Vineyard Wind 1 Offshore Wind Energy Project Biological Assessment: Final

September 2020

For the U.S. Fish and Wildlife Service

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

TABLE OF CONTENTS

LIST OF APPENDICES

Appendix A: Species Conclusions Table
Appendix B: USFWS letter Consultation Code: 05E1NE00-2019-TA-1790
Appendix C: Piping Plover Protection Plan

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AC	alternating current
ADLS	Aircraft Detection Lighting System
BA	Biological Assessment
BO	Biological Opinion
BITS	Block Island Transmission System
BIWF	Block Island Wind Facility
BOEM	Bureau of Ocean Energy Management
COP	Construction and Operation Plan
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESP	Electrical Service Platform
FAA	Federal Aviation Administration
HDD	horizontal directional drilling
IPaC	Information for Planning and Consultation
km^2	square kilometers
kV	kilovolt
MA WEA	Massachusetts Wind Energy Area
MW	megawatt
NWR	National Wildlife Refuge
OCS	Outer Continental Shelf
PDE	Project Design Envelope
rpm	revolutions per minute
RFI	Request for Interest
ROW	right-of-way
RSA	rotor-swept area
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
Vineyard Wind	Vineyard Wind LLC
WDA	wind development area
WEA	Wind Energy Area
WNS	White-Nose Syndrome
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 United States Fish and Wildlife Service (USFWS) regarding species that may be affected by the approval of a Construction and Operations Plan (COP) for the Vineyard Wind 1 Offshore Energy Project within the Massachusetts Wind Energy Area (MA WEA) on the Outer Continental Shelf (OCS) (Figure 1).

This Biological Assessment (BA) has been prepared pursuant to the ESA to evaluate potential effects of the Proposed Action described herein on ESA-listed species. This BA provides a comprehensive description of the Proposed Action, defines the Action Area, describes those species potentially impacted 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 by include approving the COP for the construction, operations, maintenance, and eventual decommissioning of the proposed offshore wind energy facility with a maximum nameplate capacity of approximately 800 megawatts (MW), associated submarine and upland cable interconnecting the wind facility to the proposed substation located in Barnstable, Massachusetts (Figure 2). Onshore support facilities would be located at existing waterfront industrial or commercial sites within Massachusetts. This document is a BA of impacts on endangered and threatened species listed under the ESA that are under the oversight of the USFWS from the construction, operations, maintenance, and decommissioning of an approximately 800 MW Project located within the Wind Development Area (WDA) of Vineyard Wind LLC (Vineyard Wind) Lease Area OCS-A 0501 (Figure 1).

Vineyard Wind's lease with BOEM (Lease OCS-A 0501) has an operations term of 25 years that commences on the date of COP approval (See https://www.boem.gov/Lease-OCS-A-0501/ at Addendum B; see also 30 CFR § 585.235(a)(3)). Vineyard Wind would need to request an extension of its operations term from BOEM in order to operate the proposed Project for 30 years. For purposes of the maximum-case scenario and to ensure NEPA coverage if BOEM grants such an extension, however, the Final EIS analyzes a 30-year operations term. The operations term includes the construction, operations and maintenance, and decommissioning phases of the project.

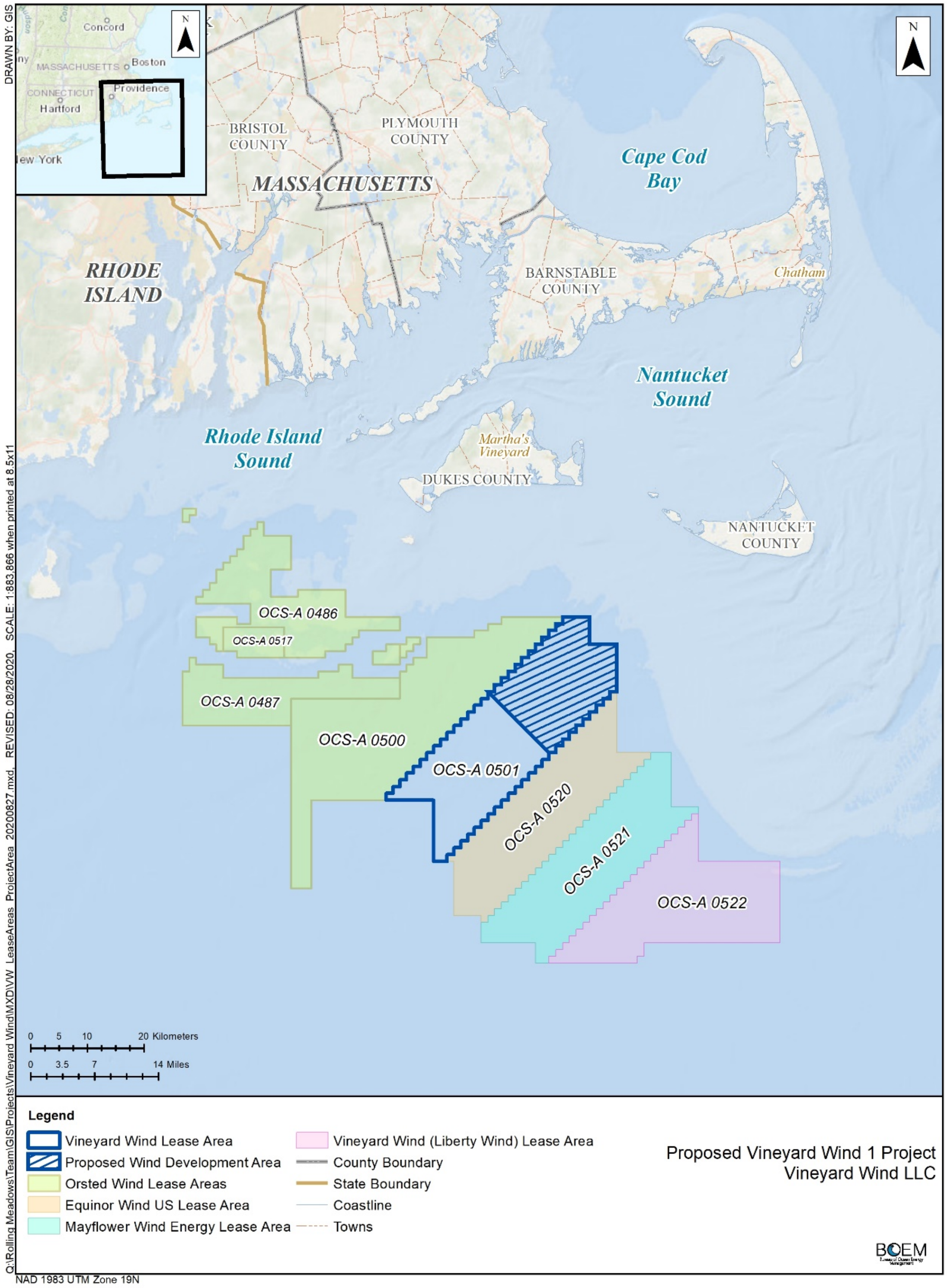


Figure 1: Proposed Project Area Relative to Massachusetts and Rhode Island Lease Areas

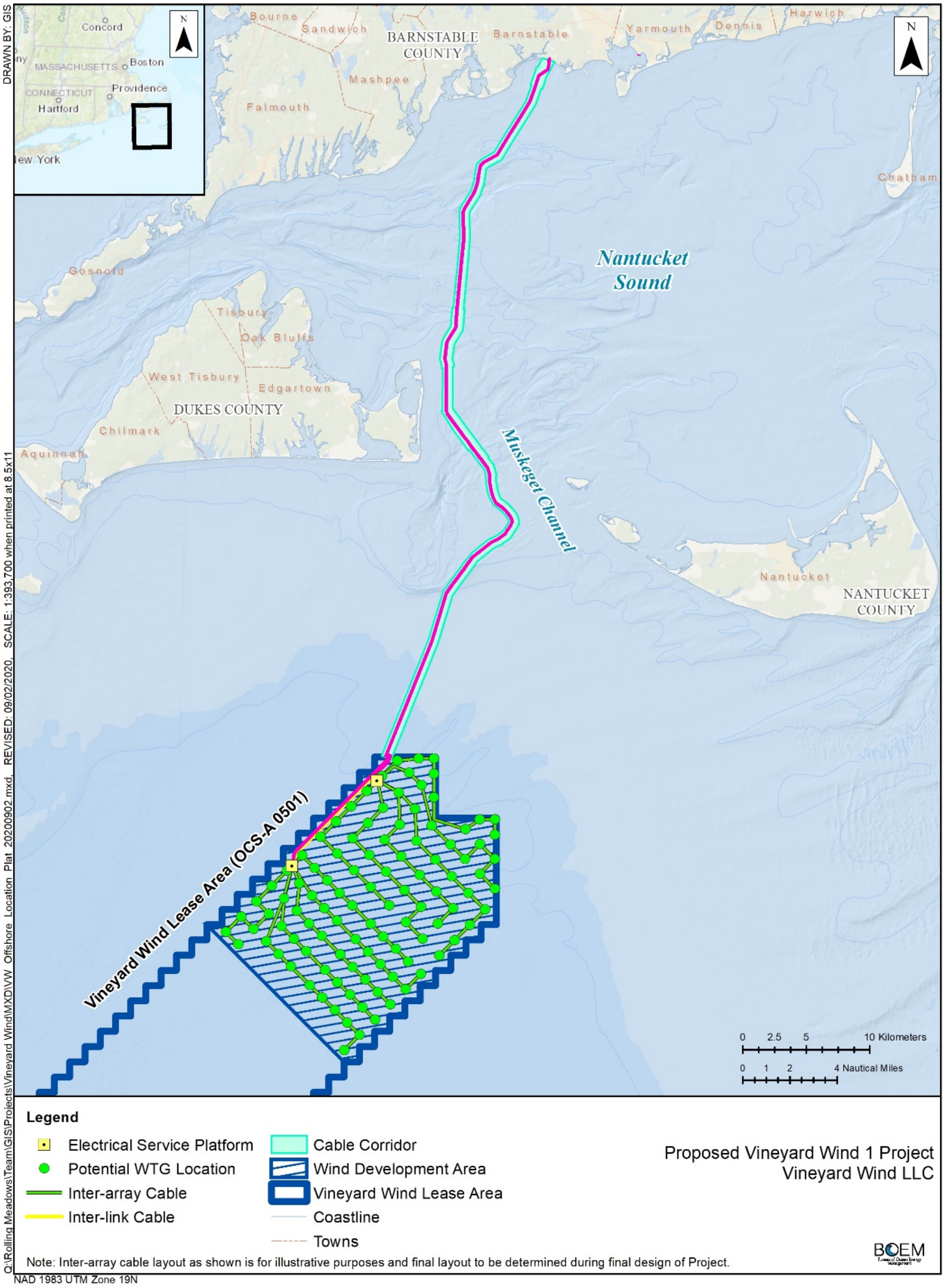


Figure 2: Proposed Offshore Project Elements

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 then 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 in the OCS offshore Massachusetts:

- In December 2010, BOEM published a Request for Interest (RFI) in the Federal Register to determine commercial interest in wind energy development offshore Massachusetts (Commercial Leasing for Wind Power on the Outer Continental Shelf [OCS] Offshore Massachusetts – Request for Interest [RFI], 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 RFI area, and to 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 ten companies interested in obtaining a commercial lease. BOEM also received 260 public comments, and in response to those comments and after taking into consideration navigation and commercial fisheries concerns, 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 Federal Register to identify lease block locations in which there was industry interest to seek commercial leases for developing wind energy projects (Commercial Leasing for Wind Power on the Outer Continental Shelf Offshore Massachusetts – Call for Information and Nominations, 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 effects associated with the commercial wind lease issuance and related activities would not significantly impact 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 (3,002 square kilometers [km^2]) 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). This lease area is 166,886 acres (675 km^2).
- On May 10, 2018, BOEM approved the Site Assessment Plan (SAP) for Lease OCS-A 0501 (Vineyard Wind). The SAP approval allows for the installation of up to two Fugro SEAWATCH

Wind LiDAR metocean buoys and includes annual reporting requirement of reporting any dead or injured avian and bat species (https://www.boem.gov/Vineyard-Wind-SAP-Approval-OCS-A-0501/)

Vineyard Wind submitted their initial Draft COP for the proposed Project for BOEM review in December 2017. BOEM provided comments on the initial draft, and Vineyard Wind revised the Draft COP and resubmitted it on March 15, 2018. After addressing additional comments from BOEM, Vineyard Wind resubmitted a revised draft COP on June 8, 2018 and October 22, 2018. The Draft COP and the COP addendum is available for viewing at BOEM's project-specific website.[1] In summary, Vineyard Wind is proposing to develop up to 800 MW of wind energy capacity in the northern portion of their lease area (see Figure 1). This northern portion of the lease area, called the WDA, is 75,614 acres (306 km^2). Additional details regarding the proposed Project are included in Chapter 2, Proposed Action and Alternatives.

1.2. CONSULTATION HISTORY

This informal consultation for Vineyard Wind builds upon BOEM's experience with similar but larger-scale offshore wind development projects on the Atlantic.

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 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, maintenance, 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 USFWS for lease issuance and site assessment activities off Rhode Island and Massachusetts. On November 1, 2012, 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 USFWS for lease issuance and site assessment activities offshore North Carolina, South Carolina, and Georgia. On March 17, 2014, 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 USFWS regarding the construction, operations, maintenance, and decommissioning of offshore wind turbines for the Cape Wind Energy Project in federal waters of Nantucket Sound, Massachusetts. The USFWS biological opinion (dated November 21, 2008, concluded that the proposed Cape Wind Energy Project was not likely to jeopardize the continued

---

[1] The Draft COP can be reviewed at https://www.boem.gov/Vineyard-Wind/.

existence of the piping plover and roseate tern and that, in all cases except collisions, the effects 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 United States Army Corps of Engineers, which informally consulted with 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 (4.8 kilometers) of Block Island, Rhode Island. On July, 31 2013, 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."

For the Virginia Offshore Wind Technology Advancement Project, BOEM was the lead agency and informally consulted with USFWS. The project is comprised of two 6 MW wind turbines 24 nautical miles offshore with a subsea export cable making landfall on Camp Pendleton Beach. On January 29, 2015, USFWS concurred with the determinations of "no effect" on hawksbill and leatherback sea turtles and "not likely to adversely affect" the green sea turtle, Kemp's Ridley sea turtle, loggerhead sea turtle, piping plover, Red knot, roseate tern, Bermuda Petrel, and Black-capped Petrel. On March 27, 2019, USFWS completed its review of the revised plan and found that no impacts to federally listed species or designated critical habitat will occur.

On July 13, 2018 and September 6, 2018, in preparation for the Draft Environmental Impact Statement (Draft EIS) 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 Project area. While the report states "there are no endangered species in this location…[and] there are no critical habitats in this location" for the proposed Project area associated with the WDA, the Draft EIS considered the possibility that ESA species may pass over the WDA during migration. The IPaC reports identify five ESA-listed species with potential to occur in the proposed Project area: northern long-eared bat (*Myotis septentrionalis*), piping plover, *Rufa* red knot, roseate tern, and American chaffseed (*Schwalbea americana*) (Appendix A). Due to the recent proposal to list the Black-capped Petrel (*Pterodroma hasitata*) as threatened, the species is included in the following analysis.

This BA assesses all aspects of the proposed Project, including construction, operations, maintenance, and decommissioning on USFWS listed species. On December 7, 2018, BOEM requested 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** ESA-listed bird species, the determination of **no effect** to ESA-listed bats, and that no critical habitat designated for listed bird species would be adversely affected by the proposed activities. Further, the proposed activities are expected to be discountable and insignificant, and thus, **not likely to adversely affect** the American chaffseed and no critical habitat has been designated for this species.

To address USFWS comments, BOEM submitted updated BAs on March 1 and April 3, 2019. On May 24, 2019, 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 on Final 4(d) Rule for the Northern Long-Eared Bat Excepted from Take Provisions (See Appendix B for a copy of the verification letter; Consultation Code: 05E1NE00-2019-E-04412).

In the summer of 2020, BOEM informed USFWS that it was updating the BA to capture changes in the project design the draft supplemental environmental impact statement for the Vineyard Wind Product (BOEM 2020), communications with Vineyard Wind, and new information. 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 (See Appendix B for a copy of the verification letter; Consultation Code: 05E1NE00-2019-TA-1790)

2. DESCRIPTION OF THE PROPOSED ACTION

The Proposed Action would include the construction, operations, maintenance, and eventual decommissioning of an up to 800 MW wind energy facility and associated export cables on the OCS offshore from Massachusetts within the Vineyard WDA (Figure 1). The Proposed Action would include the construction and installation of both offshore and onshore facilities. The proposed Project is being developed and permitted using the Project Design Envelope (PDE) concept, allowing flexibility in project elements while ensuring a timely and thorough environmental review. COP Volume I, Section 3.0 (Epsilon 2020) provides further discussion of construction methods and schedule, which this document summarizes below.

2.1. OFFSHORE FACILITIES

Proposed offshore Project elements include wind turbine generators (WTGs) and their foundations, electrical service platforms (ESPs) 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 (see Figure 1). The proposed offshore Project elements are located within federal waters with the exception of a portion of the export cable located within state waters. COP Volume I (Epsilon 2020) describes construction and installation methods in detail.

2.1.1. Wind Turbine Generators

As part of the PDE, Vineyard Wind would erect up to 100 WTGs within the WDA (Figure 2) using WTGs that can range between 8 MW and 14 MW for an 800 MW project. Based on the PDE, Vineyard Wind would mount the majority of WTGs upon monopile foundations, and up to ten WTGs on jacket foundations. A monopile is a long steel tube driven 66 to 148 feet (20 to 45 meters) into the seabed. A jacket foundation is a latticed steel frame with three or four supporting piles driven 98 to 197 feet (30 to 60 meters) into the seabed. Vineyard Wind would likely install jacket foundations in deeper WTG locations. Table 1 summarizes the range of pertinent WTG characteristics provided in the Project Envelope. See COP Volume 1, Section 3.1.1 (Epsilon 2018) for detailed WTG descriptions. The COP Volume I, Section 4.2.3.4 and 4.2.3.7 (Epsilon 2018) provides a complete discussion of the proposed WTG construction approach for foundations and WTGs, respectively.

Using 8 or 14 MW WTGs will substantially reduce collision risk of birds compared to using more and smaller turbines for an 800 MW project. This was demonstrated in a modeling study by Johnson et al. (2014) where the collision risk of 25 marine species (including three tern species) was explored for a series of 30-MW wind facilities with different sized and number of turbines. When turbines increased in size from 2 MW to 3 MW (from 15 turbines to 10 turbines), the proportion of the population at risk of collision declined by 29 percent; likewise, when turbine size increased from 3 MW to 5 MW (from 10 turbines to 6 turbines), the risk dropped another 29 percent (Johnston et al. 2014).

Table 1: Vineyard Wind Project WTG Specifications with Maximum-Case Scenario

Wind Turbine Generators	**Minimum Turbine Size**	**Maximum Turbine Size**
Turbine Size	8 MW	14 MW
Number of Turbine Positions [a]	106	106
Number of Turbines Installed	100	57
Total Height [b]	627 feet (191 meters)	837 feet (255 meters)
Hub Height	358 feet (109 meters)	473 feet (144 meters)
Rotor Diameter	538 feet (164 meters)	729 feet (222 meters)
Tip Clearance [b]	89 feet (27 meters)	105 feet (32 meters)
Foundations		
Foundation Type	Jacket (Pin Piles)	Monopole
Number of Piles/Foundation	3-4	1
Maximum area of scour protection at each foundation	19,375 square feet (1,800 square meters	22,600 square feet (2,100 square meters)

Source: COP Volume I (Epsilon 2018)

[a] Additional WTG positions allow for spare turbine locations or additional capacity to account for environmental or engineering challenges.

[b] Elevations provided are relative to Mean Lower Low Water—average of all the lower low water heights of each tidal day observed over the National Tidal Datum Epoch.

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 WTGs' total tip height is 699 ft or higher, there will be at least three additional low intensity L-810 flashing red lights at a point approximately midway between the top of the nacelle and sea level. Vineyard Wind is proposing 30 flashes per minute for air navigation lighting. Furthermore, Vineyard Wind may use either an Aircraft Detection Lighting System (ADLS) that would automatically activate aviation obstruction lights (both on the nacelle and tower, if applicable) when aircraft approach, or a system that automatically adjusts lighting intensity taking into consideration visibility conditions, both of which would require FAA and/or BOEM approval. This would dramatically reduce the amount of time the obstruction lights are on. In fact, an analysis of nighttime flight activity in the WDA found using ADLS will reduce obstruction lights to 0.1% of the time compared to traditional lighting (See COP Volume III Appendix N; Epsilon 2018).

2.1.2. Electrical Service Platforms

As part of the PDE, Vineyard Wind would construct one to two ESPs in the WDA, 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 be located along the northwest edge of the WDA and would include step-up transformers and other electrical equipment needed to connect the 66-kilovolt (kV) inter-array cables to the 220-kV export cable to the landfall location. An inter-array cable that would be buried below the seabed and then connected to the ESPs would connect between 6 and 10 WTGs. Table 2 summarizes the range of pertinent ESP characteristics provided in the Project Envelope.

If the proposed Project uses more than one ESP, a 200-kV inter-link cable would be required to connect the EPSs together. Each ESP would contain up to 123,209.85 gallons (466,400 liters) of transformer oil and 348.71 gallons (1,320 liters) of general oil. COP Section 4.2 provides additional details related to chemicals and their anticipated volumes (Volume I; Epsilon 2018). Detailed specifications of the ESPs are provide in the COP Volume 1, Section 3.1.4 (Epsilon 2018). The COP Volume I, Section 4.2.3.4 and 4.2.3.5 (Epsilon 2018) provides a complete discussion of the proposed ESP construction approach for foundations and ESPs, respectively.

Table 2: Vineyard Wind Project ESP Specifications with Maximum-Case Scenario

Electrical Service Platforms		
ESP Type	400 MW Conventional ESP	800 MW Conventional ESP
Number of ESPs	2	1
Foundations		
Foundation Type	Monopiles	Jackets
Number of Piles/Foundation	1	3-4
Maximum area of sour protection at each foundation	22,600 square feet (2,100 square meters)	26,900 square feet (2,500 square meters)
Max height [a]	215 feet (65.5 meters)	218 feet (66.5 meters)

Source: COP Volume I, Table 3.1-1 (Epsilon 2020)

[a] Elevations provided are relative to Mean Lower Low Water—average of all the lower low water heights of each tidal day observed over the National Tidal Datum Epoch.

2.1.3. Scour Protection

Vineyard Wind would place scour protection around all foundations, which would consist of rock and stone ranging from 4 to 12 inches (10 to 30 centimeters). The scour protection would be approximately 3 to 6 feet (1 to 2 meters) in height and would serve to stabilize the seabed near the foundations as well as the foundations themselves. See COP Volume I, Section 3.1.3 for detailed specifications of proposed scour protection. COP Volume I, Section 4.2.3.2 (Epsilon 2018) provides a complete discussion of the proposed scour protection construction approach.

2.1.4. Offshore Cables

Two offshore export cables in one cable corridor would connect the proposed wind facility to the onshore electrical grid via (see Figure 2). Each offshore export cable would consist of three-core 220-kV alternating current (AC) cables that would deliver power from the ESPs to the onshore facilities. As part of the PDE, Vineyard Wind has proposed several installation methods for the inter-array cable, inter-link cable, and offshore export cable. Vineyard Wind 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. Vineyard Wind may remove the upper layers of sand waves via mechanical or hydraulic means in order to achieve the proper burial depth below the stable sea bottom. Following the pre-grapnel run and any required dredging, Vineyard Wind would accomplish offshore cable laying primarily via simultaneous lay and burial using jet plowing. Vineyard Wind would install the inter-array cables using a pre-lay and jet plow embedment approach. Vineyard Wind 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 feet (1 meter) wide cable installation trench and up to a 3.3 to 6.6 feet (1 to 2 meters) 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 expect to dig into the seabed. COP Volume I (Epsilon 2018) 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.

Vineyard Wind would protect all offshore export cables and inter-array cables by the use of protection conduits that they would install 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, or half-shell pipes or similar product made from composite materials or cast iron with corrosion protection[2] (up to 10 percent of the total length of the offshore export cable system)[3].

Utilizing the Envelope Concept for this part of the Project, this BA analyzes a single primary offshore export cable corridor with two potential routes through Muskeget Channel. This BA also considers two potential landfall sites, Covell’s Beach in Barnstable, Massachusetts, and New Hampshire Avenue in Yarmouth, Massachusetts (see Figure 3). The COP Volume I, Sections 3.1.5 and 3.1.6 (Epsilon 2018), provides detailed specifications of offshore export cables and inter-array cables respectively.

2.2. ONSHORE FACILITIES

2.2.1. Landfall Site

As part of the original PDE, there were two proposed landfall locations, Covell’s Beach in Barnstable and New Hampshire Avenue in Yarmouth (Figure 3). The Covell’s Beach landfall site is located on Craigville Beach Road, near a paved parking lot entrance to a public beach owned and managed by the Town of Barnstable. The New Hampshire Avenue landfall site is located inside of Lewis Bay at a dead-end road just west of Englewood Beach at a low concrete bulkhead. The transition of the export cable from offshore to onshore would be accomplished by horizontal directional drilling (HDD), which would bring the proposed cables beneath the nearshore, tidal zone, beach, and adjoining coastal areas to one of the two proposed landfall sites. Vineyard Wind 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 vault(s), the 220-kV AC offshore export cables would be spliced to the 220-kV onshore export cables. As of 6/26/2020, Vineyard Wind has obtained all of the required state and local permits necessary to bring the offshore export cable onshore at the Covell’s Beach landing site in Barnstable. As such, no further discussion of the potential New Hampshire Avenue landfall site is provided in this document.

---

[2] A protective shell that fits around the cable

[3] Vineyard Wind intends to avoid or minimize the need for cable protection to the greatest extent feasible through careful site assessment and thoughtful selection of the most appropriate cable installation tool to achieve sufficient burial; therefore, Vineyard Wind has indicated that they expect the 10 percent value to be a conservative estimate.

The COP Volume I, Section 3.2.1 (Epsilon 2020) provides a detailed description of the proposed landfall site. The COP Volume I, Section 4.2.3.8 (Epsilon 2020) provide further discussion of the proposed construction approach at the landfall site.

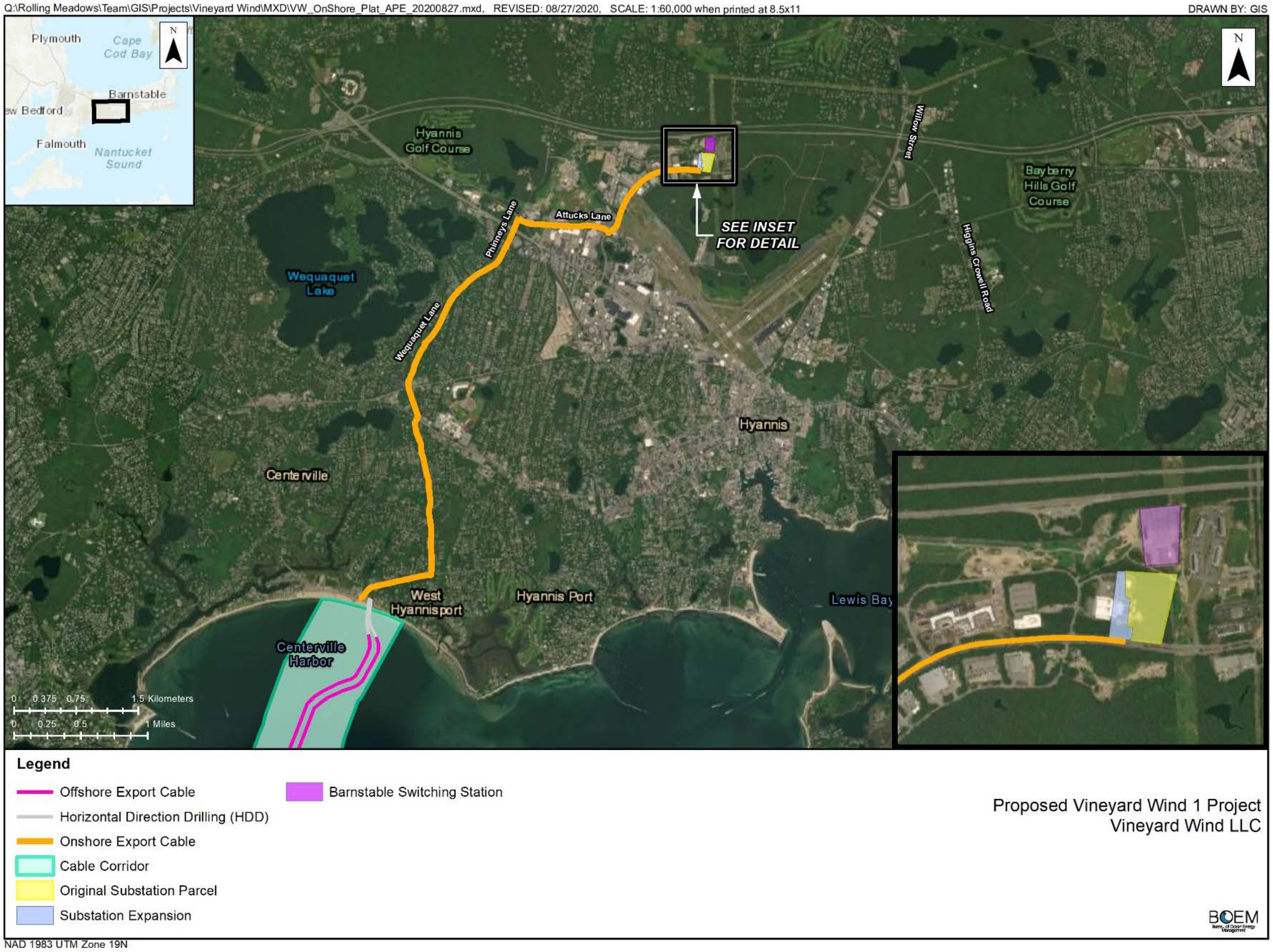


Figure 3: Proposed Landfall Site

2.2.2. Onshore Export Cable and Substation Site

The proposed Project contemplates two onshore export cable routes, with minor alternative options within each route. The majority of the two proposed onshore export cable routes would pass through already developed areas, primarily paved roads and existing utility rights of way (ROWs) and would be underground.

Vineyard Wind would run the onshore export cables through a single concrete duct bank that they would bury along the entire onshore cable route. The duct bank may vary in size along its length, utilizing an array with four conduits wide by two conduits deep or two conduits wide by four conduits deep, with a total duct bank measuring approximately 5 feet (1.5 meters) wide by 2.5 feet (0.8 meter) deep or vice versa. Vineyard Wind would typically bury the top of the duct bank to a minimum depth of at least 3 feet (0.9 meter).

The proposed onshore export cables would terminate at the proposed substation site within the Independence Park, a commercial/industrial area in Barnstable. The new onshore substation site would occupy 8.6 acres (3.5 ha). The buried duct bank would enter the proposed onshore substation site via an access road that provides access to the transmission corridor from Mary Dunn Road. The onshore substation site would connect the proposed Project to the existing bulk power grid via step-down transformers. Vineyard Wind plans to connect the proposed Project via available positions at the Eversource Barnstable Switching Station, just north of the proposed onshore substation site; however, Vineyard Wind’s COP also includes an option to connect at the West Barnstable Switching Station (see Figure 3).

The COP Volume I, Section 3.2.3 provides detailed specifications of the onshore export cable. The COP Volume 1, Section 4.2.3.9 (Epsilon 2018) provides further discussion of the proposed onshore export cable construction approach.

3. COVERED SPECIES

Three federally listed birds have the potential to occur within the MA WEA: roseate tern, piping plover, and *Rufa* red knot (*Calidris canutus rufa)*. The USFWS recently proposed to list the Black-capped Petrel as threatened (Threatened species status for Black-Capped Petrel with a Section 4(d) rule, 83 Fed. Reg. 195 [October 9, 2018]). 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. American chaffseed was recently found growing on a small patch of land in Barnstable County on Cape Cod (MDFW 2020).. No appropriate habitat for this species, which is described as, “fire-maintained…savannas and pinelands through the coastal plain” (USFWS 2018a), occurs in any part of the Action Area. As such, American chaffseed is presumed to be absent from the Action Area, and the species is 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 FR 42064). The USFWS has recently initiated a 5-year review for this species (83 FR 39113 39115). 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 rerns (*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 Massachusetts and New York (BOEM 2012; USFWS 2010). Since 2010, the number of breeding pairs of roseate terns in the US and Canada has increased 45% from 3,013 to 4,374 in 2019 (USFWS, 2020). 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 effects on roseate tern populations (USFWS 2008). Muskeget Island is in area frequented by foraging and staging roseate terns (see Figures 6 & 10), and for the first time in many decades, 40-50 pairs of roseate terns nested on Muskeget Island. However, those nests failed to produce chicks due to egg predation (S. von Oettingen, pers comm.). Although roseate terns may attempt to nest on the island in the coming years, “the duration of occupation for ‘small’ and ‘medium’ size colonies is short in the majority of cases (the median and mode are 10 and 4 years respectively)” (García-Quismondo et al., 2018).

Roseate tern foraging behavior and ecology in the region is well described. Roseate terns dive <0.5 m into the water to forage primarily on the inshore 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 3 to 12 meters 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 do travel along the coast to other nearshore foraging sites (Loring 2016, Loring et al. 2019; Figure 4). 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). In other words, roseate terns are picky feeders and do not meander around searching for food and do not follow or rely on common terns to find food.

The inshore sand lance is the primary forage fish for roseate terns and is a small to medium size (49 – 168 mm) and are chiefly found in waters shallow (<2 m) coastal waters and estuaries and not found offshore (Collette and Klein-MacPhee 2002). The average size of inshore sand lance delivered by roseate terns to chicks is 59 mm (Safina et al. 1990). This is in contrast to the offshore sand lance (*A. dubius*) which is larger (77-253 mm) 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 do consume offshore sand lance and will flush the offshore sand lance from the bottom (Hein et al. 1995). However, humpback whales are relatively rare in Action Area in spring, summer, and fall (see Fig. 30 in Kraus et al. 2016), and there was only single sighting (Appendix B, Kraus et al. 2016). Although the offshore sand lance may be in the offshore portion of the action area, the offshore portion of the action area is does not provide foraging habitat for roseate terns because the offshore sand lance is simply not available for roseate terns to forage on. Based on this information and the behavioral and foraging ecology of the roseate tern, the relatively deep and open ocean of the lease area is simply not suitable foraging habitat for roseate terns.

The region including the lease area has been intensively surveyed over the years and across seasons for marine birds (Figure 5); no roseate terns were detected during these surveys in the lease area or in the proposed offshore Action Area (USFWS 2018d and is illustrated in Figure 6). Modeling efforts based on those survey data predict that roseate terns are virtually absent from the offshore action area (Figure 7). 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 terns that were identified as roseate terns (terns that were not be identified as roseates 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 (see Winship et al. 2018). Goyert and others (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 and others (2018) to the amount of forage fish in spring. Therefore, it is not surprising that the predicted distribution of roseate terns (Figure 7) almost mirrors the estimated spring and fall distribution of sand lance around Nantucket Sound (Figure 8).

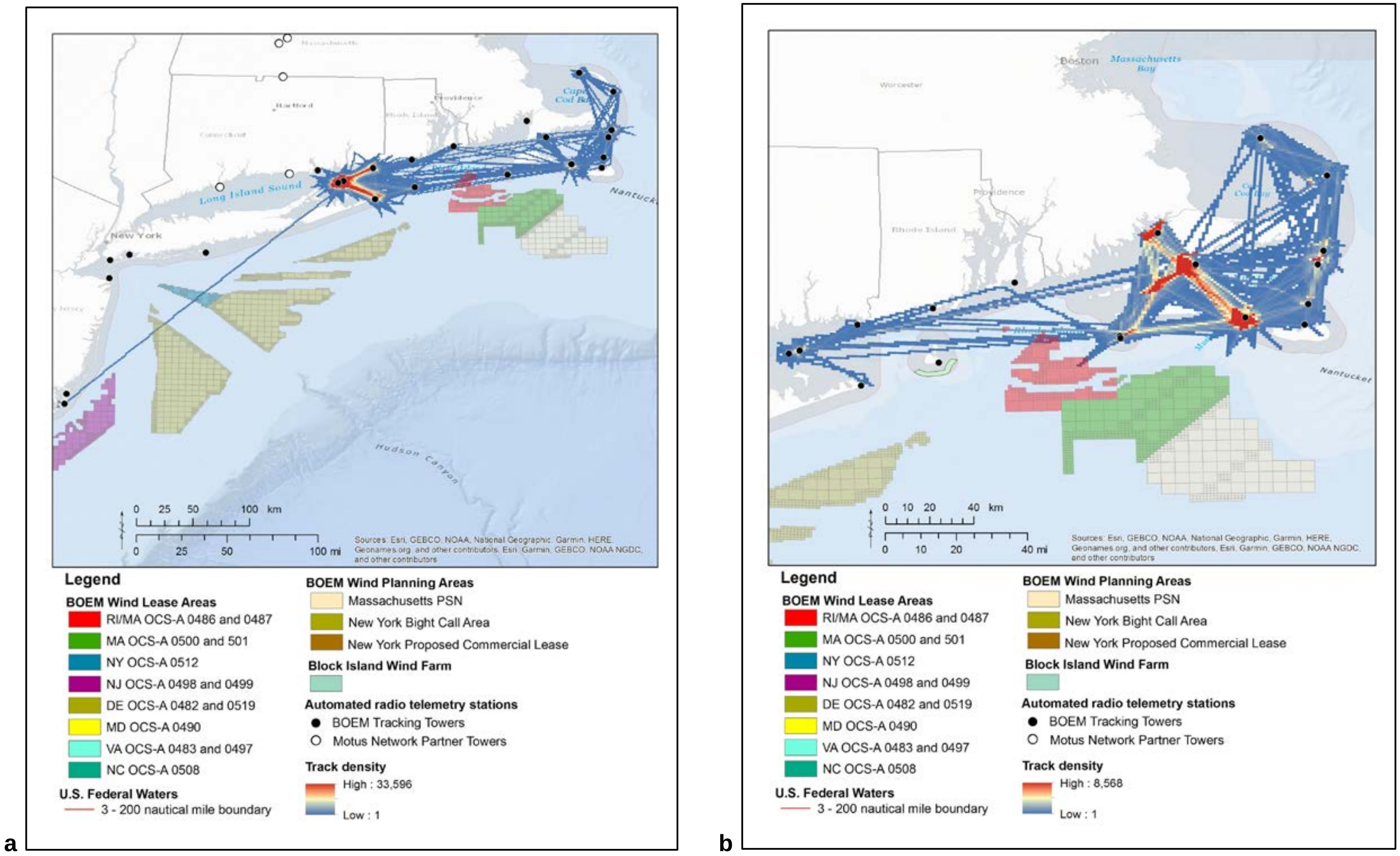
Great care is needed in making conclusions from analyses based on data that is pooled across species. Speculation that roseate terns occur and forage further offshore appears to be rooted in a series of misinterpretations of analyses that pooled data across species. For example, pooling spatial count data of common, roseate, and unidentified terns into a single group could lead one to conclude incorrectly that the distribution of roseate terns is the same as common terns. Such a conclusion is false, because the inference is restricted to the group of species as a whole. Similarly, pooling inshore and offshore sand lance data could lead to one to falsely hypothesize that roseate terns forage further offshore than they do. Not only is the reasoning behind these speculations faulty, these speculations do not represent the best available scientific information on this species.

There has also been some speculation that roseate terns may be in the WDA early spring (April and May) or during post-breeding period (August – 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 (see Figure 5) or during four weekly surveys by boat conducted in April-May 2018 (Figure 9; COP Appendix III-O Vineyard Wind Spring Tern Survey [Epsilon 2018]). Although two roseate terns were detected in May within the 501 lease but outside the WDA (Vineyard Wind 2019) and three roseate terns were detected in the nearby 521 lease in May (Mayflower 2020), the vast majority of roseate terns were observed nearshore outside of the lease area in the same areas predicted by the spring relative distribution and density model (Figure 7a). Likewise, some thought roseate terns during the post-breeding period would go further offshore perhaps to forage near the offshore portion of the 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 10) and in the same areas predicted by the summer relative distribution and density models (Figure 7b). The survey results from both efforts validate the predicted distribution and density modeling results, because neither dataset was used (see Winship et al. 2018).

A recent telemetry study found that roseate terns flew offshore when visibility was greater than 5 km and departed the study area at low altitudes (Loring et al. 2019). In addition, 37.5% flew at wind speeds <=4 m/sec (Loring et al. 2019) - below the cut in speed for an offshore wind turbine. Roseate terns typically flew 11-20 meters above the water in the WEAs and flew below the rotor swept zone 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 WDA during migration. However, none of the 145 modeled roseate tern flight paths crossed the Vineyard Wind lease area during breeding and non-breeding dispersal periods by the network of tracking stations (Loring et al. 2019; Figure 4). It is possible that the roseate terns did not pass through the lease area as they headed south (similar to common terns [see Figure J-5 in Appendix J, Loring et al 2019]). It is also possible that the terns were flying so low that they evaded detection. If the terns decided to fly higher, the stations would be able to detect them, because the same stations were also detecting the relatively high-flying red knots and piping plovers (Loring et al. 2018, Loring et al. 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 45 km 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 it out by floating on the water until conditions improved.

In conclusion, based on the behavioral and foraging ecology, the telemetry data, the survey data, very little, if any, roseate tern activity is expected within marine waters in and around the WDA and should birds pass through the area they will be flying relatively close to the ocean surface during good weather conditions.



Source: Loring et al. 2019, Figures 14 & 15.

Figure 4. a) Density of modeled flight paths (10-min tracks/1 km^2) of roseate terns (n=90) from the colony on Great Gull Island during the breeding and post-breeding periods in 2015 to 2017 (pooled); b) roseate terns (n=60) from colonies in Buzzards Bay during the breeding and post-breeding periods in 2016 and 2017 (pooled).

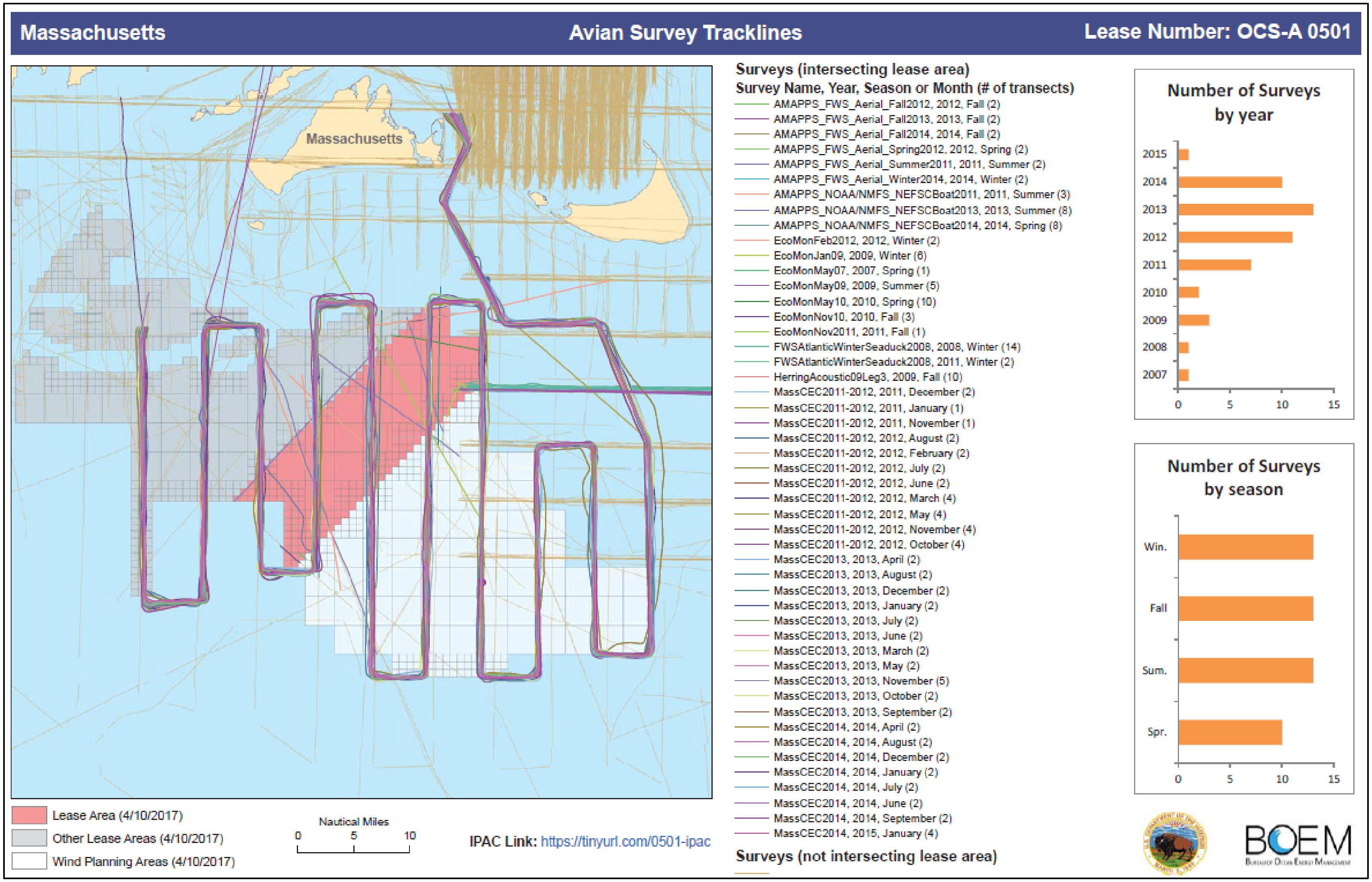
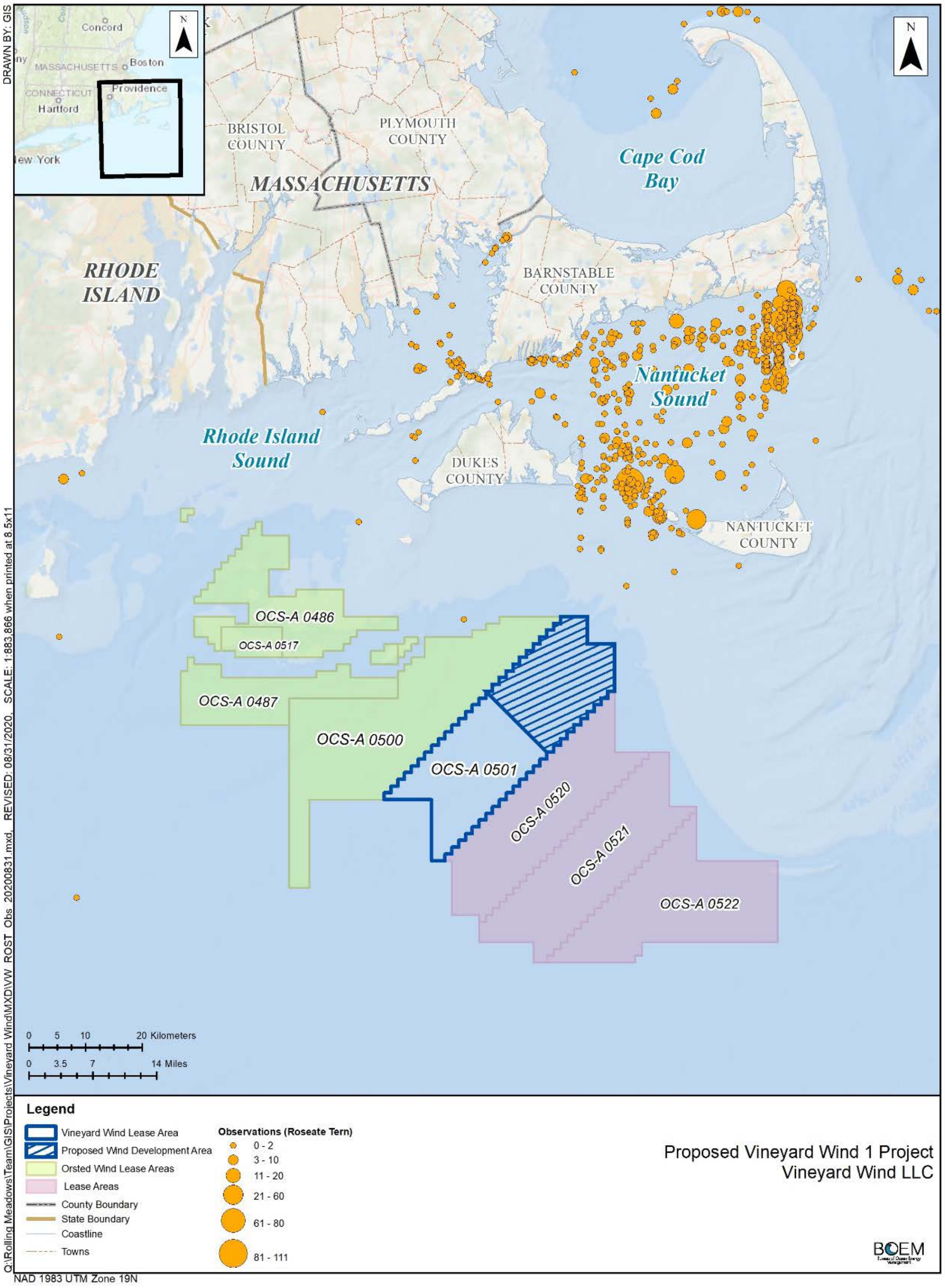
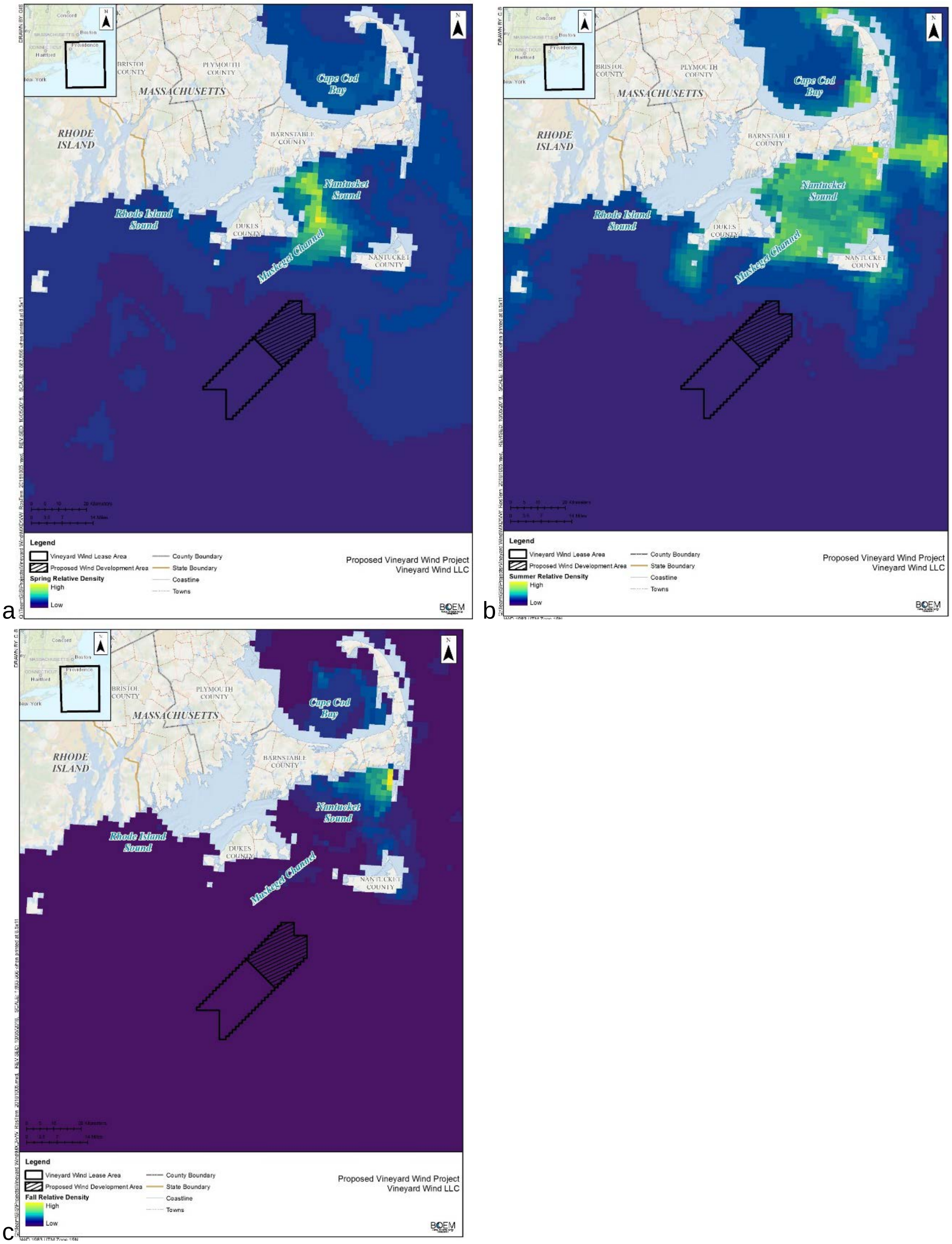


Figure 5: Avian surveys intersecting Vineyard Wind lease from 2007 to 2015.



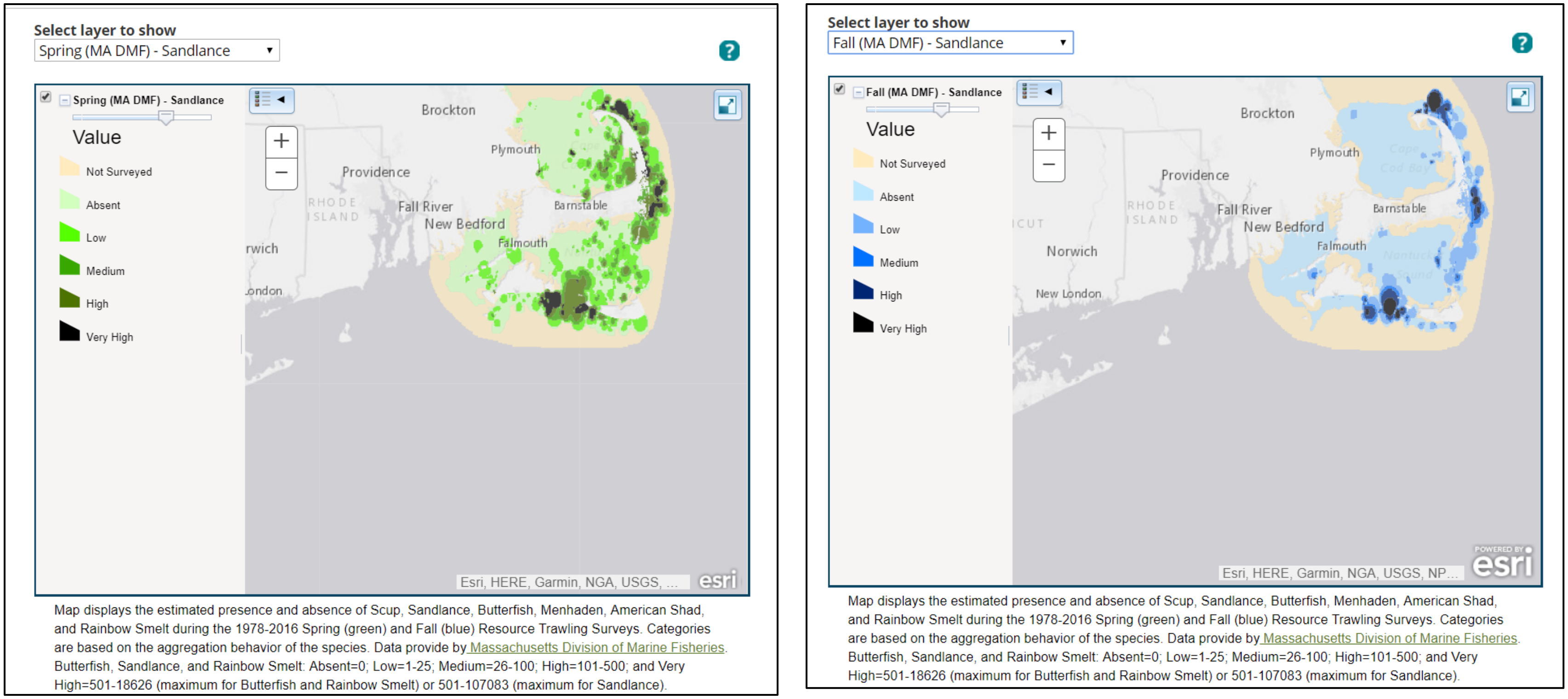
Source: USFWS. 2018. Accessed through US Department of Interior, Northwest Atlantic Seabird Catalog, Version XX. Accessed 5 October 2018.

Figure 6: Roseate Tern Observations near the Proposed Action Area



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

Figure 7: Predicted Relative Density of Roseate Terns during: a) Spring (March – May); b) Summer (June-August); and c) Fall (September – November).

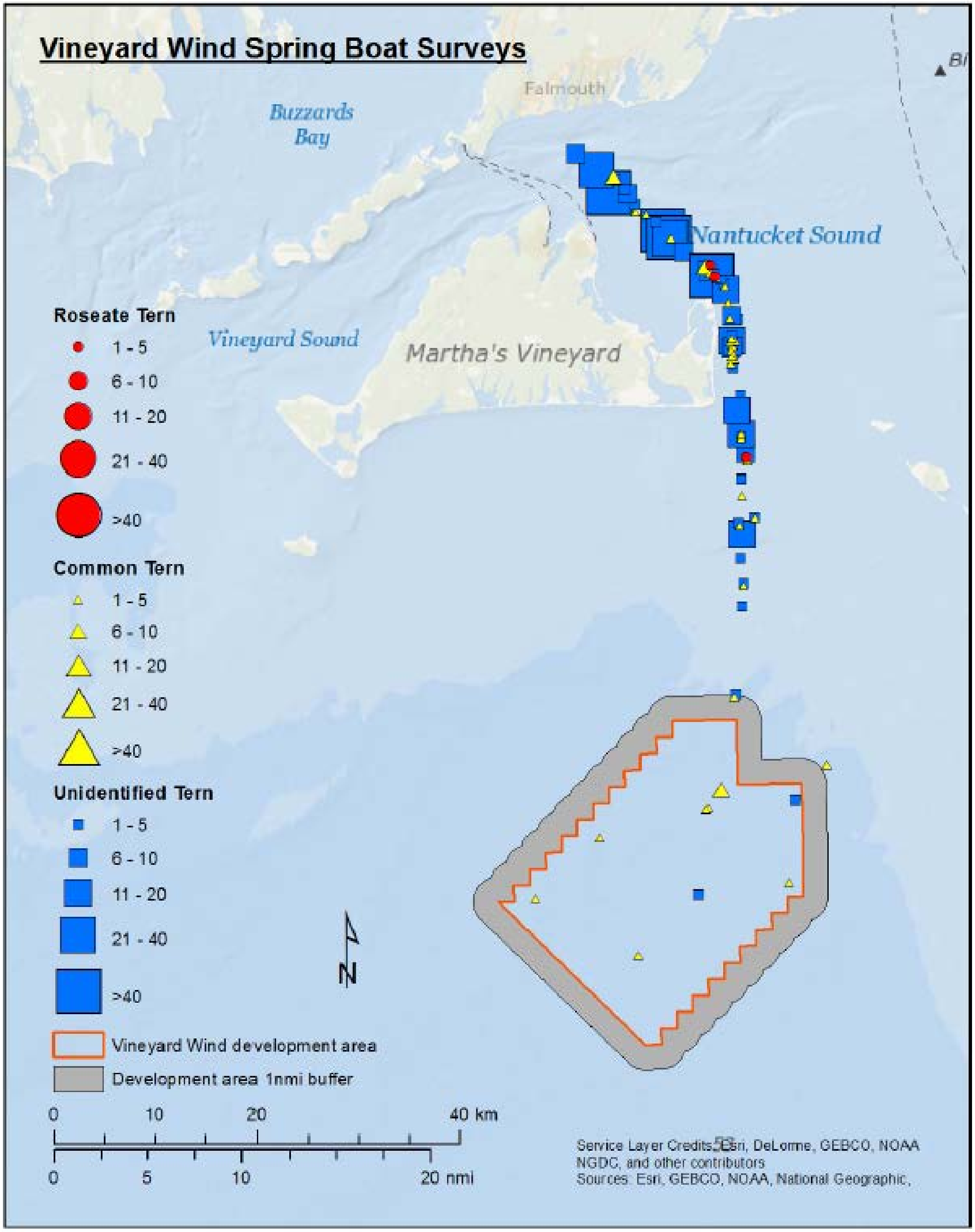


Map displays the estimated presence and absence of Scup, Sandlance, Butterfish, Menhaden, American Shad, and Rainbow Smelt during the 1978-2016 Spring (green) and Fall (blue) Resource Trawling Surveys. Categories are based on the aggregation behavior of the species. Data provide by Massachusetts Division 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).

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).

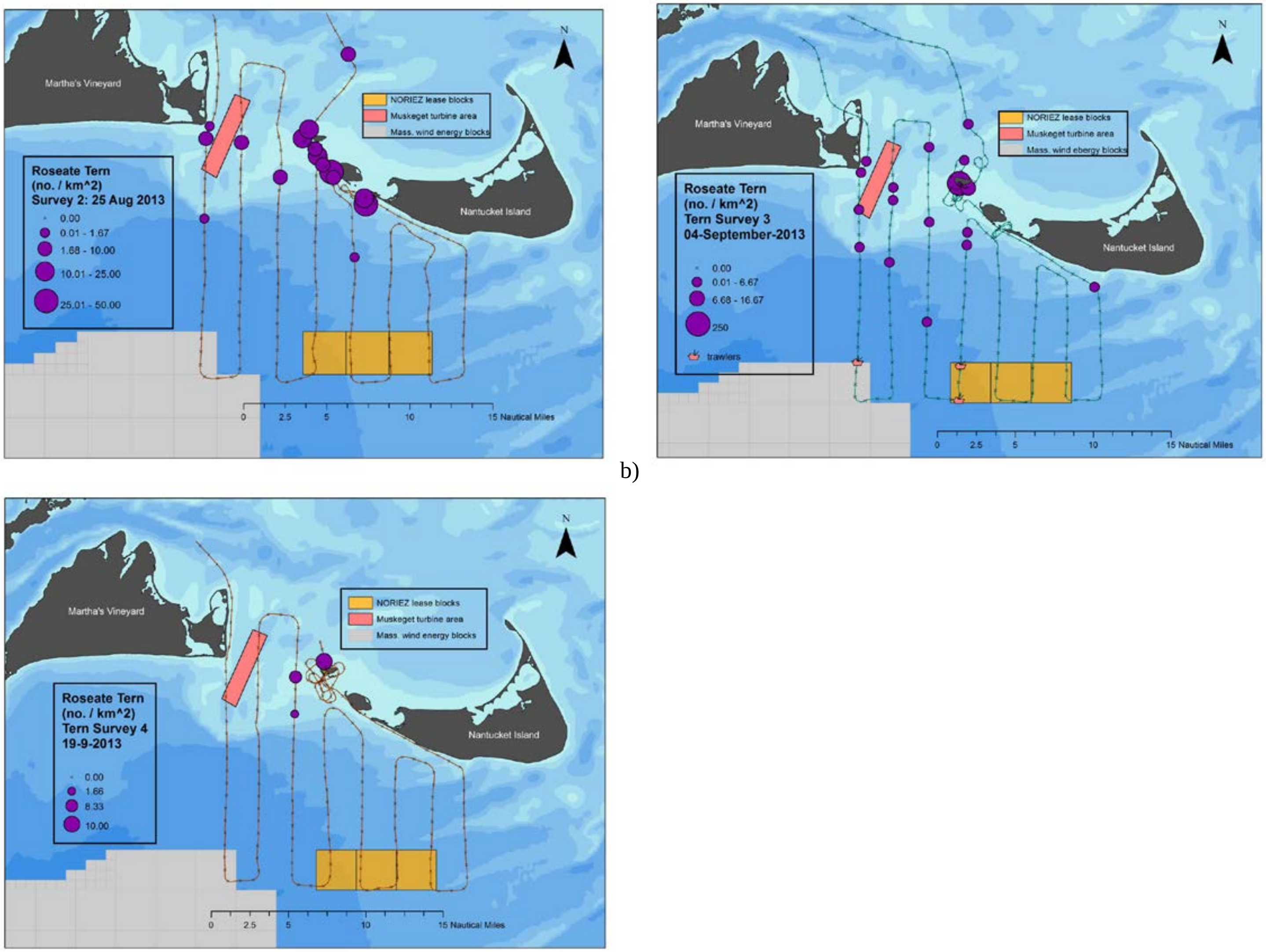
Source: Massachusetts Climate Adaptation Partnership. 2015. Massachusetts Wildlife Climate Action Tool. Accessed on 2/27/19. http://climateactiontool.org/species/forage-fish

Figure 8: Presence of sand lance during Spring and Fall.



Source: COP Appendix III-O Vineyard Wind Spring Tern Survey (Epsilon 2018).

Figure 9. Locations of all terns observed during transit and within offshore Action Area during surveys conducted in April to May 2018.



a)

b)

c)

Source: Veit and Perkins (2014).

Figure 10. Foraging roseate terns observed from aerial surveys during post-breeding period on a) August 25, b) Sept 4, and c) Sept 19.

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; USFWS 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 FR 36038). Only the Atlantic coast population has the potential to occur within the proposed Action Area during the breeding season, as well as spring and fall migration. Coastal development and 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 since that prediction, the Atlantic Coast Population has been steadily growing. In fact, since the time of its listing in 1985, the Atlantic Coast piping plover population has increased 239 percent from a low of 790 breeding pairs to an estimated 1,879 breeding pairs in 2018 (USFWS 2020). 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 piping plovers 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 washover areas to which they are restricted (USFWS 1996; USFWS 2009). Nests sites are shallow, scraped depressions in a variety of substrates situated above the high-tide line (USFWS 1996). Foraging habitat includes intertidal portions of ocean beaches, washover areas, mudflats, 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 et al. 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 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 et al. 2011). There are no records of piping plovers in the offshore Action Area during surveys (USFWS 2018d).

A recent study tracking the movement of piping plovers breeding in RI and MA found that most piping plovers fly close to and parallel to the coast with a favorable tall wind (Loring et al., 2019). In addition, 20% flew at wind speeds <=4 m/sec (Loring et al. 2019) - below the cut in speed for an offshore wind turbine. None of the RI breeding plovers (29) were predicted to fly through the Vineyard Wind lease area during fall migration, and three plovers (7% of 43 from MA) were predicted to fly over the lease area

(Loring et al., 2019). Therefore, some plovers from MA and northward might be exposed to the Vineyard lease area but not birds from RI or further south. Based on counts in 2017, there were 650 breeding pairs recorded in MA, 7 in NH, 64 in ME, and 169 in Canada (USFWS 2018c), a total of 1,780 adult birds. Out of the 1,780 adult piping plovers (=890 pairs x 2 birds per pair, USFWS 2018c) plus 1,973 fledglings (calculated from productivity data from USFWS 2018c), only 7% may fly through the Vineyard lease area in fall. Despite fledglings comprising more than half of the fall migrates, it is worth noting that the likelihood of a fledgling from New England surviving to the next breeding season is quite low, 48%, compared to adults 70-74% (USFWS 2009).

In spring, a pilot study found that plovers fitted with transmitters in the Bahamas traveled north close to shore along the US Atlantic coast, each taking weeks to move northward (Appendix I in Loring et al. 2019). No plovers were detected north of Montauk, NY, and there is no empirical evidence to suggest that plovers fly near or through the lease area in spring (Appendix I in Loring et al. 2019). During migration, most flights were above the turbine height with 15.2% of the piping plover flights within the rotor swept zone (Loring et al., 2019). Therefore, very little, if any, piping plover activity is expected with relatively few (7% out of piping plovers from MA and northward) would be 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 *Rufa* red knot population is the reduced availability of horseshoe crab (*Limulus polyphemus*) eggs in Delaware Bay arising from elevated harvest of adult crabs (Niles et al. 2008). 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. The USFWS has not designated any critical habitat for *Rufa* red knot (Threatened Species Status for the *Rufa* red knot, 79 Fed. Reg. 238 [December 11, 2018]). 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 red knot's overland migration route (Diffendorfer et al., 2017), there are no records of knots colliding with turbines (78 FR 60024).

There are no observation records of *Rufa* red knots within the WDA (USFWS 2018d). 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 and 2012b; Niles et al. 2010; Normandeau 2011). Using geolocators, Burger et al. (2012a and 2012b) and Niles et al. (2012) 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 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, 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, red knots migrated through Federal waters of the Atlantic Outer Continental Shelf during evenings with fair weather and a tailwind blowing in their direction of travel. In addition, 19% flew at wind speeds <=4 m/sec (Loring et al. 2018) - below the cut in speed for an offshore wind turbine.

Only a small portion of *Rufa* red knot population uses the US Atlantic Coast during the southward migration (Loring et al 2018). A recent study that tracked 388 red knots fitted with nanotags found that only two flew over the Vineyard Wind lease area during fall migration in November (see Table 2 in Loring et al, 2018). Most of the 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 red knots tagged while staging in MA before the fall migration, only two knots were predicted to fly over the lease area (Loring et al, 2018). Most red knots departed from MA 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 to the southwest and represent 2% of the fall staging population in MA. Given that up to 1,500 red knots stage in MA during fall (Gordon and Nations 2016), only 2% of those 1,500 staging red knots may pass through the lease area in fall. In spring, the vast majority of red knots fly directly overland from stopover areas in Delaware Bay to breeding areas in Hudson Bay Canada. However, some red knots do travel up the coast in spring as confirmed by a tracking study (see Appendix E in Loring et al. 2018). Ten percent of the fall staging population (150 knots) may pass through the Nantucket area in spring (Gordon and Nations 2016).

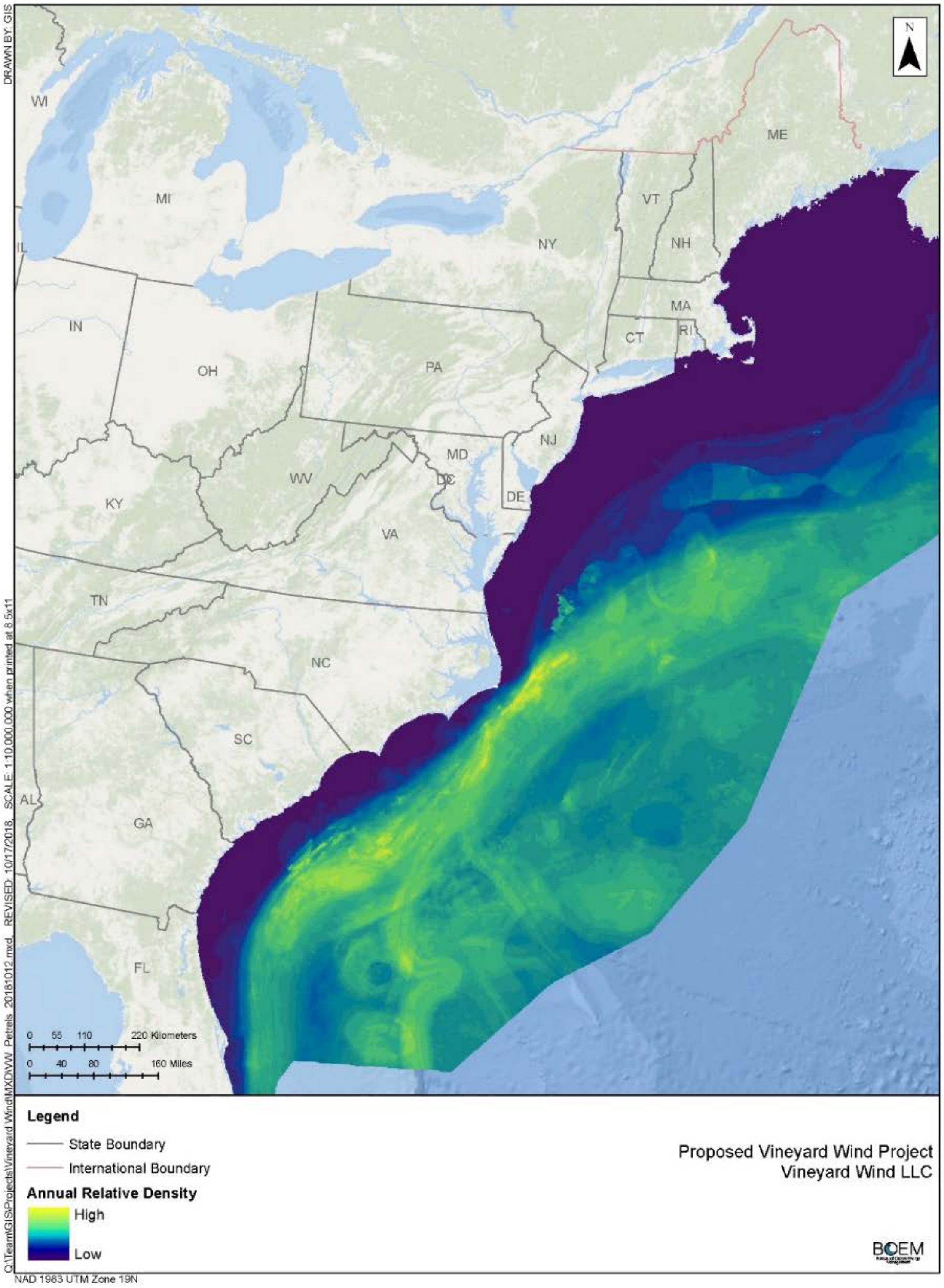
Contrary to previous assumptions (see Gordon and Nations 2016), fall migration flights occurred when visibility was ~20 km with little or no precipitation (Loring et al. 2018). Red knots migrate at high altitudes from 1,640 to 3,281 feet (500 to 1,000 meters) (Alterstam et al. 1990; Gordon and Nations 2016), well above the highest proposed RSA of 837 feet (255 meters) above Mean Lower Low Water (COP Volume I, Epsilon 2018). In contrast to these observations, a study that estimated flights heights from telemetry data found that 83% of the 25 modeled flight paths occurred much lower and within 20-200 meters 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 1,000 meters (see Appendix F, Loring et al. 2018). Nevertheless, very little, if any, Red knot activity is expected over the WDA with relatively few (2% of 1,500 birds) flying through or over the WDA during fall migration.

3.4. BLACK-CAPPED PETREL

The Black-capped Petrel is a medium-sized pelagic seabird that currently breeds at four locations on the island of Hispanola in the Caribbean Sea and spends a portion of the year at sea in the western Atlantic (Goetz et al. 2012; Jodice et al. 2015; Threatened species status for the Black-capped Petrel with a Section 4(d) Rule, 83 Fed. Reg. 195 [9 October 2018]). From January to June, Black-capped Petrel occupy nesting grounds in habitats characterized by steep mountainous terrain with a sparse and open understory, and decaying vegetation or loose soils to facilitate burrow excavation (Simmons et al. 2013; Wingate 1964). The current size of the Black-capped Petrel population is unknown, though Simmons et al. (2013) estimate it at a total of 2,000 to 4,000 birds of which perhaps 500-1000 are breeding pairs (USFWS 2018b).

Waters off the eastern coast of North America from New Jersey south to Florida are included in the pelagic distribution of Black-Capped Petrels (Figure 11). The pelagic distribution generally includes deep waters (e.g. 0.1-1.2-mile [200-2000-meter] depths) where seamounts, submarine ridges, and other landscape features bring prey items to the surface (Hanley 1987; USFWS 2018b). Areas in the deeper offshore zone near South Carolina and northern Georgia as well as the Cape Hatteras, North Carolina area are where the greatest number of Black-Capped Petrels has been found (Jodice et al. 2015; USFWS 2018b). From June through September, Black-Capped Petrels frequent the western edge of the Gulf Stream (Farnsworth 2010).

Given that (1) the Action Area is outside of the known distribution of the Black-Capped Petrel, and (2) no observations of Black-Capped Petrels exist within the Action Area, the Proposed Action would have **no effect** on the Black-Capped Petrel. As such, this document does not further discuss the species.



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

Figure 11: Modeled Predicted Relative Density of Black-Capped Petrels

3.5. 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 (WNS), 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 (4(d) Rule for the Northern Long-Eared Bat, 81 Fed. Reg. 9 [January 14, 2016]). Specifically, incidental take of northern long-eared bat is exempt from prohibition if the following criteria are met:

- No impacts on known occupied hibernation sites;
- No tree removal within 0.25 miles (0.4 kilometers) of a known occupied hibernation site; and
- No tree removal within 150 feet (45.7 meters) of a known occupied maternity roost tree between June 1 and July 31.

The annual lifecycle 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 are roosting 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, 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; Owens 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 two to three days (Carter and Feldhamer 2005; Foster and Kurta 1999; Owen et al. 2002; Timpone et al. 2010). Most foraging occurs up to three meters off the ground and between the understory and forest canopy (Brack and Whitaker 2001). Northern long eared bats forage relatively close (a few kilometers) 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 its distribution 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 habitat indicates that the closest occurrence is approximately 11.5 miles (18.5 kilometers) northwest of the proposed onshore substation site.

There are no records of northern long-eared bats on the OCS (Pelletier et al. 2013; ESS 2014; Peterson and Pelletier 2016, but see South Fork COP https://www.boem.gov/Appendix-Q/). 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). Therefore, given the rarity of the bat in the region, its ecology, and 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 effects 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 not likely to adversely affect—This is the appropriate determination if effects to 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, likely to adversely affect—This is the appropriate determination if any direct or indirect adverse effects to 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: roseate tern, piping plover, *Rufa* red knot, and northern long-eared bat. Previous assessments of Project-related impacts on avian and bat resources resulting from a variety of actions associated with the construction, operations and maintenance, and eventual 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 on federally listed bird and bat species resulting from the above covered actions are expected to be **insignificant and discountable**.

4.1. NORTHERN LONG-EARED BAT

The proposed project will remove a small amount, approximately 6.1 acres (2.5 ha), of marginal forested habitat within the 8.6 acre proposed onshore substation site (Epsilon 2020) in an industrial area. The removal of habitat will occur when bats are not active (after October 31 to March 31). A review of known occupied northern long-eared bat roost trees was conducted near the proposed substation site where forest removal will occur (see Figure 3). No occupied hibernacula were within a 0.25 mile (0.4 kilometer) of the Action Area and the nearest known occupied maternity roost was 11.5 miles (18.5 kilometers) northwest of the proposed substation. On May 24 2019, 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 (See Appendix B for a copy of the verification letter; Consultation Code: 05E1NE00-2019-E-04412).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 (See Appendix B for a copy of the verification letter; Consultation Code: 05E1NE00-2019-TA-1790). No further analysis regarding effects of onshore activities on northern long-eared bats is necessary in this BA.

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.

4.2.1.1. Substation Construction

The proposed Project's substation site is in highly disturbed residential area 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 6.1 acres (2.5 ha) of forested habitat. Neither of the shorebirds (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.

4.2.1.2. Onshore Export Cable Installation

Roseate terns, piping plovers, and *Rufa* red knots do not nest at the proposed Covell's Beach landfall site and onshore export cable installation is unlikely to disturb coastal habitat due to the use of HDD methods to make the offshore to onshore transition (COP Volume III, Section 4.2.3.8; Epsilon 2018). Covell's Beach landfall site is a private beach next to dense residential development. Piping plovers are not known to nest at Covell's Beach, though records of a single pair of piping plovers nesting at the nearby public Craigville Beach exist (e.g., Melvin 2012; MassWildlife 2018)). Nevertheless, Vineyard Wind prepared a Piping Plover Protection Plan for Massachusetts Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program in case HDD activities extend beyond April 1st (see Appendix C). Any disturbances associated with construction will be for a short duration and limited to the daytime hours. Both 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 2018) and do not provide potentially suitable habitat for foraging roseate terns, piping plovers, and *Rufa* red knots. Therefore, direct effects to roseate terns, piping plovers, or *Rufa* red knots, if any, associated with the installation of the onshore export cable would be expected to be **insignificant and discountable**.

4.2.1.3. 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 will not be expected to adversely 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) due to increased sedimentation. However, suspended sediments are expected to return to pre-construction ambient levels within two hours of construction completion (USFWS 2008).

Impacts on benthic habitats and increased turbidity during cable-laying activities have the potential to impact sand lance, an important prey resource for roseate terns (USFWS 2008). Given the nature of the construction techniques (i.e. jet plow), adverse impacts such as increased turbidity will be short-term in duration and localized in nature and will not direct affect terns because the activity is underwater. Water quality effects and disturbance resulting from the installation 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 will return to normal within a few hours of cable installation (USFWS 2008). As such, adverse effects on roseate terns, if any, resulting from installation of the offshore export cables would be **insignificant and discountable** (USFWS 2008) and would have **no effect** on piping plovers and *Rufa* red knots.

4.2.1.4. Construction and Pile Driving

The 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 impact the migratory movements or behaviors of these species through the area. Therefore, pile-driving-related construction noise may affect these bird species, but the effect would be **insignificant and discountable.**

4.2.1.5. 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 (Huppop 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 2018). ADLS may also be installed so that obstruction lights will only be activated when an aircraft are near the turbines. The use of ADLS will dramatically reduce the amount of time the obstruction lights are on. Additionally, BOEM anticipates that any additional work lights on support vessels or Project structures will be hooded downward, directed when possible to reduce illumination of adjacent waters and upward illumination, and will be used only when required to complete a project task (COP Volume I; Epsilon 2018). Therefore, the potential impacts from artificial lighting on structures and vessels during construction, operations and maintenance, and decommissioning of the Proposed Action on federally listed bird species would be expected to be **insignificant and discountable**.

4.2.1.6. Collision Effects

This section discusses the potential for impacts on federally listed species resulting from collisions with WTGs, ESPs, and construction/maintenance 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 will 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 to be **insignificant and discountable**.

Roseate Terns

The distance from shore to the offshore portions and the lack of suitable habitat of the Action Area precludes use by nesting and foraging roseate terns. Despite extensive regional surveys in the region and in the leased 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 multi-year study did not track any migrating roseate terns through the area proposed for offshore wind turbines at or above the rotor swept zone. Collison with WTGs is unlikely because terns are agile fliers and can easily avoid WTGs and fly below the rotor swept zone of offshore turbines in the region; in addition, terns fly on the OCS when visibility was greater than 5 km and at 11-20 meters above the water - below the rotor swept zone.

Although “take” (a fatality due to colliding with a moving turbine blade) is unlikely due to reasons described above, a quantitative analysis was conducted. Typically, quantitative analyses are performed when “take” is expected and there is a need to estimate the amount of “take”. Nevertheless, the quantitative analysis was conducted as an alternative approach to determine if there will be “take”.

For this project, the Band collision risk model (Band 2012) was used to estimate the annual number of roseate tern fatalities. Most of the model inputs (e.g., proportion flying in the rotor swept zone, turbine specifications, and facility dimensions) were obtained or calculated from the DEIS and P. Loring et al. 2019 (see Figure 12a for a snapshot of the model inputs). The proportion of population that flies through the WDA during migration is not currently known; therefore, it was assumed that the birds will spread themselves evenly along a ‘migration front’ spanning 135 km between Block Island and Monomoy; only birds passing through the 22 km wide WDA would be exposed to the wind farm. For spring migration (April & May), the number of passages through the migration front was based on the number of US 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 NY, CT, and MA and survived to 2017. For fall migration, all US and Canadian breeding adults (2017), fledglings (2017), and 2nd year birds (2015 birds that survived to 2017) passed through the front. Even though there is no evidence of roseate terns in the WDA (see above), a separate (‘other use’) analysis was conducted to explore the potential risk to birds that may be in the WDA in early spring (April & May) and early fall

(September). The ‘other use’ analysis used survey data from the MA WEA (Veit et al 2016) where the density “roseates” were calculated by density of unidentified terns (0.0382 = 6 roseate/157 common) times the proportion of roseates times the proportion of all terns in flight (0.9847 = 901 flying /914 total). Turbine avoidance rate of 98% was used for roseate tern (SNH 2018). The WDA had 100 operating 8MW turbines. The monthly proportion of time the turbines were in operation is based the wind speeds when roseate terns are flying (see Fig. 49 in Loring et al. 2019) rather than the proportional of the time the wind was above turbine cut-in and below cut-out speeds. . The average rpm for a turbine operating at the site is not known, so the maximum rpm speed was used which is likely to be greater than the average – an increase in rpm will increase the estimated mortality. The flight height distribution was derived from the midpoints of 1,758 ten-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). The Band model only estimates annual fatalities, so to estimate fatalities over the project’s 30-year operations term, the monthly migration passes multiplied by 30. It is important to note that using the 30-year operations term overestimates exposure, because the term includes the construction (~2 years) and decommissioning phases where the turbines will not be spinning. In addition, this analysis assumes the number of passes remains the same from one year to the next for the next 30 years.

Based on the collision risk model, the estimated annual number of fatalities for migrating roseate terns was **zero** (see Figures 12b & 12c for model outputs). Likewise, the estimated number of fatalities during the 30-year operations term was also **zero**. The results are the same using 57 14 MW turbines. Therefore, based on the above findings, the likelihood of collision fatalities resulting from the Proposed Action would be **insignificant and discountable**.

Piping Plover

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% from Massachusetts and northward) will fly over the operating turbines, and only 15% of the birds could be flying within the rotor swept zone, while the remaining birds are expected to easily avoid turbines that are spaced 0.70 to 1 nautical miles apart.

Although “take” (a fatality due to colliding with a turbine) is unlikely due to reasons described above, a quantitative analysis was conducted. Typically, quantitative analyses are performed when “take” is expected and there is a need to estimate the amount of “take”. Nevertheless, the quantitative analysis was conducted as an alternative approach to determine if there will be “take”.

For this project, the Band collision risk model (Band 2012) was used to estimate the annual number of piping plover fatalities. Most of the model inputs (e.g., migration passage, proportion flying in the rotor swept zone, turbine specifications, and facility dimensions) were obtained or calculated from the DEIS and P. Loring et al. 2019 (see Figure 13a for a snapshot of the model inputs). Despite the empirical data suggesting that 7% of the population fly through the WDA, some thought a higher rate of up to 25% may be appropriate (S. von Oettingen, pers. com.). An estimated total of 200 (= [1,780 adults + 1,082 fledglings] x 7%) migration passages through the action area occurred during August. Although there is no empirical data that plovers fly through the WDA in spring (see above), this analysis assumed 10% of the population or 178 (=1,780 adults * 10%) during their migration northward in May (S. von Oettingen, pers. com.). A range of turbine avoidance rates were used (95% to 99%) for piping plovers obtained from Hatch and Brault (2007) and Stantial (2014). The WDA had 100 operating 8MW turbines. The monthly proportion of time the turbines were in operation is based the wind speeds when piping plovers are flying (see Fig. 69 in Loring et al. 2019) rather than the proportional of the time the wind was above turbine cut-in and below cut-out speeds.. . The average rpm for a turbine operating at the site is not known, so the maximum rpm speed was used which is likely to be greater than the average – an increase in rpm will increase the estimated mortality. The flight height distribution was derived from the midpoints of 2,756 ten-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, 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). The Band model only estimates annual fatalities, so to estimate fatalities over the project's 30-year operations term, the monthly migration passes were multiplied by 30, thus during the 30-year operations term, (3,738 in May and 7,890 in August; S. von Oettingen, pers. com.). It is important to note that using the 30-year operations term overestimates exposure, because the term includes the construction (~2 years) and decommissioning phases where the turbines will not be spinning and that all turbines continue to operate year-after-year. In addition, this analysis assumes the same number of passes from one year to the next.

Based on the collision risk model, the estimated mortality rate for migrating piping plovers was **zero** (see Figure 13b for model outputs). The estimated number of fatalities during the 30-year operations term was **two**; however, given the extremely low number and the uncertainty in estimating out to 30 years, it is unlikely that there will be any mortality. The results are the same using 57 14 MW turbines. 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 to piping plovers.

Rufa Red Knot

The distance from shore to the offshore portions of the Action Area precludes use by foraging red knots. For this BA, the population of interest during the fall migration consists of the short-distance migrant subset of the *Rufa* red knot population that stages at or near the Monomoy NWR; these birds fly in a westerly direction that may include the offshore portions of the Action Area. Based on a recent study, only 2% of these migrants would fly over the Vineyard Wind lease area. Red knots are known to fly at great heights during migration (78 FR 60024) and thus most likely will safely pass over the turbines. In addition, most red knots migrate during visibility conditions of ~20 km with little or no precipitation; therefore, if some do fly lower within the rotor swept zone, they would be able to see, maneuver, and avoid the widely spaced turbines.

Although "take" (a fatality due to colliding with a turbine) is unlikely due to reasons described above, a quantitative analysis was conducted. Typically, quantitative analyses are performed when "take" is expected and there is a need to estimate the amount of "take". Nevertheless, the quantitative analysis was conducted as an alternative approach to determine if there will be "take".

For this project, the Band collision risk model (Band 2012) was used to estimate the annual number of Red knot fatalities. Most of the model inputs (e.g., migration passage, proportion flying in the rotor swept zone, turbine specifications, and facility dimensions) were obtained or calculated from the DEIS and Loring et al. 2018 (see Figure 14a for a snapshot of the model inputs). The flight height distribution was derived from the midpoints of 379 ten-minute observations of 51 red knots flying nonstop over federal waters (Loring et al 2018). An estimated total of 30 (=1,500 x 2%) migration passages through the action area occurred during November plus 3 (=150 x 2%) migration passes through the action area during May. Turbine avoidance rate of 98% was used for Red knot (SNH 2018). The WDA had 100 operating 8MW turbines. The monthly proportion of time the turbines were in operation is based the wind speeds when roseate terns are flying (see Fig. 12 in Loring et al. 2018) rather than the proportional of the time the wind was above turbine cut-in and below cut-out speeds. . . The average rpm for a turbine operating at the site is not known, so the maximum rpm speed was used which is likely to be greater than the average – an increase in rpm will increase the estimated mortality. 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). The Band model only estimates annual fatalities, so to estimate fatalities over the project's 30-year operations term, the monthly migration passes were multiplied by 30, thus during the 30 year operations term, there would be a total of 900 passes (=30 passes per year * 30 years) during November and 90 passes in May. It is important to note that using the 30-year operations term overestimates exposure, because the term includes the construction (~2 years) and decommissioning phases where the turbines will not be spinning and that all turbines continue to operate year-after-year. In addition, this analysis assumes the same number of passes from one year to the next.

Based on the collision risk model, the estimated annual number of fatalities for migrating red knots was **zero** (see Figure 14b for model outputs). Likewise, the estimated number of fatalities during the 30-year operations term was also **zero**. The results are the same using 57 14 MW turbines. Therefore, based on the above findings (including but not solely on the collision risk model), 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 to red knots.

4.2.1.7. 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 (see Section 5.2.1.4), as described above. Similarly, noise impacts resulting from decommissioning would be localized and of short duration, lasting only for the duration of structure removal. If these activities were to occur during migration period, most red knots and piping plovers in the area will be flying well above the project 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 simply fly around the noise source; therefore, the noise generated is not anticipated to impact the migratory movement or migratory behavior through the area. Therefore, the Proposed Action may affect migrating roseate terns, piping plovers, and *Rufa* red knots, but the effects, if any, would be **insignificant and discountable**.

4.2.2. Indirect Effects

Indirect effects include effects 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 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 maintenance, and eventual decommissioning of the onshore portions of the proposed Action.

Some migrating birds may encounter the offshore portion of Action Area and perhaps barrier effects posed by 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 long 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 of the offshore portions of the Action Area would be inconsequential and would not result in a measurable negative affect. Based on the information above, indirect impacts due to barrier effects on migrating piping plovers, roseate terns, or red knots in from increased energy expenditure due would be **insignificant and discountable.**

5. DETERMINATION OF EFFECTS

Given that the activities will occur on the OCS, there would be **no effect** to northern long-eared bats. Given the Action Area is outside of the known distribution of the Black-Capped Petrel, there would be **no effect** to Black-Capped Petrel.

Based on the analysis in Section 5, adverse effects, if any, on listed bird species resulting from the construction, operations and maintenance, and eventual decommissioning of the proposed onshore facilities are **not likely to adversely affect** listed bird species. This finding is due to (1) the lack of suitable nesting and/or foraging habitat (2), the limited amount of required habitat conversion, and the (3) localized and short-tern nature of the potential impacts.

Given the geographic scope of the Proposed Action, federally listed birds could occur within the offshore portions of the Action Area. Based on prior analyses in Section 5, the proposed action **May Affect** migrating roseate terns, piping plovers, and 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 migrants, the restricted time period of exposure during migration; BOEM concludes that the effects of the proposed action are insignificant and discountable. Therefore, the proposed action would **Not Likely Adversely Affect** roseate terns, piping plovers, and red knots.

6. AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

This section outlines the standard operating conditions that are part of the Proposed Action that would minimize or eliminate potential impacts on ESA-listed species of birds and bats.

- Vineyard Wind will only use red flashing strobe-like lights that meet FAA requirements for aviation obstruction lights.
- Any additional lighting (e.g., work lights) on WTG towers and support vessels must be used only when necessary, hooded downward, and directed when possible to reduce upward illumination and illumination of adjacent waters.
- Use of ADLS, which would only activate the FAA hazard lighting when an aircraft is in the vicinity of the wind facility.
- The Lessee will coordinate with the Lessor and USFWS to finalize a bird and bat post-construction monitoring plan prior to the commencement of operations. Within the first year of operations, the Lessee to install digital VHF telemetry automated receiving stations and acoustic monitoring devices to estimate the exposure of ESA species and other migratory birds to the operating wind facility. In addition, the Lessee will install acoustic bat detectors and acoustic/imaging detectors for birds. The monitoring plan will include periodic monitoring progress reports plus comprehensive annual reports followed by a discussion of each year's results with BOEM and USFWS that include the potential need for reasonable revisions to the Monitoring Plan.
- An annual report shall be provided to BOEM and FWS documenting any dead (or injured) birds or bats found on vessels and structures during construction, operations, and decommissioning. 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, available at https://www.pwrc.usgs.gov/bbl/.
- Misc. onshore measures in the piping plover Protection Plan (see Appendix C).
- Tree clearing time-of-year restriction: Require that trees (greater than 3 in diameter at breast height) not be cleared from June 1 to July 31 (See Appendix B; Consultation Code: 05E1NE00-2019-TA-1790). Alternatively, the Lessee may coordinate with BOEM and USFWS to conduct summer surveys for bats (see https://www.fws.gov/Midwest/endangered/mammals/inba/inbasummersurveyguidance.html). Report any dead, injured, or sick northern long-eared bats that found during the clearing of forest for the substation to USFWS (See Appendix B; Consultation Code: 05E1NE00-2019-TA-1790).

REFERENCES

Amelon, S., and D. Burhans. 2006. Conservation Assessment: *Myotis septentrionalis* (northern long-eared bat) in the Eastern United States. In Thompson, F. R. III, ed. 2006. Conservation assessments for five forest bat species in the Eastern United States. General Technical Report NC-260. U.S. Forest Service, North Central Research Station. St. Paul, MN. 82 p.

Band, B. 2012. Using a collision risk model to assess bird collision risks for offshore wind farms (with extended method) Report to Strategic Ornithological Support Services; http://www.bto.org/sites/default/files/u28/downloads/Projects/Final_Report_SOSS02_Band1ModelGui dance.pdf (Accessed December 4, 2018).

BOEM (Bureau of Ocean Energy Management). 2012a. Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts, Final Environmental Assessment. Accessed: July 5, 2018. Retrieved from: https://www.boem.gov/uploadedFiles/BOEM/Renewable_Energy_Program/Smart_from_the_Start/Mid-Atlantic_Final_EA_012012.pdf

BOEM (Bureau of Ocean Energy Management). 2014. Virginia offshore wind technology advancement project on the Atlantic Outer Continental Shelf offshore Virginia: Biological Assessment and Avian Risk Assessment. 46 pp.

BOEM (Bureau of Ocean Energy Management). Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New York: Biological Assessment. Office of Renewable Energy Programs. 20 pp.

BOEM (Bureau of Ocean Energy Management). 2020. Vineyard Wind 1 Offshore Wind Energy Project Supplement to the Draft Environmental Impact Statement.

Brack, V., Jr., and J. O. Whitaker, Jr. 2001. Foods of the northern Myotis, *Myotis septentrionalis*, from Missouri and Indiana, with notes on foraging. Acta Chiropterologica 3(2): 203-210.

Burger, J.C., G.L. Niles, J. Newman, G. Forcey, and L. Vliestra. 2011. Risk evaluation for federally listed (roseate tern, Piping Plover) or candidate (Red Knot) bird species in offshore waters: A first step for managing the potential impacts of wind facility development on the Atlantic Outer Continental Shelf. Renewable Energy 36: 338-351.

Burger, J., L. J. Niles, R. R. Porter, A. D. Dey, S. Koch, and C. Gordon. 2012a. Migration and Overwintering of Red Knots (*Calidris canutus rufa*) along the Atlantic Coast of the United States. Condor 114:1-12.

Burger, J., L. J. Niles, R. R. Porter, A. D. Dey, S. Koch, and C. Gordon. 2012b. Using a Shore Bird (Red Knot) Fitted with Geolocators to Evaluate a Conceptual Risk Model Focusing on Offshore Wind. Renewable Energy 43:370-377.

Caceres, M. C. and M. J. Pybus. 1997. Status of the northern long-eared bat (*Myotis septentrionalis*) in Alberta. Alberta Environmental Protection, Wildlife Management Division, Wildlife Status Report No. 3. Edmonton, AB. 19 pp.

Carter, T. C. and G. A. Feldhamer. 2005. Roost tree use by maternity colonies of Indiana bats and northern long-eared bats in Southern Illinois. Forest Ecology and Management 219: 259-268.

Collette, B. B. and G. Klein-MacPhee. 2002. Bigelow and Schroeder's Fishes of the Gulf of Maine. Smithsonian Institution Press, Washington and London. Third Edition. xxxiv + 748 pp

Curtice, C., J. Cleary, E. Shumchenia, P. N. Halpin. 2018. Marine-life Data and Analysis Team (MDAT) technical report on the methods and development of marine-life data to support regional ocean planning and management. Prepared on behalf of the Marine-life Data Analysis Team (MDAT). Accessed at: http://seamap.env.duke.edu/models/MDAT/MDAT-Technical-Report.pdf.

Diffendorfer, J.E., R. Compton, L. Kramer, Z. Ancona, and D. Norton. 2017. Onshore industrial wind turbine locations for the United States (ver. 1.2, January 2017): U.S. Geological Survey Data Series 817, https://doi.org/10.3133/ds817.

Dowling, Z., P. R. Sievert, E. Baldwin, L. Johnson, S. von Oettingen, and J. Reichard. 2017. Flight Activity and Offshore Movements of Nano-Tagged Bats on Martha's Vineyard, MA. US Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Sterling, Virginia. OCS Study BOEM 2017-054. 39 pp. + frontmatter. Available at: https://www.boem.gov/Flight-Activity-and-Offshore-Movements-of-Nano-Tagged-Bats-on-Marthas-Vineyard/

Elliott-Smith, E. and S. M. Haig. 2004. Piping Plover (*Charadrius melodus*). The Birds of North America Online (A. Poole, ed.). Ithaca: Cornell Lab of Ornithology. Accessed August 9, 2018. Retrieved from: http://bna.birds.cornell.edu/bna/species/002.

Epsilon Associates, Inc. (Epsilon). 2018. Draft Construction and Operations Plan. J, 2018. Accessed June 5, 2019. Retrieved from: https://www.boem.gov/Vineyard-Wind/

Epsilon Associates, Inc. (Epsilon). 2020. Draft Construction and Operations Plan, Volume, I Vineyard Wind Project. June 3, 2020. Accessed August 31, 2020. Retrieved from: https://www.boem.gov/sites/default/files/documents/renewable-energy/Vineyard-Wind-COP-Volume-I-Appendix-I-Complete.pdf

ESS Group, Inc. (ESS). 2014. Cape Wind Avian & Bat Pre-Construction Monitoring Report: 2013-2014. Prepared for Cape Wind Associates. 57 pp.

FAA (Federal Aviation Administration). 2018. Obstruction Marking and Lighting (Advisory Circular-70/7466-1L). Washington, D.C. 66 pp + appendices

Farnsworth, A. 2010. Black-capped Petrel (*Pterodroma hasitata*), version 1.0. In Neotropical Birds Online (T. S. Schulenberg, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. Accessed 22 October 2018. Retrieved from: https://neotropical.birds.cornell.edu/Species-Account/nb/species/bkcpet/distribution

Foster, R. W. and A. Kurta. Roosting ecology of the northern bat (*Myotis septentrionalis*) and comparisons with the endangered Indiana bat (*Myotis sodalis*). Journal of Mammalogy 80(2): 659-672.

Garcia-Quismondo, M., I. Nisbet, C. Mostello, and J. Reed. 2018. Modeling population dynamics of roseate terns (*Sterna dougallii*) in the Northwest Atlantic Ocean. Ecological Modelling. 368. 298-311.Goetz, J. E., J. H. Norris, and J. A. Wheeler, Eds. 2012. Conservation Action Plan for the Black-capped Petrel (*Pterodroma hasitata*). International Black-capped Petrel Conservation Group. Accessed 15 October 2018. Retrieved from: https://www.fws.gov/migratorybirds/pdf/management/focal-species/Black-cappedpetrel.pdf

Goyert, H.F. 2014. Relationship among prey availability, habitat, and the foraging behavior, distribution, and abundance of common terns *Sterna hirundo* and roseate terns *S. dougallii*. — Mar. Ecol. Prog. Ser. 506: 291-302.

Goyert, H. 2015. Foraging specificity and prey utilization: Evaluating social and memory-based strategies in seabirds. Behaviour, 152(7/8), 861-895. Retrieved from http://www.jstor.org/stable/24527155

Gordon, C. and C. Nations. 2016. Collision risk model for “rufa” Red Knots (*Calidris canutus rufa*) interacting with a proposed offshore wind energy facility in Nantucket Sound, Massachusetts. U. S. Department of the Interior, Bureau of Ocean Energy Management, Sterling Virginia. OCS Study BOEM 2016-045. 90 pp. + front matter and appendix. Accessed: August 13, 2018. Retrieved from: https://www.boem.gov/WEST-final-report-M14PD00050/

Hatch, J. J. and S. Brault. 2007. Collision Mortalities at Horseshoe Shoal of Bird Species of Special Concern. Final Draft. Cape Wind Report No. 5.3.2-1. January 2007.

Hanley, J. C. 1987. Aspects of the pelagic ecology and behavior of the Black-capped Petrel. The Wilson Bulletin 99(2): 153-168.

Hain, J. H., Ellis, S. L., Kenney, R. D., Clapham, P. J., Gray, B. K., Weinrich, M. T. and Babb, I. G. 1995. Apparent Bottom Feeding by Humpback Whales on Stellwagen Bank. Marine Mammal Science, 11: 464-479

Heinemann, D. (1992). Foraging ecology of roseate terns breeding on Bird Island, Buzzards Bay, Massachusetts. — USFWS, Manomet.

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

Jodice, P., R. A. Ronconi, E. Rupp, G. E. Wallace, and Y. Satage. 2015. First satellite tracks of the endangered Black-capped Petrel. Endangered Species Research 29: 23-33.

Johnston, A., A. S. C. P. Cook, L. J. Wright, E. M. Humphreys, and N. K. Burton. 2014. Modeling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines. Journal of Applied Ecology 51: 31-41.

Kerlinger, P. J. L. Gehring, W. P. Erickson, R. Curry, A. Jain, and J. Guarnaccia. 2010. Night migrant fatalities and obstruction lighting at wind turbines in North America. The Wilson Journal of Ornithology 122(4): 744-754.

Kraus, S.D., S. Leiter, K. Stone, B. Wikgren, C. Mayo, P. Hughes, R. D. Kenney, C. W. Clark, A. N. Rice, B. Estabrook and J. Tielens. 2016. Northeast Large Pelagic Survey Collaborative Aerial and Acoustic Surveys for Large Whales and Sea Turtles. US Department of the Interior, Bureau of Ocean Energy Management, Sterling, Virginia. OCS Study BOEM 2016-054. 117 pp. + appendices. https://www.boem.gov/RI-MA-Whales-Turtles/

Loring, P. H. 2016. Evaluating digital VHF technology to monitor shorebird and seabird use of offshore wind energy areas in the Western North Atlantic. PhD Dissertation. University of Massachusetts, Amherst, MA., xiv + 172 pp. Accessed 13 August 2018. Retrieved from: https://scholarworks.umass.edu/dissertations_2/761/.

Loring PH, McLaren JD, Smith PA, Niles LJ, Koch SL, Goyert HF, Bai H. 2018. Tracking movements of threatened migratory *rufa* Red Knots in U.S. Atlantic Outer Continental Shelf Waters. Sterling

(VA): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-046. 145 p. https://espis.boem.gov/Final%20Reports/BOEM_2018-046.pdf

Loring PH, Paton PWC, McLaren JD, Bai H, Janaswamy R, Goyert HF, Griffin CR, Sievert PR. 2019. Tracking Offshore Occurrence of Common Terns, Endangered Roseate Terns, and Threatened Piping Plovers with VHF Arrays. Sterling (VA): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2019-017. 149 p. https://espis.boem.gov/final%20reports/BOEM_2019-017.pdf

MassWildlife. 2018. Inventory of terns, Laughing Gulls, and Black Skimmers. Massachusetts Division of Fisheries and Wildlife. 9 pp = appendices

Mayflower. 2020. Mayflower Quarterly Survey Report: February 2020 - April 2020. Scientific Quarterly Report P00003850., 31/07/2020, 24 pp. (CONFIDENTIAL)

Melvin, S. 2012. Summary of the 2011 Massachusetts Piping Plover Census. Massachusetts Division of Fisheries and Wildlife. 19 pp.

Mostello, C. S. Unpublished Data. (Table 24. 26 Feb 2018, Final) Number of nesting pairs and productivity of Roseate Terns in the Northeastern United States and Canada, 2010-2017.

Niles, L.J., H.P. Sitters, A.D. Dey, P.W. Atkinson, A.J. Baker, K.A. Bennett, R. Carmona, K.E. Clark, N.A. Clark, C. Espoz, P. Gonzalez, B.A. Harrington, D.E. Hernandez, K.S. Kalasz, R.G. Lathrop, R.N. Matus, C.D.T. Minton, R.I.G. Morrison, M.K. Peck, W. Pitts, R.A. Robinson, and I.L. Serrano. 2008. Status of the Red Knot (*Caladris canutus rufa*) in the Western Hemisphere. Studies in Avian Biology No 36. 145 pp + appendices.

Niles, L.J., J. Burger, R.R. Porter, A.D. Dey, C.D.T. Minton, P.M. Gonzalez, A.J. Baker, J.W. Fox, and C. Gordon. 2010. First Results Using Light Level Geolocators to Track Red Knots in the Western Hemisphere Show Rapid and Long Intercontinental Flights and New Details of Migration Pathways. Wader Study Group Bulletin 117(2): 123–130.

Niles, L. J., J. Burger, R. R. Porter, A. D. Dey, C. D. T. Minton, P. M. Gonzalez, A. J. Baker, J. W. Fox, and C. Gordon. 2012. First results using light level geolocators to track Red Knots in the western hemisphere show rapid and long intercontinental flights and new details of migratory pathways. Wader Study Group Bulletin 117(2): 123-130.

Nisbet, I. C. T., M. Gochfeld, and J. Burger. 2014. Roseate Tern (*Sterna dougallii*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. Accessed on May 15, 2019 https://doi.org/10.2173/bna.370

Normandeau Associates, Inc. 2011. New insights and new tools regarding risk to roseate terns, Piping Plovers, and Red Knots from wind facility operations on the Atlantic Outer Continental Shelf. A Final Report for the U. S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Report No. BOEMRE 048-2011. Contract No. M08PC20060. 287 pp. http://www.data.boem.gov/PI/PDFImages/ESPIS/4/5119.pdf

Owen, S. F., M. A. Menzel, W. M. Ford, J. W. Edwards, B. R. Chapman, K. V. Miller, and P. B. Wood. 2002. Roost tree selection by maternal colonies of northern long-eared *Myotis* in an intensively managed forest. General Technical Report NE-292. U.S. Forest Service, Newton Square, PA. 6 pp.

Perry, R. W. and R. E. Thill. 2007. Roost selection by male and female northern long-eared bats in a pine-dominated landscape. Forest Ecology and Management 247: 220-226.

Pelletier, S.K., K. Omland, K.S. Watrous, and T.S. Peterson. 2013. Information Synthesis on the Potential for Bat Interactions with Offshore Wind Facilities – Final Report. Herndon, VA: U.S. Department of the Interior, Bureau of Ocean Energy Management, Headquarters. OCS Study BOEM No. 2013- 01163. 119 pp.

Peterson, T. S. and S. K. Pelletier. 2016. Long-term monitoring on islands, offshore structures, and coastal sites in the Gulf of Maine, mid-Atlantic, and Great Lakes – Final Report. Department of Energy. Award No. DE-EE005378. Accessed: August 10, 2018. Retrieved from: https://tethys.pnnl.gov/sites/default/files/publications/Stantec-2016-BatMonitoring.pdf

Plissner, J. H. and S. M. Haig. 2000. Viability of Piping Plover *Charadris melodus* metapopulations. Biological Conservation 92: 163-173.

Robinson Willmont, J.C., G. Forcey, and A. Kent. 2013. The relative vulnerability of migratory bird species to offshore wind energy projects on the Atlantic Outer Continental Shelf: An assessment methods and database. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2013-207. 275 pp. Retrieved from: http://www.data.boem.gov/PI/PDFImages/ESPIS/5/5319.pdf

Rock JC, Leonard ML, Boyne A. 2007. Foraging habitat and chick diets of Roseate Tern, *Sterna dougallii*, Breeding on Country Island, Nova Scotia. Avian Conservation and Ecology 2:4.

Safina C. 1990. Foraging habitat partitioning in Roseate and Common Terns. Auk 107:351-358.

Safina, C,, Wagner, R.H., Witting, D.A. & Smith, K.J. 1990. Prey delivered to roseate and common tem chicks; composition and temporal variability. Journal of Field Ornithology. 61: 331-338.

Sasse, D. B. and P. J. Perkins. 1996. Summer roosting ecology of northern long-eared bats (*Myotis septentrionalis*) in the White Mountain National Forest. p 91-101. In: R. M. R. Barclay and R. M. Bingham (eds.). Bats and Forests Symposium. British Columbia Ministry of Forests, Victoria, British Columbia, Canada.

Scottish Natural Heritage (SNH). 2018. SNH Avoidance Rate Information & Guidance Note. http://www.snh.gov.uk/docs/B721137.pdf Accessed 5/29/2019.

Simmons, T. R., D. S. Lee, and C. Haney. 2013. *Diablotin Pterodroma hasitatal*: A biography of the endangered Black-Capped Petrel. Marine Ornithology 41 (Special Issue): S3-S43.

Stantial, M. L. 2014. Flight behavior of breeding Piping Plovers: implications for risk of collision with wind turbines. M.S. Thesis, State University of New York, Syracuse. Retrieved from: https://njfishandwildlife.com/ensp/pdf/plover-turbine_stantialthesis14.pdf

Stantial, M. and J. Cohen. 2015. Estimating flight height and flight speed of breeding Piping Plovers. Journal of Field Ornithology. 86:369-377.

Timpone, J. C., J. G. Boyles, K. L. Murray, D. P. Aubrey, and L. W. Robbins. 2010. Overlap in roosting habitats of Indiana bats (*Myotis sodalis*) and norther long-eared bats (*Myotis septentrionalis*). American Midland Naturalist 163: 115-123.

Turner, G. G., D.M. Reeder, and J.T.H. Coleman. 2011. A five-year assessment of the mortality and geographic spread of white-nose syndrome in North American bats and a look to the future. Bat Research News, 52:13-27.

USFWS. 1996. Piping Plover (*Charadrius melodus*) Atlantic Coast Population Revised Recovery Plan. Hadley, MA. 245 pp.

USFWS. 1998. Roseate Tern Recovery Plan – Northeast Population, First Update. Hadley, MA. 75 pp.

USFWS. 2008. Biological Opinion for the Cape Wind Energy Project, Nantucket Sound, Massachusetts. Concord, New Hampshire. 89 pp. + Appendix. Accessed: 10 August 2018. Retrieved from: https://www.fws.gov/newengland/pdfs/CapeWind-BO-21November2008_withCovLttr.pdf.

USFWS. 2009. Piping Plover (*Charadrius melodus*) 5 Year Review: Summary and Evaluation. Hadley, MA. 206 pp

USFWS. 2010. Caribbean and Roseate Tern (*Sterna dougallii dougallii*). 5 Year Review: Summary and Evaluation. 142 pp.

USFWS. 2020. Roseate Tern Northeastern North American Population *(Sterna dougallii dougallii*) 5-Year Review: Summary and Evaluation. 55 pp.USFWS. 2020. Piping Plover (*Charadrius melodus*) 5-Year Review: Summary and Evaluation. 164 pp.

USFWS. 2014. *Rufa* Red Knot Background Information and Threats Assessment. Supplement to Endangered and Threatened Wildlife and Plants; Final Threatened Status for the *Rufa* Red Knot (*Calidris canutus rufa*). [Docket No. FWS-R5-ES-2013-0097; RIN AY17]. November 2014.

USFWS. 2018a. American Chaffseed. Accessed September 16, 2018. Retrieved from: https://www.fws.gov/southeast/wildlife/plants/american-chaffseed/

USFWS. 2018b. Species Assessment Report for the Black-capped Petrel (*Pterodroma hasitata*), Version 1.1. Atlanta, GA. 70 pp. + appendices. Access: 15 October 2018. Retrieved from: http://www.marineornithology.org/content/get.cgi?rn=994

USFWS. 2018c. 2017 Atlantic Coast Piping Plover Abundance and Productivity Estimates (September 14, 2018). Accessed on 02/25/2019 https://www.fws.gov/northeast/pipingplover/pdf/2017-Update-Final.pdf

USFWS. 2018d. Accessed through US Department of Interior, Northwest Atlantic Seabird Catalog, Version XX. Accessed 5 October 2018.

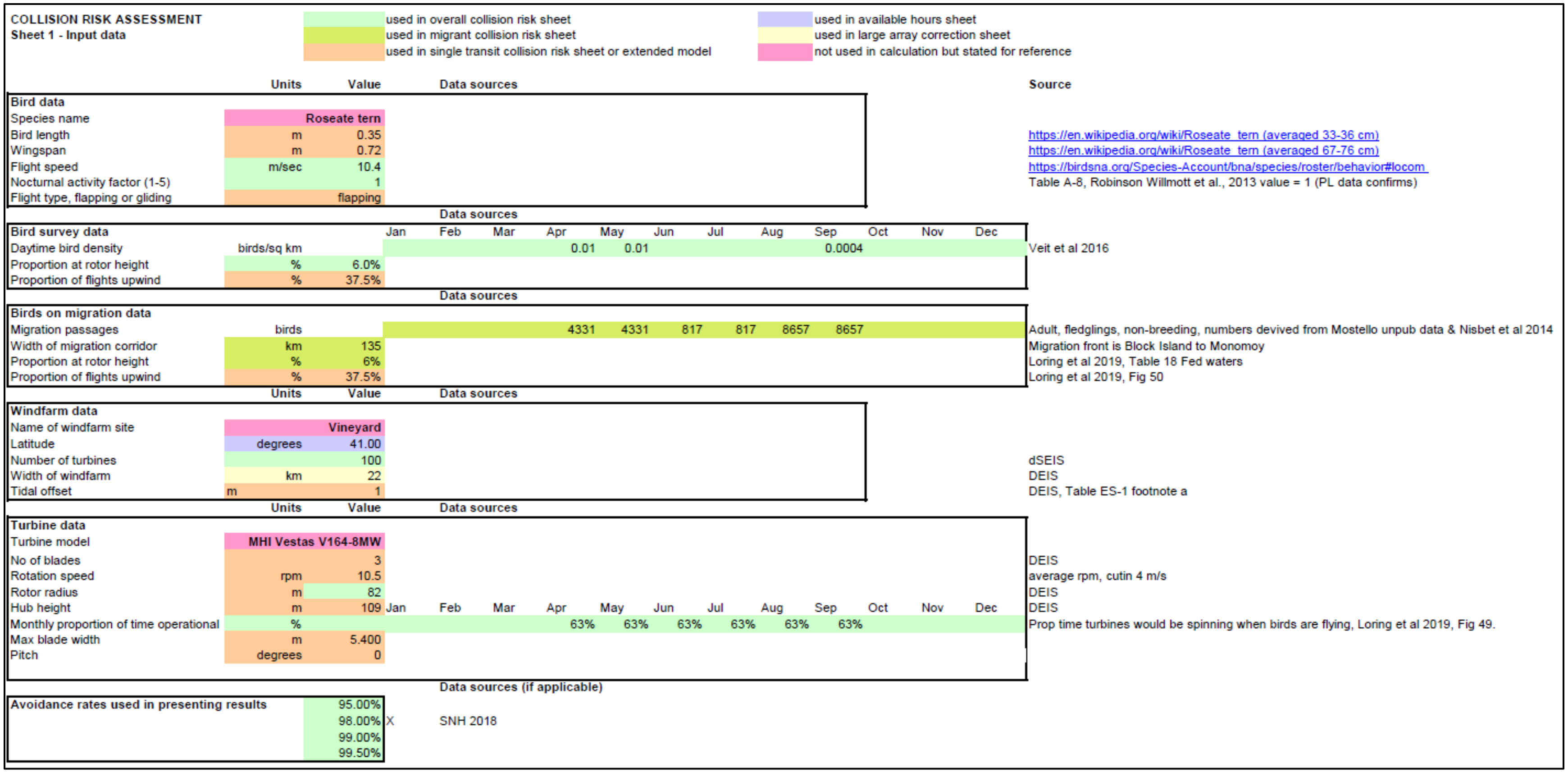
Veit, R.R. and S. A. Perkins. 2014. Aerial Surveys for Roseate and Common Terns South of Tuckernuck and Muskeget Islands July-September 2013. US Dept. of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2014-665. 13 pp. Retrieved from: https://www.boem.gov/2014-665/

Veit, R., R., T. P. White, S.A. Perkins, S. Curley. 2016. Abundance and Distribution of Seabirds off Southeastern Massachusetts, 2011-2015. U.S. Department of the Interior, Bureau of Ocean Energy Management, Sterling, Virginia. OCS Study BOEM 2016-067. 82 pp. Retrieved from: https://www.boem.gov/RI-MA-Seabirds/

Vineyard Wind. 2019. Year-Round Boat-Based Offshore Avian Surveys in the Southern Portion of Vineyard Wind Lease Area OCS-A 0501, October 2018–September 2019, Final Report. Pp. 15.

Wingate, D. B. 1964. Discovery of breeding Black-capped Petrels on Hispanola. The Auk 81: 147-159

Winship, A.J., Kinlan, B.P., White, T.P., Leirness, J.B., and Christensen, J. 2018. Modeling at-sea density of marine birds to support Atlantic marine renewable energy planning: Final report. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Sterling, VA. OCS Study BOEM 2018-010. x+67 pp. https://espis.boem.gov/final%20reports/BOEM_2018-010.pdf



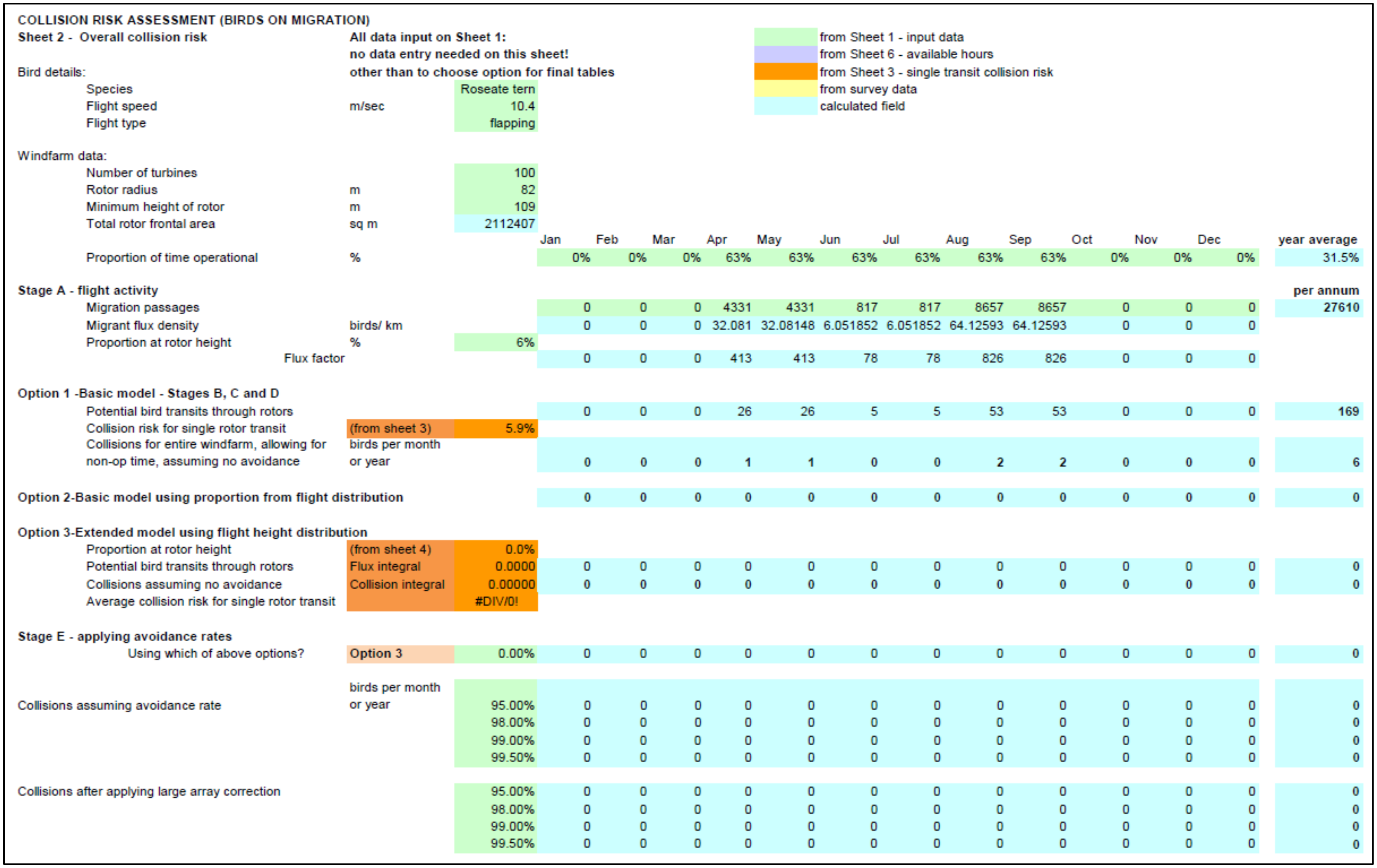
COLLISION RISK ASSESSMENT
Sheet 1 - Input data

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

	Units	Value	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Source
	Units	**Value**		**Data sources**											**Source**
Bird data															
Species name		**Roseate tern**													
Bird length	m	0.35													https://en.wikipedia.org/wiki/Roseate_tern (averaged 33-36 cm)
Wingspan	m	0.72													https://en.wikipedia.org/wiki/Roseate_tern (averaged 67-76 cm)
Flight speed	m/sec	10.4													https://birdsna.org/Species-Account/bna/species/roster/behavior#locom
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													
				Data sources											
Bird survey data			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daytime bird density	birds/sq km					0.01	0.01				0.0004				Veit et al 2016
Proportion at rotor height	%	6.0%													
Proportion of flights upwind	%	37.5%													
				Data sources											
Birds on migration data															
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
	Units	**Value**		**Data sources**											
Windfarm data															
Name of windfarm site		**Vineyard**													
Latitude	degrees	41.00													
Number of turbines		100													dSEIS
Width of windfarm	km	22													DEIS
Tidal offset	m	1													DEIS, Table ES-1 footnote a
	Units	**Value**		**Data sources**											
Turbine data															
Turbine model		**MHI Vestas V164-8MW**													
No of blades		3													DEIS
Rotation speed	rpm	10.5													average rpm, cutin 4 m/s
Rotor radius	m	82													DEIS
Hub height	m	109	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DEIS
Monthly proportion of time operational	%					63%	63%	63%	63%	63%	63%				Prop time turbines would be spinning when birds are flying, Loring et al 2019, Fig 49.
Max blade width	m	5.400													
Pitch	degrees	0													

			Data sources (if applicable)
Avoidance rates used in presenting results	95.00%		
	98.00%	X	SNH 2018
	99.00%		
	99.50%		

Figure 12a. Data used in the “input data” spreadsheet within the Band (2012) collision risk model for roseate terns.



COLLISION RISK ASSESSMENT (BIRDS ON MIGRATION)

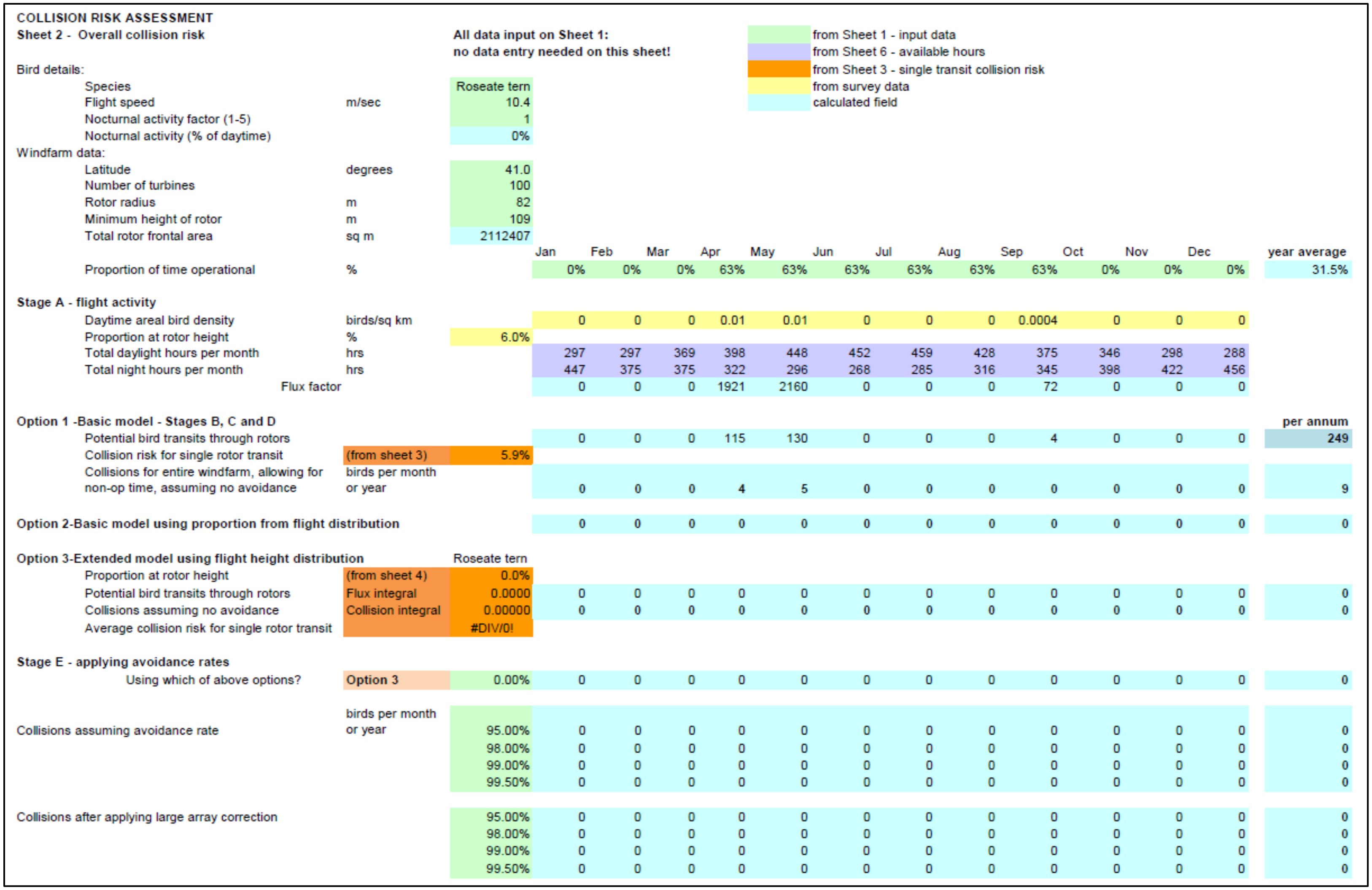
Sheet 2 - Overall collision risk

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

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year average
Bird details:															
Species		Roseate tern													
Flight speed	m/sec	10.4													
Flight type		flapping													
Windfarm data:															
Number of turbines		100													
Rotor radius	m	82													
Minimum height of rotor	m	109													
Total rotor frontal area	sq m	2112407													
Proportion of time operational	%		0%	0%	0%	63%	63%	63%	63%	63%	63%	0%	0%	0%	31.5%
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	413	413	78	78	826	826	0	0	0	
Option 1 -Basic model - Stages B, C and D															
Potential bird transits through rotors			0	0	0	26	26	5	5	53	53	0	0	0	169
Collision risk for single rotor transit	(from sheet 3)	5.9%													
Collisions for entire windfarm, allowing for non-op time, assuming no avoidance	birds per month or year		0	0	0	1	1	0	0	2	2	0	0	0	6
Option 2-Basic model using proportion from flight distribution			0	0	0	0	0	0	0	0	0	0	0	0	0
Option 3-Extended model using flight height distribution															
Proportion at rotor height	(from sheet 4)	0.0%													
Potential bird transits through rotors	Flux integral	0.0000	0	0	0	0	0	0	0	0	0	0	0	0	0
Collisions assuming no avoidance	Collision integral	0.00000	0	0	0	0	0	0	0	0	0	0	0	0	0
Average collision risk for single rotor transit		#DIV/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	0	0	0
Collisions assuming avoidance rate	birds per month or year	95.00%	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		95.00%	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

Figure 12b. Results as presented in the "Migrant collision risk" spreadsheet within Band (2012) collision risk model for roseate tern.



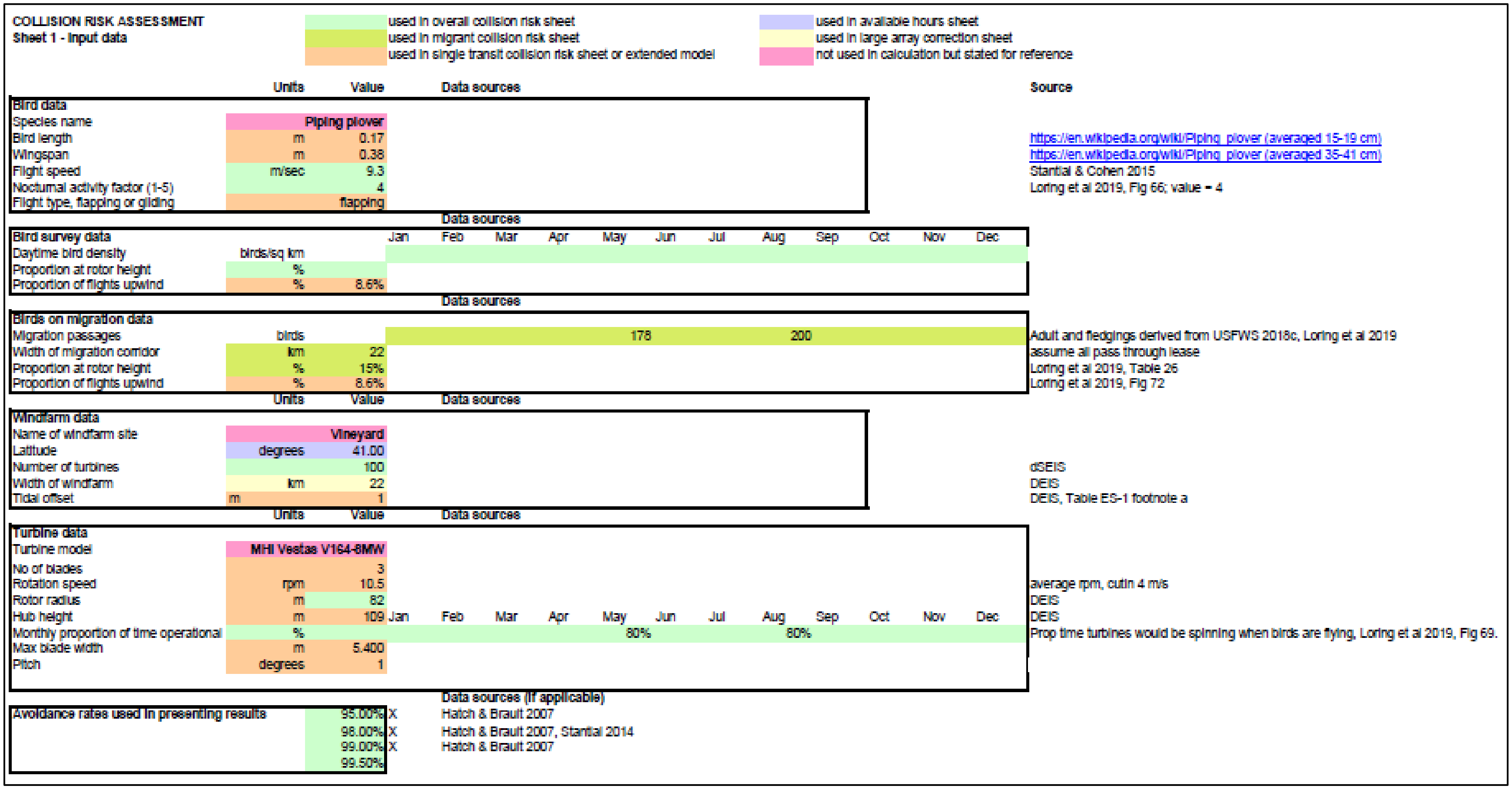
COLLISION RISK ASSESSMENT
Sheet 2 - Overall collision risk

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	10.4													
Nocturnal activity factor (1-5)		1													
Nocturnal activity (% of daytime)		0%													
Windfarm data:															
Latitude	degrees	41.0													
Number of turbines		100													
Rotor radius	m	82													
Minimum height of rotor	m	109													
Total rotor frontal area	sq m	2112407													
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year average
Proportion of time operational	%		0%	0%	0%	63%	63%	63%	63%	63%	63%	0%	0%	0%	31.5%
Stage A - flight activity															
Daytime areal bird density	birds/sq km		0	0	0	0.01	0.01	0	0	0	0.0004	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	1921	2160	0	0	0	72	0	0	0	
Option 1 -Basic model - Stages B, C and D															**per annum**
Potential bird transits through rotors			0	0	0	115	130	0	0	0	4	0	0	0	**249**
Collision risk for single rotor transit	(from sheet 3)	5.9%													
Collisions for entire windfarm, allowing for non-op time, assuming no avoidance	birds per month or year		0	0	0	4	5	0	0	0	0	0	0	0	9
Option 2-Basic model using proportion from flight distribution			0	0	0	0	0	0	0	0	0	0	0	0	0
Option 3-Extended model using flight height distribution		Roseate tern													
Proportion at rotor height	(from sheet 4)	0.0%													
Potential bird transits through rotors	Flux integral	0.0000	0	0	0	0	0	0	0	0	0	0	0	0	0
Collisions assuming no avoidance	Collision integral	0.00000	0	0	0	0	0	0	0	0	0	0	0	0	0
Average collision risk for single rotor transit		#DIV/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	0	0	0
	birds per month														
Collisions assuming avoidance rate	or year	95.00%	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		95.00%	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

Figure 12c. Results as presented in the “Other use” spreadsheet within Band (2012) collision risk model for roseate tern.



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		**Piping plover**		
Bird length	m	0.17		https://en.wikipedia.org/wiki/Piping_plover (averaged 15-19 cm)
Wingspan	m	0.38		https://en.wikipedia.org/wiki/Piping_plover (averaged 35-41 cm)
Flight speed	m/sec	9.3		Stantial & Cohen 2015
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

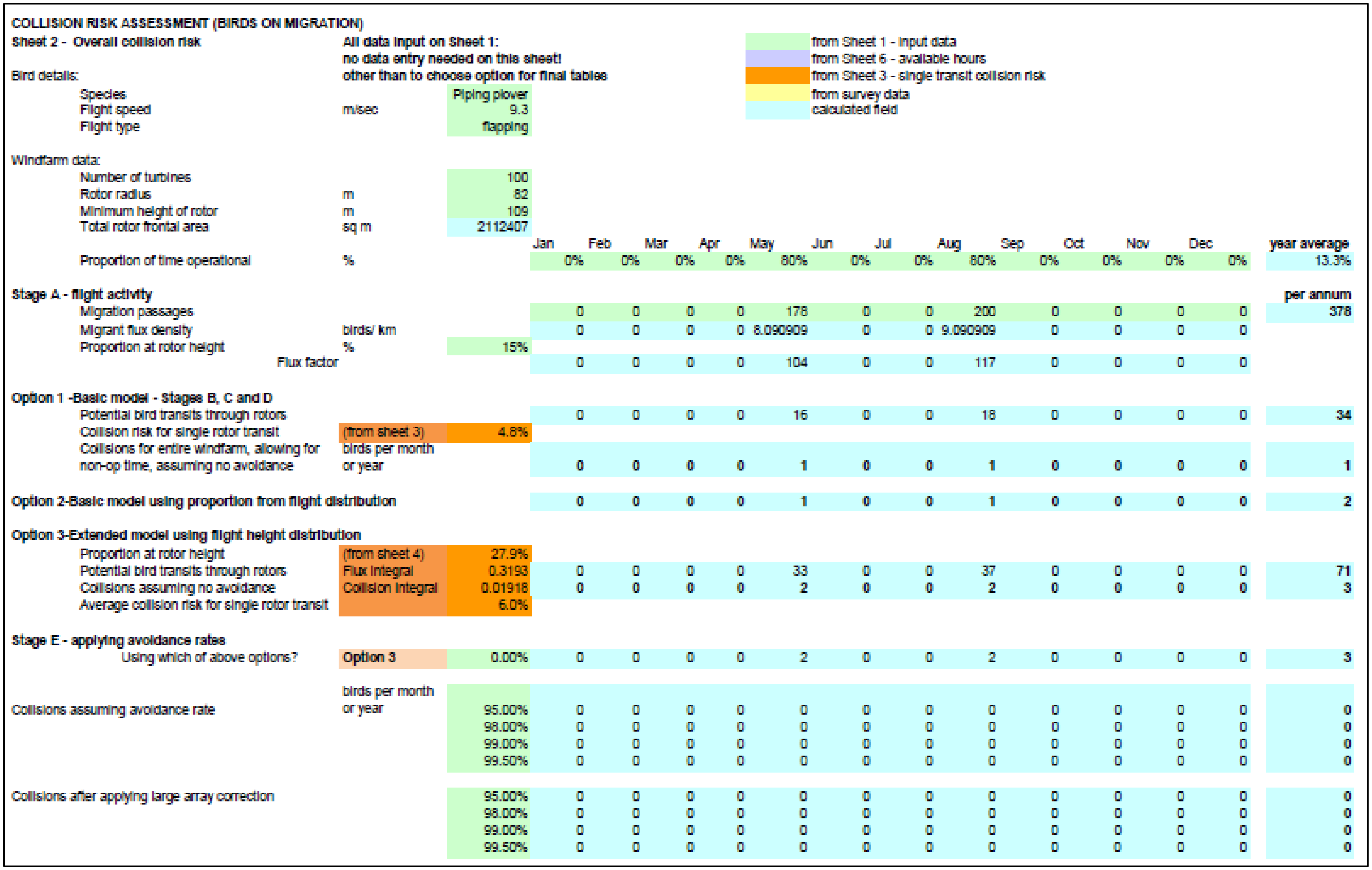
Birds on migration data															**Source**
Migration passages	birds						178			200					Adult and fledgings derived from USFWS 2018c, Loring et al 2019
Width of migration corridor	km	22													assume all pass through lease
Proportion at rotor height	%	15%													Loring et al 2019, Table 26
Proportion of flights upwind	%	8.6%													Loring et al 2019, Fig 72

Windfarm data	**Units**	**Value**	**Data sources**	**Source**
Name of windfarm site		**Vineyard**		
Latitude	degrees	41.00		
Number of turbines		100		dSEIS
Width of windfarm	km	22		DEIS
Tidal offset	m	1		DEIS, Table ES-1 footnote a

Turbine data	**Units**	**Value**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Source**
Turbine model		**MHI Vestas V164-8MW**													
No of blades		3													
Rotation speed	rpm	10.5													average rpm, cutin 4 m/s
Rotor radius	m	82													DEIS
Hub height	m	109													DEIS
Monthly proportion of time operational	%						80%			80%					Prop time turbines would be spinning when birds are flying, Loring et al 2019, Fig 69.
Max blade width	m	5.400													
Pitch	degrees	1													

Avoidance rates used in presenting results			**Data sources (if applicable)**
	95.00%	X	Hatch & Brault 2007
	98.00%	X	Hatch & Brault 2007, Stantial 2014
	99.00%	X	Hatch & Brault 2007
	99.50%		

Figure 13a. Data used in the "input data" spreadsheet within the Band (2012) collision risk model for piping plovers.



COLLISION RISK ASSESSMENT (BIRDS ON MIGRATION)

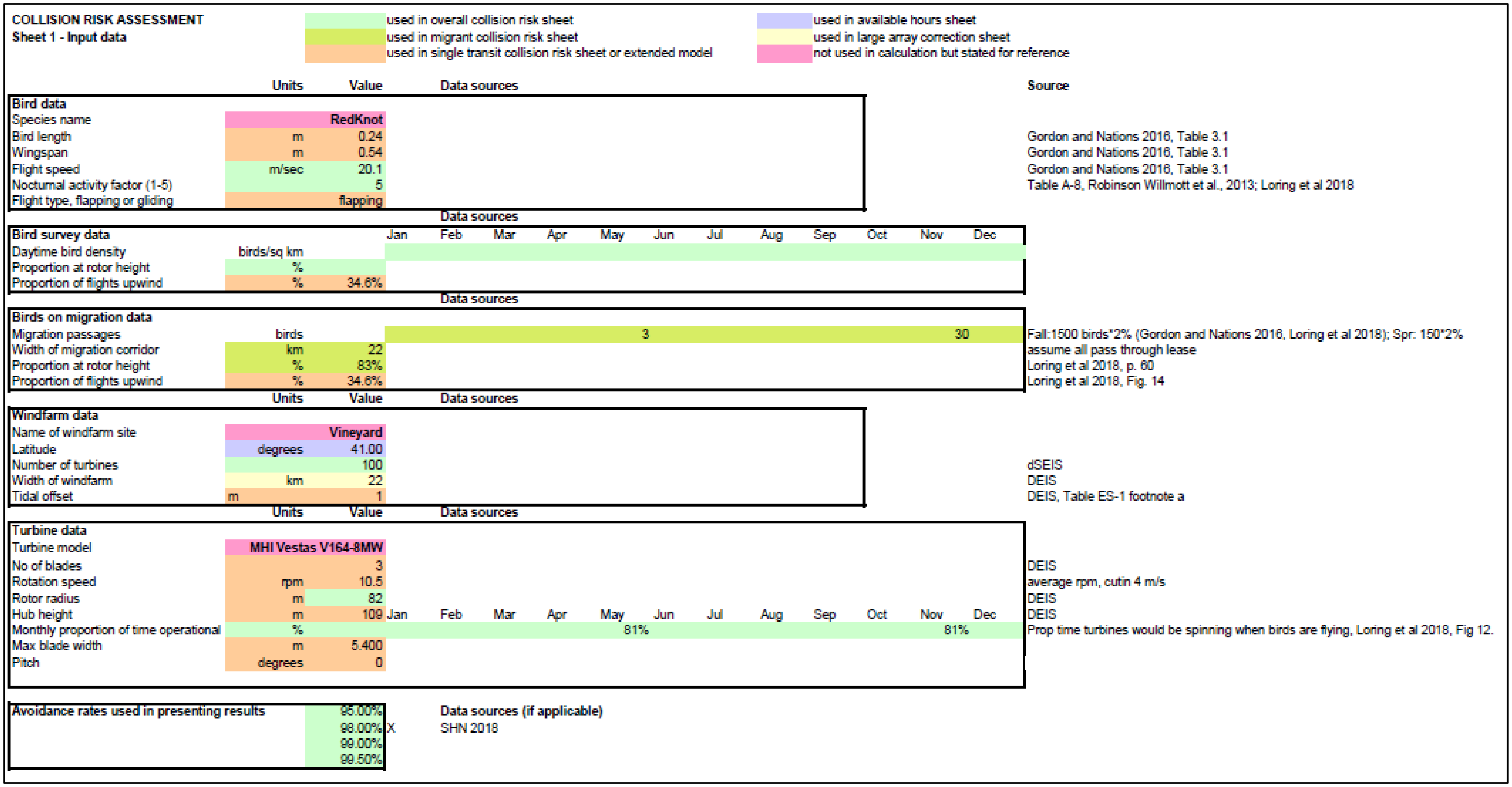
Sheet 2 - Overall collision risk

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

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year average
Bird details:															
Species		Piping plover													
Flight speed	m/sec	9.3													
Flight type		flapping													
Windfarm data:															
Number of turbines		100													
Rotor radius	m	82													
Minimum height of rotor	m	109													
Total rotor frontal area	sq m	2112407													
Proportion of time operational	%		0%	0%	0%	0%	80%	0%	0%	80%	0%	0%	0%	0%	13.3%
Stage A - flight activity															per annum
Migration passages			0	0	0	0	178	0	0	200	0	0	0	0	378
Migrant flux density	birds/ km		0	0	0	0	8.090909	0	0	9.090909	0	0	0	0	
Proportion at rotor height	%	15%													
Flux factor			0	0	0	0	104	0	0	117	0	0	0	0	
Option 1 -Basic model - Stages B, C and D															
Potential bird transits through rotors			0	0	0	0	16	0	0	18	0	0	0	0	34
Collision risk for single rotor transit	(from sheet 3)	4.8%													
Collisions for entire windfarm, allowing for non-op time, assuming no avoidance	birds per month or year		0	0	0	0	1	0	0	1	0	0	0	0	1
Option 2-Basic model using proportion from flight distribution			0	0	0	0	1	0	0	1	0	0	0	0	2
Option 3-Extended model using flight height distribution															
Proportion at rotor height	(from sheet 4)	27.9%													
Potential bird transits through rotors	Flux integral	0.3193	0	0	0	0	33	0	0	37	0	0	0	0	71
Collisions assuming no avoidance	Collision integral	0.01918	0	0	0	0	2	0	0	2	0	0	0	0	3
Average collision risk for single rotor transit		6.0%													
Stage E - applying avoidance rates															
Using which of above options?	Option 3	0.00%	0	0	0	0	2	0	0	2	0	0	0	0	3
	birds per month or year														
Collisions assuming avoidance rate		95.00%	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		95.00%	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

Figure 13b. Results as presented in the "Migrant collision risk" spreadsheet within Band (2012) collision risk model for piping plover.



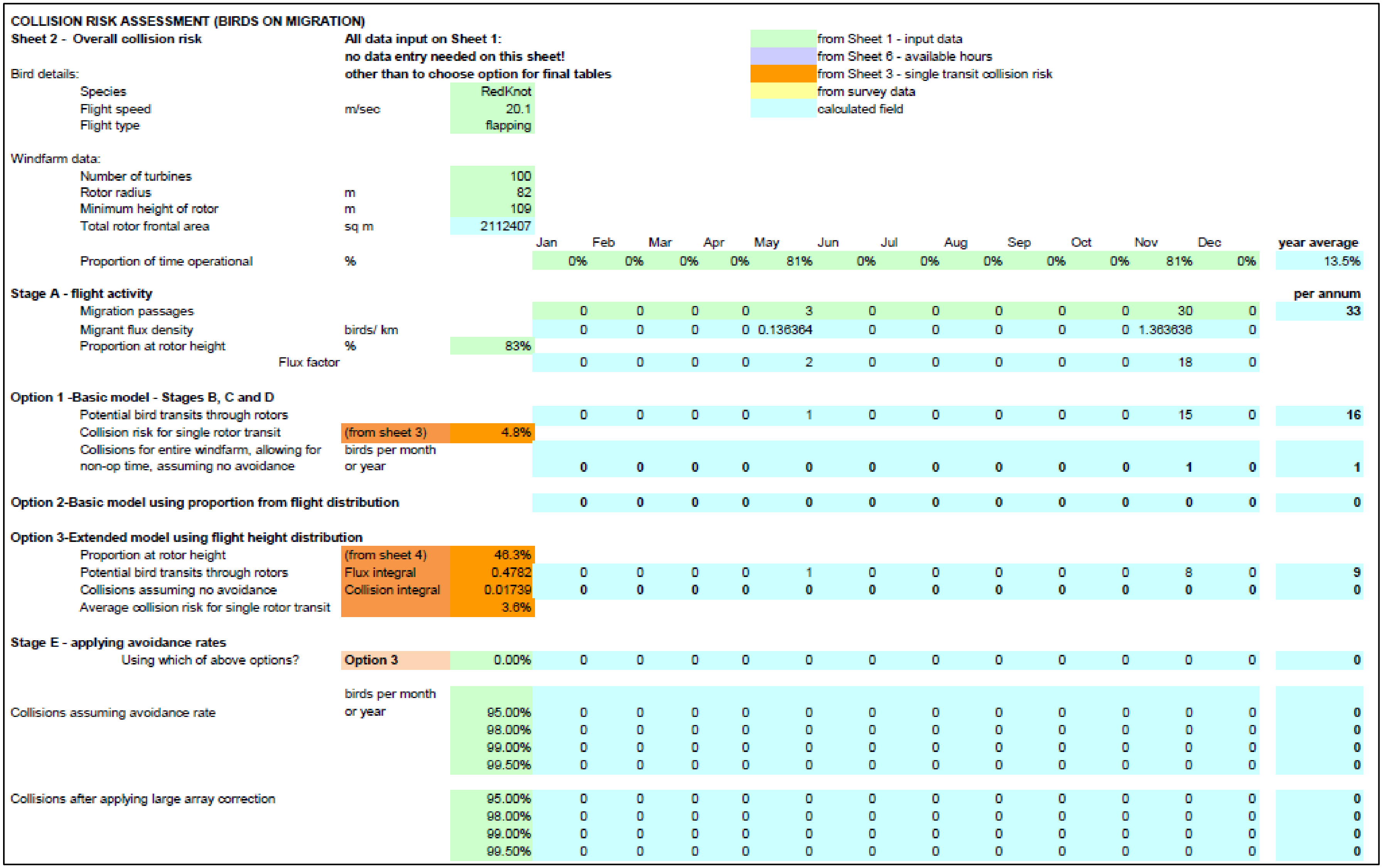
COLLISION RISK ASSESSMENT
Sheet 1 - Input data

🟩 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

	Units	Value	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Source
				Data sources											
Bird data															
Species name		RedKnot													
Bird length	m	0.24													Gordon and Nations 2016, Table 3.1
Wingspan	m	0.54													Gordon and Nations 2016, Table 3.1
Flight speed	m/sec	20.1													Gordon and Nations 2016, Table 3.1
Nocturnal activity factor (1-5)		5													Table A-8, Robinson Willmott et al., 2013; Loring et al 2018
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	%	34.6%													
				Data sources											
Birds on migration data															
Migration passages	birds						3						30		Fall:1500 birds*2% (Gordon and Nations 2016, Loring et al 2018); Spr: 150*2%
Width of migration corridor	km	22													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											
Windfarm data															
Name of windfarm site		Vineyard													
Latitude	degrees	41.00													
Number of turbines		100													dSEIS
Width of windfarm	km	22													DEIS
Tidal offset	m	1													DEIS, Table ES-1 footnote a
	Units	Value		Data sources											
Turbine data															
Turbine model		MHI Vestas V164-8MW													
No of blades		3													DEIS
Rotation speed	rpm	10.5													average rpm, cutin 4 m/s
Rotor radius	m	82													DEIS
Hub height	m	109	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DEIS
Monthly proportion of time operational	%						81%						81%		Prop time turbines would be spinning when birds are flying, Loring et al 2018, Fig 12.
Max blade width	m	5.400													
Pitch	degrees	0													

Avoidance rates used in presenting results	95.00%		Data sources (if applicable)
	98.00%	X	SHN 2018
	99.00%		
	99.50%		

Figure 14a. Data used in the “input data” spreadsheet within the Band (2012) collision risk model for Red Knot.



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		RedKnot													
Flight speed	m/sec	20.1													
Flight type		flapping													
Windfarm data:															
Number of turbines		100													
Rotor radius	m	82													
Minimum height of rotor	m	109													
Total rotor frontal area	sq m	2112407													
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**year average**
Proportion of time operational	%		0%	0%	0%	0%	81%	0%	0%	0%	0%	0%	81%	0%	13.5%
Stage A - flight activity															**per annum**
Migration passages			0	0	0	0	3	0	0	0	0	0	30	0	**33**
Migrant flux density	birds/ km		0	0	0	0	0.136364	0	0	0	0	0	1.363636	0	
Proportion at rotor height	%	83%													
Flux factor			0	0	0	0	2	0	0	0	0	0	18	0	
Option 1 -Basic model - Stages B, C and D															
Potential bird transits through rotors			0	0	0	0	1	0	0	0	0	0	15	0	**16**
Collision risk for single rotor transit	(from sheet 3)	4.8%													
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**	**1**	**0**	**1**
Option 2-Basic model using proportion from flight distribution			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Option 3-Extended model using flight height distribution															
Proportion at rotor height	(from sheet 4)	46.3%													
Potential bird transits through rotors	Flux integral	0.4782	0	0	0	0	1	0	0	0	0	0	8	0	**9**
Collisions assuming no avoidance	Collision integral	0.01739	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Average collision risk for single rotor transit		3.6%													
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**
	birds per month or year														
Collisions assuming avoidance rate		95.00%	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		95.00%	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**

Figure 14b. Results as presented in the “Migrant collision risk” spreadsheet within Band (2012) collision risk model for Red knot.

Appendix A: Species Conclusions Table

Common Name	Conclusion	ESA Section 7 Determination	Notes/Documentation
Roseate Tern *(Sterna dougallii)*	No records of species occurrence in the proposed project area.	May Affect, Not Likely to Adversely Affect	There are no records of roseate terns in the offshore portion of the project area (USFWS 2018d). In a regional telemetry study, no roseate terns were tracked flying through the proposed location of wind turbines; in addition, terns fly below the rotor swept area during migration and fly when visibility is good. Based on results from a collision risk model, no roseate terns will 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 the construction phase of the project (Epsilon 2018). To minimize the attraction of birds, the Project will consider anti-perching devices, where and if appropriate, to reduce potential bird perching locations. (Epsilon 2018). Lastly, Vineyard is developing a framework for a post-construction monitoring program for birds (Epsilon, 2018).
Piping Plover *(Charadrius melodus)*	No records of species occurrence in the proposed project area.	May Affect, Not Likely to Adversely Affect	Piping plovers may during migration over the OCS. There are no records of piping plovers in the offshore portion of the project area (USFWS 2018d). Piping plover fly outside of the rotor swept area and the small percentage (7%) of the piping plovers passing through the offshore project area will safely pass over the facility. Based on results from a collision risk model, no piping plovers will 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 the construction phase of the project (Epsilon 2018). To minimize the attraction of birds, the Project will consider anti-perching devices, where and if appropriate, to reduce potential bird perching locations. (Epsilon 2018). Lastly, Vineyard is developing a framework for a post-construction monitoring program for birds (Epsilon, 2018).

Common Name	Conclusion	ESA Section 7 Determination	Notes/Documentation
Rufa Red Knot *(Calidris canutus rufa)*	No records of species occurrence in the proposed project area.	May Affect, Not Likely to Adversely Affect	Red knots may occur during non-breeding season on the Massachusetts coast or during migration over the OCS. There are no records of red knots in the offshore portion of the project area (USFWS 2018d). 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 rotor swept area and the small percentage (2%) of the red knots passing through the offshore project area will safely pass over the facility. Based on results from a collision risk model, no red knots will 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 the construction phase of the project (Epsilon 2018). To minimize the attraction of birds, the Project will consider anti-perching devices, where and if appropriate, to reduce potential bird perching locations. (Epsilon 2018). Lastly, Vineyard is developing a framework for a post-construction monitoring program for birds (Epsilon, 2018).
Black-Capped Petrel (*Pterodroma hasitata)*	No records of species occurrence in the proposed project area.	No Effect	The Black-Capped Petrel breeds on the Island of Hispaniola, and occurs in offshore waters near the shelf break well outside of the proposed project area (see Figure 11).
Northern Long-Eared Bat (*Myotis septentrionalis)*	No records of species occurrence in the proposed Action Area	May Affect, Not Likely to Adversely Affect.	No known occupied hibernacula or maternity roost trees were identified within the Action Area (See Appendix B). Given the distance from shore, BOEM does not expect any northern long-eared bats to encounter operating WTGs, and as such, expects no adverse impacts to result from operations of the proposed Action.
American chaffseed (*Schwalbea americana*)	No records of species occurrence in the proposed onshore Action Area	No effect	No appropriate habitat for this species, which is described as, “fire-maintained…savannas and pinelands through the coastal plain” (USFWS 2018a), occurs in any part of the Action Area.
Critical habitat	No critical habitat present	No effect	IPaC

BO = biological opinion; WDA = wind development area; WTG = wind turbine generator