United States Department of the Interior

FISH AND WILDLIFE SERVICE

Virginia Field Office
6669 Short Lane
Gloucester, VA 23061

August 31, 2023

Memorandum

To: David Bigger, Environmental Protection Specialist, Office of Renewable Energy Programs, Bureau of Ocean Energy Management, Sterling, VA

From: Field Supervisor, Virginia Ecological Services, Gloucester, VA Cynthia A Schulz CYNTHIA SCHULZ 2023.08.31 13:08:16 -04'00'

Subject: Coastal Virginia Offshore Wind Commercial Project, Virginia Beach, VA

This document transmits the U.S. Fish and Wildlife Service's (Service, USFWS) biological and conference opinion (Opinion) based on our review of the referenced project and its effects on the federally listed threatened piping plover (*Charadrius melodus*) (PIPL) and rufa red knot (*Calidris canutus rufa*) (REKN), federally listed endangered northern long-eared bat (*Myotis septentrionalis*) (NLEB), and federally proposed endangered tricolored bat (*Perimyotis subflavus*) (TCB). This Opinion is issued to the Bureau of Ocean Energy Management (BOEM), as the lead federal agency, in accordance with Section 7 of the Endangered Species Act (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA). The other federal agencies include the Bureau of Safety and Environmental Enforcement (BSEE); U.S. Army Corps of Engineers (USACE), who has also been delegated permitting and monitoring authority by the U.S. Navy and Virginia National Guard; U.S. Coast Guard (USCG); and U.S. Environmental Protection Agency (EPA), each taking action under their respective statutory and regulatory authorities related to the subject project. Your June 16, 2023 request for formal consultation and conference was received on June 16, 2023.

This Opinion is based on information provided in the December 16, 2022 biological assessment (BA), the April 27, 2023 BA addendum, the May 17, 2023 onshore route alignment shift information, telephone conversations, email correspondence, and other sources of information. The consultation history is located after the literature cited. A complete administrative record of this consultation is on file in this office.

On June 16, 2023 the Service concurred with BOEM's not likely to adversely affect determinations for the federally listed endangered Indiana bat (*Myotis sodalis*), roseate tern (*Sterna dougallii dougallii*), and Kemp's ridley (*Lepidochelys kempii*) sea turtle, and for the federally listed threatened green sea turtle (*Chelonia mydas*) North Atlantic distinct population segment (DPS) and loggerhead sea turtle (*Caretta caretta*) Northwest Atlantic Ocean DPS. The Service also concurs with BOEM's not likely to adversely affect determination for the federally proposed threatened black-capped petrel (*Pterodroma hasitata*).

BOEM made no effect determinations for the federally listed endangered leatherback (*Dermochelys coriacea*) and hawksbill (*Eretmochelys imbricata*) sea turtles. The Service thinks the appropriate determination for both these species is not likely to adversely affect as provided in our June 16, 2023, memo to BOEM.

Coastal Virginia Offshore Wind Pilot (CVOW-Pilot)
Dominion Energy (Dominion) (the Lessee) is already operating 2 offshore wind turbine generators (WTGs) as a research lease in Lease Area OCS-A-497 directly west of the Coastal Virginia Offshore Wind Commercial (CVOW-C) project. The Service completed informal consultation on the CVOW-Pilot project on January 29, 2015 and concurred with determinations in a project update on March 27, 2019. The CVOW-Pilot project and data collected through post-construction monitoring and receivers installed on these turbines are referenced in this Opinion. For more detailed information on this project, see https://www.boem.gov/renewable-energy/state-activities/coastal-virginia-offshore-wind-project-cvow.

TABLE OF CONTENTS

DESCRIPTION OF PROPOSED ACTION 3
- Offshore Project Area 4
- Onshore Project Area 6
- Conservation Measures 8
- Other Project Measures Supporting Species' Monitoring, Modeling, and Mitigation 11

ACTION AREA 15

STATUS OF THE SPECIES 15
- PIPL 15
- REKN 19
- NLEB 22
- TCB 27

STATUS OF CRITICAL HABITAT 30
- PIPL 30
  - REKN 30
- NLEB 30
- TCB 31

ENVIRONMENTAL BASELINE 31
- Status of the Species within the Action Area 31
  - PIPL/REKN - Offshore 31
  - PIPL 32
  - REKN 33
  - PIPL/REKN – Onshore 38
  - NLEB 38
  - TCB 39

EFFECTS OF THE ACTION 39
- PIPL/REKN: Turbine Operation 42
- NLEB/TCB: Tree Clearing 49

CUMULATIVE EFFECTS 50

JEOPARDY ANALYSIS 51
- Jeopardy Analysis Framework 51
- Analysis for Jeopardy 52

PIPL 52
REKN 54
NLEB 56
TCB 58
INCIDENTAL TAKE STATEMENT 60
AMOUNT OR EXTENT OF TAKE ANTICIPATED 61
PIPL/REKN 61
NLEB/TCB 61
REASONABLE AND PRUDENT MEASURES 63
TERMS AND CONDITIONS 63
MONITORING AND REPORTING REQUIREMENTS 63
CONSERVATION RECOMMENDATIONS 64
REINITIATION NOTICE 68
CONSULTATION HISTORY 76
APPENDIX 1 77

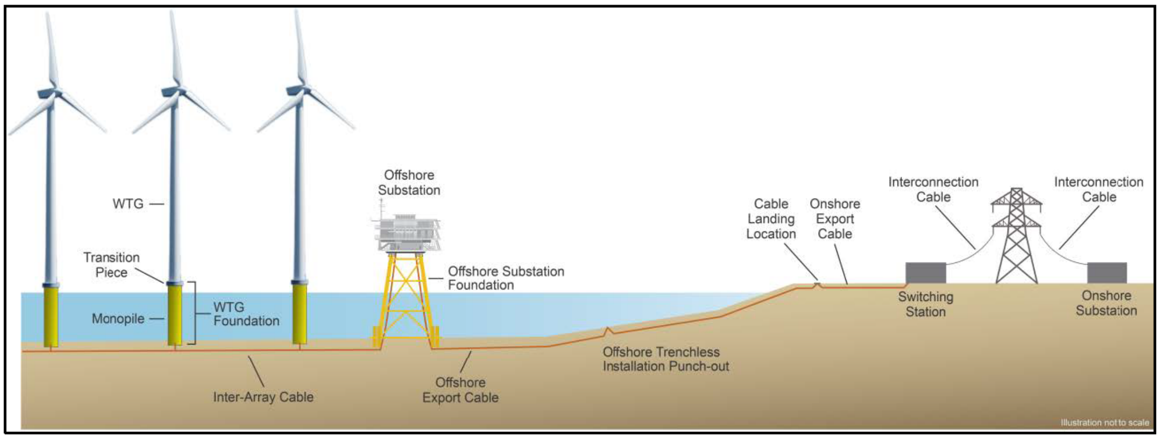
BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

Project Description

As defined in the ESA Section 7 regulations (50 CFR 402.02), “action” means “all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas.” The federal action under consideration is approval by BOEM of a Construction and Operations Plan (COP) that would authorize Dominion for construction, operation and maintenance (O&M), and eventual decommissioning of an up to 3,000-megawatt (MW) offshore wind energy facility known as the Coastal Virginia Offshore Wind Commercial (CVOW-C).

The following is a summary of the proposed action. Additional details are located in the BA, BA addendum, and the COP (BOEM 2022, BOEM 2023, Tetra Tech, Inc. 2021). The structures and cables associated with the project are shown in Figure 1.



Source: Dominion Energy 2022.
Note: The interconnection cable will begin before the switching station, at a common location north of Harpers Road.

Figure 1. Overall project design (BOEM 2022).

Offshore Project Area

Location

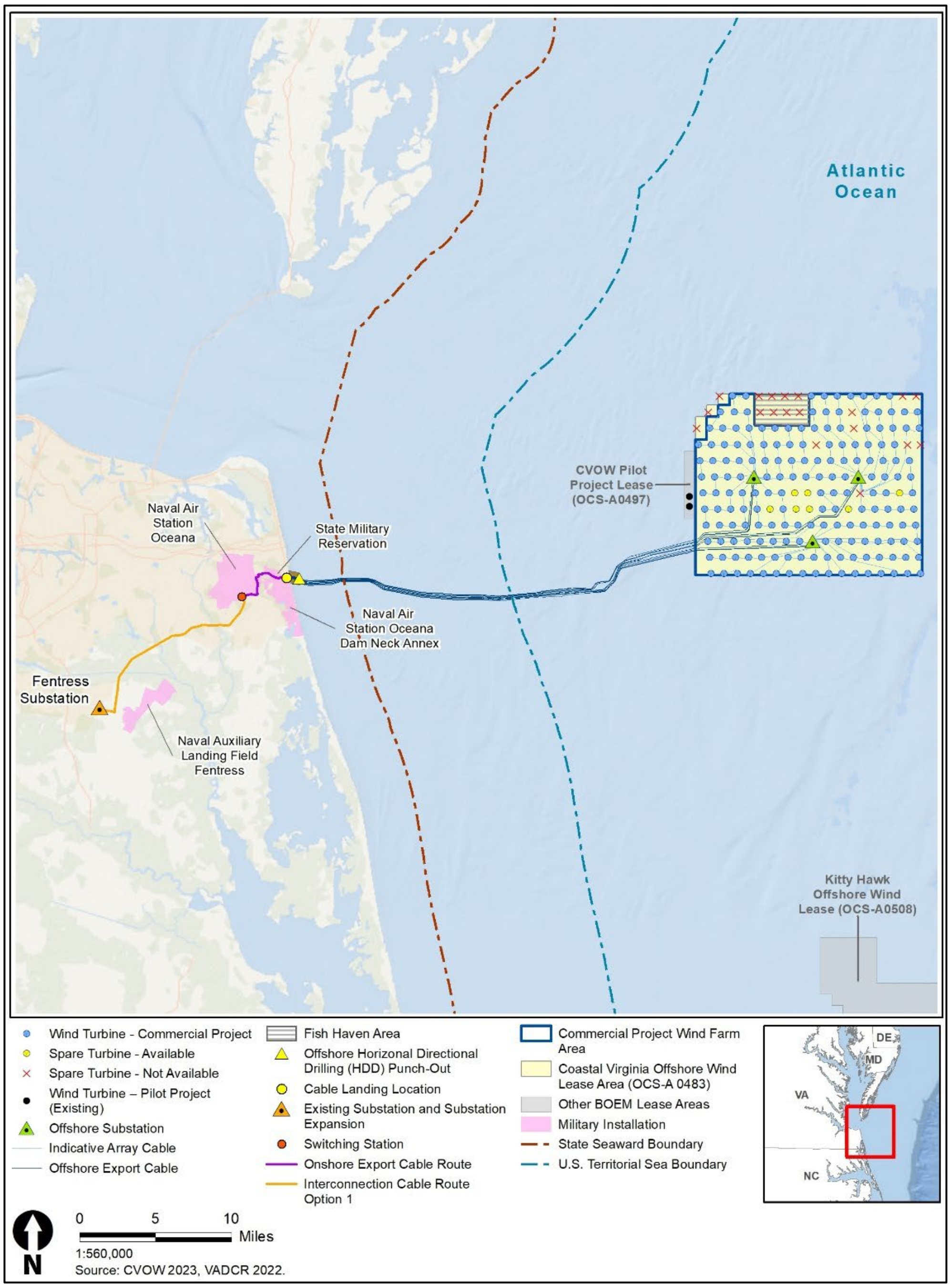
The CVOW-C offshore project area is located at the southern end of the mid-Atlantic Bight, on the outer continental shelf (OCS) except for a portion of the offshore export cables that are located within Virginia state waters (Figure 2). The WTGs and offshore substations (OSSs) are located within the BOEM Renewable Energy Lease Area OCS-A 0483 (Lease Area), approximately 27 miles (mi) (44 kilometers [km]) east of Virginia Beach, VA (Figure 1). The Lease Area is about 15 nautical mi from westernmost edge to easternmost edge and 12 mi from northernmost to southernmost edge and a total of 112,799 acres (ac).

Wind Turbine Generators

Up to 176 WTGs, ranging from 14 to 16 MWs, would be constructed in a grid pattern with 0.86 mi (1.38 km) in an east-west direction and 1.07 mi (1.72 km) in a north-south direction between turbines (Figure 2). Each WTG consists of a monopile foundation driven into the ocean floor and a transition piece mounted on top. During pile-driving, the project would utilize near-field noise mitigation systems to reflect and dampen underwater sound waves. After installation, scour protection will be placed around the base of the monopile. Total WTG height would be 833 ft (254 m) above mean sea level (MSL).

Offshore Substations

The proposed project would construct 3 OSSs to collect and export the power generated by the WTGs. The OSSs would be placed within the rows of the WTGs. Each substation would have a rated capacity of up to 900 MW and consist of 2 components, a jacket foundation and a topside. The pre-installed, piled jacket foundations would be attached to the sea floor with scour protection installed around the base. The topside would contain the decks housing the electrical and support equipment, including possibly a helideck. The distance between the base of the OSS topside and highest astronomical tide would be 76.8 ft (23.4 m).



Source: CVOW 2023, VADCR 2022.

Figure 2. CVOW-C project vicinity (BOEM 2022).

<u>Inter-Array Cables</u>

The inter-array cables would be composed of a series of cable “strings” that interconnect a small grouping of WTGs to the OSSs, gathering power to export to shore. There would be approximately 6 WTGs connected per string and approximately 12 WTG strings connected to each OSS, for a total of 36 WTG strings. The inter-array cables would be installed in a narrow temporary trench and buried to a target depth of 3.9 ft (1.2 m) to 9.8 ft (2.9 m).

<u>Offshore Export Cables</u>

The offshore export cables would transfer the electricity from the OSS to the cable landing location in Virginia Beach, VA. A total of 9 offshore export cables, 3 for each OSS, would be installed in a narrow temporary trench and buried to a target depth of 3.3 ft (1.0 m) to 16.4 ft (4.9 m). The offshore export cable route corridor would be 1,970 ft (600 m) to 9,400 ft (2,865 m) wide, depending upon site conditions.

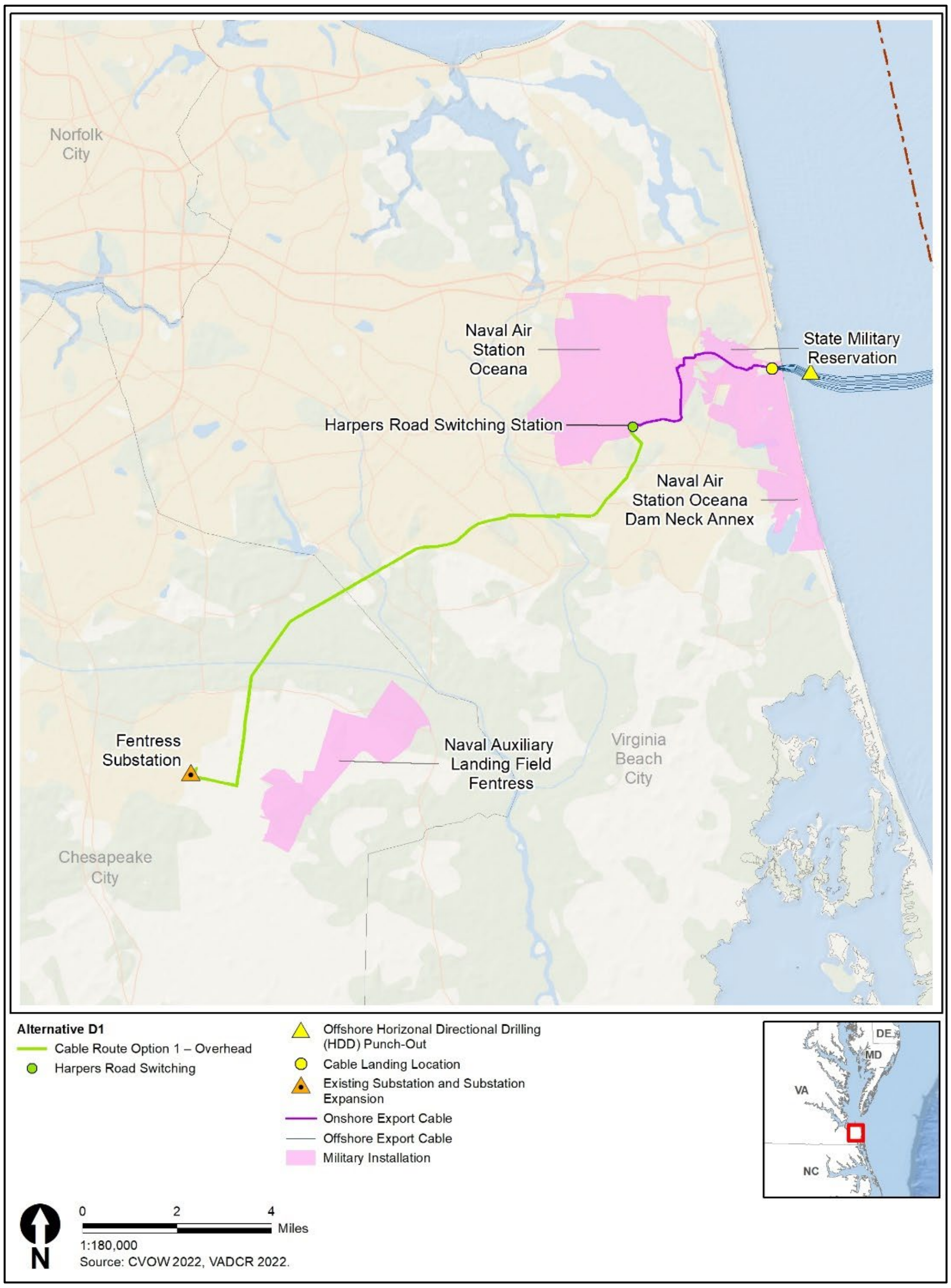
Vessels

The proposed project would utilize a variety of construction and support vessels, such as jack-up, tugs, barges, cable lay, and heavy-lift, to construct the offshore project components. Vessel traffic would range from 3 to 95 trips per day during construction, with an average of 46 trips per day, January 2023 through August 2027. Vessels would travel between the offshore project area and a leased third-party port facility, a portion of the existing Portsmouth Marine Terminal facility in Portsmouth, VA. The port would be used to store and assemble parts for offshore project components.

Onshore Project Area

Location

The project would make landfall in Virginia Beach, VA, and continue along a southwest trajectory to the project end point in Chesapeake, VA (Figure 3).



Source: CVOW 2022, VADCR 2022.

Figure 3. Onshore project area. Note, the Chicory Switching Station is not part of the proposed project. (Tetra Tech, Inc. 2023).

Cable Landing Location

The proposed project would bring the offshore export cable onshore at a cable landing location, a proposed parking lot at the State Military Reservation (SMR) Camp Pendleton. The onshore export cables would be installed using a temporary cofferdam, temporary open trench microtunnelling, and horizontal directional drilling (HDD). The cable landing location is expected to have an operational footprint of approximately 2.8 ac.

Onshore Export Cable Corridor

Along a 4.41 mi (7.10 km) long route, the onshore export cables would be installed underground to transmit the electricity from the cable landing location to a switching station. The onshore cable route would pass through a mix of habitat types, including open water, developed, forested, scrub/shrub, agricultural, and wetland. The onshore export cable route is expected to have a temporary disturbance of approximately 26.6 ac within the total expected operational corridor of approximately 51 ac.

Switching Station

The proposed project would construct an aboveground switching station, Harpers Switching Station, on a parcel north of Harpers Road. By switching the underground export cables to overhead interconnection cable, the switching station would transmit power to an existing onshore substation called the Fentress Substation. The existing terrain consists of both developed areas and a mix of forest and woody wetlands. The total expected operational footprint of the Harpers Switching Station would be 46.4 ac.

Interconnection Cable

Between the switching station and the Fentress Substation, the interconnection cable would be installed as overhead transmission facilities. The facilities would require an up to 250 ft wide construction and operational corridor. Habitat types within the proposed overhead transmission facilities include open water, developed, forested, scrub/shrub, agricultural field, and wetland. The overhead interconnection cable height would range from 75 ft to 170 ft above the surface of the ground dependent upon site conditions.

Onshore Substation

The proposed project would utilize the existing Fentress Substation as the final point of interconnection for power distribution to the existing grid. The Fentress Substation would be upgraded and/or expanded as appropriate to accommodate electricity generated by CVOW-C. The total footprint for the onshore substation would be 32.1 ac (current footprint is 11.7 ac and expansion footprint is 20.4 ac).

Construction Equipment

Construction vehicles would range from standard pickup trucks to heavy-load trucks, such as dump trucks and concrete trucks, cranes, backhoes, excavators, and bulldozers. Construction equipment would include machinery such as generators, saw-cutting machinery, pavement milling, placement, and roller machines.

Vegetation Removal

Vegetation removal includes 117.24 ac of permanent clearing and 2.35 ac of temporary clearing. Areas cleared temporarily will be restored in accordance with Dominion's restoration practices and allowed to return to a vegetative state.

Timing

The proposed project would begin construction in 2023 and be completed in 2027. Land-based construction would commence in fall 2023 and finish in 2025. Offshore construction would commence in winter 2023 and finish in 2027. Commissioning would occur from 2024 through 2027.

Operations and Maintenance

The project is anticipated to have an operating term of 33 years which commences upon COP approval. The project would lease an existing O&M facility in Virginia to monitor operations and manage maintenance and inspection programs. The project would perform routine inspection and maintenance for WTGs and OSSs using crew transfer vessels, service operation vessels, and/or helicopters. The onshore switching station and onshore substation would be equipped with monitoring equipment and regularly inspected. The overhead transmission lines would be inspected prior to being energized and routinely inspected by vegetation management crews every 3 years for woody vegetation and hazard trees.

Decommissioning

Dominion would be required to submit an application to BSEE for approval before commencement of decommissioning. The decommissioning application process for WTGs or OSSs would include an opportunity for consultation with municipal, state, and federal management agencies. Unless otherwise authorized by BSEE, Dominion would have to complete decommissioning within 2 years of the lease termination.

Conservation Measures

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

The following Conservation Measures have been adopted by BOEM (i.e., in the BA, BA Addendum, COP, and/or via subsequent correspondence).

Conservation Measures

General

- An oil spill response plan and safety management system would be developed and implemented prior to construction and installation activities.

Bat Species

Onshore Project Area

Vegetation

- Co-locate or site onshore project components, including the onshore export cable route and transmission line corridors, in or adjacent to existing rights-of-way (ROWs) or transmission line corridors, existing roads, previously disturbed areas, and other urbanized locations to the maximum extent practicable;

- Harpers Switching Station would be constructed within either previously developed areas associated with an existing golf course or small areas of mixed forest and woody wetland to minimize tree and vegetation clearing to extent practicable;
- Tree/vegetation clearing would avoid trees favorable for bat maternity roosting locations and follow the clearing timeframes below:
    - Issue date of Opinion until 3/31/2024
        - Clearing in upland areas will begin in November 2023
        - Clearing in wetlands will begin in January 2024
        - Clearing within 1.5 mi of NLEB roosts prior to 4/1/2024
    - On and after 4/1/2024
        - Clearing will occur July 31-December 14 or February 16-April 14 (adhere to time-of-year restriction (TOYR): April 15-July 30, December 15-February 15 (in forested wetlands only);
- Develop and implement a landscape restoration plan in compliance with applicable local and regional ordinances, paying specific attention to re-seeding and replanting with native plant stock;
- Revegetate temporary access areas with native plants and/or an appropriate native seed mix to the maximum extent practicable;
- Implement the most recent Dominion Integrated Vegetation Management Plan that is utilized for all its electric transmission projects;
- Monitor revegetation for a time period appropriate to ensure full revegetation as outlined in approved landscape restoration plan. Monitoring would comply with the approved landscape restoration plan and invasive species control plan, as required by local municipalities, as well as an invasive species control plan. Monitoring would serve as the primary measure for ensuring return of natural habitat functionality following completion of construction and necessary operation; and
- Install staggered silt fencing, or other appropriate measures as identified in approved erosion and sediment control plans, in areas surrounding wetlands, waterbodies, and areas with the potential to contain threatened and endangered species consistent with the ESA, rare natural communities, and habitat for reptiles and amphibians.

Lighting

- Implement lighting-reduction measures, such as downward projecting lights, lights triggered by motion sensors, and limit artificial light to the extent practicable, to avoid disruption to bat species.

Noise

- Comply with relevant City of Virginia Beach and City of Chesapeake noise requirements during operations. If the final design engineering requires sound mitigation measures, they will be implemented within the project footprint, as necessary.

Avian Species

Onshore

- Reduce potential impacts of the overhead lines by complying with Avian Power Line Interaction Committee (2012) best practices.

Avian and Bat Species

- Ensure avoidance, minimization, and mitigation measures that protect other sensitive species or habitats would be protective of listed bird and bat species and their habitats.

- Time construction activities to avoid critical periods when listed species may be affected to the extent practicable.

Onshore

- Dominion would avoid potential effects to birds and bats by using trenchless installation techniques in coastal areas at the Cable Landing Location.

Offshore

Lighting

- To aid safe navigation, CVOW-C must comply with all Federal Aviation Authority (FAA), USCG, and BOEM lighting, marking, and signage requirements. Dominion will comply with all applicable requirements while minimizing impacts through appropriate application, including directional aviation lights, that minimize visibility from shore;
- Use lighting reduction technology (e.g., low-intensity strobe lights, flashing red aviation lights) that minimizes impacts on listed species to the extent practicable;
- Dependent on technical availability, CVOW-C must use an FAA-approved vendor for the Aircraft Detection Lighting System (ADLS) on WTGs and OSSs, 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 in the offshore environment. To further reduce impacts on listed avian and bat species, Dominion would limit, where practicable, lighting which is not required by FAA and USCG, during offshore construction to reduce attraction of birds;
- Dominion is required to light each WTG and OSS 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). USCG-approved lights may not be shielded, but marine lanterns typically approved for this type of usage are designed to illuminate a horizontal plane near the sea surface, and do not direct light skyward;
- 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 Dominion's CVOW-C 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, the BOEM, BSEE, and Service will work together to evaluate the USCG-approved navigation lighting system. Specifically, the BOEM and Service will work together 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 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; and
- Potential impacts would be further minimized by reducing lighting on O&M vessels (e.g., exterior lighting on all project related vessels will be limited to include only those lights required for the safe navigation of the vessel or as required by statutory requirements), to the extent practicable.

Offshore Structures

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

For measures listed above that will be implemented to the extent practicable, BOEM will notify the Service if and how any of these are implemented.

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 and onshore areas, collision modelling, and compensatory mitigation. They are not intended to avoid or minimize the collision risk at this time.

Monitoring and Data Collection
BOEM will require Dominion to develop, in coordination with the Service and other relevant regulatory agencies, an Avian and Bat Post-Construction Monitoring Plan (PCMP) based on the Avian and Bat Post-Construction Monitoring Framework for ESA-listed and -proposed species covered in this Opinion. The PCMP will be implemented beginning with and during operation. Annual monitoring reports provided pursuant to the PCMP will be used to determine the need for adjustments to monitoring approaches for ESA-listed and -proposed species covered in this Opinion, consideration of new monitoring technologies, and/or additional periods of monitoring.

Dominion must submit for DOI (including BOEM, BSEE, and USFWS) review and concurrence the PCMP at least 45 days before beginning the ESA-listed and -proposed species surveys. BOEM, BSEE, and USFWS will review the PCMP and provide any comments on the plan within 30 calendar days of its submittal via electronic mail. Dominion must resolve all comments on the PCMP to all agencies' satisfaction before implementing the PCMP. Dominion may conclude that an agency has concurred with the PCMP if they do not provide comments on the PCMP within 30 calendar days of its submittal date. In order to obtain concurrence, the PCMP must meet the following conditions:

1. Monitoring.

    A. Offshore: For bird species covered in this Opinion, Dominion must conduct monitoring as outlined in the Avian and Bat Post-Construction Monitoring Framework, which will include (i) the use of Motus Wildlife Tracking System (Motus), satellite, and GPS tags to monitor movements of PIPL and REKN, and (ii) the installation, operation, calibration, adjustment based on calibration results, and maintenance of Motus receivers installed within the turbine array in accordance with the Development of Monitoring Protocols and Guidance for Automated Radio Telemetry Studies at Offshore Wind Farms. Receivers installed on the CVOW-Pilot turbines will also be maintained and factored into the receiver array design. The PCMP will include an initial monitoring phase involving deployment of Motus tags on bird species covered in this Opinion in conjunction with installation and operation of Motus receiving stations on turbines in the Lease Area in accordance with the Development of Monitoring Protocols and Guidance for Automated Radio Telemetry Studies at Offshore Wind Farms. The initial phase may also include deployment of satellite-based tracking technologies (e.g., GPS or Argos tags). The number and location(s) of tag deployment during any given year will be identified based on discussions with the Service. Any data collected should be archived according to the Service's Guidance for Coordination of Data from Avian Tracking Studies (USFWS 2023d). The PCMP will allow for changing methods over time to regularly update and refine collision estimates for bird species covered in this Opinion. Monitoring for bird species covered in this Opinion must be implemented when the first string of turbines is commissioned.

B. Onshore: Dominion must conduct monitoring as outlined in the Avian and Bat Post-Construction Monitoring Framework, which will include the use of radio tagging and tracking federally listed and proposed bat species. Survey protocols will follow the Service's current Range-wide Indiana Bat and Northern Long-eared Bat Survey Guidelines and given the year-round activity of the bat population in Virginia Beach, VA, could be conducted in any season in suitable habitat near the LOD. The timing and target areas of surveys will be approved by the Service, surveys may occur more frequently at the start of the lease and reduce in frequency over the 33-year lease. The PCMP will allow for changing methods over time to update methodology and study design based on results from previous years and any changes in technology.

2. Annual Monitoring Reports. Dominion must submit to BOEM (at renewable_reporting@boem.gov), BSEE (through TIMSWeb and notification email at protectedspecies@bsee.gov), and the Service (emily_argo@fws.gov) a comprehensive report after each full year of monitoring (pre- and post-construction) and within 6 months of completion of the last survey. The report must include all data, analyses, and summaries regarding ESA-listed and non-ESA-listed birds and bats. DOI will use the annual monitoring reports to assess the need for reasonable revisions (based on subject matter expert analysis) to the PCMP. DOI reserves the right to require reasonable revisions to the PCMP and may require the use of new technologies as they become available for use in offshore environments.

3. Post-Construction Quarterly Progress Reports. Dominion must submit quarterly progress reports during the implementation of the PCMP to BOEM (at renewable_reporting@boem.gov) and the Service (emily_argo@fws.gov) by the final day of the month following the end of each quarter during the first full year that the CVOW-C 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, Dominion must meet with BOEM and the Service to discuss the following: monitoring results; potential need for revisions to the PCMP, including technical refinements or additional monitoring; and potential need for any additional efforts to reduce impacts to ESA-listed and -proposed bird and bat species. If DOI determines after this discussion that revisions to the PCMP are necessary, DOI may require Dominion to modify the PCMP. If the reported monitoring results deviate substantially from the impact analysis included in the Final EIS, Dominion must transmit to DOI recommendations for new mitigation measures or monitoring methods.

5. Operational Reporting (Operations). Dominion must submit to BOEM (at renewable_reporting@boem.gov), BSEE (through TIMSWeb and notification email at

protectedspecies@bsee.gov), and the Service (emily_argo@fws.gov) an annual report for the duration of the 33-year lease, due by January 31 of each year once the first WTG is commissioned. The report must include the following monthly operational data in tabular format: proportion of time the turbines were operational (spinning) each month, average monthly revolutions per minute (rpm) of spinning turbines, and average pitch angle of blades (degrees relative to rotor plane). DOI will use this information as inputs for avian collision risk models to assess whether the results deviate substantially from the impact analysis included in the Final EIS.

6. Raw Data. Dominion must store the raw data from all avian and bat surveys and monitoring activities according to accepted archiving practices. Such data must remain accessible to DOI (BOEM, BSEE, and USFWS) upon request for the duration of the 33-year lease. Dominion must work with BOEM to ensure the data are publicly available.

Incidental Mortality Reporting

Dominion must provide an annual report, covering each calendar year for the duration of the 33-year lease, due by January 31, to BOEM, BSEE, and the Service documenting any dead or injured birds or bats found on vessels, structures, or in the ocean during construction, operations, and decommissioning. The report must contain the following information: 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 U.S. Geological Survey Bird Band Laboratory, at https://www.pwrc.usgs.gov/BBL/bblretrv/.

Incidental observations are extremely unlikely to document fatalities of listed birds that may occur due to turbine collision. While appropriately documenting and reporting avian fatalities observed incidental to O&M activities is appropriate, the PCMP 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 avian fatalities were caused by colliding with a turbine unless there is evidence to support this conclusion.

Any occurrence of a dead or injured ESA-listed or -proposed bird or bat must be reported to BOEM, BSEE, and 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. BOEM will coordinate with the Service on procedures and required permits for processing and handling specimens.

Collision Risk Model Support

BOEM has funded the development of a Stochastic Collision Risk Assessment for Movement (SCRAM) (Adams et al. 2022), which builds on and improves earlier collision risk modeling frameworks. The first generation of SCRAM was released in early 2023 and reflects a number of consequential data gaps and uncertainties. BOEM has committed to funding Phase 2 of the development of SCRAM. We expect that the current limitations of SCRAM will decrease substantially over time as more tracking data is 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, BOEM commits to continue funding the refinement and advancement of SCRAM, or its successor, with the goal of improving the accuracy and robustness of collision mortality estimates. This commitment is subject to the allocation of sufficient funds to BOEM from Congress. This commitment will remain in effect until one of the following occurs:

- the CVOW-C turbines cease operation;
- the Service concurs that a robust weight of evidence has demonstrated that collision risks to PIPL and REKN from CVOW-C's turbine operation are negligible (i.e., the risk of take from WTG operation is discountable); or
- the Service concurs that further development of SCRAM (or its successor) is unlikely to improve the accuracy or robustness of collision mortality estimates.

Collision Risk Model Utilization
BOEM will work cooperatively with the Service to re-run the Band (2012) and SCRAM models (or its successor) for the CVOW-C 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, 30, and beyond if the lease is extended).

Between these regularly scheduled model runs, BOEM will also re-run the SCRAM and Band (2012) models (or its successor) within 90 days of each major model release or update, and at any time upon request by the Service or Dominion, and at any time as desired by BOEM.

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

- the CVOW-C turbines cease operation;
- the Service concurs that a robust weight of evidence has demonstrated that collision risks to PIPL and REKN from CVOW-C's turbine operations are negligible (i.e., the risk of take from WTG operation is discountable); or
- the Service concurs that further model runs are unlikely to improve the accuracy or robustness of collision mortality estimates.

BOEM is currently undertaking a regional environmental assessment of numerous offshore wind leases in the New York Bight which is located within the greater mid-Atlantic Bight. To account for potential additive and synergistic effects of offshore wind infrastructure buildout across this section of the coast, BOEM will consider collision mortality estimates for CVOW-C in its assessment of overall collision risk for the New York Bight. The periodic updating of collision mortality estimates for the CVOW-C project, according to the above schedule, may eventually be integrated into a regional or coastwide adaptive monitoring and impact minimization framework.

Collision Minimization Coordination

BOEM will work with the Service, BSEE, appropriate state agencies, and Dominion 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. BOEM will require Dominion to adopt and deploy such minimization technologies/methods as deemed reasonable and prudent as per the minor change rule [50 CFR §402.14] under the ESA. 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. 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.

ACTION AREA

The action area is defined (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 BOEM Renewable Energy Lease Area OCS-A 0483 (Lease Area), located approximately 27 mi (44 km) east of Virginia Beach, VA (Figure 1). The Lease Area is about 15 nautical mi from westernmost edge to easternmost edge and 12 mi from northernmost to southernmost edge, which is a total of 112,799 ac. The offshore and onshore cable route areas are also included in the action area. The offshore cable route extends from the lease area to the cable landfall location on Camp Pendleton and is 1,970 ft (600 m) to 9,400 ft (2,865 m) wide. Then, the 4.41 mi (7.1 km) onshore cable route runs from Camp Pendleton to Chesapeake, VA covering 51 ac. In addition, the new Harpers Switching Station covers 46.4 ac (Figure 3). The action area also includes the area around the Lease Area and offshore and onshore cable routes that is ensonified with construction and operational noise.

STATUS OF THE SPECIES

PIPL

Listing

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

All 3 populations winter along the U.S. coast from North Carolina to Texas, as well as in Mexico and the Caribbean (USFWS 2020a). Occasional migratory stopovers by Great Lakes PIPLs in New Jersey and Virginia have been documented (Stucker et al. 2010, A. Van Zoeren, University of Minnesota, email to A. Hecht, USFWS, August 18, 2023). We have not assessed detection probability for birds from the Great Lakes population, and we currently know little about their routes to or from these sites (including wintering sites further south). We consider the likelihood that they will be affected by the proposed projects discountable and will re-evaluate this determination if warranted by new information or further analysis. The Northern Great Plains PIPLs are not known to occur within the action area; therefore, this population is not considered further in this Opinion. The Atlantic Coast PIPL 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), which includes the action area.

The following is a summary of PIPL life history relevant to this Opinion and drawn from the species revised recovery plan (USFWS 1996) and 5-year review (USFWS 2020a).

Life History and Biology

The PIPL is a small shorebird approximately 7 inches (in) long with a wingspan of about 15 in. The Atlantic Coast PIPL 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). PIPLs are present on Virginia beaches during the breeding season, generally between March 1 and August 31, though migrants may be present into October.

After they establish territories and conduct courtship rituals beginning in late March or early April, PIPL pairs form shallow depressions (nests) in the sand to lay eggs. Nests are situated above the high tide line on coastal beaches, sandflats at the ends of sand spits and barrier islands, gently sloping foredunes, blowout areas behind primary dunes, and washover areas cut into or between dunes and typically lay 4 eggs that hatch in about 27-30 days (USFWS 1996). PIPLs generally fledge only a single brood per season but may renest several times if previous nests are lost or, infrequently, if a brood is lost within several days of hatching. Flightless chicks follow their parents to feeding areas, which include the intertidal zone of ocean beaches, ocean washover areas, mudflats, sandflats, wrack lines, and the shorelines of coastal ponds, lagoons, and salt marshes. Chicks fledge after about 25-35 days. PIPLs prey on infaunal invertebrate species such as crabs and worms, which inhabit the surface layer of sand.

PIPLs are considered mature at age 1 (USFWS 1996) and may breed the first spring after hatching, although some birds do not breed their first year (Elliot-Smith and Haig 2020). Most birds breed each year if mates are available (Elliot-Smith and Haig 2020). Although PIPLs have been documented to live more than 11 years, we estimate based on typical survival rates that the average lifespan is approximately 5-6 years (USFWS 2023a). Estimates of annual adult survival in the 2000s on Long Island (70%) and eastern Canada (73%) were similar to those reported from the late 1980s in Massachusetts (74%) and Maryland (71%). There is currently no information regarding the distribution of mortality across the annual cycle of Atlantic Coast PIPLs.

Threats

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

Two threats to PIPL, climate change and WTGs, have been identified in a recent Service review (USFWS 2020a). Climate change, especially sea level rise and more frequent, intense storms, and wind turbines are likely to affect Atlantic Coast PIPLs throughout their annual cycle. Sea level rise combined with coastal development and stabilization presents a considerable threat because the coastal ecosystem's natural ability to respond to sea level rise and generate newly available habitat will be lost. An increase in storm frequency and intensity will exacerbate coastal flooding that will already be increasing due to sea level rise. While climate change related effects on PIPLs remain a continuing concern, effects of accelerating sea level rise on future availability of Atlantic Coast PIPL breeding habitats will largely depend on the response of barrier islands and barrier beaches and coastal management activities.

Although threats from WTGs are foreseeable, the magnitude is poorly understood. There is increasing certainty about the likely locations of future BOEM offshore wind leasing projects; however, the timing and extent of full buildout of the projects on the Atlantic OCS is still unknown, and effects of WTGs on migrating birds (e.g., collision, behavioral effects) are difficult to study and characterize offshore. Offshore wind leasing projects along the Atlantic Coast that were anticipated to result in incidental take of PIPL where BOEM has completed ESA Section 7 consultation are provided in Table 1.

Table 1. Summary of anticipated PIPL incidental take for Atlantic Coast offshore wind energy projects that have completed consultation with the Service (USFWS 2023b).

Date of Opinion Issuance	Project Name	PIPL Anticipated Take (Annual)	Project Duration	Total Anticipated Take for Project Duration
5/12/2023	Ocean Wind 1	<1	35 years	5
5/30/2023	Revolution Wind	<1	35 years	3
6/22/2023	Empire Wind	<1	35 years	2
6/29/2023	Sunrise Wind	<1	35 years	2

Although progress toward understanding and managing threats in this portion of the PIPL range has accelerated in recent years, substantial work remains to fully identify and remove or manage migration and wintering threats, including habitat degradation and increasing human disturbance (USFWS 2020a).

Conservation Needs

The Service frequently describes conservation needs via the conservation principles of resiliency (ability of species/populations to withstand stochastic events which is measured in metrics such as numbers, growth rates), redundancy (ability of a species to withstand catastrophic events which is measured in metrics such as number of populations and their distribution), and representation (variation/ability of a species to adapt to changing conditions which may include behavioral, morphological, genetics, or other variation) (collectively known as the 3Rs) (Wolf et al. 2015, Smith et al. 2018). The Service can then apply the appropriate regulatory framework and standards to these principals to address a variety of ESA-related decisions (e.g., listing status, recovery criteria, jeopardy, and adverse modification analysis). For Section 7(a)(2) purposes, the 3Rs can be translated into the reproduction, numbers, and distribution (RND) of a species.

The security of the Atlantic Coast PIPL is fundamentally dependent on even distribution of population growth across the breeding range to maintain a sparsely distributed species with strict biological requirements in the face of environmental variation, buffer it against catastrophes, and conserve adaptive capacity (USFWS 2020a). The Atlantic Coast PIPL population is distributed among 4 recovery units (RUs) identified as: Atlantic Canada, New England, New York-New Jersey (NY-NJ), and Southern (DE-MD-VA-NC) (USFWS 1996). Recovery criteria established in the recovery plan define population and productivity goals for each RU, as well as for the population as a whole. Attainment of these goals for each RU is an integral part of a PIPL recovery strategy that seeks to reduce the probability of extinction for the entire population by (1) contributing to the population total, (2) reducing vulnerability to environmental variation (including catastrophes), and (3) increasing likelihood of genetic interchange among subpopulations. Recovery depends on attainment and maintenance of the minimum population levels for the 4 RUs. Any appreciable reduction in the likelihood of persistence of a RU will also reduce the probability of persistence of the entire population (USFWS 1996).

Population viability analyses (PVAs) by Calvert et al. (2006) and Brault (2007) confirmed the finding of earlier PIPL PVAs that extinction risk is highly sensitive to small changes in adult and/or juvenile survival rates. Progress toward recovery could be slowed or reversed by even small, sustained decreases in survival, and it would be difficult to increase current fecundity levels sufficiently to compensate for widespread long-term declines in survival (USFWS 2009).

As described in the recovery plan (USFWS 1996), there are 5 recovery criteria that have been identified to reflect the conservation tenets of the 3Rs for the Atlantic Coast PIPL population. The recovery plan establishes population and productivity target numbers for each RU and identifies the need to further evaluate adequate population size to maintain genetic diversity as well as ensure long-term protection of breeding and wintering PIPLs and their habitat.

None of the recovery criteria have been fully met.

Current Condition

The 2021 Atlantic Coast PIPL population estimate of 2,289 pairs was almost triple the estimate of 790 pairs at the time the PIPL was listed in 1986. Overall population growth is tempered by substantial geographic and temporal variability (Table 2). The largest population increase between 1989 and 2021 occurred in the New England RU (514%), and the NY-NJ RU experienced a net increase of 81% between 1989 and 2021. However, the NY-NJ RU declined sharply from a peak of 586 pairs in 2007 to 378 pairs in 2014, before rebounding to 576 pairs in 2021. Net growth in the Southern RU was 35% between 1989 and 2021. Most of the Southern RU population increase occurred in 2003 to 2005 and 2011 to 2012, and the RU decreased 30% between 2016 and 2021. In the Atlantic Canada RU, where increases have been short-lived, the population posted a 23% net decline between 1989 and 2021. Declines in the Atlantic Canada RU typifies long-standing concerns about the uneven distribution and abundance of Atlantic Coast PIPLs (USFWS 2022a).

Atlantic Coast PIPL productivity is reported as number of chicks fledged per breeding pair. Rangewide productivity for the Atlantic Coast population from 1989 through 2006 was 1.35 chicks fledged per pair (annual range 1.16 to 1.54), and overall productivity decreased with decreasing latitude (Atlantic Canada 1.61, New England 1.44, NY-NJ 1.18, Southern 1.19). Including more recent years, average annual productivity for the U.S. Atlantic Coast from 1989 to 2018 was 1.25 fledged chicks per pair. The overall U.S. Atlantic Coast productivity estimate was 1.38 fledged chicks per pair in 2019, 1.25 in 2020, and 1.09 in 2021—the fifth lowest since 1989 (USFWS 2022a).

Low productivity has been documented in the Southern RU. Past years of low productivity (especially successive years of low productivity such as occurred in 2007-2008) have been followed by declines in breeding abundance, but the decline that began in 2016 is the steepest and most sustained observed during the last 35 years and rates in 2020 and 2021 (0.54 fledged chicks per pair in both years) were the lowest documented (USFWS 2022a).

In summary, the overall status of the Atlantic Coast PIPL is improving, though unevenly. The Atlantic Canada and Southern RUs are declining sharply, the New England RU is increasing sharply, and the NY-NJ RU is tenuously stable.

Table 2. Estimated numbers of pairs* of Atlantic Coast PIPLs per RU, 2012-2021 (USFWS 2022a).

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

*Recovery criteria (number of pairs needed for delisting) (Service 1996): Atlantic Canada RU=400 pairs, New England RU=625 pairs, NY-NJ RU=575 pairs, Southern RU=400 pairs, Total=2,000 pairs.

Summary
The primary factors influencing the status of Atlantic Coast PIPLs include habitat loss and degradation, predation, human disturbance, and inadequacy of regulatory mechanisms. While 3 of the 4 RUs have experienced net declines compared with 2008 estimates of Atlantic Coast PIPLs, the rangewide status has improved since the PIPL was listed in 1986 (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.

REKN

Listing

The REKN was listed by the Service as threatened under the ESA in 2015 (79 FR 73705). The following is a summary of REKN life history as relevant to this Opinion and drawn from the background information and threats assessment (USFWS 2014), species recovery plan (USFWS 2023c), and Species Status Assessment (SSA) (USFWS 2020b).

The REKN migrates annually between breeding grounds in the central Canadian Arctic and 4 wintering regions: (1) the Southeast U.S. through the Caribbean (SEC); (2) the western Gulf of Mexico from Mississippi through Central America and along the western coast of South America (Western); (3) northern Brazil and extending west along the northern coast of South America (North Coast of South America [NCSA]); and (4) Tierra del Fuego at the southern tip of South America (mainly in Chile) and extending north along the Patagonian coast of Argentina (Southern). The REKN shows high fidelity to its wintering region, with habitat, diet, and phenology varying appreciably among birds from different regions (USFWS 2014).

Although birds from the Western Gulf of Mexico/Central America/Pacific South America (Western) wintering region 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 wintering region is not addressed in this Opinion. Birds from the other 3 wintering regions (SEC, NCSA, Southern) are expected to occur in the action area during spring and fall migration, and may also occur in the action area during the breeding and wintering seasons.

Life History and Biology

The REKN is a medium-sized (9-10 in long) shorebird that migrates up to 9,300 mi and can complete non-stop flights of 1,500 mi or more. During both the northbound (NB) (spring) and southbound (SB) (fall) migrations, REKNs use staging and stopover areas to rest and refuel and are highly dependent on the continued existence of quality habitat at these staging areas. Major spring stopover areas along the U.S. Atlantic Coast include the Virginia Barrier Islands and Delaware Bay in Delaware and New Jersey, where REKNs recover from long migration flights, rapidly regaining weight before departing. In addition to staging areas, REKNs also use other stopover habitats in smaller numbers and/or for shorter durations. In the Southeast U.S., REKNs forage along sandy beaches, tidal mudflats, and peat banks during spring and fall migration from Maryland through Florida. Large and small groups of REKNs, sometimes numbering in the thousands, may occur in suitable habitats from the southern tip of South America to Central Canada during the migration seasons. The timing of spring and fall migration varies across the range (USFWS 2014).

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

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

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

Threats

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

Warming temperatures or changes in storm intensity and timing due to climate change may alter when horseshoe crabs lay eggs or invertebrate prey becomes available. This can change peak abundance of prey to occur at a time that does not coincide with arrival of REKNs at spring and stopover sites and their Arctic breeding grounds (USFWS 2021a). A successful migration is dependent on the timing of these events, so deviations may negatively affect the REKN. The availability of alternate prey species for REKN predators, such as Arctic fox, is being disrupted by climate change. This may increase predation on REKNs during their breeding season on the Arctic. Additionally, loss of breeding and nonbreeding habitat due to arctic warming and sea level rise, respectively, are increasing extinction risk for the species (USFWS 2021a).

Threats from wind energy development are foreseeable, but the magnitude of this threat remains poorly understood. Information is lacking to assess site-specific effects and strategies to address additive 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 REKN mortality in the coming decades (USFWS 2021a). Watts et al. (2015) found that REKNs have low limits of sustainable mortality from anthropogenic causes, such as hunting, oil spills, and wind turbine collisions. Offshore wind leasing projects along the Atlantic Coast that were anticipated to result in incidental take of REKNs where BOEM has completed ESA Section 7 consultation are provided in Table 3.

Table 3. Summary of anticipated REKN incidental take for Atlantic Coast offshore wind energy projects that have completed consultation with the Service (USFWS 2023b).

Date of Opinion Issuance	Project Name	Anticipated Take (Annual)	Project Duration	Anticipated Take (Project Duration)
5/12/2023	Ocean Wind 1	1	35 years	35
5/30/2023	Revolution Wind	18	35 years	630
6/22/2023	Empire Wind	1	35 years	37
6/29/2023	Sunrise Wind	3	35 years	31

Conservation Needs

The recovery strategy for the REKN is to maintain representation and improve resiliency and redundancy, to support REKNs with impacts from changing conditions (i.e., from climate change) across its range and across its annual cycle. Adaptive capacity of REKN is limited by factors such as a high degree of habitat specialization, timing requirements in the annual cycle, and a long-distance migration strategy (USFWS 2020b). Supporting and maintaining the limited adaptive capacity of the REKN through efforts to reduce or eliminate tractable threats in the nonbreeding range is, by necessity, the management strategy.

The Service identified 4 RUs in the recovery plan each of which correspond to the 4 wintering populations. Conservation of each RU contributes to each of the 3Rs and is essential for the recovery of the REKN. The recovery plan includes 10 recovery criteria that address the 3Rs for each RU. The recovery plan establishes population targets for each RU, based on 10-year average abundance, and addresses other conservation needs for the REKN, chiefly a wide-ranging network of nonbreeding habitats managed in a manner compatible with the population goals (USFWS 2023c).

Current Condition

Based on best available information, the current total rangewide abundance estimate is just under 64,800 REKNs, distributed across the 4 RUs (Table 4). We conclude with moderate confidence that the NCSA and SEC RUs are stable relative to the 1980s (USFWS 2020b). The Southern RU experienced a decline of about 75% during the 2000s, as well as a geographic contraction within the wintering grounds (USFWS 2020b). The Southern RU has been stable since 2011 but has not shown any signs of recovery to date (USFWS 2020b, Matus 2021, Norambuena et al. 2022). The decline of the Southern RU, which had been the largest in the 1980s, drove a decline of the REKN as a whole, mirrored in declines at several migration stopover areas and in analyses of various national and regional datasets. Overharvest of the horseshoe crab in Delaware Bay is considered the key causal factor in this decline, though numerous other past, ongoing, and emerging threats have also been identified, as discussed above (USFWS 2020b). The Service has determined that the horseshoe crab bait harvest has been adequately managed to avoid further impacts to REKNs at least since 2013 (USFWS 2014, USFWS 2022b).

Table 4. Current estimates of REKN abundance (number of individuals) by RU*.

RU	Current Abundance Estimate	Certainty	Source
Southern (mean 2020-2022)	12,704	High	Norambuena et al. 2022, Matus 2021, WHSRN 2020
NCSA	31,065	Moderate	Mizrahi 2020
SEC	15,500	Moderate	Lyons et al. 2017
Western**	5,500	Low	D. Newstead,. Coastal Bend Bays and Estuaries Program, emails to W. Walsh, Service, October 3, 2019, March 6, and June 3, 2020
Total	**64,769**		

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

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

Summary

In summary, the overall status of the REKN is stable but depleted. The NCSA and SEC RUs are stable, while the Southern RU has declined and stabilized at about 25% of its size as documented approximately 40 years ago. The primary factors influencing the status include loss of breeding and nonbreeding habitat, likely effects related to disruption of natural predator cycles on the breeding grounds, reduced prey availability throughout the nonbreeding range and increasing frequency and severity of asynchronies in the timing of the birds' annual migratory cycle relative to food and weather conditions. 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.

NLEB

Listing

The Service listed the NLEB as a threatened species on April 2, 2015 (80 FR 17974). The Service issued a final 4(d) rule for the NLEB on January 14, 2016 (81 FR 1900). On March 23, 2022 (87 FR 16442), the Service proposed reclassification of the NLEB as an endangered species. On November 30, 2022, the Service published a final rule reclassifying the NLEB from threatened to endangered and removing the species-specific 4(d) rule (87 FR 73488), which became effective on March 31, 2023 (88 FR 4908).

The following is a summary of the NLEB life history as relevant to this Opinion and drawn from the NLEB SSA Report (USFWS 2022c).

Life History and Biology

The NLEB is a wide-ranging bat species, found in 37 U.S. states and 8 Canadian provinces, it typically overwinters in caves or mines and spends the remainder of the year in forested habitats. The species generalized annual life history is summarized in Figure 4.

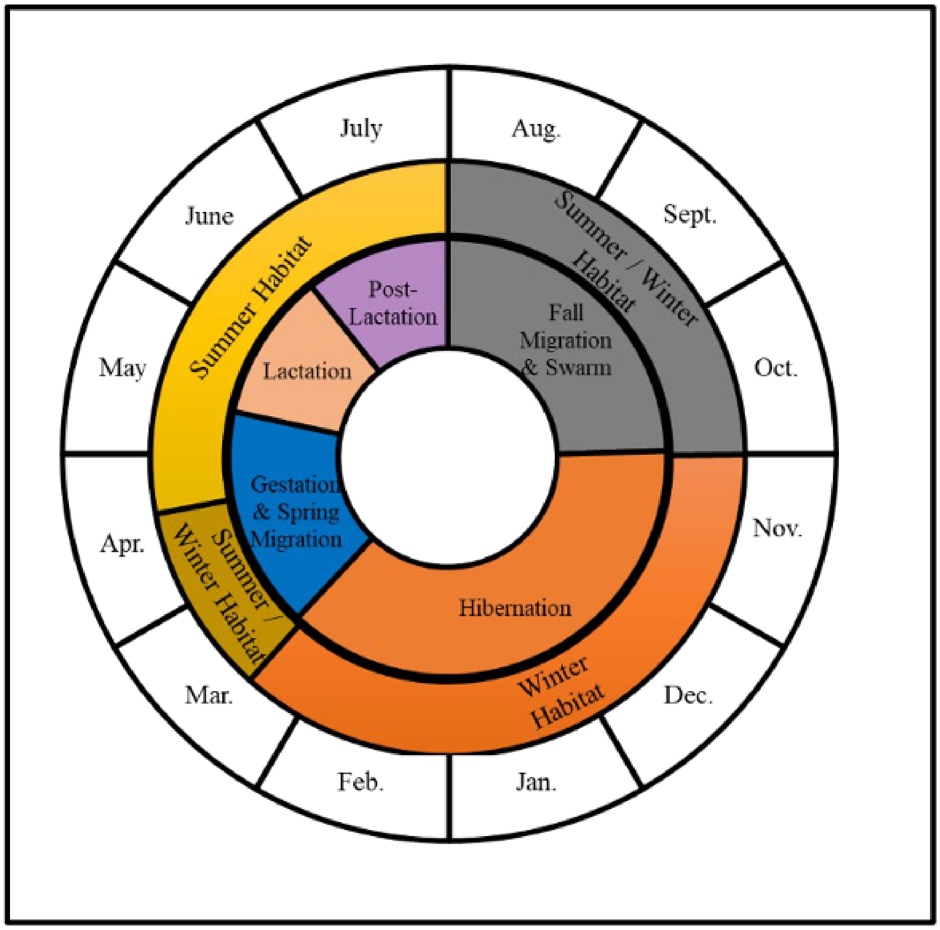


Figure 4. Generalized annual life history diagram for NLEB (adapted from Silvis et al. 2016).

Spring Staging and Fall Swarming

Spring staging for the NLEB is the time period between winter hibernation and spring migration to summer habitat (Whitaker and Hamilton 1998 *in* USFWS 2022c). During this time, bats begin to gradually emerge from hibernation, exit the hibernacula to feed, but re-enter the same or alternative hibernacula to resume daily bouts of torpor (state of mental or physical inactivity) (Whitaker and Hamilton 1998). The fall swarming period occurs between the summer and winter seasons (Lowe 2012 *in* USFWS 2022c) and the purpose of swarming behavior may include: introduction of juveniles to potential hibernacula, copulation, and stop-over sites on migratory pathways between summer and winter regions (Kurta et al. 1997 *in* USFWS 2022c, Parsons et al. 2003 *in* USFWS 2022c, Lowe 2012 *in* USFWS 2022c, Randall and Broders 2014 *in* USFWS 2022c).

On the coastal plain in Virginia and North Carolina, NLEBs do not enter hibernation but rather a short torpor period during the coldest months. Additionally, they have not been known to swarm and when breeding occurs is still unclear (G. Jordan, Service, email to, M. Armstrong et al., Service, July 17, 2023).

Summer Roosting

During the summer, NLEBs typically roost singly or in maternity colonies, consisting of females and young, underneath bark or more often in cavities or crevices of both live trees and snags (Sasse and Pekins 1996 *in* USFWS 2022c, Foster and Kurta 1999 *in* USFWS 2022c, Owen et al. 2002 *in* USFWS 2022c, Carter and Feldhamer 2005 *in* USFWS 2022c, Perry and Thill 2007 *in* USFWS 2022c, Timpone et al. 2010 *in* USFWS 2022c). Adult females give birth to a single pup annually (Barbour and Davis 1969 *in* USFWS 2022c). Parturition (birth) may occur as early as late May or early June (Easterla 1968 *in*

USFWS 2022c, Caire et al. 1979 *in* USFWS 2022c, Whitaker and Mumford 2009 *in* USFWS 2022c) and may occur as late as mid-July (Whitaker and Mumford 2009 *in* USFWS 2022c). Juvenile volancy (flight) often occurs by 21 days after birth (Kunz 1971 *in* USFWS 2022c, Krochmal and Sparks 2007 *in* USFWS 2022c) and has been documented as early as 18 days after birth (Krochmal and Sparks 2007 *in* USFWS 2022c). NLEBs are flexible in tree species selection and while they may select for certain tree species regionally, they likely are not dependent on certain species of trees for roosts throughout their range; rather, many tree species that form suitable cavities or retain bark will be used by the bats opportunistically (Foster and Kurta 1999 *in* USFWS 2022c, Silvis et al. 2016 *in* USFWS 2022c, Hyzy et al. 2020 *in* USFWS 2022c). NLEB seem to prefer intact mixed-type forests with small gaps (i.e., forest trails, small roads, or forest-covered creeks) with sparse or medium vegetation for forage and travel rather than fragmented habitat or areas that have been clear cut (USFWS 2015).

NLEBs are nocturnal insectivorous foragers and use hawking (catching insects in flight) and gleaning (picking insects from surfaces) behaviors in conjunction with passive acoustic cues (Nagorsen and Brigham 1993 *in* USFWS 2022c, Ratcliffe and Dawson 2003 *in* USFWS 2022c).

Threats

Although there are many factors influencing the status of NLEB, the primary factor influencing the viability of the NLEB is White Nose Syndrome (WNS), a disease of bats caused by a fungal pathogen. WNS has been the foremost stressor on NLEB for more than a decade. The fungus that causes the disease, *P. destructans*, invades the skin of bats and infection leads to increases in the frequency and duration of arousals during hibernation and eventual depletion of fat reserves needed to survive winter, and often results in mortality. WNS has caused estimated NLEB population declines of 97–100% across 79% of the species' range. In the coastal plain of the mid-Atlantic U.S., WNS has not been documented in captured bats, suggesting that the coastal plain may provide a refugium from WNS.

Other primary factors that influence NLEB's viability include wind energy mortality, effects from climate change, and habitat loss. Wind energy-related mortality of NLEB is proving to be a consequential stressor at local and regional levels, especially in combination with impacts from WNS. Most bat mortality at wind energy projects is caused by direct collisions with moving turbine blades. Wind energy mortality may occur over 49% of the NLEB's range (USFWS 2022c).

Climate change variables, such as changes in temperature and precipitation, may influence NLEB resource needs including suitable roosting habitat for all seasons, foraging habitat, and prey availability. Although there may be some benefit to NLEB from a changing climate, overall negative impacts are anticipated, especially at local levels. Although any climate change effects to the NLEB to date are currently considered "moderate to low," there is growing concern about impacts to bat populations in response to climate change (USFWS 2022c). Researchers have identified several climate change factors that may impact bats, including changes in hibernation; mortality from extreme drought, cold, or excessive rainfall; cyclones; loss of roosts from sea-level rise; and impacts from human responses to climate change (e.g., wind turbines). Climate change is also likely to influence disease dynamics as temperature, humidity, phenology, and other factors affect the interactions between WNS and hibernating bats (USFWS 2022c). In addition, climate change could result in phenological mismatch (e.g., timing of various insect hatches not aligning with key life-history periods of spring emergence, pregnancy, lactation, or fall swarming) and cause shifts in distribution of forest communities, invasive plants, invasive forest pest species, or insect prey. Changes in temperature and precipitation likely will influence NLEB resource needs, such as suitable roosting habitat for all seasons, foraging habitat, and prey availability (USFWS 2022c).

Habitat loss may include loss of suitable roosting or foraging habitat, resulting in longer flights between suitable roosting and foraging habitats due to habitat fragmentation, fragmentation of maternity colony networks, and direct injury or mortality. Loss of or modification of winter roosts (i.e., making hibernaculum no longer suitable) can result in impacts to individuals or at the population level (USFWS 2022c).

Conservation Needs

The NLEB SSA report was exclusively referred to in determining conservation needs as there is currently no recovery plan available for the species (USFWS 2022c). The SSA serves as a synthesis of the best available information on the biological status and thus is helpful in assessing the current and future conservation needs of the species. For NLEB, 5 representation units (RPUs) were delineated to identify genetic variation across the NLEB's range and include: Eastern Hardwoods, Southeast, Midwest, Subarctic, and East Coast. The needs of the NLEB include having a sufficient number and distribution of healthy populations to ensure NLEB can withstand annual variation in its environment (resiliency), catastrophes (redundancy), and novel or extraordinary changes in its environment (representation).
The SSA concluded, using multiple data types and analyses, downward trends in NLEB population abundance and distribution over the last 14 years and consequently, found no evidence to suggest that this downward trend will change in the future. NLEB abundance (winter and summer), number of occupied hibernacula, spatial extent, probability of persistence, and summer habitat occupancy across the range and within all RPUs are decreasing. Since the arrival of WNS, NLEB abundance steeply declined. At these low population sizes, maternity colonies are vulnerable to extirpation from stochastic events. Furthermore, NLEB's ability to recover from these low abundances is limited given their low reproduction output (1 pup per year). Therefore, NLEB's resiliency is greatly compromised in its current condition (and is projected to decline under modeled future scenarios). Additionally, because NLEB's abundance and spatial extent are projected to decline dramatically, NLEB will also become more vulnerable to catastrophic events. In other words, its redundancy has also declined dramatically. Lastly, the steep and continued declines in abundance have likely led to reductions in genetic diversity, and thereby reduced the NLEB's adaptive capacity, and a decline in the species' overall representation. Further, the projected widespread reduction in the distribution of hibernacula will lead to losses in the diversity of environments and climatic conditions occupied, which will impede natural selection and further limit NLEB's ability to adapt. Moreover, at its current low abundance, loss of genetic diversity via genetic drift will likely accelerate. Consequently, limiting natural selection process and decreasing genetic diversity will further lessen NLEB's ability to adapt to novel changes (currently ongoing as well as future changes) and exacerbate declines due to continued exposure to WNS, mortality from wind turbines, and impacts associated with habitat loss and climate change. Thus, even without further WNS spread and additional wind energy development, NLEB's viability is likely to rapidly decline over the next 10 years (USFWS 2022c).

Current condition

Available evidence, including both winter and summer data, indicates NLEB abundance has declined substantially from historical conditions (USFWS 2022c, NABat 2023). Winter hibernacula counts provide the most consistent, long-term, reliable trend data. Winter abundance (from known hibernacula) has declined rangewide (49%) and across most RPUs (0–90%). In addition, the number of extant winter colonies declined rangewide (81%; Figure 5) and across all RPUs (40–88%). There has also been a noticeable shift towards smaller colony sizes, with a 96–100% decline in the number of large hibernacula (≥100 individuals). Declining trends in abundance and occurrence are also evident across much of the NLEB's summer range. Rangewide summer occupancy declined by 80% from 2010–2019 (Figure 12). Data collected from mobile acoustic transects found a 79% decline in rangewide relative abundance from 2009–2019 and summer mist-net captures declined by 43–77% compared to pre-WNS capture rates (USFWS 2022c).

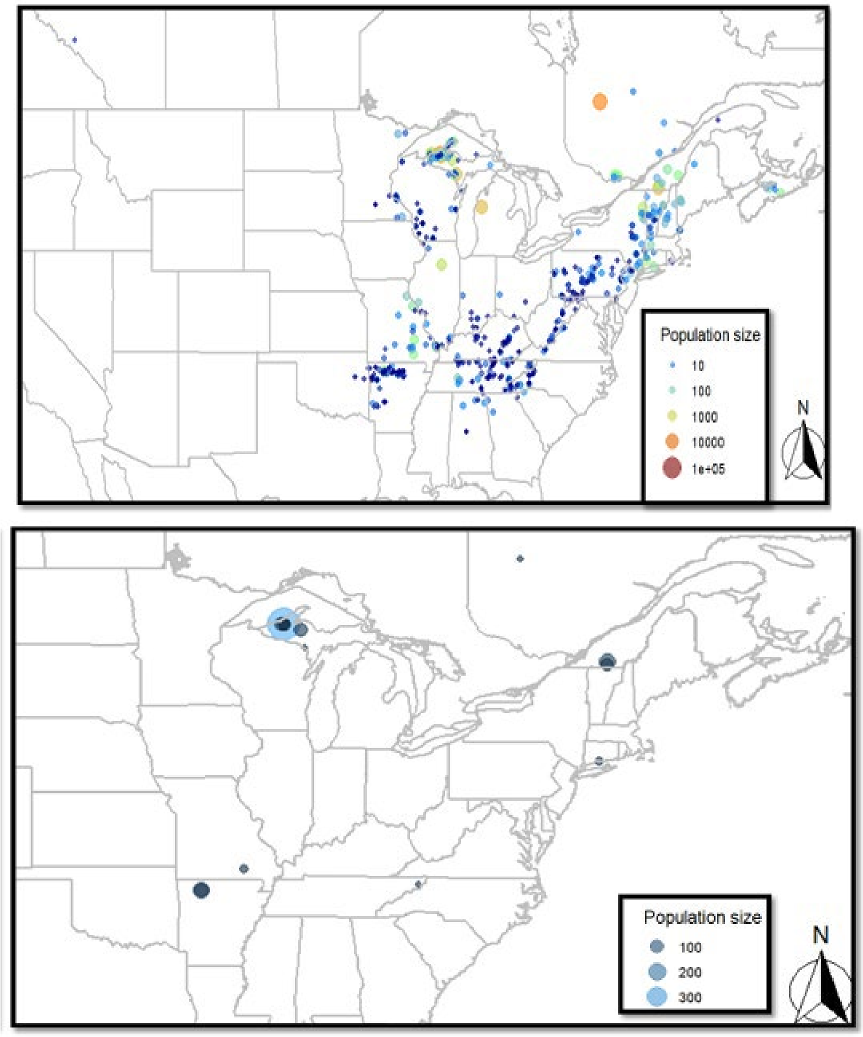


Figure 5. NLEB extant hibernacula at year 2000 (top) and projected at 2030 (bottom) given current state conditions (encompass the current abundance, growth rate, WNS occurrence, and installed wind energy capacity). Color and size reflect median hibernacula abundance (USFWS 2022c).

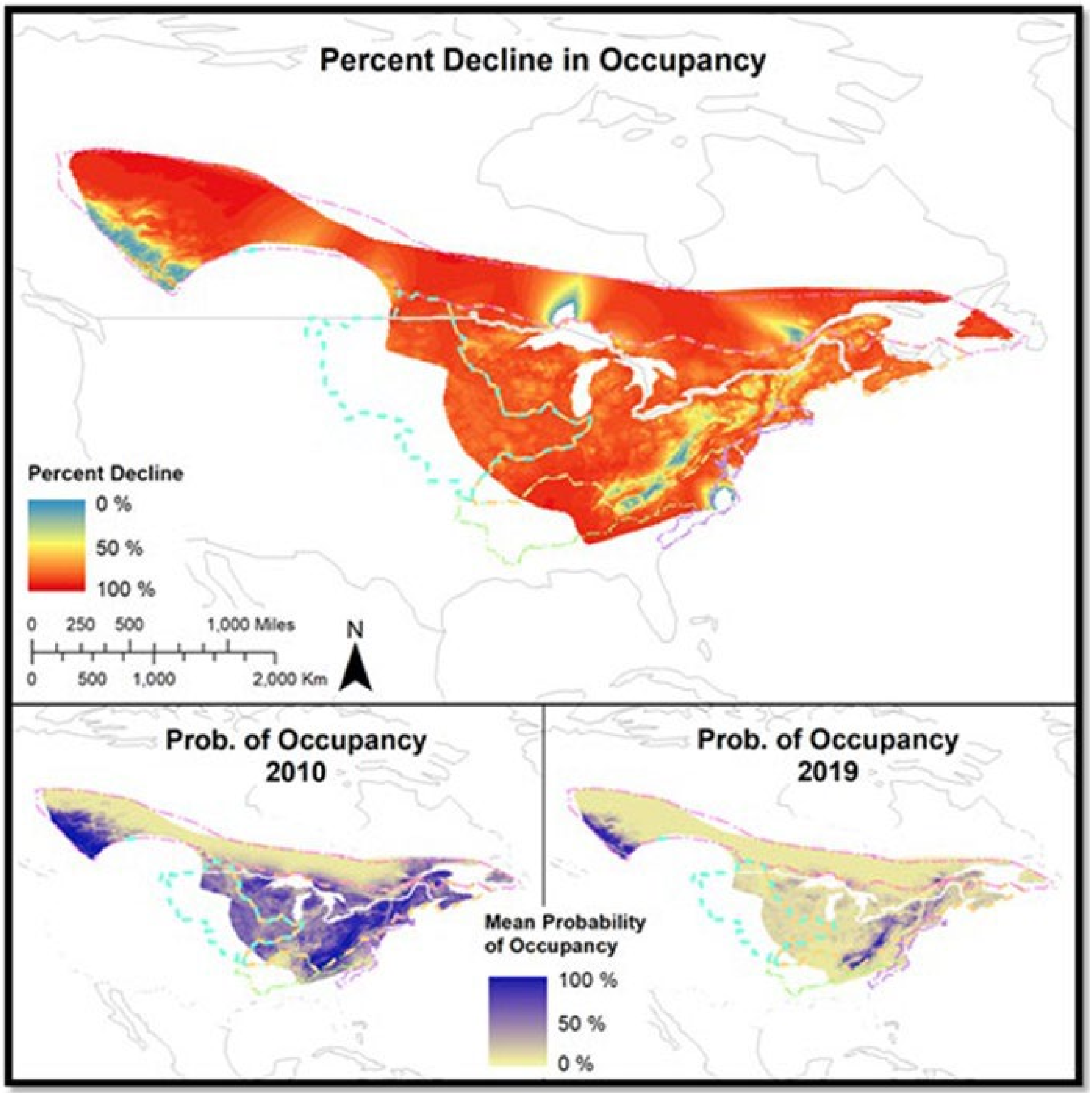


Figure 6. Predicted percent decline in probability of occupancy (top) and probability of NLEB summer occupancy in 2010 (bottom left) and 2019 (bottom right) based on data collected from stationary and mobile transect acoustic monitoring and capture records summarized at the 10 km x 10 km NABat grid cell (Stratton and Irvine 2022 *in* USFWS 2022c). Dotted boundaries correspond to RPUs. Cooler colors represent lower percent declines (top panel) or higher probability of occupancy (bottom panels; USFWS 2022c).

Summary

In summary, as a whole, the rangewide status of the NLEB is declining. Available evidence indicates NLEB abundance has and will continue to decline substantially over the next 10 years under current conditions. Even without further WNS spread and additional pressure from other stressors, the NLEB's viability has declined substantially and is expected to continue to rapidly decline over the near term. For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to the Service's NLEB website: https://ecos.fws.gov/ecp/species/9045.

TCB

Listing

The Service proposed listing TCB as endangered on September 14, 2022 (87 FR 56381). The following is a summary of TCB life history as relevant to this Opinion and drawn from the TCB SSA report (USFWS 2021b).

Life History and Biology

TCB is a widely distributed small insectivorous bat of eastern North America found in 39 U.S. states, Washington, D.C., 4 Canadian Provinces, Guatemala, Honduras, Belize, Nicaragua, and Mexico. Readily identifiable by its tricolored fur, TCBs mate in the fall, hibernate in the winter and emerge in the spring. They then migrate to summer habitat where females form maternity colonies, where young are born. Bats disperse once young can fly, and then return to winter habitats to swarm, mate, and hibernate. TCBs typically hibernate in caves and other subterranean habitats and primarily roost in foliage of live and dead trees. TCBs exhibit site fidelity to both winter and summer roost habitat. The species generalized annual life history is summarized in Figure 7.

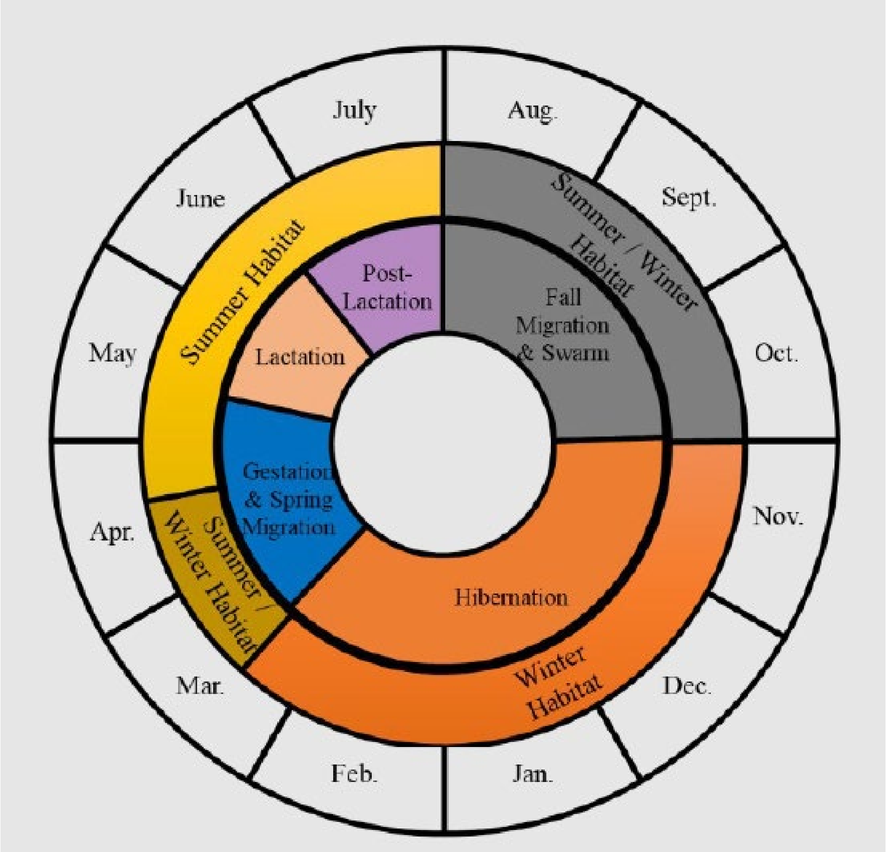


Figure 7. Generalized annual life history diagram for TCB (adapted from Silvis et al. 2016).

<u>Spring Staging and Fall Swarming</u>
TCBs disperse from winter hibernacula to summer roosting habitat in the spring. Forest is a primary component of foraging and commuting habitat. Wetlands and water features are important foraging and drinking water sources.

Like NLEB, TCB are known to occur in the coastal plain of Virginia and it is assumed they exhibit a similar life history where they do not enter hibernation and instead go into torpor for a short period during the coldest months. Additionally, they have not been known to exhibit swarming behavior in the North Carolina and Virginia coastal plain (G. Jordan, Service, email to M. Armstrong et al., Service, July 17, 2023).

<u>Summer Roosting</u>
During the spring, summer, and fall - collectively referred to as the non-hibernating seasons - TCBs primarily roost among live and dead leaf clusters of live or recently dead deciduous hardwood trees. In the southern and northern portions of the range, TCBs will also roost in Spanish moss (*Tillandsia*

usneoides) and *Usnea trichodea* lichen, respectively. In addition, TCBs have been observed roosting during summer among pine needles, eastern red cedar (*Juniperus virginiana*), within artificial roosts like barns, beneath porch roofs, bridges, concrete bunkers, and rarely within caves. Female TCBs exhibit high site fidelity, returning year after year to the same summer roosting locations. Female TCBs form maternity colonies and switch roost trees regularly. Males roost singly.

TCBs are opportunistic feeders and consume small insects including caddisflies, moths, beetles, wasps, flying ants and flies.

Threats

The primary factors influencing TCB's viability that have led to its current condition include WNS, wind energy related mortality, effects from climate change, habitat loss, and conservation efforts (USFWS 2021b).

For over a decade, WNS has been the foremost stressor on TCBs and is predicted to continue to be the primary influence into the future. The effect of WNS on TCBs has been extreme, such that most summer and winter colonies experienced severe declines following the arrival of WNS. It is estimated that the arrival of WNS led to a 10-fold decrease in TCB colony size. Additionally, because populations of the bat are depressed by this disease, human activities and other factors that were not significant before may be so now. In the North Carolina coastal plain, as with NLEB, WNS has not been documented in captured bats, suggesting that the coastal plain may provide a refugia from WNS.

Mortality of TCBs at wind energy facilities is proving to be a consequential stressor at local and regional levels, especially in combination with impacts from WNS. Most TCB mortality at wind energy projects is caused by direct collisions with moving turbine blades. Wind energy development currently overlaps with 53% of TCB's range in the U.S. and is expanding.

Climate change variables, such as changes in temperature and precipitation, may influence TCB resource needs, such as suitable roosting habitat for all seasons, foraging habitat, and prey availability. Although the TCB may benefit from changes in precipitation or temperature associated with a changing climate in some areas, we anticipate increasing landscape-scale negative impacts in the future.

Although we consider habitat loss pervasive across TCB's range, severity has likely been low given historical abundance and spatial extent; however, as TCB's spatial extent is projected to decline in the future (i.e., consolidation into fewer winter and summer colonies) negative impacts (e.g., loss of a hibernaculum or maternity colony) may be significant. Habitat loss and fragmentation may result in loss of suitable roosting or foraging habitat, requiring individuals to fly greater distances to rest and feed.

Conservation Needs

At the species level, TCBs require demographic, physically, and genetically healthy populations across a diversity of environmental conditions (resiliency), genetic and ecological diversity to maintain adaptive capacity (representation), and multiple and sufficient distribution of populations within areas of unique variation (redundancy).

TCB abundance has declined significantly and winter abundance, number of occupied hibernacula, spatial extent, and summer habitat occupancy are decreasing. Since the arrival of WNS, TCB abundance steeply declined. At these low population sizes, colonies are vulnerable to extirpation from stochastic events. Furthermore, TCB's ability to recover from these low abundances is limited given their low reproduction output (2 pups per year). Therefore, TCB's resiliency is greatly compromised in its current condition and is projected to worsen under future stressor conditions. Additionally, because TCB's spatial extent is projected to decline, TCB will become more vulnerable to catastrophic events. Lastly, the steep and continued declines in abundance have likely led to reductions in genetic diversity, thereby reducing TCB's ability to adapt to changes in its biological and physical environments. Further, the projected widespread reduction in the distribution of hibernacula will lead to losses in the diversity of environments and climatic conditions occupied, which will impede natural selection and further limit TCB's ability to adapt. Moreover, at its current low abundance, loss of genetic diversity via genetic drift will likely accelerate. Consequently, limiting natural selection process and decreasing genetic diversity will further lessen TCB's ability to adapt to novel changes (currently ongoing as well as future changes) and exacerbate declines due to continued exposure to WNS, mortality from wind turbines, and impacts associated with habitat loss and climate change. Thus, even without further WNS spread and additional wind energy development, TCB's viability is likely to rapidly decline over the next 10 years.

Current Condition

Current demographic conditions based on past declines indicate TCB's rangewide winter abundance and number of extant winter colonies have declined by 52% and 29%, respectively. TCB winter abundance has declined across all RPUs but varies spatially (24–89%). Declining trends in TCB occurrence and abundance is also evident from summer data: 1) TCB rangewide occupancy declined 28% from 2010–2019; 2) mobile acoustic detections decreased 53% from 2009–2019; and 3) summer mist-net captures declined 12% compared to pre-WNS capture rates. Based on current conditions, future projections of TCB abundance, number of hibernacula, and spatial extent will continue to decline. By 2030, rangewide abundance declines by 89%, the number of winter colonies declines by 91%, and TCB's spatial extent declines by 65%. Projected declines in TCB's abundance, number of winter colonies, and spatial extent are widespread across all RPUs under current conditions (NABat 2023).

Summary

In summary, as a whole, the rangewide status of TCB is declining. Available evidence indicates TCB abundance has and will continue to decline substantially over the next 10 years under current conditions. Even without further WNS spread and additional pressure from other stressors, TCB's viability has declined substantially and is expected to continue to rapidly decline over the near term. For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to the Service's NLEB website: https://ecos.fws.gov/ecp/species/10515.

STATUS OF CRITICAL HABITAT

PIPL

Critical habitat for wintering PIPL, 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). Designated critical habitat does not overlap the action area; therefore, critical habitat for this species is not considered in this Opinion.

REKN

Critical habitat for the REKN was proposed in 2021 (86 FR 37410) and a revision to the proposal was published in April 2023 (88 FR 22530). A final rule has not been published. The proposed critical habitat does not overlap the action area; therefore, proposed critical habitat for this species is not considered in this Opinion.

NLEB

No critical habitat has been designated for this species.

TCB

No critical habitat has been designated for this species.

ENVIRONMENTAL BASELINE

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

Status of the Species within the Action Area

PIPL/REKN - Offshore

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

The action area is located within a migration corridor for both species, and its primary value to PIPLs and REKNs is as part of a flight corridor.

Normandeau (2011) identified potential migratory flight paths that PIPL and REKN might use to cross the Atlantic OCS rather than following the coast. Both PIPLs and REKNs probably "shortcut" across the OCS using long-distance flights instead of following the coastline, although some individual birds likely complete multiple shorter-distance flights along the coast. Accordingly, both species would be exposed to WTGs on the OCS during spring and fall migrations. Typical NB migration patterns for REKNs result in less exposure to WTGs on the OCS, including in the action area, in the spring. However, both species stage for fall migration on Cape Cod and use habitats in the mid-Atlantic, and we expect some individuals will pass through the action area on long-distance, cross-OCS, southward migration flights.

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

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

PIPL

Most of our knowledge of migratory trajectories for Atlantic Coast PIPLs is derived from Loring et al. (2019) in which 150 PIPLs were fitted 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, MA, to southern Virginia. Peak exposure of PIPLs to Federal waters occurred in late July and early August. PIPLs departing from their breeding grounds in Massachusetts and Rhode Island primarily used offshore routes to stopover areas in the mid-Atlantic. Individual PIPLs were exposed to up to 4 Wind Energy Areas (WEAs) on offshore flights across the mid-Atlantic Bight. Flights in Federal waters and WEAs were strongly associated with southwest wind conditions providing positive wind support (Loring et al. 2019).

Of the 150 individuals tagged, 82% were detected by the telemetry array. Field staff observed that 25% of tagged birds dropped their transmitters on the breeding grounds. Tagged PIPLs were detected by the tracking array for an average of 46 days. Due to incomplete detection probability, 47% (70 of 150) of individuals had sufficient detection data to model migratory departure from the breeding grounds. Migratory events were identified by SB departures from breeding areas tracked by 2 or more towers within the telemetry array. Of the 70 individuals that were tracked during fall migration, 27% (19 birds) had estimated exposure to WEAs within the study area. Estimated exposure to WEAs was higher for birds tagged in Massachusetts than for birds tagged in Rhode Island. For 22 birds tagged in Massachusetts, peak estimated WEA exposure occurred within 4 hours of local sunset (19:00 hours), with 36% (8 birds) of events occurring at night and 64% (14 birds) during daylight (Loring et al. 2019).

Loring et al. (2019) reported that most offshore flight altitudes of PIPLs occurred above the rotor swept zone (RSZ). An estimated 21.3% of PIPL flights in Federal waters occurred within the RSZ. However, the RSZ for this study was defined for this study at 25 to 250 m above sea level and thus slightly smaller than the CVOW-C RSZ. Further analyzing this same set of 150 tagged PIPLs, Loring et al. (2020a) presents altitudes for 17 individual migratory flights across the mid-Atlantic Bight—3 of these flights were within the CVOW-C RSZ (Figure 8).

The data from Loring et al. (2019) have important limitations that must be taken into account. First, across all years, many PIPLs were last detected departing from their nesting areas along trajectories that intersected Federal waters and headed towards WEAs just beyond the range of land-based towers to detect exposure, such as WEAs offshore of Nantucket, MA. Therefore, estimates of exposure to Federal waters and WEAs in Loring et al. (2019) should be interpreted in the context of detection probability of the telemetry array. It is plausible that at least some of these PIPLs that appeared to be heading south intersected the CVOW-C Lease Area, but were out of the detection range of the land-based receivers. Second, it is also important to note that tags were deployed in only 2 nesting areas, and the migration flights of these sampled PIPLs may differ from PIPLs that nest in other parts of the Atlantic Coast range. For example, preliminary results from a previous mark/resight study found that 42% of PIPLs marked in Atlantic Canada were subsequently detected in New Jersey and 52% were detected in North Carolina (J. Rock, Environment and Climate Change Canada, email to W. Walsh, Service, February 1, 2023). These Canadian nesters could have significant exposure to offshore wind that has not yet been assessed. Loring et al. (2019) note several differences in the migratory flights of birds tagged in Massachusetts versus Rhode Island, indicating that probability of occurrence in the Lease Area does likely vary for PIPLs breeding in different portions of the range. Finally, it is also important to note that very little data on PIPL spring migration movements are available (only 2 birds were tracked during partial NB flights from the Bahamas [Loring et al. 2019]).

In summary, PIPLs from the New England RU are likely to occur in the CVOW-C Lease Area on a regular basis. These birds are likely to cross the Lease Area no more than 2 times per year, on spring and fall migration flights. The available information suggests that around 18% of these birds may cross the Lease Area within the RSZ. We have no information regarding occurrence of PIPL from the Atlantic Canada, NY-NJ, or Southern RUs, 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 little information on the flight paths or altitudes of spring migrants, but we presume that these are similar to fall flights.

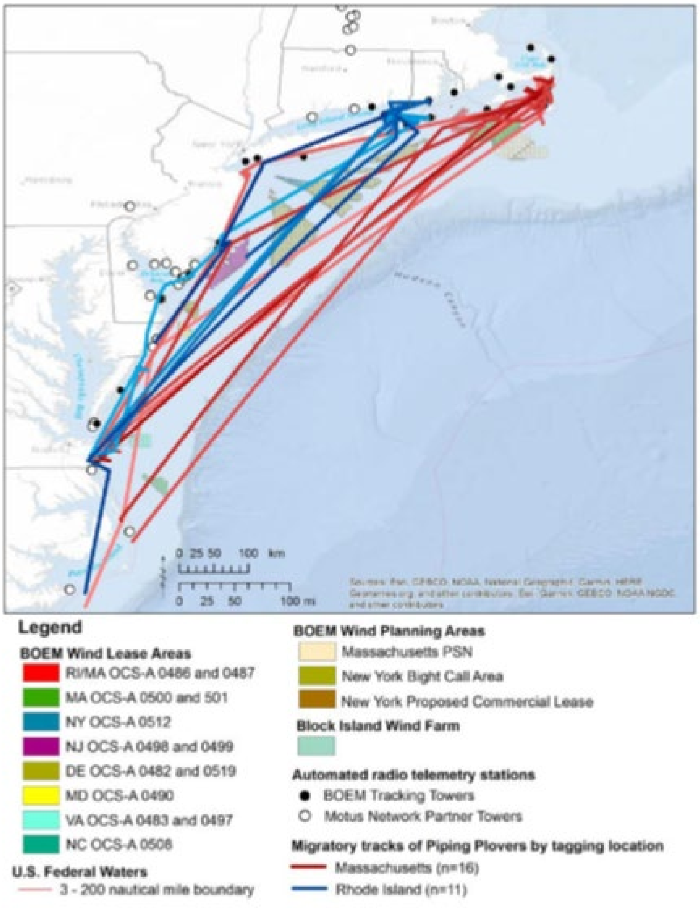


Figure 8. Figure 57 C in Loring et al. (2019), illustrating PIPL migratory flights.

REKN

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

Based on data from 93 individual REKNs and 100 geolocators, Perkins (2023) determined migration patterns and wintering areas for all RUs except the Western RU (Figure 9) using data from 2009 to 2017. REKN flight paths were categorized into subpopulations using expert elicitation and draft recovery plan maps, and individuals were assigned to the following categories: SEC (31 birds, 10 of which wintered in the Caribbean), NCSA (22 birds), Western Gulf of Mexico/Central America (Western) (24 birds), and Southern (9 birds). Seven individuals tagged in Texas were not classified. Location estimates were accurate to within 155 mi (250 km). Tagged individuals from the SEC RU were detected near Norfolk and Chesapeake Bay, VA, during spring and fall migration; individuals from the NCSA RU were detected along coastal Virginia during spring migration; and individuals from the Southern RU were detected near the Chesapeake Bay during spring migration. Given the potential 155-mi error in accuracy, it is possible that any of the birds detected in, or flying over, coastal Virginia could have flown through the CVOW-C Lease Area.

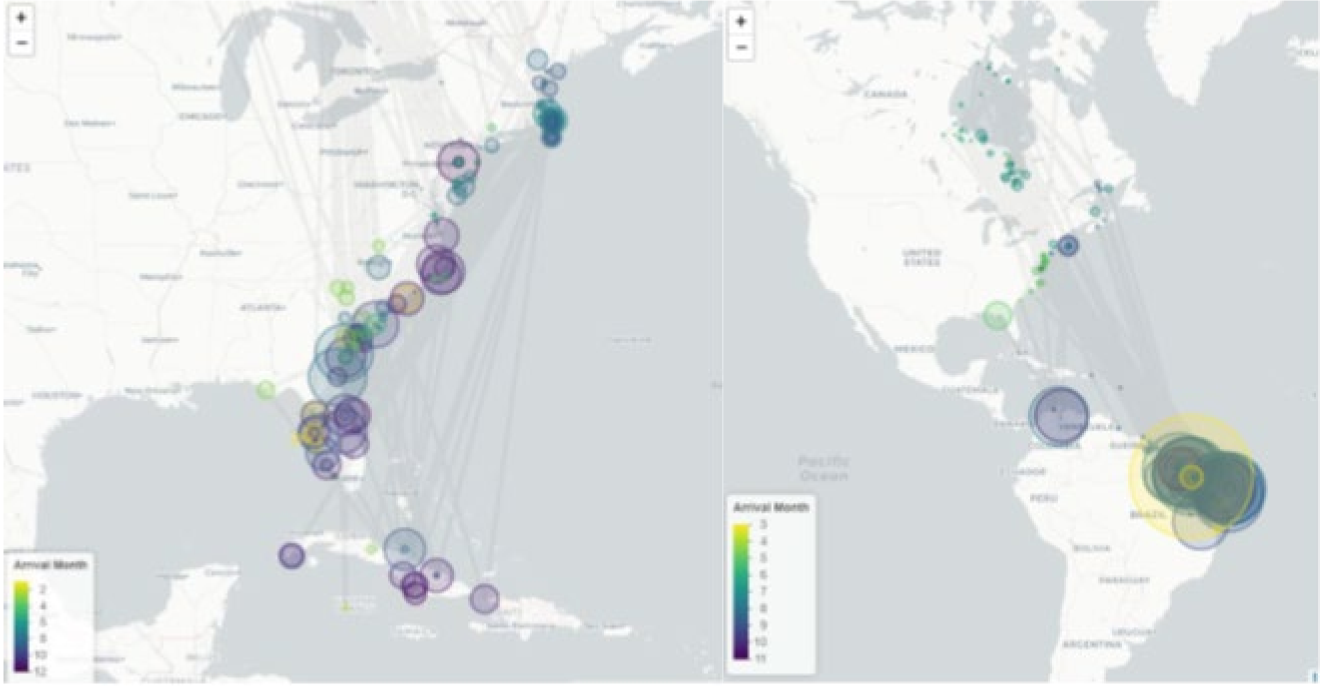


Figure 9. Figures 5b (left) and 6a (right) in Perkins (2023), illustrating REKN distribution during migration.

Using digital VHF transmitters and a Motus network of land-based receiving stations, Smith et al. (2023) tagged 96 NB REKNs in South Carolina from 2017-2019, and 12 NB REKNs in 2019, to determine whether these birds used Delaware Bay as stopover habitat. Of the 108 tagged birds, 33 were detected by the Motus network, and of those 33 birds, 9 (27%) were detected in Delaware Bay. Smith et al. (2023) found similar northward migratory pathways (Figure 10) from the southeastern U.S. as reported in Perkins (2023), although the data in Smith et al. (2023) do not provide information on offshore flight paths of REKNs departing from the southeast and mid-Atlantic, since most tend to fly overland directly to their breeding grounds in the Arctic.

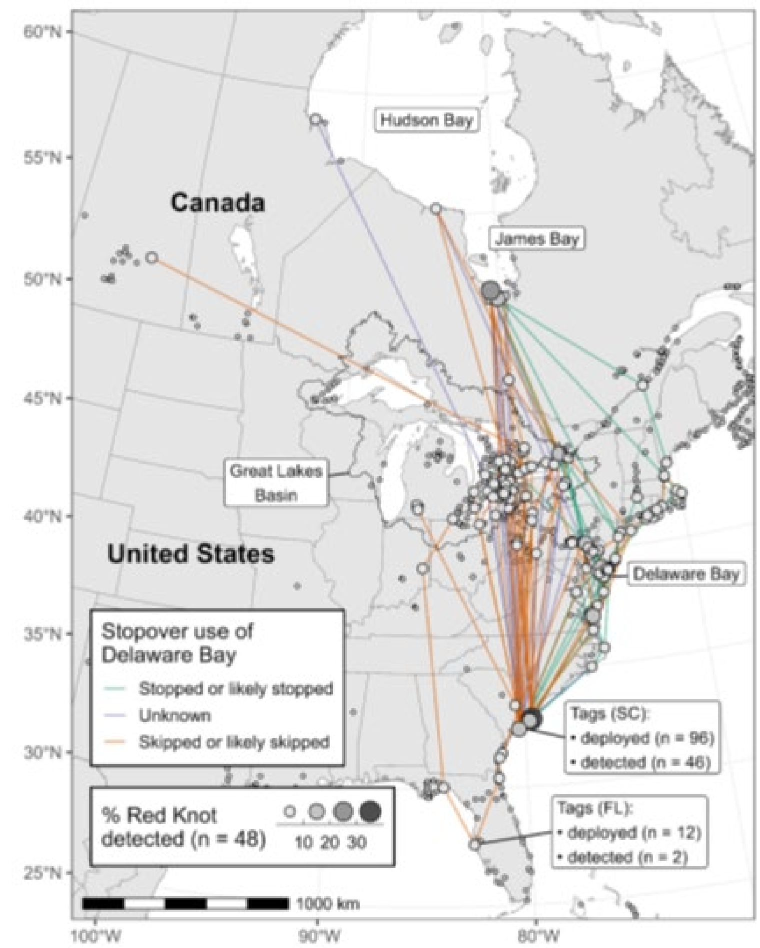


Figure 10. Figure 2 in Smith et al. (2023), illustrating REKN NB migratory flights.

To identify critical SB stopover sites and migratory pathways in Canada and the Northeastern United States, Loring et al. (2018) attached digital VHF transmitters to 388 REKNs in 2016 in 4 areas; James Bay and the Mingan Archipelago in Canada, in Massachusetts, and along the Atlantic Coast of New Jersey. Tagged REKNs were tracked using an array of automated radio telemetry stations within a study area encompassing a portion of the U.S. Atlantic, extending from Cape Cod, MA, to Back Bay, VA. A total of 59 of these 388 birds were tracked by the array in migration over Federal waters. REKNs tagged within the study area had a high likelihood of being detected in the receiver array (greater than 75%), demonstrating that tag loss and tag failure rates were low. Despite this, only 3 to 22% of REKNs tagged at stopover sites in Canada were detected within the study area, and only 2 individuals tagged in Canada were estimated to be exposed to WEAs while transiting the study area. Comparatively, 54% of birds tagged in Massachusetts and New Jersey stopover areas were detected passing through Federal waters of the Atlantic OCS in the study area, and 11% were estimated to be exposed to 1 or more WEAs both during shorter-distance flights on staging grounds and longer-distance migratory movements. Of the 388 tagged birds, 2 were detected crossing Lease OCS-A 0483. However, because the tracking array likely missed flights that occurred within the Atlantic OCS study area (due to offline stations or limited detection ranges), and because we do not know if the final detections corresponded with departure from the study area or were a result of tag loss, the estimates of exposure to Federal waters and WEAs should be considered a minimum (Loring et al. 2018).

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

Appendix F in Loring et al. (2018) contains 26 maps of estimated flight paths of tracked REKNs between Virginia and Massachusetts. Several flight paths are immediately adjacent to the offshore portion of the Lease Area.

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

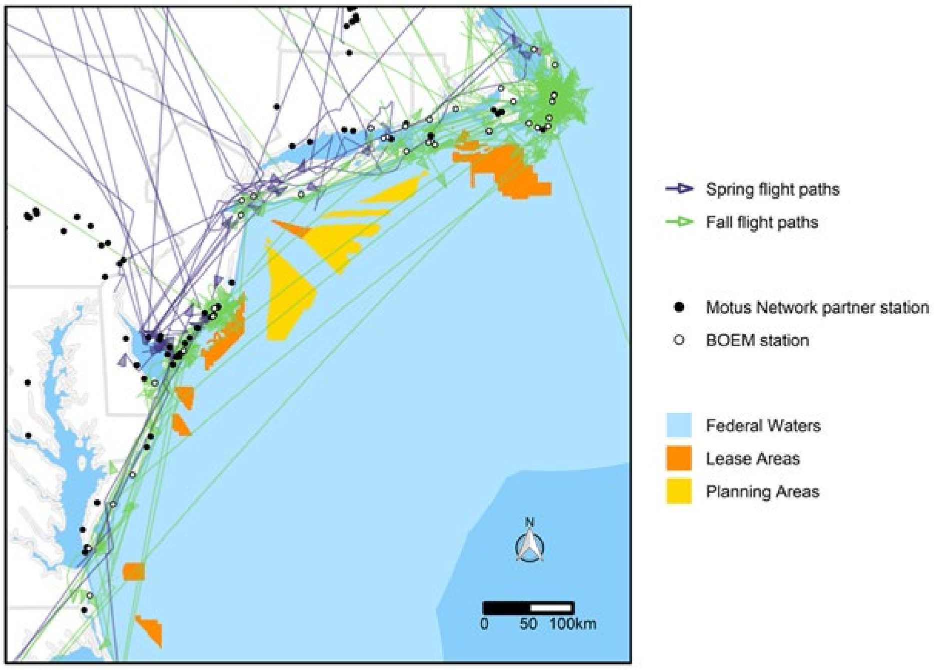


Figure 11. Figure 14 in Loring et al. (2020b), illustrating REKN migratory flights.

This growing body of evidence indicates that a substantial portion of NB REKNs fly overland from the U.S. Atlantic Coast (Florida to Delaware Bay) on a northwest trajectory to their final stopover areas along Hudson Bay in Canada. While some NB REKNs may cross the CVOW-C project action area, the overland route appears to be the predominant flyway for this portion of the NB migration (USFWS 2014, Loring et al. 2020b, USFWS 2021b, Perkins 2023), and this route entirely avoids the OCS.

The prevalence of regional movements is reflected in available tracking data. Burger et al. (2012) found that REKNs outfitted with geolocators and recaptured in Massachusetts spent over half the year migrating, at stopovers, and wintering along the Atlantic Coast, including 1 REKN that wintered on a Virginia barrier island (Figure 12). While birds in this study crossed the OCS at least twice during long-distance flights, individuals crossed even more often on shorter flights (Burger et al. 2012). As described above, Loring et al. (2018) reports that, of 99 REKNs tagged with radio transmitters, 17 birds (17%) were tracked moving through Federal waters during staging at migration stopover aeras. Loring et al. (2020b) found movements of REKNs tracked during spring were concentrated near tagging sites in the Delaware Bay and western Long Island, with some regional movements detected between staging areas. Several individuals crossed Federal waters during regional flights between staging and stopover sites located throughout the study area before departing northward towards the breeding grounds (Loring et al. 2020b).

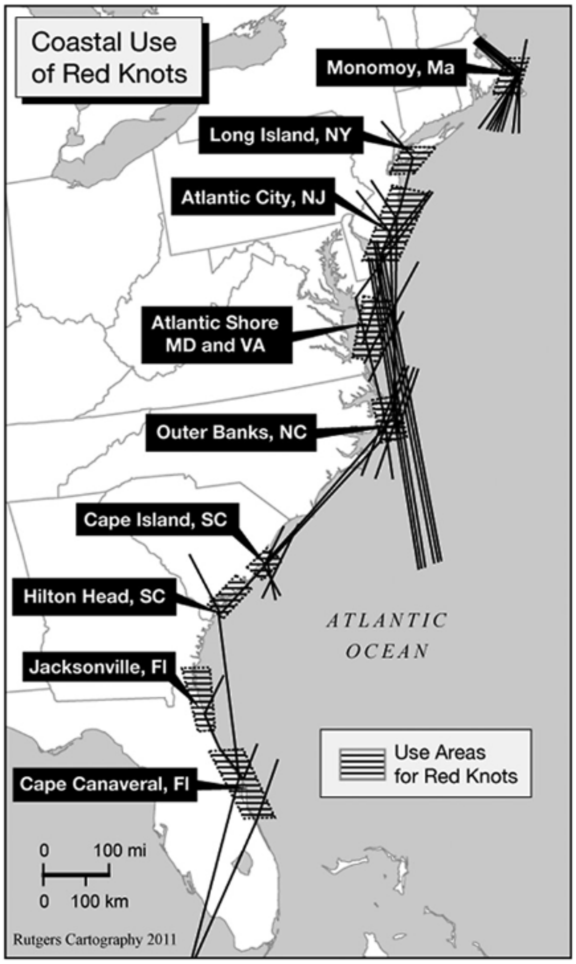


Figure 12. Figure 3 in Burger et al. (2012), illustrating areas used by REKNs on the Atlantic Coast.

In summary, REKNs from the SEC, NCSA, and Southern RUs are known to occur in the action area, though we do not know if birds from these 3 RUs use the airspace with similar frequency, timing, or altitudes. The available information indicates greater numbers of REKNs cross the OCS on fall migration flights compared to spring migration flights. Best available information indicates substantial overlap between REKN flight heights and the CVOW-C RSZ.

Summary

The available tracking data shows both PIPLs and REKNs using flight paths through or over the Lease Area. We expect both species will fly through or over the Lease Area annually during fall and spring migration, although number of individuals and flight paths will vary seasonally and annually.

PIPL/REKN – Onshore

Both PIPL and REKN occur along the Virginia Beach coastline. While PIPLs are occasionally observed on or near Virginia Beach and surrounding beaches, all known nesting activity in Virginia is restricted to the Eastern Shore. REKNs have been documented onshore and are occasionally observed on or near Virginia Beach; however they do not nest in Virginia and during migration the majority of observations are along the Eastern Shore.

NLEB

Offshore

Research on the presence or absence of NLEBs in marine environments is limited and our understanding of bats in the offshore environment is far from complete. NLEBs have been detected on coastal islands in New England indicating that these bats will travel over open water (Dowling et al. 2017). However, NLEB use of the offshore airspace in the action area has not been documented. No offshore movements by NLEBs have been detected at the CVOW-Pilot project (Normandeau Associates 2023) or the offshore CVOW-C Lease Area (COP Appendix O-2, Tetra Tech, Inc. 2021).

Onshore

Mist-net surveys were conducted in the onshore project area from the cable landing location to the interconnection cable route (Gilardi and Yates 2022). Suitable habitat was identified along 27 km (16.78 mi) of the onshore cable route area and 27 locations were surveyed over 18 nights between June 9-July 2, 2022 for a total of 115 net nights. Captured NLEB females were fitted with radio transmitters and tracked to locate their roost locations. Once a roost was located, emergence counts were conducted. Of the 110 bats captures, 3 were NLEBs and all 3 were lactating adult females suggesting there may be active maternity colonies in the area.

Two of the NLEBs were tracked from a capture site to surrounding neighborhoods but their roosts were not located. It is possible that the bats were roosting near the capture site. The capture site was a forested wetland area containing hardwood (sweetgum) and softwood species including loblolly pine, located adjacent to the ROW. The remaining NLEB was successfully tracked to a roost site which consisted of a live standing loblolly pine with 75% canopy cover and 100% bark remaining on the tree. Several additional potential but unconfirmed roosting sites for NLEB were identified during the survey based on the tracking data from the 3 captured bats and the typical characteristics of suitable roost trees.

Relative to CVOW-C's onshore project elements, NLEBs were captured in 2 primary locations. The first area is located along the export cable route, along West Neck Creek with roost locations north and south of the roadway. The second area is on the north side of the export cable route and west of the North Landing River. NLEBs were captured 0 ft to 487.6 ft from the project's LOD and 0 ft to 607.5 ft from the clearing area. Roosts were located 220.4 ft to 5,115 ft from the project's LOD and 489.6 ft to 5,235 ft from the clearing area (M. Jabs, Dominion, email to B. Houghton BOEM et. al, May 17, 2023).

NLEBs in the year-round range, which includes the action area, appear to roost singularly in the winter rather than in groups (M. Armstrong, Service, email to K. Matthews et al., Service, July 14, 2023; G. Jordan, Service, email to M. Armstrong et al., Service, July 17, 2023) and there is a strong possibility that they are breeding in late winter/early spring. The presence of reproductive males in spring suggests this and capture rates have increased around mid-February.

TCB

Offshore

Research on the presence or absence of TCBs in marine environments is limited and our understanding of bats in the offshore environment is far from complete. TCBs have been detected on coastal islands in New England indicating that these bats will travel over open water (Dowling et al. 2017) and 1 was found on a ship offshore, but it was unclear if it was roosting on the ship before it left port (Bort Thornton et al. 2023). However, TCB use of the offshore airspace in the action area has not been documented. No offshore movements by TCBs have been detected at the adjacent CVOW-Pilot project (Willmott et al. 2023) or the offshore CVOW-C Lease Area (COP Appendix O-2, Tetra Tech, Inc. 2021).

Onshore

Mist-net surveys were conducted in the onshore project area from the cable landing location to the interconnection cable route (Gilardi et al. 2022). Suitable habitat was identified along 27 km (16.78 mi) of the onshore cable route area and 27 locations were surveyed over 18 nights between June 9-July 2, 2022 for a total of 115 net nights. Captured TCB females were fitted with radio transmitters and tracked to locate their roost location. Once a roost was located, emergence counts were conducted. Of the 110 bats captured, 6 were TCBs and 3 were pregnant females suggesting there may be active maternity colonies in the area.

Four of the captured TCBs were not tracked to roost sites. The capture site habitats varied and included a lowland woodlot, offroad vehicle trails in woods running alongside a stream, a forested dirt road next to an intercoastal waterway, and a two-track road through mature forest. Two of the TCBs were successfully tracked to roost sites. One roost consisted of a live standing black ash or red maple. Emergence counts were performed twice for this roost with 11 and 8 bats emerging, respectively. The other roost was located in a swampy area and no emergence count was performed.

TCBs were captured in 3 primary locations: southeast of the Harpers Switching Station; along the export cable route, near West Neck Creek with the roost location south of the roadway; and adjacent to the export cable route and north of the North Landing River with the roost location north of the river.

EFFECTS OF THE ACTION

In accordance with 50 CFR 402.02, 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 (see § 402.17).

The potential effects of the proposed action are described in Table 5. Those components of the proposed action determined to result in “no effect” or “not likely to adversely affect” are described in Table 5 and will not be further discussed in this Opinion. Components of the project that are likely to adversely affect PIPL, REKN, NLEB, or TCB are described in Table 5 and include:

PIPL/REKN

- Turbine operation

NLEB/TCB

- Tree clearing

Table 5. Potential effects of proposed action on PIPL, REKN, NLEB, and TCB. “No effect” (NE) rows are green, “not likely to adversely affect” (NLAA) rows are yellow, and “likely to adversely affect” (LAA) rows are orange.

Activity	**Subactivity**	**Environmental Impact or Threat**	**Stressor**	**Exposure (resource affected)**	**Range of Response**	**Conservation Need Affected**	**Demographic Consequences**	**NE, NLAA, or LAA**
PIPL/REKN								
Construction - Onshore	Tree clearing	N/A	N/A	N/A	N/A	N/A	N/A	NE
	Comments: Tree clearing will occur outside of suitable habitat.							
	HDD	Increase in noise, increase in artificial lighting	Noise, lighting, disturbance	N/A	N/A	N/A	N/A	NLAA
	Comments: This activity will take place outside of migration/nesting season and the exit for the directional drilling is outside suitable habitat for these species. Therefore, effects to these species are expected to be discountable.							
	Above ground lines	N/A	N/A	N/A	N/A	N/A	N/A	NE
	Comments: These will be installed outside of suitable habitat.							
Construction - Offshore	Install inter-array cables and energy export cable	Increase in noise	Disturbance	N/A	N/A	N/A	N/A	NLAA
	Comments: The use of a ship will introduce noise, but because exposure to the noise will only occur during migration when birds are expected to be in the area for brief periods of time effects to these species are expected to be discountable.							
	Turbine and offshore substation construction	Increase in noise	Disturbance	N/A	N/A	N/A	N/A	NLAA
	Comments: The use of a ship will introduce noise, but because exposure to the noise will only occur during migration when birds are expected to be in the area for brief periods of time effects to these species are expected to be discountable.							
Operation and Maintenance	Turbine operation	Collision	Direct mortality	Individuals	Kill	Breeding	Numbers, distribution	LAA
	Comments: The Lease Area is within a migratory route for both species and 2 collision risk models predict collisions of both PIPL and REKN will occur during the 33-year lease period.							
	Lighting	Increase in artificial lighting	Disorientation	N/A	N/A	N/A	N/A	NLAA
	Comments: Turbines have aviation related lighting that only illuminates when aircraft are in the vicinity of the turbines, given the short duration these lights will be active the likelihood of overlap with migrating PIPLs or REKNs is expected to be insignificant and any effects to these species, should there be an overlap, are expected to be discountable.							
	Infrastructure maintenance	Increase in noise	Disturbance	N/A	N/A	N/A	N/A	NLAA
	Comments: The use of ships and helicopters will introduce noise; however, these events will be of short duration and PIPLs and REKNs would potentially be exposed during migration. Given the short duration of the noise the likelihood of overlap with migrating birds is expected to be insignificant and any effects to these species, should there be an overlap, are expected to be discountable.							
NLEB /TCB								
Construction - Onshore	Tree clearing	Habitat removal, physical impacts to individuals	Removal of suitable roosting and foraging habitat, crushing	Habitat, individuals	Harm, kill	Sheltering, feeding	Numbers, distribution	LAA
	Comments: Removal of suitable roosting and possible foraging habitat will result in bats spending additional energy locating a new roost and finding suitable foraging habitat and increased exposure to predators during this time. Additionally, some trees cleared during the TOYR could result in crushing bats if an undocumented roost tree is removed.							
	HDD	Increase in noise, increase in artificial lighting	Noise, lighting, disturbance	N/A	N/A	N/A	N/A	NLAA
	Comments: The onshore cable landing area for the HDD will occur on SMR Camp Pendleton in a proposed parking lot west of a firing range. While noise and artificial light will be present, because bats are not anticipated to utilize this existing developed area, effects to NLEBs and TCBs are expected to be insignificant.							
	Above ground lines	Introduction of artificial roosts	Change in habitat	N/A	N/A	N/A	N/A	NLAA
	Comments: Above ground lines may provide an artificial roosting site but no adverse effect are expected. Therefore, effects to these species are expected to be insignificant.							
Construction - Offshore	Install inter-array cables and energy export cable	Increase in noise	Disturbance	N/A	N/A	N/A	N/A	NLAA
	Comments: Equipment has the potential to generate noise resulting in disturbance to bats if they are present. NLEB and TCB have not been confirmed offshore. Although a TCB was found on a ship offshore it is unclear if the bat was travelling in the offshore environment when it roosted on the boat versus when the boat was in port (Bort Thornton et al. 2023). It is unlikely that these species will be occurring offshore; therefore, effects to these species are expected to be discountable.							
	Turbine and offshore substation construction	Increase in noise	Auditory disturbance	N/A	N/A	N/A	N/A	NLAA

	Comments: Equipment has the potential to generate noise resulting in disturbance to bats if they are present. NLEB and TCB have not been confirmed offshore. Although a TCB was found on a ship offshore it is unclear if the bat was travelling in the offshore environment when it roosted on the boat versus when the boat was in port. It is unlikely that these species will be occurring offshore; therefore, effects to these species are expected to be discountable.							
Operation and Maintenance	Turbine operation	Collision	Direct mortality	N/A	N/A	N/A	N/A	NLAA
	Comments: Wind turbines onshore have been documented to cause mortality for multiple bat species. NLEB and TCB have not been confirmed offshore. Although a TCB was found on a ship offshore it is unclear if the bat was travelling in the offshore environment when it roosted on the boat versus when the boat was in port (Bort Thornton et al. 2023). It is unlikely that these species will be occurring offshore; therefore, effects to these species are expected to be discountable.							
	Lighting	Increase in artificial lighting	Increase in prey, attraction to turbine	N/A	N/A	N/A	N/A	NLAA
	Comments: Turbines have aviation related lighting that only illuminates when aircraft are in the vicinity of the turbines. During the short duration these lights will be active they could attract invertebrates upon which bats forage to the turbines. However, NLEB and TCB have not been confirmed offshore. Although a TCB was found on a ship offshore it is unclear if the bat was travelling in the offshore environment when it roosted on the boat versus when the boat was in port. It is unlikely that these species will be occurring offshore; therefore, effects to these species are expected to be discountable.							
	Infrastructure maintenance	Increase in noise	Disturbance	N/A	N/A	N/A	N/A	NLAA
	Comments: The use of barges and helicopters will introduce noise; however, these events will be for short duration. NLEB and TCB have not been confirmed offshore. Although a TCB was found on a ship offshore it is unclear if the bat was travelling in the offshore environment when it roosted on the boat versus when the boat was in port. It is unlikely that these species will be occurring offshore; therefore, effects to these species are expected to be discountable.							

PIPL/REKN: Turbine Operation

Background

Wind turbines are known to present a collision hazard to birds in flight (Croll et al. 2022, Drewitt and Langston 2006). 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 bird behaviors, major flyways, or patterns of habitat usage change in response to environmental trends or human-driven factors. For example, over time birds may become acclimated and better able to avoid WTGs. Conversely, on a local or regional scale, additive or synergistic effects on collision risk levels may emerge as various offshore wind projects become operational. PIPLs and REKNs will eventually encounter and be forced to negotiate up to 3,092 total WTGs, as 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 (S. Vail-Muse, Service, email to W. Walsh, Service, April 14, 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).

Meta-analyses performed on 88 bird studies containing information from 93 onshore wind project sites (Thaxter et al. 2017) related collision rate to species-level traits and turbine characteristics to quantify the potential vulnerability of more than 9,500 bird species globally. Avian collision rate was affected by migratory strategy, dispersal distance, and habitat associations. 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 Accipitriformes (most diurnal birds of prey, but not falcons). Charadriiformes, the order of birds that includes both of the listed bird species addressed in this Opinion, was identified as vulnerable. However, predicted collisions within Charadriiformes were relatively low for charadriidae (PIPLs) and scolopacidae (which includes REKNs) (Thaxter et al. 2017).

Available Collision Risk Models

Technology does not currently exist to detect a collision of a PIPL or REKN with a WTG, and the likelihood of finding a carcass in the offshore environment is negligible. A body of literature has developed in recent decades and helps inform risk assessments for PIPL and REKN. However, considerable uncertainty remains, in part because most studies to date have been conducted at wind facilities on land and/or in Europe. Two different models are available to estimate collision risk for PIPL and REKN from the CVOW-C project. The first, referred to as Band or Band (2012) throughout this Opinion, estimates the number of annual collisions using input data on the target species (e.g., numbers, flight height, avoidance, body size, flight speed) and turbine details (e.g., number, size, and rotation speed of blades) (Band 2012). Band (2012) is an established method to assess collision risk for offshore wind projects; however, it has several known limitations (Masden 2015, Masden and Cook 2016), which are summarized below.

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 33-year lifespan of CVOW-C.

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

Collection of movement data during the study periods (2015 to 2017 for PIPL and in 2016 for REKN) was limited by: 1) tag battery life; 2) temporary tag attachment method/duration (i.e., to minimize risks to tagged individuals); 3) locations of tag deployment; and 4) detection range of land-based Motus stations (typically less than 12 mi [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 CVOW-C Lease Area is offshore of the southernmost Motus station and beyond detection range of the station. Therefore, the coverage of CVOW-C in SCRAM is not sufficient for estimating collisions. Additionally, while VHF receivers were installed on the CVOW-Pilot turbines and became active in 2021 (Normandeau 2023), this was outside the data window used in SCRAM, and the detection range noted using a test tag was up to 1.25 mi (2 km) from the turbine platform, which did not encompass the majority of the CVOW-C Lease Area.

The first version of SCRAM was released in early 2023 and reflects a number of data 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. 2022). Specific data gaps and uncertainties of concern include:

1. Sample size. The tracking data sample sizes that underpin the model are relatively small, and do not include all tracks now available (e.g., newer Motus data; any satellite, GPS, or geolocator data).
2. Accuracy. All of the flight tracks and altitudes that underpin the model are estimated from land-based receiving stations and are thus of limited accuracy because offshore bird movements were interpolated rather than measured directly. Model evaluation using a simulated data set suggested that the interpolations were reasonably accurate nearshore (where the 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. 2022).
3. Detection range. The detection range of Motus receiving stations varies with the altitude of the tagged bird, but is typically less than 12 mi (20 km) on average for birds in flight. The westernmost portions of the CVOW-C project are, at minimum, 27 mi (44 km) from the nearest land. Thus, none of the onshore receiving stations would have detected bird movements through the Lease Area.
4. Temporal gaps. Both movement and flight height data are currently limited to those times of year during which the tracking studies were carried out (Adams et al. 2022). There are no spring data for PIPL or REKN in SCRAM due to small sample sizes of available data (e.g., only 2 NB PIPLs tagged in the Bahamas with tracks in the U.S.) and limited tagging locations (e.g., most REKNs tagged in spring were in Delaware Bay). Any collision estimates from SCRAM are limited to the time periods listed below. Thus, "annual" SCRAM outputs should be considered only partial estimates of projected collision levels because they reflect summing across only those months for which data are available.
    A. PIPL:
        1. Collision risk evaluated: mid-incubation period and through fall migratory departure from tagging sites.
        2. Collision risk not evaluated: latter portion of fall migratory flights, spring migration and staging.
    B. REKN:
        1. Collision risk evaluated: fall migratory departure from tagging sites.
        2. Collision risk not evaluated: latter portion of fall migratory flights, spring migration and staging.
5. 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. 2022). 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. CVOW-C was at the southernmost extent the Motus array used for SCRAM and was not near any of the tagging sites for focal species. Therefore, collision risk is underestimated by SCRAM for this project area and the results were not considered in the consultation.

6. Bias in tagged birds. Both movement and flight height data are currently limited to those specific tagged populations tracked during the study periods (Adams et al. 2022). It is not yet clear if the bird tracks that underpin the current version of SCRAM are representative of all PIPL and REKN 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 PIPL were all derived from Motus tag deployment at 2 nesting areas in New England. No tracks are yet available from the Atlantic Canada portion of the PIPL breeding range. Preliminary results from a previous mark/resight study found that 42% of PIPLs marked in Atlantic Canada were subsequently detected in New Jersey and 52% were detected in North Carolina (J. Rock, Environment and Climate Change Canada, email to W. Walsh, Service, February 1, 2023). These Atlantic Canada PIPLs could have significant exposure to offshore wind that is not yet reflected in SCRAM collision risk estimates. REKN trapping sites covered a greater geographic area but may still not be fully representative of the overall population's use of the offshore airspace.
7. Variability. SCRAM cannot yet produce a range of plausible risk levels by varying certain "baked in" assumptions to which the model might be quite sensitive and which are associated with high uncertainty (e.g., avoidance rate, population size, flight height). Species-specific avoidance rates are critical to obtaining realistic and confident estimates of collision events (Masden and Cook 2016, Kleyheeg-Hartman et al. 2018). Both the Band and SCRAM models require inputs or make assumptions for bird flight height and speed and populations anticipated to occur within the WTG area. The species-specific data for these parameters are associated with large margins of error (Loring et al. 2018, Loring et al. 2019) and/or are based on surrogate species information developed for European species.

Methods for Estimating Numbers of Collisions

Given that SCRAM does not account for all migration periods, and CVOW-C is at the southernmost extent of the Motus area used for SCRAM and the limitations related to this described above, we are relying on the Band (2012) model outputs for estimating numbers of collisions. While there are limitations to the Band (2012) model, as stated above, we think Band (2012) represents the best available science given the location of the CVOW-C Lease Area and limitations of the SCRAM model.

For Band (2012) we input WTG specifications provided by BOEM (D. Bigger, BOEM, email to E. Argo, Service, April 27, 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.

2022). We followed the guidance from Band (2012) to develop a best estimate of the number of bird collisions, not a “worst case” scenario. For both species, we used Annex 6 – Assessing collision risks for birds on migration. We expect PIPLs in the action area to be limited to birds on migration flights. However, for REKNs, 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 REKNs). 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 REKN or PIPL in the vicinity of the CVOW-C Lease Area during any month; and (2) far greater numbers of migrating REKNs are present on the mid-Atlantic OCS compared to seasonally resident birds. Thus, we conclude that Annex 6 is the most appropriate application of the Band (2012) model to CVOW-C. However, we note that if and when seasonally resident REKNs 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 project (i.e., this “migratory front” is an imaginary line passing through the CVOW-C Lease Area and extending to the western and eastern edges of the migratory corridor used by each species).

Regarding assumption 1, we conclude that it generally holds true that PIPLs cross the migratory front only twice per year. However, we know from tracking and resighting data that REKNs 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 REKNs violate this assumption by crossing the migratory front more than twice per year. Regarding assumption 2, we conclude from tracking data that that none of the PIPLs or REKNs are evenly distributed across a migration corridor. However, we still find it 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 (see Appendix 1). To measure the width of the migration corridors, we projected the corridors in UTM18N in ArcGIS Pro, then created a new line shapefile (for each corridor) that intersected the centroid of the CVOW-C Lease Area and snapped to the eastern and western edges of the corridor. We then calculated the length of the line in kilometers using the “calculate geometry” tool. For PIPL, the migration corridor was based on radio tracking data for birds departing from Chatham, MA, and several sites in Rhode Island (Figures 5 and 6 in Loring et al. 2020b) and the known wintering distribution of the Atlantic Coast population (Elliot-Smith and Haig 2020, Gratto-Trevor et al. 2016, Elliott-Smith et al. 2015, Kirkconnell 2012). The PIPL migration corridor measures 265 km wide at the latitude of the CVOW-C Lease Area. At 22.2 km wide, the Lease Area occupies about 8% of the width of the PIPL migration corridor.

For REKN, the migration corridor was based on geolocator tracking data collected from 93 individual birds (with tags deployed across the species range) between 2009 and 2017 (Perkins 2023). Measuring 2,563 km across at the latitude of the CVOW-C Lease Area, the migration corridor encompasses all REKN geolocator tracks except those that are clearly associated with the Western RU. At 22.2 km wide, the Lease Area occupies about 1% of the width of the REKN migration corridor.

The final input required to run Band (2012), Annex 6, is the number of birds crossing the migratory front each month. Table 6 presents the population data we used for this purpose. All monthly numbers were multiplied by 33 to estimate number of collisions over the operational life of the CVOW-C turbines. The population data inputs were calculated as follows:

PIPL

1. Population data are from 2021 (USFWS 2021a) and exclude an unknown (but likely small) number of nonbreeding birds.
2. Numbers are based on birds Virginia northward, including Atlantic Canada. The SB total includes young-of-year (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 RUs as well as Delaware, Maryland, and Virginia.
3. The eastern edge of the migration corridor (shown in Appendix 1 and described in this Opinion) runs southwest parallel to the general orientation of the coast to account for migration staging areas in North Carolina (Weithman et al. 2018). The eastern edge of the corridor south of Cape Hatteras, NC, is also constrained westward to account for a larger numbers of PIPLs wintering in the western Bahamas (however, this has no effect on the width of the corridor at the latitude of the CVOW-C Lease Area). Future tagging may reveal some migration pathways to the east of the corridor and/or concentrations within this corridor. The corridor delineated here is based on the limited available data.

REKN

1. Population data are from Table 4.
2. Birds from the Western RU 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). Therefore, birds from the Western RU are excluded from this analysis.
3. In many years, a percentage of NB birds do not depart the mid-Atlantic until early June. For the purposes of this analysis, we attribute all NB birds to departing the mid-Atlantic to May.
4. Some juveniles and nonbreeding adults remain south of the migratory front, others cross the migratory front once in spring and spend the breeding season just south of the breeding grounds, while still others may remain in the mid-Atlantic for prolonged periods and may cross the migratory 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 REKN population was stable at around 8.75%

juveniles among wintering birds, and available data suggest the 3 REKN populations considered in this analysis are currently stable (USFWS 2021b). Thus, we assume 8.75% of the total wintering birds are juveniles (i.e., of the 59,269 total wintering birds in the 3 populations, 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 migratory front twice per year.

5. The total number of SB birds 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 = 27,041.6 pairs. 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.

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

	PIPL	REKN (Wide)
Total # northbound (NB) crossings	4,509	59,269
Young of the year (YOY)	2,903	27,041
Total # southbound (SB) crossings	7,412	86,310
# of Jan crossings	0	0
# of Feb crossings	0	0
# of Mar crossings	453 (10% of NB)	0
# of Apr crossings	2,702 (60% of NB)	0
# of May crossings	1,354 (30% of NB)	59,269 (100% of NB)
# of Jun crossings	745 (10% of SB)	2,371 (3% of SB)
# of Jul crossings	4,443 (60% of SB)	7,009 (8% of SB)
# of Aug crossings	2,224 (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)

Band (2012) provides outputs for multiple collision avoidance rates (Appendix 1). We note that blanket application of any avoidance rate does not account for differences among individual birds; acclimation to the proposed project; 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 proposed project on a PIPL or REKN (e.g., displacement, attraction) (Marques et al. 2021, Masden and Cook 2016, Gordon and Nations 2016, May 2015). The full range of Band (2012) outputs (avoidance rates of 93, 98, 99, and 99.5%) are included in Appendix 1. We are not aware of any studies of avoidance behaviors for any shorebird species, and we think that the 93% avoidance rate estimate recommended by Cook (2021) is the best available estimate for PIPLs and REKNs.

We recognize several factors suggesting the possibility of a PIPL avoidance rate greater than 93%. First, unlike the species studied by Cook (2021), PIPLs 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 (PIPLs) 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 PIPLs has been observed in distraction displays, including abrupt flights to escape potential predators during broken-wing displays (A. Hecht, Service, email to P. Loring and T. Kuras, Service, March 15, 2023). Finally, Loring et al. (2020a) found that visibility was high during their sample of SB offshore PIPL flights (mean: 11 mi [18 km], range: 9 to 12 mi [14 to 20 km]). Loring et al. (2020a) shows a range of southward migratory departure times and dates from Massachusetts and Rhode Island. Birds that departed on the same day often had variable flight durations to cover the similar distances. This information is consistent with informal observations of staggered arrivals and departures during both northward and southward migration and, in turn, reduces concerns that a large proportion of the PIPL population could simultaneously encounter weather conditions (e.g., dense fog) that would impair visibility, exerting a large effect on the average avoidance rate (A. Hecht, Service, email to P. Loring and T. Kuras, Service, March 15, 2023). Countervailing information, however, includes data from 2 PIPLs tagged in the Bahamas and tracked during their NB offshore flights that included periods of low visibility and precipitation (Appendix I in Loring et al. 2019). It is also uncertain whether agility of flights and the PIPLs' attention to visual cues observed on land extend to their behaviors during offshore migratory flights. Absent sufficient information to more precisely estimate avoidance rates and other data limitations described above, we applied the 93% collision avoidance rate to be conservative in our assessment.

For REKNs, Gordon and Nations (2016) used an avoidance rate of 93% in good weather and 75% in poor weather. REKN 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 2014, Niles et al. 2010).

The number of collisions expected over the 33-year lease period based on the Band (2012) model are shown in Table 7. WTG specifications were provided by BOEM on April 27, 2023 (D. Bigger, BOEM, email to E. Argo, Service, April 27, 2023).

Table 7. Total mortality of PIPLs and REKNs anticipated over 33-year lease of CVOW-C project at 93% collision avoidance rate calculated using the Band (2012) model following the methodology described above (see Appendix 1 for model output).

Mortality over 33-year lease at 93% collision avoidance rate	Number of individual PIPLs	Number of individual REKNs
Total	29	71

NLEB/TCB: Tree Clearing

Biodiversity Research Institute and Tetra Tech, Inc. (Gilardi and Yates 2022) conducted bat mist netting surveys June 9 – July 2, 2022, at 27 sites in accessible suitable habitat throughout the onshore cable route. NLEBs and TCBs were captured within the LOD. No roost trees were identified within the planned tree clearing area; however roost trees for both species were located approximately 200 ft or further from the planned clearing areas (Index Grid 2 and 3 in attachment from D. Bigger, BOEM, email to E. Argo, Service, March 21, 2023) and suitable habitat is distributed throughout the LOD (Figure 1-1 in Gilardi and Yates 2022).

While total vegetation removal includes 117.24 acres of permanent clearing and 2.35 acres of temporary clearing, Dominion has calculated that 117.04 ac of this is suitable forest habitat. The removal of the 117.04 ac of suitable forest habitat within the LOD will result in the loss of roosting and foraging habitat for NLEB and TCB. While none of the identified roost trees are within the planned tree clearing area, given the amount suitable habitat distributed throughout the LOD and the documented movements of bats between roost trees (Gilardi and Yates 2022), it is likely that one or more unidentified roost trees exist within this area. Impacts to both bat species include potential injury or mortality and reduced fitness.

Removing occupied roost trees in areas where bats are active year-round will result in direct effects to individuals. If bats are in torpor (i.e., state of mental or physical inactivity) during the cold winter months, adults and/or juveniles could be crushed when the tree falls or could be predated if they attempt to flee during daylight hours. If an undocumented occupied roost tree is cleared during the active season and the bats attempt to flee during daylight hours, they are more vulnerable to predation.

Dominion will adhere to the tree clearing dates identified below, and it is possible for an undocumented, occupied roost to be removed prior to April 1, 2024 resulting in impacts to NLEB and/or TCB.

Tree clearing timeframes:
Issue date of Opinion until 3/31/2024

- Clearing in upland areas will begin in November 2023
- Clearing in wetlands will begin in January 2024
- Clearing within 1.5 mi of NLEB roosts

Beginning on 4/1/2024

- Adhere to April 15-July 30 no tree removal TOYR in all habitats
- Adhere to December 15-February 15 no tree removal TOYR in forested wetlands only

Overall loss of forest habitat decreases opportunities for foraging and successful reproduction. Depending on location and size of the harvest, forest cover removal may cause a shift in home range or relocation. While little is known about staging and swarming behavior in the fall in the coastal plain, it is possible that loss of habitat in staging/swarming areas near winter roosts may cause a similar shift in habitat use for larger numbers of individuals, and may reduce fall mating success and/or reduced fitness.

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). Therefore, no cumulative effects are anticipated.

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.

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). In accordance with policy and regulation, the jeopardy analysis in this Opinion relies on 4 components: (1) Status of the Species, which evaluates the species' rangewide condition, the factors responsible for that condition, and its survival and recovery needs; (2) Environmental Baseline, which evaluates the status of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species, (3) Effects of the Action, which determines impacts of the proposed action, and (4) Cumulative Effects, which evaluates the effects of future, non-federal activities in the action area on the species. The jeopardy analysis in this Opinion emphasizes the rangewide survival and recovery needs of the listed species and the role of the action area in providing for those needs. 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 (see 50 CFR 402.14(g)).

In this section, we add the effects of the action and the cumulative effects to the status of the species and critical habitat and to the environmental baseline to formulate our Opinion as to whether the proposed action is likely to appreciably: (1) reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing the RND of that species; or (2) appreciably diminish the value of critical habitat for both the survival and recovery of a listed species.

Per the Service's consultation handbook (USFWS and NMFS 1998), survival is defined as "the species' persistence as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. Said another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter."

Per the Service's consultation handbook (USFWS and NMFS 1998), recovery is defined as "improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in Section 4(a)(1) of the ESA." The "criteria set out in Section 4(a)(1)" means determining when a species no longer meets the definition of an "endangered species" or a "threatened species" because of any of the following factors:

(A) present or threatened destruction, modification, or curtailment of habitat or range;
(B) overutilization for commercial, recreational, scientific, or educational purposes;
(C) disease or predation;
(D) inadequate existing regulatory mechanisms; and
(E) other natural or manmade factors affecting the species continued existence.

An endangered species is “in danger of extinction throughout all or a significant portion of its range” (see ESA Section 3(6)). A threatened species is “likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range” (see ESA Section 3(20)).

To conduct this analysis, we begin by assessing whether there are effects to any individuals of the species of interest (as discussed in the effects analysis section above). If all effects are insignificant, discountable, or wholly beneficial, no further consultation is required. In other words, if we conclude that individuals are *not* likely to experience reductions in reproductive success or survival likelihood, fitness consequences for the species rangewide would not be expected as well. In this case, the agency has ensured that their action is not likely to jeopardize the continued existence of the species and our analysis is completed. Conversely, if we are unable to show that individuals are unlikely to experience reductions in their reproductive success or survival likelihood, we are required to assess how those effects are or are not anticipated to result in an appreciable reduction in the likelihood of both the survival and recovery of the species. We do not assess appreciable reduction of reproduction, numbers or distribution at an individual level because we do not assess appreciable reduction of survival and recovery at an individual level.

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

Analysis for Jeopardy

PIPL

Impacts to Individuals – In this step we determine whether any individuals of the species will be exposed to stressors from the various activities that are part of the proposed action. If exposure is likely, the next step is to determine the fitness consequences of individuals exposed to those stressors. The fitness of an individual can be measured by its reproductive success (which is determined by vital rates such as fertility rates, age at first reproduction, and reproductive intervals) and its survival likelihood. To assess whether fitness consequences may occur, we determine whether and how individuals are likely to respond[1] upon exposure to the stressors and beneficial actions associated with the proposed action. As the response of individuals upon exposure depends upon their condition (i.e., their health and resiliency), we must first establish the baseline conditions for those individuals. If the baseline condition of the individuals is unknown, generally we can use information about the status of the population or of the species as a whole (depending on the information available) to infer the degree of resiliency possessed by the individuals.

As discussed in the Effects of the Action, effects of the action include effects to individual PIPLs present within the action area during spring and fall migration (Table 5). Effects include direct mortality of 29 individuals as a result of collisions with offshore wind turbines. In summary, we anticipate impacts to individual PIPLs in their survival.

Impacts to Populations – In this section, we evaluate the aggregated consequences of the reductions in the fitness of individuals on the population(s) to which those individuals belong. Specifically, we are analyzing how the reductions in individual fitness affect the population's abundance, reproduction, or growth rates to make inferences about the population's future reproductive success and its viability. Whether a population can withstand the consequences of aggregated fitness reductions in individuals depends upon its baseline status (i.e., its resiliency). Thus, our analysis entails defining the population(s) the individuals comprise and determining the current and future baseline condition of that population.

As we have concluded that individual PIPLs are likely to experience some reductions in their annual survival, we need to assess the aggregated consequences of the anticipated impacts on the population to which these individuals belong.

The Atlantic Coast PIPL population is comprised of 4 RUs; to evaluate the impacts of the proposed project on the population we need to consider these losses with respect to the 4 RUs. The Service anticipates that the 29 individuals killed will be distributed over time and the 4 RUs. The Southern RU has shown a decline in productivity since 2016, the cause of which has not been determined. A loss of individuals as a result of the proposed project could further exacerbate this productivity decline. The Atlantic Canada RU has also declined (23% net decline between 1989 and 2021) and any loss of individuals could exacerbate declines in this RU as well. The NY-NJ RU is tenuously stable (net increase of 81% between 1989 and 2021 and declined from a peak of 586 pairs in 2007 to 378 pairs in 2014, before rebounding to 576 pairs in 2021) and any loss of individuals may negatively impact this stability. An increase has been documented in the New England RU (514% increase between 1989 and 2021) and a loss of birds at the level anticipated as a result of the proposed project is not likely to be noticeable.

Over the 33-year lease term we expect 29 PIPLs to be killed (loss of approximately 1 PIPL per year), with the mortality distributed across years and RUs. The likelihood that 29 PIPLs would

---

[1] There are many possible biological responses (such as startle, alarm, flee, avoid, abandon/displace, reduced feeding success, reduced growth, reduced reproductive success, reproductive failure, and increased mortality) and many of these represent a form of take and thus must be expressed and evaluated in our Opinions. For our jeopardy analyses, however, reproductive success and survival are two metrics that may lead to population level consequences and are thus most relevant.

be killed during 1 migration event is low as PIPLs are not known to migrate in large flocks. Additionally, data are not available such that we can quantify the proportion of individuals that are likely to be killed from each RU. However, we anticipate that the number of individual birds killed will be distributed across all 4 RUs and a single RU would not have a disproportionate loss of individuals compared to the remaining RUs. As a result, no appreciable effect is expected to the Atlantic Coast population of PIPL.

Impacts to Species – The final step in our analysis is to ascertain whether the anticipated impacts on the population(s) or recovery unit are likely to reduce the likelihood of both survival and recovery of the species by impacting its RND. Our analysis evaluates how the population-level effects determined above influence the likelihood of progressing towards or maintaining the conservation needs of the species rangewide. To complete this analysis we need to first determine the rangewide status of the species and then compare 1) what the species needs, 2) what it has, and 3) what the future expected status is. Here we connect the relative importance of the impacted population(s) to the rangewide status of the species to the impacts (positive and negative) from the proposed action.

If our analyses indicate that appreciable reductions in numbers, reproduction, and distribution are likely to occur, we conclude that the action is likely to jeopardize the continued existence of the species. Appreciable reduction means that it impacts the species in a meaningful and consequentially negative way that is more than "background" noise of the species' population dynamics. If the population-level reductions do not appreciably (i.e., meaningfully) reduce the likelihood of progressing towards or maintaining one or more of the species' conservation needs, then the action is not likely to appreciably reduce the likelihood of both survival and recovery of the species, and our analysis is complete and a non-jeopardy determination is required.

As we have concluded that the Atlantic Coast population of PIPL (the listed entity) is unlikely to experience appreciable reductions in fitness, there will be no reduction in RND.

REKN

Impacts to Individuals – In this step we determine whether any individuals of the species will be exposed to stressors from the various activities that are part of the proposed action. If exposure is likely, the next step is to determine the fitness consequences of individuals exposed to those stressors. The fitness of an individual can be measured by its reproductive success (which is determined by vital rates such as fertility rates, age at first reproduction, and reproductive intervals) and its survival likelihood. To assess whether fitness consequences may occur, we determine whether and how individuals are likely to respond[2] upon exposure to the stressors and beneficial actions associated with the proposed action. As the response of individuals upon exposure depends upon their condition (i.e., their health and resiliency), we must first establish the baseline conditions for those individuals. If the baseline condition of the individuals is unknown, generally we can use information about the status of the population or of the species as

---

[2] There are many possible biological responses (such as startle, alarm, flee, avoid, abandon/displace, reduced feeding success, reduced growth, reduced reproductive success, reproductive failure, and increased mortality) and many of these represent a form of take and thus must be expressed and evaluated in our Opinions. For our jeopardy analyses, however, reproductive success and survival are two metrics that may lead to population level consequences and are thus most relevant.

a whole (depending on the information available) to infer the degree of resiliency possessed by the individuals.

As discussed in the Effects of the Action, effects of the action include effects to individual REKNs present within the action area during spring and fall migration (Table 5). Effects include direct mortality of 71 individuals as a result of collisions with offshore wind turbines. In summary, we anticipate impacts to individual REKNs in their survival.

Impacts to Populations – In this section, we evaluate the aggregated consequences of the reductions in the fitness of individuals on the population(s) to which those individuals belong. Specifically, we are analyzing how the reductions in individual fitness affect the population's abundance, reproduction, or growth rates to make inferences about the population's future reproductive success and its viability. Whether a population can withstand the consequences of aggregated fitness reductions in individuals depends upon its baseline status (i.e., its resiliency). Thus, our analysis entails defining the population(s) the individuals comprise and determining the current and future baseline condition of that population.

As we have concluded that individual REKNs are likely to experience some reductions in their annual survival, we need to assess the aggregated consequences of the anticipated impacts on the populations to which these individuals belong.

REKNs are distributed across 4 populations, identified by wintering region, with each population also considered its own RU. However, only 3 of these RUs will be impacted by the proposed project and its possible for birds from all 3 of these RUs to occur in the action area. The Service anticipates that the 71 individuals killed will be distributed over time and the 3 RUs. Given the population size estimates shown in Table 4 and apparent population stability (USFWS 2014), we conclude that loss of approximately 2 REKNs per year will have no appreciable effect on the SEC or NCSA RUs. The Southern RU would be more sensitive to loss of individuals, based not only on its smaller size but also the challenges that these birds face on their long migrations (USFWS 2020b). However, it is unlikely that all 71 of the anticipated collisions will occur to REKNs from the Southern RU, based on the smaller size of this RU and on the tracking data discussed above.

The proposed project is anticipated to impact REKNs during spring and fall migration resulting in a loss of 71 individuals distributed over the 33-year lease term and across 3 of the 4 RUs, and given the current population estimates and apparent population stability no appreciable effect is expected to any REKN RU.

Impacts to Species – The final step in our analysis is to ascertain whether the anticipated impacts on the population(s) or recovery unit are likely to reduce the likelihood of both survival and recovery of the species by impacting its RND. Our analysis evaluates how the population-level effects determined above influence the likelihood of progressing towards or maintaining the conservation needs of the species rangewide. To complete this analysis we need to first determine the rangewide status of the species and then compare 1) what the species needs, 2) what it has, and 3) what the future expected status is. Here we connect the relative importance of the impacted population(s) to the rangewide status of the species to the impacts (positive and negative) from the proposed action.

If our analyses indicate that appreciable reductions in numbers, reproduction, and distribution are likely to occur, we conclude that the action is likely to jeopardize the continued existence of the species. Appreciable reduction means that it impacts the species in a meaningful and consequentially negative way that is more than "background" noise of the species' population dynamics. If the population-level reductions do not appreciably (i.e., meaningfully) reduce the likelihood of progressing towards or maintaining one or more of the species' conservation needs, then the action is not likely to appreciably reduce the likelihood of both survival and recovery of the species, and our analysis is complete and a non-jeopardy determination is required.

As we have concluded that populations of REKN are unlikely to experience appreciable reductions in fitness, there will be no reduction in RND on the REKN as a whole.

NLEB

Impacts to Individuals – In this step we determine whether any individuals of the species will be exposed to stressors from the various activities that are part of the proposed action. If exposure is likely, the next step is to determine the fitness consequences of individuals exposed to those stressors. The fitness of an individual can be measured by its reproductive success (which is determined by vital rates such as fertility rates, age at first reproduction, and reproductive intervals) and its survival likelihood. To assess whether fitness consequences may occur, we determine whether and how individuals are likely to respond[3] upon exposure to the stressors and beneficial actions associated with the proposed action. As the response of individuals upon exposure depends upon their condition (i.e., their health and resiliency), we must first establish the baseline conditions for those individuals. If the baseline condition of the individuals is unknown, generally we can use information about the status of the population or of the species as a whole (depending on the information available) to infer the degree of resiliency possessed by the individuals.

As discussed in the Effects of the Action, effects of the action include effects to individual NLEBs present within the action area year-round (Table 5). NLEBs are active year-round in coastal Virginia, with a limited window during the coldest months when they may enter torpor. No roost trees were identified within the planned tree clearing area; however roost trees for NLEBs were located approximately 200 ft or further from the planned clearing areas. Given that NLEBs are known to roost singly, it is possible that an occupied undocumented roost tree will be removed during the TOYRs when 117.04 ac of suitable habitat are cleared. Effects of removing suitable roosting and possible foraging habitat include bats spending additional energy locating a new roost and finding suitable foraging habitat and increased exposure to predators during this time, as well as crushing if an undocumented roost tree is cleared during the TOYR. In summary, we anticipate impacts to individual NLEBs in either their survival or reproductive rates.

---

[3] There are many possible biological responses (such as startle, alarm, flee, avoid, abandon/displace, reduced feeding success, reduced growth, reduced reproductive success, reproductive failure, and increased mortality) and many of these represent a form of take and thus must be expressed and evaluated in our Opinions. For our jeopardy analyses, however, reproductive success and survival are two metrics that may lead to population level consequences and are thus most relevant.

Impacts to Populations – In this section, we evaluate the aggregated consequences of the reductions in the fitness of individuals on the population(s) to which those individuals belong. Specifically, we are analyzing how the reductions in individual fitness affect the population's abundance, reproduction, or growth rates to make inferences about the population's future reproductive success and its viability. Whether a population can withstand the consequences of aggregated fitness reductions in individuals depends upon its baseline status (i.e., its resiliency). Thus, our analysis entails defining the population(s) the individuals comprise and determining the current and future baseline condition of that population.

As we have concluded that individual NLEBs are likely to experience some reductions in their annual survival or reproductive rates, we need to assess the aggregated consequences of the anticipated impacts on the population(s) to which these individuals belong.

NLEBs on the coastal plain have not shown signs of WNS, and forested habitat is not considered a limiting factor through most of the species' range. The 117.04 ac of suitable habitat to be cleared as part of the onshore construction is primarily linear in nature and we do not anticipate that significant areas of NLEB habitat (roosting, foraging, and travel) will be affected by the proposed project. We expect that there will be suitable habitat adjacent to the LOD available to NLEBs after the tree clearing is complete.

Therefore, despite the declining status of the species in the action area, we conclude that adequate habitat will remain to maintain numbers, reproduction, and viability of the NLEB population in the action area.

Impacts to Species – The final step in our analysis is to ascertain whether the anticipated impacts on the population(s) or recovery unit are likely to reduce the likelihood of both survival and recovery of the species by impacting its RND. Our analysis evaluates how the population-level effects determined above influence the likelihood of progressing towards or maintaining the conservation needs of the species rangewide. To complete this analysis we need to first determine the rangewide status of the species and then compare 1) what the species needs, 2) what it has, and 3) what the future expected status is. Here we connect the relative importance of the impacted population(s) to the rangewide status of the species to the impacts (positive and negative) from the proposed action.

If our analyses indicate that appreciable reductions in numbers, reproduction, and distribution are likely to occur, we conclude that the action is likely to jeopardize the continued existence of the species. Appreciable reduction means that it impacts the species in a meaningful and consequentially negative way that is more than "background" noise of the species' population dynamics. If the population-level reductions do not appreciably (i.e., meaningfully) reduce the likelihood of progressing towards or maintaining one or more of the species' conservation needs, then the action is not likely to appreciably reduce the likelihood of both survival and recovery of the species, and our analysis is complete and a non-jeopardy determination is required.

As we have concluded that the coastal plain population of NLEBs is unlikely to experience consequential reductions in fitness, there will be no reduction in RND on the NLEB as a whole.

TCB

Impacts to Individuals – In this step we determine whether any individuals of the species will be exposed to stressors from the various activities that are part of the proposed action. If exposure is likely, the next step is to determine the fitness consequences of individuals exposed to those stressors. The fitness of an individual can be measured by its reproductive success (which is determined by vital rates such as fertility rates, age at first reproduction, and reproductive intervals) and its survival likelihood. To assess whether fitness consequences may occur, we determine whether and how individuals are likely to respond[4] upon exposure to the stressors and beneficial actions associated with the proposed action. As the response of individuals upon exposure depends upon their condition (i.e., their health and resiliency), we must first establish the baseline conditions for those individuals. If the baseline condition of the individuals is unknown, generally we can use information about the status of the population or of the species as a whole (depending on the information available) to infer the degree of resiliency possessed by the individuals.

As discussed in the Effects of the Action, effects of the action include effects to individual TCBs present within the action area year-round (Table 5). TCBs are active year-round in coastal Virginia, with a limited time during the coldest months when they may enter torpor. No roost trees were identified within the planned tree clearing area; however roost trees for TCBs were located approximately 200 ft or further from the planned clearing areas. Given that TCBs are known to roost singly, it is possible that an occupied undocumented roost tree will be removed during the TOYRs when 117.04 ac are cleared. Effects of removing suitable roosting and possible foraging habitat include bats spending additional energy locating a new roost and finding suitable foraging habitat and increased exposure to predators during this time, as well as crushing if an undocumented roost tree is cleared during the TOYR. In summary, we anticipate impacts to individual TCBs in either their survival or reproductive rates.

Impacts to Populations – In this section, we evaluate the aggregated consequences of the reductions in the fitness of individuals on the population(s) to which those individuals belong. Specifically, we are analyzing how the reductions in individual fitness affect the population’s abundance, reproduction, or growth rates to make inferences about the population’s future reproductive success and its viability. Whether a population can withstand the consequences of aggregated fitness reductions in individuals depends upon its baseline status (i.e., its resiliency). Thus, our analysis entails defining the population(s) the individuals comprise and determining the current and future baseline condition of that population.

As we have concluded that individual TCBs are likely to experience some reductions in their annual survival or reproductive rates, we need to assess the aggregated consequences of the anticipated impacts on the population(s) to which these individuals belong.

---

[4] There are many possible biological responses (such as startle, alarm, flee, avoid, abandon/displace, reduced feeding success, reduced growth, reduced reproductive success, reproductive failure, and increased mortality) and many of these represent a form of take and thus must be expressed and evaluated in our Opinions. For our jeopardy analyses, however, reproductive success and survival are two metrics that may lead to population level consequences and are thus most relevant.

TCBs on the coastal plain have not shown signs of WNS, and forested habitat is not considered a limiting factor through most of the species' range. The 117.04 ac of suitable habitat to be cleared as part of the onshore construction is primarily linear nature and we do not anticipate that significant areas of TCB habitat (roosting, foraging, and travel) will be affected by the proposed project. We expect that there will be suitable habitat adjacent to the LOD available to TCBs after the tree clearing is complete.

Therefore, despite the unknown status of the species in the action area, we conclude that adequate habitat will remain to maintain numbers, reproduction, and viability of the TCB population in the action area.

Impacts to Species – The final step in our analysis is to ascertain whether the anticipated impacts on the population(s) or recovery unit are likely to reduce the likelihood of both survival and recovery of the species by impacting its RND. Our analysis evaluates how the population-level effects determined above influence the likelihood of progressing towards or maintaining the conservation needs of the species rangewide. To complete this analysis we need to first determine the rangewide status of the species and then compare 1) what the species needs, 2) what it has, and 3) what the future expected status is. Here we connect the relative importance of the impacted population(s) to the rangewide status of the species to the impacts (positive and negative) from the proposed action.

If our analyses indicate that appreciable reductions in numbers, reproduction, and distribution are likely to occur, we conclude that the action is likely to jeopardize the continued existence of the species. Appreciable reduction means that it impacts the species in a meaningful and consequentially negative way that is more than "background" noise of the species' population dynamics. If the population-level reductions do not appreciably (i.e., meaningfully) reduce the likelihood of progressing towards or maintaining one or more of the species' conservation needs, then the action is not likely to appreciably reduce the likelihood of both survival and recovery of the species, and our analysis is complete and a non-jeopardy determination is required.

As we have concluded that the coastal plain population of TCBs is unlikely to experience consequential reductions in in fitness, there will be no reduction in RND on the TCB as a whole.

CONCLUSION

We considered the current overall improving rangewide status of PIPL and the declining condition of the species 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 RND of the PIPL. It is the Service's opinion that BOEM's approval of a COP for CVOW-C, as proposed, is not likely to jeopardize the continued existence of the PIPL.

We considered the current overall stable rangewide status of REKN and the stable condition of the species 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 RND of the REKN. It is the Service's opinion that BOEM's approval of a COP for CVOW-C, as proposed, is not likely to jeopardize the continued existence of the REKN.

We considered the current overall declining rangewide status of NLEB and the unknown condition of the species 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. The types of effects of the proposed action are not currently considered primary factors influencing the status of the species. While they may compound those factors, as stated in the Jeopardy Analysis, we do not anticipate any reductions in the overall RND of the NLEB. It is the Service's opinion that BOEM's approval of a COP for CVOW-C, as proposed, is not likely to jeopardize the continued existence of the NLEB.

We considered the current overall declining rangewide status of TCB and the unknown condition of the species 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. The types of effects of the proposed action are not currently considered primary factors influencing the status of the species. While they may compound those factors, as stated in the Jeopardy Analysis, we do not anticipate any reductions in the overall RND of the TCB. It is the Service's opinion that BOEM's approval of a COP for CVOW-C, as proposed, is not likely to jeopardize the continued existence of the TCB.

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 in Section 3 of the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to 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). 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 (ITS).

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

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service analyzed the effects to the species above.

PIPL/REKN

The Service has used available data to quantify and numerically express anticipated incidental take of PIPL and REKN. This numerical estimate provides a clear limit on the incidental take of PIPL and REKN anticipated and authorized in this Opinion. However, based on the difficulties associated with monitoring take in terms of affected individuals, the Service also uses surrogates to provide an additional, alternative means of monitoring take of PIPL and REKN. Under this approach, reinitiation of consultation will be triggered if the incidental take from the project exceeds the number of PIPL and REKN specified below or exceeds, in any amount or manner, the surrogates specified below.

Numeric Estimate of Anticipated Incidental Take

The Service anticipates incidental take of a total of 29 PIPLs and 71 REKNs as a result of this proposed action. The numerical estimate of incidental take was calculated based on the Band (2012) collision risk model (see calculations in Effects of the Action section). The incidental take is expected to be in the form of kill. The anticipated take is described in Table 8.

Monitoring Take

It is not practical to monitor take-related impacts in terms of individual PIPLs and REKNs for the following reasons: the offshore environment makes encountering a dead or injured individual unlikely due to the remote location, small body size of the species, and likelihood that if an injured or dead individual landed in the water it would sink, travel outside the action area with the current, and/or be preyed upon by other organisms. Therefore, modelling with Band (2012) and SCRAM (once limitations in SCRAM have been addressed), using the best available science incorporating new movement and species data, will be used to track take and determine if take has been met or exceeded. The details of how modelling will be performed can be found in the Effects of the Action section above.

NLEB/TCB

The Service anticipates incidental take of NLEB and TCB. The Service must specify the amount or extent of such incidental taking. “A surrogate (*e.g.*, similarly affected species or habitat or ecological conditions) may be used to express the amount or extent of anticipated take provided that the biological opinion or incidental take statement: Describes the causal link between the surrogate and take of the listed species, explains why it is not practical to express the amount or extent of anticipated take or to monitor take-related impacts in terms of individuals of the listed species, and sets a clear standard for determining when the level of anticipated take has been exceeded.” 50 CFR 402.14(i)(1)(i).

Here, the Service uses acres of suitable habitat impacted as a surrogate for take of NLEB and TCB. There is a causal link between acres of suitable habitat impacted and take of the NLEB and TCB because tree-clearing impacts the habitat and is the cause of all forms of take that are reasonably certain to result from the project. The incidental take is expected to be in the form of harm or kill resulting from tree clearing, due to additional energy expenditure from travelling to new roosts, increased exposure to predators, and crushing from tree felling.

It is not practical to express the amount or extent of anticipated take in terms of individuals of the listed species. These species are active at night, may switch roosts throughout the year, and reduce their activity in the winter making detection of take of individual bats impractical. Additionally, any effects to the species' food supply, fecundity, or survival would be difficult to detect (e.g., starvation or failure to reproduce cannot be detected), and effects due to habitat fragmentation and removal are often not immediately detectable (e.g., take occurs only when bats increase their activity in the area in the active season) and it would be difficult to determine the extent to which changes in broad scale population data are attributable to the project. Thus, quantifying the specific number of individuals reasonably certain to be affected by the action is not practicable.

It is likewise not practical to monitor take-related impacts in terms of individual NLEB or TCB for the following reasons: (1) these species have a small body size and are drab in color, which makes encountering dead or injured individuals unlikely; (2) any dead or injured NLEB or TCB may be eaten or scavenged; (3) NLEBs and TCBs occupy habitats (heavily forested) where they are difficult to locate (multiple roosts located varying distances from the action area); (4) NLEBs roost in small numbers during the winter (Jordan 2020) and thus are difficult to locate; (5) take may occur offsite (e.g., the bat dies outside of the action area); and (6) starvation or failure to reproduce cannot be detected. Moreover, take would occur only when the bats become more active in the summer and therefore presumably use more trees and, as a result, it is impossible to track or monitor take in real time. Furthermore, available survey techniques are effective only for determining bat presence/probable absence in a particular area; they cannot be used to track in real time the number of bats that may experience lethal or sublethal take from ongoing activities. For these reasons, it is not practicable to monitor take-related impacts in terms of individuals of the species, requiring the use of a surrogate.

Reinitiation of consultation will be triggered if the incidental take from the project exceeds the surrogate specified below.

Use of acres of suitable habitat impacted as a surrogate for take allows the Service to set a clear standard – i.e., the number of acres as described below – for determining when the level of anticipated take has been exceeded. Because the location, timing, and acreage of habitat impacts can be readily identified, measured, and monitored, this surrogate provides a clear standard for monitoring the anticipated take and for detecting when the anticipated level of take may be exceeded, thereby providing a clear trigger for reinitiating consultation.

The Service therefore will use the acreage of impacted suitable habitat as a surrogate to express and monitor take related to tree clearing for onshore construction. We calculated the area of suitable habitat impacted by tree clearing based on tables provided by Dominion detailing

acreages to be cleared (M. Jabs, Dominion, email to B. Houghton et al., May 17, 2023). These areas are described in the Effects of the Action section and depicted in Figures 1 and 3.
The 117.04 ac of suitable habitat removal sets a clear, enforceable standard, and forest habitat removal related to tree clearing outside of that specific area exceeds take. The anticipated take is described in Table 8.

Table 8. Amount and type of anticipated incidental take over 33-year lease term.

Species	Amount of Take Anticipated (Number of Individuals)	Amount of Take Anticipated (Surrogate)	Life Stage when Take is Anticipated	Type of Take	Take is Anticipated as a Result of
PIPL	29	n/a	Adults, juveniles	Kill	Collision with turbines
REKN	71	n/a	Adults, juveniles	Kill	Collision with turbines
NLEB	n/a	117.04 acres of suitable habitat	All	Harm, kill	Removal of suitable habitat, felling of undocumented roost trees resulting in crushing, or increasing vulnerability to predators
TCB					

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of PIPL, REKN, NLEB, and TCB:

PIPL/REKN/NLEB/TCB

1. Ensure that all individuals performing work onshore (i.e., Dominion staff, concessioners, contractors) are familiar with the PIPL, REKN, NLEB, and TCB and their respective habitats and are aware of all protection measures detailed in this Opinion.

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.

PIPL/REKN/NLEB/TCB

1. Provide annual training to all individuals directly or indirectly responsible for implementing and/or overseeing actions described in the BA. The training will review the protection measures outlined in the BA and how the conservation measures are to be implemented, species habitat characteristics, and applicable locations for NLEB and TCB.

MONITORING AND REPORTING REQUIREMENTS

PIPL/REKN

1. Prior to commissioning the first WTG, 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 BOEM evaluated to reduce or minimize bird collisions at the CVOW-C WTGs. Provide this summary to the Service contact email provided below.

2. Within 5 years of commissioning the first WTG, and then every 5 years for the life of the project, 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.
    A. BOEM must distribute a draft Collision Minimization Report to the Service and Dominion for a 60-day review period. 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.
    B. Following issuance of the final Collision Minimization Report, the Service may request a meeting. Within 60 days following the Service's request, BOEM must convene a meeting with the Service and Dominion. Meeting participants will discuss the Collision Minimization Report and seek consensus on whether implementation of any technologies/methods is warranted.
    C. Within 60 days of the close of the review period if a meeting is not held, BOEM must provide a plan to the Service and Dominion that details how the technologies/methods will be implemented.
3. Provide updated model runs and associated input data from both SCRAM and Band (2012) for PIPL and REKN using the best available information on each species and provide a report containing this information by December 31 of each year until the year after decommissioning is complete to the Service contact email provided below.

PIPL/REKN/NLEB/TCB

4. Care must be taken in handling any dead or injured specimens of proposed or listed species to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead or injured specimens does not imply enforcement proceedings pursuant to the ESA. The reporting of dead or injured specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective. Upon locating a dead or injured specimen, notify the Service's Virginia Law Enforcement Office at 804-771-2883 and the Virginia Field Office at the phone number provided below.
5. Notify the Service regarding the projected and actual start dates, progress, and completion of the project and verify that the removal of 117.04 acres of trees was not exceeded, and confirmation that all conservation measures were followed. Provide a report containing this information by December 31 of each year until the year after construction is complete to the Service contact email provided below.

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.

1. Adopt compensatory mitigation ratios greater than 1:1.
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 than the project-induced mortality. Thus, a compensatory mitigation ratio greater than 1:1 is recommended, particularly given the extent of full buildout of WTGs on the OCS.

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.
Develop, adopt, and implement an Offshore Wind Adaptive Monitoring and Impact Minimization Framework (Framework) for flying wildlife. 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 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.

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 (USFWS and NMFS 1998) 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 is 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 U.S. Atlantic Coast. Besides the two existing offshore wind energy facilities (Block Island Wind offshore Rhode Island and CVOW-Pilot), we understand there are 26 additional projects (including CVOW-C) in various stages of development offshore the U.S. coast from Maine to Virginia. As the Department of the Interior continues moving toward the national goal of deploying 30 gigawatts of offshore wind by 2030, we anticipate 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 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.

4. Compensatory Mitigation.

To minimize population-level effects on listed birds, BOEM should provide (or require Dominion to provide) appropriate compensatory mitigation to offset projected levels of take of listed birds from WTG collision. Compensatory mitigation should be consistent with the conservation needs of listed species as identified in Service documents including, but not limited to, listing documents, Species Status Assessments, Recovery Plans, Recovery Implementation Strategies (RIS), and 5-Year Reviews. Compensatory mitigation should preferentially address priority actions, activities, or tasks identified in a Recovery Plan, RIS, or 5-Year Review, for

PIPL and REKN; however, research, monitoring, outreach, and other recovery efforts that do not offset birds killed via collision mortality are not considered compensatory mitigation.

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

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

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

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

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

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

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

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.

REINITIATION NOTICE

This concludes formal consultation and conference on the actions outlined in the request. As provided in 50 CFR 402.16, reinitiation of consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the 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.

The ITS provided in this conference opinion does not become effective until the species is listed and the conference opinion is adopted as the biological opinion. You may ask the Service to confirm the conference opinion as a biological opinion issued through formal consultation if the TCB is listed. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference opinion as the biological opinion on the project for the TCB and no further Section 7 consultation will be necessary.

After listing of the TCB and any subsequent adoption of this conference opinion, the Federal agency shall request reinitiation of consultation if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect the species or critical habitat in a manner or to an extent not considered in this conference opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the species or critical habitat that was not considered in this conference opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

If you have any questions regarding this Opinion or our shared responsibilities under the ESA, please contact Emily Argo of this office at emily_argo@fws.gov or 804-824-2405.

cc: BOEM (Bonnie.houghton@boem.gov)
BSEE (Andrea.Heckman@bsee.gov, graham.tuttle@bsee.gov)
EPA (timmermann.timothy@epa.gov, Nevshehirlian.Stepan@epa.gov, traver.carrie@epa.gov, lapp.jeffrey@epa.gov, Rudnick.Barbara@epa.gov)
USACE (ann.m.dilorenzo@usace.army.mil, Naomi.J.Handell@usace.army.mil, Nicole.L.Woodward@usace.army.mil)
USCG (Matthew.K.Creelman2@uscg.mil, Robert.D.webb3@uscg.mil, Matthew.j.mseskun@uscg.mil, George.H.Detweiler@uscg.mil)
VDWR (ruth.boettcher@dwr.virginia.gov)

LITERATURE CITED

Adams, E.M., A. Gilbert, P. Loring, and K.A. Williams. 2022. Transparent modeling of collision risk for three federally listed bird species in relation to offshore wind energy development. Report to U.S. Department of the Interior, Bureau of Ocean Energy Management, Sterling, VA. 79 pp.

Atlantic States Marine Fisheries Commission. 2022. 2021 Revision to the adaptive resource management framework and peer review report. Arlington, VA.

Avian Power Line Interaction Committee (APLIC). 2012. Reducing Avian Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute and APLIC. Washington, D.C.

Band, B. 2012. Using a collision risk model to assess bird collision risks for offshore wind farms. Report to The Crown Estate. Thetford, Norfolk, United Kingdom. 62 pp.

Barbour, R.W., and W.H. Davis. 1969. Bats of America. The University of Kentucky Press, Lexington, KY.

Bort Thornton, J., M. Richlen, T. McDonald, and J. Bell. 2023. Opportunistic offshore sighting of a tricolored bat (*Perimyotis subflavus*). Southeastern Naturalist 22(1):N9-N12.

Bureau of Ocean Energy Management. 2022. Coastal Virginia offshore wind commercial project biological assessment for the U.S. Fish and Wildlife Service. Office of Renewable Energy Programs, Sterling, VA.

Bureau of Ocean Energy Management. 2023. Addendum to the CVOW-C Endangered Species Act biological assessment. Office of Renewable Energy Programs, Sterling, VA.

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

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.

Caire, W., R.K. LaVal, M.L. LaVal, and R. Clawson. 1979. Notes on the ecology of *Myotis keenii* (Chiroptera, Vespertilionidae) in eastern Missouri. American Midland Naturalist 102(2): 404–407.

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

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

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.

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

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

Dowling, Z., P.R. Sievert, E. Baldwin, L. Johnson, S. von Oettingen, and J. Reichard. 2017. Flight activity and offshore movements of nano-tagged bats on Martha's Vineyard, MA. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Sterling, VA.

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

Easterla, D.A. 1968. Parturition of Keen's Myotis in southwestern Missouri. Journal of Mammalogy 49(4):770.

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, Reston, VA and Environment Canada, Toronto, Ontario, Canada.

Elliott-Smith, E. and S.M. Haig. 2020. Piping plover (*Charadrius melodus*). The Cornell Lab of Ornithology Birds of the World [Internet]. Ithaca, NY [modified March 4, 2020; cited August 7, 2023]. Available here: *https://birdsoftheworld.org/bow/species/pipplo/1.0/introduction*

Foster, R.W., and A. Kurta. 1999. Roosting ecology of the northern bat (*Myotis septentrionalis*) and comparisons with the endangered Indiana bat (*Myotis sodalis*). Journal of Mammalogy 80(2):659–672.

Gilardi, E. and D. Yates. 2022. Northern long-eared bat presence/absence mist netting survey, coastal Virginia offshore wind commercial project – Hampton roads area, Virginia. Report to Dominion Energy, Richmond, VA.

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. Department of the Interior, Bureau of Ocean Energy Management, Sterling, VA.

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

Hyzy, B.A., R.E. Russel, A. Silvis, W.M. Ford, J. Riddle, and K. Russel. 2020. Investigating maternity roost selection by northern long-eared bats at three sites in Wisconsin. Endangered Species Research 41:55–65.

Jordan, G.W. 2020. Status of an anomalous population of northern long-eared bats in coastal North Carolina. Journal of Fish and Wildlife Management 11(2):665–678; e1944-687X. https://doi.org/10.3996/JFWM-20-018

Kirkconnell Paez, A. 2012. Charadrius melodus Ord, 1824. Pages 222–224 in Libro Rojo de Los Vertebrados de Cuba. Editorial Academia, La Habana.

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.

Krochmal, A.R. and D.W. Sparks. 2007. Timing of birth and estimation of age of juvenile *Myotis septentrionalis* and *Myotis lucifugus* in west–central Indiana. Journal of Mammalogy 88(3):649–656.

Kunz, T.H. 1971. Reproduction of some vespertilionid bats in central Iowa. American Midland Naturalist 86(2):477–486.

Kurta, A., J. Caryl and T. Lipps. 1997. Bats and Tippy Dam: species composition, seasonal use, and environmental parameters. Michigan Academician 29(4):473–490.

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. Bureau of Ocean Energy Management, Sterling, VA.

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. Bureau of Ocean Energy Management, Sterling, VA.

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

Loring, P.H., A.K. Lenske, J.D. McLaren, M. Aikens, A.M. Anderson, Y. Aubrey, E. Dalton, A. Dey, C. Friis, D. Hamilton, B. Holberton, D. Kriensky, D. Mizrahi, L. Niles, K.L. Parkins, J. Paquet, F. Sanders, A. Smith, Y. Turcotte, A. Vitz, and P.A. Smith. 2020b. Tracking movements of migratory shorebirds in the U.S. Atlantic Outer Continental Shelf region. Bureau of Ocean Energy Management, Sterling, VA.

Lowe, A.J. 2012. Swarming behaviour and fall roost-use of little brown (*Myotis lucifugus*), and northern long-eared bats (*Myotis septentrionalis*) in Nova Scotia, Canada. M.S. Thesis, St. Mary's University, Halifax, Nova Scotia, Canada.

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

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

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

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

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

Matus, R. 2021. Results of the 2021 aerial census at Bahía Lomas, Chile. Western Hemisphere Shorebird Reserve Network [Internet]. Manomet, MA [modified March 18, 2021; cited August 7, 2023]. Available from: *https://whsrn.org/results-of-the-2021-aerial-census-at-bahia-lomas-chile/*

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 to National Fish and Wildlife Foundation, Washington, DC.

Nagorsen, D.W. and R.M. Brigham. 1993. Bats of British Columbia. University of British Columbia Press, Vancouver, British Columbia, Canada.

Niles, LJ. 2014. Braving Brazil. A rube with a view: a journal about wildlife [Internet]. [Modified February 25, 2014; cited on August 7, 2023]. Available from *https://www.arubewithaview.com/2014/02/25/braving-brazil/.*

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.

Normandeau Associates, Inc. 2011. New insights and new tools regarding risk to roseate terns, piping plovers, and red knots from wind facility operations on the Atlantic Outer Continental Shelf. Report to U.S. Department of the Interior, Bureau of Ocean Energy Management, New Orleans, LA.

Normandeau Associates, Inc. 2023. Postconstruction bird and bat monitoring at the coastal Virginia offshore wind pilot project first annual report. Report to Dominion Energy, Richmond, VA.

North American Bat Monitoring Program. 2023. NABat Status and Trends. U.S. Geological Survey [Internet]. [Modified March 11, 2022; cited on August 7, 2023]. Available from *https://sciencebase.usgs.gov/nabat/#/results*.

Owen, S.F., M.A. Menzel, W.M. Ford, J.W. Edwards, B.R. Chapman, K.V. Miller, and P.B. Wood. 2002. Roost tree selection by maternal colonies of northern long-eared Myotis in an intensively managed forest. USDA Forest Service, Newtown Square, PA.

Parsons, S., K.J. Lewis, and J.M. Psyllakis. 2003. Relationships between roosting habitat of bats and decay of aspen in the sub-boreal forests of British Columbia. Forest Ecology and Management 177:559–570.

Perkins, G. 2023. Geolocator project coordinator: using geolocator tracking data to advance understanding of red knot migration habits. Report to Environment and Climate Change Canada, Canadian Wildlife, Sackville, New Brunswick, Canada.

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

Randall, J. and H.G. Broders. 2014. Identification and characterization of swarming sites used by bats in Nova Scotia, Canada. Acta Chiropterologica 16:109–116.

Ratcliffe, J.M. and J.W. Dawson. 2003. Behavioral flexibility: the little brown bat, Myotis lucifugus, and the northern long-eared bat, M. septentrionalis, both glean and hawk prey. Animal Behaviour 66:847–856.

Sasse, D.B. and P.J. Pekins. 1996. Summer roosting ecology of northern long-eared bats *(Myotis septentrionalis)* in the White Mountain National Forest. British Columbia Ministry of Forests Working Paper 23:91-101.

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

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. Report to U.S. Geological Survey, Reston, VA.

Silvis, A., R.W. Perry, and W.M. Ford. 2016. Relationships of three species of bats impacted by white-nose syndrome to forest condition and management. Report to Southern Research Station, United States Forest Service, Asheville, NC.

Smith D.R., N.L. Allan, C.P. McGowan, J.A. Szymanski, S.R. Oetker, and H.M. Bell. 2018. Development of a species status assessment process for decisions under the U.S. Endangered Species Act. Journal of Fish and Wildlife Management 9(1):302-320.

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

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

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

Stratton, C. and K.M. Irvine. 2022. Summertime analysis statistical report for little brown, northern long-eared, and tricolored bat Species Status Assessment. Pages 73-123 in Straw, B.R, J. A. Martin, J.D. Reichard, and B.E. Reichert, eds. Analytical assessments in support of the U.S. Fish and Wildlife Service 3-bat Species Status Assessment. U.S. Geological Survey, Fort Collins, CO; U.S. Fish and Wildlife Service, Hadley, MA, and Bat Conservation International, Austin, TX.

Stucker, J.H., F.J. Cuthbert, B. Winn, B.L. Noel, S.M. Maddock, P.R. Leary, J. Cordes, and L.C. Wemmer. 2010. Distribution of non-breeding Great Lakes piping plovers (*Charadrius melodus*) along Atlantic and Gulf of Mexico coastlines: ten years of band sightings. Waterbirds 33(1):22-32.

Tetra Tech, Inc. 2021. Construction and operations plan coastal Virginia offshore wind commercial project. Report to Dominion Energy Services, Inc., Richmond, VA.

Tetra Tech, Inc. 2023. Aerial nest survey field report coastal Virginia offshore wind commercial project. Report to Dominion Energy Services, Inc., Richmond, VA.

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

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

U.S. Fish and Wildlife Service. 1996. Piping plover (*Charadrius melodus*), Atlantic Coast population, revised recovery plan. Hadley, MA.

U.S. Fish and Wildlife Service. 2009. Piping plover (*Charadrius melodus*) 5-year review: summary and evaluation. Northeast Region, Hadley, MA and Michigan Field Office, East Lansing, MI.

U.S. Fish and Wildlife Service. 2014. Rufa red knot background information and threats assessment. Supplement to endangered and threatened wildlife and plants; final threatened status for the rufa red knot (*Calidris canutus rufa*). New Jersey Field Office, Pleasantville, NJ.

U.S. Fish and Wildlife Service. 2020a. Piping plover (*Charadrius melodus*) 5-year review: summary and evaluation. Michigan Field Office, East Lansing, MI and Northeast Region, Hadley, MA.

U.S. Fish and Wildlife Service. 2020b. Species status assessment report for the rufa red knot (*Calidris canutus rufa*). New Jersey Field Office, Galloway, NJ.

U.S. Fish and Wildlife Service. 2021a. Rufa red knot (*Calidris canutus rufa*) 5-year review:

summary and evaluation. New Jersey Field Office, Galloway, NJ.

U.S. Fish and Wildlife Service. 2021b. Species status assessment report for the tricolored bat (Perimyotis *subflavus*). Northeast Region, Hadley, MA.

U.S. Fish and Wildlife Service. 2022a. Abundance and productivity estimates - 2021 update Atlantic Coast piping plover population. Northeast Region, Hadley, MA.

U.S. Fish and Wildlife Service. 2022b. U.S. Fish and Wildlife Service evaluation of the Atlantic States Marine Fisheries Commission horseshoe crab/red knot adaptive resource management revision. Northeast Region, Hadley, MA.

U.S. Fish and Wildlife Service. 2022c. Species status assessment report for the northern long-eared bat (*Myotis septentrionalis*). Great Lakes Region, Bloomington, MN.

U.S. Fish and Wildlife Service. 2023a. Piping plover. U.S. Fish and Wildlife Service [Internet]. Falls Church, VA [modified 2023; cited August 7, 2023].

U.S. Fish and Wildlife Service. 2023b. 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. Long Island Field Office, Long Island, NY.

U.S. Fish and Wildlife Service. 2023c. Recovery plan for the rufa red knot (*Calidris canutus rufa*). New Jersey Field Office, Galloway, NJ.

U.S. Fish and Wildlife Service. 2023d. Guidance for Coordination of Data for Avian Tracking Studies.

U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1998. Endangered species consultation handbook procedures for conducting consultation and conference activities under Section 7 of the Endangered Species Act. Falls Church, VA and Silver Springs, MD. https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

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

Weithman, C.E., D. Gibson, K.M. Walker, S.B. Maddock, J.D. Fraser, S.K. Karpanty, and D.H. Catlin. 2018. Discovery of an important stopover location for migratory piping plovers (*Charadrius melodus*) on South Point, Ocracoke Island, North Carolina, USA. Waterbirds. 41(1):56-62.

Western Hemisphere Shorebird Reserve Network. 2020. Results of the 2020 aerial survey of rufa red knot in Tierra del Fuego. Western Hemisphere Shorebird Reserve Network [Internet]. Manomet, MA [modified April 28, 2020; cited August 7, 2023]. Available from**:** *https://whsrn.org/results-of-the-2020-aerial-survey-of-rufa-red-knot-in-tierra-del-fuego/.*

Whitaker, J.O. and W.J. Hamilton. 1998. Order Chiroptera: Bats. Pages 89–102 *in* Mammals of the eastern United States, Third Edition. Comstock Publishing Associates, a Division of Cornell University Press, Ithaca, NY.

Whitaker, J.O. and R.E. Mumford. 2009. Northern Myotis. Pages 207–214 *in* Mammals of Indiana. Indiana University Press, Bloomington, IN.

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.

Wolf, S., B. Hartl, C. Carroll, M.C. Neel, and D.N. Greenwald. 2015. Beyond PVA: Why recovery under the Endangered Species Act is more than population viability. Bioscience 65:200-207.

CONSULTATION HISTORY

02-23-21 – present	The Service and Dominion communicated by email and calls about the Avian/Bat Work Plan for CVOW-C and have maintained regular communication about study status.
09-16-22	The Service provided comments to BOEM on the August 31, 2022 draft BA.
12-16-22	BOEM provided a revised BA and comment responses to the Service.
03-31-23	The Service determined that the December 26, 2022 BA and subsequent emails met the criteria for a complete BA and notified FPSCI that this criteria had been met.
04-27-23	The Service received an addendum to the BA changing the effect determination for REKN.
05-17-23	The Service received updated tree clearing information.
06-15-23	The Service issued a non-concurrence letter and recommendation to initiate formal consultation.
06-16-23	BOEM requested to initiate formal consultation.

APPENDIX 1

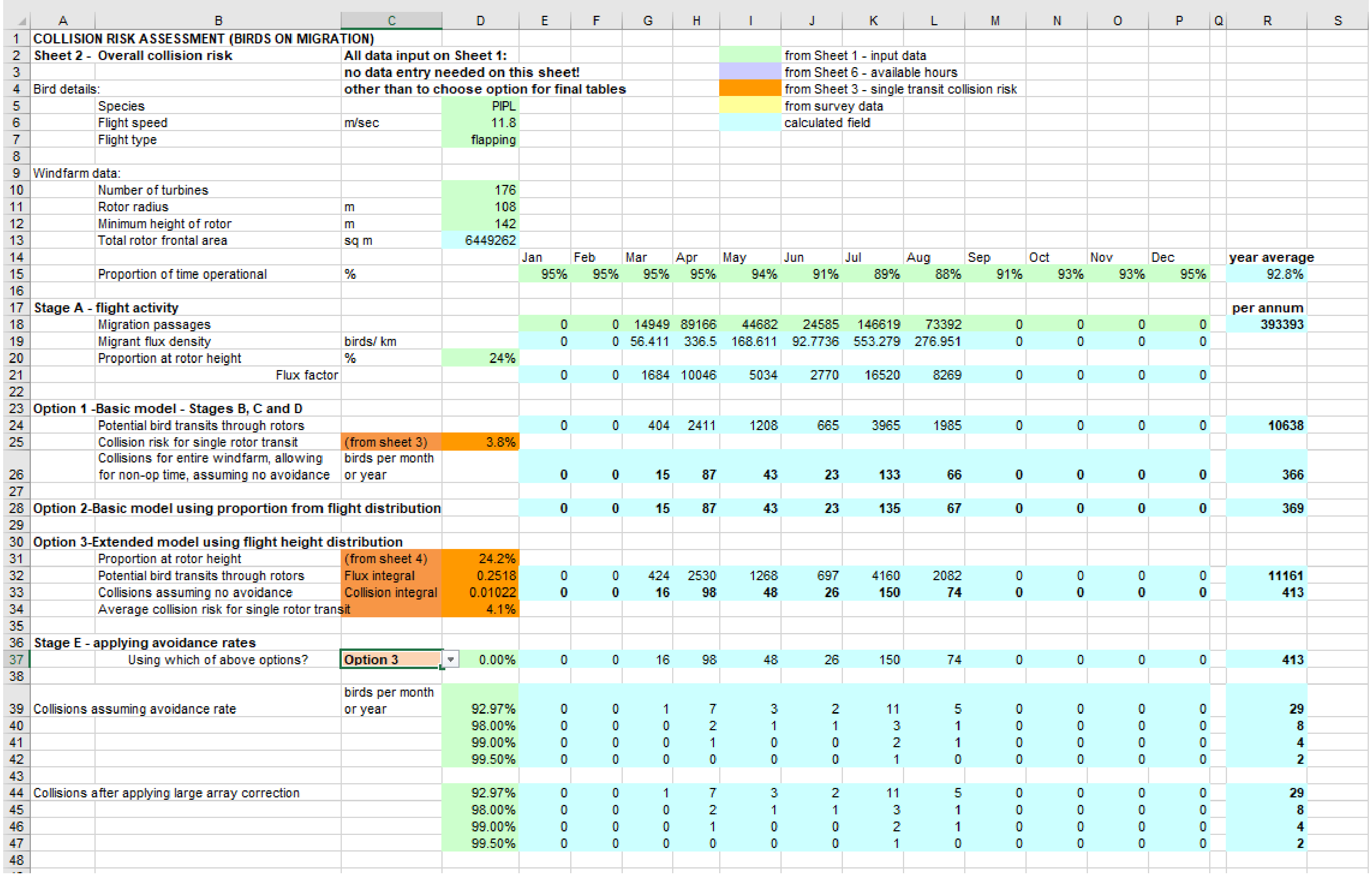
Estimated Numbers of Collisions Over 33 Years of Wind Turbine Generator (WTG) Operation as Projected by Two Different Collision Risk Models

Stochastic Collision Risk Assessment for Movement Data (SCRAM)

Estimated monthly number (95% prediction intervals) of collisions operated by SCRAM. Results include only months that have movement data and should be considered partial estimates of annual and operational collision risk. Operational risk calculated for 33-year period.

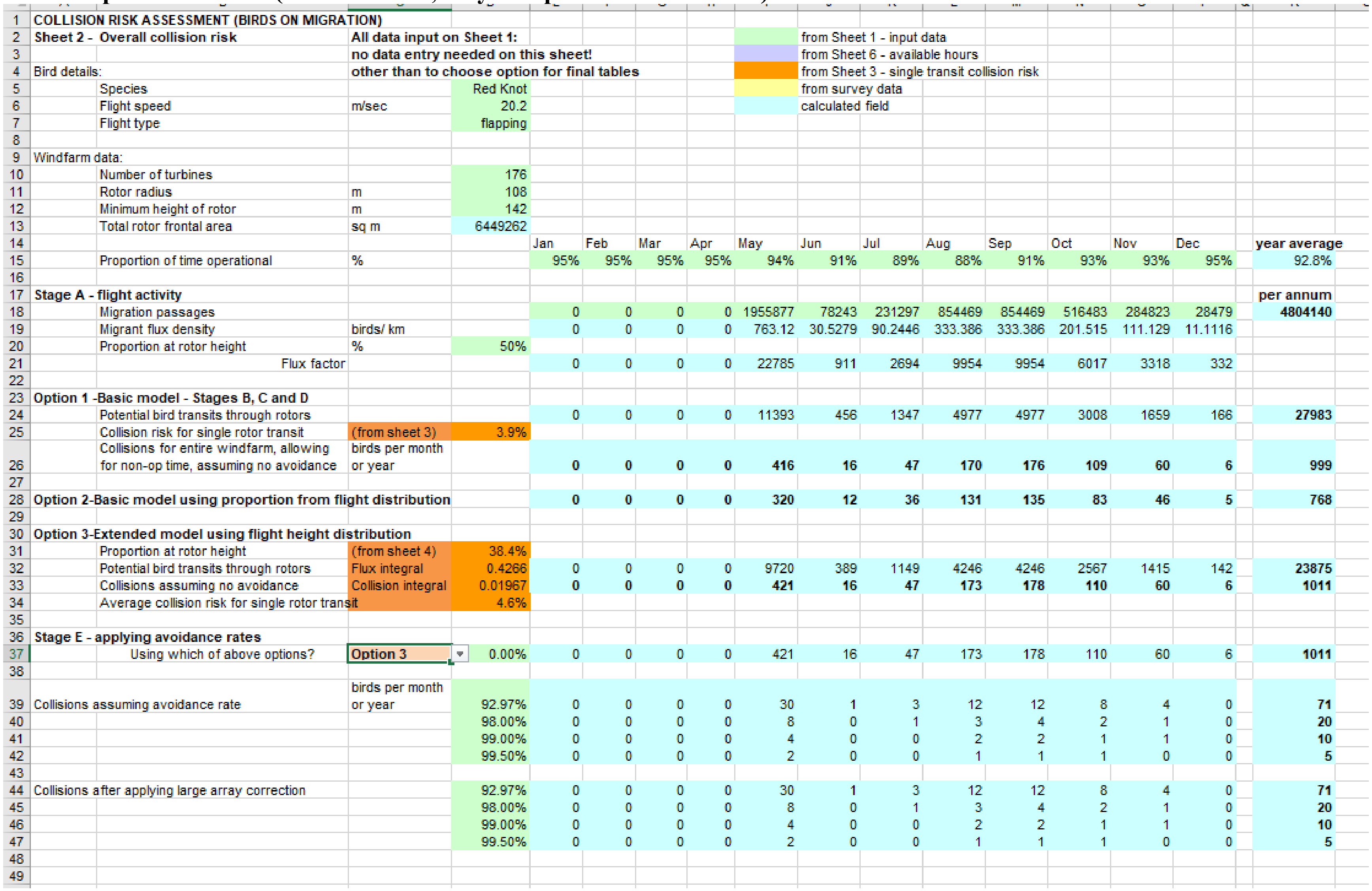
	Mean	**Lower**	**Upper**
PIPL			
Annual	0.0217	0.00015	0.17
Operational	0.7161	0.00495	5.61
REKN			
Annual	0.0859	0.00012	1.05
Operational	2.8347	0.00396	34.65

Band 2012 outputs – Piping Plover (33-year operational estimates)



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	**COLLISION RISK ASSESSMENT (BIRDS ON MIGRATION)**																		
2	**Sheet 2 -**	**Overall collision risk**	**All data input on Sheet 1:**						🟩	from Sheet 1 - input data									
3			**no data entry needed on this sheet!**						🟪	from Sheet 6 - available hours									
4	Bird details:		**other than to choose option for final tables**						🟧	from Sheet 3 - single transit collision risk									
5		Species		PIPL					🟨	from survey data									
6		Flight speed	m/sec	11.8					🟦	calculated field									
7		Flight type		flapping															
8																			
9	Windfarm data:																		
10		Number of turbines		176															
11		Rotor radius	m	108															
12		Minimum height of rotor	m	142															
13		Total rotor frontal area	sq m	6449262															
14					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		**year average**	
15		Proportion of time operational	%		95%	95%	95%	95%	94%	91%	89%	88%	91%	93%	93%	95%		92.8%	
16																			
17	**Stage A - flight activity**																	**per annum**	
18		Migration passages			0	0	14949	89166	44682	24585	146619	73392	0	0	0	0		393393	
19		Migrant flux density	birds/ km		0	0	56.411	336.5	168.611	92.7736	553.279	276.951	0	0	0	0			
20		Proportion at rotor height	%	24%															
21		Flux factor			0	0	1684	10046	5034	2770	16520	8269	0	0	0	0			
22																			
23	**Option 1 -Basic model - Stages B, C and D**																		
24		Potential bird transits through rotors			0	0	404	2411	1208	665	3965	1985	0	0	0	0		**10638**	
25		Collision risk for single rotor transit	(from sheet 3)	3.8%															
26		Collisions for entire windfarm, allowing for non-op time, assuming no avoidance	birds per month or year		**0**	**0**	**15**	**87**	**43**	**23**	**133**	**66**	**0**	**0**	**0**	**0**		**366**	
27																			
28	**Option 2-Basic model using proportion from flight distribution**				**0**	**0**	**15**	**87**	**43**	**23**	**135**	**67**	**0**	**0**	**0**	**0**		**369**	
29																			
30	**Option 3-Extended model using flight height distribution**																		
31		Proportion at rotor height	(from sheet 4)	24.2%															
32		Potential bird transits through rotors	Flux integral	0.2518	0	0	424	2530	1268	697	4160	2082	0	0	0	0		**11161**	
33		Collisions assuming no avoidance	Collision integral	0.01022	**0**	**0**	**16**	**98**	**48**	**26**	**150**	**74**	**0**	**0**	**0**	**0**		**413**	
34		Average collision risk for single rotor transit		4.1%															
35																			
36	**Stage E - applying avoidance rates**																		
37		Using which of above options?	**Option 3**	0.00%	0	0	16	98	48	26	150	74	0	0	0	0		**413**	
38																			
39	Collisions assuming avoidance rate		birds per month or year	92.97%	0	0	1	7	3	2	11	5	0	0	0	0		**29**	
40				98.00%	0	0	0	2	1	1	3	1	0	0	0	0		**8**	
41				99.00%	0	0	0	1	0	0	2	1	0	0	0	0		**4**	
42				99.50%	0	0	0	0	0	0	1	0	0	0	0	0		**2**	
43																			
44	Collisions after applying large array correction			92.97%	0	0	1	7	3	2	11	5	0	0	0	0		**29**	
45				98.00%	0	0	0	2	1	1	3	1	0	0	0	0		**8**	
46				99.00%	0	0	0	1	0	0	2	1	0	0	0	0		**4**	
47				99.50%	0	0	0	0	0	0	1	0	0	0	0	0		**2**	
48																			

Band outputs: Red Knot (wide corridor, 33-year operational estimates)



1	COLLISION RISK ASSESSMENT (BIRDS ON MIGRATION)																
2	**Sheet 2 -**	**Overall collision risk**	**All data input on Sheet 1:**						🟩	from Sheet 1 - input data							
3			**no data entry needed on this sheet!**						🟪	from Sheet 6 - available hours							
4	Bird details:		**other than to choose option for final tables**						🟧	from Sheet 3 - single transit collision risk							
5		Species		Red Knot					🟨	from survey data							
6		Flight speed	m/sec	20.2					🟦	calculated field							
7		Flight type		flapping													
8																	
9	Windfarm data:																
10		Number of turbines		176													
11		Rotor radius	m	108													
12		Minimum height of rotor	m	142													
13		Total rotor frontal area	sq m	6449262													
14					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**year average**
15		Proportion of time operational	%		95%	95%	95%	95%	94%	91%	89%	88%	91%	93%	93%	95%	92.8%
16																	
17	**Stage A - flight activity**																**per annum**
18		Migration passages			0	0	0	0	1955877	78243	231297	854469	854469	516483	284823	28479	**4804140**
19		Migrant flux density	birds/ km		0	0	0	0	763.12	30.5279	90.2446	333.386	333.386	201.515	111.129	11.1116	
20		Proportion at rotor height	%	50%													
21		Flux factor			0	0	0	0	22785	911	2694	9954	9954	6017	3318	332	
22																	
23	**Option 1 -Basic model - Stages B, C and D**																
24		Potential bird transits through rotors			0	0	0	0	11393	456	1347	4977	4977	3008	1659	166	**27983**
25		Collision risk for single rotor transit	(from sheet 3)	3.9%													
26		Collisions for entire windfarm, allowing for non-op time, assuming no avoidance	birds per month or year		**0**	**0**	**0**	**0**	**416**	**16**	**47**	**170**	**176**	**109**	**60**	**6**	**999**
27																	
28	**Option 2-Basic model using proportion from flight distribution**				**0**	**0**	**0**	**0**	**320**	**12**	**36**	**131**	**135**	**83**	**46**	**5**	**768**
29																	
30	**Option 3-Extended model using flight height distribution**																
31		Proportion at rotor height	(from sheet 4)	38.4%													
32		Potential bird transits through rotors	Flux integral	0.4266	0	0	0	0	9720	389	1149	4246	4246	2567	1415	142	**23875**
33		Collisions assuming no avoidance	Collision integral	0.01967	**0**	**0**	**0**	**0**	**421**	**16**	**47**	**173**	**178**	**110**	**60**	**6**	**1011**
34		Average collision risk for single rotor transit		4.6%													
35																	
36	**Stage E - applying avoidance rates**																
37		Using which of above options?	**Option 3**	0.00%	0	0	0	0	421	16	47	173	178	110	60	6	**1011**
38																	
39	Collisions assuming avoidance rate		birds per month or year	92.97%	0	0	0	0	30	1	3	12	12	8	4	0	**71**
40				98.00%	0	0	0	0	8	0	1	3	4	2	1	0	**20**
41				99.00%	0	0	0	0	4	0	0	2	2	1	1	0	**10**
42				99.50%	0	0	0	0	2	0	0	1	1	1	0	0	**5**
43																	
44	Collisions after applying large array correction			92.97%	0	0	0	0	30	1	3	12	12	8	4	0	**71**
45				98.00%	0	0	0	0	8	0	1	3	4	2	1	0	**20**
46				99.00%	0	0	0	0	4	0	0	2	2	1	1	0	**10**
47				99.50%	0	0	0	0	2	0	0	1	1	1	0	0	**5**
48																	
49																	

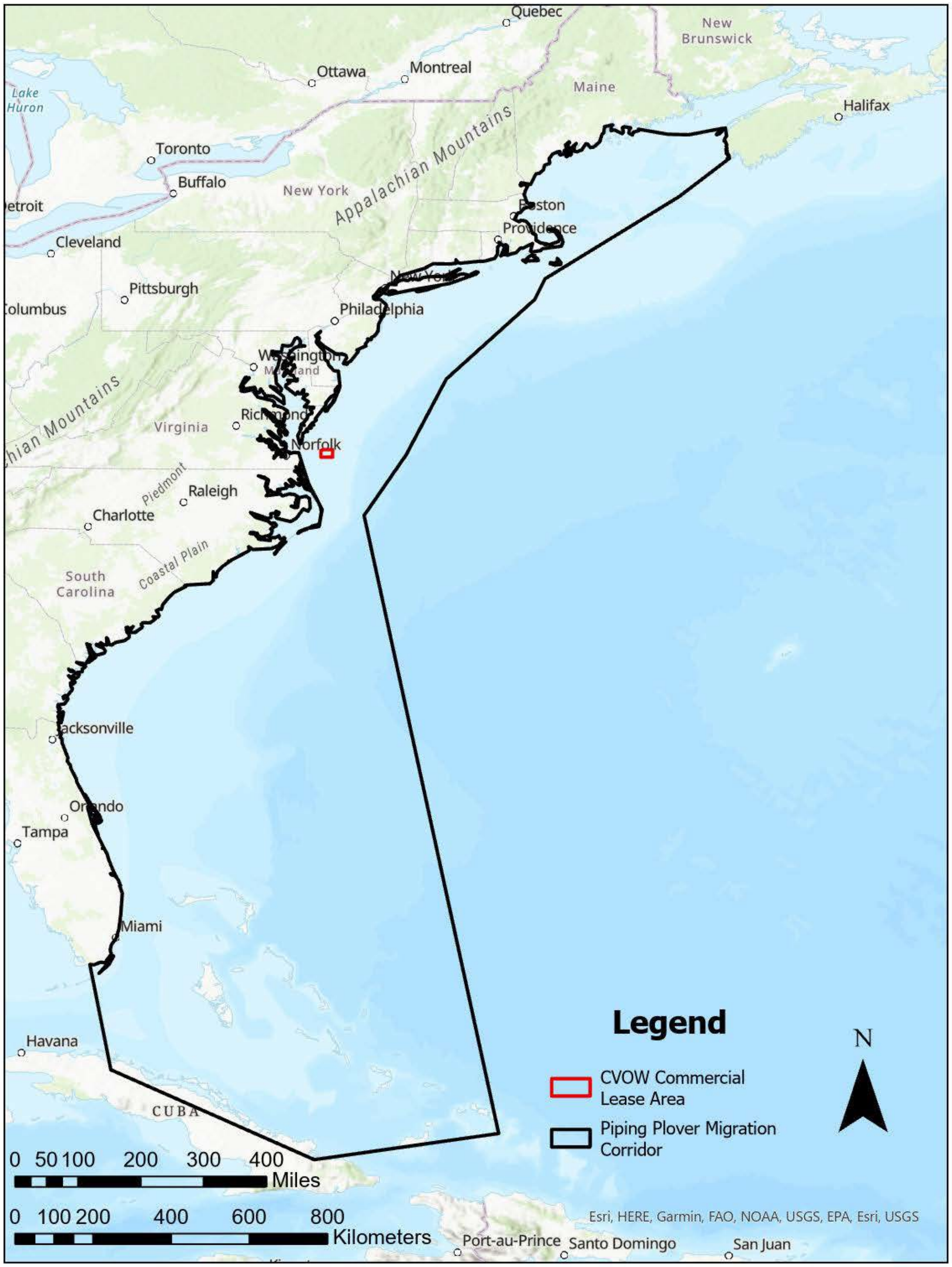


Figure 1. Piping plover migration corridor used for inputs in Band 2012 modeling.

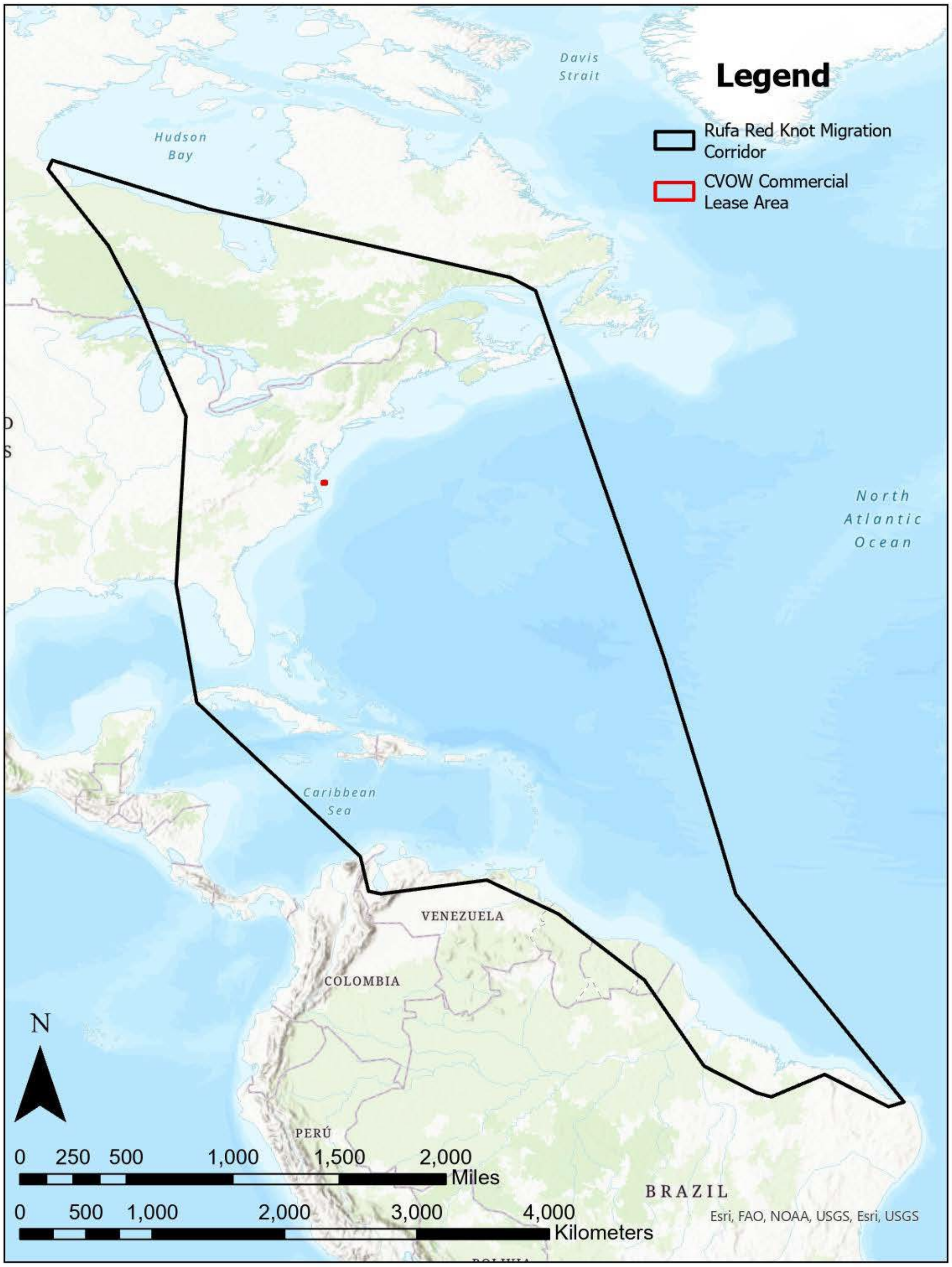


Figure 2. Rufa red knot migration corridor used for inputs in the Band 2012 modeling.