DRAFT: Recommended regional scale studies related to fisheries in the Massachusetts and Massachusetts-Rhode Island offshore Wind Energy Areas

June 2018

This document was drafted by the Massachusetts Division of Marine Fisheries and reviewed by individual staff members at the Rhode Island Division of Marine Fisheries, NOAA National Marine Fisheries Service, and BOEM Office of Renewable Energy Programs. This document does not reflect an official policy recommendation of any organization.

Introduction

At this point in time there are three wind energy areas and four leases between New York and Nantucket in the Southern New England Bight shelf region. At least one wind energy area in New York and two more leases in the Massachusetts Wind Energy Area are expected in the coming months. It is hard to predict at this point in time the number of turbines that will ultimately be placed, but the range of initial estimates are individual farms that include 15-185 turbines, so a build-out in the next decade or so could be more than 400 turbines. There is an understanding that broad-scale development of offshore wind could result in ecosystem changes, but there is uncertainty regarding the impact of these changes on the provision of ecosystem services. From September to December 2017, three forums were held: the National Academies of Science Ocean Studies Board subcommittee, the RI Offshore Wind Science Forum, and the UMass wind collaborative meeting at SMAST. Additionally, there were multiple Massachusetts Fisheries and Habitat Working Group meetings and Rhode Island Fisheries and Habitat Advisory Board meetings. There is broad consensus in the northeast that in addition to wind farm-specific impact assessment studies, regional studies should also be done to address the cumulative impact of wind farms expanding across the eastern seaboard on the marine ecosystem and on the distribution of both fish resources and the fishing industry. Conducting regional studies to address the cumulative impact of wind farms at population-level scales is also being called for in Europe (Lindeboom et al. 2015; Willsteed et al. 2017). Further, NOAA’s Greater Atlantic Regional Fisheries Office and the Northeast Fisheries Science Center have called for the establishment of a region-wide scientific research and monitoring framework with federal leadership following an ecosystem-based approach and at the

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1 The National Offshore Wind Strategy (2016) states, “Continued broad-scale and site-specific baseline assessment will remain valuable as the offshore wind industry develops. Given the expense associated with baseline data collection, it is likely that agencies will need to take an approach that combines site-specific, developer-collected, preconstruction surveys with surveys conducted for other broader scientific reasons.”
appropriate scales. This broader framework would complement sub-regional state efforts to most effectively address cumulative impacts and the known and potential future interactions of fisheries and offshore wind energy.

This document attempts to frame the research discussion so fundable studies can be prioritized and designed. In order to create such a framework, we started by identifying the management objectives as recommended in Wilding et al.’s (2017) review of European offshore wind monitoring programs:

“The identification of spatially/temporally delimited metrics and thresholds, in line with the overall management objectives, are the critical components to a logically based monitoring programme” (emphasis added).

On a regional scale we want to identify what matters, why it matters, whether it can be measured and how, and how the results will be used. The development of a research program is an opportunity to identify where multiple goals – such as the needs of the wind energy industry, the fishing industry, and the regulatory community – can be met. The first section of this report provides information about management objectives in order to help further the development of effective and informative research. The second section of this report provides three examples of specific studies that could be funded with a description of how the study could be done and how the results would be used.

The definition of management objectives and the design of the research framework will require stakeholder input to be most effective and transparent, so this document would be greatly improved with a broad stakeholder review process or workshop that includes federal fishery permit holders, fisheries organizations that represent fishermen operating in Wind Energy Areas, Fishery Management Councils, wind industry representatives including fishing representatives and liaisons, academia, and issue-specific experts (e.g. sound, navigation, radar, insurance) in order to clarify priorities and the appropriate scale at which to conduct various studies.

**Resources/affected environment**

The Massachusetts and Massachusetts-Rhode Island Wind Energy Areas are of primary concern for this document. However, the fishing industry in this region fishes between the Gulf of Maine and North Carolina, and has particular concerns about wind energy development in New York. Also, fishermen outside of the Southern New England region fish and transit through the Rhode Island and Massachusetts Wind Energy Areas. Efforts should be made to extend cooperative regional research related to offshore wind development to include a broad spatial extent across fisheries of concern in multiple states.

**Spatial Extent**

The spatial extents that are commonly discussed for regional, cumulative impact studies are the continental shelf from either New York to Nantucket or Block Island to Nantucket. It may be most appropriate to consider study area boundaries based on ecological units (large marine ecosystems), a
fish stock boundary, or a fishery region. Wilding et al (2017) recommends “eco/hydrologically defined boundaries that are relevant to the distribution of the species under investigation.” Lindeboom et al. (2015) recommends that “Because the species that are affected are part of populations extending over larger areas, the focus of the impact investigation should be widened to consider the population level of those species.” Cooke & Auster define the Southern New England ecoregion in terms of fish populations and assemblages, bathymetry, circulation and endemism as extending from the Hudson Shelf Valley northeastward to the Great South Channel (2007). However, some potential questions may affect a smaller spatial extent. Therefore, studies may need to be developed for specific metrics over different spatial extents. Studies should be designed with the appropriate spatial and temporal scales for the metric or question being asked. All related studies should attempt to be nested together using standard protocols to meet separate monitoring and impact assessment goals.

**Standardize monitoring protocols**

In order to maximize the effectiveness of the research, minimize the duplication of effort, and leverage resources to get more out of individual projects, it is important to ensure that monitoring protocols are standardized for wind farm-specific studies. As long as standard protocols are adhered to, then individual studies can be used to compare wind farms to one another and to explore regional trends. Therefore, in the studies described below, those that are the appropriate scale to rely on data collected by wind energy developers directly through their site specific studies require the monitoring protocols to be identical for all developers. Such standardization will also be necessary to describe Best Management Practices (BMPs).

Other studies will require a broader spatial extent than one or two wind energy areas. Such studies will also require the definition of monitoring protocols to ensure that if separate research groups are conducting the work the data will be appropriately collected and analyzed. These more regional studies are expected to be supported through a yet-to-be-developed joint funding mechanism.

**Leveraging existing regional monitoring programs, procedures, protocols, and time series**

The Northeast Fisheries Science center conducts and maintains ongoing fisheries monitoring and research time-series that may serve helpful in future design and execution of research endeavors. For example, several areas of fish condition and reproduction research overlap and dovetail with wind development sites. To the extent that environmental impacts will be assessed in a BACI design, NEFSC may have some ongoing time-series that could serve as a regional “Control” to interpret effects. Standardization of protocols, coordination of sampling, and collaboration of expertise would increase the value of data collected to address formative questions and strengthen the conclusions derived from them across a broad regional scale.
Communication and data transferability

We recommend that all monitoring and research studies adhere to the following principles:

- Research will be communicated
- Data and information will be archived
- Data and information will be made available in easy to access formats to other researchers and the public
- Design and execution of collaborative monitoring and research will follow best practices (e.g. Northeast Fisheries Science Center Cooperative Research Program)
- Data confidentiality for sensitive fisheries dependent monitoring data will be maintained

Fish & invertebrate species of interest

The MA WEA and MA-RI WEA encompass diverse communities of fish and other vertebrates, invertebrates, and habitats valuable to continued ecosystem health and exploitation, and worthy of monitoring and protecting. Rather than attempt to study all species potentially impacted by siting and operations of wind farms, we recommend focusing on species of particular interest and value to the region, based on economic, biological, cultural or other criteria, as well as anticipated vulnerability to wind farm impacts. A proposed list, ranking the species for various vulnerabilities, is provided below. This proposed list also includes species that are already inherently vulnerable to climate change and of particular value to individual fishing ports. It has been proposed to consider species or life stages where information is lacking or species for which additional information would benefit the stock assessment process, but neither of those variables has been used for prioritization at this point. We also recommend studies with integrated ecosystem approaches, but we think it will be important to monitor specific species as indicators as well.
<table>
<thead>
<tr>
<th>Species</th>
<th>Economic value(^1) (high suggests commercial, recreational, and management value; moderate is one or more)</th>
<th>Habitat Dependence(^1) (strong association with structured habitat or a single substrate type)</th>
<th>Cultural value(^1)</th>
<th>Vulnerability to climate change(^2)</th>
<th>Vulnerability to wind farms (vulnerability indicated in parentheses)</th>
</tr>
</thead>
</table>
| Structure associated species (black sea bass, tautog, cod, pout, cusk) | BSB High  
Cod High  
Ocean pout Low  
Tautog & Cusk not rated | BSB High  
Cod High  
Ocean pout High  
Tautog & Cusk not rated | BSB High  
Cod High  
Ocean pout Low  
Tautog & Cusk not rated | BSB High  
Tautog Very high  
Cod Moderate  
Cusk Very high | High potential to disrupt current fishing patterns if fish move into wind farm areas due to increased habitat associated with turbine foundations; indicator of reef effect |
| Channeled whelk                          |                                                                                                  |                                                                                                 | Very high            | High (almost sessile)                  |                                                                     |
| Groundfish (winter flounder, pout, summer flounder, yellowtail flounder, monkfish) | Winter flounder High  
Ocean pout Low  
Summer flounder High  
Yellowtail flounder Moderate | Winter flounder Moderate  
Ocean pout High  
Summer flounder Moderate  
Yellowtail flounder High | Winter flounder High  
Ocean pout High  
Summer flounder High  
Yellowtail flounder Low | Winter flounder Very high  
Ocean pout High  
Summer flounder Moderate  
Yellowtail flounder Low | Potentially high, esp. early life stages, wf and pout have demersal eggs, strongly demersal so more vulnerable to prey changes/damage to seafloor |
<table>
<thead>
<tr>
<th>Species</th>
<th>Economic value¹ (high suggests commercial, recreational, and management value; moderate is one or more)</th>
<th>Habitat Dependence¹ (strong association with structured habitat or a single substrate type)</th>
<th>Cultural value¹</th>
<th>Vulnerability to climate change²</th>
<th>Vulnerability to wind farms (vulnerability indicated in parentheses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jonah crab</td>
<td>Moderate*</td>
<td>Low*</td>
<td>Low*</td>
<td>Moderate</td>
<td>Potentially high (EMF impact)</td>
</tr>
<tr>
<td>Lobster</td>
<td>Moderate*</td>
<td>High (life stage specific)*</td>
<td>High*</td>
<td>Moderate</td>
<td>Potentially high (EMF impact)</td>
</tr>
<tr>
<td>Longfin squid</td>
<td>Moderate</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Potentially high (demersal egg mops)</td>
</tr>
<tr>
<td>Sea scallops</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate*</td>
<td>High</td>
<td>High (sessile)</td>
</tr>
<tr>
<td>Surf clam/Ocean quahog</td>
<td>Moderate</td>
<td>Surf clam High Ocean quahog Moderate</td>
<td>Low</td>
<td>Surf clam High Ocean quahog Very high</td>
<td>High (sessile)</td>
</tr>
<tr>
<td>Pelagic species (tuna, mackerel, bluefish)</td>
<td>High commercial and recreational*</td>
<td>Low*</td>
<td>High*</td>
<td>Mackerel Moderate Bluefish Low Tuna not rated</td>
<td>Might benefit from enhanced prey concentrations; indicator of reef effect and impacts to other highly migratory species</td>
</tr>
</tbody>
</table>


* indicates rating was provided by authors of this document, not by the NOAA documents.
The table above is the beginning of the list of important species, and will need additional input from NOAA, the fishing community, fisheries managers, and the academic community. Additional work is needed to consider the following sources of information:

- Fishermen and fisheries scientists
- NOAA NEFSC Socio-Economic Impact of Outer Continental Shelf Wind Energy Development on Fisheries in the U.S. Atlantic (2017) (www.data.boem.gov/PI/PDFImages/ESPIS/5/5580.pdf) and other revenue products generated by NOAA
- Prey species including Calanus spp and sand lance
- BOEM regional-scale studies planning document
- NOAA’s Northeast Fish and Shellfish Climate Vulnerability Assessment
- Tagged fish, including protected species such as sturgeon
- Some species have an outsized importance to specific ports

We propose that these species would be the key assessment indicators for cumulative biological impacts associated with wind farms.

**Management Objectives & Research Priorities**

*Overarching management objective*

The states of Massachusetts and Rhode Island are interested in diversifying the electric grid in New England with offshore wind while maintaining existing ecosystem function and services including healthy natural resources and water quality, profitable multi-sector marine industries including commercial and recreational fishing industries, safe and efficient navigation, and public access and enjoyment within or adjacent to offshore wind development areas.

*Individual management objectives and key research questions*

This section lays out key research questions that would be useful to assessing impact of wind farms on a regional scale and creating a quantitative assessment of compatibility with the fishing industries. There are three primary focus areas for research and monitoring: Fishing Industries, Fish Resources and Habitat, and Fisheries Management. Potential regional-scale studies are identified for each focus area to provide examples and additional context. This is not a prioritized list, but instead serves as a starting point to consider what to prioritize. Several of the potential studies have design challenges that may limit their effectiveness. Before selecting priorities it is important to consider in some detail how the study would be done with either existing or new data sources. It will also be useful to more thoroughly consider how each study would be used as an indicator for a management action and mitigation. In the section named “Next Steps” we provide an example of how a study could be summarized for prioritization.
FISHING INDUSTRIES

Objectives: Maximize compatibility of the offshore wind industry with the recreational and commercial fishing industries. Principles that pertain here include:

- Sustain the economic value of fisheries on a per port basis.
- Sustain domestic and international fishery food products
- Sustain economic and cultural diversity within fishing fleets and groups.
- Ensure fishing can still occur in wind farm areas by mitigating risk of allision (a vessel hitting a fixed object), collision (a vessel hitting another moving object), and fishing gear snags on scour protection, cables, and cable matting.
- Encourage use of fishing vessels in offshore wind research.

Key research questions and potential regional-scale studies:

1. Does spatial and temporal distribution of fishing or revenue generation change?
   a. Where is fishing effort currently distributed spatially and temporally? Does fishing pressure change inside or outside of wind farms areas?
   b. Is there more fishing in some wind farms than others? Why?
   c. Are there direct or indirect prohibitions on fishing (e.g. insurance restrictions, turbine spacing, cable protection, radio interference)? What can be done about them (e.g., develop new radio communications or other technological mitigation)?
   d. How will direct or indirect prohibitions on fishing affect other fishing areas? Where will displaced fishermen go to fish, and how will increased pressure elsewhere affect non-wind farm displaced fishermen? Which fisheries will be the most impacted?

2. How does catch composition change in wind energy areas?
   a. Commercial?
   b. Recreational?
   c. Do some wind farms have less change than others (and why)?

3. Do trip costs change? What are the impacts of these changes? What is the cost associated with these changes?
   a. Do insurance rates go up?
   b. Does fishing take longer?
      i. Do fishermen have to travel longer?
      ii. Is the CPUE lower?
      iii. Does the process of fishing take longer?
   c. Do snags occur? What are costs associated with gear and lost fishing time/catch?

4. How do fishing practices change in response to fishing in wind farms, changes in species composition, or changes in trip costs?
   a. Innovation associated with fishing in wind farms

5. Are BOEM and wind energy developers communicating effectively with the fishing industry?
   [“ongoing, effective engagement with the fishing community” from Eco and Env 2014]
a. Develop communication and tracking mechanisms such as a hotline for impacts, snags (especially on cables), lost gear, user conflicts. Do interactions with cables, allision, collision rates increase, what BMPs reduce rates?

b. Enable opportunities for fisheries development and outfitting vessels (e.g. improved equipment and training for fishing within windfarms, fishing gear and protocol research).

6. What mitigation efforts (including compensatory mitigation) are wind farms using; are they effective?

7. Do wind farms impact economic value and diversity of individual ports?
   a. Describe fishing revenue associated with individual wind farms or Wind Energy Areas. Groundfish, scallops, surf clam/ocean quahog, squid, fixed gear (lobster, whelk, crab), recreational. Explicitly include linkages to shoreside revenue and job producing infrastructure required to support fishing.
   b. Describe fishing revenue including multiplier effects from each WEA as it pertains to individual ports.
   c. Describe economic diversity of each port.
   d. How do landings change? Does economic value of fishing shift from one port to another?
   e. Can new fisheries be promoted to supplant fishing in wind energy areas?
   f. Is financial or policy support needed to enhance ability of fishing companies to include wind farm support services in their portfolio?

8. Do wind farms impact the cultural identity in ports?
   a. Which ports will be disproportionately affected by loss of fishing revenue?
   b. Do any ports experience a gain in revenue? What is the cause of any discrepancies in revenue among ports?
   c. Which ports will be heavily used by construction and operation – is there room/infrastructure to maintain access for both industries?

FISH RESOURCES AND HABITAT

Objectives: Maximize benefits of offshore wind energy production (such as carbon-free energy sources and production enhancement from the artificial reef effect) while maintaining fish populations and biological community structure. Principles that pertain here include:

- Do not disrupt or destroy high value resources, habitats, or events (e.g. spawning, aggregations) and minimize temporary disruption of these (resources and habitat are broadly defined and may include biological and non-biological aspects).
- Do not adversely affect water quality (including turbidity, chemicals)
- Prepare response plans for potential acute events such as a spill.
Potential studies should focus on how construction, operation, and decommissioning impacts (e.g. noise, vibration, turbidity & smothering, change in seafloor topography, scour, changes to currents, shading, EMF, vessel traffic, direct impact from pilings and anchors) affect species and habitats of interest.

It will be helpful to understand what the individual wind farms will do for site selection, baseline, and long-term monitoring, to determine which of those studies can be used at a regional scale. For example, if all wind farms are monitoring the reef effect, how can that data be scaled up and what regional question(s) will it answer? Can any of the data be used to improve stock assessments?

Key research questions and potential regional-scale studies:

1. Do key biological indicators change?
   a. Measure biomass and abundance of species interest at multiple scales (individual wind farms, WEAs, in gradients across the affected areas, and the region); does aggregate fish biomass change? Does biomass within wind energy areas change? Do some wind farms have less of an impact on biomass than others? Why?
   b. Species composition
   c. Fish condition (stomach content/growth rate/fecundity/energy content/etc.) for target species
   d. Describe the spawning stock biomass of the stocks of target species
   e. Spatial distribution of species of interest over time; focus on species with the greatest persistence to consider if wind farms change those patterns
   f. Pelagic to demersal ratio for individual wind farms and region-wide
   g. Benthic biomass and species composition (including infaunal, epifaunal, and fouling) on a WEA and region-wide scale – see for example the TNC ecoregional assessment.
   h. Abundance and presence of invasive and/or opportunistic species across wind farms
      i. Do some farms have more or less invasive species? Why?
      ii. What is consistent across wind farms with respect to invasives, jellyfish, mussels, tunicates, other?
   i. What is the gradient of change as you move away from individual turbines and/or wind farm areas? What is the distance of detectable habitat changes?
   j. Compare wind farms – does one wind farm have less impact that another? On what indicator? Can we elucidate why?

2. Does ecosystem/habitat change?
   a. Describe and quantify ecosystem/habitat by identifying the location, timing, quantity of key seafloor and water column habitat features – moraines, bedrock outcrops, ledges and canyons, flats, depressions (e.g. the Mud Hole), location of fronts and tide rips, persistent high chlorophyll a areas, known spawning areas, corals, sponges, attached SAV, high densities of shellfish or echinoderms
i. Use video, grab, multibeam, and sidescan data from wind farm collections to remap regional geoforms, bathymetry, and sediment texture; identify features that are unique and/or vulnerable.

ii. Compare important ecological areas as defined for Ocean Planning to look at changes over time/before and after wind farms.

iii. Consider additional technologies and parameters such as eDNA to augment extant data bases to elucidate impacts on ecosystem products and services.

b. Use indicators from Key Research Question #1 and #2a in a holistic way. What is the sum of the parts?

c. Run the NOAA integrated ecosystem model or EcoPath with EcoSim or Atlantis with clear objectives. Will this be used as an indicator for a management action? How will wind farm effects be isolated from climate or fishery-related impacts? Can these be used at a RI-MA scale or does it have to be broader?

d. Determine spawning areas, specifically, and habitat use by reproductive phase more generally

3. Conduct focused research to further our knowledge of impact of the construction and operation of wind farms on specific topics.

   a. EMF
   b. Noise
   c. Vibration
   d. Anti-fouling
   e. Scour
   f. Aggregation/artificial reef effect

FISHERIES MANAGEMENT

Objectives: Continue to meet fishery management standards under state and federal laws.

Key research questions and potential regional-scale studies:

1. Is the management system (NEFMC, MAFMC, ASMFC, states) adequate to meet the needs at multiple scales? What data is needed to allow for any management action to be taken in response to wind energy development? What management actions can be taken to react to changes linked to wind energy development?

   a. Did management (NEFMC, MAFMC, ASMFC, states) implement actions to address changes in removals/catch allocation; were these actions more necessary for some wind farms than others? Why?

   b. Did management (NEFMC, MAFMC, ASMFC, states) implement actions to balance use conflicts; were these actions more necessary for some wind farms than others? Why?

   i. Consider fisheries regulations changes to address changing use patterns? For example, if trawlers can’t go into a wind farm, will they be given another area? Will there be management action if there is no formal exclusion?
ii. If fisheries-independent surveys cannot access wind farms for sampling, how will stock assessments be done and how will the additional uncertainty in the size and condition of stocks affect quota-setting and size restrictions by management?
   c. Will WEAs or wind farms need to be put into FMPs or the Habitat Amendment?

2. Develop, improve, and adapt management practices for fishing in wind farm areas.
   a. Optimize BMPs for construction and operation by comparing the various construction methods and timing across wind farms
   b. Produce a report card that uses a mechanism such as a stoplight approach to integrate various indicators to communicate with managers. This could be developed to use specific tipping points or frame the determination of adverse impact. Should future expansion in WEAs be allowed? Should new WEAs be allowed?
   c. Determine what management actions should be taken in the face of adverse impact
   d. Develop mitigation strategies for direct and indirect impacts
      i. Were mitigation strategies effective?
   e. Improve efficiency of wind farm permitting by establishing BMPs and communication systems, as well as identifying species that are not vulnerable to wind farm construction or operations and impacts that don’t result in meaningful effects.

**Next Steps**

We recommend that the immediate next step is to have a broad review process of this document that includes the Massachusetts FWG and Rhode Island FAB, the Mid-Atlantic and New England Fishery Management Councils, the NOAA Habitat Conservation Division and NEFSC, and other fishing industry representatives including but not limited to the Responsible Offshore Development Alliance and the New Bedford Port Authority. After redrafting this document with that feedback, hold a workshop to prioritize studies, understand what additional data collection is needed, and start to build a concrete regional monitoring plan that leverages and expands upon existing programs and develops new data streams focused on answering specific concerns. As an example of how to do this, the table below includes one potential study from each major focus area (Fishing Industries, Fish Resources and Habitat, and Fisheries Management). The way a study would be done and its usefulness are assessed. This is just an example for potential next steps to help to prioritize studies. Other variables including cost and local capacity could also be used in the prioritization and design process.
<table>
<thead>
<tr>
<th>Section</th>
<th>Key research question</th>
<th>Potential study</th>
<th>Sample hypothesis</th>
<th>Study method</th>
<th>Other thoughts</th>
<th>How would the study be used?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishing Industries</td>
<td>Does spatial and temporal distribution of fishing or revenue generation change (what scale is detectable, meaningful)?</td>
<td>Where is fishing effort distributed spatially and temporally? Does fishing pressure change in wind farms?</td>
<td>Fishing activity by trawls decreases after construction of a wind farm and is displaced further from shore between NY and Nantucket.</td>
<td>Use VMS data with Northeast Ocean Data portal approach to look at fishing distribution in 10-year time periods by season. (Also see Geret DePiper’s VTR model.)</td>
<td>Yes, resolution should be carefully considered. What fisheries does the study method miss, and how/if should that be captured?</td>
<td>Basic information to understand how the wind industry affects the fishing industry. Could result in different area management.</td>
</tr>
<tr>
<td>Fish Resource &amp; Habitat</td>
<td>Do key biological indicators (abundance/biomass/community structure/spatial or temporal distribution) change (what scale is detectable, meaningful)?</td>
<td>Measure spatial distribution of focus species</td>
<td>The spatial distribution of scallops will change from the distribution as measured between X and Y years between NY and Nantucket. (High concentrations of scallops will be found in different areas than before construction.)</td>
<td>Conduct a video survey to sample juvenile and adult scallops. (Individual wind farm video surveys combined somehow with regional stock assessment information.)</td>
<td>Yes, should include physical oceanographic work to look at changes in currents that might explain different settlement patterns, food availability</td>
<td>Provides basic information to understand if wind farms create settlement areas for scallops. Could affect where people fish for scallops, could affect rotational area management.</td>
</tr>
<tr>
<td>Fisheries Management</td>
<td>Develop, improve, and adapt management practices for fishing in wind farm areas.</td>
<td>Produce a report card that uses a mechanism such as a stoplight approach to integrate various indicators to communicate with managers.</td>
<td>N/A</td>
<td>First examine existing ecosystem report cards, consider how/if to integrate with Ocean Plan Ocean Health Index. Generate score every few years.</td>
<td>Yes, unclear how tipping points might be identified.</td>
<td>This could be an effective way to integrate many of the individual study/monitoring results for use by fisheries managers, BOEM, and state CZM directors to consider wind farm impacts.</td>
</tr>
</tbody>
</table>
Acknowledgements

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References


