Amended Biological Opinion on the Effects of the Sunrise Wind Farm and Sunrise Wind Export Cable – Development and Operation on Federally Listed Species within the Jurisdiction of the Long Island Field Office, New York.

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I. BACKGROUND AND INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA), 16 U.S.C. § 1536(a)(2), states that each Federal agency shall, in consultation with the Secretary, ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. In fulfilling these requirements, each agency is to use the best scientific and commercial data available. This section of the Act sets out the consultation process, which is further implemented by regulation (50 CFR § 402).

This document represents the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) based on the Service's review of the Bureau of Ocean Energy and Management's (BOEM) Sunrise Wind Offshore Wind Biological Assessment (BA) and its effects on the federally threatened piping plover (*Charadrius melodus)* and federally threatened rufa red knot (*Calidris canutus rufa*) and its proposed critical habitat in accordance with section 7 of the ESA (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq). BOEM was the lead agency for this consultation (50 C.F.R. § 402.07).

Both the Service and the BOEM acknowledge that there are significant data gaps relative to our knowledge of bird movement through the wind lease areas. As noted in the Service's Consultation Handbook (USFWS and NMFS 1998), "Where significant data gaps exist there are two options: (1) if the action agency concurs, extend the due date of the biological opinion until sufficient information is developed for a more complete analysis; or (2) develop the biological opinion with the available information giving the benefit of the doubt to the species. These alternatives must be discussed with the action agency and the applicant, if any. Based on this discussion, a decision regarding the preparation of the biological opinion should be made and documented in the administrative record of that opinion. This subsequent analysis may have minor or major consequences (worst case scenario) depending on the significance of the missing data to the effects determination."

"If the action agency, or the applicant, insists consultation be completed without the data or analyses requested, the biological opinion or informal consultation letter should document that certain analyses or data were not provided and why that information would have been helpful in improving the data base for the consultation….The Services are then expected to provide the benefit of the doubt to the species concerned with respect to such gaps in the information base (H.R. Conf. Rep. No. 697, 96th Cong., 2nd Sess. 12 (1979)). This subsequent analysis may have minor or major consequences (worst case scenario) depending on the significance of the missing data to the effects determination. The action agency also should be advised that if and when further data become available, the need for reinitiation of consultation may be triggered" (50 CFR § 402.16) (USFWS and NMFS 1998). We have advised the BOEM that if, and when, additional data become available, reinitiation of consultation, pursuant to 50 CFR Part 4012.16, may be required.

The tools available to the Service to quantitatively predict collision impacts include two collision risk models, Band (2012) and Stochastic Collision Risk Assessment Model (SCRAM; Adams et al. in prep). Each model has its strengths and limitations as discussed further in Appendix A of this Opinion and undergo periodic updates. In addition, biological inputs to these models are also limited in scope and coverage and come with their own limitations. For instance, the Motus Wildlife Tracking System (Motus) tracking stations have limitations in how far they can detect birds beyond a certain distance from shore, which creates a level of uncertainty that alone would not provide the Service with an ability to conclude there is a reasonable certainty of take. Consequently, we use other sources of information such as survey findings, historical information, and best professional judgement to support our determination that incidental take will occur as a result of this project. However, before arriving at that decision we had to employ the above model results and information to determine whether the proposed project would jeopardize the continued existence of listed species.

II. DESCRIPTION OF PROPOSED ACTION

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 "action area" is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." As described in the BA, the federal action agencies for the project are the BOEM (which is the lead federal agency for purposes of this section 7 consultation), with the Bureau of Safety and Environmental Enforcement (BSEE), US Army Corps of Engineers (USACE), Environmental Protection Agency (EPA), the US Coast Guard (USCG), National Marine Fisheries Service Office of Protected Resources, and National Park Service (NPS) as co-action agencies.

The following project description is mainly excerpted from the BA (BOEM 2022) and the Construction and Operations Plan (COP [Stantec 2022]).

The proposed action addressed in this Opinion covers the BOEM's authorization for Sunrise Wind LLC to construct, operate and maintain, and decommission the Sunrise Wind Farm (SRWF) and Sunrise Wind Export Cable (SRWEC). The two major construction and operations components, the SRWF and the SRWEC, are described in this section. Decommissioning and site clearance surveys are anticipated at the end of the project life (25-35 years). There would be a maximum of 87 monopiles and 1 piled jacket driven for SRWF. This would include up to 87 monopiles for the wind turbine generators (WTGs) with a nameplate capacity of 11 MW per turbine and one piled jacket foundation for an offshore converter station (OCS-DC) (see WTG design specifications in Table 1, BOEM 2022; BOEM 2023). In addition to pile driving, submarine cables would be installed between the WTGs (inter-array cable [IAC]) and to shore (export cable). The SRWF would be located within federal waters on the outer continental shelf (OCS), specifically in the Lease Area A-0487, which is located approximately 16.4 nm (18.9 mi [30.4 km]) south of Martha's Vineyard, Massachusetts (Figure 1).

Some activities described and analyzed in the BA which are on and adjacent to Fire Island, NY, are under the jurisdiction of the NPS. Specifically, those areas within state waters (SRWEC-NYS) from the mean high-water line to 1,000 feet into the Atlantic Ocean, including the water column and submerged lands, and the waters within Great South Bay crossed by SRWEC-Onshore Transmission Cable, are under the jurisdiction of the NPS.

Onshore Sunrise Wind Export Cable

The onshore termination of the SRWEC would be spliced together with the Onshore Transmission Cable at the co-located transition joint bay (TJB) and link boxes located at the landfall location at Smith Point County Park, in the Town of Brookhaven, New York (BOEM 2022). The onshore portion of the SRWEC (up to 1,339 ft [408 m]) would be buried underground (i.e., above the mean high-water line) up to the TJB and the remaining, offshore portion would traverse both federal and New York State waters (Figure 1).

Onshore Interconnection and Transmission Cables

The Onshore Interconnection Cable would carry the power from the new onshore converter station (OnCS–DC) location to the existing grid at the Holbrook Substation (BOEM 2022). The Onshore Interconnection Cable would begin at a set of termination structures located at the OnCS–DC and would be routed entirely underground along Union Avenue to an existing utility-owned or controlled property for connection to the Holbrook Substation (Figure 3.3.1-1 in Stantec 2022).

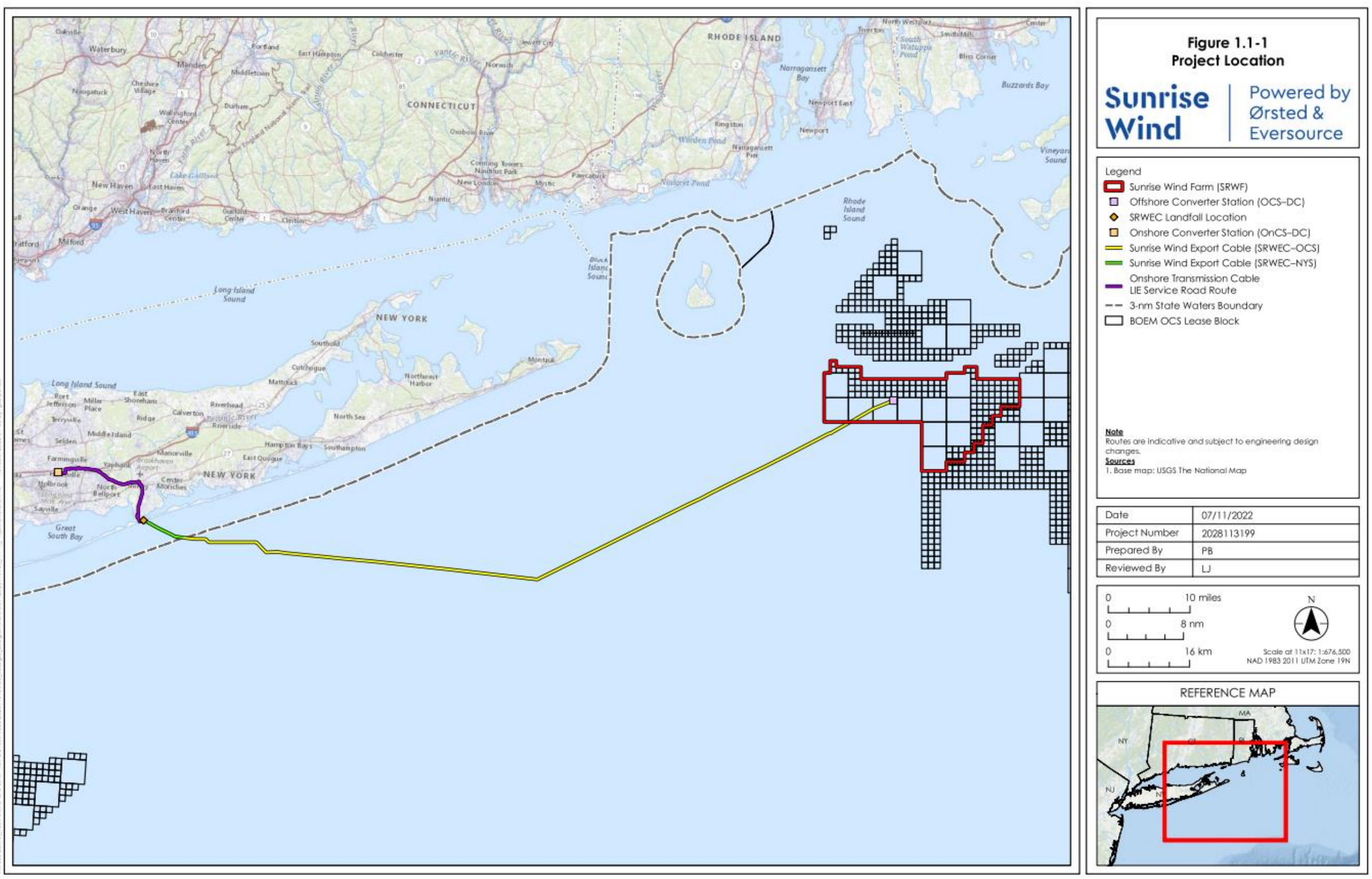

Figure 1. Sunrise Wind Farm area, outlined in red, and project overview (Figure 1.1-1 in COP, Stantec 2022)

Construction of the Onshore Transmission Cable and Onshore Interconnection Cable would involve site preparation, trench excavation, duct bank and vault installation, cable installation, cable jointing, and final testing and restoration with additional steps associated with horizontal direction drilling (HDD) and other trenchless crossing methods. The typical underground transmission cable construction sequence is provided in Table 3.3.2-3 in Stantec (2022). Temporary laydown yards would be required to support the staging of necessary equipment and materials for the installation of the Onshore Transmission Cable and Onshore Interconnection Cable. Locations selected for the use of temporary laydown yards may require additional assessments prior to use and would be approved by the applicable permitting agencies prior to utilization. These areas would be generally confined to locations containing open land or previously disturbed commercial/industrial sites with existing roadway access, such that no or minimal site improvements are required. Following the completion of the proposed project, locations used for temporary laydown yards would be restored to pre-existing conditions in accordance with landowner requests and permit requirements.

Installation of the Onshore Transmission Cable would generally require excavation of a trench within a temporary disturbance corridor. The Onshore Transmission Cable would be installed within a concrete or thermal equivalent duct bank buried to a depth consistent with local utility standards. From the OnCS–DC, the Onshore Interconnection Cable would be installed underground within a duct bank to the Holbrook Substation. A typical configuration of an underground onshore transmission circuit is shown on Figure 3.3.2-4 in the COP (Stantec 2022). A typical configuration of the installation of an underground onshore transmission circuit within a road right of way (ROW) is shown on Figure 3.3.2-5 in Stantec (2022). A typical configuration of an underground onshore interconnection circuit is shown in Figure 3.3.2-6 in the COP (Stantec 2022).

III. 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 <u>will be</u> 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 <u>will implement</u> 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 the action, and should be achievable within the authority of the action agency or applicant. Since Conservation Measures are part of the proposed action, their implementation is required under the terms of the consultation (USFWS and NMFS 1998). The Handbook also states, "If the conservation measure…does not minimize impacts to affected individuals in the action area, the beneficial effects of the conservation measure are irrelevant to the incidental take analysis."

The BOEM and Sunrise Wind LLC have proposed two sets of measures listed in the BA and COP (BOEM 2022, Stantec 2022). The first set, given below in this Section, are Conservation

Measures that avoid or minimize effects of the action on listed species in the action area. The second set, listed in Section IV, are actions that may assist in the recovery of the species via monitoring species presence and movement in the action area into the future and using this information to further our understanding of collision risks and species' use of the offshore air and water habitats. As data and knowledge gaps are addressed through implementation of the measures in Section IV, the Conservation Measures given in Section III[1] may be amended or updated, as appropriate.

A. Piping Plover and Rufa Red Knot

- Sunrise Wind LLC is committed to an indicative layout scenario with WTGs and the OCS–DC sited in a uniform east-west/north-south grid with 1.15-by-1.15-mi (1-by-1-NM [1.85-by-1.85-km]) spacing that aligns with other proposed adjacent offshore wind projects in the RI-MA Wind Energy Area (WEA) and MA WEA. This wide spacing of WTGs may reduce risk of barrier effects and/or displacement and may allow avian species to avoid individual WTGs and minimize risk of potential collision. The WTGs will have an air gap from mean sea level (MSL) to minimum blade swept height of 131.2 ft (40 m); birds crossing the area within this height range would not be at risk of collision with spinning blades.
- The distance of the SRWF offshore (greater than 15 mi [13 NM (24.1 km)]) avoids coastal areas, which are known to concentrate birds, particularly shorebirds and sea ducks.
- Sunrise Wind LLC will take measures to reduce perching opportunities at operating turbines, if appropriate based on further consultations with state and federal agencies.
- Construction and operational lighting will be limited to the minimum necessary to ensure safety and compliance with applicable regulations. Limiting lighting to that which is required for safety and compliance with applicable regulations is expected to minimize impacts on avian species.
- Sunrise Wind LLC will use Aircraft Detection Lighting System (ADLS) or related means (e.g., dimming or shielding) to limit visual impact, pursuant to approval by the FAA and BOEM, commercial and technical feasibility at the time of FDR/FIR approval, and dialogue with stakeholders. In addition to limiting visual impact, reducing lighting will also reduce the potential for impacts to avian species.

B. Turbine and Offshore Substation Specific Measures

- Anti-perching devices: To minimize attracting birds that are prone to perching, Sunrise Wind LLC must install bird perching-deterrent devices where such devices can be safely deployed on the WTGs and OCS-DC. Sunrise Wind LLC must submit for BOEM and Service approval a plan to deter perching on offshore infrastructure. The plan must

[1] Section III outlines the Conservation Measures included in the proposed action to avoid and minimize potential impacts to ESA-listed species under jurisdiction of the Service. Sunrise Wind LLC's conservation measures for specific resources are listed in the sections below, and in the concurrence letter, and are from the COP (Stantec 2022).

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, track the efficacy of the deterrents, and a timeline for installation. The plan will be based on best available science regarding the efficacy of perching deterrent devices on avoiding and minimizing collision risk.

The location of bird-deterrent devices must be proposed by Sunrise Wind LLC based on BMPs applicable to the appropriate operation and safe installation of the devices. Sunrise Wind LLC must confirm the locations of bird perching-deterrent devices as part of the documentation it must submit with the Facility Design Report.

- Offshore Lighting: To aid safe navigation, Sunrise Wind LLC must comply with all FAA, USCG, and BOEM lighting, marking and signage requirements. Sunrise Wind LLC will comply with all applicable requirements while minimizing impacts through appropriate application, including directional aviation lights, that minimize visibility from shore (BOEM 2022).

  Sunrise Wind LLC has committed to lighting reduction measures (BOEM 2022). Sunrise Wind LLC will use lighting technology that minimizes impacts on avian species to the extent practicable.

  Sunrise Wind LLC must use an FAA-approved vendor for the ADLS on WTGs and OCS-DC, 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. To further reduce impacts on birds, Sunrise Wind LLC would limit, where practicable, lighting which is not required by FAA and USCG, during offshore construction to reduce attraction of birds.

  Sunrise Wind LLC is required to light each WTG and OCS-DC in a manner that is visible by mariners in a 360-degree arc around the structure. To minimize the potential of attracting migratory birds, the top of each USCG-required marine navigation light will be shielded to minimize upward illumination (conditional on USCG approval) (BOEM 2022, Table 9, Measure 1c). The Service understands that the USCG-approved lights may not be shielded, 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 (BOEM 2022).

  Coordination with 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 a copy of Sunrise Wind LLC'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. 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.

Following approval of the PATON by the USCG, BOEM, BSEE, 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 updates to the incidental take statement accompanying this Opinion and in the annual mitigation assessments.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation actions.

IV. OTHER PROJECT MEASURES SUPPORTING SPECIES' MONITORING, MODELING, AND MITIGATION

These measures are intended to address significant data gaps in avian and bat use of offshore areas, collision modelling, and compensatory mitigation. They are not intended to avoid or minimize the collision risk present at this time.

A. Monitoring and Data Collection

BOEM will require that Sunrise Wind LLC develops and implements an Avian and Bat Post-Construction Monitoring Plan (ABPCMP) based on the Avian and Bat Post-Construction Monitoring Framework found in the BA Appendix C in coordination with the Service, New York State Department of Environmental Conservation (NYSDEC), and other relevant regulatory agencies (BOEM 2022). 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, Sunrise Wind LLC must submit an ABPCMP for BOEM, BSEE, and Service review. BOEM, BSEE, and the Service will review the ABPCMP and provide any comments on the plan within 30 calendar days of its submittal. Sunrise Wind LLC must resolve all comments on the ABPCMP to the satisfaction of BOEM, BSEE, and the Service before implementing the plan and prior to the start of WTG operations. The goals of the ABPCMP 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 listed bird species; and (3) to inform any efforts aimed at minimizing collisions or other project effects on target species.

1. Monitoring

Sunrise Wind LLC must conduct monitoring as outlined in the Avian and Bat Post-Construction Monitoring Framework (BOEM 2022 Appendix C), which will include use of radio-tags to monitor movement of ESA-listed birds in the vicinity of the project. The ABPCMP will allow for changing methods over time in order to regularly update and refine collision estimates for listed birds. Specific to this purpose, 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 receiving stations on turbines in the Lease Area following offshore Motus recommendations (https://motus.org/groups/atlantic-offshore-wind/). The initial phase may also include deployment of satellite-based tracking technologies (e.g., Global Positioning System [GPS] or Argos tags).

2. Annual Monitoring Reports

Sunrise Wind LLC must submit to BOEM (at renewable_reporting@boem.gov), the Service, and the Bureau of Safety and Environmental Enforcement (BSEE) (at OSWSubmittals@bsee.gov) 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. BOEM, the Service, and BSEE will use the annual monitoring reports to assess the need for reasonable revisions (based on subject matter expert analysis) to the ABPCMP. BOEM, 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.

3. Post-Construction Quarterly Progress Reports

Sunrise Wind LLC must submit quarterly progress reports during the implementation of the ABPCMP to BOEM (at renewable_reporting@boem.gov) 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.

4. Monitoring Plan Revisions

Within 30 calendar days of submitting the annual monitoring report, Sunrise Wind LLC must meet with BOEM, BSEE, the Service, and NYSDEC 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, BSEE, and the Service jointly determine that revisions to the ABPCMP are necessary, the BOEM will require Sunrise Wind LLC to modify the ABPCMP. If the projected collision levels, as informed by monitoring results, deviate substantially from the effects analysis included in this Opinion, Sunrise Wind LLC 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 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) 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 Sunrise Wind LLC to continue implementation of appropriate monitoring activities for listed birds (under the current and future versions of the ABPCMP) until one of the following occurs: (i) the Sunrise turbines cease operation; (ii) the Service concurs that a robust weight of evidence has demonstrated that collision risks to all two listed birds from Sunrise turbine operations are negligible (i.e., the risk of take from WTG operation is discountable); or (iii) 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 Sunrise Wind LLC to reduce or offset collision mortality.

5. Operational Reporting (Operations)

Sunrise Wind LLC must submit to the BOEM (at renewable_reporting@boem.gov) and BSEE (at OSWSubmittals@bsee.gov) an annual report summarizing monthly operational data calculated from 10-minute supervisory control and data acquisition data for all turbines together in tabular format: the proportion of time the turbines were operational (spinning at >x revolutions per minute [rpm]) each month, the average rotor speed (rpm) 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.

6. Raw Data

Sunrise Wind LLC 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. Sunrise Wind LLC must work with the BOEM to ensure the data are publicly available, as determined by BOEM and the applicant. All avian tracking data (i.e., from radio and satellite transmitters) will be stored, managed, and made available to the BOEM, 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.

B. Incidental Mortality Reporting

Sunrise Wind LLC must provide an annual report to the BOEM, BSEE, and the Service documenting any dead (or injured) birds or bats found on vessels and structures during construction, operations, and decommissioning. The report must contain the following information: the name of species, date found, location, a picture to confirm species identity (if possible), and any other relevant information. Carcasses with federal or research bands must be reported to the USGS Bird Band Laboratory, available at https://www.pwrc.usgs.gov/BBL/bblretrv/.

Incidental observations are extremely unlikely to document any fatalities of listed birds that may occur due to turbine collision. While this Conservation Measure 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.

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), but no later than 72 hours after the sighting, and, if practicable, the dead specimen will be carefully collected and preserved in the best possible state.

C. 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 two 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 and more tracking data get incorporated into the model (e.g., from more individual birds, additional geographic areas, improved bird tracking capabilities, and emerging tracking technologies), and as modeling methods and computing power continue to improve.

Via this 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:

i. the Sunrise turbines cease operation;
ii. the Service concurs that a robust weight of evidence has demonstrated that collision risks to listed birds from Sunrise turbine operation are negligible (i.e., the risk of take from WTG operation is discountable); or
iii. the Service concurs that further development of SCRAM (or its successor) is unlikely to improve the accuracy or robustness of collision mortality estimates.

D. Collision Risk Model Utilization

The BOEM will work cooperatively with the Service to re-run the SCRAM model (or its successor) for the Sunrise 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 and Band models (or its successor) within 90 days of each major model release or update, and at any time upon request by the Service or Sunrise Wind LLC, and at any time as desired by the BOEM.

The above schedule may be altered upon the mutual agreement of the BOEM, BSEE, 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 Sunrise turbines cease operation;
ii. the Service concurs that a robust weight of evidence has demonstrated that collision risks to both listed birds from Sunrise turbine operation are negligible (i.e., the risk of take from WTG operation is discountable); or
iii. the Service concurs that further model runs are unlikely to improve the accuracy or robustness of collision mortality estimates.

E. Compensatory Mitigation

To minimize population-level effects on listed birds, the BOEM will require Sunrise Wind LLC to provide appropriate compensatory mitigation as needed to offset projected levels of take of listed birds from WTG collision. Compensatory mitigation will 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 (RISs), and 5-Year Reviews. Compensatory mitigation will preferentially address priority actions, activities, or tasks identified in a Recovery Plan, RIS, or 5-Year Review, for piping plover and rufa red knot; however, research, monitoring, outreach, and other recovery efforts that do not materially offset birds lost to collision mortality will not be 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, (a) any listed species recovery unit(s) or other management unit(s) determined to be disproportionally affected by or vulnerable to collision mortality; and/or (b) those portions of a species' range where compensatory mitigation is most likely to be effective in offsetting collision mortality.

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

The BOEM will require Sunrise Wind LLC to prepare a Compensatory Mitigation Plan (Plan) prior to the start of WTG operation. At a minimum, the Plan will provide compensatory mitigation actions to offset projected levels of take of listed birds for the first 5 years of WTG operation at a ratio of 1:1. At its discretion, Sunrise Wind LLC may include actions to offset projected take over a longer time period and/or at a higher ratio. The Plan will include:

a. detailed description of one or more specific mitigation actions;
b. the specific location for each action;
c. a timeline for completion;
d. itemized costs;
e. a list of necessary permits, approvals, and permissions;
f. details of the mitigation mechanism (e.g., mitigation agreement, applicant-proposed mitigation);
g. best available science linking the compensatory mitigation action(s) to the projected level of collision mortality as described in this Opinion;
h. a schedule for completion; and
i. monitoring to ensure the effectiveness of the action(s) in offsetting the target level of take.

Plan development and implementation will occur according to the following schedule:

- At least 180 days before the start of WTG operation Sunrise Wind LLC will distribute a draft Plan to the BOEM, BSEE, the Service, the NYSDEC, and other identified stakeholders or interested parties for a 60-day review period.
- At least 90 days before the start of WTG operation, Sunrise Wind LLC will transmit a revised Plan for approval by the BOEM, BSEE, and the Service, along with a record of comments received on the draft. Sunrise Wind LLC will rectify any outstanding agency comments or concerns before final approval by the BOEM, BSEE, and the Service.
- Before or concurrent with the start of WTG operation, Sunrise Wind LLC will provide documentation to the BOEM, BSEE, and the Service showing financial, legal, or other binding commitment(s) to Plan implementation.

The BOEM will require Sunrise Wind LLC to prepare and implement a new Plan every 5 years for the life of the project, according to a schedule developed by the BOEM and approved by the Service. Compensatory mitigation actions included in each new Plan will reflect:

a. the level and effectiveness of mitigation previously provided by Sunrise Wind LLC, to date;
b. the level of take over the next 5 years as projected by SCRAM (or its successor) (see D Collision Risk Model Utilization above);
c. current information regarding any effects of offshore lighting (see Conservation Measure B: Offshore Lighting); and
d. the effectiveness of any minimization measures that have been implemented as required by the reasonable and prudent measures included in this Opinion.

F. Collision Mitigation Coordination

1. Mitigation Assessments

At least annually, and as detailed below, the BOEM, BSEE, the Service, and Sunrise Wind LLC will work together to assess the minimization of, and compensatory mitigation for, collisions of listed birds with the Sunrise Wind LLC turbines. The NYSDEC will also be invited to participate in these mitigation assessments. The first mitigation assessment will occur during the Sunrise Wind construction phase, prior to the start of WTG operation. Subsequent mitigation assessments will 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, BSEE, the Service, the NYSDEC, or Sunrise Wind LLC based on substantive new information or changed circumstances. These periodic mitigation assessments for the Sunrise may eventually be integrated into a regional or coastwide adaptive monitoring and impact minimization framework.

2. Minimization

The BOEM will work with the Service, the NYSDEC, and Sunrise Wind LLC to annually review the best available information regarding technologies and methods for minimizing collision risk to listed species, including but not limited to: WTG coloration/marking, lighting, avian deterrents, and limited WTG operational changes. The BOEM will require Sunrise Wind LLC to adopt and deploy such minimization technologies/methods as deemed reasonable and prudent. 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. The BOEM will specify the timeframe in which any required minimization measure(s) must be implemented, as well as any requirements to monitor, maintain, or adapt the measure(s) over time.

V. ACTION AREA

The action area is defined at (50 CFR 402.02) as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action. The Service has determined that the action area for this project includes the wind lease area, offshore cable alignment, OCS-DC, cable landfall location, onshore cable route, and OS, as described in the BOEM's BA.

VI. STATUS OF THE SPECIES

Per the ESA Section 7 regulations (50 CFR 402.14(g)(2)), it is the Service's responsibility to "evaluate the current status of the listed species or critical habitat."

To assess the current status of the species, it is helpful to understand the species' conservation needs which are generally described in terms of reproduction, numbers, and distribution (RND). The Service frequently characterizes RND for a given species via the conservation principles of resiliency (ability of species/populations to withstand stochastic events – numbers, growth rates), redundancy (ability of a species to withstand catastrophic events – number of populations and their distribution), and representation (variation/ability of a species to adapt to changing conditions).

The following is a summary of piping plover and red knot general life history drawn primarily from Service assessment, listing, and recovery documents. According to the Consultation Handbook (USFWS and NMFS 1998), the Service's jeopardy analysis may be based on an assessment of impacts at the level of recovery units when those units are documented as necessary to both the survival and recovery of the species in a final recovery plan. The Consultation Handbook also notes that, when the Service's review in a biological opinion focuses on the effects of the action on a discrete recovery unit, the species status section of the biological opinion is to describe the status of that unit and its significance to the species as listed (USFWS and NMFS 1998). Thus, for the piping plover and rufa red knot, the information and analysis that follows focus on birds from those recovery units that are expected to occur in the Sunrise Wind action area.

A. Piping Plover

Piping plovers breed in three discrete areas: the Atlantic Coast, the Great Lakes, and the Northern Great Plains of the U.S. and Canada. The Atlantic Coast and Northern Great Plains populations are listed under the ESA as threatened (50 FR 50726), while the Great Lakes population is listed as endangered. Birds from 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 Atlantic Coast population is the only breeding population known to occur along the coast of New York.

The Atlantic Coast 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). Piping plovers are present on the New York shore during the breeding season, generally between April 1 and August 31 (USFWS 1996).

The piping plover recovery plan (USFWS 1996) delineates four recovery units for the Atlantic Coast population: Eastern Canada (formerly Atlantic Canada), New England, New York-New Jersey (NY-NJ) and Southern (Delaware, Maryland, Virginia, and North Carolina). 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). The Southern recovery unit is not addressed in this Opinion, as these birds spend their entire life cycle south of the action area. An unverified number of birds from each of the other three recovery units are expected to occur in offshore portion of the action area during spring and fall migration.

The following paragraphs describing the status of piping plovers are excerpted, in whole or in part, from "Abundance and productivity estimates - 2021 update Atlantic Coast piping plover population" (USFWS 2021a).

Currently, as a whole, the range-wide status of the Atlantic Coast piping plover is improving, though unevenly (Table 1). The 2021 Atlantic Coast piping plover population estimate of 2,289 pairs is 22 percent higher than the 2018 estimate and almost triple the estimate of 790 pairs at the time of the 1986 ESA listing (USFWS 1996). Discounting apparent increases in New York, New Jersey, and North Carolina between 1986 and 1989, which likely were due in part to increased census effort (USFWS 1996), the population more than doubled between 1989 and 2021.

Table 1. Estimated numbers of pairs* of Atlantic Coast piping plovers, 2012-2021 (USFWS 2022)

	Eastern 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: Atlantic (Eastern) Canada=400. New England=625. NY-NJ=575. Southern=400. Total=2,000 (sustained for at least 5 years)
**Presented for context but not considered in this Opinion.

Overall population growth is tempered by very substantial geographic and temporal variability. The largest population increase between 1989 and 2021 occurred in New England (514 percent). Abundance of breeding pairs in the NY-NJ recovery unit decreased 35 percent to 378 pairs in 2014 following seven years of low productivity. However, the recovery unit experienced an overall net increase of 81 percent between 1989 and 2021. In Eastern Canada, where increases have often been quickly eroded in subsequent years, the population posted a declining overall population trend since 2007 and a net 23-percent decline between 1989 and 2021. The limiting factors now impeding recovery are thought to be occurring during migration or on the wintering grounds (Gratto-Trevor et al. 2013), but specific causal factors have not been identified at this time. Overall, the New England recovery unit is increasing, the NY-NJ recovery unit is currently stable, and the Eastern Canada recovery unit is declining (Figure 2) (USFWS 2022).

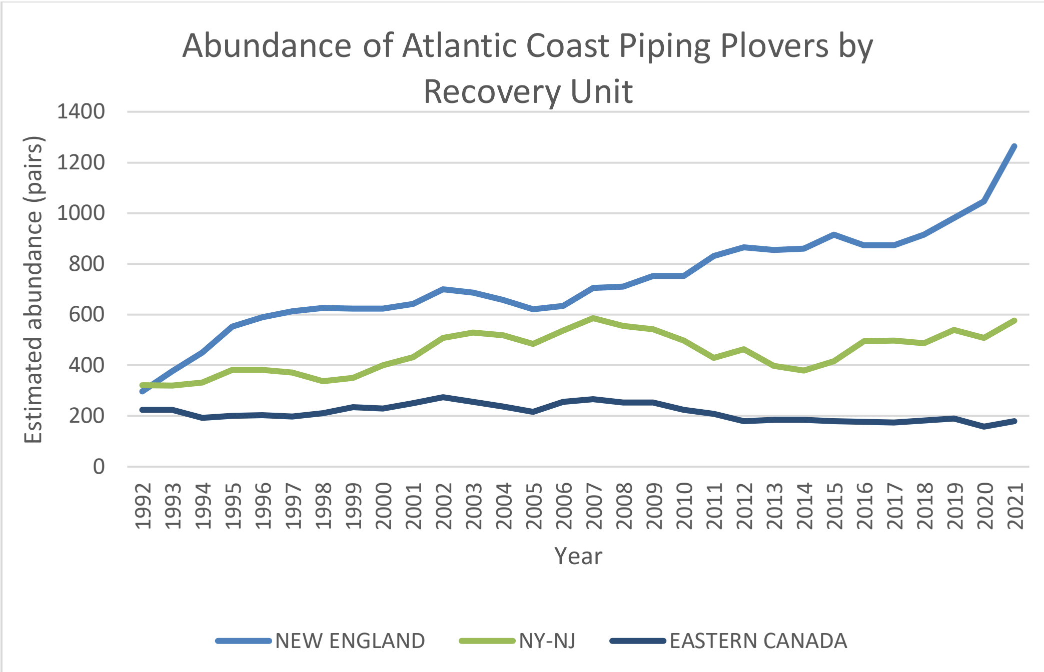

Figure 2. Estimated abundance of Atlantic Coast piping plover pairs by recovery unit from (USFWS 2022).

Average annual productivity for the U.S. Atlantic Coast during 1989-2018 was 1.25 fledged chicks per pair. The overall U.S. Atlantic Coast productivity estimates in 2019 and 2020 were 1.38 and 1.25 fledged chicks per pair, respectively. In 2021, average U.S. Atlantic productivity (1.09 fledged chicks per pair) was the fifth lowest since 1989 (USFWS 2022). The primary factors influencing the status of the Atlantic Coast piping plover population include habitat loss and degradation; human disturbance of nesting birds; predation; and oil spills (USFWS 1996). Habitat loss and degradation result from development and other physical alterations to the beach ecosystem. Severe threats from human disturbance and predation remain ubiquitous along the Atlantic Coast (USFWS 2022). These disturbances can result in crushing of eggs, failure of eggs to hatch, and death of chicks (e.g., through effects to their energy budgets).

Wind turbines are likely to affect Atlantic Coast piping plovers via the risk of collisions, although the magnitude of this effect remains unknown at this time. Information that has become available in the past decade will help assess effects of future proposed projects, but some key risk factors (e.g., avoidance rates, variation in flight altitude, differences in migratory routes and timing) need further study (USFWS 2020a). The number and locations of future proposed offshore turbines is becoming more foreseeable due to the BOEM's leasing and authorization programs; 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, etc.) are even more difficult to study and characterize offshore than on land.

As described in the recovery plan (USFWS 1996), the recovery criteria of the Atlantic Coast piping plover population include: (1) a total of 2,000 breeding pairs, distributed among the four recovery units sustained for at least 5 years; (2) a 5-year average productivity rate of 1.5 chicks per pair in each recovery unit; and (3) long-term maintenance of wintering habitat sufficient in quantity, quality, and distribution to maintain survival rates needed for a 2,000-pair population. These recovery criteria reflect the conservation tenets of representation, redundancy, and resiliency (3Rs). Sufficient information about piping plover flight behavior and the likelihood of wind turbine construction in areas used by piping plovers is not yet available to assess the need for a recovery criterion pertinent to threats from wind turbines (USFWS 2020a). For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to https://ecos.fws.gov/ecp/species/6039.

B. Rufa Red Knot

Six subspecies of red knot, *Calidris canutus*, are recognized, each with distinctive migration routes, and annual cycles. One subspecies, the rufa red knot (*Calidris canutus rufa*) was listed as threatened under the ESA in 2015 (79 FR 73705). The rufa red knot is a medium-sized (9 to 10 inches [23 to 25 cm] long) shorebird with a wingspan of 20 inches (50.8 cm) that migrates annually between its breeding grounds in the central Canadian Arctic and four wintering regions. Each wintering location is considered to support separate populations which include: (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, known as the Western population; (3) the northern coast of South America; and (4) the Atlantic coasts of Argentina and Chile, known as the Southern population (USFWS 2023b). The rufa red knot subspecies shows very high fidelity to wintering region, with habitat, diet, and phenology varying appreciably among birds from different regions (USFWS 2014). Although birds from the Western population are known to occasionally occur in the Atlantic Coast (USFWS 2014), we consider the likelihood that they will be affected by the proposed project discountable. Therefore, the Western population is not addressed in this Opinion.

The timing of spring and fall migration varies across the range (USFWS 2014). Many rufa red knots marked in Argentina and Chile are seen on the southeast Atlantic coasts of Florida, Georgia, South Carolina, and North Carolina during, but not before, May. Available data indicate that rufa red knots wintering in the Southeast use at least two distinct spring migration routes—coastal (moving north along the coast to the mid-Atlantic before departing for the Arctic) and inland (departing overland for the Arctic directly from the Southeast coast) (USFWS 2021b).

Departure from the breeding grounds begins in mid-July and continues through August (USFWS 2020b). Females are thought to leave first, followed by males and then juveniles. Adult rufa red knots pass through stopover sites along the migratory route earlier in years with low reproductive success than in years with high reproductive success. Along the U.S. Atlantic coast, southbound rufa red knots start arriving in July. Number of adults peak in mid-August and most depart by late September, although geolocators and resightings have shown some birds (especially northern-wintering knots) stay through November (USFWS 2020b).

In one study of northern wintering rufa red knots, the total time spent along the U.S. Atlantic coast (including spring, fall, and for some birds winter) averaged 218 days (range 121 to 269 days), or about 60 percent of the calendar year (USFWS 2020b).

During migration, this subspecies requires a reliable network of migration staging areas; and an ample supply of other migration stopover habitats that allow birds to shift among habitat patches as conditions change. Across the entire range and the entire annual cycle, the rufa red knot also requires reliable food resources timed to coincide with those times when birds are present, a factor that contributes to low inherent adaptive capacity (USFWS 2020b).

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 ocean- or bay-front areas, as well as tidal flats in more sheltered bays and lagoons (USFWS 2020b).

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 changing conditions (i.e., from climate change) across its range and across its annual cycle. The Service has delineated four recovery units corresponding to the four wintering populations listed above. The recovery plan establishes population targets for each recovery unit, based on 10- year average abundance. The plan also 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 2023b).

Based on best available information, the current total rangewide abundance estimate is just under 64,800 rufa red knots, distributed across the four recovery units (Table 2). The Southern recovery unit experienced a significant decline in the 1980s and 2000s, the key causal factor being overharvest of horseshoe crab in Delaware Bay which is now considered adequately managed.

Table 2. Current estimates of rufa red knot abundance by recovery unit*

Wintering Population	Current Abundance Estimate	Estimated Decline in Population Since 1980s	Population Stability	Certainty	Source
Southern (mean 2021-2022)	12,7043	75%	Stable	High	WHSRN 2020, Matus 2021, Norambuena et al. 2022
North Coast of South America	31,065	None	Stable**	Moderate	Mizrahi 2020
Southeast U.S./Caribbean	15,500	None	Stable	Moderate	Lyons et al. 2017
Western**	5,500	Unknown	Declining	Low	Newstead pers. comm. 2019, 2020
Total	**64,769**				

*Recovery criteria: Southern=35,000. Western=10,000
**North Coast of South America and the Southeast United States/Caribbean=stable or increasing
**Presented for context but not considered in this Opinion.

In summary, as a whole, the range-wide status of the rufa red knot is stable but depleted. The North Coast of South America and Southeast U.S./Caribbean recovery units are stable, while the Southern recovery unit has stabilized at only about 25 percent of its size as documented only about 40 years ago.

Although the rufa red knot benefits from long-term and widespread conservation efforts, birds from all four recovery units face threats from habitat loss and from several pervasive, climate-driven ecosystem changes. Additional threats include hunting, increased predation pressure, harmful algal blooms, human disturbance, oil spills, and wind energy development. Cumulatively, these threats are believed to be impairing the resiliency (as measured by population size) of the Southern and the Northwestern Gulf of Mexico/Central American wintering populations (USFWS 2020b).

Wind energy development is identified as a secondary, moderate threat to the rufa red knot's migration life phase (USFWS 2020b). Research has indicated the presence of rufa red knot movement through wind energy areas in the Atlantic Outer Continental (Loring et al. 2018) where BOEM is entering into offshore wind energy leases. Threats from offshore WTGs are foreseeable, but the magnitude of this threat remains poorly understood. Information is lacking to assess site-specific 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.

Individually, moderately severe threats are not expected to have effects at the level of the listed taxon. Cumulatively, however, moderate threats are presumed to exacerbate the effects of the primary threats, as they likely further reduce the subspecies' resiliency and possibly representation and redundancy.

For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to https://ecos.fws.gov/ecp/species/1864.

VII. STATUS OF CRITICAL HABITAT

Critical habitat for wintering piping plovers, including the Atlantic Coast breeding population, has been designated along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas (66 FR 36037). The designated critical habitat does not overlap the action area; therefore, critical habitat for this species is not considered in this Opinion.

Critical habitat for the rufa red knot was proposed in 2021 (86 FR 37410) and a revision to the proposal was published in April 2023 (88 FR 22530); no final rule has been published to date. The proposed critical habitat is restricted to the coasts and does not overlap the action area; therefore, critical habitat for this species is not considered in this Opinion.

VIII. ENVIRONMENTAL BASELINE

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all federal, state, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated and/or ongoing impacts of all proposed federal projects in the action area that have undergone Section 7 consultation, and the impacts of state and private actions which are contemporaneous with the consultation in progress.

A. Status of Listed Species in the Action Area

Based on the accuracy of the tracking data available to date, we make the assumption that all parts of the action area are equally likely to be utilized by listed species (i.e., we attempt to characterize levels of bird use within the action area relative to the surrounding OCS and adjacent coastline, but do not attempt to discern differences in bird utilization that may exist across the latitudinal or longitudinal gradients of the action area).

In terms of listed species avian use, the action area is located within a migration corridor for piping plovers and rufa red knots and may also be transited by seasonally resident rufa red knots undertaking regional movements across the OCS (Figure 3). For purposes of our effects analysis, we have decided to limit the action area air space to the rotor swept zone (RSZ), which extends from 131.2 ft to 787 ft (40 m to 240 m) above mean low water (Stantec 2022).

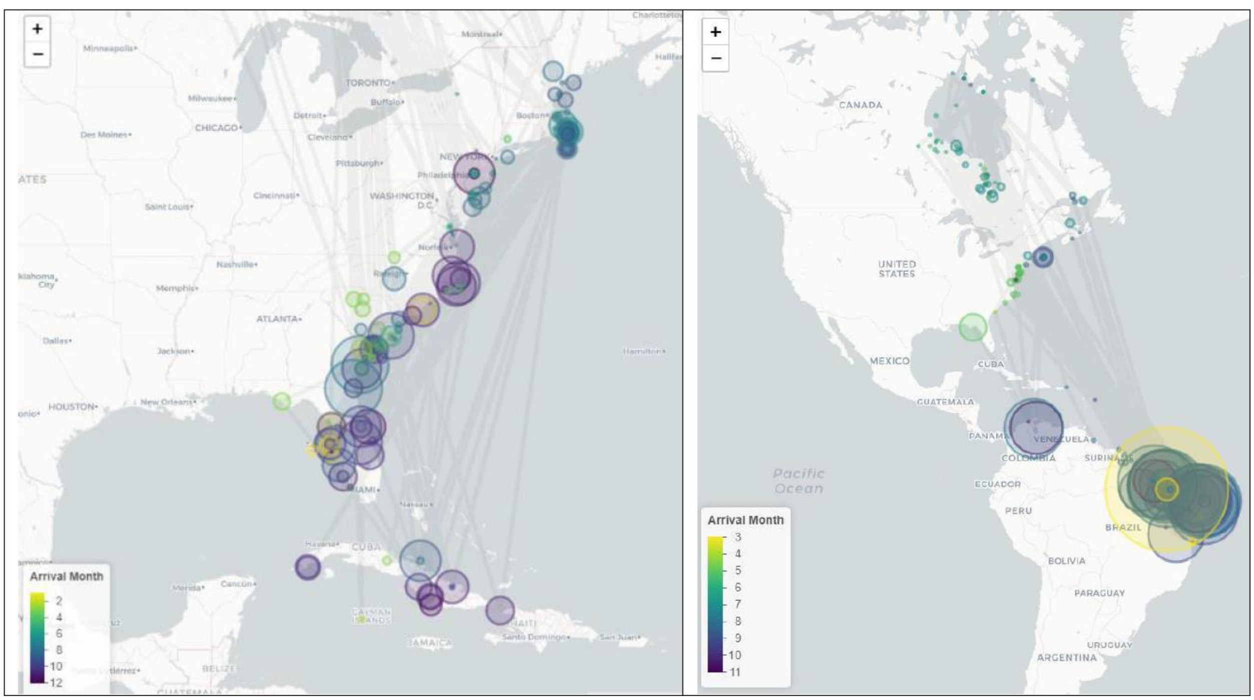

Figure 3. Rufa red knot migratory flights (Figures 5b and 6a from Perkins 2023).

1. Offshore

For the purposes of this section on the status of the species, the offshore area extends from the lease areas to the onshore open water interface.

Piping Plover

Piping plovers transit the offshore areas during spring and fall migrations (BOEM 2022; Loring et al. 2018, Loring et al. 2019, Loring et al. 2020a, Loring et al. 2020b) 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 (Figure 4). 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.

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 in Federal waters occurred within the RSZ. However, the RSZ for this study was defined for this study at 25 m to 250 m (82 ft to 820 ft) above sea level and thus larger and higher than the Sunrise Wind RSZ (40 m to 240 m (131.2 ft to 787 ft)). Further analyzing this same set of 150 tagged piping plovers, Loring et al. (2020b) presents altitudes for 17 individual migratory flights across the mid-Atlantic Bight.

Piping plovers from the New England recovery unit are likely occur in the Sunrise Wind lease area annually. Individuals are likely to cross the action area one or two times per year, on spring and fall migration fights. We have no information regarding occurrence of birds from the Eastern Canada recovery unit, 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.

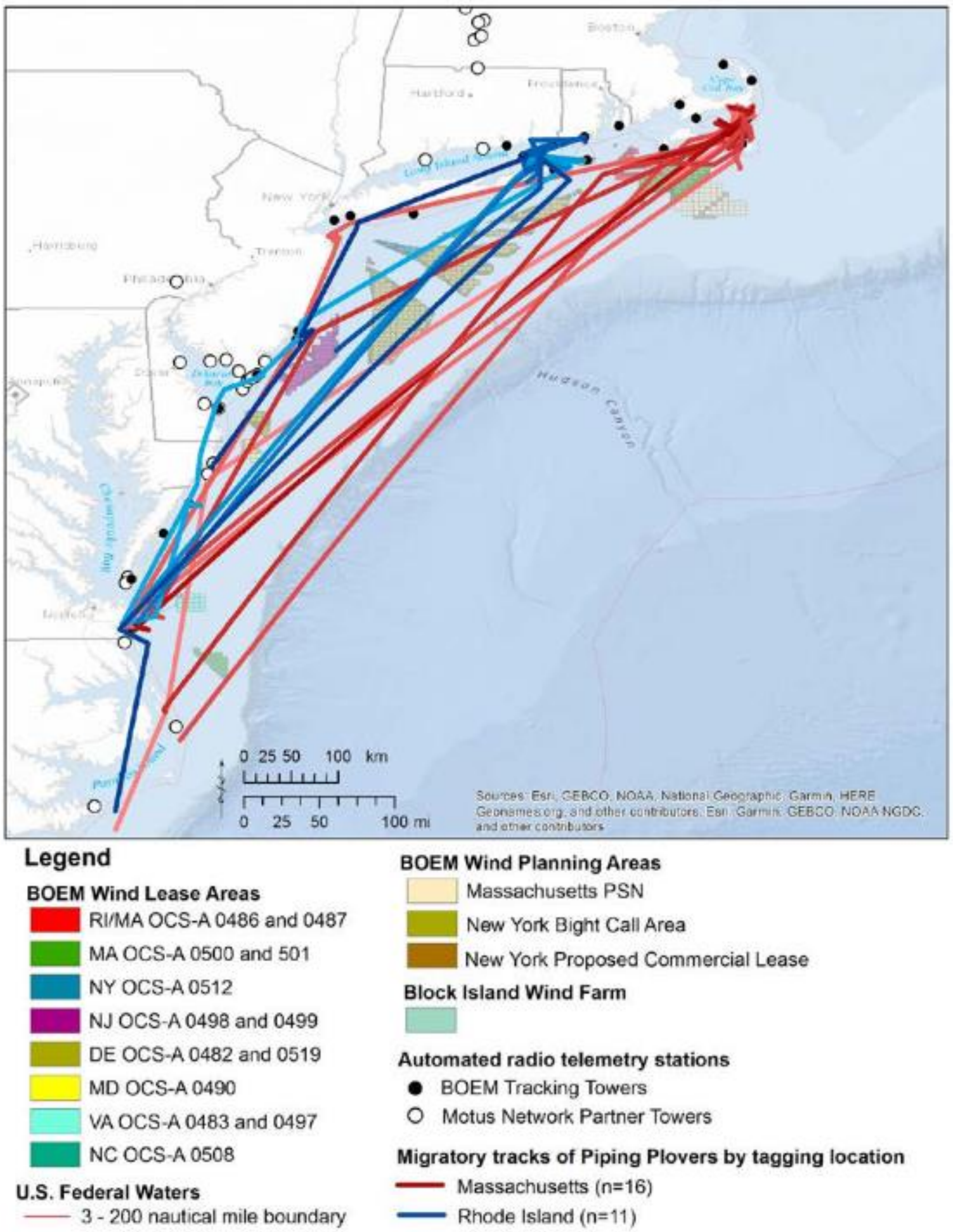

Figure 4. Figure 57, part C, in Loring et al. (2019), illustrating model estimated piping plover migratory flights intersecting the action area and other offshore wind lease areas.

Rufa Red Knot

Perkins (2023) summarized the migration patterns and wintering locations of rufa red knots based on 93 individuals tagged between 2009 and 2017. All rufa red knot tracks were reviewed and categorized into subpopulations following discussion with experts and draft recovery plan mapping. Individuals were assigned under the following categories SEC (31 birds, including 10 that wintered in the Caribbean), NCSA (22 birds), Western (24 birds), and Southern (9 birds). Seven individuals, all tagged in Texas, were unable to be classified confidently to a subpopulation. The location estimates are within an error margin of about 155 miles (250 km) (Perkins 2023).

Rufa red knots from the SEC, NCSA, and Southern recovery units are likely to occur in the action area, though it is not yet known if birds from these three recovery units use the airspace with similar frequency, timing, or altitudes. Far greater numbers of rufa red knots are believed to cross the OCS on fall migration flights compared to spring migration flights. However, this species is not limited to migration flights across the OCS, as it also makes offshore regional flights during periods of seasonal residence in the mid-Atlantic. Best available information indicates overlap between rufa red knot flights and the Sunrise Wind lease area (Figure 5).

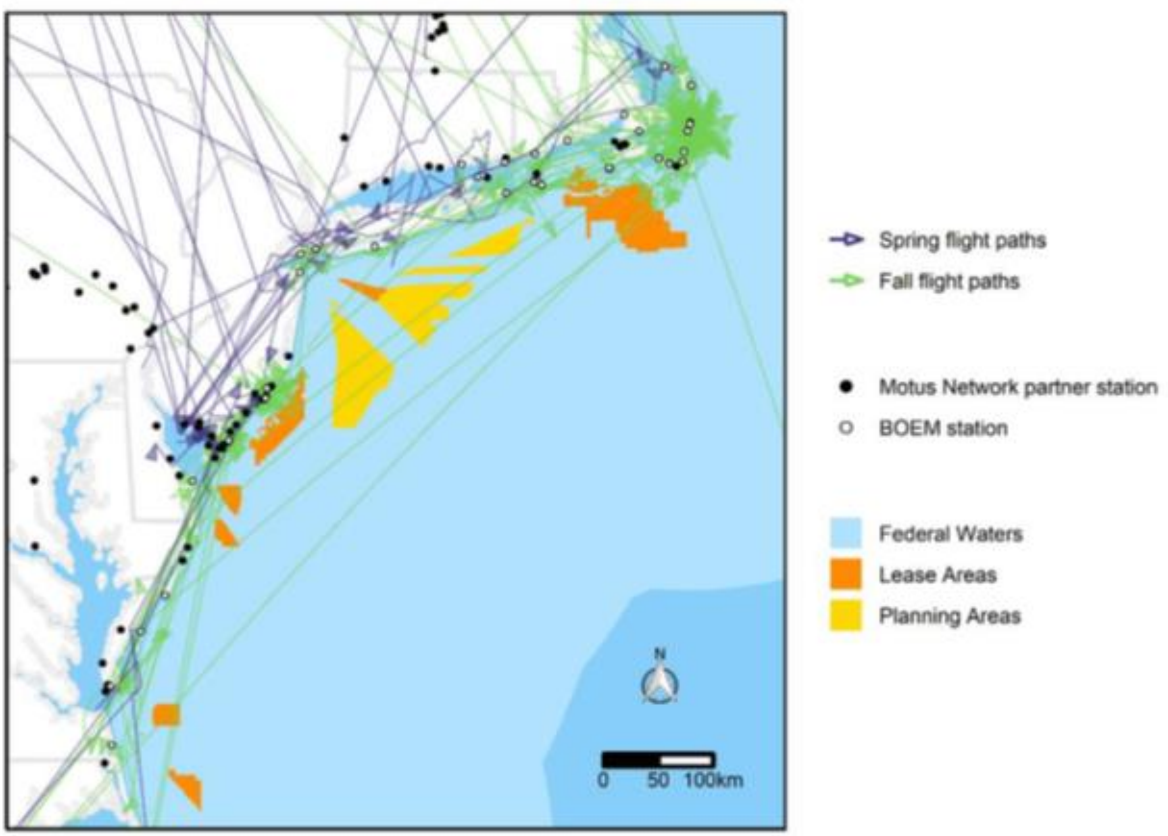

Figure 5. Modeled Flight Paths of Rufa Red Knots during Spring Migration (n = 31) and Fall Migration (n = 146) from 2014 to 2017. Source: Loring et al. 2020a, Figure 14.

2. Onshore

Each of the two species are known or expected to use the beach habitats in the onshore portion of the action area. As noted below, the highest level of information is present for the piping plover, as breeding location data has been collected in many areas of Long Island, including the action area, since its listing. Rufa red knots and piping plovers are known from observations by shorebird monitors and amateur bird watchers.

Piping Plover

Piping plover are known to breed on the eastern end of Fire Island between Old Inlet and Moriches Inlet, Suffolk County, NY. This stretch of beach falls with the NYSDEC's Fire Island East Colonial Waterbird and Piping Plover Survey breeding area. They are monitored and managed by the NPS's Fire Island National Seashore and Suffolk County Department of Parks, Recreation, and Conservation.

Piping plover are known to occur within several hundred meters or less of the proposed cable landfall alignment at Smith Point County Park.

Red Knot

In New York and New Jersey, red knots use sandy beaches and back-bay areas during spring and fall migration (Niles et al. 2008). However, the Service is not aware of long-term comprehensive monitoring of red knots within the onshore portion of the Action Area. The bulk of rufa red knot observations are from eBird.org. records from Fire Island, but these may not accurately represent the full extent of red knot presence near the proposed landfall location (Figure 6, Figure 7).

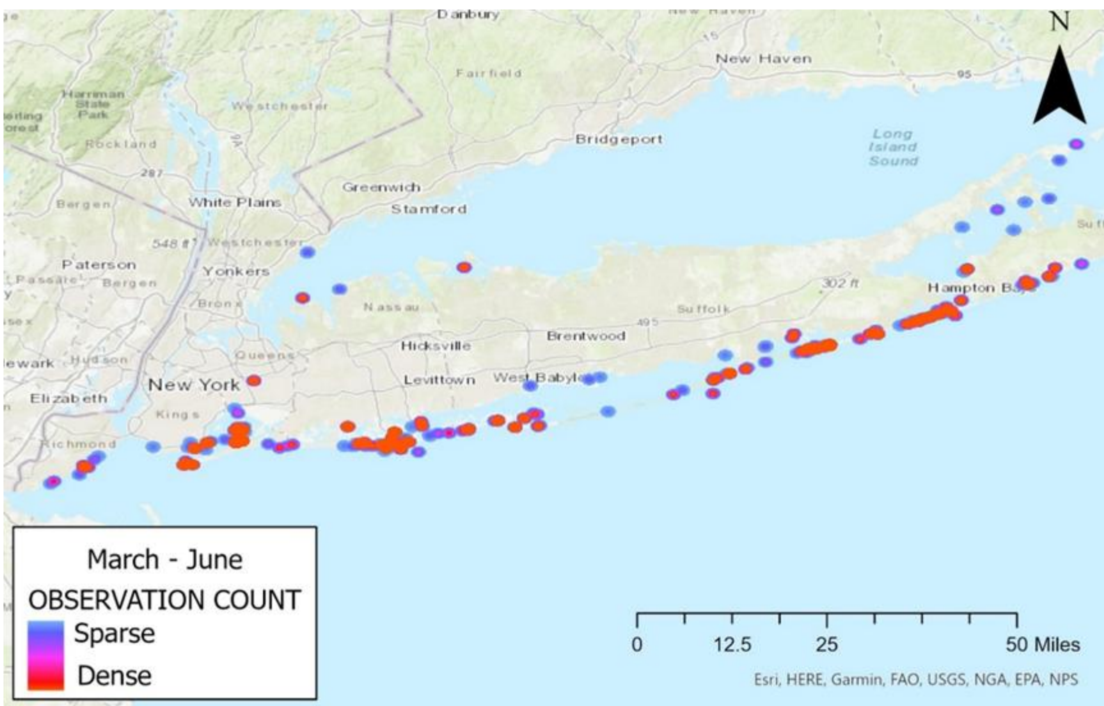

Figure 6. Heat map showing densities of red knot sightings in Long Island, New York during spring migration (March – June) from 1925 to 2020. Data courtesy of eBird (eBird Basic Dataset 2020). Caption and image from Gardner et al. (2021).

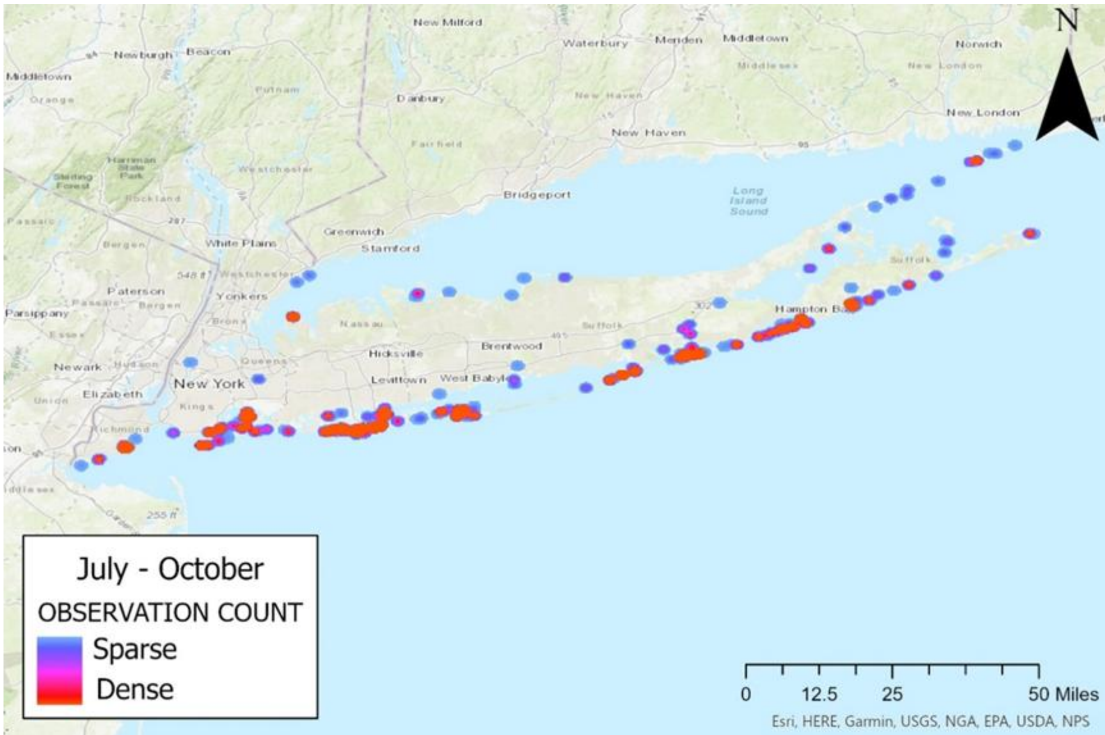

Figure 7. Heat map showing densities of red knot sightings in Long Island, New York during fall migration (July – October) from 1925 to 2020. Data courtesy of eBird (eBird Basic Dataset 2020). Caption and image from Gardner et al. (2021).

B. Factors Affecting the Species within the Action Area

Structures

There are currently no structures within the offshore action area (Landers pers comm. 2023), thus no collision hazards and no potential effects on bird behavior by way of structures or stationary sources of lighting or noise.

Vessels

Commercial, recreational, and other vessels transit the waters in and around the action area. The COP (Stantec 2022; Volume I, Section 4.8.1) presents information on vessel traffic specific to the action area. Data collected from July 2018 to June 2019 showed that an average of fewer than 10 transits per day entered the vicinity of the Lease Area from most surrounding marine routes, and the few routes with relatively higher vessel traffic are more than 20 nm from the Lease Area. Compared to WTGs, 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, Loring et al. 2019).

As noted in our concurrence with the BOEM's not likely to adversely affect determination for piping plovers due to construction and O&M vessel traffic, piping plovers are not known to occur on the OCS during the breeding season, and this species does not overwinter in New York, except for the occasional individual. Therefore, we expect piping plover use of the action area to be solely limited to migration flights, and thus conclude that construction and O&M vessel traffic in the action area has a negligible effect on this species.

As noted in our concurrence with the BOEM's not likely to adversely affect determination for red knots due to vessel traffic, juvenile and nonbreeding adult rufa red knots can occur along New York's Atlantic Coast during most months of the year and may spend longer in this region than birds stopping over during migration. Regional movements of rufa red knots are well documented (Burger et al. 2012, Loring et al. 2018). It is likely that moderate numbers of rufa red knots cross the action area on relatively lower-altitude regional flights, and that some percentage of these birds encounter one or more vessels. Such birds may make a minor course adjustment or be temporarily disoriented by noise or lights, but we conclude such effects are minor and generally do not impact fitness of the affected birds.

Direct Mortality

Listed birds in the action area may be indirectly affected by direct removals from their populations (i.e., mortality) by human activities. The overall numbers of listed birds, rangewide and within different management units, may affect the frequency with which individuals occur in the action area, and could also influence flight behavior and/or energetics if overall abundance also influences flock sizes. In addition, changes in the relative population sizes of various management units may influence patterns of timing and trajectories of flights in the action area, because birds from different units are known to exhibit differences in migration timing and routes. Sources of direct removals from populations include vehicles, collisions with human structures, hunting, oil spills, harmful algal blooms, and research activities. Direct removals are generally considered to be exerting only a minor influence on the listed bird population sizes and are not cited as a primary threat to piping plover or rufa red knots (USFWS 2020a and b). Any influence of these factors on bird use of the action area is unknown and would be extremely difficult to measure.

Climate Change

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 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).

The Intergovernmental Panel on Climate Change (IPCC) has concluded that while climate change may not lead to more frequent tropical cyclone (e.g., hurricanes) formation, the global proportion of stronger tropical cyclone instances has increased over the past four decades. The proportion of tropical cyclone intensification events, the average peak wind speeds, the peak wind speeds of the most intense tropical cyclones, and the average and maximum rain rates associated with tropical cyclones are all projected to increase on a global scale in the future (Seneviratne et al. 2021). Regarding extratropical cyclones (e.g., nor'easters), average and maximum rain rates are also projected to increase with climate change. Future wind speed changes in extratropical storms are generally expected to be small, though certain regions may experience substantial changes in extreme wind speeds. The frequency of spring severe convective storms (e.g., tornadoes, thunderstorms) is projected to increase in the U.S., resulting in a longer severe convective storm season (Seneviratne et al. 2021).

In addition to storms, flights of listed birds in the action area may also 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). We have little information to assess the extent to which piping plovers and rufa red knots may be experiencing such shifts in climatic conditions in the action area, or their vulnerability to any such changes.

Synthesis

There are currently no fixed structures in the action area, and we conclude that baseline levels of vessel traffic in the action area are having a negligible effect on listed birds. Climate change is likely influencing listed birds during their offshore flights, but how such changes may be manifesting in the action area is unknown. The magnitude of any effects from direct removal of individuals from populations of listed birds (i.e., on the usage of the action area by the remaining members of the population) is highly uncertain but presumed to be small. In summary, the environmental baseline includes no factors that are appreciably diminishing or otherwise affecting usage of the action area by listed birds.

IX. 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).

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 the number, location, height, lighting, and operational time of the WTGs; the population size and movement patterns of the bird species in question, its typical flight altitudes, and its ability to avoid collision; the landscape setting (e.g., topography on land, distance offshore); and 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 effects on collision risk levels may emerge as various offshore wind projects go into operation.

Listed birds will eventually 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 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 order Accipitriformes (most diurnal birds of prey, but not falcons) and Charadriiformes (shorebirds) was identified as vulnerable (Thatcher et al. 2017). However, predicted collisions were relatively low for charadriidae (plovers, including piping plovers) and scolopacidae (sandpipers, including red knots) (Thaxter et al. 2017).

The only adverse effect of the proposed project evaluated in this BO is collision of piping plover and rufa red knot with the SRWF turbines. If these listed species collide with any of the WTGs, then take under the ESA would occur by wounding or, more likely, killing individuals of these species. Due to the relative difficulty in observing collision mortality in the offshore environment versus on land, the effects determination primarily focuses on the statistical probability and numerical quantification of take via the SCRAM model (Adams et al. in prep) (Table 3) and the Band (2012) model (Table 4). The Service's standard for issuance of an incidental take statement 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).

Table 3. SCRAM model results (Adams et al. in prep), showing annual and life of project mortality estimates with 95 percent prediction intervals at a 92.9 percent collision avoidance rate. See Appendix B for full model input and outputs.

	Piping Plover			Red Knot		
Timeframe	**Mean**	**Lower**	**Upper**	**Mean**	**Lower**	**Upper**
Annual	0.0016	0.0002	0.0051	36.6	30.3	43.1
Operational (over 35 yrs)	0.0571	0.0053	0.1775	1281	1060.5	1508.5

Table 4. Band (2012) model results generated by the Service for the purposes of estimating mortality from turbine collisions over 35 years using 92.97 and 98 percent collision avoidance rates. See Appendix B for full model inputs and outputs.

Piping Plover (35 yrs)		Red Knot (35 yrs)	
92.97%	**98%**	**92.97%**	**98%**
2	1	31	9

X. 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" considered in this Opinion (50 CFR 402.02).

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 from various sources (off-road vehicles, pedestrians) 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 rate 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. We note that greenhouse gas emissions are generally not considered an action (in this case a State or private action) based only on its contribution to climate change, per the DOI Solicitor's Opinion M-37017. Therefore, no cumulative effects are anticipated.

XI. JEOPARDY ANALYSIS

Section 7(a)(2) of the ESA 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.

A. Jeopardy Analysis Framework

"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). The following analysis relies on 4 components: (1) Status of the Species, (2) Environmental Baseline, (3) Effects of the Action, and (4) Cumulative Effects. The jeopardy analysis in this Opinion emphasizes the range-wide survival and recovery needs of the listed species and the role of the action area in providing for those needs. It is within this context that we evaluate the significance of the proposed federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

B. Analysis for Jeopardy

Impacts to individuals – For this analysis, we presume that 100 percent of listed birds that collide with a WTG will be fatally wounded and die.

Impacts to populations – As we have concluded that individual piping plovers and red knots are likely to be killed, we need to assess the aggregated consequences of the anticipated losses of the exposed individuals on the population to which these individuals belong.

Piping Plover

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 population size across the Atlantic (Eastern) Canada, New England, and NY-NJ recovery units combined was 1,600 pairs, or 3,200 birds (USFWS 2021a). Given this current abundance level and long-term population trajectory, we conclude that the Band (2012) model predicted loss of 1 bird (98 percent avoidance rate) or 2 birds (92.97 percent avoidance rate) over 35 years will have no appreciable effect on survival rates.

Piping plover collisions may be most likely to affect the New England recovery unit, based its sheer size, which also makes it the least vulnerable to demographic effects from loss of these birds. However, available information suggests that birds from the Atlantic (Eastern) Canada recovery unit may also have significant exposure to collision risk (Rock pers. comm. 2023), which has not yet been assessed. The Atlantic (Eastern) Canada recovery unit is the most sensitive to loss of individuals, with a long-term average of only 179 pairs (358 birds). However, we conclude it is unlikely that all of the projected collisions would come from the Atlantic (Eastern) Canada unit, simply based on the much larger size (5.3 times larger) of the New England unit. The NY-NJ unit would be intermediate in sensitivity between the Atlantic (Eastern) Canada and New England recovery units. Based on current demographic data, we conclude that predicted loss of Atlantic Coast piping plovers over 35 years will have no measurable effects on any of the three recovery units. This conclusion assumes that no more than one bird will come from the Atlantic (Eastern) Canada population, and that no more than one bird (from any unit) will be lost in any given year. Demographic rates are associated with uncertainty and can change over the 35-year project life. However, any risk of population-level effects is likely to be further reduced by the provisions for Sunrise Wind LLC to provide compensatory mitigation (Section IV).

Based on current demographic data, lack of cumulative effects, and status of the species in the action area, we conclude that the loss of one to two Atlantic Coast piping plovers over 35 years will have no appreciable effects on any of the three recovery units with the noted caution about the Atlantic (Eastern) Canada recovery unit.

We acknowledge that demographic rates are associated with uncertainty and can change over the 35-year project life.

Rufa Red Knot

Given the population size estimates shown in Table 2, and apparent population stability (USFWS 2014), we conclude that the SCRAM predicted mortality of 1281 (mean 1281; 95 percent prediction interval 1060.5 to 1508.5) rufa red knots or the Band (2012) predicted mortality of 9 (98 percent avoidance rate) or 31 (92.97 percent avoidance rate) rufa red knots over 35 years will have no appreciable effect on the SEC or NCSA recovery units.

The Southern unit would be far more sensitive to loss of individuals, based not only on its smaller size but also the challenges that face these birds on their very long migrations (USFWS 2020b). However, we conclude it is unlikely that all of the projected collisions would come from the Southern unit, based on its smaller size and on the tracking data discussed above. Based on current demographic data, we conclude that predicted loss of rufa red knots generated from both models over 35 years will have no measurable effects on any of the three recovery units. This conclusion assumes that no more than nine birds total—and no more than one bird in any given year—will come from the Southern population. Demographic rates are associated with uncertainty and can change over the 35-year project life. However, any risk of population-level effects is further reduced by the compensatory mitigation commitments given in Section IV of this Opinion.

Impacts to species – Given our conclusion that the projected levels of collision mortality will have no measurable effect on any populations (i.e., recovery or management units), and that any risk of population-level effects is further offset by compensatory mitigation, we conclude that the operation of the Sunrise Wind LLC project will have no appreciable effect on the numbers of any of the two listed bird species, and no effect on reproduction or distribution of either of the two listed bird species. Thus, the project will not affect the viability of the Atlantic Coast piping plover and rufa red knot.

XII. CONCLUSION

We considered the current overall rangewide status of the piping plover (improving) and rufa red knot (stable) and the stable condition of red knots and piping plovers within the action area (environmental baseline). 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. As stated in the Jeopardy Analysis, we do not anticipate any reductions in the overall reproduction, numbers or distribution of these species. It is the Service's Opinion that the operation of the Sunrise Wind LLC 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.

XIII. 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 species, respectively, without a special exemption. Take is defined 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 include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering (50 CFR § 17.3). Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering (50 CFR § 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), 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 incidental take statement.

The measures described below are non-discretionary and must be undertaken by BOEM so that they become binding conditions of any grant or permit issued to the Sunrise Wind LLC, as appropriate, for the exemption in Section 7(o)(2) to apply. BOEM has a continuing duty to regulate the activity covered by this incidental take statement. If BOEM: (1) fails to assume and implement the terms and conditions or (2) fails to require the Sunrise Wind LLC to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of Section 7(o)(2) may lapse. To monitor the impact of incidental take, BOEM or Sunrise Wind LLC must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)].

The Service will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

XIV. AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service expects the lethal take of listed species resulting from collision of birds with operating wind energy turbines on BOEM Renewable Energy Lease Area OCS-A-0487 over the 35-year life of the Sunrise Wind project.

<u>Piping Plover</u>

The incidental take estimate is based on the Band (2012) mortality estimate at the 92.97 percent collision avoidance rate:

1. Band (2012)-derived piping plover incidental take: two piping plovers due to collision mortality over 35 years.

<u>Rufa Red Knot</u>

We compared the SCRAM mean mortality estimate and the Band (2012) mortality estimates (both at the 92.97 percent collision avoidance rate) and selected the lower of the two to establish mortality estimates for incidental take and reintiation exceedance criteria:

2. SCRAM-derived rufa red knot incidental take: 1,281 (mean; lower and upper 95 percent prediction intervals of 1061 and 1509, respectively) rufa red knots due to collision

mortality over 35 years (BOEM 2023).

3. Band (2012)-derived rufa red knot incidental take: 31 rufa red knots due to collision mortality over 35 years.

Comparing 2 and 3, above we selected the Band (2012) results to define incidental take of red knots; that is, 31 rufa red knots over 35 years as it provides the most conservative estimate of the two model results for establishing a take exceedance value for the purposes of reinitiation of consultation.

The Service analyzed the effects to the piping plover and red knot and has determined that the levels of take anticipated, as described above, from the Federal actions covered in this Opinion are not likely to result in jeopardy to these species.

We conclude that take of Atlantic Coast piping plovers and rufa red knots in the form of collision mortality from operation of the Sunrise Wind project is reasonably certain to occur. Absent sufficient information to more precisely estimate avoidance rates and other data limitations described above, we considered and adopted the full range of collision estimates presented in Tables 3 and 4. We note that the estimated levels of take are associated with high uncertainty, and we expect that it will be refined over time in accordance with the monitoring and modelling efforts proposed in Section IV of this Opinion

XV. REASONABLE AND PRUDENT MEASURES

The physical and operational parameters of WTGs are known to influence the risk of wildlife collision. At this time, the Service is not aware of any specific physical or operational 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 Sunrise Wind project. Therefore, the Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of piping plovers and rufa red knots.

1. Periodically review current technologies and methods for minimizing collision risk of listed birds, including but not limited to: WTG coloration/marking, lighting, avian deterrents, and limited WTG operational changes. 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.

XVI. TERMS AND CONDITIONS

In order to be exempt from the prohibitions of Section 9 of the ESA, BOEM must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1. Prior to the start of WTG operations at SRWF, the BOEM must extract from existing project documentation (e.g., the BA, other consultation documents, the final

Environmental Impact Statement, the COP) a stand-alone summary of technologies and methods that were evaluated by the BOEM to reduce or minimize bird collisions at the SRWF WTGs.

2. Within 5 years of the start of WTG operation, and then every 5 years for the life of the project, the BOEM must prepare a Collision Minimization Report, 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 WTGs. The review must be global in scope and include both offshore and onshore WTGs.

3. The BOEM must distribute a draft Collision Minimization Report to the Service, Sunrise Wind LLC, and NYSDEC 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.

4. Following issuance of the final Collision Minimization Report, 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 Service and Sunrise Wind LLC. Meeting participants will discuss the Report and seek consensus on whether implementation of any technologies/methods is warranted.

In the event of take, a system of notification shall be implemented following the guidelines:

Notification of injured or dead listed species will be made to USFWS Law Enforcement and Long Island Field Office. Exercise care in handling any specimens to preserve biological material in the best possible state. In conjunction with the preservation of any specimens, the BOEM is responsible for ensuring that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. Finding dead or non-viable specimens does not imply enforcement proceedings pursuant to the ESA. Reporting dead specimens is required for 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 piping plover, rufa red knot, or other listed species, initial notification must be made to the following Service offices:

Resident Agent in Charge
U.S. Fish and Wildlife Service
Office of Law Enforcement
70 East Sunrise Highway, Ste. 419
Valley Stream, NY 11581
516-825-3950

and

U.S. Fish and Wildlife Service
Long Island Field Office

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

XVII. 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. 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 BO, 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, a compensatory mitigation ratio greater than 1:1 is advisable to insure against jeopardy, particularly given the extent of full buildout of WTGs on the OCS.

Recommendation 2: Establish an Offshore Wind Adaptive Monitoring and Impact Minimization Framework, developed and carried out through a partnership of government agencies and industry representatives, to guide and coordinate monitoring, research, and avian impacts 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 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 BOEM, BSEE, the Service, State natural resource agencies responsible for flying wildlife, 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 (at a minimum, Federal waters from Maine to Virginia—optionally also Federal Atlantic waters from North Carolina to Florida and/or State waters);
    c. the species coverage of the Framework (at a minimum, federally listed, proposed, and candidate bird and bat species likely to occur in the offshore environment—optionally also other flying species of concern in the offshore environment such as certain Bird Species of Conservation Concern, At-Risk species, State-listed

species, and Species of Greatest Conservation Need as identified in State Wildlife Action Plans); and

   d. the duration of the Framework (at a minimum, the entire length of time that any offshore wind energy generation is operational OR until all members of the Principals Group are in agreement that a robust weight of scientific evidence indicates that flying wildlife are not impacted by offshore WTG operation).

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 perhaps someday even 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, including but not limited to WTG coloration/marking, lighting, avian/bat deterrents, and limited WTG operational changes that would not unduly impact energy production. At local, regional, and coastwide scales, 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 effects (collision) and indirect effects (reduced survival rates from avoidance) of WTG operation on covered species. Adopt and deploy such levels and types of mitigation as deemed appropriate by the Principals Group.

10. Consider partnering with a stakeholder or cross-sector organization, such as the Regional Wildlife Science Collaborative for Offshore Wind, 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" in the Section 7 handbook excludes future Federal actions because such actions will be subject to their own consultations. However, the analysis of environmental baseline conditions for each subsequent consultation will be limited to the action area of that particular project. This creates a situation where the effects analysis for each individual offshore wind energy project cannot fully take into account the possible additive and/or synergistic effects that may occur at 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 26 additional projects in various stages of development offshore the U.S. coast from Maine to Virginia. As the Interior Department continues moving toward the national goal of deploying 30 gigawatts of offshore wind by 2030, we anticipate still more projects beyond those 26 (e.g., within the New York Bight, Central Atlantic, and Gulf of Maine). While a thorough and robust assessment of potential direct effects (collision) and indirect effects (behavioral change) will be completed for each individual offshore wind project, 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. (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 BO 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.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

XVIII. REINITIATION NOTICE

This concludes formal consultation on the action outlined in BOEM's request for consultation on the Sunrise Wind Project. As provided in 50 CFR 402.16, reinitiation of formal 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 incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

XIX. LITERATURE CITED

Adams, E.M., A. Gilbert, P. Loring, and K.A. Williams. In preparation. Transparent modeling of collision risk for three federally-listed bird species in relation to offshore wind energy development. Report by Biodiversity Research Institute and USFWS for U.S. Department of the Interior, Bureau of Ocean Energy Management; Washington, DC.

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].

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

Bureau of Ocean Energy and Management [BOEM]. 2022. Sunrise Wind Farm and Sunrise Wind Export Cable – development and operation, biological assessment. Office of Renewable Energy Programs, Sterling, Virginia. 126 pp. + Appendices.

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

Buresch, K. 1999. Seasonal pattern of abundance and habitat use by bats on Martha's Vineyard, Massachusetts. M.S. Thesis. University of New Hampshire, Durham, New Hampshire.

Burger, J., L.J. Niles, R.R. Porter, A.D. Dey, S. Koch, and 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.

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 276:109795.

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 148:198–202.

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].

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 148:29-42.

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.

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].

Fernández-Alvarez, J.C., X. Costoya, A. Pérez-Alarcón, S. Rahimi, R. Nieto, and L. Gimeno. 2023. Dynamic downscaling of wind speed over the North Atlantic Ocean using CMIP6 projections: Implications for offshore wind power density. Energy Reports 9:873-885.

Gardner, E.D., J.D. Fraser, and S.M. Karpanty. 2021. Red knots in Long Island, NY: A literature and eBird review. Report prepared by Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA, for U.S. Fish and Wildlife Service, Long Island Field Office, Shirley, NY. 24 pp.

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.L., G.J. Robertson, and C.A. Bishop. 2013. Scientific review of the recovery program for piping plover (melodus subspecies) in Eastern Canada. Unpublished report prepared for Science and Technology Branch, Environment Canada; Saskatoon, Saskatchewan.

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.

Johnson, J.B., and J.E. Gates. 2008. Bats of Assateague Island National Seashore, Maryland. American Midland Naturalist 160:160–170.

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. U.S. Department of the Interior, Bureau of Ocean Energy Management; Sterling, Virginia. 78 pp + Appendices. Available from: https://espis.boem.gov/Final%20Reports/BOEM_2018-046.pdf [Accessed May 9, 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. U.S. Department of the Interior, Bureau of Ocean Energy Management; Sterling, Virginia. 139 pp. Available from: https://espis.boem.gov/final%20reports/BOEM_2019-017.pdf [Accessed May 9, 2023].

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, and P.A. Smith. 2020a. Tracking movements of migratory shorebirds in the U.S. Atlantic Outer Continental Shelf region. OCS Study BOEM 2021-008. U.S. Department of the Interior, Bureau of Ocean Energy Management; Sterling, Virginia. 96 pp + Appendices. Available from: https://www.boem.gov/sites/default/files/documents/renewable-energy/studies/Tracking-Migratory-Shorebirds-Atlantic-OCS.pdf [Accessed May 9, 2023].

Loring, P.H., J.D. McLaren, H.F. Goyert, and P.W.C. Paton. 2020b. Supportive wind conditions influence offshore movements of Atlantic Coast piping plovers during fall migration. Condor 122:1–16.

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(Supplement 1):1-14.

Marques, A.T., H. Batalha, and J. Bermandino. 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. Western Hemisphere Shorebird Reserve Network. https://whsrn.org/results-of-the-2021-aerial-census-at-bahia-lomas-chile/ [Accessed May 9, 2023].

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

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.

Niles, L.J., H.P. Sitters, A.D. Dey, P.W. Atkinson, A.J. Baker, K.A. Bennett, R. Carmona, K.E. Clark, N.A. Clark, and C. Espoz. 2008. Status of the red knot (*Calidris canutus rufa*) in the Western Hemisphere. Studies in Avian Biology 36:1-185.

Niles, L.J. 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, H.V., R. Matus, A. Larrea, and C. Espoz. 2022. Censos aéreos de aves playeras en el santuario de la naturaleza Bahía Lomas, Enero 2022. University Santo Tomás (Chile).

Perkins, G. 2023. Geolocator project coordinator: Using geolocator tracking data to advance understanding of red knot migration habits. EC Contract No: 3000738325. 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, and K. 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, Office of Renewable Energy Programs; Herndon, Virginia. 156 pp. + Appendices. Available from: https://espis.boem.gov/final%20reports/5319.pdf [Accessed May 10, 2023].

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

Scottish Natural Heritage [SNH]. 2018. Avoidance rates for the onshore SNH Wind Farm Collision Risk. SNH Guidance Note. 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].

Seneviratne, S.I., X. Zhang, M. Adnan, W. Badi, C. Dereczynski, A. Di Luca, S. Ghosh, I. Iskandar, J. Kossin, S. Lewis, F. Otto, I. Pinto, M. Satoh, S.M. Vicente-Serrano, M. Wehner, and B. Zhou. 2021. Weather and climate extreme events in a changing climate. Chapter 11 in climate change 2021: the physical science basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, New York, pp. 1513–1766, Available here: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter11.pdf [Accessed May 9, 2023].

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].

Simmons, A.J. 2022. Trends in the tropospheric general circulation from 1979 to 2022. Weather and Climate Dynamics 3:777–809.

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.

Stantec. 2022. Construction & operations plan. Sunrise Wind Farm Project. Revised August 19, 2022. Prepared for Sunrise Wind LLC by Stantec Consulting Services Inc. Submitted to Bureau of Ocean Energy Management; Sterling, Virginia. 933 pp + Appendices.

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: 20170829. Available from: http://dx.doi.org/10.1098/rspb.2017.0829 [Accessed May 9, 2023].

U.S. Fish and Wildlife Service [USFWS]. 1996. Piping plover (*Charadrius melodus*), Atlantic Coast population, revised recovery plan. Northeast Region; Hadley, Massachusetts. 108 pp + Appendices. Available from: https://ecos.fws.gov/docs/recovery_plan/960502.pdf [Accessed May 9, 2023].

U.S. Fish and Wildlife Service [USFWS]. 2009. Piping plover (*Charadrius melodus*) 5-year review: summary and evaluation. Northeast Region; Hadley, Massachusetts and Michigan Field Office; East Lansing, Michigan. 200 pp + Appendices. Available from: https://ecos.fws.gov/docs/five_year_review/doc3009.pdf [Accessed May 9, 2023].

U.S. Fish and Wildlife Service [USFWS]. 2014. Rufa red knot background information and threats assessment. Supplement to endangered and threatened wildlife and plants; final threatened status for the rufa red knot (*Calidris canutus rufa*) [Docket No. FWS–R5–ES–2013–0097; RIN AY17]. New Jersey Field Office; Pleasantville, New Jersey. 376 pp. + Appendices. Available from: https://www.regulations.gov/document/FWS-R5-ES-2013-0097-0703 [Accessed May 9, 2023].

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

U.S. Fish and Wildlife Service. 2020b. Species status assessment report for the rufa red knot (*Calidris canutus rufa*). Version 1.1. Ecological Services, New Jersey Field Office; Galloway, New Jersey. 55 pp. Available from: https://ecos.fws.gov/ServCat/DownloadFile/187781 [Accessed May 9, 2023].

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

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

U.S. Fish and Wildlife Service [USFWS]. 2022. Abundance and productivity estimates – 2021 update: Atlantic Coast piping plover population. Northeast Region; Hadley, Massachusetts. 16 pp. https://www.fws.gov/sites/default/files/documents/piping-plover-abundance-and-productivity-update-2021.pdf [Accessed May 11, 2023].

U.S. Fish and Wildlife Service [USFWS]. 2023a. Range-wide Indiana Bat and Northern Long-eared Bat survey guidelines. Region 3; Bloomington, Minnesota. 13 pp + Appendices. Available from: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines [Accessed May 15, 2023].

U.S. Fish and Wildlife Service [USFWS]. 2023b. Recovery plan for the rufa red knot (*Calidris canutus rufa*). Northeast Region; Hadley, Massachusetts. 22 pp. Available from: https://ecos.fws.gov/docs/recovery_plan/2023_red%20knot%20recovery%20plan_final_508%20compliant%20signed.pdf [Accessed May 9, 2023].

U.S. Fish and Wildlife Service and National Marine Fisheries Service [USFWS and NMFS]. 1998. Endangered species consultation handbook procedures for conducting consultation and conference activities under section 7 of the Endangered Species Act. 190 pp + Appendices. Available from: https://www.fws.gov/sites/default/files/documents/endangered- species-consultation-handbook.pdf [Accessed May 6, 2023].

Watts, B.D. 2015. Establishing sustainable mortality limits for shorebirds using the Western Atlantic Flyway. Wader Study 122(1):37–53.

Western Hemisphere Shorebird Reserve Network [WHSRN]. 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 May 9, 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.

PERSONAL COMMUNICATIONS

Bigger, D. 2023. Email of February 23, 2023. Environmental Protection Specialist. Office of Renewable Energy Programs, Bureau of Ocean Energy Management, Sterling, Virginia.

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

Hildreth, E. 2023. Email of April 12, 2023. Policy Analyst. Office of Renewable Energy Programs, Bureau of Ocean Energy Management, Sterling, Virginia.

Landers, L. 2023. Email of April 6, 2023. NEPA Coordinator, Environment Branch for Renewable Energy. Bureau of Ocean Energy Management, Sterling, Virginia.

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

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

Rock, J. 2023. Email of February 1, 2023. Wildlife Biologist. Environment and Climate Change, Sackville; New Brunswick, Canada.

XX. CONSULTATION HISTORY

August 8, 2022 – The BOEM transmits draft BA to the Service for review.
September 9, 2022 – Service transmits comments on draft BA to the BOEM.
December 15, 2022 – The BOEM transmits BA to the Service for the Sunrise Wind Project.
March 28, 2023 – The BOEM transmits addendum to BA to the Service which includes an updated SCRAM model assessment of collisions for red knot, piping plover and roseate tern.
June 21, 2023 – The BOEM transmits Sunrise Wind's comments on the Draft Biological Opinion to the Service via email.
Jun 26, 2023 – The Service requests via email the BOEM's response to a number of comments generated by Sunrise Wind in its review of the Draft Biological Opinion. BOEM provides its responses.

APPENDIX A

Available Collision Risk Models

Technology does not currently exist to detect a collision of either a piping plover or rufa red knot 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 (see Section IV of this Opinion), as well as for pre-construction assessments including the effects analysis in this Opinion, which is informed by a body of literature that has developed in recent decades. However, considerable uncertainty remains because most studies to date have been conducted at wind farms on land and/or in Europe. In the BA and BA addendum, the BOEM (2022, 2023) presents results from two different models in order to estimate collision risk for listed birds from the Sunrise Wind project.

The first, a model by Band (2012), is an established method to assess collision risk for offshore wind farms. It 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). 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 is sensitive to the choice of input parameters. Variability in input parameters such as bird density, flight speed, and turbine rotor speed are likely to contribute uncertainty to the final collision estimates.
3. Deterministic. Band (2012) is not a stochastic model, so it does not account for the stochasticity that pervades 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. However, this approach is relatively simplistic and can only be applied when the 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 35-year lifespan of Sunrise Wind project.

The second model, SCRAM (Adams et al. in prep), builds on the Band (2012) model 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), 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. in prep). The tagged birds 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 applied to the BA and this Opinion 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. in prep). It is important to note that SCRAM currently evaluates collision risk only for those months with movement data from Motus which, in turn, is 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 (20 km)), 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 the BOEM's past and ongoing support for the development of SCRAM. We continue to support the development and refinement of SCRAM as a scientifically sound predictive method for integrating best available information to assess collision risk for these two listed birds. However, the first version of SCRAM was only released in early 2023 and still reflects a number of consequential gaps and uncertainties. In addition to the limited data available to inform the model parameters, discussed above, there has also been limited validation of the model structure, resulting in substantial uncertainty in model results (Adams et al. in prep). Specific gaps and uncertainties of concern include:

Sample size. The tracking data sample sizes are relatively small, and do not include all tracks now available (e.g., newer Motus data; any satellite, GPS, or geolocator data).

Accuracy. All of the flight tracks and altitudes are estimated from land-based receiving stations. This results in limited accuracy because offshore bird movements were interpolated rather than measured directly. Model evaluation using a simulated data set suggest that the interpolations are reasonably accurate nearshore (where the vast majority of the Motus stations are located) but less accurate farther offshore. Even in nearshore areas, movement estimates are biased by the detection range. Estimates of flight altitude from Motus data are currently coarse approximations (Adams et al. in prep).

Detection range. The detection range of Motus receiving stations varies with altitude of the tagged bird, but is typically less than 12 miles (20 km) on average for birds in flight. Thus, there were likely gaps in coverage of the Sunrise Wind Lease Area that could lead to underestimates of collision risk.

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. in prep). 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.

Piping plovers:

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

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

Spatial bias. SCRAM assumes that the movement models represent bird airspace use in an unbiased manner. 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). As Motus stations are unequally distributed on the landscape, and different numbers of Motus stations were operated each year of the tracking study, the locations of each year's Motus stations inevitably bias resulting estimates of bird use of the offshore airspace (Adams et al. in prep). Thus, SCRAM could underestimate 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.

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. in prep). 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 just two nesting areas in New England. No tracks derived from the NY-NJ Recovery Unit, or the Atlantic (Eastern) 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 not yet available. Preliminary results from a previous mark/resight study found that 42 percent of piping plovers marked in Atlantic (Eastern) 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 may still not be fully representative of the overall population's use of the offshore airspace.

Variability. SCRAM cannot yet 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.

We appreciate the BOEM's cooperative efforts to work with the Service on the development of SCRAM with the goal of reducing uncertainty around collision risk estimates (see provisions in the project description for continued model development in Section IV of the Opinion. 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 weighted accordingly and used in combination with other sources of information in order to satisfy the ESA requirement to utilize best available scientific and commercial data. However, we do ultimately rely on the models to provide our best estimates of mortality at this time, as the model estimates are a quantitative measure that the Service and the BOEM can jointly adopt and work to refine through addressing limitations and data gaps in the variables that underpin the model calculations, as opposed to the Service unilaterally applying some qualitative corrective factor to the model results in assessing mortality. This approach is supported by the numerous bird and bat monitoring framework committees for various offshore wind projects that the Service is participating in where we are simultaneously working with the BOEM and wind developers to address these specific data gaps.

Methods for Estimating Numbers of Collisions

In light of the high uncertainty associated with both Band (2012) and SCRAM, as discussed above, we used collision projections from both models. For SCRAM, we relied on the March 28, 2023 addendum to the BA (BOEM 2023) in which the BOEM presents the outputs from SCRAM version 1.0.3. As noted 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 (that area of air space through which the rotors revolve). Compared to Band (2012), SCRAM uses the monthly population estimates in a different way. SCRAM uses movement modeling derived from Motus tracking data to determine monthly occupancy rates within half degree grid cells and then links those values to monthly population estimates to estimate species density across the Atlantic OCS where tracking data were available. SCRAM uses these density estimates at specific flight heights (data also derived from Motus tracking) along with other species and site characteristics (e.g., species-specific flight speeds and number of turbines in a specified turbine array) to estimate collision risk for locations across a portion of the Atlantic OCS where tracking data were available (Adams et al. in prep).

For Band (2012) we input WTG specifications provided by the BOEM (Bigger pers. comm. 2023), 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. in prep). We followed the guidance from Band (2012) to develop a best estimate, not a "worst case" scenario. For red knots and piping plovers, we used Annex 6 – Assessing collision risks for birds on migration. We expect piping plovers in the action area to be limited to birds on migration flights. However, for rufa red knots, use of Annex 6 means omitting from the Band (2012) analysis birds that may be seasonally resident in the mid-Atlantic and present in the action area on non-migration flights (i.e., regional movements for knots). 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 Sunrise Wind lease area during any month; and (2) far greater numbers of migrating knots and terns 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 for the Sunrise Wind project**.** However, we note that if and when seasonally resident knots occur offshore, they may spend more time in the action area, and at different flight heights, compared to migrants, and this represents an additional source of collision risk that is not reflected in the Band (2012) outputs presented below.

Under Annex 6, Band (2012) makes the following 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 (i.e., this "migratory front" is an imaginary line passing through the Sunrise Wind lease area and extends 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 migration 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 violate this assumption by crossing the migration front more than twice per year. Regarding assumption 2, we conclude from tracking data that that piping plovers and rufa red knots are not evenly distributed across their respective migration corridors. However, we still find it necessary and appropriate to consider Band (2012) outputs given the known gaps in SCRAM.

We used best available tracking and other data (including range maps) to inform the delineation of the migration corridors as shown in section VIII (A) of the Opinion. 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. 2020b) 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).

For rufa red knot, we delineated a migration corridor based on geolocator tracking data collected from 93 individual birds (with tags deployed across the species range) between 2009 and 2017 (Perkins 2023). The corridor 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 corridor because the data are still undergoing quality control, and in many cases metadata is 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 the migration corridor.

The final input required to run Band (2012), Annex 6, is the number of birds crossing the migration front each month. Table 5 presents the population data we used for this purpose. All monthly numbers were multiplied by 35 to estimate number of collisions over the operational life of the Sunrise Wind project.

Table 5. 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)

Table 5 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 Atlantic (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 (however, this has no effect on the width of the corridor at the latitude of the Sunrise Wind lease area).

Rufa Red Knot

(1) Population data are from Table 2, above in the Opinion.

(2) 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.

(3) 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.

(4) 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.

(5) 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

The complete SCRAM (Adams et al. in prep) and Band (2012) output reports are on file in the Long Island Field Office and summary information is presented in Table 6. As previously discussed in this Opinion, these estimates are associated with very high uncertainty.

Table 6. Estimated numbers of collisions over 35 years of WTG operation as projected by SCRAM (95 percent prediction interval, 92.9 percent avoidance rate).

	Piping Plover			Red Knot		
Timeframe	**Mean**	**Lower**	**Upper**	**Mean**	**Lower**	**Upper**
Annual	0.0016	0.0002	0.0051	36.6	30.3	43.1
Operational (over 35 yrs)	0.0571	0.0053	0.1775	1281	1060.5	1508.5

Table 7. Band (2012) model results generated by the Service, showing turbine mortality estimates over 35 years using 92.97 and 98 percent collision avoidance rates.

Piping Plover (35 yrs)		Red Knot (35 yrs)	
92.97%	**98%**	**92.97%**	**98%**
2	1	31	9

SCRAM uses only one avoidance rate (0.929) for the red knot and piping plover (Adams et al. in prep). 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). We are not aware of any empirical, species-specific avoidance rates available for piping plovers or rufa red knots. The selection of 0.929 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 this range, 92.9 percent, is consistent with the SCRAM model.

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). The Service considered the full range of Band (2012) outputs with avoidance rates of 92.97, 98, 99, and 99.5 percent. However, based on the best available science, we primarily consider the 92.97 and 98 percent avoidance rates in our analysis (Adams et al. in prep, Band 2012, Gordon and Nations 2016, Kleyheeg-Hartman et al. 2018, Scottish National Heritage 2018, Cook 2021).

The collision estimates presented in Table 6 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 attraction of birds leads them close to the sources of light. 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 more towards continuous than towards blinking illumination, when stars were not visible. Continuous green, blue and white light attracted significantly more birds than continuous red light in overcast situations (Rebke et al. 2019). The applicability of this study to shorebirds and terns is not yet clear. Section III of the Opinion is part of the project description and ensures future reassessment of collision projections for listed birds following approval of the maritime navigation lighting plan by the USCG.

Piping Plover

Table 7 presents a range of 1 (98 percent avoidance rate) to 2 (92.97 percent avoidance rate) piping plover collisions (Band 2012) over the 35-year life of the Sunrise Wind project. The SCRAM estimates are likely 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 in this Opinion.

We know of no studies of avoidance behaviors for any shorebird species, and hence we believe that the 92.97 percent estimate recommended by Cook (2021) is the best available estimate for piping plovers. We recognize several factors suggesting the possibility of a piping plover avoidance rate greater than 92.97 percent. 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). 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). Finally, Loring et al. (2020b) 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. (2020b) 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.

Rufa Red Knot

Tables 6 and 7 present estimates of 1,281 (95 percent prediction interval 1,061 to 1,509) rufa red knot collisions based on the SCRAM results (Adams et al. in prep) and 9 (98 percent avoidance rate) to 31 (92.97 percent avoidance rate) rufa red knot collisions based on the Band (2012) results over the 35-year life of the Sunrise Wind project. Several factors suggest collision rates on the higher end of this range:

- Data gaps bias SCRAM to underestimate collision, (e.g., lack of spring data, limited deployment areas, limited detection range of land-based receivers).
- 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 collision rates on the lower end of the range:

- While Band (2012) assumes even distribution of birds across the migration front, SCRAM accounts for the known spatial heterogeneity in rufa red knot tracks.

- While Band (2012) assumes each bird crosses the migration 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 piping plovers, lending more weight to the SCRAM estimates.
- The lack of spring data in SCRAM is less consequential for rufa red knots than for the piping plover, because a substantial fraction of birds is known to fly overland in spring from the Atlantic Coast (Florida to Delaware Bay) directly to Hudson Bay in Canada.

APPENDIX B

SCRAM and Band (2012) Model Results for Sunrise Wind