United States Department of the Interior

FISH AND WILDLIFE SERVICE

New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5087
https://www.fws.gov/office/new-england-ecological-services

September 28, 2023

Karen Baker
Bureau of Ocean Energy Management
Washington, D.C.
20240-0001

Re: Final biological opinion for the New England Wind offshore wind energy project
Project code: 2022-0077228

Dear Karen Baker:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion (Opinion) based on our review of the Bureau of Ocean Energy Management's (BOEM) biological assessment of the proposed authorization of the construction, operation, and decommissioning of the New England Wind offshore wind energy project (Project). New England Wind would be developed by Park City Wind LLC, a wholly owned subsidiary of Avangrid Renewables.

The Opinion considers the potential adverse effects of operating the Project on the federally threatened piping plover (*Charadrius melodus*) and rufa red knot (*Calidris canutus rufa*). The BOEM also requested our concurrence with the BOEM's determination that the proposed action may affect, but is not likely to adversely affect, the federally endangered roseate tern (*Sterna dougallii dougallii*). We received the BOEM's request for formal consultation on December 23, 2022, via email from David Bigger. Your request and our response are made in accordance with section 7 of the Endangered Species Act (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA). The BOEM determined the Project would have no effect on the federally endangered northern long-eared bat (*myotis septentrionalis*), northern red-bellied cooter (*Pseudemys rubriventris bangsi*), American chaffseed (*Schwalbea americana*), and sandplain gerardia (*Agalinus acuta*); or the tri-colored bat (*Perimyotis subflavus*), which is proposed for listing under the ESA.

May Affect, Not Likely to Adversely Affect Determinations

Roseate tern

The BOEM determined that the proposed action may affect, but is not likely to adversely affect, the roseate tern. Although no roseate terns have been confirmed present in the New England Wind project area, we expect roseate terns to occur in the action area annually during migratory flights and during foraging flights from the closest breeding colonies, which include islands in New York and New England (Loring et. al 2019). However, we concur with the BOEM's determination because:

- We do not expect any adverse effects during Project construction from noise, and indirect effects of habitat disturbance (e.g., from vessels, aircraft, pile driving, cable laying) would be insignificant. The likelihood of roseate terns colliding with stationary structures or vessels in the offshore environment is discountable. Turbine installation and cable laying would disturb the ocean floor, and these areas could be suitable habitat for roseate tern forage fish. However, most of the disturbance is temporary and would occur over an insignificant area relative to the surrounding available habitat.
- The best available information on roseate tern flight heights indicates the species generally would fly below the project's rotor-swept zone (RSZ) of 89 feet (ft [27 meters (m)]) to 1,171 ft (357 m) during foraging and transit flights (Hatch and Kerlinger 2004, Perkins et al. 2004, Loring et al. 2019). As compiled and summarized in USFWS (2023a), migratory flight heights of roseate terns are not well understood, and there is conflicting information on whether terns consistently occur above the RSZ during migration (Alerstam 1985, Veit and Petersen 1993) or rest and forage at sea surface during migration, potentially placing some of their migration flights through elevations consistent with the New England Wind RSZ (Oswold et al. 2023). We are not aware of information indicating, with reasonable certainty, that migrating roseate terns would cross the SouthCoast Wind wind turbine generator (WTG) area at RSZ heights with any regularity. In addition, both collision risk models (Band 2012, Adams et al. 2022) used to evaluate potential effects of the Project showed no predicted collisions over the life of the Project. Therefore, the risk of roseate terns colliding with operating WTGs is discountable.
- We expect any potential turbidity/seafloor disturbance impacts during cable emplacement and maintenance to be temporary and localized. Therefore, potential effects on prey resources such as sand lance (*Ammodytes spp.*) are expected to be insignificant.
- The likelihood of roseate terns being attracted to lighting on the WTGs is discountable, and any effects would be insignificant because (1) the aircraft detection lighting system (ADLS) would be active for a few minutes monthly, and (2) any birds that are attracted/disoriented by the ADLS are likely to be affected for only a few minutes.
- To minimize attracting birds, including roseate terns, to offshore wind farm structures, Park City Wind will install bird perching-deterrent devices, where such devices can be

safely deployed, on the WTGs and electrical service platforms (ESPs); therefore, the likelihood of roseate terns perching on WTGs and ESPs is discountable.

Consultation History

In addition to the consultation history listed below, the BOEM and the Service coordinated regularly via email, telephone, and meetings since 2021.

- September 7, 2022: The BOEM submitted a draft BA, dated September 2022, to the Service.
- November 14, 2022: The Service provided comments on the draft BA to the BOEM.
- December 23, 2022: The BOEM submitted a final BA, dated December 2022 (BOEM 2022a), to the Service and requested initiation of informal consultation under section 7 of the ESA for the New England Wind Project.
- March 28, 2023: The BOEM provided the Service with an addendum (BOEM 2023a), dated March 28, 2023, to the December 2022 BA. The addendum included updates to estimates of collision risk for species covered in the BA.
- April 6, 2023: The Service acknowledged the BOEM’s request to initiate formal consultation and confirmed that the consultation packet is complete.
- May 15, 2023: The BOEM changed the effects determination for the northern long-eared bat from “may affect, not likely to adversely affect,” to “no effect.”
- May 25, 2023: The BOEM provided additional conservation measures for inclusion in the project description.
- July 7, 2023: The BOEM provided the Service with a second addendum (BOEM 2023b), dated June 21, 2023, to the December 2022 BA. The addendum added the tri-colored bat to the species considered in the BA and determined the proposed action would have “no effect” on the tri-colored bat.
- August 2, 2023: The Service issued a draft biological opinion, dated August 2, 2023, for the proposed action to the BOEM for review.
- August 8 through 15, 2023: The BOEM, the Bureau of Safety and Environmental Enforcement, and Park City Wind submitted comments on the draft biological opinion to the Service via email, letter, and meetings.
- August 23, 2023: The BOEM provided the Service with a third addendum (BOEM 2023c), dated August 23, 2023, to the December 2022 BA. The addendum added an additional substation to the project description and modified language regarding compensatory mitigation in the project description.

We based the following Opinion on information provided in your request for consultation; the BOEM’s final biological assessment (BA) for the Project (BOEM 2022a); the BOEM’s March, July, and August 2023 addenda to the 2022 BA (BOEM 2023a, 2023b, 2023c); the BOEM’s draft environmental impact statement (draft EIS [BOEM 2022b]); the 2022 construction and operations plan (COP) for the Project (Epsilon 2022); correspondence between Service and BOEM staff; and other sources of information. We can make a complete decision file of this consultation available at the Service's New England Field Office in Concord, New Hampshire.

If you have any questions regarding this Opinion, please contact David Simmons at david_simmons@fws.gov or 603-333-5440 or me at audrey_mayer@fws.gov or 603-496-5181.

Sincerely yours,

AUDREY MAYER

Digitally signed by AUDREY MAYER
Date: 2023.09.28 13:24:39 -04'00'

Audrey Mayer
Supervisor
New England Field Office

CC:

- Karen.Baker@boem.gov
- David.Bigger@boem.gov
- Brian.Hooker@boem.gov
- Christine.crumpton@boem.gov
- James_Gruhala@fws.gov
- frankie_green@fws.gov
- stephanie_vail-muse@fws.gov
- david_simmons@fws.gov
- melissa_phillips-hagedorn@fws.gov
- lindsey.spinelli@sol.doi.gov
- Susan.Bossie@sol.doi.gov

BIOLOGICAL OPINION

BACKGROUND AND INTRODUCTION

This document represents the U.S. Fish and Wildlife Service's (Service) biological opinion (Opinion) based on the Service's review of the Bureau of Ocean Energy and Management's (BOEM) biological assessment (BA) of the New England Wind Project and its effects on the federally threatened piping plover (*Charadrius melodus)* and rufa red knot (*Calidris canutus rufa*) in accordance with section 7 of the ESA (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq). The BOEM was the lead action agency for this consultation (50 CFR 402.07).

DESCRIPTION OF PROPOSED ACTION

Project Description

As defined in the ESA section 7 regulations (50 CFR 402.02), "action" means "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." The following is a summary of the proposed action. Additional details are located in the biological assessment (BA)(BOEM 2022a), three BA addenda (BOEM 2023a, BOEM 2023b, BOEM 2023c), and the construction and operations plan (COP) for the Project (Epsilon 2022).

The BOEM proposes to approve a COP for construction, operation and maintenance (O&M), and eventual decommissioning of New England Wind, an offshore wind energy facility within the BOEM Renewable Energy Lease Area OCS-A 0534[1] (Lease Area). The New England Wind project is located on the outer continental shelf (OCS) approximately 20 miles (32 kilometers [km]) south of Martha's Vineyard, Massachusetts, and approximately 66 miles (106 km) east of Long Island, New York (Figure 1). The New England Wind project consists of two phases, Park City Wind (Phase 1) and Commonwealth Wind (Phase 2), and has a lease term of 33 years that commences upon COP approval (Figure 2).

The offshore components of the Project would include:

- up to one hundred thirty (130) grid positions for wind turbine generators (WTG) and electrical service platforms (ESP);
- inter-array cables linking the individual WTGs to the ESPs;

---

[1] The New England Wind Lease OCS-A 0534 was originally included within the Vineyard Wind 1 Lease OCS-A 0501. In mid-2021, BOEM approved the split of Lease OCS-A 0501– the northern portion remained Lease OCS-A 0501 and the southern portion was designated Lease OCS-A 0534. In late 2021, BOEM approved the assignment of Lease OCS-A 0534 to Park City Wind LLC. If Vineyard Wind 1 does not develop all WTG positions within its lease area, it may assign remaining WTG positions to Park City Wind LLC for use as one or more of the Project's WTGs and ESPs. This biological opinion considers WTG positions that were not included in a previous consultation.

- inter-link cables linking the individual ESP's together;
- up to five offshore export cables connecting the ESPs to up to two onshore/offshore transition points; and
- up to two transition points from ocean to land that would utilize horizontal directional drilling (HDD), except at Wianno Avenue, which would use open trench technique due to steep terrain.

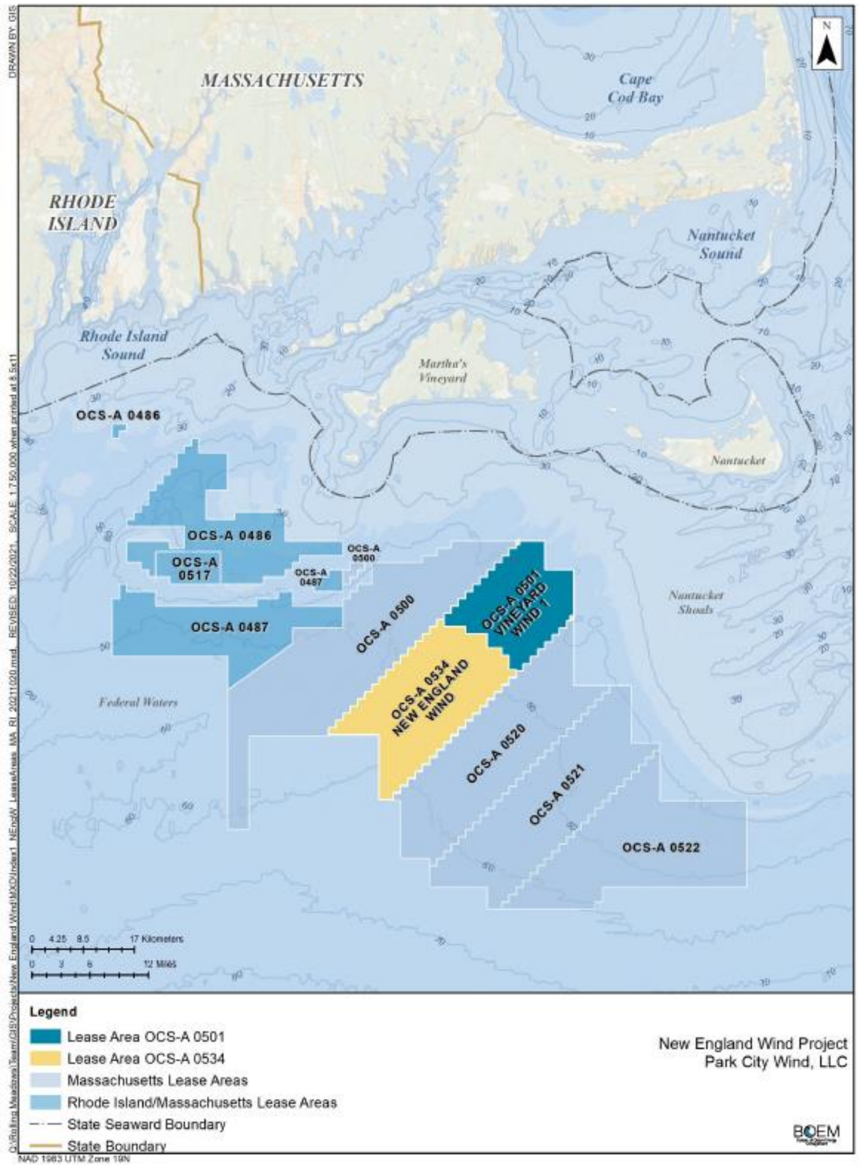


Figure 1. New England Wind project vicinity (BOEM 2022b).

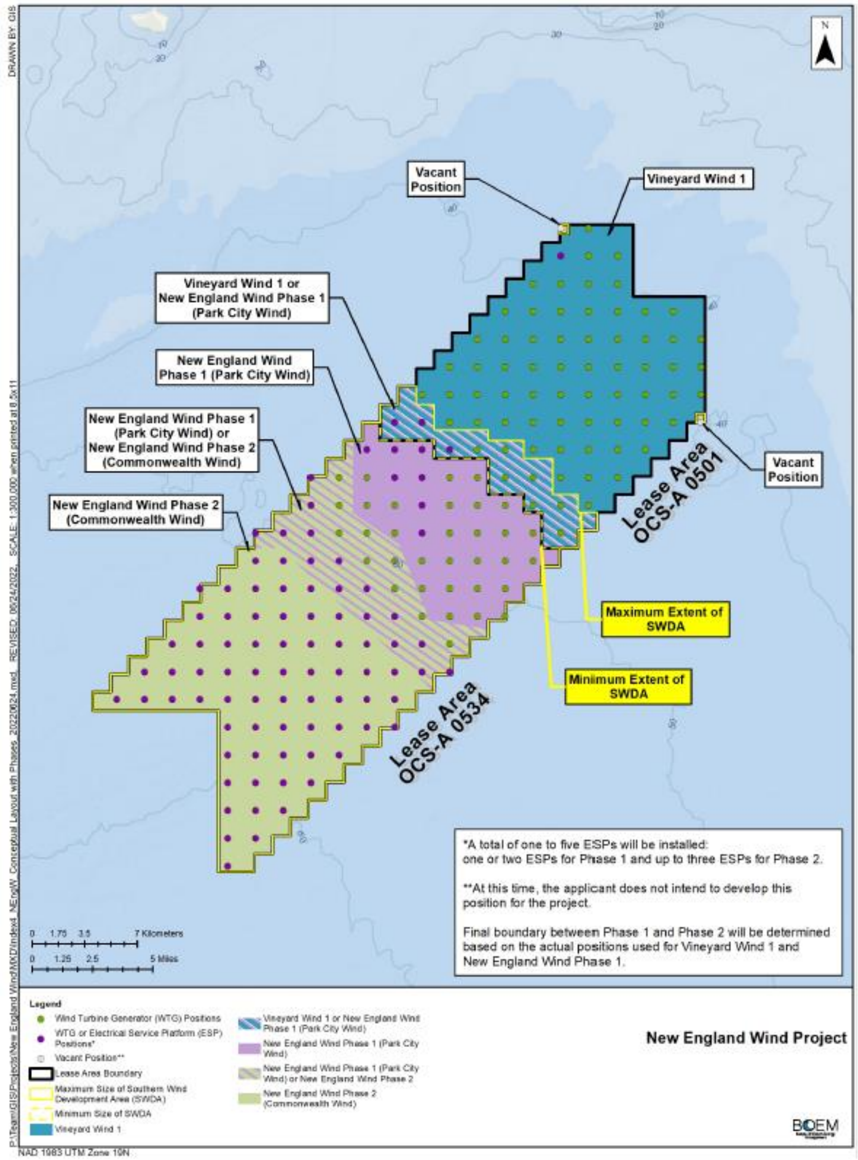


Figure 2. New England Wind wind turbine area overview (BOEM 2022b).

The onshore components of the Project would include:

- Up to 2 landfall sites:
  - Phase 1 landfall site options: Craigville Public Beach or Covell's Beach in Barnstable, Massachusetts.
  - Phase 2 landfall site options: Dowses Beach or Wianno Avenue in Barnstable, Massachusetts.

- Up to 2 underground concrete transition vaults at the landfall site to connect the offshore export cable to the onshore export cable;
- Up to 2 onshore export cables;
- Up to two onshore substations, one per phase:
    - Phase 1 substation: A substation, grid interconnection cables and facilities, and access road. This would require clearing up to 10.5 acres, on up to 3 parcels, located adjacent to or nearby the existing West Barnstable substation where the Project would connect to the electrical grid.
    - Phase 2 substation options:
        - Clay Hill substation site: A substation, stormwater features, and access road. This would require clearing up to 13.6 acres (including 13.3 acres of forested habitat), on up to 8 parcels, located approximately 0.25 miles west of the existing West Barnstable substation.
        - Old Falmouth Road substation site: This substation would require up to 18.5 acres (amount of vegetation clearing undetermined at this time), on up to 4 parcels, located approximately 2.5 miles west of the existing West Barnstable substation.

The WTGs would be arranged in a grid with 1 nautical mile (1.85 km) between turbines from north-to-south and east-to-west. Park City Wind's proposal includes a total turbine height of approximately 1,171 ft (357 meters (m)) above mean lower low water (MLLW), hub height of 702 ft (214 m) above MLLW, rotor diameter of approximately 935 ft (285 m), and an air gap of approximately 89 ft (27 m) above MLLW[2].

Conservation Measures

The Service's Consultation Handbook defines "Conservation Measures" as "actions to benefit or promote the recovery of listed species that are included by a Federal agency as an integral part of a proposed action under ESA consultation. These actions will be taken by the Federal agency or applicant, and serve to minimize or compensate for, project effects on the species under review" (USFWS and NMFS 1998). Conservation Measures may include actions that the Federal agency or applicant have committed to complete in a BA or similar document. When used in the context of the ESA, "Conservation Measures" represent actions pledged in the project description that the action agency or the applicant will implement to further the recovery of the species under review and can contribute to the Federal agency's Section 7(a)(1) responsibilities. Such measures may be tasks recommended in the species' recovery plan, should be closely related to

---

[2] The 214 m hub height is the maximum potential hub height, as reported in the COP (Epsilon 2022). However, for the collision risk model inputs, BOEM added the minimum air gap (27 m) to the maximum rotor radius (142.5 m) to obtain a hub height of 170 meters.

the action, and should be achievable within the authority of the action agency or applicant. Because Conservation Measures are part of the proposed action, their implementation is required under the terms of the consultation (USFWS and NMFS 1998). The following Conservation Measures have been adopted by BOEM (*i.e.*, in the BA and/or via subsequent correspondence) to abate collision risk to listed birds posed by operation of the New England Wind turbines. These measures also include an ongoing, long-term commitment to reduce the uncertainty associated with the estimated rates of collision mortality for each covered bird species.

Section 6 of the BA contains a list of environmental protection measures Park City Wind would implement to avoid or minimize impacts on the piping plover and rufa red knot during operation of the Project. We summarize those measures as follows:

- Install bird perching deterrents on WTGs and ESPs.
- In coordination with the BOEM, the Bureau of Safety and Environmental Enforcement (BSEE), and the U.S. Fish and Wildlife Service (Service), finalize and implement an avian and bat post-construction monitoring plan (ABPCMP), including installing technology to monitor use of, and estimate exposure to, the lease area by piping plovers and rufa red knots, other migratory birds, and bats.
- Implement a protocol for reporting any dead or injured birds and bats detected in the project area.
- Design lighting to avoid and minimize attracting birds or altering their behavior. This would include using red flashing avian obstruction lights, hooded/down-shielded lights when possible, and the aircraft detection lighting system (ADLS).
- Implement the piping plover protection plan (PPPP) at beach landfall sites.

On May 25, 2023, BOEM provided additional, and complementary, detailed conservation measures for inclusion in the project description. Detailed descriptions for each conservation measure are provided in Appendix A.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATION

"Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). In accordance with policy and regulation, the jeopardy analysis in this Opinion relies on 4 components: (1) Status of the Species, which evaluates the rangewide condition of the rufa red knot and piping plover, the factors responsible for that condition, and the species' survival and recovery needs; (2) Environmental Baseline, which evaluates the status of the rufa red knot and piping plover in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species; (3) Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action on the rufa red knot and piping plover; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities reasonably certain to occur in the action area on the rufa red knot and piping plover. The jeopardy analysis in this Opinion emphasizes the rangewide survival and recovery needs of the listed species and the role of the action area in providing for those needs. Within this context we evaluate the significance of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination (50 CFR 402.14(g)).

To conduct this analysis, we begin by assessing whether there are effects to any individuals of the species of interest (as discussed in the effects analysis section below). If we are able to show that individuals are likely to experience reductions in their reproductive success or survival likelihood, we are required to assess how those effects are or are not anticipated to result in an appreciable reduction in the likelihood of both the survival and recovery of the species.

Because many species are composed of multiple populations and there may be meaningful differences in those populations (e.g., genetics, morphology, size) to the overall species survival and recovery, it is a logical intermediate step to evaluate the effects of impacts to individuals on the population(s) they are associated with. If our analyses indicate that reductions in the reproduction, numbers, and distribution of the population(s) are not likely to occur, then there can be no appreciable reductions in reproduction, numbers, or distribution at a species level and we conclude that the action agency has ensured that their action is not likely to jeopardize the continued existence of the species. If there are reductions in the reproduction, numbers, and distribution of the population(s) impacted, we then assess whether those changes affect the overall species survival and recovery rangewide based on the importance of the population(s) for species level representation, resiliency and redundancy, the level of impact, and the status of the species.

STATUS OF THE SPECIES

Per the implementing regulations for section 7 of the ESA (50 CFR 402.14(g)(2)), the Service must "Evaluate the current status and environmental baseline of the listed species or critical habitat." The following is a summary of the species' general life history drawn primarily from Service assessment, listing, and recovery documents.

Piping Plover

Listing and Life History

Three populations of piping plover are recognized and distinguished by their distinctive breeding grounds—the Atlantic Coast, the Great Lakes, and the Northern Great Plains of the United States and Canada. Under the ESA, the Service listed the Atlantic Coast and Northern Great Plains populations as threatened and the Great Lakes population as endangered in 1986 (50 FR 50726). Additionally, the Service completed recovery plans for each breeding population.

All three populations winter along the U.S. coast from North Carolina to Texas, as well as in Mexico and the Caribbean (USFWS 2020a). The two inland breeding populations, the Great Lakes and the Northern Great Plains, breed on the shorelines of the Great Lakes and along the rivers and lakes in the Northern Great Plains, respectively. The Atlantic Coast piping plover population breeds on coastal beaches from Newfoundland to North Carolina and winters along the Atlantic Coast from North Carolina south, along the Gulf Coast, and in the Caribbean (USFWS 1996).

The Service designated critical habitat for wintering piping plovers of all three populations in 2001 (66 FR 36038) and revised the designation in 2008 (73 FR 62816). The critical habitat extends along the coast from North Carolina through Texas (USFWS 2020a). As the critical habitat does not overlap the action area, we do not consider it in this Opinion.

The piping plover is a small shorebird approximately 7 inches long with a wingspan of about 15 inches. Piping plovers are present on New England beaches during the breeding season, generally between April 1 and August 31, though migrants may be present into October. These territorial birds nest above the high tide line, usually on sandy ocean beaches and barrier islands, but also on gently sloping foredunes, blowout areas behind primary dunes, washover areas cut into or between dunes, the ends of sandspits, and deposits of suitable dredged or pumped sand. Piping plover nests consist of a shallow scrape in the sand, frequently lined with shell fragments and often located near small clumps of vegetation. Females lay up to four eggs that hatch in about 25 days. Piping plovers generally fledge only a single brood per season but may renest several times if previous nests are lost or, infrequently, if a brood is lost within several days of hatching. Flightless chicks follow their parents to feeding areas, which include the intertidal zone of ocean beaches, ocean washover areas, mudflats, sandflats, wrack lines, and the shorelines of coastal ponds, lagoons, and salt marshes. Surviving chicks fledge after about 25 to 35 days. Piping plover adults and chicks feed on marine macroinvertebrates such as worms, fly larvae, beetles, and crustaceans (USFWS 1996).

Threats

Threats to piping plovers on the Atlantic Coast include habitat loss and degradation, human disturbance of nesting birds, predation, and oil spills (USFWS 1996). All of the major threats—habitat loss and degradation, disturbance, predation—identified in the 1986 listing rule and 1996 revised recovery plan remain persistent and pervasive, and oil spills are a continuing moderate threat (USFWS 2020a). Habitat loss and degradation result from development, as well as from beach stabilization, beach nourishment, beach raking, dune stabilization, and other physical alterations to the beach ecosystem. Development and artificial shoreline stabilization pose continuing widespread threats to the low, sparsely vegetated beaches juxtaposed with abundant moist foraging substrates on which breeding Atlantic Coast piping plovers rely. Threats from human disturbance and predation remain ubiquitous along the Atlantic Coast. Human disturbance of nesting birds includes foot traffic, kites, pets, fireworks, mechanical raking, construction, and vehicle use. These disturbances can result in crushing of eggs, nest abandonment by adults, and death of chicks (e.g., through effects to their energy budgets). Predation on piping plover chicks and eggs is intensified by development because predators such as foxes (*Vulpes vulpes*), rats (*Rattus norvegicus*), raccoons (*Procyon lotor*), skunks (*Mephitis mephitis*), crows (*Corvus* spp.), and gulls (*Larus* spp.) thrive in developed areas and are attracted to beaches by human food scraps and trash. Unleashed dogs (*Canis familiaris*) and cats (*Felis domesticus*) also disturb courtship and incubation and prey on chicks and adults (USFWS 1996, 2020a). The best available information indicates that disease, environmental contaminants, and overutilization are not current threats to Atlantic Coast piping plovers (USFWS 2020a).

Two new threats, climate change and WTGs, have been identified in recent Service reviews (USFWS 2020a). Climate change, especially sea level rise, and wind turbines are likely to affect Atlantic Coast piping plovers throughout their annual cycle. Some aspects of climate change remain uncertain, but ongoing acceleration of sea level rise is well documented. Further increases in sea level rise rates are foreseeable with a high degree of certainty, and effects of sea level rise on Atlantic Coast piping plovers and their habitat will be partially determined by coastal management activities. Although threats from WTGs are foreseeable, the magnitude is poorly understood. As the BOEM's offshore wind leasing and review of projects has advanced, there is an increasing degree of certainty about the likely locations of future projects; however, the timing and extent of full coastwide buildout of WTGs on the OCS is still unknown, and any effects of the turbines on migrating birds (e.g., collision, behavioral effects) are even more difficult to study and characterize offshore than on land. Four offshore wind farm projects along the Atlantic Coast have completed formal section 7 ESA consultation. Table 1 provides an overview of the anticipated piping plover take from these projects' WTGs.

Table 1. Summary of anticipated piping plover incidental take for Atlantic Coast offshore wind energy projects that have completed formal consultation with the Service[1].

Date of Opinion Issuance	Project Name	Anticipated Take (Annual)	Project Duration	Anticipated Take (Project Duration)
5/12/2023	Ocean Wind 1	<1	35 years	5
5/30/2023	Revolution Wind	<1	35 years	3
6/22/2023	Empire Wind	<1	35 years	2
6/29/2023	Sunrise Wind	<1	35 years	2
8/31/2023	Coastal Virginia	<1	33 years	29
9/1/2023	SouthCoast Wind[2]	<1	35 years	6
TOTAL		**<6**		**~47**

[1] As part of the proposed actions for the first 4 projects in this table, the BOEM is requiring the applicants to implement compensatory mitigation for injury or death of listed species caused by the projects.

[2] USFWS 2023b

New information demonstrates the important effect of wintering site conditions on annual survival rates, a factor to which piping plover populations are highly sensitive as discussed below. Although progress toward understanding and managing threats in this portion of the range has accelerated in recent years, substantial work remains to fully identify and remove or manage migration and wintering threats, including habitat degradation and increasing human disturbance (USFWS 2020a).

Demographics and Population Trends

Piping plovers are considered mature at age one (USFWS 1996) and may breed the first spring after hatching, although some birds do not breed their first year (Elliot-Smith and Haig 2020). Most birds breed each year if mates are available (Elliot-Smith and Haig 2020). Although piping plovers have been documented to live more than 11 years, we estimate based on typical survival rates that the average lifespan is approximately 5 to 6 years (USFWS 2023c). Estimates of annual adult survival in the 2000s on Long Island (70 percent) and eastern Canada (73 percent) were similar to those reported from the late 1980s in Massachusetts (74 percent) and Maryland (71 percent). There is currently no information regarding the distribution of mortality across the annual cycle of Atlantic Coast piping plovers. Two Atlantic Coast population viability analyses (PVAs) conducted in the 2000s confirmed the consistent finding of earlier piping plover PVAs that extinction risk is highly sensitive to small changes in adult and/or juvenile survival rates (Calvert et al. 2006, Brault 2007). Progress toward recovery could be slowed or reversed by even small, sustained decreases in survival, and it would be difficult to increase current fecundity levels sufficiently to compensate for widespread long-term declines in survival (USFWS 2009).

The 2021 Atlantic Coast piping plover population estimate of 2,289 pairs was almost triple the estimate of 790 pairs at the time of the 1986 ESA listing. Overall population growth is tempered by substantial geographic and temporal variability (Table 2). In the recovery plan, the Atlantic Coast piping plover population is delineated into four recovery units including Atlantic Canada, New England, New-York-New-Jersey (NY-NJ) and Southern (Delaware, Maryland, Virginia and North Carolina [USFWS 1996]). The largest population increase between 1989 and 2021 occurred in the New England recovery unit (514 percent), and the NY-NJ recovery unit experienced a net increase of 81 percent between 1989 and 2021. However, the NY-NJ population declined sharply from a peak of 586 pairs in 2007 to 378 pairs in 2014, before rebounding to 576 pairs in 2021. In Eastern Canada, where increases have been short-lived, the population posted a net 23 percent decline between 1989 and 2021. Declines in the Eastern Canada recovery unit typifies long-standing concerns about the uneven distribution and abundance of Atlantic Coast piping plovers (USFWS 2021a).

Atlantic Coast piping plover productivity is reported as number of chicks fledged per breeding pair. Rangewide productivity for the Atlantic Coast population from 1989 through 2006 was 1.35 chicks fledged per pair (annual range 1.16 to 1.54), and overall productivity decreased with decreasing latitude (Eastern Canada 1.61, New England 1.44, NY-NJ 1.18). Including more recent years, average annual productivity for the U.S. Atlantic Coast from 1989 to 2018 was 1.25

fledged chicks per pair. The overall U.S. Atlantic Coast productivity estimate was 1.38 fledged chicks per pair in 2019, 1.25 in 2020, and 1.09 in 2021—the fifth lowest since 1989 (USFWS 2021a).

In summary, the overall status of the Atlantic Coast piping plover is improving, though unevenly. The Atlantic Canada recovery unit is declining sharply, the New England recovery unit is increasing sharply, and the NY-NJ recovery unit is tenuously stable.

Table 2. Estimated numbers of pairs* of Atlantic Coast piping plovers, 2012-2021 (USFWS 2021a)

	Atlantic Canada	**New England**	**NY-NJ**	**Southern****	**Total**
2012	179	865	463	377	1,884
2013	184	854	397	358	1,793
2014	186	861	378	354	1,779
2015	179	914	416	362	1,871
2016	176	874	496	386	1,932
2017	173	874	497	359	1,903
2018	181	916	486	295	1,878
2019	190	980	540	309	2,019
2020	158	1,047	508	277	1,990
2021	180	1,264	576	269	2,289
average	179	945	476	335	1,935

*Recovery criteria: Eastern Canada=400. New England=625. NY-NJ=575. Southern=400. Total=2,000
**Presented for context but not considered in this Opinion.

<u>Recovery</u>
The security of the Atlantic Coast piping plover is fundamentally dependent on even distribution of population growth across the breeding range, in order to maintain a sparsely distributed species with strict biological requirements in the face of environmental variation, buffer it against catastrophes, and conserve adaptive capacity (USFWS 2020a). Recovery criteria established in the recovery plan define population and productivity goals for each recovery unit, as well as for the population as a whole. Attainment of these goals for each recovery unit is an integral part of a piping plover recovery strategy that seeks to reduce the probability of extinction for the entire population by (1) contributing to the population total, (2) reducing vulnerability to environmental variation (including catastrophes), and (3) increasing likelihood of genetic interchange among subpopulations. Recovery depends on attainment and maintenance of the minimum population levels for the four recovery units. Any appreciable reduction in the likelihood of survival of a recovery unit will also reduce the probability of persistence of the entire population (USFWS 1996).

As described in the recovery plan (USFWS 1996), the recovery criteria, which reflect the conservation tenets of representation, redundancy, and resiliency (3Rs), for the Atlantic Coast piping plover population include:

1. maintain a total of 2,000 breeding pairs, distributed among the four recovery units, for at least 5 years—400 pairs in Atlantic Canada, 625 pairs in New England, 575 pairs in NY-NJ, and 400 pairs in the Southern unit;
2. verify the adequacy of a 2,000-pair population of piping plovers to maintain heterozygosity and allelic diversity over the long term;
3. 5-year average productivity rate of 1.5 chicks per pair in each recovery unit;
4. institute long-term agreements to assure protection and management sufficient to maintain the population targets and average productivity in each recovery unit; and
5. ensure long-term maintenance of wintering habitat sufficient in quantity, quality, and distribution to maintain survival rates needed for a 2,000-pair population.

None of the recovery criteria have been fully met.

Rufa red knot

Listing and Life History
The Service listed the rufa red knot as threatened under the ESA in 2015 (79 FR 73705). The Service published a proposed rule to designate critical habitat for the rufa red knot in 2021 (86 FR 37410) and published a revised proposed rule in April 2023 (88 FR 22530). The proposed critical habitat does not overlap with the action area; therefore, we do not consider critical habitat for this species in this Opinion.

The rufa red knot is a medium-sized (9 to 10 inches long) shorebird that migrates annually between breeding grounds in the central Canadian Arctic and four wintering regions: (1) the Southeast United States and through the Caribbean; (2) the western Gulf of Mexico from Mississippi through Central America and along the western coast of South America (Western); (3) northern Brazil and extending west along the northern coast of South America (North Coast of South America); and (4) Tierra del Fuego at the southern tip of South America (mainly in Chile) and extending north along the Patagonian coast of Argentina (Southern). This subspecies shows very high fidelity to wintering region, with habitat, diet, and phenology varying appreciably among birds from different regions (USFWS 2014).

Some rufa red knots migrate more than 9,300 miles, one of the longest migrations of any animal. Migrating rufa red knots can complete non-stop flights of 1,500 miles or more, converging on vital stopover areas to rest and refuel along the way. The single most important spring staging area is along the shores of Delaware Bay in Delaware and New Jersey, where rufa red knots achieve very high rates of weight gain feeding on the eggs of spawning horseshoe crabs (*Limulus* *polyphemus*). However, Delaware Bay is only one in a network of essential staging areas, where large numbers of birds recover from long migration flights, rapidly regaining weight before departing on the next leg of their journey. In addition to staging areas, rufa red knots also use other stopover habitats in smaller numbers and/or for shorter durations.

Large and small groups of rufa red knots, sometimes numbering in the thousands, may occur in suitable habitats from the southern tip of South America to central Canada during the migration seasons. The timing of spring and fall migration varies across the range (USFWS 2014).

Coastal habitats used by rufa red knots in migration and wintering areas are similar in character—generally coastal marine and estuarine habitats with large areas of exposed intertidal sediments. Migration and wintering habitats include both high-energy oceanfront or bayfront areas, as well as tidal flats in more sheltered bays and lagoons. Preferred nonbreeding microhabitats are muddy or sandy coastal areas, specifically, the mouths of bays and estuaries, tidal flats, and unimproved tidal inlets. In many wintering and stopover areas, quality high-tide roosting habitat (*i.e.*, close to feeding areas, protected from predators, with sufficient space during the highest tides, free from excessive human disturbance) is limited. In nonbreeding areas, rufa red knots require sparse vegetation to avoid predation. Unimproved tidal inlets are preferred nonbreeding habitats. Along the Atlantic Coast, dynamic and ephemeral features are important rufa red knot habitats, including sand spits, islets, shoals, and sandbars, and other features often associated with inlets.

In coastal nonbreeding areas, rufa red knots feed in the intertidal zone by probing for invertebrate prey, especially small clams, mussels, and snails, but also crustaceans, and marine worms. Horseshoe crab eggs are a preferred food wherever they occur. On the breeding grounds, rufa red knots mainly eat insects. The timing of food resources (*e.g.*, insect prey on the breeding grounds, horseshoe crab eggs or mollusks at stopover areas) with the species' migratory lifecycle is a critical need (USFWS 2014).

Threats

The Service completed a Species Status Assessment (SSA [USFWS 2020b]) that classified 24 threats to the rufa red knot. Threats that are driving the rufa red knot's status as a threatened species under the ESA are classified as High Severity in the SSA, and include loss of breeding and nonbreeding habitat due to sea level rise, coastal engineering/stabilization, coastal development, and Arctic ecosystem change; likely effects related to disruption of natural predator cycles on the breeding grounds; reduced prey availability throughout the nonbreeding range; and increasing frequency and severity of asynchronies in the timing of the species' annual migratory cycle relative to favorable food and weather conditions. Threats classified as Moderate Severity in the SSA cause additive mortality that cumulatively exacerbate the effects of the High Severity threats. Moderate Severity threats include hunting; predation in nonbreeding areas (*e.g.*, by peregrine falcons [*Falco peregrinus*]); harmful algal blooms; human disturbance; oil spills; and wind energy development, especially near the coasts. Threats classified as Low Severity in the SSA were evaluated in the final listing rule, but the Service concluded they are not contributing to the rufa red knot's threatened status under the ESA. These include beach cleaning, agriculture, research activities, and disease (USFWS 2020b). One new threat has been identified that was not considered at the time of listing, namely Arctic habitat damage caused by overabundant goose populations. At this time, we consider goose overpopulation a Moderate Severity threat, but recognize high uncertainty around how geese may be impacting rufa red knot reproductive rates (USFWS 2021b).

Threats from wind energy development are foreseeable, but the magnitude of this threat remains poorly understood. Information is lacking to assess site-specific effects and strategies to address cumulative effects of future offshore wind energy projects have not been developed. Offshore wind energy development is likely to make at least modest additional contributions to mortality in the coming decades (USFWS 2021b). Watts et al. (2015, pp. 37, 40) found that rufa red knots have notably low limits of sustainable mortality from anthropogenic causes, such as hunting, oil spills, and wind turbine collisions. Four offshore wind farm projects along the Atlantic Coast have completed formal section 7 ESA consultation. Table 3 provides an overview of the anticipated rufa red knot take from these projects' WTGs.

Table 3. Summary of anticipated rufa red knot incidental take for Atlantic Coast offshore wind energy projects that have completed formal consultation with the Service[1].

Date of Opinion Issuance	Project Name	Anticipated Take (Annual)	Project Duration	Anticipated Take (Project Duration)
5/12/2023	Ocean Wind 1	1	35 years	35
5/30/2023	Revolution Wind	18	35 years	630
6/22/2023	Empire Wind	>1	35 years	37
6/29/2023	Sunrise Wind	<1	35 years	31
8/31/2023	Coastal Virginia	>2	33 years	71
9/1/2023	SouthCoast Wind[2]	<2	35 years	67
TOTAL		**~25**		**871**

[1] As part of the proposed actions for the first 4 projects in this table, the BOEM is requiring the applicants to implement compensatory mitigation for injury or death of listed species caused by the projects.
[2] USFWS 2023b

Demographics and Population Trends

Rufa red knots exhibit low fecundity, delayed maturity, and high annual survival. The rufa red knot's typical life span is at least 7 years, with the oldest known wild bird at least 21 years old. Age of first breeding is at least 2 years (USFWS 2014). Adult birds are known to sometimes forgo breeding and remain in nonbreeding habitats during the breeding season (USFWS 2014, Martínez-Curci et al. 2020) but it is unknown how prevalent this phenomenon is and whether it varies spatially or temporally. The rufa red knot's breeding success varies dramatically among years in a somewhat cyclical manner. Two main factors seem to be responsible for this annual variation: abundance of small rodents (by indirectly affecting predation pressure on shorebirds) and weather (USFWS 2014).

Preliminary analysis suggests that an average reproductive rate in the range of 1.5 to 2 chicks per pair may be necessary for a stable population (Wilson and Morrison 2018), but further work is needed to refine this estimate. Modeling by Schwarzer (2011) suggests that populations are stable at around 8.75 percent juveniles among wintering birds, but this is also a preliminary estimate. Analysis of 2005 to 2018 data from the Delaware Bay staging area, which supports an estimated 50 to 80 percent of all rufa red knots each spring, found a mean recruitment rate of 0.075 (ASMFC 2022).

Baker et al. (2004) estimated adult survival rates for the Delaware Bay stopover population at 84.6 percent from 1994 to 1998, but only 56.4 percent from 1998 to 2001. McGowan et al. (2011) calculated a survival rate of about 92 percent for Delaware Bay from 1997 to 2008. The Atlantic States Marine Fisheries Commission (ASMFC [2022]) found an annual apparent survival rate of 93 percent at Delaware Bay from 2005 to 2018. For birds wintering in Florida, Schwarzer et al. (2012) found an average annual adult survival rate of 89 percent, with the 95 percent confidence interval overlapping the 92 percent survival estimate from McGowan et al. (2011). The similarity of Florida versus Delaware Bay survival rate estimates suggests that the key factors influencing survival may be acting outside of the wintering grounds (Schwarzer et al. 2012).

Based on best available information, the current total rangewide abundance estimate is just under 64,800 rufa red knots, distributed across four recovery units which correspond to the four wintering populations (Table 4). We conclude with moderate confidence that the North Coast of South America (NCSA) and the Southeast United States/Caribbean (SEC) recovery units are stable relative to the 1980s. The Southern recovery unit experienced a well-documented decline of about 75 percent during the 2000s, as well as a geographic contraction within these wintering grounds. The Southern wintering population has been stable since 2011 but has not shown any signs of recovery to date (USFWS 2020b, Matus 2021, Norambuena et al. 2022).

The decline of the Southern population, which had been the largest in the 1980s, drove a decline of the subspecies as a whole, mirrored in declines at several migration stopover areas and in analyses of various national and regional datasets. Overharvest of the horseshoe crab in Delaware Bay is considered the key causal factor in this decline, though numerous other past, ongoing, and emerging threats have also been identified, as discussed above (USFWS 2020b). The Service has determined that the horseshoe crab bait harvest has been adequately managed to avoid further impacts to rufa red knots at least since 2013 (USFWS 2014, USFWS 2022).

Table 4. Current estimates of rufa red knot abundance by recovery unit*

Wintering Population	**Current Abundance Estimate**	**Certainty**	**Source**
Southern (mean 2020-2022)	12,704	High	Norambuena et al. 2022, Matus 2021, WHSRN 2020
North Coast of South America	31,065	Moderate	Mizrahi 2020
Southeast U.S./Caribbean	15,500	Moderate	Lyons et al. 2017
Western**	5,500	Low	Newstead pers. comm. 2019, 2020
Total	**64,769**		

*Recovery criteria: Southern=35,000, Western=10,000
**Presented for context but not considered in this Opinion.

In summary, the overall status of the rufa red knot is stable but depleted. The NCSA and SEC recovery units are stable, while the Southern recovery unit has stabilized at about 25 percent of its size as documented approximately 40 years ago.

Recovery

The essential recovery strategy for the rufa red knot is to prevent erosion of this subspecies' limited inherent adaptive capacity by maintaining representation, and improving resiliency and redundancy, to support the rufa subspecies as it copes with inexorably changing conditions (i.e., from climate change) across its range and across its annual cycle. The Service delineated four recovery units corresponding to the four wintering populations listed above. Conservation of each recovery unit contributes to each of the 3Rs and is essential for the recovery of the entire subspecies. The recovery plan includes ten recovery criteria that address the 3Rs for each recovery unit. The recovery plan establishes population targets for each recovery unit, based on 10-year average abundance, and addresses other conservation needs for the rufa red knot, chiefly a wide-ranging network of nonbreeding habitats managed in a manner compatible with the population goals (USFWS 2023d).

ACTION AREA

The implementing regulations for section 7(a)(2) of the ESA define the "action area" as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for the Project includes surface and subsurface portions of the offshore environment, as well as nearshore and terrestrial areas affected by onshore project components.

This Opinion largely focuses on the areas where the proposed action may adversely affect one or more listed species over the operational life of the Project. Thus, this Opinion focuses on the offshore airspace within the wind turbine area, extending from the seabed to the maximum height of the turbine blade tip, as well as onshore areas where project activities may affect piping plovers or rufa red knots.

The wind turbine area is an irregularly shaped polygon (Figure 2) that is approximately 19 miles (32 km) wide. The closest land is the southwest corner of Martha's Vineyard, approximately 20 miles (32 km) to the north.

ENVIRONMENTAL BASELINE

In accordance with 50 CFR 402.02, the "environmental baseline refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline."

Status of the Species in the Action Area

Although the body of information about use of the OCS by the piping plover and rufa red knot has been growing over the last 10 to 15 years, our understanding of the species' presence in the OCS is still limited. We use all conceptual, qualitative, quantitative, and other relevant information to anticipate and describe the status of the species in the action area.

The offshore airspace within the wind turbine area is located within a migration corridor for both species, and its primary value to piping plovers and rufa red knots is as part of a flight corridor. Based on the 19.26-mile (31 km) wind farm width we used for the Band (2012) collision risk model, discussed below, the Wind Farm Area occupies about 11 percent of the width of the estimated piping plover migration corridor (180 miles [289 km]) and 0.84 of a percent of the estimated rufa red knot migration corridor (1,417 miles [2,281 km]), respectively. We focus our assessment on the WTG's rotor-swept zone (RSZ), which is between 89 ft (27m) and 1,171 ft (357 m) above MLLW.

In a literature review regarding collision risk, Burger et al. (2011) concluded that (1) the primary risk to piping plovers occurs during spring and fall migration, with risk decreasing with WTG distance from land; and (2) risk exposure of rufa red knots occurs during migratory flights, especially when flying across the OCS (rather than along the coast).

In a synthetic data analysis of the Atlantic Coast and OCS distributions of piping plover and rufa red knot, Normandeau (2011) identified potential migratory flight paths these species might use to cross the OCS rather than following the coast. Both piping plovers and rufa red knots probably "shortcut" across the OCS using long-distance flights instead of following the coastline, although some individual birds likely choose to complete multiple shorter-distance flights along the coast. Accordingly, both species would be exposed to WTGs on the OCS during spring and fall migrations, especially between Cape Cod and the mid-Atlantic U.S. Typical northbound migration patterns for rufa red knots result in less exposure to the action area in the spring. However, both species stage for fall migration on Cape Cod and use habitats in the mid-Atlantic, and we expect some individuals will pass through the action area on long-distance, cross-OCS, southward migration flights.

In recent years, emerging geospatial tracking technology has provided more specific and useful information than past methods; however, this technology requires receiving stations that currently do not exist offshore. As tagged birds move farther from receiving stations installed onshore, they eventually lose connection with receivers altogether until they again are within range of a receiver. Therefore, uncertainty about exact flight path, flight height, etc. grows dramatically in areas lacking receivers.

Tracking data used to assess the number and behavior of listed birds in the action area has been collected since 2007 and tracking technologies have advanced considerably since that time. However, studies far offshore are logistically and technologically challenging, and our understanding of how these species use the action area remains incomplete. Based on the accuracy of the tracking data available to date, we assume that all parts of the action area are equally likely to be utilized by listed species. We attempt to characterize piping plover and rufa red knot use of the action area relative to the surrounding OCS and adjacent coastline, but we do not have enough information to discern any differences in use of the action area that may exist along latitudinal or longitudinal gradients.

Piping Plover

The Great Lakes and Northern Great Plains piping plover populations are not known to occur within the action area and therefore are not considered in this Opinion. The Atlantic Coast piping plover population is known to occur within the action area as the population breeds on coastal beaches from Newfoundland to North Carolina and winters along the Atlantic Coast from North Carolina south, along the Gulf Coast, and in the Caribbean (USFWS 1996). The species could occur in suitable sandy and intertidal habitat at, or near, the export cable landfall sites.

Piping plovers from the Atlantic Coast population's Southern recovery unit spend their entire life cycle south of the action area. We expect piping plovers from each of the other three recovery units to occur in the action area during spring and fall migration.

There is no proposed or designated piping plover critical habitat within the breeding range of the Atlantic Coast population, thus critical habitat does not overlap the action area. Therefore, we do not consider critical habitat for this species in this Opinion.

Piping plovers transit the offshore areas during spring and fall migrations (Loring et al. 2019, Loring et al. 2020a) but there is limited data on the species' migration routes, flight altitudes, exposure time, and abundances in the offshore lease area as a portion of their migration route. Loring et al. (2019) fitted 150 piping plovers with digital Very High Frequency (VHF) radio transmitters at select nesting areas in Massachusetts and Rhode Island from 2015 to 2017. Tagged individuals were tracked using an array of automated VHF telemetry stations within a study area encompassing a portion of the U.S. Atlantic OCS, extending from Cape Cod, Massachusetts, to southern Virginia. Peak exposure of piping plovers to Federal waters occurred in late July and early August. Piping plovers departing from their breeding grounds in Massachusetts and Rhode Island primarily used offshore routes to stopover areas in the mid-Atlantic. Individual piping plovers were exposed to up to four Wind Energy Areas (WEAs) on offshore flights across the mid-Atlantic Bight. Flights in Federal waters and WEAs were strongly associated with southwest wind conditions providing positive wind support (Loring et al.2019).

Of the 150 individuals tagged, 82 percent were detected by the telemetry array. Field staff observed that 25 percent of tagged birds dropped their transmitters on the breeding grounds. Tagged piping plovers were detected by the tracking array for an average of 46 days. Due to incomplete detection probability, 47 percent (70 of 150) of individuals had sufficient detection data to model migratory departure from the breeding grounds. Migratory events were identified by southbound departures from breeding areas tracked by two or more towers within the telemetry array. Of the 70 individuals that were tracked during fall migration, 27 percent (19 birds) had estimated exposure to WEAs within the Study Area, including Lease OCS-A 0501[3]. Estimated exposure to WEAs was higher for birds tagged in Massachusetts than for birds tagged in Rhode Island. For 22 birds tagged in Massachusetts, peak estimated WEA exposure occurred within four hours of local sunset (19:00 hours), with 36 percent (8 birds) of events occurring at night and 64 percent (14 birds) during daylight (Loring et al.2019).

Loring et al.(2019) reported that most offshore flight altitudes of piping plovers occurred above the RSZ. An estimated 21.3 percent of piping plover flights over Federal waters occurred within the RSZ. However, the RSZ for this study was defined for this study at 25 to 250 m above sea level and thus lower and smaller than the New England Wind RSZ. Further analyzing this same set of 150 tagged piping plovers, Loring et al. (2020a) presents altitudes for 17 individual migratory flights across the mid-Atlantic Bight—all but one of these flights were within the New England Wind RSZ.

---

[3] For Loring et al. studies considered in this Opinion, the New England Wind Lease Area OCS-A 0534 was part of the Vineyard Wind's Lease Area OCS-A 0501; therefore, we consider any species presence within Lease Area OCS-A 0501 to represent species presence within Lease Area OCS-A 0534 as well.

The data from Loring et al. (2019) have important limitations that must be taken into account. First, across all years, many piping plovers were last detected departing from their nesting areas along trajectories that intersected Federal waters and headed towards WEAs just beyond the range of land-based towers to detect exposure, such as WEAs offshore of Nantucket, Massachusetts. Therefore, estimates of exposure to Federal waters and WEAs in Loring et al.(2019) should be interpreted in the context of detection probability of the telemetry array. It is plausible that at least some of these piping plovers that appeared to be heading south intersected the New England Wind action area but were out of the detection range of the land-based receivers. Second, it is also important to note that tags were deployed in only two nesting areas, and the migration flights of these sampled populations may differ from piping plovers that nest in other parts of the Atlantic Coast range. For example, preliminary results from a previous mark/resight study found that 42 percent of piping plovers marked in Atlantic Canada were subsequently detected in New Jersey and 52 percent were detected in North Carolina (Rock pers comm. 2023). These Canadian nesters could have significant exposure to offshore wind that has not yet been assessed. Loring et al.(2019) note several differences in the migratory flights of birds tagged in Massachusetts versus Rhode Island, indicating that probability of occurrence in the action area does likely vary for piping plovers breeding in different portions of the range. Finally, it is also important to note that very little data on piping plover spring migration movements are available at this time (only two birds were tracked during partial northbound flights from the Bahamas (Loring et al.2019).

In summary, piping plovers from the New England recovery unit are likely to occur in the New England Wind action area on a somewhat regular basis. These birds could occur at beaches with suitable breeding and foraging habitat. They also are likely to cross the action area typically twice per year, on spring and fall migration flights. The available information suggests that nearly all of these birds may cross the action area within the RSZ. We have no information regarding occurrence of birds from the Eastern Canada or NY-NJ recovery units, but our analysis assumes they may also be present in the action area and that they would exhibit a similar flight height distribution. We have very little information on the flight paths or altitudes of spring migrants, but we presume that these are similar to fall flights.

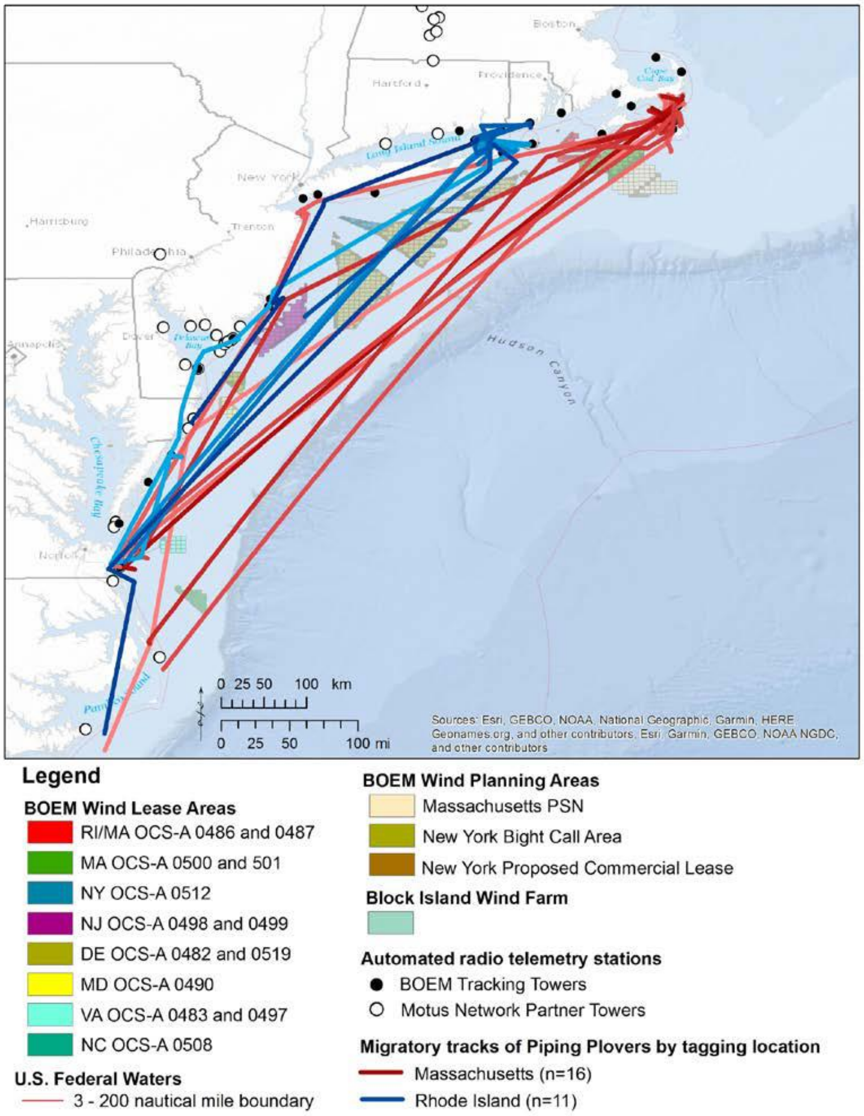


Figure 3. Figure 57 C, in Loring et al. (2019), illustrating piping plover migratory flights intersecting the action area and other offshore wind lease areas.

Rufa Red Knot

Although birds from the Western population and recovery unit are known to occasionally occur in the Atlantic Coast (USFWS 2014), we consider the likelihood that they will be affected by the proposed project is discountable. Therefore, the Western population and recovery unit are not addressed in this Opinion. We expect rufa red knots from each of the other three populations and their associated recovery units may occur in the action area during spring and fall migrations as well as during the breeding season. The species also could occur in mudflats and other suitable foraging habitat at, or near, the export cable landfall sites during migration.

The proposed rufa red knot critical habitat does not overlap with the action area; therefore, we do not consider critical habitat for this species in this Opinion.

Below, we compile the major results from studies on the breeding, nonbreeding, and migration patterns of rufa red knot by Perkins (2023), Smith et al. (2023), Loring et al. (2018 and 2020b), and Burger et al. (2012).

Based on data from 93 individual rufa red knots and 100 geolocators, Perkins (2023) determined migration patterns and wintering areas for all recovery units except the Western unit (Figure 4) using data from 2009 to 2017. Rufa red knot flight paths were categorized into subpopulations using expert elicitation and draft recovery plan maps, and individuals were assigned to the following categories: SEC (31 birds, 10 of which wintered in the Caribbean); NCSA (22 birds), Western Gulf of Mexico/Central America (Western) (24 birds), and Southern (9 birds). Seven individuals that were tagged in Texas were not classified. Location estimates were accurate to within 155 miles (250 km). Tagged individuals from the SEC recovery unit were detected in Massachusetts in May through September; and individuals from the NCSA unit were detected in Connecticut in May and in Massachusetts from July through September, during fall migration. Perkins (2023) did not detect individuals from the Southern unit stopping in Massachusetts, although some flight paths crossed southwest New England. Given the potential 155-mile error in accuracy, it is possible that any of the birds detected in, or flying over, New England could have flown through the New England Wind action area.

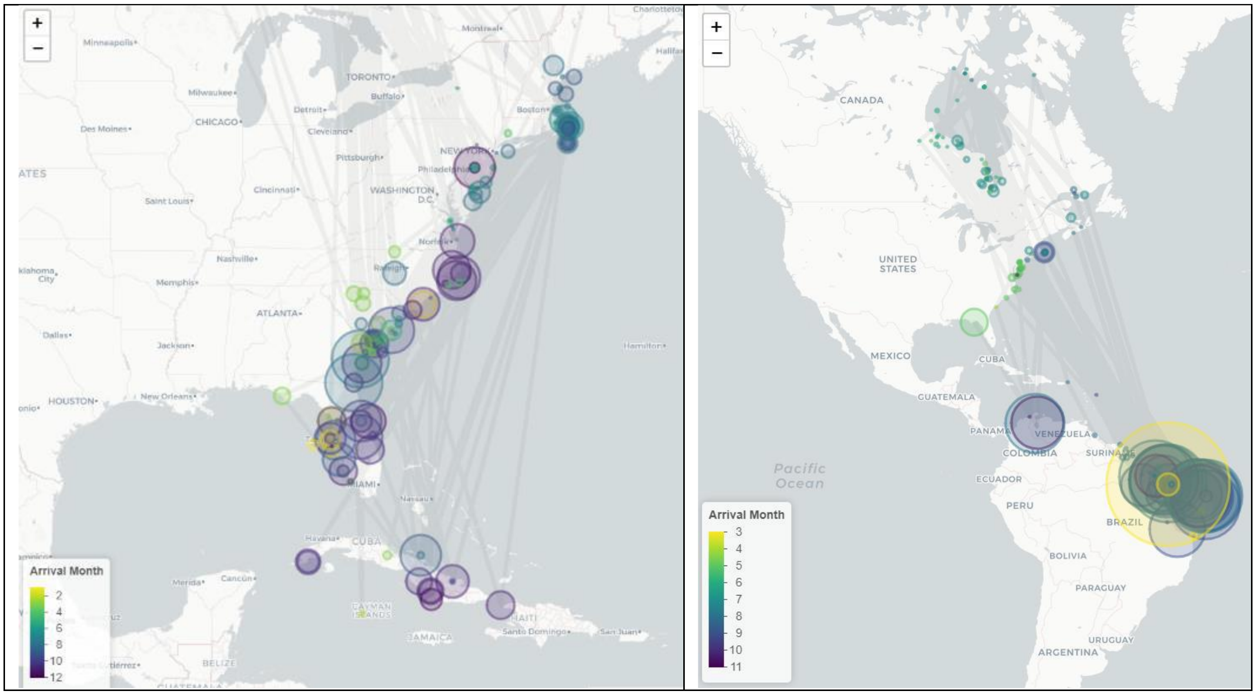


Figure 4. Figures 5b (left) and 6a (right), in Perkins (2023), illustrating rufa red knot distribution during migration. The circles represent estimated locations while the grey lines connect estimated locations for orientation purposes only.

Using digital VHF transmitters and a Motus Wildlife Tracking System (Motus) network of land-based receiving stations, Smith et al. (2023), tagged 96 northbound rufa red knots in South Carolina from 2017-2019, and 12 northbound rufa red knots in 2019, to determine whether these birds used Delaware Bay as stopover habitat. Of the 108 tagged birds, 33 were detected by the Motus network, and of those 33 birds, 9 (27 percent) were detected in Delaware Bay. A few birds made additional stops after Delaware Bay and continuing along the New England Coast. Smith et al. (2023) found similar northward migratory pathways (Figure 5) from the southeastern U.S. as reported in Perkins (2023), although the data in Smith et al. (2023) do not provide information on offshore flight paths of rufa red knots departing from the southeast and mid-Atlantic, since most tend to fly overland directly to their breeding grounds in the Arctic.

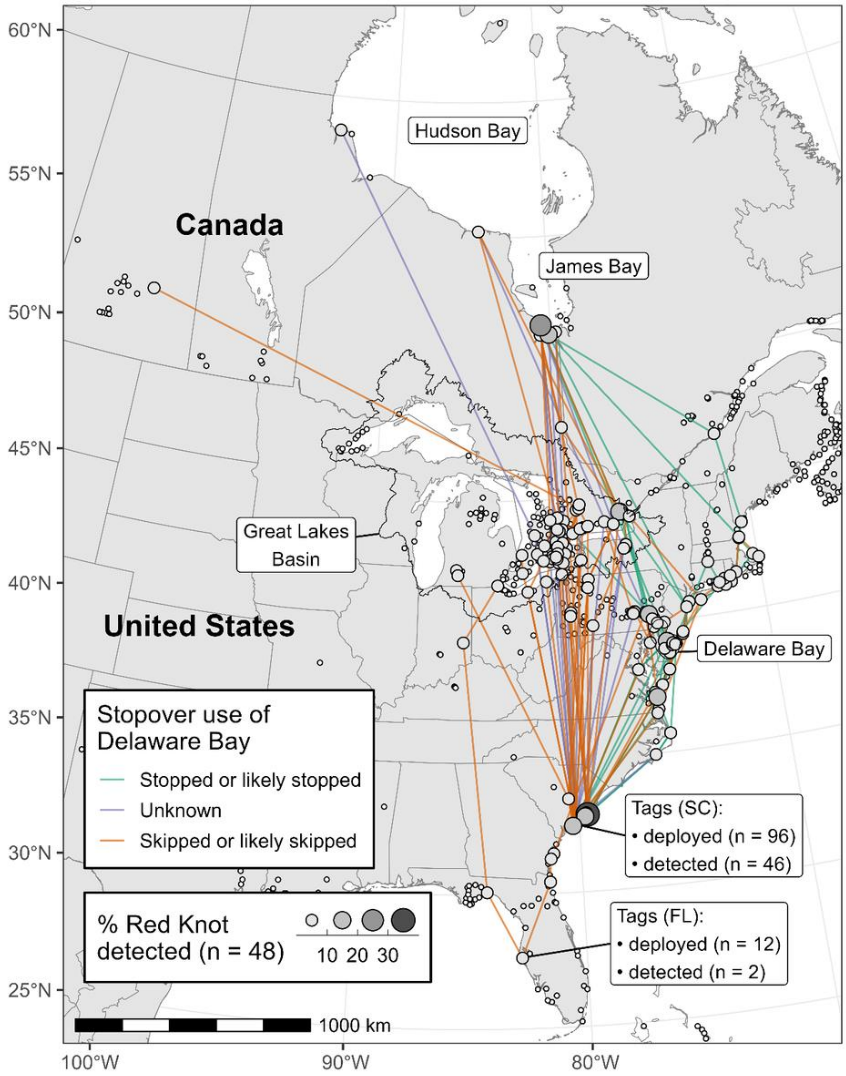


Figure 5. Figure 2, in Smith et al. (2023), illustrating rufa red knot northbound migratory flights.

To identify critical southbound stopover sites and migratory pathways in Canada and the Northeastern United States, Loring et al. (2018) attached digital VHF transmitters to 388 rufa red knots in 2016 in four areas; James Bay and the Mingan Archipelago in Canada, in Massachusetts, and along the Atlantic Coast of New Jersey. Tagged rufa red knots were tracked using an array of automated radio telemetry stations within a study area encompassing a portion of the U.S. Atlantic, extending from Cape Cod, Massachusetts to Back Bay, Virginia. A total of 59 of these 388 birds were tracked by the array in migration over Federal waters. Rufa red knots tagged within the study area had a high likelihood of being detected in the receiver array (greater than 75 percent), demonstrating that tag loss and tag failure rates were low. Despite this, only 3 to 22 percent of rufa red knots tagged at stopover sites in Canada were detected within the study area, and only two individuals tagged in Canada were estimated to be exposed to WEAs while transiting the study area. Comparatively, 54 percent of birds tagged in Massachusetts and New Jersey stopover areas were detected passing through Federal waters of the Atlantic OCS in the study area, and 11 percent were estimated to be exposed to one or more WEAs both during shorter-distance flights on staging grounds and longer-distance migratory movements. Of the 388 tagged birds, 2 were detected crossing Lease OCS-A 0501. However, because the tracking array likely missed flights that occurred within the Atlantic OCS Study Area (due to offline stations or limited detection ranges), and because we do not know if the final detections corresponded with departure from the study area or were a result of tag loss, the estimates of exposure to Federal waters and WEAs should be considered a minimum (Loring et al. 2018).

Loring et al. (2018) found that offshore migratory departures primarily occurred within several hours of civil dusk. WEA exposure events occurred primarily at night (80 percent), from 3 hours before local sunset to 1 hour following local sunrise. Flights across WEAs occurred during fair weather, under clear skies (mean visibility greater than 62 feet [19 m]) with above-average barometric pressure, mild temperatures, and little to no precipitation. Loring et al. (2018) estimated that 77 percent of rufa red knot flights across WEAs occurred in the RSZ, with a mean altitude of 348 feet (106 m) (range 72 to 2,894 feet [22 m to 882 m]). However, these estimates were subject to large error bounds and should be interpreted with caution. Further, Loring et al. (2018) defined the RSZ as 66 to 656 feet (20 m to 200 m) above sea level, lower and smaller than the RSZ for New England Wind.

Appendix F in Loring et al. (2018) contains 26 maps of estimated flight paths of tracked rufa red knots between Virginia and Massachusetts. Several flight paths intersect the action area or adjacent lease areas.

In a second migration study, Loring et al. (2020b) compiled movement data from 3,955 individuals of 17 shorebird species that were tagged with VHF transmitters from 2014 to 2017 at 21 sites widely dispersed across North and South America. The movements of tagged shorebirds were tracked using the collaborative Motus radio telemetry network, which has extensive coverage from automated radio telemetry stations distributed across eastern North America and additional coverage at key shorebird sites from Arctic Canada to South America. The Study Area encompassed a region of the U.S. Atlantic Coast extending from Cape Cod, Massachusetts, to Back Bay, Virginia, where a network of BOEM-funded automated radio telemetry stations was established for monitoring avian movements throughout adjacent waters of the Atlantic OCS (Loring et al. 2018, Loring et al. 2019). These coastal stations had an effective detection radius of about 12 miles (20 km); therefore, the bounds of the Study Area ranged from 12 miles (20 km) inland to 12 miles (20 km) offshore. To estimate broad-scale use of the study area by shorebirds, while accounting for transmitter loss, these authors examined the migratory tracks of all shorebirds detected by automated radio telemetry stations at least 31 miles (50 km) from their original tagging site and within 18 miles (30 km) of the Atlantic Coast from Mingan, Canada, in the north to the Texas- Mexico border in the south. Use of the study area was highest among three species including rufa red knots. Rufa red knots had the highest sample size in this study (1,175 birds) and 86 percent were detected within the study area (Loring et al. 2020b).

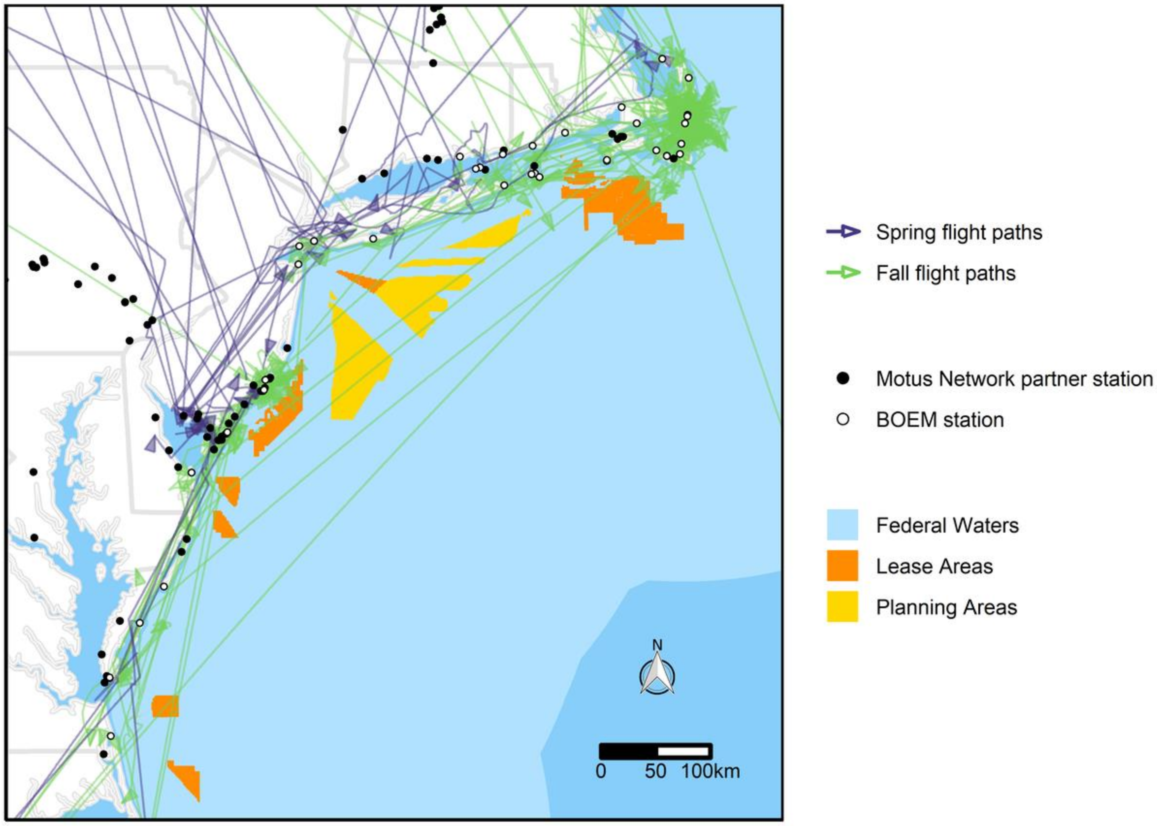


Figure 6. Figure 14 in Loring et al. (2020b), illustrating red knot migratory flights.

This growing body of evidence indicates that a substantial portion of northbound rufa red knots fly overland from the U.S. Atlantic Coast (Florida to Delaware Bay) on a northwest trajectory to their final stopover areas along Hudson Bay in Canada. Some rufa red knots do continue along the Atlantic Coast north of Delaware Bay, and some of those birds may cross the New England Wind action area. However, the overland route appears to be the predominant flyway for this leg of the northbound migration (USFWS 2014, Loring et al. 2020b, USFWS 2021b, Perkins 2023), and this route entirely avoids the OCS.

The prevalence of regional movements is reflected in available tracking data. Burger et al. (2012) found that rufa red knots outfitted with geolocators and recaptured in Massachusetts spent over half the year migrating, at stopovers, and wintering along the Atlantic Coast (Figure 7). While birds in this study crossed the OCS at least twice during long-distance flights, individuals crossed even more often on shorter flights (Burger et al. 2012). As described above, Loring et al. (2018) reports that, of 99 rufa red knots tagged with radio transmitters, 17 birds (17 percent) were tracked moving through Federal waters during staging at migration stopover areas. Loring et al. (2020b) found movements of rufa red knots tracked during spring were concentrated near tagging sites in the Delaware Bay and western Long Island, with some regional movements detected between staging areas. Several individuals crossed Federal waters during regional flights between staging and stopover sites located throughout the study area before departing northward towards the breeding grounds (Loring et al. 2020b).

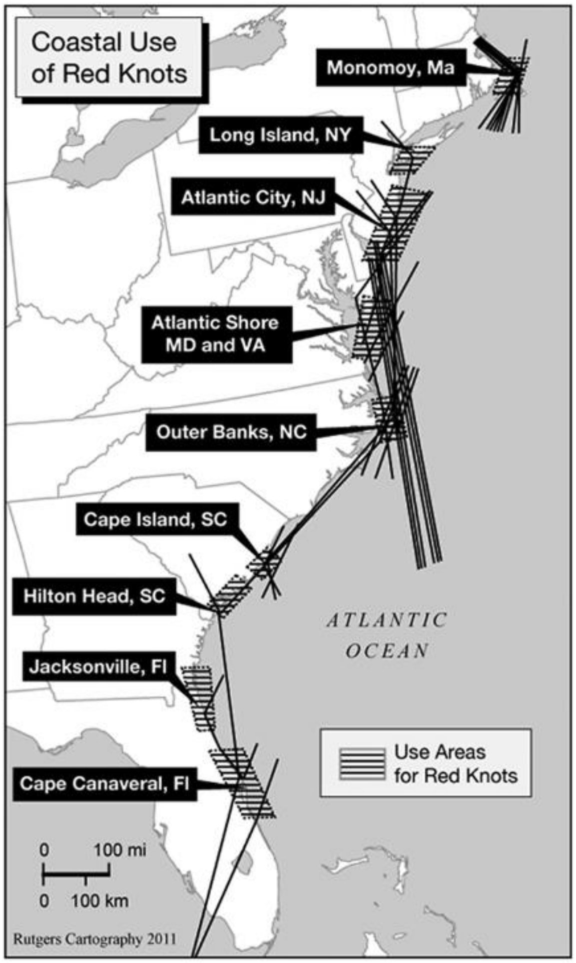


Figure 7. Figure 3 in Burger et al. (2012), illustrating areas used by red knots on the Atlantic Coast.

In summary, rufa red knots from the SEC, NCSA, and Southern recovery units are known to occur in the action area, though we do not know if birds from these three regions use the airspace with similar frequency, timing, or altitudes. The available information indicates far greater numbers of rufa red knots cross the OCS on fall migration flights compared to spring migration flights. Best available information indicates substantial overlap between rufa red knot flight heights and the New England Wind RSZ.

Summary

The available information shows both piping plover and rufa red knot likely using flight paths through or over the action area. We expect both species will fly through or over the action area annually during migrations, although likely numbers and flight paths will vary seasonally and annually. The Band (2012) and SCRAM (Adams et al. 2022) collision risk models have to make assumptions about likely numbers/density and likely flight paths or occupancy probability.

Factors Affecting the Species within the Action Area

Vessels

The draft EIS (BOEM 2022b) presents information on vessel traffic specific to the action area. Vessel traffic within the action area is predominately comprised of recreational and fishing vessels, especially between Memorial Day and Labor Day, though the area is also used by cargo vessels and tankers to a lesser extent. Data collected by the Automatic Identification System show relatively low vessel density in the WTG area. The primary travel routes through the WTG area have an average of fewer than 7 transits per day. Routes with higher vessel traffic do not intersect the Lease Area.

Most vessels do not extend very high above the ocean surface and move at relatively slow speeds. Thus, we conclude that vessels do not present a collision hazard to listed birds in the action area. Noise, activity, lighting, and air emissions associated with vessel traffic in the action area could potentially influence the behavior and/or fitness of listed birds. Any such influences are likely greater on seasonally resident birds making lower-altitude movements within or across the OCS, compared to the typically higher-altitude migration flights (Loring et al. 2018, 2019).

Piping plovers and rufa red knots are not known to occur on the OCS with the exception of migration flights, and their exposure to vessels in the action area is limited. For these reasons, we conclude that vessel traffic in the action area has an insignificant effect on these species.

Climate Change

Variation in weather is a natural occurrence and is normally not considered a threat to native species. However, persistent changes in the frequency, intensity, or timing of storms in the action area may impact listed birds using this air space. Storm impacts to birds on migration flights include energetic costs from a longer migration route as birds avoid storms, blowing birds off course, and outright mortality (USFWS 2014). For example, geolocator tracking of rufa red knots found three of four birds likely detoured from normal migration paths to avoid adverse weather during the fall migration. These birds travelled an extra 640 to 1,000 miles (1,030 to 1,609 km) to avoid storms (Niles et al. 2010, Niles 2014). The extra flying represents substantial additional energy expenditure, which on some occasions may lead to mortality (Niles et al. 2010).

In addition to storms, flights of listed birds in the action area also may be impacted by climate-driven changes in weather, such as shifting average or extreme temperatures or changing wind patterns (Simmons 2022, Fernández-Alvarez et al. 2023), although we have little information to assess the extent to which piping plovers and rufa red knots may be experiencing such shifts in climatic conditions. The Environmental Baseline in this Opinion is limited to the boundaries of the action area, and we have insufficient information to assess the extent to which piping plovers and rufa red knots may be affected by changing climate in the action area.

EFFECTS OF THE ACTION

Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02).

Onshore Project Components

Piping plovers are not likely to be adversely affected by onshore portions of the Project due to lack of suitable habitat (except for coastal beaches and intertidal areas) and avoidance of coastal habitat disturbance via HDD methods, where applicable. With the implementation of the PPPP at the cable landfall site, piping plovers are not likely to be adversely affected by onshore portions of the Project.

Rufa red knots are not likely to be adversely affected by onshore portions of the Project due to lack of suitable habitat (except for possible coastal foraging areas) and avoidance of coastal habitat disturbance via HDD methods where applicable.

Offshore Construction

We expect the construction phase of the offshore components to avoid adverse effects because piping plovers and rufa red knots would occur in the offshore space of the action area only briefly during migration and would not be present on, or in, the water. We do not expect adverse effects from collision with any stationary structures in the offshore environment during construction (whether above or below the ocean surface) or behavioral changes (e.g., displacement, attraction) that the birds may exhibit as a result of wind turbine operation. Thus, this Opinion addresses only the risk that individuals of this species will collide with any of the

WTGs over the operational life of the Project.

Collision with Wind Turbine Generators

The only adverse effect evaluated in this Opinion is collision of listed birds with the New England Wind turbines. The BA anticipated that the Project would include up to 130 turbines and up to 5 ESP in 130 grid positions. If a piping plover or rufa red knot collides with any of the WTGs, the individual likely would be injured or killed and take[4] would have occurred. Thus, this analysis focuses on the probability of collision occurring, and, if we anticipate collision, the likely number of affected birds. If we anticipate take, we will issue an incidental take statement (ITS) following this Opinion. The Service's standard for issuance of an ITS is "reasonable certainty" that take will occur (50 CFR 402.14(g)(7)). A conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available (50 CFR 402.17).

Background

Wind turbines are known to present a collision hazard to birds in flight (Drewitt and Langston 2006, Croll et al. 2022). The level of risk is associated with factors such as (1) the number, location, height, lighting, and operational time of the WTGs; (2) the population size and movement patterns of the bird species in question, its typical flight altitudes, and its ability to avoid collision; (3) the landscape setting (*e.g.*, topography on land, distance offshore); and (4) weather conditions. For most species, collision risk levels vary seasonally and differ between day and night (Drewitt and Langston 2006, Croll et al. 2022). Collision risk levels may change over time as population sizes expand or contract and as prevalent bird behaviors, major flyways, or patterns of habitat usage change in response to environmental trends or human-driven factors. For example, over time birds may become acclimated and better able to avoid WTGs. Conversely, on a local or regional scale, additive or synergistic effects on collision risk levels may emerge as various offshore wind projects go into operation.

Piping plovers and rufa red knots eventually may encounter, and be forced to negotiate, up to 3,092 total WTGs projected upon full build out of currently leased offshore areas in New England and the mid-Atlantic, not including additional areas under consideration for leasing such as the Central Atlantic and Gulf of Maine (Hildreth pers. comm. 2023). Additive or synergistic effects may also emerge between offshore wind operation and profound ecosystem shifts driven by climate change (*e.g.*, changing assemblages/distribution of prey species; phenological shifts; changing patterns of storm activity).

Avian collision rate is affected by turbine characteristics, migratory strategy, dispersal distance and habitat associations (Thaxter et al. 2017). Larger turbine capacity (megawatts) increased

---

[4] Section 3(19) of the ESA defines take as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." 16 U.S.C. 1532(19).

collision rates; however, deploying a smaller number of large turbines with greater energy output reduced total collision risk per unit energy output. Areas with high concentrations of vulnerable species were also identified, including migration corridors. Predicted collision rates were highest for Accipitriformes (most diurnal birds of prey, but not falcons). Thaxter et al. (Appendix 6, Figure S9; 2017) identified order Charadriiformes as vulnerable but predicted collision risk within Charadriiformes as relatively low for charadriidae (plovers) and scolopacidae, which includes red knots.

Available Collision Risk Models

Technology currently does not exist to reliably detect a collision of a bird with a WTG, and the likelihood of finding a bird carcass in the offshore environment is remote. Thus, until effective collision detection methods are available, we anticipate relying on collision risk modeling to estimate collision rates after construction (see Conservation Measures 4 and 7 [Appendix A]), as well as for pre-construction assessments including this effects analysis. A body of literature has developed and helps inform risk assessments for bird species. However, considerable uncertainty remains, in part, because most studies to date have been conducted at wind farms on land and/or in Europe. In the BA, the BOEM (2022a) presents results from two different models to estimate collision risk for listed birds from the Project. The BOEM's BA addendum (BOEM 2023a) provided updated collision risk estimates. The two models are Band (Band 2012) and the SCRAM (Adams et al. 2022). We consider the outputs from both models in this analysis of effects and provide a description of the models' methods, limitations, and uncertainty in Appendix B.

Table 5. Estimated numbers of collisions over 33 years of New England Wind WTG operation as projected by two different collision risk models. The SCRAM results show the estimate and 95 percent prediction interval. The air gap is measured between the water and lowest point of the WTG RSZ.

	Piping Plover	**Rufa Red Knot**
SCRAM 1.0.3		
89-foot (27 m) air gap	8.3 (5.0 – 13.5)	4.6 (0.0 – 27.0)
Band (2012)		
0.9297 avoidance rate		
89-foot (27 m) air gap	17	77

The collision estimates presented in Table 5 do not account for any attraction of listed birds to the action area by marine navigation lighting. Studying passerines migrating over the German Wadden Sea, Rebke et al. (2019) found that nocturnally migrating birds at sea were generally attracted by a single light source, and that even relatively weak sources of light (compared to others in the distant surroundings) attract nocturnal migrants flying over the sea. Based on the range of the microphones used to record bird calls in this study, the authors concluded that attracted birds pass close to the light sources. The results of this study are consistent with the body of literature showing generally stronger avian attraction to artificial light during nights with cloud cover. In this study, no light variant (*e.g.,* color) was constantly avoided by nocturnally migrating passerines crossing the sea. While intensity did not influence the number attracted, birds were drawn towards continuous light more than towards blinking illumination, when stars were not visible. Under cloudy skies, constant red light attracted significantly fewer birds than other hues (i.e., green, blue, and white) (Rebke et al. 2019). The applicability of this study to shorebirds and terns is not yet clear. Conservation Measure 2 (Appendix A) provides for reassessment of collision projections for listed birds following approval of the maritime navigation lighting plan by the U.S. Coast Guard (USCG).

Piping Plover

Table 5 presents a range of 8 to 17 piping plover collisions over the life of the New England Wind project. We conclude that the SCRAM estimates likely are too low based on the lack of spring data, the limited detection range of land-based receivers, and the limited tag deployment sites that were restricted to only one of the three recovery units covered by this Opinion.

Several factors suggest the possibility of a piping plover avoidance rate greater than 93 percent (Table 5). First, unlike the species studied by Cook (2021), piping plovers are not pelagic feeders. Hence, they will not be distracted by foraging activities during migration. Second, there is evidence of good nocturnal vision inferred by nocturnal foraging behavior (Staine and Burger 1994, Stantial and Cohen 2022) and nocturnal flights during the breeding season (Sherfy et al. 2012). Charadriidae (plovers) have specialized visual receptors and are known to possess excellent visual acuity with the ability to routinely forage during poor light conditions (del Hoyo et al. 2011), although other species with exceptional visual acuity (e.g., raptors) regularly collide with onshore WTGs. Third, agility of adult plovers has been observed in distraction displays, including abrupt flights to escape potential predators during broken-wing displays (Hecht pers. comm. 2023). How this agility translates to avoidance at the scale of a single WTG or a wind farm is unknown. Finally, preliminary data suggest that piping plovers favor high-visibility conditions when crossing the OCS. Loring et al. (2020a) found that visibility was high during their sample of southbound offshore piping plover flights (mean: 11 miles [18 km], range: 9 to 12 miles [14 to 20 km]). Loring et al. (2020a) shows a range of southward migratory departure times and dates from Massachusetts and Rhode Island. Birds that departed on the same day often had variable flight durations to cover the similar distances. This information is consistent with informal observations of staggered arrivals and departures during both northward and southward migration and, in turn, reduces concerns that a large proportion of the plover population could simultaneously encounter weather conditions (*e.g.*, dense fog) that would impair visibility, exerting a large effect on the average avoidance rate (Hecht pers. comm. 2023). Countervailing information, however, includes data from 2 birds tagged in the Bahamas and tracked during their northbound offshore flights that included periods of low visibility and precipitation (Loring et al. 2019, Appendix I). It is also uncertain whether agility of flights and the plovers' attention to visual cues observed on land extend to their behaviors during offshore migratory flights.

We conclude that Atlantic Coast piping plovers are reasonably certain to collide with the New England Wind WTGs. Collision would result in injury or death. Absent additional information to estimate more precise avoidance rates, and given other data limitations described in Appendix B, we considered the full range of collision estimates presented in Table 5. However, considering the likely over- and underestimates of the models and the disparity between the model estimates, the best estimate is likely somewhere between the two models' outputs. We determined an average of the SCRAM estimate and the 93 percent avoidance rate Band (2012) estimate would be reasonable. Accordingly, we anticipate that less than 1 piping plover annually, and up to 13 ((8.3+17)/2, rounded up to the whole bird) piping plovers over the life of the Project, will collide with the turbines. We note that this estimate is associated with high uncertainty, and we expect that it will be refined over time in accordance with the monitoring and modelling efforts described in this Opinion.

Rufa Red Knot

Table 5 presents a range of 5 to 77 rufa red knot collisions over the life of the New England Wind project. Several factors suggest a collision estimate on the higher end of this range is appropriate:

- Data gaps (*e.g.*, lack of spring data, limited deployment areas, limited detection range of land-based receivers) bias SCRAM to underestimate collision.
- The Band (2012) estimates consider only two migration flights per bird per year, omitting regional flights over the OCS which are known to occur with some regularity. This would cause underestimation of collision risk.
- Gordon and Nations (2016) used an avoidance rate of 93 percent in good weather and 75 percent in poor weather. As discussed above, rufa red knot migration flights are typically associated with fair weather (Loring et al. 2018), but birds have been known to encounter storms on their long flights (Niles et al. 2010, Niles 2014).

However, other factors suggest a collision estimate on the lower end of the range is appropriate.

- While Band (2012) assumes even distribution of birds across the migratory front, SCRAM accounts for the known spatial heterogeneity in rufa red knot tracks.
- While Band (2012) assumes each bird crosses the migratory front twice each year, SCRAM accounts for regional flights by seasonally resident birds, as it is informed by the full data set reported by Loring et al. (2018).
- Although important gaps still need to be addressed in the radio tracking data underpinning SCRAM, the sample sizes and distribution of tagging locations are far more robust for rufa red knots than for the other two listed birds, lending more weight to the SCRAM estimates.
- The lack of spring data in SCRAM is less consequential for rufa red knots than for the other two species because a substantial fraction of birds fly overland in spring from the Atlantic Coast (Florida to Delaware Bay) directly to Hudson Bay in Canada.

- Certain aspects of SCRAM's methods for calculating occupancy probability and daily exposure to WTGs can result in higher collision numbers.

We conclude that rufa red knots are reasonably certain to collide with the New England Wind WTGs. Collision would result in injury or death. Absent additional information to estimate more precise avoidance rates, and given other data limitations described in Appendix B, we considered the full range of collision estimates presented in Table 5. However, considering the likely over- and under-estimates of the models and the disparity between the model estimates, the best estimate is likely somewhere between the two models' outputs. We determined an average of the SCRAM estimate and the 93 percent avoidance rate Band (2012) estimate would be reasonable. Accordingly, we anticipate that 1 to 2 rufa red knots would collide with the WTGs annually, and up to 41 ((4.6+77)/2, rounded up to the whole bird) would collide over the life of the Project. We note that this estimate is associated with high uncertainty, and we expect that it will be refined over time in accordance with the monitoring and modelling efforts described in this Opinion.

CUMULATIVE EFFECTS

Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). We do not consider future Federal actions that are unrelated to the proposed action in this section because they require separate consultation pursuant to section 7 of the ESA.

The Service is not aware of any future state, tribal, local, or private actions that are reasonably certain to occur within the onshore or offshore portions of the action area at this time. We do not expect any change in the types or levels of non-project-related vessel traffic in the action area that would have any appreciable effect on listed birds. We expect direct mortality of listed birds to remain low and continue exerting negligible effects on birds in the action area. It is reasonably certain that human-caused climate change will continue into the foreseeable future, although there is large uncertainty around the pace and magnitude of climate change (mostly related to the uncertain trajectory of mitigation actions) (USFWS 2020b). There is also high uncertainty around how climate change may affect usage of the action area by listed birds. Therefore, we do not anticipate any cumulative effects.

JEOPARDY ANALYSIS

Section 7(a)(2) of the ESA, 16 U.S.C. 1536(a)(2), requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). Therefore, we have used those three aspects of the status of the piping plover and rufa red knot as the basis to evaluate whether the proposed action will jeopardize the continued existence of the species.

Piping Plover

Individual Effects

We estimate that less than 1 piping plover annually, and up to 13 piping plovers over 33 years, would collide with WTGs in the New England Wind action area. We expect all of these collisions would result in death.

Population Effects

Extinction risk of Atlantic Coast piping plovers is highly sensitive to small changes in adult and/or juvenile survival rates (USFWS 2009). However, the 10-year (2012 to 2021) average breeding population size across the Eastern Canada, New England, and NY-NJ recovery units combined was 1,600 pairs, or 3,200 birds (USFWS 2021a). Given this current abundance and long-term, increasing population trajectory shown in Table 2, and considering the several projects listed in Table 1, which collectively anticipate injury or death of approximately 5 piping plovers per year; we conclude that the additional loss of less than 1 individual annually and up to 13 birds over 33 years would have an insignificant effect on the Atlantic Coast piping plover. Further, the BOEM is requiring at least the first 4 projects in Table 1 to provide compensatory mitigation, which would offset the anticipated loss from those projects.

Reproduction and Numbers

The expected loss of piping plovers likely would be indistinguishable from normal population variation and would have an insignificant, if any, effect on piping plover numbers and reproduction.

Distribution

The proposed action would have an insignificant effect on piping plover numbers and would not reduce habitat for feeding, breeding, and sheltering. Therefore, the proposed action would not reduce the distribution of the piping plover.

Recovery

Piping plover collisions at New England Wind may be most likely to affect the New England recovery unit, which, based its size, is the least vulnerable to demographic effects from loss of these birds. The Eastern Canada recovery unit is much more sensitive to loss of individuals, with a long-term average of only 179 pairs (358 individuals). The numerical odds suggest most of the projected collisions would come from the New England unit, and the loss of 13 birds over 33 years would not preclude recovery in this unit. However, even if all the plovers that collide with

WTGs in New England wind are from the Eastern Canada unit, the average of 4 birds per decade would have an insignificant effect on the unit's population size and demographics and would not preclude recovery in the Eastern Canada unit. The NY-NJ unit would be intermediate in sensitivity between the Eastern Canada and New England recovery units, and, therefore, the proposed action would not reduce appreciably the likelihood of recovery in this unit.

Rufa Red Knot

Individual Effects
We estimate that up to 2 rufa red knots annually, and up to 41 rufa red knots over 33 years, would collide with WTGs in the New England Wind action area. We expect all of these collisions would result in death.

Population Effects
Given the population abundance estimates shown in Table 4, and apparent stability of the rufa red knot population (USFWS 2014); and considering the several projects listed in Table 3, which collectively anticipate injury or death of approximately 25 rufa red knots per year; we conclude that additional loss of 1 to 2 rufa red knots per year would have an insignificant effect on the rufa red knot. Further, the BOEM is requiring at least the first 4 projects in Table 3 to provide compensatory mitigation, which would offset the anticipated loss from those projects. The Southern wintering population is the smallest of the recovery unit populations that may occur in the action area. One bird is an exceedingly small percent of this population, so even if all rufa red knots that collided with WTGs in the Project were from the Southern population, the population-level effect would be insignificant. This hypothetical scenario is unlikely, and the impacts likely would be distributed across multiple populations.

Reproduction and Numbers
We consider the loss of at least 1 individual each year and any likely young they would have produced over the balance of their life when evaluating the potential impact to reproduction and numbers. There is very little information on rufa red knot recruitment rate. ASMFC (2022) estimated that pairs are not successful at producing an adult bird every year. Hypothetically, if half of the individuals taken were female, typically recruiting an average of 0.5 chicks into the adult population each year, total average annual loss to reproduction and numbers could be between 1 to 3 birds (1 or 2 from WTG collision and up to 1 from young not produced annually). Over an average 6-year reproductive life span (breeding at age 2, 7-year average life), the lost reproductive potential of 1 female could be around 3 young.

This is a coarse approximation with many assumptions. Nevertheless, this, or a similar level of, reproductive loss, within the context of the current numbers of rufa red knots (over 59,000 excluding western birds), and largely stable populations, would not have a substantial impact on reproduction and numbers.

Distribution
The proposed action would have a minor effect on rufa red knot numbers and would not reduce habitat for feeding, breeding, and sheltering. Therefore, the proposed action would not reduce the distribution of the rufa red knot.

Recovery
The Southern unit would be far more sensitive to loss of individuals (USFWS 2020b) than other recovery units. However, based on its smaller population size, and results from Perkins (2023) that suggest birds from the Southern unit are less likely to be exposed to the New England Wind project than birds from the SEC and NCSA units, we conclude it is likely that few of the projected collisions would come from the Southern unit. The majority of the collisions likely would come from the more populous SEC and NCSA units. Recovery criterion 3 (stability of the SEC and NCSA units) and 10 (juvenile survival and recruitment) are particularly applicable to this analysis and the potential effects of the Project. Based on current demographic data, and potential effects of the Project, we conclude that the anticipated effects of the Project would not reduce appreciably the likelihood of recovery of the rufa red knot.

CONCLUSION

We considered the current overall rangewide status of the piping plover and rufa red knot and the status of the species in the action area. We then assessed the effects of the proposed action, and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. We do not anticipate significant reduction in the reproduction, numbers, or distribution of these species. The Service's Opinion is that construction, operation, and decommissioning of the New England Wind offshore wind energy project, as proposed, is not likely to jeopardize the continued existence of the Atlantic Coast piping plover or the rufa red knot.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened wildlife species, respectively, without a special exemption. Take is defined in section 3 of the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to mean an act which actually kills or injures wildlife, which may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. (50 CFR 17.3). Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under section 7(b)(4) and section 7(o)(2) of the ESA, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this ITS.

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service expects the operation of the New England Wind project would cause take of piping plovers and rufa red knots by wounding and killing. This take would result from birds colliding with WTGs in the New England Wind portion of Renewable Energy Lease Area OCS-A 0534 over the 33-year life of the Project.

Based on likely collisions predicted by the two collision risk models, we anticipate:

1. up to 13 piping plovers would be wounded or killed due to collision mortality over 33 years; and
2. 1 to 2 (average 1.24) rufa red knots annually, and 41 over the life of the Project, would be wounded or killed due to collision mortality.

Absent additional information to estimate avoidance rates more precisely, account for limitations of the models, and, ultimately, determine the likely number of collisions, we considered and adopted the full range of collision estimates from Band (2012) and SCRAM. In the Effects of the Action section of the Opinion, we attempted to account for likely model estimate error, reconcile the disparate estimates of the two models, and develop a single number of likely collisions annually and over the life of the Project. These take numbers are associated with high uncertainty, and we expect the BOEM and the Service will refine them over time (see Conservation Measure 4 (Appendix A)). However, they are our best estimates based on the best available information at this time. New information that results in an increase in anticipated collisions by Band and SCRAM models (or future replacement) may meet one or more of the criteria for reinitiation of consultation at 50 CFR 402.16(a).

In addition, exceedance of the amount or extent of taking specified also may be indicated by discovery of dead piping plovers or rufa red knots for which the cause of death can be attributed to collision with a WTG at the New England Wind project. However, finding dead or injured piping plovers or rufa red knots is highly unlikely given factors that may impede discovery such as drift rate from wind displacement (Bibby 1981), carcass persistence rate (Ford et al.1996, Barrientos et al. 2018), and searcher efficiency (Barrientos et al. 2018). Nevertheless, we account for the possibility of finding dead piping plovers and rufa red knots and how that would translate to estimates of take via collision at the New England Wind project.

Information on bird carcass recovery in an ocean environment is very limited. More research has focused on carcass recovery at inland projects or at the shoreline (Barrientos et al. 2018). Recovery rates of carcasses in the open ocean would be, at most, similar to, and plausibly lower than, onshore recovery rates. In one study that, more closely than other research, approximates a situation similar to carcasses from collisions with offshore turbines, Bibby (1981) determined recovery rates as low as 0.3 percent (or 1 in 300) for dead birds that washed ashore as a result of an offshore mortality (Bibby 1981). It follows that the likelihood of recovering a piping plover or rufa red knot in the action area injured or killed by collision with a WTG is similarly low, and each carcass found reasonably would indicate that additional individuals had been killed and not recovered. Based on the available information, finding a number of carcasses equivalent to 1 percent (rounded up to the whole bird) of the total take anticipated over the life of the Project may reasonably indicate that the level of anticipated take has been exceeded or listed species are affected to an extent not previously considered. Therefore, discovery of 1 dead piping plover or 1 dead rufa red knot in the New England Wind action area, for which the cause of death can be attributed to collision with a WTG at the New England Wind project, could indicate that our anticipated amount of take was reached for the respective species, and the BOEM must contact our office immediately to determine if reinitiation of formal consultation is necessary.

REASONABLE AND PRUDENT MEASURES

At this time, the Service is not aware of any specific physical WTG adjustments that would be reasonably likely to appreciably reduce collisions of listed birds in the offshore environment. However, technology and research in this area are advancing rapidly, and new methods for reducing collisions may become available over the long operational life of the New England Wind project. Successful implementation of technologies and methods for minimizing collision risk identified through the Reasonable and Prudent Measure (RPM) could reduce the compensatory mitigation obligation, if any. See Conservation Recommendation 3, below.

The Service believes the following RPM is necessary and appropriate to minimize take of piping plovers and rufa red knots.

> Periodically review current technologies and methods for minimizing collision risk of migratory birds with WTGs, including but not limited to: WTG coloration/marking, lighting, avian deterrents, remote sensing such as radar and thermal cameras, and limited WTG operational changes.[5]

TERMS AND CONDITIONS

The measures described below are nondiscretionary and must be undertaken by the BOEM so that they become binding conditions of any grant, permit, or other approval issued to Park City Wind or other entity to develop the Project, as appropriate, for the exemption in Section 7(o)(2)

---

[5] Operational changes may include, but are not limited to, feathering, which involves adjusting the angle of the blades to slow or stop them from turning under certain conditions.

to apply. The BOEM, or subsequent lead Federal agency (i.e., the BSEE[6]) under a transition of oversight responsibility, has a continuing duty to regulate the activity covered by this ITS. If the BOEM (1) fails to assume and implement the terms and conditions, or (2) fails to require Park City Wind to adhere to the terms and conditions of the ITS through enforceable terms that are added to the permit or grant document, the protective coverage of Section 7(o)(2) may lapse.

To be exempt from the prohibitions of section 9 of the ESA, the BOEM must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. Periodically review current technologies and methods for minimizing collision risk of listed birds.

    a. Prior to the start of the first WTG operation at New England Wind, the BOEM must compile, from existing project documentation (*e.g.*, the BA, other consultation documents, the final EIS, the COP), a stand-alone summary of technologies and methods that the BOEM evaluated to reduce or minimize bird collisions at the New England Wind WTGs.

    b. Within 5 years of the start of the first WTG operation, and then every 5 years for the life of the project, the BOEM must prepare a Collision Minimization Report (CMR), reviewing best available scientific and commercial data on technologies and methods that have been implemented, or are being studied, to reduce or minimize bird collisions at offshore and onshore WTGs. The review must be global in scope.

    c. The BOEM must distribute a draft CMR to the Service, Park City Wind, and appropriate state agencies for a 60-day review period. The BOEM must address all comments received during the review period and issue the final report within 60 days of the close of the review period.

    d. Following issuance of the final CMR, the Service may call for a meeting. Within 60 days following a call for such a meeting, the BOEM must convene a meeting with the BSEE, the Service, Park City Wind, and appropriate state agencies to discuss the CMR and whether implementation of any technologies/methods is warranted.

---

[6] The reorganization of the Renewable Energy Rules (30 CFR Parts 285, 585, and 586) enacted on January 31, 2023, reassigned existing regulations governing safety and environmental oversight and enforcement of OCS renewable energy activities from the BOEM to the BSEE. The BSEE will provide and enforce safety, environmental, and conservation compliance with associated legal and regulatory requirements during project planning, construction, operations, and decommissioning; oversee operations and inspections/enforcement actions, as appropriate; oversee closeout verification efforts; oversee facility removal and inspections/monitoring; and oversee bottom clearance confirmation.

MONITORING AND REPORTING REQUIREMENTS

To monitor the impact of incidental take, the BOEM and/or Park City Wind must report the progress of the action and its impact on the species to the Service as specified in the ITS [50 CFR 402.14(i)(3)].

1. The BOEM or Park City Wind shall monitor the action area for piping plovers and rufa red knots. As effective technology and methods become available, the BOEM should include monitoring for piping plovers and rufa red knots that may have collided with a WTG during migration. The monitoring method(s) should be informed by the best available information and technology and could include boat-based monitoring, Motus stations, remote sensing, cameras, microphones, Doppler and NEXRAD radar, eDNA, etc. The monitoring should occur during the time(s) of year when collisions are most likely. Initially, monitoring will proceed according to Park City Wind's Avian and Bat Post-Construction Monitoring Framework (ABPCMF) and be operational for the first piping plover and rufa red knot migratory seasons after the WTGs are operational. Subsequently, consideration of new methods and timing will occur on the same timeline as the CMR described in the Terms and Conditions above unless the BOEM and the Service agree to a different schedule.

2. The BOEM shall notify the Service within two business days if an injured or dead piping plover or rufa red knot is identified in or within 1 mile of the New England Wind lease area.

3. The BOEM or Park City Wind shall provide a report to the Service annually summarizing monitoring efforts, methods, and results; observations of injured or dead piping plovers and rufa red knots; observations of any listed species perching on New England Wind infrastructure (including offshore substations); implementation and effectiveness of avoidance and minimization measures; and any other relevant activity and information related to the proposed action and potential impacts to listed species. The BOEM will submit the report to the Service by the end of each calendar year or at another time agreed to by the two agencies. This report can be part of a larger, more comprehensive offshore wind report submitted to the Service annually.

4. Reports and notifications will be submitted to:

Field Supervisor
New England Field Office
U.S. Fish and Wildlife Service
70 Commercial Street, Suite 300
Concord, NH 03301
newengland@fws.gov
603-223-2541

Although finding a dead or injured piping plover or rufa red knot is unlikely, care must be taken in handling any dead specimens of listed species to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead or injured specimens does not imply enforcement proceedings pursuant to the ESA. The reporting of dead or injured specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective. Upon locating a dead or injured specimen, notify the Service's New England Field Office at newengland@fws.gov and 603-223-2541.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Pursuant to 50 CFR 402.14(j), conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Recommendation 1: Adopt compensatory mitigation ratios greater than 1:1.

As discussed throughout this Opinion, estimated levels of collision mortality are associated with high uncertainty. Future advancements in SCRAM are expected to substantially reduce, but not eliminate, uncertainty. In addition, compensatory mitigation actions will likely be associated with their own levels of uncertainty (*e.g.*, probability of success, actual number of bird mortalities offset), and may occur later in time that the project-induced mortality. Thus, we recommend a compensatory mitigation ratio greater than 1:1, particularly given the extent of full buildout of WTGs anticipated on the OCS.

Recommendation 2: Establish an Offshore Wind Adaptive Monitoring and Impact Minimization Framework to guide and coordinate monitoring, research, and avian impacts assessment coastwide.

To address Service concerns related to potential effects of WTG operation on listed and other species of concern, at both the project and coastwide scales, we recommend that the BOEM develop and adopt an Offshore Wind Adaptive Monitoring and Impact Minimization Framework (Framework) for flying wildlife. Many details will need to be worked out, but here we provide some basic principles for establishment, adoption, and operation of the Framework.

1. Establish a Framework Principals Group to consist of representatives from the BOEM, the BSEE, the Service, State natural resource agencies responsible for management of birds, bats, and insect, and offshore wind energy developers/operators.

2. Develop and adopt a written Framework foundational document specifying:

    a. the governance structure of the Principals Group;
    b. the geographic coverage of the Framework;
    c. the species covered by the Framework; and
    d. the duration of the Framework.

3. Establish an annual operating budget for the Framework to be funded by offshore wind energy developers/operators.

4. Arrange for the Principals Group to meet at least annually, and for the Framework foundational document to be updated at least every 5 years.

5. Provide for experts (both internal and external to the Principals Group) to regularly assess new and improved technologies and methods for estimating collision risk of covered species and measuring or detecting collisions. Adopt and deploy such methods deemed most promising by the Principals Group.

6. Coordinate monitoring and research across wind energy projects. Share and pool data and research results coastwide.

7. Provide for experts (both internal and external to the Principals Group) to regularly assess new and improved technologies and methods for minimizing collision risk of covered species. Adopt and deploy such technologies/methods deemed most promising by the Principals Group.

8. Provide for experts (both internal and external to the Principals Group) to periodically assess new and improved technologies and methods for evaluating indirect effects to covered species from WTG avoidance behaviors (*e.g.*, impacts to time and energy budgets).

9. Periodically assess the level and type of compensatory mitigation necessary to offset any unavoidable direct and indirect effects of WTG operation on covered species. Adopt and require the levels and types of mitigation deemed appropriate by the Principals Group.

10. Consider partnering with other stakeholders or cross-sector organizations to provide administrative, institutional, and technical support to the Principals Group.

Recommendation 3: Conduct a coastwide buildout analysis that considers all existing, proposed, and future offshore wind energy development on the Atlantic OCS.

The definition of "cumulative effects" at 50 CFR 402.02 excludes future Federal actions because such actions will be subject to their own consultations under section 7 of the ESA. Further, the analysis of environmental baseline conditions for each subsequent consultation would be limited to the action area of that particular project. While we can use the Status of the Species section of a biological opinion to capture the anticipated effects of completed consultations, we cannot consider additive effects of concurrent, ongoing consultations. Even this creates a situation where the effects analysis for each individual offshore wind energy project cannot fully account for synergistic effects that may occur with nearby projects and especially not full build-out of offshore wind infrastructure along the coast.

Besides the two existing offshore wind energy facilities (Block Island Wind offshore Rhode Island and Coastal Virginia Offshore Wind), we understand there are more than 30 additional projects in various stages of development offshore the U.S. coast from Maine to Virginia. As the DOI continues moving toward the national goal of deploying 30 gigawatts of offshore wind by 2030, we anticipate still more projects beyond those 30 (*e.g.*, within the New York Bight, Central Atlantic, and Gulf of Maine). While the Service will complete a thorough assessment of potential direct and indirect effects for each individual offshore wind project, a coastwide analysis may indicate or suggest additive and/or synergistic effects among projects. Therefore, the Service recommends that the BOEM analyze potential aggregate effects from WTG operation at a coastwide scale. A coastwide analysis will work in concert with the Offshore Wind Adaptive Monitoring and Impact Minimization Framework to comprehensively assess, monitor, and manage avian impacts from wind energy development along the U.S. Atlantic coast. A Programmatic consultation for wind energy development in the New York Bight is already underway and could set the stage for a full coastwide analysis. Ultimately, a coastwide programmatic Opinion may emerge as the most effective and efficient mechanism for assessing, monitoring, minimizing, and offsetting effects to listed birds from WTG operation on the OCS.

Recommendation 4: Compensatory Mitigation.

To minimize population-level effects on listed birds, BOEM should provide, or require Park City Wind to provide, appropriate compensatory mitigation to offset projected levels of take of listed birds from WTG collision. Compensatory mitigation should be consistent with the conservation needs of listed species as identified in Service documents including, but not limited to, listing documents, Species Status Assessments, Recovery Plans, Recovery Implementation Strategies (RIS), and 5-Year Reviews. Compensatory mitigation should preferentially address priority actions, activities, or tasks identified in a Recovery Plan, RIS, or 5-Year Review, for piping plovers and rufa red knots; however, research, monitoring, outreach, and other recovery efforts that do not offset birds killed via collision mortality are not considered compensatory mitigation.

Compensatory mitigation may include, but is not limited to: restoration or management of lands, waters, sediment, vegetation, or prey species to improve habitat quality or quantity for listed birds; efforts to facilitate habitat migration or otherwise adapt to sea level rise; predator management; management of human activities to reduce disturbance to listed birds; and efforts to curtail other sources of direct human-caused bird mortality such as from vehicles, collision with other structures (e.g., power lines, terrestrial wind turbines), hunting, oil spills, and harmful algal blooms. Geographic considerations may include but are not limited to: any listed species recovery unit(s) or other management unit(s) determined to be disproportionally affected by or vulnerable to collision mortality; and/or those portions of a species' range where compensatory mitigation is most likely to be effective in offsetting collision mortality.

Compensatory mitigation for the New England Wind project may be combined with mitigation associated with other offshore wind projects, but in no case should compensatory mitigation be double-counted as applying to more than one offshore wind project.

BOEM should prepare a Compensatory Mitigation Plan prior to the commissioning of the first WTG. The Compensatory Mitigation Plan should provide compensatory mitigation actions to offset projected levels of take of listed birds at a ratio of at least 1:1 for the full 33-year lease, although it may include actions to offset projected take at a higher ratio. The Compensatory Mitigation Plan should include:

- detailed description of one or more specific mitigation actions;
- the specific location for each action;
- a timeline for completion;
- itemized costs;
- a list of necessary permits, approvals, and permissions;
- details of the mitigation mechanism (e.g., mitigation agreement, applicant-proposed mitigation);
- best available science linking the compensatory mitigation action(s) to the projected level of collision mortality as described in this Opinion;
- a schedule for completion;
- monitoring to ensure the effectiveness of the action(s) in offsetting the target level of take;
- flexibility to adjust mitigation actions based on documented effectiveness of implemented actions and the level of take projected by Band (2012) or SCRAM (or its successor), whichever is most appropriate for New England Wind taking into account model limitations;
- current information regarding any effects of offshore lighting on the species addressed in this Opinion; and
- the effectiveness of any minimization measures that have been implemented.

Compensatory Mitigation Plan development and implementation should occur according to the following schedule:

- At least 180 calendar days before the commissioning of the first WTG, the BOEM should distribute a draft Plan to the BSEE and the Service, appropriate state agencies, and other identified stakeholders or interested parties for a 60 calendar day review period.
- At least 90 calendar days before the commissioning of the first WTG, the BOEM should transmit a revised Compensatory Mitigation Plan for approval by the BSEE and the Service, along with a record of comments received on the draft Plan. The BOEM should rectify any outstanding agency comments or concerns before final approval by the BOEM, the BSEE, and the Service.
- Before or concurrent with the commissioning of the first WTG, the BOEM should provide documentation to the BSEE and the Service showing financial, legal, or other binding commitment(s) to Compensatory Mitigation Plan implementation.

At least annually, and as detailed below, the BOEM, the BSEE, the Service, and Park City Wind should work together to assess the effectiveness of compensatory mitigation for collisions of listed birds with the New England Wind turbines. The BOEM should take the lead in coordinating this effort. Appropriate state agencies should be invited to participate in these mitigation assessments. The first mitigation assessment should occur during the New England Wind construction phase, prior to the start of WTG commissioning. Subsequent mitigation assessments should be held concurrent with or shortly after the annual monitoring data review. Additional mitigation assessments (addressing minimization and/or compensatory mitigation) may be carried out at any time upon request by the BOEM, the BSEE, the Service, appropriate state agencies, or Park City Wind based on substantive new information or changed circumstances. These periodic mitigation assessments for New England Wind may eventually be integrated into a regional or coastwide adaptive monitoring and impact minimization framework.

We request the BOEM notify us of the implementation of these conservation recommendations, so we are kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

REINITIATION NOTICE

This concludes formal consultation on the proposed construction, operation, and decommissioning of the New England Wind project. As provided in 50 CFR 402.16(a), reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion…;

or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, the exemption issued pursuant to section 7(o)(2) may have lapsed and any further take could be a violation of section 4(d) or 9. Consequently, we recommend that any activity causing such take cease pending reinitiation.

LITERATURE CITED

Adams, E.M., A. Gilbert, P. Loring, K.A. Williams. 2022. Transparent Modeling of Collision Risk for Three Federally Listed Bird Species in Relation to Offshore Wind Energy Development. In preparation. Report prepared for for U.S. Department of the Interior, Bureau of Ocean Energy Management, Sterling, Virginia by Biodiversity Research Institute, Portland, Maine and U.S. Fish and Wildlife Service, Charlestown, Rhode Island.

Alerstam, T. 1985. Strategies of migratory flight, illustrated by arctic and common Terns, *Sterna paradisaea* and *Sterna hirundo*. Contributions in Marine Science Supplement 27:580-603.

[ASMFC] Atlantic States Marine Fisheries Commission. 2022. 2021 Revision to the Adaptive Resource Management Framework and Peer Review Report. Arlington, Virginia. 227 pp. + Appendices. Available here: http://www.asmfc.org/uploads/file/63d41dc32021ARM_FrameworkRevisionAndPeerReviewReport_Jan2022.pdf [Accessed April 6, 2023].

Baker, A.J., P.M. González, T. Piersma, L.J. Niles, d.N. de Lima Serrano, P.W. Atkinson, N.A. Clark, C.D.T. Minton, M.K. Peck, G. Aarts, et al. 2004. Rapid population decline in red knots: Fitness consequences of decreased refuelling rates and late arrival in Delaware Bay. Proceedings of the Royal Society Biological Sciences Series B 271(1541):875-882.

Band, B. 2012. Using a collision risk model to assess bird collision risks for offshore wind farms. Report by British Trust for Ornithology for The Crown Estate. Thetford, Norfolk, United Kingdom. 62 pp. Available from: https://tethys.pnnl.gov/publications/using-collision-risk-model-assess-bird-collision-risks-offshore-wind-farms [Accessed May 4, 2023].

Barrientos, R., R.C. Martins, F. Ascensao, M. D'Amico, F. Moreira, and L. Borda-de-Agua. 2018. A review of searcher efficiency and carcass persistence in infrastructure driven mortality assessment studies. Biological Conservation 222: 146-153.

Bibby, C.J. 1981. An experiment on the recovery of dead birds from the North Sea. Ornis Scandinavica 12(3): 261-265.

Blanco, P. 2012. *Charadrius melodus* Linnaeus, 1758 Frailecillo Blanco, piping plover. Libro rojo de los vertebrados de Cuba: 18:222-224.

[BOEM] Bureau of Ocean Energy Management. 2021. Summary of Project Updates: New England Wind (formerly Vineyard Wind South). Available from: https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/NE-Wind%20Summary%20of%20Project%20Changes.pdf [Accessed June 8, 2023].

[BOEM] Bureau of Ocean Energy Management. 2022a. New England Wind project biological assessment for the U.S. Fish and Wildlife Service. Office of Renewable Energy Programs, Sterling, Virginia. 59 pp. + Appendices. Available from: https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/New_England_Wind_USFWS_BA.pdf [Accessed May 26, 2023].

[BOEM] Bureau of Ocean Energy Management. 2022b. New England Wind project draft environmental impact statement. Office of Renewable Energy Programs, Sterling, Virginia. 501 pp. + Appendices. Available from: https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Volume%20I%20Chapters%201-3.pdf [Accessed May 26, 2023].

[BOEM] Bureau of Ocean Energy Management. 2023a. Addendum to the New England Wind biological assessment to USFWS. Office of Renewable Energy Programs, Sterling, Virginia. 2 pp.

[BOEM] Bureau of Ocean Energy Management. 2023b. Addendum to the New England Wind biological assessment to USFWS. Office of Renewable Energy Programs, Sterling, Virginia. 4 pp.

[BOEM] Bureau of Ocean Energy Management. 2023c. Addendum to the New England Wind biological assessment to USFWS. Office of Renewable Energy Programs, Sterling, Virginia. 2 pp.

Brault, S. 2007. Population viability analysis for the New England population of the piping plover (*Charadrius melodus*). Prepared for Cape Wind Associates, LLC, Boston, Massachusetts.

Burger, J., C. Gordon, J. Lawrence, J. Newman, G. Forcey, and L. Vlietstra. 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(1):338-351.

Burger, J., L.J. Niles, R.R. Porter, A.D. Dey, S. Koch, C. Gordon. 2012. Using a shore bird (red knot) fitted with geolocators to evaluate a conceptual risk model focusing on offshore wind. Renewable Energy 43:370-377.

Calvert, A.M., D.L. Amirault, F. Shaffer, R. Elliot, A. Hanson, J. McKnight and P.D. Taylor. 2006. Population assessment of an endangered shorebird: the piping plover (*Charadrius melodus melodus*) in eastern Canada. Avian Conservation and Ecology 1(3):4.

Chamberlain, D.E., M.R. Rehfisch, A.D. Fox, M. Desholm and A.J. Anthony. 2006. The effect of avoidance rates on bird mortality predictions made by wind turbine collision risk models. Ibis 148(s1):198–202.

Cook, A.S.C.P. 2021. Additional analysis to inform SNCB recommendations regarding collision risk modelling. BTO Research Report 739. Report to Natural England by British Trust for Ornithology, Thetford, Norfolk, United Kingdom. 47 pp. Available from: https://www.bto.org/sites/default/files/publications/bto_rr_739_cook_collision_risk_models_final_web.pdf [Accessed May 6, 2023].

Croll, D.A., A.A. Ellis, J. Adams, A.S.C.P. Cook, S. Garthe, M.W. Goodale, C.S. Hall, E. Hazen, B.S. Keitt, E.C. Kelsey, J.B. Leirness, D.E. Lyons, M.W. McKown, A. Potiek, K.R. Searle, F.H. Soudijn, R.C. Rockwood, B.R. Tershy, M. Tinker, E.A. VanderWerf, K.A. Williams, L. Young, and K. Zilliacus. 2022. Framework for assessing and mitigating the impacts of offshore wind energy development on marine birds. Biological Conservation 206:109795.

del Hoyo, J., A. Elliot, and J. Sargatal. 2011. Handbook of the birds of the world. Lynx Editions; Barcelona, Spain.

Drewitt, A.L. and R.H.W. Langston. 2006. Assessing the impacts of wind farms on birds. Ibis 148(s1):29-42.

Elliott-Smith, E., M. Bidwell, A.E. Holland, and S.M. Haig. 2015. Data from the 2011 International Piping Plover Census: U.S. Geological Survey Data Series 922. 296 pp. Available here: http://dx.doi.org/10.3133/ds922. [Accessed May 22, 2023].

Elliott-Smith, E. and S.M. Haig. 2020. Piping plover (*Charadrius melodus*), version 1.0. In Birds of the World. Cornell Lab of Ornithology; Ithaca, NY. Available from: https://doi.org/10.2173/bow.pipplo.01 [Accessed May 6, 2023].

Epsilon. 2022. Construction and operations plan: lease area OCS-A 0534. Submitted by Park City Wind LLC to Bureau of Ocean Energy Management, Sterling, Virginia. 373 pp + Appendices. Available from: https://www.boem.gov/sites/default/files/documents/renewable-energy/NE%20Wind%20COP%20Volume%20I%20Text%20June%202022_PUBLIC.pdf [Accessed May 26, 2023].

Ford, R.G., M.L. Bonnell, D.H. Varoujean, G.W. Page, H.R. Carter, B.E. Sharp, D. Heinemann, and J.L. Casey. 1996. Total direct mortality of seabirds from the Exxon Valdez oil spill. American Fisheries Society Symposium 18: 684-711.

Gordon, C.E. 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 (OCS Study BOEM 2016-045). U.S. Department of the Interior, Bureau of Ocean Energy Management, Sterling, Virginia. 90 pp. + frontmatter and appendix. Available from: https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/Red-Knot-Collision-Risk-Final-Report.pdf [Accessed May 6, 2023].

Gratto-Trevor, C., Haig, S. M., Miller, M. P., Mullins, T. D., Maddock, S., Roche, E., and Moore, P. 2016. Breeding sites and winter site fidelity of piping plovers wintering in the Bahamas, a previously unknown major wintering area. Journal of Field Ornithology 87(1):29-41.

Hatch, J.J. and P. Kerlinger. 2004. Evaluation of the roseate tern and piping plover for the Cape Wind Project, Nantucket Sound. Appendix 5.7-H. Report prepared for U.S. Army Corps of Engineers by ESS Group, Inc., Sandwich, Massachusetts.

Hecht, A. 2023. Email of March 15, 2023. Endangered Species Biologist. U.S. Fish and Wildlife Service, Sudbury, Massachusetts.

Hildreth, E. 2023. Email, 2023. Policy Analyst. Office of Renewable Energy Programs, Bureau of Ocean Energy Management, Sterling, Virginia.

Kleyheeg-Hartman, J.C., K.L. Krijgsveld, M.P. Collier, M.J.M. Poot, A.R. Boon, T.A. Troost, and S. Dirksen. 2018. Predicting bird collisions with wind turbines: comparison of the new empirical Flux Collision Model with the SOSS Band model. Ecological Modelling 387:144-153.

Lamb, J.S., P.H. Loring, and P.W.C. Paton. 2023. Distributing transmitters to maximize population-level representativeness in automated radio telemetry studies of animal movement. Movement Ecology 11:1.

Loring, P.H., J.D. McLaren, P.A. Smith, L.J. Niles, S.L. Koch, H.F. Goyert, and H. Bai. 2018. Tracking movements of threatened migratory rufa red knots in U.S. Atlantic Outer Continental Shelf waters. OCS Study BOEM 2018-046. Bureau of Ocean Energy Management, Sterling, Virginia. 78 pp + Appendices. Available here: https://espis.boem.gov/Final%20Reports/BOEM_2018-046.pdf [Accessed May 23, 2023].

Loring, P.H., P.W. Paton, J.D. McLaren, H. Bai, R. Janaswamy, H.F. Goyert, C.R. Griffin and P.R. Sievert. 2019. Tracking offshore occurrence of common terns, endangered roseate terns, and threatened piping plovers with VHF arrays. OCS Study BOEM 2019-017. Bureau of Ocean Energy Management, Sterling, Virginia. 139 pp. Available here: https://espis.boem.gov/final reports/BOEM_2019-017.pdf and here: https://espis.boem.gov/final%20reports/BOEM_2019-017a.pdf [Accessed May 4, 2023].

Loring, P.H., J.D. McLaren, H.F. Goyert, P.W.C. Paton. 2020a. Supportive wind conditions influence offshore movements of Atlantic Coast piping plovers during fall migration. The Condor 122(3):1-16.

Loring, P.H., A.K. Lenske, J.D. McLaren, M. Aikens, A.M. Anderson, Y. Aubrey, E. Dalton, A. Dey, C. Friis, D. Hamilton, B. Holberton, D. Kriensky, D. Mizrahi, L. Niles, K.L. Parkins, J. Paquet, F. Sanders, A. Smith, Y. Turcotte, A. Vitz, P.A. Smith. 2020b. Tracking movements of migratory shorebirds in the US Atlantic Outer Continental Shelf region. OCS Study BOEM 2021-008. Bureau of Ocean Energy Management. Sterling, Virginia. 96 pp + Appendices. Available here: https://www.boem.gov/sites/default/files/documents/renewable-energy/studies/Tracking-Migratory-Shorebirds-Atlantic-OCS.pdf [Accessed April 9, 2023].

Lyons, J.E., B. Winn, T. Teyes, and K.S. Kalasz. 2017. Post-breeding migration and connectivity of red knots in the Western Atlantic. The Journal of Wildlife Management 82(2):383-396.

Martínez-Curci, N.S., J.P. Isacch, V.L. D’Amico, P. Rojas, and G.J. Castresana. 2020. To migrate or not: drivers of over-summering in a long-distance migratory shorebird. Journal of Avian Biology 51:10.

Marques, A.T., H. Batalha, and J. Bernardino. 2021. Bird displacement by wind turbines: assessing current knowledge and recommendations for future studies. Birds 2(4):460-475.

Masden, E. 2015. Developing an avian collision risk model to incorporate variability and uncertainty. Scottish Marine and Freshwater Science 6(14).

Masden, E.A. and A.S.C.P. Cook. 2016. Avian collision risk models for wind energy impact assessments. Environmental Impact Assessment Review 56: 43–49.

Matus, R. 2021. Results of the 2021 aerial census at Bahía Lomas, Chile. Centro de Rehabilitación de Aves Leñadura. Guest author for the Western Hemisphere Shorebird Reserve Network. Available here: https://whsrn.org/results-of-the-2021-aerial-census-at-bahia-lomas-chile/ [Accessed April 6, 2023].

May, R.F. 2015. A unifying framework for the underlying mechanisms of avian avoidance of wind turbines. Biological Conservation (190):179–187.

McGowan, C.P., J.E. Hines, J.D. Nichols, J.E. Lyons, D.R. Smith, K.S. Kalasz, L.J. Niles, A.D.

Dey, N.A. Clark, P.W. Atkinson, C.D.T. Minton, W. Kendall. 2011. Demographic consequences of migratory stopover: linking red knot survival to horseshoe crab spawning abundance. Ecosphere 2(6):1-22.

Mizrahi, D.S. 2020. Aerial surveys for shorebirds wintering along northern South America's Atlantic Coast with an emphasis on semipalmated sandpipers and red knots – phase 2 (Project # 59145). Report by New Jersey Audubon Society to National Fish and Wildlife Foundation, Cape May Court House, New Jersey. 26 pp.

Newstead, D. 2019. Email of October 3, 2019. Manager, Coastal Waterbird Program. Coastal Bend Bays and Estuaries Program. Corpus Christi, Texas.

Newstead, D. 2020. Emails of March 6 and June 3, 2020. Manager, Coastal Waterbird Program. Coastal Bend Bays and Estuaries Program, Corpus Christi, Texas.

Niles, LJ. 2014. Braving Brazil. Available from https://www.arubewithaview.com/2014/02/25/braving-brazil/ [Accessed on May 16, 2023].

Niles, L.J., J. Burger, R.R. Porter, A.D. Dey, C.D.T. Minton, P.M. González, 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.

Norambuena, HV, R Matus, A Larrea, and C Espoz. 2022. Censos aéreos de aves playeras en el santuario de la naturaleza Bahía Lomas, enero 2022.

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. Prepared for the U.S. Department of the Interior, Bureau of Ocean Energy Management, New Orleans, Louisiana. 221 pp + Appendices.

Perkins, S., T. Allison, A. Jones, G. Sadoti. 2004. A survey of tern activity within Nantucket Sound, Massachusetts, during the 2003 fall staging period. Report prepared for Massachusetts Technology Collaborative by Massachusetts Audubon Society, Lincoln, Maine.

Perkins, G. 2023. Geolocator project coordinator: using geolocator tracking data to advance understanding of red knot migration habits. Prepared For Environment and Climate Change Canada, and the United States Fish and Wildlife Service by Ninox Consulting Ltd., Smithers, British Columbia, Canada. 36 pp. + Appendices.

Rebke, M., V. Dierschke, C.N. Weiner, R. Aumüller, K. Hill, and R. Hill. 2019. Attraction of nocturnally migrating birds to artificial light: The influence of colour, intensity and blinking mode under different cloud cover conditions. Biological Conservation 233:220–227.

Robinson Willmott, 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 method and database. OCS Study BOEM 2013-207. Bureau of Ocean Energy Management, Herndon, Virginia. 156 pp + Appendices. Available from: https://espis.boem.gov/final%20reports/5319.pdf [Accessed May 10, 2023].

Rock. J. 2023. Email of February 1, 2023. Wildlife Biologist. Environment and Climate Change

Canada, Sackville, New Brunswick, Canada.

Schwarzer, A.C. 2011. Demographic rates and energetics of red knots wintering in Florida. University of Florida, Gainesville, Florida, USA.

Schwarzer, A.C., J.A. Collazo, L.J. Niles, J.M. Brush, N.J. Douglass, and H.F. Percival. 2012. Annual survival of red knots (*Calidris canutus rufa*) wintering in Florida. The Auk 129(4):725-733.

Sherfy, M.H., M.J. Anteau, T.L. Shaffer, M.A. Sovada, and J.H. Stucker. 2012. Foraging ecology of least terns and piping plovers nesting on Central Platte River sandpits and sandbars. U.S. Geological Survey, Reston, Virginia. 41 pp + Appendices. Available from: https://pubs.usgs.gov/of/2012/1059/of12-1059.pdf [Accessed May 9, 2023].

Smith, A.D., F.J. Sanders, K.L. Lefevre, J.M. Thibault, K.S. Kalasz, M.C. Handmaker, F.M. Smith, T. Keyes. 2023. Spring migration patterns of red knots in the Southeast United States disentangled using automated telemetry. Unpublished report.

[SNH] Scottish Natural Heritage. 2018. Avoidance rates for the onshore SNH Wind Farm collision risk. Stilligarry, South Uist, Scotland. 4 pp. Available from: https://www.nature.scot/sites/default/files/2018-09/Wind%20farm%20impacts%20on%20birds%20-%20Use%20of%20Avoidance%20Rates%20in%20the%20SNH%20Wind%20Farm%20Collision%20Risk%20Model.pdf [Accessed May 8, 2023].

Staine, K.J. and J. Burger. 1994. Nocturnal foraging behavior of breeding piping plovers (*Charadrius melodus*) in New Jersey. The Auk 111(3): 579-587.

Stantial, M.L. and J.B. Cohen. 2022. Twenty-four hour activity patterns of breeding Atlantic Coast piping plovers. Wader Study 129(1): 65–68.

Thaxter, C.B., G.M. Buchanan, J. Carr, S.H.M. Butchart, T. Newbold, R.E. Green, J.A. Tobias, W.B. Foden, S. O'Brien, and J.W. Pearce-Higgins. 2017. Bird and bat species' global vulnerability to collision mortality at wind farms revealed through a trait-based assessment. Proceedings of the Royal Society B 284(1862): 20170829. Available here: http://dx.doi.org/10.1098/rspb.2017.0829.

[USFWS] U.S. Fish and Wildlife Service. 1996. Piping plover (*Charadrius melodus*), Atlantic Coast population, revised recovery plan. Hadley, Massachusetts. 258 pp. https://ecos.fws.gov/docs/recovery_plan/960502.pdf [Accessed May 22, 2023].

[USFWS] U.S. Fish and Wildlife Service. 2009. Piping plover (*Charadrius melodus*) 5-year review: summary and evaluation. Northeast Region, Hadley, Massachusetts and Michigan Field Office, East Lansing, Michigan. 206 pp. https://ecos.fws.gov/docs/five_year_review/doc3009.pdf [Accessed May 22, 2023].

[USFWS] U.S. Fish and Wildlife Service. 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]. New Jersey Field Office, Pleasantville, New Jersey. 376 pp. plus Appendices. https://www.regulations.gov/document/FWS-R5-ES-2013-0097-0703 [Accessed May 10, 2023].

[USFWS] U.S. Fish and Wildlife Service. 2020a. Piping plover (*Charadrius melodus*) 5-year review: summary and evaluation. U.S. Fish and Wildlife Service, Michigan Field Office, East Lansing, Michigan and Northeast Region, Hadley, Massachusetts. 164 pp. https://ecos.fws.gov/docs/five_year_review/doc6378.pdf [Accessed April 5, 2023].

[USFWS] U.S. Fish and Wildlife Service. 2020b. Species status assessment report for the rufa red knot (*Calidris canutus rufa*). Version 1.1. New Jersey Field Office, Galloway, New Jersey. https://ecos.fws.gov/ServCat/DownloadFile/187781 [Accessed April 6, 2023].

[USFWS] U.S. Fish and Wildlife Service. 2021a. Abundance and productivity estimates - 2021 update Atlantic Coast piping plover population. Hadley, Massachusetts. 16 pp. https://www.fws.gov/media/abundance-and-productivity-estimates-2021-update-atlantic-coast-piping-plover-population [Accessed April 5, 2023].

[USFWS] U.S. Fish and Wildlife Service. 2021b. Rufa red knot (*Calidris canutus rufa*) 5-year review: summary and evaluation. New Jersey Field Office, Galloway, New Jersey. 35 pp. https://ecos.fws.gov/docs/tess/species_nonpublish/3624.pdf [Accessed April 5, 2023].

[USFWS] U.S. Fish and Wildlife Service. 2022. U.S. Fish and Wildlife Service evaluation of the Atlantic States Marine Fisheries Commission horseshoe crab/red knot adaptive resource management revision. Northeast Region, Hadley, Massachusetts. 8 pp. https://www.fws.gov/sites/default/files/documents/service-evaluation-of-atlantic-states-marine-fisheries-commission-horseshoe-crab-red-knot-adaptive-resource-management-revision.pdf [Accessed April 7, 2023].

[USFWS] U.S. Fish and Wildlife Service. 2023a. Biological opinion on the effects of the Ocean Wind 1 Wind Energy Project, offshore Atlantic County, New Jersey on three federally listed species. May 2023. U.S. Fish and Wildlife Service, Galloway, New Jersey. 71 pp + Appendices.

[USFWS] U.S. Fish and Wildlife Service. 2023b. Biological opinion on the effects of the SouthCoast Wind Project on the Rufa Red Knot (*Calidris canutus rufa*; threatened) and Piping Plover (*Charadrius melodus*; threatened). September 2023. U.S. Fish and Wildlife Service, Concord, New Hampshire. 61 pp + Appendices.

[USFWS] U.S. Fish and Wildlife Service. 2023c. Piping plover (web site). Washington, D.C. https://www.fws.gov/species/piping-plover-charadrius-melodus [Accessed April 6, 2023]

[USFWS] U.S. Fish and Wildlife Service. 2023d. Recovery plan for the rufa red knot (*Calidris canutus rufa*). U.S. Fish and Wildlife Service, New Jersey Field Office, Galloway, New Jersey. 22 pages. https://ecos.fws.gov/docs/recovery_plan/2023_red%20knot%20recovery%20plan_final_508%20compliant%20signed.pdf [Accessed May 12, 2023].

[USFWS and NMFS] U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1998. Endangered species consultation handbook procedures for conducting consultation and conference activities under Section 7 of the Endangered Species Act. 190 pp + Appendices. https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf. [Accessed May 22, 2023].

Veit, R. and W. Petersen. 1993. Birds of Massachusetts. Massachusetts Audubon Society, Lincoln, MA.

Watts, B.D., E.T. Reed, and C. Turrin. 2015. Estimating sustainable mortality limits for shorebirds using the Western Atlantic Flyway. Wader Study 122(1):37-53.

[WHSRN]. Western Hemisphere Shorebird Reserve Network. 2020. Results of the 2020 aerial survey of rufa Red Knot in Tierra del Fuego. Available from: https://whsrn.org/results-of-the-2020-aerial-survey-of-rufa-red-knot-in-tierra-del-fuego/ [Accessed April 6, 2023].

Wilson, S. and R.I.G. Morrison. 2018. Appendix 1. Proportions of juvenile, sub-adult and adult birds in populations of Red Knot. Unpublished data. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Canada. 2 pp.

Appendix A. Additional Conservation Measures Included in the Project Description

1. Turbine Configuration

a. The WTG design provides a wind turbine air gap (minimum blade tip elevation to the sea surface) to minimize collision risk to marine birds[7] (*e.g.*, roseate terns) that may fly close to the ocean surface.

b. To minimize attracting birds to operating turbines, Park City Wind must install bird perching-deterrent devices where such devices can be safely deployed on WTGs and ESPs. The location of bird-deterrent devices proposed by Park City Wind must be based on best management practices applicable to the appropriate operation and safe installation of the devices. Park City Wind must submit for BOEM and Service approval a plan to deter perching on offshore infrastructure by listed species. The plan must include the type(s) and locations of bird perching-deterrent devices, include a maintenance plan for the life of the project, allow for modifications and updates as new information and technology become available, and track the efficacy of the deterrents. The plan will be based on best available science regarding the effectiveness of perching deterrent devices on minimizing collision risk.

2. Offshore Lighting

To aid safe navigation, Park City Wind must comply with all Federal Aviation Administration (FAA), USCG, and BOEM lighting, marking, and signage requirements.

a. Park City Wind will use lighting technology that minimizes impacts on avian species to the extent practicable.

b. Park City Wind will implement an ADLS on WTGs and ESPs. Park City Wind must use an FAA-approved vendor for the ADLS, which will activate the FAA hazard lighting only when an aircraft is in the vicinity of the wind facility to reduce visual impacts at night. Park City Wind must confirm the use of an FAA-approved vendor for ADLS on WTGs and ESPs in the Fabrication and Installation Report.

c. Park City Wind is required to light each WTG and ESP in a manner that is visible by mariners in a 360-degree arc around the structure. Conditional on USCG approval, and to minimize the potential of attracting migratory birds, the top of each USCG-required marine

---

[7] Some Conservation Measures taken directly from the BA or BOEM correspondence include references to species other than the listed birds addressed in this BO. In such cases, the applicability of that measure to non-listed species is not a binding provision of this BO; however, its implementation may be required by BOEM under other authorities.

navigation light will be shielded[8] to minimize upward illumination. Coordination with the USCG regarding maritime navigation lighting occurs post-COP approval, generally at least 120 calendar days prior to installation. The Service will be afforded an opportunity to review[9] a copy of Park City Wind's application to USCG to establish Private Aids to Navigation (PATON), which includes a lighting, marking, and signaling plan. The PATON application will include design specifications for maritime navigation lighting.

Following approval of the PATON by the USCG, the BOEM and the Service will work together to evaluate the USCG-approved navigation lighting system, in order to characterize the color, intensity, and duration of any light from maritime lanterns that is likely to reach the typical flight heights of listed birds and will assess the degree to which the light is likely to attract or disorient listed birds. This information will be considered, as appropriate, in future estimates of projected collision levels (see Conservation Measure 4, below), in any future updates to the ITS accompanying this BO, and in future iterations of the Compensatory Mitigation Plan (see Conservation Measure 7, below).

3. Collision Risk Model Support

The BOEM has funded the development of SCRAM, which builds on and improves earlier collision risk modeling frameworks. The Service fully supports SCRAM as a scientifically sound method for integrating best available information to assess collision risk for the listed bird species. The first generation of SCRAM was released in early 2023 and still reflects a number of consequential data gaps and uncertainties. The BOEM has already committed to funding Phase 2 of the development of SCRAM. We expect that the current limitations of SCRAM will decrease substantially over time as more tracking data are incorporated into the model (*e.g.*, from more individual birds tagged in more geographic areas, improved bird tracking capabilities, and emerging tracking technologies), and as modeling methods and computing power continue to improve. Via this Conservation Measure, the BOEM commits to continue funding the refinement and advancement of SCRAM, or its successor, with the goal of continually improving the accuracy and robustness of collision mortality estimates. This commitment is subject to the allocation of sufficient funds to the BOEM from Congress. This commitment will remain in effect until one of the following occurs:

1. the New England Wind turbines cease operation;

---

[8] The Service understands that the USCG-approved lights may not be shielded, per se, but that marine lanterns typically approved for this type of usage are designed to illuminate a horizonal plane near the sea surface, and do not direct light skyward.

[9] The Service may offer recommendations to USCG on the PATON application to minimize or reduce avian impacts. However, expertise and jurisdiction for ensuring safe navigation lay with USCG. No measures to minimize avian impacts will be adopted or pursued that are not deemed by USCG as fully compatible with safe navigation.

2. the Service concurs that a robust weight of evidence has demonstrated that collision risks to all listed birds from New England Wind turbine operation are negligible (*i.e.*, the risk of take from WTG operation is found to be discountable); or
3. the Service concurs that further development of SCRAM (or its successor) is unlikely to improve the accuracy or robustness of collision mortality estimates.

4. Collision Risk Model Utilization

The BOEM will work cooperatively with the Service to re-run the SCRAM model (or its successor) for the New England Wind project according to the following schedule:

- At least annually for the first 3 years of WTG operation.
- At least every other year for years 4 to 10 of WTG operation (*i.e.*, years 4, 6, 8, and 10).
- At least every 5 years between year 10 and the termination of WTG operation (*i.e.*, years 15, 20, 25, and 30).

Between these regularly scheduled model runs, the BOEM will also re-run the SCRAM model (or its successor) within 90 days of each major model release or update, and at any time upon request by the Service or Park City Wind, and at any time as desired by the BOEM. Prior to each model run, the BOEM and the Service will reach agreement on model inputs based on best available science, and the agencies may opt for multiple model runs using a range of inputs to reflect uncertainties in the inputs.

The above schedule may be altered upon the mutual agreement of the BOEM and the Service. The schedule is subject to sufficient allocation of funds to the BOEM from Congress. This commitment will remain in effect until one of the following occurs:

i. the New England Wind turbines cease operation;
ii. the Service concurs that a robust weight of evidence has demonstrated that collision risks to all listed birds from New England Wind turbine operation are negligible (*i.e.*, the risk of take from WTG operation is found to be discountable); or
iii. the Service concurs that further model runs are unlikely to improve the accuracy or robustness of collision mortality estimates.

The BOEM is currently undertaking a programmatic analysis of proposed offshore wind activities in the New York Bight. To account for potential additive and synergistic effects of offshore wind infrastructure buildout across this section of the coast, the BOEM will consider collision mortality estimates for New England Wind in its assessment of overall collision risk for the New York Bight. The periodic updating of collision mortality estimates for New England Wind, according to the above schedule, may eventually be integrated into a regional or coastwide adaptive monitoring and impact minimization framework.

5. Monitoring and Data Collection

An avian species monitoring plan for ESA-listed species and/or other priority species or groups will be developed and coordinated appropriate state wildlife agencies and the Service and implemented as required.

The BOEM will require Park City Wind to develop and implement an Avian and Bat[10] Post-Construction Monitoring Plan (ABPCMP) based on the ABPCMF in coordination with the BSEE, the Service, appropriate state wildlife agencies, and other relevant regulatory agencies. Annual monitoring reports will be used to determine the need for adjustments to monitoring approaches, consideration of new monitoring technologies, and/or additional periods of monitoring.

Prior to or concurrent with offshore construction activities, Park City Wind must submit an ABPCMP for BOEM, the BSEE and Service review. The BOEM, the BSEE and the Service will review the ABPCMP and provide any comments on the plan within 30 calendar days of its submittal. Park City Wind must resolve all comments on the ABPCMP to the satisfaction of the BOEM, the BSEE and the Service before implementing the plan and prior to the start of WTG operations. The objectives of the monitoring plan will include: (1) to advance understanding of how the target species utilize the offshore airspace and do (or do not) interact with the wind farm; (2) to improve the collision estimates from SCRAM (or its successor) for the three listed bird species; and (3) to inform any efforts aimed at minimizing collisions (see Conservation Measures 1 and 2, above) or other project effects on target species.

a. Monitoring. Park City Wind must develop an ABPCMP, which will include, at a minimum:
   i. Acoustic monitoring for listed birds and bats;
   ii. Installation of Motus receivers on WTGs in the New England Wind action area and support with upgrades or maintenance of two onshore Motus receivers; and
   iii. Financial support for deployment of Motus tags for 20 years to track listed bird species.

   The ABPCMP will allow for changing methods over time (see Conservation Measure 5.d, below) in order to regularly update and refine collision estimates for listed birds. The plan will include an initial monitoring phase involving deployment of Motus radio tags on listed birds, in conjunction with installation and operation of Motus Wildlife Tracking System (Motus) receiving stations on turbines in the Lease Area, following offshore Motus

---

[10] The post-construction monitoring framework and plan address listed and non-listed birds and bats. This Opinion addresses only turbine collision risk for two listed birds, and only those elements of the plan related to collision of these two species are binding provisions of this BO. However, implementation of the full plan may be required by BOEM under other authorities. In addition, the Service may provide separate monitoring recommendations for other species (e.g., listed bats, non-listed birds) and/or other issues (e.g., assessing behavioral change of listed or non-listed species) as technical assistance pursuant to the ESA, the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 703-712, as amended), and/or the National Environmental Policy Act (83 Stat. 852; 42 U.S.C. 4321 et seq.).

recommendations. The initial phase may also include deployment of satellite-based tracking technologies (*e.g.*, Global Positioning System [GPS] or Argos tags).

b. Annual Monitoring Reports. Park City Wind must submit to the BOEM (at renewable_reporting@boem.gov), the BSEE (via TIMSWeb and at protectedspecies@bsee.gov), and the Service, a comprehensive report after each full year of monitoring (pre- and post-construction) within 12 months of completion of the last avian survey. The report must include all data, analyses, and summaries regarding ESA-listed and non-ESA-listed birds and bats. The BOEM, the BSEE, and the Service will use the annual monitoring reports to assess the need for reasonable revisions (based on subject matter expert analysis) to the ABPCMP. The BOEM, the BSEE, and the Service reserve the right to require reasonable revisions to the ABPCMP and may require new technologies as they become available for use in offshore environments (see Conservation Measure 5.d, below).

c. Post-Construction Quarterly Progress Reports. Park City Wind must submit quarterly progress reports during the implementation of the ABPCMP to the BOEM (at renewable_reporting@boem.gov), the BSEE, and the Service by the 15th day of the month following the end of each quarter during the first full year that the Project is operational. The progress reports must include a summary of all work performed, an explanation of overall progress, and any technical problems encountered.

d. Monitoring Plan Revisions. Within 30 calendar days of submitting the annual monitoring report (pursuant to Conservation Measure 5.b, above), Park City Wind must meet with the BOEM, the BSEE, the Service, and appropriate state wildlife agencies to discuss the following: the monitoring results; the potential need for revisions to the ABPCMP, including technical refinements or additional monitoring; and the potential need for any additional efforts to reduce impacts. If, based on this annual review meeting, the BOEM and the Service jointly determine that revisions to the ABPCMP are necessary, the BOEM will require Park City Wind to modify the ABPCMP. If the projected collision levels, as informed by monitoring results, deviate substantially from the effects analysis included in this BO, Park City Wind must transmit to the BOEM recommendations for new mitigation measures and/or monitoring methods.

The frequency, duration, and methods for various monitoring efforts in future revisions of the ABPCMP will be determined adaptively based on current technology and the evolving weight of evidence regarding the likely levels of collision mortality for each listed bird species. The effectiveness and cost of various technologies/methods will be key considerations when revising the plan. Grounds for revising the ABPCMP include, but are not limited to:

  i. greater than expected levels of collision of listed birds;

ii. evolving data input needs (as determined by the BOEM and the Service) for SCRAM (or its successor);
iii. changing technologies for tracking or otherwise monitoring listed birds in the offshore environment that are relevant to assessing collision risk;
iv. new information or understanding of how listed birds utilize the offshore environment and/or interact with wind farms; and
v. a need (as determined by the BOEM and the Service) for enhanced coordination and alignment of tracking, monitoring, and other data collection efforts for listed birds across multiple wind farms/leases on the OCS.

The BOEM will require Park City Wind to continue implementation of appropriate monitoring activities for listed birds (under the current and future versions of the ABPCMP) until:

vi. the New England Wind turbines cease operation;
vii. the Service concurs that a robust weight of evidence has demonstrated that collision risks to all three listed birds from New England Wind turbine operation are negligible (i.e., the risk of take from WTG operation is found to be discountable); or
viii. the Service concurs that further data collection is unlikely to improve the accuracy or robustness of collision mortality estimates and is unlikely to improve the ability of the BOEM and Park City Wind to reduce or offset collision mortality (see Conservation Measure 7, below).

e. Operational Reporting (Operations). Park City Wind must submit to the BOEM (at renewable_reporting@boem.gov) and the BSEE (via TIMSWeb and at protectedspecies@bsee.gov) an annual report summarizing monthly operational data calculated from 10-minute supervisory control and data acquisition (SCADA) data for all turbines together in tabular format: the proportion of time the turbines were actually spinning each month, the average rotor speed (monthly revolutions per minute) of spinning turbines plus 1 standard deviation, and the average pitch angle of blades (degrees relative to rotor plane) plus 1 standard deviation. The BOEM and the BSEE will use this information as inputs for avian collision risk models to assess whether the results deviate substantially from the effects analysis included in this Opinion.

f. Raw Data. Park City Wind must store the raw data from all avian and bat surveys and monitoring activities according to accepted archiving practices. Such data must remain accessible to the BOEM, the BSEE, and the Service, upon request for the duration of the lease. Park City Wind must work with the BOEM to ensure the data are publicly available. All avian tracking data (*i.e.*, from radio and satellite transmitters) will be stored, managed, and made available to the BOEM, the BSEE and the Service following the protocols and procedures outlined in the agency document entitled *Guidance for Coordination of Data from Avian Tracking Studies*, or its successor.

6. Incidental Mortality Reporting[11]

Park City Wind must provide an annual report to the BOEM, the BSEE, and the Service documenting any dead (or injured) birds or bats found on vessels and structures or in the ocean during construction, operations, and decommissioning. The report must contain the following information: the name of species (if possible), 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's (USGS) Bird Banding Laboratory. Any occurrence of a dead ESA-listed bird or bat must be reported to the BOEM, the BSEE, and the Service as soon as practicable (taking into account crew and vessel safety), ideally within 24 hours and no more than two business days after the sighting. If practicable, the dead specimen will be carefully collected and preserved in the best possible state, contingent on the acquisition of the any necessary wildlife permits and compliance with Park City Wind health and safety standards.

7. Piping Plover Protection Plan

The project is proposing four possible landfall sites of which two, Craigsville and Covell Beaches, provide suitable nesting habitat for piping plovers. A single pair of piping plovers have been observed nesting at Craigsville Beach. No nesting has been observed at Covell Beach. To avoid potential impacts to piping plovers, Park City Wind has developed a Piping Plover Protection Plan (plover plan) for these two beaches which includes the following provisions (BOEM 2022a):

- Prior to horizontal directional drilling (HDD) operations, Park City Wind will provide construction personnel with the plover plan to achieve proper implementation.
- Installation of export cable conduits will not be initiated between April 1 and August 31. If HDD activities are initiated between April 1 and August 31, or if work is re-initiated after a 48-hour work stoppage during the piping plover nesting season (the aforementioned time period), the Massachusetts Natural Heritage and Endangered Species Program (NHESP), the Service, and the BOEM will be notified with the reason, anticipated duration of the work, and any additional information requested by NHESP, the Service, and the BOEM.
- If HDD activities are initiated between April 1 and August 31, or if work is re-initiated after a 48-hour work stoppage during the piping plover nesting season (the

---

[11] Incidental observations are extremely unlikely to document any fatalities of listed birds that may occur due to turbine collision. While this Conservation Measures appropriately requires documentation and reporting of any fatalities observed incidental to O&M activities, the ABPCMP will make clear that lack of documented fatalities in no way suggests that fatalities are not occurring. Likewise, the agencies will not presume that any documented fatalities were caused by colliding with a turbine unless there is evidence to support this conclusion.

aforementioned time period), Park City Wind will follow the mitigation and monitoring measures outlined in the plover plan which include:

  - A qualified biologist will perform surveys to determine the presence/absence of any nesting piping plovers within 200 yards of the work zone.
    - If no nests, scrapes, or territorial pairs are identified within 200 yards of the work zone, the shorebird monitor will document the findings, report to NHESP and Park City Wind, and Park City Wind will be cleared to mobilize into the area within 48 hours, with no further monitoring activities required.
  - If nests, scrapes, or territorial pairs are observed within 200 yards of the work zone, locations will be recorded and the following monitoring will be required, based on nests and/or chick proximity to the work zone:
    - Greater than or equal to 100 yards from work zone and nest monitored once per day at dawn (before 0600 hours) during appropriate weather conditions;
    - 50 to 100 yards from work zone and nest monitored twice per day at dawn and dusk (before 0600 hours and after 1900 hours) during appropriate weather conditions; and
    - Less than 50 yards to the work zone and no equipment may be mobilized to the OECC landing sites unless specifically permitted by the NHESP.

- In the unlikely event that disturbance associated with HDD activities to coastal beach occurs, a qualified biologist will survey the site in advance of any equipment access to the beach and ensure no remedial actions will interfere with nesting piping plovers or other state-listed species.

Appendix B. Collision Risk Models

Available Collision Risk Models
Technology currently does not exist to detect a collision of a bird with a WTG, and the likelihood of finding a bird carcass in the offshore environment is negligible. Thus, we anticipate relying on collision risk modeling to estimate collision rates after construction, as well as for pre-construction assessments including this effects analysis. The BA (BOEM 2022a) presents results from two different models to estimate collision risk for listed birds from the Project. The two models are Band (Band 2012) and the Stochastic Collision Risk Assessment for Movement (SCRAM) (Adams et al. 2022).

Band

Band (2012) estimates the number of annual collisions using input data on the target species (*e.g.*, numbers, flight height, avoidance, body size, flight speed) and turbine details (*e.g.*, number, size, and rotation speed of blades). Band (2012) is an established method to assess collision risk for offshore wind farms. However, the Band (2012) model has several known limitations, summarized here from Masden (2015) and Masden and Cook (2016):

1. **Limited transparency.** The Excel spreadsheet that underpins the Band (2012) model does not allow for easy reproducibility or review of underlying code and data, thus hindering independent verification of results.
2. **Unable to account for variability, thus cannot reflect the inherent heterogeneity of the environment.** The Band (2012) model does not consider the natural variability of certain input parameters, such as bird flight speed and turbine rotor speed, which likely results in added uncertainty surrounding collision estimates.
3. **Deterministic.** Band (2012) is not a stochastic model, so it does not account for the stochasticity present in natural systems.
4. **Limited ability to quantify uncertainty.** Recent versions of the Band (2012) model guidance provide an approach under which uncertainty can be expressed, but its use is limited to cases in which sources of variability are independent of one another. Properly accounting for uncertainty becomes increasingly important as collision risk estimates are extrapolated over time, such as the 33-year lifespan of the New England Wind Project.

Stochastic Collision Risk Assessment for Movement (SCRAM)

The SCRAM builds on Band (2012) and introduces stochasticity via repeated model iterations. The wind farm and WTG operational inputs to SCRAM are similar to those used in the Band (2012) model. Unlike Band (2012), however, SCRAM estimates species exposure to a proposed wind farm using bird passage rates based on modeled flight paths of birds fitted with Motus tags (Adams et al. 2022), which are detected by a network of land-based receiving stations operated in coordination with the Motus network. Future versions of SCRAM will be updated with new tracking data as it becomes available, but the current version of SCRAM is informed by a fixed number of Motus tag detections that were collected from 2015 to 2017 for piping plovers and in 2016 for rufa red knots. SCRAM estimates monthly collision risk for those months when the species-specific tracking data were collected, and these monthly collision estimates are summed to produce annual collision estimates reflecting the months evaluated (Adams et al. 2022). It is important to note that SCRAM currently evaluates collision risk only for those months with movement data from Motus.

Collection of movement data during the study periods was limited by (1) tag battery life; (2) temporary tag attachment method/duration (*i.e.*, to minimize risks to tagged individuals); (3) locations of tag deployment; and (4) the detection range of land-based Motus stations (typically less than 12 miles), which during the study periods were unevenly distributed along the U.S. Atlantic Coast, with core station coverage at coastal sites from Massachusetts to Virginia.

The Service appreciates BOEM's past and ongoing support for the development of SCRAM and inclusion of Conservation Measure 3, above. We continue to support the development and refinement of SCRAM as a scientifically sound method for integrating best available information to assess collision risk for migratory birds. However, the first version of SCRAM was only released in early 2023 and still reflects consequential gaps and uncertainties. In addition to the limited data available to inform the model parameters, there has been limited validation of the model structure, resulting in substantial uncertainty in model results (Adams et al. 2022). Specific gaps and uncertainties of concern include:

1. **Sample size.** The tracking data sample sizes that underpin the model are relatively small, and do not include all tracks now available (*e.g.*, newer Motus data; any satellite, GPS, or geolocator data).
2. **Accuracy.** All of the flight tracks and altitudes that underpin the model are estimated from land-based receiving stations and are thus of limited accuracy because offshore bird movements were interpolated rather than measured directly. When evaluated via modeling, accuracy seems to improve the closer to shore and, in turn, the closer to most Motus stations; however, the detection range of receiving stations influence all movement estimates, nearshore and farther offshore. Estimates of flight altitude from Motus data are currently coarse approximations (Adams et al. 2022).
3. **Detection range.** The detection range of Motus receiving stations varies with altitude of the tagged bird but is typically less than 12 miles on average for birds in flight. Portions of the New England Wind lease area are well over the detection range from land-based receiving stations. Thus, there are gaps in coverage of the action area that could lead to inaccuracies in collision risk estimates.
4. **Temporal gaps.** Both movement and flight height data are currently limited to those times of year during which the tracking studies were carried out (Adams et al. 2022). There are no spring data for piping plover or rufa red knot in SCRAM due to small sample sizes of available data (*e.g.*, only two northbound piping plovers tagged in the Bahamas with tracks in the U.S.) and limited tagging locations (*e.g.*, most rufa red knots

tagged in spring were in Delaware Bay). Any collision estimates from SCRAM are limited to the time periods listed below. Thus, “annual” SCRAM outputs should be considered only partial estimates of projected collision levels because they reflect summing across only those months for which data are available.

a. Piping plovers:
   i. Collision risk evaluated: mid-incubation period and through fall migratory departure from tagging sites
   ii. Collision risk NOT evaluated: latter portion of fall migratory flights, spring migration and staging

b. Red knots:
   i. Collision risk evaluated: fall migratory departure from tagging sites
   ii. Collision risk NOT evaluated: latter portion of fall migratory flights, spring migration and staging

5. **Spatial bias.** SCRAM assumes that modeled bird airspace use is unbiased. However, it is likely that collision risk outputs from SCRAM are biased by the proximity of a lease area to the locations of Motus tag deployment and/or its location relative to the distribution of land-based receiving stations during the tracking study periods (Lamb et al. 2023). Variability in the location and operational status of Motus stations over the tracking study’s timeframe resulted in biased estimates of bird use of the offshore airspace (Adams et al. 2022). Thus, SCRAM could inaccurately estimate collision risk for projects more distant from the tagging areas or more distant from those receiving stations that were in operation during the study periods.

6. **Bias in tagged birds.** Both movement and flight height data are currently limited to those specific tagged populations tracked during the study periods (Adams et al. 2022). It is not yet clear if the bird tracks that underpin the current version of SCRAM are representative of all piping plovers and rufa red knots utilizing the offshore airspace. Even within the seasons/regions for which tracks are available and incorporated into SCRAM, these tracks represent birds from a relatively small number of sites at which tagging took place. For example, the tracks informing SCRAM for piping plover were all derived from Motus tag deployment at two nesting areas in New England. No tracks from the Atlantic Canada portion of the piping plover breeding range, which is part of the taxon listed under the ESA and fully protected when they are in the U.S., are available yet. Preliminary results from a previous mark/resight study found that 42 percent of piping plovers marked in Atlantic Canada were subsequently detected in New Jersey, and 52 percent were detected in North Carolina (Rock pers comm. 2023). These Canadian nesters could have significant exposure to offshore wind that is not yet reflected in SCRAM collision risk estimates. Rufa red knot trapping sites covered a greater geographic area but still may not be fully representative of the overall population’s use of the offshore airspace.

7. **Variability**. SCRAM cannot produce a range of plausible risk levels by varying certain “baked in” assumptions (*e.g.*, avoidance rate, population size, flight height) to which the model might be quite sensitive, and which are associated with high uncertainty. For

> example, species-specific avoidance rates are critical to obtaining realistic and confident estimates of collision events (Masden and Cook 2016, Kleyheeg-Hartman et al. 2018). Both the Band (2012) and SCRAM models require inputs or make assumptions for bird flight height, speed and populations anticipated to occur within the WTG area. The species-specific data for these parameters are associated with large margins of error (Loring et al. 2018; Loring et al. 2019) and/or are based on surrogate species information developed for European species (Cook 2021).

We appreciate BOEM's cooperative efforts to work with the Service on the development of SCRAM with the goal of reducing uncertainty around collision risk estimates. We expect that many of the above-listed limitations of SCRAM will decrease substantially over time as Motus tags are deployed in more areas, as receiving stations are deployed offshore, and/or as new tracking technologies become available. However, at this time, given the substantial limitations described above, we conclude that SCRAM outputs should be only one factor in assessing collision risk, and must be supplemented by other sources of information in order to satisfy the ESA requirement to utilize best available scientific and commercial data.

Methods for Estimating Numbers of Collisions

Given the high uncertainty associated with both Band (2012) and SCRAM, as discussed above, we consider collision projections from both models. For SCRAM, we rely on a March 28, 2023, addendum to the BA in which the BOEM presents the outputs from SCRAM version 1.0.3. As discussed above, SCRAM uses estimated flight paths and altitudes of tagged birds, combined with monthly population size estimates, to assess exposure of each species to the RSZ. Compared to Band (2012), SCRAM uses the monthly population estimates in a different way. To estimate monthly occupancy rates (within each half degree grid cell), SCRAM uses movement modeling derived from Motus tracking data and from them produces monthly population numbers to estimate species density in the Atlantic OCS, where tracking data were available. To estimate collision risk in areas of the Atlantic OCS where data are available (and in combination with Motus tracking), SCRAM uses the density estimates at specific flight altitudes along with other known species and site characteristics, such as flight speed and number of turbines in the area of interest (Adams et al. 2022).

For Band (2012), we input WTG specifications provided by the BOEM, and we utilized the same species-specific flight height distributions (*i.e.*, derived from Motus radio tracking data) as are used in SCRAM (Adams et al. 2022). We followed the guidance from Band (2012) to develop a best estimate, not a "worst case" scenario, and we used Annex 6 – Assessing collision risks for birds on migration. Although Annex 6 is unable to account for seasonally resident birds, we expect piping plovers and rufa red knots to only occur in the action area during migration flights. We conclude that Annex 6 is the most appropriate application of the Band (2012) model to New England Wind.

Although Annex 6 is unable to account for seasonally resident birds, we selected it for the following reasons: (1) Stage B of the Band (2012) basic model (i.e., for resident birds) requires an estimate of observed bird density on an area basis, and this information is unavailable for any of the listed bird species in the vicinity of the New England Wind Lease Area during any month; and (2) far greater numbers of migrating knots are present on the mid-Atlantic OCS compared to seasonally resident birds. Thus, we conclude that Annex 6 is the most appropriate application of the Band (2012) model to New England Wind.

Under Annex 6, Band (2012) makes these assumptions:

1. the entire bird population uses a migratory corridor twice each year;
2. the birds are evenly distributed across a migration corridor; and
3. the width of the corridor can be measured at the latitude of the wind farm. This "migratory front" is an imaginary line passing through the Wind Farm Area and extending to the western and eastern edges of the migratory corridor used by each species).

Regarding assumption 1, we conclude that it generally holds true that piping plovers cross the migratory front only twice per year. However, we know from tracking and resighting data that rufa red knots may engage in reverse migration over regional geographic scales in pursuit of favorable food and other stopover conditions (USFWS 2014). Thus, an unknown number of migrating rufa red knots could violate this assumption by crossing the migratory front more than twice per year. Regarding assumption 2, we conclude from tracking data that migratory bird species do not evenly distribute across a migration corridor. However, we still find it necessary and appropriate to consider Band (2012) outputs given the known gaps in SCRAM.

We used best available tracking, range maps, and other data to inform the delineation of the migration corridors. For piping plover, the corridor was based on radio tracking data for birds departing from Chatham, Massachusetts, and several sites in Rhode Island (Loring et al. 2020a, figures 5 and 6) and the known wintering distribution of the Atlantic Coast population (Blanco 2012, Elliott-Smith et al. 2015, Gratto-Trevor et al. 2016, Elliot-Smith and Haig 2020). The piping plover corridor measures 179.68 miles (289.17 km) wide at the latitude of the New England Wind Lease Area.

For rufa red knot, we based the migration corridor on geolocator tracking data collected from 93 individual birds (with tags deployed across the species range) between 2009 and 2017 (Perkins 2023). The corridor measures 1,417 miles (2,280 km) across at the latitude of the New England Wind Lease Area and encompasses all rufa red knot geolocator tracks, except those that are clearly associated with the Western recovery unit. A considerable number of satellite/GPS tracking devices have been deployed on rufa red knots since 2020. Preliminary data from these satellite tags were evaluated but ultimately not utilized in delineating the migration corridors because the data are still undergoing quality control, and in many cases, metadata are not yet available. Although not relied upon for this mapping exercise, the preliminary satellite data do show broadly similar geographic patterns to the geolocator data and lend confidence to our delineation of these two migration corridors. Likewise, Geographic Information System layers were unavailable for the migration tracks shown in Smith et al. (2023), but the migration pathways shown in Figure 2 of that paper are broadly similar to those in Perkins (2023) and further support our delineations.

The final input required to run Band (2012), Annex 6, is the number of birds crossing the migratory front each month. Appendix B Table 1 presents the population data we used for this purpose. All monthly numbers were multiplied by 33 to estimate number of collisions over the operational life of the New England Wind turbines.

Appendix A Table 1. Population data inputs to Band (2012), Annex 6

	Piping Plover	**Rufa Red Knot**
Total northbound (NB)	2,892	59,269
Young of the year (YOY)	1,933	27,041
Total southbound (SB)	4,825	86,310
# of Jan crossings	0	0
# of Feb crossings	0	0
# of Mar crossings	290 (10% of NB)	0
# of Apr crossings	1,734 (60% of NB)	0
# of May crossings	868 (30% of NB)	59,269 (100% of NB)
# of Jun crossings	485 (10% of SB)	2,371 (3% of SB)
# of Jul crossings	2,892 (60% of SB)	7,009 (8% of SB)
# of Aug crossings	1,448 (30% of SB)	25,893 (30% of SB)
# of Sep crossings	0	25,893 (30% of SB)
# of Oct crossings	0	15,651 (18% of SB)
# of Nov crossings	0	8,631 (10% of SB)
# of Dec crossings	0	863 (1% of SB)

Appendix A Table 1 Notes:

Piping Plover:

(1) Population data are from 2021 (USFWS 2021a) and exclude an unknown (but likely small) number of nonbreeding birds.

(2) The Southern recovery unit population is excluded.

(3) The SB total includes YOY, calculated as the unweighted mean 20-year productivity rates (2002 - 2021) times the 2021 breeding pair estimate for each state within the Eastern Canada, New England, and NY-NJ recovery units.

(4) The eastern edge of the migration corridor runs southwest parallel to the general orientation of the coast to account for major migration staging areas in North Carolina. The eastern edge of the corridor south of Cape Hatteras is also constrained westward to account for much larger numbers of piping plovers wintering in the western Bahamas, although this has no effect on the width of the corridor at the latitude of the New England Wind Lease Area.

Rufa Red Knot

(1) Population data are from Table 4, above. Birds from the Western recovery unit population are sometimes documented on the Atlantic coast. However, available tracking and resighting data show that the prevailing migration corridor for these birds is overland across the mid-continent (Perkins 2023, USFWS 2021b, USFWS 2014). On this basis, birds from the Western recovery unit are excluded from this analysis.
(2) In many years, a percentage of northbound birds do not depart the mid-Atlantic until early June. But for the purposes of this analysis, we attribute them all to May.
(3) Some juveniles and nonbreeding adults remain south of the migration front, others cross the migration front once in spring and spend the breeding season just south of the breeding grounds, while still others may remain resident in the mid-Atlantic for prolonged periods and may cross the migration front multiple times. We have no estimate of the total number of nonbreeding adults in a typical year, or their distribution across the species nonbreeding range. However, we do estimate the total number of juveniles. Modeling by Schwarzer (2011) found that the Florida population was stable at around 8.75 percent juveniles among wintering birds, and available data suggest the three populations considered in this analysis are currently stable (USFWS 2021b). Thus, we assume 8.75 percent of the total wintering birds are juveniles (*i.e.*, of the 59,269 total birds, we assume 5,186 are juveniles.) We have little information on the distribution of juveniles across the species' range during any month. In light of data gaps, we assume all breeding adults, nonbreeding adults, and juveniles cross the migration front twice per year.
(4) The SB total includes YOY, calculated as 1 chick per pair. Number of pairs is calculated as [the total wintering population (59,269) minus juveniles (5,186)] divided by 2. We have no way to estimate nonbreeding adults, so we include them with breeding adults, then attempt to compensate by using a reproductive rate of 1 chick per pair, below the range estimated by Wilson and Morrison (2018) as needed for a stable population.

Analysis of Model Outputs and Projected Numbers of Collisions

As discussed at length in the Opinion, the collision risk estimates are associated with very high uncertainty. We consider these model outputs as one factor relevant to projecting the number of collisions (if any) of each listed bird species that is reasonably certain to occur over the life of the Project. However, we do not restrict our analysis to these numerical outputs due to the model limitations, discussed above, as applied specifically to each listed species, as discussed below. Instead, we consider the model outputs in the context of other relevant quantitative and qualitative information. This approach is consistent with guidance from Band (2012), who concluded, "…given the uncertainties and variability in source data, and the limited firm information on bird avoidance behavior, it seems likely that for many aspects the range of uncertainty may have to be the product of expert judgement, rather than derived from statistical analysis." This approach is also consistent with ESA policy (80 FR 26837), which states, "While relying on the best available scientific and commercial data, the Services will necessarily apply their professional judgment in reaching these determinations and resolving uncertainties or information gaps. Application of the Services' judgment in this manner is consistent with the "reasonable certainty" standard."

SCRAM uses only one avoidance rate (0.927) for piping plover and rufa red knot (Adams et al. 2022). Collision risk models are sensitive to the selection of avoidance rates (Chamberlain et al. 2006, Robinson-Willmott et al. 2013, Gordon and Nations 2016, Masden and Cook 2016, Kleyheeg-Hartman et al. 2018). The selection of 0.927 for use in SCRAM was based on a review of available literature for gulls and terns in Europe (Cook 2021). Cook (2021) presents avoidance rates for three tern species for use in the extended Band (2012) model, ranging from 85 to 99 percent; the average of 93 percent is consistent with the SCRAM model. We are not aware of any empirical, species-specific avoidance rates available for piping plovers, rufa red knots, or other shorebirds.

In addition to the lack of species-specific empirical data, we note that blanket application of any avoidance rate does not account for differences among individual birds; acclimation to the wind farm; flocking behavior; flight height or type (*e.g.*, foraging, migratory, regional transit); weather conditions or visibility; time of day; and any behavioral influence of the wind farm on the bird (*e.g.*, displacement, attraction) (May 2015, Gordon and Nations 2016, Masden and Cook 2016, Marques et al. 2021). In light of the sensitivity and uncertainty around this parameter, we consider a range of avoidance rates, consistent with the recommendation of Band (2012). However, based on Band (2012), Gordon and Nations (2016), Kleyheeg-Hartman et al. (2018), SNH (2018), Cook (2021), and Adams et al. (2023), we primarily consider the 93 and 98 percent avoidance rates in our analysis. Comparing the 93 and 98 percent avoidance rates, we selected the 93 percent avoidance rate in our analysis as it provides the most conservative estimate of the two avoidance rates for establishing a take exceedance value for the purposes of reinitiation of consultation.

Appendix C. Collision Risk Model Outputs

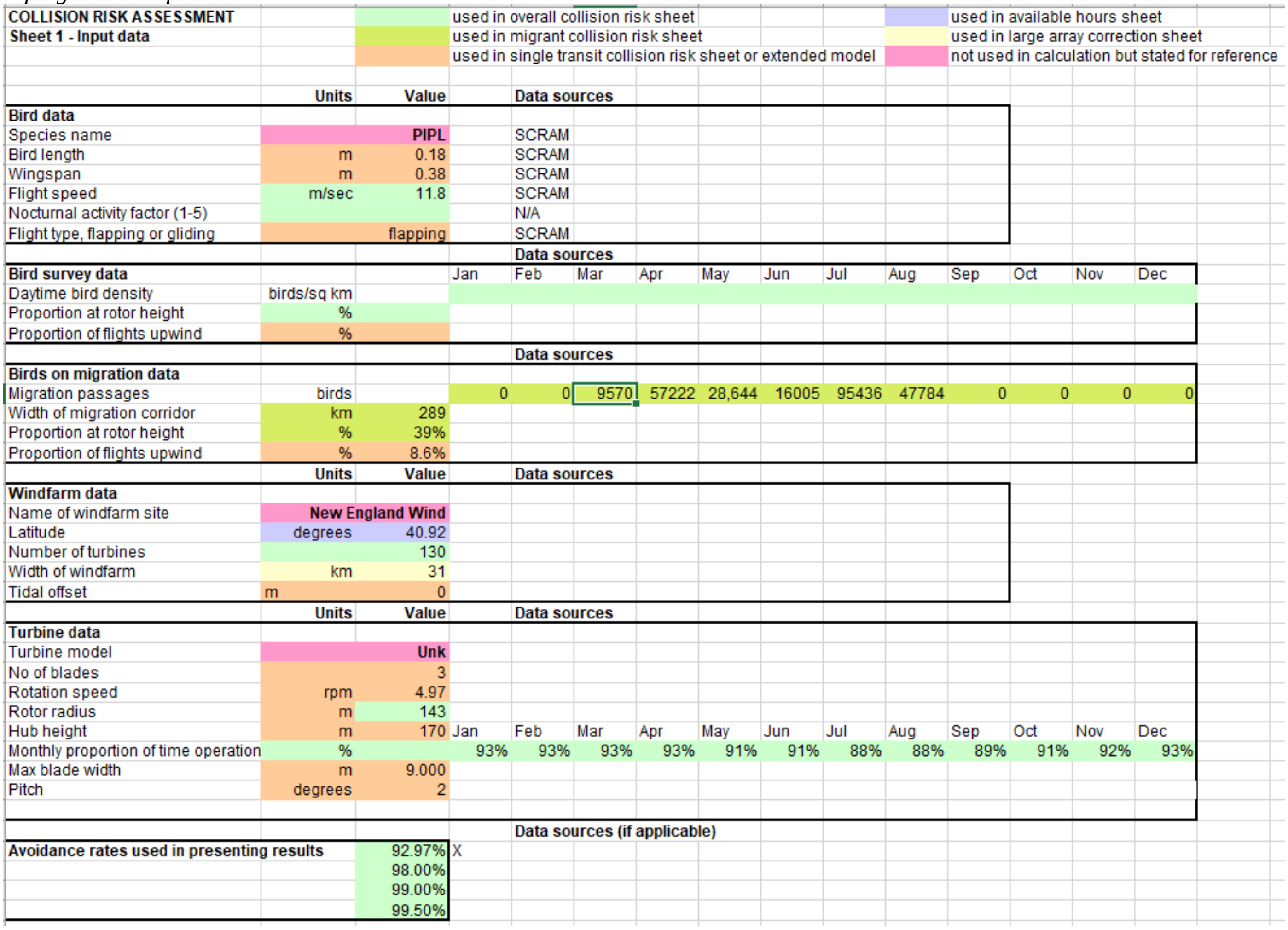
Stochastic Collision Risk Assessment for Movement Data (SCRAM)

SCRAM 1.0.3	PIPL	REKN
27 m gap	8.3 (5.0 – 13.5)	4.6 (0.0 – 27.0)

Appendix C Table 1. SCRAM outputs for 33-year New England Wind project displayed as mean (95% confidence interval).

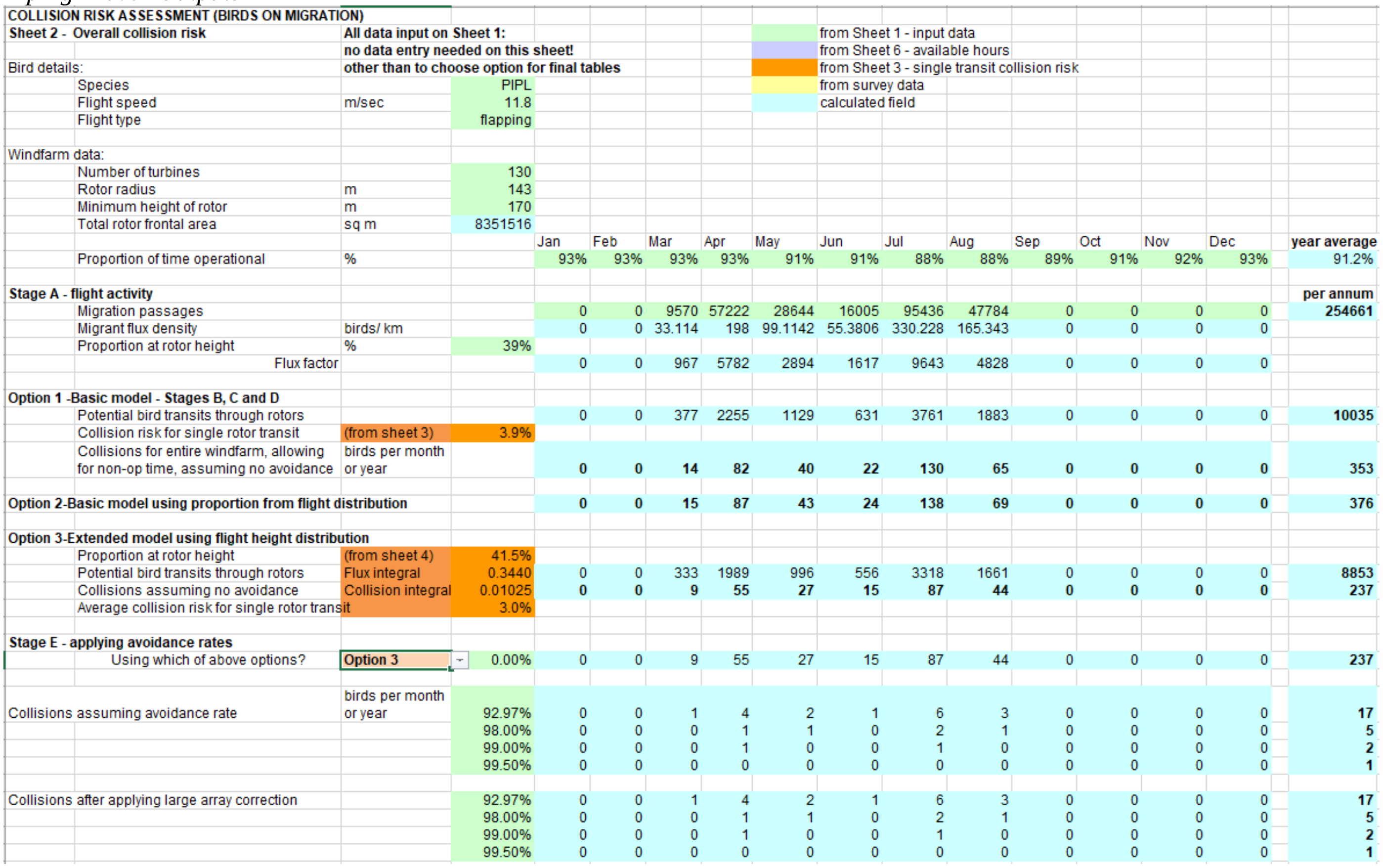
Band Inputs and Outputs

Piping Plover Inputs



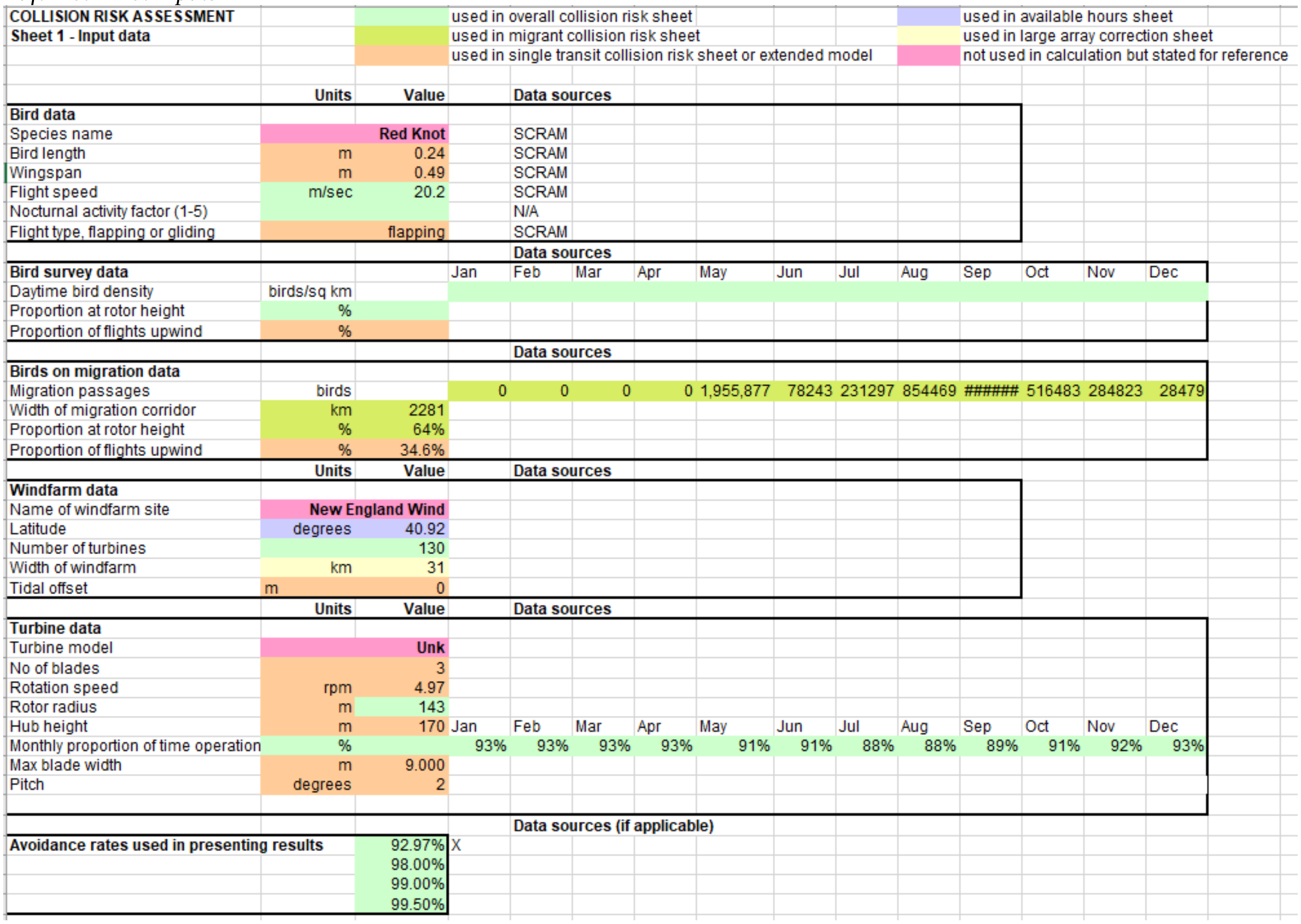
COLLISION RISK ASSESSMENT		🟩	used in overall collision risk sheet							🟪	used in available hours sheet			
Sheet 1 - Input data		🟨	used in migrant collision risk sheet							⬜	used in large array correction sheet			
		🟧	used in single transit collision risk sheet or extended model							🟥	not used in calculation but stated for reference			
	Units	**Value**		**Data sources**										
Bird data														
Species name		**PIPL**		SCRAM										
Bird length	m	0.18		SCRAM										
Wingspan	m	0.38		SCRAM										
Flight speed	m/sec	11.8		SCRAM										
Nocturnal activity factor (1-5)				N/A										
Flight type, flapping or gliding		flapping		SCRAM										
				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	%													
				Data sources										
Birds on migration data														
Migration passages	birds		0	0	9570	57222	28,644	16005	95436	47784	0	0	0	0
Width of migration corridor	km	289												
Proportion at rotor height	%	39%												
Proportion of flights upwind	%	8.6%												
	Units	**Value**		**Data sources**										
Windfarm data														
Name of windfarm site		**New England Wind**												
Latitude	degrees	40.92												
Number of turbines		130												
Width of windfarm	km	31												
Tidal offset	m	0												
	Units	**Value**		**Data sources**										
Turbine data														
Turbine model		**Unk**												
No of blades		3												
Rotation speed	rpm	4.97												
Rotor radius	m	143												
Hub height	m	170	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly proportion of time operation	%		93%	93%	93%	93%	91%	91%	88%	88%	89%	91%	92%	93%
Max blade width	m	9.000												
Pitch	degrees	2												
				Data sources (if applicable)										
Avoidance rates used in presenting results		92.97%	X											
		98.00%												
		99.00%												
		99.50%												

Piping Plover Outputs



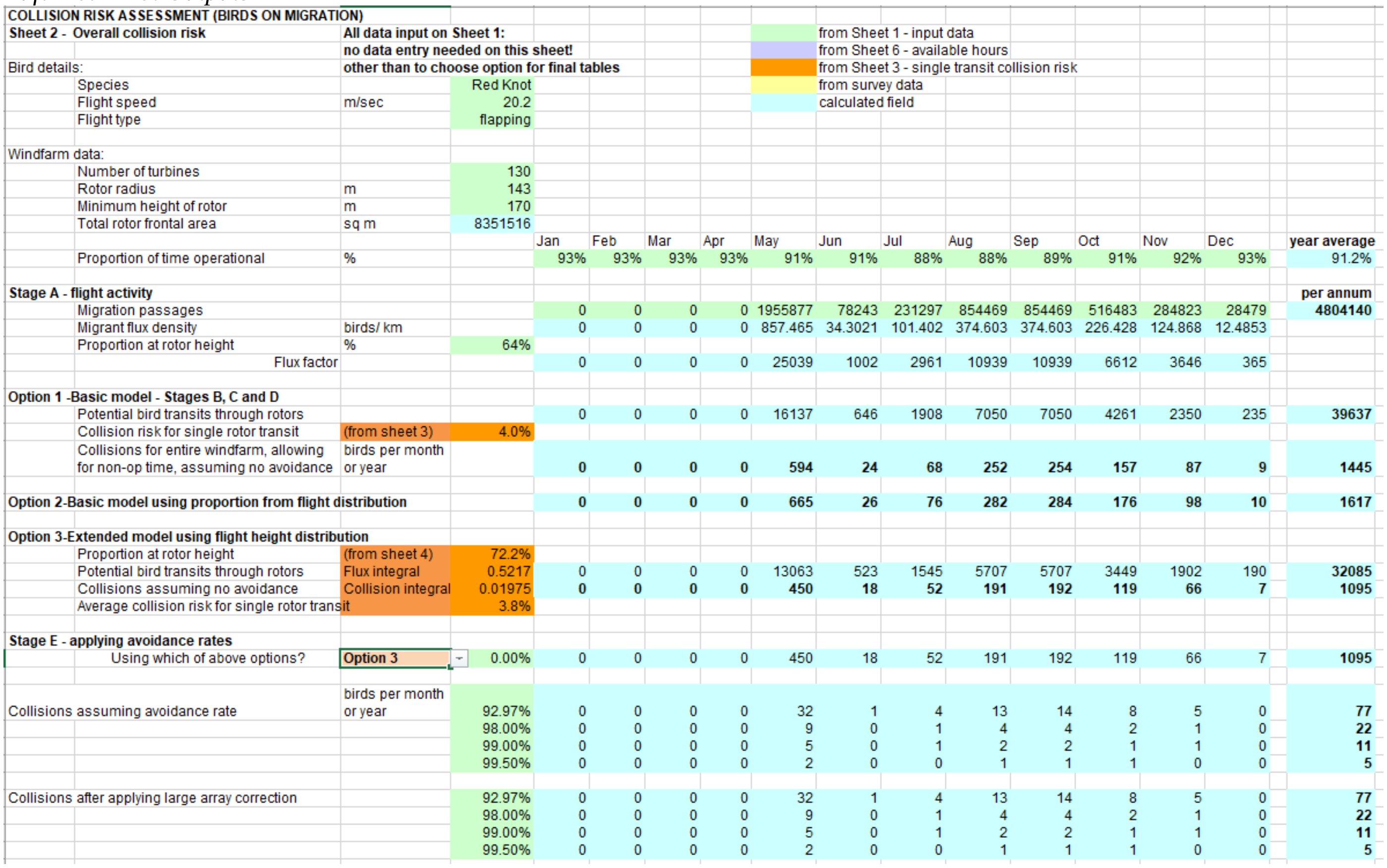
COLLISION RISK ASSESSMENT (BIRDS ON MIGRATION)															
Sheet 2 - Overall collision risk	**All data input on Sheet 1:**							🟩	from Sheet 1 - input data						
	no data entry needed on this sheet!							🟪	from Sheet 6 - available hours						
Bird details:	**other than to choose option for final tables**							🟧	from Sheet 3 - single transit collision risk						
Species		PIPL						🟨	from survey data						
Flight speed	m/sec	11.8						🟦	calculated field						
Flight type		flapping													
Windfarm data:															
Number of turbines		130													
Rotor radius	m	143													
Minimum height of rotor	m	170													
Total rotor frontal area	sq m	8351516													
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**year average**
Proportion of time operational	%		93%	93%	93%	93%	91%	91%	88%	88%	89%	91%	92%	93%	91.2%
Stage A - flight activity															**per annum**
Migration passages			0	0	9570	57222	28644	16005	95436	47784	0	0	0	0	**254661**
Migrant flux density	birds/ km		0	0	33.114	198	99.1142	55.3806	330.228	165.343	0	0	0	0	
Proportion at rotor height	%	39%													
Flux factor			0	0	967	5782	2894	1617	9643	4828	0	0	0	0	
Option 1 -Basic model - Stages B, C and D															
Potential bird transits through rotors			0	0	377	2255	1129	631	3761	1883	0	0	0	0	**10035**
Collision risk for single rotor transit	(from sheet 3)	3.9%													
Collisions for entire windfarm, allowing for non-op time, assuming no avoidance	birds per month or year		**0**	**0**	**14**	**82**	**40**	**22**	**130**	**65**	**0**	**0**	**0**	**0**	**353**
Option 2-Basic model using proportion from flight distribution			**0**	**0**	**15**	**87**	**43**	**24**	**138**	**69**	**0**	**0**	**0**	**0**	**376**
Option 3-Extended model using flight height distribution															
Proportion at rotor height	(from sheet 4)	41.5%													
Potential bird transits through rotors	Flux integral	0.3440	0	0	333	1989	996	556	3318	1661	0	0	0	0	**8853**
Collisions assuming no avoidance	Collision integral	0.01025	**0**	**0**	**9**	**55**	**27**	**15**	**87**	**44**	**0**	**0**	**0**	**0**	**237**
Average collision risk for single rotor transit		3.0%													
Stage E - applying avoidance rates															
Using which of above options?	**Option 3**	0.00%	0	0	9	55	27	15	87	44	0	0	0	0	**237**
Collisions assuming avoidance rate	birds per month or year	92.97%	0	0	1	4	2	1	6	3	0	0	0	0	**17**
		98.00%	0	0	0	1	1	0	2	1	0	0	0	0	**5**
		99.00%	0	0	0	1	0	0	1	0	0	0	0	0	**2**
		99.50%	0	0	0	0	0	0	0	0	0	0	0	0	**1**
Collisions after applying large array correction		92.97%	0	0	1	4	2	1	6	3	0	0	0	0	**17**
		98.00%	0	0	0	1	1	0	2	1	0	0	0	0	**5**
		99.00%	0	0	0	1	0	0	1	0	0	0	0	0	**2**
		99.50%	0	0	0	0	0	0	0	0	0	0	0	0	**1**

Rufa Red Knot Inputs



COLLISION RISK ASSESSMENT		🟩	used in overall collision risk sheet							🟪	used in available hours sheet			
Sheet 1 - Input data		🟨	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**		**Data sources**										
Bird data														
Species name		**Red Knot**		SCRAM										
Bird length	m	0.24		SCRAM										
Wingspan	m	0.49		SCRAM										
Flight speed	m/sec	20.2		SCRAM										
Nocturnal activity factor (1-5)				N/A										
Flight type, flapping or gliding		flapping		SCRAM										
				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	%													
				Data sources										
Birds on migration data														
Migration passages	birds		0	0	0	0	1,955,877	78243	231297	854469	######	516483	284823	28479
Width of migration corridor	km	2281												
Proportion at rotor height	%	64%												
Proportion of flights upwind	%	34.6%												
	Units	**Value**		**Data sources**										
Windfarm data														
Name of windfarm site		**New England Wind**												
Latitude	degrees	40.92												
Number of turbines		130												
Width of windfarm	km	31												
Tidal offset	m	0												
	Units	**Value**		**Data sources**										
Turbine data														
Turbine model		**Unk**												
No of blades		3												
Rotation speed	rpm	4.97												
Rotor radius	m	143												
Hub height	m	170	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly proportion of time operation	%		93%	93%	93%	93%	91%	91%	88%	88%	89%	91%	92%	93%
Max blade width	m	9.000												
Pitch	degrees	2												
				Data sources (if applicable)										
Avoidance rates used in presenting results		92.97%	X											
		98.00%												
		99.00%												
		99.50%												

Rufa Red Knot Outputs



COLLISION RISK ASSESSMENT (BIRDS ON MIGRATION)																
Sheet 2 - Overall collision risk		**All data input on Sheet 1:**						🟩	from Sheet 1 - input data							
		no data entry needed on this sheet!						🟪	from Sheet 6 - available hours							
Bird details:		**other than to choose option for final tables**						🟧	from Sheet 3 - single transit collision risk							
	Species		Red Knot					🟨	from survey data							
	Flight speed	m/sec	20.2					🟦	calculated field							
	Flight type		flapping													
Windfarm data:																
	Number of turbines		130													
	Rotor radius	m	143													
	Minimum height of rotor	m	170													
	Total rotor frontal area	sq m	8351516													
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**year average**
	Proportion of time operational	%		93%	93%	93%	93%	91%	91%	88%	88%	89%	91%	92%	93%	91.2%
Stage A - flight activity																**per annum**
	Migration passages			0	0	0	0	1955877	78243	231297	854469	854469	516483	284823	28479	**4804140**
	Migrant flux density	birds/ km		0	0	0	0	857.465	34.3021	101.402	374.603	374.603	226.428	124.868	12.4853	
	Proportion at rotor height	%	64%													
	Flux factor			0	0	0	0	25039	1002	2961	10939	10939	6612	3646	365	
Option 1 -Basic model - Stages B, C and D																
	Potential bird transits through rotors			0	0	0	0	16137	646	1908	7050	7050	4261	2350	235	**39637**
	Collision risk for single rotor transit	(from sheet 3)	4.0%													
	Collisions for entire windfarm, allowing for non-op time, assuming no avoidance	birds per month or year		**0**	**0**	**0**	**0**	**594**	**24**	**68**	**252**	**254**	**157**	**87**	**9**	**1445**
Option 2-Basic model using proportion from flight distribution				**0**	**0**	**0**	**0**	**665**	**26**	**76**	**282**	**284**	**176**	**98**	**10**	**1617**
Option 3-Extended model using flight height distribution																
	Proportion at rotor height	(from sheet 4)	72.2%													
	Potential bird transits through rotors	Flux integral	0.5217	0	0	0	0	13063	523	1545	5707	5707	3449	1902	190	**32085**
	Collisions assuming no avoidance	Collision integral	0.01975	**0**	**0**	**0**	**0**	**450**	**18**	**52**	**191**	**192**	**119**	**66**	**7**	**1095**
	Average collision risk for single rotor transit		3.8%													
Stage E - applying avoidance rates																
	Using which of above options?	**Option 3**	0.00%	0	0	0	0	450	18	52	191	192	119	66	7	**1095**
Collisions assuming avoidance rate		birds per month or year	92.97%	0	0	0	0	32	1	4	13	14	8	5	0	**77**
			98.00%	0	0	0	0	9	0	1	4	4	2	1	0	**22**
			99.00%	0	0	0	0	5	0	1	2	2	1	1	0	**11**
			99.50%	0	0	0	0	2	0	0	1	1	1	0	0	**5**
Collisions after applying large array correction			92.97%	0	0	0	0	32	1	4	13	14	8	5	0	**77**
			98.00%	0	0	0	0	9	0	1	4	4	2	1	0	**22**
			99.00%	0	0	0	0	5	0	1	2	2	1	1	0	**11**
			99.50%	0	0	0	0	2	0	0	1	1	1	0	0	**5**