Potential repercussions of offshore wind development in the Northeast U.S. on the Atlantic surfclam survey and population assessment

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Background

Offshore wind is advancing rapidly globally, and extensive wind energy development projects are planned along the Atlantic coast of the U.S. The Atlantic surfclam fishery is among the most exposed to impacts from offshore wind energy development due to the overlap of its fishing grounds with wind lease areas, the hydraulic dredges used by the fishing vessels, and the location of vessel home ports relative to the fishing grounds. The surfclam fishery is a major economic driver in communities spanning the U.S. Northeast coast. This fishery has a long-term record of effective management, consistently meeting goals of the Magnuson-Stevens Fishery Conservation and Management Act.

Objective

The overlap of the federal surfclam assessment survey strata and offshore wind areas may make some stock areas inaccessible to the existing scientific survey. Once turbines, cables, and scour protection are built out, survey operations within wind farms may be curtailed or require modification due to vessel limits, safety requirements, and assessment protocols.

The impact of a scenario in which the federal survey is excluded from wind farm leases was evaluated using a Spatially-Explicit Fishery Economic Simulator (Figure 1). The simulator integrates spatial dynamics in surfclam stock biology, fishery captain and fleet behavior, federal management decisions, and fishery economics.

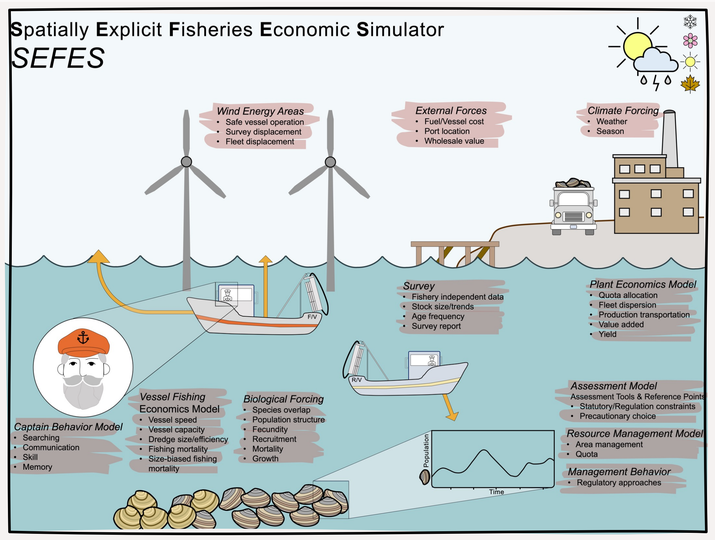


Figure 1: Spatially-Explicit Fishery Economic Simulator (*SEFES*) model includes submodels specifying surfclam population dynamics, fishery management, fishing fleet structure and behavior, and economic configuration of vessels and the processing sector.

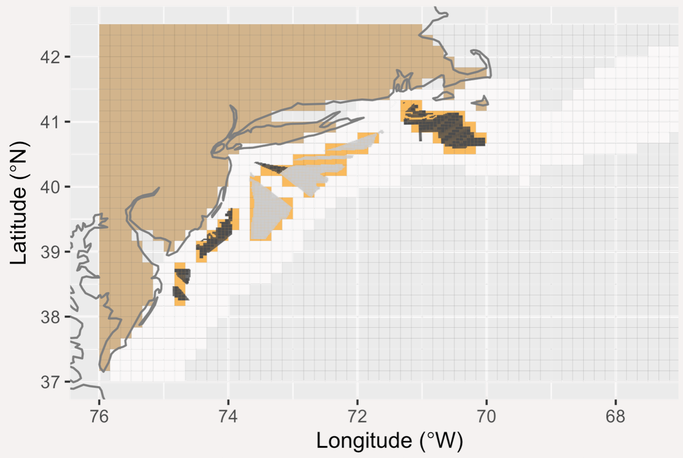


Figure 2: Map of the Northeast U.S. continental shelf showing existing offshore wind energy leases (dark grey) and potential future development areas (light grey). Model grid cells considered land (tan), those within the biological domain (white), and those in which fishing and survey vessel behavioral restrictions were imposed in wind energy areas (orange shading under wind area polygons) are indicated.

Simulations

- Three simulations were designed to assess impacts on fishery management by estimating the magnitude of changes in biological reference points (biomass and fishing mortality) arising from the overlap of offshore wind leases and areas of surfclam habitat (Figure 2) in the existing scientific survey.
- Biological reference points (BRP): reference points include spawning stock biomass (SSB) and fishing mortality (F).
- The percent change for each BRP was calculated for both wind development scenarios (BRP_{Wn}) (Figure 3) relative to the reference simulation with no imposed survey restrictions (BRP_{ref}). These changes were then applied to the observed BRP (BRP_{Obs}) values from population assessment (NEFSC, 2022) to calculate the adjusted BRP (BRP_{AdjWn}: W1- exclusion of wind lease areas; W2 - exclusion of wind lease and proposed lease areas)

$$BRP_{AdjWn} = BRP_{Obs} + \left(\frac{BRP_{Wn} - BRP_{ref}}{BRP_{ref}}\right) \times BRP_{Obs}$$

- Relative BRP ($BRP_{WnMSYproxy}$) for both wind development scenarios (W1, W2) were calculated and evaluated in relation to the status estimate from 2019 based on recommended reference points ($BRP_{Threshold}$) (NEFSC, 2022).

$$BRP_{Wn\ MSY\ proxy} = \frac{BRP_{AdjWn}}{BRP_{Threshold}}$$

Wind energy scenario	*Description*
W0	reference simulation; no wind farms
W1	Survey excluded from current wind farms — CURRENT LEASES
W2	Survey excluded from current and future wind farms — CURRENT LEASES, CALL AREAS

Figure 3: Simulation scenarios implemented to assess exclusion scenarios of wind farm development areas from the existing scientific survey for the Atlantic surf clam

Results

Relative to the reference simulation (unrestricted access), the mean model fishable biomass increased by 1.2% in the simulations including wind energy arrays. In the most restricted condition, the simulated assessment estimated the SSB to be 17% less than that of the reference simulation, placing it below the SSB target. Estimated F increased by 7%; however, it remained below the F threshold.

Changes in biological reference points are driven by the inability to access the surfclam biomass within the wind energy lease areas. Therefore, deviations in biological reference points reflect the proportion of the population excluded from the survey.

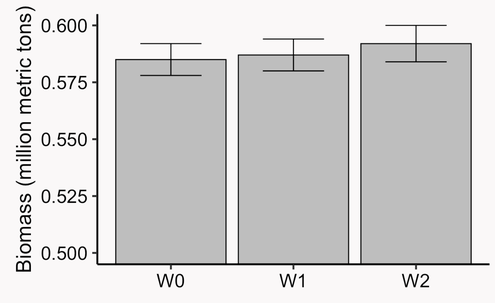


Figure 4: Changes in the total simulated Atlantic surfclam biomass from the unrestricted survey (W0) with two windfarm scenarios (W1, W2). Values shown are means taken across 10,000 observations from the last 50 years of simulations for a particular scenario. Error bars indicate one standard deviation.

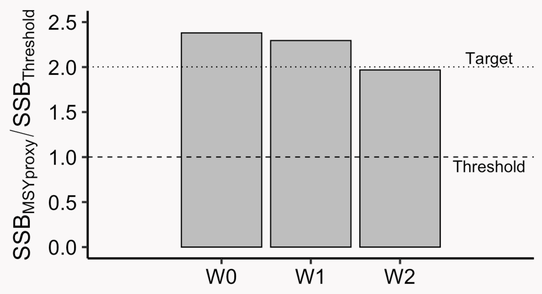


Figure 5: Change in relative spawning stock biomass ($SSB_{WnMSYproxy}/SSB_{Threshold\ (2019)}$) of Atlantic surfclam biomass from the survey in 2019 (W0) (NEFSC, 2022) with two windfarm scenarios (W1, W2). Corresponding $SSB_{Threshold\ (2019)}$ (dashed line) as well as SSB_{Target} (dotted line) are based on the recent assessment (NEFSC, 2022).

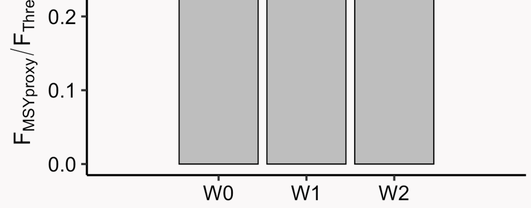


Figure 6: Change in relative fishing mortality ($F_{WnMSYproxy}/F_{Threshold\ (2019)}$) of the Atlantic surfclam fishery from the survey in 2019 (W0) (NEFSC, 2022) with two windfarm scenarios (W1, W2). Corresponding $F_{Threshold\ (2019)}$ is based on the recent assessment (NEFSC, 2022).

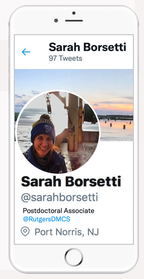
Implications

Excluding the federal surfclam surveys from the regions designated for wind energy development will alter the long-term stock assessments by increasing uncertainty in surfclam biomass estimates and other metrics used to set fishing quotas.

Offshore wind development will include infrastructure that could become obstacles that may result in *de facto* fishery exclusion areas, potentially leading to the redistribution of fishing effort and changes in quotas or catch limits. The displaced effort could lead to increased competition in remaining fishable locations.

Understanding the impacts of fishery exclusion and effort displacement from development of offshore wind energy is critical to the sustainability of various fishing industries on the Northeast U.S. continental shelf. The Atlantic surfclam can function as a model fishery to examine potential survey impacts due to windfarm development providing a coarse understanding of the magnitude of changes in survey biological reference points.

Robust plans for this and other fisheries are needed to adapt survey data collection to offshore wind development areas to reduce survey bias and uncertainty.



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NEFSC. 2022. Management Track Assessments Completed in Spring 2020. US Dept. of Commerce, Northeast Fisheries Science Center Ref. Doc. 22-09; 86 p.

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