New England Wind Project Biological Assessment

December 2022

For the U.S. Fish and Wildlife Service

U.S. Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Programs

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Acronyms and Abbreviations

Acronym	Definition
ADLS	aircraft detection lighting system
BA	biological assessment
BITS	Block Island Transmission System
BIWF	Block Island Wind Facility
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
COP	Construction and Operations Plan
DOI	U.S. Department of the Interior
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESP	electrical service platform
FAA	Federal Aviation Administration
FW	federal waters
HDD	horizontal directional drilling
hrs	hours
IPaC	Information for Planning and Consultation
km	kilometer
m	meter
m/sec	meter per second
MA WEA	Massachusetts Wind Energy Area
MW	megawatt
NA	not applicable
NORIEZ	northeast offshore renewable energy innovation zone
OCS	Outer Continental Shelf
OECC	offshore export cable corridor
OECR	onshore export cable route
ROW	right-of-way
rpm	revolutions per minute
RSZ	rotor swept zone
SCRAM	Stochastic Collision Risk Assessment for Movement
SCV	South Coast Variant
sq km	square kilometer
sq m	square meter
SWDA	Southern Wind Development Area
take	fatality due to collision with a rotating wind turbine generator blade
USFWS	U.S. Fish and Wildlife Service
WEA	wind energy area
WTG	wind turbine generator

1. Introduction

Pursuant to Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, the Bureau of Ocean Energy Management (BOEM) requests informal consultation with the U.S. Fish and Wildlife Service (USFWS) regarding the species that may be affected by the approval of a construction and operations plan (COP) for the New England Wind Project (Proposed Action or Project) within the Rhode Island and Massachusetts Lease Areas (RI/MA Lease Areas) on the Outer Continental Shelf (OCS) (Figure 1-1).

This biological assessment (BA) has been prepared pursuant to the ESA to evaluate potential impacts of the Proposed Action on ESA-listed species. This BA provides a comprehensive description of the Proposed Action, defines the Action Area, describes those species potentially affected by the Proposed Action, and provides an analysis and determination of how the Proposed Action may affect listed species and/or their habitats. The activities BOEM is considering include approving the COP for the construction and installation (construction), operations and maintenance (operations), and conceptual decommissioning (decommissioning) of the proposed offshore wind energy facility with a maximum nameplate capacity of up to 2,600 megawatts (MW), as well as associated submarine and upland cables connecting the wind facility to the proposed substations located in Barnstable and/or Bristol County, Massachusetts. Onshore support facilities would be located at existing waterfront industrial or commercial sites within Massachusetts. This document assesses impacts on endangered and threatened species listed under the ESA that are under the oversight of the USFWS from the construction, operations, and decommissioning of a project located within all of BOEM's Renewable Energy Lease Area OCS-A 0534 and potentially a portion of Lease Area OCS-A 0501,[1] hereafter referenced as the Southern Wind Development Area (SWDA).

The lease between Park City Wind, LLC (applicant) and BOEM (Lease OCS-A 0534) has an operations term of 33 years that commences on the date of COP approval; see also Code of Federal Regulations, Title 30, Section 585.235(a)(3) (30 CFR § 585.235(a)(3)). The operations term includes the construction, operations, and decommissioning stages of the Proposed Action.

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[1] The developer of the Vineyard Wind 1 Project (Vineyard Wind 1, LLC) will assign spare or extra positions in the southwestern portion of OCS-A 0501 to Park City Wind for the New England Wind Project if those positions are not developed as part of the Vineyard Wind 1 Project.

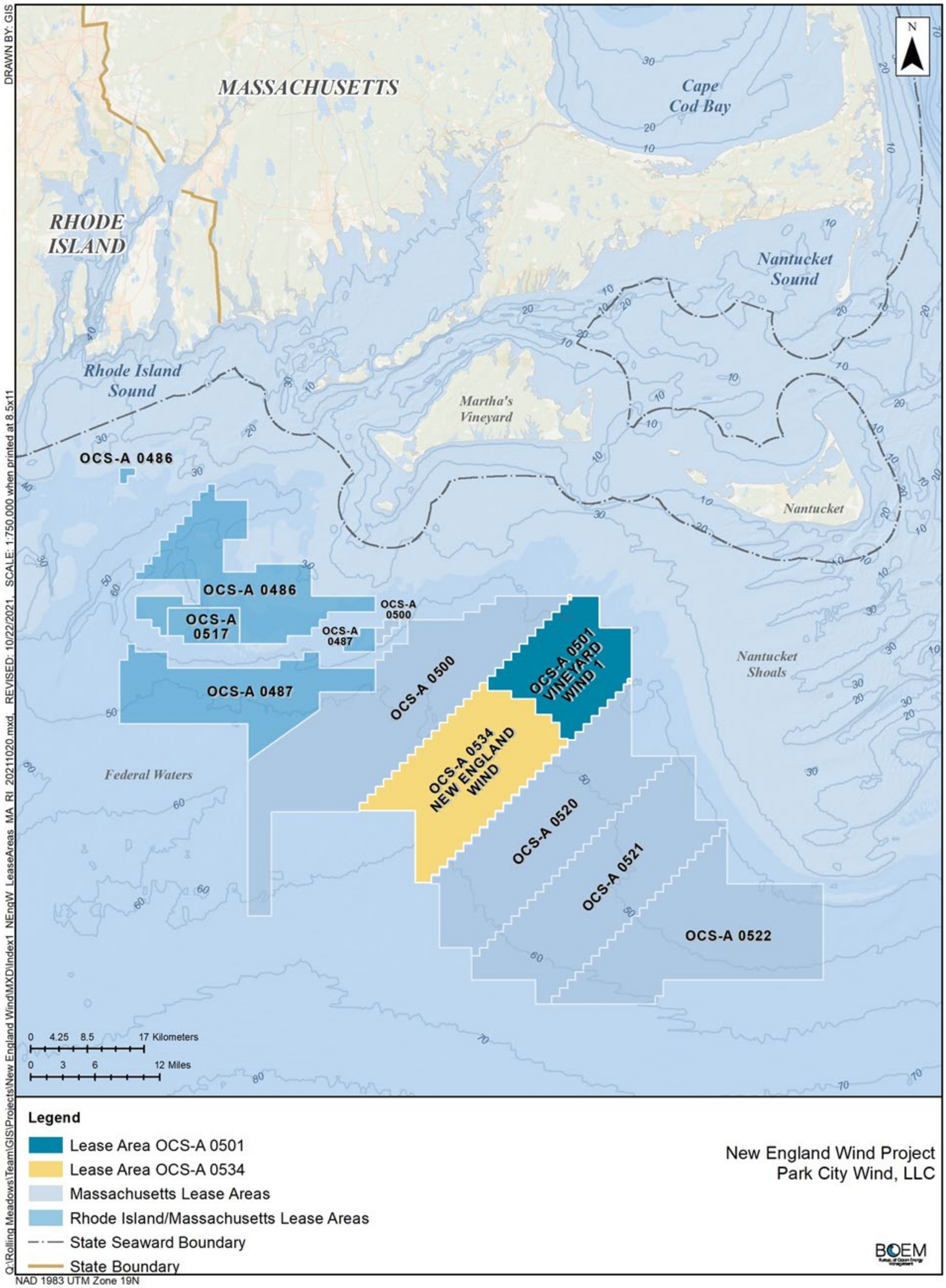

Figure 1-1: Proposed Action Area Relative to Rhode Island and Massachusetts Lease Areas

1.1 Background

BOEM's evaluation of the Atlantic coast for offshore wind development began in 2009 with public stakeholder outreach and desktop screening analysis. As part of this effort, BOEM began an initiative to identify areas compatible with offshore wind energy on a state-by-state basis. After these initial efforts, BOEM conducted the following activities related to the planning and leasing on the OCS offshore Massachusetts:

- In December 2010, BOEM published a Request for Interest in the *Federal Register* to determine commercial interest in wind energy development offshore Massachusetts (75 Fed. Reg. 82055 [December 29, 2010]). BOEM invited the public to comment and provide information on environmental issues and data for consideration in the Request for Interest area and solicit interest in offshore wind energy development. Responding to requests received from the public and the Commonwealth of Massachusetts, BOEM re-opened the comment period in March 2011. In total, BOEM received 11 indications of interest from 10 companies interested in obtaining a commercial lease. BOEM also received 260 public comments; in response to those comments and after taking into consideration navigation and commercial fisheries concerns, BOEM modified the planning area by making it 40 percent smaller than the original area.

- In February 2012, BOEM published a Call for Information and Nominations in the Fed. Reg. to identify lease block locations in which there was industry interest to seek commercial leases for developing wind energy projects (77 Fed. Reg. 5821 [February 6, 2012]). In the same month, BOEM published a Notice of Intent to prepare an environmental assessment for commercial wind leasing and site assessment activities offshore Massachusetts. The comment period for the Call for Information and Nominations yielded 32 comments and 10 nominations of interest. The comments prompted BOEM to exclude additional areas within the Massachusetts federal lease areas, including an area of high sea duck concentration, as well as an area of high-value fisheries. As a result of the environmental assessment process, BOEM issued a "Finding of No Significant Impact," which concluded that reasonably foreseeable environmental impacts associated with the commercial wind lease issuance and related activities would not significantly affect the environment.

- In June 2014, the U.S. Secretary of Interior and BOEM's Acting Director joined the Massachusetts Governor to announce that more than 742,000 acres offshore of Massachusetts in federal waters would be available for commercial wind energy leasing. This area is referred to as the MA WEA.

- In January 2015, BOEM held a competitive lease sale for the lease areas within BOEM's MA WEA. Vineyard Wind LLC (Vineyard Wind) won Lease Area OCS-A 0501 in the auction (Figure 1-1). This lease area is 166,886 acres.

- On June 28, 2021, BOEM approved the assignment of 65,296 acres of Lease Area OCS-A 0501 to Vineyard Wind 1, LLC. The assigned lease continues to be designated Lease Area OCS-A 0501. The remaining 101,590 acres, which are designated Lease Area OCS-A 0534 and where the majority of the Proposed Action would be developed, were assigned to the applicant (Draft Environmental Impact Statement [EIS]) Figure 1.1-1 [BOEM 2022]).[2] A small portion of Lease Area OCS-A 0501 not used for development of the Vineyard Wind 1 Project may be developed as part of the New England Wind Project. The applicant has the exclusive right to submit a COP for activities within Lease Area OCS-A 0534.

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[2] Except for the description of leased area, which now reflects the two different lease areas, the terms, conditions and stipulations of the two leases, including the lease effective date of April 1, 2015, remain the same.

The applicant submitted its Draft COP for the Proposed Action to BOEM for review in July 2020. The applicant resubmitted a Revised Draft COP (COP addendum) in December 2021. The Draft COP and the COP addendum is available for viewing at BOEM's Project-specific website.[3] Additional details regarding the Proposed Action are included in the Draft EIS Chapter 2, Proposed Action and Alternatives (BOEM 2022).

1.2 Consultation History

This informal consultation for the Proposed Action builds on BOEM's experience with similar but larger -scale offshore wind development projects on the Atlantic coast.

On March 24, 2011, BOEM requested informal ESA Section 7 consultation with the USFWS for lease issuance and site assessment activities off New Jersey, Delaware, Maryland, and Virginia. On June 20, 2011, the USFWS concurred with BOEM's determinations that the risk to the Roseate Tern (*Sterna dougallii*), Piping Plover (*Charadrius melodus*), Bermuda Petrel (*Pterodroma cahow*), and Rufa Red Knot (*Calidris canutus rufa*) regarding lease issuance, associated site characterization (survey work), and site assessment activities (construction, operations, and decommission of buoys and meteorological towers) was "small and insignificant" and, therefore, **not likely to adversely affect** the three ESA-listed species and one candidate species.

On October 19, 2012, BOEM requested informal ESA Section 7 consultation with the USFWS for lease issuance and site assessment activities off Rhode Island and Massachusetts. On November 1, 2012, the USFWS concurred with BOEM's determination that the Proposed Action is **not likely to adversely affect** the endangered Roseate Tern, threatened Piping Plover, and the candidate Rufa Red Knot. To evaluate collision risk, the USFWS recommended the placement of visibility sensors on the meteorological towers to collect data on the occurrence, frequency, and duration of poor visibility conditions. To date, no meteorological towers are on the OCS.

On February 12, 2014, BOEM requested informal ESA Section 7 consultation with the USFWS for lease issuance and site assessment activities offshore North Carolina, South Carolina, and Georgia. On March 17, 2014, the USFWS concurred with BOEM's determination that commercial wind lease issuance and site assessment activities would **not likely adversely affect** the Bermuda Petrel, Kirtland's Warbler (*Setophaga kirtlandii*), Roseate Tern, Piping Plover, and Rufa Red Knot.

BOEM was also involved in consultation with the USFWS regarding the construction, operations, and decommissioning of offshore wind turbines for the Cape Wind Energy Project in federal waters of Nantucket Sound, Massachusetts. The USFWS biological opinion concluded that the proposed Cape Wind Energy Project was not likely to jeopardize the continued existence of the Piping Plover and Roseate Tern and that, in all cases except collisions, the impacts were insignificant or discountable and would not result in take (mortality) of Roseate Terns and Piping Plovers (USFWS 2008).

In addition, BOEM was a cooperating agency with the U.S. Army Corps of Engineers, which informally consulted with the USFWS on the Deepwater Wind Block Island Wind Facility (BIWF) and Block Island Transmission System (BITS). The BIWF is comprised of five, 6 MW wind turbines within 3 miles of Block Island, Rhode Island. On July 31, 2013, the USFWS concurred that the proposed BITS and BIWF were **not likely to adversely affect** the American burying beetle (*Nicrophorus americanus*), Roseate Tern, Piping Plover, or Rufa Red Knot "due to insignificant (should never reach the scale where take occurs) and discountable (extremely unlikely to occur) effects."

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[3] The Draft COP can be reviewed at https://www.boem.gov/renewable-energy/state-activities/new-england-wind-formerly-vineyard-wind-south.

Starting in 2018, BOEM conducted an information consultation with USFWS for Vineyard Wind 1 Offshore Wind Energy Project comprised of up to 100 turbines. On July 8, USFWS sent a draft letter concurring with BOEM's determination that this activity may affect, but is not likely to adversely affect, Roseate Terns, Piping Plovers, and/or Red Knots. On September 2, 2020, USFWS found the onshore activity of clearing forest for the substation consistent with activities analyzed in the Service's January 5, 2016 Programmatic Biological Opinion for Northern long-eared bat (Consultation Code: 05E1NE00-2019-TA-1790). On September 3, 2020, BOEM sent an updated BA to USFWS for concurrence. The USFWS provided an ESA concurrence letter to BOEM dated October 16, 2020, for the Vineyard Wind 1 Offshore Wind Energy Project.

For the South Fork Wind Farm, BOEM provided a draft BA to the USFWS via email correspondence on January 8, 2021, for review and/or concurrence. In this document, BOEM indicated that the activity may affect, but is not likely to adversely affect, Roseate Terns, Piping Plovers, Rufa Red Knots, Northern long-eared bats (*Myotis septentrionalis*), and seabeach amaranth (*Amaranthus pumilus*). On February 1, 2021, BOEM provided supplemental information regarding the Montauk Operations and Maintenance Facility and Horizontal Directional Drilling, although the original effect determinations were not changed. The USFWS provided an ESA concurrence letter to BOEM dated March 4, 2021, for the South Fork Wind Farm Project.

On November 30, 2021, in preparation for the Draft EIS for the Proposed Action and this BA, BOEM used USFWS's Information for Planning and Consultation (IPaC) system to determine if any ESA-listed, proposed, or candidate species may be present in the proposed Action Area (Appendix A, U.S. Fish and Wildlife Service Information for Planning and Consultation Report). While the report states "there are no endangered species in this location…[and] there are no critical habitats in this location" for the Action Area associated with the SWDA, the Draft EIS considered the possibility that ESA species may pass over the SWDA during migration (BOEM 2022). The IPaC reports identify eight ESA-listed species with potential to occur in the Action Area: northern long-eared bat (*Myotis septentrionalis*), Piping Plover, Rufa Red Knot, Roseate Tern, Plymouth red-bellied turtle (*Pseudemys rubriventris bangsi*) monarch butterfly (*Danaus plexippus*), American chaffseed (*Schwalbea americana*), and sandplain gerardia (*Agalinus acuta*) (Appendix B, Species Conclusions Table).

This BA assesses all aspects of the Proposed Action, including construction, operations, and decommissioning on USFWS-listed species. BOEM is requesting concurrence (within 30 days) on BOEM's conclusions that the impacts of the proposed activities are expected to be discountable and insignificant, and, thus, **not likely to adversely affect** Piping Plover, Rufa Red Knot, Roseate Terns, and northern long-eared bats, and no critical habitat designated for these species would be affected by the proposed activities. Further, the impacts, if any of the proposed activities are expected to be discountable and insignificant, and, thus, **not likely to adversely affect** American chaffseed and sandplain gerardia, and no critical habitat has been designated for these species. Should proposed activates occur in Bristol County, as described in Section 2.2, BOEM will re-initiate consultation regarding the Plymouth red-bellied turtle, though impacts, if any, would be expected to be insignificant and discountable.

2. Description of the Proposed Action

The Proposed Action would include the construction, operations, and decommissioning of an up to 2,600 MW wind energy facility and associated export cables on the OCS offshore from Massachusetts (Figure 1-1). The Proposed Action would include construction of both offshore and onshore facilities. The Proposed Action is being developed and permitted using the Project design envelope concept, allowing flexibility in Project elements while ensuring a timely and thorough environmental review. COP Volume I, Section 3.0 (Epsilon 2022) provides further discussion of construction methods and schedule, which this document summarizes below. The Proposed Action would be developed in two phases (Figures 2-1 and 2-2).

2.1 Offshore Facilities

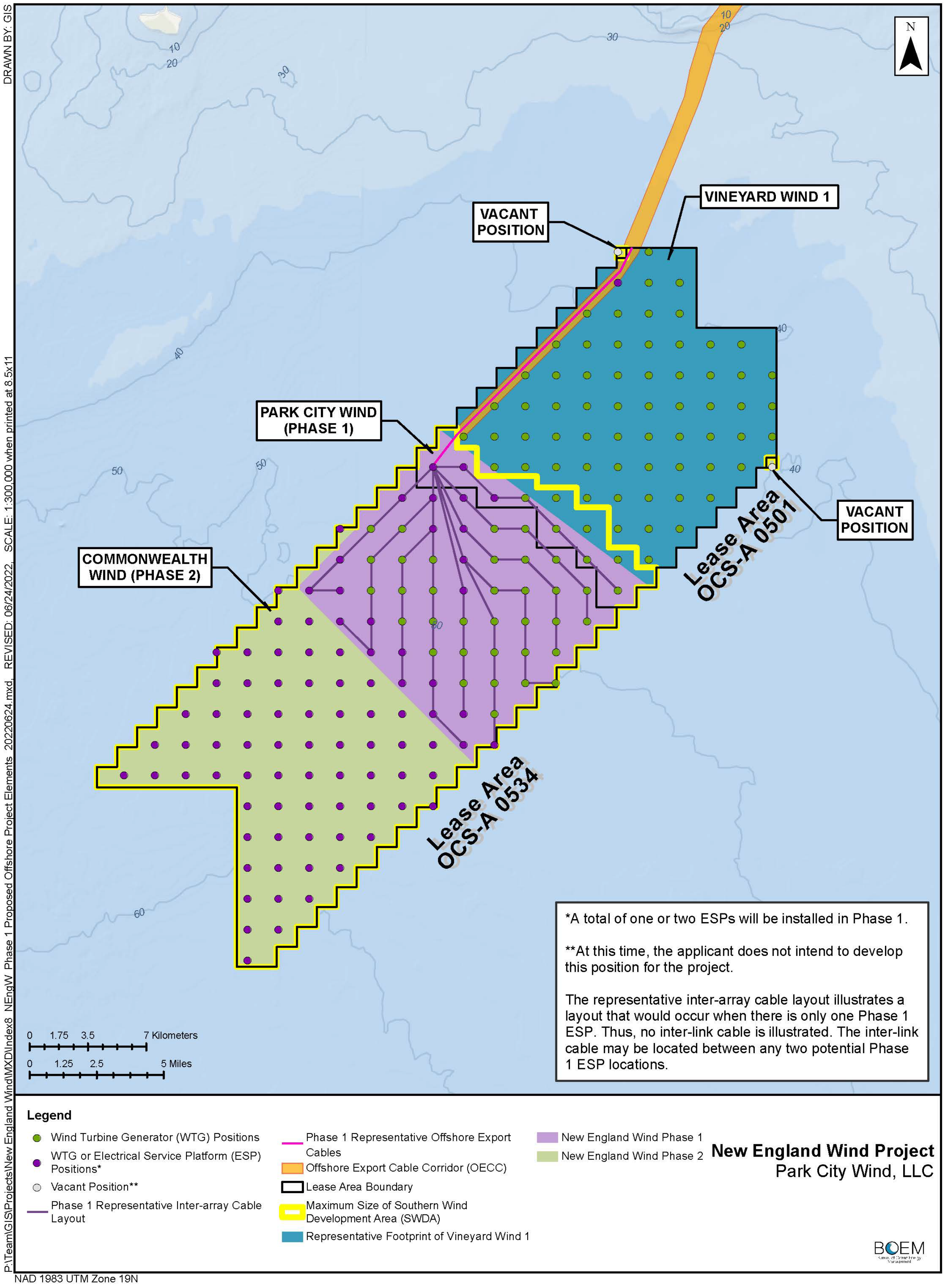
Proposed offshore Project elements include wind turbine generators (WTG) and their foundations, electrical service platforms (ESP) and their foundations, scour protection for all foundations, inter-array cables that connect the WTGs to the ESPs, the inter-link cable that connects the ESPs, and the export cable to the landfall location. The proposed offshore Project elements are located within federal waters with the exception of a portion of the export cable located within state waters. The COP (Volume I; Epsilon 2022) describes construction methods in detail.

2.1.1 Wind Turbine Generators

The applicant would erect up to 130 WTGs and ESPs within the SWDA (Figures 2-1 and 2-2). Based on the Project design envelope, the applicant would mount WTGs on monopile or jacket foundations for Phase 1 and monopile, jacket, or bottom-frame foundations for Phase 2. A monopile is a long steel tube driven up to 180 feet into the seabed. A jacket foundation is a latticed steel frame with three or four supporting pin piles driven up to 279 feet into the seabed. Monopiles for Phase 2 would be similar to those described in Phase 1. Phase 2 jacket foundations could be installed either with pin piles (as described for Phase 1) or suction buckets. If suction buckets are used, there would be three buckets to penetrate the seafloor bottom up to 49 feet. A bottom-frame foundation has a triangular space-frame type structure secured to the seafloor, which could use either pin piles or suction buckets. If pin piles are used, there would be three piles driven up to 279 feet into the seabed and suction buckets to penetrate up to 49 feet into the seabed. Additional schematic drawings and photos of proposed foundation types are included in the COP (Volume I, Section 4.2.1.1; Epsilon 2022).

Tables 2-1 2-2 summarize the range of pertinent WTG characteristics provided in the Project design envelope. See COP Volume 1, Section 3.2.1.1 and 4.2.1.1 (Epsilon 2022) for detailed WTG descriptions for Phase 1 and Phase 2, respectively. The COP (Volume I, Sections 3.3.1.4 and 4.3.1.4; Epsilon 2022) provides a complete discussion of the proposed WTG construction approach for Phase 1 and Phase 2, respectively. Each WTG would contain approximately 17,413 gallons of oils, lubricants, coolant, and diesel fuel.

The total number of WTGs installed would be based on achieving the total Project output based on existing and future Power Purchase Agreements. For this analysis, the maximum-case scenario assumes all available positions would be used to house WTGs and/or ESPs.

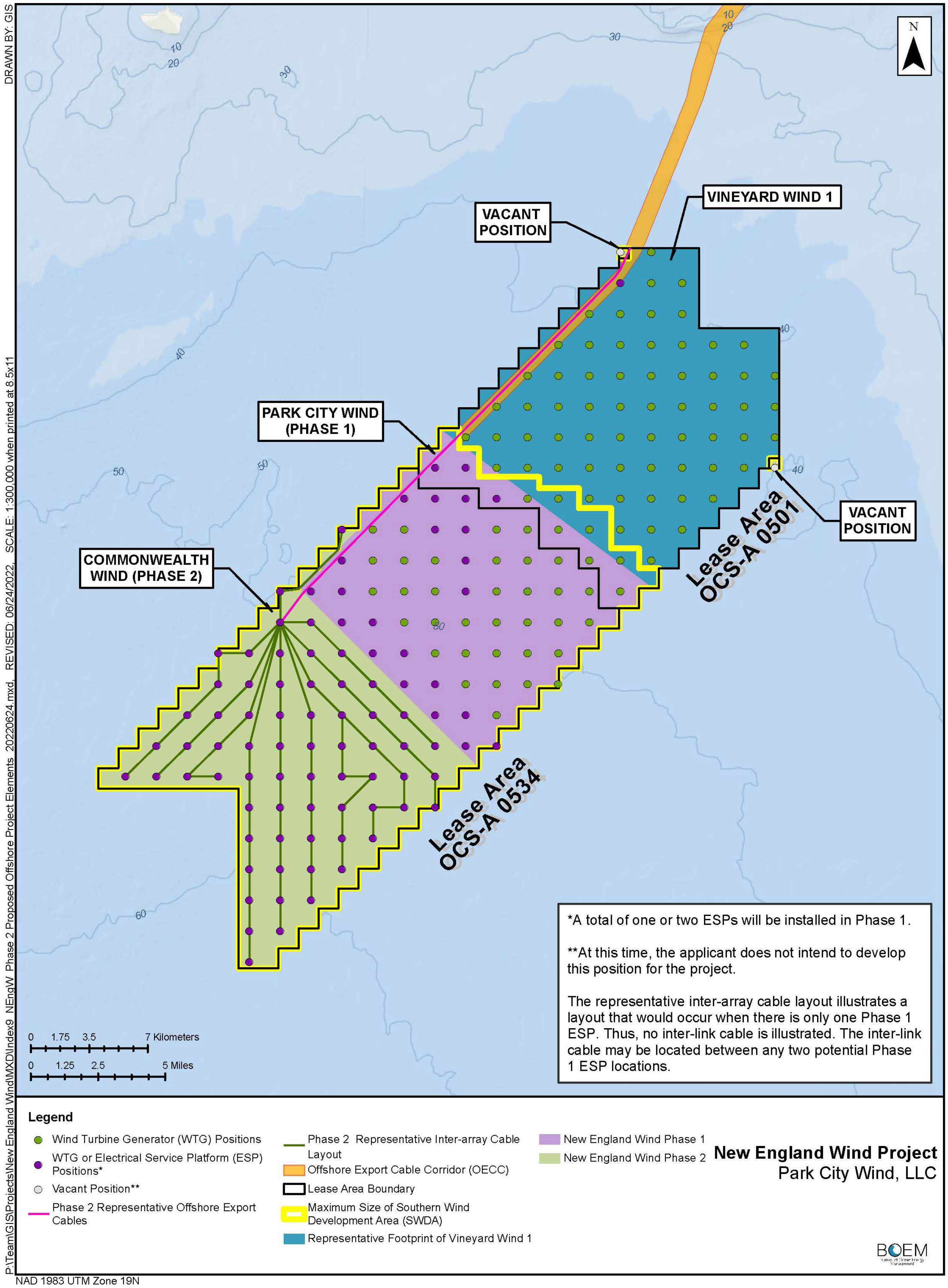


*A total of one or two ESPs will be installed in Phase 1.

**At this time, the applicant does not intend to develop this position for the project.

The representative inter-array cable layout illustrates a layout that would occur when there is only one Phase 1 ESP. Thus, no inter-link cable is illustrated. The inter-link cable may be located between any two potential Phase 1 ESP locations.

Figure 2-1: Proposed Phase 1 Offshore Project Elements



*A total of one or two ESPs will be installed in Phase 1.

**At this time, the applicant does not intend to develop this position for the project.

The representative inter-array cable layout illustrates a layout that would occur when there is only one Phase 1 ESP. Thus, no inter-link cable is illustrated. The inter-link cable may be located between any two potential Phase 1 ESP locations.

Figure 2-2: Proposed Phase 2 Offshore Project Elements

Table 2-1: Proposed Action Wind Turbine Generator Specifications with Maximum-Case Scenario

WTGs	Minimum	Maximum
Number of turbine positions	NA	130
Total height to blade tip (feet)[a]	NA	1,171
Height to top of nacelle (feet)[a]	NA	725
Rotor diameter (feet)	NA	935
Blade tip clearance above water (feet)[a]	89	NA

Source: COP Volume I; Epsilon 2022

NA = not applicable; WTG = wind turbine generator

[a] Elevations provided are relative to mean lower low water, defined as the average of all the lower low water heights of each tidal day observed over the National Tidal Datum Epoch.

Table 2-2: Proposed Action Wind Turbine Generator Foundation Specifications with Maximum-Case Scenario

Foundation Type	Monopile	Jacket	Bottom Frame
Number of piles per foundation	1	4	3
Maximum area of scour protection at each foundation (square feet)	52,272	69,696	104,544

The WTGs would include a nighttime obstruction lighting system that complies with Federal Aviation Administration (FAA) lighting standards (FAA 2018). The proposed lighting system could consist of two synchronized FAA L-864 aviation red flashing obstruction lights placed on the nacelle of each WTG. If the overall tip height exceeds 699 feet, at least three additional low-intensity L-810 flashing red lights would be placed on the tower approximately halfway between the nacelle and sea level. The applicant is proposing 30 flashes per minute for air navigation lighting. To reduce the potential impacts on nocturnal migrant bird species, the applicant is proposing to use an aircraft detection lighting system (ADLS) that would automatically activate lights when aircraft approach, which would require FAA and/or BOEM approval. This would dramatically reduce the amount of time the obstruction lights are on. An analysis of nighttime flight activity in the SWDA found using ADLS would result in total obstruction lighting for 12 minutes and 2 seconds (COP Volume III, Appendix K; Epsilon 2022). Table 2-3 illustrates the modeled amount of time that the system would be activated each month.

Table 2-3: Modeled Duration of Aircraft Detection Lighting System Activation Each Month

Month	Duration (minutes:seconds)
January	00:00
February	00:24
March	00:00
April	00:23
May	00:00
June	01:02
July	01:07
August	03:13
September	01:37
October	01:13
November	01:05
December	01:58

Source: COP Volume III-K; Epsilon 2022

2.1.2 Electrical Service Platforms

The applicant would construct up to five ESPs (up to two in Phase 1 and up to three in Phase 2) in the SWDA, each installed on a monopile or jacket foundation. The ESPs serve as the interconnection point between the WTGs and the export cable. The proposed ESPs would include step-up transformers and other electrical equipment needed to connect the inter-array cables to export cables. An inter-array cable that would be buried below the seabed and then connected to the ESPs would connect multiple WTGs. The ESPs would be up to 230 feet above the ocean surface relative to mean lower low water, with a maximum topside dimension of 328 x 197 x 125 feet. Table 2-4 summarizes the range of pertinent ESP foundation characteristics provided in the Project design envelope.

Table 2-4: Proposed Action Electrical Service Platform Foundation Specifications with Maximum-Case Scenario

Foundation Type	Monopile	Jacket
Number of piles per foundation	1	12
Maximum area of scour protection at each foundation (square feet)	52,272	230,868

An inter-link cable would be required to connect multiple ESPs within each phase together. Each ESP would contain up to 295,586 gallons of oils, lubricants, coolants, and diesel fuel. COP Sections 3.3.4.4 and 4.3.4.4 provide additional details related to chemicals and their anticipated volumes for Phases 1 and 2, respectively (COP Volume I; Epsilon 2022). Detailed specifications of the ESPs are provided in the COP Volume 1, Section 3.2.1.35 and 4.2.1.3 for Phases 1 and 2, respectively (Epsilon 2022). The COP (Volume I, Sections 3.3.1.5 and 4.3.1.5; Epsilon 2022) provides a complete discussion of the proposed ESP construction approach for Phases 1 and 2, respectively.

2.1.3 Scour Protection

The applicant would place scour protection around all foundations, which would consist of rock and stone ranging from 4 to 12 inches. The scour protection would be up to 9 feet in height and would serve to stabilize the seabed near the foundations, as well as the foundations themselves. See COP Volume I, Sections 3.2.1.4 and 4.2.1.4 (Epsilon 2022) for detailed specifications of proposed scour protection for Phase 1 and Phase 2, respectively. The COP (Volume I, Sections 3.3.1.2 and 4.3.1.2; Epsilon 2022) provides a complete discussion of the proposed scour protection construction approach for Phase 1 and Phase 2, respectively.

2.1.4 Offshore Cables

The applicant is proposing to install up to five offshore export cables in the offshore export cable corridor (OECC) and would connect the proposed wind facility to the onshore electrical grid at two locations. The applicant has proposed several installation methods for the inter-array, inter-link, and offshore export cables. The applicant would bury the cables using a jet plow, mechanical plow, and/or mechanical trenching. Prior to installation of the cables, a pre-lay grapnel run would be performed in all instances to locate and clear obstructions such as abandoned fishing gear and other marine debris. Dredging may be required in some locations to achieve proper burial depth, such as in areas where sand waves are present. The applicant may remove the upper layers of sand waves via mechanical or hydraulic means to achieve the proper burial depth below the stable sea bottom. Following the pre-grapnel run and any required dredging, the applicant would accomplish offshore cable laying primarily via simultaneous lay and burial using jet plowing. The applicant would install the inter-array cables using a pre-lay and jet plow embedment approach but could use other installation methods in certain areas depending on bottom conditions, water depth, and/or contractor preferences to ensure proper burial depth. Impacts from cable installation would include up to a 3.3-foot-wide cable installation trench and up to a 6.6-foot-wide temporary disturbance zone from the skids or tracks of the cable installation equipment, which would slide over the surface of the seafloor. The skids or tracks have the potential to disturb benthic habitat; however, the skids or tracks are not expected to dig into the seabed. COP Volume I (Epsilon 2022) describes installation methodologies in detail. Vessel types proposed for the cable installation could be vessels capable of dynamic positioning, anchored vessels, self-propelled vessels, and/or barges.

The applicant would install conduits to protect cables at the approach to each WTG and ESP foundation. In the event that cables cannot achieve proper burial depths or where the proposed offshore export cables cross existing infrastructure, the following protection methods could be used: rock placement, concrete mattresses, half-shell pipes[4], or similar product made from composite materials or cast iron with corrosion protection. The applicant estimates that up to 85 acres of seafloor would be affected by hard cable protection.

Consistent with the COP's description of the Proposed Action, this BA analyzes a single Phase 1 OECC and considers two potential Phase 1 landfall sites: Covell's Beach and Craigville Beach in Barnstable, Massachusetts (Figure 2-2). The COP (Volume I, Sections 3.2.1.5 and 3.2.1.6; Epsilon 2022) provides detailed specifications of Phase 1 offshore export cables and inter-array cables, respectively. This BA also analyzes a primary Phase 2 OECC that would be the same as Phase 1, with a variant through the western portion of the Muskeget Channel and considers two potential landfall sites at Dowses Beach and Wianno Avenue in Barnstable, Massachusetts (Figure 2-3). Additionally, if technical, logistical, grid interconnection, or other unforeseen issues prevent all Phase 2 export cables from interconnecting at Eversource's West Barnstable Substation, the applicant would develop and use the South Coast Variant (SCV) in place of or in addition to the currently proposed Phase 2 OECC (Figure 2-3). Because the SCV is a contingency, the applicant had not provided information on grid interconnection routes, onshore cable routes, landfall locations, and nearshore cable routes necessary to prepare a sufficient analysis of the SCV at the time of this BA's publication. Therefore, the SCV analysis includes available information about areas more than 3 nautical miles (3.4 miles) from shore but reflects some uncertainty. If the applicant determines that the SCV is necessary, the applicant would be required to file a COP revision per 30 CFR § 585.634, describing the need for the SCV and providing the information necessary to complete a sufficient analysis. In response, BOEM would complete additional environmental analysis and re-initiate consultation for the proposed Project.

2.2 Onshore Facilities

Onshore elements for Phase 1 include the Town of Barnstable landfall site, the onshore export cables from the landfall site to the onshore substation, the onshore substation site, and the connection from the proposed substation site to the existing bulk power grid (Figure 2-4). The applicant intends to interconnect the entire Phase 2 electrical output to the electrical grid at the West Barnstable Substation, the same location as Phase 1. This intent notwithstanding, Phase 2 could require up to two onshore transmission systems, including the proposed system in the Town of Barnstable and a second system (associated with the SCV) in Bristol County, Massachusetts. Because the applicant has not provided information on grid interconnection routes, onshore cable routes, landfall locations, and nearshore cable routes for the SCV, this BA evaluates only the proposed Phase 2 onshore facilities in the Town of Barnstable, including two potential landfall sites, one onshore export cable route (OECR), and one onshore substation site (West Barnstable Substation). Figure 2-4 shows the location of the Phase 1 onshore transmission system, while Figure 2-5 shows the Phase 2 components.

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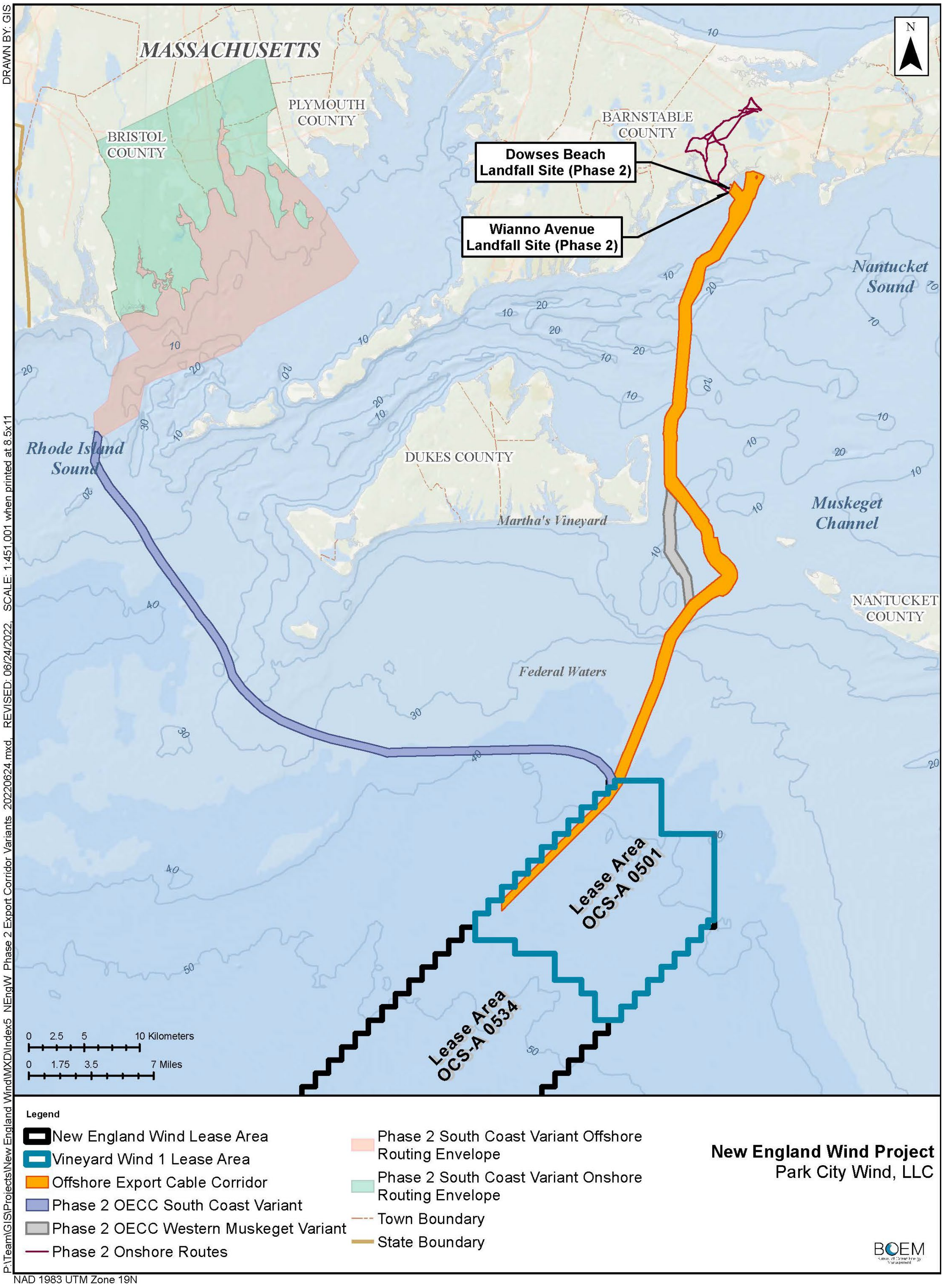
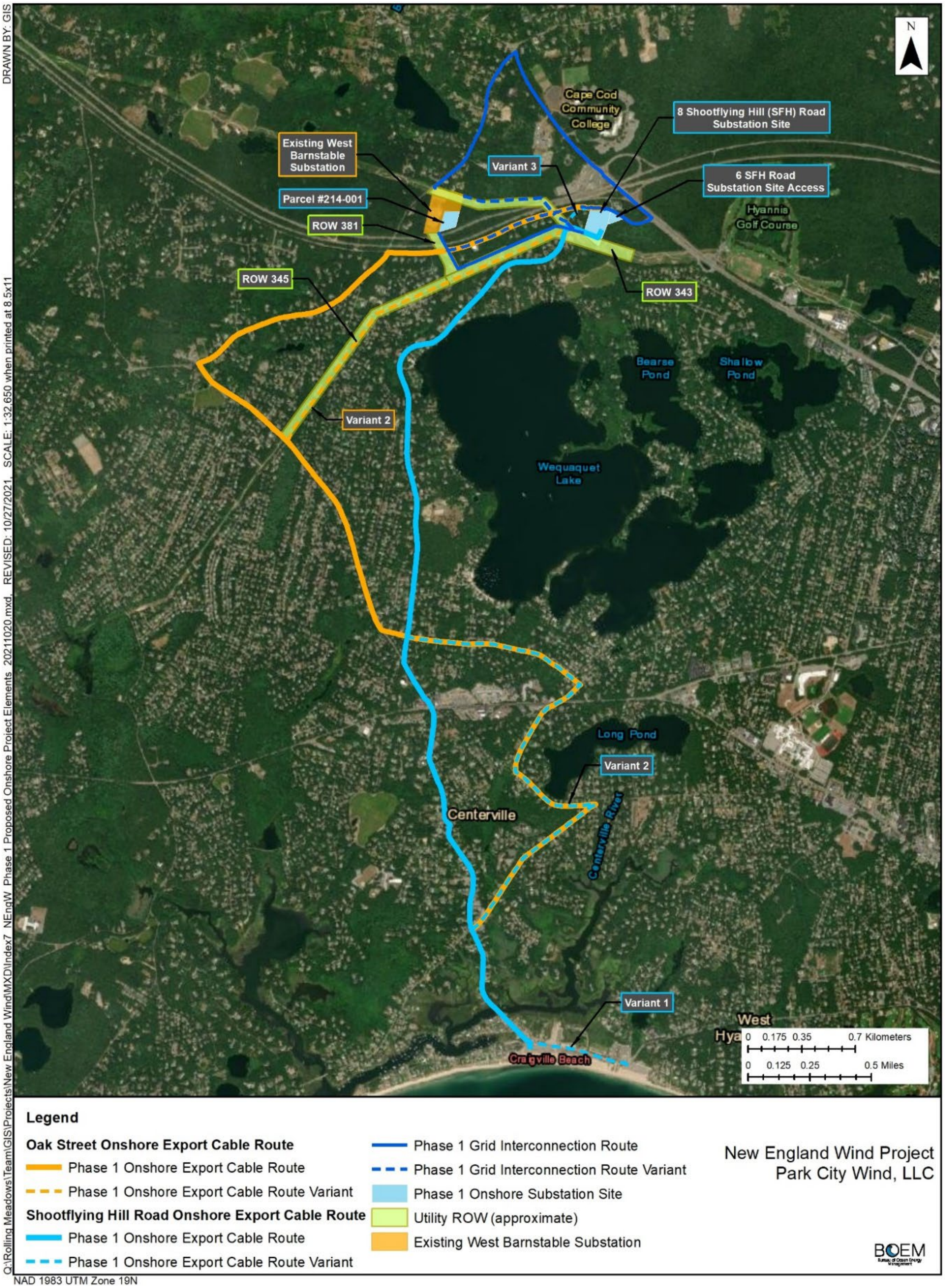
[4] A half-shell pipe is a protective shell that fits around the cable.



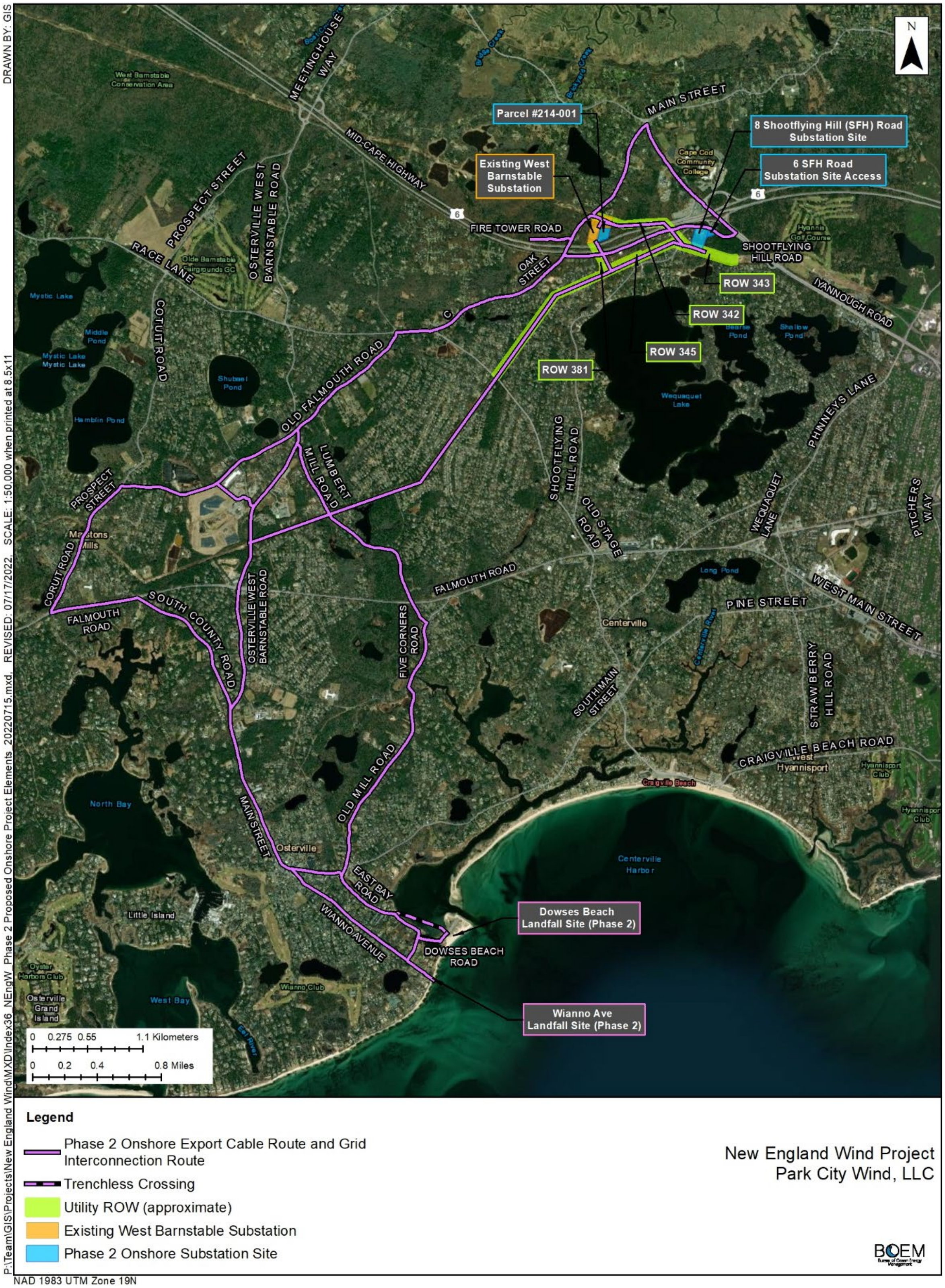
OECC = offshore export cable corridor

Figure 2-3: Phase 2 Offshore Export Cable Corridor with Variants



ROW = right-of-way

Figure 2-4: Proposed Phase 1 Onshore Elements



ROW = right-of-way

Figure 2-5: Proposed Phase 2 Onshore Elements

2.2.1 Landfall Site

The Phase 1 offshore export cables would make landfall within paved parking areas at either the Craigville Public Beach Landfall Site or the Covell's Beach Landfall Site in the Town of Barnstable. The Phase 2 offshore export cables would make landfall within paved parking areas at either the Dowses Beach Landfall Site or the Wianno Avenue Landfall Site in the Town of Barnstable. The ocean-to-land transition at the landfall sites would be made using horizontal directional drilling (HDD) techniques, which would avoid or minimize impacts on the beach, intertidal zone, and nearshore areas. Given the existing seawall and steep topography at the Wianno Avenue Landfall Site, installation at this site could use open trench techniques to achieve the ocean-to-land transition. The COP provides a detailed description of the proposed landfall sites (Volume I, Section 3.2.1; Epsilon 2022) and a detailed discussion of the proposed construction approach at the landfall sites (Volume I, Section 3.3.1.8 and 4.3.1.8; Epsilon 2022).

The applicant would construct one or more underground concrete transition vaults, also called splice vaults, at the landfall site. These would be accessible after construction via a manhole. Inside the splice vaults, the offshore export cables would be connected to the onshore export cables.

2.2.2 Onshore Export Cable and Substation Site

From the landfall site to the proposed substation site (at West Barnstable Substation), the Phase 1 OECR would be up to 6.5 miles long, depending on the cable landfall site and route variant selected (Figure 2-4), while the Phase 2 OECR would be up to 10.6 miles long (Figure 2-5). Onshore export cables for both Phase 1 and Phase 2 would be placed in a single concrete duct bank that would primarily be installed via open trenching within public roadway layouts (either beneath the road or within 10 feet of the pavement), although portions of the duct bank could be within existing utility right-of-way (ROW). The duct bank could vary in size along its length, although the typical trench for the duct bank would be 8 feet deep, 5.5 feet wide at the bottom, and 11 feet wide at the top. Excavated areas for splice vaults, either at the landfall site or along the OECR, would measure approximately 20 feet wide by 50 feet long. The top of the duct bank would typically have a minimum of 3 feet of cover comprised of properly compacted sand topped by pavement. Most of the proposed OECRs would pass through already developed areas, primarily paved roads, and existing utility ROWs and would be entirely underground. Duct bank system installation would typically occur outside of the summer peak tourist season, where feasible, to minimize traffic disruption. All work would be performed in accordance with local, state, and federal safety standards, as well as any applicant-specific requirements. The duct bank could vary in size and orientation along its length and could be installed either as a flat layout (four conduits wide by two conduits deep) or as an upright layout (two conduits wide by four conduits deep).

The Phase 1 onshore export cables would terminate at the proposed substation site on an approximately 6.7-acre commercial property at 8 Shootflying Hill Road. If necessary for engineering or other reasons, some of the onshore substation equipment currently intended for the 8 Shootflying Hill Road site could instead be placed on the 2.8-acre Parcel #214-001 immediately southeast of (and adjoining) the West Barnstable Substation. Construction would advance similarly on either site. The applicant has also acquired the 1-acre property at 6 Shootflying Hill Road and would construct an access road on this property to reach the 8 Shootflying Hill Road onshore substation site. Construction of the onshore substation would take approximately 18 to 24 months.

Ground-disturbing activities during onshore substation construction include excavation and grading. The applicant anticipates the entirety of the sites at 6 and 8 Shootflying Hill Road site would need to be cleared to accommodate grading and access. Clearance of Parcel #214-001 would also be necessary if the parcel is used for the Proposed Action. The applicant would plant a vegetated screening on the western and northern boundaries of the onshore substation site; the vegetated screening would provide visual screening for existing residences. The eastern boundary could be used for part of the perimeter access drive, and the abutting land is undeveloped wooded land. The entire site would have a perimeter access fence, and the western edge could have sound attenuation walls, if necessary.

Phase 1 would connect into the ISO New England electric grid (the regional electrical grid) at the West Barnstable Substation. The Proposed Action would install cables along a grid interconnection route, which would run up to 1.8 miles, depending on the route selected (Figure 2-4). As with the OECR, the grid interconnection route would be installed within public roadway layouts (either beneath the road or within 10 feet of the pavement) or entirely within existing utility ROWs. The grid interconnection cables would be the same type of cable as the onshore export cables and installed in an underground duct bank with the same maximum dimensions as those described for the OECR. Modifications and an expansion at the West Barnstable Substation would also be required to accommodate Phase 1. ISO New England and Eversource would determine the design and schedule of this work, which could include installation of an additional transformer and associated electrical transmission equipment (COP Volume I, Section 3.2.2; Epsilon 2022). The West Barnstable Substation expansion could occur between the existing substation and the Oak Street Substation on the northern part of the same parcel. For Phase 2, modification to the West Barnstable Substation or parcels at 6 or 8 Shootflying Hill Road and Parcel #214-001, if necessary, would likely be similar to those described for Phase 1 (COP Volume I, Section 4.2.2; Epsilon 2022).

3. Covered Species

Three federally listed birds have the potential to occur within the RI/MA Lease Areas: Roseate Tern, Piping Plover, and Rufa Red Knot (*Calidris canutus rufa)*. In addition, the northern long-eared bat is also included within this BA, as the species has the potential to occur within the onshore portions of the Action Area.

The Plymouth red-bellied turtle is currently known to occur in at least 26 ponds in Plymouth and Bristol counties. As no Project elements would occur in these counites, no impacts on the species would be expected, and it is not addressed further in this document.

The two flowering plant species listed in the IPaC report are not expected to be affected by Project activities. American chaffseed was recently found growing on a small patch of land on Cape Cod (Annear 2018). No appropriate habitat for this species, which is described as "fire-maintained…savannas and pinelands through the coastal plain" (USFWS 1995), occurs in any part of the Action Area. Similarly, while sandplain gerardia was listed as potentially occurring within the onshore footprint of the Proposed Action, all known extant populations occur on lands that are state or privately managed for the species, and these areas are not crossed by the Proposed Action. As such, American chaffseed and sandplain gerardia are presumed to be absent from the Action Area and are not addressed further in this document.

3.1 Roseate Tern

The Roseate Tern is a small colonial tern, with Atlantic and Caribbean discrete population segments that breed from Long Island, New York, north and east to Quebec and Nova Scotia and the eastern and western Caribbean Sea, respectively, and winter along the northeastern coast of South America (USFWS 1998; USFWS 2010). Roseate Terns in the northwestern Atlantic population are listed under the ESA as endangered, while terns in the Caribbean population are listed as threatened (USFWS 2010). No critical habitat has been designated for this species (52 Fed. Reg. 42064 [November 2, 1987]). The USFWS has recently initiated a 5-year review for this species (83 Fed. Reg. 39113–39115 [November 13, 2020] and 86 Fed. Reg. 32965–32968 [June 23, 2021]). The Roseate Tern is one among 61 species (out of 177 species on the Atlantic OCS) that ranked high in its relative vulnerability to collision with wind turbines (Robinson Willmott et al. 2013). This high ranking is partially driven by the amount of time the species spends foraging on the ocean, and if time on the ocean was restricted to migration the population would be ranked medium.

The northwest Atlantic Ocean population of Roseate Tern breeds on small islands or on sand dunes at the ends of barrier beaches along the Atlantic coast, occurring in mixed colonies with Common Terns (*Sterna hirundo)*. The breeding population of Roseate Terns is currently restricted to a small number of colonies located on predator-free islands from Nova Scotia to Long Island, New York, with as many as 87 percent breeding within just three colonies on islands off of Massachusetts and New York (BOEM 2012; USFWS 2010). Since 2010, the number of breeding pairs of Roseate Terns in the United States and Canada has increased 50 percent from 3,219 to 4,824 in 2017 (C. Mostello, unpublished data). In April 2017, the Bird Island Habitat Restoration Project was completed and given the documented high productivity of Bird Island, restoration and enhancement of potentially suitable habitat is likely to have measurable beneficial impacts on Roseate Tern populations (USFWS 2008).

Roseate Tern foraging behavior and ecology in the region is well described in existing literature (USFWS 1998; Kress and Hall 2004). Roseate Terns dive less than 1.6 feet into the water to forage, primarily on the American sand lance (*Ammodytes americanus*) in shallow, warmer waters near shoals, inlets, and rip currents close to shore (e.g., Safina 1990; Heinemann 1992; Rock et al. 2007). Roseate Tern foraging flights are slow and range from 9.8 to 39.3 feet above the ocean surface. During the breeding season, most terns from colonies on Great Gull Island and Buzzards Bay forage relatively close to their colonies, but some travel along the coast to other nearshore foraging sites (Loring 2016; Loring et al. 2019; Figure 3-1). In sharp contrast to Common Terns, Roseate Terns are dietary specialists and exhibit strong fidelity to foraging sites and avoidance of clusters of other feeding tern species (Goyert 2015).

The American sand lance is the primary forage fish for Roseate Terns and is a small to medium size (1.9 to 6.6 inches), chiefly found in waters shallow (less than 6.5 feet) coastal waters and estuaries and not found offshore (Collette and Klein-MacPhee 2002). The average size of American sand lance delivered by Roseate Terns to chicks is 2.3 inches (Safina et al. 1990). This is in contrast to the offshore sand lance (*A. dubius*), which is larger (3.0 to 9.9 inches) and found offshore, particularly in Nantucket Shoals and over the shallows of Georges and Browns Banks and stays on the bottom during the day (Collette and Klein-MacPhee 2002). Humpback whales consume northern sand lance and will flush the northern sand lance from the bottom (Hain et al. 1995). However, humpback whales are relatively rare in the Action Area in spring, summer, and fall, (Kraus et al. 2016). Based on this information and the behavioral and foraging ecology of the Roseate Tern, while the northern sand lance may be present in the offshore portion of the Action Area, the offshore Action Area does not provide potentially suitable foraging habitat for Roseate Terns because the northern sand lance is generally not available.

Despite intensive surveys in the region over the years and across seasons for marine birds (Figure 3-2), no Roseate Terns were detected in the lease area or in the proposed offshore Action Area (USFWS 2018; Figure 3-3). Modeling efforts based on those survey data predict that Roseate Terns are virtually absent from the offshore Action Area (Figure 3-4). This prediction is based on a statistical model that used 354 Roseate Tern sightings from many scientific surveys throughout the Atlantic OCS during the spring, summer, and fall months (Winship et al. 2018). The modeling effort only used Roseate Terns (i.e., terns that were not be identified as Roseate Terns were excluded from the analysis) and are based on the relationship between Roseate Terns and surface chlorophyll a, distance from shore, turbidity, and other factors (Winship et al. 2018). Goyert (2014) found a similar distribution pattern in a separate modeling effort that related a small subset of the Roseate Tern count data used by Winship et al. (2018) to the amount of forage fish in spring. Therefore, the predicted distribution of Roseate Terns (Figure 3-4) almost mirrors the estimated spring and fall distribution of sand lance around Nantucket Sound (Figure 3-5).

Great care is needed in making conclusions from analyses based on data that are pooled across species. Speculation that Roseate Terns occur and forage further offshore appears to be rooted in a series of misinterpretations of analyses that pooled data across species. For example, pooling spatial count data of Common Terns, Roseate Terns, and unidentified terns into a single group could lead to an inaccurate conclusion that the distribution of Roseate Terns is the same as Common Terns. Such a conclusion is false, as the inference is restricted to the group of species as a whole. Similarly, pooling American and northern sand lance data could lead to a false hypothesis that Roseate Terns forage further offshore than they do. The reasoning behind these speculations is faulty, and they do not represent the best available scientific information on this species.

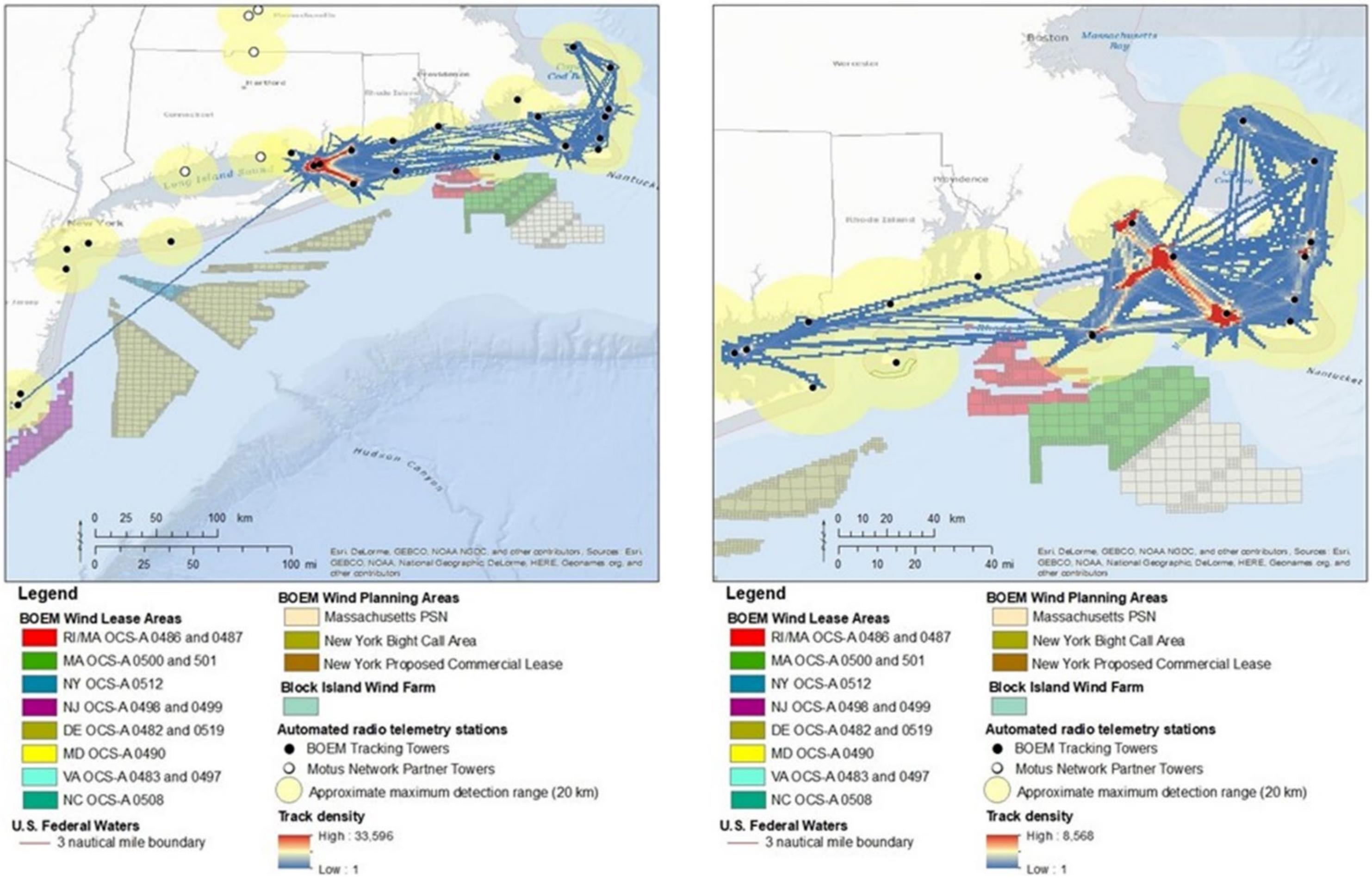
There has also been some speculation that Roseate Terns may occur in the SWDA during early spring (April and May) or during post-breeding period (August through September) while they are staging. For example, Roseate Terns observed during casual surveys from ferries in Nantucket Sound in early spring has led to speculation that Roseate Terns may be further offshore near the offshore Action Area from April to May. However, no Roseate Terns were observed in the lease area during at least five scientific surveys in April and May (Figure 3-2) or during four weekly surveys by boat conducted in April through May 2018 (COP Appendix III-C; Epsilon 2022). A total of two Roseate Terns were observed within the SWDA in May 2021 but were not observed during the course of any additional spring, summer, or fall surveys in the SWDA. Roseate Terns were observed nearshore outside of the lease area in the same areas predicted by the spring relative distribution and density model (Figure 3-4). Likewise, it was assumed that Roseate Terns would go further offshore during the post-breeding period perhaps to forage near the offshore Action Area (despite the lack of foraging habitat). However, the surveys conducted by Veit and

Perkins (2014) from late August to mid-September in waters south of Tuckernuck and Muskeget Island show Roseate Terns forage within 10 miles of the beach (Figure 3-6) and in the same areas predicted by the summer relative distribution and density models (Figure 3-4). The survey results from both efforts validate the predicted distribution and density modeling results because neither dataset was used (Winship et al. 2018).

A recent telemetry study found that terns flew offshore when visibility was greater than 3.1 miles and departed the study area at low altitudes (Figure 3-7). Roseate Terns typically flew approximately 36 to 65 feet above the water in the wind energy areas and flew below the rotor swept zone (RSZ) near the turbines in the Block Island Wind Farm (Loring et al. 2019). Given that Roseate Terns migrate mainly offshore during spring and fall (Nisbet et al. 2014), it is possible that some birds pass through the SWDA during migration. However, none of the 145 Roseate Terns that were fitted with radio transmitters were tracked flying over the SWDA during breeding and nonbreeding dispersal periods by the network of tracking stations (Loring et al. 2019; Figure 3-1). It is possible that the Roseate Terns did not pass through the lease area as they headed south (similar to Common Terns [Loring et al. 2019]). It is also possible that the Roseate Terns were flying so low that they evaded detection. If the terns decided to fly higher, the stations would be able to detect and track them because the same stations were also tracking the relatively high-flying Rufa Red Knots and Piping Plovers (Loring et al. 2018, 2019). Given that Roseate Terns were flying low as they departed the region (Loring et al. 2019), it is most likely Roseate Terns continued to fly low as they headed further out to sea even if they flew through the lease area.

Terns travel at approximately 28 miles per hour, so given that terns start their southward migration during good weather conditions, it is unlikely that they would encounter inclement conditions by the time they reached the lease area at that speed. However, in the unlikely event that the weather would suddenly change for the worse, terns could continue to fly low or ride out inclement weather by floating on the water until conditions improved.

Based on the behavioral and foraging ecology of the species, the radio telemetry data, and the survey data, very little, if any, Roseate Tern activity is expected within marine waters in and around the SWDA. Should individuals pass through the area, they would be expected to be flying below the RSZ relatively close to the ocean surface during good weather conditions.



Source: Loring et al. 2019

BOEM = Bureau of Ocean Energy Management; DE = Delaware; MA = Massachusetts; MD = Maryland; NC = North Carolina; NJ = New Jersey; NY = New York; PSN = Proposed Sale Notice; RI = Rhode Island; VA = Virginia

Figure 3-1: Track Densities (10-minute tracks/1 square kilometer) of Roseate Terns (n=90) from the Colony on Great Gull Island during the Breeding and Post-Breeding Periods in 2015 to 2017 (pooled) (left); Roseate Terns (n=60) from Colonies in Buzzards Bay during the Breeding and Post-Breeding Periods in 2016 and 2017 (pooled) (right)

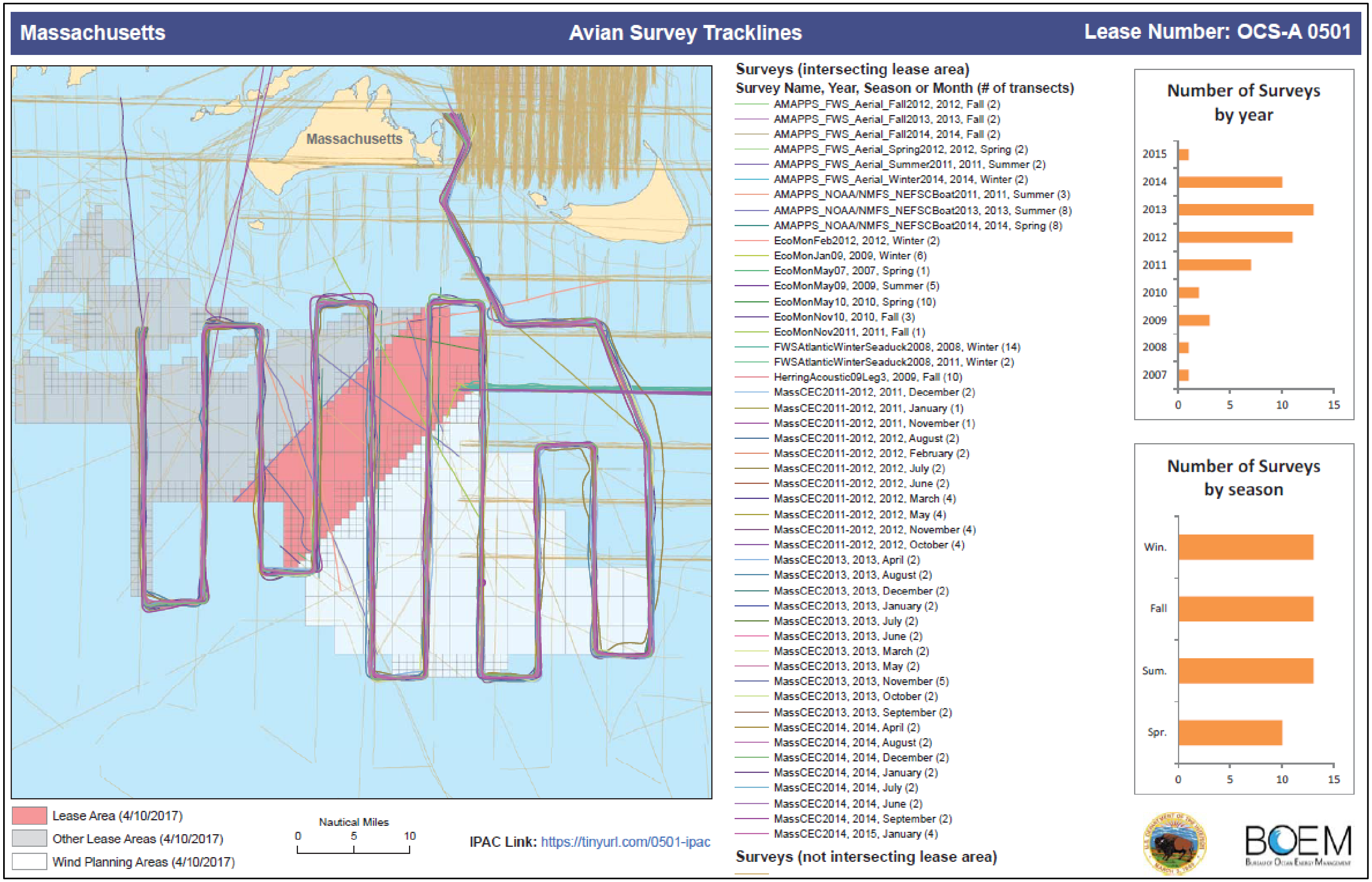


Figure 3-2: Avian Surveys Intersecting the Southern Wind Development Area

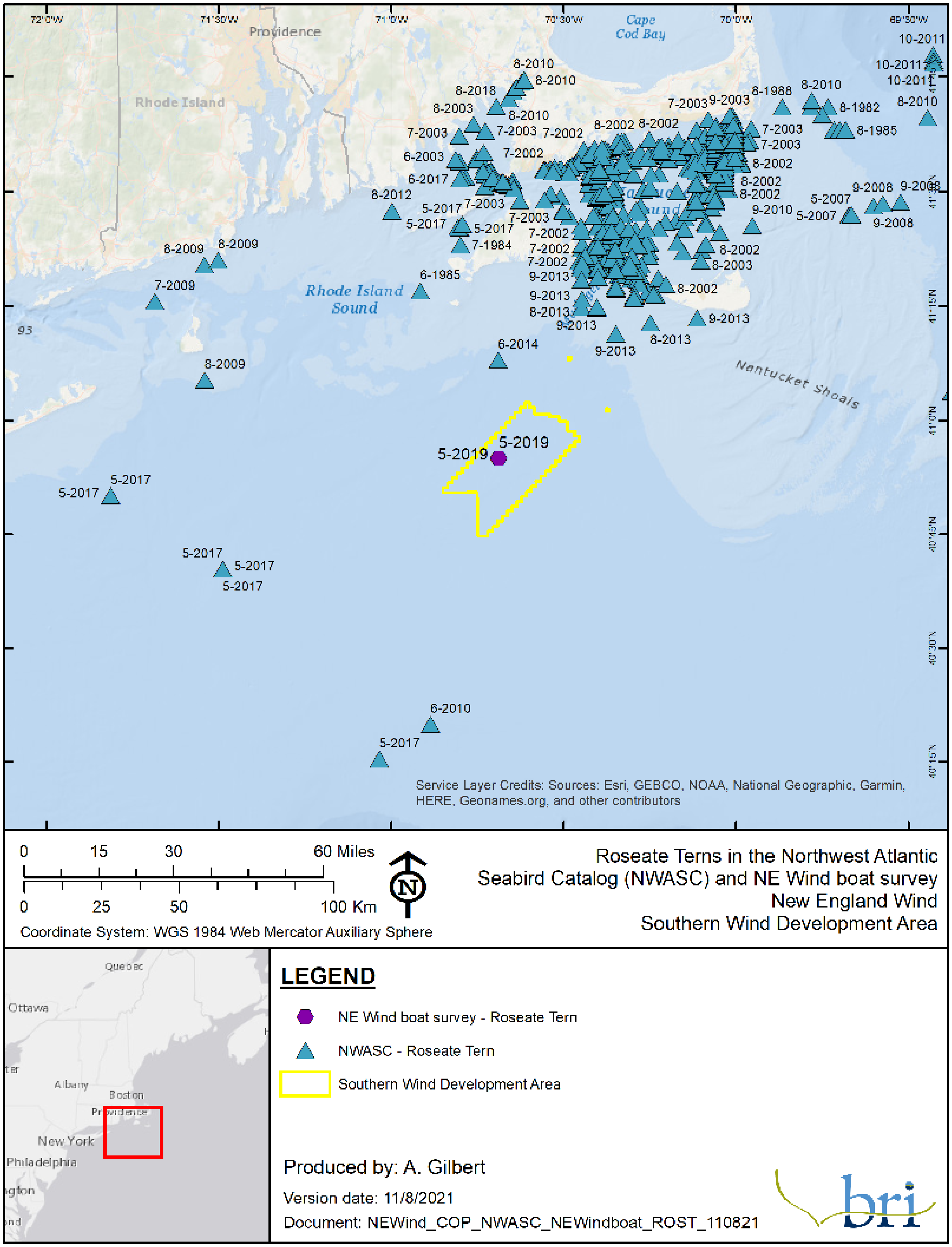
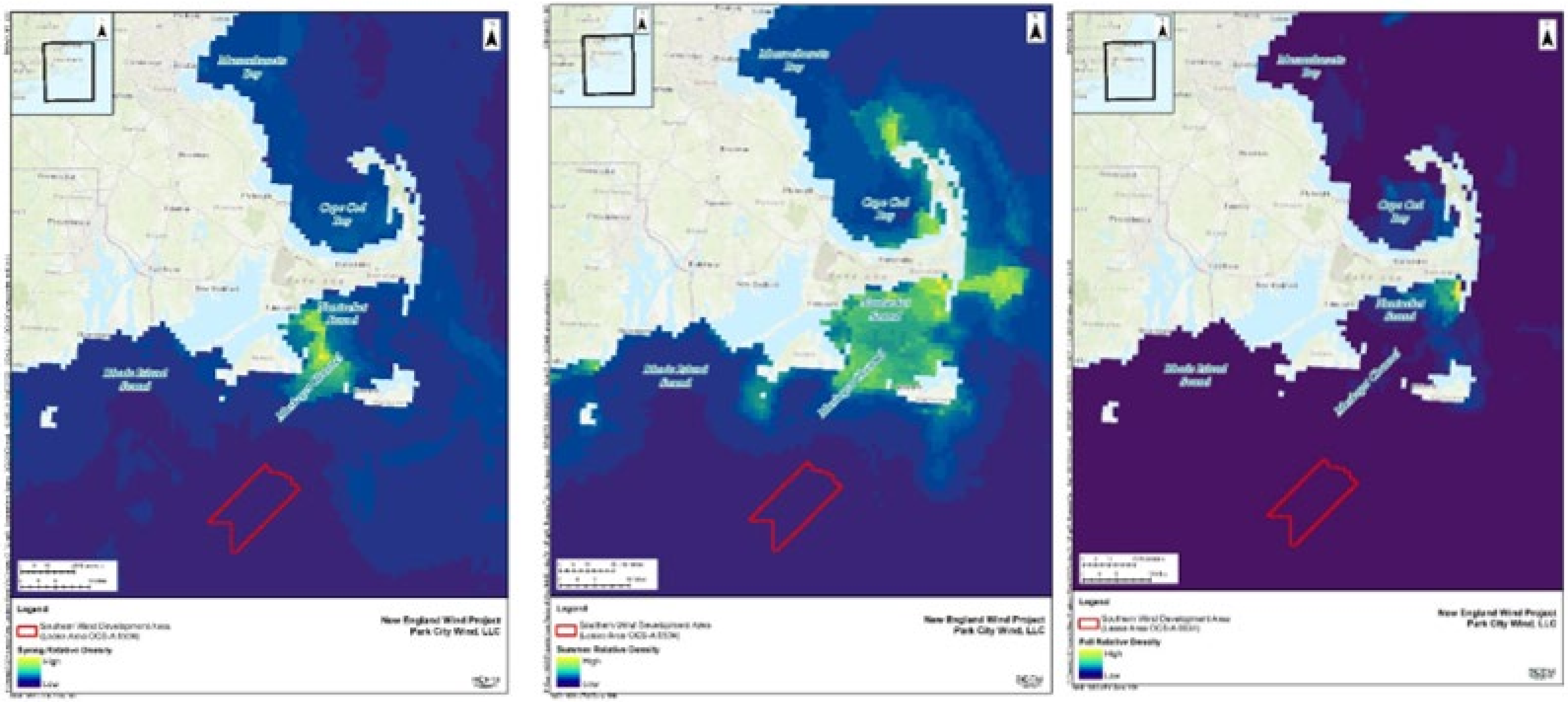
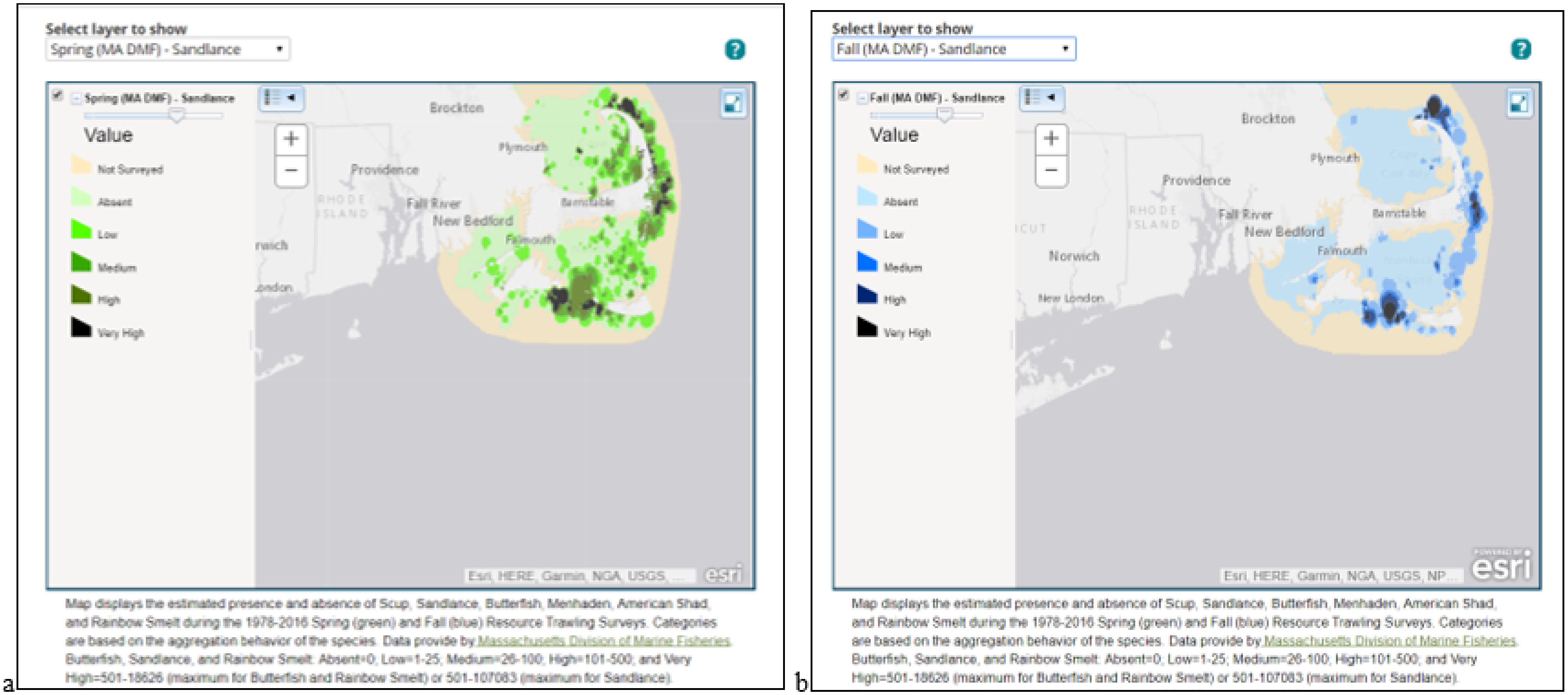


Figure 3-3: Roseate Tern Observations from the Northwest Atlantic Seabird Catalog and New England Wind Boat Surveys



Source: Winship et al. 2018; Curtice et al. 2018

Figure 3-4: Predicted Relative Density of Roseate Terns during Spring (March–May); Summer (June–August); and Fall (September–November) (left to right)



Select layer to show: Spring (MA DMF) - Sandlance

Spring (MA DMF) - Sandlance

Map displays the estimated presence and absence of Scup, Sandlance, Butterfish, Menhaden, American Shad, and Rainbow Smelt during the 1978-2016 Spring (green) and Fall (blue) Resource Trawling Surveys. Categories are based on the aggregation behavior of the species. Data provide by Massachusetts Division of Marine Fisheries. Butterfish, Sandlance, and Rainbow Smelt: Absent=0; Low=1-25; Medium=26-100; High=101-500; and Very High=501-18626 (maximum for Butterfish and Rainbow Smelt) or 501-107083 (maximum for Sandlance).

Select layer to show: Fall (MA DMF) - Sandlance

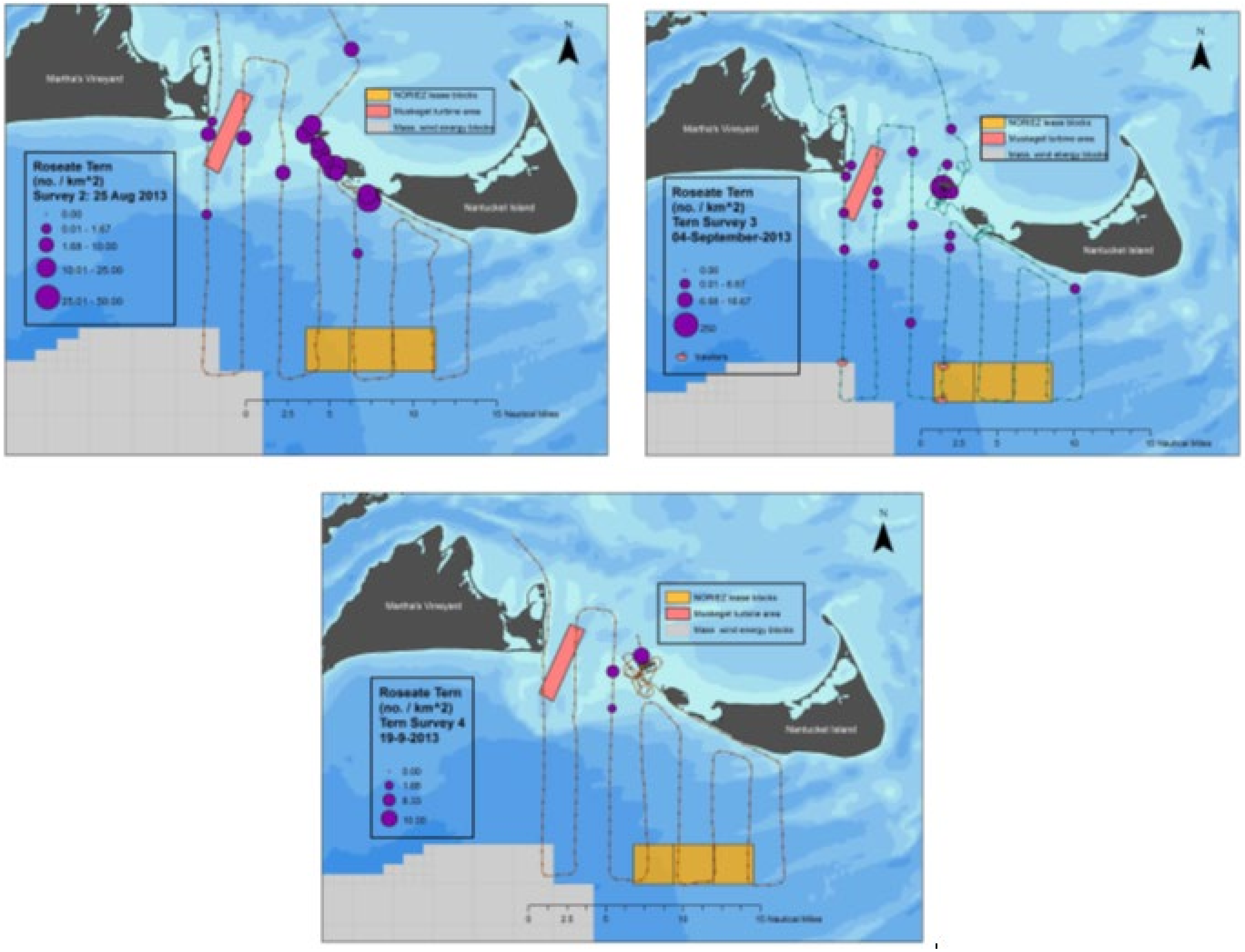
Fall (MA DMF) - Sandlance

Map displays the estimated presence and absence of Scup, Sandlance, Butterfish, Menhaden, American Shad, and Rainbow Smelt during the 1978-2016 Spring (green) and Fall (blue) Resource Trawling Surveys. Categories are based on the aggregation behavior of the species. Data provide by Massachusetts Division of Marine Fisheries. Butterfish, Sandlance, and Rainbow Smelt: Absent=0; Low=1-25; Medium=26-100; High=101-500; and Very High=501-18626 (maximum for Butterfish and Rainbow Smelt) or 501-107083 (maximum for Sandlance).

Source: Massachusetts Climate Adaptation Partnership 2015

MA DMF = Massachusetts Division of Marine Fisheries

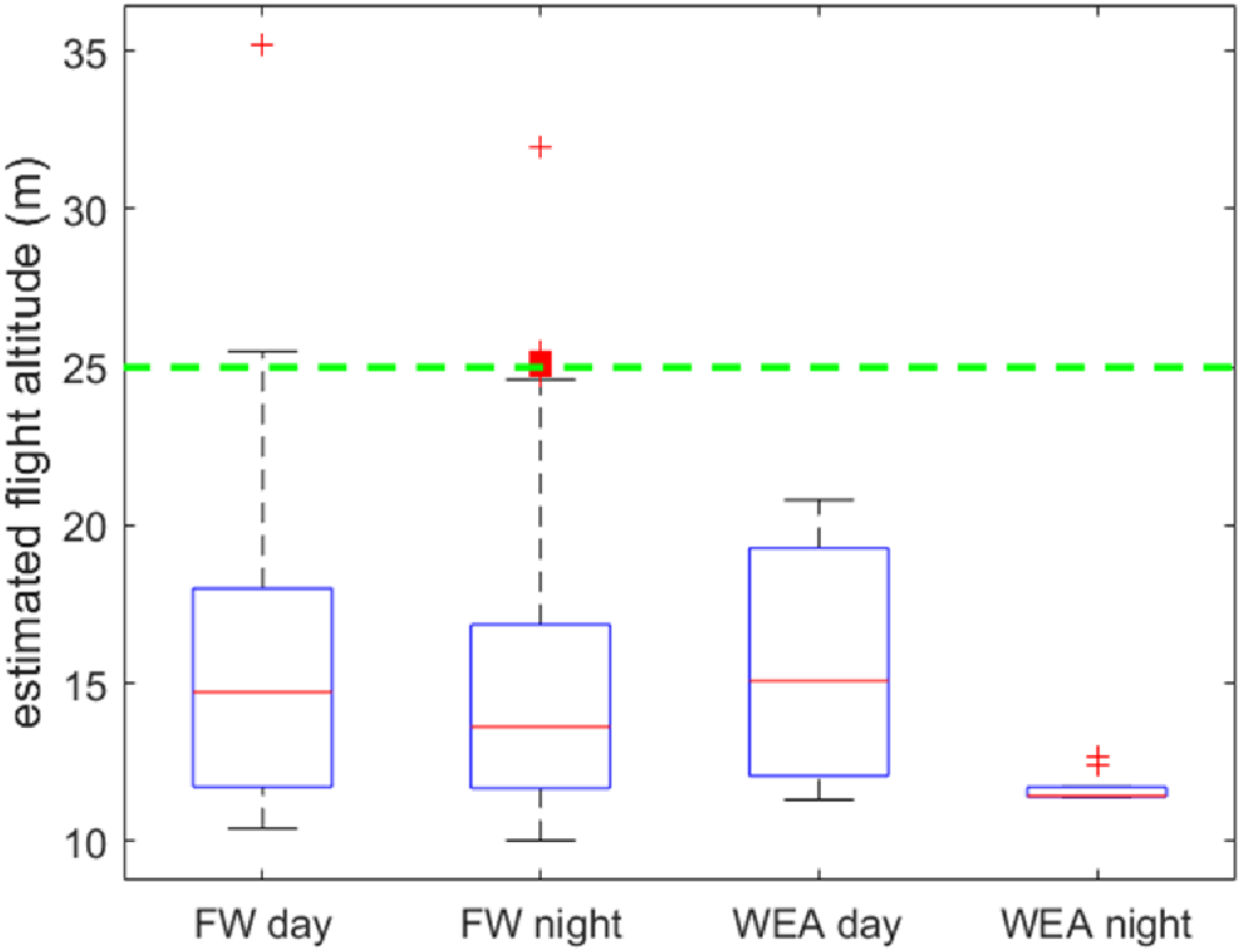
Figure 3-5: Presence of Sand Lance during Spring (left) and Fall (right)



Source: Veit and Perkins 2014

km^2 = square kilometers; no. = number; NORIEZ = northeast offshore renewable energy innovation zone

Figure 3-6: Foraging Roseate Terns Observed from Aerial Surveys during Post-Breeding Period on August 25, September 4, and September 19 (left to right)



m = meters; FW = federal waters; RSZ = rotor swept zone; WEA = wind energy area

The green-dashed line represents the lower limit of the RSZ: 25 meters (82 feett) (Loring et al. 2019). Note that the lower limit for the proposed Project is 27 meters (89 feet).

Figure 3-7: Model-Estimated Flight Altitude Ranges of Roseate Terns During Exposure to Federal Waters and Atlantic Outer Continental Shelf Wind Energy Areas

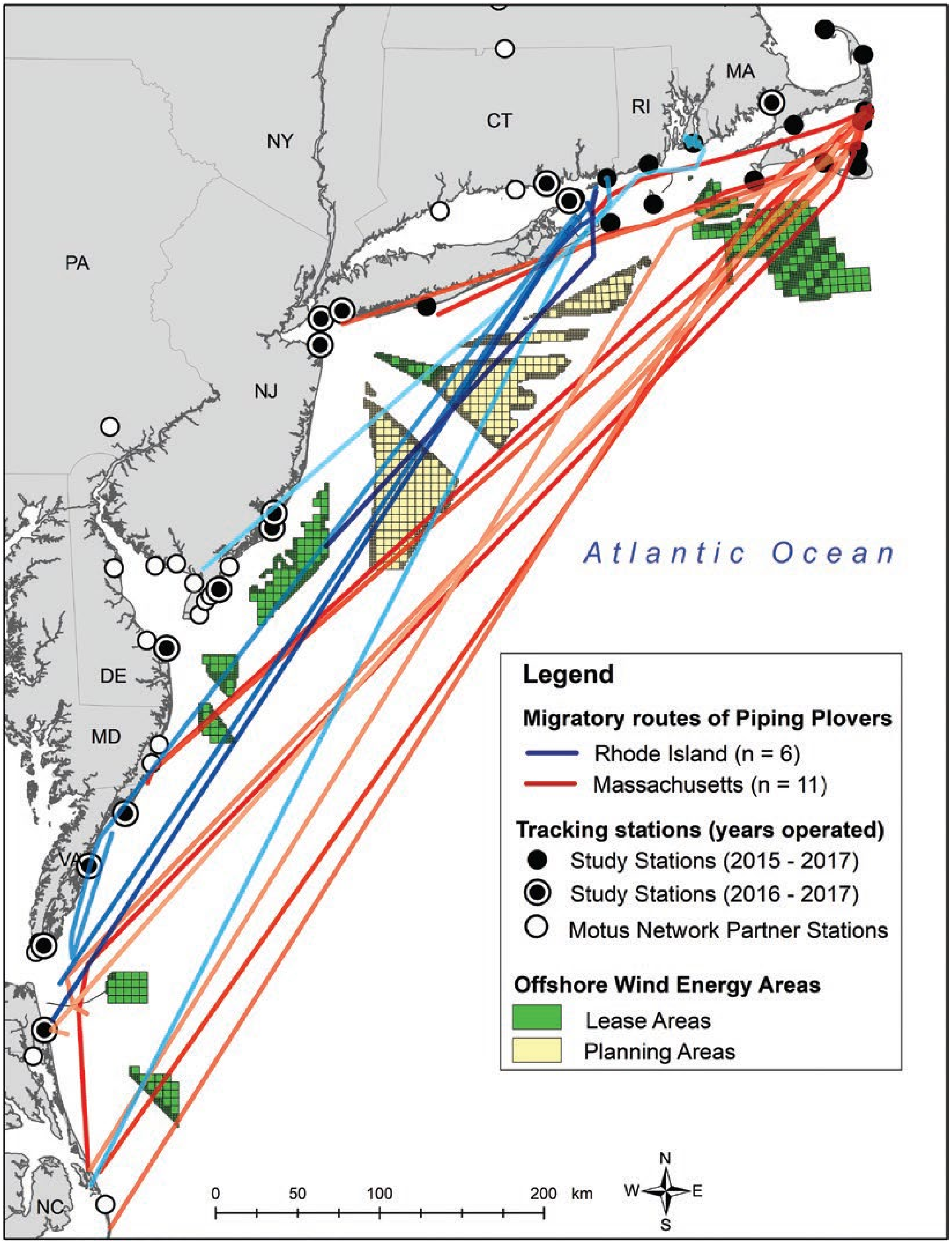
3.2 Piping Plover

The Piping Plover is a small migratory shorebird that breeds along the Atlantic coast, the Great Lakes, and the Great Plains regions of the United States and winters in coastal habitats of the southeastern United States, coastal Gulf of Mexico, and the Caribbean (Elliot-Smith and Haig 2004; USFWS 1996, 2009). The USFWS listed the Atlantic coast breeding population as threatened. Critical wintering habitat has been established along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas (66 Fed. Reg. 36038 [July 10, 2001]). Only the Atlantic coast population has the potential to occur within the Action Area during the breeding season, as well as spring and fall migration. Coastal development is the primary anthropogenic threat to Piping Plovers. Other threats include disturbance by humans, dogs, and vehicles on sandy beaches and dune habitats (Elliott-Smith and Haig 2004; USFWS 2009). Despite these population pressures, there is little risk of near-term extinction of the Atlantic Coast population of Piping Plovers (Plissner and Haig 2000), and the Atlantic coast population has been steadily growing. Since the time of its listing in 1985, the Atlantic coast Piping Plover population has increased 290 percent from a low of 790 breeding pairs to an estimated 2,289 breeding pairs in 2021 (USFWS 2022). The Piping Plover is among 72 species (out of 177 species on the Atlantic OCS) that ranked moderate in its relative vulnerability to collision with wind turbines (Robinson Willmott et al. 2013).

The breeding range of the Atlantic coast population includes the Atlantic coast of North America from Canada to North Carolina. The Piping Plover breeding season extends from April through August, with individuals arriving at breeding locations in mid-March and into April. Post-breeding staging in preparation for migration extends from late July through September (USFWS 1996). Piping Plover breeding habitat consists of generally undisturbed, sparsely vegetated, flat, sand dune-beach habitats such as coastal beaches, gently sloping foredunes, sandflats, and wash over areas to which they are restricted (USFWS 1996, 2009). Nests sites are shallow, scraped depressions in a variety of substrates situated above the high-tide line (USFWS 1996). Piping Plovers forage in the intertidal zone. Foraging habitat includes intertidal portions of ocean beaches, wash over areas, mudflats, and sandflats, as well as shorelines of coastal ponds, lagoons, and saltmarshes where they feed on beetles, crustaceans, fly larvae, marine worms, and mollusks (USFWS 1996).

While the precise migratory pathways along the Atlantic coast and to the Bahamas are not well known (USFWS 2009; Normandeau Associates, Inc. 2011), both spring and fall migration routes are believed to follow a narrow strip along the Atlantic coast. Due to the difficulty in detecting Piping Plovers in the offshore environment during migration because of the assumed nocturnal and high-elevation migratory flights, there are no definitive observations of this species in offshore environments greater than 3 miles from the Atlantic coast (Normandeau Associates, Inc. 2011). There are no records of Piping Plovers in the offshore Action Area during surveys (USFWS 2018).

A recent study tracking the movement of Piping Plovers breeding in Rhode Island and Massachusetts found that most Piping Plovers fly close and parallel to the coast with a favorable tailwind (Loring et al. 2019). None of the Rhode Island breeding plovers (29) flew through the SWDA during fall migration, and 3 plovers (7 percent of 43 from Massachusetts) flew over the lease area (Figure 3-8; Loring et al. 2019). Therefore, some plovers from Massachusetts and northward might be exposed to the SWDA but not birds from Rhode Island or further south. Based on counts in 2021, there were 967 breeding pairs recorded in Massachusetts, 13 in New Hampshire, 125 in Maine, and 180 in Canada (USFWS 2022), for a total of 2,570 adult birds. Out of the 2,570 adult Piping Plovers (=1,285 pairs x 2 birds per pair; USFWS 2022) plus 1,705 fledglings (calculated from productivity data from USFWS 2022), only 7 percent may fly through the Action Area in fall. Despite fledglings comprising more than half of the fall migrates, the likelihood of a fledgling from New England surviving to the next breeding season is quite low (48 percent, compared to adults 70 to 74 percent; USFWS 2009).



Source: Loring et al. 2020

Figure shows individual Piping Plovers tracked across a broader portion of the mid-Atlantic Bight from breeding areas in in Rhode Island (n = 6) and Massachusetts (n = 11)

Figure 3-8: Modeled Migratory Routes of Tagged Piping Plovers from Breeding Areas

In spring, a pilot study found that plovers fitted with transmitters in the Bahamas traveled north close to shore along the U.S. Atlantic coast, each taking weeks to move northward (Loring et al. 2019). No Piping Plovers detections occurred north of Montauk, New York, and there is no empirical evidence to suggest that plovers fly through or near the lease area in spring (Loring et al. 2019). During migration, most flights were above the turbine height with 15.2 percent of the Piping Plover flights within the RSZ (Loring et al. 2019). Therefore, very little, if any, Piping Plover activity is expected, with relatively few (7 percent of Piping Plovers from Massachusetts and northward) flying through or over the Action Area during migration.

3.3 Rufa Red Knot

The Rufa Red Knot is a medium-sized member of the sandpiper family that breeds in the Canadian Arctic and winters along the northwest coast of the Gulf of Mexico, along the U.S. Atlantic coast from Florida to North Carolina and along the Atlantic coasts of Argentina and Chile (USFWS 2014). Over the last 20 years, the Rufa Red Knot has declined from a population estimated at 100,000 to 150,000, down to 18,000 to 33,000 (Niles et al. 2008). The primary threat to the species is the reduced availability of Atlantic horseshoe crab (*Limulus polyphemus*) eggs in Delaware Bay arising from elevated harvest of adult crabs (Niles et al. 2008). Atlantic horseshoe crab eggs are an important dietary component during migration, and reduced availability at key migratory stopover sites may be a likely cause of recent species declines (Niles et al. 2008; USFWS 2014). Due to observed population declines, the USFWS has listed the Rufa Red Knot as threatened. On July 15, 2021, the USFWS proposed to designate approximately 649,066 acres of critical habitat for Rufa Red Knot (86 Fed. Reg. 133 [July 15, 2021]). Of the 120 units proposed for critical habitat designation, 2 areas are located in Massachusetts (Pleasant Bay and Monomoy Island), totaling approximately 5,093 acres. These areas would not be affected by the Proposed Action. The Rufa Red Knot is one of 72 species (out of 177 species on the Atlantic OCS) that ranked moderate in its relative vulnerability to collision with wind turbines (Robinson Willmott et al. 2013). Despite the presence of many onshore turbines along the Rufa Red Knot's overland migration route (Diffendorfer et al. 2017), there are no records of knots colliding with turbines (78 Fed. Reg. 60024 [May 14, 2014]).

There are no observation records of Rufa Red Knots within the SWDA (USFWS 2018). Recent studies of Rufa Red Knot migratory patterns have shown great variation in routes, but with more Mid-Atlantic to southerly concentrations during spring migration and more northerly concentrations during fall migration, including Massachusetts (Burger et al. 2012a, 2012b; Niles et al. 2010; Normandeau Associates, Inc. 2011). Using geolocators, Burger et al. (2012a, 2012b) and Niles et al. (2010) documented migration flights of Rufa Red Knots that traverse the proposed offshore facilities area associated with the Proposed Action.

A telemetry study by Loring et al. 2018 found that Rufa Red Knots that migrated during early fall departed from the Atlantic coast in a southeast direction, likely heading to long-distance wintering destinations in South America. In addition, Rufa Red Knots that migrated during late fall traveled southwest across the Mid-Atlantic Bight, likely heading to short-distance wintering destinations in the southeastern United States and Caribbean. Interestingly, Rufa Red Knots migrated through federal waters of the Atlantic OCS during evenings with fair weather and a tailwind blowing in their direction of travel. Recent radio telemetry studies of Rufa Red Knots conducted for the Ocean Wind Project support these findings. Migratory, both short distance and long distance, flight data were collected on five individuals captured at three sites in coastal New Jersey. Of these, four individuals were considered short-distance migrants, and locations established by satellite tags were associated with relatively low flight heights (mean of 256.7 feet) and were almost all well inshore of offshore lease areas in New Jersey (BRI and WRP 2022). The one individual that made a long-distance migratory flight was documented at very high flight altitudes (mean of 1,080.1 feet) for the duration of the offshore migratory flight (BRI and WRP 2022).

Only a small portion of the Rufa Red Knot population uses the U.S. Atlantic coast during the southward migration (Loring et al. 2018). A recent study that tracked 388 Rufa Red Knots fitted with nanotags found that only two flew over the SWDA during fall migration in November (Loring et al. 2018). Most of the Rufa Red Knots (254) were tagged at stop over sites in James Bay and Mingan Islands, Canada, and most headed directly south over open ocean (Loring et al. 2018). Of the 99 Rufa Red Knots tagged while staging in Massachusetts before the fall migration, only 2 flew over the lease area (Loring et al. 2018). Most Rufa Red Knots departed from Massachusetts to the southeast during from mid-August through early September, while the two that crossed the lease area left very late in mid-November traveling southwest and represent 2 percent of the fall staging population in Massachusetts. Given that, up to 1,500 Rufa Red Knots stage in Massachusetts during fall (Gordon and Nations 2016), and only 2 percent of those 1,500 staging Rufa Red Knots may pass through the lease area in fall. In spring, the vast majority of Rufa Red Knots fly directly overland from stopover areas in Delaware Bay to breeding areas in Hudson Bay Canada. However, some travel up the coast in spring as confirmed by a recent tracking study (Loring et al. 2018). Ten percent of the fall staging population (150 Rufa Red Knots) may pass through the Nantucket area in spring (Gordon and Nations 2016).

Contrary to previous assumptions (Gordon and Nations 2016), fall migration flights occurred when visibility was approximately 12 miles with little or no precipitation (Loring et al. 2018; Feigin et al. 2022). Rufa Red Knots, particularly long-distance migrants, migrate at high altitudes from 1,640 to 3,281 feet (Alerstam et al. 1990; Gordon and Nations 2016), above the highest proposed RSZ of 1,171 feet above mean lower low water (COP Volume I; Epsilon 2022). In contrast to these observations, a study that estimated flights heights from telemetry data found that 83 percent of the 25 modeled flight paths occurred much lower and within approximately 39 to 656 feet above water (Loring et al. 2018). Yet, the confidence intervals around the estimated flight heights were very broad and, in several cases, spanning from near the ocean surface to over 328 feet (Loring et al. 2018). More recent telemetry studies of Rufa Red Knots found that the average mean altitude of 17 individuals migrating from coastal New Jersey was 17.7 feet, well below the RSZ (BRI and WRP 2022). Feigin et al. (2022) found a similar result, though flight height distributions are not available at this time. As such, the most recent flight height data for migrating Rufa Red Knots suggest that collisions with operating WTGs would not be expected given the observed flight heights. Additionally, very little, if any, Rufa Red Knot activity is expected to occur over the SWDA with relatively few (2 percent of 1,500 birds) flying through or over the SWDA during fall migration.

3.4 Northern Long-Eared Bat

The federally threatened northern long-eared bat occurs throughout Massachusetts, including Cape Cod, Martha’s Vineyard, and Nantucket. White-nose syndrome, a fungal disease of hibernating bats, has devastated this wide-ranging species, once common throughout eastern North America, particularly in the northeast (Turner et al. 2011). Given observed drastic population declines, the USFWS listed the northern long-eared bat as threatened. On January 14, 2016, the USFWS published a final ESA §4(d) rule that exempts from prohibition the incidental take of the northern long-eared bat from forest clearing under certain scenarios, pending compliance with required conservation measures (81 Fed. Reg. 9 [January 14, 2016]). On March 23, 2022, the USFWS published a proposed rule to re-classify the species as endangered throughout its range (87 Fed. Reg. 16442–16452 [March 23, 2022]).

The annual life-cycle of the northern long-eared bat includes winter hibernation (caves and mines), spring staging, spring migration, summer birth of young, fall migration, and fall swarming and mating. Northern long-eared bats are often overlooked during surveys in hibernacula because they typically roost singly or in small groups in crevices and cracks in cave or mine walls with only the nose and ears exposed (Caceres and Pybus 1997). In spring, the bats leave the hibernacula to roost in trees and forage near the hibernaculum in preparation for migration. Compared to tree bats (*Ardops nichollsi*), northern long-eared bats are short-distance migrants. From approximately mid-May through mid-August, northern long-eared bats occupy summer habitat. Northern long-eared bats roost under bark and in cavities or crevices of both live and dead trees (Foster and Kurta 1999; Owen et al. 2002; Perry and Thill 2007; Sasse and Perkins 1996), as well as in anthropogenic structures (Amelon and Burhans 2006; Timpone et al. 2010). Northern long-eared bats also switch roosts frequently, typically every 2 to 3 days (Carter and Feldhamer 2005; Foster and Kurta 1999; Owen et al. 2002; Timpone et al. 2010). Most foraging occurs up to 9.8 feet off the ground and between the understory and forest canopy (Brack and Whitaker 2001). Northern long-eared bats forage relatively close (approximately 1 mile) to their roost sites (Sasse and Perkins 1996; Timpone et al. 2010).

There is no definitive estimate of population size for northern long-eared bat across the species range. This species' cryptic behavior during hibernation (i.e., roosting in cracks and crevices of hibernacula walls) makes it difficult to detect. A review of the Massachusetts' Natural Heritage & Endangered Species Program's online database of known occupied northern long-eared bat maternity roost indicates that the closest occurrence is approximately 11.5 miles northwest of the proposed onshore substation site (Mass Wildlife 2022).

There has been a total of 34 northern long-eared bats passes on the OCS (Pelletier et al. 2013; ESS 2014; Peterson and Pelletier 2016; Stantec 20018). A recent study of bat movement on Martha's Vineyard did not find evidence of offshore movement by northern long-eared bats and presented evidence of northern long-eared bats hibernating on Martha's Vineyard and Nantucket islands (Dowling et al. 2017). During the course of construction of the Block Island Wind Farm, vessel-based monitoring for bats was conducted. Of the 1,546 bat passes that were recorded, none were northern long-eared bats (Stantec 2018). Additionally, recent data from 3 years of post-construction monitoring at the Block Island Wind Farm indicate low numbers of bats present offshore only during fall migration, with no detections of northern long-eared bats (Stantec 2020). Similarly, no northern long-eared bats were detected at the Coastal Virginia Offshore Wind Project (Dominion 2022). Therefore, given the rarity of the bat in the region, its ecology, and its habitat requirements, it is extremely unlikely northern long-eared bats would traverse the offshore portions of the Action Area.

4. Effects of Proposed Action

Pursuant to ESA requirements, this BA analyzes the potential direct, indirect, and cumulative impacts of the Proposed Action on northern long-eared bat, Roseate Terns, Piping Plovers, and Rufa Red Knots and/or their habitats to determine if the Proposed Action is likely to adversely affect these species or their habitats (50 CFR § 402.12). This analysis uses the following definitions in the effects determination:

- **No effect:** Generally, a listed resource is not exposed to the Proposed Action and, therefore, no impacts (positive or negative) will occur.
- **May affect, but is not likely to adversely affect:** This is the appropriate determination if effects on listed resources are either:
  - Beneficial, meaning entirely positive, with no adverse effects;
  - Insignificant, which are related to the size of the impact and include effects that are too small to be measured, evaluated, or are otherwise undetectable; or
  - Discountable, which are effects that are extremely unlikely to occur.
- **May affect and is likely to adversely affect:** This is the appropriate determination if any direct or indirect adverse effects on listed resources that are not entirely beneficial, insignificant, or discountable will occur as a result of the Proposed Action.

The Proposed Action, as described herein, has the potential to affect the following ESA-listed species under the jurisdiction of the USFWS: northern long-eared bat, Roseate Tern, Piping Plover, and Rufa Red Knot. Previous assessments of Project-related impacts on avian and bat resources resulting from a variety of actions associated with the construction, operations, and decommissioning of an offshore wind facility have been completed by BOEM.

BOEM 2012, 2014, and 2016 and USFWS 2008 provide an assessment of these impacts and are summarized below. Impacts resulting from the above covered actions are expected to be insignificant and discountable; therefore, the Proposed Action may affect, but is not likely to adversely affect federally listed bird and bat species.

4.1 Northern Long-Eared Bat

The Proposed Action would remove up to approximate 6.7 acres of forest for the onshore substation. A review of known occupied northern long-eared bat roost trees was conducted near the proposed substation site where forest removal would occur (Figure 2-2). No occupied hibernacula were within a 0.25 mile of the Action Area, and the nearest known occupied maternity roost was 11.5 miles northwest of the proposed substation.

For the purposes of this analysis, BOEM assumes that the applicant will conduct required tree-clearing activities for the onshore portions of the proposed Project during the seasonal tree-clearing window of November 1 to March 31. As such, no direct impacts on northern long-eared bats would be expected to occur. Given the small amount of forested habitat removal required and the presence of suitable forested habitat in the vicinity of the proposed onshore Project elements, indirect impacts resulting from the removal of potentially suitable habitat may affect but are **not likely to adversely affect** northern long--eared bats. Should tree clearing be necessary outside of the seasonal clearing window as described above, presence/probable absence surveys and associated consultation with the USFWS will be required by BOEM and ESA compliance achieved through that additional consultation.

4.2 Roseate Tern, Piping Plover, and Rufa Red Knot

4.2.1 Direct Effects

Direct effects include onshore construction, drilling and cable laying, pile driving and construction, lighting, collision with structures, decommissioning, and discharge of waste and accidental fuel leaks.

4.2.2 Substation Construction

The proposed substation site is in highly disturbed residential areas and does not provide potentially suitable habitat for nesting or foraging Roseate Terns, Piping Plovers, and Rufa Red Knots. The site is located on the eastern portion of a previously developed site within the Independence Park commercial/industrial area in the Town of Barnstable. Construction of the substation site would require the removal of approximately 6.7 acres of forested habitat. None of the shorebirds (Rufa Red Knot, Roseate Tern, or Piping Plover) use urban forests for nesting, foraging, or roosting. Therefore, substation construction is expected to have **no effect** on Roseate Terns, Piping Plovers, or Rufa Red Knots.

4.2.2.1 Onshore Export Cable Installation

Roseate Terns, Piping Plovers, and Rufa Red Knots do not nest in any of the potential landfall sites. Onshore export cable installation is unlikely to disturb coastal habitat at the Covell’s Beach, Craigville Beach, and Dowses Beach landfall sites due to the proposed use of HDD methods to make the offshore to onshore transition. The Wianno Avenue Landfall Site has been completely altered with human-made structures. Covell’s Beach Landfall Site is a private beach next to dense residential development. Piping Plovers do not nest at Covell’s Beach; only records of a single pair of Piping Plovers nesting are at the nearby public Craigville Beach (Melvin 2012; MassWildlife 2018). Nevertheless, the applicant prepared a Piping Plover protection plan for Massachusetts Division of Fisheries and Wildlife Natural Heritage & Endangered Species Program in case HDD activities extend beyond April 1 (Appendix C, Draft Piping Plover Protection Plan). Any disturbances associated with construction would be short term and limited to the daytime hours. All proposed onshore cable routes are co-located with existing, previously disturbed, linear corridors (public road, rail, and electric ROWs), allowing the export cable to be buried below grade (COP Volume I; Epsilon 2022) and do not provide potentially suitable habitat for foraging Roseate Terns, Piping Plovers, and Rufa Red Knots. Therefore, installation of the onshore export cable is expected to be **insignificant and discountable** on Roseate Terns, Piping Plovers, or Rufa Red Knots.

4.2.2.2 Offshore Export Cable Installation

Seafloor disturbance resulting from the installation of the offshore export cables would not affect Piping Plovers and Rufa Red Knots, as these species are strictly terrestrial foragers and do not use aquatic habitats for foraging. While disturbance to individual foraging Roseate Tern may occur as a result of offshore export cable installation in appropriate habitat, the disturbance is not expected to be different from typical construction equipment (barges and/or dredges), and cable installation would not affect Roseate Terns (USFWS 2008). Jet-plowing activities that occur from July to mid-September have the potential to result in short-term disturbance of individual staging Roseate Terns (USFWS 2008).

Impacts on benthic habitats and increased turbidity during cable-laying activities have the potential to affect sand lance, an important prey resource for Roseate Terns (USFWS 2008). Given the nature of the construction techniques (i.e., jet plow), impacts such as increased turbidity would be short term and localized in nature and would not directly affect terns because the activity is underwater. Water quality impacts and disturbance resulting from construction and decommissioning of offshore export cables are not expected due to the short-term duration of disturbance and water column sedimentation from submarine cable construction activities (USFWS 2008). It is estimated that water turbidity conditions would return to normal within a few hours of cable installation (USFWS 2008). As such, impacts on

Roseate Terns, if any, resulting from installation of the offshore export cables would be **insignificant and discountable** (USFWS 2008), and **no effect** on Piping Plovers and Rufa Red Knots would occur.

Despite unavoidable mortality, injury/damage, or displacement of potential prey items, the area affected by the 278 acres of temporary cable emplacement footprint in the offshore proposed Project area (COP Volume III, Appendix III-T; Epsilon 2022) would be 0.2 to 0.3 percent of the 101,590- to 111,939-acre SWDA. The SWDA is comprised entirely of unconsolidated substrate, predominantly sand and mud (soft bottom). The seafloor would be disturbed by cable trenches, skid tracks, and spud prints. Although active construction would temporarily disturb benthic habitat, non-complex habitats would rapidly return to pre-Project conditions following impacts from burial. The fine- and medium-grained sand of the SWDA provides uniform and simple (non-complex) habitat typical of this region. Complex habitats may take longer to recover but would still recover completely (HDR 2020). The impacts would likely be short term, considering the natural mobility of sand in the SWDA and OECC, although full recovery of the benthic faunal assemblage may require several years (Boyd et al. 2005). Population-level impacts are not expected to occur for benthic species (i.e., generally accepted ecological and fisheries methods would be unable to detect a change in population). Neighboring benthic communities that have similar habitats and assemblages would colonize disturbed areas over time that have not been displaced by new structures. As such impacts to Roseate Terns as a result of loss of potentially suitable prey habitat would be **insignificant and discountable.**

4.2.2.3 Construction and Pile Driving

Construction of the Proposed Action would result in increased noise levels, primarily from pile-driving activities. The type and intensity of the sound and the distance it travels can vary greatly and are dependent on multiple factors including, but not limited to, atmospheric conditions, the type and size of the pile, the type of substrate, the depth of the water, and the type and size of the impact hammer. If present in the area, migrating Roseate Terns, Piping Plovers, and Rufa Red Knots may be exposed to increased noise levels due to construction activities. Species responses may range from escape behavior to mild annoyance (BOEM 2014, 2016). However, the potential noise impacts would be short term, lasting only for the duration of the pile-driving activity (3 hours per pile). In addition, these species are highly mobile and would be able to avoid the construction area; the noise from pile driving is not anticipated to affect the migratory movements or behaviors of these species through the area. Therefore, pile -driving -related construction noise may affect these bird species, but the impact would be **insignificant and discountable.**

4.2.2.4 Lighting Effects

Under poor visibility conditions (fog and rain), some migrating birds may become disoriented and circle lighted communication towers instead of continuing on their migratory path, greatly increasing their risk of collision (Hüppop et al. 2006). Tower lighting would have the greatest impact on bird species during evening hours when nocturnal migration occurs. However, red flashing aviation obstruction lights are commonly used at land-based wind facilities without any observed increase in avian mortality compared with unlit turbine towers (Kerlinger et al. 2010). The Proposed Action includes the use of red flashing aviation obstruction lights on WTGs and ESPs in accordance with FAA and BOEM requirements (COP Volume III; Epsilon 2022), and ADLS may also be installed so that obstruction lights would only be activated when an aircraft are near the turbines. The use of ADLS would dramatically reduce the amount of time the obstruction lights are operating. Additionally, BOEM anticipates that any additional work lights on support vessels or Project structures would be hooded downward and directed, when possible, to reduce illumination of adjacent waters and upward illumination, and used only when required to complete a Project task (COP Volume III; Epsilon 2022). Therefore, the potential impacts from artificial lighting of structures during construction, operations, and decommissioning of the Proposed Action on federally listed bird species would be insignificant and discountable.

4.2.2.5 Accidental Release Effects

Roseate Tern is the only federally listed species considered in this BA with the potential to be affected by accidental releases in the offshore environment. Accidental releases would not affect Piping Plovers or Rufa Red Knots, as these species are strictly terrestrial foragers and do not use aquatic habitats for foraging.

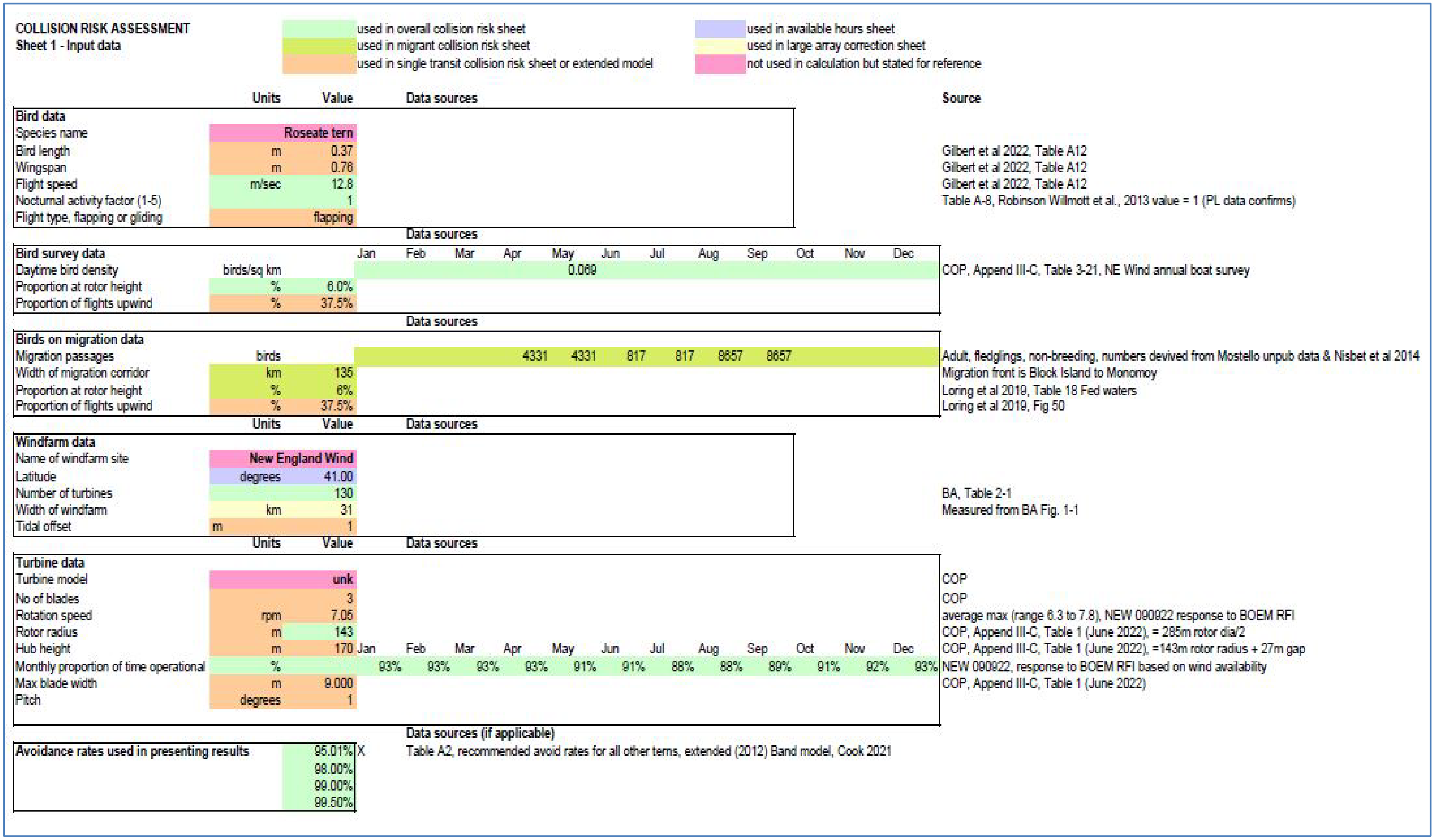
Accidental releases of fuel/fluids/hazardous materials, sediment, and/or trash and debris may increase as a result of the Proposed Action. The risk of any type of accidental release would be increased primarily during construction but also during operations and decommissioning of offshore wind facilities. Ingestion of hazardous materials could have lethal and sublethal impacts on birds, including decreased hematological function, dehydration, drowning, hypothermia, starvation, and weight loss (Briggs et al. 1997; Haney et al. 2017; Paruk et al. 2016). Additionally, even small exposures that result in oiling of feathers can lead to sublethal impacts that include changes in flight efficiencies and result in increased energy expenditure during daily and seasonal activities, including chick provisioning, commuting, courtship, foraging, long-distance migration, predator evasion, and territory defense (Maggini et al. 2017).

Some potential for mortality, decreased fitness, and health impacts exist due to the accidental release of fuel, hazardous materials, and trash and debris from Phase 1 vessels. Operational waste from Phase 1 vessels could include bilge and ballast water, sanitary and domestic wastes, and trash and debris. All Phase 1 vessels would comply with U.S. Coast Guard requirements for the prevention and control of oil and fuel spills. Proper vessel regulations and operating procedures would minimize impacts on bird species resulting from the release of debris, fuel, hazardous materials, or waste (BOEM 2012). Additionally, training and awareness of best management practices proposed for waste management and mitigation of marine debris would be required of proposed Project personnel, reducing the likelihood of occurrence to a very low risk. These releases, if any, would occur infrequently at discrete locations and vary widely in space and time; as such, impacts on Roseate Terns, if any, would be **insignificant and discountable**.

4.2.2.6 Collision Effects

This section discusses the potential for impacts on federally listed species resulting from collisions with WTGs, ESPs, and construction/operations vessels associated with the Proposed Action. These species are agile flyers and rarely collide with stationary structures such as bridges, communication towers, lighthouses, light poles, or moving vessels (e.g., boats). Birds are expected to avoid colliding with fixed structures, such as WTG towers and ESPs, and vessels. As such, the likelihood of collisions with fixed structures or vessels associated with the Proposed Action is insignificant and discountable.

The primary hazard posed to federally listed birds from offshore wind energy development would be collision mortality (Everaert and Stienen 2007; Furness et al. 2013; Robinson Willmott et al. 2013). This section focuses on the collision risk from WTGs for the Piping Plover, Rufa Red Knot, and Roseate Tern and uses the most relevant information about known occurrences and species' interactions with offshore wind developments on the Atlantic OCS. BOEM followed the parameterization of the Band Model (Band 2012) and Stochastic Collision Risk Assessment for Movement (SCRAM) (Gilbert et al. 2022) to evaluate the risk of bird collision with operating WTGs in offshore wind. These models factors bird size and flight behavior, number of individuals passing through the migratory corridor, migratory corridor and wind farm width, number of WTGs, RSZ, percentage of individuals flying at altitudes within the RSZ, predicted operating time during the migration season by month, and a behavioral avoidance modifier to estimate collision risk. Figures 4-1, 4-2, and 4-3 show the Band Model inputs for Roseate Terns, Piping Plover, and Rufa Red Knot. Appendix D, Stochastic Collision Risk Assessment for Movement Inputs and Outputs, describes the SCRAM model inputs and outputs.



COLLISION RISK ASSESSMENT
Sheet 1 - Input data

🟩 used in overall collision risk sheet
🟨 used in migrant collision risk sheet
🟧 used in single transit collision risk sheet or extended model
🟪 used in available hours sheet
⬜ used in large array correction sheet
🟥 not used in calculation but stated for reference

Bird data	Units	Value	Data sources	Source
Species name		Roseate tern		
Bird length	m	0.37		Gilbert et al 2022, Table A12
Wingspan	m	0.76		Gilbert et al 2022, Table A12
Flight speed	m/sec	12.8		Gilbert et al 2022, Table A12
Nocturnal activity factor (1-5)		1		Table A-8, Robinson Willmott et al., 2013 value = 1 (PL data confirms)
Flight type, flapping or gliding		flapping		

Bird survey data			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daytime bird density	birds/sq km						0.069								COP, Append III-C, Table 3-21, NE Wind annual boat survey
Proportion at rotor height	%	6.0%													
Proportion of flights upwind	%	37.5%													

Birds on migration data			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Migration passages	birds					4331	4331	817	817	8657	8657				Adult, fledglings, non-breeding, numbers devived from Mostello unpub data & Nisbet et al 2014
Width of migration corridor	km	135													Migration front is Block Island to Monomoy
Proportion at rotor height	%	6%													Loring et al 2019, Table 18 Fed waters
Proportion of flights upwind	%	37.5%													Loring et al 2019, Fig 50

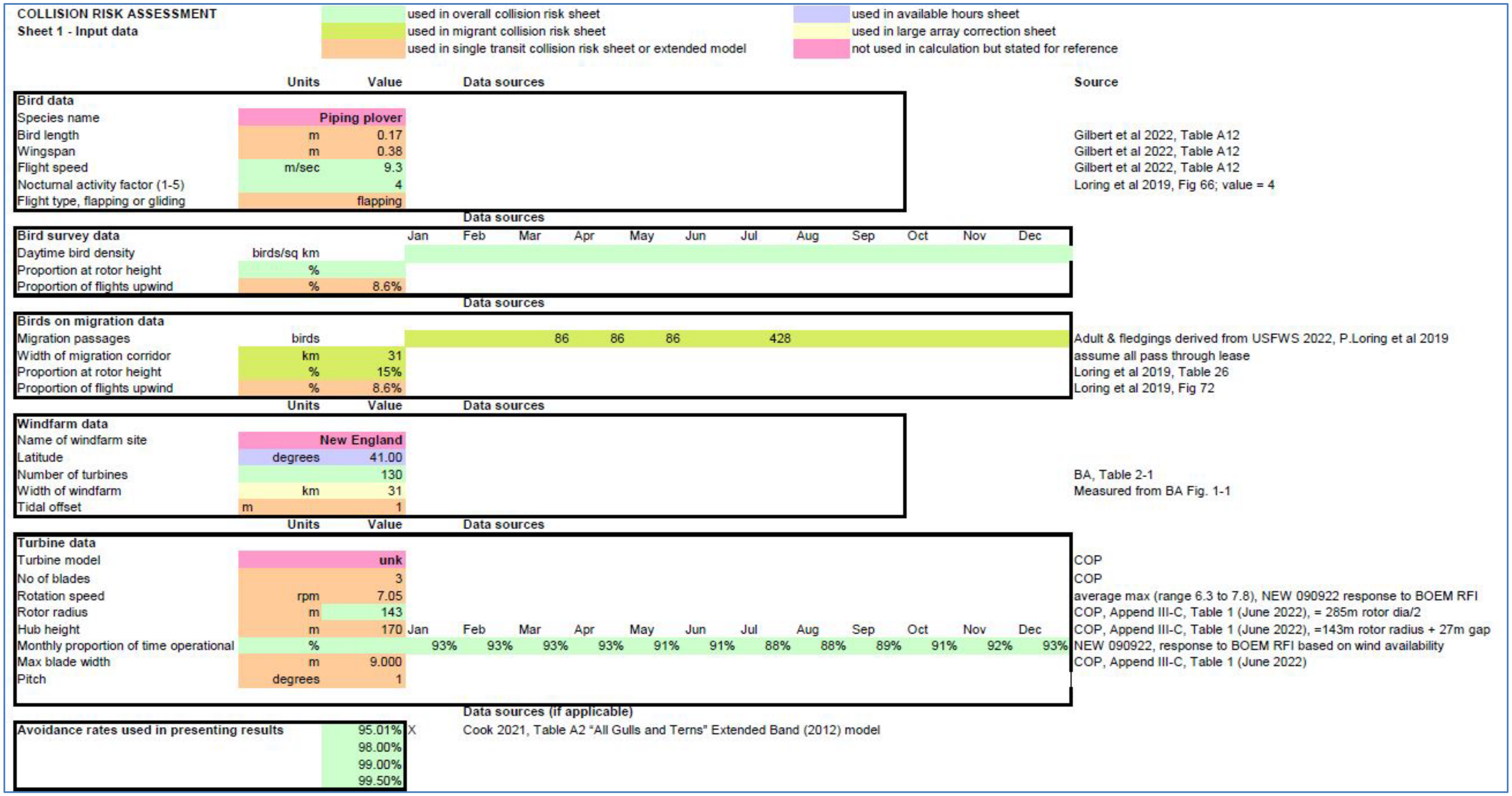
Windfarm data	Units	Value	Data sources	
Name of windfarm site		New England Wind		
Latitude	degrees	41.00		
Number of turbines		130		BA, Table 2-1
Width of windfarm	km	31		Measured from BA Fig. 1-1
Tidal offset	m	1		

Turbine data	Units	Value	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Turbine model		unk													COP
No of blades		3													COP
Rotation speed	rpm	7.05													average max (range 6.3 to 7.8), NEW 090922 response to BOEM RFI
Rotor radius	m	143													COP, Append III-C, Table 1 (June 2022), = 285m rotor dia/2
Hub height	m	170													COP, Append III-C, Table 1 (June 2022), =143m rotor radius + 27m gap
Monthly proportion of time operational	%		93%	93%	93%	93%	91%	91%	88%	88%	89%	91%	92%	93%	NEW 090922, response to BOEM RFI based on wind availability
Max blade width	m	9.000													COP, Append III-C, Table 1 (June 2022)
Pitch	degrees	1													

Avoidance rates used in presenting results			Data sources (if applicable)
	95.01%	X	Table A2, recommended avoid rates for all other terns, extended (2012) Band model, Cook 2021
	98.00%		
	99.00%		
	99.50%		

COP = Construction and Operations Plan; km = kilometer; m = meter; m/sec = meter per second; rpm = revolutions per minute; sq km = square kilometer

Figure 4-1: Data Used in the Input Data Spreadsheet within the Band (2012) Collision Risk Model for Roseate Tern



COLLISION RISK ASSESSMENT
Sheet 1 - Input data

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🟨	used in migrant collision risk sheet
🟧	used in single transit collision risk sheet or extended model
🟪	used in available hours sheet
⬜	used in large array correction sheet
🟥	not used in calculation but stated for reference

	Units	Value	Data sources	Source
Bird data				
Species name		**Piping plover**		
Bird length	m	0.17		Gilbert et al 2022, Table A12
Wingspan	m	0.38		Gilbert et al 2022, Table A12
Flight speed	m/sec	9.3		Gilbert et al 2022, Table A12
Nocturnal activity factor (1-5)		4		Loring et al 2019, Fig 66; value = 4
Flight type, flapping or gliding		flapping		

			Data sources												
Bird survey data			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daytime bird density	birds/sq km														
Proportion at rotor height	%														
Proportion of flights upwind	%	8.6%													

			Data sources												
Birds on migration data															
Migration passages	birds				86	86	86		428						Adult & fledgings derived from USFWS 2022, P.Loring et al 2019
Width of migration corridor	km	31													assume all pass through lease
Proportion at rotor height	%	15%													Loring et al 2019, Table 26
Proportion of flights upwind	%	8.6%													Loring et al 2019, Fig 72

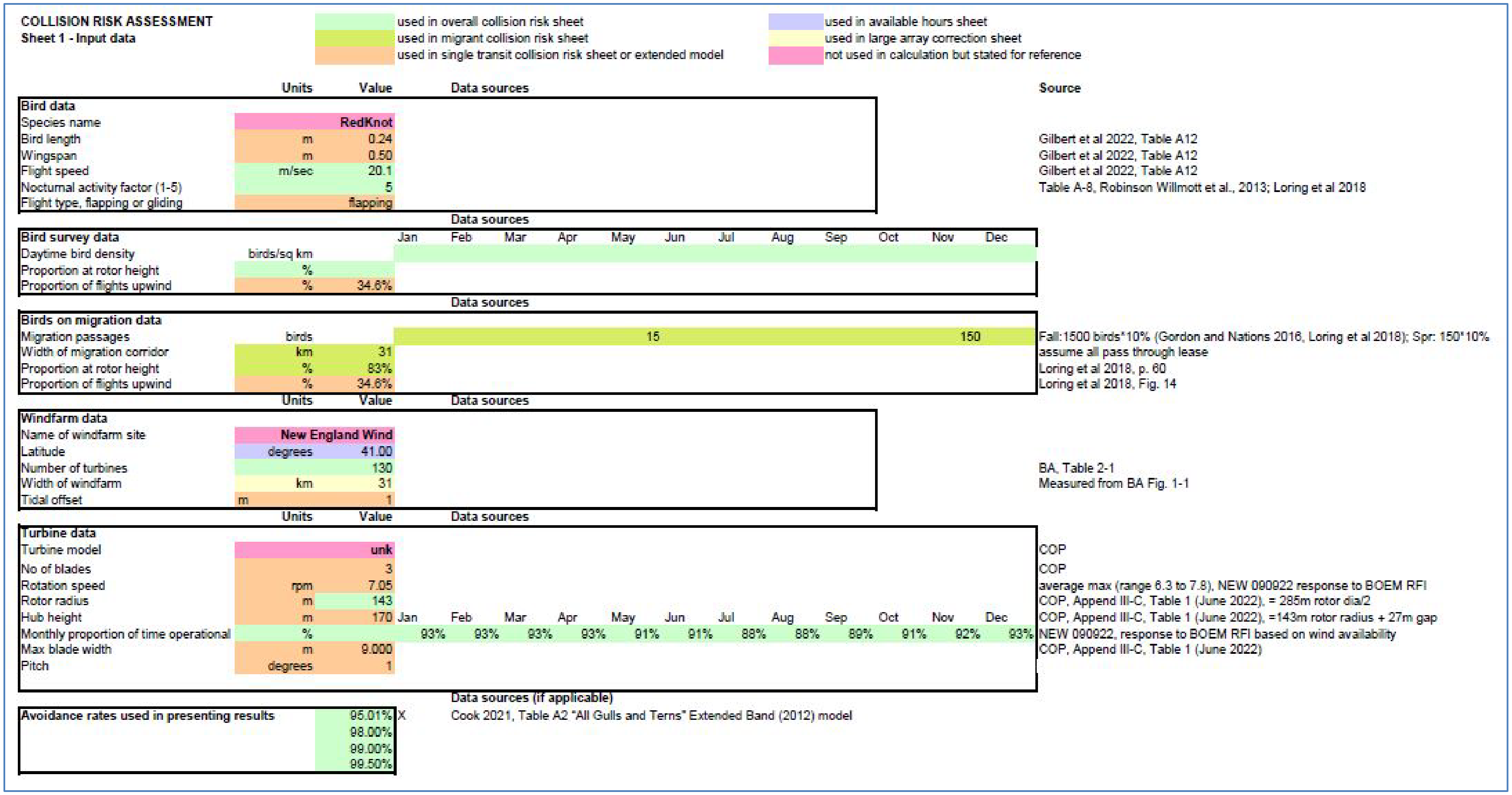
	Units	Value	Data sources	
Windfarm data				
Name of windfarm site		**New England**		
Latitude	degrees	41.00		
Number of turbines		130		BA, Table 2-1
Width of windfarm	km	31		Measured from BA Fig. 1-1
Tidal offset	m	1		

	Units	Value	Data sources												
Turbine data															
Turbine model		**unk**													COP
No of blades		3													COP
Rotation speed	rpm	7.05													average max (range 6.3 to 7.8), NEW 090922 response to BOEM RFI
Rotor radius	m	143													COP, Append III-C, Table 1 (June 2022), = 285m rotor dia/2
Hub height	m	170	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	COP, Append III-C, Table 1 (June 2022), =143m rotor radius + 27m gap
Monthly proportion of time operational	%		93%	93%	93%	93%	91%	91%	88%	88%	89%	91%	92%	93%	NEW 090922, response to BOEM RFI based on wind availability
Max blade width	m	9.000													COP, Append III-C, Table 1 (June 2022)
Pitch	degrees	1													

			Data sources (if applicable)
Avoidance rates used in presenting results	95.01%	X	Cook 2021, Table A2 "All Gulls and Terns" Extended Band (2012) model
	98.00%		
	99.00%		
	99.50%		

COP = Construction and Operations Plan; km = kilometer; m = meter; m/sec = meter per second; rpm = revolutions per minute; sq km = square kilometer

Figure 4-2: Data Used in the Input Data Spreadsheet within the Band (2012) Collision Risk Model for Piping Plover



COLLISION RISK ASSESSMENT
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⬜ used in large array correction sheet
🟥 not used in calculation but stated for reference

	Units	Value	Data sources	Source
Bird data				
Species name		RedKnot		
Bird length	m	0.24		Gilbert et al 2022, Table A12
Wingspan	m	0.50		Gilbert et al 2022, Table A12
Flight speed	m/sec	20.1		Gilbert et al 2022, Table A12
Nocturnal activity factor (1-5)		5		Table A-8, Robinson Willmott et al., 2013; Loring et al 2018
Flight type, flapping or gliding		flapping		

	Units	Value	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Source
Bird survey data															
Daytime bird density	birds/sq km														
Proportion at rotor height	%														
Proportion of flights upwind	%	34.6%													
Birds on migration data															
Migration passages	birds						15						150		Fall:1500 birds*10% (Gordon and Nations 2016, Loring et al 2018); Spr: 150*10%
Width of migration corridor	km	31													assume all pass through lease
Proportion at rotor height	%	83%													Loring et al 2018, p. 60
Proportion of flights upwind	%	34.6%													Loring et al 2018, Fig. 14

	Units	Value	Data sources	Source
Windfarm data				
Name of windfarm site		New England Wind		
Latitude	degrees	41.00		
Number of turbines		130		BA, Table 2-1
Width of windfarm	km	31		Measured from BA Fig. 1-1
Tidal offset	m	1		

	Units	Value	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Source
Turbine data															
Turbine model		unk													COP
No of blades		3													COP
Rotation speed	rpm	7.05													average max (range 6.3 to 7.8), NEW 090922 response to BOEM RFI
Rotor radius	m	143													COP, Append III-C, Table 1 (June 2022), = 285m rotor dia/2
Hub height	m	170													COP, Append III-C, Table 1 (June 2022), =143m rotor radius + 27m gap
Monthly proportion of time operational	%		93%	93%	93%	93%	91%	91%	88%	88%	89%	91%	92%	93%	NEW 090922, response to BOEM RFI based on wind availability
Max blade width	m	9.000													COP, Append III-C, Table 1 (June 2022)
Pitch	degrees	1													

			Data sources (if applicable)
Avoidance rates used in presenting results	95.01%	X	Cook 2021, Table A2 "All Gulls and Terns" Extended Band (2012) model
	98.00%		
	99.00%		
	99.50%		

COP = Construction and Operations Plan; km = kilometer; m = meter; m/sec = meter per second; rpm = revolutions per minute; sq km = square kilometer

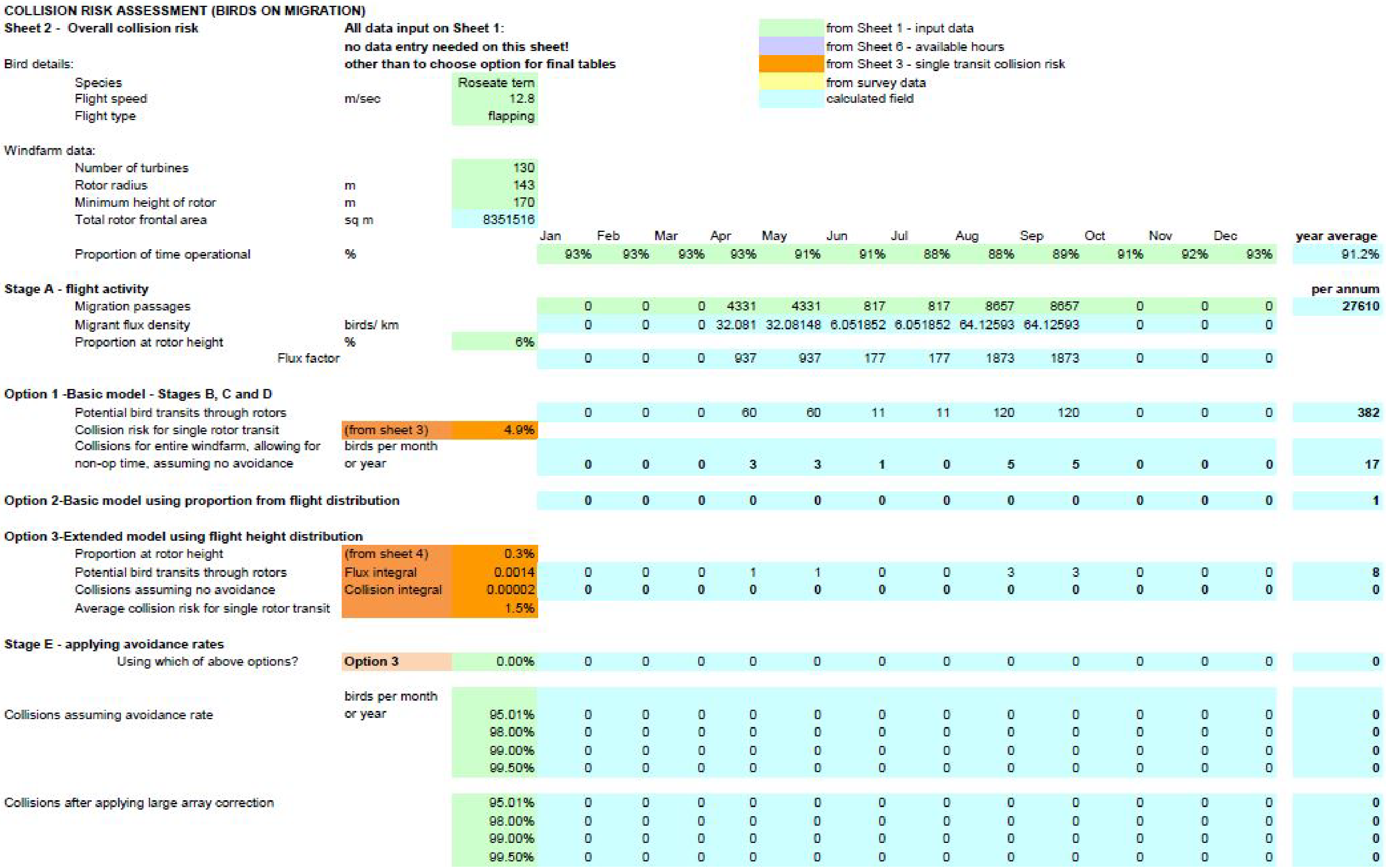
Figure 4-3: Data Used in the Input Data Spreadsheet within the Band (2012) Collision Risk Model for Rufa Red Knot

ROSEATE TERNS

The distance from shore to the offshore Project elements and the lack of suitable habitat in the Action Area precludes use by nesting and foraging Roseate Terns. Despite extensive regional surveys in the region and the Action Area, there are no records of Roseate Terns in the area proposed for offshore wind turbines. In addition, statistical models using the survey data predict an absence of Roseate Terns in the area proposed for offshore wind turbines. Although it is possible for migrating Roseate Terns to pass through the lease area, a recent multiyear study did not track any migrating Roseate Terns through the area proposed for offshore wind turbines at or above the RSZ. Collison with WTGs is unlikely because terns are agile flyers and can easily avoid WTGs and fly below the RSZ of offshore turbines in the region; in addition, terns fly on the OCS when visibility was greater than 3.1 miles and at approximately 36 to 65 feet above the water below the RSZ.

Quantitative take analyses are performed when take is expected and there is a need to estimate the amount of take. Take is unlikely due to the reasons described above; nonetheless, BOEM conducted quantitative take analyses to evaluate the impacts of the proposed Project. BOEM used the Band Model (Band 2012) to evaluate risk of injury or mortality to Roseate Tern from collision with turbines. Most of the model inputs (e.g., migration passage, proportion flying in the RSZ, turbine specifications, and facility dimensions) were obtained or calculated from the COP and Loring et al. (2019). Turbine avoidance rate of 95.01 percent was used for Piping Plover (Cook 2021). A total of 130 operating turbines each with a 27-meter (89-foot) airgap between blade and water were used in the model. The developer provided monthly estimates of wind availability.

The proportion of the Roseate Tern population that flies through the SWDA during migration is not currently known; therefore, it was assumed that the birds would spread themselves evenly along a ‘migration front’ spanning nearly 84 miles between Block Island and Monomoy; only birds passing through the 13.6-mile-wide SWDA would be exposed to the wind farm. For spring migration (April and May), the number of passages through the migration front was based on the number of U.S. and Canadian breeding adults in 2016. In June and July, the number of passages by second year birds migrating from South America was based on the number that fledged in 2015 in New York, Connecticut, and Massachusetts and survived to 2017. For fall migration, all U.S. and Canadian breeding adults (2017), fledglings (2017), and second year birds (2015 birds that survived to 2017) passed through the front. There is evidence of Roseate Terns in the SWDA, a separate (other use) analysis was conducted to explore the potential risk to birds that may be in the SWDA in early spring. The other use analysis used survey data from boat surveys in the proposed area of development in 2018 (COP, Appendix III-C; Epsilon 2022). The flight height distribution was derived from the midpoints of 1,758, 10-minute observations of 75 Roseate Terns flying nonstop over federal waters (Loring et al. 2018). Given that the flight height distribution is known for this species, fatalities estimated are based on calculations from the extended model (Option 3), and the fatality estimates are based on the large array correction factor because the turbines are in rows (Band 2012). Based on the collision risk model, the estimated annual number of fatalities for migrating Roseate Terns was **zero** (see Figures 4-4 and 4-5 for model outputs).



COLLISION RISK ASSESSMENT (BIRDS ON MIGRATION)

Sheet 2 - Overall collision risk

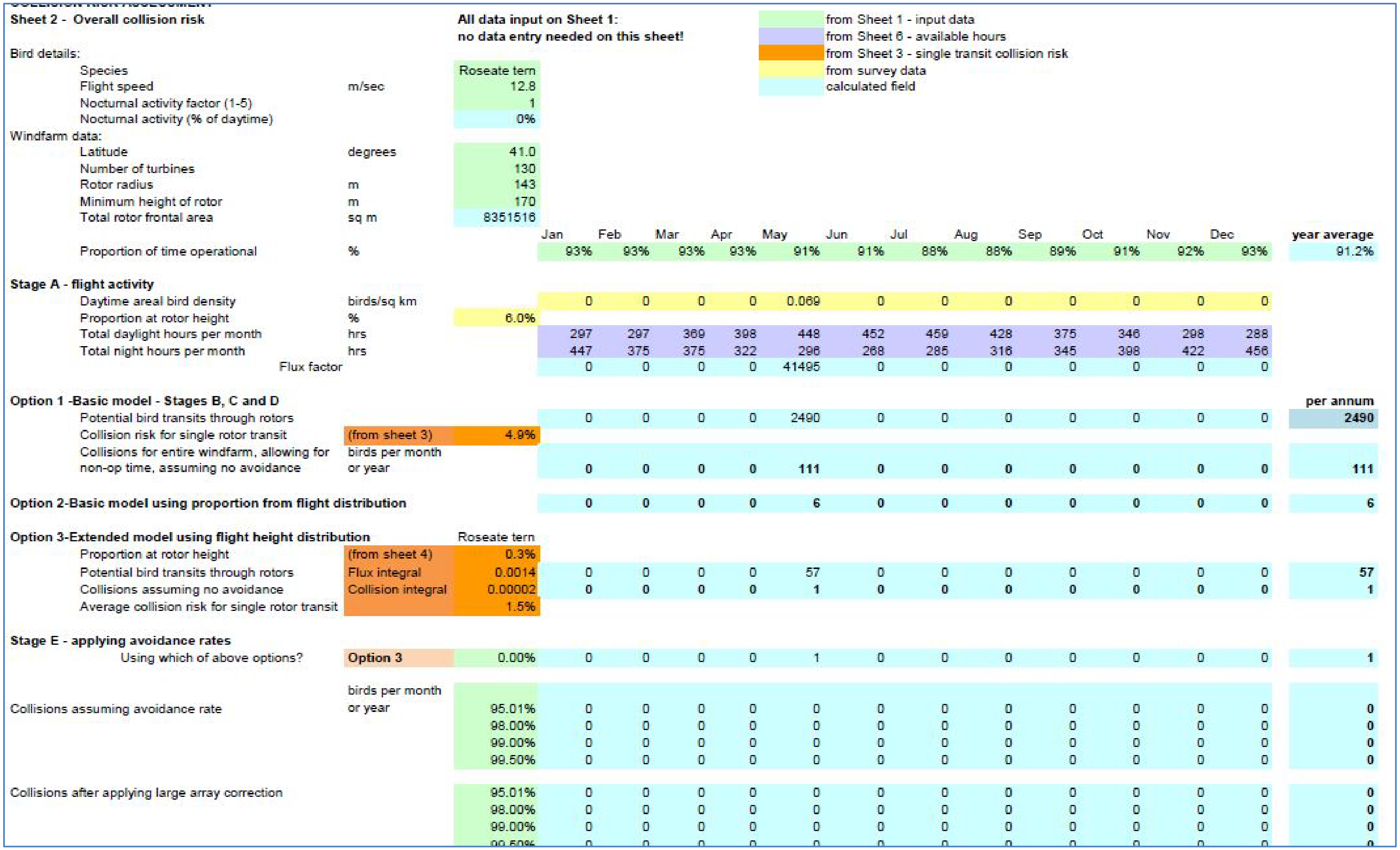
All data input on Sheet 1:
no data entry needed on this sheet!
other than to choose option for final tables

🟩 from Sheet 1 - input data
🟪 from Sheet 6 - available hours
🟧 from Sheet 3 - single transit collision risk
🟨 from survey data
🟦 calculated field

Bird details:															
Species		Roseate tern													
Flight speed	m/sec	12.8													
Flight type		flapping													
Windfarm data:															
Number of turbines		130													
Rotor radius	m	143													
Minimum height of rotor	m	170													
Total rotor frontal area	sq m	8351516													
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**year average**
Proportion of time operational	%		93%	93%	93%	93%	91%	91%	88%	88%	89%	91%	92%	93%	91.2%
Stage A - flight activity															**per annum**
Migration passages			0	0	0	4331	4331	817	817	8657	8657	0	0	0	**27610**
Migrant flux density	birds/ km		0	0	0	32.081	32.08148	6.051852	6.051852	64.12593	64.12593	0	0	0	
Proportion at rotor height	%	6%													
Flux factor			0	0	0	937	937	177	177	1873	1873	0	0	0	
Option 1 -Basic model - Stages B, C and D															
Potential bird transits through rotors			0	0	0	60	60	11	11	120	120	0	0	0	**382**
Collision risk for single rotor transit	(from sheet 3)	4.9%													
Collisions for entire windfarm, allowing for non-op time, assuming no avoidance	birds per month or year		**0**	**0**	**0**	**3**	**3**	**1**	**0**	**5**	**5**	**0**	**0**	**0**	**17**
Option 2-Basic model using proportion from flight distribution			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
Option 3-Extended model using flight height distribution															
Proportion at rotor height	(from sheet 4)	0.3%													
Potential bird transits through rotors	Flux integral	0.0014	0	0	0	1	1	0	0	3	3	0	0	0	**8**
Collisions assuming no avoidance	Collision integral	0.00002	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Average collision risk for single rotor transit		1.5%													
Stage E - applying avoidance rates															
Using which of above options?	**Option 3**	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Collisions assuming avoidance rate	birds per month or year	95.01%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		98.00%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		99.00%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		99.50%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Collisions after applying large array correction		95.01%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		98.00%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		99.00%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		99.50%	0	0	0	0	0	0	0	0	0	0	0	0	**0**

hrs = hours; m = meter; m/sec = meter per second; sq km = square kilometer; sq m = square meter

Figure 4-4: Results as Presented in the Migrant Collision Risk Spreadsheet within Band (2012) Collision Risk Model for Roseate Tern



Sheet 2 - Overall collision risk

All data input on Sheet 1:
no data entry needed on this sheet!

🟩 from Sheet 1 - input data
🟪 from Sheet 6 - available hours
🟧 from Sheet 3 - single transit collision risk
🟨 from survey data
🟦 calculated field

Bird details:															
Species		Roseate tern													
Flight speed	m/sec	12.8													
Nocturnal activity factor (1-5)		1													
Nocturnal activity (% of daytime)		0%													
Windfarm data:															
Latitude	degrees	41.0													
Number of turbines		130													
Rotor radius	m	143													
Minimum height of rotor	m	170													
Total rotor frontal area	sq m	8351516													
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**year average**
Proportion of time operational	%		93%	93%	93%	93%	91%	91%	88%	88%	89%	91%	92%	93%	91.2%
Stage A - flight activity															
Daytime areal bird density	birds/sq km		0	0	0	0	0.069	0	0	0	0	0	0	0	
Proportion at rotor height	%	6.0%													
Total daylight hours per month	hrs		297	297	369	398	448	452	459	428	375	346	298	288	
Total night hours per month	hrs		447	375	375	322	296	268	285	316	345	398	422	456	
Flux factor			0	0	0	0	41495	0	0	0	0	0	0	0	
Option 1 -Basic model - Stages B, C and D															**per annum**
Potential bird transits through rotors			0	0	0	0	2490	0	0	0	0	0	0	0	**2490**
Collision risk for single rotor transit	(from sheet 3)	4.9%													
Collisions for entire windfarm, allowing for non-op time, assuming no avoidance	birds per month or year		**0**	**0**	**0**	**0**	**111**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**111**
Option 2-Basic model using proportion from flight distribution			**0**	**0**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6**
Option 3-Extended model using flight height distribution		Roseate tern													
Proportion at rotor height	(from sheet 4)	0.3%													
Potential bird transits through rotors	Flux integral	0.0014	0	0	0	0	57	0	0	0	0	0	0	0	**57**
Collisions assuming no avoidance	Collision integral	0.00002	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
Average collision risk for single rotor transit		1.5%													
Stage E - applying avoidance rates															
Using which of above options?	**Option 3**	0.00%	0	0	0	0	1	0	0	0	0	0	0	0	**1**
Collisions assuming avoidance rate	birds per month or year	95.01%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		98.00%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		99.00%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		99.50%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Collisions after applying large array correction		95.01%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		98.00%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		99.00%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		99.50%	0	0	0	0	0	0	0	0	0	0	0	0	**0**

km = kilometer; m = meter; m/sec = meter per second; sq km = square kilometer; sq m = square meter

Figure 4-5: Results as Presented in the Other Use Spreadsheet within Band (2012) Collision Risk Model for Roseate Tern

To further inform this ESA consultation, BOEM used SCRAM to estimate the likelihood of take—more specifically, to estimate the relative likelihood of the take of one individual in a year and during the 33-year operations period of the wind farm. SCRAM uses bird passage rates based on modeled flight paths of birds fitted with nanotag transmitters (Gilbert et al 2022). The use of tracking data is representative of bird movements because the locations are recorded day and night for weeks and even months regardless of weather conditions. The wind farm and turbine operational inputs were similar to those used in the analysis using the Band Model, and the developer also provided estimates of wind speed and monthly turbine down time. As recommended, the model was run for 1,000 iterations using Option 3 (Gilbert et al 2022). The threshold number of collisions was set at one, representing a take of one or more individuals. The probability of at least one take from the SCRAM model for both scenarios was < 0.001, indicating that a single collision during fall migration is extremely unlikely—approximately one chance in 1,000 in any single year (Appendix D). The probability of a collision event during the 33-year operational period is also very small: 0.032 (calculated as $1- (1-0.001)^{33 \text{ years}}$).

Based on the results from both models, the chance of a fatality due to collision is extremely unlikely; thus, the estimated annual number of fatalities for migrating Roseate Tern is **zero**. Likewise, the estimated number of fatalities during the 33-year operations term is also **zero**. Therefore, based on the above findings, the likelihood of collision fatalities resulting from the Proposed Action would be **insignificant** and **discountable** and is **not likely to adversely affect** Roseate Terns.

PIPING PLOVER

The Piping Plover is among 72 species populations (out of 177 on the Atlantic OCS) that is ranked "medium" in its relative vulnerability to collision with WTGs (Robinson Willmott et al. 2013). The distance from shore to the proposed Project WTGs precludes the occurrence of nesting and foraging Piping Plovers in the vicinity of the proposed Projects' WTGs, and nonmigratory movements in May through August appear to be exclusively coastal (Burger et al. 2011). Flight heights during this nonmigratory period are generally well below the RSZ and occur in the immediate vicinity of the coastline (USFWS 2008; Burger et al. 2011).

Loring et al. (2019) estimated that offshore flight altitudes of 70 migrating Piping Plovers tracked with nanotags over federal waters primarily occurred above the RSZ, defined in the study as 82 to 820 feet (25 to 250 meters) above the ocean, with 15.2 percent of birds flying through the RSZ within offshore wind lease areas. This is consistent with other offshore radar studies that show migrating shorebirds generally fly at high altitudes well above the RSZ, while nearshore radar studies report lower flight heights (Williams and Williams 1990). Evidence from a recent tracking study suggests the potential for high-altitude migratory flights in at least some individuals (Paton 2016). Low cloud ceiling conditions could bring migrating Piping Plovers to lower elevations into the RSZ (Hüppop et al. 2006); however, Loring et al. (2019) found that migration typically occurs during favorable weather conditions with high visibility, little to no precipitation, and high atmospheric pressure. Piping Plovers also have good visual acuity and maneuverability in the air (Burger et al. 2011).

Radio telemetry studies of Piping Plover migratory behavior in the vicinity of the Action Area indicate that Piping Plover could fly through the proposed Project. The distance from shore to the offshore portions of the Action Area precludes use by nesting and foraging Piping Plovers. As discussed previously, migration occurs mostly along the coast during favorable weather conditions. In addition, there is a chance that a small percentage plovers (7 percent from Massachusetts and northward) would fly over the operating turbines, and only 15 percent of the birds could be flying within the RSZ, while the remaining birds are expected to easily avoid turbines that are spaced 1 nautical mile (1.9 kilometers, 1.15 miles) apart. An estimated total of 428 migration passages through the Action Area (calculated as 10 percent of [2,570 adults + 1,709 fledglings]) occurred during August. Although there are no empirical data that Piping Plovers fly through the SWDA in spring (see above), this analysis assumed 10 percent of the population or 257 (=2,570 adults x 10 percent) during their migration northward in May (S. von Oettingen, Pers. Comm., July 2020).

Quantitative take analyses are performed when take is expected and there is a need to estimate the amount of take. Take is unlikely due to the reasons described above; nonetheless, BOEM conducted quantitative take analyses to evaluate the impacts of the proposed Project. BOEM used the Band Model (Band 2012) to estimate the risk of Piping Plover collision with the proposed WTGs in the RI/MA Lease Areas. Most of the model inputs (e.g., migration passage, proportion flying in the RSZ, turbine specifications, and facility dimensions) were obtained or calculated from the COP and Loring et al. (2019). A turbine avoidance rate of 95.01 percent was used for Piping Plover (Cook 2021). A total of 130 operating turbines each with a 27-meter (89-foot) airgap between blade and water were used in the model. The developer provided monthly estimates of wind availability. The flight height distribution was derived from the midpoints of 2,756, 10-minute observations of 62 Piping Plovers flying nonstop over federal waters (Loring et al. 2018). Given that the flight height distribution is known for this species, estimated fatalities are based on calculations from the extended model (Option 3), and fatality estimates are based on the large array correction factor because the turbines are in rows (Band 2012). Based on the collision risk model, the estimated mortality rate for migrating Piping Plovers was **zero** (see Figure 4-6).

To further inform this ESA consultation, BOEM used the SCRAM model (as described for Roseate Terns above) to estimate the likelihood of take. The probability of at least one take from the SCRAM model for both scenarios was < 0.001, indicating that a single collision during fall migration is extremely unlikely—approximately one chance in 1,000 in any single year (Appendix D). The probability of a collision event during the 33-year operational period is also very small: 0.032 (calculated as 1- $(1\text{-}0.001)^{33 \text{ years}}$). Based on the results from both models, the chance of a fatality due to collision is extremely unlikely; thus, the estimated annual number of fatalities for migrating Piping Plover is **zero**. Likewise, the estimated number of fatalities during the 33-year operations term is also **zero**. Therefore, based on the above findings, the likelihood of collision fatalities resulting from the Proposed Action would be **insignificant and discountable**, and the Proposed Action is **not likely to adversely affect** Piping Plovers.

RUFA RED KNOT

The Rufa Red Knot is one of 72 species populations (out of 177 on the Atlantic OCS) that was ranked “medium” in its relative vulnerability to collision with WTGs (Robinson Willmott et al. 2013). Despite the presence of many onshore WTGs along the Rufa Red Knot’s overland migration route (Diffendorfer et al. 2017), there are no records of Rufa Red Knots colliding with WTGs (78 Fed. Reg. 60024). As stated previously, Red Knots nest in Canada, and some Red Knots may stop on Long Island during migration and feed on shore. Similar to Piping Plover above, Rufa Red Knot exposure to the projects’ WTGs would be limited to migrating individuals.

Proportionally few Rufa Red Knots are likely to cross the offshore Action Area; in fact, only one out of the 245 Rufa Red Knots fitted with tracking devices in Mingan Islands, Canada crossed the RI/MA Lease Areas (in mid-November) (Loring et al. 2018). Although there is anecdotal evidence of Rufa Red Knots flying at great heights during migration in the range of 3,281 to 9,843 feet (1,000 to 3,000 meters) (78 Fed. Reg. 60024; Burger et al. 2011; USFWS 2014), recent telemetry studies suggest that Red Knots fly much lower (Loring et al. 2018; BRI and WRP 2022; Feigin et al. 2022). Loring et al. (2018) derived flight height estimates using data collected from Red Knots fitted with nanotags; these estimates were subject to large error bounds (typically 328 to 656 feet [100 to 200 meters]) and should be interpreted with caution. However, more recent telemetry studies near projects using global positioning system satellite tags yielded more precise results and found that none of the Red Knots near the RI/MA Lease Areas flew within the RSZ but instead mostly flew below the RSZ (BRI and WRP 2022; Feigin et al. 2022). Therefore, the flight height data suggest that it is unlikely that migrating Rufa Red Knots would collide with operating WTGs based on how high Rufa Red Knots fly with respect to the projects’ spinning turbine blades. Regardless, the vast majority undertakes flights to and from areas farther south and transits offshore beyond offshore wind leases on the Atlantic OCS (Loring et al. 2018). In addition, Red Knots migrate through federal waters of the Atlantic OCS primarily during clear skies with little to no precipitation and a tailwind blowing in their direction of travel (Loring et al. 2018; BRI and WRP 2022; Feigin et al. 2022) and, thus, can easily see and avoid the turbines. An estimated total of 30 (1,500 × 2 percent) migration passages through the Action Area occurred during November, plus 3 (150 × 2 percent) migration passages through the Action Area during May.

COLLISION RISK ASSESSMENT (BIRDS ON MIGRATION)
Sheet 2 - Overall collision risk

All data input on Sheet 1:
no data entry needed on this sheet!
other than to choose option for final tables

🟩 from Sheet 1 - input data
🟪 from Sheet 6 - available hours
🟧 from Sheet 3 - single transit collision risk
🟨 from survey data
🟦 calculated field

Bird details:																
Species		Piping plover														
Flight speed	m/sec	9.3														
Flight type		flapping														
Windfarm data:																
Number of turbines		130														
Rotor radius	m	143														
Minimum height of rotor	m	170														
Total rotor frontal area	sq m	8351516														
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		**year average**
Proportion of time operational	%		93%	93%	93%	93%	91%	91%	88%	88%	89%	91%	92%	93%		91.2%
Stage A - flight activity																**per annum**
Migration passages			0	0	86	86	86	0	428	0	0	0	0	0		**686**
Migrant flux density	birds/ km		0	0	2.7742	2.7742	2.774194	0	13.80645	0	0	0	0	0		
Proportion at rotor height	%	15%														
Flux factor			0	0	81	81	81	0	403	0	0	0	0	0		
Option 1 -Basic model - Stages B, C and D																
Potential bird transits through rotors			0	0	12	12	12	0	61	0	0	0	0	0		**98**
Collision risk for single rotor transit	(from sheet 3)	4.3%														
Collisions for entire windfarm, allowing for non-op time, assuming no avoidance	birds per month or year		**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**		**4**
Option 2-Basic model using proportion from flight distribution			**0**	**0**	**2**	**2**	**1**	**0**	**7**	**0**	**0**	**0**	**0**	**0**		**12**
Option 3-Extended model using flight height distribution																
Proportion at rotor height	(from sheet 4)	47.0%														
Potential bird transits through rotors	Flux integral	0.4190	0	0	34	34	34	0	169	0	0	0	0	0		**271**
Collisions assuming no avoidance	Collision integral	0.01683	**0**	**0**	**1**	**1**	**1**	**0**	**6**	**0**	**0**	**0**	**0**	**0**		**10**
Average collision risk for single rotor transit		4.0%														
Stage E - applying avoidance rates																
Using which of above options?	**Option 3**	0.00%	0	0	1	1	1	0	6	0	0	0	0	0		**10**
	birds per month or year															
Collisions assuming avoidance rate		95.01%	0	0	0	0	0	0	0	0	0	0	0	0		**0**
		98.00%	0	0	0	0	0	0	0	0	0	0	0	0		**0**
		99.00%	0	0	0	0	0	0	0	0	0	0	0	0		**0**
		99.50%	0	0	0	0	0	0	0	0	0	0	0	0		**0**
Collisions after applying large array correction		95.01%	0	0	0	0	0	0	0	0	0	0	0	0		**0**
		98.00%	0	0	0	0	0	0	0	0	0	0	0	0		**0**
		99.00%	0	0	0	0	0	0	0	0	0	0	0	0		**0**
		99.50%	0	0	0	0	0	0	0	0	0	0	0	0		**0**

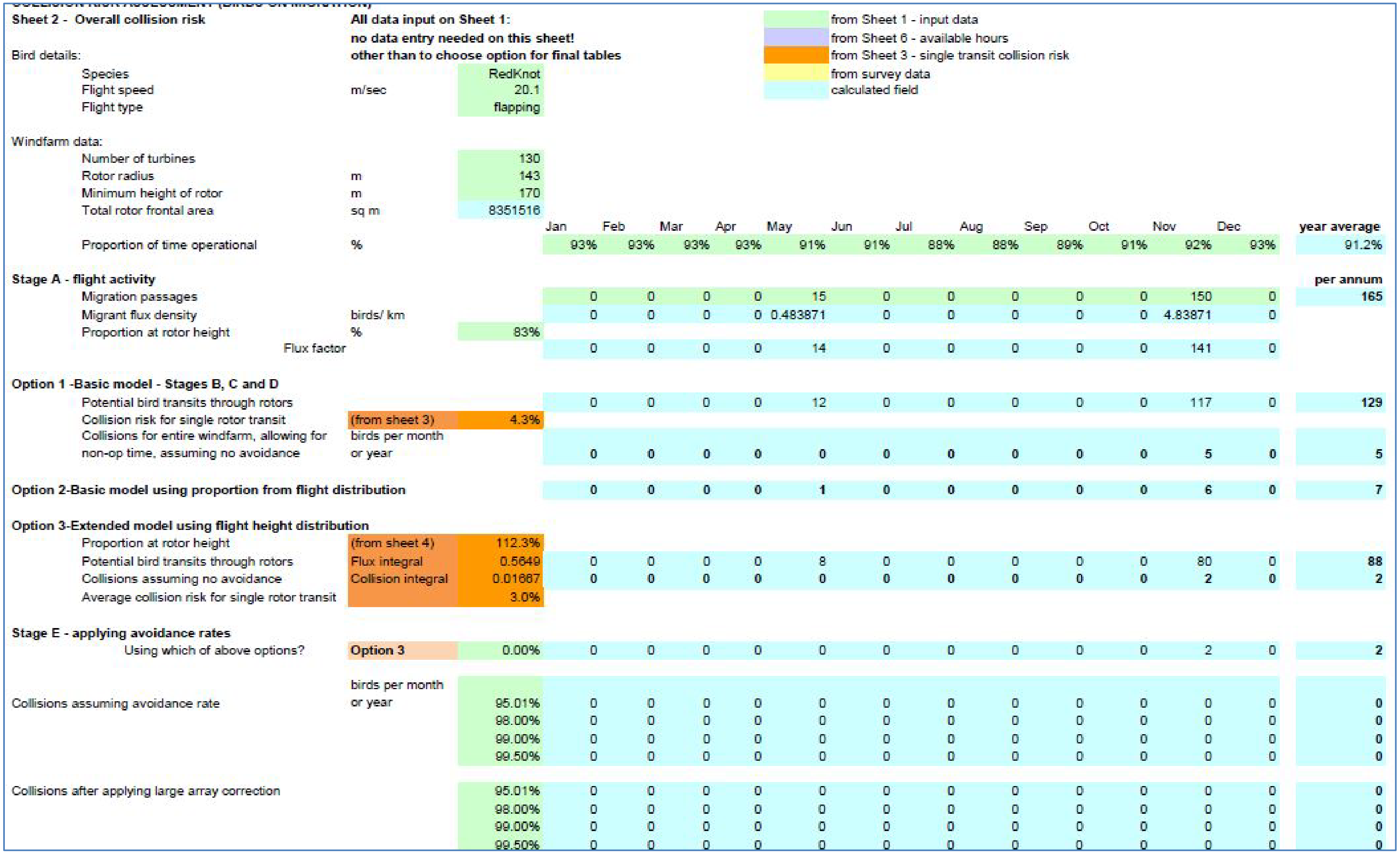
km = kilometer; m = meter; m/sec = meter per second; sq m = square meter

Figure 4-6: Results as Presented in the Migrant Collision Risk Spreadsheet within Band (2012) Collision Risk Model for Piping Plover

Quantitative take analyses are performed when take is expected and there is a need to estimate the amount of take. Take is unlikely due to the reasons described above; nonetheless, BOEM conducted quantitative take analyses to evaluate the impacts of the proposed Project. BOEM used the Band Model (Band 2012) to estimate the risk of Rufa Red Knot collision with operating WTGs in the RI/MA Lease Areas. A turbine avoidance rate of 95.01 percent was used for Red Knot (Cook 2021). A total of 130 operating turbines each with a 27-meter (89-foot) airgap between blade and water were used in the model. The developer provided monthly estimates of wind availability. The flight height distribution was derived from the midpoints of 379, 10-minute observations of 51 Rufa Red Knots flying nonstop over federal waters (Loring et al. 2018). Given that the flight height distribution is known for this species, fatalities estimated are based on calculations from the extended model (Option 3), and the fatality estimates are based on the large array correction factor because the turbines are in rows (Band 2012). Based on the collision risk model, the estimated annual number of fatalities for migrating Rufa Red Knots was **zero** (see Figure 4-7 for model outputs).

To further inform this ESA consultation, BOEM used the SCRAM model (as described for Roseate Terns above) to estimate the likelihood of take. The probability of at least one take from the SCRAM model for both scenarios was < 0.001, indicating that a single collision during fall migration is extremely unlikely—approximately one chance in 1,000 in any single year (Appendix D). The probability of a collision event during the 33-year operational period is also very small: 0.032 (calculated as 1- $(1\text{-}0.001)^{33 \text{ years}}$).

Based on the results from both models, the chance of a fatality due to collision is extremely unlikely; thus, the estimated annual number of fatalities for migrating Rufa Red Knots is **zero**. Likewise, the estimated number of fatalities during the 33-year operations term is also **zero**. Therefore, based on the above findings, the likelihood of collision fatalities resulting from the Proposed Action would be **insignificant and discountable**, and the Proposed Action is **not likely to adversely affect** Rufa Red Knots.



- 🟩 from Sheet 1 - input data
- 🟪 from Sheet 6 - available hours
- 🟧 from Sheet 3 - single transit collision risk
- 🟨 from survey data
- 🟦 calculated field

Sheet 2 - Overall collision risk	**All data input on Sheet 1:**														
	no data entry needed on this sheet!														
Bird details:	**other than to choose option for final tables**														
Species		RedKnot													
Flight speed	m/sec	20.1													
Flight type		flapping													
Windfarm data:															
Number of turbines		130													
Rotor radius	m	143													
Minimum height of rotor	m	170													
Total rotor frontal area	sq m	8351516													
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**year average**
Proportion of time operational	%		93%	93%	93%	93%	91%	91%	88%	88%	89%	91%	92%	93%	91.2%
Stage A - flight activity															**per annum**
Migration passages			0	0	0	0	15	0	0	0	0	0	150	0	**165**
Migrant flux density	birds/ km		0	0	0	0	0.483871	0	0	0	0	0	4.83871	0	
Proportion at rotor height	%	83%													
Flux factor			0	0	0	0	14	0	0	0	0	0	141	0	
Option 1 -Basic model - Stages B, C and D															
Potential bird transits through rotors			0	0	0	0	12	0	0	0	0	0	117	0	**129**
Collision risk for single rotor transit	(from sheet 3)	4.3%													
Collisions for entire windfarm, allowing for non-op time, assuming no avoidance	birds per month or year		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**5**
Option 2-Basic model using proportion from flight distribution			**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**6**	**0**	**7**
Option 3-Extended model using flight height distribution															
Proportion at rotor height	(from sheet 4)	112.3%													
Potential bird transits through rotors	Flux integral	0.5649	0	0	0	0	8	0	0	0	0	0	80	0	**88**
Collisions assuming no avoidance	Collision integral	0.01667	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**2**
Average collision risk for single rotor transit		3.0%													
Stage E - applying avoidance rates															
Using which of above options?	**Option 3**	0.00%	0	0	0	0	0	0	0	0	0	0	2	0	**2**
	birds per month or year														
Collisions assuming avoidance rate		95.01%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		98.00%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		99.00%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		99.50%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Collisions after applying large array correction		95.01%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		98.00%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		99.00%	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		99.50%	0	0	0	0	0	0	0	0	0	0	0	0	**0**

km = kilometer; m = meter; m/sec = meter per second; sq m = square meter

Figure 4-7: Results as Presented in the Migrant Collision Risk Spreadsheet within Band (2012) Collision Risk Model for Rufa Red Knot

4.2.2.7 Decommissioning

It is expected that noise levels associated with WTG and ESP decommissioning activities would be similar in scope, nature, and intensity to noise impacts associated with pile driving and construction, as described above. Similarly, noise impacts resulting from decommissioning would be localized and short term, lasting only for the duration of structure removal. If these activities were to occur during migration period, most Rufa Red Knots and Piping Plovers in the area would be flying well above the Action Area during removal, while others, including Roseate Terns, are not expected to be in the area. However, should Roseate Terns or others be in the area, they would be expected to simply fly around the noise source; therefore, the noise generated is not anticipated to affect the migratory movement or migratory behavior through the area. As such, the Proposed Action may affect migrating Roseate Terns, Piping Plovers, and Rufa Red Knots, but the impacts, if any, would be **insignificant and discountable**.

4.2.3 Indirect Effects

Indirect effects include impacts such as displacement from habitat and barrier to migration that could occur as a result of the Proposed Action but at a later time. Displacement from suitable habitat is unlikely because the WTGs associated with the Proposed Action are located far from potentially suitable nesting and foraging habitat for Roseate Terns, Piping Plovers, and Rufa Red Knots. Given the lack of suitable habitat for these species and the highly disturbed nature of the onshore portions of the Action Area, **no indirect effects** in the form of displacement are expected to occur as a result of construction, operations, and decommissioning of the onshore portions of the Proposed Action.

Some migrating birds may encounter the offshore portion of Action Area, and barrier impacts from the Proposed Action could result in longer migration flights for birds avoiding the offshore portions of the Action Area during migration. The Roseate Tern, Piping Plover, and Rufa Red Knot are long-distance migrants capable of sustained over-water migration. It is reasonable to assume that any extra energy expenditure, if any, resulting from making a relatively minor course correction to avoid individual turbines would be inconsequential and would not result in a measurable impact. Based on the information above, indirect impacts due to barrier impacts on migrating Piping Plovers, Roseate Terns, or Rufa Red Knots in from increased energy expenditure would be **insignificant and discountable.**

5. Determination of Effects

Given that the activities would occur on the OCS, there would be **no effect** on northern long-eared bats.

Based on the analysis in Chapter 4, Effects of the Proposed Action, effects, if any, on listed bird species resulting from the construction, operations, and decommissioning of the proposed onshore facilities are **not likely to adversely affect** listed bird species. This finding is due to the lack of suitable nesting and/or foraging habitat within the Action Area, the limited amount of required habitat conversion, and the localized and short-tern nature of the potential impacts.

Federally listed birds could occur within the offshore portions of the Action Area given the geographic scope of the Proposed Action. Based on prior analyses in Chapter 4, the Proposed Action **may affect** migrating Roseate Terns, Piping Plovers, and Rufa Red Knots due to pile-driving noise, onshore drilling and cable laying, tower lighting, turbine operation, and tower decommissioning. Impacts could include escape responses and alteration of migration paths. Due to the anticipated use of flashing red tower lights, small number of individual migrants potentially affected, and the restricted time period of exposure during migration, BOEM concludes that the impacts of the Proposed Action are insignificant and discountable. Therefore, the Proposed Action would **not likely adversely affect** Roseate Terns, Piping Plovers, and Rufa Red Knots.

6. Avoidance, Minimization, and Mitigation Measures

This chapter outlines the proposed avoidance, minimization, and mitigation measures to be carried out by the applicant that would minimize or eliminate potential impacts on ESA-listed species of birds and bats. The following measures are to be required by BOEM as conditions of COP approval:

- **Bird deterrent devices:** To minimize attracting birds to operating turbines, the applicant must install bird deterrent devices on WTGs and ESPs. The location of bird deterrent devices must be proposed by the applicant based on best management practices applicable to the appropriate operation and safe installation of the devices. The applicant must confirm the locations of bird deterrent devices with a monitoring plan to track the efficacy of the deterrents as part of the as-built documentation it must submit with its facility design report.

- **Avian and bat monitoring program:** At least 45 calendar days before beginning surveys, the applicant must complete, obtain concurrence from the U.S. Department of the Interior (DOI), and adopt an avian and bat monitoring plan, including coordination with interested stakeholders. The DOI will review the avian and bat monitoring plan and provide any comments on the plan within 30 calendar days of its submittal. The applicant must resolve all comments on the avian and bat monitoring plan to DOI's satisfaction before implementing the plan. The applicant may conclude that DOI has concurred in the avian and bat monitoring plan if DOI provides no comments on the plan within 30 calendar days of its submittal date. Specific provisions of the avian and bat monitoring plan include:

    - **Monitoring:** At this time, the applicant is proposing to conduct acoustic monitoring at select WTGs and/or ESPs, implement a radio tagging and telemetry program, and record incidental observations of dead or injured birds and bats. The specific monitoring components will be dependent upon research priorities and available technologies and developed as part of consultation with BOEM and USFWS in early 2023. The proposed monitoring will be informed using an adaptive management framework and will include a data sharing program. A monitoring framework, once developed, will be included in the Final BA as Appendix E, Avian and Bat Monitoring Framework.

    - **Annual monitoring reports:** The applicant must submit to BOEM (at renewable_reporting@boem.gov), USFWS, and BSEE (at OSWSubmittals@bsee.gov) a comprehensive report after each full year of monitoring (pre- and post-construction) within 6 months of completion of the last avian survey. The report must include all data, analyses, and summaries regarding ESA-listed and non-ESA-listed birds and bats. DOI will use the annual monitoring reports to assess the need for reasonable revisions (based on subject matter expert analysis) to the avian and bat monitoring plan. DOI reserves the right to require reasonable revisions to the avian and bat monitoring plan and may require new technologies as they become available for use in offshore environments.

    - **Post-construction quarterly progress reports:** The applicant must submit quarterly progress reports during the implementation of the avian and bat monitoring plan to BOEM (at renewable_reporting@boem.gov) and the USFWS by the 15th day of the month following the end of each quarter during the first full year that the proposed Project is operational. The progress reports must include a summary of all work performed, an explanation of overall progress, and any technical problems encountered.

    - **Monitoring plan revisions:** Within 15 calendar days of submitting the annual monitoring report, the applicant must meet with BOEM and USFWS to discuss the following: the monitoring results; the potential need for revisions to the avian and bat monitoring plan, including technical refinements or additional monitoring; and the potential need for any additional efforts to reduce impacts. If DOI determines after this discussion that revisions to the avian and bat monitoring plan are necessary, DOI may require the applicant to modify the avian and bat monitoring plan. If the reported monitoring results deviate substantially from the impact analysis included in the Final EIS, the applicant must transmit to DOI recommendations for new mitigation measures and/or monitoring methods.

  - **Operational reporting:** The applicant must submit to BOEM (at renewable_reporting@boem.gov) and BSEE (at OSWSubmittals@bsee.gov) an annual report summarizing monthly operational data calculated from 10-minute supervisory control and data acquisition for all turbines together in tabular format: the proportion of time the turbines were operational (spinning at or above a threshold of revolutions per minute [rpm] defined as part of consultation with BOEM, BSEE, and USFWS) each month, the average rotor speed (monthly rpm) of spinning turbines plus 1 standard deviation, and the average pitch angle of blades (degrees relative to rotor plane) plus 1 standard deviation. DOI will use this information as inputs for avian collision risk models to assess whether the results deviate substantially from the impact analysis included in the Final EIS.

  - **Raw data:** The applicant must store the raw data from all avian and bat surveys and monitoring activities according to accepted archiving practices. Such data must remain accessible to DOI and USFWS, upon request for the duration of the lease. The applicant must work with BOEM to ensure the data are publicly available. The USFWS may specify third-party data repositories that must be used, such as the Motus Wildlife Tracking System or MoveBank, and such parties and associated data standards may change over the duration of the monitoring plan.

- **Bird and bat mortality reporting:** The applicant must submit an annual report covering each calendar year, due by January 31 of the following year, documenting any dead (or injured) birds or bats found on vessels and structures during construction, operations, and decommissioning. The report must be submitted to BOEM (at renewable_reporting@boem.gov), BSEE (at OSWSubmittals@bsee.gov), and USFWS. The report must contain the following information: the name of species, date found, location, a picture to confirm species identity (if possible), and any other relevant information. Carcasses with federal or research bands must be reported to the United States Geological Survey Bird Band Laboratory (https://www.usgs.gov/labs/bird-banding-laboratory). Any occurrence of dead ESA birds or bats must be reported to BOEM, BSEE, and USFWS as soon as practicable (taking into account crew and vessel safety), but no later than 24 hours after the sighting, If practicable, carefully collect and preserve the dead specimen in the best possible state.

- **ADLS:** The applicant must use an FAA-approved vendor for the ADLS, which will activate the FAA hazard lighting only when an aircraft is in the vicinity of the wind facility to reduce visual impacts at night. The applicant must confirm the use of an FAA-approved vendor for ADLS on WTGs and ESPs in the applicant's fabrication and installation report.

- **WTG and ESP marking:** The applicant must light each WTG and ESPs in a manner that is visible by mariners in a 360-degree arc around the WTG and ESPs. Conditional on U.S. Coast Guard approval, to minimize the potential of attracting migratory birds, the top of each light will be shielded to prevent upward illumination. Additionally, structures must be marked with red flashing strobe-like lights that meet FAA requirements for aviation obstruction lighting.

- **Piping Plover protection plan:** The applicant must implement onshore measures provided in the Piping Plover protection plan (Appendix C).

- **Tree-clearing restrictions:** To avoid potential direct adverse impacts on northern long-eared bats, the applicant will conduct required tree-clearing activities of trees greater than 3 inches in diameter at breast height for the onshore portions of the proposed Project during the seasonal tree-clearing window of November 1 to March 31. Should tree clearing be necessary outside of the seasonal clearing window as described above, presence/probable absence surveys and associated consultation with the USFWS will be required by BOEM, and ESA compliance will be achieved through that additional consultation.

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Appendix A: U.S. Fish and Wildlife Service Information for Planning and Consultation Reports

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Massachusetts and Rhode Island

Local office

New England Ecological Services Field Office

☎ (603) 223-2541
📠 (603) 223-0104

70 Commercial Street, Suite 300
Concord, NH 03301-5094

http://www.fws.gov/newengland

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

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

Birds

NAME	STATUS
Piping Plover Charadrius melodus There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot Calidris canutus rufa Wherever found There is **proposed** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/1864	Threatened
Roseate Tern Sterna dougallii dougallii No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2083	Endangered

Reptiles

NAME	STATUS
Plymouth Redbelly Turtle Pseudemys rubriventris bangsi Wherever found There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/451	Endangered

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS

American Chaffseed *Schwalbea americana* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1286	Endangered
Sandplain Gerardia *Agalinis acuta* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8128	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
American Oystercatcher Haematopus palliatus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8935	Breeds Apr 15 to Aug 31
Atlantic Puffin Fratercula arctica This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/8943	Breeds Apr 15 to Aug 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Oct 15 to Aug 31

Black Scoter Melanitta nigra — Breeds elsewhere

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Black Skimmer Rynchops niger — Breeds May 20 to Sep 15

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/5234

Black-billed Cuckoo Coccyzus erythropthalmus — Breeds May 15 to Oct 10

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9399

Black-legged Kittiwake Rissa tridactyla — Breeds elsewhere

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Blue-winged Warbler Vermivora pinus — Breeds May 1 to Jun 30

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Bobolink Dolichonyx oryzivorus — Breeds May 20 to Jul 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Brown Pelican Pelecanus occidentalis — Breeds Jan 15 to Sep 30

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Canada Warbler Cardellina canadensis — Breeds May 20 to Aug 10

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Common Eider Somateria mollissima — Breeds Jun 1 to Sep 30

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Common Loon gavia immer — Breeds Apr 15 to Oct 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/4464

Common Murre Uria aalge — Breeds Apr 15 to Aug 15

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Cory's Shearwater Calonectris diomedea — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Double-crested Cormorant phalacrocorax auritus — Breeds Apr 20 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/3478

Dovekie Alle alle — Breeds elsewhere

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/6041

Eastern Whip-poor-will Antrostomus vociferus — Breeds May 1 to Aug 20

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Great Shearwater Puffinus gravis — Breeds elsewhere

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Gull-billed Tern Gelochelidon nilotica — Breeds May 1 to Jul 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9501

Hudsonian Godwit Limosa haemastica

Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Kentucky Warbler Oporornis formosus

Breeds Apr 20 to Aug 20

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

King Rail Rallus elegans

Breeds May 1 to Sep 5

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8936

Lesser Yellowlegs Tringa flavipes

Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9679

Long-eared Owl asio otus

Breeds Mar 1 to Jul 15

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3631

Long-tailed Duck Clangula hyemalis

Breeds elsewhere

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/7238

Manx Shearwater Puffinus puffinus

Breeds Apr 15 to Oct 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Pomarine Jaeger Stercorarius pomarinus

Breeds elsewhere

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Prairie Warbler Dendroica discolor

Breeds May 1 to Jul 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Prothonotary Warbler *Protonotaria citrea* Breeds Apr 1 to Jul 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Purple Sandpiper *Calidris maritima* Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Razorbill *Alca torda* Breeds Jun 15 to Sep 10

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Red-breasted Merganser *Mergus serrator* Breeds elsewhere

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Red-headed Woodpecker *Melanerpes erythrocephalus* Breeds May 10 to Sep 10

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Red-necked Phalarope *Phalaropus lobatus* Breeds elsewhere

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Red-throated Loon *Gavia stellata* Breeds elsewhere

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Ring-billed Gull *Larus delawarensis* Breeds elsewhere

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Roseate Tern *Sterna dougallii* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds May 10 to Aug 31
Royal Tern *Thalasseus maximus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Apr 15 to Aug 31
Ruddy Turnstone *Arenaria interpres morinella* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Rusty Blackbird *Euphagus carolinus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Short-billed Dowitcher *Limnodromus griseus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9480	Breeds elsewhere
South Polar Skua *Stercorarius maccormicki* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere
Surf Scoter *Melanitta perspicillata* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere
Thick-billed Murre *Uria lomvia* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Apr 15 to Aug 15

White-winged Scoter Melanitta fusca Breeds elsewhere

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Willet Tringa semipalmata Breeds Apr 20 to Aug 5

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wilson's Storm-petrel Oceanites oceanicus Breeds elsewhere

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Wood Thrush Hylocichla mustelina Breeds May 10 to Aug 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (🟩)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (🟨)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

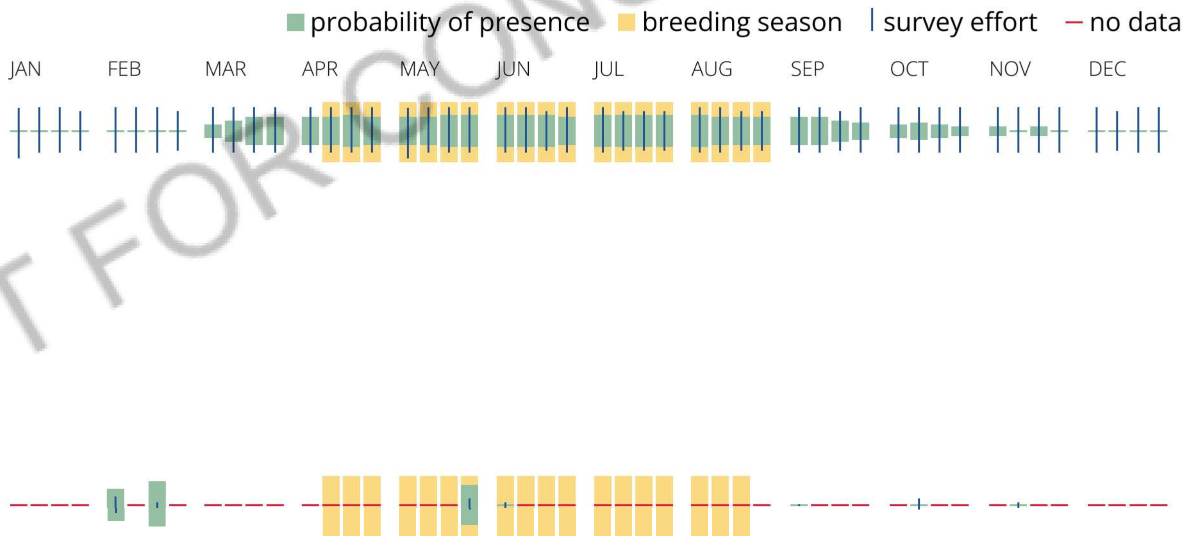
No Data (–)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

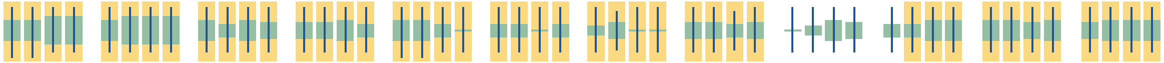
SPECIES



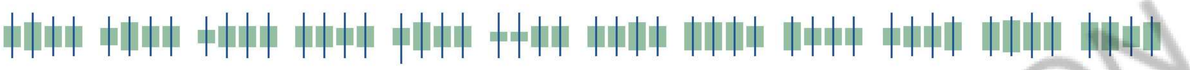
American Oystercatcher BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Atlantic Puffin Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

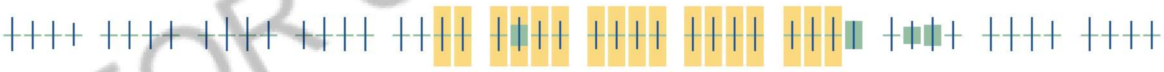
Bald Eagle
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



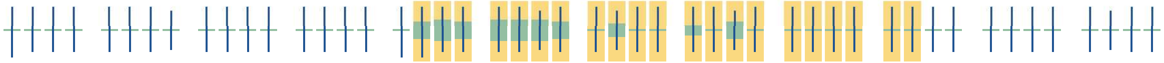
Black Scoter
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Black Skimmer
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

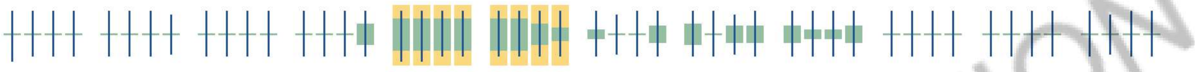


Black-billed Cuckoo
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

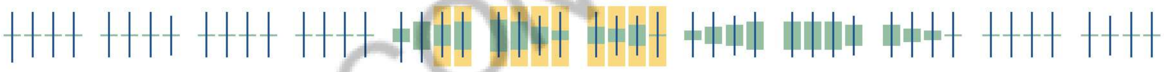


Black-legged Kittiwake
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

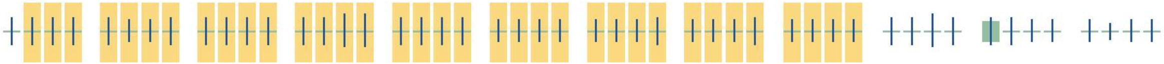
Blue-winged Warbler
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)



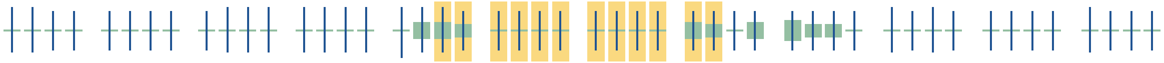
Bobolink
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



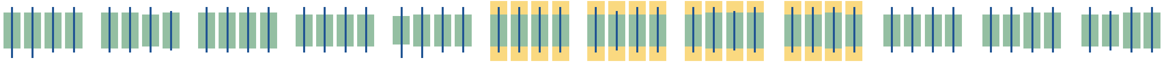
Brown Pelican
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Canada Warbler
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Common Eider
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



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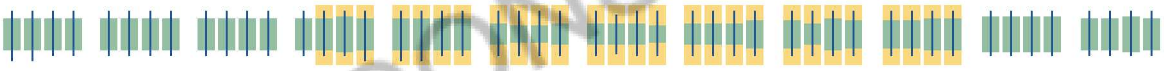
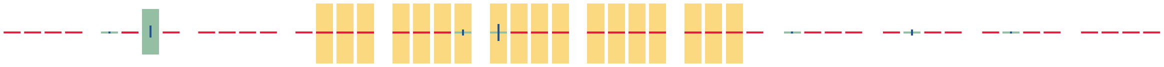
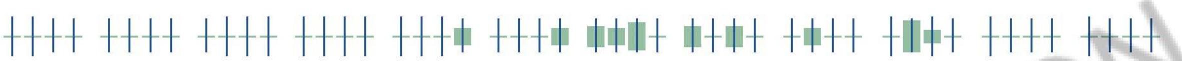
Common Loon
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



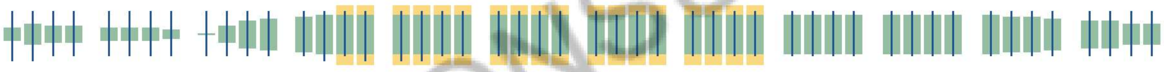
Common Murre
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Cory's Shearwater
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

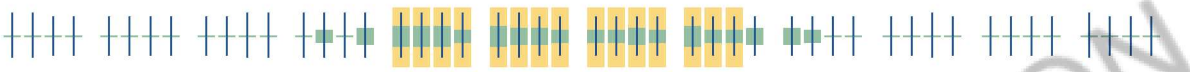


Double-crested Cormorant
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



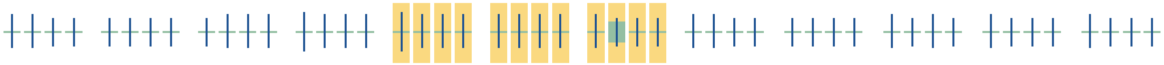
Dovekie
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

Eastern Whip-poor-will
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



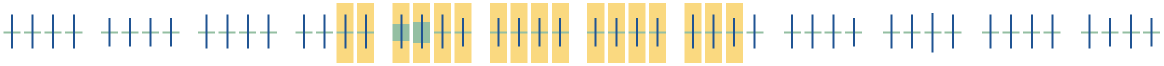
Great Shearwater
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

Gull-billed Tern
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

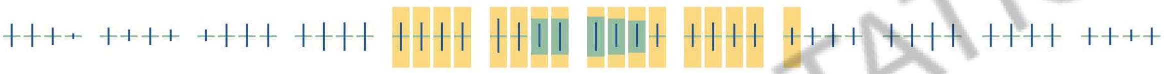


Hudsonian Godwit
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

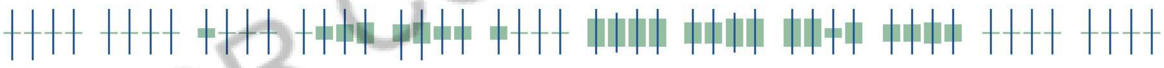
Kentucky Warbler
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



King Rail
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Lesser Yellowlegs
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



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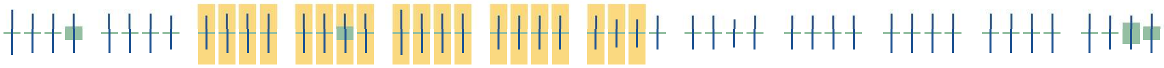
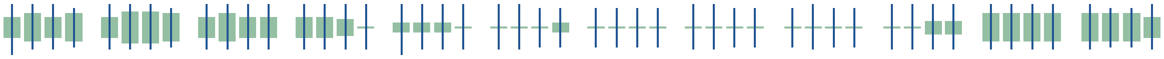
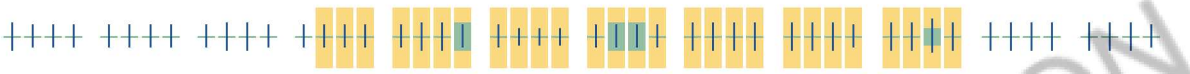
Long-eared Owl
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



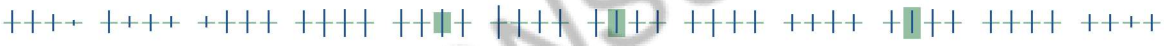
Long-tailed Duck
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



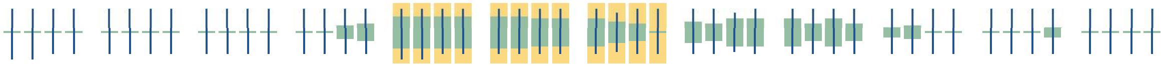
Manx Shearwater
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



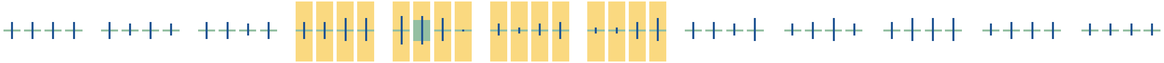
Pomarine Jaeger
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Prairie Warbler
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

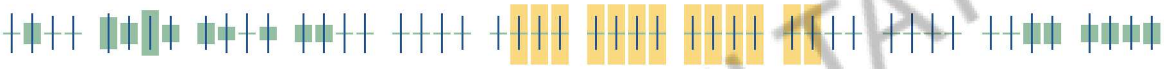


Prothonotary Warbler
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

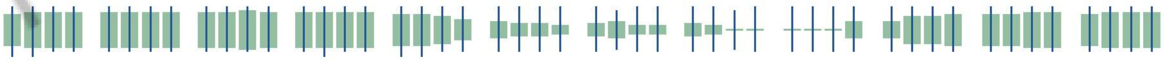


Purple Sandpiper
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

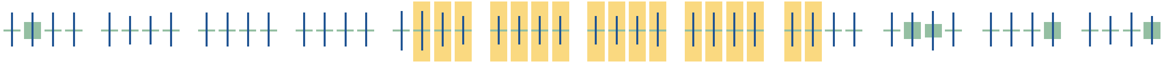
Razorbill
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



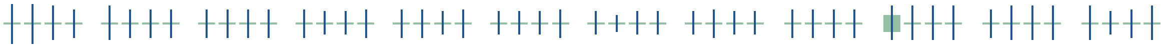
Red-breasted Merganser
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Red-headed Woodpecker
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Red-necked Phalarope
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Red-throated Loon
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

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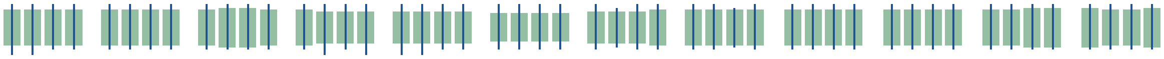
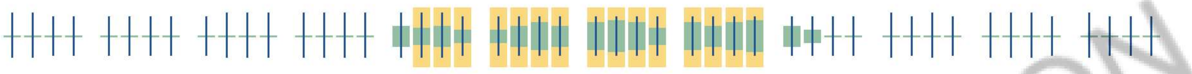
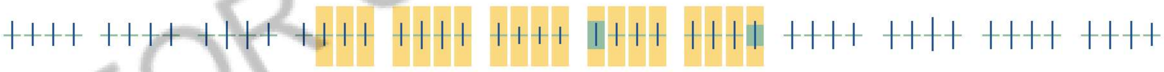
Ring-billed Gull
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



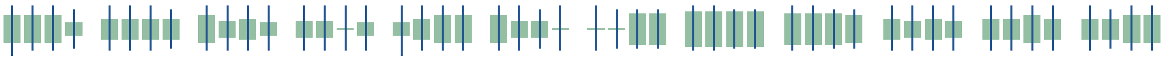
Roseate Tern
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Royal Tern
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

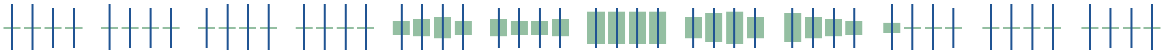


Ruddy Turnstone
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)



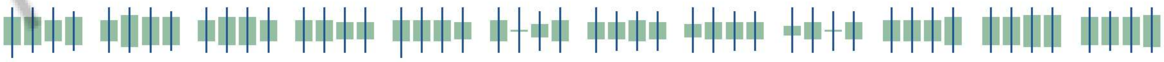
Rusty Blackbird
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

Short-billed Dowitcher
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

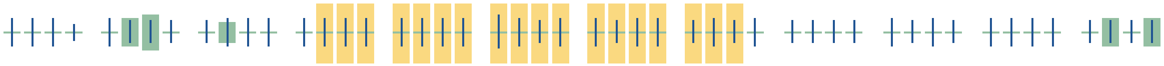


South Polar Skua
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

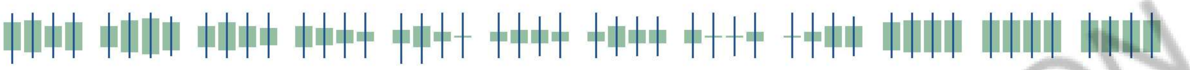
Surf Scoter
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



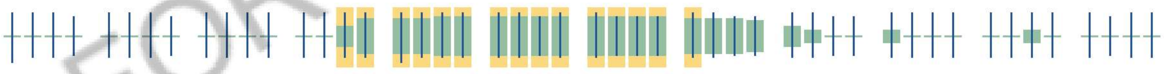
Thick-billed Murre
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



White-winged Scoter
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Willet
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Wilson's Storm-petrel
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

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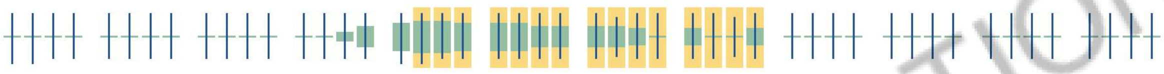
Wood Thrush
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

Wildlife refuges and fish hatcheries

REFUGE AND FISH HATCHERY INFORMATION IS NOT AVAILABLE AT THIS TIME

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

WETLAND INFORMATION IS NOT AVAILABLE AT THIS TIME

This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the NWI map to view wetlands at this location.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Appendix B: Species Conclusions Table

Name	Conclusion	ESA Section 7 Determination	Notes/Documentation
Roseate Tern (*Sterna dougallii*)	No records of species occurrence in the Action Area	May Affect, Not Likely to Adversely Affect	There are no records of Roseate Terns in the offshore portion of the Action Area (USFWS 2018). In a regional telemetry study, no Roseate Terns were tracked flying through the proposed location of wind turbines; in addition, terns fly below the RSZ during migration and fly when visibility is good. Based on results from a collision risk model, no Roseate Terns would collide with turbines. To minimize attracting birds (including passerines to the wind turbines), flashing aviation safety lights would be used on wind turbine nacelles to decrease the collision risk and, when possible, work lights, would be down shielded during Project construction (Epsilon 2022). To minimize the attraction of birds, the proposed Project would consider anti-perching devices, where and if appropriate, to reduce potential bird perching locations (Epsilon 2022). Lastly, the applicant is developing a framework for a post-construction monitoring program for birds (Epsilon 2022).
Piping Plover (*Charadrius melodus*)	No records of species occurrence in the Action Area	May Affect, Not Likely to Adversely Affect	Piping Plovers may cross the offshore portions of the Action Area during migration over the OCS. There are no records of Piping Plovers in the offshore portion of the proposed Project area (USFWS 2018). Piping Plover fly outside of the RSZ, and the small percentage (7 percent) of the Piping Plovers passing through the offshore Project area would safely pass over the facility. Based on results from a collision risk model, no Piping Plovers would collide with turbines. To minimize attracting birds (including passerines to the wind turbines), flashing aviation safety lights would be used on wind turbine nacelles to decrease the collision risk and, when possible, work lights, would be down shielded during Project construction (Epsilon 2022). To minimize the attraction of birds, the proposed Project would consider anti-perching devices, where and if appropriate, to reduce potential bird perching locations (Epsilon 2022). Lastly, the applicant is developing a framework for a post-construction monitoring program for birds (Epsilon 2022).
Rufa Red Knot (*Calidris canutus rufa*)	No records of species occurrence in the Action Area	May Affect, Not Likely to Adversely Affect	Rufa Red Knots may occur during nonbreeding season on the Massachusetts coast or during migration over the OCS. There are no records of Rufa Red Knots in the offshore portion of the proposed Project area (USFWS 2018). Rufa Red Knots migrate during high visibility conditions when there is little or no precipitation. Red knots are known to fly at great heights during migration above RSZ, and the small percentage (2 percent) of Rufa Red Knots passing through the offshore Project area would safely pass over the facility. Based on results from a collision risk model, no Rufa Red Knots would collide with turbines. To minimize attracting birds (including passerines to the wind turbines), flashing aviation safety lights would be used on wind turbine nacelles to decrease the collision risk and, when possible, work lights, would be down shielded during Project construction (Epsilon 2022). To minimize the attraction of birds, the proposed Project would consider anti-perching devices, where and if appropriate, to reduce potential bird perching locations (Epsilon 2022). Lastly, the applicant is developing a framework for a post-construction monitoring program for birds (Epsilon 2022).
Northern long-eared bat (*Myotis septentrionalis)*	No records of species occurrence in the Action Area	May Affect, Not Likely to Adversely Affect	No known occupied hibernacula or maternity roost trees were identified within the Action Area. It is assumed that tree-clearing activities would occur outside of the summer maternity season (November 1 through March 31), and no direct impacts on northern long-eared bat would occur. Should tree clearing occur during the summer maternity season (i.e., April 1 through October 31), the applicant would conduct presence/probable absence surveys in coordination with the USFWS to satisfy regulatory concerns. Given the distance from shore, BOEM does not expect any northern long-eared bats to encounter operating WTGs, and, as such, expects no impacts from operations of the Proposed Action. Lastly, the applicant is developing a framework for post-construction monitoring program for bats (Epsilon 2022).

Name	Conclusion	ESA Section 7 Determination	Notes/Documentation
Plymouth red-bellied turtle (*Pseudemys rubriventris bangsi*)	No records of the species occurrence in the proposed onshore Action Area	No effect	No known occurrences of this species are present within the Action Area.
American chaffseed (*Schwalbea americana*)	No records of species occurrence in the proposed onshore Action Area	No effect	No appropriate habitat for this species occurs in any part of the Action Area.
Sandplain gerardia (*Agalinus acuta*)	No records of species occurrence in the proposed onshore Action Area	No effect	No known occurrences of this species are present within the Action Area.
Critical habitat	No critical habitat present	No effect	No designated critical habitat for listed species occurs within the offshore or onshore portions of the Action Aera.

BOEM = Bureau of Ocean Energy Management; ESA = Endangered Species Act; OCS = Outer Continental Shelf; RSZ = rotor swept zone; WTG = wind turbine generator

References:

Epsilon (Epsilon Associates, Inc.). 2022. *Draft New England Wind Construction and Operations Plan for Lease Area OCS-A 0534*. New England Wind Project. Accessed: October 2022. Retrieved from: https://www.boem.gov/renewable-energy/state-activities/new-england-wind-formerly-vineyard-wind-south

USFWS (U.S. Fish and Wildlife Service). 2018. Accessed through U.S. Department of Interior, Northwest Atlantic Seabird Catalog, Version XX. Accessed: October 5, 2018.

Appendix C: Draft Piping Plover Protection Plan

Draft Piping Plover Protection Plan
New England Wind Phase 1/New England Wind 1 Connector
Craigville Public Beach Landfall Site and Covell's Beach Landfall Site, Barnstable, MA
NHESP File No.: XX-XXXX

Introduction

Park City Wind LLC (the Proponent) has prepared this draft Piping Plover Protection Plan (PPPP) per consultation with the Massachusetts Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program (NHESP) on April 15, 2020 regarding the New England Wind 1 Connector (NE Wind 1 Connector). The New England Wind 1 Connector PPPP aligns with the Vineyard Wind Connector 1 PPPP, which was developed in collaboration with NHESP to avoid noise-related impacts to nesting piping plovers from horizontal directional drilling (HDD) activities at the Covell's Beach Landfall Site in Barnstable, MA. The NE Wind 1 Connector will utilize a landfall site at either Craigville Public Beach, approximately 0.4 miles west of Covell's Beach, or at the Covell's Beach Landfall Site. Since both landfall sites have similar characteristics and resource areas, the New England Wind 1 Connector PPPP applies to both landfall sites under consideration for NE Wind 1 Connector.

For Vineyard Wind Connector 1, NHESP requested the following:

> *Please provide a Piping Plover protection plan that addresses measures to protect state-listed species and their habitats during the nesting season (April 1 – August 31) and a contingency plan in the event problems arise during the HDD cable installation, including:*
>
> *a. Work begins prior to April 1 and lapses for 3 or more days.*
> *b. Weather or other unforeseen problems arise which delay the start of work to April 1 – August 31.*
> *c. Problems with the HDD drill arise which require physical access to the coastal beach or result in physical disturbance to the coastal beach (e.g. obstructions, blow-outs).*
> *d. Details regarding how the work area will be delineated to prevent encroachment onto the coastal beach.*

I. Commencement of Work

The Proponent is developing a construction schedule that anticipates commencing HDD activities at either the Craigville Public Beach Landfall Site or the Covell's Beach Landfall Site prior to April 1. It is possible that HDD activities at the landfall site could extend beyond that date. It is extremely unlikely that the Proponent would initiate landfall site HDD activities *after* April 1. However, if for some currently unforeseen reason it is necessary to initiate or re-initiate after a work stoppage of over 48 hours during the Piping Plover nesting season, the Proponent will implement the following measures to avoid disturbing any nesting Piping Plovers near the landfall.

A. Notifications

The Proponent will notify NHESP, Bureau of Ocean Energy Management (BOEM), and US Fish and Wildlife Service, (collectively referred to as "the agencies") if the need to initiate activities after April 1 arises, including the reason, the anticipated duration of the work, and any other information requested by the agencies.

B. Monitoring by Credentialed Biologist

Plover monitoring as described in this plan will be carried out only by qualified biologists from an accredited organization or an individual who has at least one year of previous experience at an accredited organization conducting shorebird monitoring for Piping Plovers.

C. Pre-Mobilization Plover Survey

The Proponent will employ a shorebird monitor to perform a pre-mobilization survey of the beach and dune area adjacent to the parking lot being utilized for HDD staging at the landfall site. The purpose of this survey will be to ascertain the presence or absence of any nesting plovers within 200 yards of the work zone. For the purpose of performing plover monitoring surveys, the work zone will include a portion of the landfall site parking lot as well as the proposed HDD alignment extending across the beach area from the parking lot to Nantucket Sound.

If there are no Piping Plover nests, scrapes, or territorial pairs identified within 200 yards of the work zone, the shorebird monitor will document the findings, report to the agencies and the Proponent, and the Proponent will be cleared to mobilize into the area within 48 hours with no further monitoring activities required. However, if any Piping Plover nests, scrapes, or territorial pairs are observed within 200 yards of the work zone, the shorebird monitor will record their locations and will report back to the agencies and the Proponent, and the Proponent will implement the plover monitoring as outlined below.

D. Plover Monitoring Plan

Monitoring, if necessary, will be consistent with the procedures established under the Massachusetts NHESP's "Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns, and their Habitats in Massachusetts" for use of roads and parking lots in areas where unfledged chicks are present.[1] Daily monitoring will be conducted from the time construction equipment is mobilized to the landfall site parking lot extending through the construction phase, including equipment demobilization.

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[1] Massachusetts Division of Fisheries & Wildlife, Natural Heritage and Endangered Species Program, "Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns, and their Habitats in Massachusetts", 1993, page 8.

Under this protocol, the monitoring intensity will increase with increasing proximity of nests and/or chicks relative to the work zone and will also increase with increasing frequency of chick observations. If plovers are less than 200 yards from the construction activity, then a qualified monitor must be present to observe if nesting plovers or their young are disturbed from the activity (for example observing an increase in vocalizations, adults repeatedly leaving the nest, or adults staying off the nest for more than a few minutes). If a nest or brood consistently remains more than 100 yards from the work zone, the nest will be monitored once per day at dawn (before 0600 hours) prior to the onset of work during appropriate weather conditions. Nests or broods showing a tendency to occur within 50–100 yards of the work zone will be monitored twice per day at dawn prior to the onset of work and dusk (before 0600 hours and after 1900 hours) during appropriate weather conditions. Note that no mobilization of construction equipment to the landfall site parking lot will be allowed if any plover nest is observed within 50 yards of the work zone, unless specifically permitted by NHESP.

If the qualified shorebird monitor observes that state-listed birds are disturbed by the initiation (or re-initiation) of work, or by construction activities, then all work shall cease until such time as the plovers move away from the area (beyond 200 m) or after consultation with the agencies.

E. Training of Construction Personnel

This Piping Plover Protection Plan will be incorporated into the construction management plan that is being prepared for the HDD operations, so it can be understood in advance and implemented by site personnel should it be necessary to mobilize for HDD operations after April 1 or if ongoing HDD drilling operations at the landfall site are halted for over 48 hours after April 1.

II. Work Stoppage for over 48 Hours and Resumption

In the event that HDD operations are paused for over 48 hours after April 1, then work will not resume until a shorebird monitor inspects the area to identify any plover nests within 200 yards of the work zone. If any nests are observed within 200 yards of the work zone, the project will comply with the procedures described above for initiation of construction activities after April 1.

III. Delineation of work area to prevent encroachment onto coastal beach

The HDD staging area will be located entirely within the paved parking lot at either Craigville Public Beach or Covell’s Beach, and will be secured within a fenced and gated perimeter. If equipment access on Craigville Beach is required for any reason during the shorebird nesting season, then in advance of equipment access, notification and proposed monitoring procedures to be undertaken by the shorebird monitor must be provided to the agencies.

IV. HDD Design and Breakout Prevention

The likelihood of needing physical access to the coastal beach or the risk of impacts to the beach itself are both very low. The HDD design has been informed by site-specific geotechnical data to minimize the risk of a surficial release of drilling mud. These investigations have enabled the Project to understand the containment capacity of the soils at the drill entry point, and to establish maximum drilling pressures to prevent a breakout on the beach. To further reduce the potential for a breakout on the beach, the drilling will likely be conducted within an entry casing first 100-150 feet of the HDD, at which point the drill head will be approximately 20 feet below the grade of the beach.

Furthermore, the Project will use a drilling fluid composed of bentonite clay or mud. This benign, natural material will pose little to no threat to water quality or ecological resources in the rare instance of seepage around the HDD operations.

Effective construction management during HDD operations will further minimize the already-remote potential for beach or seafloor disturbance through drilling fluid seepage (i.e., frac-out). Drilling fluid seepage can occur when pressurization of the drill hole exceeds the containment capacity of the overburden soil material, but by providing adequate depth of cover for the HDD installation, the risk of seepage can be substantially reduced. Nonetheless, the Proponent will adhere to the operational standards discussed below to minimize the chances of drilling fluid seepage.

In the contingency planning for the HDD, prevention of drilling fluid seepage has been a primary consideration in the trajectory of the installation. As such, the HDD drill hole will likely descend from the HDD pit location to a depth of approximately 30 feet below the seafloor before rising toward the exit hole on the seafloor where installation will transition to cable burial. As the pilot hole approaches the targeted exit hole location, the contractor will minimize the amount of drilling fluid near the head to minimize the potential for a release of drilling mud as the drill head reaches the surface of the seafloor.

The geometry of the drill hole profile can also affect the potential for drilling fluid seepage. In a profile that makes compound or tight-radii turns, down-hole pressures can build, thus increasing the potential for drilling fluid seepage. The proposed drilling profile, with its smooth and gradual vertical curves, will avoid this potential effect. In addition, horizontal curvature of the HDD route will minimize the potential for pressure buildup caused by drill hole geometry.

In the unlikely event that a disturbance of the coastal beach occurs between April 1 and August 31 associated with the HDD, the Proponent will immediately mobilize a shorebird monitor to survey the site in advance of any equipment access on the beach, and will ensure that no remedial actions on the beach interfere with nesting Plovers or their chicks. The monitor will remain on-site until the equipment involved in the remedial operations on the beach has returned to the work limits within the landfall site parking lot.

V. Reporting

If monitoring is required (because HDD activities begin after April 1, or if there is a work stoppage of over 48 hours after April 1), the shorebird monitor will prepare daily field reports that will be provided to the Proponent and the agencies on a weekly basis until plover chicks from any of the nest being monitored have fledged. In addition to reporting on the status and location of the nest and brood relative to the work zone, the report will provide other pertinent details such as weather, wind direction and velocity, evidence of predators, etc. Photographs will be included to provide a visual record of any unusual observations. Following demobilization of construction equipment from the landfall site parking lot, a summary report describing the monitoring effort will also be prepared and provided to the Proponent and the agencies.

VI. Modifications to Plan

Any changes to the PPPP must be requested in writing at least two weeks prior to the anticipated implementation of said changes for review and written-approval by the NHESP.

Appendix D: Stochastic Collision Risk Assessment for Movement Model Inputs and Outputs

Summary of simulation results from SCRAM: a stochastic collision risk assessment for movement data

13 December 2022

SCRAM was developed by Biodiversity Research Institute, the University of Rhode Island, and the U.S. Fish and Wildlife Service with funding from the Bureau of Ocean Energy Management.

SCRAM run details

```
## SCRAM - the Stochastic Collision Risk Assessment for Movement version
## Version: 0.91.1 - Lyrical Brachycarpus
## Iterations: 1000
## Model option: Option 3: slower but more accurate assessment
## Project: New England
## Modeler: David Bigger
## The model run was started at: Tue Dec 13 13:26:34 2022 EST
## The model run was completed at: Tue Dec 13 13:48:47 2022 EST
## Run 1: the probability of exceeding specified threshold (1) is < 0.001.
```

Model inputs used for this analysis

Table 1: Species input parameters (mean and 95 perc. range).

Species	**Turbine model**	**Avoidance**	**Wing span**	**Body length**	**Speed**
Piping Plover	**Unk**	0.93 (0.92, 0.94)	0.38 (0.38, 0.38)	0.18 (0.17, 0.18)	11.8 (2.86, 21.38)

Table 2: Species monthly (Jan-Jun) population estimates ± SD and assumptions/limitations as specified by the USFWS using the most recent data.

Species	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Piping Plover	0 ± 0	0 ± 0	4578 ± 0	4578 ± 0	4578 ± 0	4578 ± 0

Table 3: Species monthly (Jul-Dec) population estimates ± SD and assumptions/limitations as specified by the USFWS using the most recent data.

Species	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Piping Plover	4578 ± 0	7423 ± 0	7423 ± 0	7423 ± 0	0 ± 0	0 ± 0

Population data assumptions/limitations:
1) Entire Atlantic coast population could be present in area during months listed.
2) Occurrence through October to include birds stopping over in mid-Atlantic (e.g. North Carolina). Number of birds still present in Atlantic likely lower.
3) Estimate of HY fledges, uses the 20-year (2002 - 2021) average productivity (unweighted).

Table 4: Wind farm input parameters (mean and 95 perc. range).

Species	**Turbine model**	**Num. turbines**	**Rotor radius**	**Hub height (m)**	**Blade width (m)**	**Wind speed (mps)**
Piping Plover	**Unk**	130 (130, 130)	143 (143, 143)	170 (170, 170)	9 (9, 9)	8.65 (7.64, 9.61)

Table 5: Wind farm input parameters (mean and 95 perc. range).

Species	**Turbine model**	**Prop. upwind**	**Rotor speed (rpm)**	**Pitch (radians)**	**Farm width (km)**	**Lat.**	**Long.**
Piping Plover	**Unk**	1 (1, 1)	3.18 (2.81, 3.53)	0.03 (0.03, 0.04)	31 (31, 31)	40.92	-70.66

Table 6: Monthly wind farm operational data (mean and 95 perc. range) is given for each wind farm specification.

Species	**Turbine model**	**Jan Op.**	**Feb Op.**	**Mar Op.**	**Apr Op.**	**May Op.**	**Jun Op.**
Piping Plover	**Unk**	86.9 (83.2, 90.4)	87.1 (83.4, 91)	87.2 (83.9, 90.8)	86.7 (83.1, 90.2)	85.3 (81.8, 88.8)	85 (81.5, 88.6)

Table 7: Monthly wind farm operational data (mean and 95 perc. range) is given for each wind farm specification.

Species	**Turbine model**	**Jul Op.**	**Aug Op.**	**Sep Op.**	**Oct Op.**	**Nov Op.**	**Dec Op.**
Piping Plover	**Unk**	82.6 (79, 86.2)	82.8 (79.3, 86.1)	83.4 (79.7, 86.8)	85.4 (81.6, 89)	86.3 (82.9, 89.7)	87.1 (83.6, 90.7)

Results for the SCRAM simulation

Table 8: The predicted mean and 95 perc. prediction intervals of the number of collisions per month and the total summed monthly number of collisions and 95 perc. prediction interval. Results are not shown for months that do not have movement data.

Species	**Turbine model**	**month**	**Mean number of collisions**	**Lower pred. interval**	**Upper pred. interval**
Piping Plover	**Unk**	Jan			
Piping Plover	**Unk**	Feb			
Piping Plover	**Unk**	Mar			
Piping Plover	**Unk**	Apr			
Piping Plover	**Unk**	May	0	0	0
Piping Plover	**Unk**	Jun	0	0	0.002
Piping Plover	**Unk**	Jul	0.008	0.006	0.011
Piping Plover	**Unk**	Aug	0	0	0.003
Piping Plover	**Unk**	Sep	0	0	0
Piping Plover	**Unk**	Oct			
Piping Plover	**Unk**	Nov			
Piping Plover	**Unk**	Dec			
Piping Plover	**Unk**	annual	0.009	0.007	0.013

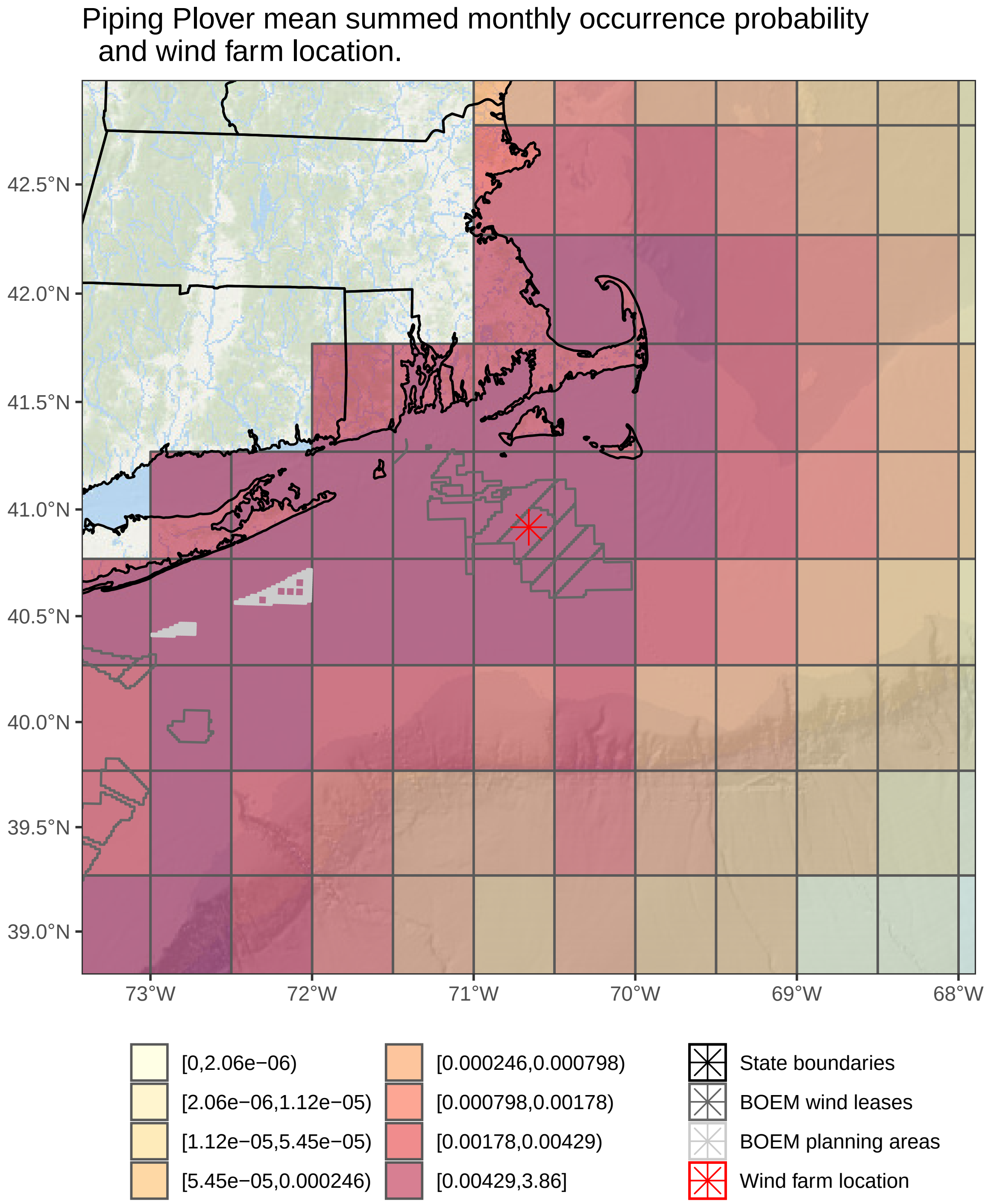

Figure 1: A map of the species occurrence probabities and wind farm location.

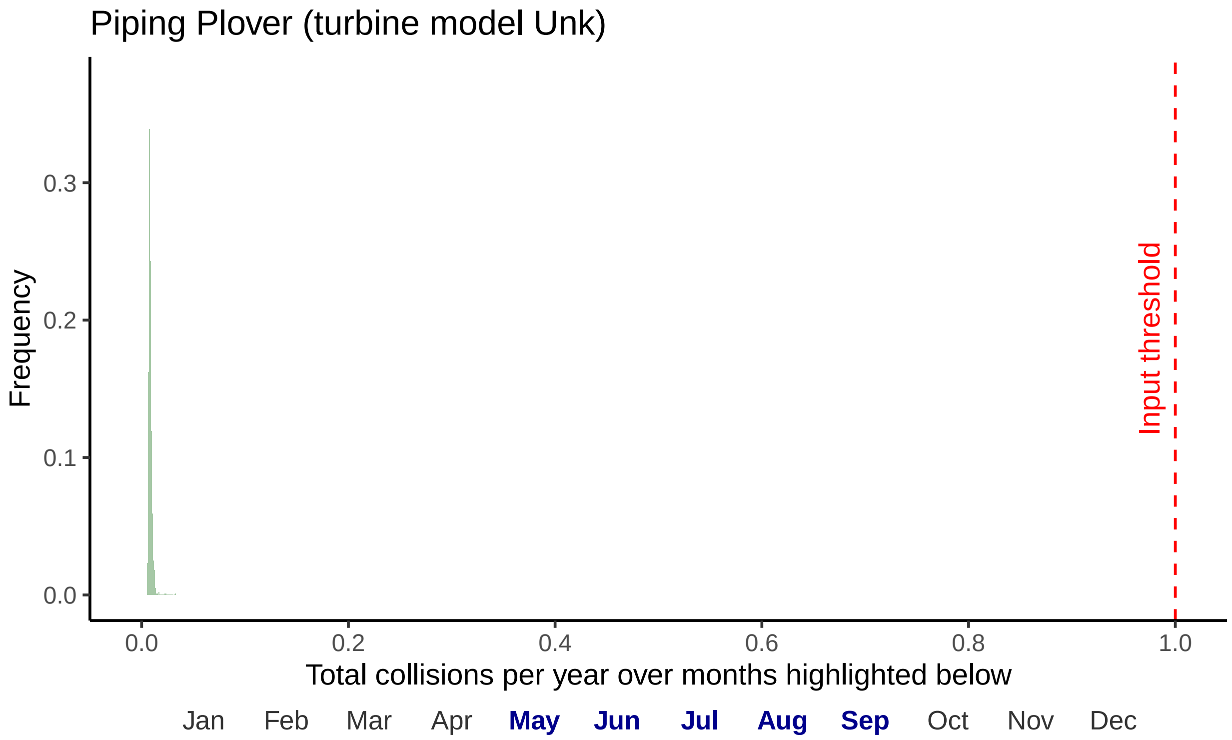

Figure 2: A frequency histogram of the total number of collisions per year. The heights of the bars show the relative frequency of each value. Months for which movement data were provided or available are shown in bold; only bold months are shown in histogram of annual collisions.

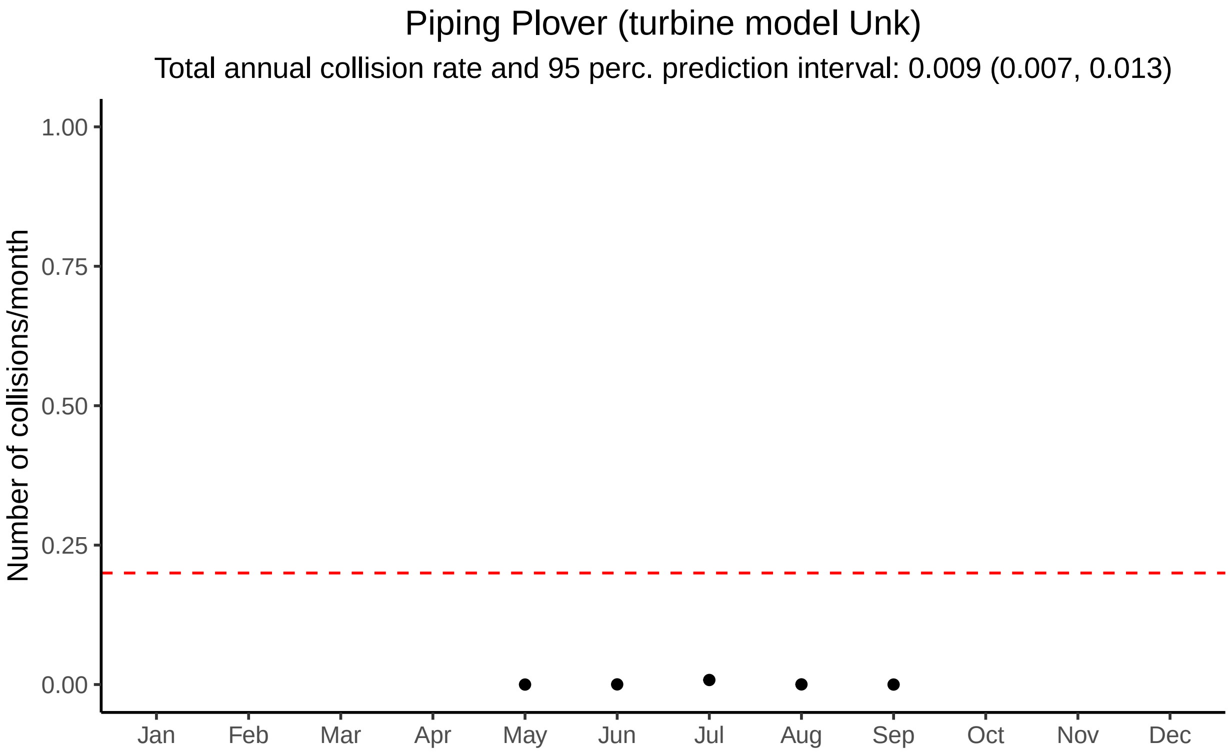

Figure 3: The predicted mean and 95 perc. prediction intervals of the number of collisions per month. Results are not shown for months that do not have movement data. Total annual collision rate and 95 perc. prediction interval are given at top. The threshold is shown divided by the number of months that movement data were available.

Summary of simulation results from SCRAM: a stochastic collision risk assessment for movement data

13 December 2022

SCRAM was developed by Biodiversity Research Institute, the University of Rhode Island, and the U.S. Fish and Wildlife Service with funding from the Bureau of Ocean Energy Management.

SCRAM run details

```
## SCRAM - the Stochastic Collision Risk Assessment for Movement version
## Version: 0.91.1 - Lyrical Brachycarpus
## Iterations: 1000
## Model option: Option 3: slower but more accurate assessment
## Project: New England
## Modeler: David Bigger
## The model run was started at: Tue Dec 13 13:54:49 2022 EST
## The model run was completed at: Tue Dec 13 14:17:16 2022 EST
## Run 1: the probability of exceeding specified threshold (1) is < 0.001.
```

Model inputs used for this analysis

Table 1: Species input parameters (mean and 95 perc. range).

Species	**Turbine model**	**Avoidance**	**Wing span**	**Body length**	**Speed**
Red Knot	**Unk**	0.93 (0.92, 0.94)	0.5 (0.45, 0.54)	0.24 (0.23, 0.25)	20.21 (16.51, 23.82)

Table 2: Species monthly (Jan-Jun) population estimates ± SD and assumptions/limitations as specified by the USFWS using the most recent data.

Species	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Red Knot	10400 ± 0	10400 ± 0	10400 ± 0	10400 ± 0	59200 ± 0	59200 ± 0

Table 3: Species monthly (Jul-Dec) population estimates ± SD and assumptions/limitations as specified by the USFWS using the most recent data.

Species	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Red Knot	59200 ± 0	59200 ± 0	72520 ± 0	54720 ± 0	41400 ± 0	10400 ± 0

Population data assumptions/limitations:

1) All pass through in spring - #s consistent w/Lyons et al super-population estimate for 2020 in DE Bay: 40,444 (95 perc. credible interval: 33,627–49,966).
2) Winter population estimates represent the total # of adults and sub-adults (in general).
3) Southern and northern wintering birds could be present during July - Sept.
4) Only northern wintering birds could be present during Oct - Nov.
5) Only southeast US and Caribbean birds could be present during Dec.
6) Birds from western Gulf population are excluded from totals in Atlantic region due to lack of information on extent to which they use the Atlantic region.
7) Numbers do not include HY birds in fall.
8) Dec number coming from Lyons et al 2017. Just includes SE US Birds, not Caribbean.
9) Issues with double counting addressed because birds may be present in different areas of Atlantic region for weeks to months.

Table 4: Wind farm input parameters (mean and 95 perc. range).

Species	**Turbine model**	**Num. turbines**	**Rotor radius**	**Hub height (m)**	**Blade width (m)**	**Wind speed (mps)**
Red Knot	**Unk**	130 (130, 130)	143 (143, 143)	170 (170, 170)	9 (9, 9)	8.66 (7.69, 9.63)

Table 5: Wind farm input parameters (mean and 95 perc. range).

Species	**Turbine model**	**Prop. upwind**	**Rotor speed (rpm)**	**Pitch (radians)**	**Farm width (km)**	**Lat.**	**Long.**
Red Knot	**Unk**	1 (1, 1)	3.18 (2.82, 3.54)	0.03 (0.03, 0.04)	31 (31, 31)	40.92	-70.66

Table 6: Monthly wind farm operational data (mean and 95 perc. range) is given for each wind farm specification.

Species	**Turbine model**	**Jan Op.**	**Feb Op.**	**Mar Op.**	**Apr Op.**	**May Op.**	**Jun Op.**
Red Knot	**Unk**	87 (83.3, 90.9)	87.2 (83.7, 91)	87.2 (83.8, 90.9)	86.7 (83.3, 90.6)	85.3 (81.8, 88.9)	85 (81.5, 88.6)

Table 7: Monthly wind farm operational data (mean and 95 perc. range) is given for each wind farm specification.

Species	**Turbine model**	**Jul Op.**	**Aug Op.**	**Sep Op.**	**Oct Op.**	**Nov Op.**	**Dec Op.**
Red Knot	**Unk**	82.5 (79.3, 85.9)	82.9 (79.5, 86.2)	83.4 (79.8, 86.9)	85.3 (81.6, 88.9)	86.2 (82.6, 89.9)	87.2 (83.5, 90.6)

Results for the SCRAM simulation

Table 8: The predicted mean and 95 perc. prediction intervals of the number of collisions per month and the total summed monthly number of collisions and 95 perc. prediction interval. Results are not shown for months that do not have movement data.

Species	**Turbine model**	**month**	**Mean number of collisions**	**Lower pred. interval**	**Upper pred. interval**
Red Knot	**Unk**	Jan			
Red Knot	**Unk**	Feb			
Red Knot	**Unk**	Mar			
Red Knot	**Unk**	Apr			
Red Knot	**Unk**	May			
Red Knot	**Unk**	Jun			
Red Knot	**Unk**	Jul			
Red Knot	**Unk**	Aug	0.003	0	0.016
Red Knot	**Unk**	Sep	0.003	0	0.028
Red Knot	**Unk**	Oct	0.001	0	0.001
Red Knot	**Unk**	Nov	0.001	0	0.017
Red Knot	**Unk**	Dec			
Red Knot	**Unk**	annual	0.009	0.004	0.036

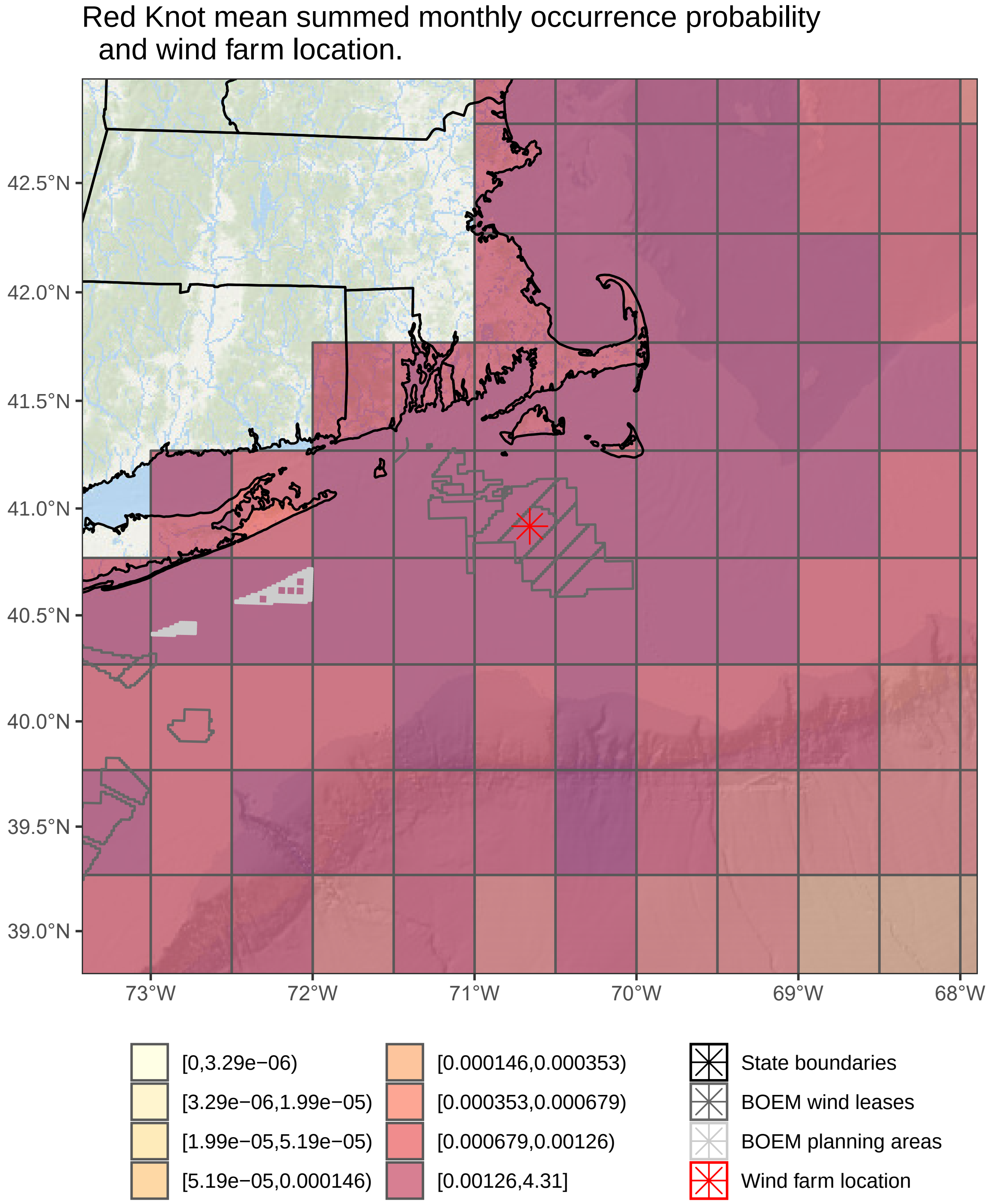

Figure 1: A map of the species occurrence probabities and wind farm location.

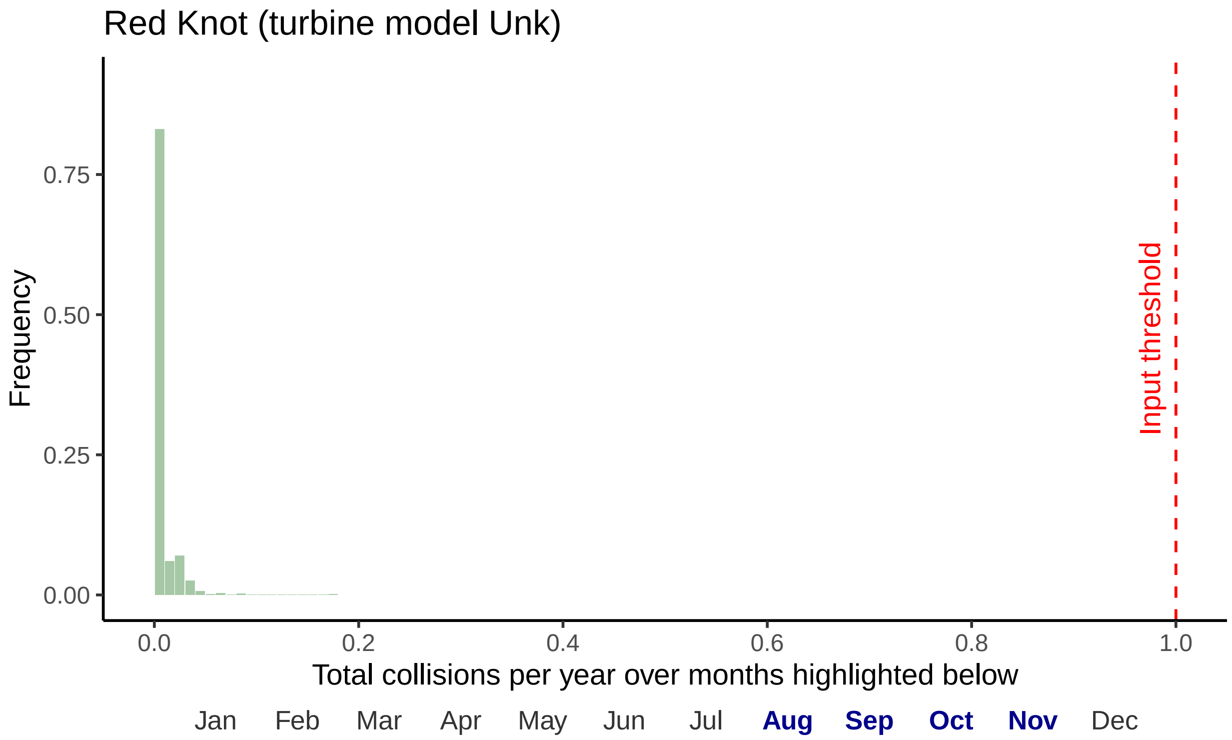

Figure 2: A frequency histogram of the total number of collisions per year. The heights of the bars show the relative frequency of each value. Months for which movement data were provided or available are shown in bold; only bold months are shown in histogram of annual collisions.

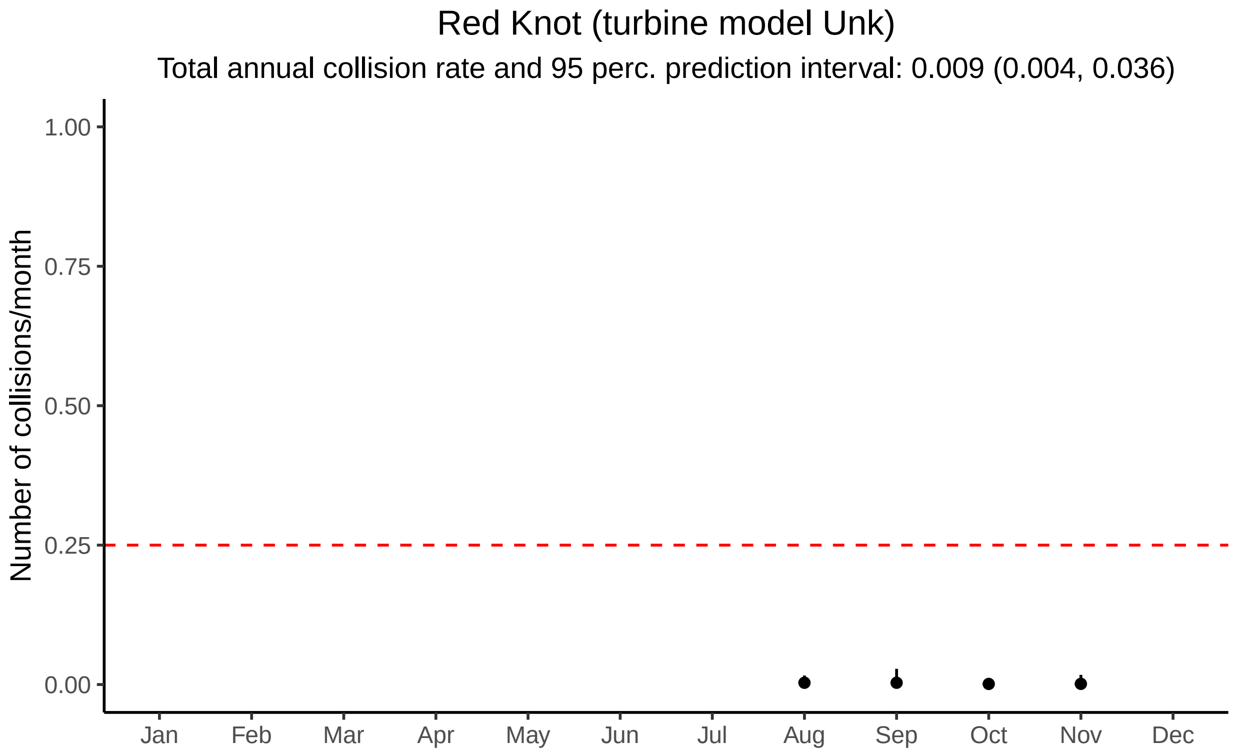

Figure 3: The predicted mean and 95 perc. prediction intervals of the number of collisions per month. Results are not shown for months that do not have movement data. Total annual collision rate and 95 perc. prediction interval are given at top. The threshold is shown divided by the number of months that movement data were available.

Summary of simulation results from SCRAM: a stochastic collision risk assessment for movement data

13 December 2022

SCRAM was developed by Biodiversity Research Institute, the University of Rhode Island, and the U.S. Fish and Wildlife Service with funding from the Bureau of Ocean Energy Management.

SCRAM run details

```
## SCRAM - the Stochastic Collision Risk Assessment for Movement version
## Version: 0.91.1 - Lyrical Brachycarpus
## Iterations: 1000
## Model option: Option 3: slower but more accurate assessment
## Project: New England
## Modeler: David Bigger
## The model run was started at: Tue Dec 13 14:19:26 2022 EST
## The model run was completed at: Tue Dec 13 14:41:52 2022 EST
## Run 1: the probability of exceeding specified threshold (1) is < 0.001.
```

Model inputs used for this analysis

Table 1: Species input parameters (mean and 95 perc. range).

Species	**Turbine model**	**Avoidance**	**Wing span**	**Body length**	**Speed**
Roseate Tern	**Unk**	0.93 (0.92, 0.94)	0.76 (0.72, 0.8)	0.37 (0.33, 0.41)	12.45 (3.39, 21.7)

Table 2: Species monthly (Jan-Jun) population estimates ± SD and assumptions/limitations as specified by the USFWS using the most recent data.

Species	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Roseate Tern	0 ± 0	0 ± 0	0 ± 0	10916 ± 0	10916 ± 0	10916 ± 0

Table 3: Species monthly (Jul-Dec) population estimates ± SD and assumptions/limitations as specified by the USFWS using the most recent data.

Species	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Roseate Tern	16251 ± 0	16251 ± 0	16251 ± 0	16251 ± 0	0 ± 0	0 ± 0

Population data assumptions/limitations:
1) Entire NW Atlantic pop could be present in area during months listed.
2) Average of most recent (2018 and 2019) productivity data from three largest colonies (representing >90 perc. of population) representative of entire population.
3) Fledging and post-breeding dispersal period occurs from July through Sept.
4) Numbers of non-breeding adults are not included.
5) Does not include non-breeding 1 and 2 year old birds that return but do not breed.
6) From Gochfeld and Burger (2020): Northeastern birds first arrive at Nantucket and Martha's Vineyard, MA, in large flocks, then disperse north as well as west. They arrive 26 Apr-20 May at Bird I., MA (Nisbet 1980, Nisbet 1981b, Nisbet 1989b), slightly later at Falkner I., CT, and Great Gull I., NY.
7) From Gochfeld and Burger (2020): Apparently all birds migrate directly from the staging area around Cape Cod across the w. North Atlantic to the West Indies (Nisbet 1984, C. Mostello). Very small numbers occur at sea off N. Carolina from late Aug to late Sep, with a peak in early Sep; the latest date was 28 Oct (D. Lee).

Table 4: Wind farm input parameters (mean and 95 perc. range).

Species	**Turbine model**	**Num. turbines**	**Rotor radius**	**Hub height (m)**	**Blade width (m)**	**Wind speed (mps)**
Roseate Tern	**Unk**	130 (130, 130)	143 (143, 143)	170 (170, 170)	9 (9, 9)	8.65 (7.72, 9.59)

Table 5: Wind farm input parameters (mean and 95 perc. range).

Species	**Turbine model**	**Prop. upwind**	**Rotor speed (rpm)**	**Pitch (radians)**	**Farm width (km)**	**Lat.**	**Long.**
Roseate Tern	**Unk**	1 (1, 1)	3.18 (2.84, 3.52)	0.03 (0.03, 0.04)	31 (31, 31)	40.92	-70.66

Table 6: Monthly wind farm operational data (mean and 95 perc. range) is given for each wind farm specification.

Species	**Turbine model**	**Jan Op.**	**Feb Op.**	**Mar Op.**	**Apr Op.**	**May Op.**	**Jun Op.**
Roseate Tern	**Unk**	86.9 (83.4, 90.5)	87.1 (83.8, 90.4)	87.1 (83.5, 91.1)	86.6 (83.1, 90.1)	85.3 (81.8, 88.9)	85.2 (81.7, 88.9)

Table 7: Monthly wind farm operational data (mean and 95 perc. range) is given for each wind farm specification.

Species	**Turbine model**	**Jul Op.**	**Aug Op.**	**Sep Op.**	**Oct Op.**	**Nov Op.**	**Dec Op.**
Roseate Tern	**Unk**	82.6 (79.1, 86.1)	82.8 (79, 86.2)	83.6 (80.1, 87.3)	85.4 (81.7, 89)	86.2 (82.7, 89.8)	87.2 (83.7, 90.6)

Results for the SCRAM simulation

Table 8: The predicted mean and 95 perc. prediction intervals of the number of collisions per month and the total summed monthly number of collisions and 95 perc. prediction interval. Results are not shown for months that do not have movement data.

Species	**Turbine model**	**month**	**Mean number of collisions**	**Lower pred. interval**	**Upper pred. interval**
Roseate Tern	**Unk**	Jan			
Roseate Tern	**Unk**	Feb			
Roseate Tern	**Unk**	Mar			
Roseate Tern	**Unk**	Apr			
Roseate Tern	**Unk**	May			
Roseate Tern	**Unk**	Jun	0.003	0.002	0.005
Roseate Tern	**Unk**	Jul	0.013	0.008	0.023
Roseate Tern	**Unk**	Aug	0.02	0.012	0.038
Roseate Tern	**Unk**	Sep	0.002	0	0.01
Roseate Tern	**Unk**	Oct			
Roseate Tern	**Unk**	Nov			
Roseate Tern	**Unk**	Dec			
Roseate Tern	**Unk**	annual	0.038	0.024	0.069

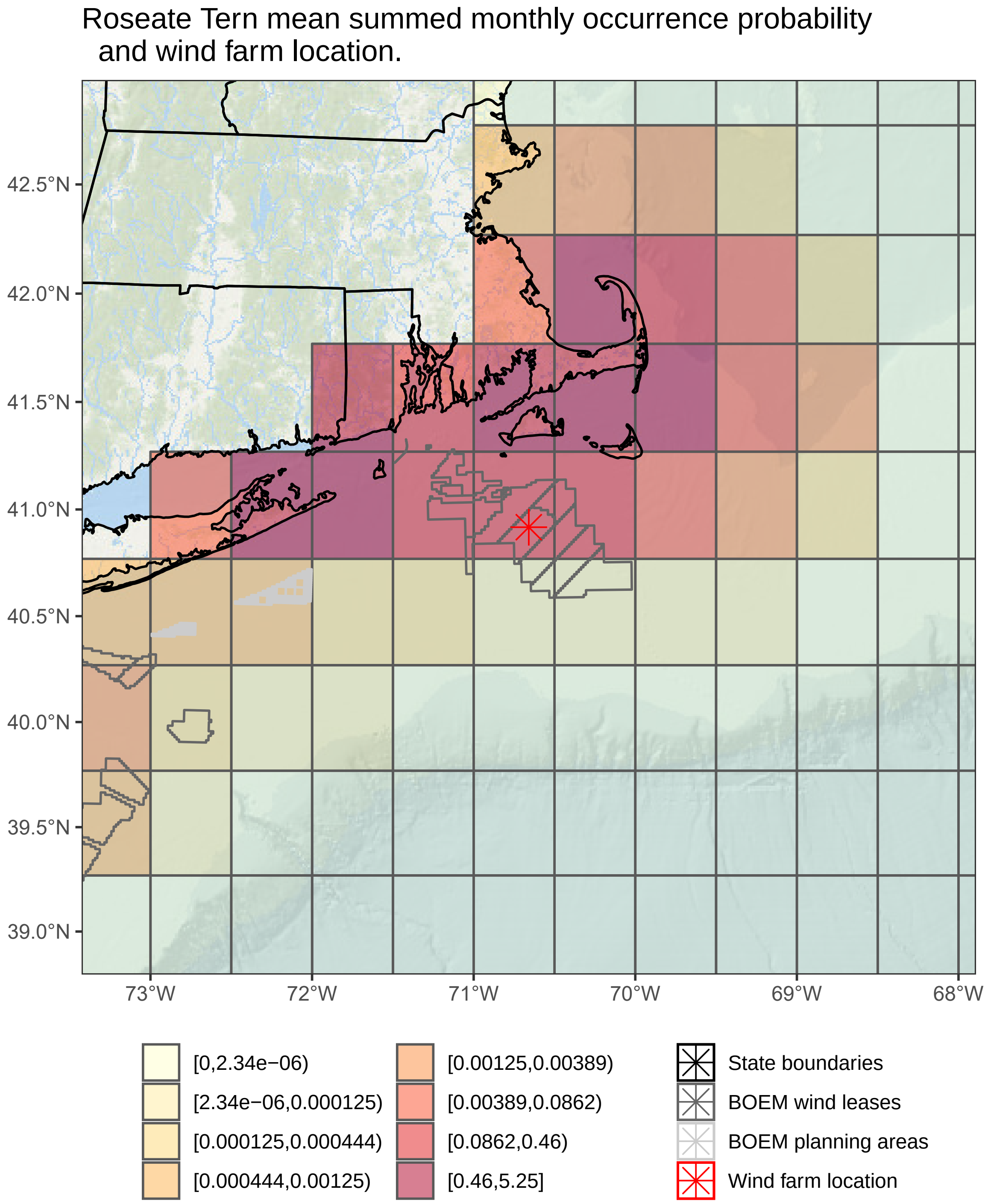

Figure 1: A map of the species occurrence probabities and wind farm location.

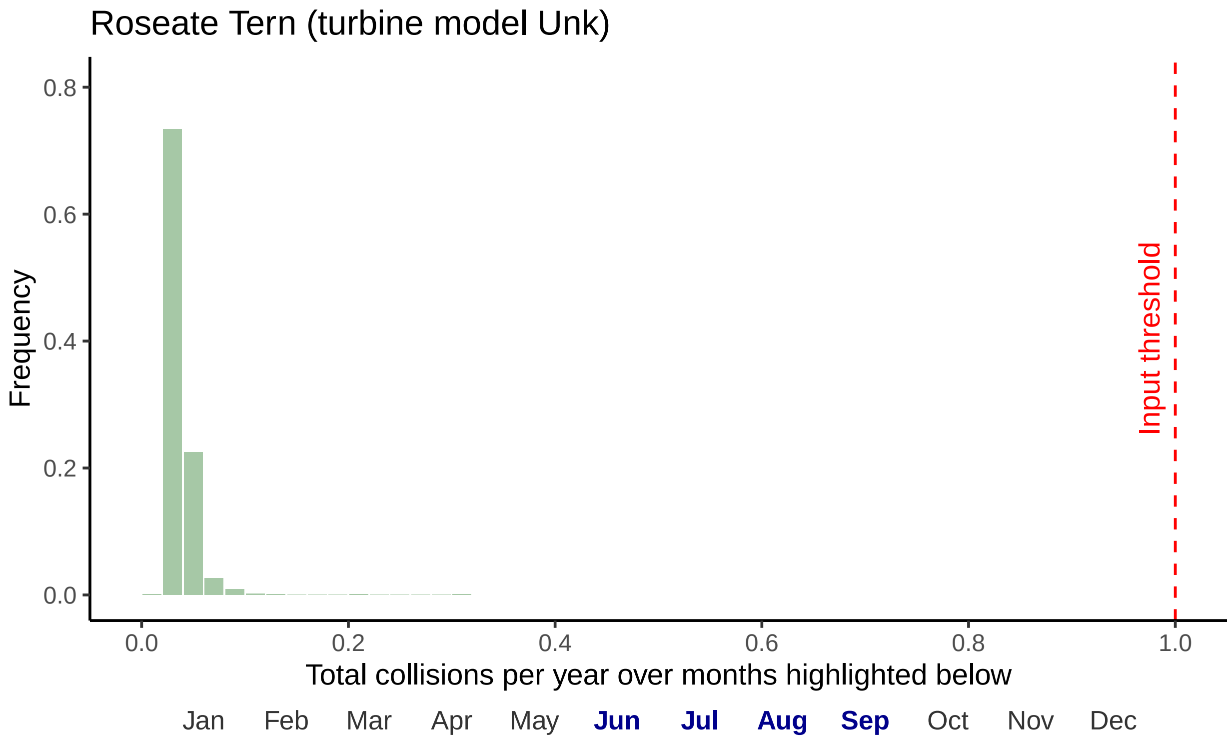

Figure 2: A frequency histogram of the total number of collisions per year. The heights of the bars show the relative frequency of each value. Months for which movement data were provided or available are shown in bold; only bold months are shown in histogram of annual collisions.

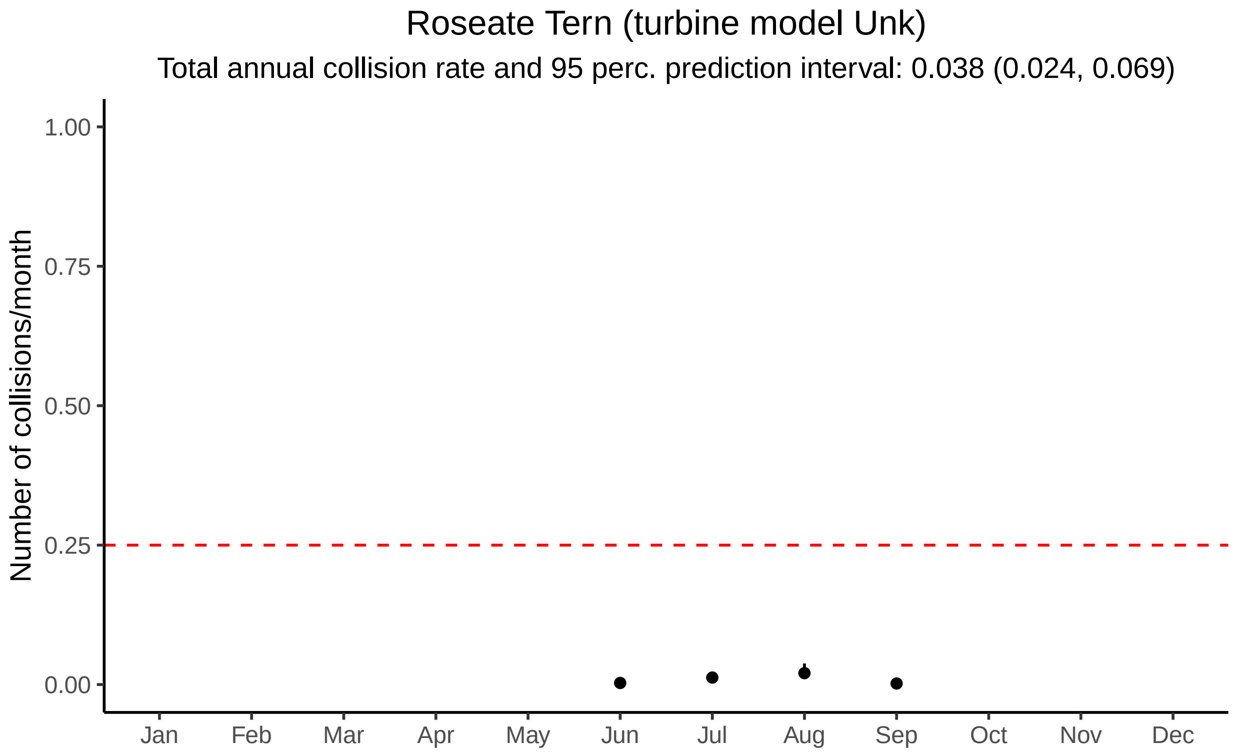

Figure 3: The predicted mean and 95 perc. prediction intervals of the number of collisions per month. Results are not shown for months that do not have movement data. Total annual collision rate and 95 perc. prediction interval are given at top. The threshold is shown divided by the number of months that movement data were available.

Appendix E: Avian and Bat Monitoring Framework

This plan is being developed in coordination with USFWS and BOEM and will be included in the Final BA.