EAFM Risk Elements, Definitions, and Indicators

EOP Committee and AP Discussion Document

2023-06-29

Introduction:

The document is organized into sections as in previous risk assessments: Ecological elements, Social and Economic elements, and Management elements. Both existing risk element (24 in total) and possible new risk elements (19 in total) are described here.

Each element within each section is on its own page. For each element we list a broad objective, the top definitions from the EOP, highlight a proposed definition, and then list potential indicators that could be considered. These are all provided as examples, context, and to start the discussion – these are not intended to recommendations/preferences by staff or considered final.

During the July 7th meeting, the EOP Committee and AP will step through each of these and offer feedback for direction and continued development.

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Ecological Elements:

Stock Assessment Performance

Broad Objective:

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).

Proposed Definitions (top 2):

#1 Modified version 1: Stock Assessment Performance - Risk of not achieving OY due to analytical limitations and/or retrospective performance concerns

2 Current version: Stock Assessment Performance - Risk of not achieving OY due to analytical limitations

Suggested Definition:

Current version: Risk of not achieving OY due to analytical limitations. The rationale is that this broad definition allows the Council to use many potential indicators, including all those cited by EOP members, but also allows the Council to change indicators without changing the definition.

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.

Fishing Mortality and Biomass status (2 separate elements)

Broad Objective:

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.

Proposed and Suggested Definitions:

Fishing Mortality – F Status
1 (current) - F Status - Risk of not achieving OY due to overfishing

Stock Biomass – B Status
1 (current) - 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.

Food web (Council-managed predators)

Broad Objective:

Fish stocks are managed using single species stock assessments, but fish stocks exist within a food web of predator and prey interactions. . This element is applied at the species level and evaluates the risk of not achieving OY due to predatory interactions between Council managed species. The species may be dependent on other Council managed species as prey.

Proposed Definitions (top 2):

1 Modified version 1: Food Web (All) - Risk of not achieving OY due to predator, prey, and protected species interactions with MAFMC managed species

2 Current version: Food Web (Council-Managed Predators) - Risk of not achieving OY due to predatory interactions between Council-managed species

Suggested Definition:

Preference depends on how the EOP and Council would like to assess food web risks to Council managed species. A single risk element covering all food web interactions (modified version 1) can be developed with further discussion. To address what is currently split into three elements addressing predator interactions, prey interactions, and protected species interactions, we can consider weighting across these interactions to identify key risks for each Council managed species, which may arise from different drivers.

Another alternative would be to separate food web risks to achieving OY for Council managed species from two sources, having one risk element assessing prey availability for each species (this one), and one risk element assessing predation pressure on each species (the next one).

Indicators:

To evaluate predation risks under the current element, the "importance" of each species as a predator must be assessed. There are not clear standardized thresholds to define this. In previous risk assessments, we used diet information to develop thresholds: an important predator of Council managed species can be defined as having more than a specified threshold level of Council managed species as a proportion of the diet by weight, where diet was estimated using the full time series of NEFSC bottom trawl survey food habits collections in all seasons, or from literature.

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.

Alternative indirect indicators of prey availability could include the fish condition indicators from the State of the Ecosystem report. These would not rely on detailed diet

information, instead reflecting the impact of environmental drivers including prey availability on fish growth.

Food web (Council-Managed Prey)

Broad Objective:

Fish stocks are managed using single species stock assessments, but fish stocks exist within a food web of predator and prey interactions. This element is applied at the species level and evaluates the risk of not achieving OY due to prey interactions between Council managed species. The species may support other Council managed species as prey or be subject to high predation mortality by Council managed species. .

Proposed Definitions (top 2):

1 - Food Web (All) - Risk of not achieving OY due to predator, prey, and protected species interactions with Council-managed species

2 (current) - Food Web (Council-Managed Prey) - Risk of not achieving OY due to interactions with Council-managed prey species

Suggested Definition:

Preference depends on how the EOP and Council would like to assess food web risks to Council managed species. As noted above, a single risk element covering all food web interactions (modified version 1) can be developed with further discussion. To address what is currently split into three elements addressing predator interactions, prey interactions, and protected species interactions, we can consider weighting across these interactions to identify key risks for each Council managed species, which may arise from different drivers.

Another alternative would be to separate food web risks to achieving OY for Council managed species from two sources, having one risk element assessing prey availability for each species (the previous element), and one risk element assessing predation pressure on each species (this element).

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.

Food web (Protected Species Prey)

Broad Objective:

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 applied at the species level and evaluates the risks of not achieving protected species objectives due to food web interactions. 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.

Proposed Definitions (top 2):

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

Suggested Definition:

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).

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.

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.

Indicators:

Similar to the elements above, food web models and diet information can be used to evaluate trends and establish thresholds of "importance" for predators and prey. Diet information for protected species is used to assess food web risk. However, protected species diet tends to be more uncertain than for fished species, and diet compositions are not reported to the species level, so past risk assessments considered protected species prey at the family level.

Other Food Web (possible new element)

Broad Objective:

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 could either:

Address risks to achieving Council managed species OY from all food web interactions (same as Modified version 1 for the first two food web elements above)

Address risks to achieving Council managed species OY from food web interactions with HMS and seabirds specifically (considered along with all other predators in 1)

Address risks to HMS management objectives from Council managed activities

Address risks to marine bird management objectives (seabirds are currently considered along with all other protected species in Food web-Protected species prey) from Council managed activities

Proposed Definitions (in rank order based on EOP feedback):

1 - Food Web (All) - Risk of not achieving OY due to predator, prey, and protected species interactions with Council-managed species (Note: this is the same option under the Food Web elements in the previous section)

2 - Other Food Web - Risks to maintaining HMS and shorebird populations due to interactions with Council-managed species

3 - Other Food Web - Risk of not achieving OY due to interactions between Council-managed species and HMS and seabirds

4 – Other Food Web - Risk to maintaining objectives for HMS and marine bird (seabird and shorebirds) because of impacts of activities managed by the Mid Atlantic Council

Suggested Definition:

Depends on whether the EOP and Council prefer to consider risks to HMS objectives (new) or whether the EOP and Council prefer to consider food web risks to managed species OY from HMS and or seabirds separately from or together with all other predators.

Indicators:

Depends on EOP and Council preference. Diet information for HMS and seabirds is similar to that for protected species in general; more uncertain than that available for fish.

Forage Base (possible new element)

Broad Objective:

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. (If the EOP envisions applying this element at the species level, the alternative risk element assessing prey availability for each species described above under "Food web-Council managed predators" addresses species-level forage base risk.)

Proposed Definitions (in rank order based on EOP feedback):

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

2 - Risk of negatively impacting the integrity of the forage base

3 - Risk of negatively impacting the integrity of the forage base, including from non-fishing activities

Suggested Definition:

The EOP and Council should consider whether the integrity of the forage base is best considered at the ecosystem level or species level. If at the species level, the alternative definition of the Food web-Council managed predators as "prey availability" may better reflect species level risk. If at the ecosystem level, the EOP and Council should consider whether the integrity of the forage base is best considered separately from, or within the current Ecosystem productivity element (see next section). If separate, a clear definition of the forage base would be the initial step.

Indicators:

Indicators of aggregate pelagic forage fish biomass and forage fish energy content are presented in the State of the Ecosystem report, and could contribute to this risk element. 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.

Ecosystem Productivity

Broad Objective:

Productivity at the base of the food web supports and ultimately limits the amount of managed species production in an ecosystem. This element is applied at the ecosystem level (the Mid-Atlantic Ecosystem Production Unit) and evaluates the risk of not achieving OY across all Council managed species due to broad changes in ecosystem productivity at the base of the food web.

Proposed Definitions (top 2):

1 - Risk of not achieving OY due to changing system productivity or spatial/temporal overlap at the base of the food web

2 (current) - Risk of not achieving OY due to changing system productivity at the base of the food web

Suggested Definition:

Current version: Ecosystem Productivity - Risk of not achieving OY due to changing system productivity at the base of the food web. The rationale is that ecosystem productivity can change due to many drivers, one of which is change in spatial/temporal overlap at the base of the food web. A broad definition allows the Council to use many potential indicators, including all those cited by EOP members, but also allows the Council to change indicators without changing the definition.

If the EOP and Council want to consider the risk of not achieving OY due to changing spatial/temporal overlap at the base of the food web that does *not* result in changes to overall ecosystem productivity, then a new element can be included to address this risk.

Indicators:

A combination of four indicators are currently used to assess risk of changing ecosystem productivity. We examine trends in total primary production, zooplankton abundance for a key Mid-Atlantic species, 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.

Population Diversity (possible new element)

Broad Objective:

Diversity within populations supports a range of potential population responses to changing conditions, stabilizing sustainable yield. This element would be applied at the species level and would evaluate risks to achieving OY due to changes in population diversity (size, sex, genetic, reproductive).

Proposed Definition:

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

Suggested Definition:

Population Diversity - 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.

Ecological Diversity (possible new element)

Broad Objective:

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. This element would be applied at the ecosystem level.

Proposed Definitions (in rank order based on EOP feedback):

1 - Risk of not achieving OY due to reduced species diversity and ecosystem structure

2 – Risk of not achieving OY due to reduced species diversity and changing ecosystem structure

Suggested Definition:

Ecological Diversity - Risk of not achieving OY due to reduced species diversity and altered ecosystem structure. 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.

Climate

Broad Objective:

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 in the region using a comprehensive assessment

Proposed Definitions:

1 (current) - Risk of not achieving OY due to projected climate change impacts on species productivity

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

#3 - Risk of not achieving OY due to lack of Council responsiveness to additional harvest opportunities related to climate change

#4 - Risk of not achieving OY by ignoring fishing opportunities from emerging species

Suggested Definition:

Current version: Climate definition - Risk of not achieving OY due to projected climate change or ocean acidification impacts on species productivity. EOP comments note that some climate impacts on stock productivity are positive, and that there may be opportunities from emerging fisheries under climate change. While positive productivity impacts have been ranked low risk in the current assessment, the EOP and Council may want to consider a separate risk element to evaluate emerging fisheries.

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.

Distribution Shifts

Broad Objective:

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. Species distribution shifts

Proposed Definitions (top 2):

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

2 - Risk of not achieving OY due to projected climate change impacts on species productivity (i.e., make this element part of #8 - Climate)

Suggested Definition:

Current version: Distribution Shifts - Risk of not achieving OY due to spatial mismatch of stocks and management as a result of climate-driven distribution shifts. The rationale is that climate impacts on productivity and climate impacts on distribution differ widely across Council managed species. Some of the Council managed species at lowest risk of climate impacts to productivity have the highest risks of distribution shift, and vice versa. Council management responses to the risks of distribution shifts are also likely to differ from Council management responses to changing productivity. Maintaining these as separate risk elements is likely to be more informative to the Council than combining them.

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. 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.

Estuarine and Coastal Habitat

Broad Objective:

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.

Proposed Definitions:

#1 (current) - Risk of not achieving OY due to threats to estuarine/nursery habitat.

#2 - Risk of not achieving Estuarine and Nearshore Coastal Habitat objectives due to MAFMC managed fish interactions

#3 - Risk of not achieving OY due to stressors and impacts to estuarine/nursery habitats

Suggested Definition:

Current version: Estuarine and Coastal Habitat - 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.

Offshore Habitat (possible new element)

Broad Objective:

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 is applied at the species level, and evaluates risk of achieving OY due to changes in offshore habitat quality and quantity.

Proposed Definitions:

1 - Risk of not achieving OY due to changing offshore habitat

2 – Risk of not achieving OY due to changing offshore habitat and ocean industrialization

Suggested Definition:

Offshore Habitat - 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 general definition, without limiting the Council or needing to change the definition to accommodate other drivers in the future.

Indicators:

Indicators of offshore habitat trends are available from species-specific habitat modeling through the Northeast Regional Habitat Assessment and multiple other efforts throughout the region.

Invasive Species (possible new element)

Broad Objective:

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

Proposed Definitions (in rank order based on EOP feedback):

1 - Risks to Council-managed stock productivity

2 - Risk of not achieving OY due to interactions with Council-managed species

Suggested Definition:

The EOP and Council would need to modify or agree on the definition of "invasive" above, then the risk element definition would follow.

Indicators:

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

Economic Elements:

Commercial Revenue

Broad Objective:

This element addresses the risk of not maximizing fishery value.

Proposed definitions (in rank order based on EOP feedback):

#1a - Commercial Fishing Revenue - Risk of not maximizing commercial CPUE

#1b (current) - Commercial Revenue - Risk of not maximizing commercial fishery value

#2a – Risk of not maximizing CPUE of target MAFMC-managed species

#2b - Risk of not achieving socio-economic goals for the commercial fishery

Suggested Definition:

Commercial Value: 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.

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.

Marine Recreational Angler Days/Trips

Broad Objective:

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.

Proposed Definitions (in rank order based on EOP feedback):

#1 - Risk of not maximizing recreational days/hours at sea

#2 (current) - Risk of not maximizing recreational fishery value and opportunities

#3 – Risk of not maximizing recreational days/hours at sea for Mid-Atlantic fisheries

#4 - Risk of not achieving the socio-economic objectives for the recreational fishery

#5 - Risk of not maximizing recreational angler days/hours at land and at sea.

Suggested Definition:

Marine Recreational Fishery Value and Opportunities: Risk of not maximizing recreational fishery value and opportunities (current definition).

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.

Commercial Fishery Resilience - Revenue Diversity

Broad Objective:

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

Proposed Definitions (in rank order based on EOP feedback):

#1 (current) - Risk of reduced commercial fishery business resilience (at permit level)

#2 – Risk of reduced commercial fishery business resilience due to new entrants/latent effort into historically important fisheries

Suggested Definition:

Current version: Commercial Fishery Resilience (Species Revenue Diversity) - Risk of reduced of 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).

Fishery Resilience (4) - Capital (possible new element)

Broad Objective:

This element ranks the risk of reduced fishery business resilience due to access to capital.

Proposed Definitions (in rank order based on EOP feedback):

#1 - Risk of reduced fishery business resilience due to business and economic pressures (e.g., insurance, inflation, gas, capital, etc.) (Note: this would essentially be a comprehensive element that combines elements #4, #5, and #6)

#2 - Risk of reduced fishery business resilience due to financial constraints (e.g., access to capital, inflation)

Suggested Definition:

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

This would collapse Commercial Fishery Resilience 2, 3, & 4 into a single element, per the Committee and AP feedback.

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 Commercial Value indicator previously identified in order to ensure no double-counting occurs.

Fishery Resilience (5) – Insurance Availability (possible new element)

Broad Objective:

This element ranks the risk of reduced fishery business resilience due to insurance availability.

Proposed Definitions (in rank order based on EOP feedback):

#1 - Risk of reduced fishery business resilience due to business and economic pressures (e.g., insurance, inflation, gas, capital, etc.) (Note: this would essentially be a comprehensive element that combines elements #4, #5, and #6)

#2 - Risk of reduced fishery business resilience due to insurance availability and cost

Suggested Definition:

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

This would collapse Commercial Fishery Resilience 2, 3, & 4 into a single element, per the Committee and AP feedback.

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 Commercial Value indicator previously identified in order to ensure no double-counting occurs.

Commercial Fishery Resilience - Shoreside Support

Broad Objective:

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

Proposed Definitions (in rank order based on EOP feedback):

#1 - Risk of reduced commercial fishery business resilience due to loss of shoreside support infrastructure

#2 - Risk of reduced shoreside support resilience

#3 (current) - Risk of reduced commercial fishery business resilience due to shoreside support infrastructure

Suggested Definition:

Commercial Fishery Resilience (Shoreside Support) - 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).

Recreational Fishery Resilience (possible new element)

Broad Objective:

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

Proposed Definitions (in rank order based on EOP feedback):

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

#2 - Risk of reduced shoreside business resilience (marinas, bait and tackle shops, etc.)

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

Suggested Definition:

Recreational Fishery Resilience (Shoreside Support) - 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?

Fishery Resilience (6) – Emerging Markets/Opportunities (possible new element)

Broad Objective:

This element ranks the risk of reduced fishery business resilience due to limited access to emerging markets/opportunities. *This risk element needs further clarification*

Proposed Definitions (in rank order based on EOP feedback):

#1 - Risk of reduced fishery business resilience due to business and economic pressures (e.g., insurance, inflation, gas, capital, etc.) (Note: this would essentially be a comprehensive element that combines elements #4, #5, and #6)

#2 - Risk of reduced fishery business resilience due to lack of access to emerging markets/opportunities

Suggested Definition:

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

This would collapse Commercial Fishery Resilience 2, 3, & 4 into a single element, per the Committee and AP feedback.

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 Commercial Value indicator previously identified in order to ensure no double-counting occurs.

Social-Cultural Elements:

Commercial Fleet Diversity

Broad Objective:

This element 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.

Proposed Definitions (in rank order based on EOP feedback):

#1 (current) - Risk of reduced fishery resilience (number and diversity of fleets)

#2 - Commercial Fishery Resilience (Revenue Diversity) - Risk of reduced of commercial fishery business resilience (at permit level) (Note: same as risk element as "Commercial Fishery Resilience – Revenue Diversity)

#3 - Risk of reduced fishery resilience (diversity of fleets)

Suggested Definition:

Commercial Fleet Diversity - 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).

Recreational Fleet Diversity (possible new element)

General Objective:

This element 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.

Proposed Definitions (in rank order based on EOP feedback):
#1 - Risk of reduced recreational fishery business resilience

#2 - Risk of reduced recreational fleet types

Suggested Definition:

Recreational Fleet Diversity - 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).

Community Vulnerability

General Objective:

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.

Proposed Definitions (in rank order based on EOP feedback):

#1 (current) - Risk of reduced community resilience (vulnerability, reliance, engagement)

#2 – Risk of reduced community resilience (vulnerability, reliance, engagement, loss of traditional knowledge)

Suggested Definition:

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

Indicators:

Current indicators include the following:

- 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.
- **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.

Food Production Elements:

Commercial Seafood Production

Broad Objective:

This element describes the risk of not optimizing domestic seafood production from Council-managed species.

Proposed Definitions (in rank order based on EOP feedback):

#1 (current) - Risk of not optimizing commercial seafood production

#2 - Risk of not increasing domestic seafood production

#3 - Risk of not maintaining domestic seafood production

#4 - Risk of decreasing domestic seafood production

Suggested Definition:

Commercial Seafood Production - Risk of not optimizing commercial seafood production (current).

Indicators:

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

Recreational/Subsistence Food Production

Broad Objective:

This element describes the risk of not maintaining personal food production.

Proposed Definitions (in rank order based on EOP feedback):

#1 (current) - Risk of not maintaining personal food production.

#2a - Risk of not satisfying demand for personal food production.

#2b - Risk of negatively impacting those who rely on personally catching/harvesting seafood for family subsistence.

#2c - Risk of not increasing personal food production.

Suggested Definition

Recreational/Subsistence Seafood Production - Risk of not maintaining personal food production (current)

Indicators:

The current indicators include total recreational harvest (all species) and harvest per angler trip.

Commercial Employment (possible new element)

Broad Objective:

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?

Proposed Definitions (in rank order based on EOP feedback):

#1 - Risk of not optimizing commercial job creation and retention

#2 - Risk of not optimizing commercial employment opportunities

#3 - Risk of not maximizing commercial employment opportunities and wages

Suggested Definition:

Commercial Employment - 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, gas, etc.)? Should it be estimated at the system level, state level, or something else?

Recreational Employment (possible new element)

Broad Objective:

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?

Proposed Definitions (in rank order based on EOP feedback):

#1 - Risk of not optimizing recreational job creation and retention

#2 - Risk of not optimizing recreational employment opportunities

#3 - Risk of not maximizing recreational employment opportunities and wages

Suggested Definition

Recreational Employment - 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?

Seafood Safety (possible new element)

Broad Objective:

This element describes the risk to market access (e.g. spiny dogfish EU market; surfclam on Georges Bank and Paralytic Shellfish Poisoning) as well as potential risks to human health. This objective should be refined if possible.

Proposed Definition:

#1 - Risk of not maintaining access to markets and not minimizing risks to human health

Suggested Definition

Seafood Safety - Risk of not maintaining access to markets and not minimizing risks to human health

Indicators:

Previously, the number of health advisories for a Council managed species was proposed to determine risk.

Management Elements:

Fishing Mortality Control

Broad Objective:

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.

Proposed Definitions (in rank order by EOP feedback):

#1 (current) - Risk of not achieving OY due to inadequate management control (measurement and monitoring)

#2 - Risk of not achieving OY due to inadequate or excessive management control (measurement and monitoring)

#3 - Risk of not achieving OY due to a mismatch of projected effects of management controls with harvest targets

Suggested Definition:

Option #3 appears to more closely reflect the intent of this element to understand how management controls may affect total catch, in either direction (too restrictive resulting in low catch or not restrictive enough resulting in catch exceeding ABC). Some slight re-wording of this option may be needed.

Indicators:

This element is currently evaluated by fishery sector (commercial and recreational); therefore, 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.

Technical Interactions

Broad Objective:

This element is applied at the species and sector (commercial and recreational) level and considerers 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.

Proposed and Suggested Definition (in rank order by EOP feedback):

#1 (current) - 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 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.

Other Ocean Uses

Broad Objective:

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/other industrial uses, etc.). 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 or other types of area-based management designations.

There are proposed new risk elements that specifically consider offshore wind and aquaculture; therefore, the scope associated with the broad objective for this risk element may need to be updated to reflect the remaining other ocean uses.

Proposed Definitions (in rank order based on EOP feedback):

#1 - Risk of not achieving OY due to fishery displacement or damage to resource/habitat from non-fishing ocean activities and user groups (Note: this definition would also change the risk element to "Other Ocean Uses and Users")

#2 (current) - Risk of not achieving OY due to fishery displacement or damage to resource/habitat from non-fishing ocean activities

#3 - Risk of not achieving OY due to fishery displacement or damage to resource/habitat from non-fishing ocean activities, user groups, and/or area designations

Suggested Definition:

Retain the current definition but maybe reword the risk element to "Other Ocean Activities" to clarify this element includes topics such as area-based measures (i.e., sanctuaries, monuments etc.) that may not be a specific ocean "use". It's not clear how other ocean "users" would be defined and if these users would be participating in activities that are different and distinct from the actual uses. If they are participants/users of these other uses, then they would be included in the current definition. In addition, users could be used as an indicator depending on how defined

Indicators:

There currently is no specific indicator for this element and expert judgment is used to determine impacts to fishery access and habitat quality and function due to other ocean uses. 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 could be calculated and qualify and spatial overlap with existing habitat and/or fishing ground locations. Could look to see what information and at what spatial scale is available from the NMFS Habitat Climate Vulnerability Assessment, the Mid-

Atlantic Council NRHA data explorer, and the America the CCC Area-Based Management tool.

Offshore Wind - Biological/Ecosystem (possible new element)

Broad Objective:

This element would be applied at the species level and considers the 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.

Proposed Definitions (in rank order based on EOP feedback):

#1 - Risk of not achieving OY due to biological impacts to stock productivity, distribution, and ecosystem structure/interactions

#2 - Risk of not achieving OY due to biological impacts to stock productivity

#3 (all offshore wind risks) - Risk of not achieving OY due to impacts on stock productivity, fishery access, scientific uncertainty, and ecosystem function

Suggested Definition:

Additional EOP/Council input is needed to identify a preference for either one Offshore Wind risk element that captures all potential risks or separate out risks into different risk elements. The risks associated with a biologically focused element are more likely to remain relatively stationary (i.e., the impacts for a particular species will be the same, but the scale may change as more offshore development changes), while scientific and access risks may be more dynamic and more tractable. Of the two biological/ecosystem focused definitions considered here, definition #1 seems to be more appropriate.

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). Translating exposure into a risk of impacts, which is likely to be different by species, may be challenging.

Offshore Wind - Fishery Science and Access (possible new element)

Broad Objective:

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.

Proposed Definitions (in rank order based on EOP feedback):

#1 (all offshore wind risks) - Risk of not achieving OY due to impacts on stock productivity, fishery access, scientific uncertainty, and ecosystem function

#2 - Risk of not achieving OY due to fishery impacts to due access, stock availability, and scientific uncertainty

Suggested Definition:

Similar to the comment under the Offshore Wind - Biological/Ecosystem risk element above, this is really how the EOP/Council wants to consider risks from offshore wind development - a comprehensive element or separate risk elements for different risks. Under this option, EOP Committee and AP feedback favored a more comprehensive risk element.

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.

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).

Offshore Energy - Exclusive of Wind (possible new element)

Broad Objective:

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.

Proposed Definitions (in rank order based on EOP feedback):

#1 - Risks from other offshore energy production not as habitat beneficial as offshore wind turbines

#2a - Risks from all offshore energy production on offshore habitat

#2b - Risks to habitat and council-managed species from non-fishing offshore activities other than wind energy

#2c - Risks of offshore energy exploration and/or production other than offshore wind

Suggested Definition:

Additional EOP/Council input on this risk element is needed. There are other risk elements that consider other ocean uses (some with/without offshore wind considerations) and habitat condition which could address the risks associated with the proposed definitions included here. Clarity and additional feedback on the metric objectives and associated risks the EOP are interested in considering for this element would be beneficial.

Indicators:

Depends upon definition.

Aquaculture (possible new element)

Broad Objective:

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.

Proposed Definitions (in rank order based on EOP feedback):

#1 - Risks from escapes and contamination on Council-managed species

#2a - Risks from wastes produced by aquaculture, antifoulants, antibiotics, and other chemicals used in aquaculture etc. used in cage culture

#2b - Risks from escapes and contamination on Council-managed species and aquaculture displacement on existing fisheries

#2c - Risks from escapes, contamination and area closures from any aquaculture species

#2d - Risks stemming from ocean aquaculture operations on wild-stock fisheries in the Mid Atlantic

Proposed Definition:

Additional feedback from the EOP/Council on this risk element would be beneficial.

Indicators:

Previous Mid-Atlantic State of the Ecosystem report have included an aquaculture indicator that provides information on total aquaculture production in the Mid-Atlantic. 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

Broad Objective:

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.

Proposed Definitions (in rank order from EOP feedback):

#1 - Regulatory Compliance - Risk of not achieving regulatory compliance due to complexity and modifications

#2 (current) - Regulatory Complexity and Stability - Risk of not achieving compliance due to regulatory complexity and modifications

#3 - Regulatory Complexity and Stability - Risk of not achieving OY due to regulatory complexity and modifications

Suggested Definition:

The revised risk element and definition associated with option #1 (Regulatory Compliance) provides a subtle but important change to highlight the risk associated with this element is compliance with the implemented regulations.

Indicators:

This element could be evaluated by quantifying the number of regulations and/or the frequency of regulatory changes, based on evaluation of the Code of Federal Regulations. In terms of recreational fisheries, the magnitude and frequency of change in management measures (size and bag limits, seasons, etc.) could also be evaluated/quantified. To date, Council staff have considered the frequency of regulatory change over the last 5 years by fishery and sector. The number of law enforcement citations or warnings could be used determine compliance, but information at the fishery and sector level could be limited. For the recreational fishery, the proportion of non-compliant harvest relative to total harvest reported by MRIP could be used as a measure of compliance for each recreational fishery.

Discards

Broad Objective:

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.

Proposed Definitions (in rank order based on EOP feedback):

#1 - Risk of not minimizing discard/bycatch mortality to extent practicable

#2 (current) - Risk of not minimizing discards/bycatch to extent practicable

#3 - Risk of not minimizing regulatory discards/bycatch to extent practicable

#4 - Risk of not minimizing incidental catch to the extent practicable.

Suggested Definition:

This is up to the EOP/Council to decide what is of most interest. Minimizing discard mortality is an important management goal and is a risk to optimizing yield and stock biomass. Including discard/bycatch mortality as part of this risk element can help highlight this priority and risk for the Council and stakeholders, but tracking with an indicator may be challenging (see additional information below).

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 were 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 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.

Allocation

Broad Objective:

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.

Proposed Definitions (in rank order based on EOP feedback):

#1 (current) - Risk of not achieving OY due to spatial mismatch of stocks and management or sub-optimal allocation by sector and/or area

#2 - Risk of not achieving OY due to mismatch between fishery conditions and existing allocations

#3 - Risk of not achieving OY due to spatial or user group mismatch of stocks and management

#4 - Risk of not achieving OY due to spatial mismatch of stocks and management as a result of climate-driven distribution shifts (note: this option would drop this risk element and would be considered as part of the "Distribution Shifts" risk element under the Ecosystem elements)

#5 - Risk of de facto allocations due to lack of recreational accountability

Suggested Definition:

EOP feedback on this element was nearly equally divided across the definition options, including the option to incorporate this risk as part of the "Distribution Shift" risk element. The risks associated with Allocation appear to be of interest to the EOP, but allocation risks due to spatial mis-match may/may not be the primary area of interest. Additional feedback from the EOP/Council on how allocation risks should be considered and what risks are most important.

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 any of the possible Allocation definitions. 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.

Essential Fish Habitat (possible new element)

Broad Objective:

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.

Proposed Definitions (in rank order based on EOP feedback):

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

#2 - Risk of not identifying and/or protecting essential fish habitat

#3 - Risk of not identifying, protecting, and loss of essential fish due to offshore wind development

Suggested Definition:

Given EOP feedback to date, the top ranked proposed definition appears to capture the risks of concern and focuses on EFH associated with Council-managed species where the Mid-Atlantic Council has some direct control and input.

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. The Council is currently reviewing EFH designations for all Council-managed species and outcomes from that action could be applied here.

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