THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
100 Cambridge Street, Suite 900, Boston, MA 02114 ◦ (617) 626-1200

October 6, 2023

Ryan Chaytors
Sunrise Wind, LLC
By its agent,
Orsted North America LLC
437 Madison Avenue, Suite 1903
New York, NY 10022

Re: CZM Federal Consistency Review of the Sunrise Wind Farm and Sunrise Wind Export Cable – Bureau of Ocean Energy Management (BOEM) Action, U.S. Army Corps of Engineers USACE) Permit, and U.S. Environmental Protection Agency (USEPA) National Pollutant Discharge Elimination System (NPDES) Permit; Massachusetts. 15 C.F.R. Part 930, Subpart E – Consistency for Outer Continental Shelf (OCS) Exploration, Development and Production Activities and Subpart D Consistency for Activities Requiring a Federal License or Permit; Massachusetts.

Dear Mr. Chaytors:

The Massachusetts Office of Coastal Zone Management (CZM) has completed its review of the proposed project to build, operate, and decommission the Sunrise Wind Farm (SRWF), which includes up to 84 wind turbine generators (WTGs, turbines) with a nameplate capacity of between 8 and 11 megawatts (MW) per turbine, up to 87 possible positions for the WTGs and offshore converter station (OCS-DC) with uniform 1 nautical mile by 1 nautical mile spacing between wind turbine foundations, up to 180 statute miles (mi)(290 km) of inter-array cables between the WTGs, OCS-DC, and one DC submarine export cable bundle (SRWEC) comprised of two cables located within an up to 104.6 mi (168.4 km) long corridor, all of which will be located within federal waters on the Outer Continental Shelf (OCS), specifically in BOEM Renewable Energy Lease Area OCS-A 0487 (Lease Area), approximately 18.9 mi (30.4 km) south of Martha's Vineyard, Massachusetts, approximately 30.5 mi (48.1 km) east of Montauk, New York (NY), and 16.7 mi (26.8 km) from Block Island, Rhode Island. The SRWF also includes an onshore converter station (OnCS-DC) in Brookhaven, Long Island. The SRWEC, a direct current (DC) electric cable, will connect the SRWF to the existing mainland electric grid at Holbrook substation, also located in Brookhaven, Long Island, New York. The SRWEC includes both offshore and onshore segments. The submarine segment of the export cable is proposed to be buried beneath the seabed within federal waters on the OCS from the OCS-DC to the boundary of New York State territorial waters.

To inform the federal consistency review, CZM reviewed the Construction and Operations Plan, Draft Environmental Impact Statement (DEIS), and the Preliminary Final Environmental Impact Statement (PFEIS) developed under the National Environmental Policy Act; and, under the Coastal Zone Management Act, the federal consistency certification, the U.S. Army Corps of Engineers (USACE) Clean Water Act Section 404/Section 10 permit application, the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) permit, and lease/easement/right-of-way application to BOEM under the Outer Continental Shelf Lands Act. Throughout the state and federal review process, CZM received the data and information necessary to make a consistency determination. However, as a designated cooperating agency, CZM will continue to review and comment on future BOEM submissions for the SRWF including the Final Environmental Impact Statement (FEIS), scheduled for release in late October 2023.

In addition to the documents reviewed above, the SRWF fisheries impact analysis acknowledged the need for mitigation to impacted fishermen to meet the CZM's enforceable policy under Ports and Harbors Policy #4. Because CZM cannot require monetary compensation for mitigation as part of CZMA federal consistency, CZM could not object for failure to pay a compensation amount or include a condition that an applicant must pay a compensation amount. However, CZM and Sunrise Wind, LLC can mutually agree upon a monetary compensation package to meet the applicable enforceable policies. As a result of extensive mitigation negotiations conducted between CZM, the Massachusetts Division of Marine Fisheries, the EEA Fisheries Working Group on Offshore Wind ("FWG"), key stakeholders, and Sunrise Wind, LLC, Sunrise Wind, LLC has entered into an agreement with the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) to provide funds totaling $11,288,000 for impacts over the life of the project. The agreement includes the Massachusetts Fisheries Direct Compensation Program including a Decommissioning Fundthe Coastal Community Fund, and the Navigation Enhancement and Training Program. The Massachusetts Fisheries Direct Compensation Program ($8,788,000 net present value (NPV)) will be used to offset economic impacts to Massachusetts commercial and charter/for-hire fishing and is intended for claims of direct economic loss to compensate Massachusetts fishermen for loss of access or reduction of harvest during construction and operation of SRWF. The Massachusetts Fisheries Decommissioning Fund ($1,000,000 NPV)) will be used to offset direct losses/impacts during decommissioning. The Coastal Community Fund ($1,000,000 NPV) will provide funding for initiatives, research, and projects that will support the co-existence of the fishing and wind industries in the offshore environment. The Navigation Enhancement and Training Program ($500,000) will support upgrades to navigation equipment, professional training opportunities, experiential learning, and other initiatives to further a positive co-existence of the fishing and offshore wind industries. The Agreement Regarding the Establishment and Funding of the Massachusetts Fisheries Direct Compensation Program, Coastal Community Fund, and Navigation Enhancement and Training Program is attached.

Based on CZM's review, all aspects of the project, including those project elements located in federal waters, and the project's effects on resources and uses in the Massachusetts coastal zone, CZM concurs with the certification that the activity as proposed is consistent with the CZM enforceable program policies.

If the above-referenced project is modified in any manner, including any changes in ownership or those resulting from permit, license, or certification revisions, including those ensuing from an appeal, or the project is noted to be having effects on coastal resources or uses that are different than originally proposed, it is incumbent upon the proponent to notify CZM, submit an explanation of the nature of the change pursuant to 15 CFR 930, and submit modified state permits, licenses, or certifications. CZM will use this information to determine if further federal consistency review is required.

Thank you for your cooperation with CZM.

Sincerely,

Lisa Berry Engler
Director

RLB/pb

cc: Lia Howard, Orsted
Michael Evans, Orsted
Melanie Gearon, Orsted
Robin Main, Hinkley Allen
Robert Vietri, USACE
Taylor Bell, USACE
Christine Jacek, USACE
Dan McKiernan, MADMF
Story Reed, MADMF
John Logan, MADMF
Steve McKenna, MACZM
Samuel Haines, MACZM
Todd Callaghan, MACZM
Robert Boeri, MACZM
Sean Duffey, MACZM
Emily Hildreth, BOEM

AGREEMENT
REGARDING THE ESTABLISHMENT AND FUNDING OF THE
MASSACHUSETTS FISHERIES DIRECT COMPENSATION PROGRAM,
COASTAL COMMUNITY FUND
AND
NAVIGATIONAL ENHANCEMENT AND TRAINING PROGRAM

This Agreement Regarding the Establishment and Funding of the Massachusetts Fisheries Direct Compensation Program, Coastal Community Fund, and Navigational Enhancement and Training Program (the "**Agreement**"), dated as of October 6, 2023, is made between Sunrise Wind, LLC ("**Sunrise Wind**") and the Massachusetts Executive Office of Energy and Environmental Affairs ("**EEA**") (together, the **"Parties**").

Recitals

WHEREAS, Sunrise Wind holds a federal Commercial Lease of Submerged Lands for Renewable Energy Development with the U.S. Bureau of Ocean Energy Management ("**BOEM**"), OCS-A 0487 (the "**Lease**"), located in federal waters;

WHEREAS, the Lease grants Sunrise Wind the exclusive right to submit to BOEM a Construction and Operations Plan ("**COP**") for a wind energy project and to conduct the activities described in the COP if approved by BOEM and other Federal agencies having jurisdiction over such project and/or activities;

WHEREAS, Sunrise Wind submitted a COP to BOEM proposing up to one hundred twenty two (122) wind turbine generators with a nameplate capacity of between 8 and 15MW per turbine, submarine cables between the wind turbine generators, one offshore converter station, and direct current electric cable ("Export Cable") that will interconnect in the Town of Brookhaven, New York, to the mainland grid (collectively, the "Project");

WHEREAS, the Coastal Zone Management Act, 16 U.S.C. § 1451 *et seq.*, as amended, requires that an applicant for a federal license or permit activity in or outside the coastal zone or an outer continental shelf plan affecting any land or water use or natural resource of a state coastal zone certify that the proposed activities comply with the enforceable policies of the state's approved program and that such activities will be conducted in a manner consistent with the program;

WHEREAS, for projects located outside a state's coastal zone, the state may formally request review from the Office for Coastal Management of the National Oceanic and Atmospheric Administration;

WHEREAS, in the absence of a formal request for review, Sunrise Wind voluntarily agreed to federal consistency review of the Project by the Massachusetts Office of Coastal Zone Management ("**CZM**") and filed a consistency certification for the Project. The CZM six-month review period commenced on September 1, 2021, was stayed approximately six times, and will conclude no later than October 6, 2023. The Project certification stated that the proposed activities comply with the enforceable policies of the Massachusetts Coastal Program (the "**Coastal Policies**") and will be conducted in a manner consistent with the enforceable policies of the Coastal Policies;

WHEREAS, the Coastal Policies seek to avoid, minimize, and mitigate impacts to coastal resources and uses of the Commonwealth including areas of high concentrations of existing water-dependent uses, which include commercial and charter/for hire fishing, to the extent practicable;

WHEREAS, portions of the Project area are fished by Massachusetts commercial and charter/for hire fishermen;

WHEREAS, Sunrise Wind acknowledges the importance of open and regular communication with members of the Massachusetts commercial and for-hire/charter fishing industries, in order to hear and understand questions or concerns with the purpose of supporting the sustainable development of Sunrise Wind and the overall future coexistence of these two industries;

WHEREAS, Sunrise Wind has modified its Project to avoid and minimize impacts to Massachusetts fishermen, including by adopting uniform 1 nautical mile by 1 nautical mile spacing between wind turbine foundations, reducing from up to 122 positions to 84 turbines at up to 87 positions to meet the Project's power purchase agreement obligations plus proposing an offshore converter station, micrositing wind turbine foundations to minimize impacts to sensitive benthic habitats, and developing a gear loss claims process to compensate fishermen for lost or damaged gear and associated business interruptions costs, among other modifications;

WHEREAS, on August 24, 2023, Sunrise Wind submitted to CZM a mitigation proposal for potential adverse impacts to Massachusetts commercial and charter/for hire fisheries from the Project based on a report by the Woods Hole Oceanographic Institution on the economic impact of the Project on Massachusetts fisheries, a Massachusetts Fisheries Direct Compensation Program Proposed Term Sheet and a Coastal Community Fund Proposed Term Sheet and a Navigation Enhancement and Training Program Term Sheet;

WHEREAS, from approximately June to October 2023, Sunrise Wind engaged in negotiations with CZM resulting in certain amendments to the proposed term sheets, as reflected in the final term sheets, attached hereto as Exhibit A-1 (Exhibit A-1 referred to as the "**Direct Compensation Program Term Sheet**"), Exhibit B-1 (Exhibit B-1 referred to as the "**Coastal Community Fund Term Sheet**"), and Exhibit C-1 (Exhibit C-1 referred to as the "**Navigation Enhancement and Training Program Term Sheet**");

WHEREAS, these negotiations included the solicitation and receipt of feedback from the Massachusetts Fisheries Working Group on Offshore Wind Energy;

WHEREAS, Sunrise Wind offered a final compensatory mitigation package to CZM of Eleven Million Two Hundred Eighty Eight Thousand Dollars ($11,288,000.00)(2023$/present value) to cover potential adverse impacts resulting from the Project so as to satisfy any and all applicable enforceable policies of the Coastal Policies. This final compensatory mitigation is for only Massachusetts fishermen;

WHEREAS, the Parties recognize and acknowledge that each proposed project that comes before CZM stands alone and must be evaluated on its own merits, and that this compensatory mitigation does not provide a precedent for future offshore wind projects;

WHEREAS, although the Office for Coastal Management of the National Oceanic and Atmospheric Administration has stated that compensation cannot be required as a means of complying with Coastal Policies and achieving federal consistency concurrence, the Parties may agree to compensation, and Sunrise Wind agrees to establish a two-part mitigation program to compensate Massachusetts fishermen for reasonably foreseeable adverse impacts not fully mitigated by the Project modifications within the Project area as outlined in the Direct Compensation Program Term Sheet and Coastal Community Fund Term Sheet;

WHEREAS, pursuant to the compensation program, Sunrise Wind will establish the Construction and Operation Mitigation Fund and the Decommissioning Fund in accordance with the Direct Compensation Program Term Sheet attached hereto as Exhibit A-1 (the Construction Operation Mitigation Fund and the Decommissioning Fund (as defined in Paragraph 4 below) shall be referred to together as the "**Direct Compensation Program**");

WHEREAS, pursuant to the compensation program, Sunrise Wind will establish a Coastal Community Fund (the "**Coastal Community Fund**") in accordance with the Coastal Community Fund Term Sheet attached hereto as Exhibit B-1;

WHEREAS, pursuant to the compensation program, Sunrise Wind will establish the Massachusetts Navigational Enhancement and Training Program (the "**Navigational Enhancement and Training Program"**) in accordance with the Navigational Enhancement and Training Term Sheet attached hereto as Exhibit C-1 (Exhibit C-1 referred to as the "**Navigational Enhancement and Training Program Term Sheet**"); and

WHEREAS, CZM will reference the terms of this Agreement in its federal consistency concurrence letter;

NOW THEREFORE, the Parties agree as follows:

Sunrise Wind Compensatory Mitigation

1. Sunrise Wind shall make one lump sum payment of Ten Million Seven Hundred Eighty Eight Thousand Dollars ($10,788,000.00)($2023/present value), as compensatory mitigation as part of its overall Project modifications and mitigations to achieve consistency with the enforceable policies of the Coastal Policies. Sunrise Wind shall also make available up to Five Hundred Thousand Dollars ($500,000)($2023) (the "**Navigational Enhancement and Training Funding**") to fund claims when made through the Navigational Enhancement and Training Program, as compensatory mitigation as part of its overall Project modifications and mitigations to achieve consistency with the enforceable policies of the Coastal Policies. The Parties agree and acknowledge that the combined sum of Eleven Million Two Hundred Eighty-Eight Thousand Dollars ($11,288,000.00) (2023$/present value) reflects the Parties' recognition that the Project is one of several offshore wind development projects proposed for the Massachusetts/Rhode Island Wind Energy Area and that each project must be evaluated on its own merits and that this compensatory mitigation does not provide a precedent for future offshore wind projects. Ten Million Seven Hundred Eighty Eight Thousand Dollars ($10,788,000.00)($2023/present value) shall be Sunrise Wind's only direct payment of financial contribution to fisheries mitigation in Massachusetts (the "**Compensatory Mitigation**").

2. A national bank, federal savings bank or federal savings and loan association, lawfully doing business within the Commonwealth, or a trust company, savings bank, or cooperative bank chartered under the laws of the Commonwealth of Massachusetts (the "**Trust Company**") shall serve as custodial administrator of the Compensatory Mitigation.

3. Within thirty (30) days after the receipt of all final federal, state and local permits, authorizations, concurrences, non-objections, and approvals necessary to construct and operate the Project as described in the approved COP, Sunrise Wind shall: (a) provide the payment of Ten Million Seven Hundred Eighty Eight Thousand Dollars ($10,788,000.00)($2023/present value) of the Compensatory Mitigation to the Trust Company to be held in an escrow account (the "**Escrow Account**") substantially in accordance with the terms of and in the form of the Compensation Mitigation Escrow Agreement attached hereto as Exhibit A-2 (the "**Escrow Agreement**") with such changes as requested/required by the Trust Company, and (b) make available Five Hundred Thousand Dollars ($500,000)(2023$/present value) of the Compensatory Mitigation for the Navigational Enhancement and Training Funding to be disbursed by Sunrise Wind upon receipt of claims pursuant to the Navigational Enhancement and Training Program Term Sheet. The Compensatory Mitigation shall be earmarked as set forth in Paragraph 4 below.

4. The Compensatory Mitigation shall be earmarked as follows:

    i. The Direct Compensation Program

        a) Eight Million Seven Hundred Eighty-Eight Thousand Dollars ($8,788,00.00) for compensation for Massachusetts commercial and for-hire charter fishing operations for mitigation of direct losses/impacts arising from the construction and operation of the Project and unforeseen, extraordinary events that lead to later business

interruption as defined in Exhibit A-3, Schedule A, ("**Operations Interruption Event**") ("**Construction and Operation Mitigation Fund**"). The Trust Company shall be provided with the following or similar investment guidelines by way of example with the suggested overall investment goal of achieving an average annual rate of return of no less than 3 percent.

a. 30 percent U.S. Treasuries with a 30-year Treasury yield of no less than 2.0 percent;

b. 40 percent Municipal bonds with a bond yield of no less than 2.5 percent; and

c. 30 percent investment-grade Corporate bonds with a bond yield of no less than 4.0 percent;

b) One Million Dollars ($1,000,000) for direct losses/impacts caused by decommissioning ("**Decommissioning Fund**"). The Trust Company shall be provided with the following or similar investment guidelines by way of example with the suggested overall investment goal of achieving an average annual rate of return of no less than 4 percent.

a. 15 percent U.S. Treasuries with a 30-year Treasury yield of no less than 2.0 percent;

b. 15 percent Municipal bonds with a bond yield of no less than 2.5 percent; and

c. 60 percent investment-grade Corporate bonds with a bond yield of no less than 4.5 percent;

ii. One Million Dollars ($1,000,000) for the Coastal Community Fund, which the Trust Company shall disburse at the direction of the Director of the Division of Marine Fisheries (the "**Director**") pursuant to the provisions herein and in accordance with the Escrow Agreement. The Trust Company shall be provided with the following or similar investment guidelines by way of example with the suggested overall investment goal of achieving an average annual rate of return of no less than 3 percent.

a) 30 percent U.S. Treasuries with a 30-year Treasury yield of no less than 2.0 percent;

b) 40 percent Municipal bonds with a bond yield of no less than 2.5 percent; and

c) 30 percent investment-grade Corporate bonds with a bond yield of no less than 4.0 percent; and

iii. Five Hundred Thousand Dollars ($500,000) will be available for the Navigational Enhancement and Training Program, and Sunrise Wind shall administer such Program in accordance with the provisions the Navigational Enhancement Training Program Term Sheet.

5. Sunrise Wind shall select, with approval from EEA and CZM, as described in the Direct Compensation Program Term Sheet (ExhibitA-1), a Technical Assistance Provider ("TAP") to provide guidance on the establishment and administration of the Direct Compensation Program over the life of the project. The TAP will be assisted by a liaison with fisheries-relevant experience, to be selected contemporaneously as the TAP. After five (5) years of Project operations, the TAP will evaluate the claims history and fees and costs of the Direct Compensation Program against the Compensatory Mitigation in the Escrow Account and, based on historical actual claims paid and associated fees and costs, make reasonable projections regarding future claims and associated fees and costs. To be clear, associated fees and costs shall include, for example, those associated with the TAP, escrow agent and any other professionals including trust/investment management. The TAP will use

their best professional judgment as to whether the balance of the Compensatory Mitigation in the Escrow Account exceeds the amounts necessary to pay anticipated claims and fees and costs. The TAP also will use their best professional judgment as to whether Decommissioning Fund earmark is sufficient based on the claims history and fees and costs of the Direct Compensation Program during the construction period and may adjust the Decommissioning Fund earmark based on their best professional judgment. If the TAP determines that the balance of the Compensatory Mitigation in the Escrow Account exceeds an amount deemed necessary to pay future claims and associated fees and costs, the TAP may transfer excess funds in an amount to be determined by the TAP to the Coastal Community Fund to be used in accordance with the purposes of the Coastal Community Fund as specified in the Coastal Community Fund Term Sheet and Fund Agreement (the Fund Agreement is to be prepared after the date hereof) ("**Fund Agreement**"). The TAP shall conduct this assessment every five (5) years thereafter and transfer funds accordingly. The TAP is not obligated to transfer any funds they reasonably believe will be necessary to satisfy future claims, fees and costs. Any Compensatory Mitigation in the Escrow Account remaining after payment of all allowed claims or twelve (12) months after Project decommissioning, whichever is later, shall be deemed earmarked to the Coastal Community Fund to be used in accordance with the purposes of the Coastal Community Fund as specified in the Coastal Community Fund Term Sheet.

6. The Trust Company and TAP selected by Sunrise Wind shall be subject to the approval of EEA, which approval shall not be unreasonably withheld, conditioned, or delayed. The TAP shall be a person, institution, or business entity with significant knowledge of the fishing industry, including the commercial fishing industry, in New England.

7. Upon selection of the Trust Company and TAP, Sunrise Wind shall have no further involvement whatsoever with respect to the Direct Compensation Program or Coastal Community Fund; provided, however, that this paragraph shall not operate as a limitation on Sunrise Wind's right to enforce this Agreement, including any limitations on the Coastal Community Fund's expenditures.

Establishment of the Direct Compensation Program

8. The purpose of the Direct Compensation Program is to provide financial compensation to eligible fishermen for mitigating direct losses/impacts to commercial and for-hire (charter) fishing from the construction, operation and decommissioning of the Project.

9. The Direct Compensation Program will be established in accordance with the Direct Compensation Program Term Sheet. The TAP selected pursuant to the Direct Compensation Program Term Sheet shall have authority and discretion to establish such additional terms and conditions for the Direct Compensation Program as are required to fulfill its purpose so long as any such additional terms and conditions are consistent with the Direct Compensation Program Term Sheet, Model Eligibility Form substantially in the form attached as Exhibit A-3, Model Claims Form substantially in the form attached as Exhibit A-4, and Model Form of Release of Liability substantially in the form attached as Exhibit A-5. Any ambiguity between the Direct Compensation Program Term Sheet and this Agreement shall be resolved by the TAP in favor of this Agreement, which embodies the final intent of the Parties with respect to the Direct Compensation Program.

10. The TAP shall determine if an eligibility period is deemed necessary. Notwithstanding anything herein to the contrary, all applicants shall apply for eligibility for the Direct Compensation Program by submitting an Eligibility Form established by the TAP in substantially the same form attached as Exhibit A-3. The eligibility period, if any, will begin prior to the claims and payment period and will last for a reasonable period of time and, in no event less than six (6) months. The TAP will approve or reject eligibility submittals during the eligibility period. Eligibility will be based on historic fishing in the Project area and a direct impact or direct loss caused by the Project.
11. The TAP will establish a claims review and decision process in accordance with the Direct Compensation Program Term Sheet. Applicants shall apply for compensation from the Direct Compensation Program for one of the three payment phases of construction and operation, decommissioning, and/or Operations

Interruptions Events by submitting a claims form substantially in the form of the Model Claims Form attached as Exhibit A-4. The TAP shall reject any claim arising longer than five (5) years after construction has been completed if the TAP determines, in their professional opinion, that the claimant did not reasonably consider all practicable opportunities to adapt to operating within the Sunrise Wind project area. The TAP will approve or reject claims submittals during the claims period.

12. All confidential, non-public or proprietary information (the "**Information**") provided by applicants to the TAP will be kept confidential unless disclosure is required by law, rule, regulation, regulatory authority or pursuant to a legal or similar process. In such an event, the TAP shall disclose only that portion of the Information that it determines it is legally required to disclose and shall request confidential treatment of any Information so disclosed. Notwithstanding anything in this Paragraph to the contrary, information pertaining to final award amounts, along with names and other identifying information, will be provided to the Division of Marine Fisheries and made a public record. Information pertaining to final award amounts, along with address and taxpayer identification numbers necessary to process payments, will be provided to the escrow agent for the purpose of issuing payments.

13. In accordance with the Direct Compensation Fund Term Sheet, the amount of payment will be based on: the eligible claimant's historical activity in the Project area such that applicants with a higher value of historical landings in the Project area will receive higher payment than those that have a lower value of historical landings; the number of eligible applicants; and preservation of funds in the Escrow Account for future applicants.

14. In consideration for receipt of funds from the Direct Compensation Program, applicants simultaneously shall execute a Form of Release of Liability substantially in the form attached as Exhibit A-5 (each a "**Release**"), and each executed Release shall be promptly forwarded to Sunrise Wind at the address set forth in Paragraph 37.

15. The Direct Compensation Program is not intended to address or provide compensation for any claims of lost or damaged gear or related economic loss. Any such claim submitted to the Direct Compensation Program shall be immediately rejected by the TAP and referred to Orsted under the Orsted Fishing Gear Conflict Prevention and Claim Procedure, which is publicly available through Orsted's Mariners' website.

Establishment of the Coastal Community Fund

16. The Coastal Community Fund shall be established as an ear-marked portion of the Escrow Account, with funds to be released by the Escrow Agent upon the written instructions of the Director.

17. Sunrise Wind will provide initial funding for the Coastal Community Fund pursuant to the Compensatory Mitigation earmark set forth in Paragraph 4.

18. The Fund shall be used to fund only projects that satisfy the Coastal Community Fund's objectives, which explicitly do not include funding for litigation, regulatory work, or petitioning activities, and that are approved by the Director after consultation with the Orsted/Eversource Coastal Community Advisory Council ("**Advisory Council**"), including for support for Massachusetts companies that support Massachusetts fishing interests.

19. The members of the Advisory Council: shall be appointed by the Commissioner of the Massachusetts Department of Fish and Game with input from CZM; may include members of the Advisory Council for South Fork Wind, LLC and any future projects that are a 50/50 joint venture between Orsted North America Inc. and Eversource Investment LLC; and shall consist of at least nine (9) members including two (2) members of the Marine Fisheries Advisory Commission, the Executive Director of the New Bedford Port Authority (or his or her designee), and six (6) members of the public at large, all of whom shall have specific expertise and background in the conduct and management of marine fisheries in Southern New England. Members shall include one representative of the lobster trap fishery, one representative of the mobile gear

fishery, one representative of a Commercial Fishery Advocacy Organization, one representative of the for-hire hook-and-line fishery, and one representative of wholesale seafood dealers. To the extent practicable, such representatives shall be owners or operators of, or be employed by, business associations located within the ports where impacts from the Project may occur, such as New Bedford/Fairhaven, Westport, Chatham, and Menemsha. The Advisory Committee members shall serve for terms of three (3) years. Any member shall be eligible for reappointment.

20. Sunrise Wind will have no rights or role with respect to the Advisory Council's management of the Coastal Community Fund or approval of project funding requests by the Director; provided, however, that this paragraph shall not operate as a limitation on Sunrise Wind's right to enforce this Agreement, including any limitations on the Coastal Community Fund's expenditures.

21. The Director may condition the approval of any project funding on the execution of a grant agreement that provides reporting to the Director and the Advisory Council and transparency to the public with respect to the spending of funds.

Navigational Enhancement and Training Funding

22. The Navigational Enhancement and Training Funding shall be established and operated by Sunrise Wind independent of EEA, the Director, the TAP and the Escrow Agent.

23. Sunrise Wind will make available funding for the Navigational Enhancement and Training Funding pursuant to the Compensatory Mitigation set forth in Paragraphs 3 and 4.

24. The Navigational Enhancement and Training Fund shall be used solely to pay approved vouchers under the Navigational Enhancement and Training Program as described in the Navigational Enhancement and Training Program Term Sheet.

Payment of Expenses for the Funds

25. The reasonable costs and expenses incurred in the establishment and implementation of the Coastal Community Fund and the Direct Compensation Program, including the fees and costs of the TAP and the fees and costs for the preparation of the Fund Agreement and Escrow Agreement, shall be paid from the Escrow Account, subject to any caps established by the Parties. After five (5) years of Project operations, by March 1 of each succeeding calendar year, the TAP will send the Parties a report on the costs and expenses paid and the income accrued to the Escrow Account over the previous calendar year and the life of the Escrow Account through December 31 of the previous calendar year ("Annual Report"). If the costs and expenses over the life of the Escrow Account exceed the income accrued over the life of the Escrow Account (a "Deficiency"), in more than three (3) consecutive Annual Reports, Sunrise Wind shall, within 30 days of receipt of the most recent Annual Report, make a payment to the Escrow Account in the amount of the Deficiency. The TAP shall treat this payment as income in any future Annual Report. In calculating a Deficiency, the TAP will not consider claims paid under the Direct Compensation Program or grants made from the Coastal Community Fund.

Precedent Conditions

26. This Agreement and the implementation of the Direct Compensation Program, Coastal Community Fund and Navigational Enhancement and Training Fund shall be contingent upon the occurrence of each of the following events:

    a. On or before October 6, 2023, CZM issuing concurrence with Sunrise Wind's federal consistency certification; and

b. Sunrise Wind receiving all other final federal, state, and local permits, authorizations, concurrences and approvals necessary to construct and operate the Project as described in the approved COP.

For the avoidance of doubt, if: (i) CZM does not issue its concurrence with Sunrise Wind's consistency certification on or before October 6, 2023; or (ii) Sunrise Wind fails to receive all other such permits, authorizations, concurrences and approvals, then Sunrise Wind shall have no further obligations under this Agreement.

Dispute Resolution

27. If either Party alleges that there exists a dispute or disagreement regarding the matters covered by this Agreement, it shall notify in writing the other Party of such alleged dispute or disagreement ("**Dispute Notice**"). The Parties shall attempt to resolve the alleged dispute or disagreement through good faith negotiations. If the Parties fail to resolve the alleged dispute or disagreement within sixty (60) days of the Dispute Notice, the Party alleging the dispute or disagreement may enforce this Agreement only by specific performance, injunctive relief or a declaratory judgment action pursuant to M.G.L. Ch. 231A *et seq*. The remedies of specific performance, injunctive relief and declaratory judgment shall be cumulative of all other rights and remedies at law or equity of the Parties under this Agreement.

Governing Law

28. This Agreement shall be construed in accordance with and all disputes hereunder shall be controlled by the laws of the Commonwealth of Massachusetts without regard to its conflict of laws principles. For the purposes of this Agreement only, Massachusetts shall be the forum state for all forms of dispute resolution between the Parties arising out of this Agreement, including but not limited to judicial actions to enforce the Agreement.

Implementation

29. CZM shall implement this Agreement on behalf of the EEA.

Entire Agreement

30. This Agreement constitutes the entire agreement of the Parties as to the subject matter herein and supersedes any and all prior oral or written agreements of the Parties. This Agreement cannot be changed or modified except in a written instrument signed by both Parties.

Recitals

31. The above recitals are incorporated herein by reference.

Successors and Assigns

32. This Agreement shall be binding upon and inure to the benefit of the Parties and their respective successors and assigns.

No Third-Party Beneficiaries

33. Except for CZM in connection with its implementation of this Agreement on behalf of EEA, the Parties do not confer any rights or remedies upon any person other than the Parties to this Agreement and their respective successors and assigns.

Severability

34. If any part of this Agreement is found to be unenforceable, the rest will remain in full force and effect and shall be interpreted so as to give full effect to the intent of the Parties.

Execution in Counterparts

35. This Agreement may be executed in counterparts and by the different Parties hereto on separate counterparts, each of which when so executed and delivered shall be an original, but all counterparts shall together constitute one and the same instrument. This Agreement may be delivered by the exchange of signed signature pages by facsimile transmission, electronic signatures, or by attaching a pdf copy to an e-mail, and any printed or copied version of any signature page so delivered shall have the same force and effect as an originally signed version of such signature page.

Notice

36. Each Party shall deliver all notices, requests, consents, claims, demands, waivers, and other communications under this Agreement (each, a "**Notice**") in writing and addressed to the other Party at its address set out below (or to any other address that the receiving Party may designate from time to time in accordance with this Paragraph 37). Each Party shall deliver all Notices by personal delivery, nationally recognized overnight courier (with all fees prepaid), or email (with confirmation of transmission), or certified or registered mail (in each case, return receipt requested, postage prepaid). Except as otherwise provided in this Agreement, a Notice is effective only (a) upon receipt by the receiving party and (b) if the party giving the Notice has complied with the requirements of this Paragraph 37:

If to EEA/CZM: Lisa Berry Engler, Director
Massachusetts Office of Coastal Zone Management
251 Causeway Street, Suite 800
Boston, Massachusetts 02114
Email: lisa.engler@state.ma.us

If to Sunrise Wind: Ryan Chaytors, Program Development Director
c/o Sunrise Wind, LLC
399 Boylston Street, 12th Floor
Boston, MA 02116
Email: ryach@orsted.com

Term; Termination

37. The term of this Agreement shall start on the date of this Agreement. If any of the "Precedent Conditions" above cannot be fulfilled, this Agreement shall terminate upon the date in which it becomes apparent that such condition set forth in the "Precedent Conditions" cannot be fulfilled. If the "Precedent Conditions" are fulfilled, this Agreement shall expire on the date on which all funds held by the Coastal Community Fund and the Direct Compensation Program have been disbursed.

Signatures on Following Page

IN WITNESS WHEREOF, the Parties have caused this Agreement to be executed as of the date first written above.

SUNRISE WIND, LLC

By: _____
Name: Ryan Chaytors
Title: Authorized Signatory

By: _____
Name:
Title: Authorized Signatory

MASSACHUSETTS EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS

By: _____
Name: Rebecca Tepper
Title: Secretary, EEA

Exhibit A-1

Direct Compensation Program Term Sheet

I. Purpose and Brief Description

- The Sunrise Wind Massachusetts Fisheries Direct Compensation Program will provide financial compensation not to exceed Nine Million Seven Hundred Eighty-Eight Thousand Dollars ($9,788,00.00) for economic loss to commercial and charter/for hire fishing as a result of the construction, operation as set forth in further detail in the Agreement and decommissioning of Sunrise Wind.
- The Sunrise Wind Massachusetts Fisheries Direct Compensation Program will pay eligible fishers within a reasonable period of time (about 45 days) after their claim is approved from an escrow account to be funded according to the process as defined in the Agreement between Sunrise Wind, LLC and EEA.
- The Sunrise Wind Massachusetts Fisheries Direct Compensation Program has two key parts: 1) determining which fishers are eligible for compensation based on their historical fishing activity in the Sunrise Wind project area; and 2) calculating the amount of individual compensation based on an open and transparent predetermined payment framework that may apply a tiered approach. In any tiered approach, every eligible fisher receives a payment but those with higher historical value landings within Sunrise Wind receive more compensation than those with lesser value landings.

II. Creation, Use and Funding of Sunrise Wind Escrow Account and Technical Assistance Provider

- Sunrise Wind will fund an escrow account for the Sunrise Wind Fisheries Direct Compensation Program in accordance with the Agreement between Sunrise Wind and EEA. The escrow will be managed by an independent third party recommended (Technical Assistance Provider or "TAP") by Sunrise Wind with approval from EEA and CZM, which approval shall not be unreasonably withheld, conditioned or delayed.
- The TAP will ease the administrative aspects of the program on fishers. The TAP will be responsible for overseeing the administration of the fund as described below. Sunrise Wind will recommend the TAP with approval from EEA and CZM, which shall not be unreasonably withheld, conditioned or delayed. The Parties recognize that efficiencies will be gained by using the same TAP for South Fork Wind, LLC, Sunrise Wind and any other future projects that are a 50/50 joint venture between Orsted North America Inc. ("Orsted") and Eversource Investment LLC ("Eversource").

III. Pre-Qualifying for Compensation During Any Eligibility Period

- The purpose of any eligibility period is to provide sufficient time for fishers to prequalify for compensation to improve the efficiency of the claim and payment phase so that the payment of approved claims will be fast.

- During any eligibility phase, fishers will be asked to fill out a simple certification form stating that they have fished in the Sunrise Wind area over a three-year period as set forth in further detail in the Agreement. Fishers will be required to list the approximate value of their landings from that area over the three years.

- The TAP will be available to assist fishers with filing for eligibility. All information from fishers will be kept confidential by Sunrise Wind and the TAP except as required by law.

- The term of any eligibility period will be subject to the discretion of the TAP, provided that any eligibility period shall begin prior to the claims and payment period and will last for a reasonable period of time and in no event less than 6 months. To be clear, an eligibility period is not required if the TAP deems it unnecessary. Notwithstanding anything herein to the contrary, each fisher shall be required to fill out the eligibility form prior to submitting a claim.

- The TAP will approve or reject eligibility submittals during any eligibility period.

- Sunrise Wind and EEA will have no rights or role with respect to the TAP's approval or rejection of eligibility submittals.

IV. Claim and Payment Period for Eligible Fishers

- The claim and payment period for eligible fishers to obtain funds from the escrow will begin no later than upon the completion of Sunrise Wind's commissioning and will last for a reasonable time period.

- Each payment form shall include a release of liability by the certifying fisher releasing Sunrise Wind. The form of Release is attached hereto in A-5.

- The amount of the payment will be based on the eligible fishers' historical activity in the Sunrise Wind lease and export cables area. Payments may be established in tiers by fishery, to be determined by the TAP using their best professional judgement.

    i. Once any eligibility period ends, tiered payment levels may be established for allocating funds. Fishers with a higher value of historical landings in the Sunrise Wind area will receive higher payment than those that have a lower value of historical landings. A minimum payment will be incorporated to ensure all fishers with any level of historical landings from the Sunrise Wind area will receive a payment. The predetermined funding framework will provide full transparency of how much compensation each eligible claimant will receive.

- Payments will be made within a reasonable time frame.

- The TAP will approve claims consistent with the funding framework, as set forth in further detail in the Agreement. Sunrise Wind, CZM and EEA will have no role with the claim and payment period. Upon approval from the TAP, the escrow agent will pay funds directly to the eligible fisher.

* * *

Exhibit A-2

Escrow Agreement

The Escrow Agreement shall be prepared after the date hereof in consultation with the selected Escrow Agent.

Exhibit A-3

Eligibility Form

Massachusetts Fisheries Direct Compensation Program Eligibility Application

Commercial fishermen and party/charter boat operations must use this form to demonstrate eligibility for compensation under the Sunrise Wind Massachusetts Fisheries Direct Compensation Program. The Massachusetts Fisheries Direct Compensation Program will provide financial compensation for mitigating direct losses/impacts to commercial fishing and party/charter boat operations during the construction, operation, and decommissioning phases of Sunrise Wind. Separate eligibility forms must be submitted for each affected vessel. Only the DMF permit holder may apply for eligibility.

This form must be completed in full and delivered to the Technical Assistance Provider (TAP) designated to administer the fund. Applicants can file the form electronically by emailing it to [TAP email address] or by mailing it to [TAP address]. You may contact the TAP by email or by phone ([TAP phone number]) if you have questions on the application.

This eligibility form may be used to prequalify for compensation to improve the efficiency of the claim and payment phase and pay claims faster. Once you are deemed eligible by the TAP, you will be asked to submit a simplified claims form to inform your direct compensation payment.

The TAP will approve or reject eligibility submittals during the eligibility period based on the information submitted with your application.

I. Applicant Information

A. Name: _____
First Last M.I.

B. Mailing Address:

_____
Street Address Apartment/Unit

_____
City State Zip

C. Place of Residence (if different from mailing address):

_____
Street Address Apartment/Unit

_____
City State Zip

D. Phone: _____

E. Email: _____

F. Fishing Operation Information (complete the section that applies):

□ Commercial fishing operation

1. Vessel Name: _____
2. State Registration Number/Coast Guard Documentation Number: _____
3. Homeport (as listed on your state or Coast Guard registration):

   _____

4. Federal Permit (if applicable): _____
5. MA Commercial Fishing Permit Number: _____
6. Tax Identification Number (TIN), if applicable: _____

□ Party and charter boat information

1. Vessel Name: _____
2. MA Charter/Party Permit Number: _____
3. Federal Permit (if applicable): _____
4. Business Name (if different from applicant name): _____
5. Tax Identification Number (TIN), if applicable: _____

II. Demonstration of Eligibility

Identify the project phase for which you are seeking eligibility to submit a claim:

□ Business interruption during construction and the operations period following construction.

□ Business interruption during the decommissioning phase.

□ Business interruption during the operations phase that arises from an extraordinary unforeseen event (e.g., extraordinary maintenance in the Project area resulting in extended constraints on access).

Applicants must stipulate to the following eligibility criteria:

- You must hold a valid state fishing or landing permit;
- You must have a homeport in Massachusetts (as documented on your vessel registration) or be a resident or incorporated business in Massachusetts; and
- You must demonstrate a history of the vessel operating in the Sunrise Wind Project area in the three years prior to eligibility and having incurred a direct impact/direct loss caused by Sunrise Wind.

Schedule A identifies the documentation needed to verify eligibility. Failure to provide adequate documentation to the TAP may lead the TAP to disqualify you from participating in the program.

III. Confidentiality

Information provided via this application process will be kept confidential by the TAP, except as otherwise required by law. Notwithstanding anything herein to the contrary, if the TAP pays a

claim, the amount of the payment and the identity of the recipient will be reported to the Division of Marine Fisheries and made a public record.

IV. Notification

The TAP will notify you of the decision regarding your eligibility by contacting you at the email address provided above.

V. Certification and Release

By completing and signing this form, I certify my understanding of the following:

A. I understand and acknowledge that the TAP will rely on the information I have provided, and I agree that the information I have provided is material to my request for eligibility. I certify upon the pains and penalties of perjury that I have provided complete and truthful information here and to the TAP for considering my eligibility.

B. I certify that I am duly authorized to bind the entity or individual and the vessel identified above.

C. I consent to allowing the TAP to use VTRs, SAFIS trip-level data, and other Massachusetts Division of Marine Fisheries data, as applicable, to verify the information contained in this application, and I waive any and all confidentiality pertaining to this information as it relates to this application.

Signature _____ Date _____

Title (if any): _____

Schedule A: Examples/Operations Interruptions Events Qualifying for Compensation

1. Possible business interruptions arising from unforeseen extraordinary events may include the following or similar event:

    - Extraordinary maintenance in the Project area resulting in extended constrained access within the Sunrise Wind Project area

2. Examples of excluded Operations Interruptions are:

    - Fishery management measures that constrain catch or access to fishing grounds (e.g., quotas, area closures) or seasonal restrictions;
    - General declines in stock for targeted species caused by climate change;
    - Environmental changes unrelated to Sunrise Wind;
    - Harmful algal blooms;
    - Vessel or other property damage;
    - Reductions in fishing activity due to personal illness or public health measures;
    - Inclement weather; or
    - Force majeure events where the direct impact to applicant was not exacerbated or contributed to by the operation or maintenance of the Sunrise Wind Project.

Schedule B. Documentation to Affirm Eligibility to Participate in the Direct Compensation Program

A. Commercial fishing documentation is required for the three years prior to construction.

- If you file Vessel Trip Reports (VTRs) with the National Marine Fisheries Service (NMFS):
  - You must submit one of the following documents:
    - Your VTR data for the relevant years; or
    - Documentation that you have authorized NMFS to release your VTR data to the TAP.
  - While optional, you may also submit:
    - Documentation that you have authorized NMFS to release vessel monitoring system (VMS) or observer program data relevant to your vessel.
    - Other detailed electronic information (e.g., chart plotter data) documenting effort within the Sunrise Wind Project Area.
- If you do not file VTRs with NMFS:
  - You must submit one of the following documents:
    - Massachusetts trip-level reporting data, whether filed electronically (through the Standard Atlantic Fisheries Information System, SAFIS) or via paper; or
    - Documentation that you have authorized the Massachusetts Division of Marine Fisheries (MADMF) to release your trip-level reporting data.
  - While optional, you may also submit other electronic information (e.g., chart plotter data) or independently maintained logbooks that document your activity in the Sunrise Wind Project Area.

B. Party/Charter boat documentation is required for the three years prior to construction:

- You must submit eTRIPS Desktop or Mobile trip data submitted to MADMF or documentation that you have authorized MADMF to release your trip data.
- While optional, you may submit other electronic information (e.g., chart plotter data) or independently maintained logbooks that document your activity in the Sunrise Wind Project Area.

Exhibit A-4

Claims Form

Massachusetts Fisheries Direct Compensation Program Claim Application

Commercial fishermen and party/charter boat operations must use this form to file claims for direct compensation of economic impacts directly attributable to the Sunrise Wind project. The Sunrise Wind Massachusetts Fisheries Direct Compensation Program will provide financial compensation for mitigating impacts to commercial and party/charter boat fishing during the construction, operation, and decommissioning phases of Sunrise Wind. Only applicants who have separately filed an eligibility form and been approved to participate in the Sunrise Wind Direct Compensation Program for the applicable project phase may complete this claim form. Separate claim forms must be submitted for each affected vessel. If you are a new fisherman in the Sunrise Wind Project Area, you will need to apply for eligibility prior to submitting this claim form.

This form must be completed in full and delivered to the Technical Assistance Provider (TAP) designated to administer the fund. Applicants can file the form electronically by emailing it to [TAP email address] or by mailing a physical copy to [TAP address]. You may contact the TAP by email or by phone ([TAP phone number]) if you have questions on the application.

I. Applicant Information

A. Name: _____
First Last M.I.

B. Phone: _____

C. Email: _____

D. Vessel Name: _____

E. State-Issued Fishing Permit Number: _____

F. Federal Fishing Permit Number (if any): _____

If any identification information (e.g., vessel name, fishing permit number) provided when you applied for eligibility has changed, please note that here:

_____

_____

_____

II. Economic Impact

A. A claim may be filed for impacts incurred in each of the following phases of the project. Please check the phase that is relevant to your claim:

- ☐ Business interruption during construction and the operations period following construction.
- ☐ Business interruption during the decommissioning phase.
- ☐ Business interruption during the operations phase that arises from an extraordinary unforeseen event (e.g., extraordinary maintenance in the Project area resulting in extended constraints on access).

B. The basis for your claim will be your average historical gross revenue.

1. Commercial Fishing Operations

Claims are estimated based on your historical gross revenue in the Sunrise Wind Project Area, incorporating the years prior to construction, decommissioning or the unforeseen operations interruptions event.

a) Complete Table 1 below to document your landings and gross revenue in each year that you fished. If you did not fish in a given year, leave the space blank.

b) Using the same table, calculate your average annual gross revenue based on the highest three years, i.e., the sum of your top three gross revenue figures divided by three. This figure will be the basis for your claim (see below).

Table 1. ESTIMATION OF AVERAGE ANNUAL COMMERCIAL FISHING REVENUE FROM WITHIN Sunrise Wind		
Year	Landings (pounds)	Gross (Ex-Vessel) Revenue ($)
5 years ago		$
4 years ago		$
3 years ago		$
2 years ago		$
Last year		$
AVERAGE ANNUAL GROSS REVENUE BASED ON TOP THREE YEARS		$

2. Party/Charter Boat Operations

Claims are estimated based on your historical gross receipts, as reported to the tax authorities, scaled for trips made in the Sunrise Wind Project Area. The TAP will compare your gross receipts in the tax year your claim event occurs to the average annual gross receipts for the three tax years immediately prior to your claim event.

a) Using Table 2 below, document the number of trips you conducted in the Sunrise Wind Project Area in each tax year.

b) Using the same table, report your annual gross receipts in each tax year. This information should be obtained from your tax returns.

c) Using the same table, calculate the difference between your pre- and post-claim annual gross receipts. The net change in gross receipts is the basis for your claim (see below).

Table 2. ESTIMATION OF PARTY/CHARTER BOAT REVENUE IMPACT FROM WITHIN Sunrise Wind		
Year	Number of Trips in Sunrise Wind Project Area	Annual Gross Receipts
3 years ago		$
2 years ago		$
Last year		$
Average Annual Pre-Claim Event Gross Receipts		$
Current year (post-claim event)		$

Net Economic Impact *(Difference Between Post-Claim Event Gross Receipts and Average Annual Pre-Claim Event Gross Receipts)*	$

C. Please attach the following documentation. If you provided this documentation with your initial eligibility form, there is no need to duplicate your submission.

1. Commercial fishing documentation: You may provide personal or business tax returns to corroborate your gross revenue data. If you prefer not to do so, please provide the following documentation:
    - If you file Vessel Trip Reports (VTRs) with the National Marine Fisheries Service (NMFS), you must submit either your VTR data for the relevant years or documentation that you have authorized NMFS to release your VTR data to the TAP.
    - If you do not file VTRs with NMFS, you must submit Massachusetts trip-level reporting data (whether filed electronically through the Standard Atlantic Fisheries Information System, SAFIS, or via paper) or documentation that you have authorized the Massachusetts Division of Marine Fisheries (MADMF) to release your trip-level reporting data.
2. Party/charter boat documentation:
    - You must provide personal or business tax returns to corroborate your gross receipts data.
    - You must submit eTRIPS Desktop or Mobile trip data submitted to MADMF or documentation that you have authorized MADMF to release your trip data.

III. Amount of Claim

Each eligible applicant may apply for a one-time pro-rata fixed payment to compensate for economic impacts. Please check the box corresponding to the impact for which you are seeking compensation:

- □ Business interruption during construction and the operations period following construction.
- □ Business interruption during the decommissioning phase.
- □ Business interruption during the operations phase that arises from an extraordinary unforeseen event (e.g., extraordinary maintenance in the Project area resulting in extended constraints on access). If more than one separate and unrelated eligible event occurs, you may apply for compensation for each such event.

Calculation of the compensation payment differs by project phase and by Applicant Type, as explained below.

A. For commercial fishing vessels:

1. Compensation for impacts during construction and operation will be calculated as Average Annual Gross Revenue times a Construction Scaling Factor, which will reflect adjustments for variable expenses to approximate net operating income.
2. Compensation for impacts during decommissioning will be calculated as Average Annual Gross Revenue times a Decommissioning Scaling Factor, which will reflect adjustments for variable expenses to approximate net operating income.
3. Compensation for impacts arising from an extraordinary unforeseen event during operations will be calculated as Average Annual Gross Revenue times a Business Interruption Scaling Factor, which will reflect adjustments for variable expenses to approximate net operating income.

B. For charter/party vessels:

1. Compensation for impacts during construction and operation will be calculated as Net Economic Impact from Section II, Table 2 times a Construction Scaling Factor, which will reflect adjustments for variable expenses to approximate net operating income.
2. Compensation for impacts during decommissioning will be calculated as Net Economic Impact from Section II, Table 2 times a Decommissioning Scaling Factor, which will reflect adjustments for variable expenses to approximate net operating income.
3. Compensation for impacts arising from unforeseen business interruption during operations will be calculated as Net Economic Impact from Section II, Table 2 times a Business Interruption Scaling Factor, which will reflect adjustments for variable expenses to approximate net operating income.

IV. Confidentiality

Information provided via this application process will be kept confidential by the TAP, except as otherwise required by law.

Notwithstanding anything herein to the contrary, information pertaining to final award amounts, along with names and other identifying information, will be provided to the Division of Marine Fisheries and made a public record. Information pertaining to final award amounts, along with address and taxpayer identification numbers necessary to process payments, will be provided to the escrow agent for the purpose of issuing payments.

V. Certification and Release

By completing and signing this form, I certify my understanding of the following:

A. As a condition to and in full consideration of any payment, I will execute the attached release.

B. I understand and acknowledge that the TAP will rely on the information I have provided, and I agree that the information I have provided is material to my claim for compensation. I certify upon the pains and penalties of perjury that I have provided complete and truthful information here and to the TAP for evaluating my claim.

C. I certify that I am duly authorized to bind the entity or individual and the vessel identified above.

D. I consent to allowing the TAP to use the information I provided, including, as applicable, VTRs, SAFIS trip-level reporting data, NMFS Dealer data, and/or information from the Massachusetts Department of Revenue, to verify the information contained in this application, and I waive any and all confidentiality pertaining to this information as it relates to this application.

Signature _____ Date _____

Title (if any): _____

Schedule A: Examples/Operations Interruptions Events Qualifying for Compensation

1. Possible business interruptions arising from unforeseen extraordinary events may include the following or similar events:
    - Extraordinary maintenance in the Project area resulting in extended constrained access within the Sunrise Wind Project area; or
2. Examples of excluded Operations Interruptions are:
    - Fishery management measures that constrain catch or access to fishing grounds (e.g., quotas, area closures) or seasonal restrictions;
    - General declines in stock for targeted species caused by climate change;
    - Environmental changes unrelated to Sunrise Wind;
    - Harmful algal blooms;
    - Vessel or other property damage;
    - Reductions in fishing activity due to personal illness or public health measures;
    - Inclement weather; or
    - Force majeure events where the direct impact to applicant was not exacerbated or contributed to by the operation or maintenance of the Sunrise Wind Project.

Exhibit A-5

Release of Liability

I, _____, have submitted a claim for compensation to the Sunrise Wind Massachusetts Fisheries Direct Compensation Program (the "Program") for business interruption losses for one of the following three Program phases described in the claims form [(1) construction and the operations period following construction, (2) decommissioning, or (3) Operations Interruptions Events] (circle one) (the "Claim").

I assert that my Claim resulted directly from the Sunrise Wind project. By signing this Release of Liability, I acknowledge that the Program has accepted and paid my Claim. My acceptance of such payment constitutes full, final and complete payment for this Claim. I agree on behalf of myself, and all my personal representatives, heirs, executors, administrators, agents, representatives, employees, affiliates, business partners, predecessors-in-interest, successors-in-interest, and assigns (the "Releasing Parties") that neither Sunrise Wind, LLC, Orsted North America, Inc., Eversource Investment LLC, nor any of their affiliates or joint venture partners, officers, directors, shareholders, employees, agents, representatives, insurers, predecessors, parents, subsidiaries, successors, and assigns (the "Released Parties") shall have any further outstanding or ongoing obligation with respect to this Claim, even if the Releasing Parties learn new information about the Claim. I agree that neither I nor the Releasing Parties will, directly or indirectly, assert any claim, or commence, join in, prosecute, participate in, or fund any part of, any suit or other proceeding of any kind against the Released Parties arising out of, related to or concerning in any way the Claim, and I and the Releasing Parties forever release and discharge the Released Parties from any liability arising under, related to, or concerning such Claim.

I acknowledge that I am duly authorized to sign on behalf of the entity indicated below. Signed under pains and penalties of perjury.

_____ _____

Date Signature

Exhibit B-1

Coastal Community Fund Term Sheet

I. Purpose

- Sunrise Wind will establish the Sunrise Wind Coastal Community Fund to provide grants for initiatives supporting coastal communities in Massachusetts.

- By way of example, but without limitation except as set forth in Paragraph 19 of the Agreement, the Sunrise Wind Coastal Community Fund may be used for the following objectives:

    - Supporting the recreational and charter boat industry;

    - Providing marketing and promotional support for processors, manufacturers of local seafood products, party or charter boat services;

    - Enhancing opportunities for training, apprenticeship, and employment in the commercial fishing industry, offshore wind industry, and other sectors of the coastal economy;

    - Improving infrastructure that supports the commercial fishing industry including but not limited to processors, wholesalers, and recreational fishers;

    - Supporting the enhancement and productivity of the commercial fishing industry; and

    - Supporting technology development to reduce potential conflicts between commercial fishing and offshore wind operations.

II. Creation, Use and Funding of the Coastal Community Fund

- Sunrise Wind will establish an escrow account that will be overseen by an independent third- party escrow agent selected by Sunrise Wind with approval from EEA, which approval shall not be unreasonably withheld, conditioned or delayed.
- Sunrise Wind will fund the escrow account according to the process as defined in the Agreement.
- These funds will be used only to fund projects that satisfy the Sunrise Wind Coastal Community Fund's objectives and as approved by the Director of the Division of Marine Fisheries, who shall act only after receiving advice from the Sunrise Wind Coastal Community Advisory Council ("Advisory Council").

- Sunrise Wind will have no rights or role with respect to the Advisory Council's approval of project funding requests.

III. Distribution of Escrow Account Funds

- Each request for project funding must be submitted to the Advisory Council and affirm that funds will be used to support projects that meet the objectives of the fund.

- The Advisory Council will review all submitted proposals. The Advisory Council will either recommend approval or rejection with an explanation, or request additional documentation necessary to complete its evaluation of a proposal.

- The process and form of such proposals will be determined by the Advisory Council and the Director.

- Upon written instructions from the Director, the escrow agent will disburse funds directly to the project applicant.

- In the event the fund is oversubscribed, the Director may, in consultation with the Advisory Council, approve partial payment of a proposal.

* * *

Exhibit B-2

Form of Fund Agreement

To be prepared after the date hereto

Sunrise Wind Navigational Enhancement and Training

Program Objectives:

- Enable commercial fishermen and for-hire vessels to acquire Navigation Equipment, as defined below, through a grant – or in other words, voucher – system; and
- Provide training and experiential learning opportunities to those navigating or operating within the Ørsted/Eversource Joint Venture Wind Lease Areas in the Rhode Island/Massachusetts Wind Energy Area ("WEA").
- Further positive co-existence between offshore wind and fishing community

Approach and Eligibility:

- Navigation Equipment for Fishermen Eligible for Direct Compensation Fund
    - Fishermen eligible for the Direct Compensation Fund (ie. have historically fished in the Sunrise Wind wind farm and are commercial or for hire fishermen) who do not already possess Navigation Equipment will automatically be eligible for a voucher to purchase Navigation Equipment. Navigation Equipment is defined as pulse compression radar systems and AIS transceivers (for AIS, further defined below);
    - One-time grants for vessels that do not already have Navigation Equipment will be available as follows: up to $10,000 will be available for each eligible fisherman with a commercial vessel or with an inspected for-hire vessel; and up to $5,000 will be available for each eligible fisherman with an uninspected for-hire vessel;
    - Vouchers may only be used to purchase and install pre-approved Navigation Equipment;
    - For those wishing to obtain AIS transceivers the following will be provided: vessels required to carry AIS, vouchers will be for Class A AIS; and for vessels not required to carry AIS, vouchers will be for Class A or Class B;
    - Each fishermen/vessel operating within the Orsted/Eversource Joint Venture Lease Areas in the WEA is eligible for only one grant from the Navigational Enhancement and Training Program to upgrade navigational equipment; and
    - The process will be administered through Sunrise Wind or its designee.
- Professional Training & Experiential Learning for Fishermen with Valid Saltwater Fishing License (Federal or Massachusetts)
    - Fishermen eligible for the Direct Compensation Fund (see above) may attend one professional training of their choice up to a value $1,000 per person. Eligible trainings include but are not limited to a captain's course, license upgrade, radar course, or rules of the road refresher.
    - In addition, the following categories of fishermen who have a valid saltwater fishing license (federal or Massachusetts) will be eligible (capped at 300) to attend one group simulator session held at USMRC in Middletown, RI or similar simulation facility within a reasonable commuting area: Private anglers (only for simulator); charter captain; and commercial fishing industry members. Up to 300 attendees will have the opportunity to navigate a vessel through a windfarm and experience various scenarios such as night conditions, adverse weather, and vessel crossings.

Funding/Cap:

- Sunrise Wind shall make available up to Five Hundred Thousand Dollars ($500,000) to fund claims when made through the Navigational Enhancement and Training Program. This Navigational Enhancement and Training Fund shall be used solely to pay approved vouchers under the Navigational Enhancement and Training Program as described herein.
- Sunrise Wind will book half-day simulator sessions at USMRC or similar simulation facility within a reasonable commuting area to accommodate demand of up to 300 potential participants as

defined above. There will be no tuition or training cost to attendees. Attendees will be limited to one visit.

- Once the funding and space at the simulators are exhausted, the program will end.

Administration:

- Navigation Equipment
    - Sunrise Wind or its designee will manage the process.
    - Sunrise Wind will approve at least 2 regional marine electronics retailers capable of installing electronic equipment.
    - Retailers may source and install navigation equipment up to the vessel's approved limit. The cost of installation counts towards the grant limit per fisherman. Retailers will invoice the escrow account for the cost of navigational equipment and installation.
- Professional Training
    - Sunrise Wind or its designee will manage the process.
    - Sunrise Wind will approve training facilities capable of providing

professional maritime courses including but not limited to OUPV courses ("Six pack" captain's course/national operator of uninspected passenger vessel), 100 ton upgrades, radar course, and rules of the road refreshers.

    - Training facilities will allow eligible participants the opportunity to attend regularly scheduled classes and invoice the fund for tuition up to $1,000.
- Experiential Learning
    - Sunrise Wind will manage reservation process and make simulator available.

Redemption Process

- Navigation Equipment
    - Applicants holding an approved voucher will contact pre-selected marine electronics installers to select Navigation Equipment.
    - Marine electronics retailers will work directly with the applicants to install Navigation Equipment.
    - After installation, retailers will bill the escrow account directly
- Professional Training
    - Interested eligible applicants will sign up for courses at approved facilities.
    - Facilities will work directly with applicants for course scheduling
    - Facilities will bill training account escrow up to $1000 for each approved applicant.
- Experiential Learning
    - Scheduling of navigation simulator will be managed by Ørsted Marine Affairs Department.

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
251 Causeway Street, Suite 800, Boston, MA 02114-2136
(617) 626-1200 FAX: (617) 626-1240

September 7, 2021

Sunrise Wind Farm and Sunrise Export Cable Project
Ryan Chaytors
Sunrise Wind, LLC
By its agent,
Orsted Wind Power North America, LLC
437 Madison Avenue, Suite 1903
New York, NY 10022

Re: CZM Federal Consistency Review of the Sunrise Wind Farm and Sunrise Export Cable Project – Bureau of Ocean Energy Management (BOEM) Action; Massachusetts.

Dear Mr. Chaytors:

The Massachusetts Office of Coastal Zone Management (CZM) received your consistency certification on September 1, 2021. CZM also obtained a copy of the Construction and Operations Plan (COP) on September 1, 2021, upon which this review will be conducted. Sunrise Wind Farm (SRWF) includes up to 122 wind turbine generators (WTGs, turbines) with a nameplate capacity of 8 to 15 megawatts (MW) per turbine, up to 123 foundations for the WTGs and offshore converter station (OCS-DC), up to 186 statute miles (mi)(300 km) of inter-array cables between the WTGs, OCS-DC, and one DC submarine export cable bundle (SRWEC) comprised of two cables located within an up to 106 mi (170 km) long corridor, all of which will be located within federal waters on the Outer Continental Shelf (OCS), specifically in BOEM Renewable Energy Lease Area OCS-A 0487 (Lease Area), approximately 18.9 mi (30.4 km) south of Martha's Vineyard, Massachusetts, approximately 30.5 mi (48.1 km) east of Montauk, New York (NY), and 16.7 mi (26.8 km) from Block Island, Rhode Island. The SRWF also includes an O&M facility that will be located onshore at Brookhaven, Long Island, New York. The SRWEC, a direct current (DC) electric cable, will connect the SRWF to the existing mainland electric grid Holbrook substation, also located in Brookhaven, Long Island, New York. The SRWEC includes both offshore and onshore segments. The submarine segment of the export cable is proposed to be buried beneath the seabed within federal waters on the OCS from the OCS-DC to the boundary of New York State territorial waters. The purpose of this letter is to provide you with public notice, scheduling, and other procedural requirements pursuant to National Oceanic and Atmospheric Administration's (NOAA) Coastal Zone Management Act (CZMA) regulations (15 CFR 923 *et seq.*), NOAA's Federal Consistency Regulations (15 CFR 930 *et seq.*), and CZM's Coastal Zone Management Program regulations (301 CMR 20 *et seq.*).

CZM will publish a notice that this proposed project is undergoing federal consistency review in the next edition of the *Environmental Monitor,* September 23, 2021. The publication date of that issue of the *Monitor* will commence a 21-day public comment period. Enclosed please find a copy of the schedule that we will follow during our review. CZM must issue our consistency decision within six months of commencement of our review, and we will make every effort to ensure our review is as expeditious as possible. If, after three months, we have been unable to complete our review, we will

notify you of outstanding issues or information needed to complete the review. As a networked program, the authorities and expertise of other state agencies are integrated and coordinated in CZM's review of projects to ensure compliance with the policies of our approved coastal program. Because consistency with CZM's enforceable policies cannot be achieved without compliance with their underlying state authorities, CZM will generally not issue a consistency decision until our networked agencies have completed their reviews. CZM looks forward to reviewing subsequent filings under NEPA. If necessary, we will contact you no later than five months from the start of the review to determine whether our review will be completed within the six-month review period, or whether a stay of the review period is recommended.

Note: It is the responsibility of the project proponent to publish a public notice of the federal consistency review by non-electronic means (e.g. local newspaper) concurrently with the public notice published in the *Environmental Monitor*.

Pursuant to the CZMA and NOAA's regulations, a federal agency cannot authorize that any work commence under the federal permit unless the federal permitting agency receives a consistency concurrence letter from CZM for the proposed project, or, if CZM objects and the project proponent appeals CZM's objection to the U.S. Secretary of Commerce and the Secretary overrides CZM's objection.

Communications regarding CZM's federal consistency review of the proposed project should be directed to Bob Boeri, at Robert.Boeri@mass.gov.

Sincerely,

Robert L. Boeri
Project Review Coordinator

RLB/pb
Enclosure

cc: Lia Howard, Orsted
Michael Evans, Orsted
Robin Main, Hinkley Allen
Robert Vietri, US Army Corps of Engineers
Taylor Bell, US Army Corps of Engineers
Christine Jacek, US Army Corps of Engineers
Dan McKiernan, MA DMF
John Logan, MA DMF
Steve McKenna, CZM Cape Cod Regional Coordinator
Dave Janik, CZM South Coast Regional Coordinator
Todd Callaghan, CZM Coastal and Marine Scientist
Mary Boatman, BOEM
Emily Hildreth, BOEM
Jeffrey Hesse, BOEM
David Kaiser, NOAA
Kerry Kehoe, NOAA

CZM Federal Consistency Review Schedule for Outer Continental Shelf (OCS) Exploration, Development, and Production Activities*

Review Steps

1.	*Document Receipt*	
(a)	Received consistency certification and necessary data and information on	September 1, 2021
(b)	Received copy of Construction and Operations Plan on	September 1, 2021
(c)	CZM federal consistency review will begin on	September 1, 2021
2.	*Public Notice*	
(a)	Notice of the initiation of this federal consistency review will appear in the next edition of the MEPA *Monitor* which will appear on or about	September 23, 2021
(b)	Publication in the *Monitor* begins a 21 day public comment period which will close on or about	October 14, 2021
3.	Applicant and federal permitting agency will be notified of review status and the basis for any further delay within 3 months of the commencement of review. Last date for review status notification is	December 1, 2021
4.	CZM will contact applicant after 5 months to determine whether all networked state agency reviews will be concluded within the review period or whether the review period should be stayed; this will occur no later than	February 1, 2022
5.	CZM must issue its consistency decision within 6 months of commencement of our review. The review period closes and a consistency decision will be issued no later than	March 1, 2022

* 301 CMR 20.04, 15 CFR 930.70 - 930.85

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
251 Causeway Street, Suite 800, Boston, MA 02114-2136
(617) 626-1200 FAX: (617) 626-1240

November 29, 2021

Sunrise Wind Farm and Sunrise Wind Export Cable
Ryan Chaytors
Sunrise Wind LLC
By its agent,
Orsted North America Inc
437 Madison Avenue, Suite 1903
New York, NY 10022

Re: CZM Federal Consistency Review of the Sunrise Wind Farm and Sunrise Wind Export Cable – Bureau of Ocean Energy Management (BOEM) Action; Massachusetts.

Dear Mr. Chaytors:

The Massachusetts Office of Coastal Zone Management (CZM) is currently reviewing the proposed project to construct and operate up to 122 wind turbine generators (WTGs, turbines) with a nameplate capacity of 880 to 1,300 megawatts (MW), up to 123 foundations for the WTGs and offshore converter station (OCS-DC), up to 186 statute miles (mi)(300 km) of inter-array cables between the WTGs, OCS-DC, and one DC submarine export cable bundle (SRWEC) comprised of two cables located within an up to 106 mi (170 km) long corridor, to include federal waters, specifically the BOEM Renewable Energy Lease Area OCS-A 0487 (Lease Area), approximately 18.9 mi (30.4 km) south of Martha's Vineyard, Massachusetts, approximately 30.5 mi (48.1 km) east of Montauk, New York (NY), and 16.7 mi (26.8 km) from Block Island, Rhode Island, and the portion of the export cable in the state waters of New York (referred to as SRWEC-NYS). The Sunrise Wind Farm Project also includes an Onshore Converter Station (OnCS–DC) and Onshore Transmission Cable that will be located in Brookhaven, Long Island, New York. The SRWEC, a direct current (DC) electric cable, will connect the Sunrise Wind Farm to the existing mainland electric grid Holbrook substation, also located in Brookhaven, Long Island, New York. The SRWEC occurs in both federal waters and state waters of New York. The submarine segment of the export cable is proposed to be buried beneath the seabed within federal waters on the OCS and in New York State waters. CZM received your completed federal consistency certification package on September 1, 2021, and a consistency decision is presently due on March 1, 2022.

CZM's federal consistency review is ongoing. As a networked program, the authorities and expertise of other state agencies are integrated and coordinated in CZM's review of projects to ensure compliance with the policies of our approved coastal program. Because consistency with CZM's enforceable policies cannot be achieved without compliance with their underlying state authorities, CZM will generally not issue a consistency decision until our networked agencies have completed their reviews of license, permit, and certificate applications identified as necessary data and information. CZM looks forward to reviewing subsequent filings under NEPA for consistency with state enforceable policies. As transmitted to Sunrise Wind on November 29, 2021, CZM will also need the requested

additional information on our Ports and Harbors enforceable policies necessary to complete this review prior to the expiration of our review. If we do not receive the NEPA documentation before February 1, 2022, CZM will contact you regarding a stay in the federal consistency review period, pursuant to NOAA's CZMA federal consistency regulations at 15 CFR 930.60(b).

Pursuant to applicable provisions of NOAA's Federal Consistency Regulations at 15 CFR 930.63, CZM may object to the consistency certification if any application for a specified state permit is denied, or if the applicant has failed to provide copies of final decisions on all applications identified as necessary data and information. As part of a consistency concurrence, CZM may stipulate conditions as may be necessary to achieve consistency with enforceable policies pursuant to provisions of NOAA's Federal Consistency Regulations (15 CFR 930.4, and 930.62). In the event an applicable plan, project proposal, or application is not modified accordingly, such conditional concurrence shall be treated as an objection to a federal consistency certification.

Communications regarding CZM's federal consistency review of the proposed project should be directed to Bob Boeri, at Robert.Boeri@state.ma.us.

Sincerely,

Robert Boeri
Project Review Coordinator

RLB/pb
CZM # 5821

cc: Lia Howard, Orsted
Michael Evans, Orsted
Robin Main, Hinkley Allen
Robert Vietri, US Army Corps of Engineers
Taylor Bell, US Army Corps of Engineers
Christine Jacek, US Army Corps of Engineers
Dan McKiernan, MA DMF
John Logan, MA DMF
Steve McKenna, CZM Cape Cod Regional Coordinator
Samuel Haines, CZM South Coast Regional Coordinator
Todd Callaghan, CZM Coastal and Marine Scientist
Mary Boatman, BOEM
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Kerry Kehoe, NOAA

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November 29, 2021

Sunrise Wind Farm and Sunrise Wind Export Cable
Ryan Chaytors
Sunrise Wind LLC
By its agent,
Orsted North America Inc
437 Madison Avenue, Suite 1903
New York, NY 10022

Re: CZM Federal Consistency Review of the Sunrise Wind Farm and Sunrise Wind Export Cable – Bureau of Ocean Energy Management (BOEM) Action; Massachusetts.

Dear Mr. Chaytors:

The Massachusetts Office of Coastal Zone Management (CZM) is currently reviewing the proposed project to construct and operate up to 122 wind turbine generators (WTGs, turbines) with a nameplate capacity of 880 to 1,300 megawatts (MW), up to 123 foundations for the WTGs and offshore converter station (OCS-DC), up to 186 statute miles (mi)(300 km) of inter-array cables between the WTGs, OCS-DC, and one DC submarine export cable bundle (SRWEC) comprised of two cables located within an up to 106 mi (170 km) long corridor, to include federal waters, specifically the BOEM Renewable Energy Lease Area OCS-A 0487 (Lease Area), approximately 18.9 mi (30.4 km) south of Martha's Vineyard, Massachusetts, approximately 30.5 mi (48.1 km) east of Montauk, New York (NY), and 16.7 mi (26.8 km) from Block Island, Rhode Island, and the portion of the export cable in the state waters of New York (referred to as SRWEC-NYS). The Sunrise Wind Farm Project also includes an Onshore Converter Station (OnCS–DC) and Onshore Transmission Cable that will be located in Brookhaven, Long Island, New York. The SRWEC, a direct current (DC) electric cable, will connect the Sunrise Wind Farm to the existing mainland electric grid Holbrook substation, also located in Brookhaven, Long Island, New York. The SRWEC occurs in both federal waters and state waters of New York. The submarine segment of the export cable is proposed to be buried beneath the seabed within federal waters on the OCS and in New York State waters. CZM received your completed federal consistency certification package on September 1, 2021, and a consistency decision is presently due on March 1, 2022.

In our review of the necessary data and information submitted for the federal consistency review of the proposed wind energy project, we have concluded that additional information is necessary to complete the determination of the proposed project's consistency with enforceable program policies of the Massachusetts coastal management program. Listed below is the applicable enforceable policy, with an excerpt of the relevant policy elements from the *Massachusetts Office of Coastal Zone Management Policy Guide* (Policy Guide) and the supplemental information requested.

Ports and Harbor Policy #4
Ports and harbors hold important state, regional, and national significance because they possess critical characteristics necessary for the successful operation of the Massachusetts maritime industry including access to deep navigation channels, flat lands appropriate for

industrial uses, connections to utilities and road/rail networks, and developed shorelines characterize which facilitate the transfer of goods from ship to shore. The enforceable Ports and Harbors Policies (#1 - 4) specifically relate to the dredging and disposal of dredged material, public benefit priorities for channel dredging, Designated Port Area management, and *the protection of water-dependent uses*.

Ports and Harbors Policy #4 states the need to preserve and enhance waterways for water dependent uses and vessel-related activities. However, the policy recognizes that protection of waterways and the water dependent uses operating within them is challenging given limited resources and the constant demand for redevelopment that may not be compatible with existing water dependent uses. The policy addresses this challenge by providing opportunities for protection by appropriately siting new uses so they do not interfere with existing operating water dependent uses. Additionally, the policy states that where existing water dependent uses are disrupted as a result of new water dependent uses at an off-site location within the proximate vicinity of the project site, adequate mitigation shall be provided.

The proposed Sunrise Wind Farm Project will be constructed in areas of state and federal waters where Massachusetts commercial fishing is known to occur as evidenced by information and data provided through the state and federal review processes and corroborated by fisheries agencies and the Massachusetts commercial fishing industry. Massachusetts commercial fishing activity currently operating in the project area will be disrupted by the proposed project because fishing activity will be precluded in parts of the project area during construction, the abundance or availability of fish may be temporarily displaced during construction, fishing activities may be restricted after construction, and landings may be affected throughout operation of the project.

Information requested

For CZM to determine the consistency of the project with the enforceable program policies of the Massachusetts coastal management program, Sunrise Wind LLC should provide an assessment of the potential economic impact of the project on the water dependent uses of Massachusetts, specifically addressing the potential economic exposure of the Massachusetts commercial fishing industry. The assessment should consider potential changes in fishing across ports, gear type, and fish species as a result of the project. In addition to the assessment of economic impacts, Sunrise Wind LLC should develop and provide a mitigation package to the Massachusetts commercial fishing industry to offset disruption, changes, or loss in fishing resulting from the project. The assessment of economic exposure and the mitigation package should incorporate data and input provided by Bureau of Ocean Energy Management (BOEM), the National Oceanic and Atmospheric Administration (NOAA), the MA Division of Marine Fisheries, MA CZM, the Massachusetts fishing industry, and other data sources, as applicable.

If you have questions about the federal consistency review process, please contact me at the above address or robert.boeri@mass.gov.

Sincerely,

Robert Boeri
Project Review Coordinator

CZM # 5821

cc: Lia Howard, Orsted
Michael Evans, Orsted
Robin Main, Hinkley Allen
Robert Vietri, US Army Corps of Engineers
Taylor Bell, US Army Corps of Engineers
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December 17, 2021

Sunrise Wind Farm and Sunrise Wind Export Cable
Ryan Chaytors
Sunrise Wind LLC
By its agent,
Orsted North America LLC
437 Madison Avenue, Suite 1903
New York, NY 10022

Re: CZM Federal Consistency Review of the Sunrise Wind Farm and Sunrise Wind Export Cable – Bureau of Ocean Energy Management (BOEM) Action; Massachusetts.

Dear Mr. Chaytors:

The Massachusetts Office of Coastal Zone Management (CZM) is currently reviewing the proposed project to construct and operate up to 102 wind turbine generators (WTGs, turbines) with a nameplate capacity of 924 to 1,122 megawatts (MW), up to 102 foundations for the WTGs and offshore converter station (OCS-DC), up to 180 statute miles (mi)(290 km) of inter-array cables between the WTGs, OCS-DC, and one DC submarine export cable bundle (SRWEC) comprised of two cables located within an up to 106 mi (170 km) long corridor, to include federal waters, specifically the BOEM Renewable Energy Lease Area OCS-A 0487 (Lease Area), approximately 18.9 mi (30.4 km) south of Martha's Vineyard, Massachusetts, approximately 30.5 mi (48.1 km) east of Montauk, New York (NY), and 16.7 mi (26.8 km) from Block Island, Rhode Island, and the portion of the export cable in the state waters of New York (referred to as SRWEC-NYS). The Sunrise Wind Farm Project also includes an Onshore Converter Station (OnCS–DC) and Onshore Transmission Cable that will be located in Brookhaven, Long Island, New York. The SRWEC, a direct current (DC) electric cable, will connect the Sunrise Wind Farm to the existing mainland electric grid Holbrook substation, also located in Brookhaven, Long Island, New York. The SRWEC occurs in both federal waters and state waters of New York. The submarine segment of the export cable is proposed to be buried beneath the seabed within federal waters on the OCS and in New York State waters. CZM received the completed federal consistency certification package on September 1, 2021, and a consistency determination is due on March 1, 2022.

CZM's federal consistency review is ongoing. As a networked program, the authorities and expertise of other state agencies are integrated and coordinated in CZM's review of projects to ensure compliance with the policies of our approved coastal program. Because consistency with CZM's enforceable policies cannot be achieved without compliance with their underlying state authorities, CZM will generally not issue a consistency decision until our networked agencies have completed their reviews of necessary data and information. As transmitted to Sunrise Wind in a letter dated November 29, 2021, CZM also requested additional information for reviewing consistency with its Ports and Harbors enforceable policies.

As discussed, the Coastal Zone Management Act Federal Consistency Regulations at 15 CFR 930.60(b) allow for a stay of the six-month review period, if mutually agreed upon by both the applicant and the state agency. The rules hold that the stay shall only be for a defined period and the agreement must state the specific date on which the stay will end. In order for CZM to review the additional material requested and other information to be provided, we propose a stay of the review, beginning on December 20, 2021, with CZM's review re-starting on November 25, 2022, and completed by February 3, 2023. Unless Sunrise and CZM mutually agree in writing to another later date, CZM will issue its consistency determination on or before February 3, 2023. Please indicate agreement to this schedule by signing below and returning this letter to CZM.

Pursuant to applicable provisions of NOAA's Federal Consistency Regulations at 15 CFR 930.63, CZM may object to the consistency certification if the project fails to meet the standards of CZM's enforceable policies, if any application for a specified state permit is denied, or if the applicant has failed to provide copies of final decisions on all applications identified as necessary data and information. CZM may stipulate conditions as may be necessary to achieve consistency with enforceable policies pursuant to provisions of NOAA's Federal Consistency Regulations (15 CFR 930.4, and 930.62). In the event an applicable plan, project proposal, or application is not modified accordingly, such conditional concurrence shall be treated as an objection to a federal consistency certification.

If you have questions about the federal consistency review process, please contact me at the above address or at robert.boeri@mass.gov.

Sincerely,

Robert L. Boeri

Robert Boeri
Project Review Coordinator

RLB/pb
CZM # 5821

Agreed to by Applicant

_____

Sunrise Wind LLC
By its agent, Orsted Wind Power North America LLC

Ryan Chaytors

_____

Ryan Chaytors,
Authorized Person

cc: Lia Howard, Orsted
Michael Evans, Orsted
Melanie Gearon, Orsted
Robin Main, Hinkley Allen
Robert Vietri, US Army Corps of Engineers
Taylor Bell, US Army Corps of Engineers
Christine Jacek, US Army Corps of Engineers
Dan McKiernan, MA DMF
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November 30, 2022

Ryan Chaytors
Sunrise Wind LLC
By its agent,
Orsted North America LLC
437 Madison Avenue, Suite 1903
New York, NY 10022

Re: CZM Federal Consistency Review of the Sunrise Wind Farm and Sunrise Wind Export Cable – Bureau of Ocean Energy Management (BOEM) Action; Massachusetts.

Dear Mr. Chaytors:

The Massachusetts Office of Coastal Zone Management (MACZM) and Sunrise Wind LLC (Sunrise Wind) hereby agree as follows.

Under Section 307 of the Coastal Zone Management Act (CZMA) and 15 CFR § 930.57, Sunrise Wind voluntarily filed a federal consistency certification with the MACZM on September 1, 2021, for the proposed Sunrise Wind Farm and Sunrise Wind Export Cable project. The proposed project is a listed activity subject to MACZM federal consistency review according to the CZMA, and the CZMA's implementing regulations at 15 C.F.R. Part 930, Subpart D – Consistency for Activities Requiring a Federal License or Permit.

Following 15 CFR § 930.60 (b), and in consideration of the parties' mutual interest that the state has additional time to fully assess the proposed Sunrise Wind project's consistency with the state's enforceable policies (requested additional information regarding consistency with the Ports and Harbors enforceable policies), the MACZM and Sunrise Wind mutually agree to the following dates and to stay the MACZM CZMA six-month review period as specified herein.

- Date the MACZM 6-month review period commenced: September 1, 2021
- Date the 6-month review period was to end: March 1, 2022
- Date the first stay began: December 20, 2021
- Date the first stay ended: November 25, 2022
- Date the decision was due: February 3, 2023
- Date the second stay begins: November 30, 2022
- Date that the fourth stay ends: January 24, 2023

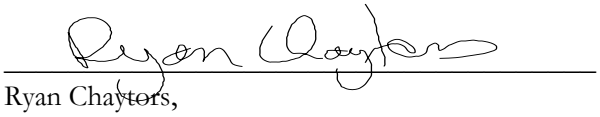
  (66 days remaining in the 6-month review period)
- Date the state's consistency decision is due: March 30, 2023

The MACZM will issue its federal consistency decision on or before March 30, 2023**.** The MACZM and Sunrise Wind mutually agree that the MACZM may issue its consistency decision during the stay period and before the end of the stay if the MACZM determines it has received sufficient information and completed its review. Any revocation or modification (including extension) of this agreement shall require mutual consent by MACZM and Sunrise Wind.

This agreement was made and entered by:

November 30, 2022
Robert L. Boeri Date
Project Review Coordinator, MACZM

Sunrise Wind, LLC
By its agent, Orsted Wind Power North America LLC



December 2, 2022
Ryan Chaytors, Date
Authorized Person

CZM # 5821

cc: Lia Howard, Orsted
Michael Evans, Orsted
Melanie Gearon, Orsted
Robin Main, Hinkley Allen
Robert Vietri, USACE
Taylor Bell, USACE
Christine Jacek, USACE
Dan McKiernan, MADMF
Story Reed, MADMF
John Logan, MADMF
Lisa Berry Engler, MACZM
Steve McKenna, MACZM
Samuel Haines, MACZM
Todd Callaghan, MACZM
Mary Boatman, BOEM
Emily Hildreth, BOEM

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
100 Cambridge Street, Suite 900, Boston, MA 02114 ◦ (617) 626-1200

March 10, 2023

Ryan Chaytors
Sunrise Wind LLC
By its agent,
Orsted North America LLC
437 Madison Avenue, Suite 1903
New York, NY 10022

Re: CZM Federal Consistency Review of the Sunrise Wind Farm and Sunrise Wind Export Cable – Bureau of Ocean Energy Management (BOEM) Action; Massachusetts.

Dear Mr. Chaytors:

The Massachusetts Office of Coastal Zone Management (MACZM) and Sunrise Wind LLC (Sunrise Wind) hereby agree as follows.

Under Section 307 of the Coastal Zone Management Act (CZMA) and 15 CFR § 930.57, Sunrise Wind voluntarily filed a federal consistency certification with the MACZM on September 1, 2021, for the proposed Sunrise Wind Farm and Sunrise Wind Export Cable project. The proposed project is a listed activity subject to MACZM federal consistency review according to the CZMA, and the CZMA's implementing regulations at 15 C.F.R. Part 930, Subpart D – Consistency for Activities Requiring a Federal License or Permit.

Following 15 CFR § 930.60 (b), and in consideration of the parties' mutual interest that the state has additional time to fully assess the proposed Sunrise Wind project's consistency with the state's enforceable policies (requested additional information regarding consistency with the Ports and Harbors enforceable policies), the MACZM and Sunrise Wind mutually agree to the following dates and to stay the MACZM CZMA six-month review period as specified herein.

- Date the MACZM 6-month review period commenced: September 1, 2021
- Date the 6-month review period was to end: March 1, 2022
- Date the first stay began: December 20, 2021
- Date the first stay ended: November 25, 2022
- Date the decision was due: February 3, 2023
- Date the second stay began: November 30, 2022
- Date the second stay ends: January 24, 2023
- Date the decision was due: March 30, 2023

• Date the third stay begins: March 10, 2023

• Date that the third stay ends: May 19, 2023

(20 days remaining in the 6-month review period)

• Date the state's consistency decision is due: June 8, 2023

The MACZM will issue its federal consistency decision on or before June 8, 2023**.** The MACZM and Sunrise Wind mutually agree that the MACZM may issue its consistency decision during the stay period and before the end of the stay if the MACZM determines it has received sufficient information and completed its review. Any revocation or modification (including extension) of this agreement shall require mutual consent by MACZM and Sunrise Wind.

This agreement was made and entered by:

Robert L. Boeri
Project Review Coordinator, MACZM

March 10, 2023
Date

Sunrise Wind, LLC
By its agent, Orsted Wind Power North America LLC

Ryan Chaytors,
Authorized Person

March 16, 2023
Date

CZM # 5821

cc: Lia Howard, Orsted
Michael Evans, Orsted
Melanie Gearon, Orsted
Robin Main, Hinkley Allen
Robert Vietri, USACE
Taylor Bell, USACE
Christine Jacek, USACE
Dan McKiernan, MADMF
Story Reed, MADMF
John Logan, MADMF
Lisa Berry Engler, MACZM
Steve McKenna, MACZM
Samuel Haines, MACZM
Todd Callaghan, MACZM
Mary Boatman, BOEM
Emily Hildreth, BOEM

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OFFICE OF COASTAL ZONE MANAGEMENT
100 Cambridge Street, Suite 900, Boston, MA 02114 ◦ (617) 626-1200

May 16, 2023

Ryan Chaytors
Sunrise Wind LLC
By its agent,
Orsted North America LLC
437 Madison Avenue, Suite 1903
New York, NY 10022

Re: CZM Federal Consistency Review of the Sunrise Wind Farm and Sunrise Wind Export Cable – Bureau of Ocean Energy Management (BOEM) Action and U.S. Army Corps of Engineers USACE) Permit; Massachusetts. 15 C.F.R. Part 930, Subpart E – Consistency for Outer Continental Shelf (OCS) Exploration, Development and Production Activities and Subpart D Consistency for Activities Requiring a Federal License or Permit; Massachusetts.

Dear Mr. Chaytors:

The Massachusetts Office of Coastal Zone Management (MACZM) and Sunrise Wind LLC (Sunrise Wind) hereby agree as follows.

Under Section 307 of the Coastal Zone Management Act (CZMA) and 15 CFR § 930.57, Sunrise Wind voluntarily filed a federal consistency certification with the MACZM on September 1, 2021, for the proposed Sunrise Wind Farm and Sunrise Wind Export Cable project. The proposed project is a listed activity subject to MACZM federal consistency review according to the CZMA, and the CZMA's implementing regulations at 15 C.F.R. Part 930, Subpart D – Consistency for Activities Requiring a Federal License or Permit.

Following 15 CFR § 930.60 (b), and in consideration of the parties' mutual interest that the state has additional time to fully assess the proposed Sunrise Wind project's consistency with the state's enforceable policies (requested additional information regarding consistency with the Ports and Harbors enforceable policies), the MACZM and Sunrise Wind mutually agree to the following dates and to stay the MACZM CZMA six-month review period as specified herein.

- Date the MACZM 6-month review period commenced: September 1, 2021
- Date the 6-month review period was to end: March 1, 2022
- Date the first stay began: December 20, 2021
- Date the first stay ended: November 25, 2022
- Date the decision was due: February 3, 2023
- Date the second stay began: November 30, 2022
- Date the second stay ends: January 24, 2023
- Date the decision was due: March 30, 2023

• Date the third stay began: March 10, 2023

• Date the third stay ends: May 19, 2023

• Date the decision was due: June 8, 2023

• Date the fourth stay begins: May 19, 2023

• Date that the fourth stay ends: July 8, 2023

(20 days remaining in the 6-month review period)

• Date the state's consistency decision is due: July 28, 2023

The MACZM will issue its federal consistency decision on or before July 28, 2023**.** The MACZM and Sunrise Wind mutually agree that the MACZM may issue its consistency decision during the stay period and before the end of the stay if the MACZM determines it has received sufficient information and completed its review. Any revocation or modification (including extension) of this agreement shall require mutual consent by MACZM and Sunrise Wind.

This agreement was made and entered by:

Robert L. Boeri
Project Review Coordinator, MACZM

May 16, 2023
Date

Sunrise Wind, LLC
By its agent, Orsted Wind Power North America LLC

Ryan Chaytors,
Authorized Person

May 16, 2023
Date

CZM # 5821

cc: Lia Howard, Orsted
Michael Evans, Orsted
Melanie Gearon, Orsted
Robin Main, Hinkley Allen
Robert Vietri, USACE
Taylor Bell, USACE
Christine Jacek, USACE
Dan McKiernan, MADMF
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Steve McKenna, MACZM
Samuel Haines, MACZM
Todd Callaghan, MACZM
Mary Boatman, BOEM
Emily Hildreth, BOEM

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
100 Cambridge Street, Suite 900, Boston, MA 02114 ◦ (617) 626-1200

July 11, 2023

Ryan Chaytors
Sunrise Wind LLC
By its agent,
Orsted North America LLC
437 Madison Avenue, Suite 1903
New York, NY 10022

Re: CZM Federal Consistency Review of the Sunrise Wind Farm and Sunrise Wind Export Cable – Bureau of Ocean Energy Management (BOEM) Action, United States Environmental Protection Agency and U.S. Army Corps of Engineers USACE) Permit; Massachusetts. 15 C.F.R. Part 930, Subpart E – Consistency for Outer Continental Shelf (OCS) Exploration, Development and Production Activities and Subpart D Consistency for Activities Requiring a Federal License or Permit; Massachusetts.

Dear Mr. Chaytors:

The Massachusetts Office of Coastal Zone Management (MACZM) and Sunrise Wind LLC (Sunrise Wind) hereby agree as follows.

Under Section 307 of the Coastal Zone Management Act (CZMA) and 15 CFR § 930.57, Sunrise Wind voluntarily filed a federal consistency certification with the MACZM on September 1, 2021, for the proposed Sunrise Wind Farm and Sunrise Wind Export Cable project. The proposed project is a listed activity subject to MACZM federal consistency review according to the CZMA, and the CZMA's implementing regulations at 15 C.F.R. Part 930, Subpart D – Consistency for Activities Requiring a Federal License or Permit and Subpart E – Consistency for Outer Continental Shelf (OCS) Exploration, Development and Production Activities.

Following 15 CFR § 930.60 (b), and in consideration of the parties' mutual interest that the state has additional time to fully assess the proposed Sunrise Wind project's consistency with the state's enforceable policies (requested additional information regarding consistency with the Ports and Harbors enforceable policies), the MACZM and Sunrise Wind mutually agree to the following dates and to stay the MACZM CZMA six-month review period as specified herein.

- Date the MACZM 6-month review period commenced: September 1, 2021
- Date the 6-month review period was to end: March 1, 2022
- Date the first stay began: December 20, 2021
- Date the first stay ended: November 25, 2022
- Date the decision was due: February 3, 2023
- Date the second stay began: November 30, 2022
- Date the second stay ends: January 24, 2023
- Date the decision was due: March 30, 2023

• Date the third stay began: March 10, 2023

• Date the third stay ends: May 19, 2023

• Date the decision was due: June 8, 2023

• Date the fourth stay began: May 19, 2023

• Date that the fourth stay ends: July 8, 2023

• Date the state's consistency decision was due: July 28, 2023

• Date the fifth stay begins: July 11, 2023

• Date that the fifth stay ends: August 29, 2023

(17 days remaining in the 6-month review period)

• Date the state's consistency decision is due: September 15, 2023

The MACZM will issue its federal consistency decision on or before September 15, 2023**.** The MACZM and Sunrise Wind mutually agree that the MACZM may issue its consistency decision during the stay period and before the end of the stay if the MACZM determines it has received sufficient information and completed its review. Any revocation or modification (including extension) of this agreement shall require mutual consent by MACZM and Sunrise Wind.

This agreement was made and entered by:

Robert L. Boeri — July 11, 2023

Robert L. Boeri
Project Review Coordinator, MACZM

Date

Sunrise Wind, LLC

Ryan Chaytors — July 13, 2023

Ryan Chaytors,
Authorized Person

Date

Kenneth Bowes,
Authorized Person

Date

CZM # 5821

cc: Lia Howard, Orsted
Michael Evans, Orsted

- Date the third stay began: March 10, 2023
- Date the third stay ends: May 19, 2023
- Date the decision was due: June 8, 2023
- Date the fourth stay began: May 19, 2023
- Date that the fourth stay ends: July 8, 2023
- Date the state's consistency decision was due: July 28, 2023
- Date the fifth stay begins: July 11, 2023
- Date that the fifth stay ends: August 29, 2023

  (17 days remaining in the 6-month review period)
- Date the state's consistency decision is due: September 15, 2023

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This agreement was made and entered by:

Robert L. Boeri
Project Review Coordinator, MACZM

July 11, 2023
Date

Sunrise Wind, LLC

Ryan Chaytors,
Authorized Person

Date

Kenneth Bowes,
Authorized Person

7/13/23
Date

CZM # 5821

cc: Lia Howard, Orsted
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THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
100 Cambridge Street, Suite 900, Boston, MA 02114 • (617) 626-1200

August 24, 2023

Ryan Chaytors
Sunrise Wind LLC
By its agent,
Orsted North America LLC
437 Madison Avenue, Suite 1903
New York, NY 10022

Re: CZM Federal Consistency Review of the Sunrise Wind Farm and Sunrise Wind Export Cable – Bureau of Ocean Energy Management (BOEM) Action and U.S. Army Corps of Engineers USACE) Permit; Massachusetts. 15 C.F.R. Part 930, Subpart E – Consistency for Outer Continental Shelf (OCS) Exploration, Development and Production Activities and Subpart D Consistency for Activities Requiring a Federal License or Permit; Massachusetts.

Dear Mr. Chaytors:

The Massachusetts Office of Coastal Zone Management (MACZM) and Sunrise Wind LLC (Sunrise Wind) hereby agree as follows.

Under Section 307 of the Coastal Zone Management Act (CZMA) and 15 CFR § 930.57, Sunrise Wind voluntarily filed a federal consistency certification with the MACZM on September 1, 2021, for the proposed Sunrise Wind Farm and Sunrise Wind Export Cable project. The proposed project is a listed activity subject to MACZM federal consistency review according to the CZMA, and the CZMA's implementing regulations at 15 C.F.R. Part 930, Subpart D – Consistency for Activities Requiring a Federal License or Permit and Subpart E – Consistency for Outer Continental Shelf (OCS) Exploration, Development and Production Activities.

Following 15 CFR § 930.60 (b), and in consideration of the parties' mutual interest that the state has additional time to fully assess the proposed Sunrise Wind project's consistency with the state's enforceable policies (requested additional information regarding consistency with the Ports and Harbors enforceable policies), the MACZM and Sunrise Wind mutually agree to the following dates and to stay the MACZM CZMA six-month review period as specified herein.

- Date the MACZM 6-month review period commenced: September 1, 2021
- Date the 6-month review period was to end: March 1, 2022
- Date the first stay began: December 20, 2021
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- Date the decision was due: February 3, 2023
- Date the second stay began: November 30, 2022
- Date the second stay ends: January 24, 2023
- Date the decision was due: March 30, 2023

- Date the third stay began: March 10, 2023
- Date the third stay ends: May 19, 2023
- Date the decision was due: June 8, 2023
- Date the fourth stay began: May 19, 2023
- Date that the fourth stay ends: July 8, 2023
- Date the state's consistency decision was due: July 28, 2023
- Date the fifth stay began: July 11, 2023
- Date that the fifth stay ends: August 29, 2023
- Date the state's consistency decision was due: September 15, 2023
- Date the sixth stay begins: August 24, 2023
- Date that the sixth stay ends: September 19, 2023

  (17 days remaining in the 6-month review period)
- Date the state's consistency decision is due: October 6, 2023

The MACZM will issue its federal consistency decision on or before October 6, 2023. The MACZM and Sunrise Wind mutually agree that the MACZM may issue its consistency decision during the stay period and before the end of the stay if the MACZM determines it has received sufficient information and completed its review. Any revocation or modification (including extension) of this agreement shall require mutual consent by MACZM and Sunrise Wind.

This agreement was made and entered by:

Robert L. Boeri
Project Review Coordinator, MACZM

August 24, 2023
Date

Sunrise Wind, LLC

Ryan Chaytors,
Authorized Person

August 25, 2023
Date

Kenneth Bowes,
Authorized Person

August 25, 2023
Date

CZM # 5821

cc: Lia Howard, Orsted
Michael Evans, Orsted
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Robin Main, Hinkley Allen
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Lisa Berry Engler, MACZM
Steve McKenna, MACZM
Samuel Haines, MACZM
Todd Callaghan, MACZM
Mary Boatman, BOEM
Emily Hildreth, BOEM

Fisheries Exposure in Massachusetts from the Sunrise Wind Lease Area and the Sunrise Export Cable Route

Hauke Kite-Powell, Di Jin, and Michael Weir
Marine Policy Center
Woods Hole Oceanographic Institution

20 August 2023

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List of Abbreviations

COP – Construction and Operations Plan

ECC – Export Cable Corridor

ECR – Export Cable Route

ECC WA – Export Cable Corridor Working Area

ECRA – Export Cable Route Area

GDP – Gross Domestic Product

MA DMF – Massachusetts Division of Marine Fisheries

NMFS – National Marine Fisheries Service

NOAA – National Oceanographic and Atmospheric Administration

PPI – Producer Price Index

RICRMC – Rhode Island Coastal Resources Management Council

RIDEM – Rhode Island Department of Environmental Management

SBRM – Standardized Bycatch Reporting Methodology

VMS – Vessel Monitoring System

VTR – Vessel Trip Report

WLA – Wind Lease Area

WTGA – Wind Turbine Generator Area

Summary

Based on NOAA data from 2008 to 2019, and adjusting for underreporting of lobster and Jonah crab landings in the VTR data, and for some dockside sales of lobster and Jonah crab, we estimate the average annual value of commercial landings from the Sunrise Wind Lease Area to be $2.76 million (2023$), or $6,420/km^2/year. Of this, $1.27 million is landed in Massachusetts. Including indirect and induced effects, these landings generate average annual economic impacts of $2.79 million in Massachusetts.

We estimate the average annual value of commercial landings from the 180 m wide Sunrise Wind Export Cable Corridor to be $174,000 (2023$), or $6,567/km^2/year. Of this, $92,000 is landed in Massachusetts. These landings generate estimated total annual economic impacts of $203,000 in Massachusetts.

We estimate that a total (lump sum) of $3,718,000 (2023$) of commercial fisheries value landed in Massachusetts is potentially exposed to the Sunrise Wind Farm development. This accounts for about 46% of the total potentially exposed commercial landed value from Sunrise Wind. It includes about $2,729,000 in direct landed value forgone due to construction-related effects, $840,000 from forgone fishing during the wind farm's operation, and $148,000 in present value of landings from decommissioning. Including indirect and induced effects, the potentially affected commercial landings result in about $8,198,000 in total (lump sum) present value economic impact in Massachusetts.

We estimate the average annual economic impact from Massachusetts-based for-hire charter fishing in and around the Sunrise Wind Lease Area to be between $251,000 and $405,000, and between $9,000 and $16,000 (2023$) from charter fishing around the Sunrise Wind Export Cable route. (Note that these areas overlap to some extent.) We estimate that a total (lump sum) of about $479,000 (2023$) in economic impact from Massachusetts-based charter fishing is potentially exposed during construction and decommissioning activities at Sunrise Wind.

There is considerable variability in the baseline data of landings and landed value from the Sunrise Wind lease area and export cable corridor. Baseline future landings will vary due to natural and fisheries-related fluctuations in stocks and prices. There is also uncertainty about the impact of wind farm construction and operation on fish stocks and landings, and about the ways that fishers will adapt their fishing practices in response to wind farm development. We consider our combined estimate of $8.68 million in 2023$ present value economic impact to Massachusetts from Sunrise Wind development on commercial and charter fishing to be a conservative upper bound on likely actual impacts.

Introduction

This report estimates the level of pre-development fishing operations intersecting with, and landings and landed value from, the Sunrise Wind Lease Area (WLA) and Export Cable Corridor (ECC) (Figure 1) associated with landings and revenue generated in Massachusetts ports, and the potential exposure of Massachusetts-based commercial and for-hire charter fishing to Sunrise Wind Farm construction, operations, and decommissioning. Sunrise Wind LLC is a joint venture between Ørsted and Eversource.

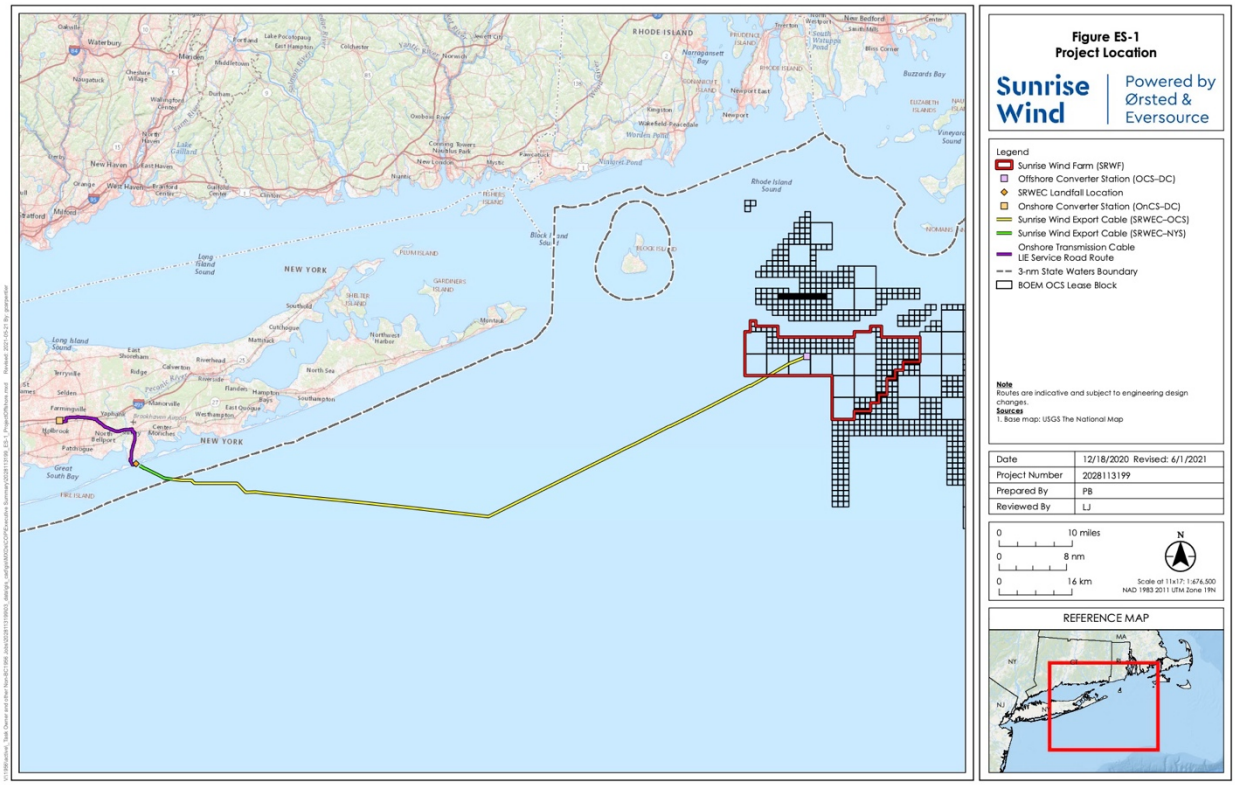

Figure 1. Sunrise Wind Lease Area and export cable route. Source: Sunrise Wind.

The WLA for Sunrise Wind lies in federal waters, some 40 km south of the mainland coast near the border between Rhode Island and Massachusetts, and has a footprint of 430.6 km^2.[1] The ECC is 147 km in length, and runs from the edge of the WLA first toward the southwest and then west toward Fire Island off the coast of Long Island, New York, to the export cable landing location near the western end of Fire Island. (Note that the export cable route is slightly longer than the ECC, because the cable route includes sections within the WLA and inland of the landing point.)

To estimate commercial fish landings along the ECC, we define a 10km wide Export Cable Route Area (ECRA) extending 5km on either side of the cable route. The 10km wide ECRA has no physical

[1] A small piece in the northeast corner of the original Sunrise WLA is not under consideration for turbine tower placement, and is not included in the WLA shapefile used for this analysis.

significance in the context of the Sunrise Wind Lease, and is defined only for the purpose of identifying fisheries landings data that reflect what may be landed from fishing along the export cable route. Only portions of the narrow, 180m wide ECC centered on the export cable may be disturbed in the process of burying the cable.

Table 1 shows the approximate length and area of these features for the Sunrise export cable route. In the sections that follow, fishery landings and values for the export cable route are estimated and reported for the ECC, as defined above.

Table 1. Sunrise Wind area parameters

Wind Lease Area footprint (km^2)	430.6
Export cable route length (km)	147
Area of 10km Export Cable Route Area (ECRA) (km^2)	1,610.9
Area of Export Cable Corridor (ECC) (km^2)	26.5
Export Cable Corridor fraction of ECRA	1.64%

Methodology

Our approach to estimating the potential impact of Sunrise Wind development on commercial fishing is to first estimate the annual landed weight and value of fish from the Sunrise WLA and ECC, and then to estimate the fraction of this annual value that may be exposed to wind farm construction, operation, and decommissioning. Our assessment method is consistent with the general framework described in the reports by Kirkpatrick *et al.*/BOEM (2017a and 2017b) on socio-economic impact of offshore wind energy development on commercial fisheries, and builds on the approach of Livermore (RIDEM 2017, 2018, and 2019), which develops high-end estimates of fishery impacts by including in baseline estimates the entire trip revenues from all trips that overlap with a wind lease area, regardless of how much fishing occurred inside or outside the area.

Separately, we estimate the gross revenue associated with for-hire charter boat fishing activity originating in Massachusetts, and the fraction of this revenue that may be exposed to Sunrise Wind development.

We estimate the annual commercial landings and landed value of fish from the Sunrise WLA and ECC using a new dataset provided by NOAA's National Marine Fisheries Service. This dataset uses modeled representations of federal Vessel Trip Report (VTR) and clam logbook fishing trip data to produce a more accurate spatial allocation of landings from each fishing trip (DePiper 2014; Benjamin *et al.* 2018). As we document below, there has been considerable variability in annual landings from these areas over the past decade; we use the average landings and landed value from 2008 to 2019 as indicative of what the areas may yield in the future.

We then estimate the fraction of this average annual value that may be at risk ("exposed") due to Sunrise Wind development, based on the nature and schedule of construction activities, operating

plans, and decommissioning plans, and on information from the scientific literature on the effects of wind farm construction and operation on commercial fish stocks and landings.

The effect of offshore wind farm construction and operation on marine ecosystems, fish stocks and fish behavior, and fishery landings is an area of ongoing research. To date, almost all offshore wind farm development has taken place outside the US. The only wind farm off the coast of New England from which lessons might be drawn directly for Sunrise Wind is the Block Island Wind Farm, a five-turbine, 30 MW project about 4 miles from Block Island, RI.

Investigations of offshore wind farms outside the US have found both positive and negative impacts on marine biota, habitats, and ecological function. The impacts include the aggregation of finfish and other marine life via the creation of artificial reefs (Bergström *et al.* 2014; Langhamer 2012; Lindeboom *et al.* 2011; Wilhelmsson and Malm 2008) and disturbance of existing ecosystems (Bergström *et al.* 2014; Wilhelmsson *et al*. 2006). Bartley *et al.* (2019) have reported on monitoring of physical and chemical conditions in the benthic environment around Block Island Wind Farm turbine towers over the two years since the towers were installed; they found some changes in the benthos in the immediate tower foundation footprint at one out of three turbine towers they investigated, and found no changes beyond 30m from any of the towers studied.

In their 2018 study, ten Brink and Dalton interviewed commercial and recreational fishers active in the waters around the Block Island Wind Farm about the perceived effects of the farm on fish stocks and fishing activity. Respondents reported murky water, underwater noise, and vibration during construction, and a lower abundance of fish such as striped bass on the side of Block Island closest to the wind farm site during the construction time window. They also reported the presence of shellfish and finfish on and around the wind turbine towers, including an increase in the abundance of cod, within months of the conclusion of construction activities. The transient negative effect on mobile species within 5-10km of wind farm construction activities observed at Block Island is consistent with findings from Europe (Bergström *et al.* 2014; Vallejo *et al.* 2017).

Hooper *et al.* (2017) report on a survey of recreational fishers and wind farms in the United Kingdom. The authors found that most fishers in their survey either had fished near a wind farm or were interested in doing so, and concluded that most UK anglers were unlikely to change their behavior in response to wind farm development.

More recently, Dalton *et al.* (2020) reported on surveys of Rhode Island recreational boaters' preferences for boating in the vicinity of offshore wind farms. Although some survey respondents identified as fishers, the survey did not explicitly target boaters interested in fishing; the mean age of respondents was above 62 years, mean boat length in excess of 37 feet, and more than 43% of respondents owned sailboats. Overall, boaters expressed a preference for not boating near (within 100 ft) of an offshore wind turbine; but boaters who fish were less negatively impacted by boating near a turbine, and boaters who had visited the Block Island Wind Farm were more accepting of trips near turbine towers than other boaters.

Given the current state of knowledge about the effects of wind farm construction and operation on fish stocks and fishery landings (Hogan *et al.* 2023), we consider five categories of possible exposure for commercial fishing from the Sunrise Wind project:

- Transient effects on fish availability due to construction activities and noise
- Transient effects due to constrained access to certain areas during construction
- Changes in fishing in the WLA during operations
- Transient effects due to constrained access to certain areas during decommissioning
- Transient effects on fish availability due to decommissioning activities

We also consider transient effects on the for-hire charter fishing industry due to construction and decommissioning of the wind farm. To the extent that for-hire charter fishing vessels from Massachusetts use the WLA and ECC, it is possible that their activities may be affected during construction and decommissioning. We consider it unlikely that the Sunrise Wind development will negatively affect the personal recreational fishing activities of Massachusetts boaters.

Estimating the effect of wind farm development on fishing activity and landings is complicated by several sources of variability and uncertainty. There is considerable year-to-year fluctuation in the historical baseline commercial landings from the wind development areas; and future fishery landings from these areas are likely to differ from historical baselines due to climate change effects (Free *et al.* 2019; Oremus 2019). There is uncertainty about the extent and duration of effects of wind farm construction on fish availability in the vicinity of the wind farm, and about the habitat and other effects (if any) of the wind farm over decades of operation. There is also uncertainty about the response of the commercial fishing industry and of for-hire charter fishing vessels to the altered "landscape" resulting from wind farm development. The current state of the science about wind farm effects on commercial fishing does not support a precise estimate of effects on fish stocks; and the future decisions of fishers are by their nature not precisely predictable, especially decades into the future, because they depend on personal assessments and decisions of individual fishers.

Acknowledging these sources of variability and uncertainty, we seek to develop a realistic, conservative estimate of the potential effect of Sunrise Wind development on Massachusetts commercial landings, landed value, and charter boat revenue. We make conservative assumptions about fishing industry response, assuming that landings from an area where access is constrained during construction, operations, or decommissioning are simply forgone, and not compensated by landings from fishing elsewhere instead. Further, we estimate impact as the landed value (gross revenue) at risk, not the net income or profit. Landed value is, by definition, larger than net income or profit from fishing. For these reasons, we consider our impacts estimate to represent an upper bound on the likely net effects of the wind farm on the Massachusetts fishing industry.

Throughout this report, we use "landed value" to refer to the direct value of fisheries landings, "impact" to refer to the economic activity generated by fisheries, including indirect and induced effects (see below), and "exposure" to refer to the portion of landed value or impacts that may be at risk due to wind farm development.

Baseline commercial fishery landings and values, 2008-2019

Commercial Fisheries Data Description

The following data description is based on information provided by the National Marine Fisheries Service (NMFS) on March 20 and April 1, 2020.[2] NOAA has been collecting and improving the Vessel Trip Report (VTR) data for decades. The data have been widely used for fisheries research, management, and economic impact assessments. To gauge landings value and quantity at the spatial scale required for the Sunrise Wind Lease Area and export cable route, NOAA has recently developed a procedure to produce high-resolution spatial information using a combination of VTR and fishery observer data. As described below, we follow the general approach developed by NOAA, which is the best approach at present, with a recognition that relevant data are not perfect. All estimates of fishery landings and values in this report are based on these NMFS data; and the data have not been amended, adjusted, or augmented in any way, with two exceptions: we make adjustments to the lobster and Jonah crab landed values to account for possible underreporting; and we make adjustments to the Rhode Island lobster and Jonah crab landings to account for dockside sales. These adjustments are described in detail in the section on Adjustment of Lobster and Jonah Crab Data below. The adjusted data appear only in Tables 11 and 12 below.

The data presented below summarize estimates of fisheries landings and values for fishing trips that intersected with the Sunrise Wind Lease Area (WLA) or its Export Cable Route Area (ECRA), from 2008 to 2019 (calendar years). Modeled representations of federal Vessel Trip Report (VTR) and clam logbook fishing trip data were queried for spatial overlap with the WLA and the ECRA, and linked to dealer data for value and landings information. As detailed in DePiper (2014) and Benjamin *et al.* (2018), to improve the spatial resolution of VTR, a spatial distribution model was developed by combining vessel trip information from VTR with matching NOAA fishery observer data, including geocoordinates of detailed fishing locations. From this model, landings and value can be summarized for a specified geographic area according to (1) species, (2) gear type, (3) port of landing, and (4) state of landing.

In essence, the DePiper approach utilizes a spatial model to distribute the total landings for each commercial fishing trip over a circular area with its center located at the geocoordinate reported in the VTR, following a distribution decreasing with the radius. The model was estimated using VTR data (for the centroid) and vessel observer data (for haul beginning and endpoints). DePiper (2014) reported that the observer data matched VTR records well (488,251 hauls in the observer data were matched to 27,358 VTR records, representing 87.5% of all hauls with either a beginning or end point of a haul recorded).

The primary purpose of the observer data collection is to monitor fishery bycatch. NOAA's Standardized Bycatch Reporting Methodology (SBRM) dictates what types of vessels (gear, species, area of operation, etc.), participating in various fisheries, should be sampled and at what rate. The numbers of sea days needed to achieve a 30% coefficient of variation (CV = standard deviation divided by mean) of total discards for each species group were derived for different SBRM fleets covering different gears, access areas, states, and mesh sizes (NEFSC 2013). For Massachusetts vessels, the observer program covered

[2] Our primary contact at NMFS was Benjamin Galuardi, a statistician at the NOAA Greater Atlantic Regional Fisheries Office. He has worked extensively on fishery data analyses in general and the VTR data in particular, and has authored or coauthored more than 30 publications on fisheries sciences and spatial statistics.

close to 20% of trips with trawl gear, around 5% of trips with dredge gear, and around 20% of trips with gillnet gear (Jin 2015).

Following the DePiper approach, the resulting high spatial resolution data were converted into raster maps. Use of this VTR raster model produces a more accurate estimate of the spatial distribution of landings than other approaches that rely entirely on the self-reported VTR/clam logbook locations, which associate all landings from the trip with a single point location. At 10 nautical mile resolution, the confidence intervals of the DePiper model estimates are around 90% for trip lengths of one to two days.

The only alternative to the DePiper approach is a model to distribute the total landings from a VTR report over the vessel's track using the Vessel Monitoring System (VMS) data. The main challenge for this approach is accurate identification of fishing and non-fishing segments of a trip. Muench *et al.* (2018) have shown that using vessel speed alone can lead to a severe misrepresentation of fishing locations. NOAA has adopted the DePiper approach as a standard procedure to generate spatial data; and we agree with NOAA that this is the best approach currently available. The main advantages of the DePiper approach are that (1) it is based on observations of actual fishing locations noted by observers at sea, and (2) it provides a systematic and consistent way to meet the increasing demand for spatial fishing data for relatively small areas in the ocean, which is important for cross project comparison.

Landings associated with the Export Cable Corridor and Export Cable Route Working Area are calculated by applying the factors in Table 1 to the landings estimated for the Export Cable Route Area. This assumes that landings are distributed uniformly across the fished sections of the ECRA.

In order to maintain the legally required data confidentiality, summaries by species, gear type, and landing location are presented individually. In addition, for records that did not meet the "rule of three" (three or more unique dealers and three or more unique permits), values are summarized in a category labeled "ALL OTHERS." Note also:

- All landed values have been converted to 2020 dollars using the Producer Price Index for "unprocessed and prepared seafood."
- Pounds are reported in Landed Pounds, unless otherwise noted.
- Data summarized here are from federal sources only.
- Fishing vessels that carry only lobster permits for federal waters are not subject to VTR requirements. Landings from trips with no VTR are not reflected in this summary.
- Other fisheries exist in state waters that may not be reflected in data from federal sources (e.g. whelk, quahog, striped bass).

We also obtained the average monthly number of trips intersecting with each area, for the period of 2014-2019.

Commercial Fishery Landings from Wind Lease Area and Export Cable Corridor

Table 2 shows the average annual level and standard deviation of total values and landings associated with fishing in the Sunrise WLA and the ECC from 2008 to 2019.

The average annual landings from the Sunrise WLA are about 2.19 million lbs (standard deviation 855,000 lbs) with a value of about $2.12 million (standard deviation $737,000). Average annual landings from the ECC are about 102,000 lbs (standard deviation 31,000 lbs) with a value of $146,000 (standard deviation $50,000).

Table 2. Average annual value and quantity of commercial fisheries landings by area

Area	*Mean* Value/year (2020 $)	*Mean* Landings/year (lbs)	*Standard Deviation* Value/year (2020 $)	*Standard Deviation* Landings/year (lbs)
Sunrise WLA	2,116,815	2,191,599	736,846	855,072
Sunrise ECC	146,040	102,423	50,083	31,388

Table 3 shows the total landings and values, for each year from 2008 to 2019, associated with fishing in the Sunrise WLA and the ECC.

Table 4 summarizes the average annual landings and value of fisheries production from the Sunrise WLA and the ECC by the top five species or species groups. Lobster, scallops, monkfish, and skate wings are among the species/products generating the greatest value from the Sunrise WLA during the 2008-2019 time period.

Table 3. Annual value and quantity of commercial fisheries landings by area.

Area	Sunrise WLA		Sunrise ECC	
Year	Value (2020 $)	Landings (lbs)	Value (2020 $)	Landings (lbs)
2008	1,615,088	1,005,003	99,660	124,213
2009	1,774,968	1,763,708	116,648	141,792
2010	1,732,042	1,569,026	147,042	93,643
2011	2,068,388	2,138,106	183,873	121,945
2012	2,370,211	2,523,020	177,409	133,283
2013	3,660,640	3,846,497	193,497	110,854
2014	2,880,896	3,179,394	215,344	100,489
2015	2,100,812	2,099,179	112,582	123,345
2016	2,818,797	3,123,434	141,753	108,395
2017	2,011,618	2,091,922	206,015	64,818
2018	1,482,612	1,890,508	106,437	70,247
2019	885,704	1,069,387	52,223	36,059

Both mobile (e.g., trawl and dredge) and fixed (e.g., pots and gillnet) gears are used in fishing operations. The trawl gear is primarily used for harvesting groundfish, dredge for scallops, and pots for lobster and crabs. The fixed gears are fished using trawls (a series of lobster pots attached to one line) with string lengths of 0.4–0.8 km (up to 1.829 km) or gillnets with typical string lengths of 0.2–3.0 km. Tables 5a and 5b break out annual landings for each area by gear type. Sinking gillnets and bottom trawls are the most significant in the WLA, followed by scallop dredges. In the ECC, bottom trawls and

scallop dredges are the most significant, followed by sinking gillnets and clam dredges. The "ALL_OTHERS" category includes landings using purse seines, other seines, and weirs/traps, and others that fall under the "rule of three" exclusion.

Table 4. Average annual landings of major species by area, 2008-2019.

	Mean		***Standard Deviation***	
Area/Species	**Value/year** (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
Sunrise WLA				
ALL_OTHERS	559,908	712,732	526,411	603,320
Monkfish	377,837	224,763	134,917	39,911
Scallops/Bushel	243,724	21,375	180,466	16,581
Skate Wings	192,400	496,211	88,291	133,949
Lobster, American	131,173	23,676	34,047	6,421
Sunrise ECC				
Scallops/Bushel	62,591	5,704	45,989	4,658
ALL_OTHERS	17,814	21,860	17,907	21,597
Quahogs/Bushel	13,528	16,670	21,151	25,726
Monkfish	13,401	7,083	5,392	1,733
Squid/Loligo	11,494	8,877	4,379	3,925

Table 5a. Average annual landings in Sunrise WLA by gear type.

	Mean		***Standard Deviation***	
Gear	**Value/year** (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
ALL_OTHERS	608,138	720,798	514,302	601,202
Dredge - Clam	-	-	-	-
Dredge - Scallop	198,211	18,120	139,265	14,111
Gillnet – Other	-	-	-	-
Gillnet – Sink	550,603	563,390	210,752	193,006
Handline	3,387	917	4,821	1,122
Longline – Bottom	621	166	1,502	393
OTHER	7,764	691	26,896	2,394
Pot – Other	178,766	71,766	42,041	24,967
Trawl – Bottom	553,197	695,988	309,568	329,261
Trawl - Midwater	16,129	119,762	22,843	167,438

Table 5b. Average annual landings in Sunrise ECC by gear type.

Gear	*Mean*		*Standard Deviation*	
	Value/year (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
ALL_OTHERS	19,559	22,229	18,779	21,493
Dredge – Clam	13,897	16,872	20,984	25,656
Dredge – Scallop	57,149	5,238	41,824	4,275
Gillnet – Other	5	3	19	12
Gillnet – Sink	15,863	11,942	5,969	3,425
Handline	206	89	124	58
Longline - Bottom	45	12	102	27
OTHER	1,794	166	2,311	210
Pot - Other	3,581	2,040	1,053	541
Trawl – Bottom	31,799	28,050	7,171	5,388
Trawl - Midwater	2,143	15,782	1,998	14,316

Table 6 summarizes annual landings and landed value for the major ports receiving landings from the two areas. Point Judith (Rhode Island) and New Bedford (Massachusetts) are the most significant ports for landings from the Sunrise Wind areas. Tables A5 through A7 in the Appendix show the complete data on average annual landings and landed value by port for Rhode Island and Massachusetts.

Tables 7a and 7b show average annual landings and landed value from the two areas by state where the catch is landed. Rhode Island and Massachusetts together account for more than 95% of landings and landed value from the WLA and more than 68% of landings from the ECC. The "others" category includes landings in Maine, Connecticut, New York, New Jersey, Maryland, North Carolina, and Virginia, as well as data flagged by the "rule of three" exclusion.

Table 6. Average annual landings at major ports in Rhode Island and Massachusetts.

Area/Port	*Mean*		*Standard Deviation*	
	Value/year (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
Sunrise WLA				
New Bedford, MA	875,504	887,422	548,737	669,281
Point Judith, RI	546,080	525,298	262,657	338,703
Little Compton, RI	226,334	259,258	107,800	134,413
Newport, RI	138,952	181,915	68,718	91,330
Sunrise ECC				
New Bedford, MA	75,390	50,137	32,864	22,755
Point Judith, RI	15,923	12,784	6,679	2,777

Table 7a. Average annual landings in Sunrise WLA by state.

State	Mean		Standard Deviation	
	Value/year (2020 $)	Landings/year (lbs)	Value/year (2020 $)	Landings/year (lbs)
Rhode Island	1,034,863	1,124,470	267,459	277,149
Massachusetts	981,602	1,002,341	551,935	695,103
Others	99,838	64,361	--	--

Table 7b. Average annual landings in Sunrise ECC by state.

State	Mean		Standard Deviation	
	Value/year (2020 $)	Landings/year (lbs)	Value/year (2020 $)	Landings/year (lbs)
Rhode Island	22,218	19,853	8,703	3,996
Massachusetts	77,407	54,210	33,681	26,059
Others	46,394	28,347	--	--

Landed value and trips by month

Table 8 and Figures 2 and 3 show the average monthly landings and values from the two areas. Table 9 reports the average monthly number of fishing trips that intersect each area.

Table 8. Average monthly value of landings, 2020$, 2014-2019 (2020$).

Month	Sunrise WLA	Sunrise ECC
Jan	181,533	15,225
Feb	108,563	15,810
Mar	111,095	19,200
Apr	161,159	25,643
May	165,798	23,047
Jun	237,018	42,712
Jul	170,048	41,095
Aug	144,073	23,846
Sep	224,291	20,819
Oct	163,778	17,847
Nov	191,969	15,994
Dec	190,477	20,273

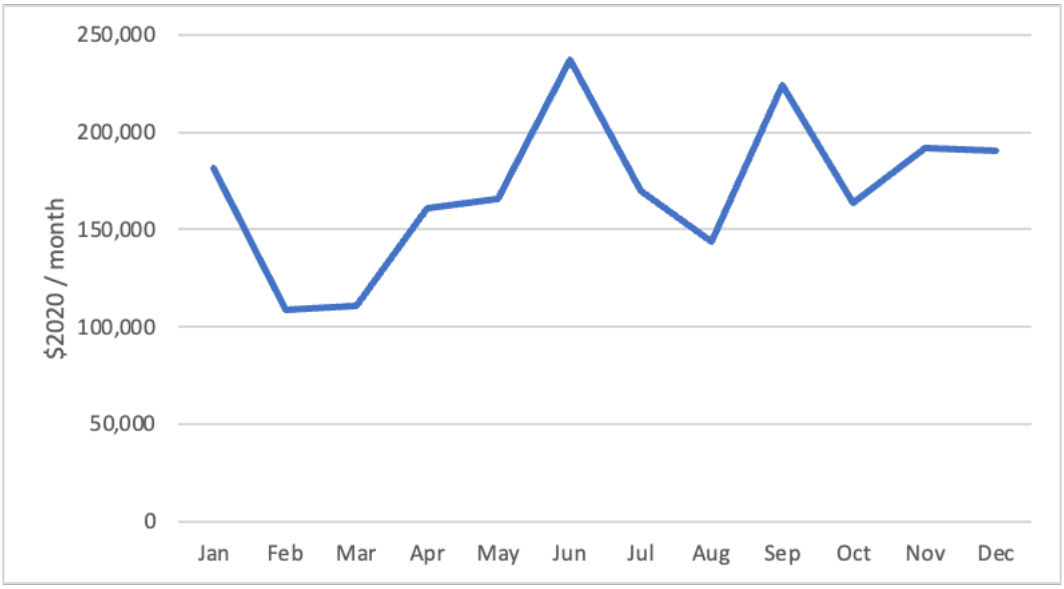

Figure 2. Average monthly value of landings, Sunrise WLA, 2014-2019.

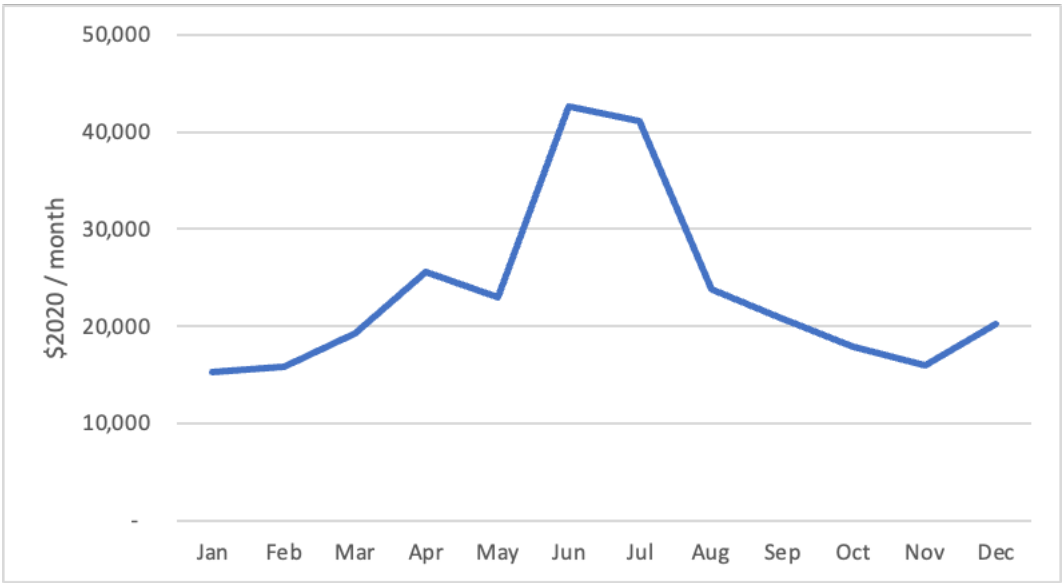

Figure 3. Average monthly value of landings, Sunrise ECC, 2014-2019.

Table 9. Average monthly number of fishing trips, 2014-2019.

Month	Sunrise WLA	Sunrise ECRA
Jan	315	480
Feb	167	323
Mar	149	305
Apr	208	452
May	367	732
Jun	502	923
Jul	575	789
Aug	579	705
Sep	501	677
Oct	380	589
Nov	335	588
Dec	365	646

Inter-annual price adjustments

We use the Bureau of Labor Statistics' Producer Price Index (PPI) for "unprocessed and prepared seafood"[3] to convert ex-vessel value of fish landings, because this index is specifically for the fishery sector. PPI is a family of indexes that measures the average change over time in selling prices received by domestic producers of goods and services; they measure price change from the perspective of the seller. In contrast, the Bureau of Economic Analysis' general Gross Domestic Product (GDP) deflator[4] measures changes in the prices of goods and services produced in the United States, including those exported to other countries, and captures price changes across all economic sectors. Table 10 shows both indexes from 2000 to 2021.

Note that the variation in the sector (i.e., fishery) specific price index is considerably larger than that of the GDP deflator. PPI decreases have been observed in several years since 2000. The GDP deflator exhibits a steady trend. We recognize that many seafood prices rose sharply in 2021, as reflected by the sharp increase in fish PPI for that year. We consider it unlikely that this will significantly alter the long-term trend, and maintain that the historical average is the best predictor of future values.

We report all values in 2020$ for consistency. These values can be easily adjusted to any other-year dollars by applying the appropriate index adjustment. Landed value may be adjusted using the PPI index. For impact values, including upstream and downstream effects (see below), it is more appropriate to use the GDP deflator to adjust, because the multipliers capture economy-wide impacts.

[3] https://www.bls.gov/ppi/#data

[4] https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=2#reqid=19&step=2&isuri=1&1921=survey

Table 10. Price indexes.

Year	GDP implicit price deflator	Percent change	PPI fish	Percent change
2000	78.0		198.1	
2001	79.8	2.25%	190.8	-3.69%
2002	81.0	1.56%	191.2	0.21%
2003	82.6	1.97%	195.3	2.14%
2004	84.8	2.68%	206.3	5.63%
2005	87.5	3.14%	222.6	7.90%
2006	90.2	3.09%	237.4	6.65%
2007	92.6	2.70%	242.8	2.27%
2008	94.4	1.92%	255.4	5.19%
2009	95.0	0.64%	250.9	-1.76%
2010	96.2	1.20%	272.4	8.57%
2011	98.2	2.08%	287.6	5.58%
2012	100.0	1.87%	287.6	-0.02%
2013	101.8	1.75%	299.4	4.12%
2014	103.7	1.87%	322.4	7.68%
2015	104.7	1.00%	322.0	-0.13%
2016	105.7	1.00%	327.6	1.74%
2017	107.7	1.90%	337.9	3.15%
2018	110.3	2.39%	344.5	1.96%
2019	112.3	1.79%	349.9	1.55%
2020	113.6	1.21%	350.8	0.27%
2021	118.4	4.15%	413.0	17.74%
Annual average		2.01%		3.66%

Adjustment of lobster and Jonah crab data

As noted above, lobster vessels that carry only lobster permits are not subject to a Vessel Trip Report (VTR) requirement. Trips without VTR are not reflected in the numbers shown in Tables 2 through 9 (cf. King 2019). To account for potentially unreported lobster and Jonah crab landings, and for dockside sales (see below), we make adjustments to the landed value data as shown in Table 11. Data in the first three rows are based on VTR data, and are taken from Table 2 and Tables A1 through A3 in the Appendix. An earlier study by Industrial Economics (2015) indicates that active lobster vessels not subject to trip report requirements in Lobster Management Area 2 may account for as much as 57% of the total lobster fishing activity in that area. (Lobster Management Area 2[5] encompasses the waters south of Rhode Island and Cape Cod to a distance of about 40 nm, and includes the Sunrise WLA.) We assume conservatively that landings from 60% of the lobster vessels in the Sunrise WLA and ECRA could therefore be unreported, and that the VTR data represent 40% of the true lobster and Jonah crab revenues. We use this as an adjustment factor, and estimate the adjusted lobster and Jonah crab revenues at 2.5 times of those in the VTR data.

Some fraction of lobster and Jonah crab landings are sold directly from boats at dockside, at a price above that reported in the dealer information on which the NOAA values above are based. Neither the

[5] http://fisheries.noaa.gov/resource/map/lobster-management-areas

fraction of landings sold in this way nor the price premium is known exactly. Based on information provided by a group of Rhode Island fishermen (pers. comm., 24 Nov. 2020), we estimate that a 15% premium on the landed value derived from NOAA data (Table 11) adequately captures this dockside sales effect for Rhode Island landings. Dockside sales are not a common practice in Massachusetts (Mass. DMF pers. comm. May 2021), so we do not apply this multiplier to Massachusetts landings.

The combined adjustment for VTR data and dockside sales is shown in rows 5 and 6 in Table 11. The net increase is shown in row 7, and the adjusted total annual landed values are shown in row 8. This adjustment results in a 13.2% increase in the estimated total annual landed value for the WLA, and 3.3% increase for the ECC.

Table 11. Adjustment of landed value for landings not captured in VTR data and for RI dockside sales.

Value (2020$)	**Sunrise WLA**	**Sunrise ECC**
Avg. VTR total $/year (Table 2)	2,116,815	146,040
Avg. VTR lobster $/year (Tables A1-A3)	131,173	1,963
Avg. VTR Jonah crab $/year (Tables A1-A3)	35,412	1,159
% of total captured by VTR	40%	40%
Adjusted lobster $/year (incl. RI dockside sales)	351,981	5,019
Adjusted Jonah crab $/year (incl. RI dockside sales)	95,022	2,964
Net increase over VTR $/year (row 5+6-2-3)	280,419	4,861
Adjusted total $/year	2,397,234	150,901
Adjusted increase over VTR total value	13.2%	3.3%

With all adjustments, we estimate the average annual landed value in Massachusetts from the Sunrise WLA to be about $1.1 million (2020$), and from the Sunrise ECC about $80,000.

Estimated indirect and induced economic impacts

Economic impact multipliers reflect the linkages between economic activity in different sectors of the economy. For example, when landings increase in the commercial fishing sector, there is an associated increase in the purchases of ice and other supplies in the region, and an increase in onshore transportation and processing of seafood. The resulting increases in economic activity in the commercial fishing supply and transportation and processing sectors are indirect effects of increased landings. In addition, because fishermen and workers in the supply, transportation, and processing industries earn greater income as a result of this increased activity, and spend some of that extra income on local goods and services, there is also an induced effect of greater spending in other sectors. The multipliers capture the combined effect of indirect and induced spending that results from higher commercial landings.

We have developed regional economic models for Massachusetts using the IMPLAN model software (IMPLAN 2004) and data for 2018 and 2019. IMPLAN software and data are commercial products widely used by researchers and management agencies to perform economic impact analyses for a user specified study region (IMPLAN 2004; Steinback and Thunberg 2006; Hoagland *et al.* 2015; UMass

Dartmouth. 2018; Cape Cod Commission 2020). Based on these models, and 2019 data, the upstream output multiplier for the commercial fishing industry in Massachusetts is 1.775.

We have also taken into account downstream economic activity, such as seafood processing, that may take place at Massachusetts businesses as a result of commercial fisheries landings. This linkage is less direct than the upstream activities, because not all seafood landed in a state is processed in the state, and seafood processors may import more seafood from elsewhere for processing when in-state landings fall short. Nonetheless, we add a downstream adjustment of 0.43, as cited by BOEM (2021) in the Vineyard Wind analysis, to the multiplier for Massachusetts landings, bringing the combined multiplier to 2.205, to account for both upstream effects and downstream effects to seafood processors. We apply the combined upstream and downstream multiplier to all landings except lobster and Jonah crab, which are adjusted for dockside sales and receive only the upstream multiplier. The corresponding combined multiplier for Rhode Island landings is 2.219; for landings in other states, we use the average of the Massachusetts and Rhode Island multipliers.

The economic impact multiplier captures the linkages between the fishing industry sector and other sectors in the Massachusetts economy. While we use a single output multiplier for the entire commercial fishing sector in a given state, we recognize that the multiplier may in fact vary across specific fisheries, species, and gear due to differences in factor inputs for fishing operations and post processing of fish landed. We use a single multiplier for the entire commercial fishing sector, reflecting an average across all gear types and species. Economy-wide inflation affects all sectors in the economy but usually does not alter the general structure of the economy. Therefore, although the baseline economic values increase with rising prices, the multiplier does not. We also recognize that other types of multipliers, such as those focusing on employment effects, have been used in other analyses. We maintain that the output multipliers we use provide a robust and accurate measure of indirect and inducted effects averaged across the fishing sectors.

Table 12. Estimated annual economic impact in Massachusetts (all values in 2020$)

		Average value of landings/year			**Total impact/year**
Area	**State**	VTR data only (Table 11, row 1)	with lobster & Jonah crab adjustment	with dockside sales adjustment (15% premium on RI lobster & JC landings)	"dockside sales" column multiplied by upstream & downstream multipliers, except RI lobster & JC
Sunrise WLA	total	2,116,815	2,366,693	2,397,234	5,214,570
Sunrise ECC	total	146,040	150,723	150,901	332,878
Sunrise WLA	MA	981,567	1,097,435	1,097,435	2,419,845
Sunrise ECC	MA	77,401	79,883	79,883	176,142

Using these multipliers, and including the lobster and Jonah crab adjustment described in the previous section, we estimate the average annual total economic impact from commercial fishing activity in the Sunrise WLA to be about $2.42 million (2020$) in Massachusetts (Table 12). We also estimate the average annual total economic impact from commercial fishing activity in the Sunrise ECC to be about $180,000 in Massachusetts. Including landings in other states, the total average annual economic impact from commercial fishing activity in the WLA is $5.21 million and in the ECC it is $333,000. These estimates are based on average annual landings value from 2008 to 2019, with lobster and Jonah crab landed value adjusted to account for boats not subject to VTR requirements.

Exposure of commercial fishery resources and fishing to wind farm development

In the following sections, we consider five categories of possible exposure of commercial fishery landings and landed value from the Sunrise Wind project:

- Transient effects on fish availability due to construction activities and noise
- Transient effects due to constrained access to certain areas during construction
- Changes in fishing in the WLA during operations
- Transient effects due to constrained access to certain areas during decommissioning
- Transient effects on fish availability due to decommissioning activities

Table 13. Assumptions for exposure of commercial fisheries to wind farm development.

Categories of Potential Exposure			Assumptions/Effects	Duration
Availability effects due to construction	WTGA+7.5km		100% of finfish leave area (a)	1 year
	WLA		Lobster/crab landings reduced 10% (b) Other shellfish landings reduced 10% (c)	2 years 5 years
	ECRA	1.6km WA	All landings reduced 10% (d)	1 year
		180m ECC	Lobster/crab landings reduced 25% (e) Other shellfish landings reduced 25% (f)	2 years 5 years
Construction constrained access	WLA		No fishing in 50% of area (g)	2 years
	ECRA	1.6km WA	No fishing in 5% of area (h)	1 year
		180m ECC	No fishing in 100% of area (i)	9 months
Effects during operations	WLA		Landings reduced by 5% (j)	30 years
	ECRA	1.6km WA	None	
		180m ECC	None	
Availability effects due to decommissioning	WLA		None beyond constrained access	
	ECRA	1.6km WA	All landings reduced 5% (k)	1 year
		180m ECC	Lobster/crab landings reduced 12.5% (l) Other shellfish landings reduced 12.5% (m)	1 year 4 years
Decommissioning constrained access	WLA		No fishing in 50% of area (n)	1 year
	ECRA	1.6km WA	No fishing in 5% of area (o)	2 months
		180m ECC	No fishing in 100% of area (p)	2 months

(a), (b), (c) etc. refer to detailed explanations in the text that follows

The assumptions and effects on fish availability and fishing activity/landings are summarized in Table 13 for each category and project area. For the purpose of estimating construction noise-related effects, we define a Wind Turbine Generator Area (WTGA) as the subset of the WLA in which turbine generator towers are to be located. The WTGA lies within the WLA and is slightly smaller in total footprint, since not all of the WLA is utilized for turbine generator towers; we recognize that final turbine generator siting decisions have not been made for Sunrise Wind, and refer here to the "indicative turbine layout" as of August 2022 (see Figure 3.3.4-1 of the Sunrise Wind Construction and Operations Plan (Sunrise Wind LLC 2022)). In the sections that follow Table 13, we describe how we arrived at the assumptions, with references in the text corresponding to the row codes (a), (b), (c), etc. in the table. The assumptions are based in part on information from the Sunrise Wind Construction and Operations Plan (Sunrise Wind LLC 2022) and from acoustic modeling work for wind farm turbine foundation installation (Küsel *et al.* (JASCO) 2022).

The estimates we present in the following sections include all commercial fishing in the Sunrise Wind project areas; we then estimate the portion of this total associated with the Massachusetts fishing sector, based on the sector's share of the Sunrise Wind area landed value. The baseline values for each project area and species group are shown in Table 14.

Table 14. Baseline landed values (2020$) used for exposure calculations.

	WLA	WTGA+7.5km	1.6km ECC WA	180m ECC
Total landed value:	**2,397,234**		**1,341,343**	**150,901**
Lobster & Jonah crab	447,004		70,961	7,983
Other crabs	2,828		773	87
Scallops	243,725		610,649	68,698
Other shellfish	4,165		1,724	194
Finfish/mobile species	1,699,512	4,210,284	657,236	73,939
MA landed value:	**1,097,435**		**710,073**	**79,883**
Lobster & Jonah crab	193,114		36,770	4,137
Other crabs	1,311		359	40
Scallops	113,015		283,158	31,855
Other shellfish	1,931		800	90
Finfish/mobile species	788,064	1,952,309	304,760	34,286

Transient availability effects due to construction

The construction schedule (Figure 3.2.2-1, page 3-6, Sunrise Wind LLC 2022) envisions construction activity in the WLA taking place mainly during the second half of 2024 and much of 2025, with some work on the inter-array cables beginning in the first half of 2024. Work on offshore foundations will take place in the second half of 2024; and work along the ECC is scheduled to take place during the second and fourth quarters of 2024, and the first quarter of 2025. To convert future effects to a common basis, we apply a real discount rate of 5% – the average of the rate usually applied in natural

resource valuation (3%) and the rate usually applied by the US government for public investment and regulatory analyses (7%).

Construction noise during drilling and pile driving, and disturbance of bottom sediments and rocks, is likely to have an impact on fish and shellfish in and around the Sunrise Wind project areas. Mobile species may leave the area because of construction noise, and species that rely on seafloor habitat may be injured or displaced.

Our estimate of the effect of construction in and around the WLA is based on a pile driving scenario involving 11 m monopiles, each installed within 24 hours, using a 4,000 kJ hammer, and 10 dB of noise attenuation. We assume conservatively that pile driving may extend over as much as nine months. We consider separately the likely effect of pile driving and turbine tower installation on shellfish (lobster, scallops, Jonah crab) and on finfish.

We assume conservatively that all finfish will leave all areas in and around the WTGA where pile driving noise exceeds 160 dB. There is no scientific evidence that the 150 dB threshold sometimes cited for "temporary behavioral changes" (Cal Trans 2015) leads to substantive relocation of finfish; and even 160 dB is far below any documented injury threshold. The Sunrise Wind Farm acoustic exposure analysis (Küsel *et al.* (JASCO) 2022) models noise propagation from pile driving at three tower locations in the Sunrise Wind layout. The distance at which pile driving noise with 10 dB of attenuation at the source drops to 160 dB for these three tower locations is found in row 5 of tables G-22, G-24, and G-26 (pages G-27, G-31, and G-35) of Küsel *et al.* (JASCO) (2022). (The data in these tables are for un-attenuated sources; the 170 dB values here are equivalent to 160 dB with 10 dB of attenuation.). The relevant distances in summer and winter are 6.67, 7.59, 6.92, 7.50, 6.82, and 7.04 km.

Based on these values, we estimate that the maximum range for pile driving noise with 10 dB of attenuation in the Sunrise Wind setting is likely to be about 7.5 km for 160 dB. We therefore assume conservatively that all finfish leave the WTGA and a 7.5 km buffer zone around the WTGA for the duration of pile driving (up to nine months) and return after a further three months (total of one year; Table 13 (a)). This is consistent with reported anecdotal observations by fishers around the Block Island Wind Farm (ten Brink and Dalton 2018), which suggest that the construction noise effect may extend 5-10km from its source, and that many finfish will return to the area within months of the end of construction. To estimate the value associated with this effect for Sunrise Wind, we obtained data from NOAA on average annual landings from a region enclosed by a 7.5 km buffer around the Sunrise WTGA. The annual value of finfish landings reported by NOAA for this region is $4,210,284 (2020$). The discounted value (at 5%) from the 2024-25 construction year is $3,380,333 (2020$), of which $1,652,645 is attributable to Rhode Island.

We also consider loss of shellfish due to construction noise and burial resulting from foundation installation and inter-array cable work. The closest approximation in the literature for a construction noise injury/mortality threshold for shellfish is the "mortality and potential mortal injury" 24-hour exposure threshold of 219 dB for "fish without swim bladders" (Popper *et al.* 2014; Küsel *et al.* (JASCO) 2022). This level of exposure will extend no more than 160 m from tower locations (Küsel *et al.* (JASCO) 2022, p. 39, Table 4.3-1, "Fish without swim bladder"), a radius that covers 1.9% of the WLA footprint assuming all 102 potential tower locations are built out (in fact the Sunrise construction plan (Sunrise LLC 2022) anticipates development at no more than 95 of these locations, up to 94 turbine towers and one offshore converter station). In addition, we account for up to 290 km of inter-array cable burial that

may disturb the seabed across a 40 m wide corridor around the cables, affecting up to 2.7% of the WLA footprint. Ignoring overlap to be conservative, this suggests a maximum combined affected seabed area amounting to 4.6% of the WLA footprint.

To be even more conservative, we increase the estimate of the effect by a factor of two, to 10% of the WLA footprint, and assume that 10% of the lobster, crab, scallop, and other shellfish populations within the WLA are adversely affected by pile driving noise, seabed disturbance around foundations, and cable installation during construction, and thus lost to fishing (Table 13 (b and c)) for all of the 2024 and 2025 construction years. We assume that lobster and crab will repopulate the portions of the WLA from which they are displaced within a year after construction work ends, and that scallop and other non-mobile shellfish stocks in those portions of the WLA will rebuild over the course of four years (Table 13(c)).

Along the ECC, the greatest effects are likely to be due to habitat disruption along the immediate cable route; cable laying does not involve the same disturbance from drilling or pile driving as turbine tower installation. We therefore consider significant displacement of mobile species from the ECC and Working Area to be unlikely. The habitat disruptions that impact non-mobile benthic species are likely to extend on average no more than 5-10m on either side of the immediate cable route – at most 12% of the ECC and 2% of the ECC WA area. To be conservative, we model a 25% reduction in landings of all shellfish for two years and all non-mobile shellfish over five years from the ECC (Table 13 (e and f)), and a 10% reduction in landings for all species for one year from the 1.6km ECC Working Area (Table 13 (d)).

Transient effects from constrained access during construction

During wind farm construction activities, fishing may be temporarily constrained in parts of the WLA and along the export cable routes. For example, Sunrise Wind anticipates a 500-yard-radius construction safety zone around tower locations during construction activities, and around any vessel installing cables. In practice, during these construction and cable-laying activities, some fishing that would have taken place in those areas is likely to shift to other nearby locations, replacing some of the forgone landings. If fishers prefer to fish within the construction areas, that is likely because these are thought to be more productive than alternatives. As an upper bound on effects from these temporary constraints, we estimate the full average value of landings linked to the affected areas.

We assume conservatively that fishing is constrained in half of the Sunrise WLA for two years (Table 13 (g)), and in 5% of the 1.6km ECC Working Area for 12 months (Table 13 (h)), during construction activities. In addition, we assume that fishing is constrained within all of the ECC area immediately around the export cable routes for a period of nine months (Table 13 (i)) as the cable is buried by a separate vessel.

We use as a basis for our calculations the average annual values for each area (Table 14), prorated according to the availability effects described above and the fraction of the year affected, discounted to 2023 at 5%, and adjusted to 2023$.[6] Note that the assumption about all finfish leaving the WTGA for a year means that there is no further effect from constrained access to finfish in the WLA. To be

[6] We use the St. Louis Fed's GDP Implicit Price Deflator data (https://fred.stlouisfed.org/data/GDPDEF.txt) for Apr. 2020 and April 2023 to adjust 2020$ to 2023$.

conservative, we do not adjust for double-counting of effects in the overlap between the 5km buffer around the WTGA and the ECC.

Table 15. Estimated value of landings associated with construction effects.

Area	**Estimated Landed Value Exposure** (2023$)	
	Total	**Massachusetts**
Sunrise WLA / WTGA + 7.5km	5,481,195	2,523,409
Export Cable Corridor / WA	398,932	205,803

Table 15 shows the combined results of the availability and constrained access effects (Table 13 (a)-(i)). The total value of landings associated with construction effects is estimated to be about $5.88 million (2023$), of which about $2.73 million is associated with landings in Massachusetts.

Effects due to fishing constraints during operations

If fishing activity is constrained at certain locations within the wind farm area during the operating life of the project, it may be appropriate to treat these areas as lost to fishing during that time. For example, areas in the immediate vicinity of turbine towers may not be accessible to bottom trawl fishing once the wind farm is built. Fishers are likely to adapt to such constraints by shifting fishing effort slightly from previous locations or tracks. This sort of adaptation by the fishing industry is made easier by the regular one-by-one nautical mile east-west/north-south grid spacing for wind turbine towers that has been adopted for Sunrise Wind and other wind development projects (Deepwater Wind South Fork 2020). Because it is not possible to know exactly how the fishing industry will respond to this change in future years, or what the implications of that adaptation will be for catch and landings, we assume here that the landings from affected areas are simply not realized. This is a conservative assumption that likely overstates the actual loss of landings due to wind farm development.

Appendices N2 and BB of the Sunrise Wind COP (Sunrise Wind LLC 2022) describe the expected effects of cooling water intake and effluent at the offshore converter station. At 8.1 million gallons per day maximum flow, the total annual flow of cooling water through the converter station is equivalent to less than 0.1% of the volume of water within the Sunrise WLA. The extent of the thermal plume from cooling water effluent (a one degree C or greater difference from ambient water temperature) will depend on the season and current speed. The largest plume would be about 25 meters from the discharge pipe, in the spring during slack tide. As such, the thermal plume will be undetectable at most times outside the 77 x 52 meter footprint of the converter station platform. While the converter station cooling water flow is expected to result in the loss of some amount of ichthyoplankton, floating fish eggs, and fish larvae as described in Appendix N2 of the Sunrise COP, we do not expect this effect to be detectable in the fish stock biomass in and around the Sunrise WLA, or in the fishery landings from the WLA.

Fishing activity constraints during wind farm operations apply only to the WLA; we do not expect any constraints along the ECC during operations. The footprint of the Sunrise Wind project area is 43,060 hectares, of which permanent structures occupy less than 10 hectares, or 0.03% of the total area. A

100m radius area around each of the turbine towers and the converter station accounts for about 0.7% of the total WLA, suggesting that less than 1% of the WLA area may be lost to fishing. Mobile gear (dredge, trawl) fishing accounts for less than half of landed value from the Sunrise WLA. We assume conservatively that as much as 5% of total baseline landings from all stocks within the WLA may be lost to fishing during operations (Table 13 (j)).

Since the Sunrise Wind project will be operating for 30 years, we estimate the potential loss associated with these forgone landings by calculating the present value of 5% of baseline landings for a 30-year period beginning in 2026.

The resulting estimate of the total present value of potential lost landings during project operations is $1,835,614 (2023$), of which $840,330 is associated with landings in Massachusetts.

Transient effects from constrained access and availability effects during decommissioning

After approximately 30 years of operations, Sunrise Wind plans to decommission the project. This involves removing the turbine towers and foundations, and the cables including the export cable.

We estimate that the duration of decommissioning, and resulting access constraints in the WLA during decommissioning, will extend for about one year. Because relatively little noise is associated with decommissioning compared to construction, we do not model decommissioning effects in the WLA beyond the effects that overlap with access constraints (Table 13 (n)).

We expect that access constraints along the export cable route will be similar to those during cable laying operations, but likely for a shorter duration. We therefore model access constraints on 5% of the ECC WA and 100% of the ECC itself for a total of two months (Table 13 (o) and (p)). Because cable removal is less disruptive that burial, we model half of the availability effect for decommissioning as we do for cable installation (Table 13 (l) and (m)).

We then discount the value of affected landings from decommissioning to 2023$ by applying a 5% discount rate. The resulting present value (2023$) estimate of potential lost landings due to access constraint and availability effects during decommissioning is $320,208, of which $148,256 is associated with landings in Massachusetts.

In summary, the total landed value from fishing in federal waters potentially exposed to Sunrise Wind project development is estimated to be about $8.0 million (2023$), of which $7.6 million is associated with the WLA (plus 7.5km perimeter) and $400,000 is associated with the ECC. Massachusetts landings account for about 46% of total landings from the WLA and 53% of total landings from the ECC. The landed value of Massachusetts commercial landings potentially exposed by Sunrise Wind development is therefore about $3.72 million (2023$). This includes about $2.73 million in forgone landings due to construction, $840,000 during operations, and $150,000 during decommissioning.

Applying the upstream and downstream multipliers as described above results in a present value estimate of $4.48 million (2023$) in indirect and induced effects in Massachusetts, for a total impact of $8.20 million.

BOEM draft guidelines for mitigation impacts to fisheries

In 2022, the Bureau of Ocean Energy Management (BOEM) of the US Department of the Interior issued draft Guidelines for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf (BOEM 2022). These draft guidelines discuss "best management practices and mitigation measures to reduce potential impacts to commercial and recreational fisheries." These include provisions for "compensation for lost fishing income," based on "ex-vessel value of the fish landed," and the recommendation that lessees consider making available funds for compensatory mitigation in the amount of "100 percent of revenue exposure for the first year after construction, 80 percent of revenue exposure 2 years after construction, 70 percent of revenue exposure 3 years after construction, 60 percent after four years, and 50 percent after five years post construction."

The BOEM draft guidelines are intended to ensure that adequate funds are available to compensate lost fishing income, and are not intended to produce a project-specific estimate of likely actual losses. For example, it is unlikely that no fishery landings of any kind will be realized from the project area in the first year after construction ("100 percent of revenue exposure"); and the draft guidelines contain no provisions for adjustment of these values in light of the specific parameters of the project, such as turbine tower spacing. As such, the payment structure suggested by BOEM in the draft guidelines should not be interpreted as equivalent to the expected losses estimated in this report.

With that caveat, we estimate that the present value (in 2023$) of the amounts BOEM recommends making available for potential losses to Massachusetts-based commercial fishing during the first five years of operations amount to $3.64 million. BOEM acknowledges that using total ex-vessel landed value as the basis for these amounts is likely to result in an over-estimation of net income loss, since net income is revenue minus expenses, and suggests that using total ex-vessel landed value "is likely to be sufficient to cover shoreside income loss" as well, without applying further multipliers.

Massachusetts-based charter fishing

To obtain data on for-hire charter fishing activity in the Sunrise Wind Lease Area (WLA) and Export Cable Corridor (ECC), we conducted an online survey of Rhode Island- and Massachusetts-based charter vessel operators. The survey asked operators to identify their fishing locations on a chart, and report for each location

- the total number of annual for-hire fishing trips that vessel took in each of the years 2017-2021,
- the average number of passengers onboard for-hire trips in each of the years 2017-2021, and
- the average amount of time spent targeting highly migratory species (HMS) relative to bottom fishing or trolling for other species during for-hire trips.

The survey was first distributed on April 18, 2022 through email lists maintained by Rhode Island Department of Environmental Management (RIDEM), Rhode Island Coastal Resources Management Council (RICRMC) and Massachusetts Division of Marine Fisheries (MADMF), and also via email by for-hire fishing industry representatives, including the Rhode Island Party and Charter Boat Association. The survey was active from April 18, 2022 until May 14, 2022.

The survey received 91 total responses from for-hire charter owners and/or operators. Sixty-six of these respondents (72%) reported that they fish in the area depicted in Figure 4. These 66 respondents reported 62 unique vessels, and reported effort data for 29 of those vessels across the five-year period of 2017-2021 (Table 16). Similar studies published in the peer-reviewed academic literature using paper mail, email, or mixed mode survey distributions typically have survey response rates around 20-30% (e.g., Dalton *et al*. 2020, Carr-Harris and Steinback 2020). Based on discussions with for-hire industry representatives, approximately 100 vessels actively engage in for-hire fishing activity in the waters depicted in Figure 4, suggesting the fishing reported by survey respondents accounts for about 29% of the total. Thus, the response rate for the primary population of interest is within an appropriate range to consider our survey distribution a success. An important note to also consider is that there are vessels in our sample that require the submission of federal VTRs. A common trend identified in the data was that some respondents did not provide data for their vessels that require VTRs. This is not a problem for this analysis as this effort data is already accounted for by the NOAA databases and summary reports used as a baseline for our subsequent analyses.

Table 16. For-hire charter fishing survey summary statistics.

Description	**Number**
Fished in the area and responded to the survey	66
Provided vessel names	62
of which based in Massachusetts	37.5
Provided annual vessel trip numbers	31
Observations with vessel trips reported (2017-2021)	142
Total trips per year	1 – 235
Average total trips per year	47.30
Passengers per vessel trip	2 – 25
Average passengers per vessel trip	5.41
Identified fishing locations on maps	29
of which based in Massachusetts	18.5

The number of anglers per year is estimated by multiplying the vessel trip number in a year and the average number of anglers per trip in that year for each vessel, and the results are then summed across vessels by area. Tables 17 and 18 show the annual vessel trips and angler counts in the survey responses for charter vessels based in Massachusetts. The Wind Turbine Generator Area (WTGA) is the area defined by the turbine tower locations and lies within, but does not include all of, the WLA shown in Figure 4. (The WTGA analysis is based on a WTGA shapefile received from Inspire Environmental in November 2020, and reflects the turbine tower layout planned for Sunrise Wind at that time. This layout is subject to change.) Note that some of the trips shown for the ECRA (Table 18) are also included in the numbers for the WTGA + 7.5km buffer (Table 17).

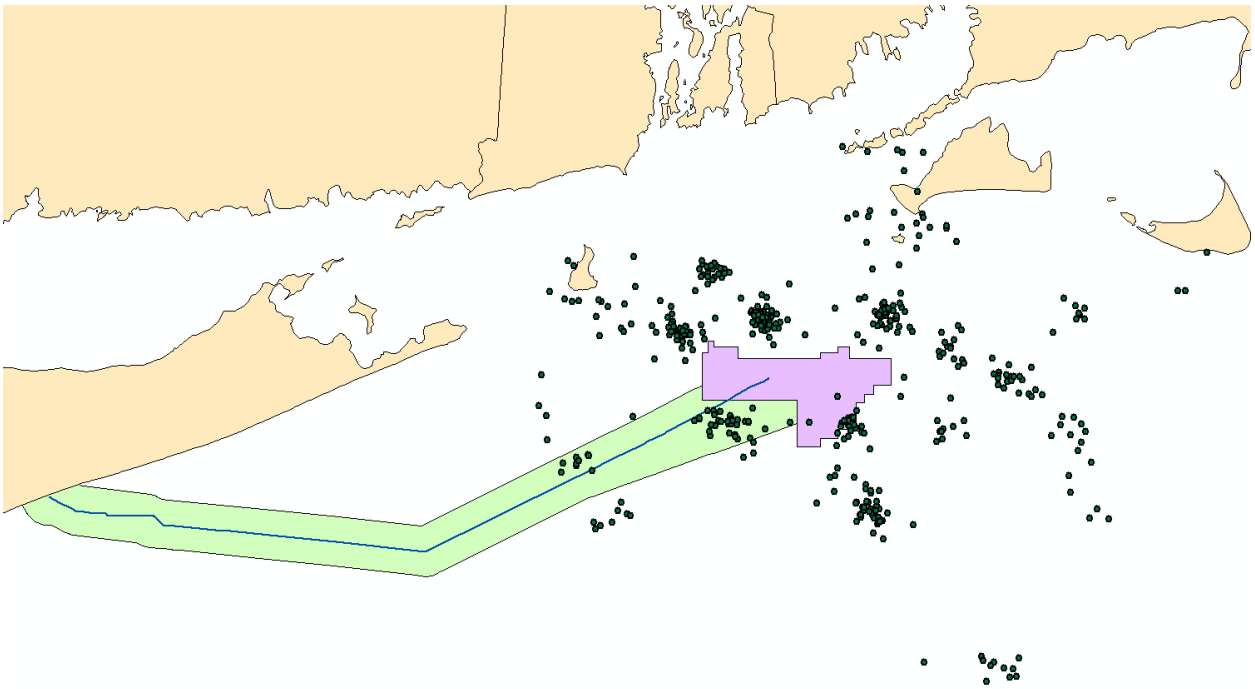

Figure 4. Charter fishing locations, 2017-2021, identified in survey responses. WLA is shown in purple, and ECRA in green.

Table 17. Number of Massachusetts-based vessel trips and anglers by year, Sunrise WLA.

Year	WLA + 7.5km buffer		WTGA + 7.5km buffer	
	Vessel Trips	Anglers	Vessel Trips	Anglers
2017	22	77	21.5	75
2018	58.5	197	45.5	197
2019	64	1,052	56	1,052
2020	67.5	850	63	836
2021	85	931	68	856
Average	***59.4***	***621.4***	***50.8***	***603.2***

Table 18. Number of Massachusetts-based vessel trips and anglers by year, Sunrise ECRA.

Year	Vessel Trips	Anglers
2017	5	30
2018	12.5	65
2019	0	0
2020	5	25
2021	0	0
Average	***4.5***	***24***

We use the revenue per angler estimates from NOAA shown in the Table 19 below for our revenue calculation. We recognize that the per angler revenue from charter boats may be an order of magnitude larger than that from party boats. The NOAA data in Table 19 represent an average across both sectors, influenced by the fact that many more people participate in party boat fishing than in charter fishing. For consistency, we convert the average revenue per angler from 2019$ ($104.94) to 2020$ ($106.15) using the GDP implicit price deflator (2019: 112.3; 2020: 113.6).

Table 19. Sunrise Wind area for-hire vessel revenue from NOAA VTR data. Source: NOAA (2021).

Year	**Revenue per angler** (2019$)
2008	87.52
2009	99.36
2010	111.48
2011	122.56
2012	116.79
2013	112.68
2014	109.76
2015	106.30
2016	101.74
2017	100.42
2018	85.71
Average	**104.94**

The annual revenue for each area is estimated by multiplying the number of anglers (Tables 17 and 18) by the average revenue per angler ($106.15). The result is then adjusted using a scale factor. For a low-end estimate, the scale factor is the ratio of the number of Massachusetts vessels responding to the

survey (37.5) to the number of these vessels for which specific fishing locations were provided (18.5). For a high-end estimate, we increase the scale factor to reflect the estimated total of 100 vessels operating in the survey area (see above), versus the 62 for which survey responses were received. Finally, an economic impact multiplier is used to reflect the overall economic impacts associated with the charter fishing direct revenue. As with commercial fishing, we recognize that this multiplier will in fact vary with different types of charter fishing (e.g. sport fishing charters versus party boats). The multiplier we use is calculated using data in the NOAA report by Lovell *et al*. (2020), and reflects an average across different types of charter fishing. The results are shown in Table 20.

Table 20. Annual revenue and economic impact from MA-based charter fishing in Sunrise Wind areas.

Area	**Annual anglers**	**Revenue per angler** (2020$)	**Scale factor**	**Annual revenue** (2020$)	**Impact multiplier**	**Annual impact** (2020$)
WLA+7.5km	621.4	106.15	Low: 2.027	133,708	1.627	217,543
			High: 3.269	215,658	1.627	350,876
WTGA+7.5km	603.2	106.15	Low: 2.027	129,792	1.627	211,172
			High: 3.269	209,342	1.627	340,600
ECRA	24.0	106.15	Low: 2.027	5,164	1.627	8,402
			High: 3.269	8,328	1.627	13,550

As Figure 4 and Table 17 illustrate, there is little evidence of charter fishing within the Sunrise WLA, but substantial charter fishing activity just outside the boundary of the WLA. (Depending on final decisions regarding turbine generator tower layout, the amount of charter fishing value affected may be lower, as suggested by the WTGA+7.5km values in Table 20.). We assume conservatively that the value of charter fishing at the Sunrise Wind development areas, including a 7.5km buffer around the entire WLA, is foregone in the construction year when pile driving takes place, since we expect finfish to leave this area due to construction noise, and also in the decommissioning year of the project. This is likely an overestimate of the actual impact, since charter fishing that would have taken place in these areas may in fact be carried out elsewhere.

Given the fact that much of the charter fishing around the Sunrise WLA takes place outside the WLA footprint, and the 1nm spacing of the turbine towers, we expect that charter fishing boats will be able to operate in and near the WLA with minor adjustments to current practice once construction is complete. We therefore do not expect charter fishing revenue to be materially impacted during the operations phase of the project.

We therefore base our calculation of exposure on the WLA with 7.5km buffer and the ECRA, ignoring any overlap. We use the combined high-end revenue and impact estimates ($215,658 + $8,328 and $350,876 + $13,550 per year, respectively), and assume that this value is forgone during the pile driving and decommissioning years. Using a 5% discount rate, and adjusting to 2023$, the present value of the two years of effects, using the high-end estimates, is about $294,000 (2023$) in revenue, and $479,000 in total impact in Massachusetts.

As noted above, we consider it unlikely that the Sunrise Wind development will substantially change the personal recreational fishing activities of Massachusetts boaters.

Conclusions

Based on NOAA data from 2008 to 2019, and adjusting for underreporting of lobster and Jonah crab landings in the VTR data, and for some dockside sales of lobster and Jonah crab, we estimate the average annual value of commercial landings from the Sunrise Wind Lease Area to be about 2,764,000 (2023$).[7] Of this, about $1,265,000 is landed in Massachusetts. Including indirect and induced effects, these landings generate average annual economic impacts of $2,791,000 in Massachusetts.

We estimate the average annual value of commercial landings from the Sunrise Wind Export Cable Corridor to be about $174,000 (2023$). Of this, about $92,000 is landed in Massachusetts. These landings generate estimated total annual economic impacts of $203,000 in Massachusetts.

We estimate that a total (lump sum) of $3,718,000 (2023$) of commercial fisheries value landed in Massachusetts is potentially exposed to the Sunrise Wind development. This accounts for about 46% of the total potentially exposed landed value for Sunrise Wind. It includes about $2,729,000 in direct landed value forgone due to construction activities, $840,000 from forgone landings during the wind farm's operation, and $148,000 in present value of foregone landings due to decommissioning.

In the context of overall commercial fishery landings in Massachusetts of more than $500 million per year (NMFS 2020), the landings potentially affected by Sunrise Wind represents about 0.55% of Massachusetts' total annual landings, with much of this exposure concentrated in the early part of Sunrise Wind's project life.

Massachusetts-based charter fishing revenue exposure to the Sunrise Wind development is estimated to have a present value of $294,000 (2023$).

Including indirect and induced effects, the potentially affected commercial landings and charter fishing revenue together result in about $8,677,000 in total (lump sum, 2023$) present value economic impact in Massachusetts. Table 21 summarizes these values.

There is considerable variability in the baseline data of landings and landed value from the Sunrise Wind areas. Baseline future landings will vary due to natural and fisheries-related fluctuations in stocks that are likely to be amplified by climate change effects. There is also uncertainty about the impact of wind farm construction and operation on fish stocks and landings, and about the ways that fishers will adapt their fishing practices in response to wind farm development. We consider our combined estimate of $8.7 million in economic impacts to Massachusetts from Sunrise Wind development effects on commercial and charter fishing to be a conservative upper bound on likely actual impacts.

[7] We use the St. Louis Fed's GDP Implicit Price Deflator data (https://fred.stlouisfed.org/data/GDPDEF.txt) for Apr. 2020 and April 2023 to adjust 2020$ to 2023$.

Table 21. Estimated Massachusetts fishing industries exposure from Sunrise Wind development

Categories of Potential Exposure		**MA Direct Landed Value/Revenue (2023$)**
Construction-related effects	WLA+	$2,523,000
	ECRA	$206,000
Effects during operations	WLA	$840,000
	ECRA	---
Decommissioning-related effects	WLA	$133,000
	ECRA	$15,000
Subtotal MA commercial direct effects		**$3,718,000**
MA for-hire charter fishing direct effects		$294,000
Total MA direct effects		**$4,012,000**

Categories of Potential Exposure	**MA Total Impact with Multipliers (2023$)**
Subtotal MA commercial fishing	**$8,198,000**
MA for-hire charter fishing	$479,000
Total Massachusetts impacts	**$8,677,000**

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Appendix

Table A1. Average annual landings by species from the Sunrise WLA, 2008-2019.

Note: lobster and Jonah crab data in this table have not been adjusted for landings not reported via VTR.

	Mean		*Standard Deviation*	
Species	**Value/year** (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
ALL_OTHERS	559,908	712,732	526,411	603,320
AMBERJACK, SPECIES NOT SPECIFIED	0	0	0	0
BLACK BELLIED ROSEFISH	0	0	0	0
BLACK SEA BASS	12,222	2,786	6,385	1,733
BLUEFISH	3,407	4,536	1,962	2,436
BONITO	291	90	476	133
BUTTERFISH	17,038	22,772	18,509	25,517
CLAM, SURF/BUSHEL	0	0	0	0
COBIA	0	0	0	0
COD	41,370	13,863	24,423	8,494
CRAB, BLUE/BUSHEL	18	15	42	36
CRAB, CANCER	0	0	0	0
CRAB, HORSESHOE	0	0	0	0
CRAB, JONAH	35,412	41,332	21,818	22,824
CRAB, ROCK/BUSHEL	2,792	4,117	3,206	4,660
CRAB, SPECIES NOT SPECIFIED	18	31	24	43
CREVALLE	0	0	0	0
CROAKER, ATLANTIC	86	189	174	425
CUNNER	730	156	1,471	255
CUSK	0	0	0	0
DOGFISH, SMOOTH	641	1,661	806	2,987
DOGFISH, SPINY	13,758	66,355	10,002	51,664
DOLPHIN FISH / MAHI-MAHI	0	0	1	1
DRUM, BLACK	0	0	0	0
EEL, AMERICAN	9	10	11	13
EEL, CONGER	215	305	304	405
EEL, SPECIES NOT SPECIFIED	17	19	16	15
FLOUNDER, AMERICAN PLAICE /DAB	306	130	747	320
FLOUNDER, FOURSPOT	20	37	30	64
FLOUNDER, SAND-DAB / WINDOWPANE / BRILL	290	374	541	691
FLOUNDER, SOUTHERN	0	0	0	0
FLOUNDER, SUMMER / FLUKE	97,628	27,773	64,534	20,822
FLOUNDER, WINTER / BLACKBACK	55,691	19,842	61,694	21,164
FLOUNDER, WITCH / GRAY SOLE	296	109	238	83
FLOUNDER, YELLOWTAIL	57,000	28,950	60,324	36,530
FLOUNDER,NOT SPECIFIED	0	0	0	0
HADDOCK ROE	1,286	1,237	2,916	3,094
HAKE, OFFSHORE	266	350	743	976

HAKE, RED / LING	7,089	23,350	6,032	22,211
HAKE, SILVER / WHITING	64,298	106,558	51,011	96,799
HAKE, WHITE	790	532	1,679	1,205
HAKE,SPOTTED	0	0	1	1
HALIBUT, ATLANTIC	63	7	112	13
HARVEST FISH	0	0	0	0
HERRING, ATLANTIC	24,654	159,535	26,124	179,528
HERRING, BLUE BACK	0	0	0	0
JOHN DORY	97	74	107	78
LOBSTER, AMERICAN	131,173	23,676	34,047	6,421
MACKEREL, ATLANTIC	4,243	17,554	7,088	38,138
MACKEREL, CHUB	2	4	7	13
MACKEREL, KING	0	0	0	0
MACKEREL, SPANISH	2	1	6	2
MENHADEN	0	1	0	2
MONK	377,837	224,763	134,917	39,911
MULLETS	1	2	4	5
OCEAN POUT	26	20	73	59
OTHER FINFISH	0	1	0	1
PERCH, WHITE	0	0	0	0
POLLOCK	94	78	105	98
PUFFER, NORTHERN	0	0	0	0
QUAHOGS/BUSHEL	0	0	0	0
RED PORGY	0	0	0	0
REDFISH / OCEAN PERCH	3	2	8	6
SCALLOPS,BAY/SHELLS	1	0	4	0
SCALLOPS/BUSHEL	243,724	21,375	180,466	16,581
SCORPIONFISH	1	1	5	4
SCUP / PORGY	63,029	92,599	51,362	78,456
SEA RAVEN	153	104	272	197
SEA ROBINS	21	124	19	122
SEATROUT, SPECIES NOT SPECIFIED	13	24	18	37
SHAD, AMERICAN	0	0	1	1
SHAD, HICKORY	0	0	0	0
SHARK, SANDBAR	0	0	0	0
SHARK, THRESHER	4	4	13	14
SHEEPSHEAD	0	0	0	0
SKATE WINGS	192,400	496,211	88,291	133,949
SKATE WINGS, CLEARNOSE	5	13	16	44
SPOT	1	4	5	13
SQUID / ILLEX	2,347	2,454	6,605	5,293
SQUID / LOLIGO	92,798	70,056	92,364	71,383
STARGAZER,NORTHERN	0	0	0	0
STRIPED BASS	3,238	677	2,335	483
SWORDFISH	0	0	0	0
TAUTOG	795	212	606	159
TILEFISH	0	0	0	0
TILEFISH, BLUELINE	3	1	4	1

TILEFISH, GOLDEN	1,963	518	1,659	404
TILEFISH, SAND	0	0	0	0
TRIGGERFISH	28	16	34	18
TUNA, ALBACORE	48	64	158	209
TUNA, LITTLE	63	74	155	163
TUNA, SKIPJACK	0	0	0	0
WEAKFISH	405	189	424	189
WHELK, CHANNELED/BUSHEL	4,157	522	7,792	974
WHELK, KNOBBED/BUSHEL	8	3	18	10
WHELK, LIGHTNING	0	0	0	0
WHELK,WAVED	0	0	0	0
WHITING, KING / KINGFISH	420	372	666	584
WOLFFISH / OCEAN CATFISH	0	0	0	0

Table A2. Average annual landings by species from the Sunrise Wind ECRA, 2008-2019.

Note: lobster and Jonah crab data in this table have not been adjusted for landings not reported via VTR. (These data are for the 10km wide ECRA, not the 180 m wide ECC.)

	Mean		***Standard Deviation***	
Species	**Value/year** (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
ALL_OTHERS	1,086,214	1,332,928	1,091,900	1,316,866
AMBERJACK, SPECIES NOT SPECIFIED	0	0	0	0
BLACK BELLIED ROSEFISH	0	0	1	1
BLACK SEA BASS	53,033	12,521	19,313	5,061
BLUEFISH	18,957	23,346	8,936	11,229
BONITO	1,050	412	1,533	595
BUTTERFISH	16,597	21,037	6,373	8,275
CLAM, SURF/BUSHEL	7,967	10,441	16,727	22,297
COBIA	26	8	43	12
COD	41,005	15,173	26,421	9,161
CRAB, BLUE/BUSHEL	147	117	340	270
CRAB, CANCER	0	0	0	0
CRAB, HORSESHOE	247	216	338	315
CRAB, JONAH	70,684	86,389	26,048	26,734
CRAB, ROCK/BUSHEL	4,138	6,237	4,594	6,911
CRAB, SPECIES NOT SPECIFIED	227	426	485	929
CREVALLE	1	1	2	2
CROAKER, ATLANTIC	457	653	1,003	1,212
CUNNER	551	162	615	152
CUSK	2	2	6	7
DOGFISH, SMOOTH	8,424	12,688	2,083	4,090
DOGFISH, SPINY	9,165	38,144	7,462	23,274
DOLPHIN FISH / MAHI-MAHI	3	1	7	2
DRUM, BLACK	0	0	1	1
EEL, AMERICAN	4,314	220	13,905	275
EEL, CONGER	1,384	1,409	1,333	1,355
EEL, SPECIES NOT SPECIFIED	1,271	1,124	1,436	1,092
FLOUNDER, AMERICAN PLAICE /DAB	234	106	372	164
FLOUNDER, FOURSPOT	271	522	198	432
FLOUNDER, SAND-DAB / WINDOWPANE / BRILL	1,685	1,943	2,831	3,254
FLOUNDER, SOUTHERN	9	3	32	9
FLOUNDER, SUMMER / FLUKE	447,054	130,148	115,523	47,087
FLOUNDER, WINTER / BLACKBACK	35,113	12,948	35,858	12,299
FLOUNDER, WITCH / GRAY SOLE	2,015	634	2,164	637
FLOUNDER, YELLOWTAIL	90,579	45,204	87,064	47,122
FLOUNDER,NOT SPECIFIED	8	4	25	11
HADDOCK ROE	1,635	1,668	5,262	5,517
HAKE, OFFSHORE	646	785	838	925

HAKE, RED / LING	9,314	18,667	3,458	7,883
HAKE, SILVER / WHITING	60,678	74,726	29,213	33,972
HAKE, WHITE	748	491	1,096	748
HAKE,SPOTTED	16	27	42	66
HALIBUT, ATLANTIC	86	11	107	15
HARVEST FISH	0	1	1	1
HERRING, ATLANTIC	148,770	1,050,510	115,439	863,625
HERRING, BLUE BACK	73	283	109	502
JOHN DORY	466	382	499	418
LOBSTER, AMERICAN	119,695	21,316	55,229	9,922
MACKEREL, ATLANTIC	31,534	135,262	49,179	243,327
MACKEREL, CHUB	299	419	1,009	1,391
MACKEREL, KING	1	0	3	1
MACKEREL, SPANISH	125	51	124	50
MENHADEN	870	7,225	1,154	9,986
MONK	817,138	431,906	328,751	105,659
MULLETS	33	38	51	64
OCEAN POUT	198	157	483	362
OTHER FINFISH	75	54	219	126
PERCH, WHITE	0	1	1	1
POLLOCK	245	245	609	687
PUFFER, NORTHERN	0	0	0	0
QUAHOGS/BUSHEL	824,865	1,016,461	1,289,689	1,568,629
RED PORGY	7	13	25	44
REDFISH / OCEAN PERCH	3	4	6	8
SCALLOPS,BAY/SHELLS	38	3	132	11
SCALLOPS/BUSHEL	3,816,495	347,782	2,804,183	283,996
SCORPIONFISH	5	14	15	34
SCUP / PORGY	170,198	213,291	47,097	80,257
SEA RAVEN	102	76	178	138
SEA ROBINS	172	754	74	309
SEATROUT, SPECIES NOT SPECIFIED	58	74	82	56
SHAD, AMERICAN	39	58	46	82
SHAD, HICKORY	7	8	23	27
SHARK, SANDBAR	1	0	2	1
SHARK, THRESHER	98	65	162	95
SHEEPSHEAD	0	1	1	1
SKATE WINGS	221,893	603,399	86,517	150,471
SKATE WINGS, CLEARNOSE	51	150	136	417
SPOT	125	161	257	383
SQUID / ILLEX	883	1,144	1,150	1,186
SQUID / LOLIGO	700,858	541,276	267,036	239,357
STARGAZER,NORTHERN	0	0	0	0
STRIPED BASS	49,469	11,721	18,535	4,349
SWORDFISH	12	3	21	4
TAUTOG	2,231	602	1,680	454
TILEFISH	0	0	1	0
TILEFISH, BLUELINE	24	12	26	14

TILEFISH, GOLDEN	7,544	1,997	6,374	1,770
TILEFISH, SAND	2	1	6	2
TRIGGERFISH	265	148	148	106
TUNA, ALBACORE	207	185	322	270
TUNA, LITTLE	388	520	364	575
TUNA, SKIPJACK	3	2	11	6
WEAKFISH	3,195	1,505	2,444	1,286
WHELK, CHANNELED/BUSHEL	2,079	430	2,291	376
WHELK, KNOBBED/BUSHEL	149	100	259	199
WHELK, LIGHTNING	55	21	152	55
WHELK,WAVED	503	707	1,210	1,670
WHITING, KING / KINGFISH	1,890	1,609	3,865	3,086
WOLFFISH / OCEAN CATFISH	0	0	0	0

Table A3. Complete species list (including those in ALL_OTHERS).

Species	Species
ALEWIFE	OCTOPUS, SPECIES NOT SPECIFIED
AMBERJACK, SPECIES NOT SPECIFIED	OTHER FINFISH
AMBERJACK,GREATER	PERCH, SAND
ANCHOVY,BAY	PERCH, WHITE
ARGENTINES,SPECIES NOT SPECIFIED	POLLOCK
ATLANTIC SALMON	POMPANO, COMMON
BLACK BELLIED ROSEFISH	PORGY,JOLTHEAD
BLACK SEA BASS	PUFFER, NORTHERN
BLUE RUNNER	QUAHOGS/BUSHEL
BLUEFISH	RED PORGY
BONITO	REDFISH / OCEAN PERCH
BULLHEADS	RIBBONFISH
BUTTERFISH	ROUGH SCAD
CLAM, ARCTIC SURF	SCALLOPS,BAY/SHELLS
CLAM, RAZOR	SCALLOPS/BUSHEL
CLAM, SPECIES NOT SPECIFIED	SCORPIONFISH
CLAM, SURF/BUSHEL	SCUP / PORGY
COBIA	SEA RAVEN
COD,MILT	SEA ROBINS
CRAB, BLUE/BUSHEL	SEA URCHINS
CRAB, CANCER	SEATROUT, SPECIES NOT SPECIFIED
CRAB, GREEN/BUSHEL	SHAD, AMERICAN
CRAB, HERMIT	SHAD, GIZZARD
CRAB, HORSESHOE	SHAD, HICKORY
CRAB, JONAH	SHARK, ANGEL
CRAB, LADY	SHARK, BLACKTIP
CRAB, RED/BUSHEL	SHARK, BLUE
CRAB, ROCK/BUSHEL	SHARK, MAKO, LONGFIN
CRAB, SPECIES NOT SPECIFIED	SHARK, MAKO, SHORTFIN
CRAB, SPIDER	SHARK, MAKO, SPECIES NOT SPECIFIED
CREVALLE	SHARK, NOT SPECIFIED
CROAKER, ATLANTIC	SHARK, NURSE
CRUSTACEANS,SPECIES NOT SPECIFIED	SHARK, PORBEAGLE
CUNNER	SHARK, SANDBAR
CUSK	SHARK, THRESHER
CUTLASSFISH, ATLANTIC	SHARK, THRESHER, BIGEYE
DOGFISH, CHAIN	SHARK, TIGER
DOGFISH, SMOOTH	SHARK, WHITE
DOGFISH, SPECIES NOT SPECIFIED	SHARK, WHITETIP
DOGFISH, SPINY	SHEEPSHEAD
DOLPHIN FISH / MAHI-MAHI	SHRIMP (MANTIS)
DRUM, BLACK	SHRIMP (PANAEID)
DRUM, SPECIES NOT SPECIFIED	SHRIMP (PANDALID)
EEL, AMERICAN	SHRIMP, SPECIES NOT SPECIFIED
EEL, CONGER	SILVERSIDES, ATLANTIC
EEL, SPECIES NOT SPECIFIED	SKATE WINGS
FLOUNDER, AMERICAN PLAICE /DAB	SKATE WINGS, CLEARNOSE
FLOUNDER, FOURSPOT	SNAIL,MOON
FLOUNDER, SAND-DAB / WINDOWPANE / BRILL	SNAPPER, OTHER
FLOUNDER, SOUTHERN	SNAPPER, RED

FLOUNDER, SUMMER / FLUKE
FLOUNDER, WINTER / BLACKBACK
FLOUNDER, WITCH / GRAY SOLE
FLOUNDER, YELLOWTAIL
FLOUNDER,NOT SPECIFIED
GROUPER, OTHER
GROUPER, SNOWY
HADDOCK ROE
HAKE, OFFSHORE
HAKE, RED / LING
HAKE, SILVER / WHITING
HAKE, WHITE
HAKE,SPOTTED
HALIBUT, ATLANTIC
HARD QUAHOG
HARVEST FISH
HERRING, ATLANTIC
HERRING, BLUE BACK
HERRING,ATLANTIC THREAD
HERRING/SARDINES,SPECIES NOT SPECIFIED
JACK,ALMACO
JOHN DORY
LADYFISH
LOBSTER, AMERICAN
LUMPFISH
MACKEREL, ATLANTIC
MACKEREL, CHUB
MACKEREL, FRIGATE
MACKEREL, KING
MACKEREL, SPANISH
MARLIN, BLUE
MENHADEN
MOLLUSKS,SPECIES NOT SPECIFIED
MONK LIVERS
MULLETS
NEEDLEFISH, ATLANTIC
OCEAN POUT
OCEAN SUNFISH / MOOLA
SPADEFISH
SPOT
SQUID / ILLEX
SQUID / LOLIGO
SQUID, SPECIES NOT SPECIFIED
SQUIRRELFISH
STARFISH
STARGAZER,NORTHERN
STING RAYS,SPECIES NOT SPECIFIED
STRIPED BASS
STURGEON, ATLANTIC
SWORDFISH
TAUTOG
TILEFISH
TILEFISH, BLUELINE
TILEFISH, GOLDEN
TILEFISH, SAND
TOADFISH, OYSTER
TRIGGERFISH
TRIGGERFISH,GRAY
TUNA, ALBACORE
TUNA, BIG EYE
TUNA, BLUEFIN
TUNA, LITTLE
TUNA, SKIPJACK
TUNA, SPECIES NOT SPECIFIED
TUNA, YELLOWFIN
TURTLE, LEATHERBACK
WAHOO
WEAKFISH / SQUETEAGUE / GRAY SEA TROUT
WEAKFISH, SPOTTED / SPOTTED SEA TROUT
WHELK, CHANNELED/BUSHEL
WHELK, KNOBBED/BUSHEL
WHELK, LIGHTNING
WHELK,WAVED
WHITING, KING / KINGFISH
WOLFFISH / OCEAN CATFISH

Table A4. Average annual landings from Sunrise WLA by port.

Port	*Mean* Value/year (2020 $)	*Mean* Landings/year (lbs)	*Standard Deviation* Value/year (2020 $)	*Standard Deviation* Landings/year (lbs)
ALL_OTHERS	53,195	71,187	114,525	143,689
ATLANTIC CITY	0	0	0	0
BARNEGAT	0	0	0	0
BARNSTABLE	43	16	148	54
BEAUFORT	2,605	1,008	2,843	1,129
BELFORD	48	20	166	71
BOSTON	1,512	2,692	2,434	5,682
BRISTOL	0	0	0	0
CAPE MAY	903	419	1,692	1,081
CHATHAM	5,033	4,278	11,127	9,439
CHILMARK	4,785	973	7,195	1,565
CHINCOTEAGUE	57	20	198	68
DAVISVILLE	1,318	1,746	3,174	5,535
FAIRHAVEN	16,201	10,368	26,977	17,169
FALL RIVER	2,931	10,891	4,303	17,377
FALMOUTH	0	0	0	0
FREEPORT	0	0	0	0
GLOUCESTER	3,693	27,040	12,275	90,800
HAMPTON	6,389	3,140	11,196	6,034
HAMPTON BAY	28	21	67	53
HARWICHPORT	1,111	207	3,051	567
HYANNIS	0	0	0	0
ISLIP	0	0	0	0
JAMESTOWN	0	0	0	0
LITTLE COMPTON	226,334	259,258	107,800	134,413
LONG BEACH	0	0	0	0
MENEMSHA	5,425	957	10,326	1,659
MONTAUK	41,198	24,325	17,716	11,684
MOREHEAD CITY	0	0	0	0
MORICHES	0	0	0	0
NANTUCKET	0	0	0	0
NEW BEDFORD	875,504	887,422	548,737	669,281
NEW LONDON	7,504	8,638	7,769	9,456
NEW SHOREHAM	718	406	760	813
NEWPORT	138,952	181,915	68,718	91,330
NEWPORT NEWS	3,176	1,528	7,079	3,798
NORTH KINGSTOWN	0	0	0	0
OCEAN CITY	0	0	0	0
ORIENTAL	0	0	0	0
OTHER NASSAU	0	0	0	0
OTHER WASHINGTON(COUNTY)	0	0	0	0
POINT JUDITH	546,080	525,298	262,657	338,703

POINT LOOKOUT	0	0	0	0
POINT PLEASANT	3,422	1,664	4,334	2,086
SANDWICH	198	191	686	660
SHINNECOCK	262	254	790	780
STONINGTON	20,969	9,586	27,023	7,596
TIVERTON	38,976	48,182	54,191	63,536
VINEYARD HAVEN	0	0	0	0
WANCHESE	1,321	501	3,633	1,376
WESTPORT	48,050	35,531	25,949	31,021
WILDWOOD	0	0	0	0
WOODS HOLE	5,680	731	13,266	1,708

Table A5. Average annual landings from Sunrise ECRA (note: not ECC) by ports.

	Mean		***Standard Deviation***	
Port	**Value/year** (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
ALL_OTHERS	143,117	176,898	191,660	245,183
ATLANTIC CITY	77,527	70,495	121,388	109,654
BARNEGAT	8,747	1,120	17,512	1,775
BARNSTABLE	0	0	0	0
BEAUFORT	17,715	6,051	21,168	6,382
BELFORD	7,339	3,311	16,143	7,042
BOSTON	855	971	1,400	1,483
BRISTOL	0	0	0	0
CAPE MAY	148,766	105,942	131,194	162,371
CHATHAM	382	231	897	619
CHILMARK	452	119	1,175	309
CHINCOTEAGUE	3,435	1,466	4,610	1,872
DAVISVILLE	13,160	5,945	33,605	16,782
FAIRHAVEN	59,094	7,831	86,941	11,476
FALL RIVER	8,662	41,781	13,879	75,814
FALMOUTH	0	0	0	0
FREEPORT	1,647	547	2,141	764
GLOUCESTER	17,206	103,963	36,986	216,104
HAMPTON	27,393	11,062	27,288	11,932
HAMPTON BAY	408,225	225,944	226,863	123,057
HARWICHPORT	243	26	841	90
HYANNIS	103	14	358	48
ISLIP	50	20	173	68
JAMESTOWN	0	0	0	0
LITTLE COMPTON	60,734	60,342	54,955	45,630
LONG BEACH	283	56	980	193
MENEMSHA	137	22	474	77
MONTAUK	619,147	338,770	191,638	82,674
MOREHEAD CITY	115	46	400	159
MORICHES	31,172	15,133	58,495	29,523
NANTUCKET	0	0	0	0

NEW BEDFORD	4,596,922	3,057,161	2,003,902	1,387,470
NEW LONDON	273,333	166,851	170,528	85,708
NEW SHOREHAM	5,998	4,614	12,427	10,998
NEWPORT	177,602	160,773	219,187	55,484
NEWPORT NEWS	40,413	7,714	42,981	7,040
NORTH KINGSTOWN	6,012	17,829	14,411	44,701
OCEAN CITY	1,644	428	3,216	808
ORIENTAL	339	142	813	334
OTHER NASSAU	123	120	425	414
OTHER WASHINGTON(COUNTY)	746	486	2,584	1,685
POINT JUDITH	970,922	779,532	407,242	169,347
POINT LOOKOUT	4,591	2,701	7,604	4,907
POINT PLEASANT	142,124	92,041	61,216	62,891
SANDWICH	0	0	0	0
SHINNECOCK	678,485	487,859	244,769	181,403
STONINGTON	165,057	66,856	90,279	34,459
TIVERTON	18,375	30,325	23,482	32,619
VINEYARD HAVEN	0	0	0	0
WANCHESE	2,741	1,040	4,033	1,463
WESTPORT	19,252	13,665	10,888	8,472
WILDWOOD	1,283	182	4,443	632
WOODS HOLE	106	16	366	54

Table A5. Complete list of ports (including those in ALL_OTHERS).

AMAGANSETT	*NEW YORK CITY*
ATLANTIC CITY	*NEWINGTON*
BARNEGAT	*NEWPORT*
BARNSTABLE	*NEWPORT NEWS*
BASS RIVER	*NIANTIC*
BEAUFORT	*NOANK*
BELFORD	*NORTH KINGSTOWN*
BOSTON	*OCEAN CITY*
BRISTOL	*OLD SAYBROOK*
BROAD CHANNEL	*ORIENT*
BROOKLYN	*ORIENTAL*
CAPE MAY	*OTHER BEAUFORT(COUNTY)*
CHATHAM	*OTHER BRONX*
CHESAPEAKE BEACH	*OTHER CAPE MAY*
CHILMARK	*OTHER CITY OF HAMPTON*
CHINCOTEAGUE	*OTHER CURRITUCK*
CITY OF SEAFORD	*OTHER DUKES*
DANVERS	*OTHER MAINE*
DARTMOUTH	*OTHER NEWPORT*
DAVISVILLE	*OTHER NORTHAMPTON*

DUXBURY
EAST HAMPTON
ENGELHARD
FAIRHAVEN
FALL RIVER
FALMOUTH
FREEPORT
GLOUCESTER
GREENPORT
GROTON
GUILFORD
HAMPTON
HAMPTON BAY
HARWICHPORT
HIGHLANDS
HOBUCKEN
HYANNIS
ISLIP
JAMESTOWN
LITTLE COMPTON
LONG BEACH
MANASQUAN
MARBLEHEAD
MARSHFIELD
MASTIC
MATTITUCK
MENEMSHA
MONMOUTH
MONTAUK
MONTVILLE
MOREHEAD CITY
MORICHES
MYSTIC
NANTUCKET
NEW BEDFORD
NEW LONDON
NEW SHOREHAM
OTHER NY
OTHER SUFFOLK
OTHER VIRGINIA
OTHER WASHINGTON
OTHER WASHINGTON(COUNTY)
OYSTER
POINT JUDITH
POINT LOOKOUT
POINT PLEASANT
PORTLAND
PROVIDENCE
PROVINCETOWN
PT. PLEASANT
ROCKLAND
ROCKPORT
SACO
SANDWICH
SHELTER ISLAND
SHINNECOCK
SMITHTOWN
SOUTH KINGSTOWN
SOUTHOLD
STONINGTON
SWAN QUARTER
TIVERTON
VINALHAVEN
VINEYARD HAVEN
VIRGINIA BEACH
WAKEFIELD
WANCHESE
WARREN
WATERFORD
WESTERLEY
WESTPORT
WILDWOOD
WOODS HOLE

Fisheries Exposure in Massachusetts from the Sunrise Wind Lease Area and the Sunrise Export Cable Route

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DRAFT

6 April 2023

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List of Abbreviations

COP – Construction and Operations Plan

ECC – Export Cable Corridor

ECR – Export Cable Route

ECC WA – Export Cable Corridor Working Area

ECRA – Export Cable Route Area

GDP – Gross Domestic Product

MA DMF – Massachusetts Division of Marine Fisheries

NMFS – National Marine Fisheries Service

NOAA – National Oceanographic and Atmospheric Administration

PPI – Producer Price Index

RICRMC – Rhode Island Coastal Resources Management Council

RIDEM – Rhode Island Department of Environmental Management

SBRM – Standardized Bycatch Reporting Methodology

VMS – Vessel Monitoring System

VTR – Vessel Trip Report

WLA – Wind Lease Area

WTGA – Wind Turbine Generator Area

Summary

Based on NOAA data from 2008 to 2019, and adjusting for underreporting of lobster and Jonah crab landings in the VTR data, and for some dockside sales of lobster and Jonah crab, we estimate the average annual value of commercial landings from the Sunrise Wind Lease Area to be $2.34 million (2020$), or $5,429/km^2/year. Of this, $1.07 million is landed in Massachusetts. Including indirect and induced effects, these landings generate average annual economic impacts of $2.31 million in Massachusetts.

We estimate the average annual value of commercial landings from the 180 m wide Sunrise Wind Export Cable Corridor to be $149,000, or $5,626/km^2/year. Of this, $79,000 is landed in Massachusetts. These landings generate estimated total annual economic impacts of $170,000 in Massachusetts.

We estimate that a total (lump sum) of $2,777,000 (2020$) of commercial fisheries value landed in Massachusetts is potentially exposed to the Sunrise Wind Farm development. This accounts for about 46% of the total potentially exposed commercial landed value from Sunrise Wind. It includes about $2,037,000 in direct landed value forgone due to construction-related effects, $629,000 from forgone fishing during the wind farm's operation, and $112,000 in present value of landings from decommissioning. Including indirect and induced effects, the potentially affected commercial landings result in about $6,123,000 in total (lump sum) present value economic impact in Massachusetts.

We estimate the average annual economic impact from Massachusetts-based for-hire charter fishing in and around the Sunrise Wind Lease Area to be between $226,000 and $364,000, and between $8,000 and $14,000 from charter fishing around the Sunrise Wind Export Cable route. (Note that these areas overlap to some extent.) We estimate that a total (lump sum) of about $356,000 (2020$) in economic impact from Massachusetts-based charter fishing is potentially exposed during construction and decommissioning activities at Sunrise Wind.

There is considerable variability in the baseline data of landings and landed value from the Sunrise Wind lease area and export cable corridor. Baseline future landings will vary due to natural and fisheries-related fluctuations in stocks and prices. There is also uncertainty about the impact of wind farm construction and operation on fish stocks and landings, and about the ways that fishers will adapt their fishing practices in response to wind farm development. We consider our combined estimate of $6.48 million in economic impact to Massachusetts from Sunrise Wind development on commercial and charter fishing to be a conservative upper bound on likely actual impacts.

Introduction

This report estimates the level of pre-development fishing operations intersecting with, and landings and landed value from, the Sunrise Wind Lease Area (WLA) and Export Cable Corridor (ECC) (Figure 1) associated with landings and revenue generated in Massachusetts ports, and the potential exposure of Massachusetts-based commercial and for-hire charter fishing to Sunrise Wind Farm construction, operations, and decommissioning. Sunrise Wind LLC is a joint venture between Ørsted and Eversource.

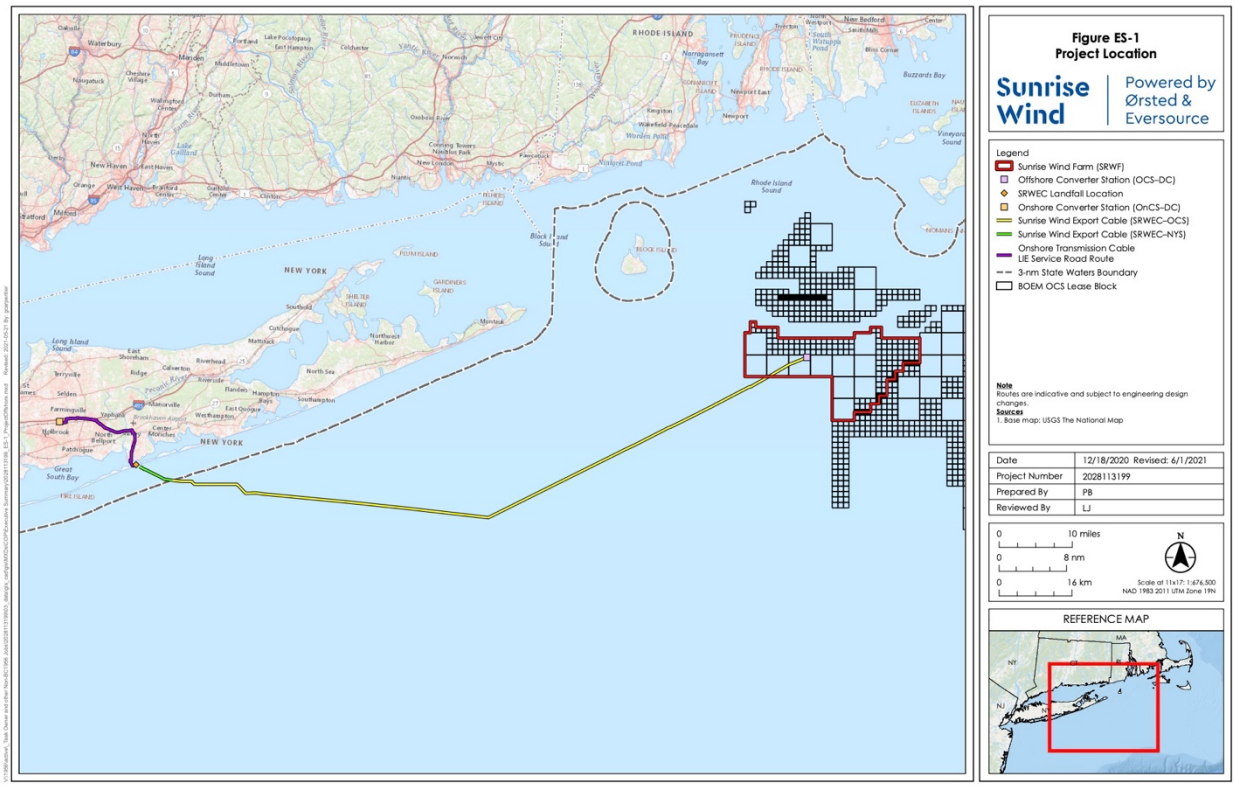

Figure 1. Sunrise Wind Lease Area and export cable route. Source: Sunrise Wind.

The WLA for Sunrise Wind lies in federal waters, some 40 km south of the mainland coast near the border between Rhode Island and Massachusetts, and has a footprint of 430.6 km^2.[1] The ECC is 147 km in length, and runs from the edge of the WLA first toward the southwest and then west toward Fire Island off the coast of Long Island, New York, to the export cable landing location near the western end of Fire Island. (Note that the export cable route is slightly longer than the ECC, because the cable route includes sections within the WLA and inland of the landing point.)

To estimate commercial fish landings along the ECC, we define a 10km wide Export Cable Route Area (ECRA) extending 5km on either side of the cable route. The 10km wide ECRA has no physical

[1] A small piece in the northeast corner of the original Sunrise WLA is not under consideration for turbine tower placement, and is not included in the WLA shapefile used for this analysis.

significance in the context of the Sunrise Wind Lease, and is defined only for the purpose of identifying fisheries landings data that reflect what may be landed from fishing along the export cable route. Only portions of the narrow, 180m wide ECC centered on the export cable may be disturbed in the process of burying the cable.

Table 1 shows the approximate length and area of these features for the Sunrise export cable route. In the sections that follow, fishery landings and values for the export cable route are estimated and reported for the ECC, as defined above.

Table 1. Sunrise Wind area parameters

Wind Lease Area footprint (km^2)	430.6
Export cable route length (km)	147
Area of 10km Export Cable Route Area (ECRA) (km^2)	1,610.9
Area of Export Cable Corridor (ECC) (km^2)	26.5
Export Cable Corridor fraction of ECRA	1.64%

Methodology

Our approach to estimating the potential impact of Sunrise Wind development on commercial fishing is to first estimate the annual landed weight and value of fish from the Sunrise WLA and ECC, and then to estimate the fraction of this annual value that may be exposed to wind farm construction, operation, and decommissioning. Our assessment method is consistent with the general framework described in the reports by Kirkpatrick *et al.*/BOEM (2017a and 2017b) on socio-economic impact of offshore wind energy development on commercial fisheries, and builds on the approach of Livermore (RIDEM 2017, 2018, and 2019), which develops high-end estimates of fishery impacts by including in baseline estimates the entire trip revenues from all trips that overlap with a wind lease area, regardless of how much fishing occurred inside or outside the area.

Separately, we estimate the gross revenue associated with for-hire charter boat fishing activity originating in Massachusetts, and the fraction of this revenue that may be exposed to Sunrise Wind development.

We estimate the annual commercial landings and landed value of fish from the Sunrise WLA and ECC using a new dataset provided by NOAA's National Marine Fisheries Service. This dataset uses modeled representations of federal Vessel Trip Report (VTR) and clam logbook fishing trip data to produce a more accurate spatial allocation of landings from each fishing trip (DePiper 2014; Benjamin *et al.* 2018). As we document below, there has been considerable variability in annual landings from these areas over the past decade; we use the average landings and landed value from 2008 to 2019 as indicative of what the areas may yield in the future.

We then estimate the fraction of this average annual value that may be at risk ("exposed") due to Sunrise Wind development, based on the nature and schedule of construction activities, operating

plans, and decommissioning plans, and on information from the scientific literature on the effects of wind farm construction and operation on commercial fish stocks and landings.

The effect of offshore wind farm construction and operation on marine ecosystems, fish stocks and fish behavior, and fishery landings is an area of ongoing research. To date, almost all offshore wind farm development has taken place outside the US. The only wind farm off the coast of New England from which lessons might be drawn directly for Sunrise Wind is the Block Island Wind Farm, a five-turbine, 30 MW project about 4 miles from Block Island, RI.

Investigations of offshore wind farms outside the US have found both positive and negative impacts on marine biota, habitats, and ecological function. The impacts include the aggregation of finfish and other marine life via the creation of artificial reefs (Bergström *et al.* 2014; Langhamer 2012; Lindeboom *et al.* 2011; Wilhelmsson and Malm 2008) and disturbance of existing ecosystems (Bergström *et al.* 2014; Wilhelmsson *et al*. 2006). Bartley *et al.* (2019) have reported on monitoring of physical and chemical conditions in the benthic environment around Block Island Wind Farm turbine towers over the two years since the towers were installed; they found some changes in the benthos in the immediate tower foundation footprint at one out of three turbine towers they investigated, and found no changes beyond 30m from any of the towers studied.

In their 2018 study, ten Brink and Dalton interviewed commercial and recreational fishers active in the waters around the Block Island Wind Farm about the perceived effects of the farm on fish stocks and fishing activity. Respondents reported murky water, underwater noise, and vibration during construction, and a lower abundance of fish such as striped bass on the side of Block Island closest to the wind farm site during the construction time window. They also reported the presence of shellfish and finfish on and around the wind turbine towers, including an increase in the abundance of cod, within months of the conclusion of construction activities. The transient negative effect on mobile species within 5-10km of wind farm construction activities observed at Block Island is consistent with findings from Europe (Bergström *et al.* 2014; Vallejo *et al.* 2017).

Hooper *et al.* (2017) report on a survey of recreational fishers and wind farms in the United Kingdom. The authors found that most fishers in their survey either had fished near a wind farm or were interested in doing so, and concluded that most UK anglers were unlikely to change their behavior in response to wind farm development.

More recently, Dalton *et al.* (2020) reported on surveys of Rhode Island recreational boaters' preferences for boating in the vicinity of offshore wind farms. Although some survey respondents identified as fishers, the survey did not explicitly target boaters interested in fishing; the mean age of respondents was above 62 years, mean boat length in excess of 37 feet, and more than 43% of respondents owned sailboats. Overall, boaters expressed a preference for not boating near (within 100 ft) of an offshore wind turbine; but boaters who fish were less negatively impacted by boating near a turbine, and boaters who had visited the Block Island Wind Farm were more accepting of trips near turbine towers than other boaters.

Given the current state of knowledge about the effects of wind farm construction and operation on fish stocks and fishery landings, we consider five categories of possible exposure for commercial fishing from the Sunrise Wind project:

- Transient effects on fish availability due to construction activities and noise
- Transient effects due to constrained access to certain areas during construction
- Changes in fishing in the WLA during operations
- Transient effects due to constrained access to certain areas during decommissioning
- Transient effects on fish availability due to decommissioning activities

We also consider transient effects on the for-hire charter fishing industry due to construction and decommissioning of the wind farm. To the extent that for-hire charter fishing vessels from Massachusetts use the WLA and ECC, it is possible that their activities may be affected during construction and decommissioning. We consider it unlikely that the Sunrise Wind development will negatively affect the personal recreational fishing activities of Massachusetts boaters.

Estimating the effect of wind farm development on fishing activity and landings is complicated by several sources of variability and uncertainty. There is considerable year-to-year fluctuation in the historical baseline commercial landings from the wind development areas; and future fishery landings from these areas are likely to differ from historical baselines due to climate change effects (Free *et al.* 2019; Oremus 2019). There is uncertainty about the extent and duration of effects of wind farm construction on fish availability in the vicinity of the wind farm, and about the habitat and other effects (if any) of the wind farm over decades of operation. There is also uncertainty about the response of the commercial fishing industry and of for-hire charter fishing vessels to the altered "landscape" resulting from wind farm development. The current state of the science about wind farm effects on commercial fishing does not support a precise estimate of effects on fish stocks; and the future decisions of fishers are by their nature not precisely predictable, especially decades into the future, because they depend on personal assessments and decisions of individual fishers.

Acknowledging these sources of variability and uncertainty, we seek to develop a realistic, conservative estimate of the potential effect of Sunrise Wind development on Massachusetts commercial landings, landed value, and charter boat revenue. We make conservative assumptions about fishing industry response, assuming that landings from an area where access is constrained during construction, operations, or decommissioning are simply forgone, and not compensated by landings from fishing elsewhere instead. Further, we estimate impact as the landed value (gross revenue) at risk, not the net income or profit. Landed value is, by definition, larger than net income or profit from fishing. For these reasons, we consider our impacts estimate to represent an upper bound on the likely net effects of the wind farm on the Massachusetts fishing industry.

Throughout this report, we use "landed value" to refer to the direct value of fisheries landings, "impact" to refer to the economic activity generated by fisheries, including indirect and induced effects (see below), and "exposure" to refer to the portion of landed value or impacts that may be at risk due to wind farm development.

Baseline commercial fishery landings and values, 2008-2019

Commercial Fisheries Data Description

The following data description is based on information provided by the National Marine Fisheries Service (NMFS) on March 20 and April 1, 2020.[2] NOAA has been collecting and improving the Vessel Trip Report (VTR) data for decades. The data have been widely used for fisheries research, management, and economic impact assessments. To gauge landings value and quantity at the spatial scale required for the Sunrise Wind Lease Area and export cable route, NOAA has recently developed a procedure to produce high-resolution spatial information using a combination of VTR and fishery observer data. As described below, we follow the general approach developed by NOAA, which is the best approach at present, with a recognition that relevant data are not perfect. All estimates of fishery landings and values in this report are based on these NMFS data; and the data have not been amended, adjusted, or augmented in any way, with two exceptions: we make adjustments to the lobster and Jonah crab landed values to account for possible underreporting; and we make adjustments to the Rhode Island lobster and Jonah crab landings to account for dockside sales. These adjustments are described in detail in the section on Adjustment of Lobster and Jonah Crab Data below. The adjusted data appear only in Tables 11 and 12 below.

The data presented below summarize estimates of fisheries landings and values for fishing trips that intersected with the Sunrise Wind Lease Area (WLA) or its Export Cable Route Area (ECRA), from 2008 to 2019 (calendar years). Modeled representations of federal Vessel Trip Report (VTR) and clam logbook fishing trip data were queried for spatial overlap with the WLA and the ECRA, and linked to dealer data for value and landings information. As detailed in DePiper (2014) and Benjamin *et al.* (2018), to improve the spatial resolution of VTR, a spatial distribution model was developed by combining vessel trip information from VTR with matching NOAA fishery observer data, including geocoordinates of detailed fishing locations. From this model, landings and value can be summarized for a specified geographic area according to (1) species, (2) gear type, (3) port of landing, and (4) state of landing.

In essence, the DePiper approach utilizes a spatial model to distribute the total landings for each commercial fishing trip over a circular area with its center located at the geocoordinate reported in the VTR, following a distribution decreasing with the radius. The model was estimated using VTR data (for the centroid) and vessel observer data (for haul beginning and endpoints). DePiper (2014) reported that the observer data matched VTR records well (488,251 hauls in the observer data were matched to 27,358 VTR records, representing 87.5% of all hauls with either a beginning or end point of a haul recorded).

The primary purpose of the observer data collection is to monitor fishery bycatch. NOAA's Standardized Bycatch Reporting Methodology (SBRM) dictates what types of vessels (gear, species, area of operation, etc.), participating in various fisheries, should be sampled and at what rate. The numbers of sea days needed to achieve a 30% coefficient of variation (CV = standard deviation divided by mean) of total discards for each species group were derived for different SBRM fleets covering different gears, access areas, states, and mesh sizes (NEFSC 2013). For Massachusetts vessels, the observer program covered

[2] Our primary contact at NMFS was Benjamin Galuardi, a statistician at the NOAA Greater Atlantic Regional Fisheries Office. He has worked extensively on fishery data analyses in general and the VTR data in particular, and has authored or coauthored more than 30 publications on fisheries sciences and spatial statistics.

close to 20% of trips with trawl gear, around 5% of trips with dredge gear, and around 20% of trips with gillnet gear (Jin 2015).

Following the DePiper approach, the resulting high spatial resolution data were converted into raster maps. Use of this VTR raster model produces a more accurate estimate of the spatial distribution of landings than other approaches that rely entirely on the self-reported VTR/clam logbook locations, which associate all landings from the trip with a single point location. At 10 nautical mile resolution, the confidence intervals of the DePiper model estimates are around 90% for trip lengths of one to two days.

The only alternative to the DePiper approach is a model to distribute the total landings from a VTR report over the vessel's track using the Vessel Monitoring System (VMS) data. The main challenge for this approach is accurate identification of fishing and non-fishing segments of a trip. Muench *et al.* (2018) have shown that using vessel speed alone can lead to a severe misrepresentation of fishing locations. NOAA has adopted the DePiper approach as a standard procedure to generate spatial data; and we agree with NOAA that this is the best approach currently available. The main advantages of the DePiper approach are that (1) it is based on observations of actual fishing locations noted by observers at sea, and (2) it provides a systematic and consistent way to meet the increasing demand for spatial fishing data for relatively small areas in the ocean, which is important for cross project comparison.

Landings associated with the Export Cable Corridor and Export Cable Route Working Area are calculated by applying the factors in Table 1 to the landings estimated for the Export Cable Route Area. This assumes that landings are distributed uniformly across the fished sections of the ECRA.

In order to maintain the legally required data confidentiality, summaries by species, gear type, and landing location are presented individually. In addition, for records that did not meet the "rule of three" (three or more unique dealers and three or more unique permits), values are summarized in a category labeled "ALL OTHERS." Note also:

- All landed values have been converted to 2020 dollars using the Producer Price Index for "unprocessed and prepared seafood."
- Pounds are reported in Landed Pounds, unless otherwise noted.
- Data summarized here are from federal sources only.
- Fishing vessels that carry only lobster permits for federal waters are not subject to VTR requirements. Landings from trips with no VTR are not reflected in this summary.
- Other fisheries exist in state waters that may not be reflected in data from federal sources (e.g. whelk, quahog, striped bass).

We also obtained the average monthly number of trips intersecting with each area, for the period of 2014-2019.

Commercial Fishery Landings from Wind Lease Area and Export Cable Corridor

Table 2 shows the average annual level and standard deviation of total values and landings associated with fishing in the Sunrise WLA and the ECC from 2008 to 2019.

The average annual landings from the Sunrise WLA are about 2.19 million lbs (standard deviation 855,000 lbs) with a value of about $2.12 million (standard deviation $737,000). Average annual landings from the ECC are about 102,000 lbs (standard deviation 31,000 lbs) with a value of $146,000 (standard deviation $50,000).

Table 2. Average annual value and quantity of commercial fisheries landings by area

Area	*Mean* Value/year (2020 $)	*Mean* Landings/year (lbs)	*Standard Deviation* Value/year (2020 $)	*Standard Deviation* Landings/year (lbs)
Sunrise WLA	2,116,815	2,191,599	736,846	855,072
Sunrise ECC	146,040	102,423	50,083	31,388

Table 3 shows the total landings and values, for each year from 2008 to 2019, associated with fishing in the Sunrise WLA and the ECC.

Table 4 summarizes the average annual landings and value of fisheries production from the Sunrise WLA and the ECC by the top five species or species groups. Lobster, scallops, monkfish, and skate wings are among the species/products generating the greatest value from the Sunrise WLA during the 2008-2019 time period.

Table 3. Annual value and quantity of commercial fisheries landings by area.

Area	Sunrise WLA		Sunrise ECC	
Year	Value (2020 $)	Landings (lbs)	Value (2020 $)	Landings (lbs)
2008	1,615,088	1,005,003	99,660	124,213
2009	1,774,968	1,763,708	116,648	141,792
2010	1,732,042	1,569,026	147,042	93,643
2011	2,068,388	2,138,106	183,873	121,945
2012	2,370,211	2,523,020	177,409	133,283
2013	3,660,640	3,846,497	193,497	110,854
2014	2,880,896	3,179,394	215,344	100,489
2015	2,100,812	2,099,179	112,582	123,345
2016	2,818,797	3,123,434	141,753	108,395
2017	2,011,618	2,091,922	206,015	64,818
2018	1,482,612	1,890,508	106,437	70,247
2019	885,704	1,069,387	52,223	36,059

Both mobile (e.g., trawl and dredge) and fixed (e.g., pots and gillnet) gears are used in fishing operations. The trawl gear is primarily used for harvesting groundfish, dredge for scallops, and pots for lobster and crabs. The fixed gears are fished using trawls (a series of lobster pots attached to one line) with string lengths of 0.4–0.8 km (up to 1.829 km) or gillnets with typical string lengths of 0.2–3.0 km. Tables 5a and 5b break out annual landings for each area by gear type. Sinking gillnets and bottom trawls are the most significant in the WLA, followed by scallop dredges. In the ECC, bottom trawls and

scallop dredges are the most significant, followed by sinking gillnets and clam dredges. The "ALL_OTHERS" category includes landings using purse seines, other seines, and weirs/traps, and others that fall under the "rule of three" exclusion.

Table 4. Average annual landings of major species by area, 2008-2019.

	Mean		***Standard Deviation***	
Area/Species	**Value/year** (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
Sunrise WLA				
ALL_OTHERS	559,908	712,732	526,411	603,320
Monkfish	377,837	224,763	134,917	39,911
Scallops/Bushel	243,724	21,375	180,466	16,581
Skate Wings	192,400	496,211	88,291	133,949
Lobster, American	131,173	23,676	34,047	6,421
Sunrise ECC				
Scallops/Bushel	62,591	5,704	45,989	4,658
ALL_OTHERS	17,814	21,860	17,907	21,597
Quahogs/Bushel	13,528	16,670	21,151	25,726
Monkfish	13,401	7,083	5,392	1,733
Squid/Loligo	11,494	8,877	4,379	3,925

Table 5a. Average annual landings in Sunrise WLA by gear type.

	Mean		***Standard Deviation***	
Gear	**Value/year** (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
ALL_OTHERS	608,138	720,798	514,302	601,202
Dredge - Clam	-	-	-	-
Dredge - Scallop	198,211	18,120	139,265	14,111
Gillnet – Other	-	-	-	-
Gillnet – Sink	550,603	563,390	210,752	193,006
Handline	3,387	917	4,821	1,122
Longline – Bottom	621	166	1,502	393
OTHER	7,764	691	26,896	2,394
Pot – Other	178,766	71,766	42,041	24,967
Trawl – Bottom	553,197	695,988	309,568	329,261
Trawl - Midwater	16,129	119,762	22,843	167,438

Table 5b. Average annual landings in Sunrise ECC by gear type.

Gear	Mean		Standard Deviation	
	Value/year (2020 $)	Landings/year (lbs)	Value/year (2020 $)	Landings/year (lbs)
ALL_OTHERS	19,559	22,229	18,779	21,493
Dredge – Clam	13,897	16,872	20,984	25,656
Dredge – Scallop	57,149	5,238	41,824	4,275
Gillnet – Other	5	3	19	12
Gillnet – Sink	15,863	11,942	5,969	3,425
Handline	206	89	124	58
Longline - Bottom	45	12	102	27
OTHER	1,794	166	2,311	210
Pot - Other	3,581	2,040	1,053	541
Trawl – Bottom	31,799	28,050	7,171	5,388
Trawl - Midwater	2,143	15,782	1,998	14,316

Table 6 summarizes annual landings and landed value for the major ports receiving landings from the two areas. Point Judith (Rhode Island) and New Bedford (Massachusetts) are the most significant ports for landings from the Sunrise Wind areas. Tables A5 through A7 in the Appendix show the complete data on average annual landings and landed value by port for Rhode Island and Massachusetts.

Tables 7a and 7b show average annual landings and landed value from the two areas by state where the catch is landed. Rhode Island and Massachusetts together account for more than 95% of landings and landed value from the WLA and more than 68% of landings from the ECC. The "others" category includes landings in Maine, Connecticut, New York, New Jersey, Maryland, North Carolina, and Virginia, as well as data flagged by the "rule of three" exclusion.

Table 6. Average annual landings at major ports in Rhode Island and Massachusetts.

Area/Port	Mean		Standard Deviation	
	Value/year (2020 $)	Landings/year (lbs)	Value/year (2020 $)	Landings/year (lbs)
Sunrise WLA				
New Bedford, MA	875,504	887,422	548,737	669,281
Point Judith, RI	546,080	525,298	262,657	338,703
Little Compton, RI	226,334	259,258	107,800	134,413
Newport, RI	138,952	181,915	68,718	91,330
Sunrise ECC				
New Bedford, MA	75,390	50,137	32,864	22,755
Point Judith, RI	15,923	12,784	6,679	2,777

Table 7a. Average annual landings in Sunrise WLA by state.

State	Mean		Standard Deviation	
	Value/year (2020 $)	Landings/year (lbs)	Value/year (2020 $)	Landings/year (lbs)
Rhode Island	1,034,863	1,124,470	267,459	277,149
Massachusetts	981,602	1,002,341	551,935	695,103
Others	99,838	64,361	--	--

Table 7b. Average annual landings in Sunrise ECC by state.

State	Mean		Standard Deviation	
	Value/year (2020 $)	Landings/year (lbs)	Value/year (2020 $)	Landings/year (lbs)
Rhode Island	22,218	19,853	8,703	3,996
Massachusetts	77,407	54,210	33,681	26,059
Others	46,394	28,347	--	--

Landed value and trips by month

Table 8 and Figures 2 and 3 show the average monthly landings and values from the two areas. Table 9 reports the average monthly number of fishing trips that intersect each area.

Table 8. Average monthly value of landings, 2020$, 2014-2019 (2020$).

Month	Sunrise WLA	Sunrise ECC
Jan	181,533	15,225
Feb	108,563	15,810
Mar	111,095	19,200
Apr	161,159	25,643
May	165,798	23,047
Jun	237,018	42,712
Jul	170,048	41,095
Aug	144,073	23,846
Sep	224,291	20,819
Oct	163,778	17,847
Nov	191,969	15,994
Dec	190,477	20,273

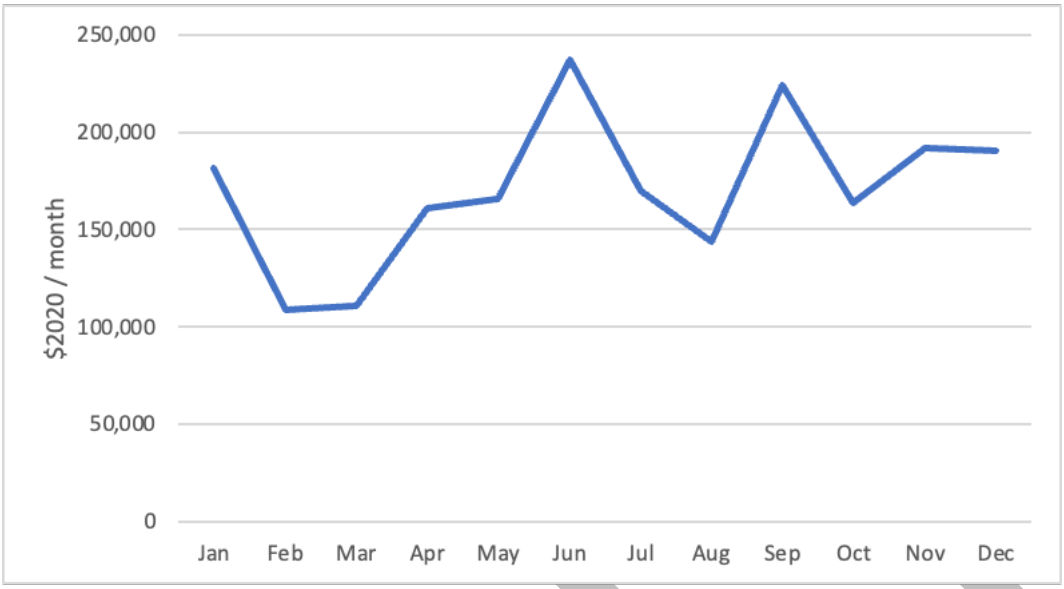

Figure 2. Average monthly value of landings, Sunrise WLA, 2014-2019.

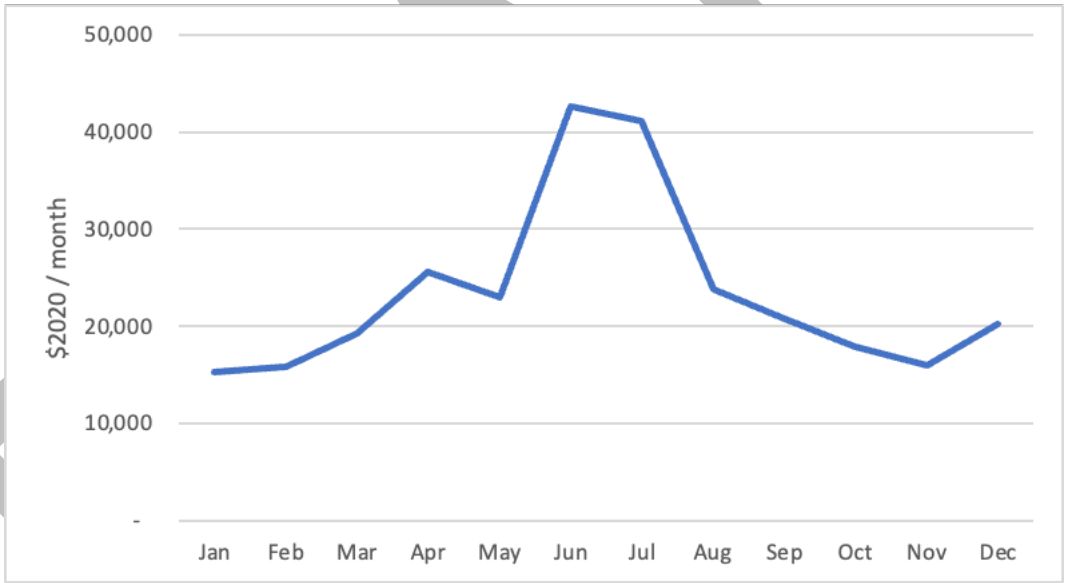

Figure 3. Average monthly value of landings, Sunrise ECC, 2014-2019.

Table 9. Average monthly number of fishing trips, 2014-2019.

Month	Sunrise WLA	Sunrise ECRA
Jan	315	480
Feb	167	323
Mar	149	305
Apr	208	452
May	367	732
Jun	502	923
Jul	575	789
Aug	579	705
Sep	501	677
Oct	380	589
Nov	335	588
Dec	365	646

Inter-annual price adjustments

We use the Bureau of Labor Statistics' Producer Price Index (PPI) for "unprocessed and prepared seafood"[3] to convert ex-vessel value of fish landings, because this index is specifically for the fishery sector. PPI is a family of indexes that measures the average change over time in selling prices received by domestic producers of goods and services; they measure price change from the perspective of the seller. In contrast, the Bureau of Economic Analysis' general Gross Domestic Product (GDP) deflator[4] measures changes in the prices of goods and services produced in the United States, including those exported to other countries, and captures price changes across all economic sectors. Table 10 shows both indexes from 2000 to 2021.

Note that the variation in the sector (i.e., fishery) specific price index is considerably larger than that of the GDP deflator. PPI decreases have been observed in several years since 2000. The GDP deflator exhibits a steady trend. We recognize that many seafood prices rose sharply in 2021, as reflected by the sharp increase in fish PPI for that year. We consider it unlikely that this will significantly alter the long-term trend, and maintain that the historical average is the best predictor of future values.

We report all values in 2020$ for consistency. These values can be easily adjusted to any other-year dollars by applying the appropriate index adjustment. Landed value may be adjusted using the PPI index. For impact values, including upstream and downstream effects (see below), it is more appropriate to use the GDP deflator to adjust, because the multipliers capture economy-wide impacts.

[3] https://www.bls.gov/ppi/#data

[4] https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=2#reqid=19&step=2&isuri=1&1921=survey

Table 10. Price indexes.

Year	GDP implicit price deflator	Percent change	PPI fish	Percent change
2000	78.0		198.1	
2001	79.8	2.25%	190.8	-3.69%
2002	81.0	1.56%	191.2	0.21%
2003	82.6	1.97%	195.3	2.14%
2004	84.8	2.68%	206.3	5.63%
2005	87.5	3.14%	222.6	7.90%
2006	90.2	3.09%	237.4	6.65%
2007	92.6	2.70%	242.8	2.27%
2008	94.4	1.92%	255.4	5.19%
2009	95.0	0.64%	250.9	-1.76%
2010	96.2	1.20%	272.4	8.57%
2011	98.2	2.08%	287.6	5.58%
2012	100.0	1.87%	287.6	-0.02%
2013	101.8	1.75%	299.4	4.12%
2014	103.7	1.87%	322.4	7.68%
2015	104.7	1.00%	322.0	-0.13%
2016	105.7	1.00%	327.6	1.74%
2017	107.7	1.90%	337.9	3.15%
2018	110.3	2.39%	344.5	1.96%
2019	112.3	1.79%	349.9	1.55%
2020	113.6	1.21%	350.8	0.27%
2021	118.4	4.15%	413.0	17.74%
Annual average		2.01%		3.66%

Adjustment of lobster and Jonah crab data

As noted above, lobster vessels that carry only lobster permits are not subject to a Vessel Trip Report (VTR) requirement. Trips without VTR are not reflected in the numbers shown in Tables 2 through 9 (cf. King 2019). To account for potentially unreported lobster and Jonah crab landings, and for dockside sales (see below), we make adjustments to the landed value data as shown in Table 11. Data in the first three rows are based on VTR data, and are taken from Table 2 and Tables A1 through A3 in the Appendix. An earlier study by Industrial Economics (2015) indicates that active lobster vessels not subject to trip report requirements in Lobster Management Area 2 may account for as much as 57% of the total lobster fishing activity in that area. (Lobster Management Area 2[5] encompasses the waters south of Rhode Island and Cape Cod to a distance of about 40 nm, and includes the Sunrise WLA.) We assume conservatively that landings from 60% of the lobster vessels in the Sunrise WLA and ECRA could therefore be unreported, and that the VTR data represent 40% of the true lobster and Jonah crab revenues. We use this as an adjustment factor, and estimate the adjusted lobster and Jonah crab revenues at 2.5 times of those in the VTR data.

Some fraction of lobster and Jonah crab landings are sold directly from boats at dockside, at a price above that reported in the dealer information on which the NOAA values above are based. Neither the

[5] http://fisheries.noaa.gov/resource/map/lobster-management-areas

fraction of landings sold in this way nor the price premium is known exactly. Based on information provided by a group of Rhode Island fishermen (pers. comm., 24 Nov. 2020), we estimate that a 15% premium on the landed value derived from NOAA data (Table 11) adequately captures this dockside sales effect for Rhode Island landings. Dockside sales are not a common practice in Massachusetts (Mass. DMF pers. comm. May 2021), so we do not apply this multiplier to Massachusetts landings.

The combined adjustment for VTR data and dockside sales is shown in rows 5 and 6 in Table 11. The net increase is shown in row 7, and the adjusted total annual landed values are shown in row 8. This adjustment results in a 13.2% increase in the estimated total annual landed value for the WLA, and 3.3% increase for the ECC.

Table 11. Adjustment of landed value for landings not captured in VTR data and for RI dockside sales.

Value (2020$)	**Sunrise WLA**	**Sunrise ECC**
Avg. VTR total $/year (Table 2)	2,116,815	146,040
Avg. VTR lobster $/year (Tables A1-A3)	131,173	1,963
Avg. VTR Jonah crab $/year (Tables A1-A3)	35,412	1,159
% of total captured by VTR	40%	40%
Adjusted lobster $/year (incl. RI dockside sales)	351,981	5,019
Adjusted Jonah crab $/year (incl. RI dockside sales)	95,022	2,964
Net increase over VTR $/year (row 5+6-2-3)	280,419	4,861
Adjusted total $/year	2,397,234	150,901
Adjusted increase over VTR total value	13.2%	3.3%

With all adjustments, we estimate the average annual landed value in Massachusetts from the Sunrise WLA to be about $1.1 million (2020$), and from the Sunrise ECC about $80,000.

Estimated indirect and induced economic impacts

Economic impact multipliers reflect the linkages between economic activity in different sectors of the economy. For example, when landings increase in the commercial fishing sector, there is an associated increase in the purchases of ice and other supplies in the region, and an increase in onshore transportation and processing of seafood. The resulting increases in economic activity in the commercial fishing supply and transportation and processing sectors are indirect effects of increased landings. In addition, because fishermen and workers in the supply, transportation, and processing industries earn greater income as a result of this increased activity, and spend some of that extra income on local goods and services, there is also an induced effect of greater spending in other sectors. The multipliers capture the combined effect of indirect and induced spending that results from higher commercial landings.

We have developed regional economic models for Massachusetts using the IMPLAN model software (IMPLAN 2004) and data for 2018 and 2019. IMPLAN software and data are commercial products widely used by researchers and management agencies to perform economic impact analyses for a user specified study region (IMPLAN 2004; Steinback and Thunberg 2006; Hoagland *et al.* 2015; UMass

Dartmouth. 2018; Cape Cod Commission 2020). Based on these models, and 2019 data, the upstream output multiplier for the commercial fishing industry in Massachusetts is 1.775.

We have also taken into account downstream economic activity, such as seafood processing, that may take place at Massachusetts businesses as a result of commercial fisheries landings. This linkage is less direct than the upstream activities, because not all seafood landed in a state is processed in the state, and seafood processors may import more seafood from elsewhere for processing when in-state landings fall short. Nonetheless, we add a downstream adjustment of 0.43, as cited by BOEM (2021) in the Vineyard Wind analysis, to the multiplier for Massachusetts landings, bringing the combined multiplier to 2.205, to account for both upstream effects and downstream effects to seafood processors. We apply the combined upstream and downstream multiplier to all landings except lobster and Jonah crab, which are adjusted for dockside sales and receive only the upstream multiplier. The corresponding combined multiplier for Rhode Island landings is 2.219; for landings in other states, we use the average of the Massachusetts and Rhode Island multipliers.

The economic impact multiplier captures the linkages between the fishing industry sector and other sectors in the Massachusetts economy. While we use a single output multiplier for the entire commercial fishing sector in a given state, we recognize that the multiplier may in fact vary across specific fisheries, species, and gear due to differences in factor inputs for fishing operations and post processing of fish landed. We use a single multiplier for the entire commercial fishing sector, reflecting an average across all gear types and species. Economy-wide inflation affects all sectors in the economy but usually does not alter the general structure of the economy. Therefore, although the baseline economic values increase with rising prices, the multiplier does not. We also recognize that other types of multipliers, such as those focusing on employment effects, have been used in other analyses. We maintain that the output multipliers we use provide a robust and accurate measure of indirect and inducted effects averaged across the fishing sectors.

Table 12. Estimated annual economic impact in Massachusetts (all values in 2020$)

		Average value of landings/year			**Total impact/year**
Area	**State**	VTR data only (Table 11, row 1)	with lobster & Jonah crab adjustment	with dockside sales adjustment (15% premium on RI lobster & JC landings)	"dockside sales" column multiplied by upstream & downstream multipliers, except RI lobster & JC
Sunrise WLA	total	2,116,815	2,366,693	2,397,234	5,214,570
Sunrise ECC	total	146,040	150,723	150,901	332,878
Sunrise WLA	MA	981,567	1,097,435	1,097,435	2,419,845
Sunrise ECC	MA	77,401	79,883	79,883	176,142

Using these multipliers, and including the lobster and Jonah crab adjustment described in the previous section, we estimate the average annual total economic impact from commercial fishing activity in the Sunrise WLA to be about $2.42 million in Massachusetts (Table 12). We also estimate the average annual total economic impact from commercial fishing activity in the Sunrise ECC to be about $180,000 in Massachusetts. Including landings in other states, the total average annual economic impact from commercial fishing activity in the WLA is $5.21 million and in the ECC it is $333,000. These estimates are based on average annual landings value from 2008 to 2019, with lobster and Jonah crab landed value adjusted to account for boats not subject to VTR requirements.

Exposure of commercial fishery resources and fishing to wind farm development

In the following sections, we consider five categories of possible exposure of commercial fishery landings and landed value from the Sunrise Wind project:

- Transient effects on fish availability due to construction activities and noise
- Transient effects due to constrained access to certain areas during construction
- Changes in fishing in the WLA during operations
- Transient effects due to constrained access to certain areas during decommissioning
- Transient effects on fish availability due to decommissioning activities

Table 13. Assumptions for exposure of commercial fisheries to wind farm development.

Categories of Potential Exposure			Assumptions/Effects	Duration
Availability effects due to construction	WTGA+7.5km		100% of finfish leave area (a)	1 year
	WLA		Lobster/crab landings reduced 10% (b) Other shellfish landings reduced 10% (c)	2 years 5 years
	ECRA	1.6km WA	All landings reduced 10% (d)	1 year
		180m ECC	Lobster/crab landings reduced 25% (e) Other shellfish landings reduced 25% (f)	2 years 5 years
Construction constrained access	WLA		No fishing in 50% of area (g)	2 years
	ECRA	1.6km WA	No fishing in 5% of area (h)	1 year
		180m ECC	No fishing in 100% of area (i)	9 months
Effects during operations	WLA		Landings reduced by 5% (j)	30 years
	ECRA	1.6km WA	None	
		180m ECC	None	
Availability effects due to decommissioning	WLA		None beyond constrained access	
	ECRA	1.6km WA	All landings reduced 5% (k)	1 year
		180m ECC	Lobster/crab landings reduced 12.5% (l) Other shellfish landings reduced 12.5% (m)	1 year 4 years
Decommissioning constrained access	WLA		No fishing in 50% of area (n)	1 year
	ECRA	1.6km WA	No fishing in 5% of area (o)	2 months
		180m ECC	No fishing in 100% of area (p)	2 months

(a), (b), (c) etc. refer to detailed explanations in the text that follows

The assumptions and effects on fish availability and fishing activity/landings are summarized in Table 13 for each category and project area. For the purpose of estimating construction noise-related effects, we define a Wind Turbine Generator Area (WTGA) as the subset of the WLA in which turbine generator towers are to be located. The WTGA lies within the WLA and is slightly smaller in total footprint, since not all of the WLA is utilized for turbine generator towers; we recognize that final turbine generator siting decisions have not been made for Sunrise Wind, and refer here to the "indicative turbine layout" as of August 2022 (see Figure 3.3.4-1 of the Sunrise Wind Construction and Operations Plan (Sunrise Wind LLC 2022)). In the sections that follow Table 13, we describe how we arrived at the assumptions, with references in the text corresponding to the row codes (a), (b), (c), etc. in the table. The assumptions are based in part on information from the Sunrise Wind Construction and Operations Plan (Sunrise Wind LLC 2022) and from acoustic modeling work for wind farm turbine foundation installation (Küsel *et al.* (JASCO) 2022).

The estimates we present in the following sections include all commercial fishing in the Sunrise Wind project areas; we then estimate the portion of this total associated with the Massachusetts fishing sector, based on the sector's share of the Sunrise Wind area landed value. The baseline values for each project area and species group are shown in Table 14.

Table 14. Baseline landed values (2020$) used for exposure calculations.

	WLA	WTGA+7.5km	1.6km ECC WA	180m ECC
Total landed value:	**2,397,234**		**1,341,343**	**150,901**
Lobster & Jonah crab	447,004		70,961	7,983
Other crabs	2,828		773	87
Scallops	243,725		610,649	68,698
Other shellfish	4,165		1,724	194
Finfish/mobile species	1,699,512	4,210,284	657,236	73,939
MA landed value:	**1,097,435**		**710,073**	**79,883**
Lobster & Jonah crab	193,114		36,770	4,137
Other crabs	1,311		359	40
Scallops	113,015		283,158	31,855
Other shellfish	1,931		800	90
Finfish/mobile species	788,064	1,952,309	304,760	34,286

Transient availability effects due to construction

The construction schedule (Figure 3.2.2-1, page 3-6, Sunrise Wind LLC 2022) envisions construction activity in the WLA taking place mainly during the second half of 2024 and much of 2025, with some work on the inter-array cables beginning in the first half of 2024. Work on offshore foundations will take place in the second half of 2024; and work along the ECC is scheduled to take place during the second and fourth quarters of 2024, and the first quarter of 2025. To convert future effects to a common basis, we apply a real discount rate of 5% – the average of the rate usually applied in natural

resource valuation (3%) and the rate usually applied by the US government for public investment and regulatory analyses (7%).

Construction noise during drilling and pile driving, and disturbance of bottom sediments and rocks, is likely to have an impact on fish and shellfish in and around the Sunrise Wind project areas. Mobile species may leave the area because of construction noise, and species that rely on seafloor habitat may be injured or displaced.

Our estimate of the effect of construction in and around the WLA is based on a pile driving scenario involving 11 m monopiles, each installed within 24 hours, using a 4,000 kJ hammer, and 10 dB of noise attenuation. We assume conservatively that pile driving may extend over as much as nine months. We consider separately the likely effect of pile driving and turbine tower installation on shellfish (lobster, scallops, Jonah crab) and on finfish.

We assume conservatively that all finfish will leave all areas in and around the WTGA where pile driving noise exceeds 160 dB. There is no scientific evidence that the 150 dB threshold sometimes cited for "temporary behavioral changes" (Cal Trans 2015) leads to substantive relocation of finfish; and even 160 dB is far below any documented injury threshold. The Sunrise Wind Farm acoustic exposure analysis (Küsel *et al.* (JASCO) 2022) models noise propagation from pile driving at three tower locations in the Sunrise Wind layout. The distance at which pile driving noise with 10 dB of attenuation at the source drops to 160 dB for these three tower locations is found in row 5 of tables G-22, G-24, and G-26 (pages G-27, G-31, and G-35) of Küsel *et al.* (JASCO) (2022). (The data in these tables are for un-attenuated sources; the 170 dB values here are equivalent to 160 dB with 10 dB of attenuation.). The relevant distances in summer and winter are 6.67, 7.59, 6.92, 7.50, 6.82, and 7.04 km.

Based on these values, we estimate that the maximum range for pile driving noise with 10 dB of attenuation in the Sunrise Wind setting is likely to be about 7.5 km for 160 dB. We therefore assume conservatively that all finfish leave the WTGA and a 7.5 km buffer zone around the WTGA for the duration of pile driving (up to nine months) and return after a further three months (total of one year; Table 13 (a)). This is consistent with reported anecdotal observations by fishers around the Block Island Wind Farm (ten Brink and Dalton 2018), which suggest that the construction noise effect may extend 5-10km from its source, and that many finfish will return to the area within months of the end of construction. To estimate the value associated with this effect for Sunrise Wind, we obtained data from NOAA on average annual landings from a region enclosed by a 7.5 km buffer around the Sunrise WTGA. The annual value of finfish landings reported by NOAA for this region is $4,210,284 (2020$). The discounted value (at 5%) from the 2024-25 construction year is $3,380,333 (2020$), of which $1,652,645 is attributable to Rhode Island.

We also consider loss of shellfish due to construction noise and burial resulting from foundation installation and inter-array cable work. The closest approximation in the literature for a construction noise injury/mortality threshold for shellfish is the "mortality and potential mortal injury" 24-hour exposure threshold of 219 dB for "fish without swim bladders" (Popper *et al.* 2014; Küsel *et al.* (JASCO) 2022). This level of exposure will extend no more than 160 m from tower locations (Küsel *et al.* (JASCO) 2022, p. 39, Table 4.3-1, "Fish without swim bladder"), a radius that covers 1.9% of the WLA footprint assuming all 102 potential tower locations are built out (in fact the Sunrise construction plan (Sunrise LLC 2022) anticipates development at no more than 95 of these locations, up to 94 turbine towers and one offshore converter station). In addition, we account for up to 290 km of inter-array cable burial that

may disturb the seabed across a 40 m wide corridor around the cables, affecting up to 2.7% of the WLA footprint. Ignoring overlap to be conservative, this suggests a maximum combined affected seabed area amounting to 4.6% of the WLA footprint.

To be even more conservative, we increase the estimate of the effect by a factor of two, to 10% of the WLA footprint, and assume that 10% of the lobster, crab, scallop, and other shellfish populations within the WLA are adversely affected by pile driving noise, seabed disturbance around foundations, and cable installation during construction, and thus lost to fishing (Table 13 (b and c)) for all of the 2024 and 2025 construction years. We assume that lobster and crab will repopulate the portions of the WLA from which they are displaced within a year after construction work ends, and that scallop and other non-mobile shellfish stocks in those portions of the WLA will rebuild over the course of four years (Table 13(c)).

Along the ECC, the greatest effects are likely to be due to habitat disruption along the immediate cable route; cable laying does not involve the same disturbance from drilling or pile driving as turbine tower installation. We therefore consider significant displacement of mobile species from the ECC and Working Area to be unlikely. The habitat disruptions that impact non-mobile benthic species are likely to extend on average no more than 5-10m on either side of the immediate cable route – at most 12% of the ECC and 2% of the ECC WA area. To be conservative, we model a 25% reduction in landings of all shellfish for two years and all non-mobile shellfish over five years from the ECC (Table 13 (e and f)), and a 10% reduction in landings for all species for one year from the 1.6km ECC Working Area (Table 13 (d)).

Transient effects from constrained access during construction

During wind farm construction activities, fishing may be temporarily constrained in parts of the WLA and along the export cable routes. For example, Sunrise Wind anticipates a 500-yard-radius construction safety zone around tower locations during construction activities, and around any vessel installing cables. In practice, during these construction and cable-laying activities, some fishing that would have taken place in those areas is likely to shift to other nearby locations, replacing some of the forgone landings. If fishers prefer to fish within the construction areas, that is likely because these are thought to be more productive than alternatives. As an upper bound on effects from these temporary constraints, we estimate the full average value of landings linked to the affected areas.

We assume conservatively that fishing is constrained in half of the Sunrise WLA for two years (Table 13 (g)), and in 5% of the 1.6km ECC Working Area for 12 months (Table 13 (h)), during construction activities. In addition, we assume that fishing is constrained within all of the ECC area immediately around the export cable routes for a period of nine months (Table 13 (i)) as the cable is buried by a separate vessel.

We use as a basis for our calculations the average annual values for each area (Table 14), prorated according to the availability effects described above and the fraction of the year affected, and discounted to 2020$ at 5%. Note that the assumption about all finfish leaving the WTGA for a year means that there is no further effect from constrained access to finfish in the WLA. To be conservative, we do not adjust for double-counting of effects in the overlap between the 5km buffer around the WTGA and the ECC.

Table 15. Estimated value of landings associated with construction effects.

Area	**Estimated Landed Value Exposure** (2020$)	
	Total	**Massachusetts**
Sunrise WLA / WTGA + 7.5km	4,088,869	1,882,360
Export Cable Corridor / WA	298,817	154,155

Table 15 shows the combined results of the availability and constrained access effects (Table 13 (a)-(i)). The total value of landings associated with construction effects is estimated to be about $4.39 million (2020$), of which about $1.88 million is associated with landings in Massachusetts.

Effects due to fishing constraints during operations

If fishing activity is constrained at certain locations within the wind farm area during the operating life of the project, it may be appropriate to treat these areas as lost to fishing during that time. For example, areas in the immediate vicinity of turbine towers may not be accessible to bottom trawl fishing once the wind farm is built. Fishers are likely to adapt to such constraints by shifting fishing effort slightly from previous locations or tracks. This sort of adaptation by the fishing industry is made easier by the regular one-by-one nautical mile east-west/north-south grid spacing for wind turbine towers that has been adopted for Sunrise Wind and other wind development projects (Deepwater Wind South Fork 2020). Because it is not possible to know exactly how the fishing industry will respond to this change in future years, or what the implications of that adaptation will be for catch and landings, we assume here that the landings from affected areas are simply not realized. This is a conservative assumption that likely overstates the actual loss of landings due to wind farm development.

Fishing activity constraints during wind farm operations apply only to the WLA; we do not expect any constraints along the ECC during operations. The footprint of the Sunrise Wind project area is 43,060 hectares, of which permanent structures occupy less than 10 hectares, or 0.03% of the total area. A 100m radius area around each of the turbine towers accounts for about 0.7% of the total WLA, suggesting that less than 1% of the WLA area may be lost to fishing. Mobile gear (dredge, trawl) fishing accounts for less than half of landed value from the Sunrise WLA. We assume conservatively that as much as 5% of total baseline landings from all stocks within the WLA may be lost to fishing during operations (Table 13 (j)).

Since the Sunrise Wind project will be operating for 30 years, we estimate the potential loss associated with these forgone landings by calculating the present value of 5% of baseline landings for a 30-year period beginning in 2026.

The resulting estimate of the total value of potential lost landings during project operations is $1,374,953, of which $629,443 is associated with landings in Massachusetts.

Transient effects from constrained access and availability effects during decommissioning

After approximately 30 years of operations, Sunrise Wind plans to decommission the project. This involves removing the turbine towers and foundations, and the cables including the export cable.

We estimate that the duration of decommissioning, and resulting access constraints in the WLA during decommissioning, will extend for about one year. Because relatively little noise is associated with decommissioning compared to construction, we do not model decommissioning effects in the WLA beyond the effects that overlap with access constraints (Table 13 (n)).

We expect that access constraints along the export cable route will be similar to those during cable laying operations, but likely for a shorter duration. We therefore model access constraints on 5% of the ECC WA and 100% of the ECC itself for a total of two months (Table 13 (o) and (p)). Because cable removal is less disruptive that burial, we model half of the availability effect for decommissioning as we do for cable installation (Table 13 (l) and (m)).

We then discount the value of affected landings from decommissioning to 2020$ by applying a 5% discount rate. The resulting present value (2020$) estimate of potential lost landings due to access constraint and availability effects during decommissioning is $239,849, of which $111,050 is associated with landings in Massachusetts.

In summary, the total landed value from fishing in federal waters potentially exposed to Sunrise Wind project development is estimated to be about $6.0 million (2020$), of which $5.68 million is associated with the WLA (plus 7.5km perimeter) and $321,000 is associated with the ECC. Massachusetts landings account for about 46% of total landings from the WLA and 53% of total landings from the ECC. The landed value of Massachusetts commercial landings potentially exposed by Sunrise Wind development is therefore about $2.78 million. This includes about $2.04 million in forgone landings due to construction, $629,000 during operations, and $111,000 during decommissioning.

Applying the upstream and downstream multipliers as described above results in an estimate of $3.34 million in indirect and induced effects in Massachusetts, for a total impact of $6.12 million.

Massachusetts-based charter fishing

To obtain data on for-hire charter fishing activity in the Sunrise Wind Lease Area (WLA) and Export Cable Corridor (ECC), we conducted an online survey of Rhode Island- and Massachusetts-based charter vessel operators. The survey asked operators to identify their fishing locations on a chart, and report for each location

- the total number of annual for-hire fishing trips that vessel took in each of the years 2017-2021,
- the average number of passengers onboard for-hire trips in each of the years 2017-2021, and
- the average amount of time spent targeting highly migratory species (HMS) relative to bottom fishing or trolling for other species during for-hire trips.

The survey was first distributed on April 18, 2022 through email lists maintained by Rhode Island Department of Environmental Management (RIDEM), Rhode Island Coastal Resources Management Council (RICRMC) and Massachusetts Division of Marine Fisheries (MADMF), and also via email by for-hire fishing industry representatives, including the Rhode Island Party and Charter Boat Association. The survey was active from April 18, 2022 until May 14, 2022.

The survey received 91 total responses from for-hire charter owners and/or operators. Sixty-six of these respondents (72%) reported that they fish in the area depicted in Figure 4. These 66 respondents reported 62 unique vessels, and reported effort data for 29 of those vessels across the five-year period of 2017-2021 (Table 16). Similar studies published in the peer-reviewed academic literature using paper mail, email, or mixed mode survey distributions typically have survey response rates around 20-30% (e.g., Dalton *et al*. 2020, Carr-Harris and Steinback 2020). Based on discussions with for-hire industry representatives, approximately 100 vessels actively engage in for-hire fishing activity in the waters depicted in Figure 4, suggesting the fishing reported by survey respondents accounts for about 29% of the total. Thus, the response rate for the primary population of interest is within an appropriate range to consider our survey distribution a success. An important note to also consider is that there are vessels in our sample that require the submission of federal VTRs. A common trend identified in the data was that some respondents did not provide data for their vessels that require VTRs. This is not a problem for this analysis as this effort data is already accounted for by the NOAA databases and summary reports used as a baseline for our subsequent analyses.

Table 16. For-hire charter fishing survey summary statistics.

Description	**Number**
Fished in the area and responded to the survey	66
Provided vessel names	62
of which based in Massachusetts	37.5
Provided annual vessel trip numbers	31
Observations with vessel trips reported (2017-2021)	142
Total trips per year	1 – 235
Average total trips per year	47.30
Passengers per vessel trip	2 – 25
Average passengers per vessel trip	5.41
Identified fishing locations on maps	29
of which based in Massachusetts	18.5

The number of anglers per year is estimated by multiplying the vessel trip number in a year and the average number of anglers per trip in that year for each vessel, and the results are then summed across vessels by area. Tables 17 and 18 show the annual vessel trips and angler counts in the survey responses for charter vessels based in Massachusetts. The Wind Turbine Generator Area (WTGA) is the area defined by the turbine tower locations and lies within, but does not include all of, the WLA shown in Figure 4. (The WTGA analysis is based on a WTGA shapefile received from Inspire Environmental in November 2020, and reflects the turbine tower layout planned for Sunrise Wind at that time. This layout is subject to change.) Note that some of the trips shown for the ECRA (Table 18) are also included in the numbers for the WTGA + 7.5km buffer (Table 17).

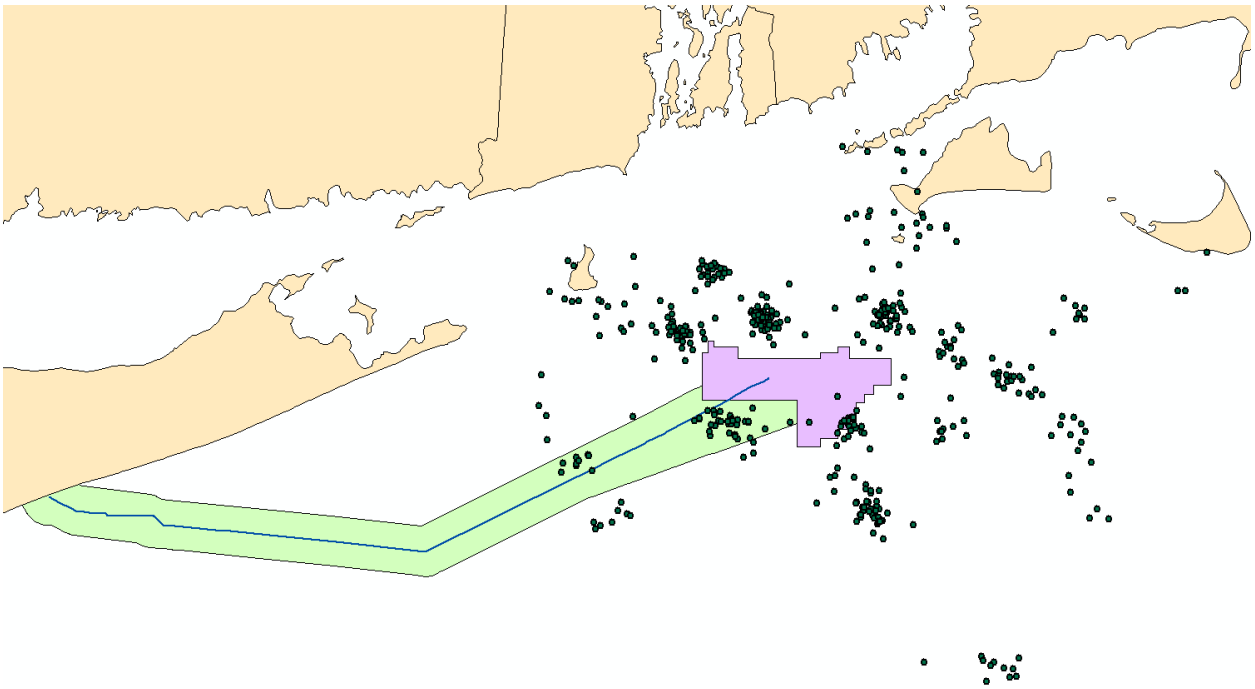

Figure 4. Charter fishing locations, 2017-2021, identified in survey responses. WLA is shown in purple, and ECRA in green.

Table 17. Number of Massachusetts-based vessel trips and anglers by year, Sunrise WLA.

Year	WLA + 7.5km buffer		WTGA + 7.5km buffer	
	Vessel Trips	Anglers	Vessel Trips	Anglers
2017	22	77	21.5	75
2018	58.5	197	45.5	197
2019	64	1,052	56	1,052
2020	67.5	850	63	836
2021	85	931	68	856
Average	***59.4***	***621.4***	***50.8***	***603.2***

Table 18. Number of Massachusetts-based vessel trips and anglers by year, Sunrise ECRA.

Year	Vessel Trips	Anglers
2017	5	30
2018	12.5	65
2019	0	0
2020	5	25
2021	0	0
Average	***4.5***	***24***

We use the revenue per angler estimates from NOAA shown in the Table 19 below for our revenue calculation. We recognize that the per angler revenue from charter boats may be an order of magnitude larger than that from party boats. The NOAA data in Table 19 represent an average across both sectors, influenced by the fact that many more people participate in party boat fishing than in charter fishing. For consistency, we convert the average revenue per angler from 2019$ ($104.94) to 2020$ ($106.15) using the GDP implicit price deflator (2019: 112.3; 2020: 113.6).

Table 19. Sunrise Wind area for-hire vessel revenue from NOAA VTR data. Source: NOAA (2021).

Year	Revenue per angler (2019$)
2008	87.52
2009	99.36
2010	111.48
2011	122.56
2012	116.79
2013	112.68
2014	109.76
2015	106.30
2016	101.74
2017	100.42
2018	85.71
Average	**104.94**

The annual revenue for each area is estimated by multiplying the number of anglers (Tables 17 and 18) by the average revenue per angler ($106.15). The result is then adjusted using a scale factor. For a low-end estimate, the scale factor is the ratio of the number of Massachusetts vessels responding to the

survey (37.5) to the number of these vessels for which specific fishing locations were provided (18.5). For a high-end estimate, we increase the scale factor to reflect the estimated total of 100 vessels operating in the survey area (see above), versus the 62 for which survey responses were received. Finally, an economic impact multiplier is used to reflect the overall economic impacts associated with the charter fishing direct revenue. As with commercial fishing, we recognize that this multiplier will in fact vary with different types of charter fishing (e.g. sport fishing charters versus party boats). The multiplier we use is calculated using data in the NOAA report by Lovell *et al*. (2020), and reflects an average across different types of charter fishing. The results are shown in Table 20.

Table 20. Annual revenue and economic impact from MA-based charter fishing in Sunrise Wind areas.

Area	Annual anglers	Revenue per angler (2020$)	Scale factor	Annual revenue (2020$)	Impact multiplier	Annual impact (2020$)
WLA+7.5km	621.4	106.15	Low: 2.027	133,708	1.627	217,543
			High: 3.269	215,658	1.627	350,876
WTGA+7.5km	603.2	106.15	Low: 2.027	129,792	1.627	211,172
			High: 3.269	209,342	1.627	340,600
ECRA	24.0	106.15	Low: 2.027	5,164	1.627	8,402
			High: 3.269	8,328	1.627	13,550

As Figure 4 and Table 17 illustrate, there is little evidence of charter fishing within the Sunrise WLA, but substantial charter fishing activity just outside the boundary of the WLA. (Depending on final decisions regarding turbine generator tower layout, the amount of charter fishing value affected may be lower, as suggested by the WTGA+7.5km values in Table 20.). We assume conservatively that the value of charter fishing at the Sunrise Wind development areas, including a 7.5km buffer around the entire WLA, is foregone in the construction year when pile driving takes place, since we expect finfish to leave this area due to construction noise, and also in the decommissioning year of the project. This is likely an overestimate of the actual impact, since charter fishing that would have taken place in these areas may in fact be carried out elsewhere.

Given the fact that much of the charter fishing around the Sunrise WLA takes place outside the WLA footprint, and the 1nm spacing of the turbine towers, we expect that charter fishing boats will be able to operate in and near the WLA with minor adjustments to current practice once construction is complete. We therefore do not expect charter fishing revenue to be materially impacted during the operations phase of the project.

We therefore base our calculation of exposure on the WLA with 7.5km buffer and the ECRA, ignoring any overlap. We use the combined high-end revenue and impact estimates ($215,658 and $350,876/year, respectively), and assume that this value is forgone during the pile driving and decommissioning years. Using a 5% discount rate, the present value of the two years of effects, using the high-end estimates, is about $218,000 (2020$) in revenue, and $356,000 in total impact in Massachusetts.

As noted above, we consider it unlikely that the Sunrise Wind development will substantially change the personal recreational fishing activities of Massachusetts boaters.

Conclusions

Based on NOAA data from 2008 to 2019, and adjusting for underreporting of lobster and Jonah crab landings in the VTR data, and for some dockside sales of lobster and Jonah crab, we estimate the average annual value of commercial landings from the Sunrise Wind Lease Area to be about 2,397,000 (2020$). Of this, about $1,097,000 is landed in Massachusetts. Including indirect and induced effects, these landings generate average annual economic impacts of $2,420,000 in Massachusetts.

We estimate the average annual value of commercial landings from the Sunrise Wind Export Cable Corridor to be about $151,000. Of this, about $80,000 is landed in Massachusetts. These landings generate estimated total annual economic impacts of $176,000 in Massachusetts.

We estimate that a total (lump sum) of $2,777,000 (2020$) of commercial fisheries value landed in Massachusetts is potentially exposed to the Sunrise Wind development. This accounts for about 46% of the total potentially exposed landed value for Sunrise Wind. It includes about $2,037,000 in direct landed value forgone due to construction activities, $629,000 from forgone landings during the wind farm's operation, and $111,000 in present value of foregone landings due to decommissioning.

In the context of overall commercial fishery landings in Massachusetts of more than $500 million per year (NMFS 2020), the landings potentially affected by Sunrise Wind represents about 0.55% of Massachusetts' total annual landings, with much of this exposure concentrated in the early part of Sunrise Wind's project life.

Massachusetts-based charter fishing revenue exposure to the Sunrise Wind development is estimated to have a present value of $218,000.

Including indirect and induced effects, the potentially affected commercial landings and charter fishing revenue together result in about $6,479,000 in total (lump sum, 2020$) present value economic impact in Massachusetts. Table 21 summarizes these values.

There is considerable variability in the baseline data of landings and landed value from the Sunrise Wind areas. Baseline future landings will vary due to natural and fisheries-related fluctuations in stocks that are likely to be amplified by climate change effects. There is also uncertainty about the impact of wind farm construction and operation on fish stocks and landings, and about the ways that fishers will adapt their fishing practices in response to wind farm development. We consider our combined estimate of $6.48 million in economic impacts to Massachusetts from Sunrise Wind development effects on commercial and charter fishing to be a conservative upper bound on likely actual impacts.

Table 21. Estimated Massachusetts fishing industries exposure from Sunrise Wind development

Categories of Potential Exposure		MA Direct Landed Value/Revenue (2020$)
Construction-related effects	WLA+	$1,882,000
	ECRA	$154,000
Effects during operations	WLA	$629,000
	ECRA	---
Decommissioning-related effects	WLA	$100,000
	ECRA	$12,000
Subtotal MA commercial direct effects		**$2,777,000**
MA for-hire charter fishing direct effects		$218,000
Total MA direct effects		**$2,995,000**

Categories of Potential Exposure	MA Total Impact with Multipliers (2020$)
Subtotal MA commercial fishing	**$6,123,000**
MA for-hire charter fishing	$356,000
Total Massachusetts impacts	**$6,479,000**

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Appendix

Table A1. Average annual landings by species from the Sunrise WLA, 2008-2019.

Note: lobster and Jonah crab data in this table have not been adjusted for landings not reported via VTR.

Species	*Mean* Value/year (2020 $)	*Mean* Landings/year (lbs)	*Standard Deviation* Value/year (2020 $)	*Standard Deviation* Landings/year (lbs)
ALL_OTHERS	559,908	712,732	526,411	603,320
AMBERJACK, SPECIES NOT SPECIFIED	0	0	0	0
BLACK BELLIED ROSEFISH	0	0	0	0
BLACK SEA BASS	12,222	2,786	6,385	1,733
BLUEFISH	3,407	4,536	1,962	2,436
BONITO	291	90	476	133
BUTTERFISH	17,038	22,772	18,509	25,517
CLAM, SURF/BUSHEL	0	0	0	0
COBIA	0	0	0	0
COD	41,370	13,863	24,423	8,494
CRAB, BLUE/BUSHEL	18	15	42	36
CRAB, CANCER	0	0	0	0
CRAB, HORSESHOE	0	0	0	0
CRAB, JONAH	35,412	41,332	21,818	22,824
CRAB, ROCK/BUSHEL	2,792	4,117	3,206	4,660
CRAB, SPECIES NOT SPECIFIED	18	31	24	43
CREVALLE	0	0	0	0
CROAKER, ATLANTIC	86	189	174	425
CUNNER	730	156	1,471	255
CUSK	0	0	0	0
DOGFISH, SMOOTH	641	1,661	806	2,987
DOGFISH, SPINY	13,758	66,355	10,002	51,664
DOLPHIN FISH / MAHI-MAHI	0	0	1	1
DRUM, BLACK	0	0	0	0
EEL, AMERICAN	9	10	11	13
EEL, CONGER	215	305	304	405
EEL, SPECIES NOT SPECIFIED	17	19	16	15
FLOUNDER, AMERICAN PLAICE /DAB	306	130	747	320
FLOUNDER, FOURSPOT	20	37	30	64
FLOUNDER, SAND-DAB / WINDOWPANE / BRILL	290	374	541	691
FLOUNDER, SOUTHERN	0	0	0	0
FLOUNDER, SUMMER / FLUKE	97,628	27,773	64,534	20,822
FLOUNDER, WINTER / BLACKBACK	55,691	19,842	61,694	21,164
FLOUNDER, WITCH / GRAY SOLE	296	109	238	83
FLOUNDER, YELLOWTAIL	57,000	28,950	60,324	36,530
FLOUNDER,NOT SPECIFIED	0	0	0	0
HADDOCK ROE	1,286	1,237	2,916	3,094
HAKE, OFFSHORE	266	350	743	976

HAKE, RED / LING	7,089	23,350	6,032	22,211
HAKE, SILVER / WHITING	64,298	106,558	51,011	96,799
HAKE, WHITE	790	532	1,679	1,205
HAKE,SPOTTED	0	0	1	1
HALIBUT, ATLANTIC	63	7	112	13
HARVEST FISH	0	0	0	0
HERRING, ATLANTIC	24,654	159,535	26,124	179,528
HERRING, BLUE BACK	0	0	0	0
JOHN DORY	97	74	107	78
LOBSTER, AMERICAN	131,173	23,676	34,047	6,421
MACKEREL, ATLANTIC	4,243	17,554	7,088	38,138
MACKEREL, CHUB	2	4	7	13
MACKEREL, KING	0	0	0	0
MACKEREL, SPANISH	2	1	6	2
MENHADEN	0	1	0	2
MONK	377,837	224,763	134,917	39,911
MULLETS	1	2	4	5
OCEAN POUT	26	20	73	59
OTHER FINFISH	0	1	0	1
PERCH, WHITE	0	0	0	0
POLLOCK	94	78	105	98
PUFFER, NORTHERN	0	0	0	0
QUAHOGS/BUSHEL	0	0	0	0
RED PORGY	0	0	0	0
REDFISH / OCEAN PERCH	3	2	8	6
SCALLOPS,BAY/SHELLS	1	0	4	0
SCALLOPS/BUSHEL	243,724	21,375	180,466	16,581
SCORPIONFISH	1	1	5	4
SCUP / PORGY	63,029	92,599	51,362	78,456
SEA RAVEN	153	104	272	197
SEA ROBINS	21	124	19	122
SEATROUT, SPECIES NOT SPECIFIED	13	24	18	37
SHAD, AMERICAN	0	0	1	1
SHAD, HICKORY	0	0	0	0
SHARK, SANDBAR	0	0	0	0
SHARK, THRESHER	4	4	13	14
SHEEPSHEAD	0	0	0	0
SKATE WINGS	192,400	496,211	88,291	133,949
SKATE WINGS, CLEARNOSE	5	13	16	44
SPOT	1	4	5	13
SQUID / ILLEX	2,347	2,454	6,605	5,293
SQUID / LOLIGO	92,798	70,056	92,364	71,383
STARGAZER,NORTHERN	0	0	0	0
STRIPED BASS	3,238	677	2,335	483
SWORDFISH	0	0	0	0
TAUTOG	795	212	606	159
TILEFISH	0	0	0	0
TILEFISH, BLUELINE	3	1	4	1

TILEFISH, GOLDEN	1,963	518	1,659	404
TILEFISH, SAND	0	0	0	0
TRIGGERFISH	28	16	34	18
TUNA, ALBACORE	48	64	158	209
TUNA, LITTLE	63	74	155	163
TUNA, SKIPJACK	0	0	0	0
WEAKFISH	405	189	424	189
WHELK, CHANNELED/BUSHEL	4,157	522	7,792	974
WHELK, KNOBBED/BUSHEL	8	3	18	10
WHELK, LIGHTNING	0	0	0	0
WHELK,WAVED	0	0	0	0
WHITING, KING / KINGFISH	420	372	666	584
WOLFFISH / OCEAN CATFISH	0	0	0	0

Table A2. Average annual landings by species from the Sunrise Wind ECRA, 2008-2019.

Note: lobster and Jonah crab data in this table have not been adjusted for landings not reported via VTR. (These data are for the 10km wide ECRA, not the 180 m wide ECC.)

	Mean		***Standard Deviation***	
Species	**Value/year** (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
ALL_OTHERS	1,086,214	1,332,928	1,091,900	1,316,866
AMBERJACK, SPECIES NOT SPECIFIED	0	0	0	0
BLACK BELLIED ROSEFISH	0	0	1	1
BLACK SEA BASS	53,033	12,521	19,313	5,061
BLUEFISH	18,957	23,346	8,936	11,229
BONITO	1,050	412	1,533	595
BUTTERFISH	16,597	21,037	6,373	8,275
CLAM, SURF/BUSHEL	7,967	10,441	16,727	22,297
COBIA	26	8	43	12
COD	41,005	15,173	26,421	9,161
CRAB, BLUE/BUSHEL	147	117	340	270
CRAB, CANCER	0	0	0	0
CRAB, HORSESHOE	247	216	338	315
CRAB, JONAH	70,684	86,389	26,048	26,734
CRAB, ROCK/BUSHEL	4,138	6,237	4,594	6,911
CRAB, SPECIES NOT SPECIFIED	227	426	485	929
CREVALLE	1	1	2	2
CROAKER, ATLANTIC	457	653	1,003	1,212
CUNNER	551	162	615	152
CUSK	2	2	6	7
DOGFISH, SMOOTH	8,424	12,688	2,083	4,090
DOGFISH, SPINY	9,165	38,144	7,462	23,274
DOLPHIN FISH / MAHI-MAHI	3	1	7	2
DRUM, BLACK	0	0	1	1
EEL, AMERICAN	4,314	220	13,905	275
EEL, CONGER	1,384	1,409	1,333	1,355
EEL, SPECIES NOT SPECIFIED	1,271	1,124	1,436	1,092
FLOUNDER, AMERICAN PLAICE /DAB	234	106	372	164
FLOUNDER, FOURSPOT	271	522	198	432
FLOUNDER, SAND-DAB / WINDOWPANE / BRILL	1,685	1,943	2,831	3,254
FLOUNDER, SOUTHERN	9	3	32	9
FLOUNDER, SUMMER / FLUKE	447,054	130,148	115,523	47,087
FLOUNDER, WINTER / BLACKBACK	35,113	12,948	35,858	12,299
FLOUNDER, WITCH / GRAY SOLE	2,015	634	2,164	637
FLOUNDER, YELLOWTAIL	90,579	45,204	87,064	47,122
FLOUNDER,NOT SPECIFIED	8	4	25	11
HADDOCK ROE	1,635	1,668	5,262	5,517
HAKE, OFFSHORE	646	785	838	925

HAKE, RED / LING	9,314	18,667	3,458	7,883
HAKE, SILVER / WHITING	60,678	74,726	29,213	33,972
HAKE, WHITE	748	491	1,096	748
HAKE,SPOTTED	16	27	42	66
HALIBUT, ATLANTIC	86	11	107	15
HARVEST FISH	0	1	1	1
HERRING, ATLANTIC	148,770	1,050,510	115,439	863,625
HERRING, BLUE BACK	73	283	109	502
JOHN DORY	466	382	499	418
LOBSTER, AMERICAN	119,695	21,316	55,229	9,922
MACKEREL, ATLANTIC	31,534	135,262	49,179	243,327
MACKEREL, CHUB	299	419	1,009	1,391
MACKEREL, KING	1	0	3	1
MACKEREL, SPANISH	125	51	124	50
MENHADEN	870	7,225	1,154	9,986
MONK	817,138	431,906	328,751	105,659
MULLETS	33	38	51	64
OCEAN POUT	198	157	483	362
OTHER FINFISH	75	54	219	126
PERCH, WHITE	0	1	1	1
POLLOCK	245	245	609	687
PUFFER, NORTHERN	0	0	0	0
QUAHOGS/BUSHEL	824,865	1,016,461	1,289,689	1,568,629
RED PORGY	7	13	25	44
REDFISH / OCEAN PERCH	3	4	6	8
SCALLOPS,BAY/SHELLS	38	3	132	11
SCALLOPS/BUSHEL	3,816,495	347,782	2,804,183	283,996
SCORPIONFISH	5	14	15	34
SCUP / PORGY	170,198	213,291	47,097	80,257
SEA RAVEN	102	76	178	138
SEA ROBINS	172	754	74	309
SEATROUT, SPECIES NOT SPECIFIED	58	74	82	56
SHAD, AMERICAN	39	58	46	82
SHAD, HICKORY	7	8	23	27
SHARK, SANDBAR	1	0	2	1
SHARK, THRESHER	98	65	162	95
SHEEPSHEAD	0	1	1	1
SKATE WINGS	221,893	603,399	86,517	150,471
SKATE WINGS, CLEARNOSE	51	150	136	417
SPOT	125	161	257	383
SQUID / ILLEX	883	1,144	1,150	1,186
SQUID / LOLIGO	700,858	541,276	267,036	239,357
STARGAZER,NORTHERN	0	0	0	0
STRIPED BASS	49,469	11,721	18,535	4,349
SWORDFISH	12	3	21	4
TAUTOG	2,231	602	1,680	454
TILEFISH	0	0	1	0
TILEFISH, BLUELINE	24	12	26	14

TILEFISH, GOLDEN	7,544	1,997	6,374	1,770
TILEFISH, SAND	2	1	6	2
TRIGGERFISH	265	148	148	106
TUNA, ALBACORE	207	185	322	270
TUNA, LITTLE	388	520	364	575
TUNA, SKIPJACK	3	2	11	6
WEAKFISH	3,195	1,505	2,444	1,286
WHELK, CHANNELED/BUSHEL	2,079	430	2,291	376
WHELK, KNOBBED/BUSHEL	149	100	259	199
WHELK, LIGHTNING	55	21	152	55
WHELK,WAVED	503	707	1,210	1,670
WHITING, KING / KINGFISH	1,890	1,609	3,865	3,086
WOLFFISH / OCEAN CATFISH	0	0	0	0

Table A3. Complete species list (including those in ALL_OTHERS).

Species	Species
ALEWIFE	OCTOPUS, SPECIES NOT SPECIFIED
AMBERJACK, SPECIES NOT SPECIFIED	OTHER FINFISH
AMBERJACK,GREATER	PERCH, SAND
ANCHOVY,BAY	PERCH, WHITE
ARGENTINES,SPECIES NOT SPECIFIED	POLLOCK
ATLANTIC SALMON	POMPANO, COMMON
BLACK BELLIED ROSEFISH	PORGY,JOLTHEAD
BLACK SEA BASS	PUFFER, NORTHERN
BLUE RUNNER	QUAHOGS/BUSHEL
BLUEFISH	RED PORGY
BONITO	REDFISH / OCEAN PERCH
BULLHEADS	RIBBONFISH
BUTTERFISH	ROUGH SCAD
CLAM, ARCTIC SURF	SCALLOPS,BAY/SHELLS
CLAM, RAZOR	SCALLOPS/BUSHEL
CLAM, SPECIES NOT SPECIFIED	SCORPIONFISH
CLAM, SURF/BUSHEL	SCUP / PORGY
COBIA	SEA RAVEN
COD,MILT	SEA ROBINS
CRAB, BLUE/BUSHEL	SEA URCHINS
CRAB, CANCER	SEATROUT, SPECIES NOT SPECIFIED
CRAB, GREEN/BUSHEL	SHAD, AMERICAN
CRAB, HERMIT	SHAD, GIZZARD
CRAB, HORSESHOE	SHAD, HICKORY
CRAB, JONAH	SHARK, ANGEL
CRAB, LADY	SHARK, BLACKTIP
CRAB, RED/BUSHEL	SHARK, BLUE
CRAB, ROCK/BUSHEL	SHARK, MAKO, LONGFIN
CRAB, SPECIES NOT SPECIFIED	SHARK, MAKO, SHORTFIN
CRAB, SPIDER	SHARK, MAKO, SPECIES NOT SPECIFIED
CREVALLE	SHARK, NOT SPECIFIED
CROAKER, ATLANTIC	SHARK, NURSE
CRUSTACEANS,SPECIES NOT SPECIFIED	SHARK, PORBEAGLE
CUNNER	SHARK, SANDBAR
CUSK	SHARK, THRESHER
CUTLASSFISH, ATLANTIC	SHARK, THRESHER, BIGEYE
DOGFISH, CHAIN	SHARK, TIGER
DOGFISH, SMOOTH	SHARK, WHITE
DOGFISH, SPECIES NOT SPECIFIED	SHARK, WHITETIP
DOGFISH, SPINY	SHEEPSHEAD
DOLPHIN FISH / MAHI-MAHI	SHRIMP (MANTIS)
DRUM, BLACK	SHRIMP (PANAEID)
DRUM, SPECIES NOT SPECIFIED	SHRIMP (PANDALID)
EEL, AMERICAN	SHRIMP, SPECIES NOT SPECIFIED
EEL, CONGER	SILVERSIDES, ATLANTIC
EEL, SPECIES NOT SPECIFIED	SKATE WINGS
FLOUNDER, AMERICAN PLAICE /DAB	SKATE WINGS, CLEARNOSE
FLOUNDER, FOURSPOT	SNAIL,MOON
FLOUNDER, SAND-DAB / WINDOWPANE / BRILL	SNAPPER, OTHER
FLOUNDER, SOUTHERN	SNAPPER, RED

FLOUNDER, SUMMER / FLUKE
FLOUNDER, WINTER / BLACKBACK
FLOUNDER, WITCH / GRAY SOLE
FLOUNDER, YELLOWTAIL
FLOUNDER,NOT SPECIFIED
GROUPER, OTHER
GROUPER, SNOWY
HADDOCK ROE
HAKE, OFFSHORE
HAKE, RED / LING
HAKE, SILVER / WHITING
HAKE, WHITE
HAKE,SPOTTED
HALIBUT, ATLANTIC
HARD QUAHOG
HARVEST FISH
HERRING, ATLANTIC
HERRING, BLUE BACK
HERRING,ATLANTIC THREAD
HERRING/SARDINES,SPECIES NOT SPECIFIED
JACK,ALMACO
JOHN DORY
LADYFISH
LOBSTER, AMERICAN
LUMPFISH
MACKEREL, ATLANTIC
MACKEREL, CHUB
MACKEREL, FRIGATE
MACKEREL, KING
MACKEREL, SPANISH
MARLIN, BLUE
MENHADEN
MOLLUSKS,SPECIES NOT SPECIFIED
MONK LIVERS
MULLETS
NEEDLEFISH, ATLANTIC
OCEAN POUT
OCEAN SUNFISH / MOOLA
SPADEFISH
SPOT
SQUID / ILLEX
SQUID / LOLIGO
SQUID, SPECIES NOT SPECIFIED
SQUIRRELFISH
STARFISH
STARGAZER,NORTHERN
STING RAYS,SPECIES NOT SPECIFIED
STRIPED BASS
STURGEON, ATLANTIC
SWORDFISH
TAUTOG
TILEFISH
TILEFISH, BLUELINE
TILEFISH, GOLDEN
TILEFISH, SAND
TOADFISH, OYSTER
TRIGGERFISH
TRIGGERFISH,GRAY
TUNA, ALBACORE
TUNA, BIG EYE
TUNA, BLUEFIN
TUNA, LITTLE
TUNA, SKIPJACK
TUNA, SPECIES NOT SPECIFIED
TUNA, YELLOWFIN
TURTLE, LEATHERBACK
WAHOO
WEAKFISH / SQUETEAGUE / GRAY SEA TROUT
WEAKFISH, SPOTTED / SPOTTED SEA TROUT
WHELK, CHANNELED/BUSHEL
WHELK, KNOBBED/BUSHEL
WHELK, LIGHTNING
WHELK,WAVED
WHITING, KING / KINGFISH
WOLFFISH / OCEAN CATFISH

Table A4. Average annual landings from Sunrise WLA by port.

Port	*Mean* Value/year (2020 $)	*Mean* Landings/year (lbs)	*Standard Deviation* Value/year (2020 $)	*Standard Deviation* Landings/year (lbs)
ALL_OTHERS	53,195	71,187	114,525	143,689
ATLANTIC CITY	0	0	0	0
BARNEGAT	0	0	0	0
BARNSTABLE	43	16	148	54
BEAUFORT	2,605	1,008	2,843	1,129
BELFORD	48	20	166	71
BOSTON	1,512	2,692	2,434	5,682
BRISTOL	0	0	0	0
CAPE MAY	903	419	1,692	1,081
CHATHAM	5,033	4,278	11,127	9,439
CHILMARK	4,785	973	7,195	1,565
CHINCOTEAGUE	57	20	198	68
DAVISVILLE	1,318	1,746	3,174	5,535
FAIRHAVEN	16,201	10,368	26,977	17,169
FALL RIVER	2,931	10,891	4,303	17,377
FALMOUTH	0	0	0	0
FREEPORT	0	0	0	0
GLOUCESTER	3,693	27,040	12,275	90,800
HAMPTON	6,389	3,140	11,196	6,034
HAMPTON BAY	28	21	67	53
HARWICHPORT	1,111	207	3,051	567
HYANNIS	0	0	0	0
ISLIP	0	0	0	0
JAMESTOWN	0	0	0	0
LITTLE COMPTON	226,334	259,258	107,800	134,413
LONG BEACH	0	0	0	0
MENEMSHA	5,425	957	10,326	1,659
MONTAUK	41,198	24,325	17,716	11,684
MOREHEAD CITY	0	0	0	0
MORICHES	0	0	0	0
NANTUCKET	0	0	0	0
NEW BEDFORD	875,504	887,422	548,737	669,281
NEW LONDON	7,504	8,638	7,769	9,456
NEW SHOREHAM	718	406	760	813
NEWPORT	138,952	181,915	68,718	91,330
NEWPORT NEWS	3,176	1,528	7,079	3,798
NORTH KINGSTOWN	0	0	0	0
OCEAN CITY	0	0	0	0
ORIENTAL	0	0	0	0
OTHER NASSAU	0	0	0	0
OTHER WASHINGTON(COUNTY)	0	0	0	0
POINT JUDITH	546,080	525,298	262,657	338,703

POINT LOOKOUT	0	0	0	0
POINT PLEASANT	3,422	1,664	4,334	2,086
SANDWICH	198	191	686	660
SHINNECOCK	262	254	790	780
STONINGTON	20,969	9,586	27,023	7,596
TIVERTON	38,976	48,182	54,191	63,536
VINEYARD HAVEN	0	0	0	0
WANCHESE	1,321	501	3,633	1,376
WESTPORT	48,050	35,531	25,949	31,021
WILDWOOD	0	0	0	0
WOODS HOLE	5,680	731	13,266	1,708

Table A5. Average annual landings from Sunrise ECRA (note: not ECC) by ports.

	Mean		***Standard Deviation***	
Port	**Value/year** (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
ALL_OTHERS	143,117	176,898	191,660	245,183
ATLANTIC CITY	77,527	70,495	121,388	109,654
BARNEGAT	8,747	1,120	17,512	1,775
BARNSTABLE	0	0	0	0
BEAUFORT	17,715	6,051	21,168	6,382
BELFORD	7,339	3,311	16,143	7,042
BOSTON	855	971	1,400	1,483
BRISTOL	0	0	0	0
CAPE MAY	148,766	105,942	131,194	162,371
CHATHAM	382	231	897	619
CHILMARK	452	119	1,175	309
CHINCOTEAGUE	3,435	1,466	4,610	1,872
DAVISVILLE	13,160	5,945	33,605	16,782
FAIRHAVEN	59,094	7,831	86,941	11,476
FALL RIVER	8,662	41,781	13,879	75,814
FALMOUTH	0	0	0	0
FREEPORT	1,647	547	2,141	764
GLOUCESTER	17,206	103,963	36,986	216,104
HAMPTON	27,393	11,062	27,288	11,932
HAMPTON BAY	408,225	225,944	226,863	123,057
HARWICHPORT	243	26	841	90
HYANNIS	103	14	358	48
ISLIP	50	20	173	68
JAMESTOWN	0	0	0	0
LITTLE COMPTON	60,734	60,342	54,955	45,630
LONG BEACH	283	56	980	193
MENEMSHA	137	22	474	77
MONTAUK	619,147	338,770	191,638	82,674
MOREHEAD CITY	115	46	400	159
MORICHES	31,172	15,133	58,495	29,523
NANTUCKET	0	0	0	0

NEW BEDFORD	4,596,922	3,057,161	2,003,902	1,387,470
NEW LONDON	273,333	166,851	170,528	85,708
NEW SHOREHAM	5,998	4,614	12,427	10,998
NEWPORT	177,602	160,773	219,187	55,484
NEWPORT NEWS	40,413	7,714	42,981	7,040
NORTH KINGSTOWN	6,012	17,829	14,411	44,701
OCEAN CITY	1,644	428	3,216	808
ORIENTAL	339	142	813	334
OTHER NASSAU	123	120	425	414
OTHER WASHINGTON(COUNTY)	746	486	2,584	1,685
POINT JUDITH	970,922	779,532	407,242	169,347
POINT LOOKOUT	4,591	2,701	7,604	4,907
POINT PLEASANT	142,124	92,041	61,216	62,891
SANDWICH	0	0	0	0
SHINNECOCK	678,485	487,859	244,769	181,403
STONINGTON	165,057	66,856	90,279	34,459
TIVERTON	18,375	30,325	23,482	32,619
VINEYARD HAVEN	0	0	0	0
WANCHESE	2,741	1,040	4,033	1,463
WESTPORT	19,252	13,665	10,888	8,472
WILDWOOD	1,283	182	4,443	632
WOODS HOLE	106	16	366	54

Table A5. Complete list of ports (including those in ALL_OTHERS).

AMAGANSETT	*NEW YORK CITY*
ATLANTIC CITY	*NEWINGTON*
BARNEGAT	*NEWPORT*
BARNSTABLE	*NEWPORT NEWS*
BASS RIVER	*NIANTIC*
BEAUFORT	*NOANK*
BELFORD	*NORTH KINGSTOWN*
BOSTON	*OCEAN CITY*
BRISTOL	*OLD SAYBROOK*
BROAD CHANNEL	*ORIENT*
BROOKLYN	*ORIENTAL*
CAPE MAY	*OTHER BEAUFORT(COUNTY)*
CHATHAM	*OTHER BRONX*
CHESAPEAKE BEACH	*OTHER CAPE MAY*
CHILMARK	*OTHER CITY OF HAMPTON*
CHINCOTEAGUE	*OTHER CURRITUCK*
CITY OF SEAFORD	*OTHER DUKES*
DANVERS	*OTHER MAINE*
DARTMOUTH	*OTHER NEWPORT*
DAVISVILLE	*OTHER NORTHAMPTON*

DUXBURY
EAST HAMPTON
ENGELHARD
FAIRHAVEN
FALL RIVER
FALMOUTH
FREEPORT
GLOUCESTER
GREENPORT
GROTON
GUILFORD
HAMPTON
HAMPTON BAY
HARWICHPORT
HIGHLANDS
HOBUCKEN
HYANNIS
ISLIP
JAMESTOWN
LITTLE COMPTON
LONG BEACH
MANASQUAN
MARBLEHEAD
MARSHFIELD
MASTIC
MATTITUCK
MENEMSHA
MONMOUTH
MONTAUK
MONTVILLE
MOREHEAD CITY
MORICHES
MYSTIC
NANTUCKET
NEW BEDFORD
NEW LONDON
NEW SHOREHAM
OTHER NY
OTHER SUFFOLK
OTHER VIRGINIA
OTHER WASHINGTON
OTHER WASHINGTON(COUNTY)
OYSTER
POINT JUDITH
POINT LOOKOUT
POINT PLEASANT
PORTLAND
PROVIDENCE
PROVINCETOWN
PT. PLEASANT
ROCKLAND
ROCKPORT
SACO
SANDWICH
SHELTER ISLAND
SHINNECOCK
SMITHTOWN
SOUTH KINGSTOWN
SOUTHOLD
STONINGTON
SWAN QUARTER
TIVERTON
VINALHAVEN
VINEYARD HAVEN
VIRGINIA BEACH
WAKEFIELD
WANCHESE
WARREN
WATERFORD
WESTERLEY
WESTPORT
WILDWOOD
WOODS HOLE

Fisheries Exposure in Massachusetts from the Sunrise Wind Lease Area and the Sunrise Export Cable Route

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DRAFT

15 January 2023

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List of Abbreviations

COP – Construction and Operations Plan

ECC – Export Cable Corridor

ECR – Export Cable Route

ECC WA – Export Cable Corridor Working Area

ECRA – Export Cable Route Area

GDP – Gross Domestic Product

MA DMF – Massachusetts Division of Marine Fisheries

NMFS – National Marine Fisheries Service

NOAA – National Oceanographic and Atmospheric Administration

PPI – Producer Price Index

RICRMC – Rhode Island Coastal Resources Management Council

RIDEM – Rhode Island Department of Environmental Management

SBRM – Standardized Bycatch Reporting Methodology

VMS – Vessel Monitoring System

VTR – Vessel Trip Report

WLA – Wind Lease Area

WTGA – Wind Turbine Generator Area

Summary

Based on NOAA data from 2008 to 2019, and adjusting for underreporting of lobster and Jonah crab landings in the VTR data, and for some dockside sales of lobster and Jonah crab, we estimate the average annual value of commercial landings from the Sunrise Wind Lease Area to be $2.34 million (2020$), or $5,429/km^2/year. Of this, $1.07 million is landed in Massachusetts. Including indirect and induced effects, these landings generate average annual economic impacts of $2.31 million in Massachusetts.

We estimate the average annual value of commercial landings from the 180 m wide Sunrise Wind Export Cable Corridor to be $149,000, or $5,626/km^2/year. Of this, $79,000 is landed in Massachusetts. These landings generate estimated total annual economic impacts of $170,000 in Massachusetts.

We estimate that a total (lump sum) of $2,234,000 (2020$) of commercial fisheries value landed in Massachusetts is potentially exposed to the Sunrise Wind Farm development. This accounts for about 46% of the total potentially exposed commercial landed value from Sunrise Wind. It includes about $1,493,000 in direct landed value forgone due to construction-related effects, $629,000 from forgone fishing during the wind farm's operation, and $112,000 in present value of landings from decommissioning. Including indirect and induced effects, the potentially affected commercial landings result in about $4,926,000 in total (lump sum) present value economic impact in Massachusetts.

We estimate the average annual economic impact from Massachusetts-based for-hire charter fishing in and around the Sunrise Wind Lease Area to be between $199,000 and $321,000, and between $8,000 and $14,000 from charter fishing around the Sunrise Wind Export Cable route. (Note that these areas overlap to some extent.) We estimate that a total (lump sum) of about $326,000 (2020$) in economic impact from Massachusetts-based charter fishing is potentially exposed during construction and decommissioning activities at Sunrise Wind.

There is considerable variability in the baseline data of landings and landed value from the Sunrise Wind lease area and export cable corridor. Baseline future landings will vary due to natural and fisheries-related fluctuations in stocks and prices. There is also uncertainty about the impact of wind farm construction and operation on fish stocks and landings, and about the ways that fishers will adapt their fishing practices in response to wind farm development. We consider our combined estimate of $5.25 million in economic impact to Massachusetts from Sunrise Wind development on commercial and charter fishing to be a conservative upper bound on likely actual impacts.

Introduction

This report estimates the level of pre-development fishing operations intersecting with, and landings and landed value from, the Sunrise Wind Lease Area (WLA) and Export Cable Corridor (ECC) (Figure 1) associated with landings and revenue generated in Massachusetts ports, and the potential exposure of Massachusetts-based commercial and for-hire charter fishing to Sunrise Wind Farm construction, operations, and decommissioning. Sunrise Wind LLC is a joint venture between Ørsted and Eversource.

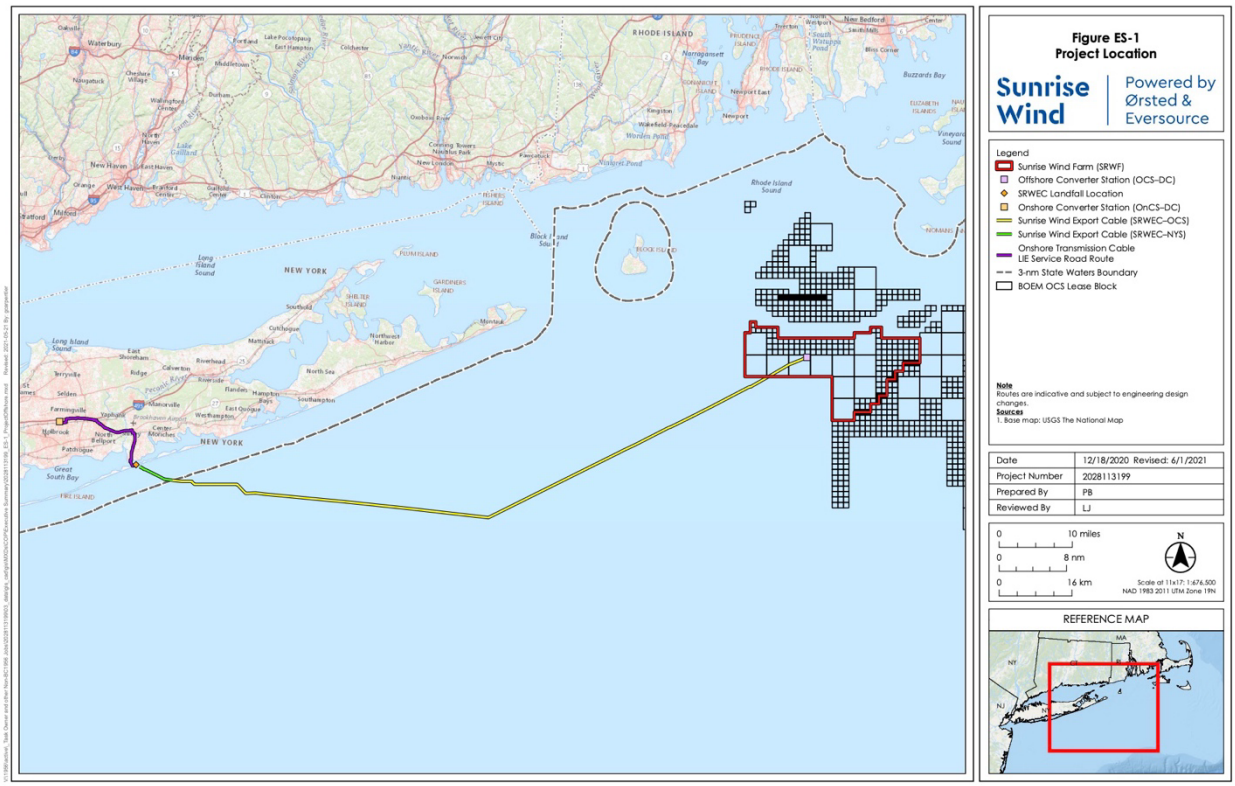

Figure 1. Sunrise Wind Lease Area and export cable route. Source: Sunrise Wind.

The WLA for Sunrise Wind lies in federal waters, some 40 km south of the mainland coast near the border between Rhode Island and Massachusetts, and has a footprint of 430.6 km^2.[1] The ECC is 147 km in length, and runs from the edge of the WLA first toward the southwest and then west toward Fire Island off the coast of Long Island, New York, to the export cable landing location near the western end of Fire Island. (Note that the export cable route is slightly longer than the ECC, because the cable route includes sections within the WLA and inland of the landing point.)

To estimate commercial fish landings along the ECC, we define a 10km wide Export Cable Route Area (ECRA) extending 5km on either side of the cable route. The 10km wide ECRA has no physical

[1] A small piece in the northeast corner of the original Sunrise WLA is not under consideration for turbine tower placement, and is not included in the WLA shapefile used for this analysis.

significance in the context of the Sunrise Wind Lease, and is defined only for the purpose of identifying fisheries landings data that reflect what may be landed from fishing along the export cable route. Only portions of the narrow, 180m wide ECC centered on the export cable may be disturbed in the process of burying the cable.

Table 1 shows the approximate length and area of these features for the Sunrise export cable route. In the sections that follow, fishery landings and values for the export cable route are estimated and reported for the ECC, as defined above.

Table 1. Sunrise Wind area parameters

Wind Lease Area footprint (km^2)	430.6
Export cable route length (km)	147
Area of 10km Export Cable Route Area (ECRA) (km^2)	1,610.9
Area of Export Cable Corridor (ECC) (km^2)	26.5
Export Cable Corridor fraction of ECRA	1.64%

Methodology

Our approach to estimating the potential impact of Sunrise Wind development on commercial fishing is to first estimate the annual landed weight and value of fish from the Sunrise WLA and ECC, and then to estimate the fraction of this annual value that may be exposed to wind farm construction, operation, and decommissioning. Our assessment method is consistent with the general framework described in the reports by Kirkpatrick *et al.*/BOEM (2017a and 2017b) on socio-economic impact of offshore wind energy development on commercial fisheries, and builds on the approach of Livermore (RIDEM 2017, 2018, and 2019), which develops high-end estimates of fishery impacts by including in baseline estimates the entire trip revenues from all trips that overlap with a wind lease area, regardless of how much fishing occurred inside or outside the area.

Separately, we estimate the gross revenue associated with for-hire charter boat fishing activity originating in Massachusetts, and the fraction of this revenue that may be exposed to Sunrise Wind development.

We estimate the annual commercial landings and landed value of fish from the Sunrise WLA and ECC using a new dataset provided by NOAA's National Marine Fisheries Service. This dataset uses modeled representations of federal Vessel Trip Report (VTR) and clam logbook fishing trip data to produce a more accurate spatial allocation of landings from each fishing trip (DePiper 2014; Benjamin *et al.* 2018). As we document below, there has been considerable variability in annual landings from these areas over the past decade; we use the average landings and landed value from 2008 to 2019 as indicative of what the areas may yield in the future.

We then estimate the fraction of this average annual value that may be at risk ("exposed") due to Sunrise Wind development, based on the nature and schedule of construction activities, operating

plans, and decommissioning plans, and on information from the scientific literature on the effects of wind farm construction and operation on commercial fish stocks and landings.

The effect of offshore wind farm construction and operation on marine ecosystems, fish stocks and fish behavior, and fishery landings is an area of ongoing research. To date, almost all offshore wind farm development has taken place outside the US. The only wind farm off the coast of New England from which lessons might be drawn directly for Sunrise Wind is the Block Island Wind Farm, a five-turbine, 30 MW project about 4 miles from Block Island, RI.

Investigations of offshore wind farms outside the US have found both positive and negative impacts on marine biota, habitats, and ecological function. The impacts include the aggregation of finfish and other marine life via the creation of artificial reefs (Bergström *et al.* 2014; Langhamer 2012; Lindeboom *et al.* 2011; Wilhelmsson and Malm 2008) and disturbance of existing ecosystems (Bergström *et al.* 2014; Wilhelmsson *et al*. 2006). Bartley *et al.* (2019) have reported on monitoring of physical and chemical conditions in the benthic environment around Block Island Wind Farm turbine towers over the two years since the towers were installed; they found some changes in the benthos in the immediate tower foundation footprint at one out of three turbine towers they investigated, and found no changes beyond 30m from any of the towers studied.

In their 2018 study, ten Brink and Dalton interviewed commercial and recreational fishers active in the waters around the Block Island Wind Farm about the perceived effects of the farm on fish stocks and fishing activity. Respondents reported murky water, underwater noise, and vibration during construction, and a lower abundance of fish such as striped bass on the side of Block Island closest to the wind farm site during the construction time window. They also reported the presence of shellfish and finfish on and around the wind turbine towers, including an increase in the abundance of cod, within months of the conclusion of construction activities. The transient negative effect on mobile species within 5-10km of wind farm construction activities observed at Block Island is consistent with findings from Europe (Bergström *et al.* 2014; Vallejo *et al.* 2017).

Hooper *et al.* (2017) report on a survey of recreational fishers and wind farms in the United Kingdom. The authors found that most fishers in their survey either had fished near a wind farm or were interested in doing so, and concluded that most UK anglers were unlikely to change their behavior in response to wind farm development.

More recently, Dalton *et al.* (2020) reported on surveys of Rhode Island recreational boaters' preferences for boating in the vicinity of offshore wind farms. Although some survey respondents identified as fishers, the survey did not explicitly target boaters interested in fishing; the mean age of respondents was above 62 years, mean boat length in excess of 37 feet, and more than 43% of respondents owned sailboats. Overall, boaters expressed a preference for not boating near (within 100 ft) of an offshore wind turbine; but boaters who fish were less negatively impacted by boating near a turbine, and boaters who had visited the Block Island Wind Farm were more accepting of trips near turbine towers than other boaters.

Given the current state of knowledge about the effects of wind farm construction and operation on fish stocks and fishery landings, we consider five categories of possible exposure for commercial fishing from the Sunrise Wind project:

- Transient effects on fish availability due to construction activities and noise
- Transient effects due to constrained access to certain areas during construction
- Changes in fishing in the WLA during operations
- Transient effects due to constrained access to certain areas during decommissioning
- Transient effects on fish availability due to decommissioning activities

We also consider transient effects on the for-hire charter fishing industry due to construction and decommissioning of the wind farm. To the extent that for-hire charter fishing vessels from Massachusetts use the WLA and ECC, it is possible that their activities may be affected during construction and decommissioning. We consider it unlikely that the Sunrise Wind development will negatively affect the personal recreational fishing activities of Massachusetts boaters.

Estimating the effect of wind farm development on fishing activity and landings is complicated by several sources of variability and uncertainty. There is considerable year-to-year fluctuation in the historical baseline commercial landings from the wind development areas; and future fishery landings from these areas are likely to differ from historical baselines due to climate change effects (Free *et al.* 2019; Oremus 2019). There is uncertainty about the extent and duration of effects of wind farm construction on fish availability in the vicinity of the wind farm, and about the habitat and other effects (if any) of the wind farm over decades of operation. There is also uncertainty about the response of the commercial fishing industry and of for-hire charter fishing vessels to the altered "landscape" resulting from wind farm development. The current state of the science about wind farm effects on commercial fishing does not support a precise estimate of effects on fish stocks; and the future decisions of fishers are by their nature not precisely predictable, especially decades into the future, because they depend on personal assessments and decisions of individual fishers.

Acknowledging these sources of variability and uncertainty, we seek to develop a realistic, conservative estimate of the potential effect of Sunrise Wind development on Massachusetts commercial landings, landed value, and charter boat revenue. We make conservative assumptions about fishing industry response, assuming that landings from an area where access is constrained during construction, operations, or decommissioning are simply forgone, and not compensated by landings from fishing elsewhere instead. Further, we estimate impact as the landed value (gross revenue) at risk, not the net income or profit. Landed value is, by definition, larger than net income or profit from fishing. For these reasons, we consider our impacts estimate to represent an upper bound on the likely net effects of the wind farm on the Massachusetts fishing industry.

Throughout this report, we use "landed value" to refer to the direct value of fisheries landings, "impact" to refer to the economic activity generated by fisheries, including indirect and induced effects (see below), and "exposure" to refer to the portion of landed value or impacts that may be at risk due to wind farm development.

Baseline commercial fishery landings and values, 2008-2019

Commercial Fisheries Data Description

The following data description is based on information provided by the National Marine Fisheries Service (NMFS) on March 20 and April 1, 2020.[2] NOAA has been collecting and improving the Vessel Trip Report (VTR) data for decades. The data have been widely used for fisheries research, management, and economic impact assessments. To gauge landings value and quantity at the spatial scale required for the Sunrise Wind Lease Area and export cable route, NOAA has recently developed a procedure to produce high-resolution spatial information using a combination of VTR and fishery observer data. As described below, we follow the general approach developed by NOAA, which is the best approach at present, with a recognition that relevant data are not perfect. All estimates of fishery landings and values in this report are based on these NMFS data; and the data have not been amended, adjusted, or augmented in any way, with two exceptions: we make adjustments to the lobster and Jonah crab landed values to account for possible underreporting; and we make adjustments to the Rhode Island lobster and Jonah crab landings to account for dockside sales. These adjustments are described in detail in the section on Adjustment of Lobster and Jonah Crab Data below. The adjusted data appear only in Tables 11 and 12 below.

The data presented below summarize estimates of fisheries landings and values for fishing trips that intersected with the Sunrise Wind Lease Area (WLA) or its Export Cable Route Area (ECRA), from 2008 to 2019 (calendar years). Modeled representations of federal Vessel Trip Report (VTR) and clam logbook fishing trip data were queried for spatial overlap with the WLA and the ECRA, and linked to dealer data for value and landings information. As detailed in DePiper (2014) and Benjamin *et al.* (2018), to improve the spatial resolution of VTR, a spatial distribution model was developed by combining vessel trip information from VTR with matching NOAA fishery observer data, including geocoordinates of detailed fishing locations. From this model, landings and value can be summarized for a specified geographic area according to (1) species, (2) gear type, (3) port of landing, and (4) state of landing.

In essence, the DePiper approach utilizes a spatial model to distribute the total landings for each commercial fishing trip over a circular area with its center located at the geocoordinate reported in the VTR, following a distribution decreasing with the radius. The model was estimated using VTR data (for the centroid) and vessel observer data (for haul beginning and endpoints). DePiper (2014) reported that the observer data matched VTR records well (488,251 hauls in the observer data were matched to 27,358 VTR records, representing 87.5% of all hauls with either a beginning or end point of a haul recorded).

The primary purpose of the observer data collection is to monitor fishery bycatch. NOAA's Standardized Bycatch Reporting Methodology (SBRM) dictates what types of vessels (gear, species, area of operation, etc.), participating in various fisheries, should be sampled and at what rate. The numbers of sea days needed to achieve a 30% coefficient of variation (CV = standard deviation divided by mean) of total discards for each species group were derived for different SBRM fleets covering different gears, access areas, states, and mesh sizes (NEFSC 2013). For Massachusetts vessels, the observer program covered

[2] Our primary contact at NMFS was Benjamin Galuardi, a statistician at the NOAA Greater Atlantic Regional Fisheries Office. He has worked extensively on fishery data analyses in general and the VTR data in particular, and has authored or coauthored more than 30 publications on fisheries sciences and spatial statistics.

close to 20% of trips with trawl gear, around 5% of trips with dredge gear, and around 20% of trips with gillnet gear (Jin 2015).

Following the DePiper approach, the resulting high spatial resolution data were converted into raster maps. Use of this VTR raster model produces a more accurate estimate of the spatial distribution of landings than other approaches that rely entirely on the self-reported VTR/clam logbook locations, which associate all landings from the trip with a single point location. At 10 nautical mile resolution, the confidence intervals of the DePiper model estimates are around 90% for trip lengths of one to two days.

The only alternative to the DePiper approach is a model to distribute the total landings from a VTR report over the vessel's track using the Vessel Monitoring System (VMS) data. The main challenge for this approach is accurate identification of fishing and non-fishing segments of a trip. Muench *et al.* (2018) have shown that using vessel speed alone can lead to a severe misrepresentation of fishing locations. NOAA has adopted the DePiper approach as a standard procedure to generate spatial data; and we agree with NOAA that this is the best approach currently available. The main advantages of the DePiper approach are that (1) it is based on observations of actual fishing locations noted by observers at sea, and (2) it provides a systematic and consistent way to meet the increasing demand for spatial fishing data for relatively small areas in the ocean, which is important for cross project comparison.

Landings associated with the Export Cable Corridor and Export Cable Route Working Area are calculated by applying the factors in Table 1 to the landings estimated for the Export Cable Route Area. This assumes that landings are distributed uniformly across the fished sections of the ECRA.

In order to maintain the legally required data confidentiality, summaries by species, gear type, and landing location are presented individually. In addition, for records that did not meet the "rule of three" (three or more unique dealers and three or more unique permits), values are summarized in a category labeled "ALL OTHERS." Note also:

- All landed values have been converted to 2020 dollars using the Producer Price Index for "unprocessed and prepared seafood."
- Pounds are reported in Landed Pounds, unless otherwise noted.
- Data summarized here are from federal sources only.
- Fishing vessels that carry only lobster permits for federal waters are not subject to VTR requirements. Landings from trips with no VTR are not reflected in this summary.
- Other fisheries exist in state waters that may not be reflected in data from federal sources (e.g. whelk, quahog, striped bass).

We also obtained the average monthly number of trips intersecting with each area, for the period of 2014-2019.

Commercial Fishery Landings from Wind Lease Area and Export Cable Corridor

Table 2 shows the average annual level and standard deviation of total values and landings associated with fishing in the Sunrise WLA and the ECC from 2008 to 2019.

The average annual landings from the Sunrise WLA are about 2.19 million lbs (standard deviation 855,000 lbs) with a value of about $2.12 million (standard deviation $737,000). Average annual landings from the ECC are about 102,000 lbs (standard deviation 31,000 lbs) with a value of $146,000 (standard deviation $50,000).

Table 2. Average annual value and quantity of commercial fisheries landings by area

Area	*Mean* Value/year (2020 $)	*Mean* Landings/year (lbs)	*Standard Deviation* Value/year (2020 $)	*Standard Deviation* Landings/year (lbs)
Sunrise WLA	2,116,815	2,191,599	736,846	855,072
Sunrise ECC	146,040	102,423	50,083	31,388

Table 3 shows the total landings and values, for each year from 2008 to 2019, associated with fishing in the Sunrise WLA and the ECC.

Table 4 summarizes the average annual landings and value of fisheries production from the Sunrise WLA and the ECC by the top five species or species groups. Lobster, scallops, monkfish, and skate wings are among the species/products generating the greatest value from the Sunrise WLA during the 2008-2019 time period.

Table 3. Annual value and quantity of commercial fisheries landings by area.

Area	Sunrise WLA		Sunrise ECC	
Year	Value (2020 $)	Landings (lbs)	Value (2020 $)	Landings (lbs)
2008	1,615,088	1,005,003	99,660	124,213
2009	1,774,968	1,763,708	116,648	141,792
2010	1,732,042	1,569,026	147,042	93,643
2011	2,068,388	2,138,106	183,873	121,945
2012	2,370,211	2,523,020	177,409	133,283
2013	3,660,640	3,846,497	193,497	110,854
2014	2,880,896	3,179,394	215,344	100,489
2015	2,100,812	2,099,179	112,582	123,345
2016	2,818,797	3,123,434	141,753	108,395
2017	2,011,618	2,091,922	206,015	64,818
2018	1,482,612	1,890,508	106,437	70,247
2019	885,704	1,069,387	52,223	36,059

Both mobile (e.g., trawl and dredge) and fixed (e.g., pots and gillnet) gears are used in fishing operations. The trawl gear is primarily used for harvesting groundfish, dredge for scallops, and pots for lobster and crabs. The fixed gears are fished using trawls (a series of lobster pots attached to one line) with string lengths of 0.4–0.8 km (up to 1.829 km) or gillnets with typical string lengths of 0.2–3.0 km. Tables 5a and 5b break out annual landings for each area by gear type. Sinking gillnets and bottom trawls are the most significant in the WLA, followed by scallop dredges. In the ECC, bottom trawls and

scallop dredges are the most significant, followed by sinking gillnets and clam dredges. The "ALL_OTHERS" category includes landings using purse seines, other seines, and weirs/traps, and others that fall under the "rule of three" exclusion.

Table 4. Average annual landings of major species by area, 2008-2019.

	Mean		***Standard Deviation***	
Area/Species	**Value/year** (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
Sunrise WLA				
ALL_OTHERS	559,908	712,732	526,411	603,320
Monkfish	377,837	224,763	134,917	39,911
Scallops/Bushel	243,724	21,375	180,466	16,581
Skate Wings	192,400	496,211	88,291	133,949
Lobster, American	131,173	23,676	34,047	6,421
Sunrise ECC				
Scallops/Bushel	62,591	5,704	45,989	4,658
ALL_OTHERS	17,814	21,860	17,907	21,597
Quahogs/Bushel	13,528	16,670	21,151	25,726
Monkfish	13,401	7,083	5,392	1,733
Squid/Loligo	11,494	8,877	4,379	3,925

Table 5a. Average annual landings in Sunrise WLA by gear type.

	Mean		***Standard Deviation***	
Gear	**Value/year** (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
ALL_OTHERS	608,138	720,798	514,302	601,202
Dredge - Clam	-	-	-	-
Dredge - Scallop	198,211	18,120	139,265	14,111
Gillnet – Other	-	-	-	-
Gillnet – Sink	550,603	563,390	210,752	193,006
Handline	3,387	917	4,821	1,122
Longline – Bottom	621	166	1,502	393
OTHER	7,764	691	26,896	2,394
Pot – Other	178,766	71,766	42,041	24,967
Trawl – Bottom	553,197	695,988	309,568	329,261
Trawl - Midwater	16,129	119,762	22,843	167,438

Table 5b. Average annual landings in Sunrise ECC by gear type.

Gear	Mean		Standard Deviation	
	Value/year (2020 $)	Landings/year (lbs)	Value/year (2020 $)	Landings/year (lbs)
ALL_OTHERS	19,559	22,229	18,779	21,493
Dredge – Clam	13,897	16,872	20,984	25,656
Dredge – Scallop	57,149	5,238	41,824	4,275
Gillnet – Other	5	3	19	12
Gillnet – Sink	15,863	11,942	5,969	3,425
Handline	206	89	124	58
Longline - Bottom	45	12	102	27
OTHER	1,794	166	2,311	210
Pot - Other	3,581	2,040	1,053	541
Trawl – Bottom	31,799	28,050	7,171	5,388
Trawl - Midwater	2,143	15,782	1,998	14,316

Table 6 summarizes annual landings and landed value for the major ports receiving landings from the two areas. Point Judith (Rhode Island) and New Bedford (Massachusetts) are the most significant ports for landings from the Sunrise Wind areas. Tables A5 through A7 in the Appendix show the complete data on average annual landings and landed value by port for Rhode Island and Massachusetts.

Tables 7a and 7b show average annual landings and landed value from the two areas by state where the catch is landed. Rhode Island and Massachusetts together account for more than 95% of landings and landed value from the WLA and more than 68% of landings from the ECC. The "others" category includes landings in Maine, Connecticut, New York, New Jersey, Maryland, North Carolina, and Virginia, as well as data flagged by the "rule of three" exclusion.

Table 6. Average annual landings at major ports in Rhode Island and Massachusetts.

Area/Port	Mean		Standard Deviation	
	Value/year (2020 $)	Landings/year (lbs)	Value/year (2020 $)	Landings/year (lbs)
Sunrise WLA				
New Bedford, MA	875,504	887,422	548,737	669,281
Point Judith, RI	546,080	525,298	262,657	338,703
Little Compton, RI	226,334	259,258	107,800	134,413
Newport, RI	138,952	181,915	68,718	91,330
Sunrise ECC				
New Bedford, MA	75,390	50,137	32,864	22,755
Point Judith, RI	15,923	12,784	6,679	2,777

Table 7a. Average annual landings in Sunrise WLA by state.

	Mean		*Standard Deviation*	
State	**Value/year** (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
Rhode Island	1,034,863	1,124,470	267,459	277,149
Massachusetts	981,602	1,002,341	551,935	695,103
Others	99,838	64,361	--	--

Table 7b. Average annual landings in Sunrise ECC by state.

	Mean		*Standard Deviation*	
State	**Value/year** (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
Rhode Island	22,218	19,853	8,703	3,996
Massachusetts	77,407	54,210	33,681	26,059
Others	46,394	28,347	--	--

Landed value and trips by month

Table 8 and Figures 2 and 3 show the average monthly landings and values from the two areas. Table 9 reports the average monthly number of fishing trips that intersect each area.

Table 8. Average monthly value of landings, 2020$, 2014-2019 (2020$).

Month	**Sunrise WLA**	**Sunrise ECC**
Jan	181,533	15,225
Feb	108,563	15,810
Mar	111,095	19,200
Apr	161,159	25,643
May	165,798	23,047
Jun	237,018	42,712
Jul	170,048	41,095
Aug	144,073	23,846
Sep	224,291	20,819
Oct	163,778	17,847
Nov	191,969	15,994
Dec	190,477	20,273

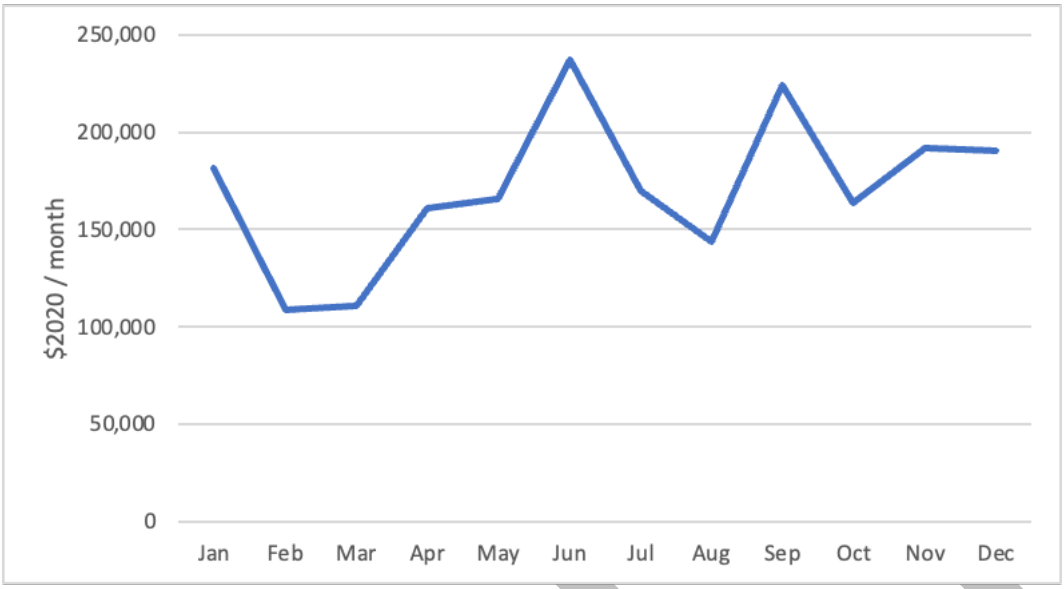

Figure 2. Average monthly value of landings, Sunrise WLA, 2014-2019.

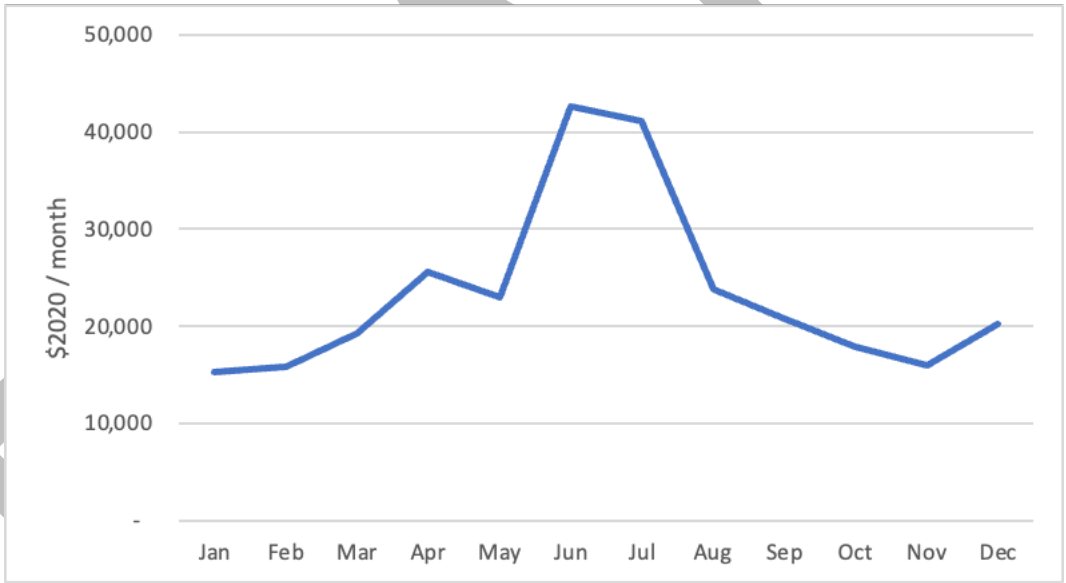

Figure 3. Average monthly value of landings, Sunrise ECC, 2014-2019.

Table 9. Average monthly number of fishing trips, 2014-2019.

Month	Sunrise WLA	Sunrise ECRA
Jan	315	480
Feb	167	323
Mar	149	305
Apr	208	452
May	367	732
Jun	502	923
Jul	575	789
Aug	579	705
Sep	501	677
Oct	380	589
Nov	335	588
Dec	365	646

Inter-annual price adjustments

We use the Bureau of Labor Statistics' Producer Price Index (PPI) for "unprocessed and prepared seafood"[3] to convert ex-vessel value of fish landings, because this index is specifically for the fishery sector. PPI is a family of indexes that measures the average change over time in selling prices received by domestic producers of goods and services; they measure price change from the perspective of the seller. In contrast, the Bureau of Economic Analysis' general Gross Domestic Product (GDP) deflator[4] measures changes in the prices of goods and services produced in the United States, including those exported to other countries, and captures price changes across all economic sectors. Table 10 shows both indexes from 2000 to 2021.

Note that the variation in the sector (i.e., fishery) specific price index is considerably larger than that of the GDP deflator. PPI decreases have been observed in several years since 2000. The GDP deflator exhibits a steady trend. We recognize that many seafood prices rose sharply in 2021, as reflected by the sharp increase in fish PPI for that year. We consider it unlikely that this will significantly alter the long-term trend, and maintain that the historical average is the best predictor of future values.

We report all values in 2020$ for consistency. These values can be easily adjusted to any other-year dollars by applying the appropriate index adjustment. Landed value may be adjusted using the PPI index. For impact values, including upstream and downstream effects (see below), it is more appropriate to use the GDP deflator to adjust, because the multipliers capture economy-wide impacts.

[3] https://www.bls.gov/ppi/#data

[4] https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=2#reqid=19&step=2&isuri=1&1921=survey

Table 10. Price indexes.

Year	GDP implicit price deflator	Percent change	PPI fish	Percent change
2000	78.0		198.1	
2001	79.8	2.25%	190.8	-3.69%
2002	81.0	1.56%	191.2	0.21%
2003	82.6	1.97%	195.3	2.14%
2004	84.8	2.68%	206.3	5.63%
2005	87.5	3.14%	222.6	7.90%
2006	90.2	3.09%	237.4	6.65%
2007	92.6	2.70%	242.8	2.27%
2008	94.4	1.92%	255.4	5.19%
2009	95.0	0.64%	250.9	-1.76%
2010	96.2	1.20%	272.4	8.57%
2011	98.2	2.08%	287.6	5.58%
2012	100.0	1.87%	287.6	-0.02%
2013	101.8	1.75%	299.4	4.12%
2014	103.7	1.87%	322.4	7.68%
2015	104.7	1.00%	322.0	-0.13%
2016	105.7	1.00%	327.6	1.74%
2017	107.7	1.90%	337.9	3.15%
2018	110.3	2.39%	344.5	1.96%
2019	112.3	1.79%	349.9	1.55%
2020	113.6	1.21%	350.8	0.27%
2021	118.4	4.15%	413.0	17.74%
Annual average		2.01%		3.66%

Adjustment of lobster and Jonah crab data

As noted above, lobster vessels that carry only lobster permits are not subject to a Vessel Trip Report (VTR) requirement. Trips without VTR are not reflected in the numbers shown in Tables 2 through 9 (cf. King 2019). To account for potentially unreported lobster and Jonah crab landings, and for dockside sales (see below), we make adjustments to the landed value data as shown in Table 11. Data in the first three rows are based on VTR data, and are taken from Table 2 and Tables A1 through A3 in the Appendix. An earlier study by Industrial Economics (2015) indicates that active lobster vessels not subject to trip report requirements in Lobster Management Area 2 may account for as much as 57% of the total lobster fishing activity in that area. (Lobster Management Area 2[5] encompasses the waters south of Rhode Island and Cape Cod to a distance of about 40 nm, and includes the Sunrise WLA.) We assume conservatively that landings from 60% of the lobster vessels in the Sunrise WLA and ECRA could therefore be unreported, and that the VTR data represent 40% of the true lobster and Jonah crab revenues. We use this as an adjustment factor, and estimate the adjusted lobster and Jonah crab revenues at 2.5 times of those in the VTR data.

Some fraction of lobster and Jonah crab landings are sold directly from boats at dockside, at a price above that reported in the dealer information on which the NOAA values above are based. Neither the

[5] http://fisheries.noaa.gov/resource/map/lobster-management-areas

fraction of landings sold in this way nor the price premium is known exactly. Based on information provided by a group of Rhode Island fishermen (pers. comm., 24 Nov. 2020), we estimate that a 15% premium on the landed value derived from NOAA data (Table 11) adequately captures this dockside sales effect for Rhode Island landings. Dockside sales are not a common practice in Massachusetts (Mass. DMF pers. comm. May 2021), so we do not apply this multiplier to Massachusetts landings.

The combined adjustment for VTR data and dockside sales is shown in rows 5 and 6 in Table 11. The net increase is shown in row 7, and the adjusted total annual landed values are shown in row 8. This adjustment results in a 13.2% increase in the estimated total annual landed value for the WLA, and 3.3% increase for the ECC.

Table 11. Adjustment of landed value for landings not captured in VTR data and for RI dockside sales.

Value (2020$)	**Sunrise WLA**	**Sunrise ECC**
Avg. VTR total $/year (Table 2)	2,116,815	146,040
Avg. VTR lobster $/year (Tables A1-A3)	131,173	1,963
Avg. VTR Jonah crab $/year (Tables A1-A3)	35,412	1,159
% of total captured by VTR	40%	40%
Adjusted lobster $/year (incl. RI dockside sales)	351,981	5,019
Adjusted Jonah crab $/year (incl. RI dockside sales)	95,022	2,964
Net increase over VTR $/year (row 5+6-2-3)	280,419	4,861
Adjusted total $/year	2,397,234	150,901
Adjusted increase over VTR total value	13.2%	3.3%

With all adjustments, we estimate the average annual landed value in Massachusetts from the Sunrise WLA to be about $1.1 million (2020$), and from the Sunrise ECC about $80,000.

Estimated indirect and induced economic impacts

Economic impact multipliers reflect the linkages between economic activity in different sectors of the economy. For example, when landings increase in the commercial fishing sector, there is an associated increase in the purchases of ice and other supplies in the region, and an increase in onshore transportation and processing of seafood. The resulting increases in economic activity in the commercial fishing supply and transportation and processing sectors are indirect effects of increased landings. In addition, because fishermen and workers in the supply, transportation, and processing industries earn greater income as a result of this increased activity, and spend some of that extra income on local goods and services, there is also an induced effect of greater spending in other sectors. The multipliers capture the combined effect of indirect and induced spending that results from higher commercial landings.

We have developed regional economic models for Massachusetts using the IMPLAN model software (IMPLAN 2004) and data for 2018 and 2019. IMPLAN software and data are commercial products widely used by researchers and management agencies to perform economic impact analyses for a user specified study region (IMPLAN 2004; Steinback and Thunberg 2006; Hoagland *et al.* 2015; UMass

Dartmouth. 2018; Cape Cod Commission 2020). Based on these models, and 2019 data, the upstream output multiplier for the commercial fishing industry in Massachusetts is 1.775.

We have also taken into account downstream economic activity, such as seafood processing, that may take place at Massachusetts businesses as a result of commercial fisheries landings. This linkage is less direct than the upstream activities, because not all seafood landed in a state is processed in the state, and seafood processors may import more seafood from elsewhere for processing when in-state landings fall short. Nonetheless, we add a downstream adjustment of 0.43, as cited by BOEM (2021) in the Vineyard Wind analysis, to the multiplier for Massachusetts landings, bringing the combined multiplier to 2.205, to account for both upstream effects and downstream effects to seafood processors. We apply the combined upstream and downstream multiplier to all landings except lobster and Jonah crab, which are adjusted for dockside sales and receive only the upstream multiplier. The corresponding combined multiplier for Rhode Island landings is 2.219; for landings in other states, we use the average of the Massachusetts and Rhode Island multipliers.

The economic impact multiplier captures the linkages between the fishing industry sector and other sectors in the Massachusetts economy. While we use a single output multiplier for the entire commercial fishing sector in a given state, we recognize that the multiplier may in fact vary across specific fisheries, species, and gear due to differences in factor inputs for fishing operations and post processing of fish landed. We use a single multiplier for the entire commercial fishing sector, reflecting an average across all gear types and species. Economy-wide inflation affects all sectors in the economy but usually does not alter the general structure of the economy. Therefore, although the baseline economic values increase with rising prices, the multiplier does not. We also recognize that other types of multipliers, such as those focusing on employment effects, have been used in other analyses. We maintain that the output multipliers we use provide a robust and accurate measure of indirect and inducted effects averaged across the fishing sectors.

Table 12. Estimated annual economic impact in Massachusetts (all values in 2020$)

		Average value of landings/year			**Total impact/year**
Area	**State**	VTR data only (Table 11, row 1)	with lobster & Jonah crab adjustment	with dockside sales adjustment (15% premium on RI lobster & JC landings)	"dockside sales" column multiplied by upstream & downstream multipliers, except RI lobster & JC
Sunrise WLA	total	2,116,815	2,366,693	2,397,234	5,214,570
Sunrise ECC	total	146,040	150,723	150,901	332,878
Sunrise WLA	MA	981,567	1,097,435	1,097,435	2,419,845
Sunrise ECC	MA	77,401	79,883	79,883	176,142

Using these multipliers, and including the lobster and Jonah crab adjustment described in the previous section, we estimate the average annual total economic impact from commercial fishing activity in the Sunrise WLA to be about $2.42 million in Massachusetts (Table 12). We also estimate the average annual total economic impact from commercial fishing activity in the Sunrise ECC to be about $180,000 in Massachusetts. Including landings in other states, the total average annual economic impact from commercial fishing activity in the WLA is $5.21 million and in the ECC it is $333,000. These estimates are based on average annual landings value from 2008 to 2019, with lobster and Jonah crab landed value adjusted to account for boats not subject to VTR requirements.

Exposure of commercial fishery resources and fishing to wind farm development

In the following sections, we consider five categories of possible exposure of commercial fishery landings and landed value from the Sunrise Wind project:

- Transient effects on fish availability due to construction activities and noise
- Transient effects due to constrained access to certain areas during construction
- Changes in fishing in the WLA during operations
- Transient effects due to constrained access to certain areas during decommissioning
- Transient effects on fish availability due to decommissioning activities

Table 13. Assumptions for exposure of commercial fisheries to wind farm development.

Categories of Potential Exposure			Assumptions/Effects	Duration
Availability effects due to construction	WTGA+5km		100% of finfish leave area (a)	1 year
	WLA		Lobster/crab landings reduced 10% (b) Other shellfish landings reduced 10% (c)	2 years 5 years
	ECRA	1.6km WA	All landings reduced 10% (d)	1 year
		180m ECC	Lobster/crab landings reduced 25% (e) Other shellfish landings reduced 25% (f)	2 years 5 years
Construction constrained access	WLA		No fishing in 50% of area (g)	2 years
	ECRA	1.6km WA	No fishing in 5% of area (h)	1 year
		180m ECC	No fishing in 100% of area (i)	9 months
Effects during operations	WLA		Landings reduced by 5% (j)	30 years
	ECRA	1.6km WA	None	
		180m ECC	None	
Availability effects due to decommissioning	WLA		None beyond constrained access	
	ECRA	1.6km WA	All landings reduced 5% (k)	1 year
		180m ECC	Lobster/crab landings reduced 12.5% (l) Other shellfish landings reduced 12.5% (m)	1 year 4 years
Decommissioning constrained access	WLA		No fishing in 50% of area (n)	1 year
	ECRA	1.6km WA	No fishing in 5% of area (o)	2 months
		180m ECC	No fishing in 100% of area (p)	2 months

(a), (b), (c) etc. refer to detailed explanations in the text that follows

The assumptions and effects on fish availability and fishing activity/landings are summarized in Table 13 for each category and project area. For the purpose of estimating construction noise-related effects, we define a Wind Turbine Generator Area (WTGA) as the subset of the WLA in which turbine generator towers are to be located. The WTGA lies within the WLA and is smaller in total footprint, since not all of the WLA is utilized for turbine generator towers; we recognize that final turbine generator siting decisions have not been made for Sunrise Wind, and refer here to the "indicative turbine layout" as of August 2022 (see Figure 3.3.4-1 of the Sunrise Wind Construction and Operations Plan (Sunrise Wind LLC 2022)). In the sections that follow Table 13, we describe how we arrived at the assumptions, with references in the text corresponding to the row codes (a), (b), (c), etc. in the table. The assumptions are based in part on information from the Sunrise Wind Construction and Operations Plan (Sunrise Wind LLC 2022) and from acoustic modeling work for wind farm turbine foundation installation (Denes *et al.* (JASCO) 2018).

The estimates we present in the following sections include all commercial fishing in the Sunrise Wind project areas; we then estimate the portion of this total associated with the Massachusetts fishing sector, based on the sector's share of the Sunrise Wind area landed value. The baseline values for each project area and species group are shown in Table 14.

Table 14. Baseline landed values (2020$) used for exposure calculations.

	WLA	WTGA+5km	1.6km ECC WA	180m ECC
Total landed value:	**2,397,234**		**1,341,343**	**150,901**
Lobster & Jonah crab	447,004		70,961	7,983
Other crabs	2,828		773	87
Scallops	243,725		610,649	68,698
Other shellfish	4,165		1,724	194
Finfish/mobile species	1,699,512	2,751,244	657,236	73,939
MA landed value:	**1,097,435**		**710,073**	**79,883**
Lobster & Jonah crab	193,114		36,770	4,137
Other crabs	1,311		359	40
Scallops	113,015		283,158	31,855
Other shellfish	1,931		800	90
Finfish/mobile species	788,064	1,275,752	304,760	34,286

Transient availability effects due to construction

The construction schedule (Figure 3.2.2-1, page 3-6, Sunrise Wind LLC 2022) envisions construction activity in the WLA taking place mainly during the second half of 2024 and much of 2025, with some work on the inter-array cables beginning in the first half of 2024. Work on offshore foundations will take place in the second half of 2024; and work along the ECC is scheduled to take place during the second and fourth quarters of 2024, and the first quarter of 2025. To convert future effects to a common basis, we apply a real discount rate of 5% – the average of the rate usually applied in natural

resource valuation (3%) and the rate usually applied by the US government for public investment and regulatory analyses (7%).

Construction noise during drilling and pile driving, and disturbance of bottom sediments and rocks, is likely to have an impact on fish and shellfish in and around the Sunrise Wind project areas. Mobile species may leave the area because of construction noise, and species that rely on seafloor habitat may be injured or displaced.

Our estimate of the effect of construction in and around the WLA is based on a pile driving scenario involving 11 m monopiles, each installed within 24 hours, using a 4,000 kJ hammer, and 10 dB of noise attenuation. We assume conservatively that pile driving may extend over as much as nine months. We consider separately the likely effect of pile driving and turbine tower installation on shellfish (lobster, scallops, Jonah crab) and on finfish.

We assume conservatively that all finfish will leave all areas in and around the WTGA where pile driving noise exceeds 160 dB. There is no scientific evidence that the 150 dB threshold sometimes cited for "temporary behavioral changes" (Cal Trans 2015) leads to substantive relocation of finfish; and even 160 dB is far below any documented injury threshold. The maximum range for pile driving noise in the Sunrise Wind setting is likely to be about 4,800 m for 160 dB (Denes *et al.* (JASCO) 2018, p. G-52, row 4 of Table G-7). We therefore assume conservatively that all finfish leave the WTGA and a 5 km buffer zone around the WTGA for the duration of pile driving (up to nine months) and return after a further three months (total of one year; Table 13 (a)). This is consistent with reported anecdotal observations by fishers around the Block Island Wind Farm (ten Brink and Dalton 2018), which suggest that the construction noise effect may extend 5-10km from its source, and that many finfish will return to the area within months of the end of construction. To estimate the value associated with this effect for Sunrise Wind, we obtained data from NOAA on average annual landings from a region enclosed by a 5 km buffer around the Sunrise WTGA. The annual value of finfish landings reported by NOAA for this buffer area is $2,751,244 (2020$). The discounted value (at 5%) from the 2024-25 construction year is $2,208,906 (2020$), of which $1,024,270 is attributable to Massachusetts.

We also consider loss of shellfish due to construction noise and burial resulting from foundation installation and inter-array cable work. The closest approximation in the literature for a construction noise injury/mortality threshold for shellfish is the "mortality and potential mortal injury" 24-hour exposure threshold of 219 dB for "fish without swim bladders" (Popper *et al.* 2014; Denes *et al.* (JASCO) 2018). This level of exposure will extend no more than 160 m from tower locations (Denes *et al.* (JASCO) 2018, p. G-54, top row of Table G-9), a radius that covers 1.9% of the WLA footprint assuming all 102 potential tower locations are built out (in fact the Sunrise construction plan (Sunrise LLC 2022) anticipates development at no more than 95 of these locations, up to 94 turbine towers and one offshore converter station). In addition, we account for up to 290 km of inter-array cable burial that may disturb the seabed across a 40 m wide corridor around the cables, affecting up to 2.7% of the WLA footprint. Ignoring overlap to be conservative, this suggests a maximum combined affected seabed area amounting to 4.6% of the WLA footprint.

To be even more conservative, we increase the estimate of the effect by a factor of two, to 10% of the WLA footprint, and assume that 10% of the lobster, crab, scallop, and other shellfish populations within the WLA are adversely affected by pile driving noise, seabed disturbance around foundations, and cable installation during construction, and thus lost to fishing (Table 13 (b and c)) for all of the 2024 and 2025

construction years. We assume that lobster and crab will repopulate the portions of the WLA from which they are displaced within a year after construction work ends, and that scallop and other non-mobile shellfish stocks in those portions of the WLA will rebuild over the course of four years (Table 13(c)).

Along the ECC, the greatest effects are likely to be due to habitat disruption along the immediate cable route; cable laying does not involve the same disturbance from drilling or pile driving as turbine tower installation. We therefore consider significant displacement of mobile species from the ECC and Working Area to be unlikely. The habitat disruptions that impact non-mobile benthic species are likely to extend on average no more than 5-10m on either side of the immediate cable route – at most 12% of the ECC and 2% of the ECC WA area. To be conservative, we model a 25% reduction in landings of all shellfish for two years and all non-mobile shellfish over five years from the ECC (Table 13 (e and f)), and a 10% reduction in landings for all species for one year from the 1.6km ECC Working Area (Table 13 (d)).

Transient effects from constrained access during construction

During wind farm construction activities, fishing may be temporarily constrained in parts of the WLA and along the export cable routes. For example, Sunrise Wind anticipates a 500-yard-radius construction safety zone around tower locations during construction activities, and around any vessel installing cables. In practice, during these construction and cable-laying activities, some fishing that would have taken place in those areas is likely to shift to other nearby locations, replacing some of the forgone landings. If fishers prefer to fish within the construction areas, that is likely because these are thought to be more productive than alternatives. As an upper bound on effects from these temporary constraints, we estimate the full average value of landings linked to the affected areas.

We assume conservatively that fishing is constrained in half of the Sunrise WLA for two years (Table 13 (g)), and in 5% of the 1.6km ECC Working Area for 12 months (Table 13 (h)), during construction activities. In addition, we assume that fishing is constrained within all of the ECC area immediately around the export cable routes for a period of nine months (Table 13 (i)) as the cable is buried by a separate vessel.

We use as a basis for our calculations the average annual values for each area (Table 14), prorated according to the availability effects described above and the fraction of the year affected, and discounted to 2020$ at 5%. Note that the assumption about all finfish leaving the WTGA for a year means that there is no further effect from constrained access to finfish in the WLA. To be conservative, we do not adjust for double-counting of effects in the overlap between the 5km buffer around the WTGA and the ECC.

Table 15. Estimated value of landings associated with construction effects.

Area	**Estimated Landed Value Exposure** (2020$)	
	Total	**Massachusetts**
Sunrise WLA / WTGA + 5km	2,917,442	1,339,169
Export Cable Corridor / WA	298,817	154,155

Table 15 shows the combined results of the availability and constrained access effects (Table 13 (a)-(i)). The total value of landings associated with construction effects is estimated to be about $3.22 million (2020$), of which about $1.49 million is associated with landings in Massachusetts.

Effects due to fishing constraints during operations

If fishing activity is constrained at certain locations within the wind farm area during the operating life of the project, it may be appropriate to treat these areas as lost to fishing during that time. For example, areas in the immediate vicinity of turbine towers may not be accessible to bottom trawl fishing once the wind farm is built. Fishers are likely to adapt to such constraints by shifting fishing effort slightly from previous locations or tracks. This sort of adaptation by the fishing industry is made easier by the regular one-by-one nautical mile east-west/north-south grid spacing for wind turbine towers that has been adopted for Sunrise Wind and other wind development projects (Deepwater Wind South Fork 2020). Because it is not possible to know exactly how the fishing industry will respond to this change in future years, or what the implications of that adaptation will be for catch and landings, we assume here that the landings from affected areas are simply not realized. This is a conservative assumption that likely overstates the actual loss of landings due to wind farm development.

Fishing activity constraints during wind farm operations apply only to the WLA; we do not expect any constraints along the ECC during operations. The footprint of the Sunrise Wind project area is 43,060 hectares, of which permanent structures occupy less than 10 hectares, or 0.03% of the total area. A 100m radius area around each of the turbine towers accounts for about 0.7% of the total WLA, suggesting that less than 1% of the WLA area may be lost to fishing. Mobile gear (dredge, trawl) fishing accounts for less than half of landed value from the Sunrise WLA. We assume conservatively that as much as 5% of total baseline landings from all stocks within the WLA may be lost to fishing during operations (Table 13 (j)).

Since the Sunrise Wind project will be operating for 30 years, we estimate the potential loss associated with these forgone landings by calculating the present value of 5% of baseline landings for a 30-year period beginning in 2026.

The resulting estimate of the total value of potential lost landings during project operations is $1,374,953, of which $629,443 is associated with landings in Massachusetts.

Transient effects from constrained access and availability effects during decommissioning

After approximately 30 years of operations, Sunrise Wind plans to decommission the project. This involves removing the turbine towers and foundations, and the cables including the export cable.

We estimate that the duration of decommissioning, and resulting access constraints in the WLA during decommissioning, will extend for about one year. Because relatively little noise is associated with decommissioning compared to construction, we do not model decommissioning effects in the WLA beyond the effects that overlap with access constraints (Table 13 (n)).

We expect that access constraints along the export cable route will be similar to those during cable laying operations, but likely for a shorter duration. We therefore model access constraints on 5% of the ECC WA and 100% of the ECC itself for a total of two months (Table 13 (o) and (p)). Because cable removal is less disruptive that burial, we model half of the availability effect for decommissioning as we do for cable installation (Table 13 (l) and (m)).

We then discount the value of affected landings from decommissioning to 2020$ by applying a 5% discount rate. The resulting present value (2020$) estimate of potential lost landings due to access constraint and availability effects during decommissioning is $239,849, of which $111,050 is associated with landings in Massachusetts.

In summary, the total landed value from fishing in federal waters potentially exposed to Sunrise Wind project development is estimated to be about $4.83 million (2020$), of which $4.51 million is associated with the WLA (plus 5km perimeter) and $321,000 is associated with the ECC. Massachusetts landings account for about 46% of total landings from the WLA and 53% of total landings from the ECC. The landed value of Massachusetts commercial landings potentially exposed by Sunrise Wind development is therefore about $2.23 million. This includes about $1.49 million in forgone landings due to construction, $629,000 during operations, and $111,000 during decommissioning.

Applying the upstream and downstream multipliers as described above results in an estimate of $2.69 million in indirect and induced effects in Massachusetts, for a total impact of $4.93 million.

Massachusetts-based charter fishing

To obtain data on for-hire charter fishing activity in the Sunrise Wind Lease Area (WLA) and Export Cable Corridor (ECC), we conducted an online survey of Rhode Island- and Massachusetts-based charter vessel operators. The survey asked operators to identify their fishing locations on a chart, and report for each location

- the total number of annual for-hire fishing trips that vessel took in each of the years 2017-2021,
- the average number of passengers onboard for-hire trips in each of the years 2017-2021, and
- the average amount of time spent targeting highly migratory species (HMS) relative to bottom fishing or trolling for other species during for-hire trips.

The survey was first distributed on April 18, 2022 through email lists maintained by Rhode Island Department of Environmental Management (RIDEM), Rhode Island Coastal Resources Management Council (RICRMC) and Massachusetts Division of Marine Fisheries (MADMF), and also via email by for-hire fishing industry representatives, including the Rhode Island Party and Charter Boat Association. The survey was active from April 18, 2022 until May 14, 2022.

The survey received 91 total responses from for-hire charter owners and/or operators. Sixty-six of these respondents (72%) reported that they fish in the area depicted in Figure 4. These 66 respondents reported 62 unique vessels, and reported effort data for 29 of those vessels across the five-year period of 2017-2021 (Table 16). Similar studies published in the peer-reviewed academic literature using paper mail, email, or mixed mode survey distributions typically have survey response rates around 20-30% (e.g., Dalton *et al*. 2020, Carr-Harris and Steinback 2020). Based on discussions with for-hire industry representatives, approximately 100 vessels actively engage in for-hire fishing activity in the waters depicted in Figure 4, suggesting the fishing reported by survey respondents accounts for about 29% of the total. Thus, the response rate for the primary population of interest is within an appropriate range

to consider our survey distribution a success. An important note to also consider is that there are vessels in our sample that require the submission of federal VTRs. A common trend identified in the data was that some respondents did not provide data for their vessels that require VTRs. This is not a problem for this analysis as this effort data is already accounted for by the NOAA databases and summary reports used as a baseline for our subsequent analyses.

Table 16. For-hire charter fishing survey summary statistics.

Description	Number
Fished in the area and responded to the survey	66
Provided vessel names	62
of which based in Massachusetts	37.5
Provided annual vessel trip numbers	31
Observations with vessel trips reported (2017-2021)	142
Total trips per year	1 – 235
Average total trips per year	47.30
Passengers per vessel trip	2 – 25
Average passengers per vessel trip	5.41
Identified fishing locations on maps	29
of which based in Massachusetts	18.5

The number of anglers per year is estimated by multiplying the vessel trip number in a year and the average number of anglers per trip in that year for each vessel, and the results are then summed across vessels by area. Tables 17 and 18 show the annual vessel trips and angler counts in the survey responses for charter vessels based in Massachusetts. The Wind Turbine Generator Area (WTGA) is the area defined by the turbine tower locations and lies within, but does not include all of, the WLA shown in Figure 4. (The WTGA analysis is based on a WTGA shapefile received from Inspire Environmental in November 2020, and reflects the turbine tower layout planned for Sunrise Wind at that time. This layout is subject to change.) Note that some of the trips shown for the ECRA (Table 18) are also included in the numbers for the WTGA + 5km buffer (Table 17).

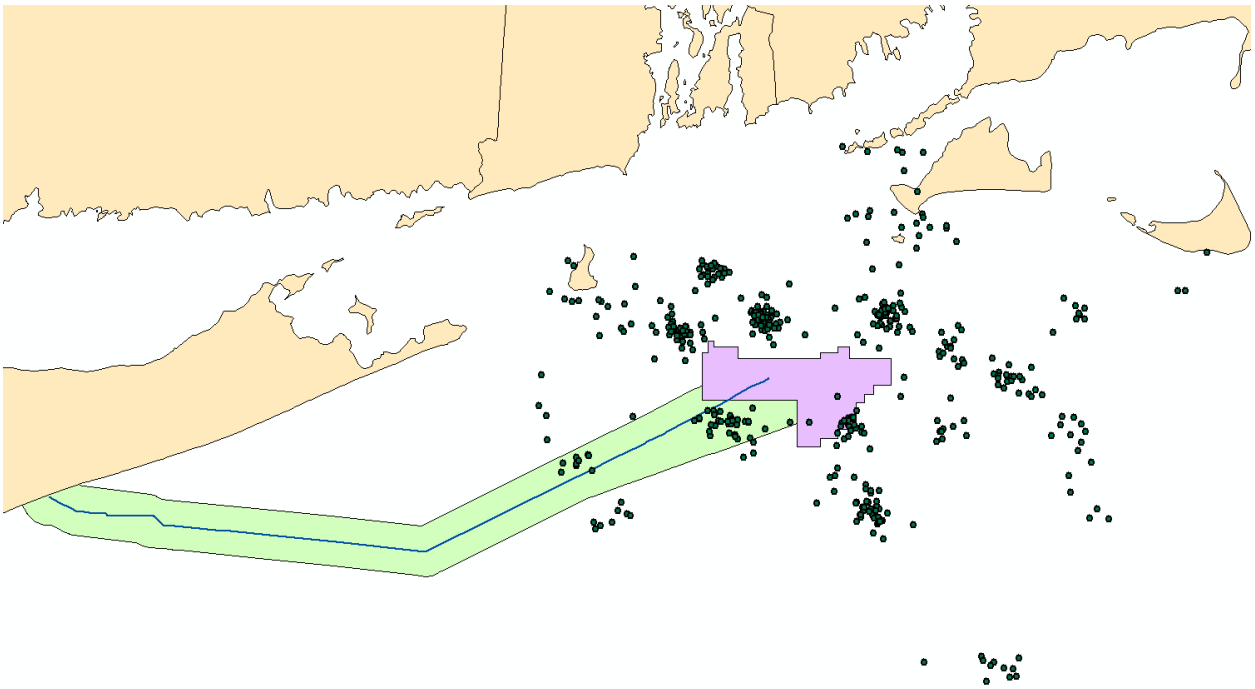

Figure 4. Charter fishing locations, 2017-2021, identified in survey responses. WLA is shown in purple, and ECRA in green.

Table 17. Number of Massachusetts-based vessel trips and anglers by year, Sunrise WLA.

Year	WLA + 5km buffer		WTGA + 5km buffer	
	Vessel Trips	Anglers	Vessel Trips	Anglers
2017	16.5	75	62.5	355
2018	35.5	157	67.5	389
2019	51	1,032	21	120
2020	51	780	47	262
2021	55	795	51	287
Average	***41.8***	***567.8***	***21.7***	***282.6***

Table 18. Number of Massachusetts-based vessel trips and anglers by year, Sunrise ECRA.

Year	Vessel Trips	Anglers
2017	5	30
2018	12.5	65
2019	0	0
2020	5	25
2021	0	0
Average	***4.5***	***24***

We use the revenue per angler estimates from NOAA shown in the Table 19 below for our revenue calculation. We recognize that the per angler revenue from charter boats may be an order of magnitude larger than that from party boats. The NOAA data in Table 19 represent an average across both sectors, influenced by the fact that many more people participate in party boat fishing than in charter fishing. For consistency, we convert the average revenue per angler from 2019$ ($104.94) to 2020$ ($106.15) using the GDP implicit price deflator (2019: 112.3; 2020: 113.6).

Table 19. Sunrise Wind area for-hire vessel revenue from NOAA VTR data. Source: NOAA (2021).

Year	Revenue per angler (2019$)
2008	87.52
2009	99.36
2010	111.48
2011	122.56
2012	116.79
2013	112.68
2014	109.76
2015	106.30
2016	101.74
2017	100.42
2018	85.71
Average	**104.94**

The annual revenue for each area is estimated by multiplying the number of anglers (Tables 17 and 18) by the average revenue per angler ($106.15). The result is then adjusted using a scale factor. For a low-end estimate, the scale factor is the ratio of the number of Massachusetts vessels responding to the

survey (37.5) to the number of these vessels for which specific fishing locations were provided (18.5). For a high-end estimate, we increase the scale factor to reflect the estimated total of 100 vessels operating in the survey area (see above), versus the 62 for which survey responses were received. Finally, an economic impact multiplier is used to reflect the overall economic impacts associated with the charter fishing direct revenue. As with commercial fishing, we recognize that this multiplier will in fact vary with different types of charter fishing (e.g. sport fishing charters versus party boats). The multiplier we use is calculated using data in the NOAA report by Lovell *et al*. (2020), and reflects an average across different types of charter fishing. The results are shown in Table 20.

Table 20. Annual revenue and economic impact from MA-based charter fishing in Sunrise Wind areas.

Area	Annual anglers	Revenue per angler (2020$)	Scale factor	Annual revenue (2020$)	Impact multiplier	Annual impact (2020$)
WLA+5km	567.8	106.15	Low: 2.027	122,171	1.627	198,773
			High: 3.269	197,029	1.627	320,566
WTGA+5km	202.6	106.15	Low: 2.027	43,593	1.627	70,925
			High: 3.269	70,303	1.627	114,383
ECRA	24.0	106.15	Low: 2.027	5,164	1.627	8,402
			High: 3.269	8,328	1.627	13,550

As Figure 4 and Table 17 illustrate, there is little evidence of charter fishing within the Sunrise WLA, but substantial charter fishing activity just outside the boundary of the WLA. (Depending on final decisions regarding turbine generator tower layout, the amount of charter fishing value affected may be lower, as suggested by the WTGA+5km values in Table 20.). We assume conservatively that the value of charter fishing at the Sunrise Wind development areas, including a 5km buffer around the entire WLA, is foregone in the construction year when pile driving takes place, since we expect finfish to leave this area due to construction noise, and also in the decommissioning year of the project. This is likely an overestimate of the actual impact, since charter fishing that would have taken place in these areas may in fact be carried out elsewhere.

Given the fact that much of the charter fishing around the Sunrise WLA takes place outside the WLA footprint, and the 1nm spacing of the turbine towers, we expect that charter fishing boats will be able to operate in and near the WLA with minor adjustments to current practice once construction is complete. We therefore do not expect charter fishing revenue to be materially impacted during the operations phase of the project.

We therefore base our calculation of exposure on the WLA with 5km buffer and the ECRA, ignoring any overlap. We use the combined high-end revenue and impact estimates ($205,357 and $334,116/year, respectively), and assume that this value is forgone during the pile driving and decommissioning years. Using a 5% discount rate, the present value of the two years of effects, using the high-end estimates, is about $200,000 (2020$) in revenue, and $326,000 in total impact in Massachusetts.

As noted above, we consider it unlikely that the Sunrise Wind development will substantially change the personal recreational fishing activities of Massachusetts boaters.

Conclusions

Based on NOAA data from 2008 to 2019, and adjusting for underreporting of lobster and Jonah crab landings in the VTR data, and for some dockside sales of lobster and Jonah crab, we estimate the average annual value of commercial landings from the Sunrise Wind Lease Area to be about 2,397,000 (2020$). Of this, about $1,097,000 is landed in Massachusetts. Including indirect and induced effects, these landings generate average annual economic impacts of $2,420,000 in Massachusetts.

We estimate the average annual value of commercial landings from the Sunrise Wind Export Cable Corridor to be about $151,000. Of this, about $80,000 is landed in Massachusetts. These landings generate estimated total annual economic impacts of $176,000 in Massachusetts.

We estimate that a total (lump sum) of $2,233,000 (2020$) of commercial fisheries value landed in Massachusetts is potentially exposed to the Sunrise Wind development. This accounts for about 46% of the total potentially exposed landed value for Sunrise Wind. It includes about $1,493,000 in direct landed value forgone due to construction activities, $629,000 from forgone landings during the wind farm's operation, and $111,000 in present value of foregone landings due to decommissioning.

In the context of overall commercial fishery landings in Massachusetts of more than $500 million per year (NMFS 2020), the landings potentially affected by Sunrise Wind represents about 0.45% of Massachusetts' total annual landings, with much of this exposure concentrated in the early part of Sunrise Wind's project life.

Massachusetts-based charter fishing revenue exposure to the Sunrise Wind development is estimated to have a present value of $200,000.

Including indirect and induced effects, the potentially affected commercial landings and charter fishing revenue together result in about $5,252,000 in total (lump sum, 2020$) present value economic impact in Massachusetts. Table 21 summarizes these values.

There is considerable variability in the baseline data of landings and landed value from the Sunrise Wind areas. Baseline future landings will vary due to natural and fisheries-related fluctuations in stocks that are likely to be amplified by climate change effects. There is also uncertainty about the impact of wind farm construction and operation on fish stocks and landings, and about the ways that fishers will adapt their fishing practices in response to wind farm development. We consider our combined estimate of $5.25 million in economic impacts to Massachusetts from Sunrise Wind development effects on commercial and charter fishing to be a conservative upper bound on likely actual impacts.

Table 21. Estimated Massachusetts fishing industries exposure from Sunrise Wind development

Categories of Potential Exposure		MA Direct Landed Value/Revenue (2020$)
Construction-related effects	WLA+	$1,339,000
	ECRA	$154,000
Effects during operations	WLA	$629,000
	ECRA	---
Decommissioning-related effects	WLA	$100,000
	ECRA	$12,000
Subtotal MA commercial direct effects		**$2,234,000**
MA for-hire charter fishing direct effects		$200,000
Total MA direct effects		**$2,434,000**

Categories of Potential Exposure	MA Total Impact with Multipliers (2020$)
Subtotal MA commercial fishing	**$4,926,000**
MA for-hire charter fishing	$326,000
Total Massachusetts impacts	**$5,252,000**

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Appendix

Table A1. Average annual landings by species from the Sunrise WLA, 2008-2019.

Note: lobster and Jonah crab data in this table have not been adjusted for landings not reported via VTR.

Species	*Mean* Value/year (2020 $)	*Mean* Landings/year (lbs)	*Standard Deviation* Value/year (2020 $)	*Standard Deviation* Landings/year (lbs)
ALL_OTHERS	559,908	712,732	526,411	603,320
AMBERJACK, SPECIES NOT SPECIFIED	0	0	0	0
BLACK BELLIED ROSEFISH	0	0	0	0
BLACK SEA BASS	12,222	2,786	6,385	1,733
BLUEFISH	3,407	4,536	1,962	2,436
BONITO	291	90	476	133
BUTTERFISH	17,038	22,772	18,509	25,517
CLAM, SURF/BUSHEL	0	0	0	0
COBIA	0	0	0	0
COD	41,370	13,863	24,423	8,494
CRAB, BLUE/BUSHEL	18	15	42	36
CRAB, CANCER	0	0	0	0
CRAB, HORSESHOE	0	0	0	0
CRAB, JONAH	35,412	41,332	21,818	22,824
CRAB, ROCK/BUSHEL	2,792	4,117	3,206	4,660
CRAB, SPECIES NOT SPECIFIED	18	31	24	43
CREVALLE	0	0	0	0
CROAKER, ATLANTIC	86	189	174	425
CUNNER	730	156	1,471	255
CUSK	0	0	0	0
DOGFISH, SMOOTH	641	1,661	806	2,987
DOGFISH, SPINY	13,758	66,355	10,002	51,664
DOLPHIN FISH / MAHI-MAHI	0	0	1	1
DRUM, BLACK	0	0	0	0
EEL, AMERICAN	9	10	11	13
EEL, CONGER	215	305	304	405
EEL, SPECIES NOT SPECIFIED	17	19	16	15
FLOUNDER, AMERICAN PLAICE /DAB	306	130	747	320
FLOUNDER, FOURSPOT	20	37	30	64
FLOUNDER, SAND-DAB / WINDOWPANE / BRILL	290	374	541	691
FLOUNDER, SOUTHERN	0	0	0	0
FLOUNDER, SUMMER / FLUKE	97,628	27,773	64,534	20,822
FLOUNDER, WINTER / BLACKBACK	55,691	19,842	61,694	21,164
FLOUNDER, WITCH / GRAY SOLE	296	109	238	83
FLOUNDER, YELLOWTAIL	57,000	28,950	60,324	36,530
FLOUNDER,NOT SPECIFIED	0	0	0	0
HADDOCK ROE	1,286	1,237	2,916	3,094
HAKE, OFFSHORE	266	350	743	976

HAKE, RED / LING	7,089	23,350	6,032	22,211
HAKE, SILVER / WHITING	64,298	106,558	51,011	96,799
HAKE, WHITE	790	532	1,679	1,205
HAKE,SPOTTED	0	0	1	1
HALIBUT, ATLANTIC	63	7	112	13
HARVEST FISH	0	0	0	0
HERRING, ATLANTIC	24,654	159,535	26,124	179,528
HERRING, BLUE BACK	0	0	0	0
JOHN DORY	97	74	107	78
LOBSTER, AMERICAN	131,173	23,676	34,047	6,421
MACKEREL, ATLANTIC	4,243	17,554	7,088	38,138
MACKEREL, CHUB	2	4	7	13
MACKEREL, KING	0	0	0	0
MACKEREL, SPANISH	2	1	6	2
MENHADEN	0	1	0	2
MONK	377,837	224,763	134,917	39,911
MULLETS	1	2	4	5
OCEAN POUT	26	20	73	59
OTHER FINFISH	0	1	0	1
PERCH, WHITE	0	0	0	0
POLLOCK	94	78	105	98
PUFFER, NORTHERN	0	0	0	0
QUAHOGS/BUSHEL	0	0	0	0
RED PORGY	0	0	0	0
REDFISH / OCEAN PERCH	3	2	8	6
SCALLOPS,BAY/SHELLS	1	0	4	0
SCALLOPS/BUSHEL	243,724	21,375	180,466	16,581
SCORPIONFISH	1	1	5	4
SCUP / PORGY	63,029	92,599	51,362	78,456
SEA RAVEN	153	104	272	197
SEA ROBINS	21	124	19	122
SEATROUT, SPECIES NOT SPECIFIED	13	24	18	37
SHAD, AMERICAN	0	0	1	1
SHAD, HICKORY	0	0	0	0
SHARK, SANDBAR	0	0	0	0
SHARK, THRESHER	4	4	13	14
SHEEPSHEAD	0	0	0	0
SKATE WINGS	192,400	496,211	88,291	133,949
SKATE WINGS, CLEARNOSE	5	13	16	44
SPOT	1	4	5	13
SQUID / ILLEX	2,347	2,454	6,605	5,293
SQUID / LOLIGO	92,798	70,056	92,364	71,383
STARGAZER,NORTHERN	0	0	0	0
STRIPED BASS	3,238	677	2,335	483
SWORDFISH	0	0	0	0
TAUTOG	795	212	606	159
TILEFISH	0	0	0	0
TILEFISH, BLUELINE	3	1	4	1

TILEFISH, GOLDEN	1,963	518	1,659	404
TILEFISH, SAND	0	0	0	0
TRIGGERFISH	28	16	34	18
TUNA, ALBACORE	48	64	158	209
TUNA, LITTLE	63	74	155	163
TUNA, SKIPJACK	0	0	0	0
WEAKFISH	405	189	424	189
WHELK, CHANNELED/BUSHEL	4,157	522	7,792	974
WHELK, KNOBBED/BUSHEL	8	3	18	10
WHELK, LIGHTNING	0	0	0	0
WHELK,WAVED	0	0	0	0
WHITING, KING / KINGFISH	420	372	666	584
WOLFFISH / OCEAN CATFISH	0	0	0	0

Table A2. Average annual landings by species from the Sunrise Wind ECRA, 2008-2019.

Note: lobster and Jonah crab data in this table have not been adjusted for landings not reported via VTR. (These data are for the 10km wide ECRA, not the 180 m wide ECC.)

	Mean		***Standard Deviation***	
Species	**Value/year** (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
ALL_OTHERS	1,086,214	1,332,928	1,091,900	1,316,866
AMBERJACK, SPECIES NOT SPECIFIED	0	0	0	0
BLACK BELLIED ROSEFISH	0	0	1	1
BLACK SEA BASS	53,033	12,521	19,313	5,061
BLUEFISH	18,957	23,346	8,936	11,229
BONITO	1,050	412	1,533	595
BUTTERFISH	16,597	21,037	6,373	8,275
CLAM, SURF/BUSHEL	7,967	10,441	16,727	22,297
COBIA	26	8	43	12
COD	41,005	15,173	26,421	9,161
CRAB, BLUE/BUSHEL	147	117	340	270
CRAB, CANCER	0	0	0	0
CRAB, HORSESHOE	247	216	338	315
CRAB, JONAH	70,684	86,389	26,048	26,734
CRAB, ROCK/BUSHEL	4,138	6,237	4,594	6,911
CRAB, SPECIES NOT SPECIFIED	227	426	485	929
CREVALLE	1	1	2	2
CROAKER, ATLANTIC	457	653	1,003	1,212
CUNNER	551	162	615	152
CUSK	2	2	6	7
DOGFISH, SMOOTH	8,424	12,688	2,083	4,090
DOGFISH, SPINY	9,165	38,144	7,462	23,274
DOLPHIN FISH / MAHI-MAHI	3	1	7	2
DRUM, BLACK	0	0	1	1
EEL, AMERICAN	4,314	220	13,905	275
EEL, CONGER	1,384	1,409	1,333	1,355
EEL, SPECIES NOT SPECIFIED	1,271	1,124	1,436	1,092
FLOUNDER, AMERICAN PLAICE /DAB	234	106	372	164
FLOUNDER, FOURSPOT	271	522	198	432
FLOUNDER, SAND-DAB / WINDOWPANE / BRILL	1,685	1,943	2,831	3,254
FLOUNDER, SOUTHERN	9	3	32	9
FLOUNDER, SUMMER / FLUKE	447,054	130,148	115,523	47,087
FLOUNDER, WINTER / BLACKBACK	35,113	12,948	35,858	12,299
FLOUNDER, WITCH / GRAY SOLE	2,015	634	2,164	637
FLOUNDER, YELLOWTAIL	90,579	45,204	87,064	47,122
FLOUNDER,NOT SPECIFIED	8	4	25	11
HADDOCK ROE	1,635	1,668	5,262	5,517
HAKE, OFFSHORE	646	785	838	925

HAKE, RED / LING	9,314	18,667	3,458	7,883
HAKE, SILVER / WHITING	60,678	74,726	29,213	33,972
HAKE, WHITE	748	491	1,096	748
HAKE,SPOTTED	16	27	42	66
HALIBUT, ATLANTIC	86	11	107	15
HARVEST FISH	0	1	1	1
HERRING, ATLANTIC	148,770	1,050,510	115,439	863,625
HERRING, BLUE BACK	73	283	109	502
JOHN DORY	466	382	499	418
LOBSTER, AMERICAN	119,695	21,316	55,229	9,922
MACKEREL, ATLANTIC	31,534	135,262	49,179	243,327
MACKEREL, CHUB	299	419	1,009	1,391
MACKEREL, KING	1	0	3	1
MACKEREL, SPANISH	125	51	124	50
MENHADEN	870	7,225	1,154	9,986
MONK	817,138	431,906	328,751	105,659
MULLETS	33	38	51	64
OCEAN POUT	198	157	483	362
OTHER FINFISH	75	54	219	126
PERCH, WHITE	0	1	1	1
POLLOCK	245	245	609	687
PUFFER, NORTHERN	0	0	0	0
QUAHOGS/BUSHEL	824,865	1,016,461	1,289,689	1,568,629
RED PORGY	7	13	25	44
REDFISH / OCEAN PERCH	3	4	6	8
SCALLOPS,BAY/SHELLS	38	3	132	11
SCALLOPS/BUSHEL	3,816,495	347,782	2,804,183	283,996
SCORPIONFISH	5	14	15	34
SCUP / PORGY	170,198	213,291	47,097	80,257
SEA RAVEN	102	76	178	138
SEA ROBINS	172	754	74	309
SEATROUT, SPECIES NOT SPECIFIED	58	74	82	56
SHAD, AMERICAN	39	58	46	82
SHAD, HICKORY	7	8	23	27
SHARK, SANDBAR	1	0	2	1
SHARK, THRESHER	98	65	162	95
SHEEPSHEAD	0	1	1	1
SKATE WINGS	221,893	603,399	86,517	150,471
SKATE WINGS, CLEARNOSE	51	150	136	417
SPOT	125	161	257	383
SQUID / ILLEX	883	1,144	1,150	1,186
SQUID / LOLIGO	700,858	541,276	267,036	239,357
STARGAZER,NORTHERN	0	0	0	0
STRIPED BASS	49,469	11,721	18,535	4,349
SWORDFISH	12	3	21	4
TAUTOG	2,231	602	1,680	454
TILEFISH	0	0	1	0
TILEFISH, BLUELINE	24	12	26	14

TILEFISH, GOLDEN	7,544	1,997	6,374	1,770
TILEFISH, SAND	2	1	6	2
TRIGGERFISH	265	148	148	106
TUNA, ALBACORE	207	185	322	270
TUNA, LITTLE	388	520	364	575
TUNA, SKIPJACK	3	2	11	6
WEAKFISH	3,195	1,505	2,444	1,286
WHELK, CHANNELED/BUSHEL	2,079	430	2,291	376
WHELK, KNOBBED/BUSHEL	149	100	259	199
WHELK, LIGHTNING	55	21	152	55
WHELK,WAVED	503	707	1,210	1,670
WHITING, KING / KINGFISH	1,890	1,609	3,865	3,086
WOLFFISH / OCEAN CATFISH	0	0	0	0

Table A3. Complete species list (including those in ALL_OTHERS).

Species	Species
ALEWIFE	OCTOPUS, SPECIES NOT SPECIFIED
AMBERJACK, SPECIES NOT SPECIFIED	OTHER FINFISH
AMBERJACK,GREATER	PERCH, SAND
ANCHOVY,BAY	PERCH, WHITE
ARGENTINES,SPECIES NOT SPECIFIED	POLLOCK
ATLANTIC SALMON	POMPANO, COMMON
BLACK BELLIED ROSEFISH	PORGY,JOLTHEAD
BLACK SEA BASS	PUFFER, NORTHERN
BLUE RUNNER	QUAHOGS/BUSHEL
BLUEFISH	RED PORGY
BONITO	REDFISH / OCEAN PERCH
BULLHEADS	RIBBONFISH
BUTTERFISH	ROUGH SCAD
CLAM, ARCTIC SURF	SCALLOPS,BAY/SHELLS
CLAM, RAZOR	SCALLOPS/BUSHEL
CLAM, SPECIES NOT SPECIFIED	SCORPIONFISH
CLAM, SURF/BUSHEL	SCUP / PORGY
COBIA	SEA RAVEN
COD,MILT	SEA ROBINS
CRAB, BLUE/BUSHEL	SEA URCHINS
CRAB, CANCER	SEATROUT, SPECIES NOT SPECIFIED
CRAB, GREEN/BUSHEL	SHAD, AMERICAN
CRAB, HERMIT	SHAD, GIZZARD
CRAB, HORSESHOE	SHAD, HICKORY
CRAB, JONAH	SHARK, ANGEL
CRAB, LADY	SHARK, BLACKTIP
CRAB, RED/BUSHEL	SHARK, BLUE
CRAB, ROCK/BUSHEL	SHARK, MAKO, LONGFIN
CRAB, SPECIES NOT SPECIFIED	SHARK, MAKO, SHORTFIN
CRAB, SPIDER	SHARK, MAKO, SPECIES NOT SPECIFIED
CREVALLE	SHARK, NOT SPECIFIED
CROAKER, ATLANTIC	SHARK, NURSE
CRUSTACEANS,SPECIES NOT SPECIFIED	SHARK, PORBEAGLE
CUNNER	SHARK, SANDBAR
CUSK	SHARK, THRESHER
CUTLASSFISH, ATLANTIC	SHARK, THRESHER, BIGEYE
DOGFISH, CHAIN	SHARK, TIGER
DOGFISH, SMOOTH	SHARK, WHITE
DOGFISH, SPECIES NOT SPECIFIED	SHARK, WHITETIP
DOGFISH, SPINY	SHEEPSHEAD
DOLPHIN FISH / MAHI-MAHI	SHRIMP (MANTIS)
DRUM, BLACK	SHRIMP (PANAEID)
DRUM, SPECIES NOT SPECIFIED	SHRIMP (PANDALID)
EEL, AMERICAN	SHRIMP, SPECIES NOT SPECIFIED
EEL, CONGER	SILVERSIDES, ATLANTIC
EEL, SPECIES NOT SPECIFIED	SKATE WINGS
FLOUNDER, AMERICAN PLAICE /DAB	SKATE WINGS, CLEARNOSE
FLOUNDER, FOURSPOT	SNAIL,MOON
FLOUNDER, SAND-DAB / WINDOWPANE / BRILL	SNAPPER, OTHER
FLOUNDER, SOUTHERN	SNAPPER, RED

FLOUNDER, SUMMER / FLUKE
FLOUNDER, WINTER / BLACKBACK
FLOUNDER, WITCH / GRAY SOLE
FLOUNDER, YELLOWTAIL
FLOUNDER,NOT SPECIFIED
GROUPER, OTHER
GROUPER, SNOWY
HADDOCK ROE
HAKE, OFFSHORE
HAKE, RED / LING
HAKE, SILVER / WHITING
HAKE, WHITE
HAKE,SPOTTED
HALIBUT, ATLANTIC
HARD QUAHOG
HARVEST FISH
HERRING, ATLANTIC
HERRING, BLUE BACK
HERRING,ATLANTIC THREAD
HERRING/SARDINES,SPECIES NOT SPECIFIED
JACK,ALMACO
JOHN DORY
LADYFISH
LOBSTER, AMERICAN
LUMPFISH
MACKEREL, ATLANTIC
MACKEREL, CHUB
MACKEREL, FRIGATE
MACKEREL, KING
MACKEREL, SPANISH
MARLIN, BLUE
MENHADEN
MOLLUSKS,SPECIES NOT SPECIFIED
MONK LIVERS
MULLETS
NEEDLEFISH, ATLANTIC
OCEAN POUT
OCEAN SUNFISH / MOOLA
SPADEFISH
SPOT
SQUID / ILLEX
SQUID / LOLIGO
SQUID, SPECIES NOT SPECIFIED
SQUIRRELFISH
STARFISH
STARGAZER,NORTHERN
STING RAYS,SPECIES NOT SPECIFIED
STRIPED BASS
STURGEON, ATLANTIC
SWORDFISH
TAUTOG
TILEFISH
TILEFISH, BLUELINE
TILEFISH, GOLDEN
TILEFISH, SAND
TOADFISH, OYSTER
TRIGGERFISH
TRIGGERFISH,GRAY
TUNA, ALBACORE
TUNA, BIG EYE
TUNA, BLUEFIN
TUNA, LITTLE
TUNA, SKIPJACK
TUNA, SPECIES NOT SPECIFIED
TUNA, YELLOWFIN
TURTLE, LEATHERBACK
WAHOO
WEAKFISH / SQUETEAGUE / GRAY SEA TROUT
WEAKFISH, SPOTTED / SPOTTED SEA TROUT
WHELK, CHANNELED/BUSHEL
WHELK, KNOBBED/BUSHEL
WHELK, LIGHTNING
WHELK,WAVED
WHITING, KING / KINGFISH
WOLFFISH / OCEAN CATFISH

Table A4. Average annual landings from Sunrise WLA by port.

Port	*Mean* Value/year (2020 $)	*Mean* Landings/year (lbs)	*Standard Deviation* Value/year (2020 $)	*Standard Deviation* Landings/year (lbs)
ALL_OTHERS	53,195	71,187	114,525	143,689
ATLANTIC CITY	0	0	0	0
BARNEGAT	0	0	0	0
BARNSTABLE	43	16	148	54
BEAUFORT	2,605	1,008	2,843	1,129
BELFORD	48	20	166	71
BOSTON	1,512	2,692	2,434	5,682
BRISTOL	0	0	0	0
CAPE MAY	903	419	1,692	1,081
CHATHAM	5,033	4,278	11,127	9,439
CHILMARK	4,785	973	7,195	1,565
CHINCOTEAGUE	57	20	198	68
DAVISVILLE	1,318	1,746	3,174	5,535
FAIRHAVEN	16,201	10,368	26,977	17,169
FALL RIVER	2,931	10,891	4,303	17,377
FALMOUTH	0	0	0	0
FREEPORT	0	0	0	0
GLOUCESTER	3,693	27,040	12,275	90,800
HAMPTON	6,389	3,140	11,196	6,034
HAMPTON BAY	28	21	67	53
HARWICHPORT	1,111	207	3,051	567
HYANNIS	0	0	0	0
ISLIP	0	0	0	0
JAMESTOWN	0	0	0	0
LITTLE COMPTON	226,334	259,258	107,800	134,413
LONG BEACH	0	0	0	0
MENEMSHA	5,425	957	10,326	1,659
MONTAUK	41,198	24,325	17,716	11,684
MOREHEAD CITY	0	0	0	0
MORICHES	0	0	0	0
NANTUCKET	0	0	0	0
NEW BEDFORD	875,504	887,422	548,737	669,281
NEW LONDON	7,504	8,638	7,769	9,456
NEW SHOREHAM	718	406	760	813
NEWPORT	138,952	181,915	68,718	91,330
NEWPORT NEWS	3,176	1,528	7,079	3,798
NORTH KINGSTOWN	0	0	0	0
OCEAN CITY	0	0	0	0
ORIENTAL	0	0	0	0
OTHER NASSAU	0	0	0	0
OTHER WASHINGTON(COUNTY)	0	0	0	0
POINT JUDITH	546,080	525,298	262,657	338,703

POINT LOOKOUT	0	0	0	0
POINT PLEASANT	3,422	1,664	4,334	2,086
SANDWICH	198	191	686	660
SHINNECOCK	262	254	790	780
STONINGTON	20,969	9,586	27,023	7,596
TIVERTON	38,976	48,182	54,191	63,536
VINEYARD HAVEN	0	0	0	0
WANCHESE	1,321	501	3,633	1,376
WESTPORT	48,050	35,531	25,949	31,021
WILDWOOD	0	0	0	0
WOODS HOLE	5,680	731	13,266	1,708

Table A5. Average annual landings from Sunrise ECRA (note: not ECC) by ports.

	Mean		***Standard Deviation***	
Port	**Value/year** (2020 $)	**Landings/year** (lbs)	**Value/year** (2020 $)	**Landings/year** (lbs)
ALL_OTHERS	143,117	176,898	191,660	245,183
ATLANTIC CITY	77,527	70,495	121,388	109,654
BARNEGAT	8,747	1,120	17,512	1,775
BARNSTABLE	0	0	0	0
BEAUFORT	17,715	6,051	21,168	6,382
BELFORD	7,339	3,311	16,143	7,042
BOSTON	855	971	1,400	1,483
BRISTOL	0	0	0	0
CAPE MAY	148,766	105,942	131,194	162,371
CHATHAM	382	231	897	619
CHILMARK	452	119	1,175	309
CHINCOTEAGUE	3,435	1,466	4,610	1,872
DAVISVILLE	13,160	5,945	33,605	16,782
FAIRHAVEN	59,094	7,831	86,941	11,476
FALL RIVER	8,662	41,781	13,879	75,814
FALMOUTH	0	0	0	0
FREEPORT	1,647	547	2,141	764
GLOUCESTER	17,206	103,963	36,986	216,104
HAMPTON	27,393	11,062	27,288	11,932
HAMPTON BAY	408,225	225,944	226,863	123,057
HARWICHPORT	243	26	841	90
HYANNIS	103	14	358	48
ISLIP	50	20	173	68
JAMESTOWN	0	0	0	0
LITTLE COMPTON	60,734	60,342	54,955	45,630
LONG BEACH	283	56	980	193
MENEMSHA	137	22	474	77
MONTAUK	619,147	338,770	191,638	82,674
MOREHEAD CITY	115	46	400	159
MORICHES	31,172	15,133	58,495	29,523
NANTUCKET	0	0	0	0

NEW BEDFORD	4,596,922	3,057,161	2,003,902	1,387,470
NEW LONDON	273,333	166,851	170,528	85,708
NEW SHOREHAM	5,998	4,614	12,427	10,998
NEWPORT	177,602	160,773	219,187	55,484
NEWPORT NEWS	40,413	7,714	42,981	7,040
NORTH KINGSTOWN	6,012	17,829	14,411	44,701
OCEAN CITY	1,644	428	3,216	808
ORIENTAL	339	142	813	334
OTHER NASSAU	123	120	425	414
OTHER WASHINGTON(COUNTY)	746	486	2,584	1,685
POINT JUDITH	970,922	779,532	407,242	169,347
POINT LOOKOUT	4,591	2,701	7,604	4,907
POINT PLEASANT	142,124	92,041	61,216	62,891
SANDWICH	0	0	0	0
SHINNECOCK	678,485	487,859	244,769	181,403
STONINGTON	165,057	66,856	90,279	34,459
TIVERTON	18,375	30,325	23,482	32,619
VINEYARD HAVEN	0	0	0	0
WANCHESE	2,741	1,040	4,033	1,463
WESTPORT	19,252	13,665	10,888	8,472
WILDWOOD	1,283	182	4,443	632
WOODS HOLE	106	16	366	54

Table A5. Complete list of ports (including those in ALL_OTHERS).

AMAGANSETT	*NEW YORK CITY*
ATLANTIC CITY	*NEWINGTON*
BARNEGAT	*NEWPORT*
BARNSTABLE	*NEWPORT NEWS*
BASS RIVER	*NIANTIC*
BEAUFORT	*NOANK*
BELFORD	*NORTH KINGSTOWN*
BOSTON	*OCEAN CITY*
BRISTOL	*OLD SAYBROOK*
BROAD CHANNEL	*ORIENT*
BROOKLYN	*ORIENTAL*
CAPE MAY	*OTHER BEAUFORT(COUNTY)*
CHATHAM	*OTHER BRONX*
CHESAPEAKE BEACH	*OTHER CAPE MAY*
CHILMARK	*OTHER CITY OF HAMPTON*
CHINCOTEAGUE	*OTHER CURRITUCK*
CITY OF SEAFORD	*OTHER DUKES*
DANVERS	*OTHER MAINE*
DARTMOUTH	*OTHER NEWPORT*
DAVISVILLE	*OTHER NORTHAMPTON*

DUXBURY
EAST HAMPTON
ENGELHARD
FAIRHAVEN
FALL RIVER
FALMOUTH
FREEPORT
GLOUCESTER
GREENPORT
GROTON
GUILFORD
HAMPTON
HAMPTON BAY
HARWICHPORT
HIGHLANDS
HOBUCKEN
HYANNIS
ISLIP
JAMESTOWN
LITTLE COMPTON
LONG BEACH
MANASQUAN
MARBLEHEAD
MARSHFIELD
MASTIC
MATTITUCK
MENEMSHA
MONMOUTH
MONTAUK
MONTVILLE
MOREHEAD CITY
MORICHES
MYSTIC
NANTUCKET
NEW BEDFORD
NEW LONDON
NEW SHOREHAM
OTHER NY
OTHER SUFFOLK
OTHER VIRGINIA
OTHER WASHINGTON
OTHER WASHINGTON(COUNTY)
OYSTER
POINT JUDITH
POINT LOOKOUT
POINT PLEASANT
PORTLAND
PROVIDENCE
PROVINCETOWN
PT. PLEASANT
ROCKLAND
ROCKPORT
SACO
SANDWICH
SHELTER ISLAND
SHINNECOCK
SMITHTOWN
SOUTH KINGSTOWN
SOUTHOLD
STONINGTON
SWAN QUARTER
TIVERTON
VINALHAVEN
VINEYARD HAVEN
VIRGINIA BEACH
WAKEFIELD
WANCHESE
WARREN
WATERFORD
WESTERLEY
WESTPORT
WILDWOOD
WOODS HOLE

September 29, 2023

Funds Overview

Sunrise Wind, Fisheries Compensatory Mitigation

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Commercial and Community Funds

Commercial Fisheries Compensation Fund

Objective: Direct financial compensation to commercial and for-hire fishers

Eligible Parties: Commercial and for-hire fishers

Administration: Claims process managed by third party (TAP) with support from fisheries liaison

Process:

- Sunrise Wind funds escrow account
- Eligibility period, if used by TAP, to pre-qualify fishers based on historical activity in the Project area
- Eligible fishers submit claims to TAP
- TAP processes claims and directs compensation from escrow

Coastal Community Fund

Objective: Funding to benefit the general fishing community and associated industries

Eligible Parties: Fishing community and associated industries

Administration: Escrow and general administration managed by independent council of fisheries representatives in concert with MA CZM

Process:

- Sunrise Wind funds escrow account
- Eligible parties submit proposals for grants and/or direct payments
- Independent council of fisheries representatives advises DMF Director on proposals to be funded
- DMF directs funds from escrow
- Periodical review to assess distribution among commercial and community funds

Navigational Enhancement and Training Program

Objectives: 1) enable commercial fishermen and for-hire vessels to acquire navigation equipment through a grant/voucher system and 2) provide training and experiential learning opportunities to those navigating the Orsted/Eversource lease areas.

Navigation Equipment

- Fishers eligible for the Commercial Fisheries Compensation Fund will automatically be eligible for a voucher to purchase navigation equipment.
- One-time grants in the form of a voucher of up to $10,000 will be available for each commercial vessel and inspected for-hire vessel and $5,000 for any uninspected for-hire vessel that does not already have navigation equipment.
- The process will be administered by the Technical Assistance Provider (TAP).

Professional Training & Experiential Learning

- Private anglers, charter captains, or commercial fishing industry members with a valid saltwater fishing license (federal or State) may attend a simulator session held at USMRC in Middletown, RI. Attendees will have the opportunity to navigate a vessel through a windfarm and experience various scenarios such as night conditions, adverse weather, and vessel crossings.
- Fishers in the commercial, for-hire, or party industries may attend one eligible professional training of their choosing up to $1,000 per person. Eligible trainings include but are not limited to a captain's course, license upgrade, or rules of the road refresher.

Sunrise Wind - Compensatory Mitigation Package

Commercial Fisheries Compensation Fund	$9,788,000
Coastal Community Fund	$1,000,000
Navigational Enhancement & Training Program	$500,000
Total Compensation (present value)	$11,288,000

August 24, 2023

Sunrise Wind

Fisheries Compensatory Mitigation Package

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Sunrise Wind Fisheries Exposure Analysis

Marine Policy Center, Woods Hole Oceanographic Institution, August 23, 2023

Categories of Potential Exposure		MA Direct Landed Value/Revenue (2023$)
Construction-related effects	WLA+	$2,523,000
	ECRA	$206,000
Effects during operations	WLA	$840,000
	ECRA	---
Decommissioning-related effects	WLA	$133,000
	ECRA	$15,000
Subtotal MA commercial direct effects		**$3,718,000**
MA for-hire charter fishing direct effects		$294,000
Total MA direct effects		**$4,012,000**

Categories of Potential Exposure	MA Total Impact with Multipliers (2023$)
Subtotal MA commercial fishing	**$8,198,000**
MA for-hire charter fishing	$479,000
Total Massachusetts impacts	**$8,677,000**

Compensatory Mitigation Package

1. Commercial Fisheries Compensation Fund: **$10,388,000**

Objective: Direct financial mitigation to commercial and for-hire fishers

2. Coastal Community Fund: **$400,000**

Objective: Benefit the fishing community and associated industries

3. Navigational Enhancement & Training Program: **$500,000**

Objective: 1) enable acquisition of navigation equipment and 2) provide training and experiential learning

Total Compensation (present value): **$11,288,000**

Incorporates BOEM draft guidance loss percentages

Maintains WHOI loss assessment for construction and decommissioning and economic multipliers

Commercial and Community Funds

1. Commercial Fisheries Compensation Fund

Who: Commercial and for-hire fishers operating in the Project area

How: Direct payments in response to claims

- Eligibility period to pre-qualify fishers based on defined eligibility requirements
- Payments based on historical activity in the Project area
- Escrow and program administration managed by independent third party

2. Coastal Community Fund

Who: General fishing community and associated industries

How: Grants and direct payments in response to proposals

- Selection of project funding made by an independent council formed with fisheries input
- Escrow and program administration managed by independent third party

3. Navigational Enhancement and Training Program

Objectives: 1) enable commercial fishermen and for-hire vessels to acquire navigation equipment through a grant/voucher system and 2) provide training and experiential learning opportunities to those navigating the Orsted/Eversource lease areas

Navigation Equipment

- Fishers eligible for the Commercial Fisheries Compensation Fund will automatically be eligible for a voucher to purchase navigation equipment.
- One-time grants in the form of a voucher of up to $10,000 will be available for each commercial vessel and inspected for-hire vessel and $5,000 for any uninspected for-hire vessel that does not already have navigation equipment.
- The process will be administered by the Technical Administration Provider (TAP) selected to manage the Commercial Fisheries Compensation Fund.

Professional Training & Experiential Learning

- Private anglers, charter captains, or commercial fishing industry members with a valid saltwater fishing license (federal or State) may attend a simulator session held at USMRC in Middletown, RI. Attendees will have the opportunity to navigate a vessel through a windfarm and experience various scenarios such as night conditions, adverse weather, and vessel crossings.
- Fishers in the commercial, for-hire, or party industries may attend one eligible professional training of their choosing up to $1,000 per person. Eligible trainings include but are not limited to a captain's course, license upgrade, or rules of the road refresher.

NEW BEDFORD
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February 13, 2023

I am writing on behalf of the New Bedford Port Authority to offer some preliminary comments regarding the draft Fisheries Exposure in Massachusetts reports prepared by the Woods Hole Oceanographic Institution (WHOI) for the Sunrise and Revolution offshore wind developments. As the most valuable fishing port in the nation and the hub for countless onshore businesses and families who rely on the industry, we believe that it is vital that the actual impact of the development of offshore wind on the economy and people of Massachusetts be established using the best available data, methods and information.

As indicated in the reports, WHOI estimates that Sunrise wind will have a total impact on the commercial fishing economy in Massachusetts during the 30-year lifespan of the project of $4,926,000. This includes an estimated loss of only $629,000 "from forgone fishing during the wind farm's operation." WHOI estimates that the total impact of the Revolution wind project will be $2,740,000 for the entire 30 years, with $347,000 of total loss "from forgone fishing during the wind farm's operation." It is our position that these numbers drastically underestimate the impact of these developments, especially during the operational phase.

We would like to offer the following specific issues with the reports:

- The analysis limits its estimated permanent loss to fishing area to a small portion of the Wind Farm area. This is based on 100-meter area around the turbines (1% 0f the wind farm area) that is then expanded to 5% of the total area of the lease. The report takes no account for tides, currents, wind other vessels in the area in the area. No dragger or scalloper captain (even single dredge vessels) under any seas or wind would fish anywhere near a distance of 100 meters of a turbine tower. They will likely try to stay ½ mile away. It is highly doubtful that even lobster captains would go that close with any wind etc. The relatively small area designated for lost fishing during operations is what drives the extremely low estimated loss of fishing revenue during operation of the wind farm ($629K and $347K respectively). The actual area within the wind energy areas that will be functionally off limits to commercial fishing for logistical or safety reasons is almost certain to be vastly larger than the 100-meter boundary that was analyzed.

- The report mentions ecological effects affecting stocks but only takes these effects into consideration during the construction and decommissioning phases but not during operations. There needs to be a clear justification why impacts and constraints on fishing in the wind energy areas during the operations were not calculated.

- The report cites some studies that show positive and negative effects from wind turbines and assumes that they cancel each other out. Positive effects are based on attraction of fish, lobsters and crabs to artificial reefs and wrecks. The vast majority of the studies are also not based in the waters in question or the fisheries at issue. The only study remotely relevant is on the Block Island Wind farm, a far smaller demonstration-scale wind operation. Further, even a cursory review of commercial fishing data shows that the Block Island area is not a key commercial fishing ground and is not in any way a key scallop area. Among those concerns previously brought up by commercial fishermen regarding offshore wind are noise from the construction and operation of wind turbines potentially driving fish away and undersea foundations risk becoming artificial reefs that alter the distribution of species in wind lease areas. Wind turbines may also alter ocean currents in a way that affects the mid-Atlantic "cold pool", a vast area of cold water near the seafloor that allows numerous species, including scallops, clams and flounder, to thrive. In fact, the artificial reef effect of the installation is a detriment to the most valuable fishery in the country, scallops. One of the only areas where the impact of offshore wind installations is well documented is that wind energy areas create an artificial reef environment. Studies have indicated that the artificial reef has multiple negative impacts upon the ecosystem. The addition of scour pads creates habitat where there was none previously. Scallops are predominately found in areas with sandy bottom with no rocks. The introduction of an artificial reef in productive scallop habitat brings in homes for scallop predators like cod, wolffish, eel pout, crabs and sea stars where there were none previously. As there simply are no studies addressing the potential impact upon the most valuable fishery in these wind areas, any estimate of exposure must err on the side of there being a significant impact.

- As noted above, the report estimates the permanent loss of fishing revenues during operations of the wind farm by calculating the present value of 5% of baseline values for a 30-year period beginning in 2025. This commonly used method estimates revenues and cost for each of the 30 years and discounts the net revenue back to the present by discounting for time. Revenues in the future are worth less in the present because of the loss of interest that could have been collected. The calculation depends on estimating future revenues and costs and the discount rate. The report uses the historical average (2000-2021) of the producer price index as the expected increase in prices (p. 17 & 18) to estimate future ex-vessel prices for fish and shellfish. Fish prices are increasing at a rate more than the 3.7% used in the estimates. The report also overestimates the discount rate by using a rate of 5%, which is far more than the rate in recent years. In short, the report underestimates future price increases in the wind farm for fish & shellfish. This significantly underestimates future losses in ex-vessel revenue from fish & shellfish.

- The report states that it only included revenue and not costs in the calculations, but this is not accurate. Costs are included in the multipliers (Table 22, p. 33)

- Present Value (PV) is a financial model generally used for financial investments. While we understand that it is a generally accepted tool, fishermen are not investors. If history has shown us anything when it comes to fishermen, it has shown that they continue to fish during the lean times as well as the boom times. A better calculation might be to use the basic number of lost revenue over the 30-year span, If the reported numbers are truly to be considered "conservative" they must assume the higher number for lost revenue.

The reports both contain the following disclaimers twice in each report:

> "There is considerable variability in the baseline data of landings and landed value from the xxxxxxxxx lease area and export cable corridor. Baseline future landings will vary due to natural and fisheries-related fluctuations in stocks and prices. There is also uncertainty about the effects of wind farm construction and operation on fish stocks and landings, and about the ways that fishers will adapt their fishing practices in response to wind farm development. We consider our combined estimate of about xxxxx million in economic exposure for Massachusetts commercial and charter fishing from xxxxxxxxxx development to be a conservative upper bound on likely actual losses."

> "There is considerable variability in the baseline data of landings and landed value from the xxxxxxxx areas. Baseline future landings will vary due to natural and fisheries-related fluctuations in stocks that are likely to be amplified by climate change effects. There is also uncertainty about the impact of wind farm construction and operation on fish stocks and landings, and about the ways that fishers will adapt their fishing practices in response to wind farm development. We consider our combined estimate of xxxxxxx million in economic impacts to Massachusetts from xxxxxxxx development effects on commercial and charter fishing to be a conservative upper bound on likely actual impacts."

These quotes state there is uncertainty involving "future landings", "stock fluctuations", "climate change", and the "ways fishers will adapt their fishing practices" in response to the wind farms. The quotes go on to state that for these reasons, they feel that the estimated losses are the "upper bound" of the losses. In other words, the authors are assuming there may be less fishermen and less fish due to other things besides offshore wind and that the fishermen will simply adapt and catch fish in a different way or different location. They make this assumption despite the fact that, as stated by the Rhode Island Fishermen's Advisory Board in their review of a WHOI report provided in connection with another development, "not once is mentioned any interview with an actual fisherman about what might take place during operations."

If the reports are truly to be considered as "conservative" and the "upper bound" of the losses suffered by commercial fishermen, shoreside businesses, and the communities that rely on their revenue, then the authors simply cannot make every assumption in favor of the wind operations. This goes for the actual fishing area impacted by operations, the impact of climate change and the behavior of the fishermen.

There are serious concerns within the commercial fishing industry about the potential impacts to their livelihoods from the construction and operations of the offshore wind developments. While the offshore wind industry is brand new to the United States and the northeast waters and has yet to become operational, the concerns and uncertainty of the fishermen are certainly justified. All involved will readily admit that there are many unknowns related to those potential impacts. However, given the extent of the interventions in the marine environment from the construction of foundations, the undersea cables, and ongoing disruptions from vibrations, acoustics, substation operations and other activities, not to mention the challenges of either fishing within or traversing through the wind energy areas, it is more than reasonable to expect there will be significant adverse impacts to commercial fishing. Exposure analyses such as these that seem to suggest negligible impacts can only serve to sow doubt within the commercial fishing industry that their concerns are being taken seriously now and will be acknowledged and addressed when they are experienced in the coming years. This doubt is only amplified when the analysis comes from such a respected organization as WHOI. The level of uncertainty around the impacts demands a sober assessment and preparation for what those impacts could be. If such anticipated impacts end up not materializing in the future, that will be demonstrated by continued productive fishing, and measures to provide support for the fishermen will prove unnecessary. However, it will be too late to help them if these negative impacts are experienced, and no sufficient mechanism was put in place due to unrealistic exposure analyses that were based on the narrowest possible metrics and assumptions. It is also critical to remember that none of these reports consider the cumulative impact of all of the wind areas together. Any error or assumption must be in favor of the group whose livelihood is at stake.

Regards,

Blair S. Bailey
General Counsel

From: Beth Casoni <beth.casoni@lobstermen.com>
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Subject: RE: Reminder: Fishing Industry meeting re: Sunrise Wind and New England Wind fisheries compensatory mitigation

Good morning Lisa,

After looking over the presentations by both companies on the economic impact to the industry seems to be low in the funding for their mitigation packages.

Avangrid is applying a multiplier of 1.83 upstream and .83 downstream for their estimates which is extremely low.

Orsted doesn't give their multiplier while their overall package seems higher, but this is where most of the fleet is fishing as this is hard bottom and the fishing industry will be greatly impacted for years to come.

When we talk about the economic impact of the lobster fishery, we use a ~3.5 multiplier collectively. The cost of doing business has gone up over 400% and the industry has not seen a cost increase for their goods over the last twenty years. The ex-vessel paid to the lobstermen has ranged from an average of $4.55lb. in 2004 to $4.66lb. in 2020 and $7.36lb. in 2021 which was an anomaly. (*Please see the MADMF Lobster Tables attached for your review. Once I have the 2022 table, I will share these with you so that you can see the price drop from 2021.)*

I would ask that the government and industries collectively develop an acceptable multiplier for all mitigation packages to follow. This is such a critical component of all of these mitigation talks that it should not be left up to one publication or academic institution.

If you have any questions, please feel free to give me a call on cell.

Thank you for your thoughtful consideration on our comments.

Kind regards,

Beth Casoni
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