Mid-Atlantic Fishery Management Council

Scientific and Statistical Committee Meeting

May 12, 2021

Research Track Assessment Schedule and Information

Background

In late May, the Northeast Region Coordinating Council (NRCC) will review project proposals and decide what stock-specific and/or topic-based assessments will be placed on the 2026 research track stock assessment schedule. The current 2021-2025 research track schedule is provided in Table 1.

A group of 14 proposals, 8 stock-specific and 6 topic-based, were identified by NRCC partners as a potential "wish list" of species and topics that could be further developed, evaluated, and considered for the 2026 research track schedule. An NRCC stock assessment planning group, comprised of NRCC partners including SSC members, recently reviewed the 14 proposals under consideration. After the review, the planning group developed consensus recommendations for both topic-based and stock-specific priorities for the NRCC to consider and ultimately decide which will be added to the 2026 schedule. Those that don't make the 2026 schedule, along with any new proposals, will then be considered in 2022 by the NRCC when developing the 2027 research track schedule.

The recommended priority proposals (1 topic-based and 3 stock-specific) that will be reviewed by the NRCC are provided here for SSC review. The SSC should provide any feedback on the proposals and identify any priorities the NRCC might want to consider.

Table 1. Current 2021-2025 research track stock assessment schedule as approved by the NRCC

YEAR	"SPRING" STOCKS/TOPIC	"FALL" STOCKS/TOPIC
2021	Haddock- GOM, GB, EGB (TRAC)	Butterfish and Shortfin Squid
2022	American Plaice, Spiny Dogfish	Black Sea Bass, Bluefish
2023	Cod- GOM, GB & EGB (TRAC)	Applying State-Space Models
2024	Golden Tilefish, Scallops	Yellowtail Flounder - CC/GOM, SNE/MA, and GB (TRAC)
2025	Atlantic herring, American lobster	Ensemble modeling

Stock-Specific Proposals

1. Winter Flounder (3 stocks)

Background

The last benchmark assessment was completed at SARC 52 in 2011 for all three winter flounder stocks. An analytical model for Gulf of Maine (GOM) winter flounder was not accepted at SARC 52 due to serve retrospective error. The GOM winter flounder assessment is based on a simple 30+ cm area swept biomass estimate using non-overlapping strata from three different surveys (MDMF, MENH, NEFSC). The Georges Bank (GB) winter flounder assessment is based on a VPA model formulation while the Southern New England (SNE) winter flounder assessment uses an ASAP model. Both the GB and SNE stocks were determined to be overfished and are in rebuilding plans.

Research Focus/Goals

Georges Bank winter flounder

The assessment of the Georges Bank stock is considered "data-poor" for the following reasons:

1. The VPA model lacks adequate age and discard data

    a. There are no Canadian length or age data for their GB sea scallop dredge fleet and there are no Canadian survey age-length keys (we have asked that age data be collected during their spring surveys, but to no avail)
    b. NEFSC spring and fall BT survey age-length keys are used to estimate US discards-at-age for a large portion of the US bottom trawl and scallop dredge/trawl time-series because the NEFOP discard length-frequency data in recent years consists of very small sample sizes or are lacking.
    c. The stock-recruit relationship is so poor that the B-H steepness factor for this stock is "fixed" and based on the steepness factor estimate for the SNE-MAB winter flounder stock. That is the reason these two stocks have historically been assessed concurrently.

The retrospective error associated with use of the VPA model is major for this stock.

The current VPA model cannot account for the measurement error and process error associated with use of the available assessment data. Consequently, the next assessment should be a Research Track assessment. Improvements to the type and quantity of Canadian data are unlikely to be implemented by the Canada Division of Fisheries and Oceans because winter flounder are not an important commercial species there. Rather than data improvements, a Research Track assessment for this stock should focus on investigating a new assessment model. An ASAP model is a more flexible model than the VPA model and should be investigated to determine its utility. However, a model other than ASAP may be required (e.g., state-space model) to solve some of the assessment problems associated with this stock.

Gulf of Maine winter Flounder

Evidence of the conflicting trends which led to the rejection of the GOM analytical model still appear to be present in the data inputs. There is a lack of a relationship between the large decrease in the catch with little change in the indices and and/or size structure over time. The indices have remain flat since

SARC 52 with little change in the size structure while catches have remained near record lows. Questions remain as to why this stock does not appear to response to recent low catches and exploitation rates.

Southern New England Mid-Atlantic winter flounder

The SNE stock has also been near record low catches and low fishing mortality rates over the last decade. Recruitment is also near record lows and the indices of abundance are not responding to low catches. Indices of abundance suggest the stock continues to decline. There are also recent concerns surrounding the uncertainty with the built up of cryptic biomass in the assessment model through assumptions with dome shape selectivity. Like with the GB stock concerns also remain with the use of the stock recruit based biological reference points for the SNE stock. Questions also remain as to the role of environmental factors for inhibiting the rebuilding of the SNE stock.

Conclusion

Biological reference point issues based on the present stock-recruit relationship could be addressed in an upcoming level 3 management track assessment for GB and SNE stocks. Concerns with selectivity could also perhaps be addressed in a future level 3 management track assessment for the SNE stock. However, a change from a VPA to ASAP model formulation for GB will require a new benchmark assessment. At this time, it is not clear what new information will be available to inform a GOM winter flounder benchmark assessment with regards to answering important questions with conflicting trends in the input data. It will be difficult to vet a GOM benchmark analytical model formulation through peer review with conflicting trends remaining that led to a continued serve retrospective pattern. It is recommended for the current stock assessment time-table that SNEMA and GOM winter flounder remain in the management track and that GB winter flounder is put on the research track for 2026.

2. Longfin Squid

Doryteuthis pealeii is an important component of the Northeast U.S. ecosystem, as both predator and prey. The species has a lifespan of 6-8 months, is semelparous, and spawns year-round with two spawning peaks that result in two dominant intra-annual cohorts (Brodziak and Macy, 1996; Macy and Brodziak, 2001). These cohorts have different growth and maturation rates, similar to many other loliginid squid species. Since the 1996 benchmark assessment (SARC 21), these two intra-annual cohorts have been recognized and separate per-recruit analyses have been conducted on each cohort to account for the differences in their growth rates and sizes-at-maturity. Nevertheless, a single set of reference points has been adopted for *D. pealeii,* mainly because the reviews of squid stock assessments have been viewed as short-lived finfish stocks for which the results must be "annualized". Globally, the assessment and management of most other loliginid squid stocks are conducted separately for each cohort (i.e., separate reference points).

The two *D. pealeii* cohorts show differences in apparent productivity levels. The biomass level of the cohort caught in the NEFSC spring survey is only about $1/5^{th}$ of the biomass level for the cohort caught in the fall survey, yet the relative exploitation rate on the spring survey cohort is higher than it is for the fall survey cohort. Thus, the cohort caught in the spring survey is at greater risk for recruitment overfishing. However, if the two cohorts were assessed and managed as separate stocks, cohort-specific quotas could be established to account for the differences in apparent productivity.

Since the 2010 benchmark assessment (SARC 51), swept-area biomass and relative exploitation rates have been estimated separately for each of the two intra-annual cohorts. However, a single BMSY proxy is then estimated for stock status determination. This involves averaging the spring and fall survey biomass estimates. At the February 25, 2020 AOP meeting for this stock, a Level 3 Management Track assessment was recommended, but the proposal to improve the assessment by conducting separate reference points for each of the two intra-annual cohorts was rejected because it would mean assessing them as separate "stocks" and would therefore require a Research Track assessment. However, the AOP members agreed that because the current assessment already involves separate biomass and relative exploitation rate estimates for each cohort, the estimation of separate BMSY proxies could be presented as an "exploratory" analysis in the upcoming June 2020 Management Track assessment.

There is currently no Research Track assessment planned for *D. pealeii* through 2025 and the stock is only assessed every three years, despite its sub-annual lifespan. Consequently, rather than wait for more than five years, this proposal aims to address the issue of assessing the two intra-annual cohorts as separate stocks in 2025 in a Research Track assessment. In addition, research would also include the estimation of F reference points (currently lacking) along with determining the potential for conducting in-season assessments (for adaptive management) of this sub-annual species as is considered the ideal way to assess and manage cephalopod stocks.

3. Monkfish

Background

Monkfish assessment results historically have been viewed with caution due to uncertainties in data inputs and underlying assumptions. These include likely catch underreporting in the early years of the fishery, low catchability of monkfish in fishery-independent surveys, lack of information on stock structure, and perhaps most importantly, our inability to age them (and therefore lack of information on growth). The first two problems are no longer as significant, as the early catch record may be less important with the passage of years and modernization of the NEFSC bottom trawl survey greatly increased the catchability of monkfish. However, stock structure is still not clearly understood and aging methods have recently been invalidated.

Monkfish are assessed as if they constitute two separate stocks (split roughly by Georges Bank), but aspects of their biology suggest a panmictic population. A genetic study currently underway (Monkfish RSA) may shed light on this topic before 2025, and long term tagging studies begun in 2007 could also help elucidate this question; however, results have been very slow to emerge from the tagging study.

A recent study found that the vertebral method for ageing monkfish is not valid and suggested that the illicium (the first dorsal fin ray) may be a feasible alternative age structure (Bank et al. 2020, Fish. Bull. 118:8-20). Subsequent work (S. Sutherland and A. Richards, in progress) has failed to validate ageing with illicia, but has shown that growth rates far exceed those estimated using vertebrae. A study in progress (Univ. MD) using hard part microchemical structure (vertebra, otolith, illicium) and known-age monkfish may allow interpretation of marks on hard parts that will allow age interpretation. That study is expected to be completed in 2021. A second study using histological methods for ageing (similar to shark vertebral ageing) is also underway (Monkfish RSA), and is expected to be completed in 2021 or 2022.

Research Focus/Goals

1) Review the relevant evidence for stock structure of monkfish to evaluate whether there is significant mixing between monkfish management areas and structure the assessment accordingly.

2) If an accurate and unbiased ageing method can be developed, an age-based assessment could be conducted. However, hard parts for monkfish have not been collected since 2007, so historical catch at age and population age structure would need to be estimated from an age-length key.

3) If ageing is not possible, explore data-poor methods and index-based methods for assessing monkfish and developing reference points.

Topic-Based Proposal

Note: the ecosystem proposal provided below is a previous version and is currently being re-written to be more focused in scope and issues to consider. The updated proposal will be provided if available prior to the SSC meeting.

1. Consideration of ecosystem information and dynamic reference points in assessments

Background

Single-species age-based stock assessments have traditionally incorporated ecosystem impacts through the use of estimated weights at age matrices that integrate over all aspects of the ecosystem. Changes in weights at age from consistent gears, such as bottom trawl surveys, reflect changes in the population as well as measurement variability. Large scale declines in weights at age have been observed in a number of stocks in the region and indicate a decrease in ecosystem productivity. These changes in weights at age have been used when estimating biological reference points, resulting in a general decrease in the combined reference points across all stocks, again indicating a decrease in ecosystem productivity.

Mechanistic relationships to explain these changes in ecosystem productivity have not been easy to find or, when proposed, have not held up over time. Nearly all published explanatory relationships between environmental variables and stock productivity metrics have broken down as more years of data were collected. This is because the ecosystem is too complex to explain with a single variable. The changes currently occurring, and expected to occur in the near future, due to climate change are expected to exacerbate the difficulty in making predictions because of the lack of historical observations under similar conditions.

Research Focus/Goals

The goal of this research track is to address the call for Ecosystem Based Fishery Management that acknowledges changing climate conditions when making management recommendations. The two regional Councils have adopted different approaches to this issue. The MAFMC is adding ecosystem effects to single-species stock assessments, while the NEFMC is attempting to address ecosystem impacts holistically using multi-species models. These different approaches will both need to be addressed in this Research Track through closed-loop simulations to explore the trade-offs in each

approach. Identifying situations where the standard single-species stock assessment advice is incorrect should be a priority. Scientific advice for how to manage a stock that is expected to lose all its habitat in the region due to global climate change could also be addressed to inform short-term management advice.