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New York Bight Offshore Wind Farms: Collaborative Development of Strategies and Tools to Address Commercial Fishing Access

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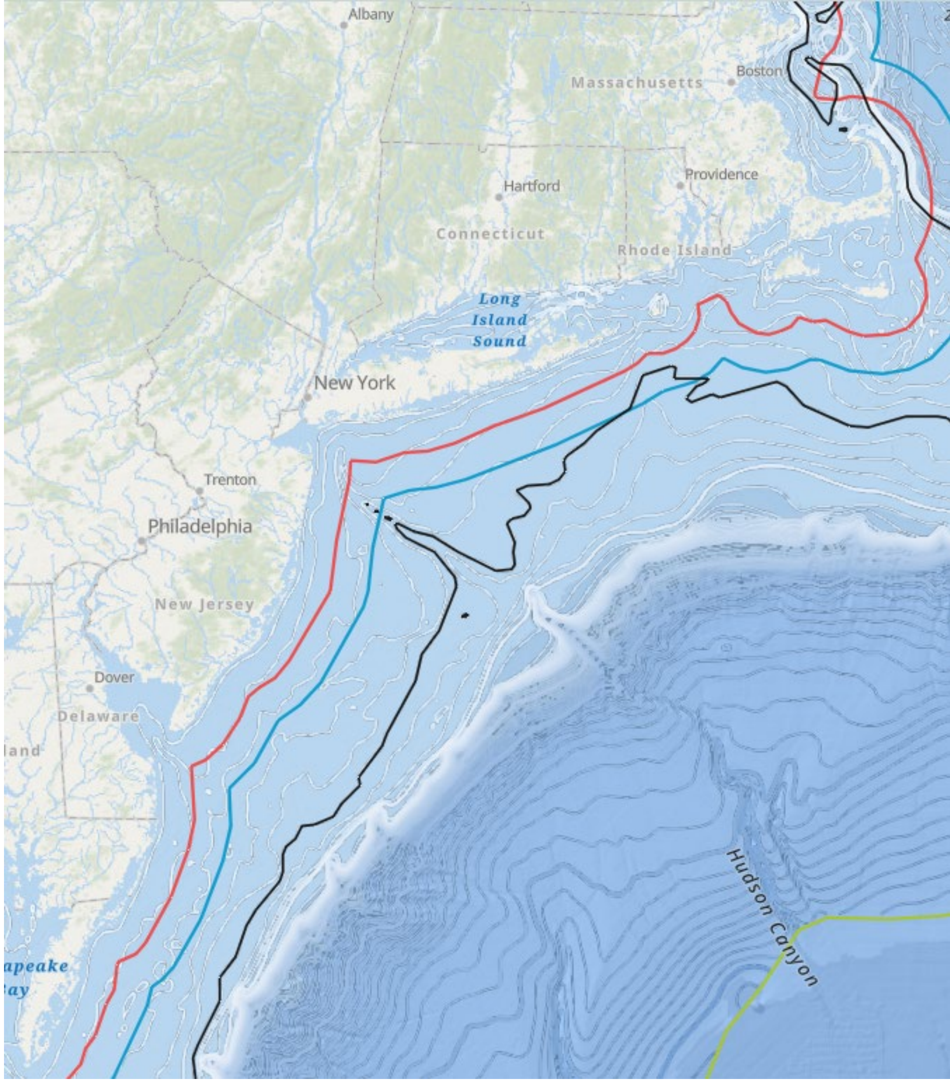
Agenda

INTRODUCE THE TEAM AND THE PROJECT

OVERVIEW OF PROJECT TASKS AND OUTCOMES

DISCUSSION



Project Team

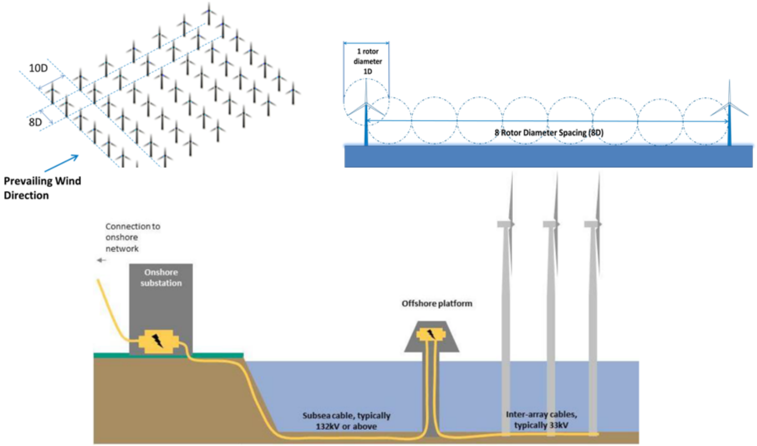
- **NYSERDA Project Manager:** Morgan Brunbauer
- **National Renewable Energy Laboratory (NREL)**
  - Overall project lead
  - Provided expert technical knowledge of offshore wind farm design, controls, and layout, as well as advances in turbine and substructure designs
  - Led techno-economic cost modeling for scenarios and project dissemination
- **Responsible Offshore Development Alliance (RODA)**
  - Provided fisheries expertise through its broad coalition of fishing associations and companies
  - Led information gathering and interviews with fishing industry
- **Global Marine Group**
  - Provided expert knowledge of offshore cable system considerations.
  - Led pilot project study and development of engineering practices for reducing risk
- **Project Advisory Committee**
  - Consisted of membership from the fishing industry, offshore wind industry, and federal agencies
  - Met regularly, provided advice, and reviewed draft versions of chapters in the final report

Project Overview

- **Overall goal** was to collaboratively develop *technical strategies and tools*, including new datasets and modeling, to minimize the disruption of commercial fishing within fixed-bottom offshore wind arrays, while also ensuring economical energy generation and safe operation for the industry.

- **Primary issue** is that *turbines, cables, and other structures* can make it difficult to actively fish or navigate in vicinity of a wind project, including direct and indirect access restrictions due to physical obstructions, risk, and safety.

- **Our aim** was to minimize the extent to which offshore wind development may restrict the access of fishermen due to self-determined or external risk assessments or the physical constraints of various vessels and gear types.



Offshore wind farm design considerations for fishing access include elements, such as turbine spacing, foundation design, anchoring, and cabling.

Project Tasks

Task #1 – Information Gathering and Surveys

- Performed literature review, data assessment, and gap analysis. Conducted interviews with sets of fishery participants to identify regional needs and risks in the New York Bight.

Task #2 – Scenario Development and Analysis

- Developed and analyzed a realistic set of offshore wind project scenarios to better understand how to minimize access constriction to fishermen and reduce risk to vessels and gear.

Task #3 – Validation of Approach/Pilot Study

- Identified and assessed a pilot project that provided a small-scale preliminary study to evaluate the applicability and feasibility of select mitigation measures for a specific locale.

Task #4 – Information Sharing and Dissemination

- Developed a StoryMap project summary that will be hosted on the MarineCadastre. Disseminated findings, such as at AFS 2021 Annual Meeting and E-TWG/F-TWG.

Task 1: Information Gathering and Surveys

- The **literature review** assessed approximately 150 literature resources associated with European wind farms and initial OSW development in U.S. waters.
- Consideration was given to risks to the commercial fishing industry across a broad range of categories, including operational risks to fishing due to structures and hazards, as well as regulatory, socioeconomic, insurance, and species redistribution impacts.
- Operational risks to fishing due to structures and hazards were within the main scope of this project; they include:
  - **Overall size, shape, and location of project area**: The total footprint that OSW project areas will have and their proximity to and spatial overlap with historic fishing grounds.
  - **Turbine array layout**: The directionality, grid uniformity, and spacing of turbine arrays that could influence fishing vessel transit and harvesting.
  - **Cabling**: Inter-array and export power cables with considerations for the operability of fishing vessels within an array and along cable routes.
  - **Protective materials**: Materials on the seafloor used to protect the turbine and cable infrastructure against changing benthic conditions and accidental damage.

Summary of Identified Operational Mitigation Measures from Literature Review

Overall Size, Shape, and Location of Project Area

- Perform project-specific navigational safety risk assessments (NSRAs) based on the individual specifications of a project.
- Site away from areas of high fish concentration when possible; otherwise considering colocation needs.
- Consider limiting geographic size of individual wind turbines and of total project arrays.
- Use state-of-the-art methods for windfarm layout design.

Turbine Array Layout

- Utilize fishermen's expertise to develop specific project designs.
- Test out navigation and gear use within windfarm arrays.
- Consider transit requirements.
- Execute long-term monitoring programs in combination with targeted research.

Cabling

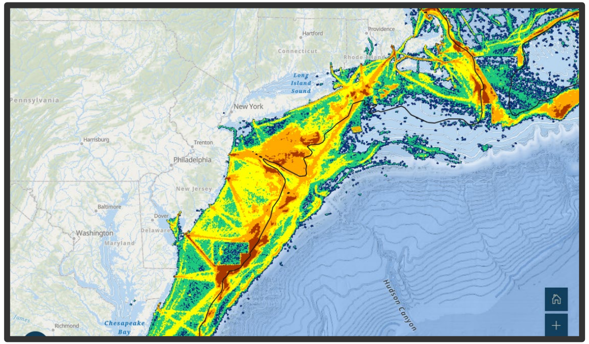
- Design cable routes to maximize the potential for good cable burial.
- Optimize export and inter-array cable layouts that account for existing fishing activity, including minimizing amount of cable laid.
- Lay power cables using methods that cause the least damage to the seabed.
- Lay High Voltage DC cables with opposing electrical currents alongside each other and with sufficient burial.
- Plan cable location and directionality with delineation of cable locations on charts.
- Consider decommissioning plans.

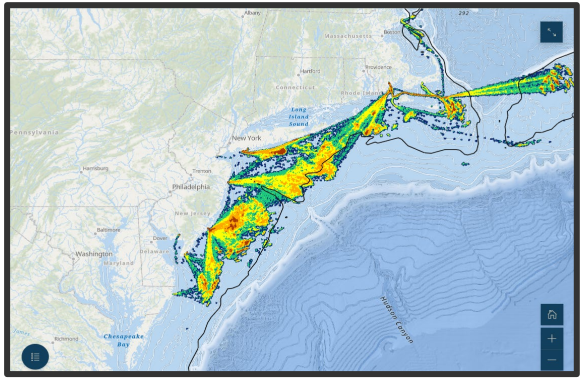
Protective Materials

- Perform additional research on materials design to understand fishing and environmental impacts, including reef effect.
- Require removal of debris from the seabed resulting from OSW turbine construction and operation.

Data Assessment and Gap Analysis

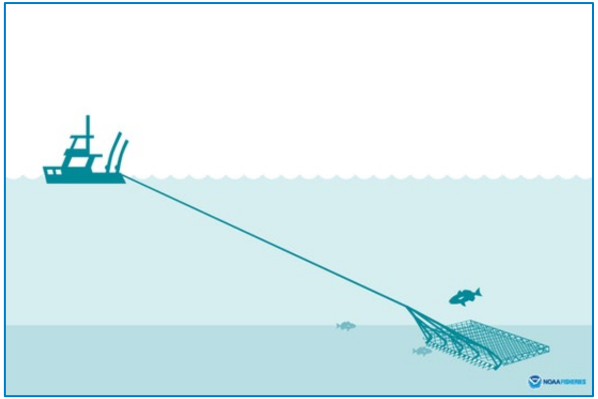
- The project team performed an assessment to identify the relevant **existing datasets in each fishery** as well as fishing practices used in the region to inform the development of mitigation strategies.
- Fisheries are dynamic, and therefore data collection is inherently complicated.
- Data sets are considered **fishery-dependent** or **fishery-independent** based on whether they are collected from commercial sources during fishing operations, or from scientists conducting resource monitoring that does not co-occur with commercial fishing.
- Some **examples** of fishery-dependent data sources assessed (i.e., those collected from commercial sources during fishing operation) include:
    - Vessel Trip Reports (VTRs)
    - Vessel Monitoring System (VMS)
    - Dealer Data
    - Observer Data
    - Automatic Identification System (AIS) Data





Example density of commercial fishing for sea scallops (top) and ocean quahog (bottom) over a two-year period (2015 and 2016).

Interviews to Identify Needs and Risks



Example dredge gear.

- In the Northeast U.S., there is limited research on fishing operational needs and risks for fishermen operating within and around OSW arrays.
- Interviews were conducted to gather data on scallop and surfclam/ocean quahog (SC/OQ) fishermen's operational characteristics to aid in filling these gaps.*
- These interviews gathered qualitative data from sea scallop fishermen (7 respondents) and SC/OQ fishermen (collective industry response) on:
    - Fishing operations (e.g., tow characteristics, operating with other vessels/gear, sea state conditions) and
    - Fishermen's concerns with operating within or around a wind array.
- Results from the literature review, interviews, and assessment of data sources helped inform follow-on project tasks associated with scenario development and a pilot study for developing and testing impact minimization solutions that minimize access restrictions for fishermen in OSW arrays, while ensuring economical energy generation and safe operations.

*The federal limited access Atlantic sea scallop and SC/OQ fisheries were identified as being most appropriate for this study given their importance in the NY Bight and representation by an easily-defined group of participants.

Task 2 – Scenario Development and Analysis

- **Objective:** Develop and analyze a realistic set of OSW project scenarios to minimize access constriction to fishermen and reduce risk to vessels and gear.
- Specifically, scenarios were developed to better understand the potential **range of technical options** for a wind project located within the NY Bight based on fishing operations for the scallop and SC/OQ industries.
- For use in all scenarios, the project team outlined a design space for a **representative commercial scale OSW project** in the New York Bight.
- The **core assumptions** were developed based on input from the previous task, PAC feedback, and various data sources are shown here.

Parameter	Value	Rationale
Nominal Plant Capacity	800 MW	Representative of commercial scale plant capacities
Project Area	30,147 acres (122 km^2)	Use area of Baseline Scenario for comparability
Turbine Rating	12 and 15 MW	Similar to announced turbine ratings for near-term U.S. projects
Array Cable Type	66 kV	3-core, copper, 66kV cross-linked polyethylene (XLPE) insulated cables with diameters of 630mm and 185mm
Array Cable Burial Depth	6.6 feet (2 m)	Based on PAC feedback
Water Depth	148 feet (45 m)	Representative of NY Bight
Distance to Shore	65 nautical miles, nmi (120 km)	Representative of NY Bight
Foundation Type	Monopile	Representative of near-term U.S. projects
Metocean Conditions	Wind Speed and Wave Height Time Series	Hourly estimates of global climate (ERA5 product)

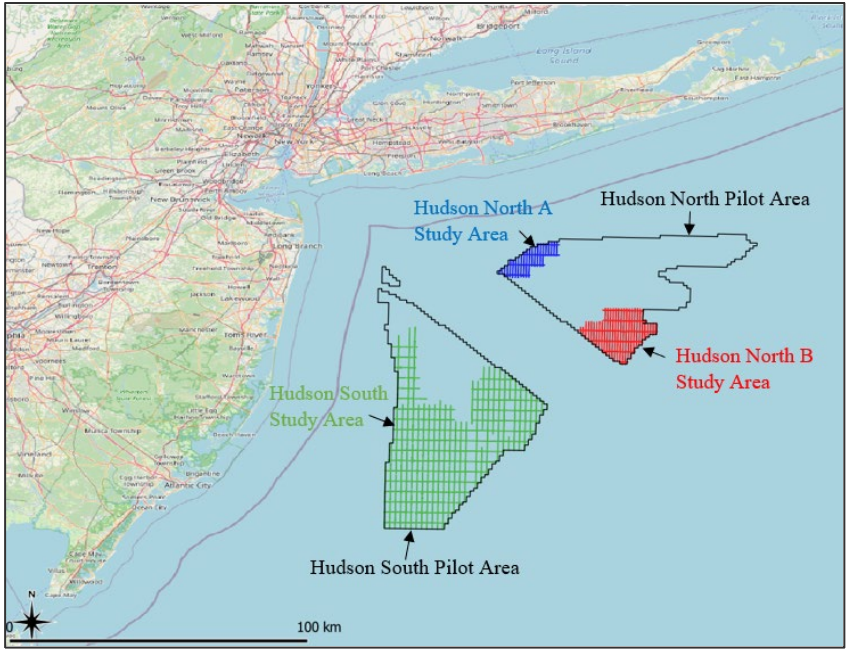
Scenario Descriptions and Value to Fishermen

- An **overview of the project scenarios** analyzed are shown including layouts with the placement of wind turbines, offshore substations (OSS), and inter-array cables.
- The **cost and performance impacts** of the different access scenarios were quantified relative to a Baseline Scenario in terms of annual energy production (AEP), capital expenditures (CapEx), and levelized cost of energy (LCOE).
- **Increasing turbine or no-build area spacing** decreases AEP relative to a Baseline Scenario optimized for AEP, with the exception of Scenario 6 (Turbine Upsizing). This is due to increased wake losses and leads to higher LCOE in all but Scenario 6 relative to the Baseline Scenario.
- **Since the array cable costs only represented 2-4% of the Total CapEx, changes in AEP drove differences in LCOE.**
- **Turbine upsizing** from 12 MW to 15 MW turbines (Scenario 6) may present multiple advantages for fishermens' access and developers' project costs if turbine positions can be more favorably arranged to help reduce cable crossings and increase the area available to fisheries.

Scenario Name	Minimum Turbine Spacing	Total CapEx ($ or % change from Baseline)	AEP (GWh or % change from Baseline)	Array Cable System Cost ($ or % change from Baseline)	Array Cable Installation Cost ($ or % change from Baseline)	LCOE ($/MWh)
Baseline: Optimal AEP	0.63 nmi (1.17 km)	$2.589B	3744 GWh	$65.9M	$21.8M	60
Scenario 1: OSS Relocation	0.63 nmi (1.17 km)	1.08%	0%	+34.4%	+7.2%	60
Scenario 2: Widen Rows	0.63 nmi (1.17 km)	-0.57%	-2.3%	-17.1%	-6.5%	61
Scenario 3: 2nmi No-Build Area	0.57 nmi (1.06 km)	-0.18%	-2.5%	-5.25%	-2.1%	61
Scenario 4: 5 nmi No-Build Area (High AEP)	0.45 nmi (0.84 km)	+0.24%	-2.3%	+8.1%	+0.9%	61
Scenario 5: 5 nmi No-Build Area (Low AEP)	0.50 nmi (0.92 km)	-0.75%	-6.4%	-22.6%	-7.9%	63
Scenario 6: Turbine Upsizing	0.72 nmi (1.33 km)	-3.82%	+2.0%	-22.4%	-21.1%	57

Task 3 – Validation of Approach/Pilot Study

- To further develop technical strategies and tools to minimize the disruption of commercial fishing within OSW arrays, the **pilot project** built on inputs from the results of the fishing surveys and the layout configuration scenarios.
- Investigated **seabed characteristics within the Hudson North and Hudson South** Bureau of Ocean Energy Management (BOEM) call areas in the New York Bight.
- Focused on seabed conditions that could affect the wind turbine foundation, OSS foundation(s), and cable installation and burial, as these are components of OSW infrastructure most likely to affect **mobile bottom-tending fishing gear**.
- **Assumptions** applied include:
  - Uniform fishing potential across all the sites to prevent bias and allow for future variation of fishing effort distribution.
  - Remaining within the technological limits of fixed-bottom foundations (<60 m) in the New York Bight region.
  - Removal of any existing lease areas (to remove potential for project conclusions to influence currently leased developments).



Hudson North and Hudson South lease areas assessed in the pilot project.

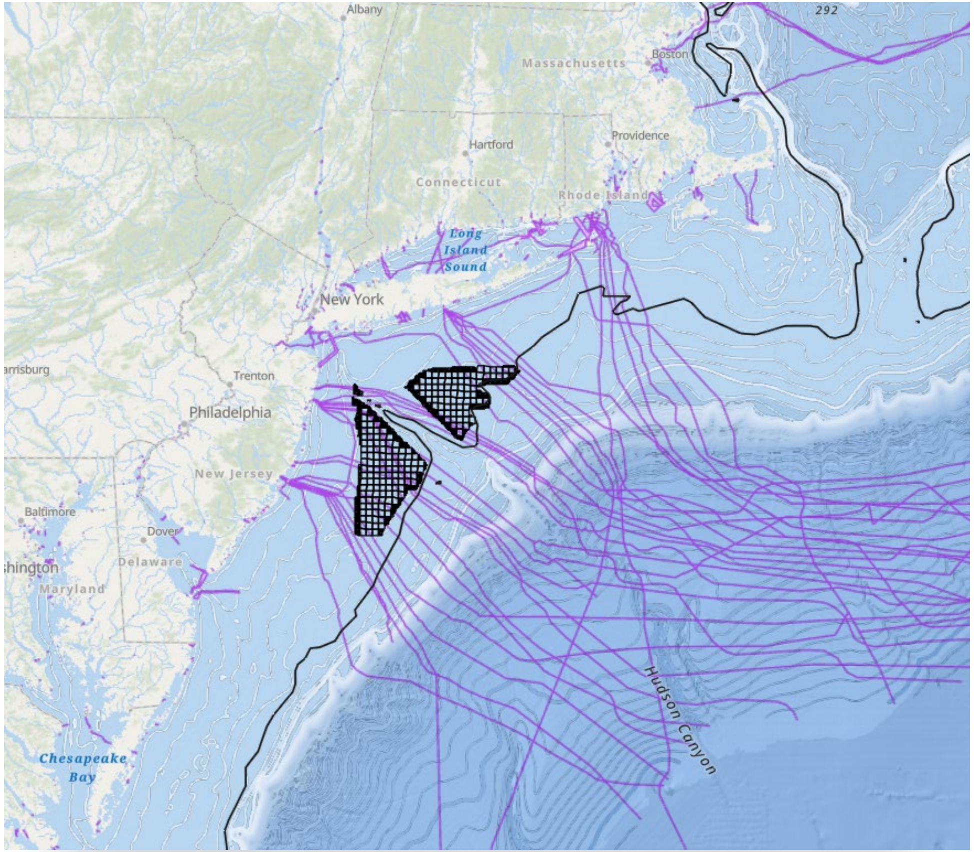
Pilot Project

- The selected approach was to create a list of regional **seabed and environmental characteristics** to be found in the New York Bight and specifically the pilot project area, including:
  - Seabed features such as ripples, banks, channels, mounds and seabed obstructions
  - Environmental considerations such as currents, scour formation around existing seabed objects, existing infrastructure and seabed surface sediment types).
- Publicly available **GIS datasets** were compiled and mapped to identify where these features and conditions were located or predicted.
- The table shown shows the datasets compiled and used by the pilot project and their associated metadata.

Dataset	Source	Description
Regional Bathymetry	Bathymetry at 1/3rd Arc sec (approx. 8m) and 1 Arc sec (approx. 24m) resolution, giving continuous coarse bathymetry data across the pilot project area	Bathymetry at 1/3rd Arc sec (approx. 8m) and 1 Arc sec (approx. 24m) resolution, giving continuous coarse bathymetry data across the pilot project area
Alpine 2017 Survey (For NYSERDA)	NOAA NCEI	Selective bathymetry at 4m resolution, giving a more detailed view of selective strips across the pilot project area
Gardline 2021 Survey (For NYSERDA) Hudson North A&B, Hudson South	NYSERDA	Selective bathymetry at 0.5m resolution, giving a highly detailed view of partial areas across the pilot project area, side scan sonar targets and magnetic anomalies
Coast Survey's Automated Wreck and Obstruction Information System (AWOIS)	NOAA/BOEM via www.marinecadastre.gov	Contains information on over 10,000 submerged wrecks and obstructions in the coastal waters of the United States.
NOAA Raster Nautical Charts (RNCs)	NOAA Office of Coast Survey	Unexpected ordinances (UXO)
BOEM Call Areas	NOAA/BOEM via www.marinecadastre.gov	BOEM OSW Call Areas
FVCOM (Finite Volume Coastal Ocean Model) Current Data	University of Massachusetts-Dartmouth and the Woods Hole Oceanographic Institute	Surface and Bottom current data
Georgia Tech Research Corporation Coastal Tidal Currents	Georgia Tech Research Corporation	Tidal currents
Georgia Tech Research Corporation Ocean Currents	Georgia Tech Research Corporation	Ocean currents
Atlantic Seafloor Sediments (CONMAP)	NOAA/BOEM via www.marinecadastre.gov	Sediment grain size distributions and trends along U.S. East Coast
BOEM Marine Minerals Information System	BOEM via https://mmis.doi.gov/BOEMMMIS/ BOEM via https://mmis.doi.gov/BOEMMMIS/	Sand resource areas
USGS Sediment Texture data (ecstdb) (2014)	USGS via www.marinecadastre.gov	Seabed texture
USGS usSEABED database	USGS via www.marinecadastre.gov	National seafloor sediments
USGS Seafloor Stress and Sediment Mobility Database	USGS via https://www.usgs.gov/centers/whcmsc/science/sea-floor-stress-and-sediment-mobility-database	Seafloor stress and sediment mobility

Cable Route Engineering Practices, Burial, and Protection

- Having assessed the pilot area characteristics, a **set of engineering practices** were developed to help reduce the chance of interaction between fishing gear and OSW infrastructure, in particular power cables.
- The result is a **"toolbox"** of surf clam, ocean quahog, and scallop "fishing friendly" engineering approaches that can be adopted by OSW project developers.
- The following table summarizes perceived risks to scallop and surf clam/ocean quahog fishing activities and **engineering practices to reduce risk** in the pilot project area.



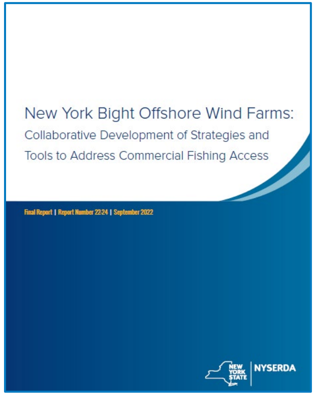
Examples of existing subsea cables in the region.

Engineering Practices to Reduce Risks in Pilot Area

Description of Risk to Scallop and Surf Clam/Ocean Quahog Activities	Engineering Practices to Reduce Risk	Comments on Pilot Project Area
Trawl gear snagging cables at cable crossings	• Ensure crossing design considers trawl activity and uses materials which minimize the chances of snagging fishing gear • Determine existing crossed cable depth so that if practical the inter-array cable can be buried over the top • Reduce # of crossings by using the mutualized crossing point concept • Reduce # of crossings by using appropriate windfarm layout strategies • Reduce # of crossings by clearing OSS cables before new inter-array cable is installed • Undertake periodic inspection surveys to monitor cable crossing condition and share with marine stakeholders	• The pilot project area does feature an extensive amount of existing telecom cables and 14 of these are believed to be in service at this time • The probability that OSW farm's inter-array cables will require cable crossings is high
Trawl gear snagging on exposed cables due to seabed scour	• Obtain data on local metocean and seabed sediment environment and carry out detailed seabed mobility and scour prediction studies to inform good scour protection engineering • Undertake periodic inspection surveys to monitor scour conditions and share with marine stakeholders	• Seabed scour has been visually identified at between 8 and 11% of the seabed boulders and debris found by the Gardline 2020 survey data. • The shallow soil and seabed current environment are similar across all the sites. • The depth of scour found around sonar contacts reached a maximum of 3ft (1m)
Trawl gear snagging on cable protection system (CPS)	• CPS design not to extend further than necessary beyond any scour protection and transition to buried cable at earliest opportunity • Investigate latest developments in cable connection technology and ensure CPS system is appropriate to the site conditions	• The information by the study used has not provided an indication on the type and design suited to the pilot sites and will be determined by the developers
Reduction of effective fishing area within array	• Use a windfarm layout and turbine power size to suit the specific development area to maximize access based on strategies identified previously	• The existing telecoms cable infrastructure may offer opportunities to co-locate wider lanes in the array and increase separation of wind turbines locally
Damage to fishing gear due to scour protection (rock)	• Investigate and collaborate on scour protection designs at the base of wind turbines to explore if they can be made fishing friendly • Ensure scour protection design is appropriate to site conditions; not over engineered	• Seabed scour has been visually identified at between 8 and 11% of the seabed boulders and debris found by the Gardline 2020 survey data. • The shallow soil and seabed current environment are similar across all the sites. • The depth of scour found around sonar contacts reached a maximum of 3ft (1m)

Information Sharing and Dissemination

- Final report was published in September 2022:
  - https://www.nyserda.ny.gov/All-Programs/Offshore-Wind/Focus-Areas/Impacts-and-Benefits
- StoryMap (first page shown above) was developed to tell the story of the project in a graphically (GIS)-rich manner and will be hosted on the MarineCadastre.
- Presented at the AFS Annual Meeting in 2022.
- Provided updates to NOAA and E-TWG/F-TWG as requested.



Considerations for Next Steps

- This project developed technical strategies and tools to help minimize the disruption of commercial fishing within OSW arrays in the New York Bight.
  - Scope primarily focused on the commercial fishing industries for Atlantic scallops and SC/OQ and fishing access within future fixed-bottom OSW farms in the New York Bight.
- Recommendations for future research includes:
  - Focus on other commercial and recreational fishing gear types used in the region to determine their unique requirements and risks associated with fishing access in OSW farms.
  - Understanding how the choice of scour protection and other protective materials may impact fisheries ecology in the region.
  - Environmental and socioeconomic issues related to potential changes to insurance policies, potential redistribution of species and fishing effort, and socioeconomic impacts to fishing communities and businesses.
  - Co-design to minimize risks associated with future floating OSW installations and considerations for both fixed and mobile fishing gear types in the central Atlantic and other regions where wind development is being considered.

Thank you. Questions?

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