Title: Potential economic impacts to fishery-dependent shoreside businesses from development of the Coastal Virginia Offshore Wind project

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Executive Summary

The development of offshore wind energy in Virginia may impact both commercial and recreational fisheries. Overlap with fishing grounds and potential displacement of fishing effort could reduce commercial landings, while recreational fisheries may increase utilization of the area due to increased fish habitat. These changes in fishing activity might then lead to changes in upstream and downstream economic activities by businesses that depend on commercial and recreational fisheries, such as seafood processors and distributors, gear manufacturers, dockside services, and bait and tackle shops. This analysis evaluates the potential shoreside industry impacts following the development of the Coastal Virginia Offshore Wind (CVOW) site using economic impact models, semi-structured interviews, and an analysis of community social vulnerability.

Economic impacts associated with changes in commercial fishing activities were assessed using IMPLAN modeling software and based on customized production functions. The analysis considered three potential impact scenarios (low, medium, high) and nine impact regions. Consideration of economic impacts from changes in recreational fishing relied on previously published impact estimates. Semi-structured interviews were used to inform structure and estimates in the IMPLAN model, as well as to better understand the perspectives of commercial and recreational industry members regarding offshore wind energy development. Interviewees included commercial fishers, seafood processors and wholesalers, and shoreside support businesses and also recreational fishers and charter/guide fishing captains. As a third component to the analysis of potential shoreside impacts of offshore wind development, ports targeted within the IMPLAN model were also focal communities of a social vulnerability analysis using NOAA Fisheries Community Social Vulnerability Indicators (CSVIs). The CSVIs enable additional consideration of how impacts could be disproportionately experienced—both positively and negatively—based on a community's broader social vulnerability.

Findings in this report highlight the potential impacts for shoreside industries from changes in commercial and recreational fishing activity, as well as associated uncertainties. Based on the IMPLAN analysis, Dare County, NC may be the most economically impacted from the CVOW site, while Hyde County, NC may be least impacted. Interviews suggest that there is little understanding of what the long-term impacts on fishing and dependent industries from development of the CVOW site will be, although positive and negative short-term impacts were mentioned by interviewees. CSVIs indicate that communities in NC are most vulnerable to impacts of offshore wind development due to a combination of high vulnerabilities identified in the CSVI.

Introduction

The development of offshore wind energy in Virginia, and the US Mid-Atlantic more broadly, may impact commercial fisheries due to spatial overlap and potential displacement of fishing effort (Kirkpatrick et al. 2017; Methratta et al. 2020; Scheld et al. 2022). Recreational fishing activity, meanwhile, may increase due to increased fish habitat and increased fishing opportunities. Changes in seafood landings and fishing activity arising from offshore wind energy development can affect upstream and downstream businesses in the marine economy, such as seafood processors and distributors, gear manufacturers, and dockside services (Hooper et al. 2018). Economic impact models are important policy tools that allow estimation of the total economic impacts arising from changes in output and spending, including downstream and upstream indirect and induced impacts known as "multiplier effects". Indirect and induced economic impacts depend on industry production functions and inter-industry transactions, capturing how spending and incomes change across an economy in response to a change in output for one or a subset of sectors.

This analysis focused on potential impacts to shoreside industries following development of the Coastal Virginia Offshore Wind (CVOW) project (OCS-0483, "Project") (Figure 1; see Appendix for description of the direct compensation fund structure). There is considerable uncertainty regarding potential impacts due to variability in fishing activity as well as a limited understanding of the extent to which commercial fishing effort will be displaced and recreational fishing effort will increase. This analysis therefore considers a suite of scenarios to capture the range of potential shoreside impacts. A small set of interviews with members of the fishing and shoreside industries was used to contextualize potential interactions and impacts between these sectors and offshore wind energy development. Further, these interviews were used to assist in establishing the suite of impact scenarios considered. Customized production functions were developed for impacted commercial fishing sectors and the seafood wholesale and processing industries. Economic impacts from reduced commercial fishing activity were assessed using IMPLAN modeling software (Impact Analysis for Planning; Huntersville, NC). Economic impacts from increased recreational activity were assessed using previously published impact estimates for this sector.

Community social vulnerability was also assessed using NOAA Fisheries Community Social Vulnerability Indicators (CSVIs; Jepson & Colburn, 2013). Focusing on the same target ports used in the IMPLAN model, community vulnerability data was evaluated to further predict how offshore wind development could potentially influence these communities, both positively and negatively. Vulnerability indicators are meant to characterize broad community vulnerability and are not specific to the CVOW site or offshore wind development. These indicators can be useful in contextualizing how economic and environmental changes may be experienced across communities with different levels and types of vulnerabilities.

Methods

Semi-structured interviews: Approach

Semi-structured interviews were conducted to inform structure and estimates in the IMPLAN model as well as to better understand how the CVOW site would potentially impact the livelihoods of commercial fishers and the seafood industry more broadly. Specifically, interviews to inform the model targeted three industry groups: 1) commercial fishers, 2) seafood processors and wholesalers, and 3) shoreside support businesses (e.g., engine repair, gear manufacturing). These interviews were not intended to be representative of the entire sample population for each group but were important to provide context and affirm metrics for the IMPLAN model. The semi-structured format for interviews utilized an interview guide to ensure that questions critical to IMPLAN model development were asked of each participant, but allowed flexibility for new, participant-driven ideas to emerge and provide context or detail that the research team may not have previously considered. Interview guides were similar in content, but tailored to each industry group (fishers, seafood processors/wholesalers, and shoreside businesses). For example, fishers were asked about their fishing behavior near the CVOW site, gear and vessel costs, and how their behavior might change with CVOW construction. Seafood processors and wholesaler interviews focused on the types of species purchased, potential changes in purchasing behavior, and costs. Shoreside business interviews were similar to seafood processors and wholesaler interviews, focusing on the proportion of business that comes from fishers targeting Whelk, Black Sea Bass, Spiny Dogfish, Squid, Summer Flounder, or Atlantic Croaker, as well as potential impacts and behavior changes from the development of the CVOW site. Additional interviews with the recreational fishing sector, including sport fishing and charter/guide captains, were conducted to understand the potential impacts of the CVOW site on recreational fishing behavior and perspectives regarding offshore wind. These interviews were not a component of the IMPLAN analysis.

A combination of purposive and snowball sampling was used to identify interview participants, with the overall aim of reaching commercial fishers most likely to be impacted by or interact with the CVOW site and the businesses who might be impacted by a change in the fishing activity of those fishers. Initial, purposively sampled interviews included commercial fishers targeting Whelk, Black Sea Bass, and/or Spiny Dogfish, as well as buyers of these species and/or buyers of Summer Flounder, Bluefish, and Butterfish. These species were focused on as they are most likely to be the target species fished in and around the CVOW site (NOAA 2024a). Participants were identified through key informants familiar with these fisheries and through a data request from the Virginia Marine Resources Commission for buyers of Whelk, Black Sea Bass, Spiny Dogfish, Summer Flounder, Bluefish, and Butterfish (≥1000 lbs. between 2020-2024) in Virginia. The interviews with fishers were used to develop additional contacts with seafood processors and wholesalers and shoreside support businesses (i.e., fishers were asked who they sell to and where they buy gear and/or take their vessels for repair; recommended businesses were also contacted). Recreational fishers and charter captains/guides were recruited through a contact that works extensively with the recreational fishing sector in Virginia.

Semi-structured interviews: Participant sample

Twelve interviews occurred with a combination of commercial fishers, seafood buyers, gear manufacturers, and recreational fishers (both charter/for-hire and non-charter). Interviews were held via phone (n=9), video conferencing (n=1), and in-person (n=2). In-person interviews were held at a fish house and seafood restaurant/processing facility. Interviews included a combination of all targeted industry roles, but due to concerns related to participant identification, more detail related to the breakdown of those industry roles and numbers cannot be provided (i.e., revealing the number of participants by role may remove possible anonymity for certain participants). Interview lengths ranged from 5 to 30 minutes. Interviews were recorded with permission and transcribed verbatim using Otter.ai (Mountain View, CA). When unable to record, detailed notes were taken to capture participant responses. Protocols approved by William and Mary's Institutional Review Board were followed for each interview (Protocol PHSC-2024-04-26-17020-amscheld). Upon completion of the interview, participants had the option to receive a $75 incentive for their time and participation.

Estimation of economic impacts: Landings reductions

Potential reductions in commercial fishery landings arising from fishing effort displacement due to CVOW Project development were estimated using two sources. First, NOAA Fisheries provides reports on "Socioeconomic Impacts of Atlantic Offshore Wind Development", which include estimates of historical landings from individual lease sites (NOAA 2024a). From the report for CVOW, the table "Total Fifteen Year Revenues and Landings from the

Most Impacted Species for the Ten Most Impacted Ports (by Revenue)" was used to calculate average annual landings in 2022 US Dollars (USD) by species for the following ports: Hampton, VA; Newport News, VA; Norfolk, VA; Virginia Beach, VA; Engelhard, NC; Wanchese, NC; Cape May, NJ; Davisville, RI; and North Kingstown, RI (Table 1).

Landings available through the NOAA report had two primary limitations: 1) they were not representative of landings for non-federally managed species; and 2) they did not include landings exposure from potential interaction with the export cable corridor. Data from a recent report by Capital Trade, Incorporated, commissioned by the Virginia Marine Resources Commission, was used to supplement NOAA landings exposure estimates (Collis 2023). This report included landings exposure estimates for three fisheries: Shrimp, Spiny Dogfish, and Whelk (Table 2). Values were presented in 2021 USD and were adjusted to 2022 dollars using the GDP Implicit Price Deflator (US BEA 2024). Aggregate landings values for these species were distributed across ports as follows: Chincoteague, VA (5%); Hampton, VA (10%); Newport News, VA (10%); Norfolk, VA (25%); Virginia Beach, VA (25%); and Wanchese, NC (25%) (Table 3).

Estimation of economic impacts: Production functions

Each species with potential landings exposure (Tables 1-3) was assigned a gear type based on dominant gear types used to target the species in the region. There were three dominant gear types: gillnet, traps/pots, and trawl. Cost structures vary across fleets, which can impact indirect economic impacts resulting from a change in fishery output. Intermediate input production functions capture the distribution of spending across input factors for a particular industry or production process and were specified for each gear type considered here. Production functions were developed by refining the default commercial fishing spending pattern in IMPLAN using information from Steinback and Thunberg (2006) and as collected through industry interviews (Table 4).

The following modifications to the spending pattern for IMPLAN industry "17 Commercial fishing" were made: 1) commodity "3017 Fish" was added and allocated 20% of costs for trap/pot vessels to capture costs associated with bait use; 2) commodity "3105 Manufactured ice" was added and allocated 5% of costs for all vessel types; 3) commodity "3406 Food and beverage stores" was added and allocated 1%, 1%, and 4% of costs for gillnet, trap/pot, and trawl vessels, respectively; 4) commodity "3515 Commercial and industrial machinery and equipment repair and maintenance" was added to account for gear maintenance and allocated 15%, 7%, and 5% of costs for gillnet, trap/pot, and trawl vessels, respectively; 5) spending on commodities "3420 Scenic and sightseeing transportation services and support activities for transportation”, “3477 Landscape and horticultural services”, and “3481 Junior colleges, colleges, universities, and professional schools” was reduced to zero; and 6) spending patterns for commodities “3154 Refined petroleum products”, “3157 Petroleum lubricating oil and grease”, and “3399 Wholesale services - Petroleum and petroleum” were assumed to be representative of trawl vessels, however, values were reduced by half for gillnet and trap/pot vessels, who do not tow mobile gear and generally do not take multi-day trips. All other values within the spending pattern for IMPLAN industry “17 Commercial fishing” were used as specified after normalizing to ensure intermediate input costs summed to 100%. (Note that when referring to IMPLAN industries or commodities the numeric index value used is included for clarity, e.g., commercial fishing is specified as industry 17 in IMPLAN)

Input-output models are typically structured to return indirect and induced economic impacts associated with economic activity upstream of where the change in output occurs. Commercial fisheries supply products to other economic sectors and, therefore, changes in commercial fishery output could lead to changes in both upstream and downstream business activity. This analysis considered two additional downstream sectors in estimating economic impacts: seafood wholesale and seafood processing. To ensure indirect and induced economic impacts were not double counted, production functions for these sectors did not include costs associated with the purchase of seafood. The intermediate input production function used for seafood wholesale was adapted from Steinback and Thunberg (2006) (Table 5). The spending pattern included in IMPLAN for industry “92 Seafood product preparation and packaging” was used as provided after reducing spending on commodity “3017 Fish” to zero. Intermediate input spending patterns for seafood wholesale and seafood processing were normalized such that they summed to 100%.

Estimation of economic impacts: IMPLAN scenarios

A variety of economic impact scenarios were explored using information on commercial fishery landings exposure and customized industry production functions. All scenarios considered reductions in output for commercial fisheries, seafood wholesalers, and seafood processors across ten ports: Chincoteague, VA; Hampton, VA; Newport News, VA; Norfolk, VA; Virginia Beach, VA; Engelhard, NC; Wanchese, NC; Cape May, NJ; Davisville, RI; and North Kingstown, RI. These ports were associated with regions in IMPLAN by identifying the corresponding city or county. Both Davisville, RI and North Kingstown, RI are in Washington County, RI and thus one IMPLAN region was used for both ports.

Output reductions for each industry across the nine regions considered were estimated for low, medium, and high impact scenarios (Tables 6 and 7). The low impact scenario assumed 10% of exposed commercial fishery annual revenues were lost and that 25% of these output reductions were passed on to seafood wholesalers and seafood processors. The medium impact scenario assumed that 50% of exposed commercial fishery annual revenue from NOAA (2024a) and 25% of exposed commercial fishery annual revenue from Collis (2023) were lost. In this scenario, it was assumed that 50% of output reductions were passed on to seafood wholesalers and seafood processors. The high impact scenario assumed that 100% of exposed commercial fishery annual revenues were lost and that 100% of these output reductions were passed on to seafood wholesalers and seafood processors.

Economic impact scenarios were analyzed in IMPLAN using “Industry Impact Analysis (Custom) Events”, which allows customization of the production function. The production function used in IMPLAN sets total output equal to the sum of employee compensation, proprietor income, taxes on production and imports, other property income, and expenditures on intermediate inputs. Users can specify all components of the production function or just individual pieces and allow IMPLAN to determine missing values using default specifications. In this analysis, it was assumed that employee compensation, proprietor income, and taxes represented 30%, 10%, and 5% of total output for all sectors, respectively. Other property income was set to zero for all production functions. For the included fishing sectors, this implied that intermediate inputs made up 55% of total output value. For the seafood wholesale and seafood processing industries, costs associated with purchase of fish were not included in production functions to avoid double counting indirect and induced effects. For these downstream industries, it was assumed that purchase of fish represented 30% of total output value and, therefore, intermediate inputs represented 25% of total output value (see Tables 8-13 for impact event specifications). There is no processing sector activity in Norfolk or Virginia Beach, VA. Processing sector impact events were removed for these regions. As the impacts assessed here represented potential losses in output, all values entering production functions for impact events were negative.

IMPLAN returns a variety of summary information following estimation of an economic impact event. Here we focus on a select number of industries that have a direct dependence on commercial fishing, including commercial fishing itself due to bait supply, ice manufacturing, ship and boat building and repair, fuel, warehousing and storage, and gear repair (Table 14). In this analysis, shoreside impacts are considered the direct effects of losses in output for seafood wholesale and seafood processing industries (i.e., Tables 11-13) and the indirect and induced effects for industries specified in Table 14.

Estimation of economic impacts: For-hire and private boat recreational sectors

Recreational anglers and the for-hire sector are known to utilize structure when targeting certain species, including artificial reefs and offshore energy infrastructure (e.g., Dugas et al. 1979). The construction of CVOW may, therefore, produce positive economic impacts if it increases recreational or for-hire fishing effort. The extent of potential changes in recreational and for-hire fishing due to construction of offshore wind energy infrastructure is highly uncertain. It is expected that offshore wind energy infrastructure will attract private and for-hire anglers targeting structure-associating species, however, it is not known whether this would represent increases in overall fishing effort or simply a redistribution of fishing effort (i.e., trips that would have occurred elsewhere are redirected to offshore wind energy sites). Due to this uncertainty, three potential impact scenarios are considered in this analysis: a low or no impact scenario, where fishing effort at CVOW is simply redirected from elsewhere; a medium impact scenario, where there is a 5% increase in offshore fishing effort by private and for-hire boats; and a high impact scenario, where there is a 20% increase in offshore fishing effort by private and for-hire boats.

Data available from the Marine Recreational Information Program was used to assess average annual offshore fishing effort for private and for-hire anglers. Total fishing trips taken from all Virginia ports to sites in the Federal Exclusive Economic Zone (EEZ) from 2014 to 2023 were obtained through an online data query (NOAA 2024b). This data was used to estimate potential effort increases under low, medium, and high impact scenarios (Table 15). Lovell et al. (2020) provides estimates of economic impacts for private anglers and the for-hire sector by state based on a national survey of angler expenditures. Aggregate estimates for total sales impacts in Virginia resulting from all for-hire and private recreational saltwater fishing were divided by fishing effort to obtain economic impact estimates per trip of $472.19 (for-hire) and $48.42 (private angler). These values were used together with scenario-specific effort increases to estimate potential positive economic impacts associated with CVOW development. It should be noted that these economic impact values include impacts to all sectors, not just shoreside businesses directly dependent on fishing activity. Spending patterns described in Lovell et al. 2020 indicate that ~75% of for-hire trip expenditures were in sectors directly dependent on fishing (bait, ice, guide fees, and crew tips) while ~50% of private angler trip expenses were in sectors directly dependent on fishing (bait, ice, and boat fuel).

Community social vulnerability analysis

NOAA Fisheries developed social indicators for coastal communities engaged in fishing activities to characterize community well-being (Jepson & Colburn, 2018). These Community Social Vulnerability Indicators (CSVIs) include “14 statistically robust social, economic, and climate change indicators that uniquely characterize and evaluate a community’s vulnerability and resilience to disturbances.” Often, these “disturbances” take shape as changes to fishing regulations, extreme weather events, climate change impacts, or other major events (e.g., oil spills). For the purposes of this analysis, the development of offshore wind represents a potential disturbance.

The CSVIs are categorized into five indicator groups: fishing engagement and reliance, environmental justice, climate change, economic, and gentrification pressure. Within each group are specific indicators that contribute to the overall characterization of that particular component of social vulnerability (Table 16). Indicator scores range from 0 to 4, with 1 representing least vulnerable or at risk and 4 most vulnerable (relative to that indicator). Values of 0 correspond to no available data. For the full methodology of how indicators were generated, refer to Jepson and Colburn (2013).

Communities considered for the social vulnerability analysis included the same ports that were featured in the IMPLAN scenarios (Figure 2). Data were analyzed using the most recent three years of CSVI data (2018-2020) to allow for analysis over time and avoid potentially anomalous years.

Results and Discussion

Semi-structured interviews: Summary of findings

The primary function of interviews was to inform the IMPLAN model rather than generalize responses to represent a larger sample population. Interviewees provided specific numbers to inform IMPLAN model parameters and to compare predicted outcomes; they also discussed the observed and predicted impacts of offshore wind development more generally. The summary here is included to share the additional context described in interviews.

As a collective set, interviews provided mixed perspectives regarding the CVOW site. Nearly all interviewees noted uncertainty surrounding the site and its long-term impacts to the fishing industry, with several suggesting that larger vessels might be the ones most impacted because they are more likely to be working those areas (compared to smaller net-fishing vessels). Multiple interviewees suggested that impacts would depend on the degree of access to the CVOW site (e.g., if the site was closed to fishing, it would have a greater negative impact). Similarly, several interviewed believed that impacts would be minimal, assuming that access would not be restricted.

The negative impacts focused on target species and the likelihood of species moving away during construction (particularly Whelk, also known locally as Conchs). Some interviewees also pointed to impacts on Croaker. Other negative impacts included restricted access, unsafe conditions during adverse weather as well as due to restricted space if/as vessels are forced to work closer to one another, gear damaged due to increased boat traffic, and fishery loss. One interviewee noted possible impacts related to public perceptions of seafood safety for anything harvested near wind turbines and cables. In some cases, interviewees suggested that impacts may be temporary or short-term, such as those potentially linked to installation. Still, others expressed concern that these same activities could have long-lasting effects.

Multiple participants acknowledged that restrictions and potential impacts of offshore wind would be yet another obstacle put upon commercial fishers, citing other examples of increasing restrictions, real estate competition for working waterfront space (and the conversion of working waterfronts), foreign markets that are challenging to compete with, and protected species concerns. Several indicated that these sorts of broader community and industry changes have already begun to ripple throughout the shoreside support sector (e.g., gear manufacturers) and pointed to impacts in other regions such as Maryland and Massachusetts. Others noted that the layering of restrictions and impacts could be especially problematic for Conch fishers.

Some interviewees, more often those involved with recreational fisheries, suggested potential positive impacts of offshore wind development at the CVOW site. Most recreational fishers interviewed, including charter and non-charter captains, predicted that the expansion of wind turbines in the CVOW site will attract more pelagic species. This in turn could inspire boat upgrades to pursue deeper water species and could increase recreational fishing activity overall (potentially with management implications). Another interviewee echoed the prediction of increased fishing activity but focusing on related costs and linked economic input of additional trips, etc. One recreational fisher noted concern that existing wind activity may alter the behavior of some species, like Striped Bass and Black Sea Bass, leading to reduced catch. At the same time, other interviewees noted increased numbers of Black Sea Bass and other fish at wind farm sites. As stated above, the overall set of interviews revealed varying perceptions and predictions of the impacts of offshore wind, paired with a moderate degree of uncertainty.

Economic impact estimates

Estimates of total economic impacts (direct, indirect, induced) across all sectors are presented in Table 17. Restricting model output to only include seafood wholesale, seafood processing, and support industries considered directly dependent on commercial fishing (Table 14), indicated direct impacts of -$41,586 to -$1,663,449, indirect impacts of -$8,769 to -$126,567, and induced impacts of -$804 to -$14,577 across low, medium, and high impact scenarios (Table 18). Total impacts (direct, indirect, induced) for the medium impact scenario were estimated to be -$245,254.

Estimates across low, medium, and high impact scenarios for industries directly dependent on commercial fishing by IMPLAN region are presented in Table 19. The lowest direct economic impacts occur in Hyde County, NC and Cape May County, NJ (-$136 low scenario and -$5,416 high scenario), while the highest direct economic impacts occur in Dare County, NC (-$13,401 for low scenario and -$536,094 for high scenario). Norfolk, VA had the highest indirect economic impacts, ranging from -$3,089 in the low scenario to -$44,966 in the high impact scenario. Dare County, NC had the highest induced impacts (-$253 in low impact scenario to -$5,014 in high impact scenario). Hyde County, NC had the lowest economic impact in terms of indirect and induced impacts.

Increased recreational fishing in the CVOW site is estimated to be associated with $0 to $1,393,146 in economic impacts (Table 20). Total economic impacts from recreational increases for the medium impact scenario are estimated at $348,156. Note that these estimates include all sectors, not just those directly dependent on recreational fishing.

Community social vulnerability analysis

Nine target communities were analyzed to consider social vulnerability as it may relate to the development of offshore wind. These communities were chosen to align with ports evaluated within the IMPLAN model scenarios (Figure 2). Communities were evaluated relative to all CSVI data, including fishing engagement and reliance, environmental justice, gentrification, economic indicators, and climate change (Tables 21 - 25). Vulnerability indicators were developed to better understand community vulnerability relative to a potential disturbance. These indicators are not specific to offshore wind but were used to understand how potential changes induced by development at the CVOW site might affect shoreside communities.

The indicators perhaps most directly linked to potential impacts of offshore wind are those within the fishing engagement and reliance group. Focusing on communities in NC and VA as they are more likely to experience impacts than the comparison sites in RI and NJ, fishing-related vulnerability suggests relatively high levels of both commercial and recreational engagement in Newport News (though recreational is potentially decreasing), Hampton, and Virginia Beach, VA as well as Wanchese, NC. Chincoteague, VA had medium engagement for both types of fisheries and Norfolk, VA had low commercial engagement paired with high recreational engagement. Fisheries reliance was more consistent across communities, with low or medium scores across all communities except for Wanchese, NC where values ranged from medium to high over the three-year period.

Considering engagement and reliance together for these communities, the data suggest that fisheries engagement is high – i.e., if offshore wind were to impact commercial or recreational fisheries, that impact would be experienced by a relatively large component of the population – but reliance is low, suggesting that impacts may not be significant in terms of the degree of individual impact (i.e., fishing is likely not a primary source of income or activity for most of the individuals involved). Wanchese, however, represents the exception, particularly for recreational reliance. Data suggest that Wanchese's vulnerability related to fisheries could lead to disproportionately large community impacts if offshore wind development were to negatively affect fishing activity. Alternatively, if offshore wind development at the CVOW site is linked to positive recreational fisheries impacts, Wanchese (as well as other communities but to a lesser extent) could benefit given high recreational engagement and reliance.

In addition to fisheries-specific vulnerability, layered or compounded vulnerabilities could suggest that a community will experience a larger than expected impact from a disturbance. In other words, if offshore wind development negatively impacts a community's commercial fishing industry and that community is also highly vulnerable within other indicator categories (e.g., environmental justice and/or climate change), the impacts may be larger than directly predicted. Alternatively, a particularly vulnerable community that benefits from offshore wind development could incur larger than expected benefits (e.g., if recreational fisheries or local economies experience benefits). For the NC and VA communities considered in this analysis, only Engelhard, NC had high environmental justice-related vulnerabilities, suggesting that any development should proceed with attention to how environmental impacts might affect this community as effects would likely be amplified and/or compound existing challenges related to poverty and personal disruption. Gentrification indicators were generally low to medium for all communities as was economic vulnerability related to labor force. Economic vulnerability related to housing characteristics was high for both Wanchese and Engelhard, NC suggesting that existing housing is highly vulnerable to coastal hazards (including rent/mortgage as well as physical structure). Climate change indicators suggest relatively high vulnerability for both sea level rise (all communities) and storm surge risk (all except Newport News, VA). Though it is a challenge to predict exactly how the development of offshore wind in the CVOW area would or could influence the analyzed port communities, the presence of intersecting high vulnerabilities, particularly in North Carolina, draws attention to both a needed caution in considering broader community impacts as well as opportunity if there are ways that offshore wind development could reduce some of these vulnerabilities (e.g., better paying or more reliable employment opportunities that could ultimately contribute to housing improvements as well overall higher household income).

Conclusion

The Coastal Virginia Offshore Wind Project, along with other offshore wind development, has the potential to impact commercial and recreational fishing industries at various levels (see Appendix for description of the direct compensation fund structure). These impacts are regionally dependent, varied across individual sectors, and come with a high degree of uncertainty. This analysis utilized semi-structured interviews, economic impact models, and indicators of community social vulnerability to understand potential impacts to shoreside businesses and communities. Impacts are anticipated to be both negative and positive, potentially offsetting each other to a degree in aggregate, though ultimately redistributing benefits derived from ocean resources across user groups and coastal communities.

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Tables & Figures

Table 1. Commercial fishery landings exposure estimates from NOAA (2024a). Annual revenues (2022 USD) represent average landings (2008-2022) by species and port.

Port	Species	Annual Revenue ($2022)
Hampton, VA	Atlantic croaker	333
Hampton, VA	Bluefish	67
Hampton, VA	Illex squid	467
Hampton, VA	Longfin squid	467
Hampton, VA	Summer flounder	800
Hampton, VA	Other/NA	2,800
Newport News, VA	Atlantic croaker	800
Newport News, VA	Longfin squid	67
Newport News, VA	Red crab	333
Newport News, VA	Summer flounder	1,200
Newport News, VA	Other/NA	800
Norfolk, VA	Other/NA	1,333
Virginia Beach, VA	Black sea bass	31,400
Virginia Beach, VA	Channeled whelk	2,133
Virginia Beach, VA	Conger eel	400
Virginia Beach, VA	Other/NA	3,600
Engelhard, NC	Summer flounder	533
Engelhard, NC	Other/NA	3,333
Wanchese, NC	Atlantic croaker	267
Wanchese, NC	Black sea bass	1,600
Wanchese, NC	Bluefish	67
Wanchese, NC	Menhaden	67
Wanchese, NC	Summer flounder	400
Wanchese, NC	Other/NA	533
Cape May, NJ	Bluefish	67
Cape May, NJ	Chub mackerel	133
Cape May, NJ	Illex squid	1,000
Cape May, NJ	Longfin squid	2,400
Cape May, NJ	Summer flounder	133
Cape May, NJ	Other/NA	133
Davisville, RI	Longfin squid	1,867
Davisville, RI	Other/NA	3,000
North Kingstown, RI	Longfin squid	667
North Kingstown, RI	Other/NA	5,867

Table 2. Commercial fishery landings exposure estimates from Collis (2023) for fisheries that are either state managed or may interact with the export cable corridor. Values from Collis (2023) were adjusted for inflation.

Fishery	Annual Revenue ($2022)
Shrimp	319,152
Spiny dogfish	251,304
Whelk	948,851

Table 3. Commercial fishery landings exposure estimates for Shrimp, Spiny Dogfish, and Whelk by port.

Port	Species	Annual Revenue ($2022)
Chincoteague, VA	Shrimp	15,958
Chincoteague, VA	Spiny dogfish	12,565
Chincoteague, VA	Whelk	47,443
Hampton, VA	Shrimp	31,915
Hampton, VA	Spiny dogfish	25,130
Hampton, VA	Whelk	94,885
Newport News, VA	Shrimp	31,915
Newport News, VA	Spiny dogfish	25,130
Newport News, VA	Whelk	94,885
Norfolk, VA	Shrimp	79,788
Norfolk, VA	Spiny dogfish	62,826
Norfolk, VA	Whelk	237,213
Virginia Beach, VA	Shrimp	79,788
Virginia Beach, VA	Spiny dogfish	62,826
Virginia Beach, VA	Whelk	237,213
Wanchese, NC	Shrimp	79,788
Wanchese, NC	Spiny dogfish	62,826
Wanchese, NC	Whelk	237,213

Table 4. Fishing vessel intermediate input production functions. Values are expenditure shares, or the percentage of total intermediate input costs spent on a particular commodity.

Expenditure Category	IMPLAN	Gillnet	Trap/pot	Trawl
Existing				
3060 Maintained and repaired nonresidential structures	0.71	0.73	0.60	0.67
3121 Other textile products	2.84	2.93	2.40	2.66
3138 Cut stock, resawn and planed lumber	2.02	2.08	1.71	1.89
3154 Refined petroleum products	18.69	9.35	9.35	18.69
3157 Petroleum lubricating oil and grease	3.49	1.75	1.75	3.49
3245 Hardware	2.47	2.55	2.09	2.31
3259 Other fabricated metals	0.03	0.03	0.03	0.03
3322 Electric lamp bulbs and parts	0.06	0.06	0.05	0.06
3347 Motor vehicle gasoline engines and engine parts	0.30	0.31	0.25	0.28
3348 Motor vehicle electrical and electronic equipment	0.48	0.50	0.41	0.45
3349 Motor vehicle transmission and power train parts	1.03	1.06	0.87	0.97
3352 Other motor vehicle parts	1.46	1.51	1.23	1.37
3353 Motor vehicle steering, suspension components (except spring), and brake systems	0.18	0.19	0.15	0.17
3360 Ships	3.49	3.60	2.95	3.27
3392 Wholesale services - Motor vehicle and motor vehicle parts and supplies	0.97	1.00	0.82	0.91
3393 Wholesale services - Professional and commercial equipment and supplies	0.50	0.52	0.42	0.47
3394 Wholesale services - Household appliances and electrical and electronic goods	3.58	3.69	3.02	3.35
3395 Wholesale services - Machinery, equipment, and supplies	5.36	5.53	4.53	5.02
3396 Wholesale services - Other durable goods merchant wholesalers	2.69	2.78	2.27	2.52
3398 Wholesale services - Grocery and related product wholesalers	0.25	0.26	0.21	0.23
3399 Wholesale services - Petroleum and petroleum products	3.96	1.98	1.98	3.96
3400 Wholesale services - Other nondurable goods merchant wholesalers	1.28	1.32	1.08	1.20
3401 Wholesale services - Wholesale electronic markets and agents and brokers	0.20	0.21	0.17	0.19
3402 Retail services - Motor vehicle and parts dealers	0.05	0.05	0.04	0.05
3415 Rail transportation services	0.18	0.19	0.15	0.17
3416 Water transportation services	0.17	0.18	0.14	0.16
3417 Truck transportation services	1.58	1.63	1.33	1.48
3419 Pipeline transportation services	0.09	0.09	0.08	0.08
3420 Scenic and sightseeing transportation services and support activities for transportation	8.86	0.00	0.00	0.00

3439 Nondepository credit intermediation and related activities	0.09	0.09	0.08	0.08
3441 Monetary authorities and depository credit intermediation	0.42	0.43	0.35	0.39
3444 Other insurance	29.46	30.40	24.87	27.61
3445 Insurance agencies, brokerages, and related services	0.00	0.00	0.00	0.00
3455 Legal services	0.15	0.15	0.13	0.14
3456 Accounting, tax preparation, bookkeeping, and payroll services	0.64	0.66	0.54	0.60
3457 Architectural, engineering, and related services	0.32	0.33	0.27	0.30
3460 Computer systems design services	0.11	0.11	0.09	0.10
3461 Other computer related services, including facilities management services	0.15	0.15	0.13	0.14
3477 Landscape and horticultural services	0.99	0.00	0.00	0.00
3481 Junior colleges, colleges, universities, and professional schools	0.13	0.00	0.00	0.00
3509 Full-service restaurant services	0.27	0.28	0.23	0.25
3510 Limited-service restaurant services	0.13	0.13	0.11	0.12
3538 Noncomparable imports	0.17	0.18	0.14	0.16
Added:				
3017 Fish	0.00	0.00	20.00	0.00
3406 Food and beverage stores	0.00	1.00	1.00	4.00
3105 Manufactured ice	0.00	5.00	5.00	5.00
3515 Commercial and industrial machinery and equipment repair and maintenance	0.00	15.00	7.00	5.00
Total	100.00	100.00	100.00	100.00

Table 5. Seafood wholesale intermediate input production function. Values are expenditure shares, or the percentage of total intermediate input costs, excluding fish, spent on a particular commodity.

Expenditure Category	
3039 Electricity	2.27
3048 Natural gas distribution	2.27
3105 Manufactured ice	4.63
3147 Paperboard containers	4.47
3408 Retail services - Gasoline stores	5.43
3417 Truck transportation services	6.79
3422 Warehousing and storage services	24.33
3433 Wired telecommunications	1.13
3434 Wireless telecommunications (except satellite)	1.13
3439 Nondepository credit intermediation and related activities	4.47
3441 Monetary authorities and depository credit intermediation	4.47
3445 Insurance agencies, brokerages, and related services	6.79
3448 Tenant-occupied real estate services	11.26
3456 Accounting, tax preparation, bookkeeping, and	1.16
3465 Accounting, tax preparation, bookkeeping, and payroll services	6.62
3476 Services to buildings	11.42
3512 Automotive repair and maintenance, except car washes	1.36
Total	100

Table 6. Commercial fishery revenue reductions by port and associated IMPLAN region for economic impact scenarios considering low, medium, and high levels of impact. Values are 2022 USD. The low impact scenario assumes 10% of exposed annual revenue is lost. The medium impact scenario assumes 50% of exposed annual revenue from NOAA (2024a) and 25% of exposed annual revenue from Collis (2023) is lost. The high impact scenario assumes 100% of exposed annual revenue is lost.

Port	IMPLAN Region	Fishery	Low	Medium	High
Chincoteague, VA	Accomack County, VA	gillnet	1,257	3,141	12,565
		traps/pots	4,744	11,861	47,443
		trawl	1,596	3,989	15,958
Hampton, VA	Hampton, VA	gillnet	2,513	6,283	25,130
		traps/pots	9,489	23,721	94,885
		trawl	3,685	10,446	36,849
Newport News, VA	Newport News, VA	gillnet	2,513	6,283	25,130
		traps/pots	9,567	24,116	95,674
		trawl	3,433	9,184	34,326
Norfolk, VA	Norfolk, VA	gillnet	6,283	15,706	62,826
		traps/pots	23,797	59,683	237,973
		trawl	8,036	20,234	80,361
Virginia Beach, VA	Virginia Beach, VA	gillnet	6,283	15,706	62,826
		traps/pots	27,475	78,070	274,746
		trawl	7,979	19,947	79,788
Engelhard, NC	Hyde County, NC	gillnet	0	0	0
		traps/pots	0	0	0
		trawl	387	1,933	3,866
Wanchese, NC	Dare County, NC	gillnet	6,283	15,706	62,826
		traps/pots	23,912	60,255	239,117
		trawl	8,082	20,462	80,818
Cape May, NJ	Cape May County, NJ	gillnet	0	0	0
		traps/pots	0	0	0
		trawl	387	1,933	3,866
Davisville, RI	Washington County, RI	gillnet	0	0	0
North Kingstown, RI		traps/pots	0	0	0
		trawl	1,140	5,701	11,401
		Total	158,837	414,360	1,588,374

Table 7. Seafood wholesale and seafood processor revenue reductions by port and associated IMPLAN region for economic impact scenarios considering low, medium, and high levels of impact. Values are 2022 USD. The low impact scenario assumes 25% of low impact commercial fishery revenue reductions are passed on (see Table 6). The medium impact scenario assumes 50% of medium impact commercial fishery revenue reductions are passed on. The high impact scenario assumes 100% of high impact commercial fishery revenue reductions are passed on.

Port	IMPLAN Region	Low	Medium	High
Chincoteague, VA	Accomack County, VA	1,899	9,496	75,965
Hampton, VA	Hampton, VA	3,922	20,225	156,865
Newport News, VA	Newport News, VA	3,878	19,791	155,131
Norfolk, VA	Norfolk, VA	9,529	47,812	381,160
Virginia Beach, VA	Virginia Beach, VA	10,434	56,862	417,360
Engelhard, NC	Hyde County, NC	97	967	3,866
Wanchese, NC	Dare County, NC	9,569	48,212	382,761
Cape May, NJ	Cape May County, NJ	97	967	3,866
Davisville, RI and North Kingstown, RI	Washington County, RI	285	2,850	11,401
	Total	39,709	207,180	1,588,374

Table 8. Low impact scenario event specification. Values are 2022 USD and represent losses to each component of vessel production functions.

IMPLAN Region	Fishery	Employee Compensation	Proprietor Income	Taxes	Intermediate Inputs
Accomack County, VA	gillnet	377	126	63	691
	traps/pots	1,423	474	237	2,609
	trawl	479	160	80	878
Hampton, VA	gillnet	754	251	126	1,382
	traps/pots	2,847	949	474	5,219
	trawl	1,105	368	184	2,027
Newport News, VA	gillnet	754	251	126	1,382
	traps/pots	2,870	957	478	5,262
	trawl	1,030	343	172	1,888
Norfolk, VA	gillnet	1,885	628	314	3,455
	traps/pots	7,139	2,380	1,190	13,088
	trawl	2,411	804	402	4,420
Virginia Beach, VA	gillnet	1,885	628	314	3,455
	traps/pots	8,242	2,747	1,374	15,111
	trawl	2,394	798	399	4,388
Hyde County, NC	gillnet	0	0	0	0
	traps/pots	0	0	0	0
	trawl	116	39	19	213
Dare County, NC	gillnet	1,885	628	314	3,455
	traps/pots	7,173	2,391	1,196	13,151
	trawl	2,425	808	404	4,445
Cape May County, NJ	gillnet	0	0	0	0
	traps/pots	0	0	0	0
	trawl	116	39	19	213
Washington County, RI	gillnet	0	0	0	0
	traps/pots	0	0	0	0
	trawl	342	114	57	627
	Total	47,651	15,884	7,942	87,361

Table 9. Medium impact scenario event specification. Values are 2022 USD and represent losses to each component of vessel production functions.

IMPLAN Region	Fishery	Employee Compensation	Proprietor Income	Taxes	Intermediate Inputs
Accomack County, VA	gillnet	942	314	157	1,728
	traps/pots	3,558	1,186	593	6,523
	trawl	1,197	399	199	2,194
Hampton, VA	gillnet	1,885	628	314	3,455
	traps/pots	7,116	2,372	1,186	13,047
	trawl	3,134	1,045	522	5,745
Newport News, VA	gillnet	1,885	628	314	3,455
	traps/pots	7,235	2,412	1,206	13,264
	trawl	2,755	918	459	5,051
Norfolk, VA	gillnet	4,712	1,571	785	8,639
	traps/pots	17,905	5,968	2,984	32,826
	trawl	6,070	2,023	1,012	11,128
Virginia Beach, VA	gillnet	4,712	1,571	785	8,639
	traps/pots	23,421	7,807	3,903	42,938
	trawl	5,984	1,995	997	10,971
Hyde County, NC	gillnet	0	0	0	0
	traps/pots	0	0	0	0
	trawl	580	193	97	1,063
Dare County, NC	gillnet	4,712	1,571	785	8,639
	traps/pots	18,077	6,026	3,013	33,140
	trawl	6,139	2,046	1,023	11,254
Cape May County, NJ	gillnet	0	0	0	0
	traps/pots	0	0	0	0
	trawl	580	193	97	1,063
Washington County, RI	gillnet	0	0	0	0
	traps/pots	0	0	0	0
	trawl	1,710	570	285	3,135
	Total	124,308	41,436	20,718	227,898

Table 10. High impact scenario event specification. Values are 2022 USD and represent losses to each component of vessel production functions.

IMPLAN Region	Fishery	Employee Compensation	Proprietor Income	Taxes	Intermediate Inputs
Accomack County, VA	gillnet	3,770	1,257	628	6,911
	traps/pots	14,233	4,744	2,372	26,093
	trawl	4,787	1,596	798	8,777
Hampton, VA	gillnet	7,539	2,513	1,257	13,822
	traps/pots	28,466	9,489	4,744	52,187
	trawl	11,055	3,685	1,842	20,267
Newport News, VA	gillnet	7,539	2,513	1,257	13,822
	traps/pots	28,702	9,567	4,784	52,621
	trawl	10,298	3,433	1,716	18,879
Norfolk, VA	gillnet	18,848	6,283	3,141	34,554
	traps/pots	71,392	23,797	11,899	130,885
	trawl	24,108	8,036	4,018	44,199
Virginia Beach, VA	gillnet	18,848	6,283	3,141	34,554
	traps/pots	82,424	27,475	13,737	151,110
	trawl	23,936	7,979	3,989	43,883
Hyde County, NC	gillnet	0	0	0	0
	traps/pots	0	0	0	0
	trawl	1,160	387	193	2,126
Dare County, NC	gillnet	18,848	6,283	3,141	34,554
	traps/pots	71,735	23,912	11,956	131,514
	trawl	24,245	8,082	4,041	44,450
Cape May County, NJ	gillnet	0	0	0	0
	traps/pots	0	0	0	0
	trawl	1,160	387	193	2,126
Washington County, RI	gillnet	0	0	0	0
	traps/pots	0	0	0	0
	trawl	3,420	1,140	570	6,271
	Total	476,512	158,837	79,419	873,606

Table 11. Low impact scenario event specification. Values are 2022 USD and represent losses to each component of wholesale and processing production functions. Note that values for Norfolk, VA and Virginia Beach, VA only represent losses to the wholesale sector as these regions do not have seafood processing.

IMPLAN Region	Employee Compensation	Proprietor Income	Taxes	Intermediate Inputs
Accomack County, VA	570	190	95	475
Hampton, VA	1,176	392	196	980
Newport News, VA	1,163	388	194	970
Norfolk, VA	2,859	953	476	2,382
Virginia Beach, VA	3,130	1,043	522	2,608
Hyde County, NC	29	10	5	24
Dare County, NC	2,871	957	478	2,392
Cape May County, NJ	29	10	5	24
Washington County, RI	86	29	14	71
Total	11,913	3,971	1,985	9,927

Table 12. Medium impact scenario event specification. Values are 2022 USD and represent losses to each component of wholesale and processing production functions. Note that values for Norfolk, VA and Virginia Beach, VA only represent losses to the wholesale sector as these regions do not have seafood processing.

IMPLAN Region	Employee Compensation	Proprietor Income	Taxes	Intermediate Inputs
Accomack County, VA	2,849	950	475	2,374
Hampton, VA	6,067	2,022	1,011	5,056
Newport News, VA	5,937	1,979	990	4,948
Norfolk, VA	14,343	4,781	2,391	11,953
Virginia Beach, VA	17,058	5,686	2,843	14,215
Hyde County, NC	290	97	48	242
Dare County, NC	14,464	4,821	2,411	12,053
Cape May County, NJ	290	97	48	242
Washington County, RI	855	285	143	713
Total	62,154	20,718	10,359	51,795

Table 13. High impact scenario event specification. Values are 2022 USD and represent losses to each component of wholesale and processing production functions. Note that values for Norfolk, VA and Virginia Beach, VA only represent losses to the wholesale sector as these regions do not have seafood processing.

IMPLAN Region	Employee Compensation	Proprietor Income	Taxes	Intermediate Inputs
Accomack County, VA	22,790	7,597	3,798	18,991
Hampton, VA	47,059	15,686	7,843	39,216
Newport News, VA	46,539	15,513	7,757	38,783
Norfolk, VA	114,348	38,116	19,058	95,290
Virginia Beach, VA	125,208	41,736	20,868	104,340
Hyde County, NC	1,160	387	193	967
Dare County, NC	114,828	38,276	19,138	95,690
Cape May County, NJ	1,160	387	193	967
Washington County, RI	3,420	1,140	570	2,850
Total	476,512	158,837	79,419	397,093

Table 14. IMPLAN industries considered in assessing economic impacts of reductions in commercial fishery output.

IMPLAN Industry Index	Description
17	Commercial fishing
92	Seafood product preparation and packaging
105	Manufactured ice
360	Ship building and repairing
361	Boat building
398	Wholesale - Grocery and related product wholesalers (seafood)
399	Wholesale - Petroleum and petroleum products
408	Retail - Gasoline stores
422	Warehousing and storage
515	Commercial & industrial machinery & equipment repair, maintenance

Table 15. Average annual fishing effort (trips) in Federal EEZ from Virginia sites for private/rental boat and for-hire modes 2014-2023 and low, medium, and high impact scenarios indicating potential fishing effort increases of 0%, 5%, and 20% due to development of the CVOW site.

	Average Trips	Low	Medium	High
For-hire	6,024	0	301	1,205
Private angler	85,105	0	4,255	17,021

Table 16. NOAA Fisheries Community Social Vulnerability Indicators.

CSVI Group	Indicator	Definition
Fishing engagement and reliance	Commercial engagement	Measures the presence of commercial fishing through fishing activity through permits, fish dealers, and vessel landings. A high rank indicates more engagement.
	Commercial reliance	Measures the presence of commercial fishing relative to population size through fishing activity. A high rank indicates more reliance.
	Recreational engagement	Measures the presence of recreational fishing through fishing activity estimates. A high rank indicates more engagement.
	Recreational reliance	Measures the presence of recreational fishing relative to population. A high rank indicates increased reliance.
Environmental justice	Poverty	Expressed as those receiving assistance, families below the poverty line, and individuals older than 65 and younger than 18 in poverty. A high rank indicates a high rate of poverty.
	Population composition	Corresponds to the demographic makeup of a community including race, marital status, age, and ability to speak English. A high rank indicates a more vulnerable population.
	Personal disruption	Captures unemployment status, educational attainment, poverty, and marital status. A high rank indicates less personal capacity to adapt to changes.
Climate change	Sea level rise	Signifies the overall risk of inundation from projected sea level rise between one to six feet over the next ~90 years based upon combined projections. A high rank indicates more vulnerability to sea level rise.
	Storm surge risk	Refers to the overall risk of flooding from hurricane storm surge. The indicator represents the "worst-case" possibility of inundation based on combined hurricane storm surge categories. A high rank indicates more vulnerability to storm surge.
Economic	Labor force structure	Characterizes the availability of employment including females employed, population in the labor force, self-employment, and social security recipients. A high rank indicates fewer employment opportunities.
	Housing characteristics	A measure of infrastructure vulnerability to coastal hazards including median rent and mortgage, number of rooms, and presence of mobile homes. A high rank means more vulnerable infrastructure and a more vulnerable population.
Gentrification pressure	Housing disruption	Represents factors that indicate a fluctuating housing market where displacement may occur due to rising home values and rents. A high rank means more vulnerability for those in need of affordable housing.
	Retiree migration	Characterizes communities with a higher concentration of retirees and elderly people (households with inhabitants over 65 years), population receiving social security or retirement income, and level of participation in the workforce. A high rank indicates a more vulnerable population.
	Urban sprawl	Describes areas experiencing gentrification through increasing population density, proximity to urban centers, home values, and the cost of living. A high rank indicates a more vulnerable population.

Table 17. IMPLAN model estimates for direct, indirect, induced, and total economic impacts under low, medium, and high impact scenarios considering all industries. Values are 2022 USD rounded to the nearest dollar.

Impact Scenario	Direct	Indirect	Induced	Total
Low	-$201,242	-$49,644	-$39,929	-$290,815
Medium	-$633,109	-$151,035	-$131,297	-$915,441
High	-$3,260,026	-$746,128	-$707,666	-$4,713,820

Table 18. IMPLAN model estimates for total direct, indirect, induced, and total economic impacts under low, medium, and high impact scenarios considering industries directly dependent on commercial fishing. Values are 2022 USD rounded to the nearest dollar.

Impact Scenario	Direct	Indirect	Induced	Total
Low	-$41,586	-$8,769	-$804	-$51,159
Medium	-$216,612	-$25,978	-$2,664	-$245,254
High	-$1,663,449	-$126,567	-$14,577	-$1,804,593

Table 19. IMPLAN model estimates for direct, indirect, and induced impacts under low, medium, and high impact scenarios considering industries directly dependent on commercial fishing by IMPLAN region. Values are 2022 USD rounded to the nearest dollar.

IMPLAN Region	Scenario	Direct	Indirect	Induced
Accomack County, VA	low	-$2,661	-$639	-$52
	medium	-$13,302	-$1,783	-$171
	high	-$106,398	-$8,611	-$1,020
Hampton, VA	low	-$5,490	-$881	-$82
	medium	-$28,324	-$2,588	-$282
	high	-$219,702	-$12,544	-$1,637
Newport News, VA	low	-$5,432	-$1,120	-$72
	medium	-$27,720	-$3,300	-$243
	high	-$217,277	-$16,499	-$1,425
Norfolk, VA	low	-$6,649	-$3,089	-$178
	medium	-$33,361	-$8,853	-$530
	high	-$265,960	-$44,966	-$2,787
Virginia Beach, VA	low	-$7,280	-$1,321	-$154
	medium	-$39,675	-$4,119	-$499
	high	-$291,219	-$19,345	-$2,418
Hyde County, NC	low	-$136	-$5	-$3
	medium	-$1,355	-$41	-$17
	high	-$5,416	-$154	-$52
Dare County, NC	low	-$13,401	-$1,596	-$253
	medium	-$67,527	-$4,563	-$845
	high	-$536,094	-$22,430	-$5,014
Cape May County, NJ	low	-$136	-$29	-$3
	medium	-$1,355	-$164	-$22
	high	-$5,416	-$413	-$65
Washington County, RI	low	-$400	-$90	-$8
	medium	-$3,994	-$566	-$53
	high	-$15,967	-$1,604	-$158
Total	low	-$41,585	-$8,770	-$805
	medium	-$216,613	-$25,977	-$2,662
	high	-$1,663,449	-$126,566	-$14,576

Table 20. Economic impacts per trip for for-hire and private angler trips from Lovell et al. 2020 and under low, medium, and high impact scenarios associated with increases of 0%, 5%, and 20% effort increases due to development of the CVOW site.

	Trip Impact	Low	Medium	High
For-hire	$472.19	0	$142,129	$568,989
Private angler	$48.42	0	$206,027	$824,157
Total		0	$348,156	$1,393,146

Table 21. Fishing engagement and reliance indicators of vulnerability for ports considered in economic impact modeling. Note: Vulnerability describes community social vulnerability to a disturbance (generally); the indicator is not specific to offshore wind.

Fishing Engagement and Reliance

		Commercial Engagement			Commercial Reliance			Recreational Engagement			Recreational Reliance		
Community Name	**State**	2018	2019	2020	2018	2019	2020	2018	2019	2020	2018	2019	2020
North Kingstown	RI	4	4	1	1	1	1	1	1	1	1	1	1
Cape May	NJ	4	4	4	4	4	4	4	4	4	4	3	4
Chincoteague	VA	2	2	2	2	2	2	2	2	2	2	1	2
Newport News	VA	4	4	4	1	1	1	4	3	1	1	1	1
Hampton	VA	4	4	4	1	1	1	4	4	4	1	1	1
Norfolk	VA	2	2	2	1	1	1	4	4	4	1	1	1
Virginia Beach	VA	2	3	3	1	1	1	4	4	4	1	1	1
Wanchese	NC	4	4	4	3	2	2	4	3	4	4	2	4
Engelhard	NC	2	2	1	1	2	1	1	1	1	1	1	1

KEY: Vulnerability Rankings	0	1	2	3	4
	No Data	Low	Med	Med-High	High

Table 22. Environmental justice indicators of vulnerability for ports considered in economic impact modeling. Note: Vulnerability describes community social vulnerability to a disturbance (generally); the indicator is not specific to offshore wind.

		Environmental Justice								
		Poverty			Population Composition			Personal Disruption		
Community Name	**State**	2018	2019	2020	2018	2019	2020	2018	2019	2020
North Kingstown	RI	1	1	1	1	1	1	1	1	1
Cape May	NJ	1	1	1	1	1	1	1	1	1
Chincoteague	VA	1	1	1	1	1	1	2	2	1
Newport News	VA	2	2	2	3	3	3	2	2	2
Hampton	VA	2	2	2	2	2	2	2	2	2
Norfolk	VA	3	3	3	2	2	2	3	3	3
Virginia Beach	VA	1	1	1	2	2	2	1	1	1
Wanchese	NC	1	1	1	2	1	1	1	1	1
Engelhard	NC	4	4	3	2	2	2	4	3	4

KEY: Vulnerability Rankings	0	1	2	3	4
	No Data	Low	Med	Med-High	High

Table 23. Gentrification indicators of vulnerability for ports considered in economic impact modeling. Note: Vulnerability describes community social vulnerability to a disturbance (generally); the indicator is not specific to offshore wind.

		Gentrification								
		Housing Disruption			Retiree Migration			Urban Sprawl		
Community Name	**State**	2018	2019	2020	2018	2019	2020	2018	2019	2020
North Kingstown	RI	2	1	1	1	1	1	1	1	1
Cape May	NJ	4	4	4	4	3	3	2	1	1
Chincoteague	VA	1	2	2	4	3	4	1	1	1
Newport News	VA	1	1	1	1	1	1	1	1	1
Hampton	VA	2	2	1	1	1	1	1	1	1
Norfolk	VA	3	2	2	1	1	1	1	1	1
Virginia Beach	VA	2	2	2	1	1	1	1	1	1
Wanchese	NC	2	1	2	1	1	1	1	1	1
Engelhard	NC	1	1	1	1	2	1	1	0	0

KEY: Vulnerability Rankings	0	1	2	3	4
	No Data	Low	Med	Med-High	High

Table 24. Economic indicators of vulnerability for ports considered in economic impact modeling. Note: Vulnerability describes community social vulnerability to a disturbance (generally); the indicator is not specific to offshore wind.

		Economic Indicators					
		Labor Force			Housing Characteristics		
Community Name	**State**	2018	2019	2020	2018	2019	2020
North Kingstown	RI	1	1	1	1	1	2
Cape May	NJ	3	3	3	1	2	2
Chincoteague	VA	4	4	4	3	3	4
Newport News	VA	1	1	1	2	2	2
Hampton	VA	1	1	1	2	2	2
Norfolk	VA	1	1	1	2	2	2
Virginia Beach	VA	1	1	1	1	1	1
Wanchese	NC	1	1	1	3	3	4
Engelhard	NC	1	1	2	3	4	4

KEY: Vulnerability Rankings	0	1	2	3	4
	No Data	Low	Med	Med-High	High

Table 25. Climate change indicators of vulnerability for ports considered in economic impact modeling. Note: Vulnerability describes community social vulnerability to a disturbance (generally); the indicator is not specific to offshore wind.

		Climate Change					
		Sea Level Rise Risk			Storm Surge Risk		
Community Name	**State**	2018	2019	2020	2018	2019	2020
North Kingstown	RI	1	1	1	1	1	1
Cape May	NJ	2	2	2	3	3	3
Chincoteague	VA	4	4	4	4	4	4
Newport News	VA	3	3	4	2	2	2
Hampton	VA	4	4	3	4	4	4
Norfolk	VA	3	3	4	4	4	4
Virginia Beach	VA	4	4	4	4	4	4
Wanchese	NC	4	4	4	3	3	3
Engelhard	NC	0	0	4	4	4	4

KEY: Vulnerability Rankings	0	1	2	3	4
	No Data	Low	Med	Med-High	High

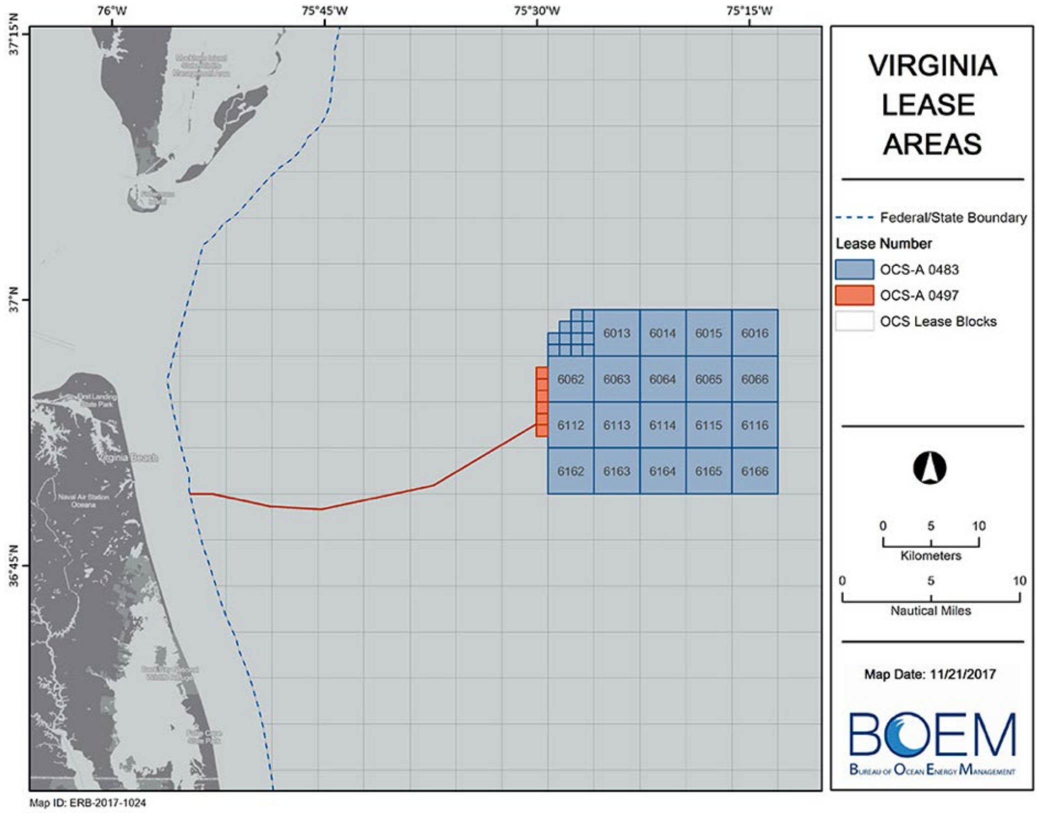

Figure 1. Coastal Virginia Offshore Wind commercial lease shown in blue. Image from https://www.boem.gov/renewable-energy/state-activities/virginia-activities (accessed September 30, 2024).

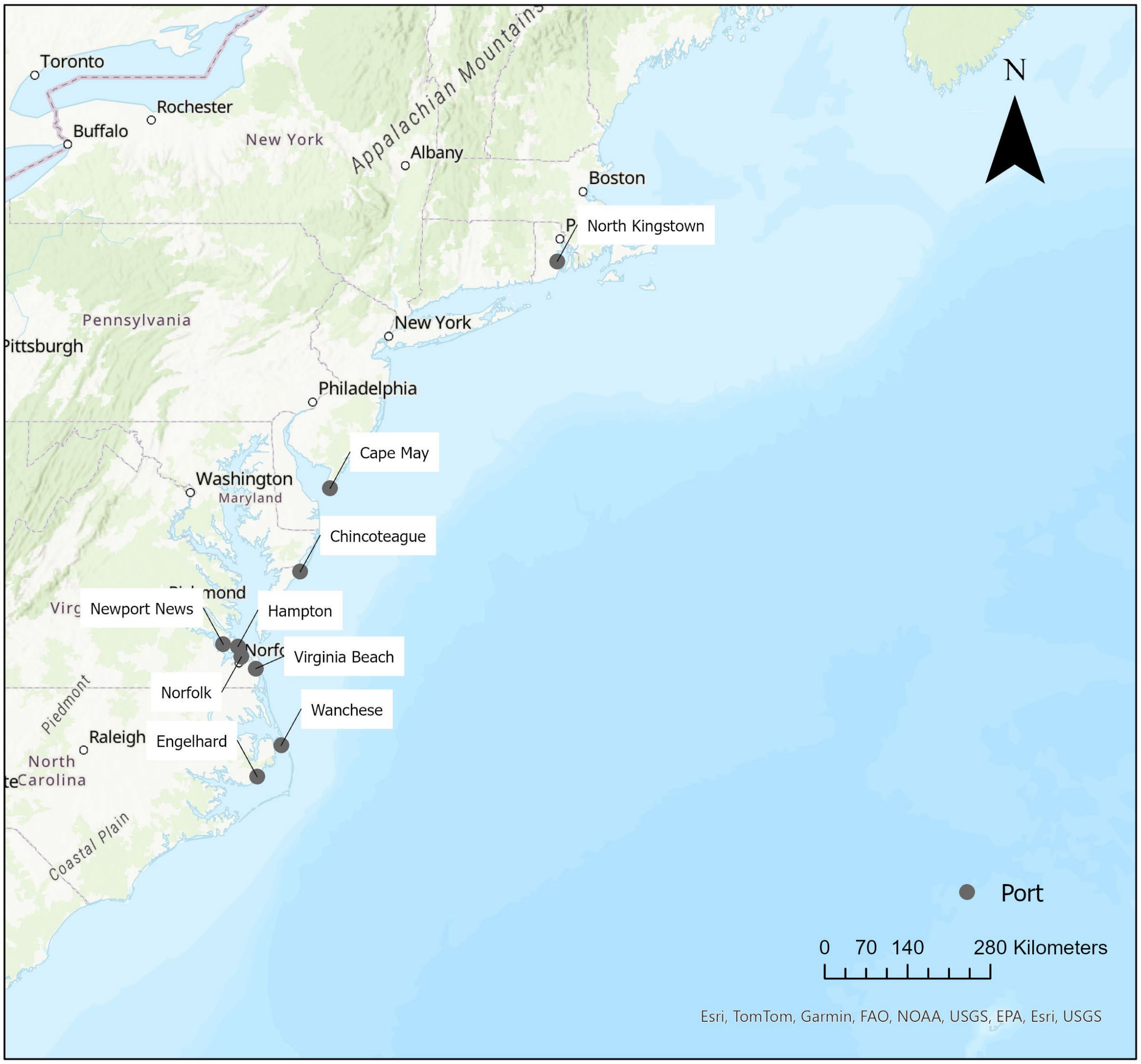

Figure 2. Regions and port communities considered in IMPLAN and social vulnerability analyses.

Appendix

Direct Compensation Fund Structure

In addition to the shoreside support services report described in COP Approval Condition 6.1.2, the condition requires a detailed description of the Direct Compensation Fund structure. These compensation/mitigation funds are established for compensation of income losses by commercial or for-hire fishermen directly related to the development of the Coastal Virginia Offshore Wind Commercial Project. Virginia Electric and Power Company, d/b/a Dominion Energy Virginia (Dominion Energy) describes the structure of the Direct Compensation Fund as follows.

In accordance with the Fisheries Compensatory Mitigation Plan (COP Appendix V-3), the Dominion Energy Coastal Virginia Offshore Wind Project (henceforth "the Project") will establish three distinct compensation mechanisms: the Gear Loss Compensation Program (which has been previously established and paid out claims), the Compensatory Mitigation Fund, and the Surfclam Compensatory Mitigation Fund. The Gear Loss Compensation fund provides as-needed compensation for loss or damage to commercial fishing gear impacted by project construction. Both the Compensatory Mitigation Fund and the Surfclam Compensatory Mitigation Fund are established to provide compensation for adverse economic impacts on fishery-related businesses resulting from the Project for both direct and indirect (shoreside) claims related to commercial and for-hire recreational fisheries. Dominion Energy will provide up to $40,000,000 to fund the Compensatory Mitigation Fund and an additional $3,000,000 to the Surfclam Compensatory Mitigation Fund.

Claims to the Compensatory Mitigation Fund will be due within 2 calendar years of the year of claimed economic impact (i.e., claims for 2023 would be due by December 31, 2025). Claims may be filed by any fishery-related business or individual that generally aligns with the above three categories, or their agent. Claimants must provide documentary evidence sufficient to demonstrate the claimed economic losses based on a comparison with similar pre-Project activities. Reasonable third-party costs associated with preparing claims (such as accounting services) are also eligible for reimbursement by the Compensatory Mitigation Fund. Claimants also should make reasonable efforts to quantify economic benefits attributable to the Project and to offset economic loss claims proportionally (e.g., increases in abundance of one species due to the presence of structure may offset losses related to another species). Duplicate claims are prohibited, inclusive of any claims made through other programs.

In consultation with the third-party administrator and VMRC, Dominion Energy will develop, and release detailed Compensatory Mitigation Fund program documentation (the "Compensatory Mitigation Program Documents"). The Compensatory Mitigation Program Documents may be revised from time to time to reflect best practices based on experience gained through administering the Compensatory Mitigation Fund, further guidance from BOEM, or input from VMRC. Program documentation and guidance will be available on a dedicated program website independent of the Project website, however there will be links provided from the Project website to the Fisheries Compensation Program website.