UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543-1026

01 March, 2023

Mid-Atlantic Fishery Management Council
800 North State Street, Suite 201
Dover, DE 19901
Scientific and Statistical Committee

To the SSC,

In this memo we list comments and requests received on the 2019-2022 State of the Ecosystem (SOE) reports, and how we responded to those requests. We include comments from both Councils because adjustments to the report were made in response to both. We welcome feedback on whether this memo is useful and how to improve it for future SOE reporting.

The memo is now reorganized into categories of requests in descending order of overall Council priority. The new Priority column was derived from combined discussion with the Mid-Atlantic SSC ecosystem working group and a survey of selected MAFMC members coordinated by Council staff in July 2022.

The attached document includes a table where we summarize all comments and requests with sources. The Status and Progress columns briefly summarize how we responded, with a more detailed response in the numbered Memo Section. In each detailed response, we refer to SOE sections where changes are found or describe information that was not sufficiently developed to include in the 2023 SOE in an effort to solicit feedback on how best to develop indicators for future reports.

We welcome comments on the entire SOE report as well as information included in this memo, and look forward to feedback from the SSC and Council.

Sincerely,

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encl: State of the Ecosystem 2023: Request Tracking Memo

cc: Jon Hare

Introduction

In the table below we summarize all comments and requests with sources. The memo is now reorganized into categories of requests in descending order of overall Council priority. The new Priority column was derived from combined discussion with the Mid-Atlantic SSC ecosystem working group and a survey of selected MAFMC members coordinated by Council staff in July 2022. The Progress column briefly summarizes how we responded, with a more detailed response to each request in a section for each request category. In the Status column, "In SOE" indicates a change included in the report(s).

Table 1: State of the Ecosystem requests by category and Council priority.

Request	Year	Rank	Source	Status	Progress
System level thresholds/ref pts					
Compare EOF (Link) thresholds to empirical thresholds (Large, Tam)	2021	Highest	MAFMC SSC	In progress	Analysis planning with Mid SSC
Trend Analysis / Inflection / Break points	2019 - 2022	Highest	Both Councils and SSCs	In progress	Prototype analysis 2022-2023
Optimum yield for ecosystem	2021	Highest	NEFMC	In progress	Analysis planning with Mid SSC
How does phyto size comp affect EOF indicator, if at all?	2021	High	MAFMC	In progress	Analysis planning with Mid SSC
Sum of TAC/ Landings relative to TAC	2021	Moderate	MAFMC SSC	In SOE-MAFMC, In progress-NEFMC	Seafood Production section
Nutrient input, Benthic Flux and POC (particulate organic carbon) to inform benthic productivity by something other than surface indicators	2021	Low	MAFMC SSC	Not started	Lacking resources this year
Reduce indicator dimensionality with multivariate statistics	2020	Lowest	NEFMC	In progress	Analysis planning with Mid SSC
Management					
Incorporate social sciences survey from council	2020	High	NEFMC	Not started	Lacking resources this year
Management complexity	2019	High	MAFMC	In progress	Student work needs further analysis, no further work this year
Recreational bycatch mortality as an indicator of regulatory waste	2021	High	MAFMC SSC	Not started	Lacking resources this year
Include New England ports with significant reliance on mid species be included in the Mid SOE	2022	Unranked	MAFMC	In SOE	Other Ocean Uses: Offshore Wind section
Re-evaluate EPUs	2020	Lowest	NEFMC	Not started	Lacking resources this year
Short term forecasts					
Using phytoplankton trends to forecast fish stocks	2022	High	MAFMC	Not started	Lacking resources this year
Short term forecasting (water temp, productivity)	2022	High	NEFMC	Not started	Lacking resources this year
Regime shifts					
Time series analysis (Zooplankton/Forage fish) to tie into regime shifts	2021	High	MAFMC SSC	In progress	Individual projects started
Regime shifts in Social-Economic indicators	2021	High	NEFMC SSC	In progress	Analysis planning with Mid SSC
Multiple system drivers					
Linking Condition	2020	High	MAFMC	In progress	Not ready for 2023
Avg weight of diet components by feeding group	2019	High	Internal	In progress	Part of fish condition project
Cumulative weather index	2020	Moderate	MAFMC	In progress	Data gathered for prototype

Request	Year	Rank	Source	Status	Progress
Fall turnover date index	2021	Moderate	MAFMC SSC	In SOE	Climate and Ecosystem Productivity section
Modeling cold pool/warm core ring and wind development interactions	2022	Moderate	MAFMC	Not started	Lacking resources this year
Impact of climate on data streams (changes in catchability of survey)	2022	Moderate	NEFMC SSC	Not started	Lacking resources this year
Young of Year index from multiple surveys	2019	Moderate	MAFMC	Not started	Lacking resources this year
Links between species availability inshore/offshore (estuarine conditions) and trends in recreational fishing effort?	2021	Unranked	MAFMC	In progress	Bluefish prey index inshore/offshore partially addresses
Tell Social stories like we try to tell biological stories	2022	Unranked	GARFO	Not started	Lacking resources this year
What determines a "risk"? Include aquaculture as a risk?	2022	Unranked	NEFMC SSC	Not started	Lacking resources this year
Mean stomach weight across feeding guilds	2019	Low	MAFMC	In progress	Intern evaluated trends in guild diets
Environmental Justice - Further Explanation and maybe have Soc Sci folks on call to explain	2022	Low	MAFMC SSC	In SOE	Social and cultural section
Changing per capita seafood consumption as driver of revenue?	2021	Low	MAFMC	Not started	Lacking resources this year
Relate OA to nutrient input; are there "dead zones" (hypoxia)?	2021	Low	MAFMC	Not started	Lacking resources this year
Estuarine Water Quality	2020	Low	NEFMC	In SOE-MAFMC, In progress-NEFMC	Intern project 2021 needs expansion
Decomposition of diversity drivers highlighting social components	2021	Lowest	MAFMC SSC	Not started	Lacking resources this year
Indicators of chemical pollution in offshore waters	2021	Lowest	MAFMC	Not started	Lacking resources this year
Estuarine condition relative to power plants and temp	2019	Lowest	MAFMC	Not started	Lacking resources this year
Functional group level status/thresholds/ref pts					
Forage availability index (Herring/Sandlance)	2021	Moderate	NEFMC	In SOE	Climate and Ecosystem Productivity section
VAST and uncertainty	2020	Moderate	Both Councils	In progress	Not ready for 2023
Seal index	2020	Low	MAFMC	In progress	Not ready for 2023
Apex predator index (pinnipeds)	2021	Low	NEFMC	In progress	Protected species branch developing time series
Biomass of spp not included in BTS	2020	Lowest	MAFMC	Not started	Lacking resources this year
Stock level indicators					
Shellfish growth/distribution linked to climate (system productivity)	2019	Moderate	MAFMC	In progress	Project with A. Hollander
Indicator of scallop pred pops poorly sampled by bottom trawls	2021	Moderate	NEFMC	Not started	Lacking resources this year
Sturgeon Bycatch	2021	Lowest	MAFMC SSC	Not started	Lacking resources this year
SOE admin					
SOE usage tracking	2022	Unranked	MAFMC SSC	In progress	Request in to communications experts
Include estimates of inclusion years in request memo	2022	Unranked	NEFMC SSC	In progress	Reorganized memo to clarify project timing

Responses to comments

System level thresholds/reference points

Further refining ecosystem level overfishing (EOF) indicators and investigating optimum yield (OY) at the ecosystem level was identified as highest priority by both the MAFMC SSC working group and by surveyed MAFMC members. Methods for evaluating ecosystem indicator trends, inflection points, and breakpoints (regimes, see below) were also ranked highest priority by both SSC and Council as these methods apply to ecosystem level thresholds and reference points, as well as to indicators at the functional group or stock level, or to indicators of climate or habitat risk. Several other SSC and Council requests are related to or support these analyses and can likely be addressed by planned analyses.

The EOF indicators were first presented in 2021 and were discussed in depth with the MAFMC SSC working group in April 2022 and February 2023. Considerable progress has been made on updating data inputs for the EOF indicators and planning for system level threshold analyses with the MAFMC SSC. After reviewing previous presentations of the EOF indicators, Andy Beet (NEFSC) reviewed solutions to several data input problems identified in July 2022 (menhaden landings were added and differences between different data sources were resolved). An outstanding data input task is completing discard estimates for all species in the Northeast US, which is in progress.

An in depth review of methods and associated thresholds for the three EOF indicators has been completed. A plan for adapting these methods to data specific to our region (primary production and landings) was discussed with the MAFMC SSC. Finally, a simulation study is being planned to use the Northeast US Atlantis ecosystem model [1] to investigate robustness of thresholds and determine how informative they can be. This portion of the research will likely address the MAFMC request to evaluate how phytoplankton size composition might affect the EOF indicator. It will also address SSC questions raised about tradeoffs between fishing for different species groups to address EOF, and how climate driven changes in transfer efficiency might be incorporated into or impact EOF indicators. In addition, the NEUS Atlantis model may be able to address the lower priority requests on nutrient input and benthic flux contributions to system productivity once model sensitivity analysis determines whether these model components behave reasonably. We expect to present results of EOF analyses to the SSC in late 2023. If reviews are positive, EOF indicators may appear in the 2024 SOE, and if further work is needed they should appear in the 2025 SOE.

Automated methods for estimating both short term and long term trends, evaluating time series inflection points, and identifying breakpoints (regimes) are being tested.

- The `ecodata` R package already incorporates long term trend estimation based on Hardison et al. [2]. This research found that trends were most robustly distinguished from autocorrelation in indicator time series of 30 years or longer. However, there is still considerable interest in robust methods for assessing short term trends, especially for the most recent portions of time series and for shorter indicator time series. In 2022, work was initiated on short term trend analysis robust to autocorrelation by Andy Beet and Kim Bastille (NEFSC). The short term trend fitting method needs more simulation testing to address performance with missing data. If this simulation can be completed, it is likely to be available for SOE and risk assessment analyses in 2023 for possible inclusion in the 2024 SOE.

- Kim Bastille (NEFSC) has also been working on methods to identify inflection points in indicator time series based on Large et al. [3] and [4]. A standardized method has been implemented as a prototype and applied to several existing SOE indicators in 2022, but several questions on default approaches to be used across multiple indicators require more in depth analysis and review. If this work can be completed, it is likely to be available for SOE and risk assessment analyses in 2023 for possible inclusion in the 2024 SOE.

- A method for identifying breakpoints has been implemented by Kim Bastille and Laurel Smith (NEFSC) and a prototype analysis developed using SOE indicators in 2022. If this method can be further developed, it may be reviewed in 2023 along with other regime shift analyses (see below).

Work is in progress by John Walden and Geret DePiper (NEFSC) to combine multiple indicators into single integrated indices (Index Numbers) using Data Envelopment Analysis. This work has been reviewed by the MAFMC SSC ecosystem working group in July 2022 and again in February 2023. Index Numbers evaluate sets of environmental indicators and management output indicators to determine system performance. The approach combines

important management outputs linked to objectives (e.g. commercial revenue, recreational days fished, right whale abundance) and likely ecosystem drivers of change in these outputs (e.g., chlorophyll a, zooplankton, aggregate fish biomass) into an analysis evaluating aggregating inputs and outputs into single indicators used to determine whether system performance has improved over time relative to a reference year. An initial case study using the SOE indicators identified above was presented in July 2022, and a follow up analysis evaluating individual Index Numbers for SOE management objectives (Seafood Production, Recreational Opportunities, etc.) was presented in February 2023. Integrated Index Numbers based on some of these case studies may be further reviewed by the MAFMC SSC ecosystem working group and developed for the 2024 SOE.

Management

Council members tended to give higher priority rankings to requests in this category relative to the SSC working group, but overall both ranked management related requests high priority.

In 2022, MAFMC requested that New England ports with significant reliance on Mid-Atlantic managed species be included in the Mid-Atlantic SOE analysis of potential risks to fishery management from offshore wind development. Angela Silva (NEFSC) evaluated landings for all New England ports by both value and pounds, and included New England ports with over 50% of maximum value or pounds MAFMC managed species landed from wind areas between 2008-2021. Six ports were identified as "significantly reliant" using this criteria, and we included this information in the 2023 MAFMC SOE (p.43-44).

We lacked resources to address three high-ranked requests this year, including incorporating a social sciences survey from the NEFMC, continuing development of a management complexity indicator started by an intern in 2020, and developing an indicator of regulatory waste based on recreational bycatch mortality.

We are unfamiliar with the social sciences survey highlighted by NEFMC. Additional information on this survey is needed in order to follow up on this request.

It may be possible to address the requests on management complexity and recreational bycatch mortality as part of the Mid-Atlantic EAFM risk assessment update in 2023 if appropriate expertise can be brought into this process.

The request to re-evaluate Ecosystem Production Units (EPUs) was ranked lowest priority. We do not forsee having the resources to address this request, which is a large project, in the near future.

Short term forecasts

The SSC working group ranked these new requests higher priority relative to Council members, but overall both ranked short term forecasting requests high priority.

While using phytoplankton trends to forecast fish stocks may be feasibly simulation tested within the Atlantis modeling framework described above for EOF indicators, this is a long term project that would require dedicated effort to achieve, likely by a postdoctoral researcher.

Some experimental short term forecasts of regional water temperature are currently available, and could be investigated or presented to the SSCs during the 2024 cycle if this remains a high priority. Short term forecasts of species distributions for fisheries management are in progress with Rutgers University and MAFMC, which may also address this request. Skill assessment of these forecasts, as well as determining the context in which they would be used (stock assessment projections? habitat projections? other uses?) would be needed to bring them into the management process (this is better developed for the ongoing Rutgers/MAFMC project). Incorporating short term forecasts into the SOE outside the ongoing Rutgers/MAFMC project would require a similar level of effort to the phytoplankton/fish forecasting project above.

Additional resources are needed to address these requests in the coming year.

Regime shifts

Adding information on regime shifts was considered a high priority by both the Council and SSC. Time series analysis of zooplankton and forage fish to evaluate potential linked regime shifts is currently in progress, and multiple projects may contribute to this. We are working to coordinate existing projects (see below) into a synthesis product for the

SOE. Because the projects are on different timelines, it is difficult to give a target date for SOE synthesis. However, we expect to have some project results published prior to the 2024 SOE. With these publications complete, some synthesis may be presented in the following SOE cycle.

Table 2: Selected Regime Shift Projects. Methods: rpart = recrusive partitioning R package, DFA = dynamic factor analysis, EOF = empirical orthoganal function, SEWS = spatial early warning signals, DEA = data envelopment analysis, GAMs = general additive models. Ecosystem Component: Env = environmental drivers, Fish = fish, Zoo = zooplankton, Landings = fishery landings.

Analysis	Methods	Ecosystem Component	Temporal Scale	Spatial Scale	Availability
SOE Indicator Comparison	rpart	Env to Fish	Annual	EPU	Available Now
Condition (1)	rpart	Env to Fish	Annual, fall only	EPU or shelf	Multi species available now
Condition (2)	DFA	Fish	Annual?	EPU	In progress
Zooplankton	multiple	Zoo	Seasonal	EPU	In review
Zooplankton VAST	EOF	Zoo	Seasonal	EPU	In progress
SST	SEWS	Env	Annual?	NW Atlantic	In progress
DEA	DEA	Zoo to Landings	Annual	EPU	In progress
Stock Recruit	changepoint and GAMs	Fish	Annual	Stock	Not started, could use stock smart

Regime shifts in socio-economic indicators may be addressed in the ongoing work described above by John Walden and Geret DePiper (NEFSC) integrating multiple indicators into Index Numbers. Once the structure of the Index Numbers is determined, these time series can be evaluated for change points using any of the methods described in the table above.

Multiple system drivers

This category contains a wide array of requests with many projects currently in progress. There were two requests ranked high priority, eight ranked moderate priority (or unranked because they are newer requests), and eight ranked low or lowest priority. Given the number of SOE requests, those ranked lowest priority that have not already been started are unlikely to be addressed.

The high priority request in this category is incorporating the ongoing fish condition project and associated analyses into the SOE. Regime shift analyses of fish condition may be available for the 2024 SOE, while linking fish condition to ecosystem drivers using GAMs will require more time with current resources.

One moderate priority request was included in the 2023 SOE: a fall turnover index has been included in both the MAFMC and NEFMC reports in the Climate and Ecosystem Productivity sections.

One low priority request was included in the 2023 SOE: we updated text with further explanation of the Environmental Justice indicators.

An unranked request to evaluate links between species availability inshore and offshore and trends in recreational fishing effort was partially addressed using a spatial index of forage fish to evaluate bluefish availability to the recreational fishery during the research track assessment in December 2022. This forage fish index has been included in the 2023 SOE.

Several other moderate/unranked and low priority requests are currently in progress or started as intern projects, including a cumulative weather index, mean stomach weights across feeding guilds, and estuarine water quality for the NEFMC SOE. If sufficient resources are found to finish these projects, they could be included in the 2024 SOE.

Functional group level status/thresholds/ref pts

Requests in this category were considered moderate to low priority by the SSC and Council. However, many were already in progress prior to ranking, and one has been included in the 2023 SOE.

The NEFMC requested a forage availability index (including both managed species such as herring and unmanaged species such as sandlance). A spatial index of forage availability was developed for the bluefish research track assessment as described above. This index was partitioned into EPUs and presented in both the 2023 MAFMC and NEFMC SOEs in the Climate and Ecosystem Productivity sections.

Gray seal pup count indices are already included in the NEFMC SOE, and indices of populations for other seals and apex predators are in development by the protected species branch. These additional indices were not ready for the 2023 report.

Investigating time series of biomass for species not well represented in bottom trawl surveys was partially addressed by the forage index included in the 2023 report. However, only a subset of forage species are not well represented in bottom trawl surveys, and other species that are not forage are also not well represented in bottom trawl surveys. This request was ranked lowest priority by the Council and SSC, and given the difficulty of synthesizing data on poorly sampled species, is unlikely to be addressed in the near future.

Stock level indicators

Requests in this category were ranked moderate to lowest priority by the SSC and Council. Indicators of this nature would be well suited to Ecosystem and Socioeconomic Profiles (ESP) developed during research track assessments for individual stocks. Some aspects of these indicators may benefit SOE reporting as well.

One request, linking shellfish growth and distribution to climate change and system productivity, is in progress. Alexis Hollander (VIMS) completed her thesis on surfclam growth in relation to bottom temperature in 2022, and information from this work can likely be included in the 2024 SOE, pending publication of student thesis results.

The request for indicators of scallop predators that are poorly sampled by bottom trawls is similar to the request in the category above addressing all species not well sampled by bottom trawls. It is possible that this request could be clarified and addressed during a scallop research track assessment.

The request for a sturgeon bycatch indicator was ranked lowest priority by the SSC and Council, so is unlikely to be addressed in the near future.

SOE admin

These relatively new requests were not ranked; however, both are in progress.

Investigation of uses of the SOE as requested by the MAFMC SSC is in progress with the assistance of NOAA communications experts using a combination of website analytics and citation information. We hope to have an update on uses of the SOE for the 2024 report/request memo.

The restructuring of this memo according to prioritization is intended to partially address the requests for timelines on in progress SOE requests by the NEFMC SSC. While not all project timelines are currently available, we have reported estimates in this document where possible. In addition, the effort to prioritize requests in 2022 ensures that limited resources are applied to the highest priority issues.

References

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