing Site
- Cable Route
- Shore Approach
- Important Bird Nesting Beach

0 1.5 Miles

1 inch = 1.5 miles (At original document size of 8.5x11)

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Base map: ESRI World Topographic Map web mapping service.

Stantec

Project Location 195601308
Long Island, New York

Prepared by GAC on 2017-10-26
Technical Review by EMA on 2017-10-26
Independent Review by BR on 2017-10-26

Client/Project
CH2M HILL, Inc.
Deepwater South Fork COP Support

Figure No.
2

Title
Landing Site Location and Important Bird Nesting Beaches

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2.0 AVIAN RESOURCES

2.1 REVIEW OF EXISTING DATA AND LITERATURE

Table 1. provides a list of resources Stantec used to describe avian ecology and potential distribution in the Study Area.

Table 1. Relevant data sources. Avian studies conducted with results relevant to the proposed SFWF, SFEC – OCS, and SFEC – NYS sites

Citation	Survey	Location	Data
Powers (1983) Sussman and USGS (2014)	National Marine Fisheries Service ship-based Jan 1978–Feb 1980	Northeastern US: Coastal Ocean	Bird species and numbers
Sussman and USGS (2014) Manomet Bird Observatory (not dated)	Cetacean and Seabird Assessment Program ship-based 1980–1988	Northwestern Atlantic Ocean shelf waters	Abundance and distribution: Cetaceans Seabirds Marine turtles
Paton et al. (2010) Winiarski et al. (2012)	University of RI Ocean SAMP Jan 2009–Jul 2012 Land-based, ship-based, aerial, radar	Rhode Island Sound Block Island Sound Inner Continental Shelf	Spatial distribution, abundance, and flight heights of offshore birds
Tetra Tech and DeTect (2012)	Block Island Wind Farm 2009–2011 Land-based, ship-based, aerial videography, radar, historical migration data review, acoustic monitoring	Block Island, coastal waters	Spatial distribution, abundance, and flight heights of offshore and land birds
Veit et al. (2016)	BOEM Lease Blocks Nov 2011–Jan 2015 Aerial	WEA south of Nantucket and Martha's Vineyard	Seabird abundance and distribution
Veit et al. (2015)	BOEM Research Aug 2008–Feb 2013 Ship-based	Eastern United States, shelf waters, Cape Hatteras to Gulf of Maine	Abundance and distribution of pelagic birds
Veit and Perkins (2014)	BOEM Lease Blocks Jul–Sep 2013	South of Tuckernuck and Muskeget islands	Abundance and distribution of common and roseate terns
Taylor et al. (2017)	Multiple radio telemetry surveys	Eastern Canada and United States	Nanotag detections of many bird species

Citation	Survey	Location	Data
O'Connell et al. (2009, 2011)	Compendium of Avian Occurrence	U.S. Atlantic Coast, Continental Shelf waters, Florida to Maine	Compilation of information on seabirds (>400,000 records) and shorebirds Computer models Seabird distribution maps
Gordon and Nations (2016)	Collision Risk Model for rufa red knot	Nantucket Sound	Large list of parameters for informing wind farm risk to knots

2.1.1 Literature Reviews

As part of their avian research, Paton et al. (2010) summarized historical studies of avian use in nearshore and offshore waters within Rhode Island Ocean Special Area Management Plan (RI Ocean SAMP) boundaries. O'Connell et al. (2011) compiled and synthesized information on shorebird use in the OCS.

2.1.2 Agency Consultations

Deepwater Wind South Fork, LLC (DWSF) requested information regarding rare and listed species occurrences at the SFWF and SFEC from the New York Department of Environmental Conservation's (NYSDEC) Natural Heritage Program (NYNHP) database and US Fish and Wildlife Service's (USFWS) Information for Planning and Consultation (IPaC) online tool. The agency response letters are available in Appendix B.

2.1.3 Surveys

We reviewed geospatial data and maps from the following recent surveys and studies.

2.1.3.1 RI Ocean SAMP

RI Ocean SAMP research effort surveyed nearshore and offshore waters of Rhode Island (Paton et al., 2010; Winiarski et al., 2012). The RI Ocean SAMP carried out thorough surveys of Rhode Island Sound, Block Island Sound, and Inner Continental Shelf.[2] These surveys included the following:

1. land-based seawatch,
2. ship-based transects,
3. aerial strip transects,
4. boat-based transects nearshore, and
5. horizontal and vertical radar.

[2] For the RI Ocean SAMP, Paton et al. (2010) defined the Inner Continental Shelf as the area south of Rhode Island and Block Island sounds that extends to the Continental Shelf Slope (as per Rhode Island Coastal Resources Management Council, 2010).

The aerial and boat-based surveys included transects within the SFWF site. The results of these surveys were integral to the information we summarized for each of the species groups in Section 2.2.

2.1.3.2 Block Island Wind Farm

Pre-construction

Development of the Block Island Wind Farm (Figure 1) included pre-construction surveys of waters within 24 km (15 mi) of the SFWF and waters within the cable route (Tetra Tech and DeTect, 2012). Surveys took place on Block Island and within 5 km (3 mi) to the southeast in the wind farm area. Pre-construction surveys included the following:

1. onshore seawatch and raptor surveys,
2. acoustic monitoring,
3. boat-based survey,
4. aerial videography, and
5. radar monitoring.

Post-construction

After the Block Island Wind Farm became operational, Deepwater Wind and Stantec deployed 2 acoustic bird recorders on the south side of the platforms of Turbine 1 and Turbine 3 from August 3, 2017, through January 9, 2018, to document offshore avian activity within an operational wind facility.

Deepwater Wind and Stantec also conducted boat-based bird monitoring for the operating Block Island Wind Farm. Given the relevance of those results to the evaluation of risk posed by the SFWF the results of those efforts are summarized in detail in the SFWF Risk Assessment and in further detail in a report currently being prepared (Stantec, in prep.).

2.1.3.3 Historic Research

The following surveys were conducted in the region and provide historical context:

1. National Marine Fisheries Service boat surveys from January 1978 through February 1980 (Powers, 1983; Sussman and USGS, 2014),
2. Cetacean and Seabird Assessment Program from 1980 to 1987 (Sussman and USGS, 2014; Manomet Bird Observatory, not dated).

2.1.4 Modeling

Using survey data from U.S. Atlantic waters, researchers modeled seabird occurrence to illustrate distribution and relative abundance (O'Connell et al., 2009; O'Connell et al., 2011; Kinlan et al., 2016). These data were used to create distribution and relative abundance maps for the Study Area (Appendix A).

2.2 AVIAN ECOLOGY AND DISTRIBUTION IN THE STUDY AREA

Avian resources are described for the SFWF, SFEC – OCS, and SFEC – NYS and presented in phylogenetic order for each project component. The description of avian resources in the Study Area is based on the literature discussed in Section 2.1.

Avian distribution and relative abundance maps are presented by season and provided in Appendix A. Maps show the results of predictive modeling applied to data from the Compendium of Avian Occurrence Information for the Continental Shelf waters along the U.S. Atlantic Coast (Curtice et al., 2016; Kinlan et al., 2016). Avian Relative Abundance probability model results are the long-term average relative abundance of individuals per strip transect segment. Source data used to create the models are from January 1978 through April 2014 as developed and maintained by U.S. Geological Survey, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration National Centers for Coastal Ocean Science (O'Connell et al., 2009; Kinlan et al., 2016).

Recent data on listed species include preliminary results of digital VHF (nanotag) tracking studies funded through Bureau of Ocean Energy Management (BOEM). Loring et al. (2017a, b) provide preliminary summaries of data collected from red knots (*Calidris canutus rufa*) tagged in Cape Cod, Massachusetts; roseate (*Sterna dougallii*) and common terns (*S. hirundo*) tagged in New York and Massachusetts, and piping plovers (*Charadrius melodus*) tagged in Massachusetts and Rhode Island. The summaries include 2016 data gathered from BOEM's automated radio telemetry stations located on southern New England and mid-Atlantic coasts.

2.2.1 South Fork Wind Farm

We looked at occurrence and modeled data for birds in the SFWF and within 8 km (5 mi). The SFWF would be located in the temperate marine waters of the OCS immediately south of Rhode Island Sound at Cox Ledge (Figure 1) where depths range 30 to 40 m (100–130 ft). Offshore waters provide high value-foraging habitat for seabirds in locations with a varied resource base of forage fish, crustaceans, and mollusks. The SFWF would be located in deep water where there are no shoals, but fish, crustaceans, and other zooplankton are available at all depths.

The benthic assessment report for the Study Area detected patchy cobbles and boulders on sand, sand with mobile gravel, and sand sheets as the dominant broad habitat types in the SFWF (Inspire, 2018). Soft sediment fauna dominated along with attached fauna on the cobbles and boulders. Benthic taxa observed included hydroids, barnacles, surface-burrowing and tube building fauna, squid, (Loliginidae; eggs observed), and sand dollar beds. Benthic taxa likely to occur include anemones, lobster (*Homarus americanus*), Jonah crab (*Cancer borealis*), sea pens (Pennatulidae), shrimp, and amphipods.

Bird groups likely to use deeper offshore waters within the SFWF are summarized in Table 2.

Table 2. Avian Species Groups in SFWF.

Timing, distribution, and status of avian species groups that have potential to occur in the South Fork Wind Farm work area[1]

Species Group	Status	Seasonal Use	Peak Season	Primary Location	Status in Offshore Deep Water[2]
Loons		Migrant, winter resident	Fall, winter	Nearshore, offshore	
Common	State special concern				Uncommon
Red-throated					Uncommon
Shearwaters		Summer resident	Summer	Offshore	
Manx	--				Common
Great	--				Abundant
Sooty	--				Common
Cory's	--				Abundant
Audubon's	--				Rare
Northern fulmars	--	Winter resident	Fall, winter	Offshore	Uncommon
Storm-petrels		Summer resident	Summer	Offshore	
Wilson's	--				Abundant
Leach's	--				Uncommon
Northern gannets	--	Migrant, winter resident	Spring, fall, winter	Offshore	Common
Sea ducks		Migrant, winter resident	Winter	Nearshore, offshore	
Common eider	--				Uncommon
Black scoter	--				Uncommon
White-winged scoter	--				Uncommon
Surf Scoter	--				Uncommon
Long-tailed duck					Uncommon
Jaegers		Migrant	Spring, fall	Offshore, nearshore	
Parasitic	--				Uncommon
Pomarine	--				Rare

Species Group	Status	Seasonal Use	Peak Season	Primary Location	Status in Offshore Deep Water[2]
Gulls		Breeder, migrant, winter resident	Year-round	Nearshore, offshore	
Herring	--				Common
Great black-backed	--				Uncommon
Bonaparte's	--				Uncommon
Laughing	--				Common
Black-legged kittiwakes	--	Migrant, winter resident	Winter	Offshore	Abundant
Terns		Breeder, migrant	Summer	Nearshore, offshore	
Common	NY Threatened				Rare
Roseate	Federal Endangered NY Endangered				Rare
Least	NY Threatened				Rare
Alcids		Migrant, winter resident	Winter	Nearshore, offshore	
Razorbill	--				Uncommon
Common murre	--				Uncommon
Thick-billed murre	--				Uncommon
Atlantic puffin	--				Rare
Dovekie	--				Common
Black guillemot	--				Uncommon
Landbirds[3]		Migrant	Spring, fall	Migrating	Uncommon

[1] Sources: Paton et al. (2010); Tetra Tech and DeTect (2012); Winiarski et al. (2012); Sussman and USGS (2014)
[2] Sources: Paton et al. (2010); Sussman and USGS (2014)
[3] Observed land bird species: various swallow species

Migratory flight heights of seabirds are not well understood. Krüger and Garthe (2001) reported relationships of flight heights of seabirds to wind direction and speed. More birds flying into the wind flew at lower altitudes (0–2 m [0–6.6 ft]) as wind speed increased. Conversely, more birds experiencing tail winds flew at higher altitudes (>2 m [6.6 ft]), and altitudes increased with increasing tail wind speeds.

Deepwater Wind conducted vertical scanning radar surveys for the Block Island Wind Farm (Figure 1). During peak passage rate periods offshore, the average target flight height was within the rotor-swept zone, but in the upper portions of the proposed turbine model (Tetra Tech and DeTect, 2012). Most peak activity periods offshore were recorded during the fall (70%) and winter (25%), whereas nearshore and onshore peak activity periods occurred during the summer (55% and 80%, respectively) followed by spring and fall. During most peak activity periods offshore, average target flight heights were within the rotor-swept zone (95% of peak periods).

Surveyors do not use vertical scanning radar systems to make species level identification. However, it is possible to relate vertical scanning data to corresponding events recorded during other surveys, such as boat-based and onshore visual surveys. Tetra Tech and DeTect (2012) concluded during the boat-based surveys that sea duck abundance was highest, in general, during the fall migration period and winter.

Important pelagic[3] forage fish in the SFWF include alewife (*Alosa pseudoharengus*), blueback herring (*A. aestivalis*), Atlantic herring (*Clupea harengus*), Atlantic mackerel (*Scomber scombrus*), and the eggs and larvae of larger pelagic fish, such as haddock (*Melanogrammus aeglefinus*), monkfish (*Lophius americanus*), and red hake (*Urophycis chuss*). Other important forage foods include eel, squid, shrimp, and krill.

2.2.1.1 Loons

Both common (*Gavia immer*) and red-throated loons (*G. stellata*) occur in large numbers in Rhode Island Sound from October to May (Paton et al., 2010). Seasonal distribution and relative abundance of common loons are shown in Figure A in Appendix A. Both species typically forage in water <20 m (66 ft) deep and generally concentrate <10 km (6 mi) from shore, though loons can occur much further offshore depending on the availability of prey fish and weather conditions (Daub, 1989). Common loons are completely flightless for about a 6-week period from March to May during molt (Evers et al., 2010). Paton et al. (2010) indicated that loons moved further offshore as spring progressed. These data suggest that loons spend winter foraging mainly in nearshore areas and then move further offshore as flight feathers are replaced. Loons that winter south of Rhode Island Sound may migrate through the SFWF to and from breeding sites (Paton et al., 2010).

The RI Ocean SAMP surveys observed approximately 50% of loons flying below 10 m (33 ft), 9% flying above 25 m (82 ft), and 1% flying over 125 m (410 ft). Higher flight altitudes were determined to be associated with migratory movements (Paton et al., 2010).

[3] When describing fish, pelagic species are those that inhabit the water column in contrast to demersal species, which occur near the bottom of the water column in benthic habitats.

2.2.1.2 Procellariiforms

The Procellariiforms, collectively known as storm-petrels or tubenoses, are pelagic birds that depend on the ocean year-round for food resources (Durant et al., 2004). In the summer, thousands of shearwaters and storm-petrels use the southern sections of Rhode Island Sound and the Inner Continental Shelf during their migratory movements in the Atlantic Ocean (Powers et al., 1983; O'Connell et al., 2009; Paton et al., 2010).

Shearwaters

Shearwaters likely to occur in the Study Area include Manx (*Puffinus puffinus*), great (*P. gravis*), sooty (*P. griseus*), and Cory's (*Calonectris diomedea*) shearwaters. Audubon's shearwaters (*Puffinus lherminieri*) can occur, but their incidences are rare. Seasonal distribution and relative abundance of great and Cory's shearwaters are shown in Figure B and Figure C in Appendix A. Only Manx shearwaters breed in the northeastern Atlantic Ocean, but all four species can occur in the region during their non-breeding seasons. A relatively new breeding bird in North America (first nest record in 1973; Bierregaard et al., 1975), Manx shearwaters are reported to breed regularly only on Middle Lawn Island off Newfoundland's Burin Peninsula; irregular nest sites have occurred elsewhere (Lee and Haney, 1996). Cory's shearwaters have a broad breeding range, nesting on islands in the eastern Atlantic Ocean and Mediterranean Sea. Great shearwaters have an extremely large range, but this species predominately breeds at three sites in the far south Atlantic Ocean. Sooty shearwaters breed in the far south Atlantic and Pacific oceans.

All four species are common, but most observations in the Study Area are of greater and Cory's shearwaters (Paton et al., 2010). Manx shearwaters were most often detected feeding on small fish, squid, and crustaceans (Lee and Haney, 1996) in the shallower waters of Georges Bank, west to Cox Ledge, and north to Stellwagen Bank (Powers, 1983). Paton et al. (2010) detected only Cory's shearwater regularly in nearshore waters. Paton et al. (2010) reported all observations of shearwater flight heights to be <10 m (33 ft).

Fulmars

The North American Atlantic population of northern fulmars (*Fulmarus glacialis*) primarily breeds at colonies on the northern and eastern coasts of Baffin Island and vicinity along with a few small colonies in Labrador and Newfoundland (Gaston et al., 2006, Mallory et al., 2012). Fulmars are expected to occur infrequently in the SFWF. Paton et al. (2010) reported 100% detections of fulmars flying <10 m (33 ft).

Storm-petrels

Storm-petrels likely to occur in the Study Area include Wilson's (*Oceanites oceanicus*) and Leach's storm-petrel (*Oceanodroma leucorhoa*). Both species are pelagic but breed in very different locations. In the Atlantic Ocean, Leach's storm-petrels breed on islands in Canada's Maritime Provinces, and Wilson's storm-petrels breed in the southern hemisphere. Both species can occur in the offshore waters of New England from May through September. Wilson's storm-petrel is one of the most abundant seabird species observed in the offshore waters of New England, and their numbers peak in June and July. Leach's storm-petrel is uncommon and typically found in New England's offshore waters in fall. Winiarski et al (2012) detected storm-petrels most often alone or in small groups, although on occasion observed flocks up to 70 individuals. During the RI Ocean SAMP surveys, nearly all observations of storm-petrels flying were of individuals just above the surface of the water (<10 m [33 ft]); Paton et al., 2010; Winiarski et al., 2012).

2.2.1.3 Gannets

Northern gannets (*Morus bassanus*) breed on coastal cliffs and islands in eastern Canada. In autumn, all age groups move south to waters overlying the Continental Shelf where they may winter from New England to Florida and into the Gulf of Mexico. Seasonal distribution and relative abundance of northern gannets are shown in Figure D in Appendix A. In general, northern gannets tend to occur far offshore foraging on and following schools of pelagic fish (e.g., herring, mackerel, sand lance [*Ammodytes* spp.]) and squid. They will also follow commercial fishing vessels into nearshore areas (Paton et al., 2010; Winiarski et al. 2012), but primarily remain offshore. They are often observed in very large flocks (several hundred) and forage by diving into water from >30 m (100 ft) up to catch prey (Mowbray, 2002). When commuting locally, northern gannets will typically fly 5 to 50 m (16–164 ft) above the water (Paton et al., 2010).

2.2.1.4 Sea Ducks

Potential sea duck species include common eider (*Somateria mollissima*), black scoter (*Melanitta americana*), white-winged scoter (*M. fusca*), surf scoter (*M. perspicillata*), and long-tailed duck (*Clangula hyemalis*). Water depth and bivalve community influence preferred sea duck foraging areas (Nilsson et al., 2016). While bathymetry in the Study Area is known, bivalve communities are presently unmapped and can be expected to change locally. Foraging depths for sea ducks are often <30 m (100 ft) and generally average <21 m (70 ft). Seasonal distribution and relative abundance of each of the sea ducks are shown in Figure E, Figure F, Figure G, Figure H, and Figure I in Appendix A.

Black and surf scoters and common eiders will typically concentrate close to shore (<2 km [1 mi]; 2 km) in winter (Paton et al., 2010; Winiarski et al., 2012), but white-winged scoters and long-tailed ducks have been observed to be relatively more pelagic (Veit et al., 2016). The distribution of common eiders is likely to be related to the incidence of blue mussels (*Mytilus edulis*; Veit et al., 2016), but echinoderms, particularly green sea urchin (*Strongylocentrotus droebachiensis*), and spider crab (*Hyas araneus*) are also important winter foods (Goudie and Ankney, 1986; Guillemette et al., 1992). While engaging in foraging and roosting activities, sea ducks will generally fly low over the water surface, usually <10 to 15 m (33–50 ft) above the water (ESS Group, 2005; Paton et al., 2010). When commuting, such as when sea ducks move between daytime and nighttime roosts, flight heights may be more variable (URI, unpublished data as cited in Paton et al., 2010) and possibly related to wind conditions (direction and speed; Krüger and Garthe, 2001). In the northeastern United States, sea ducks have been observed to migrate along the coast and overland (Sea Duck Joint Venture, 2012). Migration flight heights are unknown.

2.2.1.5 Shorebirds

Plovers, oystercatchers, stilts, avocets, and yellowlegs are generally thought to migrate along the coast, rarely venturing into offshore waters. There is evidence that some fall-migrating shorebirds will travel over the open Atlantic Ocean to reach the Caribbean, including piping plovers, Wilson's plovers (*C. wilsonia*), black-necked stilts (*Himantopus mexicanus*), and greater (*Tringa melanoleuca*) and lesser yellowlegs (*T. flavipes*) (O'Connell et al., 2011). With the exception of red-necked phalaropes (*Phalaropus lobatus*), shorebirds are not expected to use the open ocean for resting or feeding but would occur on the coastline.

Piping Plover (Federal Threatened, State Endangered)

Loring et al. (2017a) tracked tagged birds that departed from coastal Rhode Island and traveled off shore through Block Island Sound or took a coastal route through Long Island Sound. Most birds tagged at Monomoy, Massachusetts departed in a southbound direction and traveled through the eastern portion of Nantucket Sound and southbound over Nantucket Island (Loring et al., 2017a).

Rufa Red Knot (Federal Threatened)

During spring migration on the U.S. Atlantic coast, the highest numbers of rufa red knots (*Calidris canutus rufa*) occur on New Jersey and Delaware shores of Delaware Bay where they forage on an abundant supply of horseshoe crab (*Limulus polyphemus*) eggs (Morrison and Harrington, 1992; Clark et al., 1993). Relative to numbers in the mid-Atlantic region, few individuals occur on Massachusetts shores following this event (Veit and Peterson, 1993). During fall migration, red knots fly primarily over the open ocean, but a few important stopovers include Cape Cod, mainland areas of Massachusetts, New York, and New Jersey (Niles et al., 2008, Harrington et al., 2010). From mid-July to early August, approximately 1,000 to 2,000 red knots occur on the Massachusetts coast during the fall migration (USFWS, 2014). Birds tagged with geolocators were detected over the OCS after leaving the Delaware Bay in spring or leaving coastal Massachusetts in the fall (Niles et al., 2010). This suggests that red knots could conceivably fly through the SFWF during either season.

Preliminary results from BOEM's nanotag study found that of the 99 red knots tagged on Cape Cod, 85 individuals had valid detections from BOEM's telemetry array (locations from Cape Cod to Cape Hatteras). Of these 85 birds, 40 individuals showed distinct migratory departures from Nantucket Sound in late-summer or early fall. Of these 40 birds, 32 were last detected in Nantucket Sound departing in a southeasterly direction (Loring et al., 2017b). The remaining eight birds were detected in the mid-Atlantic; trajectories were toward Long Island and directly across the Atlantic Ocean toward Virginia. Detection results from one of these eight birds provided sufficient data for estimating altitude as it flew across Nantucket Sound. A localization model estimated the bird's altitude ranged from 650 to 820 m (2,133–2,690 ft).

Red-necked Phalarope

Red-necked phalaropes are primarily pelagic in fall and winter, the periods when they would be expected to occasionally occur in the SFWF. Seasonal distribution and relative abundance of red-necked phalaropes are shown in Figure J in Appendix A. Feeding largely on plankton, phalaropes would occur in areas that experience upwelling and mixing. Rubega et al. (2000) indicate red-necked phalaropes wintering off the southeastern United States occurred mainly 40 to 80 km (25–50 mi) offshore in waters 20 to 40 m (131 ft) deep. Phalaropes generally fly low to the water when foraging, but likely fly at much higher elevations when migrating. Red-necked phalaropes detected during the RI Ocean SAMP surveys were primarily of birds sitting on the water; flying birds flew <10 m (33 ft) in elevation (Paton et al., 2010; Winiarski et al., 2012).

2.2.1.6 Jaegers

The RI Ocean SAMP surveys detected pomarine (*Stercorarius pomarinus*), parasitic (*S. parasiticus*), and long-tailed jaegers (*S. longicaudus*), but numbers were very low (Paton et al., 2010; Winiarski et al., 2012). All three of these jaegers are Holarctic breeders. Jaegers could occur in the Study Area during migration, but they are considered uncommon offshore migrants in New England waters. Parasitic jaegers are often observed migrating overland (Haven and Lee, 1999); pomarine and long-tailed jaegers may migrate beyond the Continental Shelf (Haven and Lee, 1998; Haven and Lee, 2000). Although limited to only a few detections, jaegers were observed either sitting on the water or flying at <10 meters (33 ft). A few birds were detected flying up to 125 m (410 ft).

2.2.1.7 Gulls and Kittiwakes

Previous surveys have detected up to 10 species of gulls and 1 species of kittiwake in the SFWF (Paton et al., 2010; Winiarski et al., 2012; Sussman and USGS, 2014); six of the gull species and the kittiwake are common. All will occur offshore except ring-billed gulls (*Larus delawarensis*), which tend to remain close to shore or on land when migrating or wintering (Pollet et al., 2012). Seasonal distribution and relative abundance of herring gulls (*L. argentatus*) and black-legged kittiwakes (*Rissa tridactyla*) are shown in Figure K and Figure L in Appendix A. Gulls often occur in flocks, and some flocks have hundreds, possibly thousands, of birds. Herring and great black-backed gulls (*Larus marinus*) breed locally and are two of the most abundant waterbirds observed in the area (Paton et al., 2010). Both spend the summers nearshore and move to more offshore habitats in fall and winter when they are often observed following fishing vessels (Paton et al., 2010). Bonaparte's (*Chroicocephalus philadelphia*) and laughing gulls (*Leucophaeus atricilla*) are both common migrants, and Bonaparte's gulls will spend winter months in the Study Area (Paton et al., 2010). All gulls are present in nearshore and offshore habitats except for black-legged kittiwake, which is an offshore specialist, primarily found in deeper water (>50 m [164 ft]) and only in winter. Paton et al. (2010) observed gulls typically flew near the water surface while foraging (<15 m [50 ft]), but higher when searching for food over large areas.

2.2.1.8 Terns

In the northeastern United States, terns are breeders and migrants. Common and least terns (*Sternula antillarum*) breed locally on Massachusetts, Rhode Island, Connecticut, and Long Island shores. Roseate terns are discussed in more detail in the subsection below. Other tern species, such as Arctic tern (*Sterna paradisaea*) and Forster's tern (*Sterna forsteri*), also occur in the northeast but their presence off the southern New England coast would be very abbreviated during the spring and fall migration periods or sporadic and inconsistent.

Terns have been reported in deeper waters of the Continental Shelf, but these occurrences are rare compared to their presence in nearshore habitats. Paton et al. (2010) reported only a few common terns and unidentified terns during ship-based transects that surveyed the deeper waters of the RI Ocean SAMP Study Area. Seasonal distribution and relative abundance of common terns are shown in Figure M in Appendix A. For aerial surveys, tern species often cannot be distinguished, but Winiarski et al. (2012) reported most tern detections occurred near coastlines in summer during aerial surveys in the RI Ocean SAMP Study Area. Terns of any species would be rare in the SFWF, and they would be most likely to occur in spring or summer (Paton et al., 2010; Winiarski et al., 2012). Paton et al. (2010) reported observing 94% of flying terns at <25 m (82 ft) above the water surface.

In June 2016, Loring et al. (2017a) radio-tagged 123 common and roseate terns on Great Gull Island, New York and Buzzards Bay (Bird and Penikese islands), Massachusetts. Common terns began departing Bird Island in mid-June and Great Gull Island in mid-July. Based on Motus array detections, common terns made coastal movements. Great Gull Island birds primarily frequented sites west of Buzzards Bay, whereas birds tagged in Buzzards Bay remained around Cape Cod.

Roseate Tern (Federal Endangered, State Endangered)

The northeastern population of roseate tern nests on islands from Nova Scotia to New York (common terns are almost always included in these colonies). Seasonal distribution and relative abundance of roseate terns are shown in Figure N in Appendix A. Breeding roseate terns concentrate primarily in two locations: Great Gull Island, New York, located within a string of islands that separate Long Island and Block Island sounds; and three islands (Bird, Ram, and Penikese islands) located in Buzzards Bay, Massachusetts. Great Gull Island and the three Buzzard Bay islands support over 90% of the nesting roseate terns in the endangered northeast population (USFWS, 2010; Loring et al., 2017a).

Staging roseate terns have been reported in large flocks with other terns at inlets and islands from Long Island to Maine in late summer (mid-July to mid-September) (Veit and Petersen, 1993; Shealer and Kress, 1994). Birds were observed moving from the breeding colonies, sometimes in an easterly or northeasterly direction (Nisbet, 1984; Shealer and Kress, 1994) to concentrate in places where foraging was optimal. Cape Cod and islands to the south (Martha's Vineyard and Nantucket Island) may be the most important staging areas for roseate terns (Trull et al., 1999; Jedrey et al., 2010; USFWS, 2010). When terns leave Cape Cod to head south in fall migration (late-August and early September), individuals could fly through the SFWF.

During the June 2016 tern nanotag study, Loring et al. (2017a) found roseate terns began departing Bird Island in mid-June and Great Gull Island in early July, as was also the case for common terns. Movements were confined to shores and islands of Massachusetts, Rhode Island, and New York. Great Gull Island birds primarily frequented sites west of Buzzards Bay, and birds tagged in Buzzards Bay remained around Cape Cod, as was again the case for common terns as well.

Roseate terns would be unlikely to occur in the SFWF during the breeding season. Any instances of roseate tern occurrence would likely be in late-summer when they begin to make their migration south from staging areas. It is possible that roseate terns could fly through the SFWF after leaving Cape Cod.

Least Tern (State Threatened)

The coastal least tern (*S. a. antillarum*) breeds north to coastal Maine, east to the Bahamas, south through the West Indies, and eastern Mexico to Venezuela (Thompson et al., 1997). The RI Ocean SAMP surveys detected few terns of any species in deep water habitats (Paton et al., 2010; Winiarski et al., 2012). Like other terns, least terns are expected to use waters closer to shore and are unlikely to occur in the SFWF. Least terns are relatively common in coastal New England and Long Island from May through August.

2.2.1.9 Alcids

Alcid species with potential to occur in the SFWF in winter include razorbill (*Alca torda*), common murre (*Uria aalge*), and thick-billed murre (*U. lomvia*). Uncommon alcids may include Atlantic puffin (*Fratercula arctica*), dovekie (*Alle alle*), and black guillemot (*Cepphus grylle*). Aerial surveys of the RI Ocean SAMP Study Area indicated alcids were among the most abundant bird groups from late-fall to early spring, particularly in January when their numbers peak (Paton et al., 2010; Winiarski et al., 2012). Seasonal distribution and relative abundance of razorbills and dovekies are shown in Figure O and Figure P in Appendix A. These birds will occur throughout the Study Area in offshore and nearshore habitats. However, dovekies will be most abundant in waters of the Continental Shelf (Curtice et al., 2016, Kinlan et al., 2016). Alcids will generally occur alone or in small groups, but also occasionally in flocks >100 individuals. The RI Ocean SAMP observers recorded alcids most often roosting on the water surface and foraging (diving). There were very few observations of alcids flying, and all those observed flew at <10 m (33 ft).

Alcids, particularly dovekies, are likely to occur in the SFWF. Individuals or flocks are expected to forage, rest, and commute at low altitudes (often <10 m [33 ft]).

2.2.1.10 Land Birds

The RI Ocean SAMP surveys seldom observed land birds flying over offshore waters, and observations occurred primarily during migration seasons. Occurrences of land birds in the SFWF are likely to be infrequent. New data from telemetry studies show land birds making long-distance movements offshore. Smith et al. (unpublished data) tracked merlins (*Falco columbarius*) from Monomoy National Wildlife Refuge to Nantucket Island, Block Island, Montauk, and over the Continental Shelf. A telemetry study sponsored by USFWS National Wildlife Refuges (NWR) found saltmarsh sparrows (*Ammodramus caudacutus*) tagged in Maine making tracks over Rhode Island and Block Island sounds.

2.2.2 SFEC – OCS

The proposed route for the SFEC – OCS heads west from the SFWF and tracks south of Block Island and the ocean feature, Block Island Ridge (Figure 1). At roughly 43 km (27 mi) from the SFWF, the route enters the eastern marine boundary of the New York Bight (according to USFWS, 1997). Water depths in this area remain >30 m (100 ft) until the cable route turns north to progress toward the shores of Long Island. The benthic assessment report for the Study Area detected sand with mobile gravel and sand sheets along the SFEC – OCS (Inspire, 2018). Dominant biotic subclass was soft sediment fauna with occasional attached fauna. Epifauna observed included anemones, barnacles, bryozoans, a crab, gastropods, hydroids, limpets, sand dollars, a scallop, shrimp, and sea pens. Hydroids and barnacles were detected at sample sites with cobbles and boulders.

The SFEC – OCS is primarily a pelagic environment, and bird species composition, distribution, seasonality, and resource base are likely to be similar to that described for the SFWF. Where the proposed cable route travels south of Montauk Point, the bird community is expected to include more coastal species. This section briefly describes the addition of coastal species to the pelagic community. Table 3. provides a summary of birds likely to occur in the SFEC – OCS.

Within 5 to 16 km (3–100 mi) of the Long Island shore, the waters are approximately 12 to 24 m (40–90 ft) deep. In the area where the proposed cable route comes within 16 km (10 mi) of Montauk Point, pelagic species become more uncommon and the composition of birds begins to include species that occur both nearshore and offshore. The discussion in this section is largely based on the results from the RI Ocean SAMP aerial surveys (Paton et al., 2010; Winiarski et al., 2012). Comments regarding individual species habitat preferences, ecology, and flight characteristics are occasionally repetitive with those already described within the SFWF area, but are still maintained in each area description for reference purposes.

2.2.2.1 Loons

Both common and red-throated loons can occur in relatively large concentrations between Block Island and Montauk in winter and spring (Paton et al., 2010; Winiarski et al., 2012). As previously noted, loons generally concentrated <10 km (6 mi) from shore and preferred water <20 m (66 ft) deep for foraging. Data suggest that loons spend winter foraging mainly in nearshore areas and then move further offshore after losing flight feathers.

The RI Ocean SAMP surveys observed approximately 50% of loons flying below 10 m (33 ft), 9% flying above 25 m (82 ft), and 1% flying over 125 m (410 ft). Higher flight altitudes were determined to be associated with migratory movements (Paton et al., 2010).

2.2.2.2 Shearwaters

Shearwaters tend to be more abundant offshore than nearshore and are more likely to be detected singly or in small flocks in the area where the SFEC – OCS is 5 to 16 km (3–10 mi) from Long Island. Flight heights are typically <10 m (33 ft) above the water surface. It should be noted that shearwater numbers in late summer can be high in the Study Area relative to other bird groups, tens of thousands of shearwaters occur in the waters of the OCS, west of Nantucket Island, and southwest of Cape Cod.

2.2.2.3 Gannets

Gannets occur in waters south of Block Island and near Montauk predominately in fall, winter, and spring. Again, their occurrences are often associated with fishing vessels. Paton et al. (2010) detected gannets during aerial surveys in winter in the vicinity of the SFEC – OCS southeast of Montauk Point.

Table 3. Avian Species Groups in the SFEC – OCS.
Timing, distribution, and status of avian species groups likely to occur in the SFEC – OCS[1]

Bird Group	Seasonal Use	Peak Seasons	Peak/Primary Location	Status in Deepwater[2]
Loons	Migrant, winter resident	Fall, Winter	Offshore, nearshore	More common nearshore
Shearwaters	Summer resident	Summer	Offshore	Common
Storm-petrels	Summer resident	Summer	Offshore	Common
Gannets	Migrant, winter resident	Winter, Spring, Fall	Offshore	Common
Sea ducks[3]	Migrant, winter resident	Winter, Spring, Fall	Offshore, nearshore	Uncommon
Jaegers	Migrant	Spring, Summer, Fall	Offshore	Rare
Gulls[4]	Breeder, migrant, winter resident	Year-round	Offshore, nearshore	More common nearshore
Kittiwakes	Migrant, winter resident	Winter	Offshore	Abundant
Terns	Migrant, post-breeding	Summer	Offshore, nearshore	Rare offshore
Alcids	Migrant, winter resident	Winter	Offshore, nearshore	More common nearshore; exc. dovekie, more abundant offshore
Landbirds[5]	Migrant	Spring, Fall	Migrating	Uncommon

[1] Sources: Paton et al. (2010); Tetra Tech and DeTect (2012); Winiarski et al. (2012); Sussman and USGS (2014)
[2] Sources: Paton et al. (2010); Sussman and USGS (2014)
[3] Observed waterfowl species: common eider, surf scoter, black scoter, long-tailed duck, white-winged scoter, red-breasted merganser
[4] Observed gull species: herring gull, great black-backed gull, laughing gull, ring-billed gull, Bonaparte's gull
[5] Observed land bird species: various swallow species

2.2.2.4 Sea Ducks

Waterfowl species occurring in the coastal portion of the SFEC – OCS include the sea ducks. The incidence of scoters is likely to increase as the route comes within 5 km (3 mi) of shore and would be highest in winter and spring. Eiders would still be uncommon, and occurrences would be more concentrated along the Rhode Island coast.

2.2.2.5 Shorebirds

As explained for the SFWF, shorebirds are not expected to occur away from shore unless flying during migratory movements. Most shorebirds migrate along the coast and land on the shore to rest and feed.

Piping Plover (Federal Threatened, State Endangered)

Paton et al. (2010) recorded very few detections of piping plovers. Of those observed flying, individuals flew <10 m (33 ft) above the water or ground. The onshore survey for the Block Island Wind Farm (Figure 1) detected two piping plovers. Piping plovers are not expected to occur in the vicinity of the coastal SFEC – OCS.

Rufa Red Knot (Federal Threatened)

Rufa Red knots fly primarily over the open ocean during migration, particularly in fall. It is possible that rufa red knots may fly through the area of the coastal SFEC – OCS.

2.2.2.6 Gulls and Kittiwakes

Gulls are expected to be common and seasonally abundant in the vicinity of the SFEC – OCS as it approaches the coast. Winiarski et al. (2012) detected gull species year-round and in large numbers south and west of Block Island during the RI Ocean SAMP surveys. Black-legged kittiwakes are also likely to occur, particularly in winter, but will not be as common in nearshore waters.

2.2.2.7 Terns

The RI Ocean SAMP surveys (Paton et al., 2010; Winiarski et al., 2012) detected most terns in nearshore waters, with most detections closer to the Rhode Island coast. Tern species with potential to occur in the SFEC – NYS include Caspian (*Hydroprogne caspia*), royal (*Thalasseus maximus*), common, Forster's (*Sterna forsteri*), roseate, least, and black (*Chlidonias niger*) terns along with the black skimmer (*Rynchops niger*). Common, least, and roseate terns breed locally in coastal habitats and are common from April to October. The black skimmer also breeds locally but is relatively uncommon. Caspian, royal, and black terns occasionally occur as migrants in the area but are relatively uncommon. Forster's terns occasionally breed on Long Island, the northern limit of their breeding range, but this tern would be uncommon even as a migrant.

Roseate Tern (Federal Endangered, State Endangered)

The RI Ocean SAMP surveys (Paton et al., 2010) detected very few roseate terns during the ship-based surveys (eight in summer 2009) with one detection occurring 7 km (4 mi) south of Block Island. Terns may forage in the vicinity of the SFEC – OCS, particularly in spring or summer, though their numbers are not expected be high.

Least Tern (State Threatened)

Although it is difficult to distinguish tern species from aerial surveys, the RI Ocean SAMP surveys (Paton et al., 2010; Winiarski et al., 2012) reported few terns of any species in deep water habitats. Over 32 trips in 2 years, the offshore boat-based survey conducted 5 km (3 mi) from shore for the Block Island Wind Farm (Figure 1) observed 67 terns but observed only 1 least tern (Tetra Tech and DeTect, 2012). This individual flew 10 to 25 m (33–82 ft) above the water surface.

2.2.2.8 Alcids

Winiarski et al. (2012) detected large numbers of alcids in the vicinity of the SFEC – OCS in winter and spring. Common murre and razorbills are among the alcids most likely to use nearshore waters in winter and spring (Kinlan et al., 2016).

2.2.2.9 Land Birds

Nighttime migrating passerines will fly over the open water, typically at high altitudes (>305 m [1,000 ft]); however, height of flight would depend on weather conditions. They are likely to fly over nearshore waters at low altitudes (<152 m [500 ft]) when descending to coastal stopover sites.

2.2.3 SFEC – NYS

Long Island's south shore is a glacial outwash plain that slopes down from the moraines to a system of lagoons, ponds, and beaches. The south shore is very densely developed, and much of the native landscape has been exposed to dredging, grid-ditching, erosion, and filling. The east end of Long Island is home to the Peconic River and estuary, extensive pine barrens, and the largest remaining tracts of maritime heath, shrub, and grasslands in New York.

As the proposed cable route passes south of Long Island (Figure 2), it would be placed in waters that are 24 to 30 m (80–100 ft) deep before turning northwest toward the shore. At 5 km (3 mi) from shore, waters are still relatively deep, i.e., 18 to 24 m (60–80 ft). Water depths are >9 m (30 ft) within 457 m (1,500 ft) of the shore at Wainscot, Beach Hampton, and Hither Hills Beach where the approach to the shore suddenly steepens to shallow depths. Consequently, the development of submerged aquatic vegetation beds, i.e., sea duck foraging habitat, is possible only within the immediate nearshore portions of the three SFEC – NYS routes. However, the benthic survey assessment did not detect flora at sample sites within the SFEC – NYS (Inspire 2018). Soft sediment fauna was the dominant biotic subclass indicated by surface tubes and burrows. Small surface-burrowing fauna and sand dollar beds were the dominant biotic group.

Table 4. provides a summary of likely occurrence of birds in the SFEC – NYS. The nearshore open waters surrounding Montauk Point provide wintering waterfowl habitat over beds of blue mussel and kelp. The SFEC – NYS cable will be more than 5 km (3 mi) from these shallow waters that are part of Endeavor Shoals or Montauk Shoal.

Data from local surveys, such as Christmas Bird Counts, indicate a variety of land birds and waterbirds. Horseshoe crabs breed on the beaches in large numbers during the spring providing forage for migrant shorebirds, including the rufa red knot.

Using data from Sussman and USGS (2014), species known to occur in the New York Bight, the location of the SFEC route, include terns, gulls, and shorebirds during summer and sea ducks, loons, and alcids during winter. In the fall, the highest densities of seabirds are observed south and east of Montauk Point and along the south shore of Long Island. Other more pelagic species that could occur in the area of the SFEC – NYS include Cory's shearwater, northern gannet, and black-legged kittiwake.

2.2.3.1 Loons

As previously reported, Paton et al. (2010) report loons generally concentrated <10 km (6 mi) from shore and preferred water <20 m (66 ft) deep for foraging, though this species can occur much further offshore depending on the availability of prey fish and weather conditions (Daub, 1989). Common loons are completely flightless for about a 6-week period around March to May during molt (Evers et al., 2010). Paton et al. (2010) indicated that loons moved further offshore as spring progressed. These data suggest that loons spend winter foraging mainly in nearshore areas and then move further offshore as flight feathers are replaced. Christmas Counts at Accabonac Harbor have reported common loons.

The RI Ocean SAMP surveys observed approximately 50% of loons flying below 10 m (33 ft), 9% flying above 25 m (82 ft), and 1% flying over 125 m (410 ft). Higher flight altitudes were determined to be associated with migratory movements (Paton et al., 2010).

2.2.3.2 Grebes

Grebes in the SFEC – NYS would include horned (*Podiceps auritus*) and red-necked grebes (*P. grisegena*). Horned grebes are relatively common in small numbers, while red-necked grebes are relatively uncommon. Both species only occur in winter with peak numbers in March.

2.2.3.3 Gannets

Northern gannets are a common migrant and winter resident in nearshore and offshore waters of the Study Area. Peak migration occurs during April and May in spring and November and December in fall. Gannets are more often seen flying and foraging as opposed to resting on the water surface.

Table 4. Avian Species Groups in the SFEC – NYS.

Timing, distribution, and status of avian species groups likely to occur in the cable route and landfall sites of the SFEC – NYS[1]

Bird Group	Seasonal Use	Peak/Primary Seasons	Peak/Primary Location	Status in Coastal Waters[2]
Loons	Migrant, winter resident	Fall, Winter	Offshore, nearshore	Common
Grebes	Migrant, winter resident	Winter	Nearshore	Occasional
Gannets	Migrant, winter resident	Spring, fall	Offshore	Uncommon
Cormorants	Summer breeder; winter resident	Summer, fall	Nearshore	Common (exc. great cormorant, occasional)
Sea ducks[3]	Winter resident	Winter	Offshore, nearshore	Common
Geese, bay ducks, fish ducks, and dabblers[4]	Migrant, winter resident	Fall, winter	Offshore, nearshore	Common
Shorebirds[5]	Breeding, migrant, winter resident	Spring, fall	Nearshore, onshore	Common
Gulls[6]	Breeding, migrant, winter resident	Spring, summer	Offshore, nearshore, onshore	Abundant
Kittiwakes	Winter resident	Winter	Offshore	Occasional
Terns[7]	Breeding, migrant	Summer, fall	Nearshore, onshore	Common
Landbirds[8]	Breeding, migrant, winter resident	Spring, summer	Onshore	Common

[1] Sources: Paton et al. (2010); O'Connell et al. (2011); Tetra Tech and DeTect (2012); Viet et al. (2016); land-based surveys and nearshore boat surveys
[2] Sources: Paton et al. (2010); Sussman and USGS (2014)
[3] Observed sea duck species: black scoter, white-winged scoter
[4] Observed geese and duck species: Canada goose, brant, common goldeneye, bufflehead, greater scaup, hooded merganser, red-breasted merganser, American black duck, mallard, American widgeon, harlequin duck
[5] Observed overwintering shorebird species: purple sandpiper, sanderling, dunlin, piping plover
[6] Observed gull species: herring gull, great black-backed gull, laughing gull, ring-billed gull, Bonaparte's gull
[7] Observed tern species and allies: common tern, Forster's tern, roseate tern, least tern, black skimmer
[8] Observed land birds include raptors, herons, doves, and passerines

2.2.3.4 Cormorants

Potential cormorants include double-crested cormorant (*Phalacrocorax auritus*) and great cormorant (*P. carbo*), but only double-crested cormorants are local breeders and quite abundant. Great cormorants are uncommon winter residents in the Study Area. Either species is likely to occur only in nearshore waters

2.2.3.5 Waterfowl

Sea Ducks

In the winter, the densest concentration of sea ducks occurs near Montauk and 16 km (10 mi) west and within 2 km (1 mi) of the shore (Kerlinger and Curry, 2002). In the area of the SFEC – NYS, potential sea ducks include black and white-winged scoters. Scoters will concentrate in the thousands close to shore (<2 km [1 mi]) in winter. Recent Christmas Bird Counts recorded large numbers of scoters off the south shore in Nassau County (Kerlinger and Curry, 2002). Christmas counts have documented several hundred white-winged scoters, long-tailed ducks, and common eiders in Accabonac Harbor, as well as Canada goose (*Branta canadensis*), horned grebe, common loon, green-winged teal (*Anas crecca*), bufflehead (*Bucephala albeola*), and other waterbird species.

Sea ducks will fly short distances while foraging (Perkins et al., 2004), and some will make similar movements at night during roosting periods (Tulp et al., 1999). Foraging and roosting flight heights are usually less than 30 m (100 ft) above the water while commuting flight heights are more variable.

Swans, Geese, and Bay and Dabbling Ducks

Both tundra (*Anser serrirostris*) and mute (*Cygnus olor*) swans could occur in the area of the SFEC – NYS, although not in large numbers. Canada geese are more likely to occur at inland ponds and fields, but brant (*Branta bernicla*) are common winter residents in the bays and harbors on the east end of Long Island. Bay ducks, including common goldeneye (*Bucephala clangula*), bufflehead, common merganser (*Mergus merganser*), red-breasted merganser (*M. serrator*), harlequin duck (*Histrionicus histrionicus*), and greater scaup (*Aythya marila*), are likely to use the inshore and coastal areas of Long Island. Dabbling ducks are unlikely to use the south shore waters of Long Island; they would tend to occur in the bays and harbors of the north shore.

2.2.3.6 Shorebirds

Shorebirds are generally believed to migrate along the coastline, resting and foraging along the way. Breeding shorebirds on Long Island include piping plover, American oystercatcher (*Haematopus palliates*), and killdeer (*Charadrius vociferous*). Several species will overwinter on Long Island (sanderling [*Calidris alba*], dunlin [*C. alpine*], purple sandpiper [*C. maritima*]), but most shorebirds occur as migrants. Other species likely to occur on Long Island in the Study Area during migration include black-bellied plover (*Pluvialis squatarola*), semipalmated plover (*Charadrius semipalmatus*), ruddy turnstone (*Arenaria interpres*), semipalmated sandpiper (*Calidris pusilla*), and short-billed dowitcher (*Limnodromus griseus*). Shorebirds will forage in the intertidal zone of beaches. Paton et al., (2010) observed most shorebirds flying at <10 m (33 ft; 87%).

Piping Plover (Federal Threatened, State Endangered)

Piping plovers are expected to occur primarily on coastal beaches except during migration (Paton et al., 2010). Migratory movements are described above in Section 2.2.1, South Fork Wind Farm.

The town of East Hampton monitors piping plovers during nesting on the south shore and in the bays and harbors at the eastern end of Long Island (Town of East Hampton, 2015a; Town of East Hampton, 2015b; Town of East Hampton, 2017). Regular piping plover nesting locales occur at most beaches, including sites proximal to the SFEC – NYS Beach Lane cable landing site.

In 2017, there were 35 pairs of piping plover at 12 active nests (Town of East Hampton, 2017). Relative to the Beach Lane Landing Site (SFEC – Onshore), a Wainscot Pond pair fledged 0 young, and 6 pairs at Georgica Pond and Georgica Beach fledged 9 young (Town of East Hampton, 2017; Figure 2). These locations abut the Beach Lane site. Relative to the Hither Hills Landing Site (SFEC – Onshore), Napeague Beach is the closest piping plover nest site (1.6 km [1 mi]) where 6 pairs fledged 13 young in 2017 (Town of East Hampton, 2017).

The shoreline of Hither Hills State Park has had nesting piping plovers (K. Gaidasz, NYSDEC, personal communication).

At all sites on Long Island shores, nesting birds often endure heavy disturbance pressure from people, natural predators, loose dogs, cats, and vehicles.

Rufa Red Knot (Federal Threatened)

During migration, rufa red knots occur on large waterbodies with suitable shoreline habitat. Heavy concentrations can occur on the south shore of Long Island in spring and fall. Preliminary results from BOEM's nanotag study detected birds flying in the vicinity of Long Island's south shore (Loring et al., 2017b).

2.2.3.7 Gulls and Kittiwakes

Laughing, ring-billed, herring, and great black-backed gulls are likely to be among the most abundant species in the area of the SFEC – NYS. Herring and great black-backed gulls can occur year-round, laughing gulls are summer breeders, and ring-billed gulls are winter residents. Bonaparte's gulls are common during the winter months, but in relatively low numbers. These species can occur anywhere in the vicinity of the SFEC – NYS and may be flying, foraging, resting on the water, and roosting on shores.

Black-legged kittiwakes have the potential to occur off Montauk Point, but they are a more pelagic species, and their numbers are likely to be low and occurrences infrequent.

2.2.3.8 Terns and Skimmers

The RI Ocean SAMP surveys (Paton et al., 2010; Winiarski et al., 2012) detected most terns in nearshore waters, with most detections closer to the Rhode Island coast. Tern species with potential to occur in the SFEC – NYS include Caspian, royal, common, Forster's, roseate, least and black terns along with the black skimmer. Common and least terns and black skimmers breed locally in coastal habitats and are common from April to October. Roseate terns breed in coastal habitats but are not as common. Caspian, royal, and black terns would occur as migrants in the area and are relatively uncommon. Forster's terns occasionally breed on Long Island and would be uncommon even as migrants.

Historically and recently, least terns nested on Wainscott Beach and Napeague Beach (Town of East Hampton, 2015b; NYSDEC, 2016; Town of East Hampton, 2017). In 2017, Georgica Pond's 60 pairs of least terns fledged 24 young, and Napeague Beach's 6 pairs fledged 3 young (Town of East Hampton, 2017).

Roseate Tern (Federal Endangered)

Most detections of roseate terns occurred during the sea-watch surveys (125; May to September) and boat-based surveys of nearshore habitats (935; August). During 2009, an ornithologist working for New Jersey Audubon Society on Block Island observed roseate terns at several sites from July 21 through August 30 (Paton et al., 2010). The RI Ocean SAMP surveys observed 40% of roseate terns flying below 10 m (33 ft) above the water and 60% flying 10 to 25 m (33–82 ft) above the water.

Roseate terns nest sporadically on islands in Gardiners Bay, but the largest colony in the northeast is found on Great Gull Island, which is in Long Island Sound and roughly 32 km (14 mi) from the nearest cable route landing site at Hither Hills.

Least Tern (State Threatened)

Least terns can be expected to occur in coastal waters around Long Island from May to September. The town of East Hampton monitors nesting least terns along with piping plovers.

Coastal least terns nest in colonies on bare or sparsely vegetated sand, mud, shell, or stone just above the high-tide line often swept by periodic, high storm tides (Thompson et al., 1997). On Long Island, they frequently nest on peninsulas, barrier islands, and sandy shorelines on bays and the coast (MacLean et al., 1991 as cited by Thompson et al., 1997; Town of East Hampton, 2015; Town of East Hampton 2017), often sharing habitats with piping plovers.

In 2015, the East Hampton town sites had approximately 120 pairs of breeding least terns (Town of East Hampton, 2015). Least tern breeding sites included Georgica Pond (48 pairs, 30 young fledged), within 610 m (2,000 ft) northeast of where the SFEC – NYS Beach Lane landing site is located, and Wiborg Beach (4 pairs, 0 fledged), approximately 5 km (3 mi) northeast of Beach Lane. The colony at Napeague Beach East (16 pairs, 18 young fledged) is approximately 3 km (1.8 mi) southwest of the SFEC – NYS Hither Hills land site.

In 2017, nest monitoring estimated there were 125 pairs of least terns in East Hampton (Town of East Hampton, 2017). Breeding sites included Georgica Pond (60 pairs, 24 young fledged) and Napeague Beach (6 pairs, 3 young fledged).

The shoreline of Hither Hills State Park has had nesting least terns (K. Gaidasz, NYSDEC, personal communication).

Black Skimmer (State Special Concern)

Massachusetts and New York represent the northern breeding limit of the black skimmer. Black skimmers arrive at breeding colonies in late-April and leave in September or October, congregating in large flocks (e.g., 1,000+) at Jamaica Bay, New York until mid-December (Gochfeld and Burger, 1994). In New York, black skimmers almost exclusively nest among colonies of mixed tern species and prefer to use beaches, salt marsh islands, dredge spoil islands, and sand bars along the southern coast of Long Island. The two largest colonies in New York are located at Breezy Point, Queens, and Nickerson Beach in Nassau County (Smith, 2015). Paton et al. (2010) detected only three black skimmers during the RI Ocean SAMP surveys. Skimmers could occur in the areas of the South Shore sites of the SFEC – NYS.

2.2.3.9 Land Birds

A variety of land birds have potential to occur in upland and coastal habitats associated with the on-land portions of the SFEC – NYS including numerous raptor, heron, dove, and passerine species. A wide variety of migrant passerines and other land birds use Long Island as a stopover and could fly over the cable route when coming to land. These migrants include species that could breed in the surrounding dune, coastal wetland, shrub, forested, and urban habitats in the immediate vicinity of the on-shore line as well as species with breeding ranges further to the north and east that only pass through Long Island in spring and fall.

Fewer breeding land bird species would occur in the area relative to potential migrant species. These breeding bird species primarily include locally nesting marsh and wading birds using nearby coastal wetlands and common swallows, thrushes, corvids, sparrows, and blackbirds using the residential, backyard, and small field habitats within which the onshore, underground line occurs.

Species occurring only in winter are even fewer and may include species such as snow buntings (*Plectrophenax nivalis*), horned larks (*Eremophila alpestris*), and snowy owls (*Bubo scandiacus*).

Northern Harrier (State Threatened)

Northern harriers (*Circus cyaneus*) are likely to use similar habitats for breeding and wintering on Long Island. Habitats may include meadows, freshwater and brackish marshes, active and fallow agricultural fields, and abandoned fields.

Coming from the Hither Hills Landing Site, the Onshore Cable Route runs through Breeding Bird Atlas survey blocks that document breeding harriers (NYSDEC, 2016). Also, Hither Hills State Park has had nesting harriers in suitable habitats (K. Gaidasz, NYSDEC, personal communication).

2.2.4 Bird Ecology and Distribution Summary

Table 5 summarizes the information on bird species with special status based on the available data presented in the previous sections.

Table 5. Special status birds with potential to occur in the SFWF study area.

Species	Status	Applicable Regulatory Protections	In Project Area	Potential and Location	Season Likely	Frequency
common loon	state special concern	MBTA	documented; SFEC – OCS	high; SFWF, SFEC – OCS, SFEC – NYS	winter	abundant
northern harrier	state threatened	6 NYCRR Part 182 MBTA	unconfirmed	moderate; SFEC – Onshore	year-round	uncommon
osprey	state special concern	MBTA	unconfirmed	high; SFEC – OCS, SFEC – NYS, SFEC – Onshore	spring, summer, fall, migration	common
bald eagle	state threatened	BGEPA 6 NYCRR Part 182 MBTA	unconfirmed	low; SFWF, SFEC – OCS, SFEC – NYS, SFEC – Onshore	migration	uncommon
piping plover	federal threatened state endangered	federal ESA Section 7 6 NYCRR Part 182 MBTA	documented; SFEC – Onshore; <1 mile from Beach Lane	high; SFEC – NYS, SFEC – Onshore	spring, summer	uncommon
red knot	federal threatened	federal ESA Section 7 MBTA	unconfirmed	high; SFEC – NYS, SFEC – Onshore	spring/ fall migration	common
least tern	state threatened	6 NYCRR Part 182 MBTA	documented; SFEC – Onshore; <1 mile from Beach Lane	high; SFEC – NYS, SFEC – Onshore	summer	uncommon
roseate tern	federal endangered state endangered	federal ESA Section 7 6 NYCRR Part 182 MBTA	unconfirmed	moderate; SFWF, SFEC – OCS, SFEC – NYS	spring, summer, fall	occasional
common tern	state threatened	6 NYCRR Part 182 MBTA	unconfirmed	moderate; SFWF, SFEC – OCS, SFEC – NYS, SFEC – Onshore	spring, summer, fall	common
black skimmer	state special concern	MBTA	unconfirmed	low; SFEC – NYS, SFEC – Onshore	spring, summer, fall	occasional
common nighthawk	state special concern	MBTA	unconfirmed	probable; SFEC – Onshore	spring, summer	uncommon
horned lark	state special concern	MBTA	unconfirmed	probable; SFEC – Onshore	year-round, winter	uncommon

3.0 BAT RESOURCES

The extent of scientific knowledge regarding the presence and behavior of bats in the offshore environment (>5 km [3 mi]) from the coastline) is limited. There have been few investigations targeting bats offshore, but bats in the offshore environment are difficult to research logistically. Existing data include anecdotal records, records incidental to other scientific research, and a few studies that targeted bats. Therefore, the description of bat resources in the Study Area is based on a relatively small body of literature and survey data. Relevant information includes results from the following sources:

- Department of Energy regional offshore and coastal acoustic monitoring research surveys in New England and mid-Atlantic coastal regions (Stantec, 2016a)
- RI Ocean SAMP study (Smith and McWilliams, 2012; Smith and McWilliams, 2016)
- Pre-and post-construction data from the Block Island Wind Farm (Tetra Tech and DeTect, 2012; Stantec, 2016b; BIWF, unpublished data from construction and post-construction studies)
- Research Vessel (R/V) Fugro Enterprise acoustic survey within the SFWF and SFEC (Stantec, 2016b; Stantec, in draft)
- BOEM Information Synthesis on the Potential for Bat interactions with Offshore Wind Facilities Final Report (Pelletier et al., 2013)
- Telemetry study of northern long-eared bats (*Myotis septentrionalis*) on Martha's Vineyard (Dowling et al., 2017)

3.1 REVIEW OF EXISTING DATA AND LITERATURE

3.1.1 Literature Review

Pelletier et al. (2013) conducted a comprehensive and in-depth literature review of available historic observations of bats and scientific studies that included information on bats in the northeastern and mid-Atlantic coastal regions of the United States. This effort reviewed available published and unpublished environmental and technological literature, including national and international sources. Information was acquired through reviews of existing databases and scientific references, index searches, and personal contacts with other researchers. Stantec used this information to assess potential direct and indirect impacts of offshore wind energy development on bat species.

3.1.2 Agency Consultations

DWSF requested information regarding rare and listed species occurrences at the SFWF and SFEC from the NYSDEC's NYNHP database and USFWS's IPaC online tool. The agency response letters are available in Appendix B.

3.1.3 Surveys

3.1.3.1 RI Ocean SAMP

As part of the RI Ocean SAMP studies, Smith and McWilliams (2012) conducted passive acoustic monitoring of bats at four sites on the Rhode Island coast and two sites on Block Island. Full-spectrum ultrasonic detectors ran from early September to early November. Three sites were monitored for 2 years (including the Block Island sites), and three sites were only monitored for 1 year.

3.1.3.2 Block Island Wind Farm

Pre-construction

Deepwater Wind conducted acoustic monitoring in summer, fall, and spring at four onshore sites on Block Island and two offshore sites (one buoy 5.6 km [3.5 mi] to the south and one buoy 27,8 km [17.3 mi] to the east of Block Island). Detections of bats was largely limited to the island and nearshore waters, with relatively low rates of detection offshore. Most bat activity was recorded during August and October followed by late-May.

Construction

Deepwater Wind conducted vessel-based acoustic bat monitoring (Stantec, 2016b) during construction of the WTGs at the Block Island Wind Farm (Figure 1). Four bat detectors were installed on two barges used for erecting the WTGs and operated from August 2 to 17, 2016.

Post-construction

Deepwater Wind and Stantec deployed 2 ultrasonic acoustic bat detectors on the south side of the platforms of Turbine 1 and Turbine 3 from August 3, 2017 through January 9, 2018 to document bat activity at an operational offshore wind facility.

Deepwater Wind and Stantec conducted vessel-based acoustic bat monitoring on the R/V Fugro Enterprise from July 14 to November 15, 2017, to record offshore bat activity near Block Island Wind Farm. The purpose of the survey was to provide supplemental information about bat and bird activity near operating offshore wind turbines. [See next section for details.]

3.1.3.3 SFWF and SFEC Acoustic Survey

Deepwater Wind and Stantec conducted vessel-based acoustic bat monitoring on the R/V Fugro Enterprise from July 14 to November 15, 2017, to record offshore bat activity within and proximal to the SFWF and SFEC. The survey provided information on bat activity.

The vessel, outfitted with acoustic bat detectors, sailed from New Bedford, Massachusetts and surveyed waters within and proximal to Block Island, including the Block Island Wind Farm, and in the areas of the SFWF, SFEC – OCS, SFEC – NYS, and other areas in the region. Stantec conducted a preliminary analysis of the data to determine relative bat activity in the project area.

3.1.3.4 Martha's Vineyard

During late-summer and early fall of 2016, Dowling et al. (2017) conducted a telemetry study on Martha's Vineyard and tracked northern long-eared bats, little brown bats (*Myotis lucifugus*), big brown bats (*Eptesicus fuscus*), and eastern red bats (*Lasiurus borealis*).

3.1.3.5 New England Region

Stantec (2016a) conducted acoustic monitoring at 19 offshore/coastal sites in New England from Kent Island, New Brunswick southward to a Northeastern Regional Association of Coastal and Ocean Observing Systems (NERACOOS) buoy location off the coast of Gloucester, Massachusetts from 2009 through 2015. Bats were detected at all offshore/coastal sites April through November, and peak passes occurred in August and September. The number of bat passes was negatively related to distance from the mainland, but bats were still recorded at more than 40 km (25 mi) from shore. Although low in terms of overall activity levels, ship-based acoustic surveys conducted in association with the offshore/coastal sites documented bat activity up to 130 km (81 mi) from shore, with a mean distance of all shipboard calls at 60 km (37 mi).

3.1.3.6 Mid-Atlantic Region

Sjollema et al. (2014) conducted a boat-based acoustic study in New Jersey, Delaware, and Maryland from spring 2009 through fall 2010. Bats were detected within 22 km (13.6 mi) of the shoreline.

3.2 BAT ECOLOGY OFFSHORE

3.2.1 Distribution and Timing

Historic observations and a few scientific studies indicate that bats migrate and possibly forage offshore. They will use islands, ships, and other offshore structures as opportunistic or deliberate stopover sites (Pelletier et al., 2013). Atlantic island observations during the migratory period beyond those directly surveyed by Stantec, include several accounts from Bermuda (Pelletier et al., 2013), which is 1,075 km (670 mi) from the nearest United States' coast.

Relevant to the Study Area, anecdotal evidence includes observations of bats in the following locations:

- Georges Bank, 209 km (130 mi) from Cape Sable, Nova Scotia (Norton, 1930)
- 386 km (240 mi) east of Cape Cod (Norton, 1930)
- 105 km (65 mi) off northern Atlantic shore (Carter, 1950)

- 209 km (130 mi) southeast of Nantucket Island (Griffin, 1940)
- 153 km (95 mi) south-southeast of Montauk Point, Long Island (Mackiewicz and Backus, 1956)

Bats may forage offshore during migration, perhaps to avoid competition or to exploit certain food sources (Ahlén et al., 2009). Detections of bats anecdotally in the offshore environment happened most often during the migratory periods, particularly in fall (Nichols, 1920; Thomas, 1921; Norton, 1930; Griffin, 1940; Carter, 1950; Mackiewicz and Backus, 1956; Pelletier et al., 2013).

Stantec (2016a) documented widespread and seasonally predictable presence of multiple bat species at remote sites (>32 km [20 mi] from shore), which indicates bats can fly considerable distances offshore during migration. At sample sites in the Gulf of Maine, relatively high detection rates (>100 passes per night) occurred at Seguin Island (4 km [2.5 mi] from mainland), Kent Island (30 km [18.8 mi] from mainland), and Petit Manan Point (on mainland). Detections at buoys and ships were relatively low (<5 bat passes per night). Anecdotal and survey data suggest bat activity is relatively higher on the coast as compared to offshore (Pelletier et al., 2013; Stantec, 2016a). In the Gulf of Maine, bat passes per detector tended to be highest in August and September. Species differed in seasonal activity patterns with eastern red bats detected over an extended July–October period, hoary bats (*Lasiurus cinereus*) in mid-August, and silver-haired bats (*Lasionycteris noctivagans*) in early September.

From five weather buoys in the Gulf of Maine and the Albemarle ATON (aid to navigation) and Chesapeake Light Tower in the mid-Atlantic, acoustic data provide relevant information for considering potential bat activity at offshore wind turbines. These sites lack natural habitat of any kind, but Stantec (2016a) recorded bat activity at each of these sites, detecting bats during an unexpectedly high percent of nights. However, detection rates were relatively low (<10 bat passes per night).

For the RI Ocean SAMP, Smith and McWilliams (2012) operated acoustic detectors at two locations on Block Island and four locations on the Rhode Island mainland. For the two Block Island sites, they reported distinct passage rates between the two sites and across the 2 years. There were 108.8 and 19.4 bat passes per night in 2010 and 24.8 and 3.4 bat passes per night in 2011. Roughly half of all bat activity on Block Island occurred on 3 to 10 nights from early-September to early-October.

During construction of the WTGs at the Block Island Wind Farm (Figure 1), four bat detectors installed on two barges operated from August 2 to 17, 2016, and recorded 1,546 bat passes (28.6 passes per detector night) (Stantec 2016b). Bat activity levels were highest on nights with relatively warm temperatures and low wind speeds. Only two bat passes were recorded on nights with mean wind speed >4.5 meters per second (10.1 miles per hour), and only four bat passes were recorded on nights with mean temperatures less than 18°C (64°F).

Bat detectors deployed at the Block Island Wind Farm from August 2017 to January 2018 recorded 1,111 bat passes. At Turbine 1, the monthly detection rate was highest in August (9.3

passes per detector night), decreasing each month with no bat passes recorded from November through January. At Turbine 3, the monthly detection rate was highest in September (13.8 passes per detector night, again decreasing each month with no bat passes recorded from November through January. September 16 had the highest number of recorded bat passes at both Turbine 1 (81 bat passes) and Turbine 3 (273 bat passes).

Dowling et al. (2017) tracked northern long-eared bats on Martha's Vineyard and found no offshore movements among the tagged individuals in summer (four bats) or fall (one bat). Conversely, this study detected tagged little brown bats and eastern red bats making offshore movements.

A preliminary data analysis of the R/V Fugro Enterprise survey found bat detectors recorded 911 bat calls for a rate of 7.3 passes per detector-night. The highest monthly detection rate was recorded in August (17.2 passes per detector-night) and only a few bat passes were recorded in July. The night with the highest number of recorded bat passes was August 16 (n = 190) (Stantec, in draft).

3.2.2 Species Composition

Historic observations of bats offshore have been predominately of the migratory tree-roosting species. However, focused surveys documented offshore detections of species considered to be non-migratory and subject to population declines due to white-nose syndrome (Ahlén, 2006; Ahlén et al., 2007; Ahlén, et al. 2009; Stantec, 2016a).

In their coastal and offshore acoustic study (Stantec (2016a) found silver-haired and hoary bats, although detected at low levels across sites, occurred at high percentages of sites and were consistently less affected by distance from shore than other species. Eastern red bat was the most widespread observed species, occurring at 97% of all locations monitored and accounting for 40% of all identified bat passes, but also showed pronounced declines in activity with increasing distance from shore (Stantec 2016a). *Myotis* species, although abundant at certain coastal sites and present at even the most remote sites, were detected infrequently at remote offshore sites. In the Gulf of Maine, *Myotis* species made up a large portion of identified bat passes at coastal and medium island sites. Few *Myotis* passes were detected at structures, ships, small islands, and large islands. Hoary bats and silver-haired bats were detected in small numbers but were the most frequently detected species at offshore structures (95% and 89%, respectively; Stantec, 2016a).

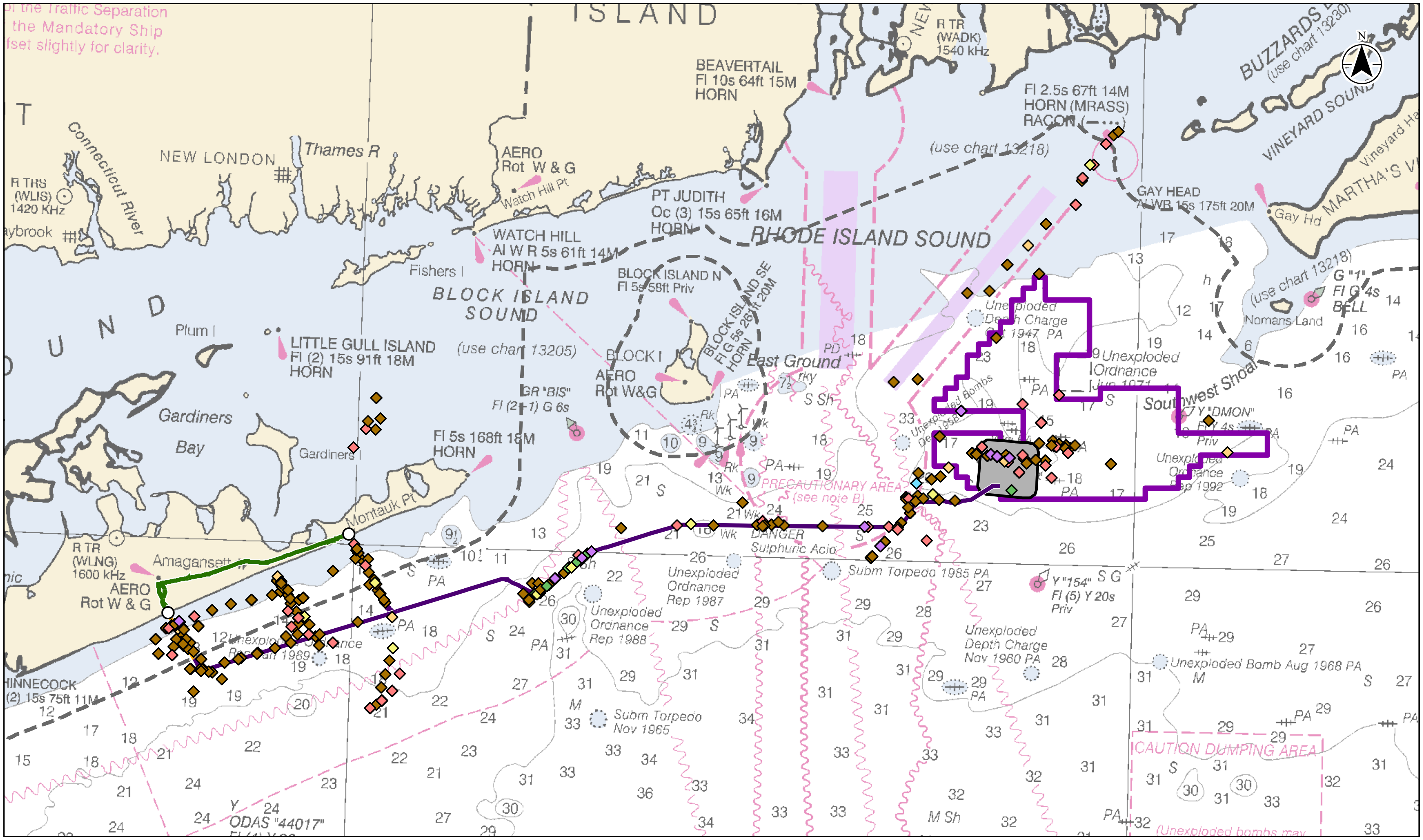
Based on results of acoustic monitoring on Block Island for the RI Ocean SAMP survey, Smith and McWilliams (2012) reported use by long-distance migratory tree roosting bats, including silver-haired bat, hoary bat, and eastern red bat. Non-migratory bats included big brown bat and tri-colored bat (*Perimyotis subflavus*). Detectors also recorded a number of potential *Myotis* species, but exact species identification was uncertain. Of classified calls at all six sites, most were of eastern red bats and silver-haired bats, while *Myotis* were relatively rare.

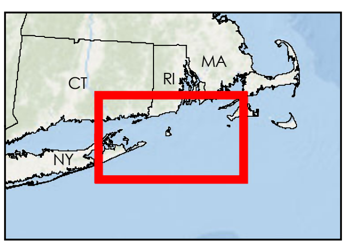
Pre-construction onshore monitoring for the Block Island Wind Farm positively identified silver-haired bat, eastern red bat, hoary bat, and Myotis species (Tetra Tech and DeTect, 2012). Offshore, vessel-based acoustic monitoring during construction of the Block Island Wind Farm recorded 1,546 bat passes (Stantec, 2016b). Of these passes, 1,307 (85%) were assigned to a species, 9 (<1%) were assigned to a species group, and 230 (15%) were categorized as high frequency or low frequency unknown. Of the 1,307 passes identified to species, eastern red bats accounted for 90% (n = 1,180), hoary bats accounted for 9% (n = 112), and silver-haired bats accounted for 1% (n = 14). One pass was labeled as a big brown bat, and no passes were identified as *Myotis* species (Stantec, 2016b). Species composition was similar among the four detectors.

Of the 1,111 bat passes recorded at the Block Island Wind Farm from August through October 2017, 1,086 (98%) were assigned to a species using Kaleidoscope Pro software (version 3.1.7; Wildlife Acoustics). Species composition was similar between detectors. Of the 1,086 passes identified to species, eastern red bats accounted for 52.8% (n = 573), silver-haired bats accounted for 29.1% (n = 316), and hoary bats accounted for 11.9% (n = 129). Big brown bats and tri-colored bats each accounted for 3% (n = 33), respectively. Two passes were labeled as little brown bat, and no passes were identified as small-footed bat or northern long-eared bat.

During the R/V Fugro Enterprise survey of the SFWF and SFEC, acoustic detectors recorded 911 bat passes. Kaleidoscope Pro software (version 3.1.7; Wildlife Acoustics) assigned 896 (98%) of bat passes to a species and classified 15 (2%) bat passes as a bat of unknown species (NoID) (Stantec, in draft). Of the 896 passes identified to species, eastern red bats accounted for 69.2% (n = 620) and silver-haired bats accounted for 12.9% (n = 116). Other identified species represented less than 5% of bat passes. Figure 3 displays the survey results of bat call types and distribution. Bat call identifications are defined as the following: RBTB = eastern red bat / tri-colored bat; BBSH = big brown bat / silver-haired bat; HB = hoary bat; MYLU = little brown bat; MYSE = northern long-eared bat; MYLE = small-footed bat; NoID = unknown species.

In a telemetry survey on Martha's Vineyard, Dowling et al. (2017) detected little brown bats and eastern red bats making offshore movements, but not northern long-eared bats. These telemetry data suggest that the tagged northern long-eared bats did not forage offshore in summer (four adult females) or depart in fall (one adult female). The study involved a small sample size, but it is possible that northern long-eared bats overwinter on Martha's Vineyard.





Legend

- SFWF
- SFEC - OCS
- SFEC - NYS
- SFEC - Onshore
- Landing Site
- Lease Area OCS-A 0486
- Submerged Lands Act Boundary

Bat Call Detection Location

- RBTB (651)
- BBSH (160)
- HB (19)
- MYLU (31)
- MYSE (34)
- MYLE (1)
- NoID (15)

0 10 Miles

1:633,600 (At original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 19N
2. Base map: West Quoddy Head to New York NOAA Nautical Chart.

Stantec

Project Location
Offshore Rhode Island

195601308
Prepared by GC on 2018-02-14
Technical Review by LB on 2018-02-15
Independent Review by SP on 2018-02-15

Client/Project
CH2M HILL, Inc.
Deepwater South Fork COP Support

Figure No.
3

Title
Species composition and distribution, R/V Fugro Enterprise bat acoustic survey, 2017

3.3 BAT ECOLOGY AND DISTRIBUTION IN THE STUDY AREA

Stantec (2016a) found relative bat activity (mean number of bat passes per night) on coastal and offshore sites to be comparable to terrestrial sites. Prior statistical analyses also failed to detect significant differences in bat activity levels at island versus mainland sites (Pelletier et al., 2013). Bats are regularly detected at remote islands and offshore structures, but primarily on a seasonal basis, with declining activity as the distance from shore increases. This suggests bats could occur anywhere in the Study Area, particularly during the fall migratory period. Table 6 provides a summary of probable occurrence of bat species in the Study Area.

Table 6. Timing, distribution, and relative frequency of occurrence of bat species and species groups in the SFWF Study Area.

Species/Species Group	Occurrence	Peak Occurrence	Relative Frequency of Occurrence		
			Onshore	Nearshore	Offshore
Red bat	May to October	August	Seasonally common	Uncommon	Infrequent
Hoary bat	July to October	August	Seasonally common	Uncommon	Infrequent
Silver-haired bat	May, July, August	August	Seasonally common	Uncommon	Infrequent
Myotis and other non-migratory bats	May to October	August	Abundant	Uncommon	Rare

Source: Stantec (2016a)

A preliminary data analysis (Stantec, in draft) of the R/V Fugro Enterprise acoustic survey documented bat detections in the SFWF, SFEC – OCS, and SFEC – NYS (Figure 3). During the survey, bat detectors recorded 911 bat calls (7.3 passes per detector-night). The highest monthly detection rate occurred in August (17.2 passes per detector-night) and only a few bat passes were recorded in July. The night with the highest number of recorded bat passes was August 16 (n = 190) (Stantec, in draft). Detectors documented offshore bat activity during roughly 1/3 of surveyed nights and at distances beyond 38 km (24 miles) from the nearest land. Bats were detected largely in all places the vessel traveled.

3.3.1 South Fork Wind Farm

Based on the results of the vessel-based acoustic survey, bats could potentially occur in the SFWF during migration. They are most likely to be migratory species, but non-migratory species also have the potential to occur (Figure 3). The R/V Fugro Enterprise traveled within the proposed SFWF where detectors recorded bat passes August-November, with most calls recorded in September. Species identified within the mapped SFWF included silver-haired bat, hoary bat, eastern red bat, tri-colored bat, and little brown bat. One call was identified as a northern long-eared bat approximately 0.4 miles from the southeastern edge of the SFWF.

3.3.2 SFEC – OCS

Both migratory and non-migratory bats could potentially occur anywhere along the proposed SFEC – OCS, mainly during late-summer and fall migration, but also potentially during summer and spring migration (Pelletier et al., 2013, Stantec, 2016a; Stantec, in draft). Field surveys on Block Island documented resident populations of bats and indicated the island may act as a migration stopover point for migratory tree roosting species (Tetra Tech and DeTect, 2012; Stantec, 2016b; BIWF, unpublished data). The surveys demonstrated that Block Island, and to a lesser extent nearshore waters immediately surrounding the island, provide habitat for at least five species of bat including big brown bat, little brown bat, eastern red bat, silver-haired bat, and hoary bat. Passive and active acoustic monitoring data showed detections were predominately limited to the island and nearshore waters with a low rate of detection offshore. Bats are more likely to occur where the proposed SFEC – OCS route approaches the south shore of Long Island (Figure 3).

Based on the results of the vessel-based acoustic survey, bats could potentially occur anywhere along the SFEC – OCS, particularly during migration (Figure 3). They are most likely to be migratory species, but non-migratory species may also occur. The R/V Fugro Enterprise traveled the length of the proposed SFEC – OCS where detectors recorded bat passes August-November, with most calls recorded in August. Species identified included silver-haired bat, hoary bat, eastern red bat, tri-colored bat, big brown bat, small-footed bat, little brown bat, and northern long-eared bat.

3.3.3 SFEC – NYS

Anecdotal and survey-focused evidence includes bat detections on the coast of Long Island in fall (Merriam, 1887). Mist-netting surveys and acoustic monitoring documented all eight species that could potentially occur in Long Island (Cane, 2011; Fishman, 2013). The NYSDEC has been monitoring and tracking northern long-eared bats on Long Island in recent years. These efforts have documented positive identification of a northern long-eared bat within 2.4 km (1.5 miles) of the proposed Hither Hills SFEC – Onshore Cable Route to the SFEC – Onshore Substation. Conversely, NYSDEC monitoring has not made positive identification for northern long-eared bats within 2.4 km of the Beach Lane Landing Site (K. Jennings and K. Gaidasz, NYSDEC, personal communication).

Based on the results of the vessel-based acoustic survey, bats could potentially occur along the SFEC – NYS at either of the two land site options, particularly during migration (Figure 3). The R/V Fugro Enterprise traveled the length of both proposed SFEC – NYS options where detectors recorded bat passes August-November, with most calls recorded in August. Species identified included silver-haired bat, hoary bat, eastern red bat, tri-colored bat, big brown bat, and little brown bat.

3.3.4 Bat Ecology Offshore Summary

In summary, the northern long-eared bat is the only bat species with potential to occur in the SFWF study area that is afforded protection under the federal ESA and New York's Fish and Wildlife Law. Northern long-eared bats have a high potential to occur in the areas of the SFEC – NYS, SFEC – Onshore, and SFEC – Onshore Substation. Their potential to occur in the areas of the SFWF and SFEC – OCS is low and likely to happen during the month of August.

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APPENDICES

APPENDIX A AVIAN DISTRIBUTION MAPS

Figure A. Common Loon Relative Abundance

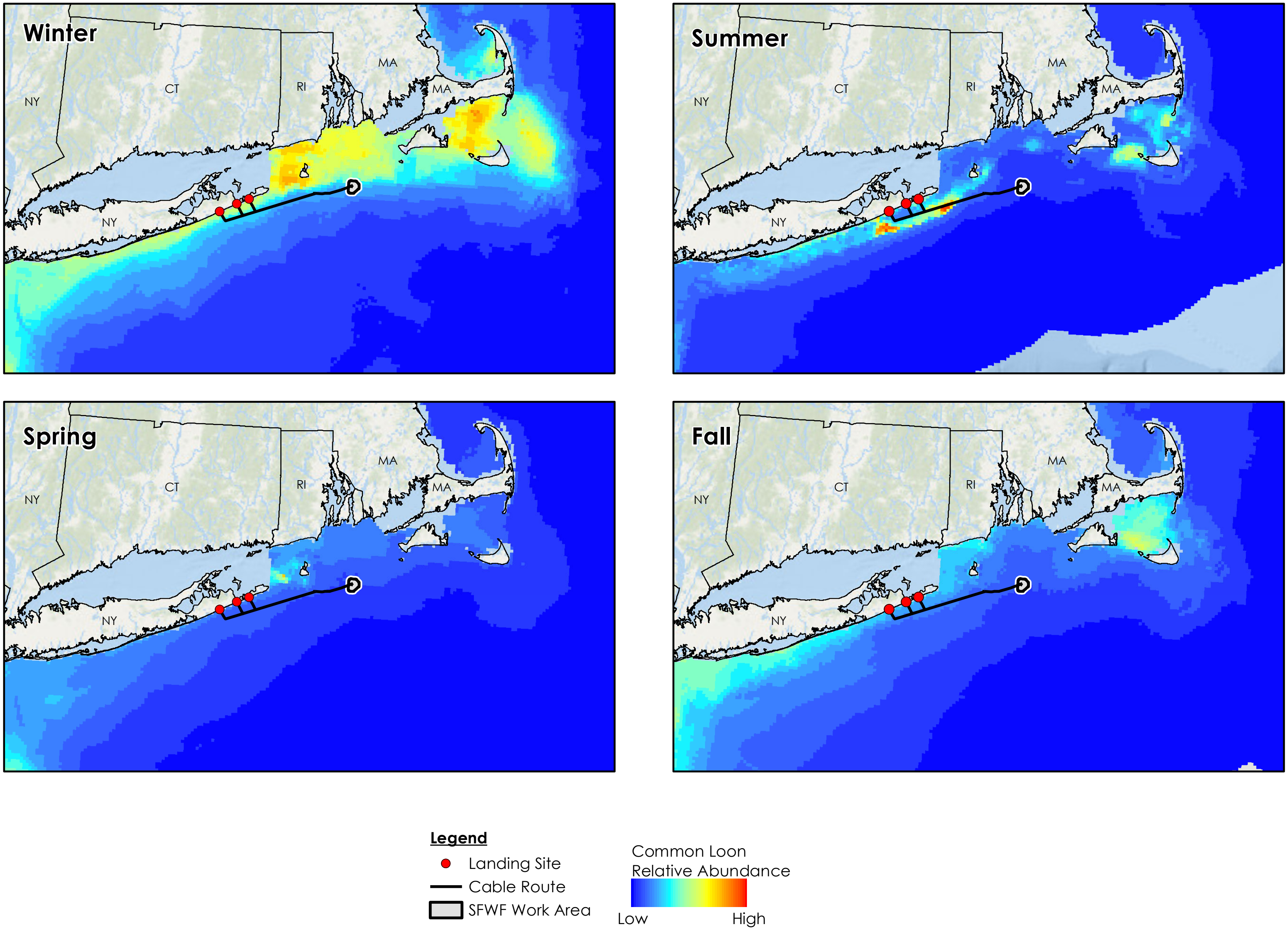


Figure B. Great Shearwater Relative Abundance

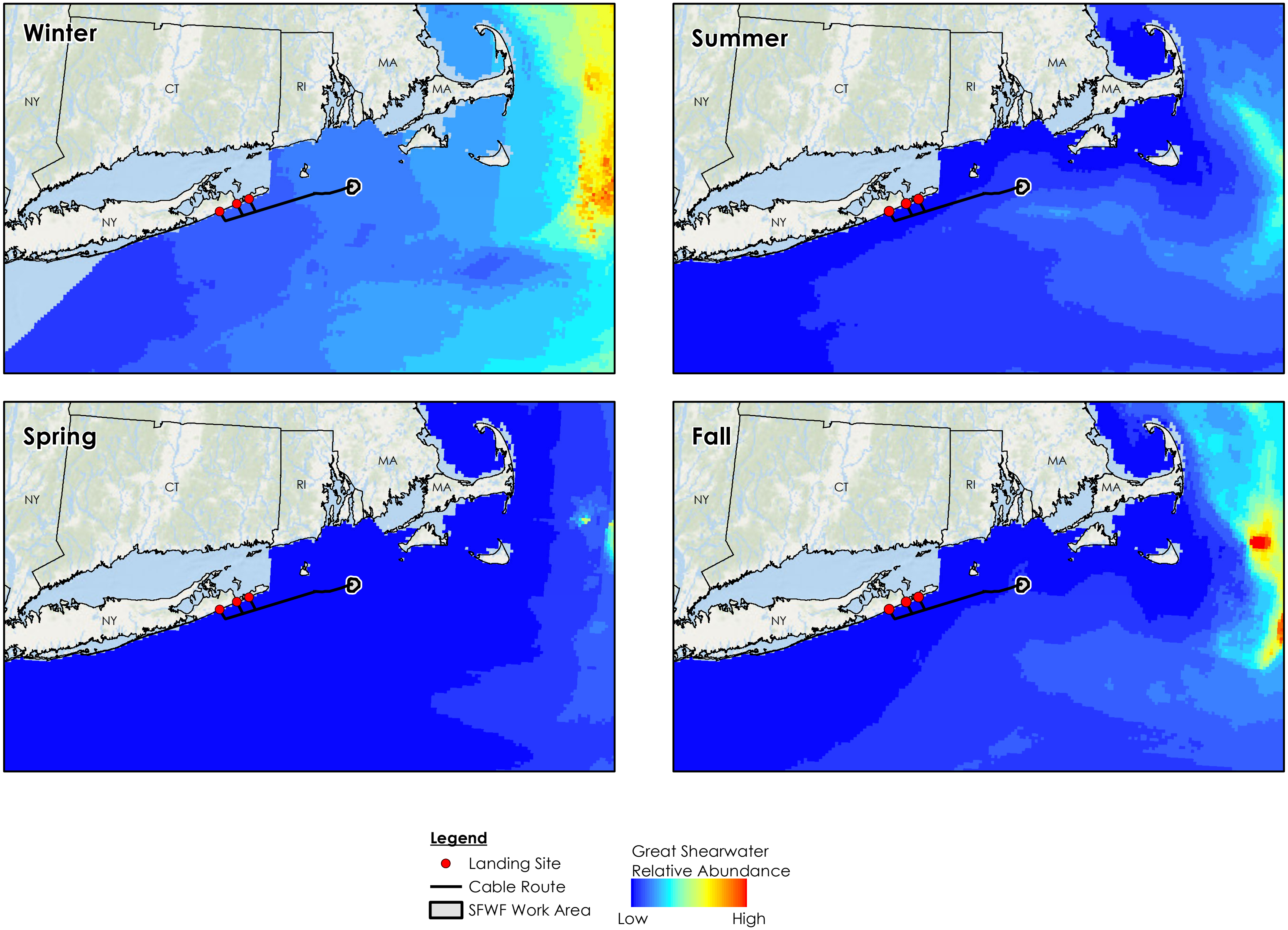


Figure C. Cory's Shearwater Relative Abundance

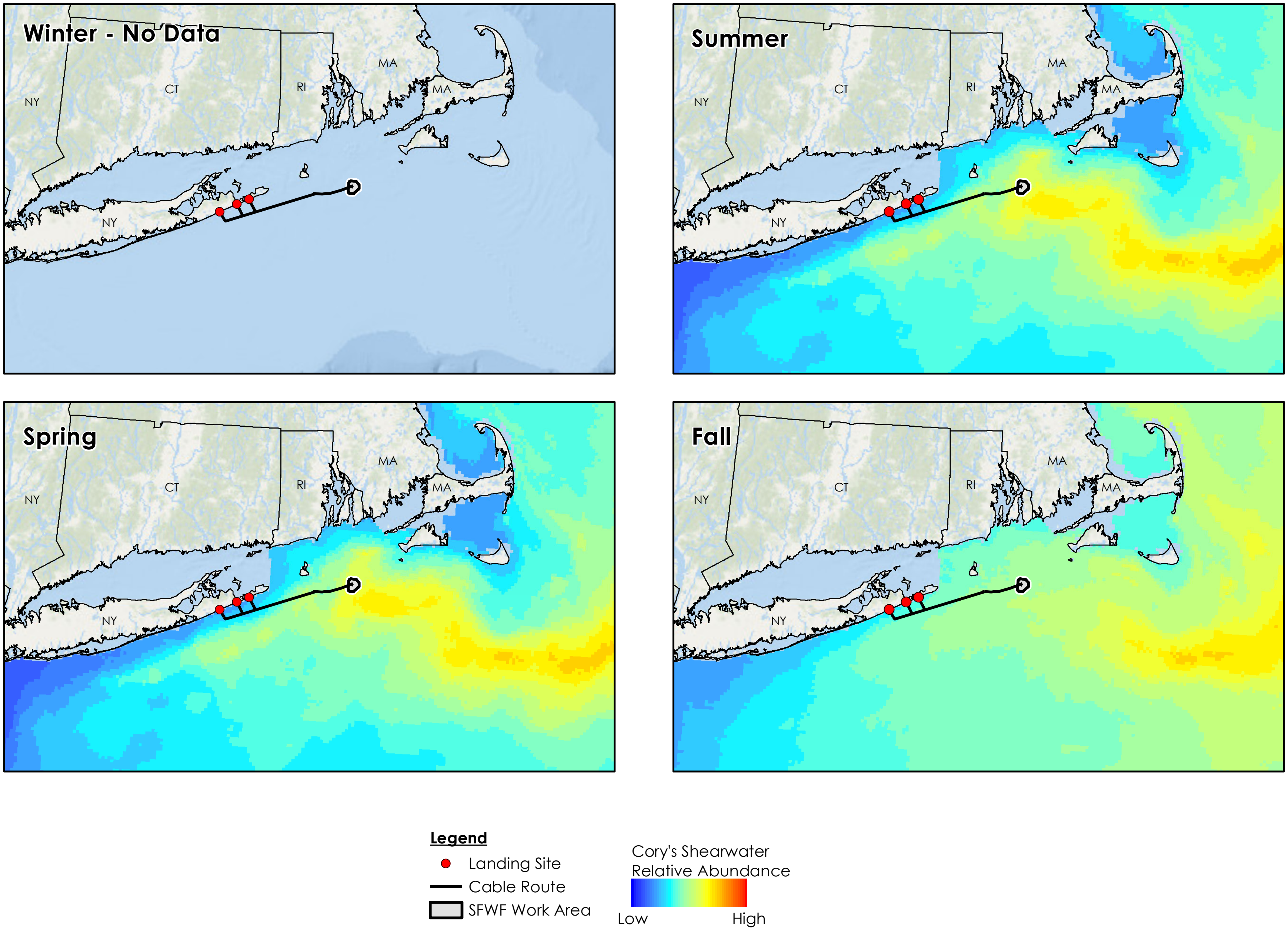


Figure D. Northern Gannet Relative Abundance

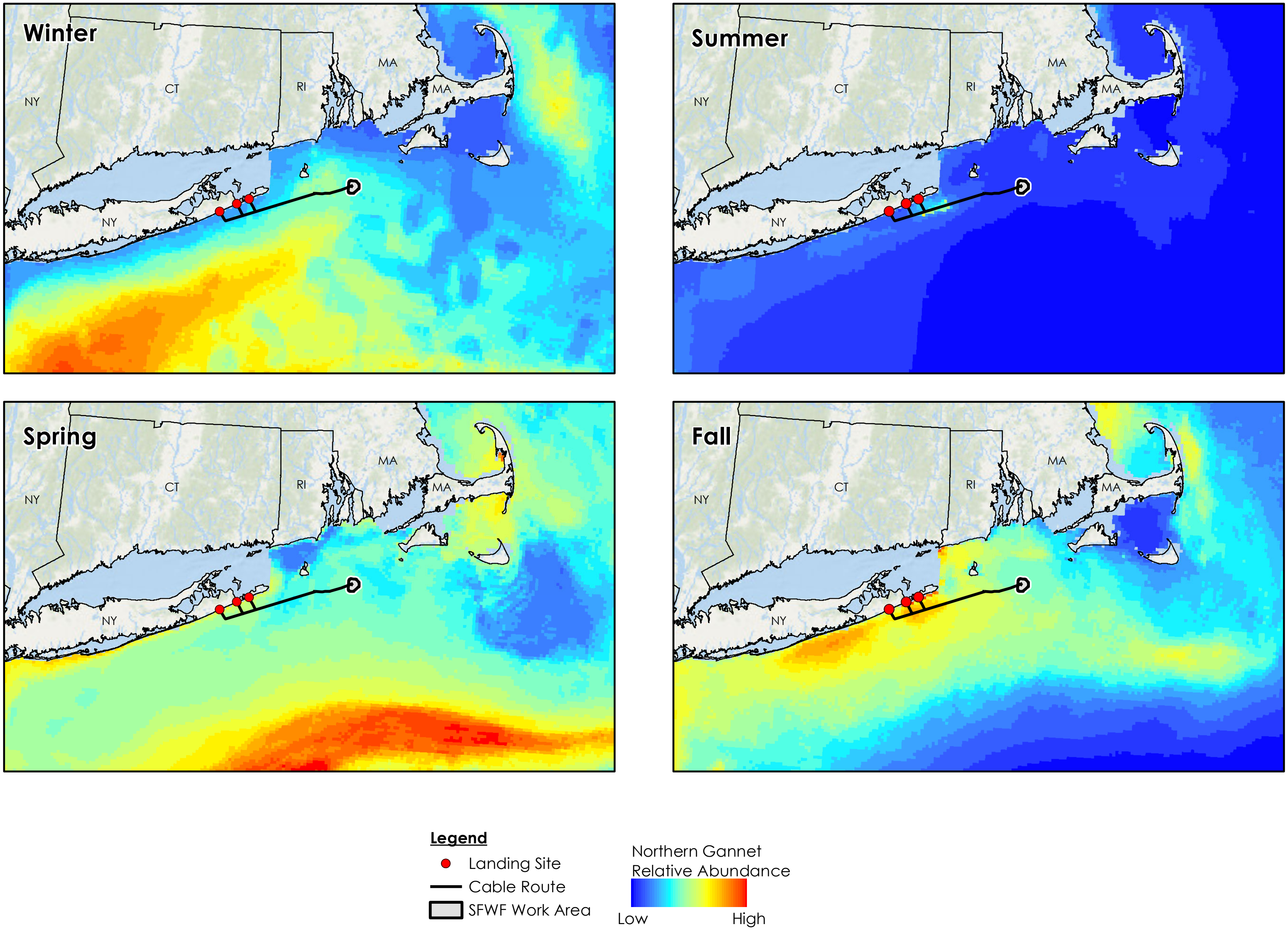


Figure E. Common Eider Relative Abundance

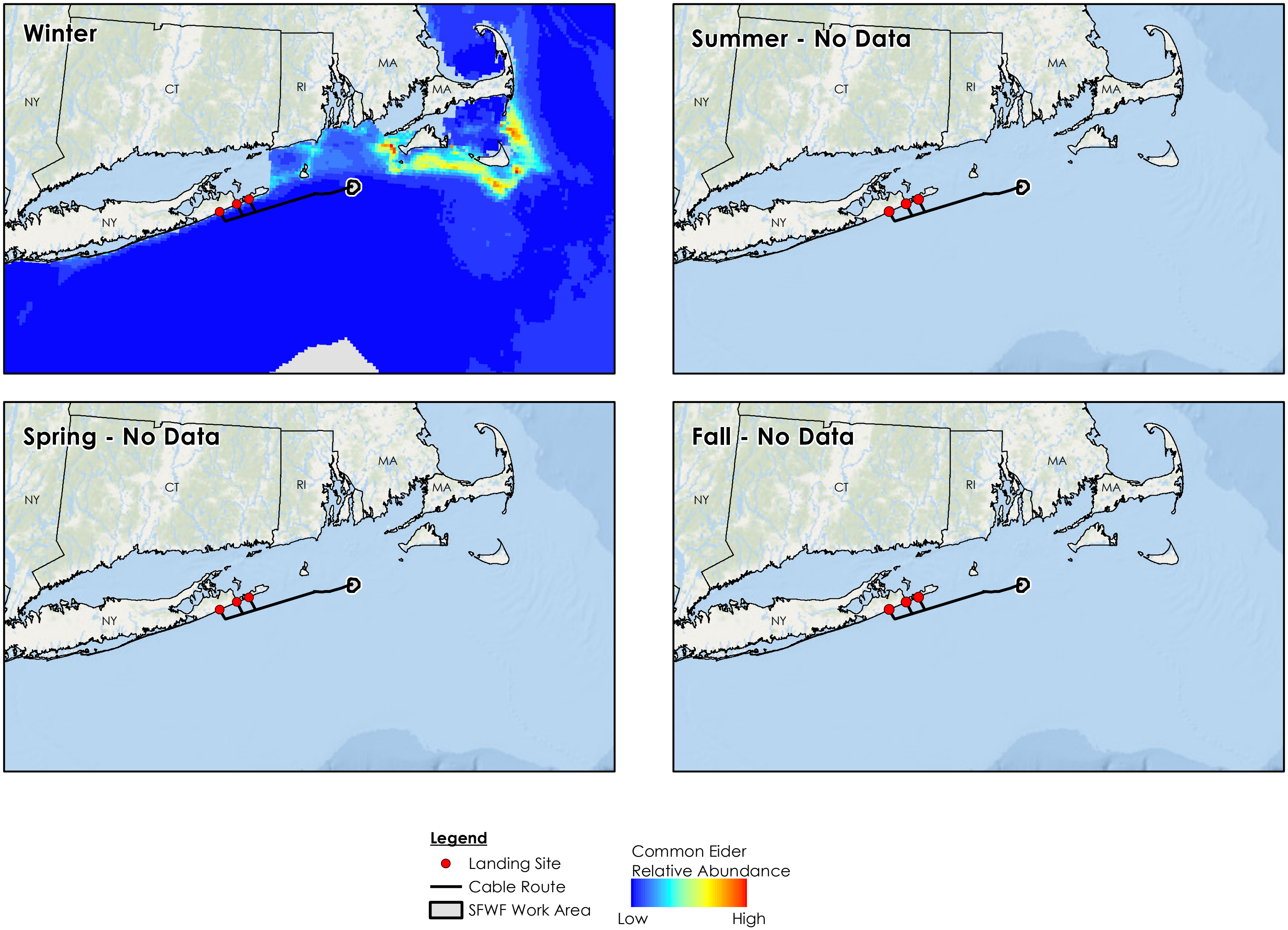


Figure F. Black Scoter Relative Abundance

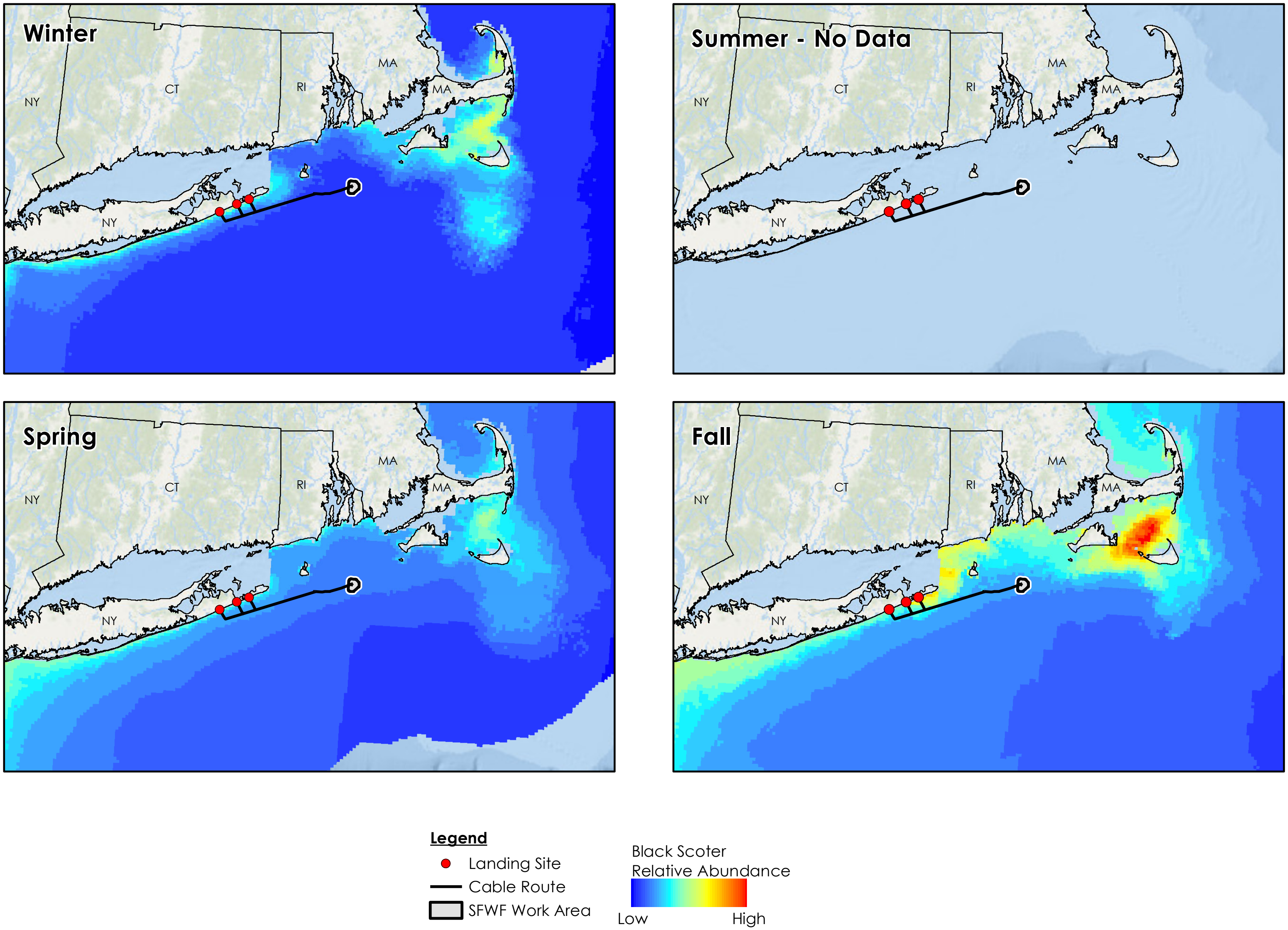


Figure G. White-winged Scoter Relative Abundance

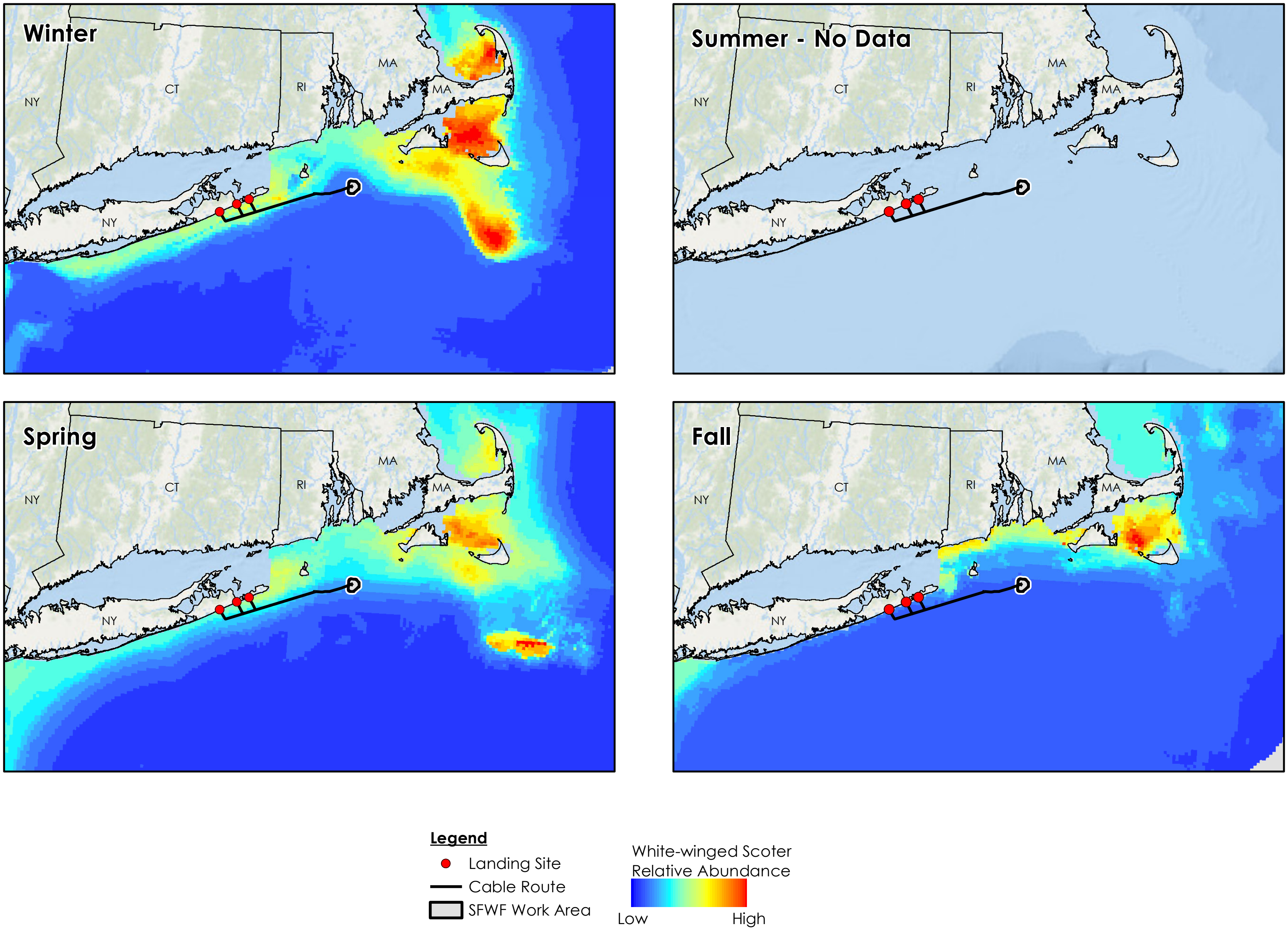


Figure H. Surf Scoter Relative Abundance

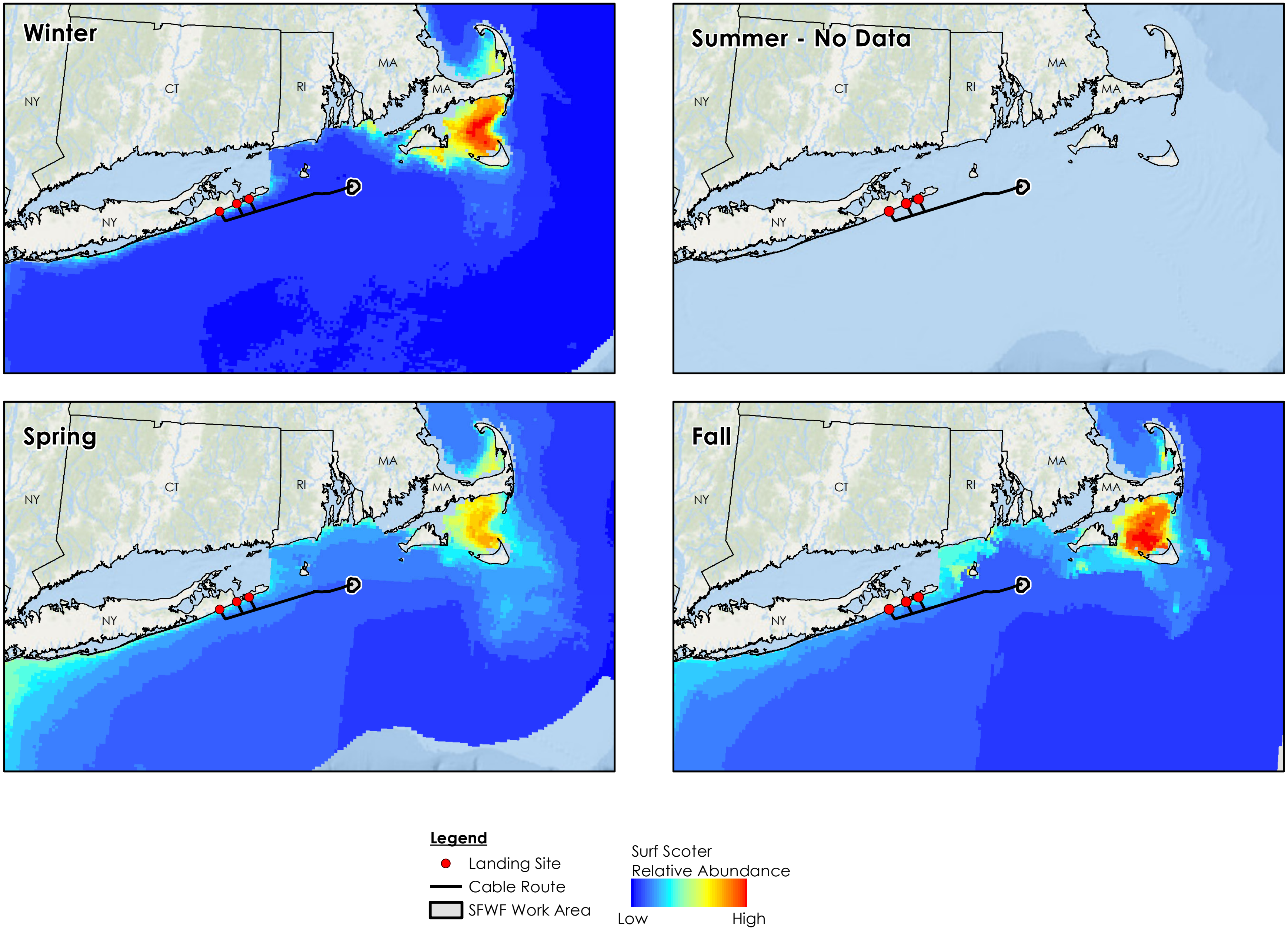


Figure I. Long-tailed Duck Relative Abundance

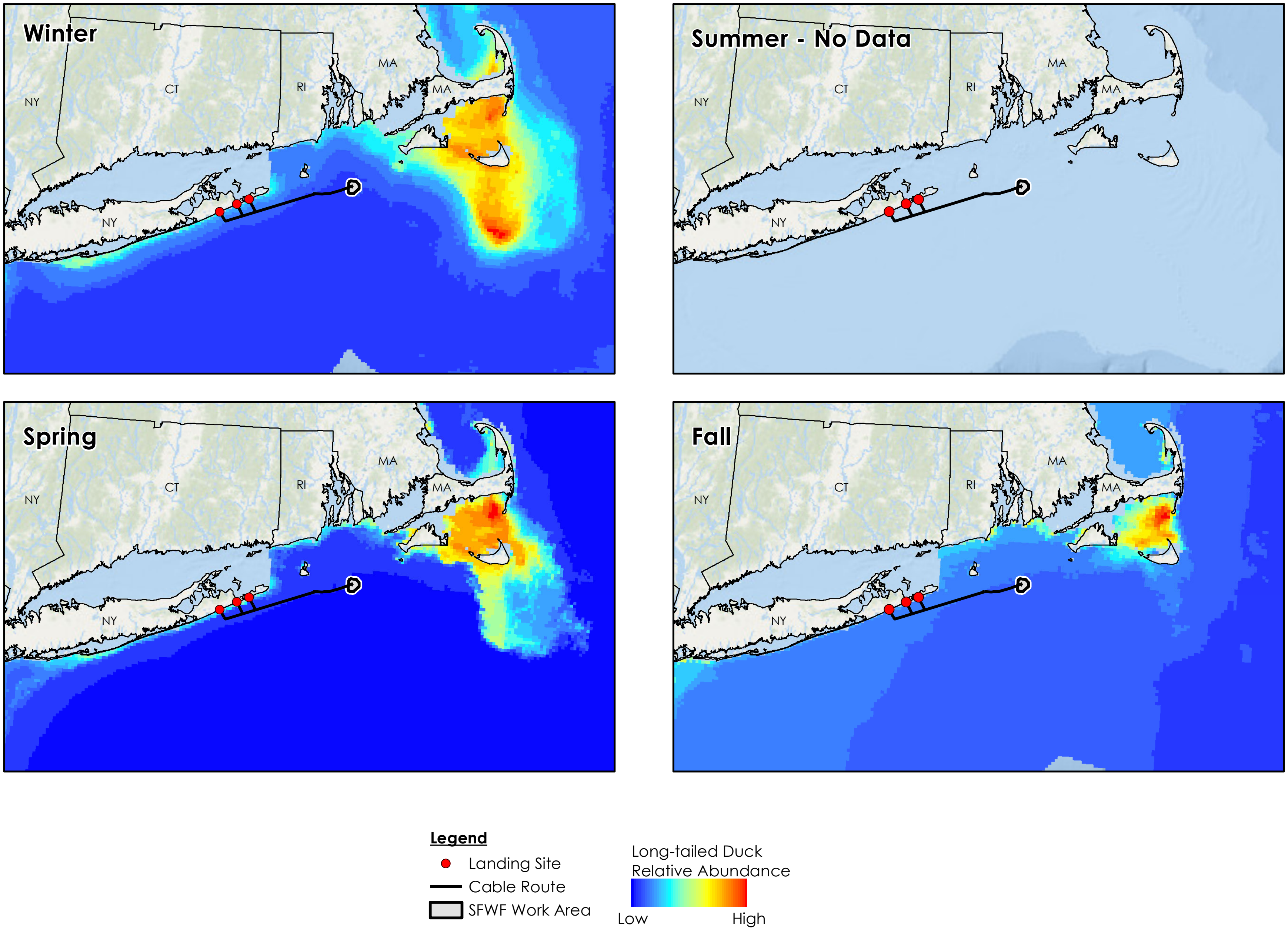


Figure J. Red-necked Phalarope Relative Abundance

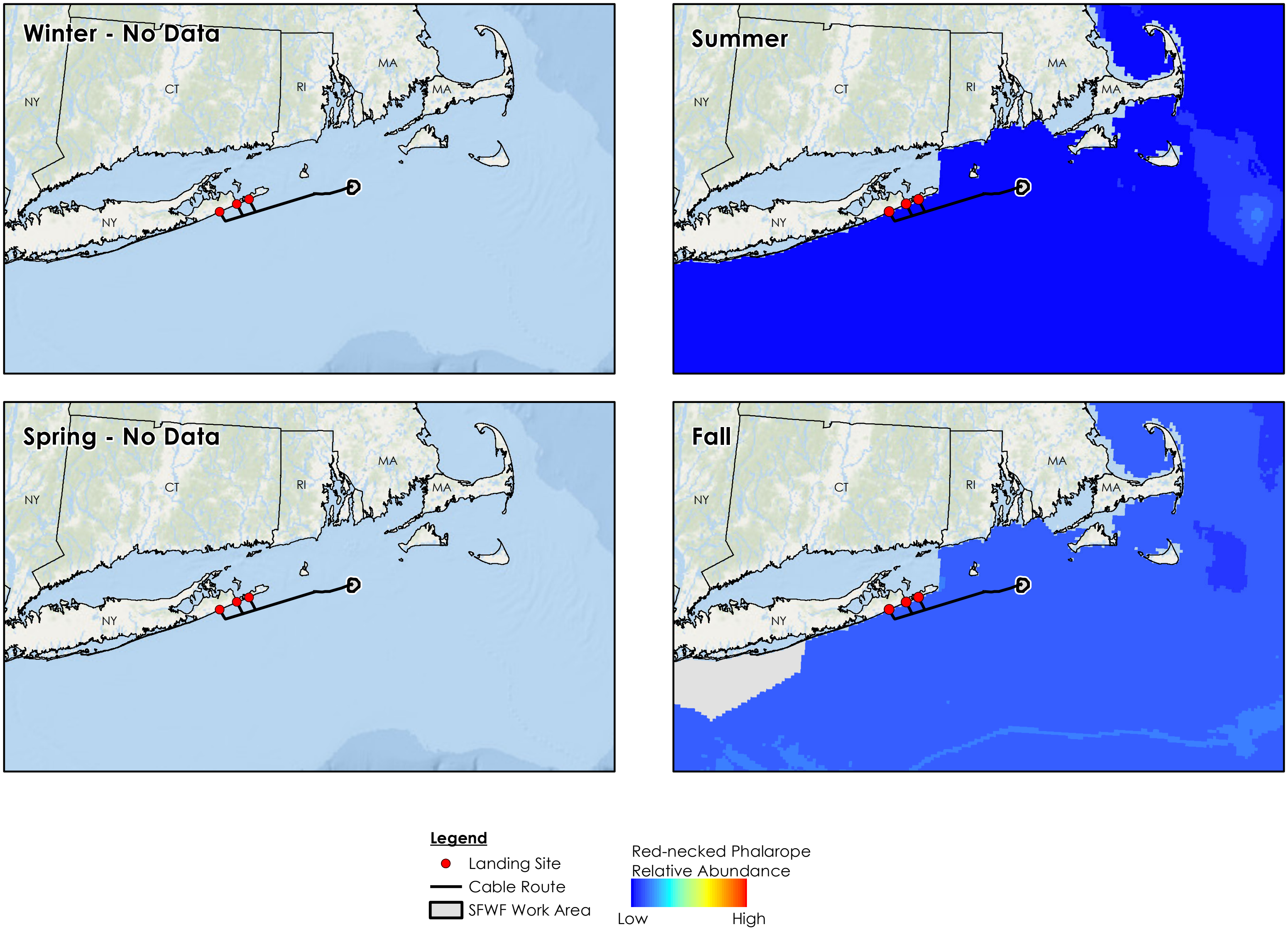


Figure K. Herring Gull Relative Abundance

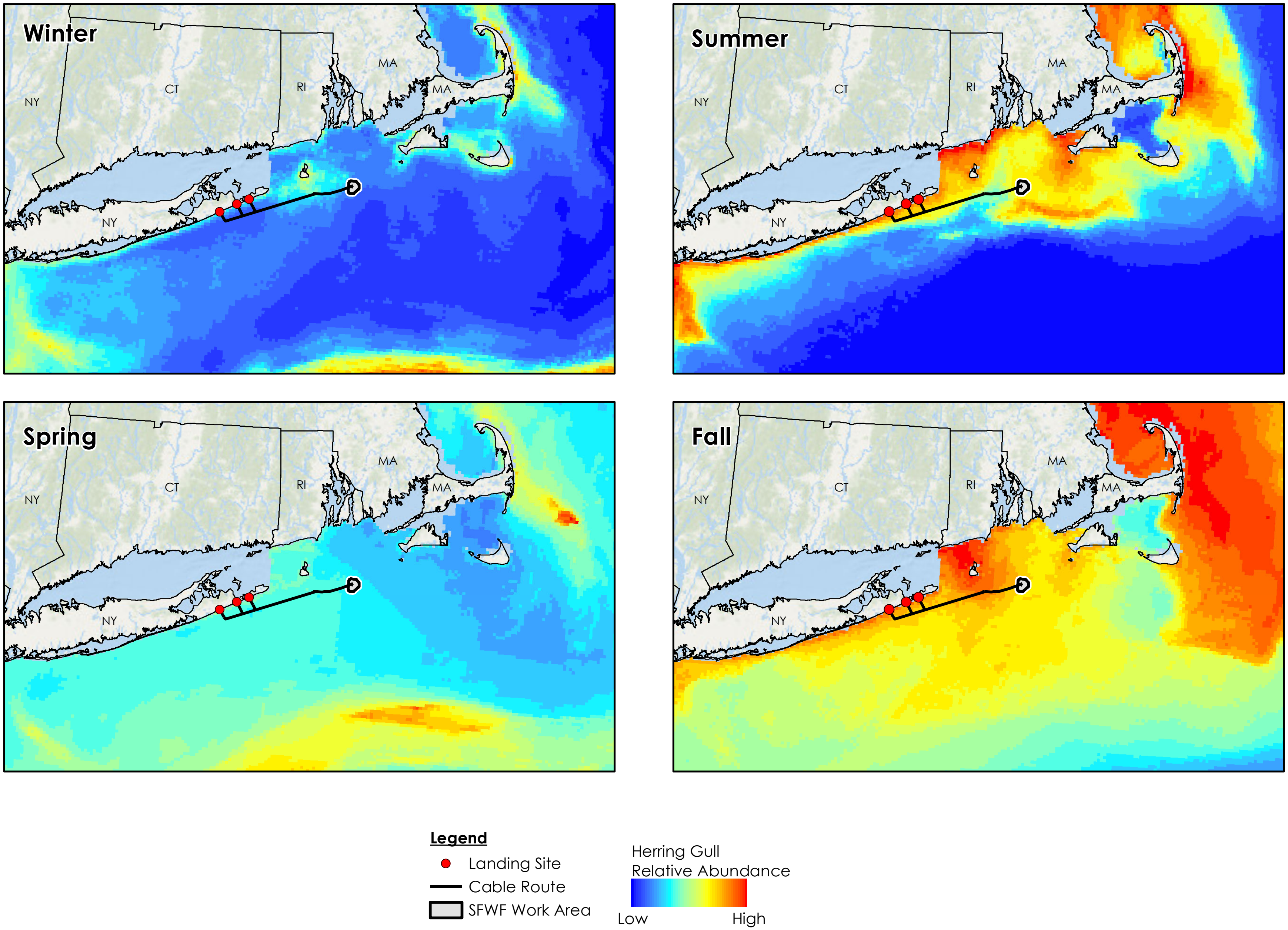


Figure L. Black-legged Kittiwake Relative Abundance

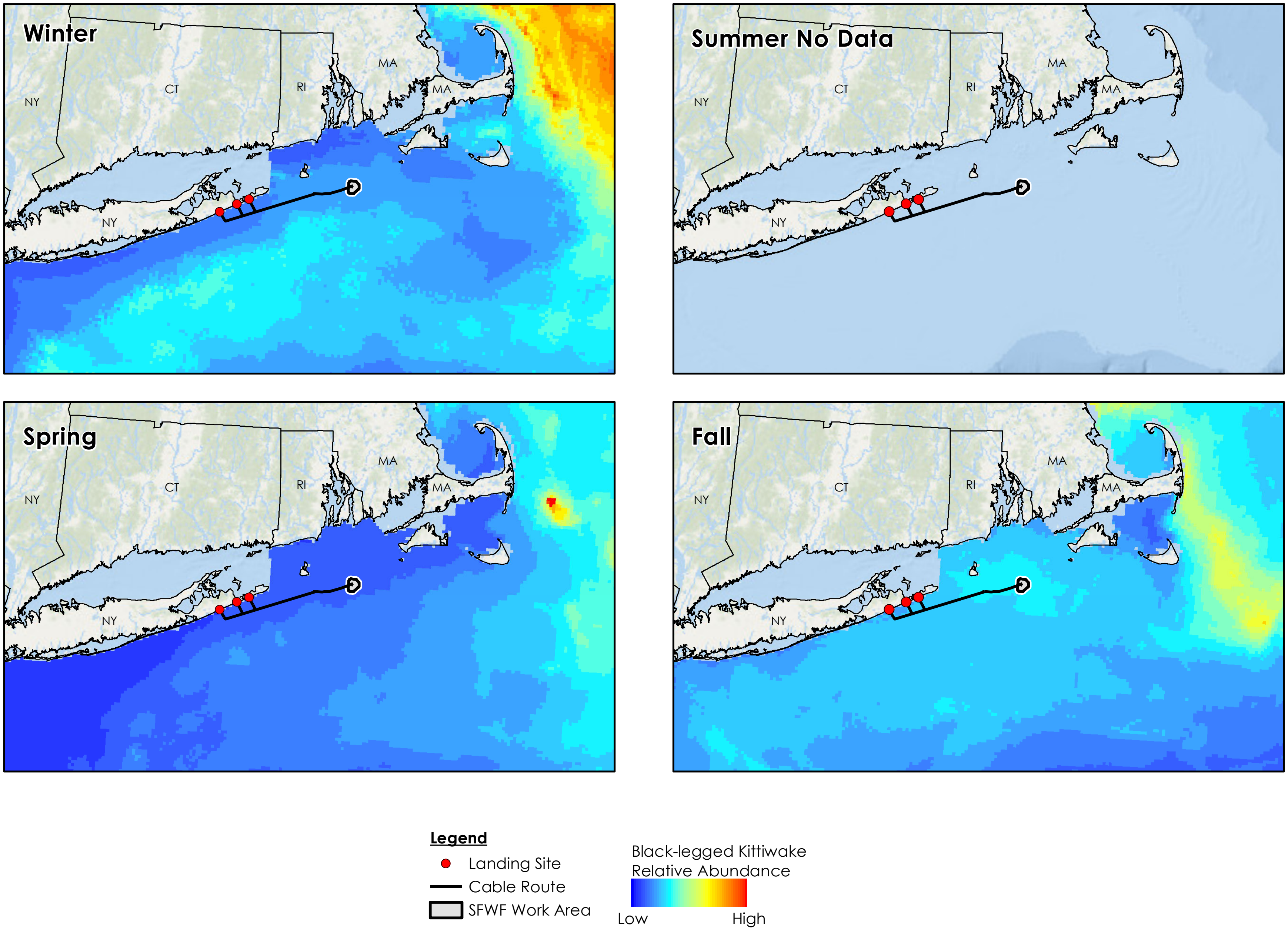


Figure M. Common Tern Relative Abundance

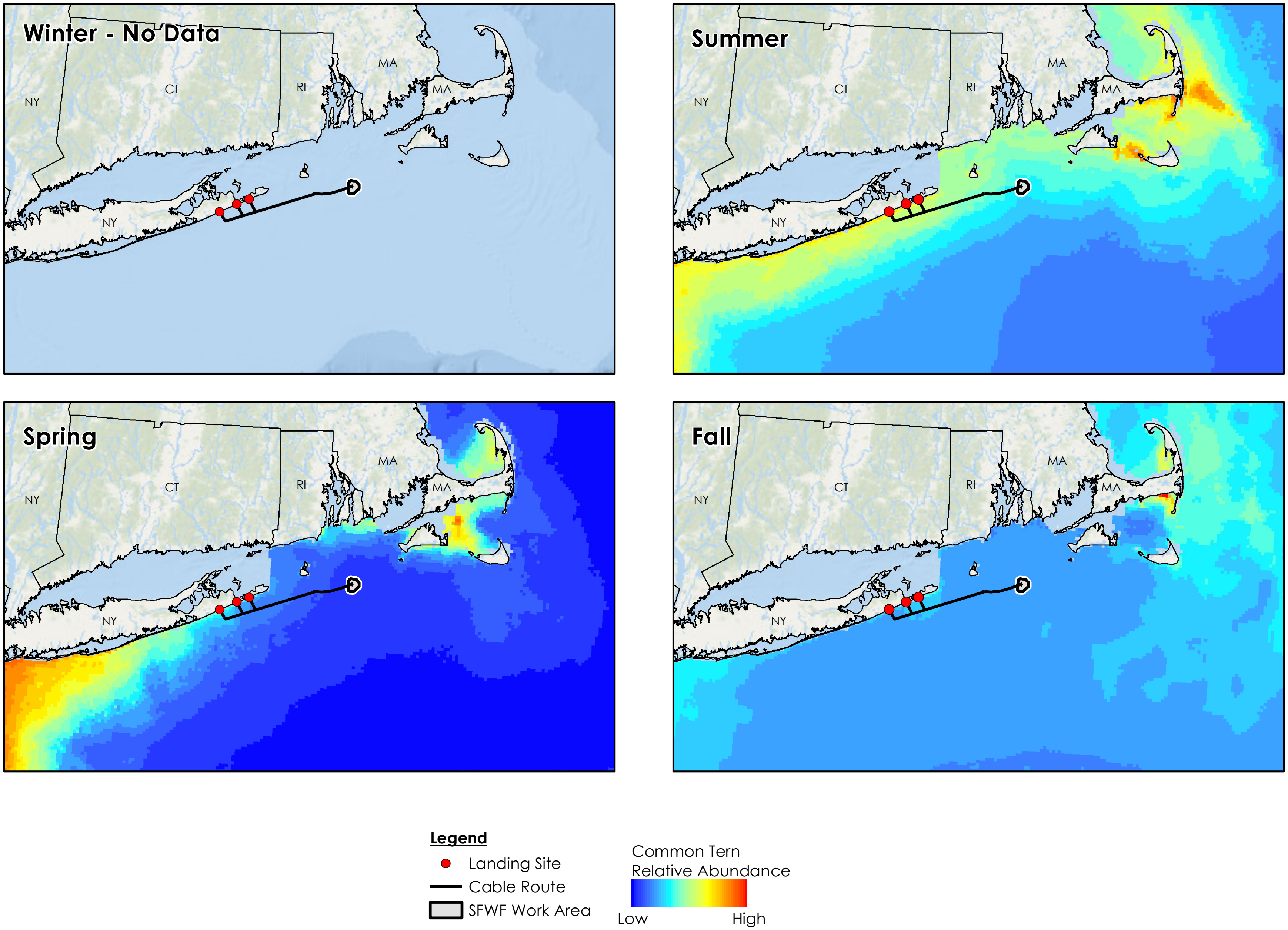


Figure N. Roseate Tern Relative Abundance

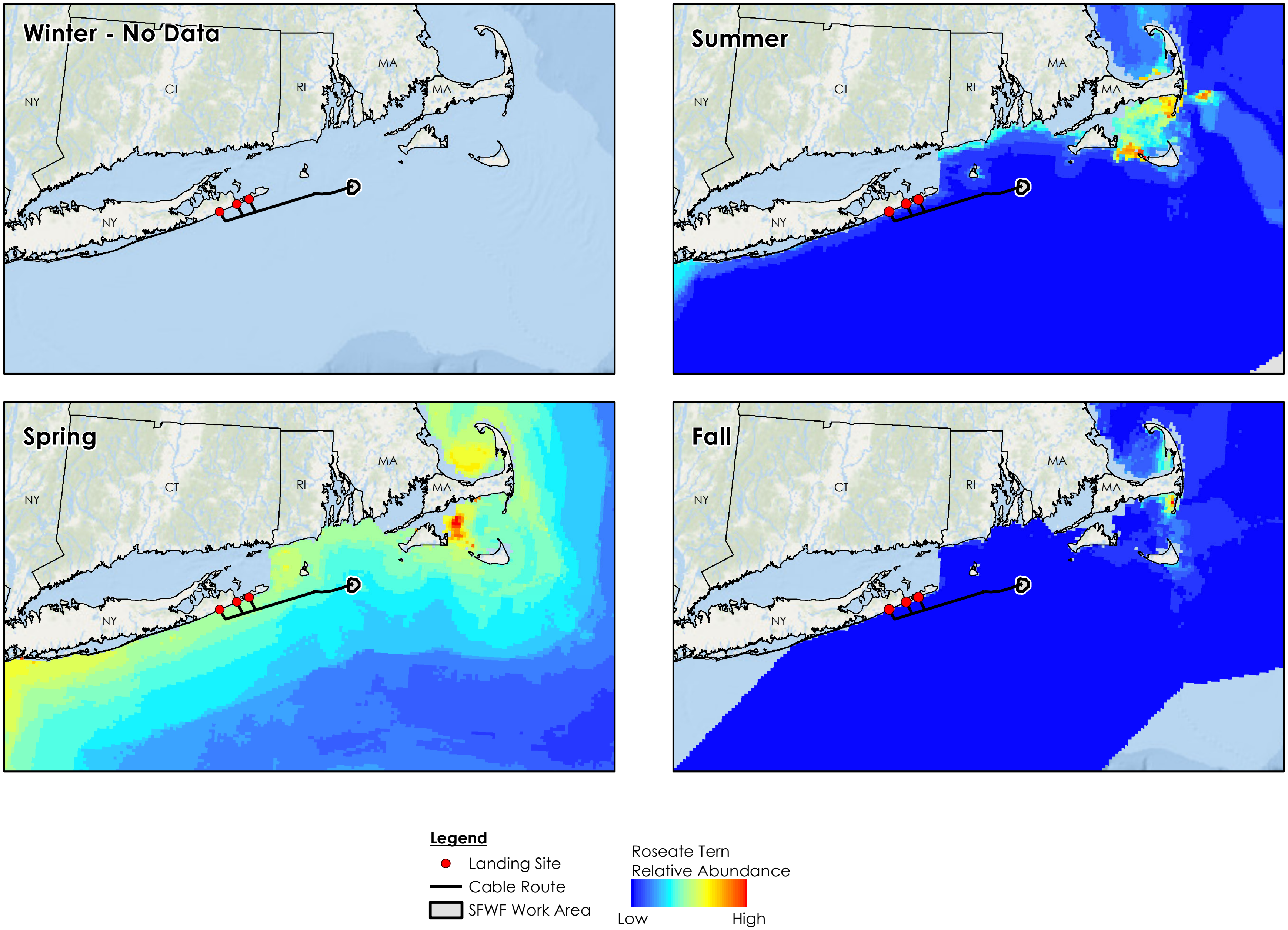


Figure O. Razorbill Relative Abundance

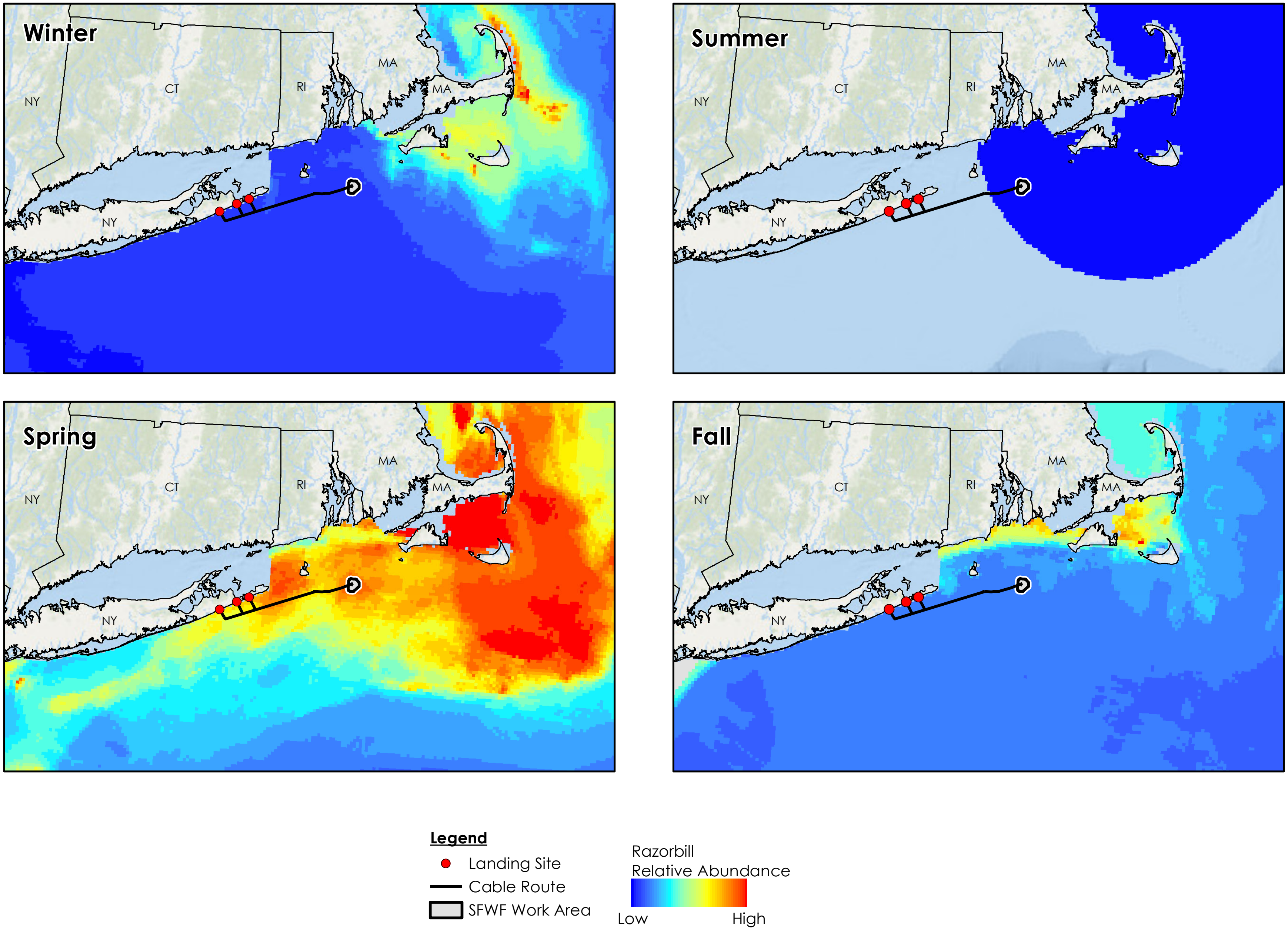
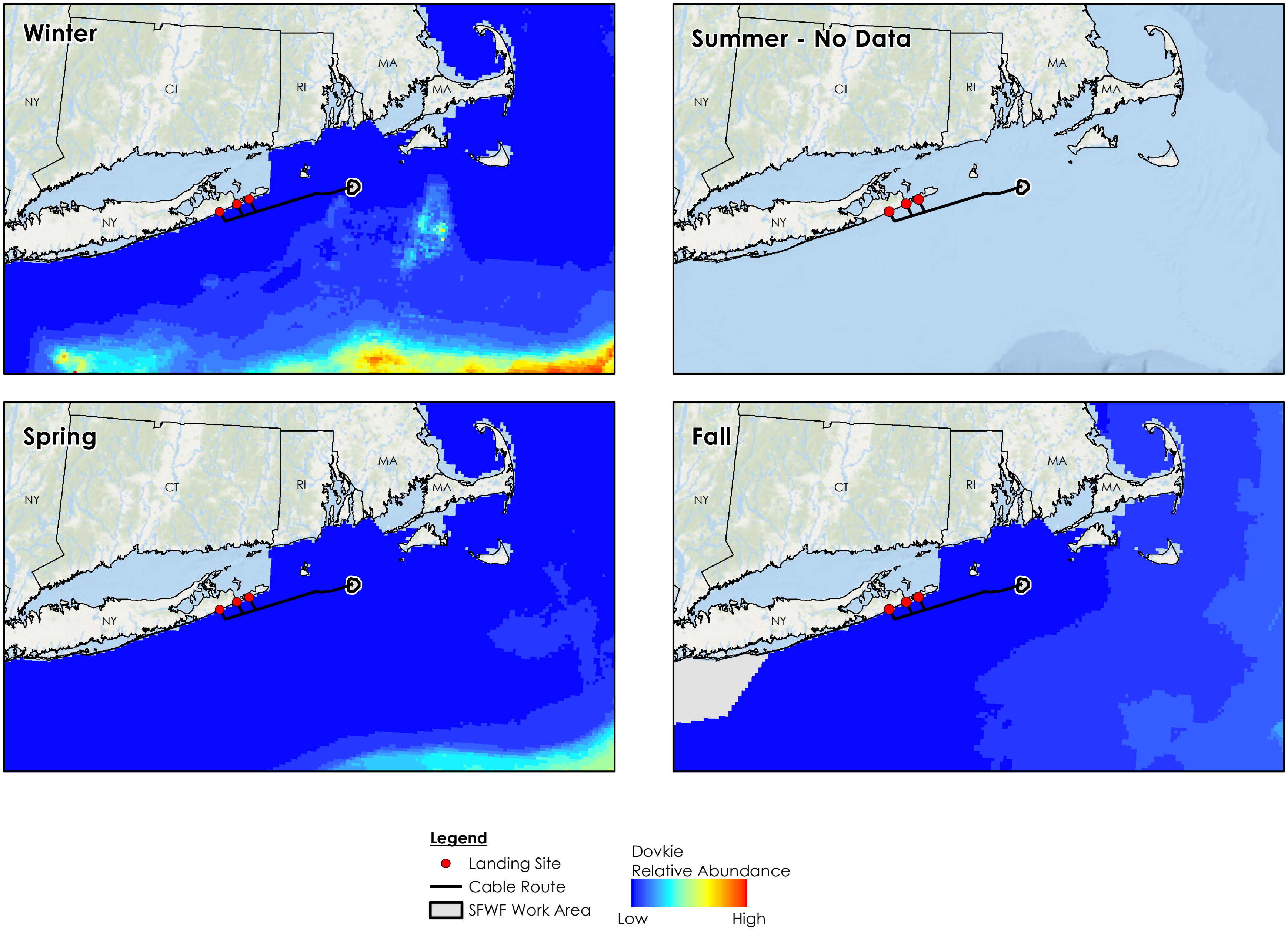


Figure P. Dovkie Relative Abundance



APPENDIX B AGENCY CONSULTATION LETTERS

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Fish and Wildlife, New York Natural Heritage Program
625 Broadway, Fifth Floor, Albany, NY 12233-4757
P: (518) 402-8935 | F: (518) 402-8925
www.dec.ny.gov

May 11, 2017

David Kennedy
VHB
100 Motor Parkway, Suite 135
Hauppauge, NY 11788

Re: Proposed ~11-mile underground transmission line for the Deepwater Wind South Fork Wind Farm
County: Suffolk Town/City: East Hampton

Dear Mr. Kennedy:

In response to your recent request, we have reviewed the New York Natural Heritage Program database with respect to the above project.

Enclosed is a report of rare or state-listed animals and plants, and significant natural communities that our database indicates occur at the project site, or in its vicinity.

For most sites, comprehensive field surveys have not been conducted; the enclosed report only includes records from our database. We cannot provide a definitive statement as to the presence or absence of all rare or state-listed species or significant natural communities. Depending on the nature of the project and the conditions at the project site, further information from on-site surveys or other sources may be required to fully assess impacts on biological resources.

Our database is continually growing as records are added and updated. If this proposed project is still under development one year from now, we recommend that you contact us again so that we may update this response with the most current information.

The presence of the plants and animals identified in the enclosed report may result in this project requiring additional review or permit conditions. For further guidance, and for information regarding other permits that may be required under state law for regulated areas or activities (e.g., regulated wetlands), please contact the NYS DEC Region 1 Office, Division of Environmental Permits, as listed at www.dec.ny.gov/about/39381.html.

Sincerely,

Nick Conrad

Nicholas Conrad
Information Resources Coordinator
New York Natural Heritage Program

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The following state-listed animals have been documented in the vicinity of the project site.

The following list includes animals that are listed by NYS as Endangered, Threatened, or Special Concern; and/or that are federally listed or are candidates for federal listing.

For information about any permit considerations for the project, contact the Permits staff at the NYSDEC Region 1 Office. For information about potential impacts of the project on these species, and how to avoid, minimize, or mitigate any impacts, contact the Wildlife Manager.

A listing of Regional Offices is at http://www.dec.ny.gov/about/558.html.

The following species have been documented near the project site, within 0.5 mile.

COMMON NAME	*SCIENTIFIC NAME*	*NY STATE LISTING*	*FEDERAL LISTING*	
Birds				
Piping Plover *Breeding*	*Charadrius melodus*	Endangered	Threatened	339
Northern Harrier *Breeding*	*Circus cyaneus*	Threatened		7352

This report only includes records from the NY Natural Heritage database. For most sites, comprehensive field surveys have not been conducted, and we cannot provide a definitive statement as to the presence or absence of all rare or state-listed species. Depending on the nature of the project and the conditions at the project site, further information from on-site surveys or other sources may be required to fully assess impacts on biological resources.

If any rare plants or animals are documented during site visits, we request that information on the observations be provided to the New York Natural Heritage Program so that we may update our database.

Information about many of the listed animals in New York, including habitat, biology, identification, conservation, and management, are available online in Natural Heritage's Conservation Guides at www.guides.nynhp.org, and from NYSDEC at www.dec.ny.gov/animals/7494.html.

The following rare plants, rare animals, and significant natural communities have been documented at the project site, or in its vicinity.

We recommend that potential onsite and offsite impacts of the proposed project on these species or communities be addressed as part of any environmental assessment or review conducted as part of the planning, permitting and approval process, such as reviews conducted under SEQR. Field surveys of the project site may be necessary to determine the status of a species at the site, particularly for sites that are currently undeveloped and may still contain suitable habitat. Final requirements of the project to avoid, minimize, or mitigate potential impacts are determined by the lead permitting agency or the government body approving the project.

The following animals, while not listed by New York State as Endangered or Threatened, are of conservation concern to the state, and are considered rare by the New York Natural Heritage Program.

COMMON NAME	*SCIENTIFIC NAME*	*NY STATE LISTING*	*HERITAGE CONSERVATION STATUS*
Moths			
Coastal Barrens Buckmoth	*Hemileuca maia ssp. 5*	Special Concern	Imperiled in NYS and Globally Uncommon

East Hampton Airport, 1983-fall: The moths were observed in pine oak barrens disturbed by development. 8617

COMMON NAME	*SCIENTIFIC NAME*	*NY STATE LISTING*	*HERITAGE CONSERVATION STATUS*
Beetles			
Nine-spotted Lady Beetle	*Coccinella novemnotata*	Unlisted	Critically Imperiled in NYS and Globally Rare

Amagansett, 2011-08-16: The lady beetles were found on an organic farm. 14571

The following significant natural communities are considered significant from a statewide perspective by the NY Natural Heritage Program. They are either occurrences of a community type that is rare in the state, or a high-quality example of a more common community type. By meeting specific, documented criteria, the NY Natural Heritage Program considers these community occurrences to have high ecological and conservation value.

COMMON NAME	*SCIENTIFIC NAME*	*NY STATE LISTING*	*HERITAGE CONSERVATION STATUS*
Wetland/Aquatic Communities			
Maritime Freshwater Interdunal Swales			High-quality Occurrence of Rare Community Type

Napeague Dunes: This is a large, relatively intact community comprised of many patches within a large natural area. Most patches are of excellent quality and high diversity, surrounded by high-quality natural communities. Other patches have been more impacted by past land use, off-road vehicles, and encroachment by non-native species that alter structure and composition. 590

COMMON NAME	*SCIENTIFIC NAME*	*NY STATE LISTING*	*HERITAGE CONSERVATION STATUS*
Upland/Terrestrial Communities			
Maritime Pitch Pine Dune Woodland			High-quality Occurrence of Rare Community Type and Globally Rare

Napeague Woods: This is a very large maritime pitch pine dune woodland with very good condition, with few disturbances outside of the natural processes (such as sand movement and salt spray), and within a moderately intact landscape. It is bissected into large fragments by transportation corridors. 10026

Maritime Dunes High-quality Occurrence of Uncommon Community Type

Napeague Dunes: This is a large example in a good landscape setting and part of a managed natural area. Vehicular access and impacts affect the rank of these otherwise very high-quality dunes. 1454

Maritime Heathland High-quality Occurrence of Rare Community Type and Globally Uncommon

Napeague Dunes: This is an expansive example of maritime heathland in a good landscape setting and part of a protectable 1700 acre natural area. Vehicular access and impacts affect the rank of this otherwise very high-quality example of maritime heathland. 3238

The following plants are listed as Endangered or Threatened by New York State, and/or are considered rare by the New York Natural Heritage Program, and so are a vulnerable natural resource of conservation concern.

COMMON NAME	*SCIENTIFIC NAME*	*NY STATE LISTING*	*HERITAGE CONSERVATION STATUS*

Vascular Plants

Northern Blazing-star	*Liatris scariosa var. novae-angliae*	Threatened	Imperiled in NYS and Globally Uncommon

Cranberry Hole Roadsides, 2010-09-21: Groups 1-6: The plants are growing in maritime heathland along the roadside. Group 7-8: The plants are growing in a disturbed maritime grassland. The population is small, in good habitat, but precariously close to the road. 5321

Napeague Dunes, 2009-09-14: The plants were observed in a sandy, dry, and fairly undisturbed roadside and herbaceous edge of scrubby pine/oak woods. The habitat is open xeric. 7072

Southern Arrowwood	*Viburnum dentatum var. venosum*	Threatened	Imperiled in NYS

Atlantic Double Dunes, 1989-10-04: Roadside weedy vegetation in community of stabilized dunes and wetlands in depressions. 2008

Cranberry Hole Roadsides, 2003-07-29: An oak-pine woodland and a maritime shrubland. The plants are at the border of the roadside and the woodland. 3991

Skimhampton Roadsides, 1992-07-19. 10385

Seabeach Knotweed	*Polygonum glaucum*	Rare	Vulnerable in NYS and Globally Uncommon

West Napeague, 2010-09-21: Groups 1-2: The plants are growing on a wide section of beach near cannery and along the upper edge of the beach to the northeast. The plants are growing on open sand above the cobbles and mixed in with other plants at the vegetated edge. Group 3: The plants were growing on the beach area just seaward of the line of beach grass. There is a rock jetty to the east. 4352

Fresh Pond Inlet, 1984-07-28: This is a very disturbed, maintained channel (i.e., dredge spoil) into "Fresh Pond". The beach is very disturbed. 10096

Slender Blue Flag	*Iris prismatica*	Threatened	Imperiled in NYS

Cranberry Hole Roadsides, 2010-06-03: The plants are in a wet area at the border of a wet shrubland and the sandy roadside. The plants are in good habitat along the road. 13513

Carolina Clubmoss	*Pseudolycopodiella caroliniana*	Endangered	Critically Imperiled in NYS

Cranberry Hole Roadsides, 2009-09-11: The plants are growing in a maritime interdunal swale. The swale is situated alongside a road and is surrounded by good-quality maritime heathland. There are 500 square meters of plants reproducing in good-quality habitat by the roadside. 1634

In addition, Napeague State Park has records of 9 other state-listed plants, 25 rare moths, and 4 other significant natural communities.

This report only includes records from the NY Natural Heritage database. For most sites, comprehensive field surveys have not been conducted, and we cannot provide a definitive statement as to the presence or absence of all rare or state-listed species. Depending on the nature of the project and the conditions at the project site, further information from on-site surveys or other sources may be required to fully assess impacts on biological resources.

If any rare plants or animals are documented during site visits, we request that information on the observations be provided to the New York Natural Heritage Program so that we may update our database.

Information about many of the rare animals and plants in New York, including habitat, biology, identification, conservation, and management, are available online in Natural Heritage's Conservation Guides at www.guides.nynhp.org, from NatureServe Explorer at www.natureserve.org/explorer, and from USDA's Plants Database at http://plants.usda.gov/index.html (for plants).

Information about many of the natural community types in New York, including identification, dominant and characteristic vegetation, distribution, conservation, and management, is available online in Natural Heritage's Conservation Guides at www.guides.nynhp.org. For descriptions of all community types, go to www.dec.ny.gov/animals/97703.html for Ecological Communities of New York State.

The following rare plants and rare animals have historical records at your project site, or in its vicinity.

The following rare plants and animals were documented in the vicinity of the project site at one time, but have not been documented there since 1979 or earlier, and/or there is uncertainty regarding their continued presence. There is no recent information on these plants and animals in the vicinity of the project site and their current status there is unknown. In most cases the precise location of the plant or animal in this vicinity at the time it was last documented is also unknown.

If suitable habitat for these plants or animals is present in the vicinity of the project site, it is possible that they may still occur there. We recommend that any field surveys to the site include a search for these species, particularly at sites that are currently undeveloped and may still contain suitable habitat.

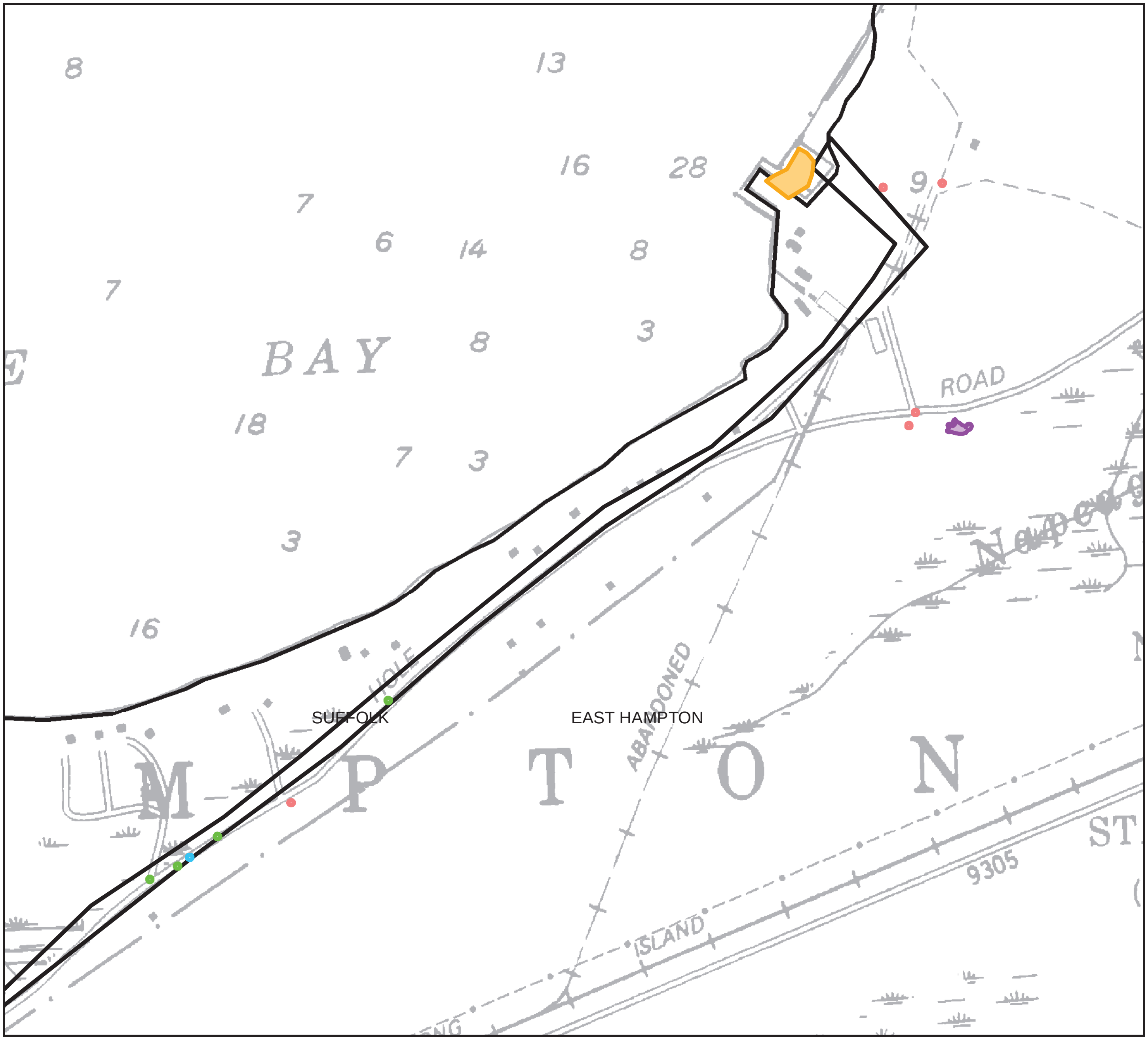
COMMON NAME	*SCIENTIFIC NAME*	*NYS LISTING*	*HERITAGE CONSERVATION STATUS*
Beetles			
Hairy-necked Tiger Beetle	*Cicindela hirticollis*	Unlisted	Critically Imperiled in NYS
1928-pre: The beetles were found on a beach along a coastal bay.			13705
Vascular Plants			
Gypsy-wort	*Lycopus rubellus*	Endangered	Critically Imperiled in NYS
1977-08-30: Cranberry Hole Roadsides. A marsh.			6942

This report only includes records from the NY Natural Heritage database. For most sites, comprehensive field surveys have not been conducted, and we cannot provide a definitive statement as to the presence or absence of all rare or state-listed species. Depending on the nature of the project and the conditions at the project site, further information from on-site surveys or other sources may be required to fully assess impacts on biological resources.

If any rare plants or animals are documented during site visits, we request that information on the observations be provided to the New York Natural Heritage Program so that we may update our database.

Information about many of the rare animals and plants in New York, including habitat, biology, identification, conservation, and management, are available online in Natural Heritage's Conservation Guides at www.guides.nynhp.org, from NatureServe Explorer at www.natureserve.org/explorer, and from USDA's Plants Database at http://plants.usda.gov/index.html (for plants).

Prepared May 23, 2017 by the NY Natural Heritage Program, Albany, NY



1:10,000

0 0.05 0.1 0.2 0.3 0.4 Miles

NY Natural Heritage Program Database Records

Legend

- Portion of Project Site
- Carolina Clubmoss
- Northern Blazing-star
- Seabeach Knotweed
- Slender Blue Flag
- Southern Arrowwood

DOT 1:24,000 Planimetric Images

This map, and the locations that are displayed, are considered sensitive information, and are intended for the internal use of the recipient; they should not be included in any document that will be made available to the public, without permission from NY Natural Heritage. Some records listed in the accompanying report may not be shown on this map. Please see the report for details.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Fish and Wildlife, New York Natural Heritage Program
625 Broadway, Fifth Floor, Albany, NY 12233-4757
P: (518) 402-8935 | F: (518) 402-8925
www.dec.ny.gov

August 8, 2017

David Kennedy
VHB
100 Motor Parkway, Suite 135
Hauppauge, NY 11788

Re: Transmission Line alternative routes for Deepwater Wind South Fork Wind Farm
County: Suffolk Town/City: East Hampton

Dear Mr. Kennedy:

In response to your recent request, we have reviewed the New York Natural Heritage Program database with respect to the above project.

Enclosed is a report of rare or state-listed animals and plants, and significant natural communities that our database indicates occur in the vicinity of the project site. Also included are lists of rare species and significant natural communities for Napeague State Park and Hither Hills State Park.

For most sites, comprehensive field surveys have not been conducted; the enclosed report only includes records from our database. We cannot provide a definitive statement as to the presence or absence of all rare or state-listed species or significant natural communities. Depending on the nature of the project and the conditions at the project site, further information from on-site surveys or other sources may be required to fully assess impacts on biological resources.

Our database is continually growing as records are added and updated. If this proposed project is still under development one year from now, we recommend that you contact us again so that we may update this response with the most current information.

The presence of the plants and animals identified in the enclosed report may result in this project requiring additional review or permit conditions. For further guidance, and for information regarding other permits that may be required under state law for regulated areas or activities (e.g., regulated wetlands), please contact the NYS DEC Region 1 Office, Division of Environmental Permits, as listed at www.dec.ny.gov/about/39381.html.

Sincerely,

Nick Conrad

Nicholas Conrad
Information Resources Coordinator
New York Natural Heritage Program

877

The following state-listed animals have been documented in the vicinity of the project route.

The following list includes animals that are listed by NYS as Endangered, Threatened, or Special Concern; and/or that are federally listed or are candidates for federal listing.

For information about any permit considerations for the project, contact the Permits staff at the NYSDEC Region 1 Office. For information about potential impacts of the project on these species, and how to avoid, minimize, or mitigate any impacts, contact the Wildlife Manager.

A listing of Regional Offices is at http://www.dec.ny.gov/about/558.html.

The following species have been documented within .5 mile of the project site.

COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	FEDERAL LISTING	
Birds				
Northern Harrier	*Circus cyaneus*	Threatened		7352
Breeding: Napeague State Park, Hither Hills State Park, Napeague Harbor				
Least Tern	*Sternula antillarum*	Threatened		2003
Breeding: Napeague Beach, and near Hither Hills, Napeague Lane and Beach Lane landing sites				
Piping Plover	*Charadrius melodus*	Endangered	Threatened	2116
Breeding: Napeague Beach, and near Hither Hills, Napeague Lane, Beach Lane, and Napeague State Park landing sites				
Butterflies				
Frosted Elfin	*Callophrys irus*	Threatened		1902
Near Cedar Street and Stephen Hands Path				

This report only includes records from the NY Natural Heritage database.

If any rare plants or animals are documented during site visits, we request that information on the observations be provided to the New York Natural Heritage Program so that we may update our database.

Information about many of the listed animals in New York, including habitat, biology, identification, conservation, and management, are available online in Natural Heritage's Conservation Guides at www.guides.nynhp.org, and from NYSDEC at www.dec.ny.gov/animals/7494.html.

The following rare animals, rare plants, and significant natural communities have been documented at the project route, or within 0.1 mile.

We recommend that potential onsite and offsite impacts of the proposed project on these species or communities be addressed as part of any environmental assessment or review conducted as part of the planning, permitting and approval process, such as reviews conducted under SEQR. Field surveys of the project site may be necessary to determine the status of a species at the site, particularly for sites that are currently undeveloped and may still contain suitable habitat. Final requirements of the project to avoid, minimize, or mitigate potential impacts are determined by the lead permitting agency or the government body approving the project.

The animals listed in this report, while not listed by New York State as Endangered or Threatened, are of conservation concern to the state, and are considered rare by the New York Natural Heritage Program.

The plants listed in this report are listed as Endangered or Threatened by New York State, and/or are considered rare by the New York Natural Heritage Program, and so are a vulnerable natural resource of conservation concern.

The natural communities listed in this report are considered significant from a statewide perspective by the NY Natural Heritage Program. They are either occurrences of a community type that is rare in the state, or a high quality example of a more common community type. By meeting specific, documented criteria, the NY Natural Heritage Program considers these community occurrences to have high ecological and conservation value.

COMMON NAME	*SCIENTIFIC NAME*	*NY STATE LISTING*	*HERITAGE CONSERVATION STATUS*
Along Stephen Hands Path, Hedges Lane, and Old Montauk Highway			
Orange Fringed Orchid	*Platanthera ciliaris*	Endangered	Critically Imperiled in NYS
1998: Grassy wet roadside, mowed. Growing in red maple swamp.			
Vicinity of East Hampton Airport, the railroad to the south, Hedges Lane, and Stephen Hands Path			
Coastal Barrens Buckmoth	*Hemileuca maia ssp. 5*	Special Concern	Imperiled in NYS and Globally Uncommon
1983-fall: The moths were observed in pine oak barrens disturbed by development.			
Pitch Pine-Oak Forest			High Quality Occurrence
Coastal Oak-Heath Forest			High Quality Occurrence of Uncommon Community Type
This is a very large mature occurrence with several large intact cores lacking exotic plants and well recovered from historical cutting. The community is located in a forested landscape that is relatively large for the coastal region.			
Near Old Stone Highway and Town Lane, Amagansett			
Nine-spotted Lady Beetle	*Coccinella novemnotata*	Unlisted	Critically Imperiled in NYS and Globally Rare
2011-08-16: The lady beetles were found on an organic farm.			

COMMON NAME	*SCIENTIFIC NAME*	*NY STATE LISTING*	*HERITAGE CONSERVATION STATUS*

Along intersection of Cross Highway and Fresh Pond Road

Bushy Rockrose	*Crocanthemum dumosum*	Threatened	Imperiled in NYS and Globally Uncommon

1999-09-09: Roadside, a grassy open mound with sandy soil and oak trees on a street corner. The lot was undeveloped.

Fresh Pond Inlet, Devon, near Fresh Pond Road and Fresh Pond Landing Site

Seabeach Knotweed	*Polygonum glaucum*	Rare	Vulnerable in NYS and Globally Uncommon

1984-07-28: This is a very disturbed, maintained channel (i.e., dredge spoil) into "Fresh Pond". The beach is very disturbed.

Along Cranberry Hole Road west of Napeague State Park

Northern Blazing-star	*Liatris scariosa* var. *novae-angliae*		and Globally Uncommon

2010-09-21: The plants are growing in maritime heathland along the roadside.

Napeague State Park: Along Montauk Highway and Old Montauk Highway

Maritime Pitch Pine Dune Woodland — High Quality Occurrence of Rare Community Type and Globally Rare

This is a very large maritime pitch pine dune woodland with very good condition, with few disturbances outside of the natural processes (such as sand movement and salt spray), and within a moderately intact landscape.

Maritime Heathland — High Quality Occurrence of Rare Community Type and Globally Uncommon

This is an expansive example of maritime heathland in a good landscape setting and part of a 1700 acre natural area.

Maritime Freshwater Interdunal Swales — High Quality Occurrence of Rare Community Type

This is a large, relatively intact community comprised of many patches within a large natural area. Most patches are of excellent quality and high diversity, surrounded by high-quality natural communities. Other patches have been more impacted by past land use, off-road vehicles, and encroachment by non-native species that alter structure and composition.

Maritime Dunes — High Quality Occurrence of Uncommon Community Type

This is a large example in a good landscape setting and part of a managed natural area.

COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	HERITAGE CONSERVATION STATUS

Napeague State Park: Along Old Montauk Highway

Marsh Straw Sedge	*Carex hormathodes*	Threatened	Imperiled in NYS

1990-09-08: Upper high marsh and brackish meadow.

Northern Blazing-star	*Liatris scariosa* var. *novae-angliae*	Threatened	Imperiled in NYS and Globally Uncommon

2015-09-16: The plants are growing in an extensive and diverse dune and brackish meadow complex bordered by dry pine woods and a salt marsh.

Coast Flatsedge	*Cyperus polystachyos* var. *texensis*	Endangered	Critically Imperiled in NYS

2009-09-09: The plants are growing along a sand road and in a brackish meadow at the edge of sparsely vegetated high marsh.

Sea-pink	*Sabatia stellaris*	Threatened	Imperiled in NYS

2015-09-16: The plants are growing in a brackish meadow and at the edge of a high salt marsh surrounded by low dunes to the north.

Slender Crabgrass	*Digitaria filiformis*	Endangered	Critically Imperiled in NYS

1995-09-21: The plants are in sandy soil near a salt marsh.

Seaside Plantain	*Plantago maritima* var. *juncoides*	Threatened	Imperiled in NYS

2009-09-09: The plants are growing in a brackish meadow and along an infrequently used sand road.

Marsh Fimbry	*Fimbristylis castanea*	Threatened	Imperiled in NYS

2015-09-16: The plants are growing in a sparsely to moderately vegetated high marsh with *Spartina patens* and in a brackish meadow bordering the marsh.

High Salt Marsh — High Quality Occurrence of Uncommon Community Type

This community is of moderate size, with good species composition and structure and connection to other estuarine communities. It is located within a fairly large area of natural cover, intersected by several roads and small developments.

Low Salt Marsh — High Quality Occurrence of Uncommon Community Type

This is small example of low salt marsh community with good condition, within a moderate sized tidal marsh complex with good connectivity to natural tidal regimes and associated natural communities, within a fairly intact landscape area.

Salt Shrub — High Quality Occurrence

This is a very large example of this community, embedded within a moderate size salt marsh complex and a relatively large natural area, but with some alterations and obstructions to tidal flows.

Brackish Meadow — High Quality Occurrence of Rare Community Type and Globally Rare

This is a relatively large-sized, diverse, fairly well-protected example of this community with a small percentage of non-native plant species, moderate alterations to tidal flows, and some trampling.

COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	HERITAGE CONSERVATION STATUS

Along Old Montauk Highway south of Napeague State Park

Slender Blue Flag	*Iris prismatica*	Threatened	Imperiled in NYS

2010-06-02: The plants are in a roadside ditch next to natural vegetation in maritime shrubland.

Napeague State Park: Along Montauk Highway

Northern Blazing-star	*Liatris scariosa* var. *novae-angliae*	Threatened	Imperiled in NYS and Globally Uncommon

2009-09-14: The plants were observed in a sandy, dry, and fairly undisturbed roadside and herbaceous edge of scrubby pine/oak woods; and in patches of maritime heathland surrounded by salt marsh. A railroad line passes nearby some of the locations.

Napeague State Park: Near Montauk Highway

Curlygrass Fern	*Schizaea pusilla*	Endangered	Critically Imperiled in NYS

2004-06-23: The plants are in a low wet swale running roughly east to west bordered by shrubs and a dry pine-oak woods upland.

Slender Blue Flag	*Iris prismatica*	Threatened	Imperiled in NYS

2010-07-20: The plants are growing in brackish and freshwater wetlands, and in peat and sand in a maritime interdunal swale.

Narrow-leaf Sea-blite	*Suaeda linearis*	Endangered	Critically Imperiled in NYS

2009-09-13: The plants are growing along the edge of a high salt marsh. The marsh is part of a larger complex of salt marsh, brackish meadow, maritime dunes, and maritime heathland communities. A railroad line passes nearby the site.

Sea-pink	*Sabatia stellaris*	Threatened	Imperiled in NYS

2009-09-13: The plants are growing along the edge of a high salt marsh. The marsh is part of a larger complex of salt marsh, brackish meadow, maritime dunes, and maritime heathland communities. A railroad line passes nearby the site.

Seaside Plantain	*Plantago maritima* var. *juncoides*	Threatened	Imperiled in NYS

2009-09-13: The plants are growing along the edge of a high salt marsh. The marsh is part of a larger complex of salt marsh, brackish meadow, maritime dunes, and maritime heathland communities. A railroad line passes nearby the site.

Coast Flatsedge	*Cyperus polystachyos* var. *texensis*	Endangered	Critically Imperiled in NYS

2009-09-09: The plants are growing along a sand road and in a brackish meadow at the edge of sparsely vegetated high marsh.

COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	HERITAGE CONSERVATION STATUS

Napeague State Park: At or near Napeague State Park landing site

Seabeach Knotweed	*Polygonum glaucum*	Rare	Vulnerable in NYS and Globally Uncommon

2010-09-21: The plants are growing on a wide section of beach near cannery.

Maritime Heathland			High Quality Occurrence of Rare Community Type and Globally Uncommon

This is an expansive example of maritime heathland in a good landscape setting and part of a 1700 acre natural area.

Along Montauk Highway between Napeague State Park and Hither Hills State Park

Southern Arrowwood	*Viburnum dentatum* var. *venosum*	Threatened	Imperiled in NYS

2003-07-30: The plant was in a shrubland along the highway.

Sandplain Wild Flax	*Linum intercursum*	Threatened	Imperiled in NYS

1985-10-10: Low stabilized dunes with interdunal swales and a salt marsh to the north. The habitat is unusual and the species is not usually seen in dune sand.

Hither Hills State Park: Along Montauk Highway and Old Montauk Highway

Southern Arrowwood	*Viburnum dentatum* var. *venosum*	Threatened	Imperiled in NYS

2003-07-30: A maritime shrubland located at the edges of a roadside. The soil is sandy and well-drained.

Blunt Mountain-mint	*Pycnanthemum muticum*	Threatened	Imperiled in NYS

2009-09-13: The population is located along a highway roadside and along the edges of interdunal swales. The plants are growing in the open, densely vegetated bands between the road and the wet interdunal swales. The swales are surrounded by wet coastal maritime shrubland and a maritime dune system.

Serrate Round-leaf Boneset	*Eupatorium pubescens*	Endangered	Critically Imperiled in NYS

2009-09-13: The plants are growing in an open, densely vegetated band between the road and a wet interdunal swale, and in the transition zone between the swale and the maritime dunes.

Maritime Freshwater Interdunal Swales			High Quality Occurrence of Rare Community Type

This is a moderately large community, with high representative diversity, nearby and adjacent transportation corridors and frequent occurrence of non-native species (primarily *Phragmites*), in a relatively intact natural landscape.

COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	HERITAGE CONSERVATION STATUS

Hither Hills State Park: Along Montauk Highway and Old Montauk Highway (cont.)

Maritime Pitch Pine Dune Woodland — High Quality Occurrence of Rare Community Type and Globally Rare

This is a large maritime pitch pine dune woodland in very good condition, with little disturbance, natural processes, unbisected by roads, and in a moderate-size intact landscape block.

Maritime Dunes — High Quality Occurrence of Uncommon Community Type

This is a large maritime dune community with representative native species, in a relatively intact regional landscape. Some trail use and off-road vehicle use occur in the dunes and the non-native *Phragmites* is frequent in some areas.

Hither Hills State Park: Near Montauk Highway

Coastal Oak-Hickory Forest — High Quality Occurrence of Uncommon Community Type

This is a moderate-size to large, mature and recovering intact forest, with little disturbance, in a regionally intact landscape.

Hither Hills State Park: At or near Hither Hills landing site

Marine Intertidal Gravel/Sand Beach — High Quality Occurrence of Uncommon Community Type

This is a large marine intertidal beach with intact natural natural processes of tides, waves, and winds, embedded in a landscape of mixed natural and somewhat altered habitats.

Seabeach Knotweed	*Polygonum glaucum*	Rare	Vulnerable in NYS and Globally Uncommon

2003-09-10: A maritime beach on a barrier island.

In addition to the species and communities listed here, many others occur at Napeague State Park and Hither Hills State Park; a full list is provided in a separate document.

This report only includes records from the NY Natural Heritage database. For most sites, comprehensive field surveys have not been conducted, and we cannot provide a definitive statement as to the presence or absence of all rare or state-listed species. Depending on the nature of the project and the conditions at the project site, further information from on-site surveys or other sources may be required to fully assess impacts on biological resources.

If any rare plants or animals are documented during site visits, we request that information on the observations be provided to the New York Natural Heritage Program so that we may update our database.

Information about many of the rare animals and plants in New York, including habitat, biology, identification, conservation, and management, are available online in Natural Heritage's Conservation Guides at www.guides.nynhp.org, from NatureServe Explorer at www.natureserve.org/explorer, and from USDA's Plants Database at http://plants.usda.gov/index.html (for plants).

Information about many of the natural community types in New York, including identification, dominant and characteristic vegetation, distribution, conservation, and management, is available online in Natural Heritage's Conservation Guides at www.guides.nynhp.org. For descriptions of all community types, go to www.dec.ny.gov/animals/97703.html for Ecological Communities of New York State.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Fish and Wildlife, New York Natural Heritage Program
625 Broadway, Fifth Floor, Albany, NY 12233-4757
P: (518) 402-8935 | F: (518) 402-8925
www.dec.ny.gov

March 19, 2018

David Kennedy
VHB
100 Motor Parkway, Suite 135
Hauppauge, NY 11788

Re: Deepwater Wind South Fork Wind Farm and associated transmission line routes
County: Suffolk Town/City: East Hampton

Dear Mr. Kennedy:

In response to your recent request, we have reviewed the New York Natural Heritage Program database with respect to the above project.

Enclosed is a report of rare or state-listed animals and plants, and significant natural communities that our database indicates occur in the vicinity of the project site. Note that the offshore waters area of the project has records of **humpback and fin whales**, both state- and federally listed. Also attached are lists of rare species and significant natural communities for Napeague State Park and Hither Hills State Park.

For most sites, comprehensive field surveys have not been conducted; the enclosed report only includes records from our database. We cannot provide a definitive statement as to the presence or absence of all rare or state-listed species or significant natural communities. Depending on the nature of the project and the conditions at the project site, further information from on-site surveys or other sources may be required to fully assess impacts on biological resources.

Our database is continually growing as records are added and updated. If this proposed project is still under development one year from now, we recommend that you contact us again so that we may update this response with the most current information.

The presence of the plants and animals identified in the enclosed report may result in this project requiring additional review or permit conditions. For further guidance, and for information regarding other permits that may be required under state law for regulated areas or activities (e.g., regulated wetlands), please contact the NYS DEC Region 1 Office, Division of Environmental Permits, as listed at www.dec.ny.gov/about/39381.html.

Sincerely,

Nick Conrad

Nicholas Conrad
Information Resources Coordinator
New York Natural Heritage Program

The following state-listed animals have been documented in the vicinity of the project route.

The following list includes animals that are listed by NYS as Endangered, Threatened, or Special Concern; and/or that are federally listed or are candidates for federal listing.

For information about any permit considerations for the project, contact the Permits staff at the NYSDEC Region 1 Office, dep.r1@dec.ny.gov, (631) 444-0365. For information about potential impacts of the project on these species, and how to avoid, minimize, or mitigate any impacts, contact:
for whales -- Lisa Bonacci, Marine Endangered Species Biologist, lisa.bonacci@dec.ny.gov, (631) 444-0462.
for other species -- Region 1 Wildlife Manager, (631) 444-0310.

The following species have been documented within .5 mile of the project site.

COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	FEDERAL LISTING	
Birds				
Piping Plover	*Charadrius melodus*	Endangered	Threatened	2116
Breeding: at Hither Hills landing site, near Beach Lane landing site, and on Napeague, Amagansett, and East Hampton Beaches				
Least Tern	*Sternula antillarum*	Threatened		2003
Breeding: near Hither Hills and Beach Lane landing sites, and on Napeague, Amagansett, and East Hampton Beaches				
Northern Harrier	*Circus cyaneus*	Threatened		7352
Breeding: Napeague Meadows, Napeague State Park, Hither Hills State Park, Napeague Harbor				

The following marine species have been documented in the offshore waters area of the project site.

COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	FEDERAL LISTING	
Humpback Whale	*Megaptera novaeangliae*	Endangered	Endangered	15039
Nonbreeding				
Fin Whale	*Balaenoptera physalus*	Endangered	Endangered	15040

This report only includes records from the NY Natural Heritage database.

If any rare plants or animals are documented during site visits, we request that information on the observations be provided to the New York Natural Heritage Program so that we may update our database.

Information about many of the listed animals in New York, including habitat, biology, identification, conservation, and management, are available online in Natural Heritage's Conservation Guides at www.guides.nynhp.org, and from NYSDEC at www.dec.ny.gov/animals/7494.html.

The following rare animals, rare plants, and significant natural communities have been documented at the project route, or within 0.1 mile.

We recommend that potential onsite and offsite impacts of the proposed project on these species or communities be addressed as part of any environmental assessment or review conducted as part of the planning, permitting and approval process, such as reviews conducted under SEQR. Field surveys of the project site may be necessary to determine the status of a species at the site, particularly for sites that are currently undeveloped and may still contain suitable habitat. Final requirements of the project to avoid, minimize, or mitigate potential impacts are determined by the lead permitting agency or the government body approving the project.

The animals listed in this report, while not listed by New York State as Endangered or Threatened, are of conservation concern to the state, and are considered rare by the New York Natural Heritage Program.

The plants listed in this report are listed as Endangered or Threatened by New York State, and/or are considered rare by the New York Natural Heritage Program, and so are a vulnerable natural resource of conservation concern.

The natural communities listed in this report are considered significant from a statewide perspective by the NY Natural Heritage Program. They are either occurrences of a community type that is rare in the state, or a high quality example of a more common community type. By meeting specific, documented criteria, the NY Natural Heritage Program considers these community occurrences to have high ecological and conservation value.

A GIS dataset of significant natural communities is available from the NYS GIS Clearinghouse, www.gis.ny.gov/gisdata/inventories/details.cfm?DSID=1241.

Records in this report are listed approximately in order from west to east.

COMMON NAME	*SCIENTIFIC NAME*	*NY STATE LISTING*	*HERITAGE CONSERVATION STATUS*
Vicinity of East Hampton Airport			
Coastal Barrens Buckmoth	*Hemileuca maia ssp. 5*	Special Concern	Imperiled in NYS and Globally Uncommon
1983-fall: The moths were observed in pine oak barrens disturbed by development.			
Vicinity of East Hampton Airport, the railroad to the south, Hedges Lane, Stephen Hands Path, and Wainscott Northwest Road			
Pitch Pine-Oak Forest			High Quality Occurrence
Along Skimhampton Road, just east of intersection with Pantigo Road in Pantigo			
Southern Arrowwood	*Viburnum dentatum* var. *venosum*	Threatened	Imperiled in NYS
1992-07-19			
Amagansett: Near Old Stone Highway and Town Lane			
Nine-spotted Lady Beetle	*Coccinella novemnotata*	Unlisted	Critically Imperiled in NYS and Globally Rare
2011-08-16: The lady beetles were found on an organic farm.			

COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	HERITAGE CONSERVATION STATUS

Along Cranberry Hole Road just northeast of intersection with Montauk Highway and railroad, west of Napeague State Park

Northern Blazing-star	*Liatris scariosa* var. *novae-angliae*	Threatened	Imperiled in NYS and Globally Uncommon

2010-09-21: The plants are growing in maritime heathland along the roadside.

Near Montauk Highway, in western part of Napeague State Park

Slender Blue Flag	*Iris prismatica*	Threatened	Imperiled in NYS

2016-08-08: The plants are growing in brackish and freshwater wetlands dominated by Juncus and Scirpus, and in a sea level fen.

Curlygrass Fern	*Schizaea pusilla*	Endangered	Critically Imperiled in NYS

2004-06-23: The plants are in a low wet swale running roughly east to west bordered by shrubs and a dry pine-oak woods upland.

Napeague State Park: Along Montauk Highway and railroad through most of the park

Northern Blazing-star	*Liatris scariosa* var. *novae-angliae*	Threatened	Imperiled in NYS and Globally Uncommon

2009-09-14: The plants were observed in a sandy, dry, and fairly undisturbed roadside and herbaceous edge of scrubby pine/oak woods; and in patches of maritime heathland surrounded by salt marsh. A railroad line passes nearby some of the locations.

Maritime Pitch Pine Dune Woodland	High Quality Occurrence of Rare Community Type and Globally Rare

This is a very large maritime pitch pine dune woodland with very good condition, with few disturbances outside of the natural processes (such as sand movement and salt spray), and within a moderately intact landscape.

Maritime Heathland	High Quality Occurrence of Rare Community Type and Globally Uncommon

This is an expansive example of maritime heathland in a good landscape setting and part of a 1700 acre natural area.

Maritime Freshwater Interdunal Swales	High Quality Occurrence of Rare Community Type

This is a large, relatively intact community comprised of many patches within a large natural area. Most patches are of excellent quality and high diversity, surrounded by high-quality natural communities. Other patches have been more impacted by past land use, off-road vehicles, and encroachment by non-native species that alter structure and composition.

COMMON NAME	*SCIENTIFIC NAME*	*NY STATE LISTING*	*HERITAGE CONSERVATION STATUS*

Along Old Montauk Highway just northwest of intersection with Montauk Highway, between Montauk Highway and railroad

Slender Blue Flag	*Iris prismatica*	Threatened	Imperiled in NYS

2010-06-02: The plants are in a roadside ditch next to natural vegetation in maritime shrubland.

Napeague State Park: south of Napeague Harbor, between Montauk Highway and railroad, and/or along railroad

Northern Blazing-star	*Liatris scariosa* var. *novae-angliae*	Threatened	Imperiled in NYS and Globally Uncommon

2009-09-13: The plants are growing in patches of maritime heathland surrounded by salt marsh. The marsh is part of a larger complex of salt marsh, brackish meadow, maritime dunes, and maritime heathland communities.

Narrow-leaf Sea-blite	*Suaeda linearis*	Endangered	Critically Imperiled in NYS

2009-09-13: The plants are growing along the edge of a high salt marsh. The marsh is part of a larger complex of salt marsh, brackish meadow, maritime dunes, and maritime heathland communities. A railroad line passes nearby the site.

Sea-pink	*Sabatia stellaris*	Threatened	Imperiled in NYS

2009-09-13: The plants are growing along the edge of a high salt marsh. The marsh is part of a larger complex of salt marsh, brackish meadow, maritime dunes, and maritime heathland communities. A railroad line passes nearby the site.

Seaside Plantain	*Plantago maritima* var. *juncoides*	Threatened	Imperiled in NYS

2009-09-13: The plants are growing along the edge of a high salt marsh. The marsh is part of a larger complex of salt marsh, brackish meadow, maritime dunes, and maritime heathland communities. A railroad line passes nearby the site.

Coast Flatsedge	*Cyperus polystachyos* var. *texensis*	Endangered	Critically Imperiled in NYS

2009-09-09: The plants are growing along a sand road and in a brackish meadow at the edge of sparsely vegetated high marsh.

Dwarf Glasswort	*Salicornia bigelovii*	Threatened	Imperiled in NYS

2009-09-13: The plants are growing along the sandy edge of a high salt marsh. The marsh is part of a larger complex of salt marsh, brackish meadow, maritime dunes, and maritime heathland communities. A railroad line passes near the site.

High Salt Marsh	High Quality Occurrence of Uncommon Community Type

This community is of moderate size, with good species composition and structure and connection to other estuarine communities. It is located within a fairly large area of natural cover, intersected by several roads and small developments.

Maritime Dunes	High Quality Occurrence of Uncommon Community Type

This is a large example in a good landscape setting and part of a managed natural area.

COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	HERITAGE CONSERVATION STATUS

Along Montauk Highway between Napeague State Park and Hither Hills State Park

Southern Arrowwood	*Viburnum dentatum* var. *venosum*	Threatened	Imperiled in NYS

2003-07-30: The plant was in a shrubland along the highway.

Sandplain Wild Flax	*Linum intercursum*	Threatened	Imperiled in NYS

1985-10-10: Low stabilized dunes with interdunal swales and a salt marsh to the north. The habitat is unusual and the species is not usually seen in dune sand.

Hither Hills State Park: Along Montauk Highway and Old Montauk Highway

Southern Arrowwood	*Viburnum dentatum* var. *venosum*	Threatened	Imperiled in NYS

2003-07-30: A maritime shrubland located at the edges of a roadside. The soil is sandy and well-drained.

Blunt Mountain-mint	*Pycnanthemum muticum*	Threatened	Imperiled in NYS

2009-09-13: The population is located along a highway roadside and along the edges of interdunal swales. The plants are growing in the open, densely vegetated bands between the road and the wet interdunal swales. The swales are surrounded by wet coastal maritime shrubland and a maritime dune system.

Serrate Round-leaf Boneset	*Eupatorium pubescens*	Endangered	Critically Imperiled in NYS

2009-09-13: The plants are growing in an open, densely vegetated band between the road and a wet interdunal swale, and in the transition zone between the swale and the maritime dunes.

Maritime Freshwater Interdunal Swales — High Quality Occurrence of Rare Community Type

This is a moderately large community, with high representative diversity, nearby and adjacent transportation corridors and frequent occurrence of non-native species (primarily *Phragmites*), in a relatively intact natural landscape.

Maritime Pitch Pine Dune Woodland — High Quality Occurrence of Rare Community Type and Globally Rare

This is a large maritime pitch pine dune woodland in very good condition, with little disturbance, natural processes, unbisected by roads, and in a moderate-size intact landscape block.

Maritime Dunes — High Quality Occurrence of Uncommon Community Type

This is a large maritime dune community with representative native species, in a relatively intact regional landscape. Some trail use and off-road vehicle use occur in the dunes and the non-native *Phragmites* is frequent in some areas.

Hither Hills State Park: Near Montauk Highway

Coastal Oak-Hickory Forest — High Quality Occurrence of Uncommon Community Type

This is a moderate-size to large, mature and recovering intact forest, with little disturbance, in a regionally intact landscape.

Hither Hills State Park: At or near Hither Hills landing site, and along Napeague Beach

COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	HERITAGE CONSERVATION STATUS
Seabeach Amaranth	*Amaranthus pumilus*	Threatened *and* Federally Listed as Threatened	Vulnerable in NYS and Globally Uncommon

2008: A maritime beach.

COMMON NAME	SCIENTIFIC NAME	NY STATE LISTING	HERITAGE CONSERVATION STATUS
Seabeach Knotweed	*Polygonum glaucum*	Rare	Vulnerable in NYS and Globally Uncommon

2003: A maritime beach.

Marine Intertidal Gravel/Sand Beach — High Quality Occurrence of Uncommon Community Type

This is a large marine intertidal beach with intact natural natural processes of tides, waves, and winds, embedded in a landscape of mixed natural and somewhat altered habitats.

In addition to the species and communities listed here, many others occur at Napeague State Park and Hither Hills State Park; a full list is provided in a separate document.

This report only includes records from the NY Natural Heritage database. For most sites, comprehensive field surveys have not been conducted, and we cannot provide a definitive statement as to the presence or absence of all rare or state-listed species. Depending on the nature of the project and the conditions at the project site, further information from on-site surveys or other sources may be required to fully assess impacts on biological resources.

If any rare plants or animals are documented during site visits, we request that information on the observations be provided to the New York Natural Heritage Program so that we may update our database.

Information about many of the rare animals and plants in New York, including habitat, biology, identification, conservation, and management, are available online in Natural Heritage's Conservation Guides at www.guides.nynhp.org, from NatureServe Explorer at www.natureserve.org/explorer, and from USDA's Plants Database at http://plants.usda.gov/index.html (for plants).

Information about many of the natural community types in New York, including identification, dominant and characteristic vegetation, distribution, conservation, and management, is available online in Natural Heritage's Conservation Guides at www.guides.nynhp.org. For descriptions of all community types, go to www.dec.ny.gov/animals/97703.html for Ecological Communities of New York State.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Long Island Ecological Services Field Office
340 Smith Road
Shirley, NY 11967
Phone: (631) 286-0485 Fax: (631) 286-4003

In Reply Refer To: February 07, 2018
Consultation Code: 05E1LI00-2018-SLI-0238
Event Code: 05E1LI00-2018-E-00523
Project Name: South Fork Wind Farm: Wind Turbine Generator Area and South Fork Export Cable

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

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This species list is provided by:

Long Island Ecological Services Field Office
340 Smith Road
Shirley, NY 11967
(631) 286-0485

Project Summary

Consultation Code: 05E1LI00-2018-SLI-0238

Event Code: 05E1LI00-2018-E-00523

Project Name: South Fork Wind Farm: Wind Turbine Generator Area and South Fork Export Cable

Project Type: POWER GENERATION

Project Description: Proposed offshore wind energy project interconnecting with the Long Island Power Authority transmission system on Long Island. The SFWF is planned to consist of up to 15 wind turbine generators, a collection system consisting of an offshore substation and inter-array cables, and an export cable from the offshore substation to Long Island, and an onshore cable from shore to substation.

This iPAC request is for the South Fork Export Cable and South Fork Wind Farm.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/40.996927519482455N71.70309443094693W

Counties: Suffolk, NY

Endangered Species Act Species

There is a total of 6 threatened, endangered, or candidate species on this species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

Mammals

NAME	STATUS
Northern Long-eared Bat Myotis septentrionalis No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Birds

NAME	STATUS
Piping Plover Charadrius melodus Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot Calidris canutus rufa No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Roseate Tern Sterna dougallii dougallii Population: northeast U.S. nesting pop. No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2083	Endangered

Flowering Plants

NAME	STATUS
Sandplain Gerardia Agalinis acuta No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8128	Endangered
Seabeach Amaranth Amaranthus pumilus No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8549	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Long Island Ecological Services Field Office
340 Smith Road
Shirley, NY 11967-2258
Phone: (631) 286-0485 Fax: (631) 286-4003

In Reply Refer To: May 01, 2018
Consultation Code: 05E1LI00-2018-SLI-0445
Event Code: 05E1LI00-2018-E-00962
Project Name: South Fork Wind Farm: Onshore portion of South Fork Export Cable, from shore to substation.

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

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Attachment(s):

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This species list is provided by:

Long Island Ecological Services Field Office
340 Smith Road
Shirley, NY 11967-2258
(631) 286-0485

Project Summary

Consultation Code: 05E1LI00-2018-SLI-0445

Event Code: 05E1LI00-2018-E-00962

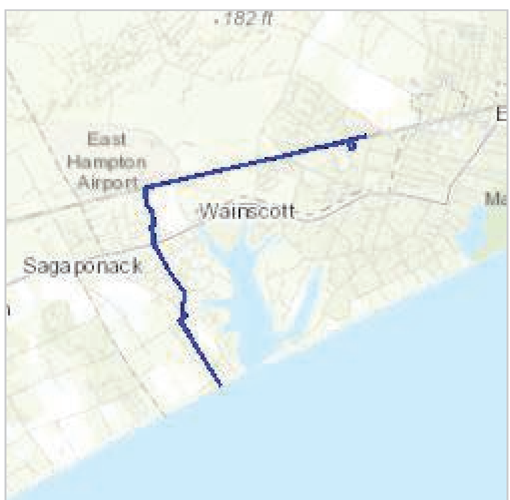
Project Name: South Fork Wind Farm: Onshore portion of South Fork Export Cable, from shore to substation.

Project Type: Guidance

Project Description: Proposed offshore wind energy project interconnecting with the Long Island Power Authority transmission system on Long Island. The SFWF is planned to consist of up to 15 wind turbine generators, a collection system consisting of an offshore substation and inter-array cables, and an export cable from the offshore substation to Long Island, and an onshore cable from shore to substation.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/40.9610616409216N72.21129350977697W



Counties: Suffolk, NY

Endangered Species Act Species

There is a total of 6 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

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See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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Mammals

NAME	STATUS
Northern Long-eared Bat Myotis septentrionalis No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

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NAME	STATUS
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Flowering Plants

NAME	STATUS
Sandplain Gerardia *Agalinis acuta* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8128	Endangered
Seabeach Amaranth *Amaranthus pumilus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8549	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Long Island Ecological Services Field Office
340 Smith Road
Shirley, NY 11967-2258
Phone: (631) 286-0485 Fax: (631) 286-4003

In Reply Refer To: May 10, 2018
Consultation Code: 05E1LI00-2018-SLI-0463
Event Code: 05E1LI00-2018-E-01005
Project Name: South Fork Wind Farm: Onshore Alternative Routes of the South Fork Export Cable

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

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340 Smith Road
Shirley, NY 11967-2258
(631) 286-0485

Project Summary

Consultation Code: 05E1LI00-2018-SLI-0463

Event Code: 05E1LI00-2018-E-01005

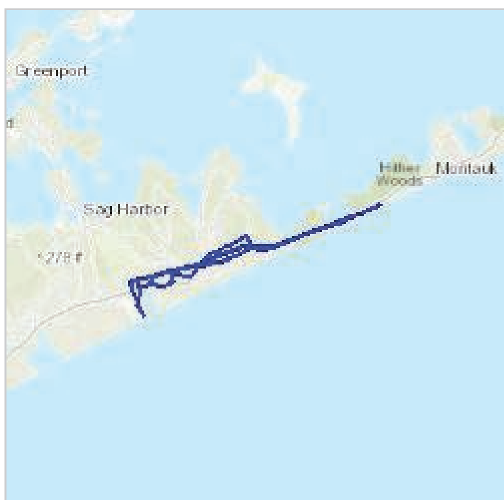
Project Name: South Fork Wind Farm: Onshore Alternative Routes of the South Fork Export Cable

Project Type: POWER GENERATION

Project Description: Proposed offshore wind energy project interconnecting with the Long Island Power Authority transmission system on Long Island. The SFWF is planned to consist of up to 15 wind turbine generators, a collection system consisting of an offshore substation and inter-array cables, and an export cable from the offshore substation to Long Island, and an onshore cable from shore to substation.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/40.970178463142915N72.15672547082693W



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Birds

NAME	STATUS
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Red Knot Calidris canutus rufa No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
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Flowering Plants

NAME	STATUS
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Seabeach Amaranth *Amaranthus pumilus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8549	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Appendix B LITERATURE SUMMARY

Offshore Avian and Bat Literature Summary

This compilation summarizes available information regarding avian and bat use of marine environments, and what is known about impacts to birds and bats from existing offshore wind projects, primarily in Europe. When available, data are provided for federally or state-listed species that are of particular interest to the Risk Assessment, including the federally listed roseate tern (Sterna dougallii), rufa red knot (Calidris canutus rufa), piping plover (Charadrius melodus), and northern long-eared bat (Myotis septentrionalis), as well as the state-listed least tern (Sternula antillarum) and common tern (Sterna hirundo).

Note that this summary is organized by sections that correspond to Key Risk Factors outlined in the Risk Assessment. In some cases, there are compounding influences among key factors such as flight height, weather, and visibility and lighting; therefore, there is some overlap in these section discussions.

BIRDS

AVIAN COLLISION RISK

Current collision fatality data from existing offshore wind turbine generators (WTGs) is extremely limited and largely anecdotal given the technical difficulties associated with detecting collisions combined with the loss of carcasses landing in the water. As a partial substitute, Tetra Tech conducted a beached-bird survey before construction, during construction, and post-construction for the Block Island Wind Farm (BIWF) from June 2015 to July 2017 (Tetra Tech, 2017). Searches were conducted at three beaches on Block Island, Scotch Beach, Snake Hole/Vail Beach, and south of Ballard's Beach. In 2015, 2016, and 2017, there were 0.29, 0.11, and 0.02 birds per search found among the three beaches combined. For all 3 years combined, there were 8 different species found with great black-backed gull (*Larus argentatus; n = 7*), herring gull (*Larus argentatus; n = 4*), and cormorant (n = 4) consisting of the species most commonly found (Tetra Tech, 2017). There was one shearwater carcass found floating on the water during one of Stantec's post-construction ship-based transect surveys, but it was a few miles from the nearest turbine; no other similar observations were made during these surveys (Stantec, in prep).

Reliance on data extracted from beached-bird carcass counts (and incidental observations) to assess fatality impacts is limited at best due to the many environmental factors that potentially influence results, e.g., sea currents, tides, weather events, and variable scavenger activity (Flint and Fowler, 1998; Flint et al., 1999). However, it is notable that there was not an increase in carcasses found post-construction and that 2017 had the lowest bird per search rate observed during the beached-bird survey period. A similar study was conducted at a nearshore wind facility located in northeast England where researchers conducted beached-bird surveys over an 11-year period (Newton and Little 2009, as cited by Huppop et al., in press). The study documented 3,748 carcasses but only 114 birds (3%) were attributed to the wind farm. Gulls and eiders were most commonly found but researchers suspected that small birds (e.g., passerines) were likely more difficult to recover (Newton and Little 2009, as cited by Huppop et al., in press).

At this nearshore facility, they estimated 16.5–21.5 bird fatalities/turbine/year (Newton and Little 2009, as cited by Huppop et al. in press).

At the Alpha Ventus wind farm in the North Sea, Germany, researchers collected 3 years of data using remote sensing technologies. Despite documentation of hundreds of birds flying through or near WTG blades, no collision events were recorded; however, the authors noted that detection of targets using these technologies are reduced in fog and mist, and on the night that a mass fatality event occurred at an illuminated research platform in the project area, visibility was too poor to observe birds in rotor areas (Hill et al., 2014). At an offshore wind facility in southern Kalmar Sound, Sweden, Petterson (2005) reported one common eider collision out of approximately 2 million sea ducks recorded.

Available information from research platforms at proposed and existing wind farms, as well as at oil platforms, lighthouses, and lightships suggest bird collisions do occur at a variety of types of offshore structures. There are estimates of hundreds of birds per year at individual research platforms; however, lighting (particularly white, steady burning lights) and/or steel cables of towers on these structures are believed to be associated with increased risk (Hill et al., 2014). Night migrating passerine carcasses are most commonly detected at offshore structures, with thrushes, starlings, and skylarks most commonly found at European offshore structures, and vireos, kinglets, and wood warblers most commonly found at structures off the coast of North America (Huppop et al., in press). Passerines have been the most commonly found bird carcasses at offshore and coastal structures including lighthouses, platforms, and ships (Huppop et al., in press). At illuminated lightships in the North and Baltic Seas there have been 100 to 200 collision fatalities found per year (Hansen, 1954 as cited by Hill et al., 2014). Hundreds of bird collisions also likely to occur each year with individual, illuminated tall structures such as masts and oil rigs (Hill et al., 2014). Estimates suggest that brightly illuminated oil platforms in the Gulf of Mexico may result in 200,000 bird fatalities per year, and as many as 6 million fatalities at oil and gas platforms in the North Sea per year (Huppop et al., in press). Below are additional examples of documented collision events with lit structures offshore, and a summary surrounding the circumstances of these events:

- At an illuminated research platform with an 81-meter (m) (266-foot) lattice tower in the North Sea, 767 birds of 34 species were found from late 2003 to late 2007; the authors estimated 150 collisions per year at this platform (Huppop et al., in press).
- In November 2010, 88 bird carcasses consisting of nocturnal migrants were found on the deck of the FINO1 research platform at the Alpha Ventus wind farm in the German North Sea that included a brightly lit mast with steel cables standing approximately 100 m (328 feet) above a platform (Hill et al., 2014). It was suspected that the actual number of fatalities was likely much higher, but many were suspected to have fallen into the water, with some potentially taken by scavengers. The birds were assumed to be attracted to the illuminated platform, then collided with the mast and guy wires.
- At another research platform, FINO2, in the Baltic Sea, a visual automated recording system documented bird collisions with the steel cables, just before sunrise, and also with a steel grid on the platform at night (Schulz et al., 2011, as cited by Hill et al., 2014).

- Eight red-necked phalarope collision fatalities were documented at the Montauk Lighthouse, East Hampton, New York in August 1892 (Bull, 1974, as cited by Rubega et al., 2000).

Due to differences in lighting and structural features between these other stationary offshore structures and WTGs, risk of collision at WTGs is not expected to necessarily be similar between these types of structures (Hill et al., 2014).

The types of birds that occur, and their flight and foraging behaviors, vary among onshore and coastal habitats compared to offshore habitats; therefore, collision impacts observed at onshore, coastal, and nearshore WTGs may not be directly transferable to offshore WTGs. However, fatality data from coastal and onshore wind farms represent one of the best available information sources. Passerines are the most abundant group of birds occurring in North America and, due to their abundance and nocturnal migration behaviors, species within this group (e.g., warblers, vireos, thrushes, sparrows) account for most avian fatalities documented at onshore wind facilities (Erickson et al., 2014), representing approximately 80 percent of known fatalities reported (Johnson et al., 2004; Erickson et al., 2001). For onshore wind facilities in the U.S., Loss et al. 2013 estimated a mean fatality rate of 5.25 birds per turbine per year, and a mean of 6.86 birds per turbine per year for eastern wind facilities specifically.

A study conducted at a coastal wind farm in the Netherlands documented songbird, waterbird, and shorebird collision fatality rates ranging from 0.04 to 0.14 fatalities per turbine per day (Winkelman 1995, as cited by Kerlinger and Curry, 2002). The study indicated that the location of turbines on the coast near large concentrations of migrant and wintering waterfowl, shorebirds, and songbirds influenced risk of collision (Winkelman 1995, as cited by Kerlinger and Curry, 2002).

Mortality surveys at the coastal Massachusetts Maritime Academy (MMA) turbine (with a maximum height of 73.5 m [241 feet]) near the Cape Cod Canal in Buzzards Bay, documented 5 birds found during mortality searches in both years combined, three of these birds (a laughing gull [*Larus atricilla*], osprey [*Pandion haliaetus*], and a great black-backed gull) were presumed to have collided with the turbine (Vlietstra, 2007). Despite this turbine's location in an area used by terns during the breeding period and its distance of 12 km (7 mi) from a tern colony, there were no tern fatalities found. Additional monitoring at the MMA turbine documented 4 bird carcasses, with no terns or listed species found; the authors estimated 1.8 to 3.3 bird fatalities per year at the MMA turbine (Gordon, 2011).

At the proposed offshore Cape Wind Project in Nantucket Sound, it was estimated that there would be 4–5 roseate tern and 0.5 piping plover fatalities per turbine per year (Burger et al., 2011) and 0.16 red knot fatalities per turbine per year (Gordon and Nations, 2016). However, the proposed location of the Cape Wind WTGs is closer to shore and in closer proximity to nesting habitats; therefore, these estimates would not be directly transferable to other wind projects on the Atlantic Outer Continental Shelf (AOCS).

AVIAN AVOIDANCE/ATTRACTION BEHAVIORS

The ability of birds to detect and avoid the WTGs, either by small- or large-scale avoidance behaviors, is a factor influencing risk of collision. Small scale avoidance (micro avoidance) may include slight alterations to flight paths or flight heights (either vertically or horizontally) to avoid close encounters with the WTGs, while large scale avoidance could occur out to distances of 1.5–2.0 km (0.9–1.2 mi) from WTGs, and possibly as far as 4 km (2.5 mi) (Petersen et al., 2006). Avoidance behaviors may be influenced by a variety of factors, including time of day/visibility, artificial and natural lighting, and WTG configuration. A study conducted with vertically oriented radar suggests that migrating birds may react to turbines by 'vertical deflection' at night instead of the horizontal avoidance primarily observed during the day (Blew et al., 2006, as cited by Peterson et al., 2006).

Avoidance behaviors are highly species-specific. At the Nysted wind farm, some species such as loons and gannets were not observed flying between WTGs while gulls were often observed flying between WTGs (Petersen et al., 2006). High winds, periods of reduced visibility, or distractions may influence a bird's ability to react to a moving turbine blade (Willmott et al., 2013). While slower bird flight speeds, higher mass, and low maneuverability are thought to increase risk of collision (Chamberlain et al., 2005, as cited by Willmott et al., 2013), available data suggest species with high maneuverability and rapid flight also collide with turbines and some species with low maneuverability can avoid collision (Willmott et al., 2013).

Available data from offshore projects in Europe indicate most birds avoid close encounters with turbines by either passing near or between turbines. Avoidance behaviors differed by time of day and by species (Petersen et al., 2006; Fox et al., 2006). The typical distance at which an avoidance reaction occurred was 500 m (1,640 feet) from turbines at night and 3 km (1.9 mile) during the day (Peterson et al., 2006). Depending on flight height, birds may alter their flight paths horizontally or vertically to avoid encounters with the individual turbines or the general wind farm area. Radar data indicated nocturnal migrating birds increased their flight altitude presumably to avoid the wind farm (Peterson et al., 2006).

Based primarily on visual observation and radar data at offshore wind farms in Europe, Willmott et al. (2013) assessed macro avoidance rates (complete avoidance of the wind facility and not entering turbine arrays) in quantifying collision and displacement sensitivity rankings for birds that may occur in the marine environment. Groups with the highest macro avoidance rates (90% or greater) included scoters and other migrant seaducks (both day and night) (Willmott et al., 2013). The following were the macro avoidance ranges for different bird groups specifically: divers (loons) 52−68 percent, seaducks 53−95.5 percent, northern gannets 64−72 percent, grebes and tubenoses 50 percent, cormorants 18−23 percent, gulls 18−76.4 percent, skuas and jaegers 0 percent, terns 30−69.5 percent, alcids 45−68 percent, shorebirds 27 percent, and landbirds 35 percent (Willmott et al., 2013). Birds with high macro avoidance rates may be at less risk of collision but possibly at more risk due to more long-term impacts associated with displacement. Willmott et al., 2013 indicated that micro avoidance rates (active change to flight behavior to avoid an individual turbine once within a wind farm) in the marine environment are lacking; however, one study by Desholm (2005) used thermal imaging to conclude that micro avoidance is greater than 99 percent. The authors concluded that based on available micro avoidance rates and macro avoidance behaviors, there is likely very high overall avoidance for most species groups in the marine environment (Willmott et al., 2013).

Collision avoidance rates (micro avoidance) for some bird types have been estimated using the Band Collision Risk Model based on data from onshore wind farms in the U.S. or nearshore studies in Europe. Fernley et al. (2006) estimated avoidance rates of geese at four wind projects ranging from 99.8 percent to 100.0 percent, despite high use by geese at these sites. Whitfield and Madders (2006) estimated the avoidance rate of harriers at eight wind farms in the U.S. These estimates ranged from 93.2 percent to 100.0 percent. Other available bird avoidance rates include 99.6 percent mainly for gull species at Blyth Harbor in Northeast England; 99.5 percent for golden eagle (*Aquila chrysaetos*) at an onshore facility in the U.S.; and 99.9 percent for passerines at the Oosterbierum wind farm in the Netherlands (Chamberlain et al., 2006). There are however limitations to the Band Collision Risk Model method for estimating bird avoidance rates as it does not account for differences among bird activities and behaviors under a range of conditions, and because avoidance rates exhibited by a range of species are understudied (Chamberlain et al., 2006). More relevant to the marine environment are estimated avoidance rates of northern gannets that researches used to model collision risk at proposed offshore wind farms in Scotland: 99.0% and 98.5% (Cleasby et al., 2015).

Based on approximately 230 days of study from July 2014 to April 2016 at the Thanet Offshore Wind Farm in the UK, there were 6 collisions observed out of 299 (2 percent) video recordings of seabirds passing within the rotor-swept zone (including a 10-m [33-foot] buffer) (Skov et al., 2018). Most birds adjusted their flight path to fly parallel to the rotor-zone, while relatively few crossed perpendicular to the spinning rotor. Among gannets and gull or kittiwake species, avoidance rates ranged from 0.996 to 0.999. However, these estimates are largely based on daytime data collected during fair conditions with decent visibility and therefore may not represent the full range of avian avoidance behaviors (Skov et al., 2018).

Hatch and Brault (2007) used avoidance rates of 95.3 and 98.3 percent for terns and 98 percent for piping plovers to model collision risk of listed species at a proposed offshore wind project in Nantucket Sound. Terns have been exhibited turbine-avoidance behavior at the majority of existing offshore and near-shore facilities in Europe (Peterson et al., 2006; Pettersson, 2005); however, terns have experienced high collision mortality at one project sited within 100 m (328 feet) of a tern colony (Everaert and Stienen, 2006). The study conducted in 2007 and 2006 at the coastal MMA turbine indicated continued use of the area by terns, and avoidance of the RSZ when the turbine was operating at greater than 1 rotation per minute (rpm; Vlietstra, 2007). When the rpm was greater than 1, terns were 4 to 5 times less abundant within 50 m (164 feet) of turbine blades. The Bird and Ram Island Massachusetts tern colonies are located 11 km (7 mi) and 20 km (12 mi) from the MMA turbine. During 351 observation hours from mid-May through mid-September 2010, there were 215 terns (10 of which were roseate terns, all others were common terns) observed (Gordon, 2011). Of these terns, 94.2 percent (n = 203) traveled near the turbine when it was spinning (> 1 rpm). Of these 203 birds, 96.2 percent flew in Zone 3 (an area including a 73.5 m radius above the nacelle), but none flew within the RSZ (Gordon, 2011). No tern fatalities were observed during any monitoring studies at this turbine (Gordon, 2011). It was hypothesized that terns visually and acoustically detected spinning blades when the rotor was operating (Vlietstra, 2007).

AVIAN FLIGHT HEIGHT

At the Alpha Ventus wind farm in in the North Sea, Germany, an automated radar unit could detect larger targets up to 1,500 m (4,921 feet) asl; however, most birds were detected at heights 200 m (656 feet) asl or less (Hill et al., 2014). The greatest activity and higher flights detected by the radar were correlated to favorable migration conditions (Hill et al., 2014). The authors noted that if the weather turns, birds can be forced down to lower flight heights over a period of a few hours (Hill et al., 2014). The radar at Alpha Ventus recorded migrants, during such conditions, flying in several directions near turbines and the illuminated research platform as well as circling flights around the illuminated research platform (Hill et al., 2014).

Weather conditions such as wind speed and direction influence bird flight heights. Available information suggest that flight altitudes vary widely under different weather conditions. For example, researchers at a site in Europe found that for cormorant, waterfowl, gull, and shorebird flight altitudes often varied between 0 and 200 m (656 feet). Some variation in waterfowl and shorebird altitudes was attributed to wind direction (Krijsveld, 2005, as cited by Willmott et al., 2013). In general, when migrating, birds are expected to fly at heights where winds are in favorable directions to minimize energy expenditure (Gauthreaux, 1991; Huppop, 2006, as cited by Willmott et al. 2013). It is expected that most bird groups would fly below the RSZ when commuting into a headwind, to conserve energy. If traveling in following winds birds would be expected to fly at greater altitudes.

Modeling using data describing flight heights of 25 bird species (including waterbirds, waterfowl, and seabirds) from surveys at 32 proposed offshore wind farms in Europe, showed many birds fly within approximately 21 m (70 feet) of the sea surface (Johnston et al., 2014). These results demonstrate that use of larger turbines may reduce collision risk for marine birds (Johnston et al., 2014). Researchers modeled a collision risk estimate of 1,500 adult northern gannets during the breeding season due to proposed wind facilities located within 50 km (31 mi) of the world's largest northern gannet breeding colony in Scotland; because the gannets' median flight height is 27 m (89 feet), researchers recommended a minimum WTG blade reach no lower than 30 m (98 feet) (Cleasby et al., 2015). However, other available data suggest birds migrating over land appear to be more at risk of collision with taller turbines (Loss et al., 2013). These conflicting results suggest that risk of collision at taller turbines would depend on the species and type of behavior. While many seabirds may commute or forage just above wave height, long-distance migrants such as shorebirds are known to fly at heights above 4,000 m (13,123 feet) (Huppop et al., in press).

During a study conducted in 2007 and 2006 at the MMA wind turbine, near the Cape Cod Canal in Buzzards Bay, of 8 roseate terns observed, flight altitudes were consistently below the RSZ (which is between 8 and 21 m (26−69 feet) above ground at this site; Vlietstra, 2008). Boat-based surveys in Buzzards Bay indicated that of 1,467 roseate terns observed, 68 percent flew between 0 and 3 m (0–10 feet), while 26 percent flew between 3 and 15 m (10−49 feet), and 5 percent flew between 15 and 30 m (49−98 feet) asl (Gordon, 2011). Only 13 roseate terns flew at heights greater than 30 m (Gordon, 2011).

Terns have been observed at heights well above the RSZ when making migratory movements. There have been observations of what were assumed to be both roseate and common terns departing South Beach in Massachusetts in the fall around sunset, apparently heading toward their wintering grounds, and quickly gaining altitudes of hundreds of meters (Veit and Petersen, 1993). Other species of terns have been observed migrating at heights above 3,000 m (9,842 feet) when migrating over land (Alerstam, 1985). Alerstam (1985) used radar to track terns (common and arctic [*Sterna paradisaea*]) crossing southern Sweden in late-July. Small flocks took off in the evening and ascended at rates of about 1.2 m/s to heights of 1,000–3,000 m (3,281–9,842 feet). Some flocks were observed circling in thermals. These observations suggest that terns start migratory flights in the evening and fly at high altitudes during the night (Nisbet et al., 2017). It is likely that nighttime migration movements of terns traveling offshore would generally flight at great heights, particularly on clear nights with following winds. The flight height, however, would be dependent on weather conditions. If terns were to depart in unfavorable conditions such as strong headwinds, their flight heights would likely be lower. Tern species have been observed flying close to the water's surface during strong headwinds (Alerstam, 1985).

Departure for migration for most shorebirds, including red knots, tends to occur on sunny days in the few hours before twilight (Harrington, 2001). Red knots tend to occur in larger flocks than many other shorebird species with flock sizes at over one hundred individuals; the average size of red knot flocks consisted of roughly 50 individuals at one study location (Harrington, 2001). Observations suggest red knots fly in v-formations, and mixed flocks eventually segregate according to species after departure from beaches (Harrington, 2001). Flocks observed departing for migration, gained altitudes at a relatively high rate of 0.91 m/s (31 mph) compared to 7 other species observed (Harrington, 2001). Limited migration behavior information suggests that red knots mainly migrate during periods of good visibility and that they may travel at relatively high altitudes.

CHANGES TO FORAGING/PERCHING HABITAT

Fish are known to congregate around floating or stationary structures in the marine environment (Kragefky, 2014). Offshore WTG foundations may create some level of a localized artificial reef effect, where fish may find shelter or food (Kragefky, 2014). Further, turbulence at WTGs may force prey items to the surface, providing potential foraging opportunities (Dierschke et al., 2016).

Cormorants and large gulls have regularly been observed roosting on above water structures, and terns have been observed at European offshore facilities perching on turbine bases before the towers were constructed (Dierschke et al., 2016). At the Alpha Ventus wind farm, birds were observed on separate occasions perching on a WTG deck platform (20 m [66 feet] asl), including a group of cormorants, a peregrine falcon, a kestrel, and groups of pigeons (Hill et al., 2014). Offshore wind farms were believed to result in range expansion for cormorants further offshore because they were able to take advantage of above water structures for resting and drying feathers, but their observed attraction to offshore wind farms may have also been a result of increases in food availability (Dierschke et al., 2016).

WEATHER

Most migration however occurs during favorable weather conditions when wind and thermal air conditions are more stable and conducive to long distance, energy-efficient flight. Petersen et al. (2006) observed a substantial decrease in the volume of migrating waterbirds during weather periods of elevated collision risk and indicated fewer waterbirds migrated during periods of low visibility and strong headwinds. Flight heights are expected to be greater on those clear nights with following winds. If birds were to depart in unfavorable conditions such as strong headwinds, their flight heights would likely be lower. Tern species have been observed flying close to the water's surface during strong headwinds (Alerstam, 1985).

Using the radar data coupled with NEXRAD data the authors of the BIWF pre-construction radar study suggested there were few nights during migration with low visibility coinciding with high passage rates; however, the authors noted that precipitation blocks the view on the radar screen and few if any targets were discernible during rain events, so periods with rain were excluded from the analysis (Tetra Tech and DeTect, 2012).

Departure for migration for most shorebirds, including red knots, tends to occur on sunny days in the few hours before twilight (Harrington, 2001). Limited migration behavior information suggests that red knots mainly migrate during periods of good visibility and that they may travel at relatively high altitudes (Harrington, 2001).

VISIBILITY AND LIGHTING

Based on a small sample of nighttime videos recorded from July 2014 to April 2016 at the Thanet Offshore Wind Farm in the UK, it was estimated that nighttime activity accounted for only 3% of both nighttime and daytime activity combined (Skov et al., 2018).

Many types of avian migrants travel at night. There is little data available on roseate tern nighttime migration; however, other species of tern are known to travel extensively at night (Alerstam, 1985). Alerstam (1985) used radar to track terns (common and arctic) crossing southern Sweden in late-July. Observations suggest that terns start migratory flights in the evening and fly at high altitudes during the night (Nisbet et al., 2017a). Terns are believed to migrate both day and night (Nisbet et al., 2014 and 2017; Burger et al., 2011). Piping plover migratory activity is expected to largely occur at night (Gordon, 2011). Red knots are long-distance migrants and their non-stop flights may span both day and night

It is well documented that artificial lighting can attract and disorient nocturnal migrating birds, both in onshore and offshore settings. Most bird types are believed to use natural sources of light to some extent to navigate while migrating, including shorebirds, seabirds, and passerines (Rubega et al., 2000; Huntington et al., 1996; Kerlinger et al., 2010). Certain types of lighting, particularly during fog or rain conditions at night, further increase risk of collision. White light has been found to be more of an attractant for birds than red lighting (Hill et al., 2014), and steady burning lights compared to pulsing strobe lights can pose more of a risk (Patterson, 2012; Kerlinger, 2000; Kerlinger et al., 2010).

"Fall out" events are known to occur when nocturnal migrants are looking for a place to land after rapidly decreasing their height of flight when encountering adverse weather. Fall out events are a phenomenon that occur at both onshore and offshore locations, and are typically associated with locations with sources of artificial lighting. For example, there was a fall out event involving large numbers of mainly warblers on Machias Seal Island (which has an operational lighthouse), located approximately 16 km (10 mi) offshore from Maine in May 2011 (Paton and McWilliams, 2017).

Some species of seabird are known to be attracted to light, particularly during fog, including storm-petrels and alcids (Huntington et al., 1996; Wiese et al., 2001). There have been reports of large numbers of dovekies being attracted to highly illuminated offshore oil platforms on the Grand Banks off Newfoundland (Montevecchi and Stenhouse, 2002). Passerine species are known to be attracted to the refracted lighting at "offshore obstacles" during periods of fog or rain (Huppop et al., 2006). While feeding in groups at night in areas illuminated with artificial lighting, gannets have been observed to plunge-dive into obstructions such as boat decks or fish holds while diving for scraps between boats; they have also been observed to get injured on nearby wires while diving (Mowbray, 2002). Other species of marine birds have been observed to forage at night like black-legged kittiwake (Hatch et al., 2009), or during low light conditions such as common eider and white-winged scoter (Goudie et al., 2000; Brown and Fredrickson, 1997). Murres are known to forage at night while at breeding colonies (Gaston and Hipfner, 2000) and therefore may also forage at night in wintering areas. Storm-petrels can be attracted to prey using their sense of smell, so they may use this mechanism to forage at night or during other low-light periods (Huntington et al., 1996).

Certain types of lighting, particularly during fog or rain conditions at night, may increase risk of collision. As discussed in the Avian Collision Risk Section of this summary, there have been reports of fatality events at other offshore structures including oil rigs and research platforms; bright, steady burning lights have been considered a large factor contributing to these large-scale collision events which may involve hundreds to possibly thousands of birds per night (Huppop et al., in press). Kerns and Kerlinger (2004) found 33 passerine fatalities at onshore turbines located adjacent to a substation, as well as under structures at the substation itself, at a wind farm in West Virginia. The substation was brightly lit with sodium vapor lights at night and the fatalities occurred during heavy fog conditions at night. The lighting was turned off after the event and no other large-scale fatality events were discovered.

Studies have demonstrated that steady burning aviation obstruction lighting, and some other types of lighting, on tall structures can result in collisions by attracting or disorienting night migrating birds, especially during periods of fog, rain, or low cloud ceiling (Gehring and Kerlinger, 2007; Huppop et al., 2006). Other studies suggest that there are no statistical correlations between mortality at turbines that have aviation lighting versus un-lit WTGs at onshore wind farms (Jain et al., 2007; Kerlinger et al., 2010). It should be noted that the effects of aviation lighting under compounding factors such as low cloud cover or fog on collision risk at onshore or offshore wind farms have not been thoroughly investigated. The substantially higher numbers of fatalities observed at lit communication towers (at heights greater than 305 m [1,000 feet]) in the U.S. may be influenced by the greater heights of the towers, the guy wires, or the steady-burning lights mounted on many communication towers (Jain et al., 2007; Kerlinger, 2000), as compared to the pulsing aviation lights on WTGs.

At the Nysted and Horns Rev wind farm in Denmark, wind turbines positioned at the outer edge of the wind farm are equipped with two medium intensity flashing red lights on the top of the nacelles and the lights operate at a frequency of 20–60 flashes per minute (Peterson et al., 2006). Radar observations suggest that birds approached the turbines at closer distances at night than during the day, and that more birds entered the wind farm at night than during the day; however, observations indicated avoidance behavior of the turbines by nighttime migrants. The typical distance at which an avoidance reaction occurred was 500 m (1,640 feet) from turbines at night and 3 km (1.9 mi) during the day (Peterson et al., 2006). It may be that that migrating birds react later to the turbines at night due to decreased visibility, but are eventually able to detect the turbines due to lighting mounted on the nacelles or natural sources of nighttime lighting.

DISTURBANCE

Marine birds may be disturbed by construction activities or operation and maintenance of offshore wind farms. Certain species groups such as seaducks and alcids may be more sensitive to disturbances such as vessel traffic, noise, and spinning WTG blades. Razorbills have been observed to flush from nest sites or resting areas in large numbers due to the approach of boats or due to other loud noises (Lavers et al., 2009). Some birds can be displaced up to hundreds of meters from the source of the activity (Gill, 2005). Alternatively, some groups of birds such as gulls are attracted to vessel activity due to association with fishing boats and potential foraging opportunities (Nisbet et al., 2017b; Hatch et al., 2009; Wiley and Lee, 2000; Dierschke et al., 2016). Gulls and terns and other similar bird groups are known to regularly forage near recreational fishing boats, ships, and other man-made structures. At the Nysted and Horns Rev facilities in Denmark, gulls were abundant in the construction area likely because of the increased vessel activity (Petersen et al., 2006). An increase in the presence of terns and gulls observed in areas around the Horns Rev offshore facility in Denmark was also believed to be associated with increased boat activity for maintenance (Petersen et al., 2006). Paton et al. (2010), indicated that gannets were concentrated around active fishing vessels within the OSAMP study area.

A summary of observations from operational wind farms in Europe indicated that areas with regular vessel and helicopter traffic for maintenance were avoided, either partly or completely, by sensitive species including divers and seaducks (Dierschke et al., 2016). At the Utgrunden wind farm, long-tailed ducks (*Clangula hyemalis*) and red-breasted mergansers (*Mergus serrator*) would flush from vessel traffic, and the long-tailed ducks would return to the same area about 30 minutes after the disturbance (Dierschke et al., 2016). Red-throated divers were believed to be displaced from the Alpha Ventus wind farm due to increases in maintenance vessel traffic after construction (Dierschke et al., 2016).

For some species like gulls, occurrence in wind farms was not correlated with operational activity; at Tuno Knob in Europe, blade movements and noise did not appear to impact common eider occurrence in the wind farm, roosting birds did not relocate when turbines were not spinning but then began to spin (Dierschke et al., 2016).

Shorebirds and terns may be sensitive to nearshore or onshore construction activities. In New York, the average flushing distance of non-incubating piping plover adults and juveniles in response to pedestrians, joggers, and vehicles was 18.7 m (61.4 feet), 19.5 m (64.0 feet), and 20.4 m (67.0 feet), respectively (USFWS, 1996). The recommended disturbance buffer around nest sites is typically a 50 m (164 feet) buffer (USFWS, 1996). A study investigating shorebird roost site selection at an important staging and over-wintering site in South Carolina indicated that of 8 species studied, red knots were relatively sensitive to vessel traffic. The authors determined that red knots avoided roosting at sites that experienced high average boat activity, and responded to boat activity within 1,000 m (3,280 feet) (Peters and Otis, 2007).

DISPLACEMENT/AVOIDANCE

Displacement impacts can be complicated and difficult to detect, and impacts may not be immediately observable or attributable to one source of disturbance. At European offshore facilities, displacement effects may be due to the presence of turbine structures and seem to be more pronounced when turbines are spinning, but displacement may also be attributed to boat traffic for maintenance of the wind farm (Dierschke et al., 2016). At offshore wind farms in Europe, species including red-throated loon, northern gannet, northern fulmar, and red-crested grebe showed either complete absence or a strong decrease in abundance post-construction, while others including red-breasted merganser and several gull species demonstrated a higher abundance post-construction; cormorants showed a large increase in abundance while their abundance was minimal during pre-construction (Dierschke et al., 2016). Differences between pre- and post-construction distribution data of long-tailed duck at Nysted were thought to be a result of a combination of a variety of factors including avoidance of the wind farm, disturbance from increased traffic, annual changes in food availability/distribution, and also potentially the presence of predators (Petersen et al., 2011, as cited by Willmott et al., 2013). Petersen et al. (2006) found that scoters were among species exhibiting complete avoidance of turbine areas, yet were numerous in the surrounding waters. At Tuno Knob in Denmark, aerial and ground surveys were used to compare the abundance of birds before and after the construction of the wind farm. These surveys suggested that while there were fewer birds post-construction at the wind farm, numbers remained stable at a control site (Guillemette et al., 1998). However, the change was believed to be due to differences in natural changes in food availability and not the presence of the wind facility. At Horns Rev, divers and scoters were less abundant post-construction than pre-construction (Drewitt and Langston, 2006). Loons and common scoters showed an increased avoidance of both the Horns Rev and Nysted facilities and this effect was documented at distances between 2 and 4 km (1.2–2.5 mi) from the facility (Petersen et al., 2006). Divers (e.g., loons) and seaducks (e.g., scoters) are among species considered more vulnerable to impacts due to displacement (Furness et al., 2013), likely because they seem to be more tied to specific foraging locations (Dierschke et al., 2016).

If displaced from preferred foraging habitat, increases in energy expenditure to access other habitats or to forage in less productive areas could ultimately lead to reduced survivorship and/or reduced reproductive success (McDonald et al., 2012, as cited by Willmott et al., 2013). Species with less restricted foraging habitat needs and diverse prey sources would be at less of a risk due to displacement (Willmott et al., 2013). Breeding birds that need to remain within range of nesting areas may be more susceptible to displacement impacts but non-breeding birds that are less restricted in their range may be able to use alternative foraging locations (Busch and Garthe, 2016). The species groups identified as most vulnerable to displacement with Willmott et al.'s (2013) disturbance sensitivity ranking system included seaducks, loons, and some alcids due to restrictions in their prey availability and high macro avoidance rates. Other bird groups ranked as highly sensitive to displacement were those that spend relatively more time in the area of interest, and/or feed or breed in that area. Jaegers in general appear to be less sensitive to displacement due to 0 percent macro avoidance; however, the lack of macro avoidance puts them at higher risk of collision. Species with the lowest (e.g., zero) displacement sensitivity scores were those that do not feed or rest on the OCS including passerines and most shorebird species (aside from phalaropes) (Willmott et al., 2013). The authors found that macro avoidance and habitat flexibility are important factors in a species' vulnerability to displacement. Displacement impacts at an offshore wind farm would depend on the quality and uniqueness of the location as a foraging habitat and the availability of other foraging areas (Dierschke et al., 2017). Kaiser (2002) used visual observation data in combination with statistical modeling to predict the change in over-winter mortality rates of common scoter because of displacement from potential feeding habitat due to avoidance of wind facilities in Liverpool Bay. The study indicated that the displacement of common scoter from areas around four of five wind facilities (existing, authorized, or proposed) would have no adverse effect to the over-winter mortality of the population. This study supports that species with habitat flexibility and variable prey sources would be at decreased risk of mortality, or other fitness-related impacts.

Mendel et al. (2014) conducted a digital analysis of aerial and ship-based transect surveys and a literature summary of pre-construction, construction, and post-construction data. Among bird groups studied (divers, gulls, gannets, alcids and kittiwakes), most species showed a decreased abundance during post-construction compared to pre-construction, and for those species with greater overall abundance throughout the wind farm and reference areas, most species were more abundant beyond 3 km (1.9 mi) of the wind farm. Divers appeared to actively avoid wind farm areas at distances of 1.1 km (0.7 mi) or greater, and divers showed no habituation at sites for which long-term studies were available for divers, even 5–6 years after operation (Mendel et al., 2014). Results were similar for gannets, they also did not enter wind farms post-construction and their closest observation was 1 km from outer WTGs (Mendel et al., 2014). Common guillemots (*Uria aalge*) and lesser black-backed gulls (*Larus fuscus*) were also less abundant within 2 km (1.2 mi) of wind farms. Variations in species reactions to the Alpha Ventus wind farm on different days and seasons was attributed to variable prey availability and weather conditions (Hill et al., 2014).

In some cases, birds were believed to be attracted to offshore wind farms rather than be displaced. At the Alpha Ventus wind farm, birds were observed on separate occasions perching on a WTG deck platform (20 m [66 feet] asl), including a group of cormorants, a peregrine falcon, a kestrel, and groups of pigeons (Hill et al., 2014). Offshore wind farms were believed to result in range expansion for cormorants further offshore because they were able to take advantage of above water structures for resting and drying feathers, but their observed attraction to offshore wind farms may have also been a result of increases in food availability (Dierschke et al., 2016). Displacement behaviors may be temporary if birds become habituated to the presence of the wind farm. In some instances, avoidance was observed by birds during the first years of operation but then abundance eventually increased, presumably due to increased prey availability around the underwater structures (Dierschke et al., 2016). Razorbill and common guillemot began to occur in wind farms after a few years of operation, possibly due to reef effect and changes in food supply or habituation (Dierschke et al., 2016). Herring gulls were observed foraging around turbines, and lesser black-backed gulls and great cormorants were observed foraging on invertebrates that had settled on foundations. Other species observed foraging in wind farms included divers and gannets, cormorants, terns, scoters, long-tailed ducks, and guillemots (Dierschke et al., 2016). Preliminary results at a wind farm in the United Kingdom showed displacement of red-throated loons during the first few years of monitoring from 2005 to 2008; however, data from consecutive monitoring in 2008 to 2009 showed the same abundance observed during pre-construction studies, with a slightly different distribution (Clough, 2012, as cited by Willmott at al., 2013). Red-throated loons are highly mobile in winter and may be better able to find alternative foraging sites following displacement; however, they show a strong stress response which would temporarily limit their ability to exploit new locations immediately after displacement (Dierschke et al., 2016).

Roseate terns were ranked with relatively high displacement sensitivity on the Atlantic OCS (Willmott et al., 2013). However, terns have been observed to continue using wind farm areas at existing offshore and near-shore facilities in Europe, during both migration and breeding periods. Post-construction radar studies during migration at the Nysted and Horns Rev wind farms in Denmark indicate that although the greatest levels of movement occurred outside of the wind farms, terns continued to migrate through the wind farm areas (Petersen et al., 2006). Visual data indicated that while most terns generally avoided the direct wind farm area, terns increased their use of the 2 km (1.2 mi) zone surrounding the facility (Petersen et al., 2006). Terns were observed foraging at the outer edges of the facility around turbine structures. Small flocks flew into the farm, but then exited the area after passing through the second row of turbines (Petersen et al., 2006). Sandwich terns (*S. sandvicensis*) entered the wind farm between two turbines more frequently when one or both turbines were not active (Petersen et al., 2006). Piping plover and red knot had zero displacement sensitivity rankings (Willmott et al., 2013); they do not forage or rest in the OCS. Passerines had the same ranking. While roseate terns had a relatively high displacement sensitivity ranking, data from offshore projects in Europe suggest terns do continue to occur in and around operational wind farms.

Based on preliminary analysis of ship-based avian survey data from the BIWF, estimated bird density did not vary significantly among segment groups pre-construction (adj. $R2 = 0.010$, $P = 0.230$, $F(2, 93) = 1.495$) but was significantly lower inside the turbine area during post-construction surveys (adj. $R2 = 0.232$, $P < 0.001$, $F(2, 69) = 11.73$) (Figure 0-1). The same pattern was evident for most species groups, although not statistically significant for most groups (Figure 0-2).

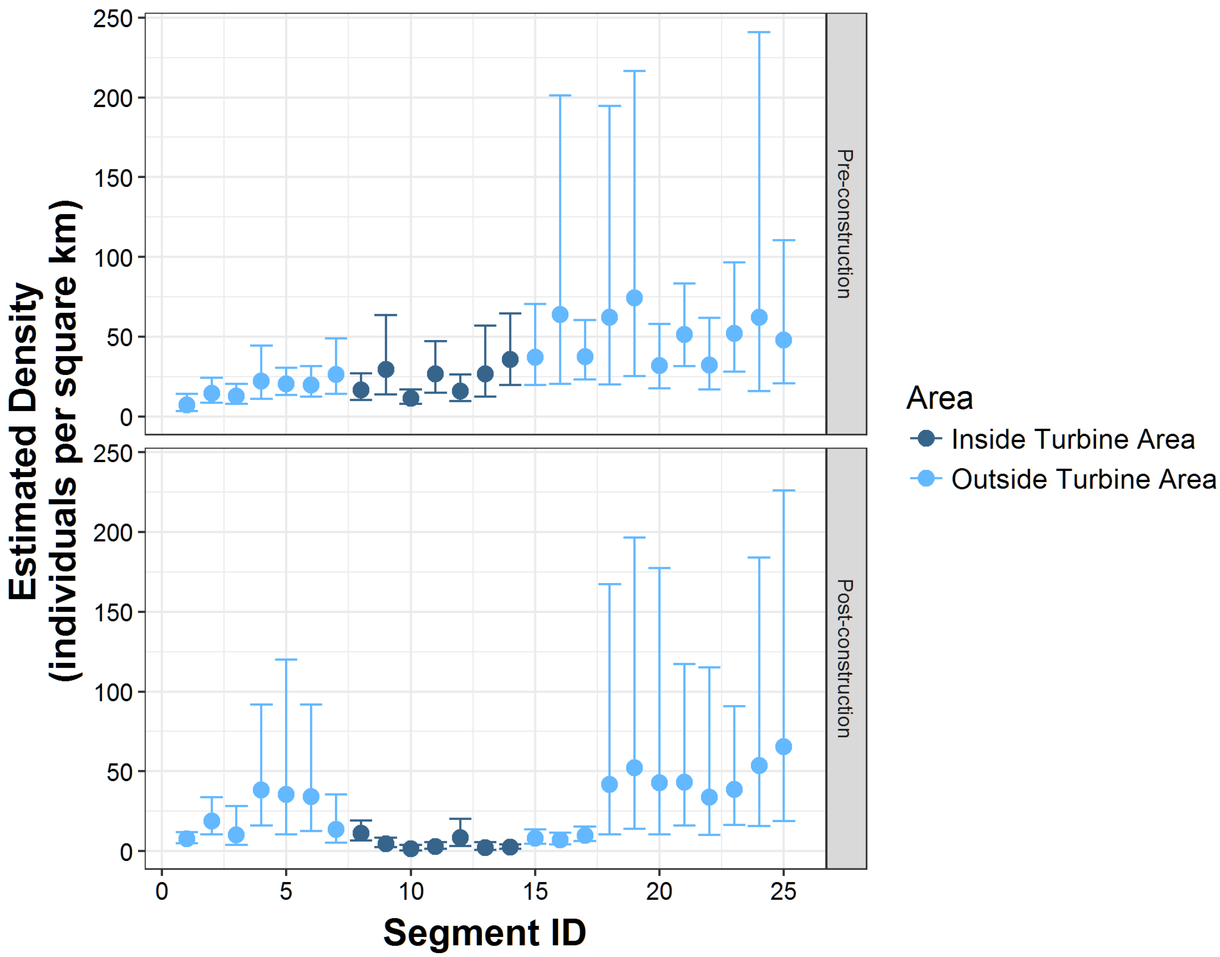

Figure 0-1. Avian density (combined species) per segment during pre- and post-construction avian ship-based surveys at the Block Island Wind Farm.

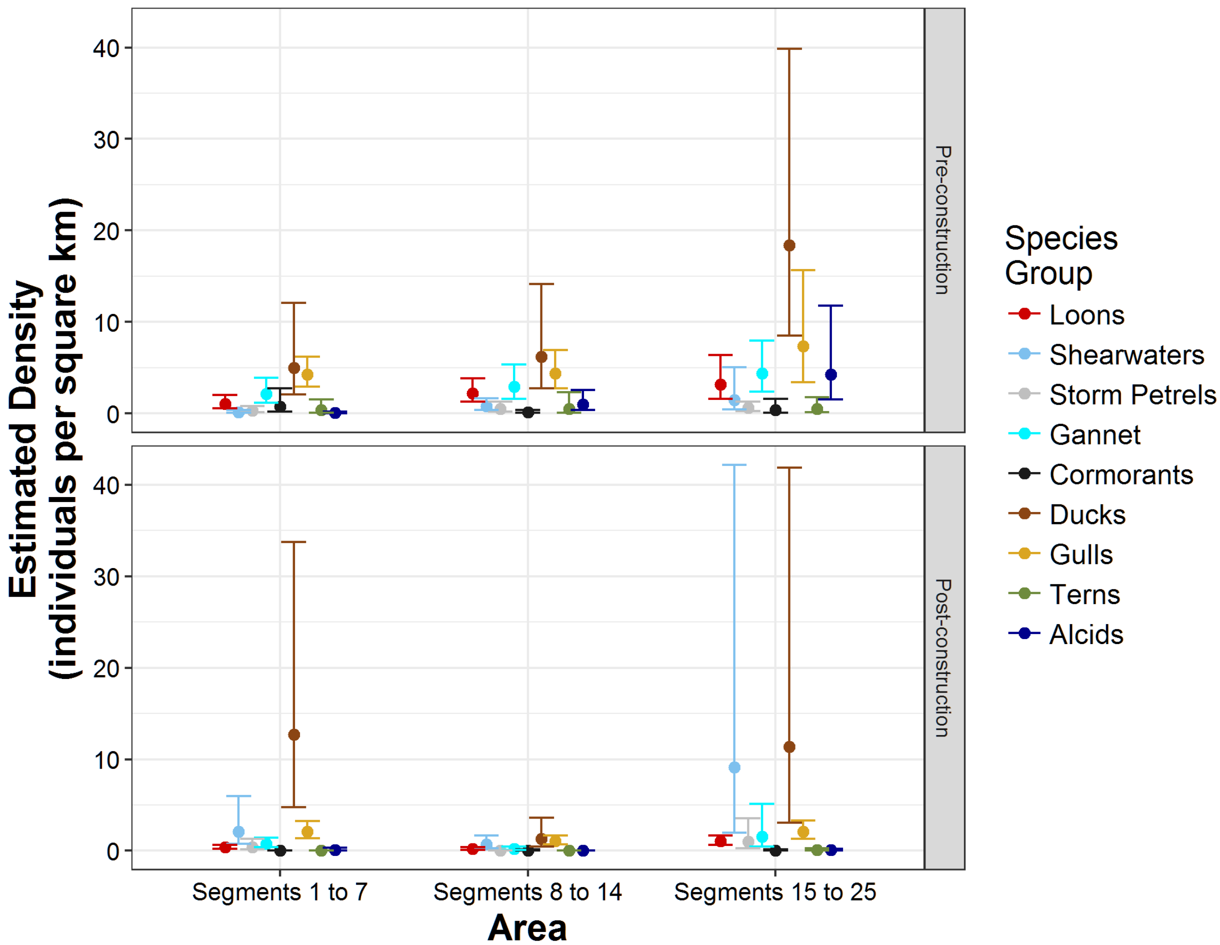

Figure 0-2. Avian density estimates for common species groups per segment group during pre-construction and post-construction avian ship-based surveys at the Block Island Wind Farm (error bars represent 95% confidence limits calculated from analysis of each independent survey transect).

BARRIER EFFECT

During migration movements or while commuting, the presence of WTGs may result in barrier effects to birds if they make either small- or large-scale avoidance movements around individual WTGs or around a wind farm area in general. At the wind facility in Kalmar Sound, Sweden, the post-construction migratory flight paths of ducks, geese, and cormorants shifted up to 2 km (1.2 mi) eastward from the path primarily used during pre-construction as the birds made efforts to avoid flying less than 1 km (0.6 mi) from WTGs (Pettersson, 2005). When the birds' increased energy expenditure was calculated, it was estimated that their migration flight path was extended by 1.2–2.9 km (0.7–1.8 mi) resulting in a 0.2–0.5 percent extension to their overall migration distance (Pettersson, 2005). In the Baltic Sea, common eiders were observed taking a detour to avoid a wind farm which resulted in a 500 m (1,640 feet) increase in an overall 1,400 km (870 mi) flight distance (Masden et al. 2009, as cited by Huppop et al., in press). Masden et al. (2009) estimated that cumulative increases in expenditure for avoiding 100 wind farms during migration would result in increased energy expenditure equating to 1 percent of a migrant bird's body mass. However, cumulative impacts may be greater for wintering seabirds avoiding a wind farm daily while traveling from roosting to foraging locations.

Visual confirmation and radar surveys during migration periods from 2003 to 2005 at the Nysted and Horns Rev offshore facility in Denmark observed shorebird migration through the facilities. The behavior of shorebirds flying towards the wind farm was noted for four flocks of shorebirds. Flocks of golden plover and oystercatcher passed above the WTGs, while a single whimbrel entered the wind farm at the height of the rotors and flew southward through the wind farm. A flock of curlews hesitated before entering the wind farm, then increased their flight altitude and their wing beat frequency to pass above the wind farm (Petersen et al., 2006). These observations suggest shorebirds may slightly increase energy expenditure to fly above or around offshore WTGs. The energy expended while birds make efforts to avoid offshore wind farms is believed to result in small increases in energy expended across their entire migration movements. The authors suggest the increased energy expended may be comparable to other increases in energy spent to avoid other hazards encountered during migration including adverse weather (Petersen et al., 2006; Dierschke et al., 2016) or low food availability (Dierschke et al., 2016).

Terns have been observed to continue using wind farm areas at existing offshore and nearshore facilities, during both migration and breeding periods. Common and arctic terns, observed flying near WTGs at a facility in Kalmar Sound, Sweden, flew between WTGs or right next to the WTGs instead of veering off in wide curves as waterfowl species were observed to do (Pettersson, 2005). Most birds were observed making slight alterations to their flight paths while traveling past WTGs to avoid approaching individual WTGs. At the Utgrunden wind facility in the Baltic Sea, long-tailed ducks were observed to fly between WTGs as they traveled between foraging locations (Pettersson, 2005).

BATS

BAT COLLISION RISK

Emerging data suggest bats regularly occur offshore, particularly during migratory periods. Historic records from lighthouses and ships, and recent acoustic and telemetry surveys suggest that several species of bats migrate offshore and use islands, ships, and other offshore structures as stopover sites during migration (Pelletier et al., 2013; Stantec, 2016b; Stantec, in prep; Dowling et al., 2017). Bats have been documented as far as 130 km (81 mi) off the coast of New Jersey (Stantec, 2016a); and in the late-summer, 2003, there was a group of Myotis roosting on a fishing boat 110 km (68 mi) from shore in the Gulf of Maine (Thompson et al., 2015, as cited by Dowling et al., 2017).

Bat acoustic studies at existing offshore wind projects in the Scandinavian Peninsula and southern Sweden and Denmark detected 11 species (out of 18 potential species) flying over the ocean up to 14 km from shore (Ahlén, 2006, Ahlén et al. 2007, 2009, as cited by Pelletier et al., 2013). Acoustic detectors recorded bats at all 12 offshore wind turbines monitored. Bat migration and foraging over marine environments appeared to be common, and species not previously thought to be migratory were detected offshore during migration.

European studies (Ahlén, 2006; Ahlén et al., 2007, 2009; Hutterer et al., 2005, as cited by Pelletier et al., 2013) have documented bat migration across areas in the Baltic Sea between Scandinavia and mainland Europe, as well as bats foraging on insects around offshore turbines and possibly also on crustaceans on the sea surface. Bats may forage offshore either during migration or during the summer, possibly taking advantage of suitable foraging conditions or seasonal insect prey availability (Pelletier et al., 2013). At an offshore wind farm in the Baltic Sea, Sweden, nocturnal radar data showed *Nyctalus noctula* foraging at sea and returning to land before dawn (Ahlén et al., 2009).

It is possible that the timing and distributions of insect migrations offshore influence bat activity offshore (Pelletier et al., 2013). Both terrestrial insects, that travel offshore, and insects that hatch from the water may provide food sources for bats (Ahlén et al., 2007, 2009, as cited by Pelletier et al., 2013). Additionally, Ahlén et al. (2009) observed two bat species taking prey from the water surface where net samples to investigate food sources collected crustaceans but no insects. Bats roosted and foraged on and near existing turbines in the Baltic Sea, and insects were found to accumulate around turbines (Ahlén et al., 2007, 2009, as cited by Pelletier et al., 2013).

Because bats occur in the offshore environment, there is a risk of collision with offshore WTGs. As discussed above for birds, there is currently no way to confirm bat collision rates at offshore WTGs; however, there are emerging remote sensing technologies that are being used to investigate collision risk. At the Nysted wind facility in Denmark, researchers recorded 17 thermal video images at one offshore WTG, 2 of these were confirmed images of bats, and one animal (bird or bat) was observed to collide with a moving blade and fall out of frame (Petersen et al. 2006, as cited by Huppop et al., in press).

Bats are considered less at risk of collision with stationary objects than birds as they are known to travel using echolocation (Schnitzler et al., 2003). However, bats are susceptible to spinning blades and more importantly, may be seasonally attracted to wind turbines (Kunz et al., 2007). The attraction to tall structures by bats for roosting and mating has been documented at coastal and offshore lighthouses and other tall, manmade structures (Pelletier et al., 2013) as well as offshore wind turbines (Ahlén et al., 2007; Ahlén et al., 2009; Stantec, 2016b). Insect activity around a constant (non-blinking) lighthouse tower light on Sequin Island was believed to attract foraging bats (Stantec, 2016a; Pelletier et al., 2013). Offshore structures, like ships at sea, provide potential roosting platforms and benefit to exhausted bats during long-distance migration. During construction of the WTGs at BIWF, crew members from the construction vessels made multiple observations of bats roosting on construction vessels during the day (Stantec, 2016b).

Onshore wind power is now being considered a potentially significant source of mortality for migrating bats based on the results of post-construction monitoring studies (Williams, 2003; Johnson and Strickland, 2004; Kerns and Kerlinger, 2004; Arnett et al., 2005; Curry and Kerlinger, 2007; Kunz et al., 2007; Arnett et al., 2008). Bat fatality has been notably high at some onshore wind farms, with as many as 70 bats per turbine per year (Arnett et al. 2008; Rydell et al. 2010a and Brinkmann et al. 2011, as cited by Huppop et al., in press). Several North American bat populations are declining, and bats are slow to reproduce, with most North American species having only one or two pups per year making them more vulnerable to impacts (Arnett et al., 2013).

Long-distance migrants such as eastern red bat, hoary bat and silver-haired bat have represented most fatalities at onshore wind projects in North America; however, other non-migratory species such as *Myotis* (including the federally threatened northern long-eared bat), big brown bat, and tri-colored bat have been documented during onshore fatality surveys as well (Kunz et al., 2007; Gruver and Bishop-Barros, 2015). Emerging data suggest all of these species occur off the Atlantic Coast, including locations in the OCS (Stantec, 2016a; Stantec, 2016b; Stantec, in prep).

Because key factors such as seasonal occurrence and species use at onshore and offshore locations likely differ, it is not expected that observed impacts at onshore facilities are directly transferable to offshore wind farms. However, emerging data suggests that several species of bats occur in the offshore environment and the same mechanisms that influence risk at onshore WTGs may apply to risk at offshore WTGs.

BAT AVOIDANCE/ATTRACTION BEHAVIORS

Several hypotheses regarding bats' vulnerability to collision with onshore wind turbines have been proposed. Bats are more likely to be attracted to WTGs than to avoid them. Bat acoustic call characteristics recorded at a research platform at a wind farm in the Baltic Sea suggested foraging and exploratory behaviors (Huppop and Hill 2016, as cited by Huppop et al., in press).

Bats may be attracted to wind turbines due to curiosity about motion or noise from turbines, or potential roosting opportunities on turbine structures (Stantec, 2016a). Bats are known to use echolocation both over land and water for orientation as well as for hunting insect prey (Schnitzler et al., 2003; Ahlén et al., 2009). However, while they may be able to visually or acoustically detect stationary towers, they may not be able to, at the same time, detect the moving blades. Insects may concentrate around turbines due to lighting or the heat of the nacelles, which could in turn attract bats to turbines for foraging opportunities.

BAT FLIGHT HEIGHT

There is limited information regarding bat flight heights in the OCS. During Biodiversity Research Institute's mid-Atlantic offshore baseline survey project, the researchers documented 17 bats offshore (mostly eastern red bats) either during boat-based or high-resolution video aerial surveys. Bats were detected 16–70 km (10–43 mi) offshore. All bats were seen migrating during the day during good weather conditions, and most of those bats seen during video aerial surveys were flying several hundred meters above sea level (Hatch et al., 2013, as cited by Williams et al., 2015).

Bat flight behavior was documented during a 2005 to 2006 study at the Utgrunden wind farm in Kalmar Sound, Sweden (located near a lighthouse) using radar, visual surveys, and acoustic surveys. Researchers documented activity patterns onshore as well as at the base of offshore turbines. Flight heights were believed to be influenced by the presence of insects because bats typically flew at heights of less than 40 m (131 feet) above the surface, and were observed foraging at the top of wind turbines (Ahlén et al., 2007, as cited by Pelletier et al., 2013). Bats have been observed to quickly change their flight height in response to tall vertical structures in marine environments such as ships, bridges, and wind turbines (Ahlén et al., 2007, 2009, as cited by Pelletier et al., 2013).

Bats may find the lower wind speeds at the water surface preferable for flight (Pelletier et al., 2013). In Sweden, Rydell (1986) found that the northern bat (*Eptesicus nilssoni*) typically flew 2–5 m (7–16 feet) above the surface of lakes. Even the typically high flying common noctule (*Nyctalus noctula*) (known to fly as high as 1,200 m [3,937 feet] over land) flew lower than 10 m (33 feet) above the surface (Ahlén et al., 2007, 2009, as cited by Pelletier et al., 2013). In the Baltic Sea, bats generally flew close to the surface (between 0 and 10 m asl), possibly using echolocation off the surface for navigation (Ahlén et al., 2007, 2009, as cited by Pelletier et al., 2013).

While there is limited data regarding bat flight heights offshore in the U.S., post-construction fatality data and acoustic data collected at onshore wind sites indicate that bats do fly at heights within the RSZ of modern wind turbines. The species primarily detected at these greater heights during acoustic surveys, and found most frequently during fatality surveys, include long-distance migrants such as hoary bats, eastern red bats, and silver-haired bats (Stantec, unpublished data; Arnett et al., 2008). However, fatalities of species of *Myotis*, including northern long-eared bat have been documented at onshore wind projects, and acoustic detections of these species have been documented at heights at, or approaching, the RSZ (Stantec, unpublished data).

CHANGES TO FORAGING/ROOSTING HABITAT

At offshore wind projects, it is possible bats will investigate the tall structures on an otherwise flat landscape for roosting opportunities or for navigational purposes, which could increase their risk of collision with turbine blades. In the Scandinavian Peninsula, southern Sweden, and Denmark, Ahlén et al. (2009) observed bats roosting on WTGs, ships, bridges, and lighthouses during migration over offshore, island, and coastal locations. Bats were observed roosting on a group of wind turbines 5.8 km (3.6 mi) offshore as well as foraging over the adjacent waters. Bats were observed roosting in turbine nacelles (Ahlén et al., 2009, as cited by Pelletier et al., 2013). During installation of WTGs at the BIWF, crew members from the construction vessels provided multiple reports of bats roosting on the construction vessels during the day (Stantec, 2016b).

WEATHER

Specific weather conditions may contribute to bat collisions with wind turbines. Low cloud cover or thermal inversions following the approach of fronts may influence bats to fly at lower altitudes when migrating (Kunz et al., 2007). Post-construction studies, at onshore facilities in North America that investigated relationships between bat fatalities and weather patterns found that most bats were killed on nights with low wind speeds (< 6 m/s [13 mph]) and that fatalities increased immediately before and after passage of storm fronts (Arnett et al., 2008).

Although bat collision mortality has been documented during inclement weather (Johnson et al., 2004), collisions at onshore facilities occur most frequently on nights with wind speeds of less than 4–6 m/s (9–13 mph) (Arnett et al., 2005; Kunz et al., 2007; Arnett et al., 2008). Mortality data from onshore wind farms indicate that bat collision mortality is expected to occur mainly on nights with calm winds during migratory periods, when relatively more bats are migrating at greater altitudes in favorable conditions. Onshore, low cloud cover or thermal inversions following the approach of fronts may influence bats to fly at lower altitudes when migrating (Kunz et al., 2007). It is assumed that bats would use the same flight behaviors when traveling during these same conditions over the water; however, once over water, they may have less flexibility in choosing conditions during which to fly due to limited roosting opportunities.

Cryan and Brown (2007) determined that certain weather factors influence the timing of migratory hoary bat occurrence at an island migration stop-over location in the Pacific. Low wind speeds, low moon light, overcast conditions, and low barometric pressure were associated with bat arrivals and departures. Island arrivals were most associated with passing storm fronts in autumn (Cryan and Brown, 2007). Based on acoustic data collected up to 22 km (14 mi) offshore of the mid-Atlantic, Sjollema (2011) found that bat activity decreased as wind speed increased. Over the Baltic Sea, most bat activity took place at wind speeds less than 5 m/s (11 mph); foraging bats were generally observed during relatively calm conditions (Ahlén et al., 2007, as cited by Pelletier et al., 2013).

Based on Stantec's 2009 to 2014 acoustic study at coastal and offshore locations in the Gulf of Maine, mid-Atlantic, and Great Lakes regions, wind speed and temperature were found to influence patterns in acoustic bat activity. Increases in nightly mean wind speed had a negative effect on bat activity while temperature had a positive effect on bat activity, particularly between 10 and 20°C (50–68°F) (Stantec, 2016a). The effect of wind speed and temperature on bat activity is seasonally variable: during summer, nightly bat activity is likely linked to foraging behavior, and cold temperatures or high winds are likely to reduce prey availability; during fall migration, however, bats may take advantage of favorable wind directions and may be more likely to fly during colder weather (Stantec, 2016a).

During the BIWF post-construction bat acoustic survey, 99 percent (n = 1,079) of bat passes (recorded during periods for which weather data was also available) occurred when wind speeds were < 5.0 m/s (11 mph) (Stantec, in prep). Three hundred and fifty-nine (33%) bat passes occurred when wind speeds were 0.0 m/s, influenced by the large number of bat passes recorded on September 16, 2017 when wind speeds were 0.0 m/s for most of the night. Species group composition was generally consistent regardless of wind speed (Stantec, in prep). Bat activity had a positive relationship with warmer temperatures (91% of bat activity was recorded when temperatures were ≥ 15.0°C), with very little bat activity documented when temperatures were below 15.0°C (Stantec, in prep). During the Fugro bat acoustic survey for the SFWF, 82 percent (n = 736) of recorded bat passes for which corresponding weather data were available occurred when wind speeds were < 5.0 m/s and temperatures were ≥ 15.0°C; very little bat activity was recorded when temperatures were below 15.0°C (Stantec, in prep).

VISIBILITY AND LIGHTING

Artificial lighting may attract bats, most likely by attracting their insect prey. At the island stop-over in the Pacific, Cryan and Brown (2007) found that high intensity lights emitted from a lighthouse on the island was believed to influence the presence of migratory bats at this location. Pelletier et al. (2013) indicated that the constant light source from a lighthouse on Sequin Island was believed to attract insects which, in turn, attracted bats to forage. The Seguin Island location, located 3.9 km (2.4 mi) offshore, documented a relatively high number of bat passes. This study site was unique among other locations because it was the only lighthouse included in the survey where the beacon was constantly lit and did not flash (Pelletier et al., 2013). Aviation lighting on WTGs has not been shown to influence bat fatalities at existing onshore wind farms (Cryan and Brown, 2007).