2020 Management Track Peer Review Committee Report

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The Peer Review Committee (PRC) for Management Track Assessments met via webinar on June 22-25, 2020. Attendance at the meeting is provided in Appendix A. The PRC was asked to provide technical reviews of management track assessments for Atlantic herring (*Clupea harengus*), butterfish (*Peprilus triacanthus*), Atlantic surfclam (*Spisula solidissima*) and longfin inshore squid (*Doryteuthis (Amerigo) pealeii*). The assessments for these four species were prepared under guidelines prepared by 2020 Assessment Oversight Panel (AOP). These guidelines provide a pathway for continuing development of previously accepted assessments for each species including incorporation of the most recent data and understanding of biology of the species being assessed. The 2020 Assessment Oversight Panel considered Atlantic herring and butterfish to be Level 2 assessments and Atlantic surfclam and longfin squid as Level 3 assessments. As a result of this designation, the assessments for all four species required peer review.

We thank Russ Brown (Population Dynamics Branch Chief) and Michele Traver (Assessment Process Lead) for their support during the meeting. We thank the staff of the Population Dynamics Branch at NEFSC for the open and collaborative spirit with which they engaged the PRC. Our thanks extend not only to the analysts for each assessment, but also to the rapporteurs for taking extensive notes during the meeting. We also thank the other participants for helping make the meeting productive and collegial. Finally, the PRC thanks the staff at NEFSC for supporting the logistics during the meeting.

The PRC endorsed the assessments for all four species presented at the meeting for use in management. Analytical assessments were produced for Atlantic herring, butterfish, and Atlantic surfclam, each of which used a statistical catch-at-age model (Atlantic herring and butterfish) or a catch-at-age-and-length model (Atlantic surfclam). The assessment for longfin squid uses swept area biomass to estimate stock status. In each case the PRC endorsed the model and the inferences that resulted as representing the best scientific information available (BSIA), thereby providing a foundation for staff and the Mid-Atlantic and New England Fishery Management Councils and their SSCs to evaluate stock status and provide scientific advice.

Atlantic Herring

The 2020 assessment update for Atlantic herring is a Level 2 assessment in accord with the decision at the 29 April 2020 meeting of the AOP. The 2020 assessment is an update from the 2018 benchmark assessment (SAW 65) that used an ASAP modeling framework.

The PRC concludes that the 2020 assessment update for Atlantic herring is technically sufficient to evaluate stock status and provide scientific advice. The assessment represents BSIA for this stock for management purposes. The PRC agrees with the assessment report that the Atlantic herring stock is overfished and overfishing is not occurring. This is a change in status from the results of the 2018 benchmark assessment that indicated that the stock was not overfished and overfishing was not occurring.

The 2020 assessment used different methods to derive biological references points (BRPs) and conduct short-term projections than those in the 2018 benchmark assessment. The BRPs in the 2020 assessment were derived using only the selectivity of the mobile fleet (exclusively a USA fleet) because the fixed gear fleet (>90% Canadian) is not quota regulated and not subject to the same harvest control rules as the USA mobile fleet. However, the short-term

projections included catches from both fleets to ensure that the stock dynamics and probability of overfishing and overfished were still subject to the total stock harvests.

Terms of Reference (TOR)

1. Estimate catch from all sources including landings and discards.

This TOR was satisfactorily addressed. Landings and discard data from 2018 and 2019 were added to those used in the 2018 benchmark. Because Canadian fixed gear catches markedly increased in 2018 (11,912 mt) and remained high in 2019 (5,115 mt) while USA mobile catches declined (45,189 mt in 2018; 12,721 mt in 2019) due to regulatory changes, the percent of the annual total catch taken by the Canadian fishery significantly increased to 21% in 2018 and 29% in 2019. From 2012 to 2017, Canadian catches accounted for between 1% and 7% of the annual total catches.

The age compositions of catches from the two fleets also differ. The USA mobile fleet primarily harvests fish that are age 3 and older, while the Canadian fixed gear fleet generally harvests herring that are age 2 and younger (although in 2019, age 3 fish were also caught).

2. *Evaluate indices used in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.).*

This TOR was satisfactorily addressed. All four of the survey indices used in the benchmark assessment (NEFSC spring bottom trawl survey, NEFSC fall bottom trawl survey, NEFSC shrimp bottom trawl survey, and the NEFSC fall survey acoustic index) were updated through 2019. As well, survey age composition and age-length data were updated through 2019 from the NEFSC spring and fall surveys. Age data from the summer shrimp survey were collected for the first time in 2019.

Trends in relative abundance of herring from all four surveys indicate a substantial decline in stock abundance during the past few years. All four of the survey indices in 2019 were at or near record-low values. The most relevant Canadian assessments of the stock show similar trends in abundance.

Although the surveys do not efficiently catch age-0 or age-1 fish, they do track cohorts well from age 2 onwards and thereby provide information on year class strength.

3. *Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) as possible (depending on the assessment method) for the times series using the approved assessment method and estimate their uncertainty. Include retrospective analyses if possible (both historical and within-model) to allow a comparison with previous assessments, and to examine model fit.*

a. Include bridge runs to sequentially document each change from the previously accepted model to the updated model proposed for this peer review.

b. Prepare a "Plan B" assessment that would serve as an alternate approach to providing scientific advice to management if the analytical assessment were to not pass review.

This TOR was satisfactorily addressed. The same ASAP model configuration used in the 2018 benchmark assessment was used in the 2020 update. Diagnostic and residual patterns were evaluated for all of the model input data (fleet catches, fleet age compositions, survey abundance indices and age compositions), as well as for the estimates of fishing mortality, biomass, spawning stock biomass, and recruitment. The diagnostic and residual patterns were acceptable (i.e., residuals generally randomly distributed) and similar to those in the 2018 benchmark assessment.

No retrospective adjustments were needed in the assessment. A Plan B assessment was not necessary because the model-based assessment was accepted.

4. *Re-estimate or update BRP's as defined by the management track level and recommend stock status. Also provide quantitative descriptions of stock status based on simple indicators/metrics (e.g., age-size-structure, temporal trends in population size or recruitment, indices.).*

This TOR was satisfactorily addressed. BRPs were re-estimated in the 2020 assessment using only the selectivity of the USA mobile fishing fleet and exclude any mortality from the catches from the unregulated Canadian fixed gear fleet. This is likely to result in biased reference points to an unknown degree, but there are no widely accepted methods for calculating BRPs when one of the fleets is not controlled. The fixed gear catches are treated as management uncertainty and a risk issue that needs to be addressed by managers. In essence, the re-estimated BRPs are US-based reference points and allow stock status relative to these reference points to be affected by Canadian fixed gear catches, which are unregulated and outside of US control.

The re-estimated BRPs are the following:

F_{msy} proxy = 0.54; SSB_{msy} proxy = 269,000 mt; SSB threshold (1/2 SSB_{msy}) = 134,500 mt; MSY = 99,400 mt.

An F40% proxy was used for the overfishing threshold and the SSB proxy reference points are based on long-term stochastic projections.

Estimated spawning stock biomass has been declining since 2014 (when SSB was 317,080 mt) and in 2019 was estimated to be 77,883 mt, the lowest value since the late 1980s. The 2019 SSB is 29% of the SSB_{msy} value (269,000 mt) and below the SSB threshold. Therefore, the stock is now overfished.

Fishing mortality (F) on the fully-recruited age groups to the USA mobile fleet (ages 7-8) has markedly declined since 2010, and F in 2019 was estimated to be 0.25, the lowest value since the early 1990s, and well below the overfishing threshold F_{msy} proxy value (0.54). Therefore, overfishing is not occurring

Recruitment has shown high variability over the past 50+ years, which is attributed to the episodic nature of herring recruitment. Since 2013, recruitment has declined to record-low levels. Median age 1 recruitment in the stock is 3.43 billion fish at age 1. Recruitment of age 1 fish in 2019 was estimated to be 666 million fish.

5. *Conduct short-term stock projections when appropriate.*

This TOR was satisfactorily addressed. Short-term (2021-2023) projections were conducted using the harvest control rule described in Amendment 8 of the Atlantic Herring Fishery Management Plan as applied solely to the US mobile gear fleet. Annual catches by the Canadian fixed gear fleet were assumed to be constant at 4,778 mt, the sum of the 10-year (2010-2019) averages of the Canadian (4,669 mt) and US (109 mt) fixed gear catches. For 2020, the total catch was assumed to be 16,319 mt, resulting in an SSB of 56,375 mt and F=0.243 for the US mobile gear fleet.

6. *Respond to any review panel comments or SSC concerns from the most recent prior research or management track assessment.*

This TOR was satisfactorily addressed. However, several uncertainties exist in the stock assessment. These include:

- There is uncertainty in the natural mortality rate (M), which is assumed in the assessment to be constant among ages and years. This assumption is common in stock assessments of many fish species because studies to determine natural mortality rates in exploited fish populations are difficult to conduct. Some insight on M for herring might be gained from the results of multispecies models that incorporate prey and predator relationships.
- The projections are uncertain because (1) recruitment in 2019 is imprecisely estimated and (2) recruitment in 2022 was drawn from the CDF of the long-term recruitment estimates, which results in a mean value about

equal to the long term average. The PRC notes that achieving mean recruitment is unlikely given the very low recruitment estimates in the most recent years.

- Continued poor recruitment will be the principal factor influencing stock status in the near future, as fishing mortality is now low compared to historical levels.

Recommendations

1. Because acoustic methods are regularly used to survey and assess herring stocks in other areas of the world, use of a dedicated acoustic survey should be explored further.
2. The reference points assume an absence of fixed gear fishing, which means that fishing at the $F_{40\%}$ rate would not be expected to achieve $SSB_{40\%}$. The panel suggests modifying the current approach to include the effect of catches in the fixed gear fleet. For example, the SSB reference points could be modified to also estimate the F reference point. The approach would involve conducting long-term projections of the population under different assumptions of mobile gear F. The fixed gear catches would remain the same as in the current approach. The unfished condition would have the mobile gear F = 0 and the fixed gear catch = 0. A grid search over the mobile gear F could be used to find the mobile gear F that achieves 40% of the unfished SSB. The PRC recommends attempting this approach for the next management track or research track stock assessment.