



Mid-Atlantic Fishery Management Council

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MEMORANDUM

Date: September 21, 2023
To: Council
From: Brandon Muffley, Council staff
Subject: Meeting Materials – Ecosystem Approach to Fisheries Management (EAFM) Risk Assessment

On Wednesday, October 4, 2023, the Mid-Atlantic Fishery Management Council (Council) will review the proposed updates to the EAFM risk assessment. The Ecosystem and Ocean Planning (EOP) Committee and Advisory Panel conducted a comprehensive review of the risk assessment and are recommending changes to the risk elements that would be included in a revised risk assessment. The Council will review the EOP recommendations and approve the final list of risk elements to be included in the updated EAFM risk assessment report to be completed in April 2024.

Materials listed below are provided for Council consideration of this agenda item.

- Briefing Memo: EAFM risk assessment review background and meeting goals
- September 13-14, 2023 Ecosystem and Ocean Planning (EOP) Committee and AP meeting summary
- Draft EAFM Risk Element Overview

Ecosystem Approach to Fisheries Management Risk Assessment Review

October 2023 Council Meeting

Prepared By: Brandon Muffley, Council Staff
September 21, 2023

Background:

Conducting a risk assessment is the first step the Council’s Ecosystem Approach to Fisheries Management (EAFM) structured decision framework (Figure 1) and is intended to identify and prioritize ecosystem interactions and help the Council decide where to focus limited resources to address priority ecosystem considerations in its science and management programs. The [initial EAFM risk assessment](#) was completed in 2017 and, based on an evaluation of the initial risk assessment, summer flounder was identified as the most “high risk” fishery. This led to the development of a conceptual model (Step 2), which identified the key risk factors affecting summer flounder and its fisheries. Utilizing the results of the conceptual model, the Council conducted a management strategy evaluation (MSE, Step 3) to identify management measure that address live and dead discards in the recreational summer flounder fishery. The outcomes and modeling framework developed through the MSE are currently being used by the Council in management action development and during the specification setting process for other recreational species. Developing a comprehensive and robust risk assessment was a critical step in successfully completing the structured decision process and developing tools to support and inform priority science and management decisions.



Figure 1. The Mid-Atlantic Fishery Management Council’s EAFM structured decision framework to incorporate ecosystem considerations into management (from Gaichas et al. 2016).

Since 2017, the EAFM risk assessment has been updated annually using the utilizing information from the Northeast Fisheries Science Center (NEFSC) Mid-Atlantic State of the Ecosystem Report to provide a snapshot of the current ecosystem risks to meeting the Council’s management objectives. While the risk assessment has been updated to utilize the most recent information available, the risk elements, indicators, and ranking criteria have remained the same as in the original risk assessment. However, there is a significant amount of additional information and new analyses available to help inform an updated risk assessment that could reflect the Council’s changing management priorities.

Given the length of time since its initial development, the availability of new information and analyses, and ever-changing risks facing Council-managed fisheries, the Council agreed to

conduct a comprehensive review of the EAFM risk assessment. The goal of the review was to produce an updated risk assessment that incorporates the latest scientific information, reflects the Council’s current priorities, and can be adaptive and responsive to new and changing conditions that can support a variety of Council management needs. This review also provides the opportunity to possibly expand the Council’s use of the risk assessment information within other Council-related ecosystem and management activities.

Ecosystem and Ocean Planning (EOP) Committee and Advisory Panel (AP) review

Similar to the approach taken during the development of the original assessment, the review was conducted jointly with the EOP Committee and AP to ensure input and key risks of interest by the Council and stakeholders were identified. The EOP Committee and AP initiated the risk assessment review in late 2022 and met on five separate occasions between November 2022 and September 2023 to address different components of the risk assessment.

- **November 2022** – overview of risk assessment and review, initial ideas for new risk elements ([Meeting page and materials](#))
- **April 2023** - consider risk elements and definitions ([Meeting page and materials](#))
- **July 2023** – review elements and definitions and consider indicators ([Meeting page and materials](#))
- **August 2023** – continue review of elements and definitions and consider indicators ([Meeting page and materials](#))
- **September 2023** – review elements, definitions, indicators and consider risk ranking criteria ([Meeting page and materials](#))

Also similar to the original assessment, the group took a collaborative and iterative approach to conduct the review with each meeting building off the discussion and decisions from the meeting prior (Figure 2). Prior to each meeting, technical staff from the Council and NEFSC would solicit initial feedback from the Committee and AP on the upcoming meeting topics through questionnaires or other methods. This initial feedback would then be used to develop discussion documents that would help guide and focus the Committee and AP discussion and input during the meeting. This process of getting early input, refining documents based on the feedback, and then focused discussion during the meeting allowed for the group to efficiently move through a highly complex and extensive review.

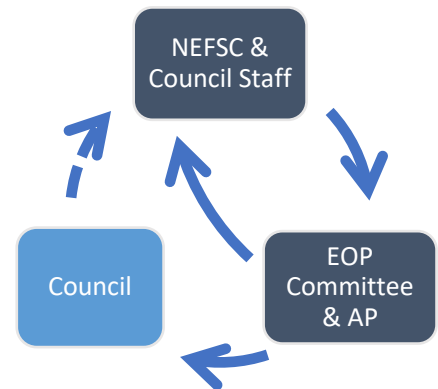


Figure 2. Iterative process taken by Council, EOP Committee, AP, and technical staff to conduct the comprehensive review and update of the EAFM risk assessment.

Following the first meeting, the Committee and AP identified a total of 43 possible risk elements that would be considered in a revised risk assessment. Those elements were a mixture of existing elements (23) that are included in the current assessment and potentially new (20) risk elements suggested by the Committee and/or AP. During the subsequent meetings, the Committee and AP worked to develop and refine the different risk element components (description, definition, indicator, and risk criteria) for all 43 elements. Risk element descriptions, definitions, and indicators (at least in draft form) were developed for each

element. Depending on the status of the indicator development, risk criteria were developed for many of the risk elements. At the September meeting, the Committee and AP addressed outstanding issues on those risk elements where additional, more substantive feedback was needed and made recommendations on each risk element under consideration.

Of the 43 risk elements considered by the Committee and AP, 28 elements are recommended to be included in a revised risk assessment report, 6 elements are recommended to be placed in the parking lot to be considered later when additional information is available, and 9 elements are recommended to be removed as a stand-alone risk element but be used as a potential indicator under another risk element (Tables 1-3). A summary of the Committee and AP recommendations for each of the 43 risk elements, including recommendations for indicators and other element revisions, can be found in Tables 1-3.

More information on the discussion and recommendations developed by the EOP Committee and AP during their September 13-14, 2023 meeting can be found in the meeting summary behind Tab 7. In addition, there is an EAFM Risk Element Overview document behind the Tab that provides the element description, definition, indicator(s) (if applicable), and risk criteria (if applicable) for all 43 risk elements considered. This document incorporates the most recent feedback and recommendations developed by the EOP Committee and AP at their September meeting.

October Council Meeting Outcomes and Next Steps:

During the October Council meeting, the Council will receive an overview of the risk assessment review conducted by the EOP Committee and AP. The Council will then review the recommendations developed by the Committee and AP and decide which risk elements will initially be included in the revised risk assessment. The Council can also provide any additional feedback and direction on any of the risk element components.

Technical staff from the Council and NEFSC will then develop a revised risk assessment that includes those risk elements selected by the Council and incorporates all of the feedback provided by the Council, EOP Committee, and AP regarding the risk element components. A revised draft risk assessment will be completed in March 2024 and will include the most up-to-date information and relevant indicators derived from the 2024 Mid-Atlantic State of the Ecosystem report. The draft risk assessment will then be presented to the EOP Committee and AP for their final feedback and recommendations regarding the inclusion, deletion, or parking/later consideration of any risk element for Council consideration. At the April 2024 Council meeting, the Council will then review and approve the new EAFM risk assessment for use by the Council in future management documents, priorities, and decisions.

In addition to completing a revised and updated risk assessment, another goal of this review was to make the risk assessment more adaptable to account for emerging risks and include new information. The Committee and AP kept this thought in mind as they conducted the review. For example, the definitions were developed to be specific enough to describe the current risk but also broad enough to ensure future risks could also be considered. They also identified potential indicators that may not be ready now but could be developed in the future with additional data and new analytical tools. Staff plan to develop a process for Council consideration by which the risk assessment can be modified and updated without needing another comprehensive review.

This approach should make the process more efficient, save Council and NEFSC resources, and make the risk assessment more informative and actionable for the Council.

The final goal for this review was to identify opportunities to potentially expand the use of the risk assessment and ecosystem information into other Council products, priorities, and decisions. While the direct application and benefits of the risk assessment were demonstrated through the outcomes of the EAFM structured decision framework process, there are opportunities to integrate ecosystem and climate information more fully into the Council process. Additional work and discussion on this goal needs to be done, but the Committee and AP identified some initial areas of potential application, including: incorporating relevant information into Fishery Information Documents and AP Fishery Performance reports, support outcomes of the East Coast Climate Change Scenario Planning efforts, and linking to SSC Ecosystem Work Group products and Ecosystem and Socio-economic Profile reports. More information on all of these goals will be provided to the Council in April 2024 when the revised risk assessment is reviewed.

Table 1. Summary of the Ecosystem and Ocean Planning Committee and Advisory Panel recommendations for *Ecological Risk Elements* considered during the 2022-2023 comprehensive review of the EAFM risk assessment.

Risk Element Name	Existing/New	Element Recommendation <i>(Keep, Remove, Combine, Consider Later)</i>	Indicators <i>(Existing, New, Consider Later)</i>	Other Element Updates <i>(Definition, Indicators, Criteria)</i>
Stock Assessment Performance	Existing	Keep	Existing and New	Revised criteria to account for new indicators
Fishing Mortality Status	Existing	Keep	Existing	Same as existing element
Stock Biomass Status	Existing	Keep	Existing	Same as existing element
Food Web (1) - Prey Availability	Existing	Keep	Existing and New	Updated name and definition, new indicators, and revised criteria
Food Web (2) - Predation Pressure	Existing	Keep	Existing and New	Updated name and definition, new indicators, and revised criteria
Food Web (3) - Protected Species Prey	Existing	Keep	Existing	Revised criteria to account for different protected species objectives and status
Food Web (4) - Other (birds, HMS)	New	Remove	Consider Later	Considered under the new definitions and indicators for Food Web (2) and (3)
Ecosystem Productivity	Existing	Keep	Existing, New, and Consider Later	Possibly revise criteria to account for new indicator(s)
Forage Base	New	Remove	New	To become an indicator under the Ecosystem Productivity element
Population Diversity	New	Consider Later	Consider Later	Important to track, needs development, pilot a species
Ecological Diversity	New	Consider Later	Consider Later	Continue development, track in State of the Ecosystem report
Climate	Existing	Keep	Existing and New	Updated definition, new indicators, and revised criteria
Distribution Shifts	Existing	Keep	Existing	Same as existing element
Estuarine and Coastal Habitat	Existing	Keep	Existing	Same as existing element
Offshore Habitat	New	Keep	New	Definition developed, indicators (empirical and model based) identified, criteria developed
Invasive Species	New	Remove	New	To become an indicator under the Estuarine/Coastal and Offshore Habitat risk elements

Table 2. Summary of the Ecosystem and Ocean Planning Committee and Advisory Panel recommendations for *Socio-Economic Risk Elements* considered during the 2022-2023 comprehensive review of the EAFM risk assessment.

Risk Element Name	Existing/New	Element Recommendation <i>(Keep, Remove, Combine, Consider Later)</i>	Indicators <i>(Existing, New, Consider Later)</i>	Other Element Updates <i>(Definition, Indicators, Criteria)</i>
Economic Elements				
Commercial Value	Existing	Keep	Existing and Consider Later	Updated name and continue development of Net Revenue indicator
Marine Recreational Angler Days/Trips	Existing	Keep	Existing	Updated definition
Commercial Fishery Resilience (1) - Revenue Diversity	Existing	Keep	Existing and Consider Later	Develop indicators at vessel and port level and revised criteria
Commercial Fishery Resilience (2) - Shoreside Support	Existing	Keep	Existing	Same as existing element
Recreational Fishery Resilience (1) - Shoreside Support	New	Consider Later	Consider Later	Continue development of element and possible indicators
Commercial Fishery Resilience (4) - Capital	New	Remove	Consider Later	Important to track, potentially develop an indicator to be included under other/future resilience elements
Commercial Fishery Resilience (5) - Insurance Availability	New	Remove	Consider Later	Important to track, potentially develop an indicator to be included under other/future resilience elements
Commercial Fishery Resilience (6) - Emerging Markets/Opportunities	New	Remove	Consider Later	Important to track, potentially develop an indicator to be included under other/future resilience elements
Seafood Safety	New	Remove	Consider Later	Combine any potential indicators as part of Commercial Fishery Resilience (6)
Social-Cultural Elements				
Commercial Fishery Resilience (3) - Fleet Diversity	Existing	Keep	Existing	Same as existing element

Recreational Fishery Resilience (2) - Fleet Diversity	New	Keep	New and Consider Later	Description and definition developed, identified indicators to include and develop further, draft criteria
Community Vulnerability	Existing	Keep	Existing	Same as existing element
Food Production Elements				
Commercial Fishing Production	Existing	Keep	Existing and New	Changed name from Seafood Production to Fishing Production to account for all harvest, new indicators for bait/non-food, criteria still to be developed
Recreational/Subsistence Seafood Production	Existing	Keep	Existing and Consider Later	Existing definition, indicators, and risk criteria remain, further develop subsistence indicators
Commercial Fishery Employment	New	Consider Later	Consider Later	Description and definition developed, identified potential indicators for future consideration, criteria to be determined
Recreational Fishery Employment	New	Consider Later	Consider Later	Description and definition developed, identified potential indicators for future consideration, criteria to be determined

Table 3. Summary of the Ecosystem and Ocean Planning Committee and Advisory Panel recommendations for *Management Risk Elements* considered during the 2022-2023 comprehensive review of the EAFM risk assessment.

Risk Element Name	Existing/New	Element Recommendation <i>(Keep, Remove, Combine, Consider Later)</i>	Indicators <i>(Existing, New, Consider Later)</i>	Other Element Updates <i>(Definition, Indicators, Criteria)</i>
Fishing Mortality Control	Existing	Keep	Existing and New	Updated definition, new indicators from State of the Ecosystem report, same criteria
Technical Interactions	Existing	Keep	Existing and Consider Later	Existing definition, indicators, and risk criteria, consider further development of new indicators
Offshore Wind - Biological/Ecosystem	New	Keep	New	Description and definition developed, potential indicators identified, criteria to be determined
Offshore Wind - Fishery Science and Access	New	Keep	New	Description and definition developed, indicators from the State of the Ecosystem report and initial criteria identified
Offshore Energy Exclusive of Wind	New	Remove	Consider Later	As other offshore energy activities take place, develop an indicator to include under Other Ocean Activities element
Aquaculture	New	Remove	Consider Later	As aquaculture activities take place, develop an indicator to include under Other Ocean Activities element
Other Ocean Activities	Existing	Keep	New and Consider Later	Updated the description and definition with focus on access, identified a suite of potential indicators, criteria to be updated
Regulatory Complexity and Stability	Existing	Keep	Existing and Consider Later	Updated the definition, use existing indicators and identified new ones for development, potential revisions to criteria

Allocation	Existing	Keep	Existing and Consider Later	Description and definition remain unchanged, existing and potential new indicators available, keep existing criteria for now and evaluate in future
Discards	Existing	Keep	Existing, New and Consider Later	Updated and expanded description and definition, suite of indicators were identified to account for new definition, updated criteria
Essential Fish Habitat	New	Consider Later	Consider Later	Developed description and definition, further develop indicators and criteria once EFH Amendment is complete



Ecosystem and Ocean Planning Committee and Advisory Panel Meeting

September 13-14, 2023

Meeting Summary

The Mid-Atlantic Fishery Management Council's (Council) Ecosystem and Ocean Planning (EOP) Committee and Advisory Panel (AP) met jointly on September 13-14, 2023 in Baltimore, MD and via webinar to continue their comprehensive review of the Ecosystem Approach to Fisheries Management (EAFM) risk assessment. The Committee and AP provided input on a series of outstanding issues associated with specific risk elements under consideration. The Committee and AP recommended a final list of elements and the associated indicators and risk criteria for Council review. The Council will consider approving a revised suite of risk elements to be included in an updated EAFM risk assessment to be completed in the spring of 2024.

The EOP AP and Committee also discussed a draft policy and process for Council review of exempted fishing permit (EFP) applications for species listed as ecosystem components (EC) under the Unmanaged Forage Omnibus Amendment (Forage Amendment). Those discussions will be summarized in a separate document.

EOP Committee Attendees: M. Duval (Committee Chair), A. Nowalsky, S. Winslow, J. Hermsen, J. Grist, T. Schlichter (Committee Vice-Chair), R. Ruhle, M. Luisi (Council Vice-Chair), S. Lenox, J. Cimino

EOP Advisory Panel Attendees: C. LoBue, B. Brady, F. Akers, P. Simon, P. Lyons-Gromen, J. Hancher, J. Kaelin, J. Deem, P. deFur, J. Firestone, E. Bochenek

Other Attendees: S. Gaichas, G. DePiper, B. Muffley, E. Keiley, J. Beaty, A. Weinstein, K. Wilke, K. Dancy, M. Fenton, R. Silva

As part of the EAFM risk assessment review, the Committee and AP identified, developed, and worked to refine 43 existing and potentially new risk elements. This was the first in-person meeting of the Committee and AP during the review, and it was decided to utilize the time to focus on those risk elements where additional input and direction was needed. Two discussion documents were provided as background material for Committee and AP feedback. The first document (found [here](#)) was the focus of the September meeting and included information on those risk elements where additional, more substantive feedback was needed in order to move forward with development of those risk elements. The second discussion document (found [here](#)) included information on the remaining risk elements where there was greater agreement and/or fewer changes identified by the Committee and AP. These elements were not discussed during

the meeting, but Committee and AP members were encouraged to provide feedback on any of the risk elements and information in the discussion document following the meeting.

Below are the consensus outcomes and recommendations associated with each risk element reviewed during the September meeting.

Ecosystem Elements:

- **Food Web – Council-Managed Predators**
 - The group recommended retaining this element in the revised risk assessment. They also agreed to change the element name to “Food Web – Prey Availability” and revise the definition to more clearly indicate this risk element considers the prey availability for Council-managed predators.
 - There was agreement to use the two proposed indicators – an aggregate forage fish index and fish condition index for each managed species.
 - Overall support for the proposed risk criteria but suggested an evaluation of the indicators with 1, 3, 5 years of data to inform the criteria rankings.
- **Food Web – Council-Managed Prey**
 - Similar to the previous element, the group recommended retaining this risk element and agreed to change the name to “Food Web – Predation Pressure” and update the definition to account for predation pressure from all sources on Council-managed prey species.
 - The group supported the existing indicator that uses food habits data combined with key predator population trends. They also suggested potentially including an indicator that compares predation pressure (M2) to fishing mortality (F) to help capture the relative importance of predation. Once developed, this potential new indicator will be brought back to the Committee and AP for feedback in spring 2024.
- **Food Web – Protected Species Prey**
 - The Committee and AP considered modifying the risk element definition that would have consider risks to meeting protected species objectives due to all food web interactions (predator, prey, other biological interactions) - not just those protected species interactions with Council-managed species as currently considered. Ultimately, the group felt the modified definition would likely be too big an issue to address and decided to retain the existing definition.
 - Since the definition remains as is currently included in the risk assessment, the group supported using the existing indicators but did recommend the risk criteria include more protected species-specific management objective considerations.
- **Ecosystem Productivity**
 - The group recommended retaining this risk element, current definition, and the four existing indicators. The group also recommend adding a new forage base indicator which calculates the aggregate pelagic forage fish biomass available in the Mid-Atlantic.
 - The SSC’s Ecosystem Work Group is also developing ecosystem overfishing targets and thresholds for the Mid-Atlantic that could be incorporated here in the future.
 - Given the number and range of indicators available for this risk element, the group recommended additional evaluation of the indicators and how they will be used, in

aggregate or individually, to inform the risk criteria rankings. Based on the results of the evaluation, the risk criteria definitions may need to be modified.

- **Population Diversity**
 - This was a new risk element being considered by the Committee and AP and would consider the risks associated with declining or changing species/stock diversity (size, sex, reproductive).
 - The group noted this is an important issue to track but more work was needed and recommended parking this risk element and consider potentially incorporating it later when more information is available and potential indicators could be developed.
 - The group also suggested piloting the development of this element and potential indicators with some example stocks such as summer flounder and scup where there is a lot of information already available. The results from these pilot examples could determine if this may be a useful risk element.
- **Ecological Diversity**
 - This was a new risk element being considered by the Committee and AP and would consider the risks associated with declining or changing species diversity and altered ecosystem structure and function.
 - There are a number of potential ecological diversity indicators available from the State of the Ecosystem report (e.g., zooplankton, larval, and adult species diversity), but the group was unsure how to interpret the information and draw any conclusions.
 - The group recommended parking this risk element and continue to track these indicators in the State of the Ecosystem reports and determine how these may be incorporated in the future.
- **Offshore Habitat**
 - This risk element was first considered during the development of the initial risk assessment but was parked due to data limitations. Since then, a significant amount of new information available, including habitat models and vulnerability assessments.
 - The group recommended including this risk element and associated definition in the revised risk assessment. The group also recommended using model-based indicators that identify offshore habitat occupancy and that potentially include important habitat features (e.g., cold pool) and habitat vulnerability.
- **Invasive Species**
 - This was a new indicator being considered by the Committee and AP and would consider threats to Council-managed species due to interactions with invasive species (non-native to ecosystem and which causes harm).
 - While there are some invasive species examples within the Mid-Atlantic (e.g., blue catfish, lionfish, green crab, harmful algal blooms), the risk imposed by these species is unknown.
 - The group recommended removing this as a potential risk element and include as a potential indicator under the Estuarine/Coastal Habitat and Offshore Habitat risk elements.

Socio-Economic Elements:

- **Commercial Revenue**

- The Committee and AP recommended retaining this element in the revised risk assessment and agreed to change the element name to “Commercial Value” to capture the interest in overall profits, not just revenue generated by the commercial sector.
- The group reviewed a new/alternative indicator that looked at net revenue (gross revenue – trip costs), but the information available to inform this indicator only includes a sub-set of fishing activity in the Mid-Atlantic.
 - Given this, the group recommended retaining the current indicator and risk criteria, but supported further development of the net revenue indicator for future consideration.
- **Commercial Fishery Resilience (1) – Revenue Diversity**
 - The group recommended retaining this existing risk element and current definition.
 - The group supported the existing indicator which is applied across the entire commercial sector but suggested evaluating by vessel category and port level to understand the potential changes in diversity at the species level and understand community resilience.
 - The group also suggested refinement to the risk criteria definitions for the Low-Moderate risk level.
- **Commercial Fishery Resilience (4, 5, 6) – Capital, Insurance, Emerging Markets**
 - These are new commercial resilience risk elements being considered by the Committee and AP that would account for the various business and economic pressures encountered by commercial fishing operations.
 - Given the lack, and highly variable nature, of information available for many of these elements, the group was unsure if these elements would have any value as stand-alone risk elements. The group also noted there are other risk elements that consider how revenue and fleet structure might be changing.
 - Therefore, the group recommended removing these as stand-alone risk elements but consider them for potential indicator development that could inform other commercial fishery resilience risk elements.
- **Commercial and Recreational Fishery Resilience – Shoreside Support**
 - This element is currently included in the risk assessment that considers reduced resilience due to loss of commercial shoreside support. The Committee and AP have been considering adding a similar risk element for recreational shoreside support (marinas, bait and tackle shops etc.).
 - The group recommended retaining the current commercial shoreside support risk element, definition, indicators, and criteria ranking.
 - The group is interested in including recreational shoreside support in the future, but expressed concern about the existing data and current status of indicator development. Therefore, it was recommended to park this risk element, collect additional information, and allow for continued development of potential indicators.
- **Recreational/Subsistence Seafood Production**
 - The group recommended retaining this existing risk element, current definition, indicators, and ranking criteria.
 - The group also supported the potential development of indicators that would evaluate the subsistence component of this risk element. Understanding how this sector of the recreational fishery may be changing is important to know, particularly for equity and environmental justice considerations. However, this is likely to be a complex issue

driven by a variety of factors (e.g., location, culture, ethnicity etc.) and data availability.

- **Recreational Fleet Diversity**
 - This is a new indicator being considered by the Committee and AP and is currently included in the State of the Ecosystem report. This indicator considers the risk to maintaining equity in recreational access to fishery resources.
 - The group recommended including this risk element, definition and diversity index indicator in the revised risk assessment. The group also recommended the continued development of a harvest:catch ratio by mode indicator for review by the Committee and AP in early 2024. The intent of this indicator would be to evaluate if recreational fishing behavior/preferences are changing (i.e., harvest versus catch and release) within the different recreational modes/sectors.
- **Commercial and Recreational Employment**
 - Both of these are new elements being considered by the Committee and AP and would consider the risks of not optimizing or maintaining commercial and recreational job creation and retention.
 - The group recommended parking both of these elements until additional work and development could occur. As a potential indicator, the group suggested utilizing VTR information (number of crew and days absent or crew and trips) that might provide a timeseries of employment (or proxy for employment) at the individual level.
- **Commercial Seafood Production**
 - The group recommended retaining this element in the revised risk assessment and agreed to change the element name to “Commercial Fishing Production” and to modify the definition to account for not only commercial seafood production but also commercial landings that are used for bait. The Committee and AP felt tracking bait landings was important for the Mid-Atlantic and these landings ultimately result in the harvest of seafood.
 - The group recommended using the current indicators of total seafood and bait landings in the Mid-Atlantic, but also recommended developing a seafood:bait ratio as another indicator to track the composition of total commercial harvest.
 - Given the revised definition and new indicators, updated risk criteria will need to be developed for Committee and AP review in early 2024.

Management Elements:

- **Offshore Wind – Biological/Ecosystem**
 - This, and the element below, are new elements being considered by the Committee and AP that consider different risks associated with offshore wind development. This offshore wind risk element would consider the biological impacts to stock productivity, distribution, and ecosystem structure and function.
 - The group recommended including this element in the revised risk assessment and agreed to the risk element definition. The group identified potential indicators but noted further development is needed. Once indicators are developed, potential risk criteria can then be determined.
- **Offshore Wind – Fishery Science and Access**

- This risk offshore wind risk element would consider the fishery impact risks due to fishing access and scientific uncertainty.
- The group recommended including this element in the revised risk assessment and agreed to the risk element definition. The group also supported using a suite of indicators currently included in the State of the Ecosystem report (e.g., commercial revenue in lease areas, including port and EEJ revenue, and spatial overlap between lease areas and NEFSC fishery independent surveys). Additional development of risk criteria is needed and will be presented to the Committee and AP for consideration in early 2024.
- **Offshore Energy – Exclusive of Wind**
 - This was a new indicator being considered by the Committee and AP that would evaluate the risks to fishery access from non-wind related offshore energy development (e.g., oil and gas, tidal etc.).
 - Given the limited development of these activities in the Mid-Atlantic, the group recommended removing this as a stand-alone risk element and be included as a potential indicator under the Other Ocean Activities risk element (see below).
- **Aquaculture**
 - This was a new indicator being considered by the Committee and AP that would evaluate the risks to fishery access from federal waters aquaculture development in the Mid-Atlantic.
 - Given the limited development of offshore/federal water aquaculture activities in the Mid-Atlantic, the group recommended removing this as a stand-alone risk element and be included as a potential indicator under the Other Ocean Activities risk element (see below).
- **Other Ocean Uses**
 - This is an existing element in the current risk assessment but primarily focused on the risks associated with offshore wind. Given the recommendation to include two new offshore wind risk elements, the group recommended changing the risk element name to “Other Ocean Activities” and update the definition to focus on potential fishery displacement impacts from a suite of other ocean activities (e.g., energy, shipping, aquaculture, monuments/sanctuaries etc.)
 - The group identified potential indicators and, depending on the activity, could be considered now or will need to be developed once an activity occurs in the region.
- **Regulatory Complexity and Stability**
 - The group recommended keeping this risk element in the revised risk assessment with modifications to the definition to highlight the risk of non-compliance due to frequent and complex regulation changes.
 - The group also recommended continuing with the existing qualitative indicator but suggested alternative indicators be considered including regulatory differences between states and the frequency of mid-year regulation changes. Once additional indicators are developed, updated risk criteria will be to be reviewed by the Committee and AP in early 2024.
- **Essential Fish Habitat**
 - This is a new risk element being considered by the Committee and AP and would consider the risks associated with not identifying and/or protecting essential fish habitat (EFH). The group noted there are other habitat risk elements that focus more

- on the ecological impacts for Council-managed fisheries. Since the Council has a direct role and authority under MSA, the group recommended retaining this as a new stand-alone element given its management focus.
- The Council is currently working on an amendment to update EFH designations for all Council managed species. Any revisions to EFH designations through the amendment will likely not occur until late 2025. Given the timing of the amendment, the group recommended parking this risk element until the results and outcomes from the amendment are complete.

Of the 43 risk elements considered by the Committee and AP, 28 elements are recommended to be included in a revised risk assessment report, 6 elements are recommended to be placed in the parking lot to be consider later when additional information is available, and 9 elements are recommended to be removed as a stand-alone risk element but be used as an potential indicator under another risk element.

At the October 3-5, 2023 Council meeting, the Council will review the Committee and AP recommendations and approve the final list of risk elements to be included in a revised risk assessment to be completed in spring 2024.



EAFM Risk Element Overview

Risk Element Information and Recommendations for Council Consideration

September 21, 2023

Below is a list of all 43 risk elements, grouped by category (Ecological, Socio-economic, and Management), considered by the Council's Ecosystem and Ocean Planning (EOP) Committee and Advisory Panel (AP) during their comprehensive review of the EAFM risk assessment. For each element, there is an element description, definition, indicator(s) (if applicable), and risk criteria (if applicable). The information associated with each element incorporates the most recent feedback and recommendations developed by the EOP Committee and AP at their September 13-14, 2023 meeting. The Council will review the EOP Committee and AP recommendations at the October 3-5, 2023 Council meeting and will finalize the list of risk elements to potentially be included in a revised risk assessment report. Technical staff from the Council and NEFSC will develop a revised draft risk assessment in early 2014 using the most recent information and indicators from the 2024 Mid-Atlantic State of the Ecosystem report. The draft risk assessment will be presented to the EOP Committee and AP in March 2024 for final feedback and recommendations regarding the inclusion, deletion, or parking/later consideration of any risk element for Council consideration. The Council will then review and approve the new EAFM risk assessment for use by the Council in future management documents, priorities, and decisions.

As a reminder:

Risk Elements - identify what we are measuring. They can be any aspect that may threaten achieving the biological, economic, or social objectives that the Council desires from a fishery.

Definitions - describe why we are measuring it and clearly state what is at risk.

Indicators - are how we measure risk and are observations that gives information about the risk element.

Risk Criteria - help specify what is the risk, ranging from low to high.

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Ecological Elements

Stock Assessment Performance

Description:

Stock assessments provide the scientific basis for sustainable fishery management in this region. This risk element is applied at the species level, and addresses risk to achieving OY due to scientific uncertainty based on analytical and data limitations. The Council risk policy accounts for scientific uncertainty in assessments, with methods for determining scientific uncertainty currently being refined by the Council's Scientific and Statistical Committee (SSC).

Other assessment-related risk elements (F status and B status) describe risks according to our best understanding of stock status, but assessment methods and data quality shape that understanding.

Definition:

Risk of not achieving OY due to analytical limitations

Indicators:

The Council currently uses indicators from stock assessment review and a qualitative assessment of general assessment data quality. The EOP and Council can continue to use pass/fail criteria from independent stock assessment reviews, and more formally incorporate data quality indicators (including data quality impacts from any source of scientific survey constraint), assessment retrospective performance indicators, or other indicators of analytical limitations. The SSC OFL CV process already reviews many aspects of analytical assessment uncertainty, including data quality and retrospective performance, which may be incorporated in this EAFM risk assessment.

Proposed risk criteria:

Low risk for assessment performance was defined as stock assessment model(s) passing peer review, and stocks having high data quality. Low-Moderate risk was assessment passing peer review, but some key data and/or reference points are lacking. The Moderate-High risk category was not used for this element in the past, but could include consideration of major data gaps and or large retrospective patterns that require adjustment. High risk was the assessment failing peer review, and/or that considerable data shortcomings required the use of data-limited tools.

An alternative set of criteria could apply OFL CVs used by the SSC for establishing ABC, which represent overall assessment uncertainty. An OFL CV of 60% could represent the low risk category, 100% the low-moderate risk category, 150% the moderate-high risk category, and stocks without an assessment (where OFL CV is usually not applied) remaining in the high risk category. If applying these criteria, we could change the name of this to "Assessment uncertainty" to match what the SSC is evaluating.

<i>Risk Level</i>	<i>Definition</i>
Low	Assessment model(s) passed peer review, high data quality, small retrospective pattern
Low-Moderate	Assessment passed peer review but some data and/or reference points may be lacking
Moderate-High	Assessment passed peer review but with major data quality issue or large retrospective pattern
High	Assessment failed peer review or no assessment, data-limited tools applied

Fishing Mortality Status and Stock Biomass Status

Description:

Managed fisheries are required to be prosecuted within fishing mortality limits and managed stocks are required to be maintained above minimum threshold biomass levels to preserve sustainable yield. These elements are applied at the species level. Because OY is the objective, and OY is at most MSY under U.S. law, fishing mortality (F) limit reference points are based on F_{MSY} , while the stock biomass (B) target is biomass at MSY (B_{MSY}). F and B status relative to established MSY-based target and limit reference points or proxies (Gabriel and Mace, 1999) from stock assessments therefore indicate the level of risk to achieving OY from either overfishing or stock depletion, respectively.

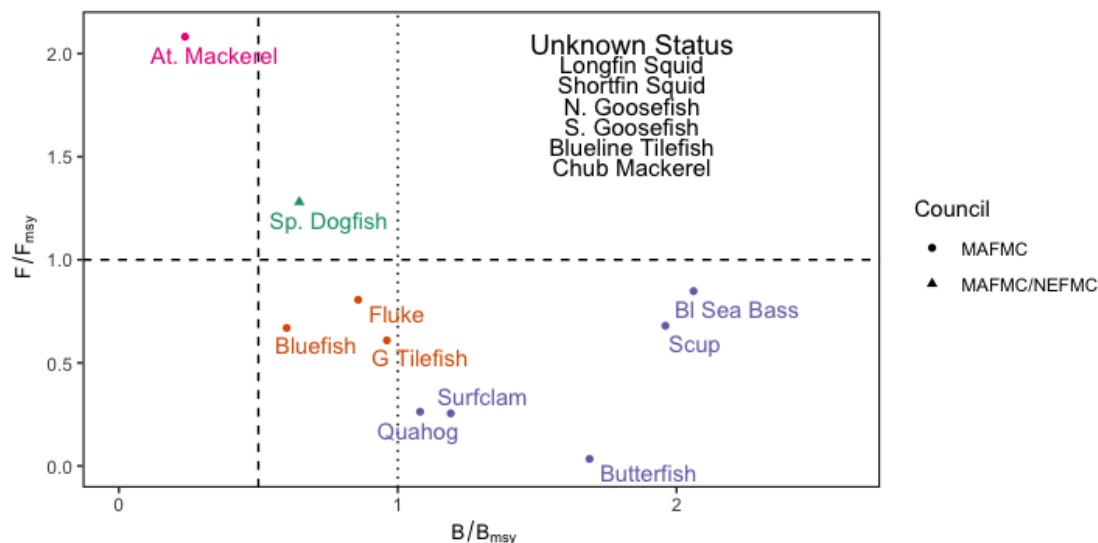
Definitions:

Fishing Mortality – F Status: Risk of not achieving OY due to overfishing

Stock Biomass – B Status: Risk of not achieving OY due to depleted stock

Indicators:

Stock assessments estimate both current F relative to the F reference point and current B relative to the B reference point and these indicators are used directly. When these quantities are not estimated due to analytical limitations, the SSC can evaluate the weight of evidence for risk of overfishing and overfished status based on evidence outside the stock assessment, and this evaluation is used in the EAFM risk assessment.



Summary of single species status for MAFMC and jointly federally managed stocks (Spiny dogfish and both Goosefish). The dotted vertical line is the target biomass reference point of B_{msy} . The dashed lines are the management thresholds of one half B_{msy} (vertical) or F_{msy} (horizontal). Stocks in red are below the biomass threshold (overfished) and have fishing mortality above the limit (subject to overfishing), stocks in green are above the biomass threshold but have fishing mortality above the limit. Remaining stocks have fishing mortality

within limits: stocks in orange are above the biomass threshold but below the biomass target, and stocks in purple are above the biomass target.

Proposed risk criteria:

We applied low and high risk criteria for these elements as defined in U.S. law. Low risk criteria are $F < F_{MSY}$ and $B > B_{MSY}$ for an individual stock. High risk criteria are $F > F_{MSY}$ and $B < 0.5 B_{MSY}$ for an individual stock. The Council established the intermediate risk categories to address stocks with unknown status. Moderate-high risk was defined as unknown status in the absence of other information for both F and B . Low-moderate risk was defined as unknown status, but with a weight of evidence indicating low overfishing risk for F . Similarly, low-moderate risk for B was either $0.5 B_{MSY} < B < B_{MSY}$ or unknown status, but with a weight of evidence indicating low risk that the population is depleted.

<i>Risk Level</i>	<i>Definition</i>
Low	$F < F_{MSY}$
Low-Moderate	Unknown, but weight of evidence indicates low overfishing risk
Moderate-High	Unknown status
High	$F > F_{MSY}$

<i>Risk Level</i>	<i>Definition</i>
Low	$B > B_{MSY}$
Low-Moderate	$B_{MSY} > B > 0.5 B_{MSY}$, or unknown, but weight of evidence indicates low risk
Moderate-High	Unknown status
High	$B < 0.5 B_{MSY}$

Food Web (1) - Prey Availability

Description:

This element is applied at the species level.

Fish stocks and protected species stocks are managed using single species approaches, but fish and protected species stocks exist within a food web of predator and prey interactions. This element is one of two separating food web risks to achieving OY for Council managed species from two sources. This first element assesses prey availability for each species, and the second food web risk element assesses predation pressure on each species (see next element).

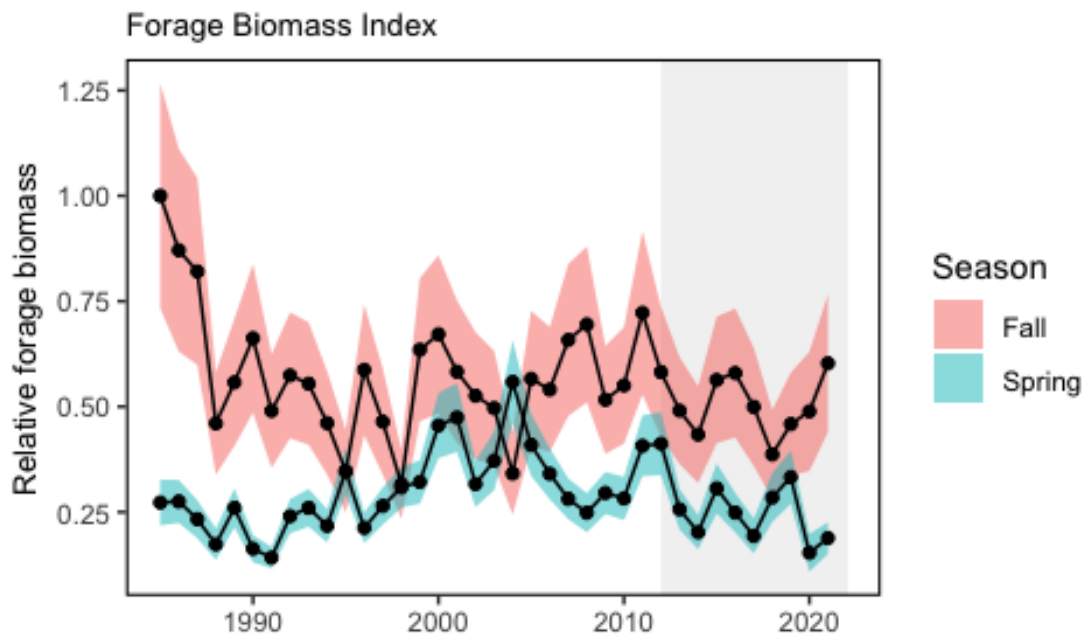
Definition:

Risk of not achieving OY for Council managed species due to availability of prey.

Indicators:

Indicators of prey availability for each Council managed species would be based on food habits information for the Council managed species combined with population trends for key prey species (if available). Prey could include all species (Council managed, other-managed, and non-managed) or a subset as determined by the EOP and Council.

Another indicator of prey could be based on stomach contents of predators, as was used for the 2022 bluefish research track assessment and presented in the 2023 State of the Ecosystem report. This index includes 22 forage species and was designed for bluefish, but also includes important forage for summer flounder and other Council managed species.



Forage fish index developed for the 2022 bluefish research track stock assessment

A secondary indicator of prey availability would include the fish condition indicators from the State of the Ecosystem report (shown below under Ecosystem Productivity). These would not rely on detailed diet information, instead reflecting the impact of environmental drivers including prey availability on fish growth.

Diet information was gathered from the Northeast Fisheries Science Center (NEFSC) food habits database and other sources (Smith and Link, 2010; Johnson et al 2008).

Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	Prey availability high (not limiting) and/or good fish condition past 5 years
Low-Moderate	Aggregate prey available for this species has stable or increasing trend, moderate condition
Moderate-High	Aggregate prey available for this species has significant decreasing trend, poor condition
High	Managed species highly dependent on prey with limited and declining availability, poor condition

Food Web (2) - Predation Pressure

Description:

This element is applied at the species level.

Fish stocks and protected species stocks are managed using single species approaches, but fish and protected species stocks exist within a food web of predator and prey interactions. This element is one of two separating food web risks to achieving OY for Council managed species from two sources. This second food web risk element assesses predation pressure on each species, and the first element assesses prey availability for each species (see element above).

Definition:

Risk of not achieving OY for Council managed species due to predation pressure.

Indicators:

Indicators of predation pressure on a Council managed species would be based on food habits information for predators of the species combined with key predator trends. This could be derived from empirical information or food web/multispecies models. Predators could include all species (protected, HMS, Council managed, other-managed, and unmanaged) or a subset as determined by the EOP and Council. Predation mortality (M2) compared to fishing mortality (F) to evaluate the relative importance of predation mortality is another indicator that could help inform the risk criteria levels.

Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	Predation pressure represents low proportion of overall mortality
Low-Moderate	Predation pressure moderate proportion of overall mortality, decreasing mortality trend
Moderate-High	Predation pressure moderate proportion of overall mortality, increasing mortality trend
High	Predation pressure represents high proportion of overall mortality, increasing mortality trend

Food Web (3) - Protected Species Prey

Description:

This element is applied at the species level.

Fish stocks and protected species stocks are managed using single species approaches, but fish and protected species stocks exist within a food web of predator and prey interactions. The previous two elements focus on Council managed species OY, while this element focuses on protected species objectives (maintain or recover populations and minimize bycatch).

This element ranks the risks of not achieving protected species objectives due to species interactions with Council managed species. In the US, protected species include marine mammals (under the Marine Mammal Protection Act), Endangered and Threatened species (under the Endangered Species Act), and migratory birds (under the Migratory Bird Treaty Act). In the Northeast US, endangered/threatened species include Atlantic salmon, Atlantic and shortnose sturgeon, all sea turtle species, and five whales.

Definition:

Risk of not achieving protected species objectives due to interactions with Council-managed species

Indicators:

Food web models and diet information can be used to establish thresholds of “importance” for predators and prey. Although monkfish occasionally ingest seabirds (Perry et al., 2013), there are no Council-managed species that are important predators of protected species (Smith and Link, 2010), so here we rank only risks where Council managed species represent prey of protected species. An important prey of protected species is defined here as individually comprising >30% of the predator’s diet by weight. Critical prey warranting a high risk ranking would be a majority (>50%) of diet for an individual protected species.

Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	Few interactions with any protected species
Low-Moderate	Important prey of 1-2 protected species, or important prey of 3 or more protected species with management consideration of interaction
Moderate-High	Important prey of 3 or more protected species
High	Managed species is sole prey for a protected species

Food Web (4) – Other

Description:

Fish stocks and protected species stocks are managed using single species approaches, but fish and protected species stocks exist within a food web of predator and prey interactions. This element would be applied at the species level. The proposed new element would address risks to HMS management objectives from Council managed activities.

Definition:

Risks to maintaining HMS and shorebird populations due to interactions with Council-managed species.

The Ecosystem and Ocean Planning Committee and Advisory Panel recommended removing this as a stand-alone risk element and consider as a potential indicator under the Food Web (2) and (3) risk elements.

Ecosystem Productivity

Description:

This element is applied at the ecosystem level (the Mid-Atlantic Ecosystem Production Unit).

Productivity at the base of the food web supports and ultimately limits the amount of managed species production in an ecosystem.

Definition:

Risk of not achieving OY due to changing system productivity at the base of the food web.

Indicators:

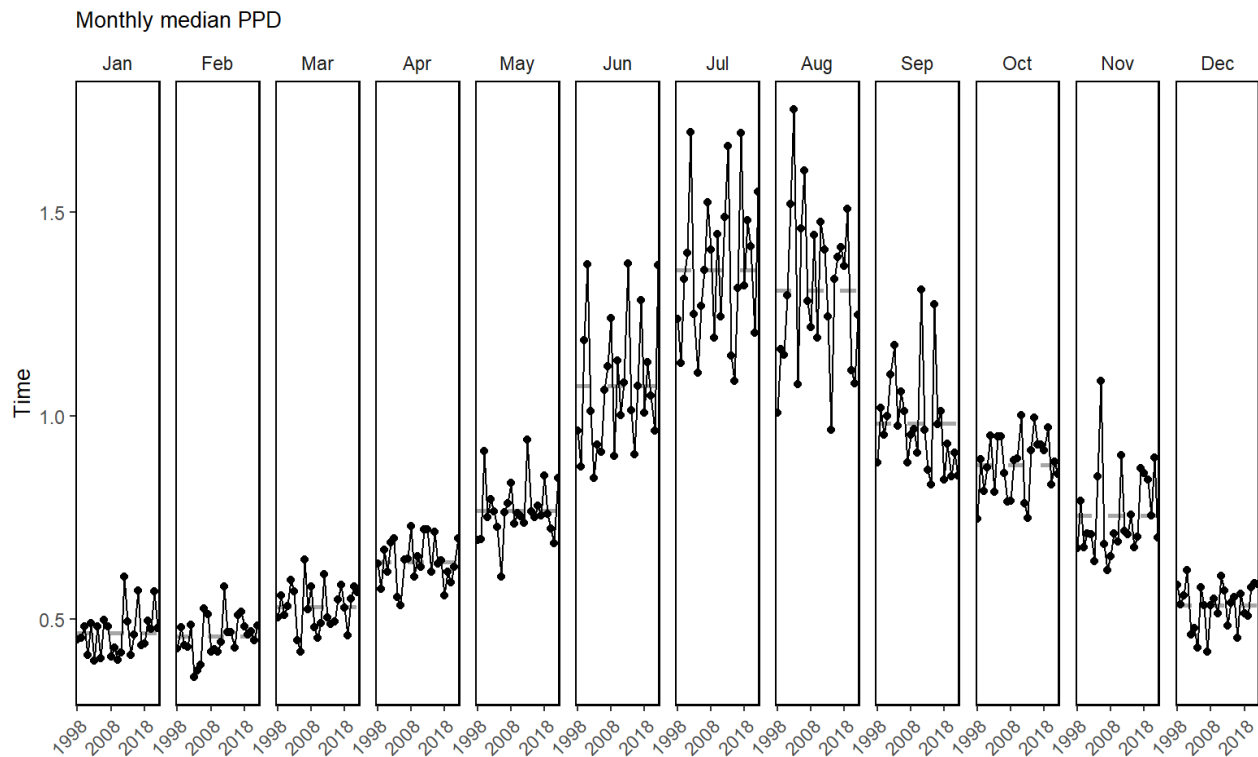
A combination of five indicators will be used to assess the risk of changing ecosystem productivity. We examine trends in total primary production, zooplankton abundance for a key Mid-Atlantic species, aggregate forage fish (new), and two aggregate fish productivity measures: condition factor (weight divided by length of individual fish) and a survey based “recruitment” (small fish to large fish) index. An assessment-based recruitment index was recently added to the State of the Ecosystem report as well. Because benthic crustaceans are important prey for many Council-managed species, we note a benthic production indicator is desirable but not yet available.

These indicators evaluate ecosystem productivity in aggregate, which may change due to drivers such as decreasing primary productivity, changes in spatial/temporal overlap at the base of the food web, or other factors.

For primary production and fish productivity, the spatial scale of analysis is the Mid-Atlantic Ecosystem Production Unit.

Primary production

Primary production has fluctuated recently with current conditions near average. The observed stability in system productivity is in contrast to an apparent shift in the timing of the bloom cycle in the Mid-Atlantic. Comparing remote sensing information from the 1970-80s to 1997-2015 information suggests that winter productivity was historically higher in the MAB and that the spring bloom we see today was less prominent. Shifts in timing of low trophic level production can affect Council managed fish species through early life history stages that feed on zooplankton.

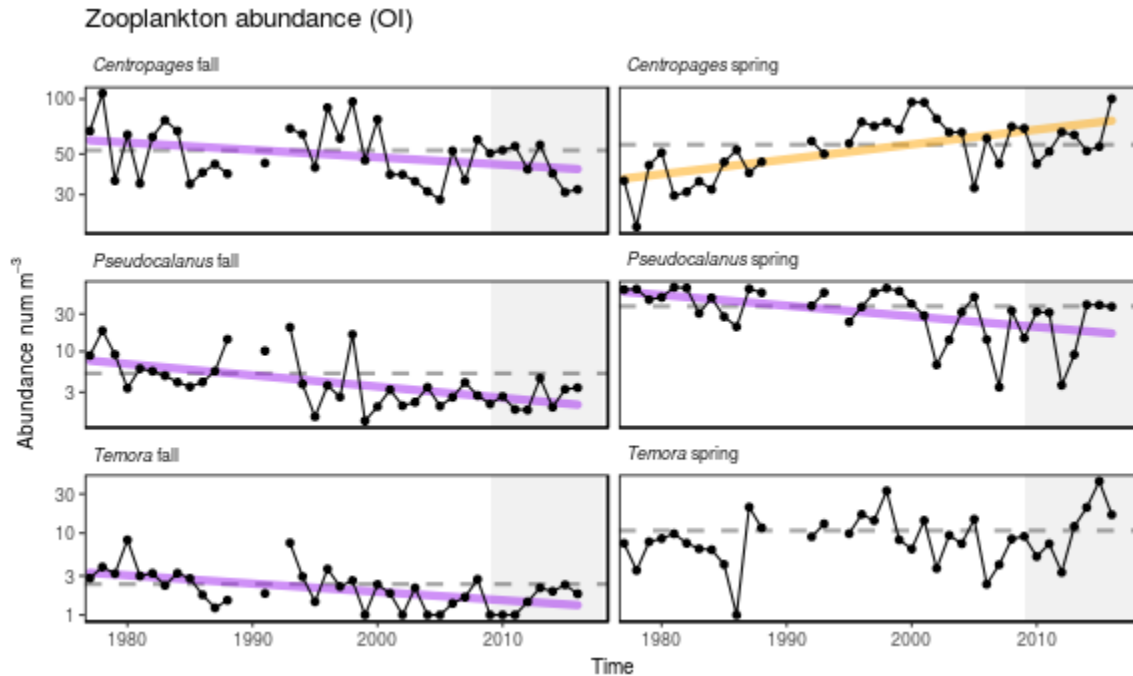


Monthly primary production trends show the annual cycle (i.e. the peak during the summer months) and the changes over time for each month.

Zooplankton abundance

Zooplankton provide a critical link between phytoplankton at the base of the food web, and higher trophic organisms such as fish, mammals, and birds. Changes in the species composition and biomass of the zooplankton community have a great potential to affect recruitment success and fisheries productivity, and climate change may be the most important pathway for these changes to manifest. Therefore these indices are relevant to both productivity and trophic structure objectives.

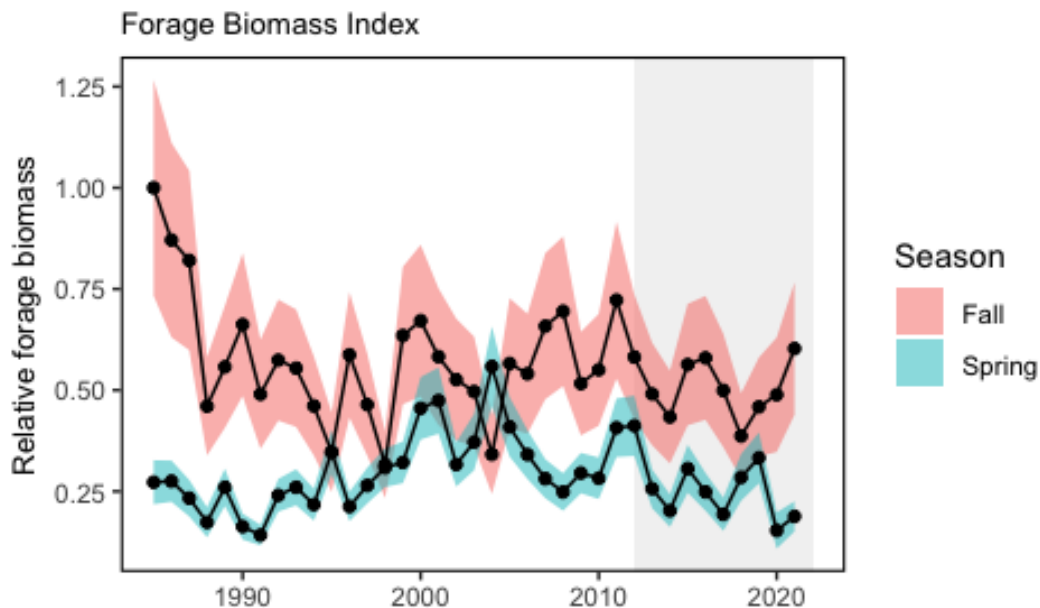
The time series of zooplankton biovolume suggest that overall zooplankton production has not changed over time. However, the dominant species of zooplankton in the Mid-Atlantic, *Centropages typicus*, shows a seasonal shift in abundance. This suggests a change in timing of zooplankton reproductive cycles, which may impact fish species such as Atlantic mackerel.



Time series of zooplankton abundance from 2019 SOE

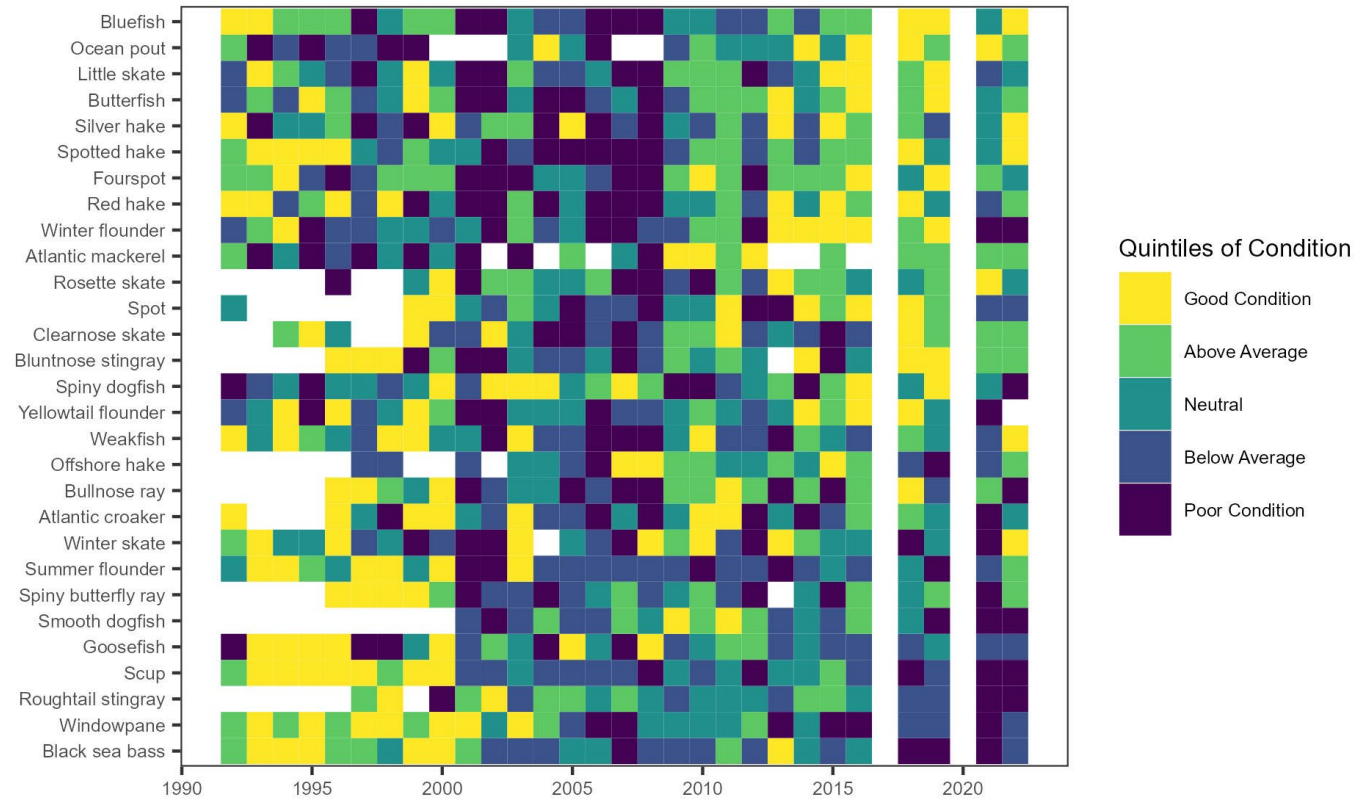
Forage Base - new indicator

The amount of forage available is one important driver of fish productivity. Indicators of aggregate pelagic forage fish biomass and forage fish energy content are presented in the State of the Ecosystem report. Indicators of benthic forage are under development but not yet available. Food habits data from surveys and literature could be used to define the forage base common to all Council managed and protected species.



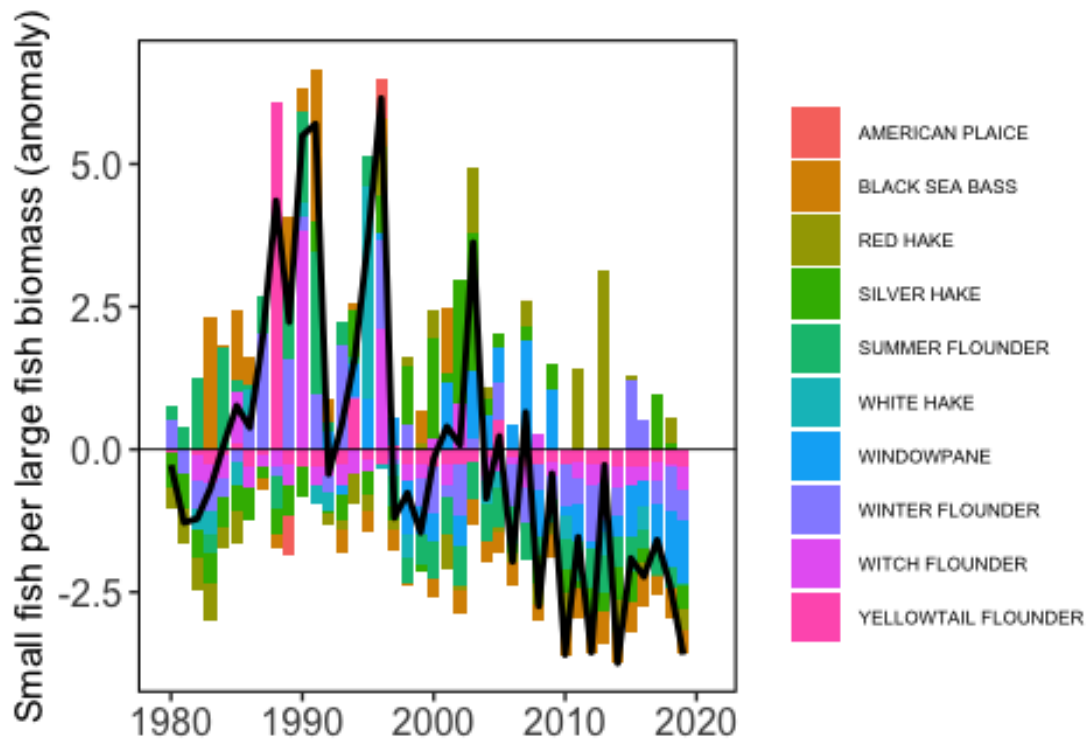
Fish condition

Fish condition is measured as the weight per length—a measure of “fatness”. This information is from NEFSC bottom trawl surveys and shows a change in condition across all species at around 2000. Around 2010-2013 many species started to have better condition, though black sea bass remain thinner for their length on average.

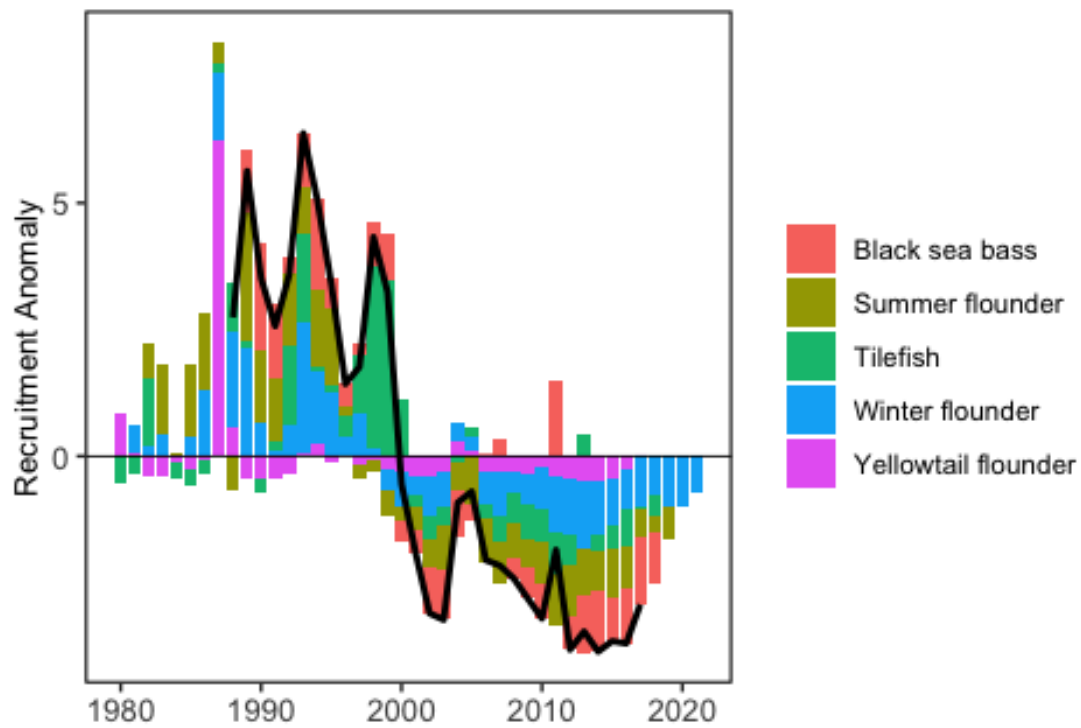


Fish productivity

The number of small fish relative to the biomass of larger fish of the same species, as derived from the NEFSC survey, is a simple measure of productivity intended to complement model-based stock assessment estimates of recruitment. There is a general decrease in this indicator when aggregated across managed and unmanaged species in the Mid-Atlantic. The plot includes black sea bass, butterfish, clearnose skate, fourspot flounder, little skate, scup, spiny dogfish, summer flounder, thorny skate, windowpane flounder, winter flounder, and winter skate.



MAB Recruitment Anomaly from Stock Assessments



Potential risk criteria:

Low risk for this element was defined as no trends in ecosystem productivity across all five indicators. The Low-Moderate risk criterion was trend(s) in ecosystem productivity for 1-2 indicators, whether increasing or decreasing. The Moderate-High risk criterion was trends in ecosystem productivity (3+ measures, increase or decrease). The High risk criterion was decreasing trends across 4 or more indicators.

<i>Risk Level</i>	<i>Definition</i>
Low	No trends in ecosystem productivity
Low-Moderate	Trend in ecosystem productivity (1-2 measures, increase or decrease)
Moderate-High	Trend in ecosystem productivity (3+ measures, increase or decrease)
High	Decreasing trend in ecosystem productivity, 4+ measures

Forage Base (new)

Description:

The amount of forage available is one important driver of fish productivity. This element would be applied at the ecosystem level, and evaluates whether there is sufficient aggregate forage available to provide supporting ecosystem services to managed and protected species.

Definition:

Risk to not maintaining aggregate forage base and ecosystem function for Council-managed species and protected species.

The Ecosystem and Ocean Planning Committee and Advisory Panel recommended removing this as a stand-alone risk element and consider as a potential indicator under the Ecosystem Productivity risk element.

Population Diversity (new)

Description:

This element would be applied at the species level.

Changes (particularly reduction) in diversity at the species/stock level (size, sex, reproductive) can impact stock productivity, and therefore yield.

Definition:

Risk of not achieving OY due to reduced species/stock diversity (size, sex, genetic, reproductive).

The Ecosystem and Ocean Planning Committee and Advisory Panel recommended parking this risk element and consider potentially incorporating it later when more information is available and potential indicators could be developed.

Ecological Diversity (new)

Description:

This element would be applied at the ecosystem level.

Diversity of species within ecosystems provides the capacity to adapt to change at the ecosystem level, stabilizing ecosystem structure and function for dependent fishing communities.

Definition:

Risk of not achieving OY due to reduced species diversity and altered ecosystem structure and function.

The Ecosystem and Ocean Planning Committee and Advisory Panel recommended parking this risk element and continue to track potential indicators (e.g., zooplankton, larval, and adult diversity) in the State of the Ecosystem reports and determine how these may be incorporated in the future.

Climate

Description:

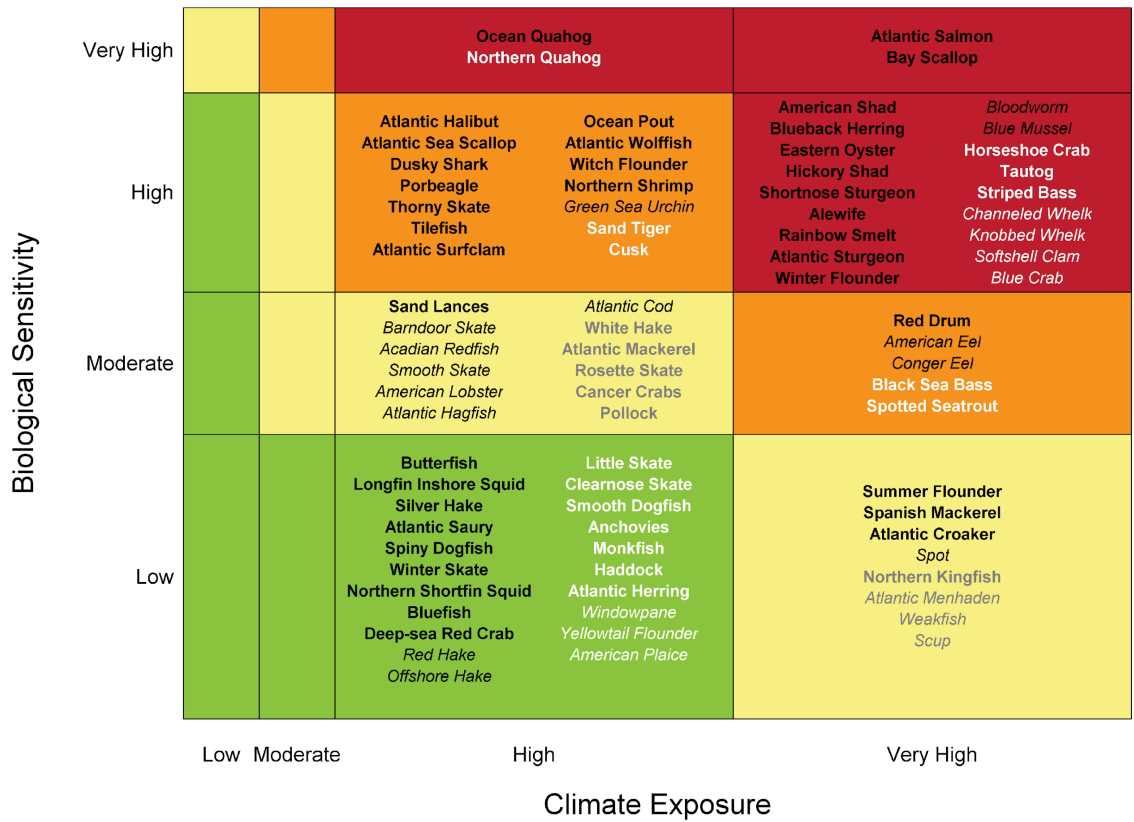
Climate change is expected to alter environmental conditions for managed fish in the Northeast US. This element is applied at the species level, and evaluates risks to species productivity (and therefore to achieving OY) due to projected climate change factors in the region using a comprehensive assessment (Hare et al., 2016) and other climate indicators (e.g., Mid-Atlantic ocean acidification).

Definition:

Risk of not achieving OY due to projected climate change or ocean acidification impacts on species productivity.

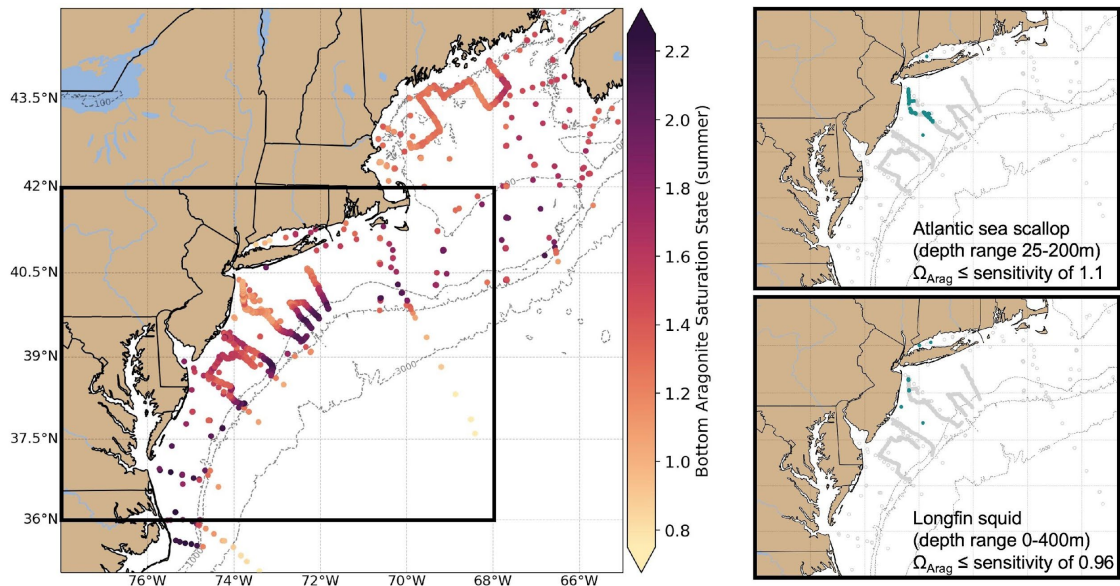
Indicators:

Indicators for climate productivity risk were taken from a climate vulnerability assessment (Hare et al., 2016) that evaluated exposure of each species to multiple climate threats, including ocean and air temperature, ocean acidification, ocean salinity, ocean currents, precipitation, and sea level rise. The assessment also evaluated the sensitivity (*not extinction risk*) of each species based on habitat and prey specificity, sensitivity to temperature and ocean acidification, multiple life history factors, and number of non-climate stressors. Additional indicators linking temperature and ocean acidification to individual stocks are presented in the State of the Ecosystem reports.



Hare et al., 2016 Climate vulnerability by species, Northeast US

Indicator: Mid Atlantic Ocean acidification



Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	Low climate vulnerability ranking
Low-Moderate	Moderate climate vulnerability ranking
Moderate-High	High climate vulnerability ranking, climate indicators impacting the stock increasing (worsening)
High	Very high climate vulnerability ranking, climate indicators impacting the stock increasing (worsening)

Low risk ranking was defined as a low climate vulnerability ranking. Low-Moderate risk was a moderate climate vulnerability ranking. Moderate-High risk was a high climate vulnerability ranking. High risk was a very high climate vulnerability ranking.

Distribution Shifts

Description:

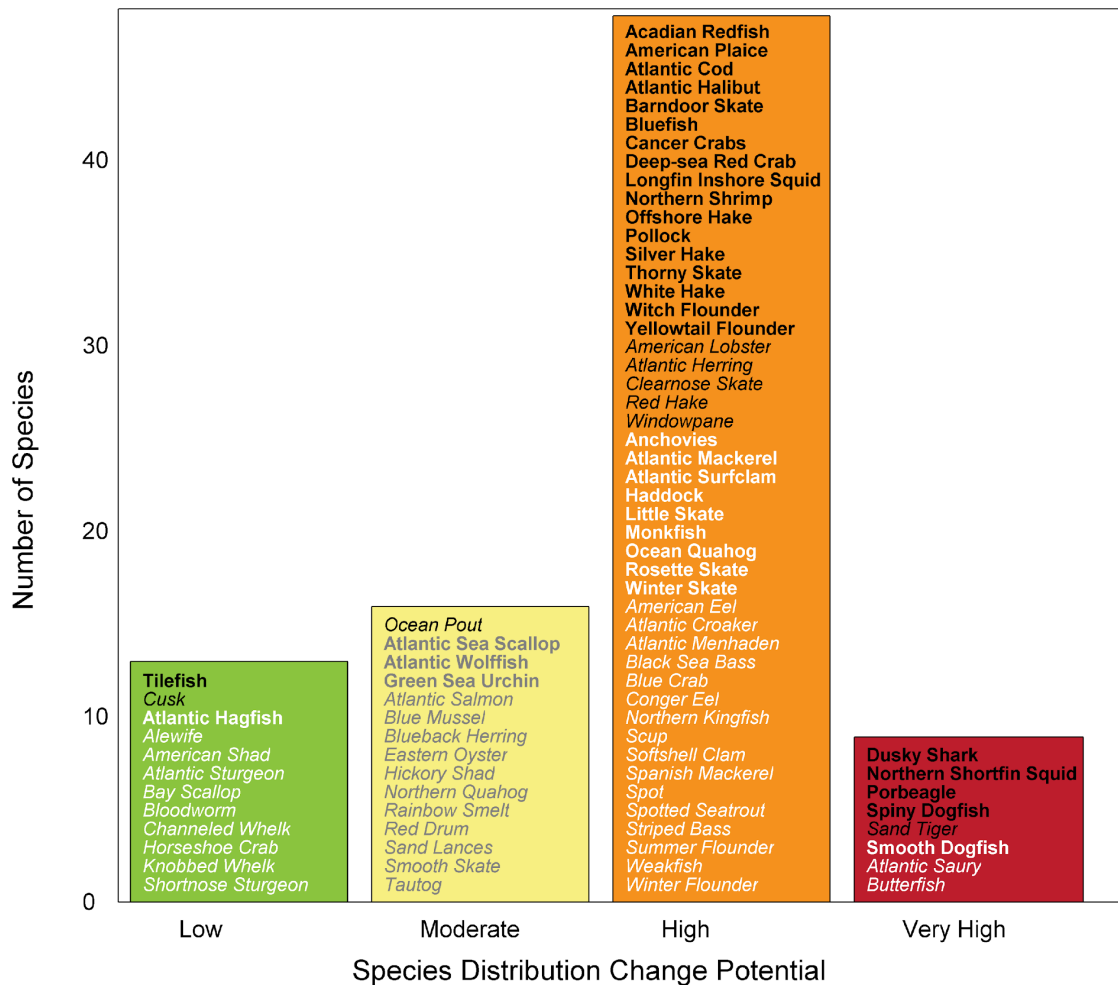
Climate change is expected to drive changes in spatial distribution for managed fish in the Northeast US as environmental conditions become more or less favorable for each stock throughout its range. Species distribution shifts in turn can increase risks of ineffective spatial catch allocation; if catch allocation is greatly mismatched with species distribution OY may not be achieved. This element is applied at the species level, and evaluates risks of species distribution shifts due to projected climate change in the Northeast US.

Definition:

Risk of not achieving OY due to spatial mismatch of stocks and management as a result of climate-driven distribution shifts.

Indicators:

Risks of species distribution shifts due to projected climate change in the Northeast US were assessed in a comprehensive assessment (Hare et al., 2016). We applied those distribution shift risk rankings directly in the risk assessment.



Hare et al., 2016 Distribution shift risk by species, Northeast US

In addition, changes in species distribution are monitored using fisheries independent bottom trawl surveys. Two distribution shift indicators are derived from these surveys: kernel density plots of recent distribution compared with 1970s distribution, and time series of the along shelf position of the center of distribution.

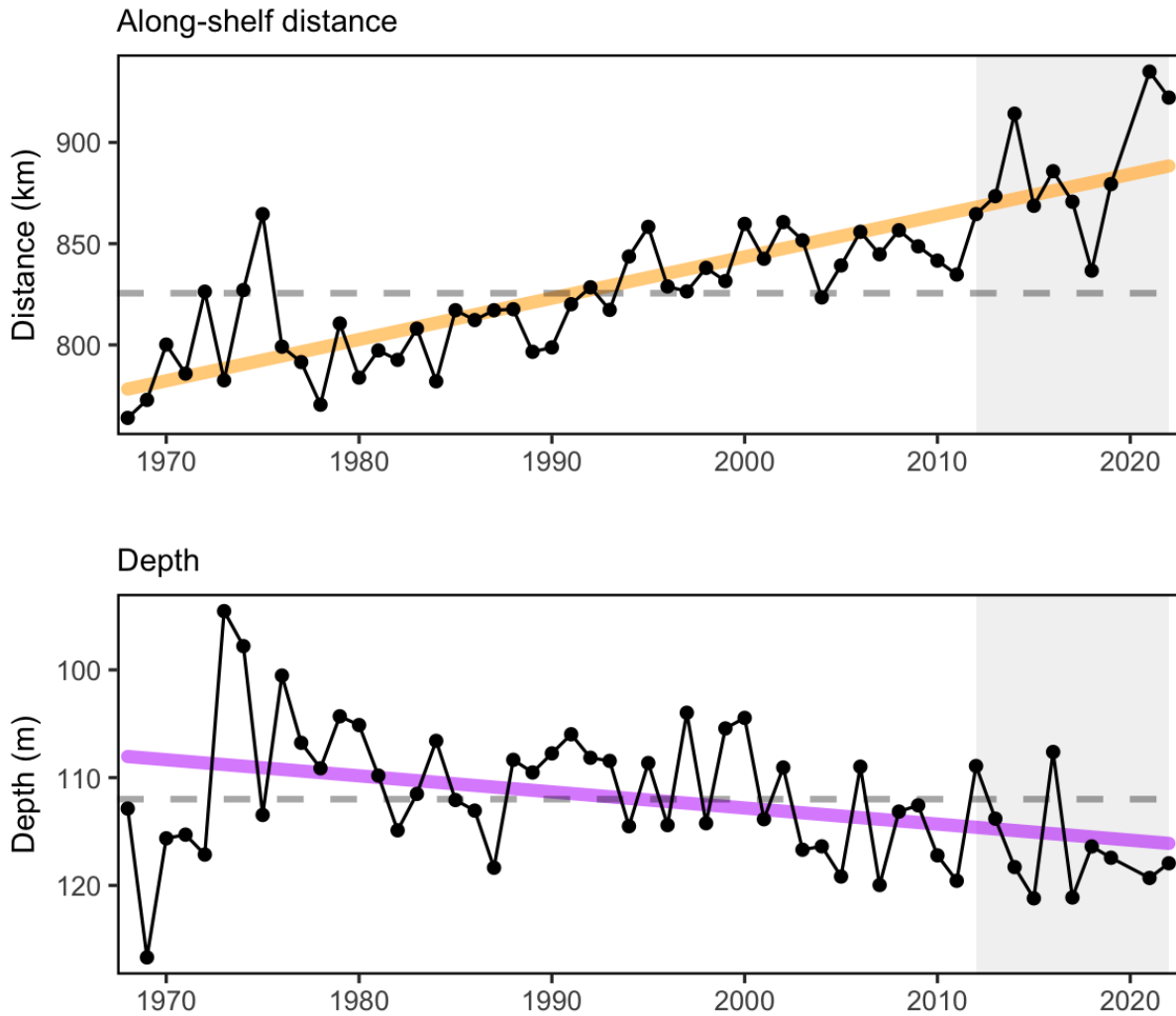
Historical vs. current distribution

Spatial distribution has changed over time for some species more than for others. The distribution of black sea bass, as measured by NEFSC surveys, has shifted northward relative to historical distributions. In contrast, the distribution of longfin squid in the Mid-Atlantic has remained relatively stable.

Species distribution models incorporating habitat variables show where distributions have increased or decreased over time: <https://www.fisheries.noaa.gov/new-england-mid-atlantic/ecosystems/fisheries-habitat-northeast-us-shelf-ecosystem>

Changes in along shelf position

The annual centroid of a species' distribution can be characterized by the position in the ecosystem along an axis oriented from the southwest to the northeast, referred to as the along shelf distance, and by depth. Along shelf distances range from 0 to 1360 km, which relates to positions along the axis from the origin in the southwest to the northeast. All species combined show a shift to the northeast and into deeper water. Individual Council managed species distribution centroids, aside from squids, also showed this trend to the northeast along the shelf in previous analysis.



Aggregate species shifts from the 2023 State of the Ecosystem report

Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	Low potential for distribution shifts
Low-Moderate	Moderate potential for distribution shifts
Moderate-High	High potential for distribution shifts, observed distribution shifts
High	Very high potential for distribution shifts, observed distribution shifts

Estuarine and Coastal Habitat

Description:

Estuarine and coastal habitat provides important nursery grounds for Council managed species, and is changing in quality and quantity due to multiple stressors from climate, land use, and coastal development. This element is applied at the species level, and evaluates risk of not achieving OY due to threats to estuarine and nearshore coastal habitat/nursery grounds.

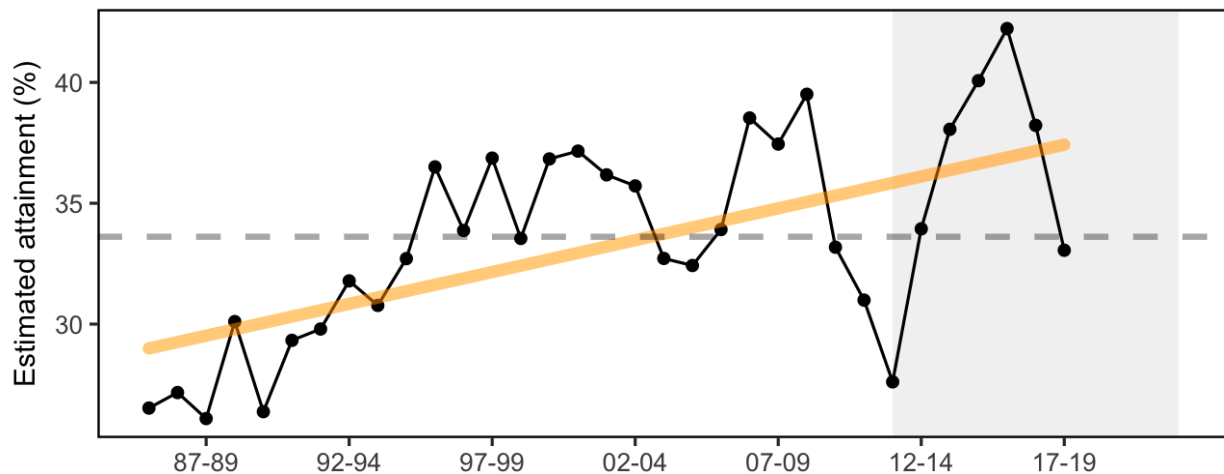
Definition:

Risk of not achieving OY due to threats to estuarine/nursery habitat.

Indicators:

Risk was determined by first evaluating the estuarine dependence of species, and then by enumerating threats to the estuarine habitat required by these species. An assessment of national coastal and estuarine condition was used in this assessment. Water and habitat quality assessments produced for Chesapeake Bay, Delaware Bay, Long Island Sound, and other coastal estuaries have been developed and can be considered in the future. The National Coastal Condition Assessment for the Northeast US (US EPA, 2012) was used to evaluate estuarine and coastal condition. This report lists water, sediment, benthic, and coastal habitat quality as well as fish contamination. State of the Ecosystem reports now include up to date indicators of Chesapeake Bay habitat conditions which could be included as indicators.

Chesapeake Bay Water Quality Attainment



Improvement in overall Chesapeake Bay water quality, from 2022 SOE

Species specific habitat use indicators for Chesapeake Bay are in development. As reported in the 2023 SOE, Chesapeake Bay suitable habitat for juvenile summer flounder growth has declined by 50% or more. Climate change is expected to continue impacting habitat function and use for multiple species. Habitat is improving in some areas (tidal fresh SAV,

oyster reefs), but eelgrass is declining. Similar information from multiple East Coast estuaries could be integrated into the risk assessment as it becomes available.

Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	Not dependent on nearshore coastal or estuarine habitat
Low-Moderate	Estuarine dependent, estuarine condition stable
Moderate-High	Estuarine dependent, estuarine condition fair
High	Estuarine dependent, estuarine condition poor

Species were defined as low risk if not dependent on nearshore coastal or estuarine habitat. Low-Moderate risk were estuarine dependent species with a stable estuarine condition. Moderate-High risk were estuarine dependent species with a fair estuarine condition. High risk were estuarine dependent species with a poor estuarine condition.

Offshore Habitat (new)

Description:

This element would be applied at the species level.

Offshore habitat, defined here as all habitat outside of the estuary and beyond the immediate coastal/nearshore areas, supports all life stages of many Council managed species, and is changing in quality and quantity due to multiple stressors from climate to other ocean uses such as offshore wind development. This element evaluates risk of achieving OY due to changes in offshore habitat quality and quantity.

Definition:

Risk of not achieving OY due to changing offshore habitat. The rationale is that multiple drivers of offshore habitat change, including ocean industrialization, are included in this definition.

Indicators:

Indicators of offshore habitat trends are available from species-specific habitat modeling through the [Northeast Regional Habitat Assessment](#), [NEFSC](#), and multiple other efforts throughout the region.

Indicators include the amount of habitat, quality of habitat, or other aspects of habitat important to support fish productivity. For example, the cold pool is a seasonal habitat feature linked to several species in the Mid-Atlantic with indicators for spatial extent, duration, and temperature within the feature.

Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	No trends in offshore habitat
Low-Moderate	Trend in offshore habitat (1-2 measures, increase or decrease)
Moderate-High	Trend in offshore habitat (3+ measures, increase or decrease)
High	Decreasing trend in offshore habitat, 4+ measures

Invasive Species (new)

Description:

Invasive species (defined as non-native to the ecosystem *and* likely to cause harm to the environment and or economy) are spread by human activity and have the potential to disrupt ecosystem structure and function.

This element would be applied at the ?? ecosystem level.

It would evaluate risks to OY across all Council managed species due to invasive species interactions and impacts on stock productivity.

Definition:

Risk of not achieving OY due to invasive species threats to managed species productivity.

The Ecosystem and Ocean Planning Committee and Advisory Panel recommended removing this as a stand alone risk element and consider as a potential indicator under the Estuarine/Coastal Habitat and Offshore Habitat risk elements.

Economic Elements

Commercial Value

Description:

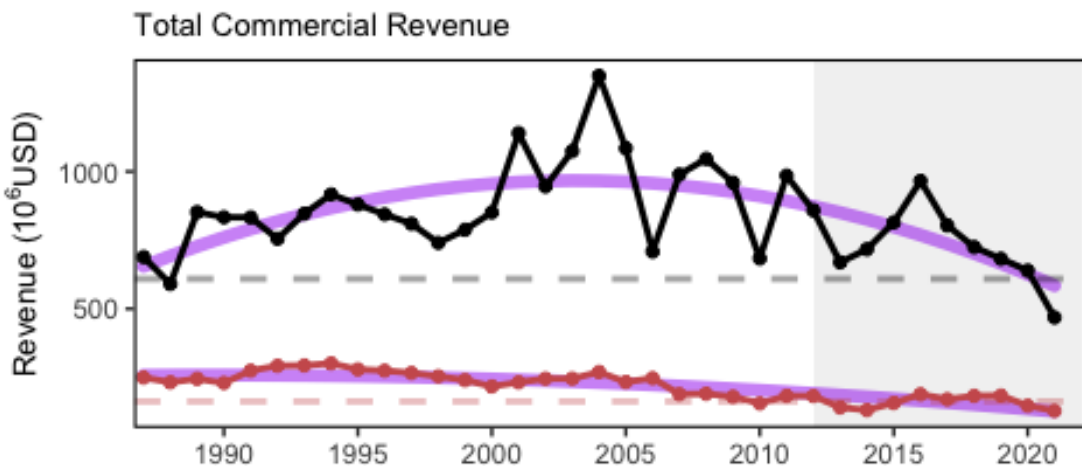
This element is applied at the ecosystem level, and addresses the risk of not maximizing fishery value. Revenue serves as a proxy for commercial profits, which is the component of a fishery's value that this element is ultimately attempting to assess risk towards. Lack of cost information across all fleet segments precludes the assessment of risk to profitability itself at the ecosystem level.

Definition:

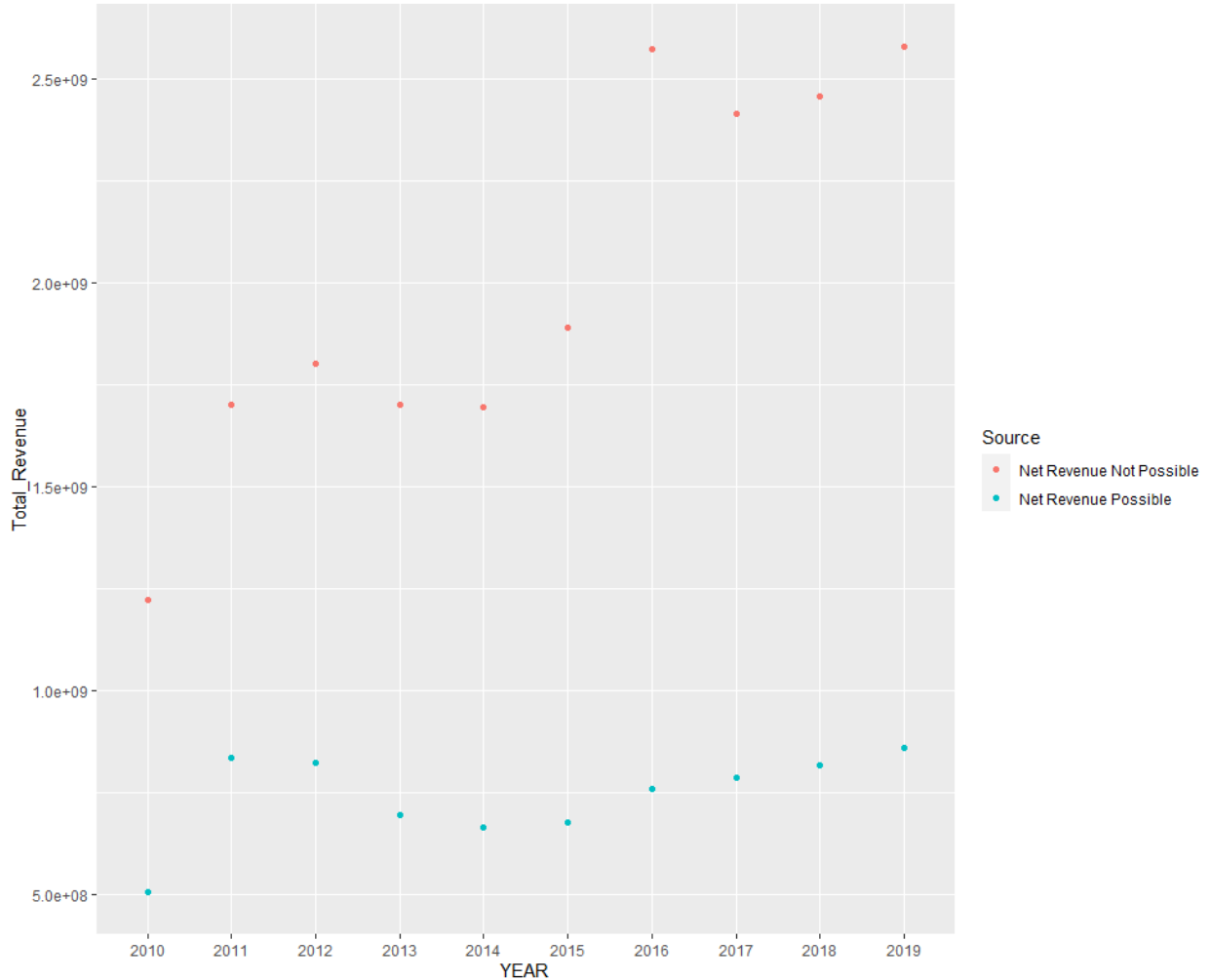
Risk of not maximizing commercial fishery value.

Indicators:

Gross revenue is the current indicator for this element, and can be developed for all fishing activity within the Mid-Atlantic and for all Council managed species. Revenue serves as a proxy for commercial profits, which is the component of a fishery's value that this element is ultimately attempting to assess risk towards. Currently this indicator is aggregated and presented at the ecosystem-level.



Net revenue (Gross revenue - trip costs) is a better proxy for trip value, in an economic context. However, this metric can be calculated only for trips by vessels holding federal licenses and submitting Vessel Trip Reports. This indicator would thus not capture all fishing within the region, and of potential interest to the Council. It underrepresents the total revenue generated regionally by about ½, and does not present the same trends as the subset for which net revenue can be generated. See figure below for the comparison of all revenue from Hatteras to the Canadian border versus what net revenue can be calculated for. The Ecosystem and Ocean Planning Committee and Advisory Panel recommended continued development of this indicator.



Potential risk criteria:

Low risk was defined as no trend and low variability in revenue. Low-Moderate risk was increasing or overall high variability in revenue. Moderate-High risk was a significant long-term revenue decrease. High risk was a significant recent decrease in revenue.

<i>Risk Level</i>	<i>Definition</i>
Low	No trend and low variability in revenue
Low-Moderate	Increasing or high variability in revenue
Moderate-High	Significant long term revenue decrease
High	Significant recent decrease in revenue

Marine Recreational Angler Days/Trips

Description:

Providing recreational opportunities is a stated goal of optimal fishery management under the legal definition of “benefits to the nation”. Recreational fishing is important in the Mid-Atlantic region with the economic and social aspects of many coastal communities being highly dependent on recreational fishing.

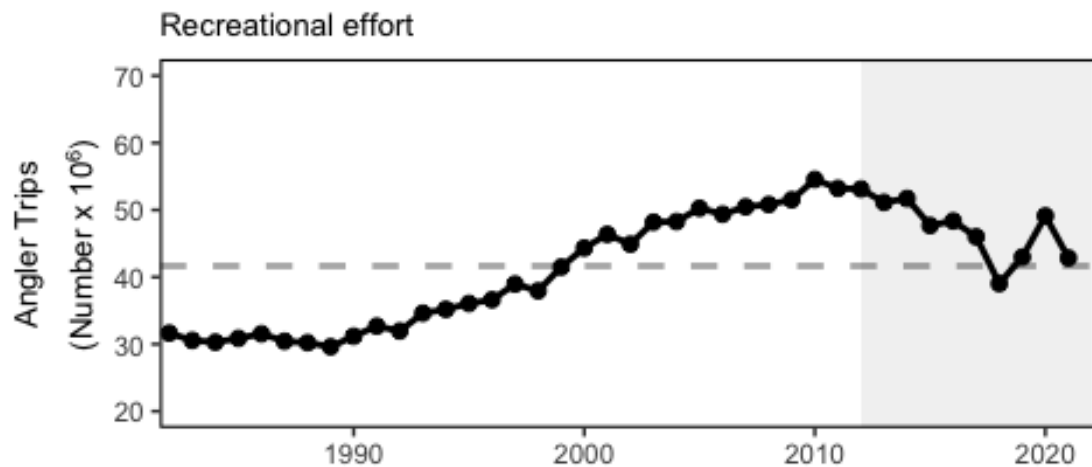
This element is assessed at the ecosystem level where it applies equally to all recreationally fished species. Providing recreational opportunities is a stated goal of optimal fishery management under the legal definition of “benefits to the nation”. Recreational fishing is important in the Mid-Atlantic region with the economic and social aspects of many coastal communities being highly dependent on recreational fishing.

Definition:

Risk of not maximizing recreational fishery value and opportunities.

Indicators:

Currently, angler days and trips are the proxy indicators for the value generated from recreational fishing. Although willingness to pay would better capture the economic concept of recreational value, this information is not gathered systematically in the region. Potentially, multiple indicators could be used to better proxy for recreational fishery value.



Potential risk criteria:

Angler days and trips are the proxy indicators for the value generated from recreational fishing.

<i>Risk Level</i>	<i>Definition</i>
Low	No trends in angler days/trips
Low-Moderate	Increasing or high variability in angler days/trips

<i>Risk Level</i>	<i>Definition</i>
Moderate-High	Significant long term decreases in angler days/trips
High	Significant recent decreases in angler days/trips

Commercial Fishery Resilience (1) - Revenue Diversity

Description:

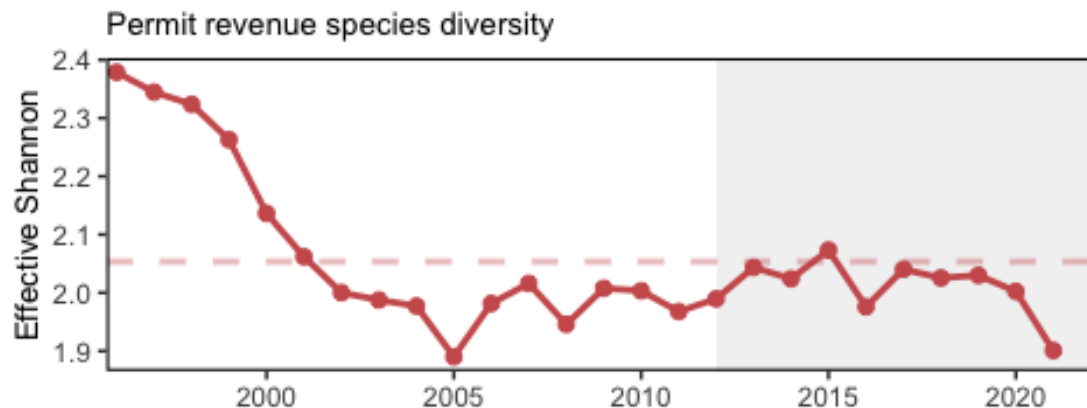
This element is applied at the ecosystem level, and addresses the potential risk of reduced commercial fishery business resilience by evaluating species diversity of revenue at the permit level.

Definition:

Commercial Fishery Resilience (Species Revenue Diversity) - Risk of reduced commercial fishery business resilience (at permit level).

Indicators:

Currently the average effective Shannon index for species revenue at the permit level is used to calculate diversity for all permits landing any amount of Council-managed species within a year (including both monkfish and spiny dogfish). Although the exact value of the effective Shannon index is relatively uninformative in this context, the relative value identifies changes in diversity.



Although the Shannon index provides a measure proportional to each type's relative frequency, the effective Shannon index has the added benefit of converting diversity measures onto a common scale, which is important when averaging across permits after calculation. As such, the effective Shannon index was selected as the preferred index of fishing diversity, consistent with the literature (Thunberg & Correia 2015).

Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	No trend in diversity measure
Low-Moderate	Increasing trend or high variance in diversity measure
Moderate-High	Significant long term downward trend in diversity measure

<i>Risk Level</i>	<i>Definition</i>
High	Significant recent downward trend in diversity measure

Low risk was defined as no trend and low variability in the diversity measure. Low-Moderate risk was an increasing trend or overall high variance in the diversity measure. Moderate-High risk was a significant long term decrease in the diversity measure. High risk was a significant recent decrease in the diversity measure.

Commercial Fishery Resilience (2) - Shoreside Support

Description:

This element is applied at the ecosystem level, and ranks the risk of reduced commercial fishery business resilience due to shoreside support infrastructure by examining the number of shoreside support businesses.

Definition:

Risk of reduced commercial fishery business resilience due to loss of shoreside support infrastructure.

Indicators:

Indicators include the number of shoreside support businesses. The number of shoreside support businesses were tallied for all Mid-Atlantic states in two categories: number of companies (Quarterly Census of Employment and Wages. Obtained September 27, 2017. US Department of Labor, Bureau of Labor Statistics. <https://www.bls.gov/cew/home.htm>) and number of non-employer entities Non-employer Statistics.” Obtained September 28, 2017. U.S. Census Bureau. <https://www.census.gov/programs-surveys/nonemployer-statistics.html>), which we consider separately. Non-employer entities are businesses that have no paid employees (i.e. entrepreneurs, or the owner is the workforce), while the shoreside support companies include all businesses with paid employees. Some state level data was not included due to confidentiality.

The number of shoreside support companies include seafood merchant wholesalers, seafood product preparation and packaging, and seafood markets across all Mid-Atlantic states. The indicator shows a significant long-term and short-term decrease, which represents moderate-high risk to fishery resilience. The number of non-employer entities, including seafood preparation and packaging and seafood markets, shows a long-term increase. Data from other shoreside fishery supporting businesses, such as gear manufacturers and welding companies, are not included here due to aggregation of the statistics across non-fishing industries (e.g. net manufacturers combined with all other businesses).

Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	No trend in shoreside support businesses
Low-Moderate	Increasing or high variability in shoreside support businesses
Moderate-High	Significant recent decrease in one measure of shoreside support businesses
High	Significant recent decrease in multiple measures of shoreside support businesses

Recreational Fishery Resilience - Shoreside Support (new)

Description:

This element ranks the risk of reduced fishery business resilience due to shoreside support infrastructure by examining the number of shoreside support businesses.

Definition:

Risk of reduced fishery business resilience due to shoreside support infrastructure (marinas, bait and tackle shops, etc.).

The Ecosystem and Ocean Planning Committee and Advisory Panel recommended parking this risk element, collect additional information, and allow for continued development of potential indicators.

Commercial Fishery Resilience (4,5,6) - Capital, Insurance Availability, and Emerging Markets/Opportunities (new)

Description:

This element is applied at the ?? level.

Definition:

Risk of reduced fishery business resilience due to business and economic pressures.

Indicators:

Indicators capturing the risk envisioned by the Committee/AP could include access to capital, inflation, gas prices, insurance prices, etc.

The Ecosystem and Ocean Planning Committee and Advisory Panel recommended removing these as stand-alone risk elements but consider them for potential indicator development that could inform other commercial fishery resilience risk elements.

Seafood Safety (new)

This element is applied at the ??? level. This element describes the risk to market access (e.g. spiny dogfish EU market; surfclam on GB and PSP) for Council-managed species. This element would not consider the potential risks to human health.

The Ecosystem and Ocean Planning Committee and Advisory Panel recommended removing as a stand-alone risk element and consider as a potential indicator in other commercial fishery resilience risk elements.

Social-Cultural Elements

Commercial Fishery Resilience (3) – Fleet Diversity

Description:

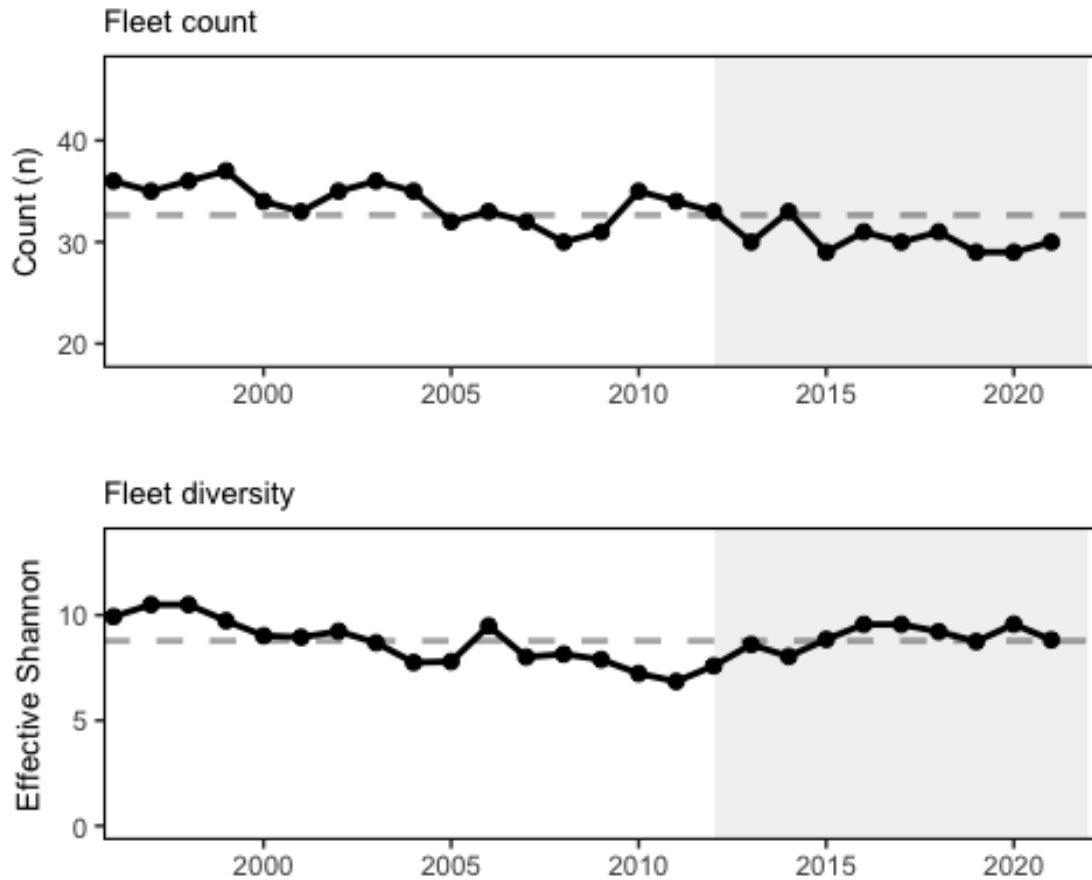
This element is applied at the ecosystem level, and ranks the risk to maintaining equity in access to fishery resources. Beyond equity concerns, maintaining diversity can provide the capacity to adapt to change at the ecosystem level for dependent fishing communities, and can address objectives related to stability.

Definition:

Risk of reduced fishery resilience (number and diversity of fleets).

Indicators:

Currently the diversity in revenue generated by different fleet segments, as well as a count of the number of active fleets, at the ecosystem level. A fleet is defined here as the combination of gear (Scallop Dredge, Other Dredge, Gillnet, Hand Gear, Longline, Bottom Trawl, Midwater Trawl, Pot, Purse Seine, or Clam Dredge) and vessel length category (Less than 30 ft, 30 to 50 ft, 50 to 75 feet, 75 ft and above). The effective Shannon index is used to calculate the diversity of revenue across these fleets. Although the exact value of the effective Shannon index is relatively uninformative in this context, the relative value identifies changes in diversity.



Other metrics for diversity exist. The Simpson index is a common measure of biodiversity, but has the undesirable attribute of being asymmetric and weighing more common types more heavily than the less common types. Although the Shannon index provides a measure proportional to each type’s relative frequency, the effective Shannon index has the added benefit of converting diversity measures onto a common scale. As such, the effective Shannon index was selected as the preferred index of fishing diversity, consistent with the literature and ensuring no differential treatment between large and small fleets (Thunberg & Correia 2015).

Potential risk criteria:

Low risk was defined as no trend and low variability in the diversity measure. Low-Moderate risk was increasing variability or overall high variability in the diversity measure. Moderate-High risk was a significant long-term decrease in the diversity measure. High risk was a significant recent decrease in the diversity measure.

<i>Risk Level</i>	<i>Definition</i>
Low	No trend in diversity measure
Low-Moderate	Increasing or high variability in diversity measure

<i>Risk Level</i>	<i>Definition</i>
Moderate-High	Significant long term downward trend in diversity measure
High	Significant recent downward trend in diversity measure

Recreational Fleet Diversity (new)

Description:

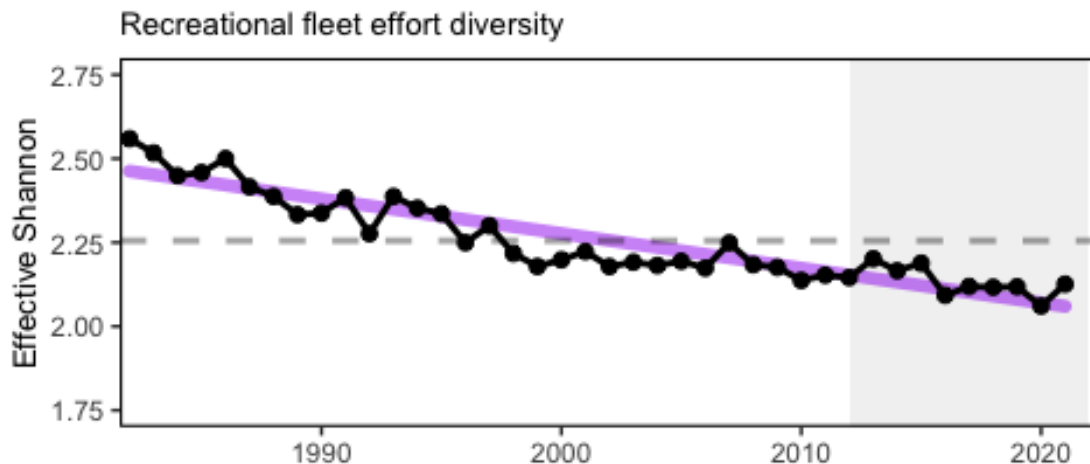
This element is applied at the ecosystem level, and ranks the risk to maintaining equity in recreational access to fishery resources. Beyond equity concerns, maintaining diversity can provide the capacity to adapt to change at the ecosystem level for dependent fishing communities, and can address objectives related to stability.

Definition:

Risk of reduced recreational fishery business resilience (diversity of modes).

Indicators:

Recreational fleet effort diversity is already presented in the Mid-Atlantic State of the Ecosystem Report. This indicator is an effective Shannon estimate of diversity of effort across mode (i.e. effort by shoreside, private boat, and for-hire anglers).



Other metrics for diversity exist. The Simpson index is a common measure of biodiversity, but has the undesirable attribute of being asymmetric and weighing more common types more heavily than the less common types. Although the Shannon index provides a measure proportional to each type's relative frequency, the effective Shannon index has the added benefit of converting diversity measures onto a common scale. As such, the effective Shannon index was selected as the preferred index of fishing diversity, consistent with the literature and ensuring no differential treatment between large and small mode contributions (Thunberg & Correia 2015).

The Ecosystem and Ocean Planning Committee and AP also recommended a harvest:catch ratio by mode indicator. The intent of this indicator would be to evaluate if recreational fishing behavior/preferences are changing (i.e., harvest versus catch and release) within the different recreational modes/sectors.

Potential risk criteria:

Similar criteria could be applied as for commercial diversity. Low risk was defined as no trend and low variability in the diversity measure. Low-Moderate risk was increasing variability or overall high variability in the diversity measure. Moderate-High risk was a significant long-term decrease in the diversity measure. High risk was a significant recent decrease in the diversity measure.

<i>Risk Level</i>	<i>Definition</i>
Low	No trend in diversity measure
Low-Moderate	Increasing or high variability in diversity measure
Moderate-High	Significant long term downward trend in diversity measure
High	Significant recent downward trend in diversity measure

Community Vulnerability

Description:

This element ranks the vulnerability of communities to events such as regulatory changes to fisheries, wind farms, and other ocean-based businesses, as well as to natural hazards, disasters, and climate change. Vulnerability metrics can help assess the relative impact of system changes on human communities dependent on and engaged in fishing activities.

This element is applied at the ecosystem level.

Definition:

Risk of reduced community resilience (vulnerability, reliance, engagement).

Indicators:

The NOAA Fisheries Community Social Vulnerability Indicators (CSVIs; Jepson and Colburn (2013)) are statistical measures of the vulnerability of communities to events such as regulatory changes to fisheries, wind farms, and other ocean-based businesses, as well as to natural hazards, disasters, and climate change. The CSVIs currently serve as indicators of social vulnerability, gentrification pressure vulnerability, commercial and recreational fishing dependence (with dependence being a function of both reliance and engagement), sea level rise risk, species vulnerability to climate change, and catch composition diversity. We use a combination of these five indicators for the most fishery dependent communities to evaluate overall social risk levels.

Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	Few (<10%) vulnerable fishery dependent communities
Low-Moderate	10-25% of fishery dependent communities with >3 high vulnerability ratings
Moderate-High	25-50% of fishery dependent communities with >3 high vulnerability ratings
High	Majority (>50%) of fishery dependent communities with >3 high vulnerability ratings

Below is a brief description for each vulnerability category based on the NOAA social indicator study (Colburn et al., 2016; Jepson and Colburn, 2013):

- **Fishing dependence** indices portray the importance or level of dependence of commercial or recreational fishing to coastal communities.
- **Social vulnerability** indices represent social factors that can shape either an individual or community's ability to adapt to change. These factors exist within all communities regardless of the importance of fishing.

- **Gentrification pressure** indices characterize those factors that, over time may indicate a threat to commercial or recreational working waterfront, including infrastructure.

Here, we define gentrification in fishing communities as described by Colburn and Jepson (2012), where coastal population growth combined with an influx of higher-income people seeking waterfront property can increase property values and displace working-class residents engaged in resource-dependent activities. “Three common elements of gentrification are reuse of waterfront structures, construction of new housing, and growth within the services sector (Colburn and Jepson, 2012).”

Communities are ranked as high, medium high, moderate, or low relative to the respective indicator. Community dependence on commercial and recreational fishing is mixed, with notably more communities in the Mid-Atlantic dependent on recreational fishing. While communities with high to medium high risk for social vulnerability are broadly distributed in suburban and rural areas of the Mid-Atlantic region, communities with high to medium high gentrification pressure are concentrated in beachfront communities near urban areas in New York and New Jersey.

The social and economic impacts of climate change have been modeled through application of social indicators of fishing dependent communities (Jepson and Colburn, 2013). Assessment of a range of social indicators has been applied in the Mid-Atlantic Region to predict vulnerability of communities to regulatory changes and disasters. More recently this methodology has been extended to include specific indicators of vulnerability to climate change and linked to species vulnerability assessments (Colburn et al., 2016; Hare et al., 2016). The tools developed through this approach are vital to an evaluation of the risks of climate change facing coastal communities dependent on fishing. Below is a description of the CSVIs related to climate change.

- **Sea level rise index** is a measure of the overall risk of inundation from sea level rise based on community area lost from one to six foot level projections over the next ~90 years. A high rank indicates a community more vulnerable to sea level rise.
- **Species vulnerability** is measured by the proportion of community fish landings that attributed to species vulnerable to climate change.
- **Catch composition diversity** is the relative abundance of species landed in a community. It is measured by Simpson’s Reciprocal Index, and a higher index value indicates greater diversity. Communities with a diverse array of species landed may be less vulnerable to climate change.

Sea level rise is predicted to have variable impacts on coastal communities. The Mid-Atlantic region has a 3-4 times higher than global average sea level rise rate (Sallenger et al. 2012). Mid-Atlantic communities clustered around the Chesapeake Bay area and the New Jersey shore had especially high vulnerability to sea level rise (Fig.). These vulnerabilities include infrastructure (docks, marinas, bait shops, gear storage) and access to shore-based facilities due realignment of coastal communities.

Mid-Atlantic fishing communities with total landings value of \$100,000 or more were mapped for their dependence on species vulnerable to climate change and catch composition diversity (Simpson Reciprocal Index). A number of communities in southern New Jersey, Maryland and Virginia are highly dependent on species such as clams that are highly vulnerable to climate change while displaying low catch composition diversity. Communities with this situation are considered more vulnerable to climate change in general.

While the maps provide an overview of the social and climate indicator results for the Mid-Atlantic coastal communities, Table identifies Mid-Atlantic communities that are most highly dependent on both commercial and recreational fishing. The varying vulnerability level to social factors, gentrification pressure, and climate change in these communities provide a more comprehensive profile and should be taken into account in the decision making process for fishery management.

To estimate “high” vulnerability across all current indicators (which are ranked on different scales), we tallied rankings from Table of MedHigh or High for social vulnerability and gentrification pressure, along with rankings of High risk from sea level rise, High/Very High species vulnerability, and rankings of Low catch composition diversity. We considered a majority (3 or more out 5) to represent high risk to a community overall because with only 5 indicators, this means that a majority (60-100%) of the individual indicators were high risk. Low risk ranking was defined as few (<10%) vulnerable fishery dependent communities with 3 or more high vulnerability rating. Low-Moderate risk was 10-25% of fishery dependent communities with 3 or more high vulnerability ratings. Moderate-High risk was 25-50% of fishery dependent communities with 3 or more high vulnerability ratings. High risk was a majority (>50%) of fishery dependent communities with 3 or more high vulnerability ratings.

Food Production Elements

Commercial Fishing Production

Description:

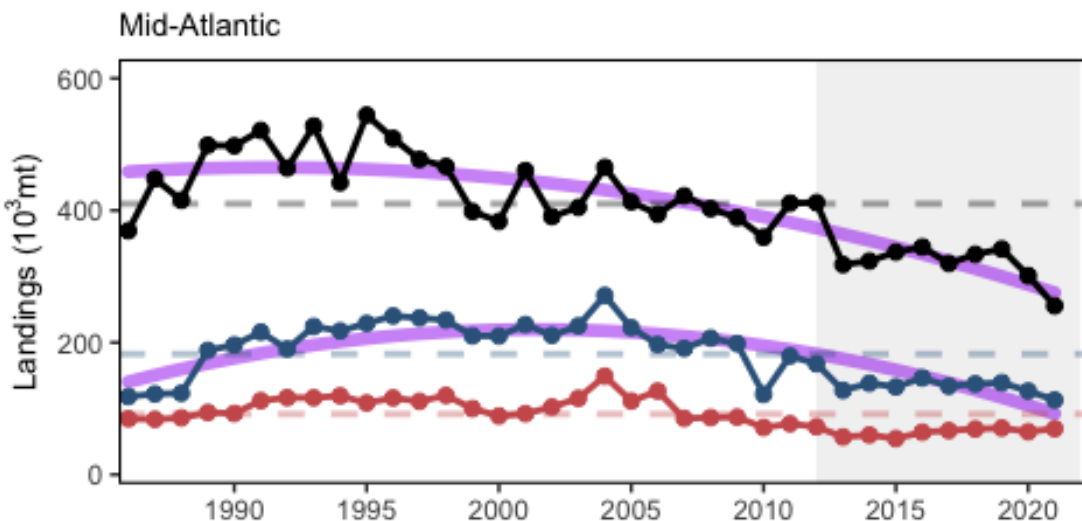
This element is applied at the ecosystem level, and describes the risk of not optimizing domestic commercial fishing production from Council-managed species and total commercial fishing production in the Mid-Atlantic. Commercial seafood landings, as well as total landings which include bait, are used to assess fishing production.

Definition:

Risk of not optimizing total commercial fishing production.

Indicators:

Commercial seafood landings from Council managed species (in red below) and total landings (in black) which include bait and industrial uses were used to assess fishing production.



Time series of landings of bait from the Federal Commercial Dealer Database.

Potential risk criteria:

The criteria still needs to be developed to account for both seafood and total commercial landings.

Recreational/Subsistence Food Production

Description:

This element is applied at the ecosystem level, and describes the risk of not maintaining personal food production.

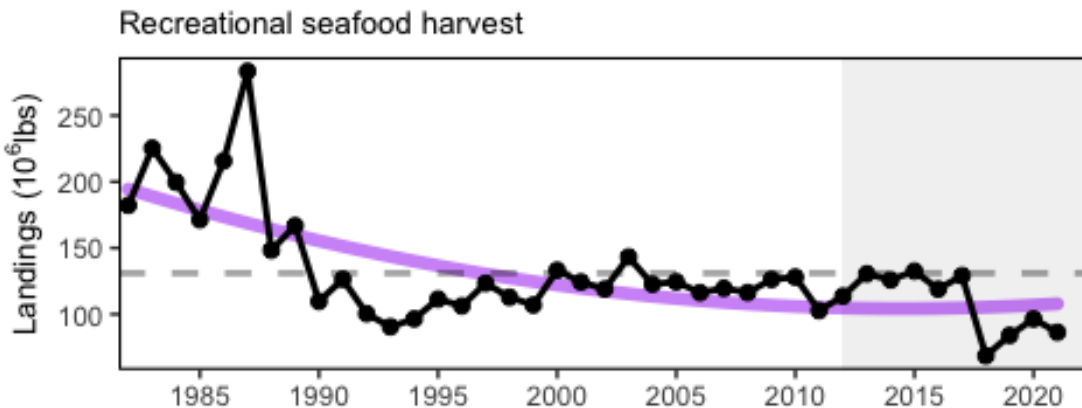
Definition:

Risk of not maintaining personal food production

Indicators:

Total recreational harvest (all species) and harvest per angler are currently used as indicators in the Mid-Atlantic region. Recreational seafood landings (as opposed to total catch which includes catch and release that are captured under other Risk Elements/indicators) were used to assess food use of recreationally caught fish.

The Ecosystem and Ocean Planning Committee and Advisory Panel also supported the potential development of new indicators that would evaluate the subsistence component of this risk element.



Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	No trend or increase in recreational landings
Low-Moderate	Increasing or high variability in recreational landings
Moderate-High	Significant long term decrease in recreational landings
High	Significant recent decrease in recreational landings

Low risk was defined as no trend, or an increase in recreational seafood landings. Low-Moderate risk was increasing or high variability in recreational seafood landings. Moderate-High risk was a significant long-term decrease in recreational seafood landings. High risk was a significant recent decrease in recreational seafood landings.

Commercial Employment (new)

Description:

This element ranks the risk of not optimizing or maintaining employment opportunities in the commercial sector. What does optimized employment entail?

Definition:

Risk of not optimizing or maintaining commercial job creation and retention

The Ecosystem and Ocean Planning Committee and Advisory Panel recommended parking this risk element until additional work and development could occur. As a potential indicator, the group suggested utilizing commercial VTR information (number of crew and days absent) that might provide a timeseries of employment (or proxy for employment) at the individual level.

Recreational Employment (new)

Description:

This element ranks the risk of not optimizing or maintaining employment opportunities in the recreational sector. What does optimized employment entail?

Definition:

Risk of not optimizing or maintaining recreational job creation and retention.

The Ecosystem and Ocean Planning Committee and Advisory Panel recommended parking this risk element until additional work and development could occur. As a potential indicator, the group suggested utilizing party/charter VTR information (number of crew and days/trips) that might provide a timeseries of employment (or proxy for employment) at the individual level.

Management Elements

Fishing Mortality Control

Description:

This element is applied at the species and sector (commercial and recreational) level, and addresses the level of management control in terms of catch estimation and monitoring to prevent overfishing. Adequate management control indicates a low risk of overfishing, while poor management control indicates a higher risk of overfishing and hence not achieving OY.

The ability to control total catch within the specified Acceptable Biological Catch (ABC) is necessary to prevent overfishing, which is a fundamental requirement of US fisheries law. Chronic or persistent overfishing can lead to stock depletion and ultimately to a stock being declared as overfished and requiring a stock rebuilding plan. The ability to constrain catch is a function of the efficacy of the catch monitoring program for each species and sector which relies on both proactive (in-season closure) and reactive (pay backs for overages in subsequent years) accountability measures (AMs). Under certain circumstances, specification of management measures which are too strict could lead to “underfishing” (not achieving the desired quota) and hence not achieving OY.

Definition:

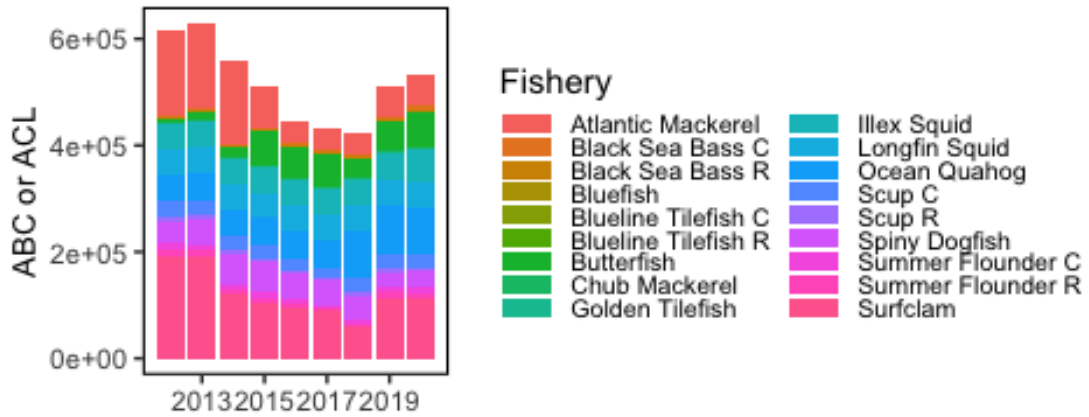
Risk of not achieving OY due to a mismatch of projected effects of management controls with harvest/catch targets.

Indicators:

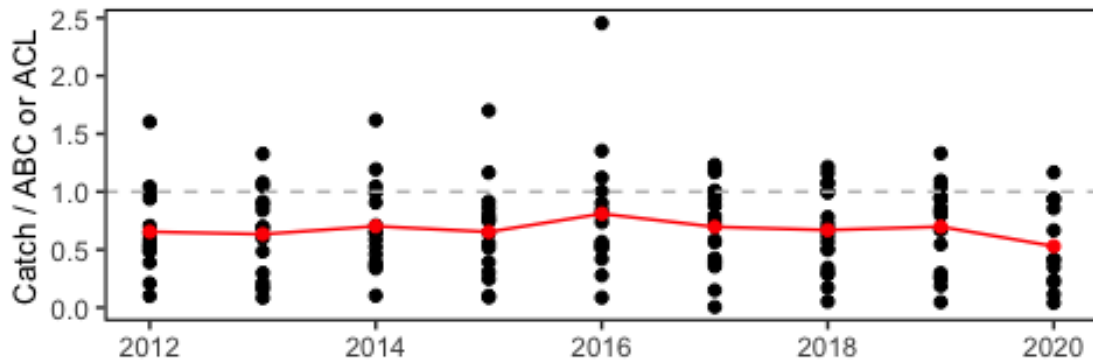
Total catch at the fishery sector level compared to the appropriate catch limit (ABC or Annual Catch Limit, ACL). For the commercial fishery, NMFS dealer data in conjunction with estimates of dead discards from the most recent stock assessment are used to compare the annual catch limit to actual annual catch. For the recreational sector, Marine Recreational Information Program (MRIP) estimates of recreational landings and dead discards in conjunction with stock assessment estimates of recreational discards in weight are used to compare the annual catch limit to actual annual catch estimates.

Landings only information could potentially be considered if underfishing appears to be more important or if discards are low for a fishery sector. Discards are also addressed under a separate risk element. However, the current risk element is “Fishing Mortality Control” which would include both landings and discards. The Mid-Atlantic State of the Ecosystem report now includes an indicator that looks at total catch divided by total ABC or ACL across all Mid-Atlantic species if a broader look across managed species is preferred.

ABC or ACL for MAFMC Managed Species



MAFMC Catch per ABC or ACL



Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	No recent history (last 5 years) of overages
Low-Moderate	Small recent overages, but infrequent
Moderate-High	Routine recent overages, but small to moderate
High	Routine recent significant overages

Technical Interactions

Description:

This element is applied at the species and sector (commercial and recreational) level and considers potential interactions with non-Council-managed species, including protected species, on Council-managed fisheries. Here the risk is caused by negative consequences from fishing activity regulated under Council FMPs which interacts with species managed by other agencies, including bycatch of protected species. For example, interactions with species protected under the U.S. Marine Mammal Protection Act (MMPA) could result in greater restrictions in Council managed fisheries, increasing the risk that OY would not be achieved in those fisheries.

Definition:

Risk of not achieving OY due to interactions with non-Council managed species, including protected species.

Indicators:

The current indicator used is the MMPA category fishery level (Category I - frequent incidental mortality or injury; Category II - occasional incidental mortality or injury; Category III, remote likelihood of incidental mortality or injury) assigned to the dominant gear type associated with the fishery sector. This indicator is relatively static over time and may not appropriately track risk associated with these technical interactions.

Could look at the total number of protected species “takes” by a fishery sector by year or five year period. Could also consider regulatory changes that were considered and/or implemented to reduce technical interactions in Mid-Atlantic fisheries.

Proposed risk criteria:

Evaluation of this risk element requires quantification of the likelihood that non-Council AMs would be triggered and impact fishing activities for Council managed species. In addition, NMFS manages incidental mortality of mammals through take reductions plans which could negatively impact a fishery.

<i>Risk Level</i>	<i>Definition</i>
Low	No interactions with non-Council managed species
Low-Moderate	Interactions with non-Council managed species but infrequent, Category II fishery under MMPA with limited takes; or AMs not likely triggered
Moderate-High	AMs in non-Council managed species may be triggered; or Category I fishery under MMPA (but takes less than PBR)
High	AMs in non-Council managed species triggered; or Category I fishery under MMPA and takes above PBR

Offshore Wind – Biological/Ecosystem (new)

Description:

This element would be applied at the species level and considers the biological and ecosystem risks of offshore wind development on Council-managed fishery resources and/or the supporting habitat. Offshore wind development is expected to cover 2.4 million acres of ocean space by 2030 in the Greater Atlantic region (ME through NC). Within these lease areas, there are 3,400 foundations (i.e., wind turbines) with over 9,000 miles of interconnecting cable proposed for construction. Offshore wind siting, construction, and operation has the potential for a variety of biological impacts and associated risks for fisheries resources. Habitat alteration, local hydrodynamic changes, underwater noise, and electromagnetic fields (EMF) can affect stock productivity, food availability and migration patterns. However, these risks are likely different across species and habitat types and more research is needed to fully understand these impacts.

Definition:

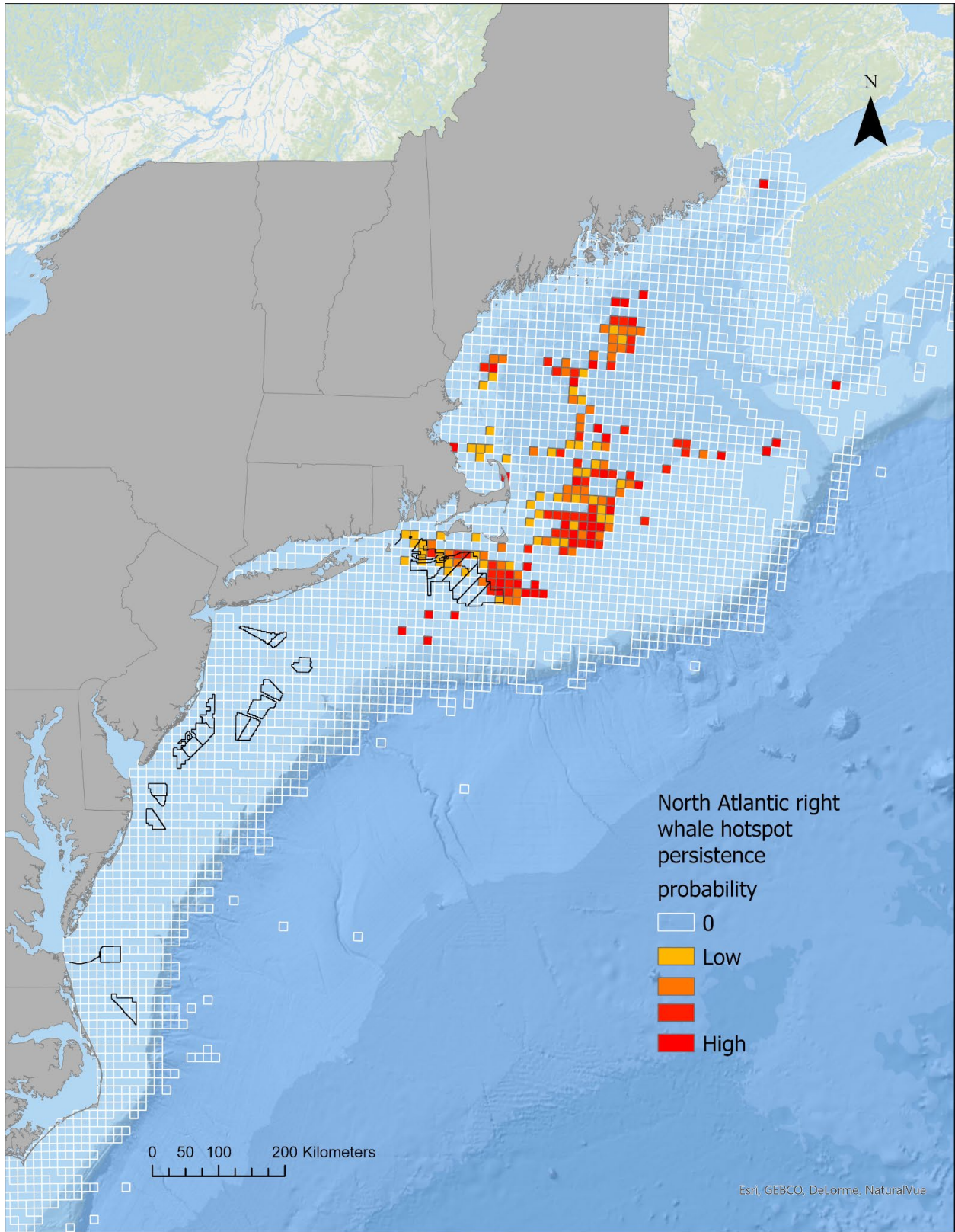
Risk of not achieving OY due to biological impacts to stock productivity, distribution, and ecosystem structure and function.

Indicators:

Information and relevant data at the species level available in the NOAA Tech Memo titled “Fisheries and Offshore Wind Interactions: Synthesis of Science”.

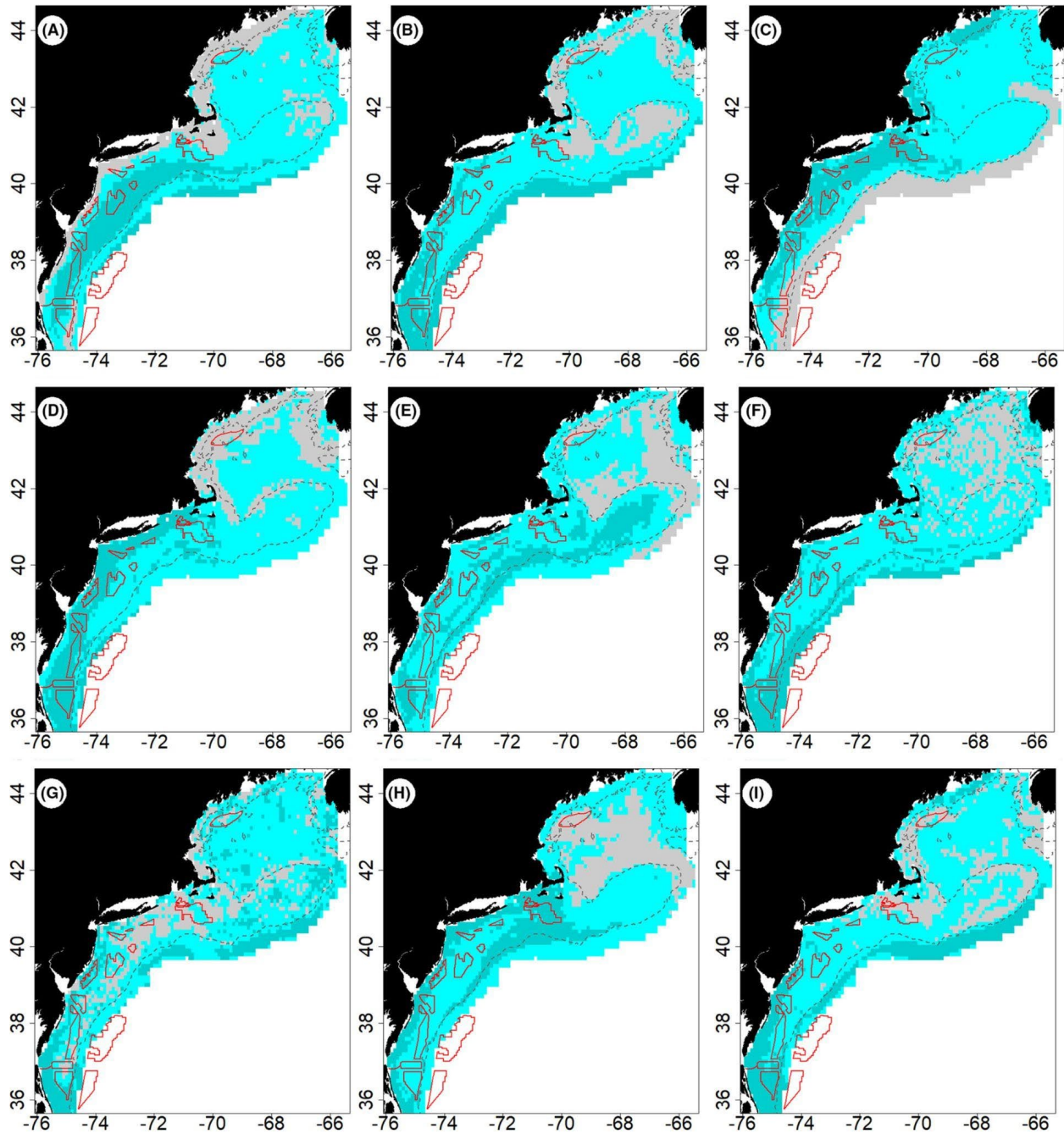
Species distribution overlap with offshore wind from a couple of potential data sources (e.g., <https://apps-st.fisheries.noaa.gov/dismap/DisMAP.html>). However, translating exposure into a risk of impacts, which is likely to be different by species, may be challenging.

From the State of the Ecosystem report - Right whale spatial overlap with offshore wind lease areas to help inform the ecosystem structure/function component of the definition.



Right whale hot spots overlap with offshore wind lease areas

In addition, recent work by Friedland et al. 2023 (<https://afspubs.onlinelibrary.wiley.com/doi/full/10.1002/mcf2.10230>), evaluated the habitat usage by forage species within and outside of offshore wind lease areas. This information could also be used to help inform the ecosystem structure/function component of the definition.



Mean occupancy habitats at the 20% (light blue) and 80% (dark blue) quantile thresholds across forage species; gray shows the model extent. Taxa with spring models include (A) Atlantic Mackerel, (B) Atlantic Menhaden, and (C) Atlantic Herring; taxa with autumn

models include **(D)** Round Herring, **(E)** longfin inshore squid, **(F)** Atlantic Chub Mackerel, **(G)** Spanish Sardine, **(H)** Butterfish, and **(I)** Atlantic Thread Herring.

Potential risk criteria:

To be developed.

Offshore Wind – Fishery Science and Access (new)

Description:

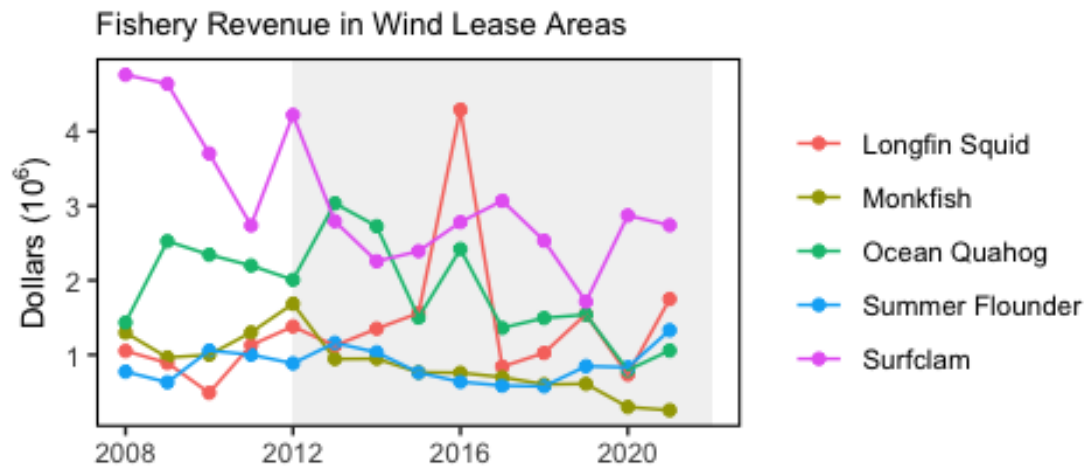
This element would be applied at the species and sector (commercial and recreational) level and considers the risks of offshore wind development on data and science quality and to fishery/fleet access for Council-managed fishery resources. Given the anticipated overlap between offshore wind lease areas and spatial coverage of many fishery-dependent survey strata, there are anticipated survey impacts through “preclusion, habitat change, changes in statistical design, and reduced sampling productivity” (Hogan et al. 2023). These impacts to the quality and quantity of the data could have implications for stock assessments, scientific uncertainty, and catch levels. As wind turbine construction and operation continues and expands, fishing fleet access, fishing operations, and revenue are anticipated to change.

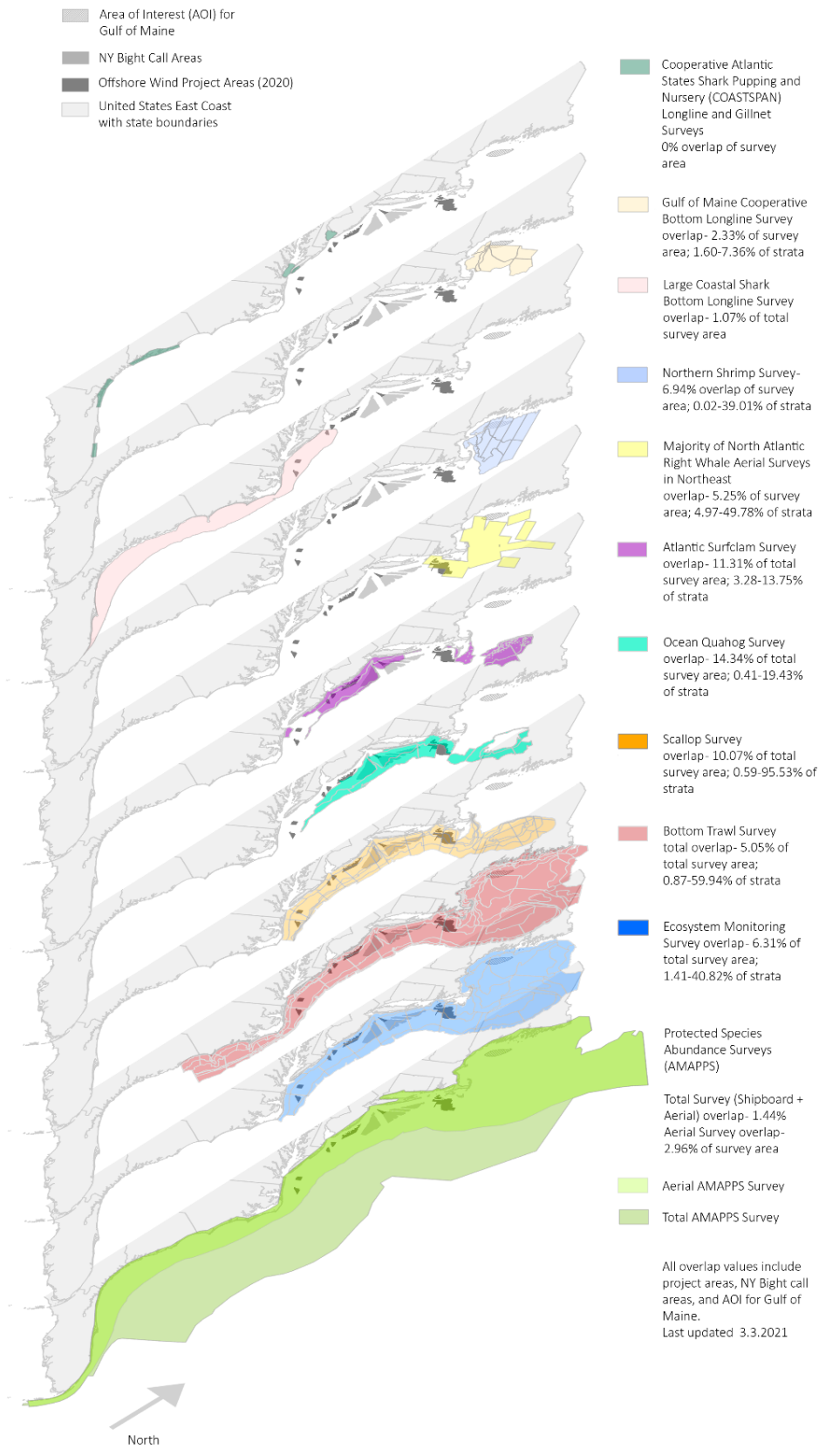
Definition:

Risk of not achieving OY due to fishery impacts due to access and scientific uncertainty.

Indicators:

Indicators for the Mid-Atlantic State of the Ecosystem and socioeconomic impacts web site. Fishery revenue and party charter activity from within lease areas by species, fleet, or community, community vulnerability/engagement/EEJ, spatial overlap of lease areas and federal fisheries surveys.





Spatial overlap map with NEFSC surveys (From 2021 SOE; wind areas are out of date)

FishRules and FishBrain apps for recreational fishing spatial overlap information (work is still under review).

Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	0-3% revenue in lease area; no/low EEJ concerns; 0-5% spatial overlap for relevant survey(s)
Low-Moderate	4-10% revenue in lease area; low-moderate EEJ concerns; 5-20% spatial overlap for relevant survey(s)
Moderate-High	11-20% revenue in lease area; moderate-high EEJ concerns; 21-40% spatial overlap for relevant survey(s)
High	>20% revenue in lease area; high EEJ concerns; >40% spatial overlap for relevant survey(s)

Offshore Energy Exclusive of Wind (new)

Description:

This element would be applied at the species and sector (commercial and recreational) level and considers the risks of non-wind related energy development offshore, which could include tidal energy turbines, oil and gas extraction, and other development of offshore energy infrastructure.

Definition:

Risks of all offshore energy exploration and/or production on fishery displacement.

The Ecosystem and Ocean Planning Committee and Advisory Panel recommended removing this as a stand-alone risk element and be included as a potential indicator under the Other Ocean Activities risk element (see below).

Aquaculture (new)

Description:

There is growing interest in the continued development and expansion of aquaculture production to support the increasing consumption of seafood and complement wild-caught fisheries. The Council does have an aquaculture policy, but does not have regulatory authority over aquaculture permitting, development, or operation. This element would be applied at the species level and would consider the biological and/or spatial risks of aquaculture development on Mid-Atlantic Council managed fisheries.

Definition:

Risks to fishery access from area closures due to aquaculture development in the Mid-Atlantic.

The Ecosystem and Ocean Planning Committee and Advisory Panel recommended removing this as a stand-alone risk element and be included as a potential indicator under the Other Ocean Activities risk element (see below).

Other Ocean Activities

Description:

This element is applied at the species and sector (commercial and recreational) level, and addresses the risk of fishery displacement or damage of a fishery resource and/or supporting habitat as a result of non-fishing activities in the ocean (e.g., energy development/aquaculture/shipping/other industrial uses, etc.). Many of these activities are in planning stages but not yet implemented in the region. It also includes evaluation of risk to Council fisheries from area-based measures outside of the control of the Council, including area closures implemented by other Councils to protect sensitive habitats, spawning areas, etc. and/or through marine monument/sanctuaries or other types of area-based management designations.

Definition:

Risk of not achieving OY due to fishery displacement from non-fishing ocean activities and/or area designations.

Indicators:

A more quantitative approach (similar to that done for offshore wind) could be applied with GIS mapping to determine the spatial footprint of current and future planned non-fishing activities (if available) could be calculated and quantify and spatial overlap with existing habitat and/or fishing ground locations. With a quantitative evaluation, potential to use a range/binning approach to specify risk level (e.g., 0-10% overlap, low risk, 11-20% overlap, low-moderate risk etc.), but those bins and risk level would likely be arbitrary. Depending on scope of element and how applied, could use the NMFS Habitat Climate Vulnerability Assessment, the Mid-Atlantic Council NRHA data explorer, and the America the CCC Area-Based Management tool for spatial mapping and overlap calculations.

Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	No spatial overlap with fisheries
Low-Moderate	Low-moderate overlap with fisheries
Moderate-High	Moderate-high overlap with fisheries
High	High overlap with fisheries; other uses could seriously disrupt fishery prosecution

Further refinement of the criteria will be needed to identify potential thresholds to indicate a specific risk level.

Regulatory Complexity and Stability

Description:

This element is applied at the species and sector (commercial and recreational) level. Constituents have frequently raised concerns about the complexity and continually changing fishery regulations and the need to simplify them to improve their efficacy. Complex and constantly changing regulations may lead to non-compliance and/or impact other fisheries. Non-compliance could have stock assessment, data quality, management, and fairness and equity implications.

Revised definition:

Risk of not achieving OY due to frequency of regulatory modifications and regulatory complexity, which may have an adverse effect on compliance.

Indicators:

Continue with a qualitative evaluation using the frequency of any regulatory change over the last 5 years by fishery and sector.

Potential alternative indicators include: quantifying the number of regulations and/or the frequency of regulatory changes, based on evaluation of the Code of Federal Regulations; frequency of mid-changes; number of states in management unit with different regulations (recreational bluefish versus black sea bass for example); noncompliant harvest relative to total harvest reported by MRIP to track compliance.

Potential risk criteria:

Risk levels and definitions will need to be updated depending upon the indicators developed for this risk element.

Allocation

Description:

Many Mid-Atlantic fisheries have some allocation component and any adjustments/changes in allocation can be driven by a number of factors which can present a variety of management, biological, and fishery risks. This element is applied at the species and sector level, and addresses the risk of not achieving OY due to spatial mismatch of stocks and management allocations or because of sub-optimal allocation by sector and/or area.

Definition:

Risk of not achieving OY due to spatial mismatch of stocks and management or sub-optimal allocation by sector and/or area.

Indicators:

Currently, the Allocation indicator consists of whether or not the Council is considering or an ongoing management action that might have any sort of allocation outcome/implication (by sector, region, permit holder etc.). However, this indicator does not directly get at the actual risk associated with spatial mis-match or sub-optimal allocation.

Indicators quantifying the difficulty of allocation could include a combination of distribution shifts (see above) and the number of interests (sectors, states, etc.) requiring allocation. There are new analyses and tools available (Palacios-Abrentes et al 2023 - <https://doi.org/10.1371/journal.pone.0279025>) that could provide more insight on actual mismatch risks for some species and sectors.

Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	No recent or ongoing Council discussion about allocation
Low-Moderate	<i>This category not used</i>
Moderate-High	<i>This category not used</i>
High	Recent or ongoing Council discussion about allocation

Currently, there are no definitions to specify intermediate levels of risk for this element, so only low and high risk criteria have been developed. A Low risk ranking was no recent or ongoing Council discussion about allocation. High risk was defined as recent or ongoing Council discussion about allocation.

Discards

Description:

This element is applied at the species and sector level. Stakeholders have identified the reduction of discards as a high priority in the Council management program, especially those caused by regulations since they represent biological and economic waste. Discards of either the target or non-target species in the fishery would be taken into consideration.

Definition:

Risk of not minimizing regulatory discards, bycatch mortality, and incidental catch to extent practicable.

Indicators:

NMFS provides estimates of discards by species based, in large part, on at-sea observations collected in the Northeast Fisheries Observer Program (NEFOP), for stock assessment purposes and quota monitoring. The observer program provides information on the reason for discarding during a commercial trip. In addition, the MRIP provides estimate of discards by species for the recreational fisheries. Discards and incidental catch will be evaluated for each species and fishery with a focus on identifying discards caused by regulations for each fishery sector. The ratio of regulatory discards to total discards for the target species could be applied or the ratio of discards to overall catch of the target species could be applied. A similar, or combined, approach could be applied for non-target species.

Discard mortality indicators might be more challenging, at least in terms of tracking improvements/declines over time. Discard mortality rates by species and gear type are not estimated annually, or even every 10 years, and are typically based on results developed from targeted research projects. Therefore, a static discard mortality rate by species and gear is applied to the discard estimate.

Potential risk criteria:

Low risk was defined as no significant discards and incidental catch (<5%). Low-Moderate risk was low or episodic discarding and incidental catch (<20%). Moderate-High risk was regular discarding and incidental catch (20% or more) but managed at an acceptable level. High risk was high discarding and incidental catch (>40%) and difficulty in management. A similar approach could be applied to discard mortality risks: low - mortality <5% for dominant gear; low-moderate - mortality <25% for dominant gear; moderate-high - mortality <50% for dominant gear; mortality >50% for dominant gear.

<i>Risk Level</i>	<i>Definition</i>
Low	No significant discards or incidental catch; no significant discard mortality
Low-Moderate	Low or episodic discards and incidental catch; low discard mortality

<i>Risk Level</i>	<i>Definition</i>
Moderate-High	Regular discards and incidental catch but managed; moderate discard mortality
High	High discards and incidental catch, difficult to manage; high discard mortality.

Essential Fish Habitat (new)

Description:

The MSA requires federal fishery management councils and NOAA’s National Marine Fisheries Service to designate Essential Fish Habitat (EFH) for species managed under federal fishery management plans. EFH designation is important because it means those areas will be given additional consideration before any federal agencies are allowed to carry out activities in those areas. This element would be applied at the species level and would consider risks for not properly identifying and/or projecting EFH for Council-managed species.

Definition:

Risk of not identifying and/or protecting essential fish habitat and implications for Council-managed species.

Indicators:

The Northeast Habitat Climate Vulnerability Assessment and the Northeast Regional Habitat Assessment (<https://www.mafmc.org/nrha>) Data Explorer could be used to help identify EFH and critical habitats and potentially quantify changes in the total/spatial extent of these habitats over time (ie., compare current EFH areas to updated EFH areas). Quantifying the spatial overlap of offshore wind lease areas and EFH footprint.

The Council is currently reviewing EFH designations for all Council-managed species and outcomes from that action could be used to develop the indicators considered here.

Potential risk criteria:

<i>Risk Level</i>	<i>Definition</i>
Low	No-little change in EFH quantity; little-small spatial overlap between offshore wind lease area and designated EFH
Low-Moderate	Low -moderate change in EFH quantity; low-moderate overlap between offshore wind lease area and designated EFH
Moderate-High	Moderate-high change in EFH quantity; moderate-high overlap between offshore wind lease area and designated EFH
High	High change in EFH quantity; high overlap between offshore wind lease area and designated EFH

The Council is currently working on an amendment to update EFH designations for Council managed species. Development of any indicators, if using those provided above, and evaluation of ranking criteria would likely not occur until sometime in 2025 once the EFH amendment is complete.

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