EAFM Risk Elements Needing Further Discussion

Ecosystem and Ocean Planning Committee and AP Discussion Document #1

2023-09-06

Below is a list of risk elements, grouped by category (Ecological, Socio-economic, and Management), that will be the focus of discussion during the September 13-14, 2024 Ecosystem and Ocean Planning (EOP) Committee and AP meeting. An element description, definition, indicators, and potential risk criteria (if applicable/available) are provided for each risk element. This information has been updated and refined to reflect the feedback and direction provided by the Committee and AP during previous meetings. In addition, there is a list of decisions associated with each element in which specific input is needed from the Committee and AP. The goal of the meeting will be to address these decisions for each element. This input will help refine the list of risk elements, specify indicator data and considerations, and inform risk criteria development.

This document focuses on those risk elements where additional, more substantive feedback is needed in order to move forward with development of these risk elements. There is a second discussion document that includes the remaining risk elements the EOP Committee and AP have been considering (found at the Sept 13-14 EOP meeting page: https://www.mafmc.org/council-events/2023/sept-13-14/eop-comm-ap). There was greater agreement and/or fewer changes identified by the Committee and AP for those risk elements. While we are not planning to go over these risk elements during the September meeting, Committee and AP members are strongly encouraged to provide feedback on any of the information in the document following the meeting.

Contents

Ecological Elements

Food Web - Council-Managed Predators: change to "Food Web: Prey Availability"

Decisions which need to be made:

1. Approve changed element name and definition
2. Approve potential indicators for further development
    a. Indices of aggregate forage for each managed species
    b. Condition indices for each managed species
3. Review potential risk criteria and suggest alternatives

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).

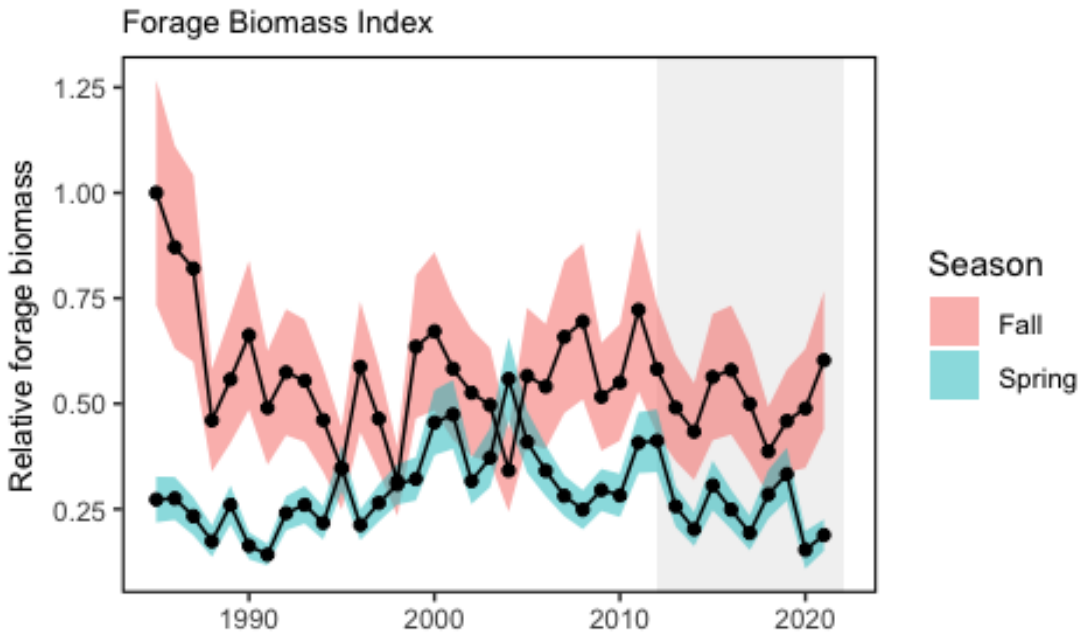
Proposed definition:

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

Indicators:

Indicators of prey availability for each Council managed species could 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

Alternative indirect indicators of prey availability could 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:

Risk Level	*Definition*
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 - Council-Managed Prey: change to "Food Web: Predation Pressure"

Decisions which need to be made:

1. Approve changed element name and definition
2. Approve potential indicators for further development
    a. Indices of predation pressure for each managed species
        i. Food web model based (includes full food web)
        ii. Empirical (diet data + predator biomass trend; fish predators only)
3. Review potential risk criteria and suggest alternatives

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 could 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.

Potential risk criteria:

Risk Level	*Definition*
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 - Protected Species Prey

Decisions which need to be made:

1. Clarify definition to match risks of highest concern to the Council
2. Modify indicators and risk criteria as necessary for definition

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).

Proposed definitions:

1 - Risk of not achieving protected species objectives due to species interactions (not just MAFMC-managed species)

2 (current) - Risk of not achieving protected species objectives due to interactions with Council-managed species

If the Council is most interested in general food web risks to protected species, modified version 2 achieves this, leading to a broader set of indicators than currently used, but we may not be able to apply it at the species level.

If the Council is most interested in the food web risks to protected species that are most likely to be related to Council management decisions, the current version focused on Council managed species as prey achieves this.

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.

Indicators (previously used):

As above, 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:

Risk Level	*Definition*
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

Previous risk discussion:

Risk ranking criteria for the multispecies protected species category were developed to address interactions across species. Low risk ranking criteria were few interactions with any protected species. Low risk was defined as few interactions with any protected species. Low-Moderate risk was a Council-managed species being important prey of 1-2 protected species, or important prey of 3 or more protected species with management consideration of the interaction. Moderate-High risk criteria was a Council-managed species being important prey of 3 or more protected species. Finally, High risk criteria was a Council-managed species being critical (>50%) prey for a protected species.

Diet information for protected species tends to be more uncertain than for fished species, and diet compositions are not reported to the species level, so we consider diet at the family level for these rankings. Atlantic salmon, both species of sturgeon, and sea turtles rarely if ever prey on Council managed species, as reviewed in the Council Forage Fish white paper (Burke et al., 1993, 1994; Johnson et al., 1997; McClellan and Read, 2007; Savoy, 2007; Seney and Musick, 2007; Shoop and Kenney, 1992). We restrict further analysis to marine mammal and seabird prey. Longfin squids are estimated to comprise >30% of diet for one protected species, pilot whale, in the Northeast US (Gannon et al., 1997; Smith et al., 2015), therefore we rank this species low-moderate risk for this element. Shortfin squid were identified as important prey for two pelagic seabirds in the Northeast US (Powers and Backus, 1987), and therefore ranked low-moderate risk. Unmanaged forage fish such as sand lance and saury were identified as important prey for >3 seabird species in the Northeast US (Powers and Backus, 1987), as well as grey seals (Smith et al., 2015). The Council has enacted measures to restrict fishing on unmanaged forage species, such that they rank low-moderate risk for this element. All other Council-managed species do not meet the threshold of important prey of protected species based on available information for marine mammal diets in the Northeast US (Smith et al., 2015), and seabird diets (Barrett et al., 2007; Bowser et al., 2013; Powers, 1983; Powers and Backus, 1987; Powers and Brown, 1987; Schneider and Heinemann, 1996), so they rank low risk for this element.

Ecosystem Productivity

Decisions which need to be made:

1. Approve adding forage base indicators to this element
    a. Instead of having a separate forage base risk element at the ecosystem level
    b. Modification of Food web: prey availability addresses risk due to changing prey availability at the species level
2. Approve current indicators and/or suggest indicators for additional development
    a. Aggregate indicators of fish size? Friedland et al 2023b
3. Review current risk criteria and suggest alternatives

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.

Proposed definition:

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

Indicators:

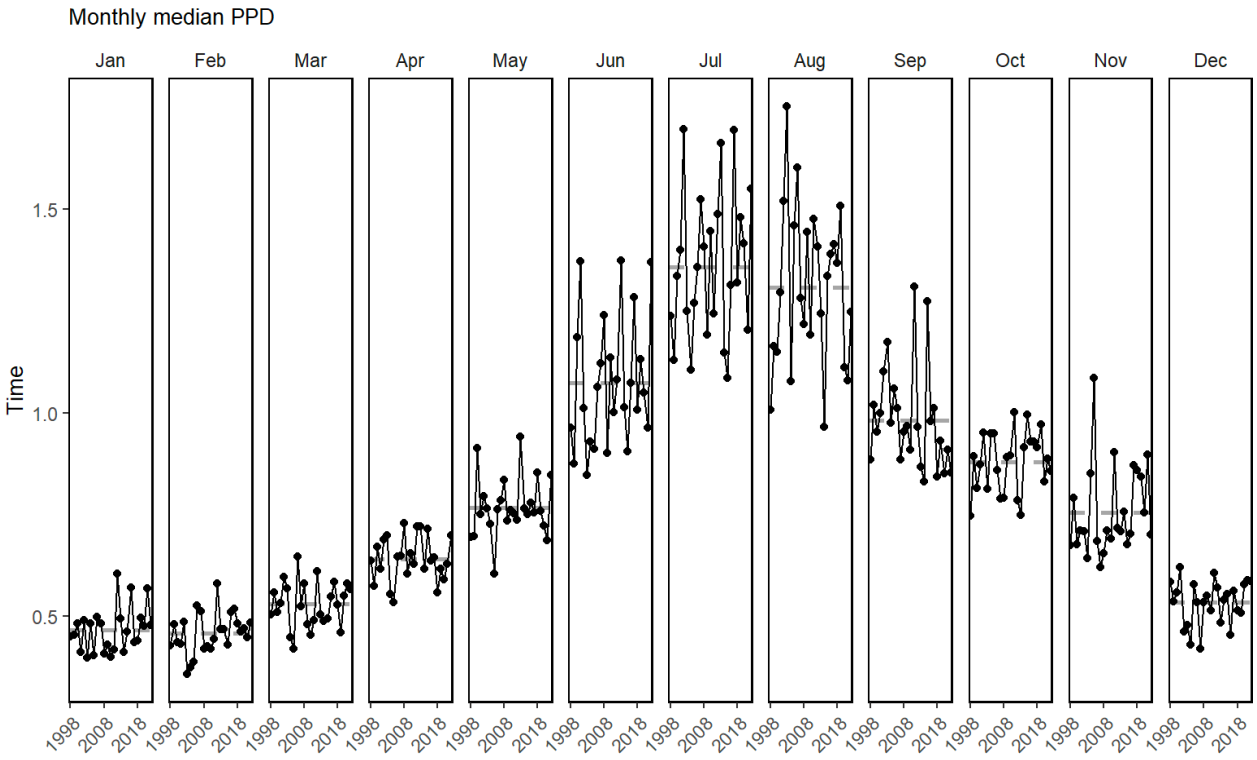
A combination of four indicators are currently used to assess risk of changing ecosystem productivity; the proposal is to add a fifth. We examine trends in total primary production, zooplankton abundance for a key Mid-Atlantic species, aggregate forage fish (new), and two aggregate fish productivity 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, as indicated in Figure .

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.

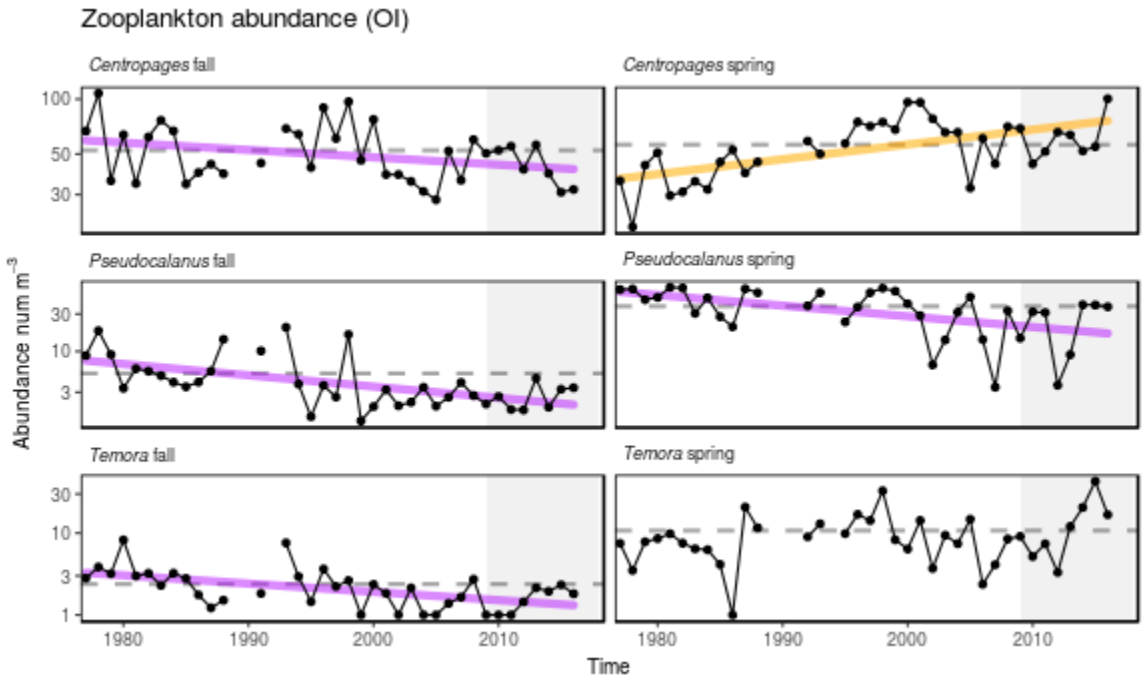


Monthly primary production trends show the annual cycle (i.e. the peak during the summer months) and the changes over time for each month.

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.

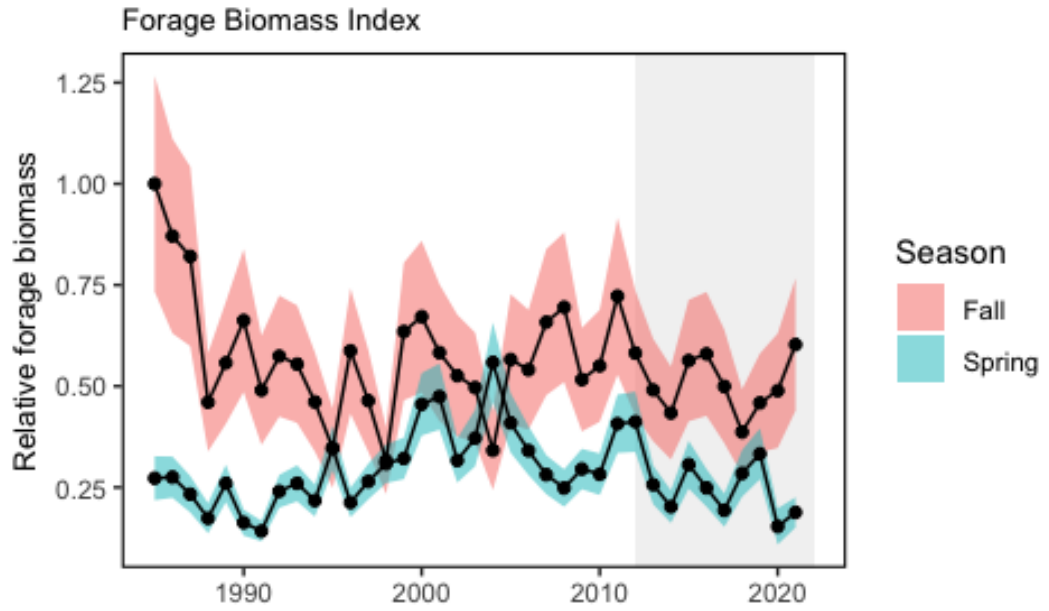
The time series of zooplankton biovolume suggest that overall zooplankton production has not changed over time. However, the dominant species of zooplankton in the Mid-Atlantic, *Centropages typicus*, shows a seasonal shift in abundance. This suggests a change in timing of zooplankton reproductive cycles,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



Time series of zooplankton abundance from 2019 SOE

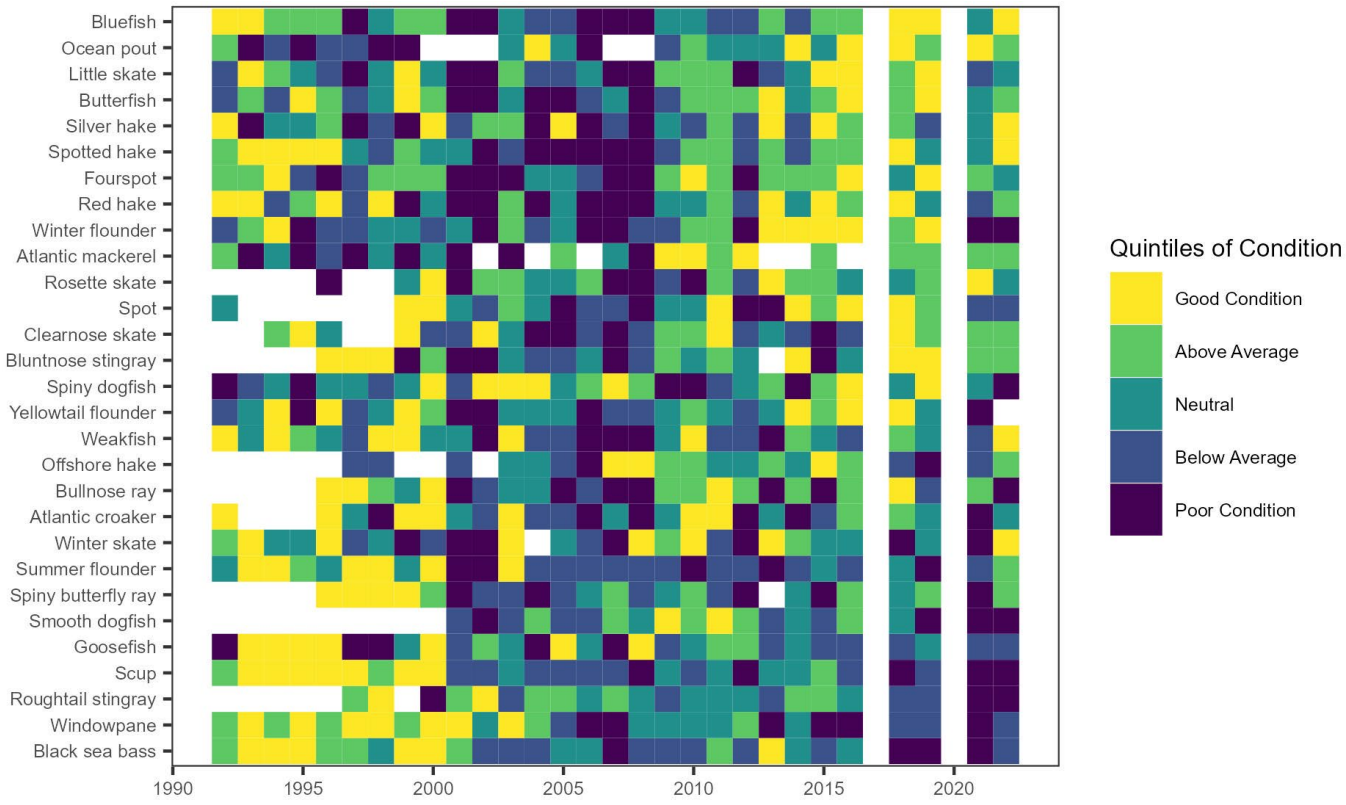
Incorporate Forage Base as new indicator

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.



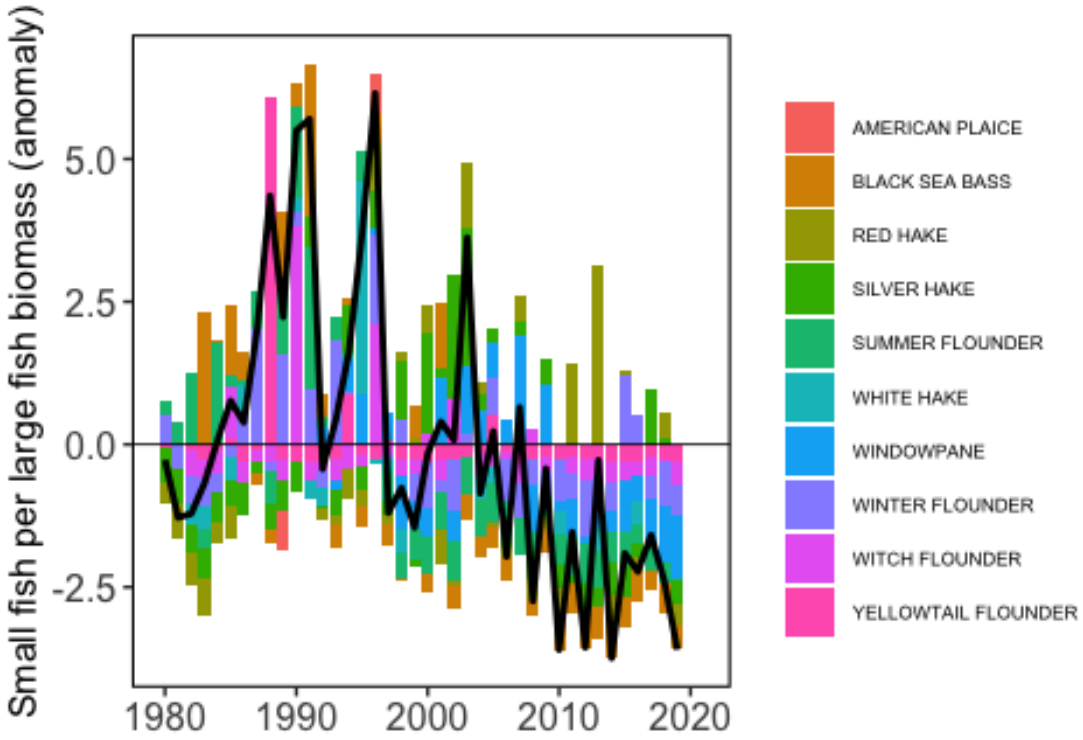
Fish condition

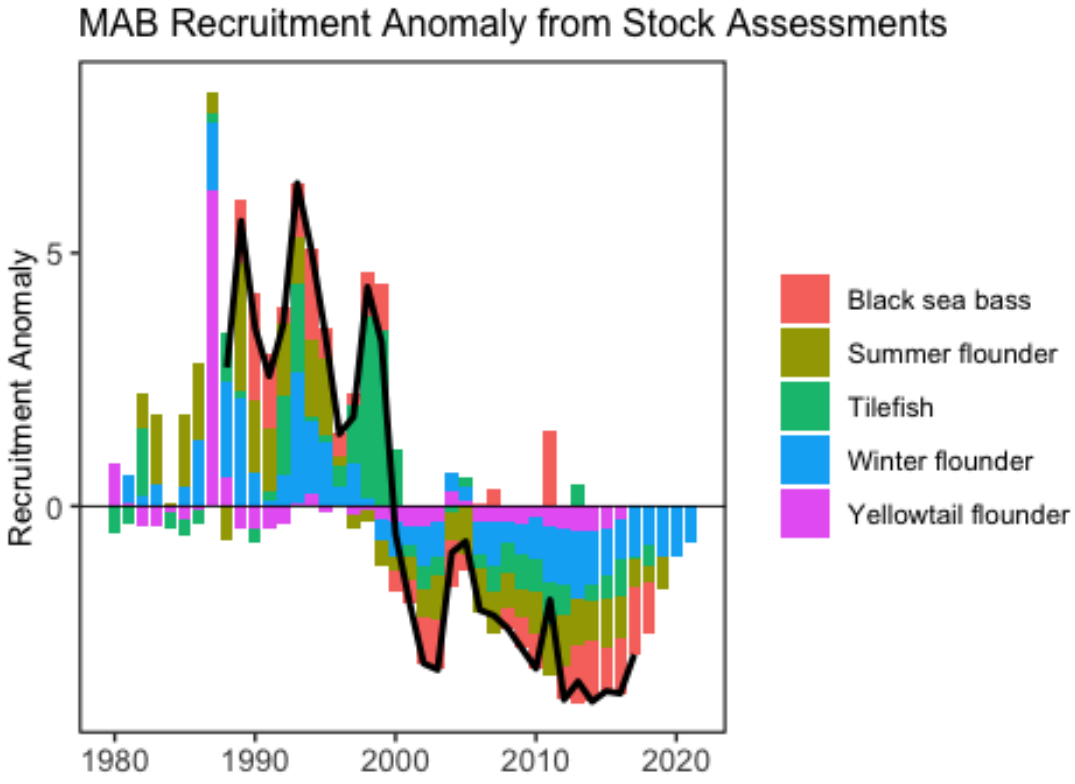
Fish condition is measured as the weight per length–a measure of "fatness". This information is from NEFSC bottom trawl surveys and shows a change in condition across all species at around 2000. Around 2010-2013 many species started to have better condition, though black sea bass remain thinner for their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


Small fish per large fish biomass (anomaly)
5.0
2.5
0.0
-2.5
1980
1990
2000
2010
2020
AMERICAN PLAICE
BLACK SEA BASS
RED HAKE
SILVER HAKE
SUMMER FLOUNDER
WHITE HAKE
WINDOWPANE
WINTER FLOUNDER
WITCH FLOUNDER
YELLOWTAIL FLOUNDER


MAB Recruitment Anomaly from Stock Assessments
Recruitment Anomaly
5
0
1980
1990
2000
2010
2020
Black sea bass
Summer flounder
Tilefish
Winter flounder
Yellowtail flounder

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.

Risk Level	*Definition*
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

Previous risk discussion:

To summarize, primary production shows no trend (although the seasonal timing of primary production may be changing). Similarly, there are no trends in overall zooplankton abundance, but a dominant Mid-Atlantic species shows different trends by season, possibly also indicating a shift in timing. Fish condition showed a drop across all species in the early 2000s, but most species appear to have recovered. There is a significant decreasing trend in aggregate numbers of small fish per large fish. This one clear trend, along with changes in timing at lower trophic levels, suggest a low-moderate risk of changing ecosystem productivity in the Mid-Atlantic ecosystem.

Population Diversity (new)

Decisions which need to be made:

1. Clarify risk definition: short term vs long term risk to OY
2. Prioritize species and approve potential indicators for development (inadequate capacity to do all species for 2024 but can possibly add 1-2 each year)
    a. Indicators of age and size diversity are likely available from stock assessment inputs
    b. Indicators of genetic and reproductive diversity require more specification to determine availability
3. Review potential risk criteria, modify for multiple indicators, and suggest alternatives
4. Consider specifying risk criteria reflecting definition of short term versus long term risk to OY

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.

Proposed definition:

Risk of not achieving OY due to reduced species/stock diversity (size, sex, genetic, reproductive). Clarification of risk to OY over the short term or long term would be useful.

Indicators:

Stock specific indicators of size and age diversity could be derived from stock assessment information. Indicators of genetic and reproductive diversity would require investigation to determine availability by stock. It is possible that size and or age structure and diversity could be used as a proxy for reproductive diversity supported by larger and or older female fish.

Potential risk criteria:

Risk Level	*Definition*
Low	No trend in diversity measure
Low-Moderate	Significant long term trend (either direction) in diversity measure
Moderate-High	Significant recent increasing trend in diversity measure
High	Significant recent downward trend in diversity measure

Ecological Diversity (new)

Decisions which need to be made:

1. Clarify risk definition: short term vs long term risk to OY
2. Approve potential indicators for further development
    a. Zooplankton diversity (increasing, potentially indicating reduced abundance of a dominant species)
    b. Larval fish diversity
    c. Adult fish diversity
    d. others?
3. Review potential risk criteria, modify for multiple indicators, and suggest alternatives
4. Consider specifying risk criteria reflecting definition of short term versus long term risk to OY

Description:

This element would be applied at the ecosystem level.

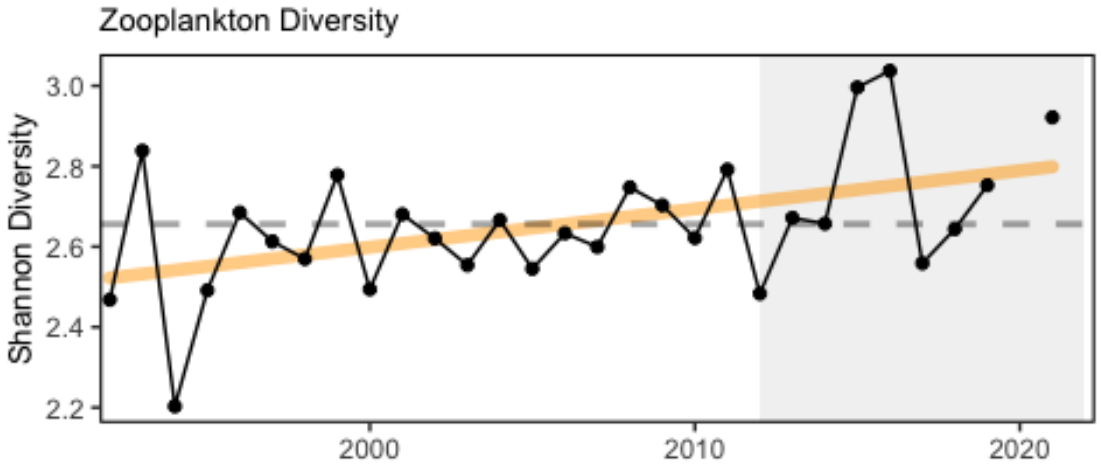
Diversity of species within ecosystems provides the capacity to adapt to change at the ecosystem level, stabilizing ecosystem structure and function for dependent fishing communities.

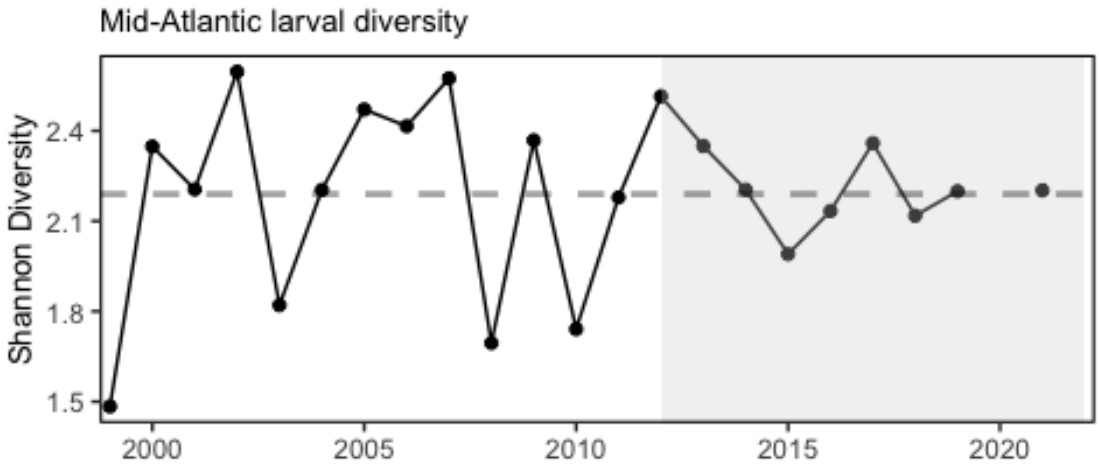
Proposed Definition:

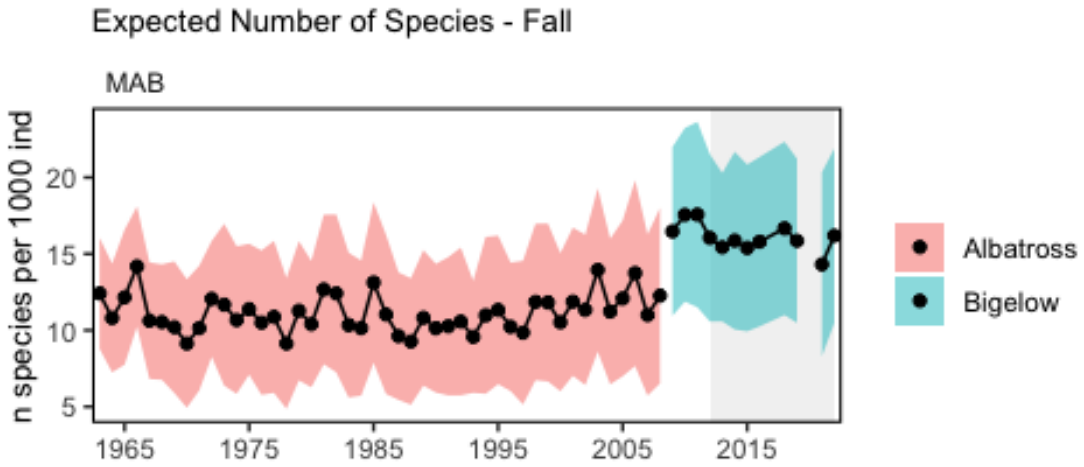
Risk of not achieving OY due to reduced species diversity and altered ecosystem structure and function. Clarification of risk to OY over the short term or long term would be useful.

Indicators:

Ecological diversity indicators from surveys (adult fish, juvenile fish, and zooplankton) are included in the State of the Ecosystem reports.







Potential risk criteria:

Risk Level	*Definition*
Low	No trend in diversity measure
Low-Moderate	Significant long term trend (either direction) in diversity measure
Moderate-High	Significant recent increasing trend in diversity measure
High	Significant recent downward trend in diversity measure

Offshore Habitat (new)

Decisions which need to be made:

1. Clarify habitat change most relevant to each species to target indicators?
2. Review potential indicators
    a. Time series of habitat occupancy by species (Friedland et al 2023); Decreasing trends in species core habitat could indicate higher risk
    b. Time series of habitat feature attributes (e.g. cold pool extent, number of warm core rings): Decreasing trends in amount or quality of habitat feature could indicate higher risk to associated species
    c. Time series of habitat threats (e.g. harmful algal blooms, hypoxic events, invasive species?); Increasing trends could indicate higher risk

Description:

This element would be applied at the species level.

Offshore habitat 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.

Proposed 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 can 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:

Risk Level	*Definition*
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)

Decisions which need to be made:

1. Clarify the definition
    a. Identify the focal risks of invasive species as a separate element?
    b. Could an indicator of invasive species impact on ecosystem productivity be included within the ecosystem productivity element?
    c. Could an indicator of invasive species be included in the estuarine and/or offshore habitat and/or aquaculture risk elements?
2. Clarify the level of application
    a. Ecosystem level: general risks to productivity
    b. Species level: risk to individual species

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.

Proposed definition:

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

Indicators:

Invasive species in the Northwest Atlantic would be identified through a combination of literature search, survey, and fishery data.

Potential risk criteria:

Risk Level	*Definition (ecosystem level example)*
Low	No invasive species affecting fisheries
Low-Moderate	Invasive species affecting 1-2 managed species/fisheries
Moderate-High	Invasive species affecting 3-4 managed species/fisheries
High	Invasive species affecting 4+ managed species/fisheries

Economic Elements

Commercial Value

Decisions which need to be made:

1. What Indicators do the EOP Committee/AP want to move forward?
    a. Gross revenue: Current indicator
    b. Net revenue: Can only be calculated for ~50% subset of trips (federally-permitted)
    c. CPUE - EOP/AP would need to indicate how this could be standardized across fisheries
2. If something other than Gross Revenue, risk criteria need to be revisited.

Description:

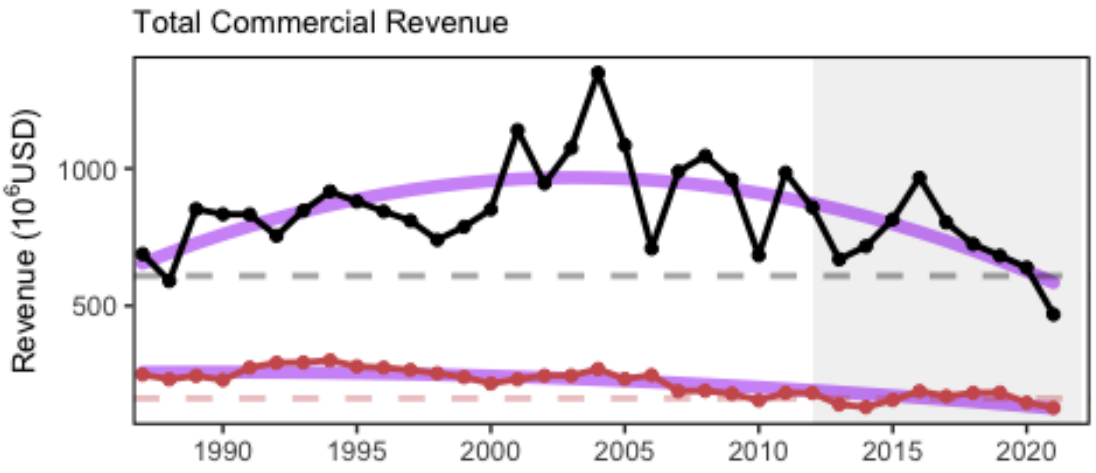
This element is applied at the ecosystem level, and addresses the risk of not maximizing fishery value. Revenue serves as a proxy for commercial profits, which is the component of a fishery's value that this element is ultimately attempting to assess risk towards. Lack of cost information across all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

Definition:

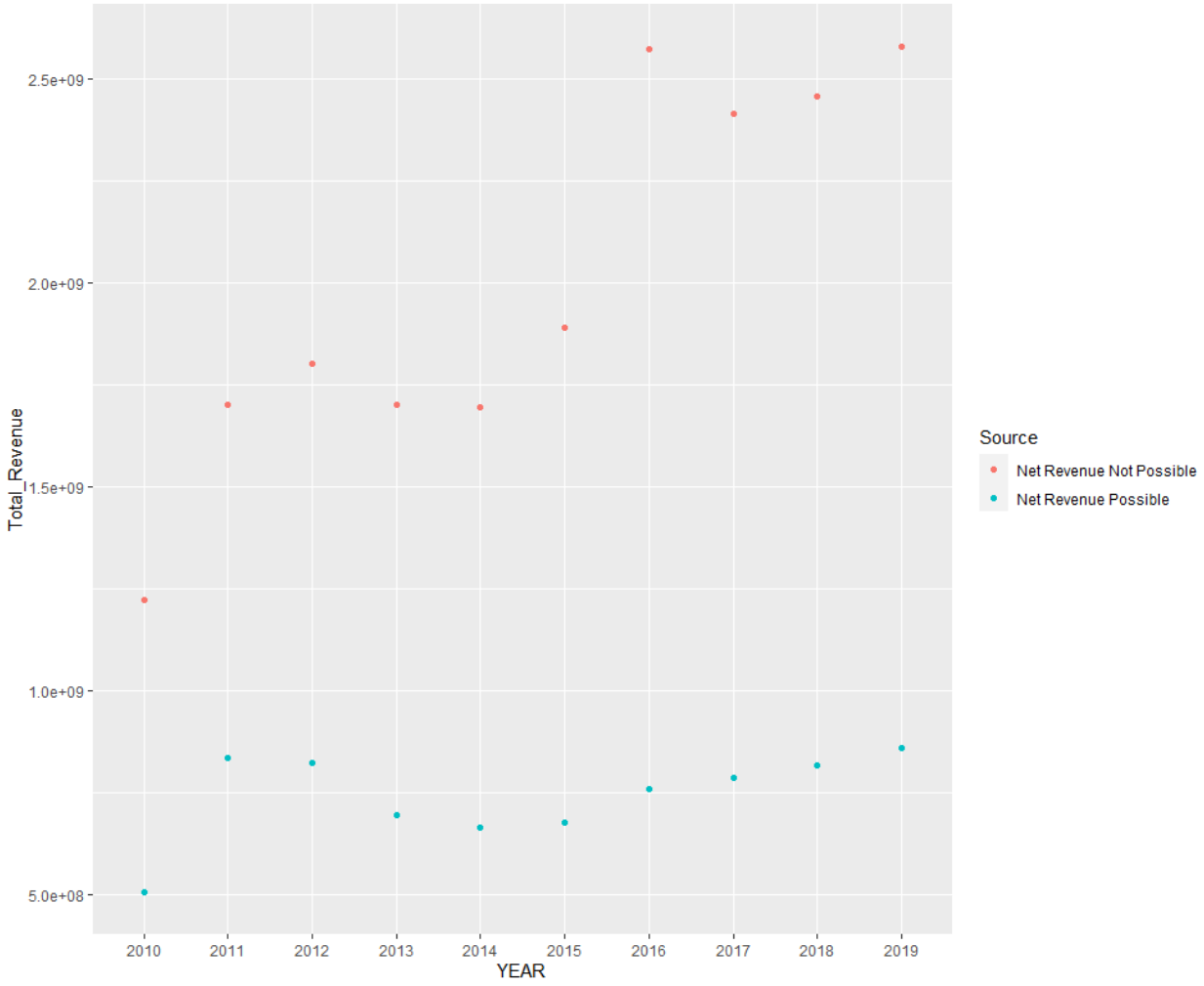
Risk of not maximizing commercial fishery value.

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.



Catch per unit effort has been suggested by the AP/Committee. However, clarity would be needed in terms of how this indicator should be calculated and interpreted in order to better inform Council decision-making.

Potentially, multiple indicators could be used to better proxy for commercial fishery value.

Proposed 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.

Risk Level	*Definition*
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

Previous risk discussion:

Aggregate commercial revenue for Council-managed species was calculated. Consistent with other published work (Gaichas et al. (2016), Figs 2-3) there is a long term significant decrease in revenue, indicating moderate-high risk to commercial fishery profit.

Commercial Fishery Resilience - Revenue Diversity

Decisions which need to be made:

1. Does the AP want to keep this element?

Description:

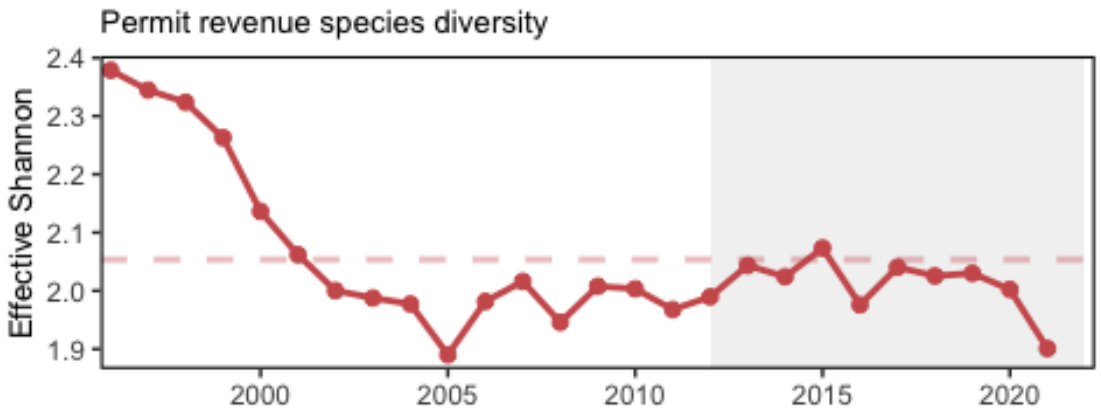
This element is applied at the ecosystem level, and addresses the potential risk of reduced commercial fishery business resilience by evaluating species diversity of revenue at the permit level.

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.



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, 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:

Risk Level	*Definition*
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

Low risk was defined as no trend and low variability in the diversity measure. Low-Moderate risk was increasing 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.

Commercial Fishery Resilience (4,5,6): combine into Commercial fishery resilience (business and economic pressures)

Decisions which need to be made:

1. What level does this element get assessed at?
    a. Regional, state, other?
    b. Does the Committee/AP want Resilience 4, 5, 6 and seafood market access rolled into one element?
2. How does this element differ from the Commercial value element?
3. What indicators do the Committee and AP think would help in decision-making?

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. However, the Committee/AP would need to clarify how this differs from the other elements previously identified in order to ensure no double-counting occurs.

Potential risk criteria:

Risk Level	*Definition*
Low	No trend in access to capital
Low-Moderate	Increasing or high variability in access to capital
Moderate-High	Significant long term decrease in access to capital
High	Significant recent decrease in access to capital

Risk Level	*Definition*
Low	No trend in insurance availability
Low-Moderate	Increasing or high variability in insurance availability
Moderate-High	Significant long term decrease in insurance availability
High	Significant recent decrease in insurance availability

Seafood Safety (merge into discussion of fishery resilience)

Description:

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) more than potential risks to human health.

Potential risk criteria:

Risk Level	*Definition*
Low	No current seafood safety advisory
Low-Moderate	Current seafood safety advisory for high risk individuals in some states
Moderate-High	Current seafood safety advisory for general population in some states
High	Current seafood safety advisory for general population in majority of states

Commercial Fishery Resilience - Shoreside Support

Decisions which need to be made:

1. Which indicators are most useful to support decision-making?
2. Does the Committee/AP suggest consolidating commercial/recreational support given inability to delineate some indicators?

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:

Current 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 (Fig. , Lower right). 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:

Risk Level	*Definition*
Low	No trend in shoreside support businesses
Low-Moderate	Increasing or high variability in shoreside support businesses

Risk Level	*Definition*
Moderate-High	Significant recent decrease in one measure of shoreside support businesses
High	Significant recent decrease in multiple measures of shoreside support businesses

Previous risk discussion:

Low risk was defined as no trend and low variability in the number of shoreside support businesses. Low-Moderate risk was increasing variability or overall high variability in shoreside support businesses. Moderate-High risk was a significant recent decrease in one measure of shoreside support businesses. High risk was a significant recent decrease in multiple measures 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, showed 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).

Recreational Fishery Resilience - Shoreside Support (new)

Decisions which need to be made:

1. Which indicators are most useful to support decision-making?
2. Does the Committee/AP suggest consolidating commercial/recreational support given inability to delineate some indicators?
3. What are the risk criteria to be employed on selected indicators?

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.).

Indicators:

Number of shoreside support businesses, including marinas and bait and tackle shops. Are there other businesses which should be tracked?

The number of recreational shoreside support companies are difficult to assess from existing datasets. Within the Quarterly Census of Employment and Wages (https://www.bls.gov/cew/home.htm) and Non-employer Statistics (https://www.census.gov/programs-surveys/nonemployer-statistics.html) datasets, bait and tackle stores fall under NAICS 451110 - Sporting goods stores, and pleasure boat rental falls within NAICS 532284 - Recreational Goods Rental, and pleasure boat repair yards are classified under NAICS 811490 - Other Personal and Household Goods Repair and Maintenance, and ice houses are classified under NAICS 312113 - block ice manufacturing and ice (except dry ice) manufacturing, with no further delineation possible. Marinas are defined under NAICS 713930, Ship Building and Repairing (NAICS 336611), and Boat building (NAICS 336612) do not distinguish the type of boats serviced. Retailing marine supplies fall under boat dealers (NAICS 441222), and boat fuel falls under Other Gasoline Stations (NAICS 447190), the latter of which does not distinguish type (auto/marine) or fuel. There are a number of avenues by which better indicators could be generated. However, the development of new indicators would benefit from ranking the importance of potential indicators

Potential risk criteria:

Likely to depend on ultimate indicators selected.

Social-Cultural Elements

Recreational Fleet Diversity (new)

Decisions which need to be made:

1. Which indicators are most useful to support decision-making?
    a. Current effort diversity metric
    b. Ratio of harvest/catch by mode - needs clearer definition

Description:

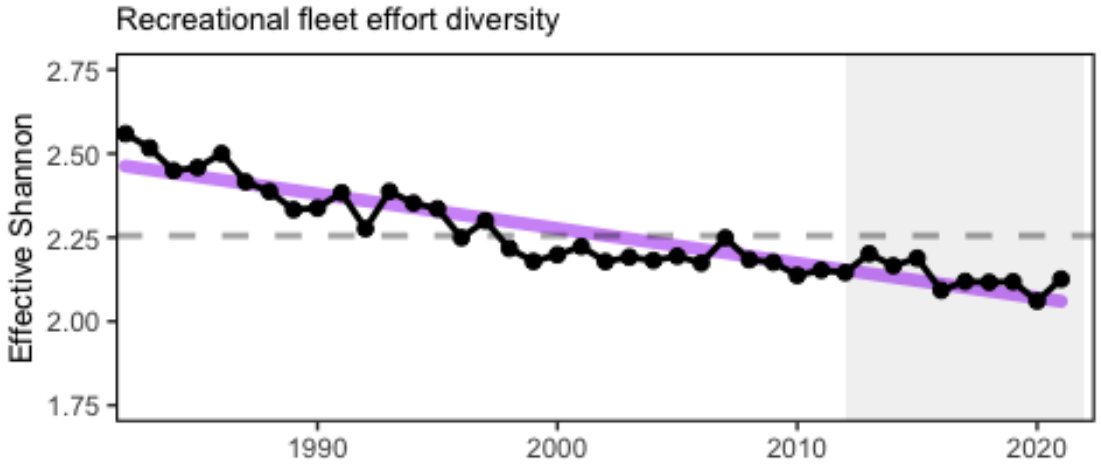
This element is applied at the ecosystem level, and ranks the risk to maintaining equity in recreational access to fishery resources. Beyond equity concerns, maintaining diversity can provide the capacity to adapt to change at the ecosystem level for dependent fishing communities, and can address objectives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

Definition:

Risk of reduced recreational fishery business resilience.

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).

There was some discussion in July that a ratio of harvest/catch by mode might be more informative. However, this indicator would need to be more clearly defined for management purposes.

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.

Risk Level	*Definition*
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

Food Production Elements

Recreational/Subsistence Food Production

Decisions which need to be made:

1. Which indicators are most useful to support decision-making?
    a. Current total seafood harvest
    b. Percent of protein derived from seafood - needs clearer definition
    c. Cost of seafood - needs clearer definition

Description:

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

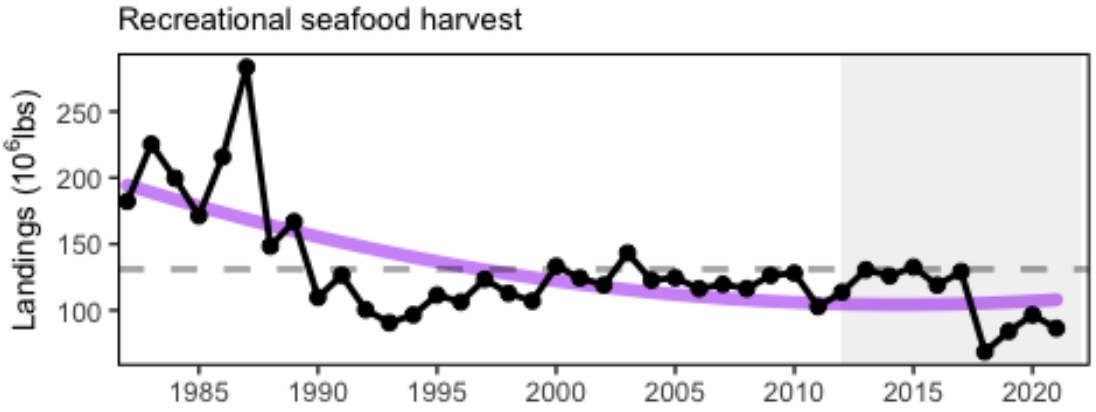
Definition:

Risk of not maintaining personal food production

Indicators:

Currently utilizes total recreational harvest (all species) and harvest per angler were evaluated 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.

At the July 7 meeting, there was some discussion of broadening to be percent of protein derived from seafood, or cost of seafood. However, it is unclear how these would be used within a management context, and clarification is needed.



Potential risk criteria:

Risk Level	*Definition*
Low	No trend or increase in recreational landings
Low-Moderate	Increasing or high variability in recreational landings

Risk Level	*Definition*
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.

Previous risk discussion:

This significant long term decrease in both recreational landings and recreational landings per angler represents a moderate-high risk to recreational food production.

Commercial Employment (new)

Decisions which need to be made:

1. Which indicators are most useful to support decision-making?
    a. creation - needs clearer definition
    b. retention - needs clearer definition
    c. opportunity - needs clearer definition
    d. wages - needs clearer definition
2. What are the risk criteria to be employed on selected indicators?

Description:

This element ranks the risk of not optimizing employment opportunities in the commercial sector. This objective should be refined if possible. What does optimized employment entail?

Definition:

Risk of not optimizing commercial job creation and retention

Indicators:

Number of individuals employed by commercial fisheries. This indicator needs to be refined. For example, should this include solely those employed directly by fishing vessels, or should this include all employment (e.g. ice houses, fuel, etc.)? Should it be estimated at the system level, state level, or something else? NAICS codes make tracking marine fuel,

Potential risk criteria:

Likely to depend on indicators chosen.

Recreational Employment (new)

Decisions which need to be made:

3. Which indicators are most useful to support decision-making?
    a. creation - needs clearer definition
    b. retention - needs clearer definition
    c. opportunity - needs clearer definition
    d. wages - needs clearer definition
4. What are the risk criteria to be employed on selected indicators?

Description:

This element ranks the risk of not optimizing employment opportunities in the recreational sector. This objective should be refined if possible. What does optimized employment entail?

Definition:

Risk of not optimizing recreational job creation and retention

Indicators:

Number of individuals employed by recreational fisheries. This indicator needs to be refined. For example, should this include solely those employed directly by charter/party fishing vessels, or should this include all employment (e.g. bait shops, marinas, etc.)? Should it be estimated at the system level, state level, or something else?

Potential risk criteria:

Likely to depend on indicators chosen.

Commercial Seafood Production

Decisions which need to be made:

1. Do the EOP Committee & AP want to change the definition?
    a. Risk of not optimizing commercial seafood production.
    b. Risk of not maintaining commercial seafood production.
2. Which indicators are most useful to support decision-making?
    a. Current total seafood harvest
    b. Add bait landings as an input to seafood harvest? - needs clearer definition

Description:

This element is applied at the ecosystem level, and describes the risk of not optimizing domestic seafood production from Council-managed species. Commercial seafood landings (as opposed to total landings which include bait and industrial uses) were used to assess seafood provision.

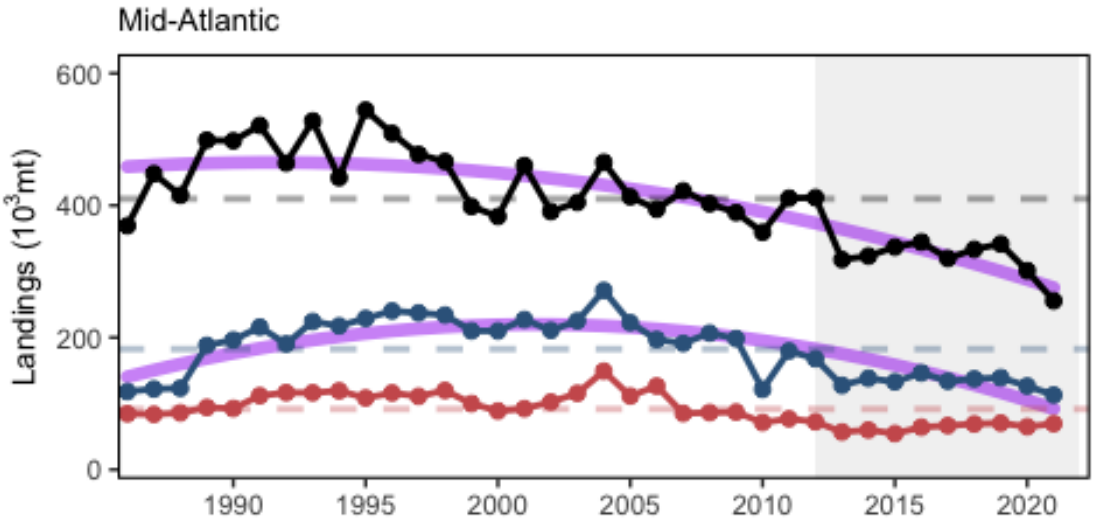
Definition:

Risk of not optimizing commercial seafood production.

Risk of not maintaining commercial seafood production.

Indicators:

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



Bait Landings

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

Proposed risk criteria:

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

Risk Level	*Definition*
Low	No trend or increase in seafood landings
Low-Moderate	Increasing or high variability in seafood landings
Moderate-High	Significant long term decrease in seafood landings
High	Significant recent decrease in seafood landings

Previous risk discussion:

Commercial seafood landings from Council managed species were assembled. Because this is total landings, years prior to 1977 include foreign landings (in particular, of Atlantic mackerel, which account for much of the observed spike). Recent landings are all domestic fisheries. Looking across all regions, there is a significant recent decrease in seafood landings, indicating high risk to regional domestic seafood production.

Management Elements

Other Ocean Activities

Decisions which need to be made:

1. Agree with new element name change (old Other Ocean Uses)
2. Scope and considerations within this element given the other risk elements currently under development (e.g., offshore wind, offshore energy, aquaculture).
3. Indicators and qualitative and/or quantitative approaches to inform risk criteria

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/sand mining/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 or damage to resource/habitat from non-fishing ocean activities and/or area designations.

Potential indicators:

There currently are no specific indicators for this element and expert judgment has been used to determine impacts to fishery access and habitat quality and function due to other ocean activities. Anticipated offshore wind impacts were the primary focus of this qualitative evaluation.

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 qualify and spatial overlap with existing habitat and/or fishing ground locations. With a quantitative evaluation, potential to use a range/binned 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:

Risk Level	*Definition*
Low	No spatial overlap with fisheries; no impact on habitat

Risk Level	*Definition*
Low-Moderate	Low-moderate overlap with fisheries; minor habitat impacts but transient
Moderate-High	Moderate-high overlap with fisheries; minor habitat impacts but persistent
High	High overlap with fisheries; other uses could seriously disrupt fishery prosecution; major permanent habitat impacts

Previous and additional risk discussion:

As mentioned above, Council staff used expert knowledge and a qualitative approach to determine the risk level associated with the impacts to fishery access and habitat quality due to other ocean uses with a primary focus on offshore wind. At the August 22nd meeting, potential new/alternative indicators and data identified by the EOP Committee and AP were also primarily associated with offshore wind - e.g., vessel effort/fishing footprint and displacement, and vessel revenue.

Additional feedback and specific direction as to what components should/should not be included within this risk element is needed. Knowing the scope of this element will then help inform potential indicators, particularly for those areas that might still be in development or planning stages, and whether or not qualitative/quantitative approaches are available. Once that is specified, defining and evaluating the risk criteria could then be conducted.

Offshore Wind Biological/Ecosystem (new)

Decisions which need to be made:

1. Determine if one comprehensive offshore wind element, two separate elements, or retain under Other Ocean Activities element
2. Identify indicators specific to this element that could inform risk criteria

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:

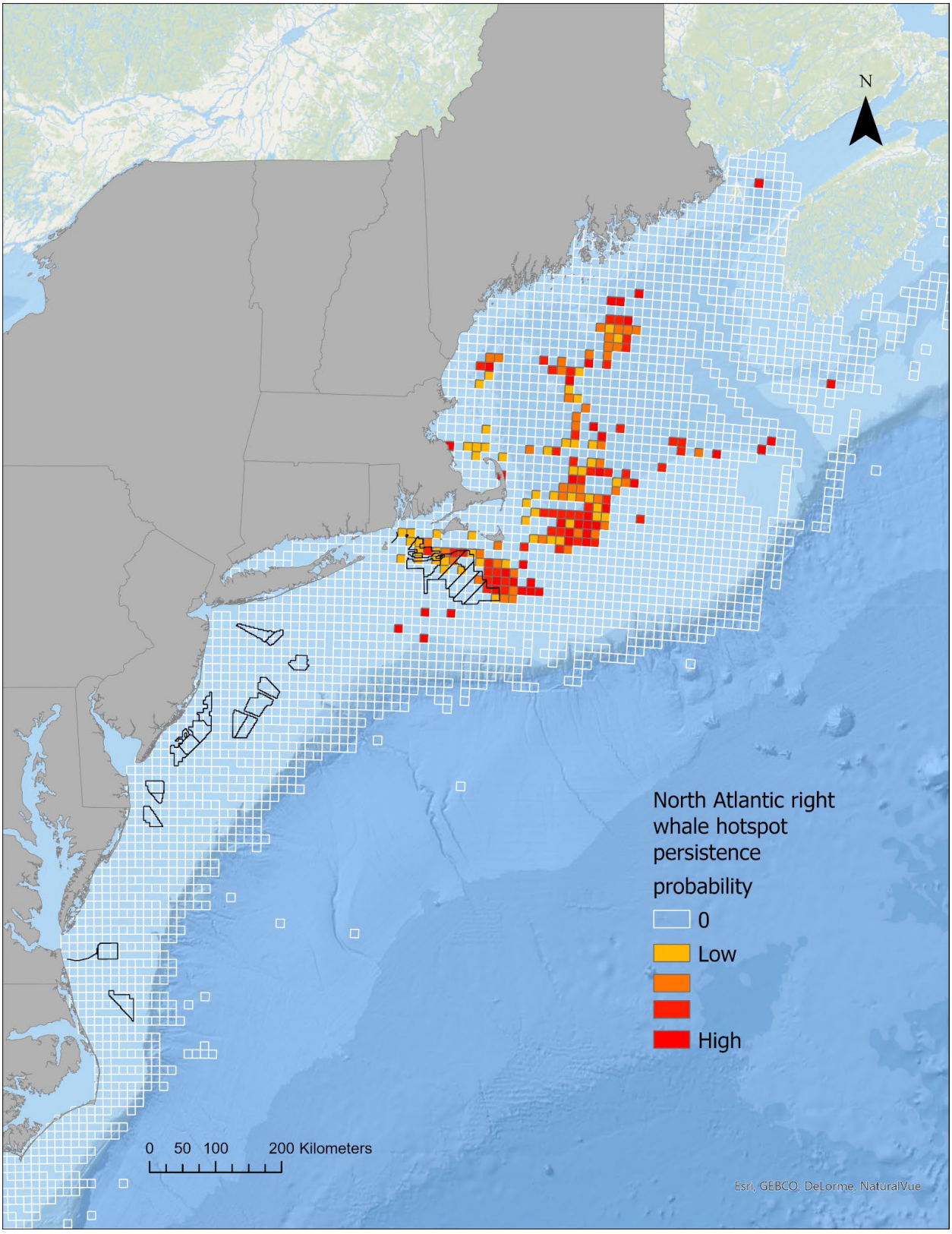
Risk of not achieving OY due to biological impacts to stock productivity, distribution, and ecosystem structure and function.

Indicators:

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

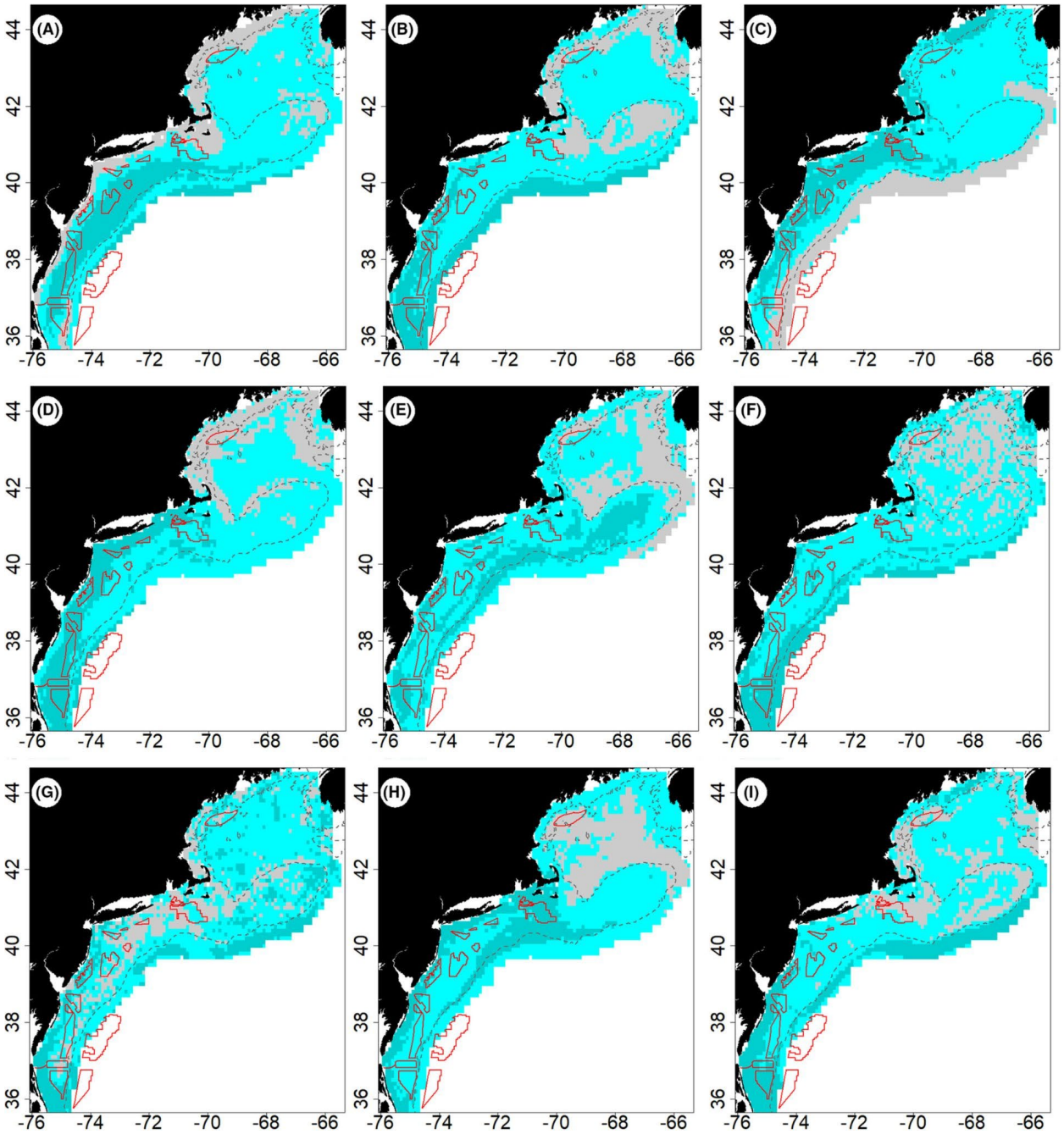
Species distribution overlap with offshore wind from a couple of potential data sources (e.g., https://apps-st.fisheries.noaa.gov/dismap/DisMAP.html). However, translating exposure into a risk of impacts, which is likely to be different by species, may be challenging.

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:

There is the potential that the ranking criteria associated with a biologically focused element could remain relatively stationary in that the impacts for a particular species will remain the same (i.e., if offshore wind affects a stock's productivity, habitat, or recruitment, that effect is likely not going to change). However, the magnitude of those effects may change as the scale of offshore wind development changes. As noted above, developing an indicator that quantifies the impacts and translates to risk will likely be challenging. Some of the ecosystem structure and function indicators could be useful to develop risk criteria

Offshore Wind Fishery Science and Access (new)

Decisions which need to be made:

1. Determine if one comprehensive offshore wind element, two separate elements, or retain under Other Ocean Activities element.
2. Review and identify potential indicators - use now and/or future
3. Feedback on risk criteria, triggers/bins, and suggest alternatives.

Description:

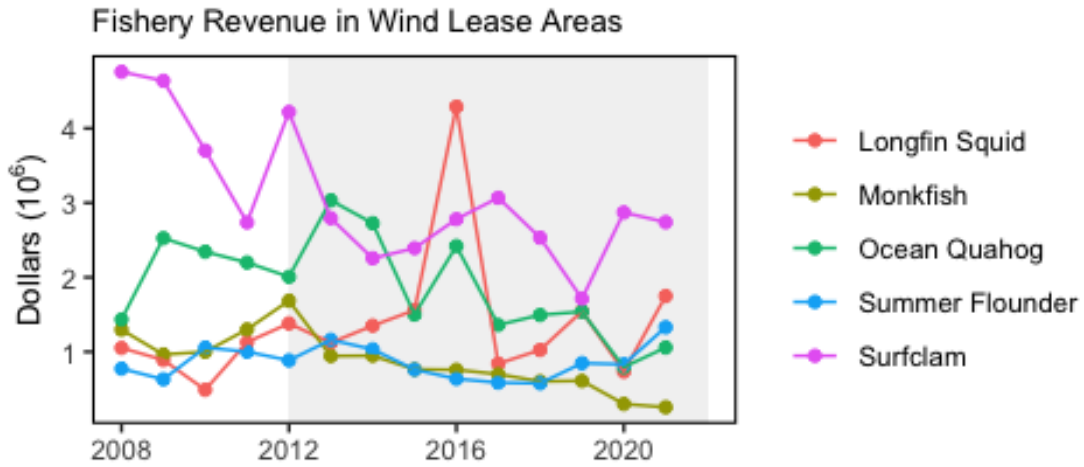
This element would be applied at the species and sector (commercial and recreational) level and considers the risks of offshore wind development on data and science quality and to fishery/fleet access for Council-managed fishery resources. Given the anticipated overlap between offshore wind lease areas 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.

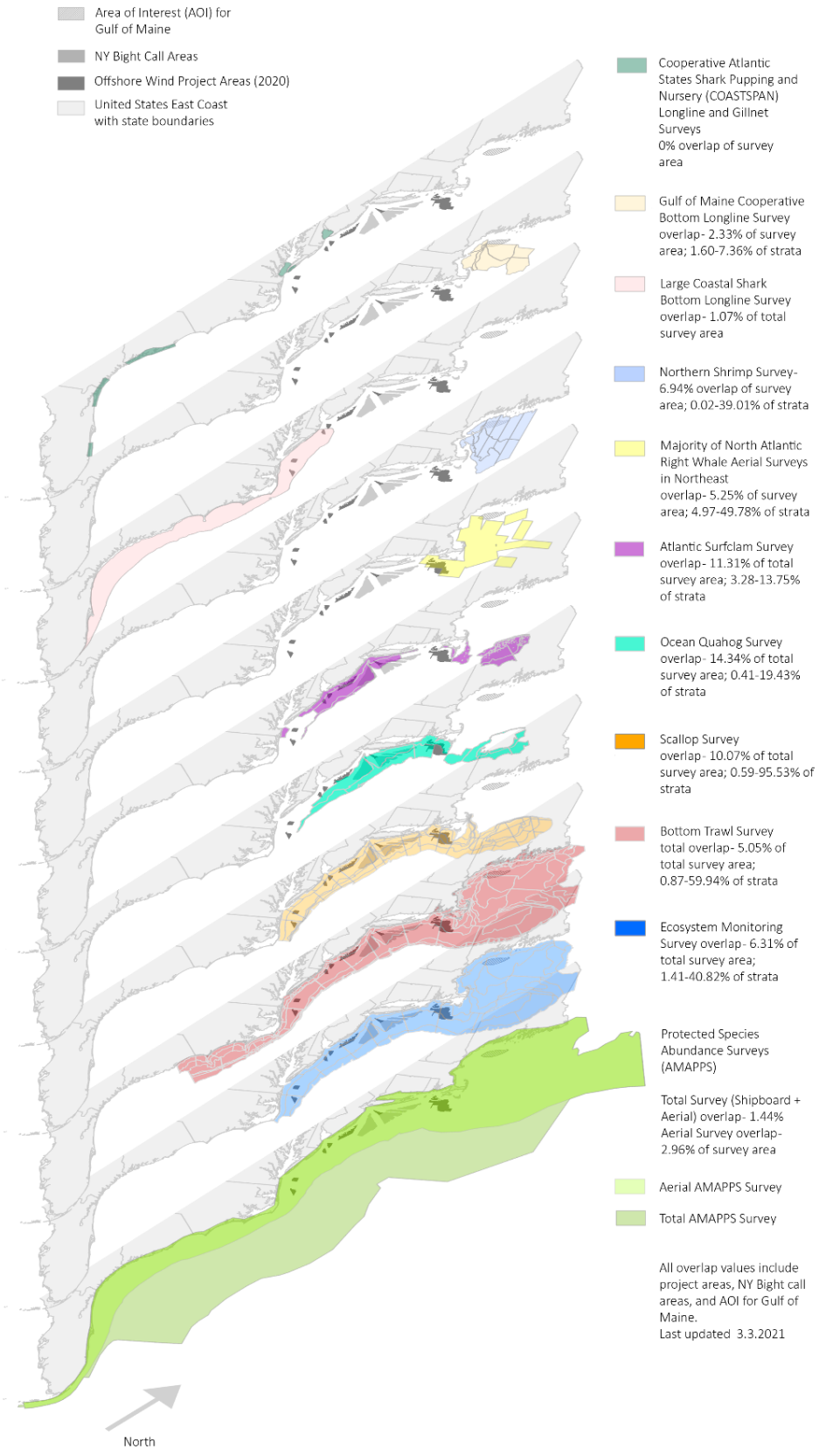
Definition:

Risk of not achieving OY due to fishery impacts due to access, stock availability, 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.




Area of Interest (AOI) for Gulf of Maine
NY Bight Call Areas
Offshore Wind Project Areas (2020)
United States East Coast with state boundaries
Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) Longline and Gillnet Surveys
0% overlap of survey area
Gulf of Maine Cooperative Bottom Longline Survey
overlap- 2.33% of survey area; 1.60-7.36% of strata
Large Coastal Shark Bottom Longline Survey
overlap- 1.07% of total survey area
Northern Shrimp Survey-
6.94% overlap of survey area; 0.02-39.01% of strata
Majority of North Atlantic Right Whale Aerial Surveys in Northeast
overlap- 5.25% of survey area; 4.97-49.78% of strata
Atlantic Surfclam Survey
overlap- 11.31% of total survey area; 3.28-13.75% of strata
Ocean Quahog Survey
overlap- 14.34% of total survey area; 0.41-19.43% of strata
Scallop Survey
overlap- 10.07% of total survey area; 0.59-95.53% of strata
Bottom Trawl Survey
total overlap- 5.05% of total survey area;
0.87-59.94% of strata
Ecosystem Monitoring Survey overlap- 6.31% of total survey area;
1.41-40.82% of strata
Protected Species Abundance Surveys (AMAPPS)
Total Survey (Shipboard + Aerial) overlap- 1.44%
Aerial Survey overlap- 2.96% of survey area
Aerial AMAPPS Survey
Total AMAPPS Survey
All overlap values include project areas, NY Bight call areas, and AOI for Gulf of Maine.
Last updated 3.3.2021
North

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

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

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

Potential risk criteria:

Risk Level	*Definition*
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)

Indicators included in risk criteria do not cover all areas of interest and those identified in definition. Input on other indicators to be included - in short term or for longer term development. The bins included here are examples and provided for discussion and feedback from the Committee and AP on possible alternatives or input on how to determine bins. Any thoughts on how to utilize the different criteria to assign the risk level - e.g., need two of the three indicators within the same risk level to assign total risk level for element - would be helpful.

Offshore Energy Exclusive of Wind (new)

Decisions which need to be made:

1. Decide to retain as its own element or combine and be considered within Other Ocean Activities risk element.
    a. Given the status of these activities in the Mid-Atlantic, determine if putting in a parking lot for further development and future consideration is most appropriate.
2. Input on potential indicators

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 offshore habitat.

Indicators:

In the Mid-Atlantic, these projects are under consideration and more in the planning phase for potential future development. As these projects become further developed and come on line in the future, similar indicators as to those being considered under Other Ocean Activities and Offshore Wind could be considered (e.g., spatial overlap, fisheries revenue).

Aquaculture (new)

Decisions which need to be made:

1. Decide to retain as its own element or combine and be considered within Other Ocean Activities risk element.
    a. Given the status of aquaculture development in the Mid-Atlantic, determine if putting in a parking lot for further development and future consideration is most appropriate.
2. Input on potential indicators.

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 from escapement, contamination via chemicals or parasites, area closures, and economic losses to wild stock fisheries in the Mid Atlantic.

Indicators:

There are currently no aquaculture operations for Council managed species or in federal waters, but a variety of aquaculture projects are in various stages of development and review. As offshore aquaculture develops, the spatial overlap and revenue impacts between aquaculture areas and existing fishing operations could be developed (similar to analyses conducted for offshore wind).

Regulatory Complexity and Stability

Decisions which need to be made:

1. Does the revised definition reflect priority risks of Committee and AP
2. Feedback and direction on possible indicators that could be used to inform risk criteria.

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 regulatory complexity, frequent modifications, and lack of compliance.

Indicators:

Currently, this element is qualitatively evaluated by Council staff using the frequency of any regulatory change over the last 5 years by fishery and sector.

Potential indicators provided previously - quantifying the number of regulations and/or the frequency of regulatory changes, based on evaluation of the Code of Federal Regulations. The number of law enforcement citations/warnings or noncompliant harvest relative to total harvest reported by MRIP to track compliance.

Previous and additional risk discussion:

At the August 22nd meeting, the EOP Committee and AP expressed a variety of concerns about this risk element. The definition included above is a revised definition supported by the Committee and AP that includes OY considerations and includes regulatory complexity, stability, and compliance. The Committee and AP also felt the existing and proposed indicators are insufficient.

Additional discussion on the priority risks the Committee and AP are interested in tracking and any input on potential indicators that might be considered to track these risks.

Essential Fish Habitat (new)

Decisions which need to be made:

1. Decision to retain as a stand alone element o rif EFH associated risks are captured or should be included under Estuarine and Coastal Habitat and Offshore Habitat risk elements.
2. Feedback on proposed indicators and timing of their development - most will likely require the updated EFH designations developed through Council's Omnibus EFH amendment which wont be completed until 2025.
3. Input on potential risk criteria and associated bins and thresholds.

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:

Risk Level	*Definition*
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

Risk Level	*Definition*
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

Given the potential indicators identified above, this is an example risk criteria approach provided for feedback by the Committee and AP. In addition, any Committee and AP input on possible bins/thresholds associated with each risk level would be helpful. As mentioned above, 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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