Rhode Island Fisheries Exposure

from the Sunrise Wind Lease Area and the Sunrise Export Cable Route

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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 $2.40 million (2020$), or $5,567/km^2/year. Of this, $1.19 million is landed in Rhode Island. Including indirect and induced effects, these landings generate average annual economic impacts of $2.55 million in Rhode Island.

We estimate the average annual value of commercial landings from the 180 m wide Sunrise Wind Export Cable Corridor to be $151,000, or $5,694/km^2/year. Of this, $23,000 is landed in Rhode Island. These landings generate estimated total annual economic impacts of $51,000 in Rhode Island.

We estimate that a total (lump sum) of $2,883,000 (2020$) of commercial fisheries value landed in Rhode Island is potentially exposed to the Sunrise Wind Farm development. This accounts for about 48% of the total potentially exposed commercial landed value from Sunrise Wind. It includes about $2,088,000 in direct landed value forgone due to construction-related effects, $681,000 from forgone fishing during the wind farm's operation, and $113,000 in present value of landings from decommissioning. Including indirect and induced effects, the potentially affected commercial landings result in about $6,251,000 in total (lump sum) present value economic impact in Rhode Island.

We estimate the average annual economic impact from Rhode Island-based for-hire charter fishing in and around the Sunrise Wind Lease Area to be between $317,000 and $511,000, and between $135,000 and $218,000 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 $718,000 (2020$) in economic impact from Rhode Island-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 $6.97 million in economic impact to Rhode Island 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 Rhode Island ports, and the potential exposure of Rhode Island-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.

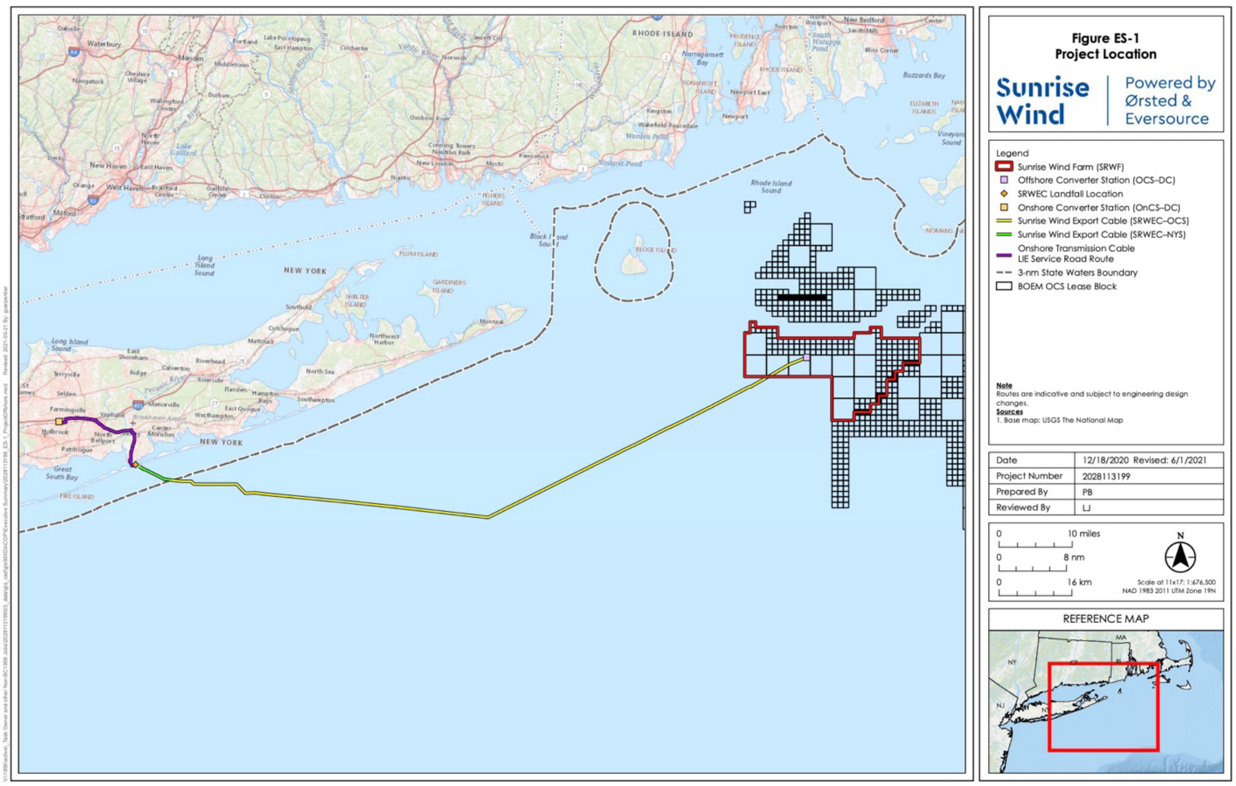

Figure 1. Sunrise Wind Lease Area and export cable route. Source: Sunrise Wind.

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 (km2)	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 Rhode Island, 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 Rhode Island 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 Rhode Island 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 Rhode Island 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 Rhode Island 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

[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.

areas, states, and mesh sizes (NEFSC 2013). For Rhode Island vessels, the observer program covered around 8% of trips with trawl gear and around 3% 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 (ECC) are calculated by applying the factors in Table 1 to the landings estimated for the ECRA. 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, bluefish).

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

Commercial Fishery Landings from Wind Energy and Export Cable Route Areas

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 $)	Landings/year (lbs)	***Standard Deviation*** Value/year (2020 $)	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.

	Mean		***Standard Deviation***	
Gear	**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.

	Mean		***Standard Deviation***	
Area/Port	**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

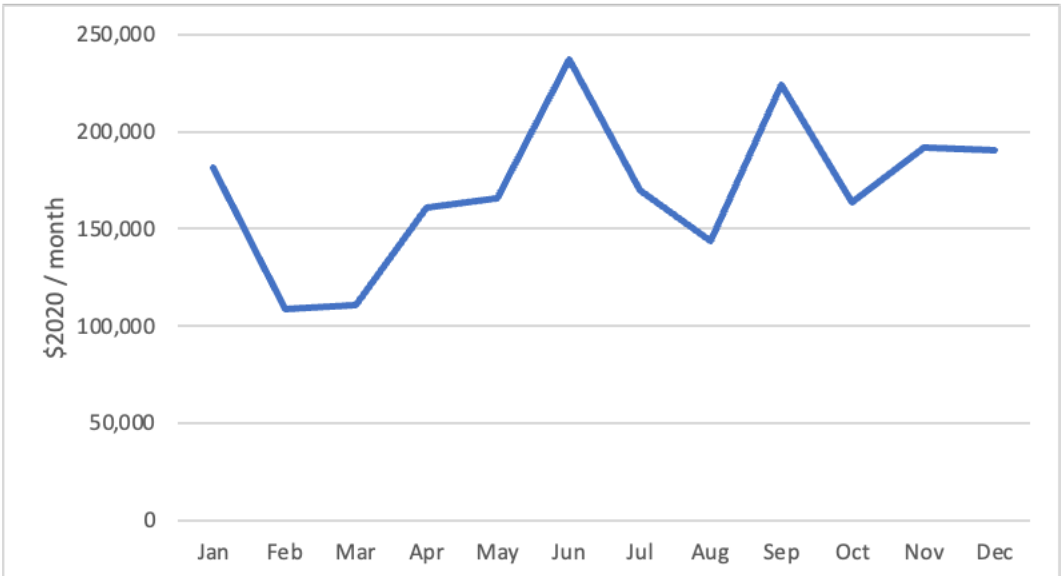

Figure 2. Average monthly value of landings, Sunrise WLA, 2014-2019.

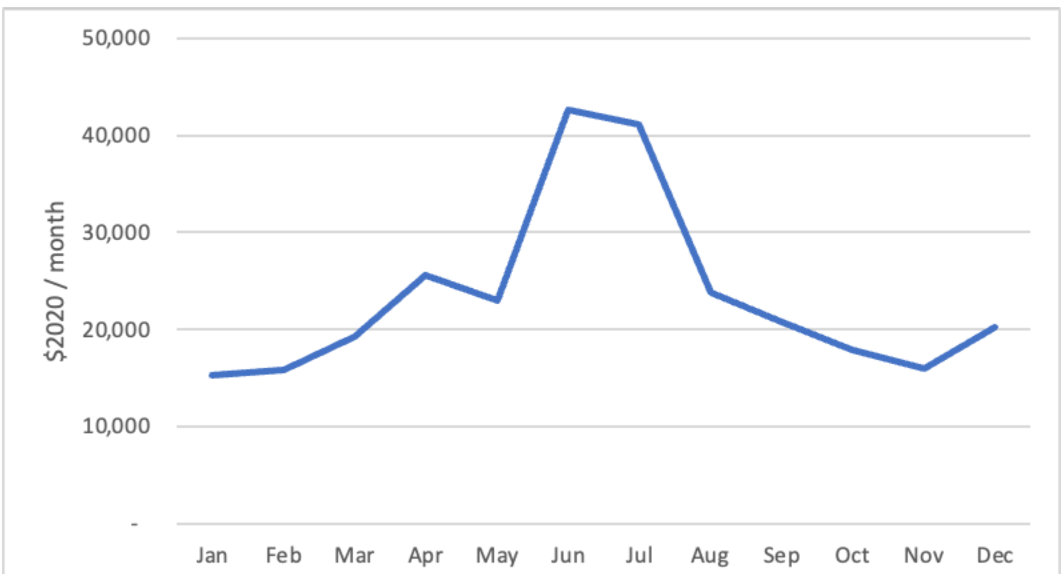

Figure 3. Average monthly value of landings, Sunrise ECC, 2014-2019.

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	351,981	5,019
Adjusted Jonah crab $/year	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 Rhode Island from the Sunrise WLA to be about $1.16 million (2020$), and from the Sunrise ECC about $23,000.

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 Rhode Island 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 Rhode Island is 1.84.

We have also taken into account downstream economic activity, such as seafood processing, that may take place at Rhode Island 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 0.379, based on discussion with Rhode Island seafood industry representatives, to the multiplier for Rhode Island landings, bringing the combined multiplier to 2.219, 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 Massachusetts landings is 2.205; 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 Rhode Island 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 Rhode Island (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	RI	1,034,911	1,157,076	1,187,617	2,546,580
Sunrise ECC	RI	22,213	22,925	23,103	50,748

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 $2.55 million in Rhode Island (Table 12). We also estimate the average annual total economic impact from commercial fishing activity in the Sunrise ECC to be about $51,000 in Rhode Island. 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)	2 years
			Other shellfish landings reduced 10% (c)	5 years
	ECRA	1.6km WA	All landings reduced 10% (d)	1 year
		180m ECC	Lobster/crab landings reduced 25% (e)	2 years
			Other shellfish landings reduced 25% (f)	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)	1 year
			Other shellfish landings reduced 12.5% (m)	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 Rhode Island 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
RI landed value:	**1,187,617**		**205,360**	**23,103**
Lobster & Jonah crab	234,150		12,135	1,365
Other crabs	1,383		378	43
Scallops	119,157		298,546	33,586
Other shellfish	2,036		843	95
Finfish/mobile species	830,891	2,058,408	321,322	36,149

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 7.5 km buffer around the WTGA and the ECC.

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

Area	**Estimated Landed Value Exposure** (2020$)	
	Total	**Rhode Island**
Sunrise WLA / WTGA + 7.5km	4,105,647	2,022,294
Export Cable Corridor / WA	298,817	66,250

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 $2.08 million is associated with landings in Rhode Island.

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 value of potential lost landings during project operations is $1,374,953, of which $681,167 is associated with landings in Rhode Island.

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 $112,967 is associated with landings in Rhode Island.

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 $5.7 million is associated with the WLA (plus 7.5 km perimeter) and $321,000 is associated with the ECC. Rhode Island landings account for about 50% of total landings from the WLA and 15% of total landings from the ECC. The landed value of Rhode Island commercial landings potentially exposed by Sunrise Wind development is therefore about $2.88 million. This includes about $2.09 million in forgone landings due to construction, $681,000 during operations, and $113,000 during decommissioning.

Applying the upstream and downstream multipliers as described above results in an estimate of $3.37 million in indirect and induced effects in Rhode Island, for a total impact of $6.25 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 2020$) of the amounts BOEM recommends making available for potential losses to Rhode Island-based commercial fishing during the first five years of operations amount to $2.95 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.

Rhode Island-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 from Block Island to Nantucket, 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 Rhode Island	24.5
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 Rhode Island	10.5

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 Rhode Island. 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 + 7.5 km buffer (Table 17).

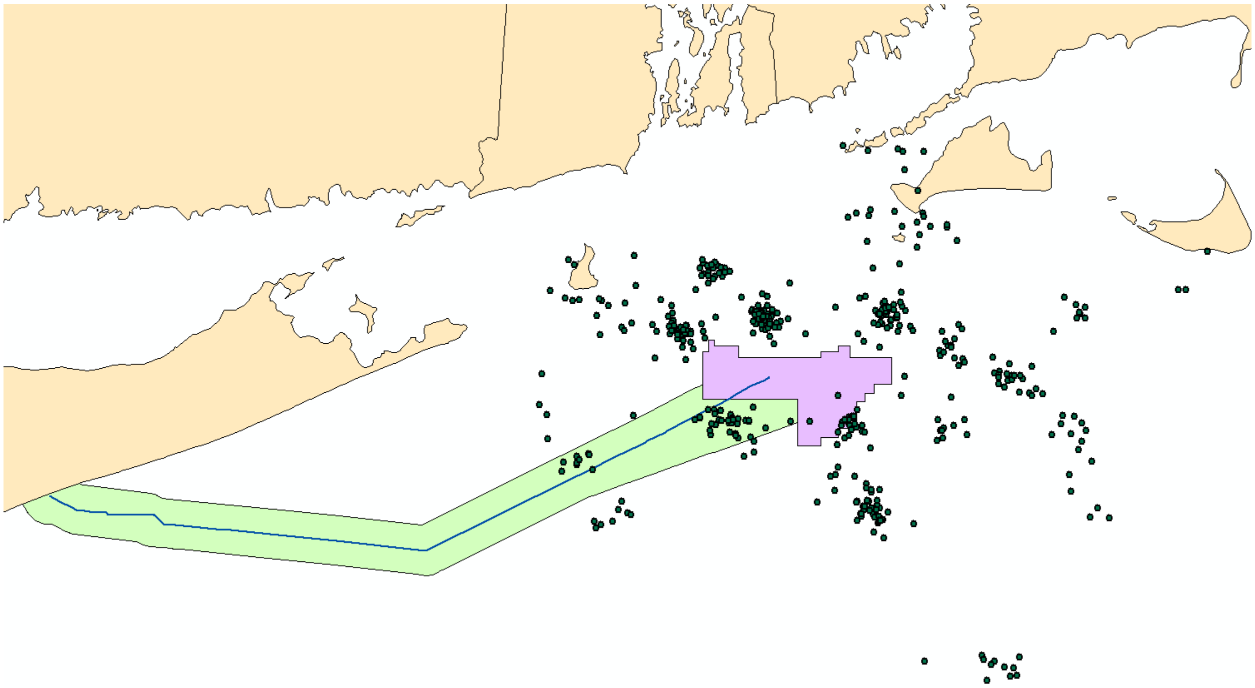

Figure 4. Charter fishing locations, 2017-2021, identified in survey responses. WLA is shown in purple, and ECRA in green.

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

Year	**WLA + 7.5 km buffer**		**WTGA + 7.5 km buffer**	
	Vessel Trips	**Anglers**	**Vessel Trips**	**Anglers**
2017	157	894	108.5	625
2018	145.5	857	124.5	731
2019	114	651	71	407
2020	108.5	598	73	386
2021	172	947	135	739
Average	**139.4**	**789.4**	**102.4**	**577.6**

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

Year	Vessel Trips	Anglers
2017	43	244
2018	49.5	295
2019	70	417
2020	58	344
2021	72	381
Average	**58.5**	**336.2**

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 Rhode Island vessels responding to the survey (24.5) to the number of these vessels for which specific fishing locations were provided (10.5). 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 RI-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	789.4	106.15	Low: 2.333	195,525	1.622	317,141
			High: 3.763	315,362	1.622	511,517
WTGA+7.5km	577.6	106.15	Low: 2.333	143,064	1.622	232,050
			High: 3.763	230,749	1.622	374,275
ECRA	336.2	106.15	Low: 2.333	83,271	1.622	135,066
			High: 3.763	134,308	1.622	217,848

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 7.5 km 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 7.5 km buffer and the ECRA, ignoring any overlap. We use the combined high-end revenue and impact estimates ($315,362 + $134,308 and $511,517 + $217,848 per 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 $443,000 (2020$) in revenue, and $718,000 in total impact in Rhode Island.

Rhode Island-based private recreational fishing

We estimate that Rhode Island-based private recreational fishing in the Sunrise Wind WLA amounts to about 1,470 trips per year, and annual expenditure of about $126,000 (2020$). This estimate is based on Marine Recreational Information Program (MRIP[6]) data on RI-based private recreational fishing effort in federal waters, assuming that this fishing effort is uniformly distributed over the known recreational and for-hire fishing grounds in federal waters, and the intersection of RI OSAMP recreational fishing maps and our for-hire charter fishing survey with the Sunrise WLA.

Some of this recreational fishing is likely to be diverted to other locations during the Sunrise construction period. During Sunrise Wind operations, we expect recreational fishing in the Sunrise WLA to be at or above pre-construction levels,[7] due to fish aggregations around wind farm structures. On aggregate over the life of the project, we expect no net change in RI-based recreational fishing economic value from the Sunrise Wind development.

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 $1,188,000 is landed in Rhode Island. Including indirect and induced effects, these landings generate average annual economic impacts of $2,547,000 in Rhode Island.

We estimate the average annual value of commercial landings from the Sunrise Wind Export Cable Corridor to be about $151,000. Of this, about $23,000 is landed in Rhode Island. These landings generate estimated total annual economic impacts of $51,000 in Rhode Island.

We estimate that a total (lump sum) of $2,883,000 (2020$) of commercial fisheries value landed in Rhode Island is potentially exposed to the Sunrise Wind development. This accounts for about 48% of the total potentially exposed landed value for Sunrise Wind. It includes about $2,088,000 in direct landed value forgone due to construction activities, $681,000 from forgone landings during the wind farm's operation, and $113,000 in present value of foregone landings due to decommissioning.

Rhode Island-based charter fishing revenue exposure to the Sunrise Wind development is estimated to have a present value of $443,000.

Including indirect and induced effects, the potentially affected commercial landings and charter fishing revenue together result in about $6,969,000 in total (lump sum, 2020$) present value economic impact in Rhode Island. Table 21 summarizes these values.

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[6] https://www.fisheries.noaa.gov/recreational-fishing-data/about-marine-recreational-information-program

[7] Smythe et al. (2021) found that offshore wind farms did not necessarily conflict with angling, and the RI wind farm was viewed as an enhanced fishing destination.

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 $6.97 million in economic impacts to Rhode Island from Sunrise Wind development effects on commercial and charter fishing to be a conservative upper bound on likely actual impacts.

Table 21. Estimated Rhode Island fishing industries exposure from Sunrise Wind development

Categories of Potential Exposure		**RI Direct Landed Value/Revenue (2020$)**
Construction-related effects	WLA+	$2,022,000
	ECRA	$66,000
Effects during operations	WLA	$681,000
	ECRA	---
Decommissioning-related effects	WLA	$108,000
	ECRA	$5,000
Subtotal RI commercial direct effects		**$2,883,000**
RI for-hire charter fishing direct effects		$443,000
Total RI direct effects		**$3,325,000**

Categories of Potential Exposure	**RI Total Impact with Multipliers (2020$)**
Subtotal RI commercial fishing	**$6,251,000**
RI for-hire charter fishing	$718,000
Total Rhode Island impacts	**$6,969,000**

References

Bartley, M.L., P. English, J.W. King, and A.A. Khan; HDR. 2019. Benthic monitoring during wind turbine installation and operation at the Block Island Wind Farm, Rhode Island – Year 2. Final report to the US Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2019-019.

Benjamin, S., M.Y. Lee, and G. dePiper. 2018. Visualizing fishing data as rasters. NEFSC Ref Doc 18-12; 24 pp. https://www.nefsc.noaa.gov/publications/crd/crd1812/

Bergström, L., L. Kautsky, T. Malm, R. Rosenberg, M. Wahlberg, N. Åstrand Capetillo, and D. Wilhelmsson. 2014. Effects of offshore wind farms on marine wildlife – a generalized impact assessment. *Environmental Research Letters* 9(3).

Bureau of Ocean Energy and Minerals (BOEM), US Department of the Interior. 2022. Guidelines for mitigating impacts to commercial and recreational fisheries on the outer continental shelf pursuant to 30 CFR Part 585. https://www.boem.gov/sites/default/files/documents/renewable-energy/DRAFT%20Fisheries%20Mitigation%20Guidance%2006232022_0.pdf

California Department of Transportation. 2015. Technical guidance for assessment and mitigation of the hydroacoustic effects of pile driving on fish. Report #CTHWANP-RT-15-306.01.01.

Cape Cod Commission. 2020. Economic Impact of Cape Cod Harbors. October. https://capecodcommission.org/resource-library/file?url=%2Fdept%2Fcommission%2Fteam%2FWebsite_Resources%2Feconomicdevelopment%2FHarborStudyReport_Final.pdf

Dalton, T., M. Weir, A. Calianos, N. D'Aversa, and J. Livermore. 2020. Recreational boaters' preferences for boating trips associated with offshore wind farms in US waters. *Marine Policy* 122:103216. https://doi.org/10.1016/j.marpol.2020.104216

Küsel, E.T., M.J. Weirathmueller, M.@. Koessler, K.E. Zammit, J.E. Quijano, C. Kanu, K.E. Limpert, M.E. Clapsaddle, and D.G. Zeddies (JASCO). 2022. 2. Sunrise Wind Farm Project: Underwater Noise and Exposure Modeling. Document 02109, Version 7.0. Technical report by JASCO Applied Sciences for Sunrise Wind LLC. https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/SRW01_COP_Appl1_Underwater%20Acoustic%20Modelling%20Report_2022-08-19_508.pdf

DePiper, G.S. 2014. Statistically assessing the precision of self-reported VTR fishing locations. NOAA Technical Memorandum NMFS-NE-229. https://repository.library.noaa.gov/view/noaa/4806

Free, C.M., J.T. Thorson, M.L. Pinsky, K.L. Oken, J. Wiedenmann, and O.P. Jensen. 2019. Impacts of historical warming on marine fisheries production. *Science* 363:979-983.

Hoagland, P., T.M. Dalton, D. Jin and J.B. Dwyer. 2015. An approach for analyzing the spatial welfare and distributional effects of ocean wind power siting: the Rhode Island/Massachusetts Area of Mutual Interest. *Marine Policy* 58:51-59.

Hogan, F., B. Hooker, B. Jensen, L Johnston, A. Lipsky, E. Methratta, A. Silva, and A. Hawkins. 2023. Fisheries and Offshore Wind Interactions: Synthesis of Science. NOAA technical memorandum NMFS-NE 291. https://doi.org/10.25923/tcjt-3a69

Hooper, T., M. Ashley, and M. Austen. 2015. Perceptions of fishers and developers on the co-location of offshore wind farms and decapod fisheries in the UK. *Marine Policy* 61:16–22. https://doi.org/10.1016/j.marpol.2015.06.031

Hooper, T., C. Hattam, and M. Austen. 2017. Recreational use of offshore wind farms: experiences and opinions of sea anglers in the UK. *Marine Policy* 78:55-60. https://doi.org/10.1016/j.marpol.2017.01.013

IMPLAN Group. 2004. IMPLAN Professional: Social Accounting and Impact Analysis Software. 3rd Edition. Huntersville, NC.

Industrial Economics. 2015. Atlantic Large Whale Take Reduction Plan: Introduction to NMFS' Co-Occurrence Model. Presentation at Annual Meeting of the Marine Mammal Commission. May 6. Industrial Economics, Inc., Cambridge, MA.

Jin, D. 2015. Statistical Analysis of Trip Cost Data Collected by The Northeast Observer Program. Project Report. December 4. Woods Hole Oceanographic Institution, Marine Policy Center, Woods Hole, MA.

King, D.M. 2019. Economic exposure of Rhode Island commercial fisheries to the Vineyard Wind Project. Report prepared for Vineyard Wind LLC by King and Associates, Inc. Plymouth, MA.

Kirkpatrick, A.J., S. Benjamin, G.S. DePiper, T. Murphy, S. Steinback, and C. Demarest. 2017a. Socio-economic impact of Outer Continental Shelf wind energy development on fisheries in the U.S. Atlantic. Volume I – Report Narrative. U.S Dept. of the Interior, Bureau of Ocean Energy Management, Atlantic OCS Region, Washington, D.C. OCS Study BOEM 2017-012. 150 pp.

Kirkpatrick, A.J., S. Benjamin, G.S. DePiper, T. Murphy, S. Steinback, and C. Demarest. 2017b. Socio-economic impact of Outer Continental Shelf wind energy development on fisheries in the U.S. Atlantic. Volume II – Appendices. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Atlantic OCS Region, Washington, D.C. OCS Study BOEM 2017-012. 191 pp.

Kneebone, J. and C. Capizzano. 2020. A comprehensive assessment of baseline recreational fishing effort for highly migratory species in southern New England and the associated Wind Energy Area. Final report to Vineyard Wind LLC, May 4, 2020.

Langhamer, O. 2012. Artificial reef effect in relation to offshore renewable energy conversion: state of the art. *The Scientific World Journal*, 2012. https://doi.org/10.1100/2012/386713

Leung, D.Y.C. and Y. Yang. 2012. Wind energy development and its environmental impact: a review. *Renewable and Sustainable Energy Reviews* 16(1):1031–1039. https://doi.org/10.1016/j.rser.2011.09.024

Lindeboom, H.J., H.J. Kouwenhoven, M.J.N. Bergman, S. Bouma, S. Brasseur, R. Daan, R.C. Fijn, D. deHaan, S. Sirksen, R. van Hal, R. Hille Ris Lambers, R. ter Horstede, K.L. Krijgsveld, M. Leopold, and M. Scheidat. 2011. Short-term ecological effects of an offshore wind farm in the Dutch coastal zone; a compilation. Environmental Research Letters 6(3). https://doi.org/10.1088/1748-9326/6/3/035101

Lüdeke, J. 2017. Offshore wind energy: good practice in impact assessment, mitigation and compensation. *Journal of Environmental Assessment Policy and Management* 19(01):1750005. https://doi.org/10.1142/S1464333217500053

Maar, M., K. Bolding, J. Kjerulf, J.L.S. Hansen, and K. Timmermann. 2009. Local effects of blue mussels around turbine foundations in an ecosystem model of Nysted off-shore wind farm, Denmark. *Journal of Sea Research* 62(2–3):159–174.

Muench, A., G.S. DePiper and C. Demarest. 2018. On the precision of predicting fishing location using data from the vessel monitoring system (VMS). *Canadian Journal of Fisheries and Aquatic Sciences* 75(7):1036–1047. https://cdnsciencepub.com/doi/10.1139/cjfas-2016-0446

National Marine Fisheries Service (NMFS). 2020. Online landings database. https://foss.nmfs.noaa.gov/apexfoss/

Northeast Fisheries Science Center (NEFSC) and Northeast Regional Office. 2013. Proposed 2013 Observer Sea Day Allocation. Prepared for Northeast Regional Coordinating Committee. June 27. NOAA Fisheries, 166 Water Street, Woods Hole, MA.

Oremus, K.L. 2019. Climate variability reduces employment in New England fisheries. PNAS 116(52):26444-26449. https://doi.org/10.1073/pnas.1820154116

Popper, A.N., A.D. Hawkins, R.R. Fay, D.A. Mann, S. Bartol, T.J. Carlson, S. Coombs, W.T. Ellison, R.L. Gentry, et al. 2014. Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. ASA S3/SC1.4 TR-2014. Springer Briefs in Oceanography. ASA Press and Springer. https://doi.org/10.1007/978-3-319-06659-2.

Rhode Island Department of Environmental Management (RIDEM). 2019. Rhode Island fishing value in the Vineyard Wind Construction and Operations Plan area. Rhode Island Department of Environmental Management Division of Marine Fisheries.

Rhode Island Department of Environmental Management (RIDEM). 2018. Spatiotemporal and economic analysis of Vessel Monitoring System data within the New York Bight call areas. Rhode Island Department of Environmental Management Division of Marine Fisheries.

Rhode Island Department of Environmental Management (RIDEM). 2017. Spatiotemporal and economic analysis of Vessel Monitoring System data within wind energy areas in the greater North Atlantic, Addendum I. Rhode Island Department of Environmental Management Division of Marine Fisheries.

Smythe, T., D. Bidwell, G. Tyler, G., 2021. Optimistic with reservations: The impacts of the United States' first offshore wind farm on the recreational fishing experience. Marine Policy 127, 104440. https://doi.org/10.1016/j.marpol.2021.104440

Steinback, S.R. 1999. Regional Economic Impact Assessments of Recreational Fisheries: An Application of the IMPLAN Modeling System to Marine Party and Charter Boat Fishing in Maine. *North American Journal of Fisheries Management* 19:3, 724-736.

Scott R. Steinback. S.R. and E.M. Thunberg. 2006. Northeast Region Commercial Fishing Input-Output Model. NOAA Technical Memorandum NMFS-NE-188. Northeast Fisheries Science Center, Woods Hole, Massachusetts.

Sunrise Wind LLC. 2022. Sunrise Wind Construction and Operations Plan. Rev. 3, August 2022. https://www.boem.gov/renewable-energy/state-activities/sunrise-wind-construction-and-operation-plan ten Brink, T.S., T. Dalton, and J. Livermore. 2018. Perceptions of commercial and recreational fishers on the potential ecological impacts of the Block Island Wind Farm (US), the first offshore wind farm in North America. *Frontiers of Marine Science* 5:439, doi: 10.3389/fmars.29187.00439

Vallejo, G.C., K. Grellier, E.J. Nelson, R.M. McGregor, S.J. Canning, F.M. Caryl, and N. McLean. 2017. Responses of two marine top predators to an offshore wind farm. *Ecology and Evolution*, (February), 8698–8708. https://doi.org/10.1002/ece3.3389

Wilber, D.H., D.A. Carey, and M. Griffin. 2018. Flatfish habitat use near North America's first offshore wind farm. *Journal of Sea Research* 139(November 2017):24–32. https://doi.org/10.1016/j.seares.2018.06.004

Wilhelmsson, D., and T. Malm. 2008. Fouling assemblages on offshore wind power plants and adjacent substrata. *Estuarine, Coastal and Shelf Science* 79:459–466. https://doi.org/10.1016/j.ecss.2008.04.020

Wilhelmsson, D., T. Malm, and C.O. Marcus. 2006. The influence of offshore windpower on demersal fish. *ICES Journal of Marine Science* 63(63). https://doi.org/10.1016/j.icesjms.2006.02.001

Willsteed, E., A.B. Gill, S.N.R. Birchenough, S. Jude. 2017. Assessing the cumulative environmental effects of marine renewable energy developments: Establishing common ground. *Science of the Total Environment* 577(15 January 2017):19-32. https://doi.org/10.1016/j.scitotenv.2016.10.152

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 $)	Landings/year (lbs)	***Standard Deviation*** Value/year (2020 $)	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