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EDITORIAL

Fisheries, Climate Change, and Offshore Wind Energy Development on US Continental Shelf Regions

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ABSTRACT

Areas along the US continental shelf that have been designated for extensive offshore wind farm installations over the coming decades overlap with regions that support economically important fisheries. These fisheries are undergoing changes in distribution in response to warming ocean water temperatures. The combination of expanding offshore wind energy infrastructure and changing environmental conditions presents new challenges for these offshore fisheries. The contributions in this special issue consider responses of habitat, biology, and socio-economic aspects of commercial and recreational fisheries to the coincident stressors of changing oceanographic conditions, climate change, and development of offshore renewable energy. The synthesis of the current state of understanding at the nexus of these interactions provided by these contributions points to areas of research needed to advance co-existence of fisheries with expanded use of the offshore ocean environment that is undergoing rapid environmental change.

1 | Introduction

Areas along the US continental shelf that have been designated as sites for extensive offshore wind farm installations over the coming decades often overlap with primary marine habitat for commercially important fisheries (Szostek et al. 2025). Existing and planned wind farm installations on the US East Coast continental shelf (Figure 1) overlap with regions that have historically supported culturally, ecologically, and economically important fisheries (Colburn et al. 2016) operating out of New England and Mid-Atlantic ports. These fisheries generate USD 2 billion per year in landings revenues, or about 40% of the national total (NMFS 2025). Shellfish fisheries that operate on the Mid-Atlantic continental shelf provide examples of fisheries at risk to potential economic impact of offshore wind energy infrastructure. The economic value of the combined Atlantic surfclam (*Spisula solidissima*) and ocean quahog (*Articia islandica*) fishery exceeds USD 100,000 in most lease areas (Figure 2A). The value of the Atlantic sea scallop (*Placopecten magellanicus*) fishery in the same lease areas is an order of magnitude higher, exceeding USD 1 million in many of the lease areas (Figure 2B). These fisheries, and others that operate within the leased grounds, are at risk if installation of wind energy infrastructure precludes fishing operations, which in turn places dependent communities and industries at risk, thereby magnifying the potential economic impact.

The Mid-Atlantic wind farm installation is occurring simultaneously with warming ocean water temperatures that are affecting the many important fishery stocks in the region (Friedland et al. 2025). The distributions of commercially and recreationally important benthic and mobile fishery species are shifting in response to habitat changes produced by warming ocean bottom water temperatures (Hare et al. 2016; Hofmann et al. 2018).

The combined challenges of increased ocean use in support of energy and commercial needs, and the effects of changing environmental conditions are pushing management of offshore resources into uncharted areas. Management based solely on stock biomass surveys is no longer adequate. Rather, approaches

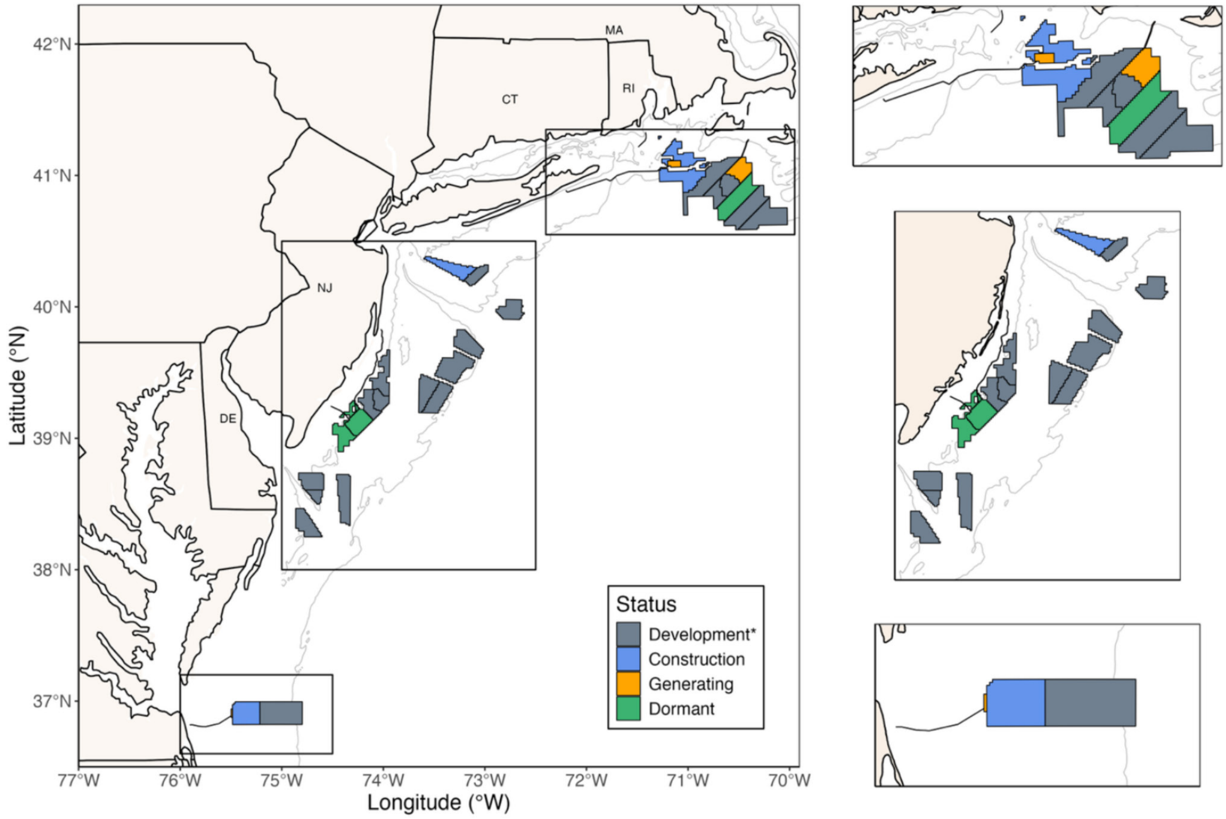

FIGURE 1 | Distribution of permitted offshore wind energy lease sites as of 2025 along the US East Coast continental shelf. The status of each wind energy lease site is shown as in development (planning, permitting, and approval stages; gray) under construction (blue), generating power (orange), or dormant (green). The 25- and 50-m isobaths are shown (thin gray lines).

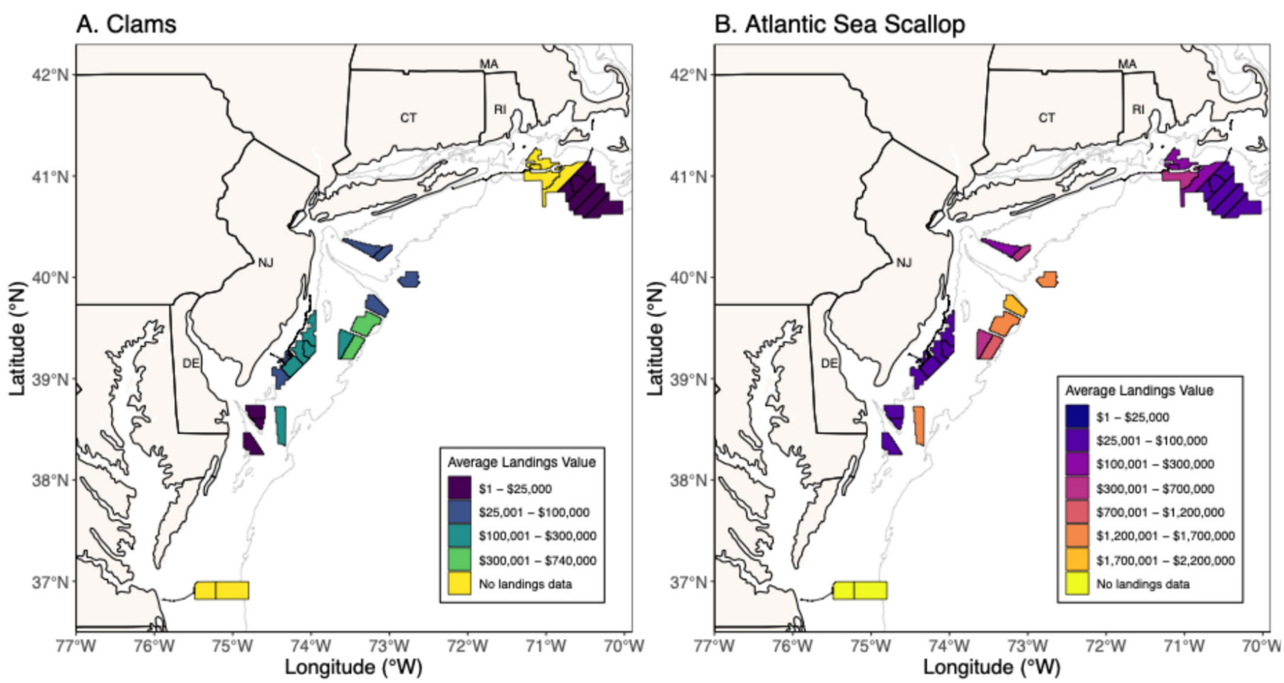

FIGURE 2 | Annual average federal fishery landings values generated within each offshore wind lease area for (A) Clams (Atlantic surfclams + ocean quahogs) and (B) Atlantic sea scallop. The 25- and 50-m isobaths are shown (thin gray lines). Annual landings value is the average of landings from 2019 through 2024 obtained from the NOAA Socioeconomic Impacts of Atlantic Offshore Wind Development, GARFO online data resource; accessed October 29, 2025. https://www.fisheries.noaa.gov/resource/data/socioeconomic-impacts-atlantic-offshore-wind-development.

that merge ecological, socio-economic, management, and fisheries perspectives are more relevant for addressing the issues affecting fishery resources along the US East Coast continental shelf. The contributions in this special issue consider responses of habitat, biology, and socio-economic aspects of commercial fisheries to the coincident stressors of changing oceanographic conditions, climate change, and development of offshore renewable energy. The synthesis of the current state of understanding at the nexus of these interactions provided by these contributions points to areas of research needed to advance co-existence of fisheries with expanded use of the offshore ocean environment that is undergoing rapid environmental change.

The conceptual fishery resource monitoring plan outlined in Grothues et al. (2026) provides a strategy for assessing effects on specific stocks in given wind energy lease areas using carefully designed before-after-control impact studies that integrate oceanographic drivers and account for specific constraints encountered by surveys during or after construction. The monitoring plan is designed to detect changes in resources using non-extractive and extractive sampling techniques that are combined with traditional survey methods. A key component of the monitoring plan is emphasis on the development and integration of cooperative approaches to engage fishers in data collection.

The proposed wind farm installations for the US East Coast (Figure 1) will introduce hard substrate into areas that are presently dominated by mud, sand, and shell debris. Stokesbury et al. (2026) merged two decades of drop camera sediment image data with U.S. Geological Survey physical substrate data to develop maps of the spatial distribution of the probability of the presence of different substrate types. Analysis of current habitat conditions showed that the lease areas for wind farm installation disproportionately occupy habitats comprised of sandy, soft sediment, and shell hash; habitats critical to several of the most economically valuable finfish and shellfish fisheries on the US East Coast. The baseline probability map provided for benthic substrates within and outside offshore wind lease areas can be used to statically assess changes to critical fisheries habitats from wind energy installations.

Kneebone et al. (2026) also used an integrative approach to merge data from a federal fishery survey, scientific tagging programs, and an angler survey to develop a fishery baseline for recreational fishery efforts targeting highly migratory species. Like many commercial fisheries, these recreational fisheries are commonly prosecuted in the areas currently under lease for offshore wind energy installations. The spatial distributions of current recreational fishing effort patterns provide baselines for measuring the effects of offshore wind energy installations on this important fishing sector.

The exposure of the high value Atlantic sea scallop fishery (~USD 465 million in average annual ex-vessel landings over the past 5 years, NMFS 2025) to risk from offshore wind energy development was evaluated by Chaji et al. (2026) using metrics that represented the fishery (e.g., ex-vessel revenue) and three distinct métiers (e.g., limited access days at sea). Their analysis found that the current configuration of approved wind energy lease areas on the northeast US continental shelf would result in relatively small economic risk for the fishery. Chaji et al. (2026) also pointed to the importance of early stakeholder input into the planning and development process in mitigating the potential economic risk of offshore wind energy development on the scallop industry.

The above studies represent conditions and outcomes produced by past and current ocean climates. But ocean conditions on the Mid-Atlantic shelf and distributions of species are changing and will continue to change over the three-decade lifetime of the existing and planned wind energy installations (Figure 1). Anticipation of outcomes from the cumulative impacts of wind energy development and climate requires understanding of present conditions and interactions so that potential future states can be projected.

The challenge of providing this understanding and projecting future states is undertaken in the final three contributions to the special issue. Spencer, Powell, Klinck, Munroe, Borsetti, et al. (2026) provided projections of changes in Atlantic surfclam range through 2095 using a clam habitat model informed by future water temperatures derived from an ensemble of high-resolution ocean-ecosystem projections downscaled from global Earth System models. The projected changes in Atlantic surfclam range were considered in relation to overlap with ocean quahog habitat (Spencer, Powell, Klinck, Munroe, LeClaire, et al. 2026) and expansion of new fishing grounds into offshore wind lease areas (Moya et al. 2026). Collectively, the three analyses predict that climate warming will result in expansion of Atlantic surfclam range over the lifetime of the planned offshore wind energy projects, with new fishing grounds becoming available in areas off Long Island outside of regions included in designated wind farm lease areas (Figure 1).

With 8 GW of offshore wind energy generation coming online globally in 2024, the worldwide power generation capacity of offshore wind reached 83.2 GW (Williams et al. 2025). Global offshore wind power generation is dominated by projects in China and the United Kingdom, with the United States slowly adding capacity, contributing a total of 174 MW in 2024 (Williams et al. 2025). Several of the first projects permitted, under construction, or generating power in the U.S. are those on the U.S. Mid-Atlantic continental shelf (Figure 1). Timelines for these projects have become highly uncertain because of inflation, project costs, and supply chain issues (Williams et al. 2025), and more recently because of political challenges and lack of federal support (White House 2025). The challenges faced by the U.S. offshore wind industry may present an opportunity to undertake thoughtful pre-construction (baseline) sampling and modeling studies that will strengthen the scientific basis for evaluating change and interactions among fisheries, climate, and offshore wind development. The contributions in this special issue provide guidance for how this can be done.

Author Contributions

Daphne M. Munroe: conceptualization, writing – original draft, review and editing, funding acquisition. **Eileen E. Hofmann:** conceptualization, writing – original draft, review and editing. Both authors contributed critically to the drafts and gave final approval for publication.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available in NOAA Socioeconomic Resources at https://www.fisheries.noaa.gov/resource/data/socioeconomic-impacts-atlantic-offshore-wind-development. These data were derived from the following resources available in the public domain: - NOAA, https://www.fisheries.noaa.gov/resource/data/socioeconomic-impacts-atlantic-offshore-wind-development.

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