

2022 Management Track Peer Review Panel Report

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Executive Summary

Eleven fish stock assessments were reviewed by the September 2022 Management Track peer review panel. Eight of these were Level 2 Expedited Reviews: Gulf of Maine and Georges Bank winter flounder (*Pseudopleuronectes americanus*), Atlantic halibut (*Hippoglossus hippoglossus*), Georges Bank haddock (*Melanogrammus aeglefinus*), north and south monkfish (*Lophius piscatorius*), Southern New England/MidAtlantic yellowtail flounder (*Limanda ferruginea*), and American plaice (*Hippoglossoides platessoides*). The remaining three stocks received Level 3 Enhanced Review: white hake (*Urophycis tenuis*), Gulf of Maine haddock (*Melanogrammus aeglefinus*), and pollock (*Pollachius virens*). Levels of review were as recommended by the Assessment Oversight Panel (Appendix A).

The Peer Review Panel (Panel) for the September 2022 Management Track Assessments met via webinar on September 19-22, 2022. The Panel was to determine whether the completed management track assessment was technically sufficient to (a) evaluate stock status, (b) provide scientific advice and (c) successfully address the assessment Terms of Reference (Appendix B). Tables 1 and 2 present a list of the stocks, names of the lead analyst/presenters, and conclusions about stock status and the assessment.

Attendance at the meeting is provided in Appendix C with the Agenda shown in Appendix D.

We thank Russ Brown (Population Dynamics Branch Chief) and Michele Traver (Assessment Process Lead) for their support during the meeting and to the staff of the Population Dynamics Branch at NEFSC for the open and collaborative spirit with which they engaged the Panel. Dr. Brown’s presentation on Data Changes was especially appreciated.

Our thanks also extend to the rapporteurs for taking extensive notes during the meeting and to staff of the New England Fishery Management Council/NOAA Fisheries Greater Atlantic Regional Fisheries Office who provided context and additional background.

The Panel has suggestions for improvements that could be made for review of Management Track assessments:

1. The SASI portal is an incredible asset for these reviews, and we support its continued maintenance. It is not unusual for documents and data to change on the drive during the period of the review, and as such, it would be useful if a version control mechanism was implemented to allow the reviewers to be notified when changes are made to documents on the site.

2. For transboundary stocks, it would be useful to have a presentation of the science and management for the Canadian fishery.
3. For species with multiple stocks, consider providing an overview of stock status, structure, etc. at the beginning of the stocks' presentations.

The Panel also has several crosscutting recommendations with respect to the individual stock assessments:

1. Assessment analysts should consider splitting the bottom trawl time series into two stanzas – Albatross versus Bigelow for those stocks where calibration between the two vessels surveys results was weak (e.g., pollock and white hake).
2. The NEFSC Bottom Longline Survey should be continued and considered for incorporation in future stock specific Management Track assessments once the time-series has grown.
3. The ASMFC shrimp survey provides valuable information on early year-classes for several species and should continue to be supported by NOAA (and perhaps renamed to the “Summer Survey”).
4. Reduction in Port sampling for individual lengths and age structures represents a significant threat to the stock assessment enterprise. NOAA should decide whether it can return Port sampling to levels comparable with those achieved prior to 2019. If they cannot, they should increase catch sampling by observers (either ASM or NEFOP) to balance the loss of these data.
5. NOAA should continue to evaluate the use of dynamic reference points with analytic assessments.
6. Assessments for stocks at very low abundance with low fishery mortality rates, showed sharp increases in abundance in projection years (e.g., Gulf of Maine winter flounder, SNE/MA yellowtail flounder). This is a highly uncertain prediction because these increases may be an artifact of the model considering that low fishing mortality directly leads to increased abundance.

The Panel considered general data changes that were applied across assessments, including:

1. Adaptation to survey indices resulting from the missing 2020 research surveys due to the Covid-19 pandemic;
2. Increased uncertainty in catch related indices resulting from reduced Port, NEFOP/ASM observer, and recreational intercept sampling in 2020;
3. Use of the Catch Accounting and Monitoring System (CAMS) data for commercial landings for 2020 and 2021; and
4. Revised swept-area adjusted survey indices for the NEFSC Bigelow Bottom Trawl Surveys.

Table 1. Stocks reviewed at September 2022 Management Track Assessment Peer Review meeting

Stock	Lead Analyst/Presenter	Peer Review Panel conclusion on Stock Status
Expedited Review		
Gulf of Maine winter flounder	Paul Nitschke	<ul style="list-style-type: none"> ● Stock’s overfished status is unknown but overfishing is not occurring
Georges Bank winter flounder	Alex Hansell	<ul style="list-style-type: none"> ● Stock is not overfished and overfishing is not occurring
Atlantic halibut	Dan Hennen	<ul style="list-style-type: none"> ● Stock status is unknown
Georges Bank haddock	Liz Brooks	<ul style="list-style-type: none"> ● Stock is not overfished and overfishing is not occurring
Monkfish - North	Jon Deroba	<ul style="list-style-type: none"> ● Stock status is unknown
Monkfish – South	Jon Deroba	<ul style="list-style-type: none"> ● Stock status is unknown
Southern New England/MidAtlantic yellowtail flounder	Chris Legault	<ul style="list-style-type: none"> ● Stock is overfished but overfishing is not occurring
American plaice	Larry Alade	<ul style="list-style-type: none"> ● Stock is not overfished and overfishing is not occurring
Enhanced Review		
White hake	Kathy Sosebee	<ul style="list-style-type: none"> ● Stock is not overfished and overfishing is not occurring
Gulf of Maine haddock	Charles Perretti	<ul style="list-style-type: none"> ● Stock is not overfished and overfishing is occurring
Pollock	Brian Linton	<ul style="list-style-type: none"> ● Stock is not overfished and overfishing is not occurring

Table 2. Peer review Panel recommendations on final assessment/projection methods from September 2022 Management Track Assessment Peer Review meeting

Stock	Lead Analyst/Presenter	Peer Review Panel Recommendations
Expedited Review		
Gulf of Maine winter flounder	Paul Nitschke	<ul style="list-style-type: none"> • Use the proposed area-swept approach with the average of the 2 spring and 1 fall surveys
Georges Bank winter flounder	Alex Hansell	<ul style="list-style-type: none"> • Use the proposed ADAPT-VPA model
Atlantic halibut	Dan Hennen	<ul style="list-style-type: none"> • Use the proposed FSD approach
Georges Bank haddock	Liz Brooks	<ul style="list-style-type: none"> • Use the proposed WHAM model with the Gaussian Markov Random Field estimates of Weights At Age for projections, and update projections to use F_{40}
Monkfish - North	Jon Deroba	<ul style="list-style-type: none"> • Use the proposed Ismooth approach
Monkfish – South	Jon Deroba	<ul style="list-style-type: none"> • Use the proposed Ismooth approach
Southern New England/MidAtlantic yellowtail flounder	Chris Legault	<ul style="list-style-type: none"> • Use the proposed ASAP model
American plaice	Larry Alade	<ul style="list-style-type: none"> • Use the proposed WHAM model with the 2019 Weights At Age for both the base model and the projections
Enhanced Review		
White hake	Kathy Sosebee	<ul style="list-style-type: none"> • Use the proposed ASAP model but do not use the 2020 WAA data in the average for projections and exclude BLLS data
Gulf of Maine haddock	Charles Perretti	<ul style="list-style-type: none"> • Use the proposed ASAP model with the cohort growth model estimates of WAA for projections and exclude BLLS data
Pollock	Brian Linton	<ul style="list-style-type: none"> • Use the proposed ASAP model tuned to one fleet with the 1970 to present time series

Expedited Reviews

Gulf of Maine winter flounder

The 2022 assessment of Gulf of Maine winter flounder (*Pseudopleuronectes americanus*) updates the 2020 area-swept management track assessment (NEFSC 2022¹). The analytic method was rejected in 2008 with GARM (2008) and again at SARC52 (2011). Area swept assessments have been used since then. Updates were made of commercial and recreational fishery catch data, research survey indices of abundance, and the area-swept estimates of 30+ cm biomass based on the fall NEFSC, Massachusetts Department of Marine Fisheries (MaDMF), and Maine-New Hampshire (MeNH) surveys.

Retrospective adjustments were not made to the model results. A small change in Q of the NEFSC surveys resulted from a recent paired tow efficiency study (Miller et al in 2020²) which reduced the biomass estimate for much of the time series. Biomass (30+ cm) in 2021 was estimated to be 5,093 mt. The 2021 30+ cm exploitation rate was estimated to be 0.033 which is 14% of the overfishing exploitation threshold proxy (E_{MSY} proxy = 0.23).

Based on this updated assessment, the Gulf of Maine winter flounder stock's overfished status is unknown but overfishing is not occurring.

Projections are not possible with area-swept based assessments. However, catch advice can still be provided, and as suggested by the AOP, the assessment scientist considered two approaches:

- One approach provided catch advice using a method like that used with the 2020 operational assessment, which averaged the last two years of the fall surveys to make better use of the available new information and to help stabilize the catch advice. Because the 2020 fall survey was not conducted, the updated 2021 and 2022 spring and 2021 fall 30+ cm area-swept biomass were averaged (4,660 mt) which implies an OFL of 1,072 mt based on the E_{MSY} proxy and a catch of 804 mt for 75% of the E_{MSY} proxy.
- A second approach provided was to base the catch advice on 75% of $E_{40\%}$ (75% E_{MSY} proxy) using the terminal year fall survey area-swept estimate, assuming $q=0.81$ on the wing spread. The latter was updated using the average efficiency from 2009-2021 from the sweep experiment (Miller et al. 2020²). Updated 2021 fall 30+ cm area-swept biomass (5,093 mt) implies an OFL of 1,171 mt based on the E_{MSY} proxy and a catch of 879 mt for 75% of the E_{MSY} proxy.

¹ NEFSC. 2022. Fall Management Track Assessments 2020., US Dept Commer, Northeast Fish Sci Cent Ref Doc. 22-08; 168 p. <https://doi.org/10.25923/8n72-q136>

² Miller, T.J., D. Richardson, P. Politis, J. Blaylock, J. Manderson, and C. Roebuck. 2020. Relative efficiency of a chain sweep and the rockhopper sweep used for the NEFSC bottom trawl survey and biomass estimates for winter and windowpane flounder and red hake stocks. U.S. Dept. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 20-XX; 31 p.

*The Peer Review Panel (Panel) **recommended** that while the choice of approaches to providing catch advice does not have a major impact, it was the Panel’s consensus that averaging the 2 spring (2021 and 2022) and 1 fall (2021) surveys was the better choice for this assessment. Averaging reduces the noise resulting from “year” effects (i.e., the balance between day and night tows, plus length effects in the day-time tows). The protocol for the next (e.g., 2024) assessment will need to revisit this decision once multiple sequential fall surveys are available.*

*The Panel is **concerned** more about the uncertainty surrounding the rapid increase in catch advice given the stock’s depressed condition despite low fishing pressure. These historically low exploitation rates could be leading to the increased projected abundance seen in the most recent surveys, and an increase in effort could cap the stock’s nascent recovery.*

Research suggestion –

- *The Center should also consider statistical approaches that overcome the imbalance between day and night tows in a stratum.*
- *Consider applying year specific q 's rather than averaging the full time series.*

The Panel concluded that the 2022 assessment update for Gulf of Maine winter flounder fulfilled the recommendations of the AOP, is technically sufficient to partially evaluate stock status and provide scientific advice and meets the Terms of Reference for the stock’s assessment. The assessment represents Best Scientific Information Available (BSIA) for this stock for management purposes.

Georges Bank winter flounder

The 2022 assessment of Georges Bank winter flounder (*Pseudopleuronectes americanus*) updates the 2020 operational ADAPT-VPA assessment which included data for 1982-2019 (NEFSC 2020³). This assessment updates commercial fishery catch data, research survey biomass indices, and the analytical VPA assessment model and reference points through 2021. Additionally, stock projections have been updated through 2025. Note that the stock is in a revised rebuilding plan, based on fishing at 70% of F_{MSY} , with rebuilding by 2029.

Unadjusted spawning stock biomass (SSB) in 2021 was estimated to be 7,159 mt and the 2021 fully selected fishing mortality (F) was estimated to be 0.049. However, the 2021 point estimate of SSB and F, when adjusted for retrospective error (0.59% for SSB and -0.36% for F), are outside the 90% confidence intervals of the unadjusted 2021 point estimates. Therefore, the values used in the stock status determination were the retrospective-adjusted values of $F_{2021}=0.076$ which is 17% of the 2022 overfishing threshold ($F_{MSY} = 0.452$), and $SSB_{2021}=4,503$ mt which is 60% of the biomass target for an overfished stock (2022 $SSB_{MSY} = 7,503$ with a threshold of 50% of SSB_{MSY}).

Based on this updated assessment, the Georges Bank winter flounder stock is not overfished and overfishing is not occurring.

³NEFSC. 2022. Operational Assessment of 14 Northeast Groundfish Stocks Updated Through 2018. US Dep Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 22-06; 227 p.

Short-term projections of biomass were derived by sampling from a cumulative distribution function of recruitment estimates (1982-2020 year class) from the final run of the ADAPT-VPA model. The annual fishery selectivity, maturity ogive (a 3-year moving window), and mean weights-at-age used in the projection are the most recent five-year averages (2017-2021). An SSB retrospective adjustment factor of 0.629 was applied in the projections.

The estimated catch for 2022 is 278 mt, which results in catch advice of 2,360, 1,963 and 1,819 mt for 2023-2025 respectively.

*Though the estimates of retrospective pattern have declined (at least for SSB), the Panel noted the persistence of retrospective bias in this assessment. This could be an artifact of the VPA model, and an evaluation of retrospective patterns in the winter flounder stocks could be insightful. Ultimately, the Panel could see no utility in going to an index-based approach and **recommended** the VPA model be accepted as is.*

Recommendations –

- Consider using change point analysis to identify recruitment stanzas
- Consider statistical catch at age model in next Research Track

The Panel concluded that the 2022 assessment update for Georges Bank winter flounder fulfilled the recommendations of the AOP, is technically sufficient to evaluate stock status and provide scientific advice and meets the Terms of Reference for the stock's assessment. The assessment represents Best Scientific Information Available (BSIA) for this stock for management purposes.

Atlantic halibut

The 2022 assessment of Atlantic halibut (*Hippoglossus hippoglossus*) updates the 2019 “Plan B” assessment use of the First Second Derivative (FSD) model (Rago 2018⁴) with additional commercial fishery catch data, commercial discard indices and fall bottom trawl survey indices of abundance through 2021.

A “Plan B” assessment does not allow for the estimation of reference points (i.e., F_{MSY} , and SSB_{MSY} cannot be determined).

Short term projections are not possible using the FSD approach. The FSD approach is based on applying a multiplier to the catch from the previous year and cannot be projected beyond the catch time series. The catch multiplier for 2021 resulting from the FSD model is 0.85 and the estimated catch for 2021 is 174 mt, which results in catch advice of 149 mt for 2022.

*The Panel considered the analyst's recommendation that Atlantic halibut's stock status should be considered unknown. Given that there is no accepted previous assessment to provide stock status and that the “Plan B” approach does not generate reference points, the Panel strongly **recommended** listing stock status as unknown.*

⁴ Rago, P.J. 2018. Halibut Assessment Report for 2017 for New England Fishery Management Council, January 24, 2018. Unpublished report. Available online at [SASINF](#)

*The Panel raised two concerns with this assessment. The first was the intersection of the US fishery and stock with those of Canada's fishery and stock. Even though the US assessment tries to account only for the portion of the Atlantic halibut stock that is found on Georges Bank and the Gulf of Maine, it is possible (perhaps likely) that this is only one part of a larger stock of Atlantic halibut that extends onto the Canadian Scotian shelf. Tracking data available from halibut released in the Gulf of Maine suggest a significant number of these fish travel into Canadian waters. The recent high catches of halibut by Canadian fisheries on Georges Bank (e.g., in area 5ZEJ) can only be sustainable if the area is part of a larger stock. As such, the Panel **recommended** that NMFS and DFO develop a more coordinated approach to the assessment of Atlantic halibut across the region. The Panel endorses at the least a scientific workshop to discuss the stock's science.*

*The second, much smaller concern, was how the missing fall 2020 survey was treated in the analysis. Imputing or smoothing by averaging values between the two surveys before and after 2020 was the agreed upon **recommendation**.*

For the next Management Track assessment of the stock, consider different weighting of the commercial discard and survey abundance indices and the potential for use of a CPUE index.

The Panel concluded that the 2022 assessment update for Atlantic halibut fulfilled the recommendations of the AOP and is technically sufficient to provide scientific advice and meets the Terms of Reference for the stock's assessment. It does not provide sufficient information to evaluate stock status. The assessment represents Best Scientific Information Available (BSIA) for this stock for management purposes.

Georges Bank haddock

The 2022 assessment of the Georges Bank haddock (*Melanogrammus aeglefinus*) stock is the Management Track update of the 2022 Research Track assessment and the 2019 operational assessment (NEFSC 2022⁵). Note that this assessment was also peer reviewed as part of the 2022 haddock Research Track assessment. Prior to the 2021-22 research track, the last benchmark assessment for this stock was in 2008 (Brooks et al., 2008)⁶. This assessment utilizes the Woods Hole Assessment Model (WHAM) and updates commercial fishery catch data, research survey indices of abundance, weights and maturity at age, and reference points through 2021. Stock projections have been updated through 2025.

Retrospective adjustments of the model results were not necessary. Spawning stock biomass (SSB) in 2021 was estimated to be 79,513 mt which is 66% of the biomass target (SSB_{MSY} proxy = 120,580 mt). The 2021 average fishing mortality on ages 5-7 was estimated to be 0.137 which

⁵ NEFSC. 2022. Operational Assessment of 14 Northeast Groundfish Stocks Updated Through 2018. US Dep Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 22-06; 227 p.

⁶ Brooks, E.N, M.L. Traver, S.J. Sutherland, L. Van Eeckhaute, and L. Col. 2008. In. Northeast Fisheries Science Center. 2008. Assessment of 19 Northeast Groundfish Stocks through 2007: Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Northeast Fisheries Science Center, Woods Hole, Massachusetts, August 4-8, 2008. US Dep Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 08-15; 884 pp + xvii.

is 55% of the overfishing threshold proxy (F_{MSY} proxy = 0.25). The F is expressed as the average F on ages 5-7, and F_{MSY} proxy is $F_{40\%SPR}$.

Stock status was not reported for the 2021-22 research track but based on this analysis the stock was not overfished and overfishing was not occurring.

Short term projections were conducted in WHAM, which propagates uncertainty in the processes of recruitment and deviations in transitions between ages. For projection specifications, the Plan Development Team supplied an estimate of total catch for 2022, and then fishing mortality was set equal to $F_{40\%SPR}$ for 2023-2025. Annual fishery selectivity, maturity, and weights at age were fixed at 2020-2021 values, following analyses and decisions made at the 2021 research track. Weights at age for catch and SSB that were predicted from a Gaussian Markov Random Field (GMRF) model, rather than a recent 2-year average, were preferred by the peer reviewers for this management track and were used in the projections summarized in this report. The overfished threshold is 60,290 mt, and the stock is not projected to drop below this value in 2025.

The estimated catch for 2022 is 9,914 mt, which results in catch advice of 18,482, 17,287, and 14,555 mt for 2023-2025, respectively.

The Panel's discussion on this assessment focused on the choice of Weight At Age (WAA) and selectivity functions to use in the projections. The Panel noted that the two functions seemed to show opposite trajectories over the past decade – WAA was decreasing while selectivity at age was increasing, which suggests that size-based selectivity is possible. However, the latter could have also been affected by fleet targeting and management changes.

*Nonetheless, the question remained about which of the two approaches to WAA (i.e. two-year averaging or Gaussian Markov Random Field model [GMRF]) should be used for projections. Ultimately, the Panel **recommended** that the GMRF approach be used, in part because of its quick response to changes and because a model-based approach was more robust than a two-year average. The Panel **recommends** that the analyst continue to evaluate the utility/accuracy of GMRF vs averaging.*

Finally, the Panel acknowledged that the eastern Georges Bank haddock stock assessment, also WHAM based, has produced a different interpretation of stock's status and trajectory.

The Panel concluded that the 2022 assessment update for Georges Bank haddock fulfilled the recommendations of the AOP, is technically sufficient to evaluate stock status and provide scientific advice and meets the Terms of Reference for the stock's assessment. The assessment represents Best Scientific Information Available (BSIA) for this stock for management purposes.

Monkfish - North

The 2022 assessment for the northern stock of monkfish (*Lophius piscatorius*) updates the 2019 assessment (NEFSC 2020⁷) with additional commercial fishery catch data through 2021, and research survey indices of abundance and area-swept biomass through 2022.

An analytic assessment was not possible due to the lack of a reliable aging methodology. As a result, the “Ismooth” (previously planBsmooth; Legault et al. in press⁸; <https://github.com/cmlegault/PlanBsmooth>) approach used in the 2020 assessment was updated for this management track assessment. This “Ismooth” approach re-scales the NMFS spring and fall BTS by their respective means (i.e., so each time series has mean equal to one) and averages the fall observation in year y with the spring observation in year $y+1$ to create a single time series for analysis. A LOESS-smooth is then applied to the combined time series, and a log-linear regression fit to the most recent three years of index predictions from the LOESS fit. The slope of the regression provides a direction and rate of change in the indices that is multiplied by recent catch to provide catch advice. However, neither of the 2020 bottom trawl surveys were available. Consequently, the preferred approach was to use a combined spring and fall BTS time series with the missing 2020 observations replaced with the mean of the 2019 and 2021 observations. Using this method, the multiplier was 0.829 in the North.

An “Ismooth” assessment does not allow for the estimation of reference points (i.e., F_{MSY} , and SSB_{MSY} cannot be determined). Therefore, the status of the stock relative to overfishing and being overfished must be unknown.

Short term projections are not possible using the “Ismooth” approach.

The Panel spent considerable time discussing the appropriate term which the multiplier should be applied against – ABC or catch. The former has been the practice since the Ismooth approach was first applied to monkfish and moving to catch would result in a major shift in catch advice. Applying the multiplier against the catch would result in a significant decrease in ABC advice. Estimates of area-swept minimum biomass developed from the chain sweep study indicate a high biomass from what is observed in the BTS but follow the same trends. On the other hand, the Ismooth approach was designed to be applied to catch and is derived from catch data. Other index methods also are based on catch. Thus, application of the multiplier to catch is more consistent with ISmooth’s design and other index based methods^{9,10}. Ultimately the

⁷ NEFSC. 2020. Operational assessment of the black sea bass, scup, bluefish, and monkfish stocks, updated through 2018. NEFSC Ref Doc 20-01; 160 p.

⁸ Legault, C.M., J. Wiedenmann, J.J. Deroba, G. Fay, T.J. Miller, E.N. Brooks, R.J. Bell, J.A. Langan, J.M. Cournane, A.W. Jones, and B. Muffley. 2022. Data Rich but Model Resistant: An Evaluation of data-limited methods to manage fisheries with failed age-based stock assessments. Canadian Journal of Fisheries and Aquatic Sciences. <https://doi.org/10.1139/cjfas-2022-0045>

⁹ Carruthers, T., L. Kell, D. Butterworth, M. Maunder, H. Geromont, C. Walters, M. McAllister, R. Hillary, P. Levontin, T. Kitakado, and C. Davies. 2015. Performance review of simple management procedures. ICES Journal of Marine Science 73(2):464–482.

¹⁰ NEFSC. 2020. Research Track Assessment for Index-Based Methods and Control Rules. Woods Hole, MA. 59 p.

group could not reach a consensus decision, though a majority supported the application of the multiplier against catch.

The Panel also considered whether stock status should be considered unknown. Given that the current stock status is based on a failed assessment, and that the Ismooth approach does not generate reference points, the Panel strongly **recommended** listing stock status as unknown.

The Panel had several research **recommendations**:

- Both the shrimp and scallop survey indices should be considered for inclusion in future assessments
- Given the lack of success developing an aging technique, NMFS should not continue to pursue this avenue of research; consider estimating growth through cohort tracking
- Given the lack of growth information on Monkfish, it was recommended the analyst explore a Simple Delay-Difference Model as a potential modeling approach relative to the Ismooth method
- Other Data Limited methods should also be considered for the assessment.
- A better understanding of stock structure (beyond North and South) could improve the assessment effort
- Reconsider the catchability coefficient of the chain swept estimates and how this applies to separate surveys

The Panel concluded that the 2022 assessment update for northern stock of monkfish fulfilled the recommendations of the AOP and is technically sufficient to provide scientific advice and meets the Terms of Reference for the stock's assessment. It does not provide sufficient information to evaluate stock status. The assessment represents Best Scientific Information Available (BSIA) for this stock for management purposes.

Monkfish - South

The 2022 assessment for the southern stock of monkfish (*Lophius piscatorius*) updates the 2019 assessment (NEFSC 2020¹¹) with additional commercial fishery catch data through 2021, and research survey indices of abundance and area-swept biomass through 2022.

An analytic assessment was not possible due to the lack of a reliable aging methodology. As a result, the “Ismooth” (previously planBsmooth; Legault et al. in press¹²; <https://github.com/cmlegault/PlanBsmooth>) approach used in the 2020 assessment was updated for this management track assessment. This “Ismooth” approach re-scales the NMFS spring and fall bottom trawl survey (BTS) by their respective means (i.e., so each time series has mean equal to one) and averages the fall observation in year y with the spring observation in year $y+1$ to create a single time series for analysis. A LOESS-smooth is then applied to the combined time

¹¹ NEFSC. 2020. Operational assessment of the black sea bass, scup, bluefish, and monkfish stocks, updated through 2018. NEFSC Ref Doc 20-01; 160 p.

¹² Legault, C.M., J. Wiedenmann, J.J. Deroba, G. Fay, T.J. Miller, E.N. Brooks, R.J. Bell, J.A. Langan, J.M. Courneane, A.W. Jones, and B. Muffley. 2022. Data Rich but Model Resistant: An Evaluation of data-limited methods to manage fisheries with failed age-based stock assessments. Canadian Journal of Fisheries and Aquatic Sciences. <https://doi.org/10.1139/cjfas-2022-0045>

series, and a log-linear regression fit to the most recent three years of index predictions from the LOESS fit. The slope of the regression provides a direction and rate of change in the indices that is multiplied by recent catch to provide catch advice. However, neither of the 2020 bottom trawl surveys were available. Consequently, the preferred approach was to use a combined spring and fall BTS time series with the missing 2020 observations replaced with the mean of the 2019 and 2021 observations. Using this method, the multiplier was 0.646 in the south.

An “Ismooth” assessment does not allow for the estimation of reference points (i.e., F_{MSY} , and SSB_{MSY} cannot be determined). Therefore, the status of the stock relative to overfishing and being overfished must be unknown.

Short term projections are not possible using the “Ismooth” approach.

The Panel spent considerable time discussing the appropriate term which the multiplier should be applied against – ABC or catch. The former has been the practice since the Ismooth approach was first applied to monkfish and moving to catch would result in a major shift in catch advice. Applying the multiplier against the catch would result in a significant decrease in ABC advice. Estimates of area-swept minimum biomass developed from the chain sweep study indicate a high biomass from what is observed in the BTS but follow the same trends. On the other hand, the Ismooth approach was designed to be applied to catch and is derived from catch data. Other index methods also are based on catch, rather than ABC^{13,14}. Thus, application of the multiplier to catch is more consistent with ISmooth’s design and other index based methods. Ultimately the group could not reach a consensus decision, though a majority supported the application of the multiplier against catch.

*The Panel also considered whether stock status should be considered unknown. Given that the current stock status is based on a failed assessment, and that the Ismooth approach does not generate reference points, the Panel strongly **recommended** listing stock status as unknown.*

*The Panel had several research **recommendations**:*

- *Both the shrimp and scallop survey indices should be considered for inclusion in future assessments*
- *Given the lack of success developing an aging technique, NMFS should not continue to pursue this avenue of research further. Instead, NMFS should consider estimating growth through cohort tracking*
- *Given the lack of growth information on Monkfish, it was recommended that the analyst explore a Simple Delay-Difference Model as one potential modeling approach in the next research track assessment.*
- *Other Data Limited methods should also be considered for that assessment.*

13 Carruthers, T., L. Kell, D. Butterworth, M. Maunder, H. Geromont, C. Walters, M. McAllister, R. Hillary, P. Levontin, T. Kitakado, and C. Davies. 2015. Performance review of simple management procedures. ICES Journal of Marine Science 73(2):464–482.

¹⁴ NEFSC. 2020. Research Track Assessment for Index-Based Methods and Control Rules. Woods Hole, MA. 59 p.

- *A better understanding of stock structure (beyond the border of Northern and Southern stocks) could improve the assessment effort*
- *Reconsider the catchability coefficient of the chain swept estimates and how this applies to separate surveys*

The Panel concluded that the 2022 assessment update for southern stock of monkfish fulfilled the recommendations of the AOP and is technically sufficient to provide scientific advice and meets the Terms of Reference for the stock's assessment. It does not provide sufficient information to evaluate stock status. The assessment represents Best Scientific Information Available (BSIA) for this stock for management purposes.

Southern New England/Mid-Atlantic yellowtail flounder

The 2022 assessment for Southern New England/MidAtlantic yellowtail flounder (*Limanda ferruginea*) updates the 2012 benchmark assessment use of the ASAP model (NEFSC 2012¹⁵) with additional commercial fishery catch data, five research survey indices of abundance, and reference points through 2019-2021. Stock projections have been updated through 2025.

Retrospective adjustments were made to the ASAP model (Run23) results. Spawning stock biomass in 2021 was estimated to be 70 mt which is 4% of the biomass target ($SSB_{MSY} = 1,715\text{mt}$). The 2021 fully selected fishing mortality was estimated to be 0.082 which is 23% of the overfishing threshold proxy ($F_{MSY \text{ proxy}} = 0.349$).

Based on this updated assessment, the SNE/MA yellowtail flounder stock was overfished but overfishing was not occurring.

Short term projections of biomass were derived by sampling from an empirical cumulative distribution function of 30 recruitment estimates (1990-2019) from the ASAP model results based on recent estimates of recruitments from the model time. The annual fishery selectivity is from the most recent selectivity block in the model, the maturity ogive is the same as assumed for all years in the model, and mean weights at age are from 2014-2019 due to low or no sampling in 2020 and 2021. Retrospective adjustments were applied in the projections.

The estimated catch for 2022 is 4 mt, which results in catch advice of 55, 84 and 152 mt for 2023-2025 respectively.

The Panel was very impressed by the amount of work devoted to a stock with its biomass close to the origin.

The Panel was again concerned about the limited sampling for WAA for this stock.

There was concern that the outyear catch advice was overly optimistic given the stock's current biomass and observed failure to recruit. Much of this increase seems to have been fueled by the

¹⁵ NEFSC. 2012. 54th Northeast Regional Stock Assessment Workshop (54th SAW) Assessment Report. US Dept Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 12-18.; 600 p.

low fishing pressure and simulated recruitment, which the model responds to by showing sharp increases in biomass. This could be exacerbated by the low sampling in 2020-2021.

Given the status of this stock, NOAA should be sure to provide a timely stock assessment update, and not allow the timing of the specie's Research Track effort interfere with this update.

The Panel concluded that the 2022 assessment update for SNE/MA yellowtail flounder fulfilled the recommendations of the AOP, is technically sufficient to evaluate stock status and provide scientific advice and meets the Terms of Reference for the stock's assessment. The assessment represents Best Scientific Information Available (BSIA) for this stock for management purposes.

American plaice

The 2022 assessment for American plaice (*Hippoglossoides platessoides*) is the Management Track assessment resulting from the 2022 Research Track assessment (NEFSC 2022¹⁶). This WHAM assessment updates commercial fishery catch data, research survey indices of abundance, and reference points through 2021. Stock projections have been updated through 2025.

Retrospective patterns were minor and retrospective adjustments for terminal year estimates were not needed. Spawning stock biomass in 2021 was estimated to be 18,809 mt, corresponding to 99% of the biomass target (SSB_{MSY} proxy = 19,051mt). The 2021 fully selected fishing mortality was estimated to be 0.045, corresponding to 11% of the overfishing threshold proxy (F_{MSY} proxy = 0.414).

Based on this management track assessment, the stock was not overfished and overfishing was not occurring.

Short-term projections were conducted in the WHAM model, which propagates uncertainty in the recruitment and survival processes. The annual fishery selectivity, maturity ogive, and mean weights-at-age used in the projections represent the most recent 5-year averages, following the decisions made at the 2022 research track. The stock is projected to remain above the overfished threshold throughout the short-term projection period.

The estimated catch for 2022 is 653 mt, which results in catch advice of 7,316, 6,670, and 6,105 mt for 2023-2025, respectively.

The Panel focused much of their discussion on the choice of WAA in both the base model and the projections. Both the 2020 and 2021 catch WAA showed steep declines from the 2019 data. These declines were sufficiently large to cast doubt on the data. Various explanations were provided for the observed decrease of WAA, none of which could be easily resolved. The analyst considered several approaches to the analysis including using the observed WAA, using no WAA for the two years, and substituting 2019 WAA for the 2020-2021 WAA. Ultimately, the best

¹⁶ Northeast Fisheries Science Center (In Progress). Report of the 2022 American plaice Research Track Assessment working group. Available at: [SASINF](#).

solution appeared to be the latter. After considerable discussion, the Panel **recommended** that the 2019 WAA be used for both the base WHAM model and the projections.

The Panel also **recommended** that the cause of this phenomena be thoroughly reviewed. If this is a result of inadequate or biased Port Sampling of landings, it is an example of the problems that inadequate sampling will introduce in future assessments for this and other stocks. Here it appears to make the strong 2013 cohort very difficult to track.

The Panel endorses several of the Research Track recommendations:

- Exploration of archived observer otolith samples for characterizing age composition of discards
- Investigation of approaches to compare models with and without environmental covariates.
- Investigation of alternative estimates of natural mortality

The Panel concluded that the 2022 assessment update for American plaice fulfilled the recommendations of the AOP, is technically sufficient to evaluate stock status and provide scientific advice and meets the Terms of Reference for the stock's assessment. The assessment represents Best Scientific Information Available (BSIA) for this stock for management purposes.

Enhanced Reviews

White hake

The 2022 assessment for white hake (*Urophycis tenuis*) is an update to the 2019 operational assessment (NEFSC 2022¹⁷) and the last benchmark assessment (NEFSC 2013¹⁸). This assessment updates commercial fishery catch data, research survey indices of biomass, adds additional surveys, and updates the ASAP assessment model and reference points through 2021. Stock projections have been updated through 2025.

The Panel concluded that the 2022 assessment update for white hake fulfilled the recommendations of the AOP, is technically sufficient to evaluate stock status and provide scientific advice and meets the Terms of Reference for the stock's assessment. The assessment represents Best Scientific Information Available (BSIA) for this stock for management purposes.

¹⁷ NEFSC. 2022. Operational Assessment of 14 Northeast Groundfish Stocks Updated Through 2018. US Dep Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 22-06; 227 p.

¹⁸ NEFSC. 2013. 56th Northeast Regional Stock Assessment Workshop (56th SAW) Assessment Report. US Dep Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 13-10; 868 p.

Terms of Reference

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

This TOR was satisfactorily addressed.

U.S. and Canadian commercial landings and discard data were updated by market category through 2021 with CAMS tables used for 2020-2021. Catch was split by red/white hake market category using proportion by area fished. Market category of extra-large hake was combined with large hake because of a lack of landings.

US discards were estimated using a method like the NEFSC's Standard Bycatch Reporting Methodology (SBRM) approach by gear type. Longline discards were assumed to be the same Catch at Age (CAA) as large-mesh trawl discards, scallop dredge and shrimp trawl discards were the same CAA as small mesh discards and sink gill net discards were the same CAA as landings and discards combined.

*The Panel **recommends** that the SBRM method be used in the next assessment.*

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.

Spring and fall tow-specific swept area NEFSC bottom trawl survey indices were updated through 2021 (2020 surveys were not conducted). Additional US survey data were evaluated – the ASMFC shrimp survey (including age and length data) and the NEFSC bottom longline survey. As with other stocks, no 2020 survey data were available except for the fall BLLS. A pooled Age Length Key (ALK) from previous years was used as a proxy for the missing 2020 WAA/CAA.

3. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) as possible (depending on the assessment method) for the time 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 assessment results and projections, 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 backup assessment approach that would serve as an alternative for providing scientific advice to management if the analytical assessment were to not pass review

This TOR was satisfactorily addressed.

The Base model used here was the final accepted ASAP model from the preceding operational assessment of white hake using catch and survey data for 1963-2021. Catches At Age (CAA) for 1963-2018 were updated with additional CAA for 2019-2021. The missing 2020 CAA was considered using pooled Age Length keys (no survey ages) with sensitivity to leaving out 2020 CAA. Survey selectivities were set to fully selected at age 3 and other ages were allowed to be estimated, while fishery selectivity was set to full for ages 6-9. The assessment includes two selectivity blocks 1963-1997 and 1998-2021. Shrimp survey and Bottom Longline Survey indices were both evaluated for incorporation into the model.

Other than the introduction of new data, there were only minor changes to the previous assessment. As a result, bridge runs showed negligible differences from the prior assessment.

*The Panel **recommended** that this assessment include the BTS and the shrimp survey, but not the bottom longline survey (BLLS). This should be reevaluated at the next management track assessment when more data is available for both surveys. They may be useful in that both surveys sample age classes which may not be well sampled by the BTS. Consideration should also be given to including the Maine -New Hampshire surveys in the next assessment.*

*The Panel also **recommended** that future assessments consider splitting the Albatross and Bigelow BTS time series.*

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

This TOR was satisfactorily addressed.

The retrospective pattern improved with adjustments made to the model. Spawning stock biomass (SSB) in 2021 was estimated to be 19,369 mt which is 67% of the biomass target (SSB_{MSY} proxy = 28,039). The 2021 fully selected fishing mortality was estimated to be 0.105 which is 66% of the overfishing threshold proxy (F_{MSY} proxy = 0.1599).

Note that if the missing CAA is left blank in this analysis there were slight differences compared to using a pooled Age Length key. Without the 2020 CAA, the retrospective pattern is better but doesn't use the length compositions currently in hand.

Based on this updated assessment, the white hake stock is not overfished and overfishing is not occurring.

*As with other stocks, the Panel **recommends** that the pooled age length key be used rather than simply leaving the missing 2020 blank in the reference point calculations.*

5. Conduct short-term stock projections when appropriate.

This TOR was satisfactorily addressed.

Short term projections of catch and SSB were derived by sampling from a cumulative distribution function of recruitment estimates from ASAP from 1995-2019. The annual fishery selectivity, maturity ogive, and mean weights at age used in the projection are the most recent 5-year (2017-2021) averages. The numbers-at-age used to start the projections were adjusted for retrospective bias using age-specific rho estimates. An SSB retrospective adjustment factor of 0.694 was applied in the projections.

The estimated catch for 2022 is 1,964 mt, which results in catch advice of 2,347, 2,258, and 2285 mt for 2023-2025, respectively.

*While the projection technique appears appropriate, the Panel **recommends** averaging CAA/WAA over the most recent five years of data without the inclusion of 2020.*

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

This TOR was partially addressed, as the assessor presented their research recommendations but not those arising from previous assessment reviews or from the SSC.

This Panel has several research recommendations for potential improvement of the assessment:

- *The highest priority is to complete aging of collections from various sources with Fishery Observer collections being the most important (it provides missing information on catch). Then, aging of collections from the MENH and shrimp surveys should continue.*
- *Evaluate whether there is any difference between fishery and survey Weights At Age*
- *Using a recruitment time series reaching back to 1995 may be inappropriate and NMFS should determine whether there is a more appropriate recruitment stanza for the stock. A change point analysis might be helpful.*
- *At the time of the next Management Track assessment, NMFS should reevaluate use of the shrimp survey data (is the improvement to the retrospective pattern an artifact of adding another index?)*
- *Reevaluate the utility of the Bottom Longline Survey in the assessment once additional years of data are available*
- *Consider splitting the two NEFSC Bottom Trawl Surveys into separate Albatross and Bigelow indices*
- *Evaluate the sensitivity of recruitment to the CV used (0.5)*

Gulf of Maine haddock

The 2022 assessment of the Gulf of Maine haddock (*Melanogrammus aeglefinus*) stock is the Management Track update of the 2021 Research Track assessment and 2019 operational assessment (NEFSC 2022¹⁹). Note that this assessment was also peer reviewed as part of the 2021 haddock Research Track assessment. This assessment updates commercial and recreational fishery catch data, research survey indices of abundance, and the analytical ASAP assessment model and reference points through 2021. Stock projections have been updated through 2025.

The Panel concluded that the 2022 assessment update for Gulf of Maine haddock fulfilled the recommendations of the AOP, is technically sufficient to evaluate stock status and provide scientific advice and meets the Terms of Reference for the stock's assessment. The assessment represents Best Scientific Information Available (BSIA) for this stock for management purposes.

Terms of Reference

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

This TOR was satisfactorily addressed.

Commercial and recreational discards, landings, and age composition were updated through 2021.

An issue with the commercial Numbers and Weight At Age (NAA/WAA) exists for 2021 in that only one “Large” fish was sampled in 2021. Only 6% of the catch was Large, but the effect of this low sampling was investigated further by considering three solutions: 1) Assign all Large catch to the one observed length, 2) borrow the 2020 Large samples and expand them annually, and 3) borrow the 2020 Large samples and expand them quarterly. After examining NAA and its CV, and WAA, the analyst determined that use of the 2020 Large samples with quarterly expansion provided the most robust solution.

The Panel was concerned about the low level of Port side sampling of commercial landings that has occurred since 2019.

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.

Spring and fall tow-specific swept area NEFSC bottom trawl survey indices as well as survey maturities, and weights at age were updated through 2021 (2020 surveys were not conducted). The NEFSC 2014-2021 Bottom Longline Survey results were also considered for inclusion in the model.

¹⁹ NEFSC. 2022. Operational Assessment of 14 Northeast Groundfish Stocks Updated Through 2018. US Dep Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 22-06; 227 p.

3. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) as possible (depending on the assessment method) for the time 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 assessment results and projections, and to examine model fit.
 - c. Include bridge runs to sequentially document each change from the previously accepted model to the updated model proposed for this peer review.
 - d. Prepare a backup assessment approach that would serve as an alternative for providing scientific advice to management if the analytical assessment were to not pass review

This TOR was satisfactorily addressed.

The Base model used here was the final accepted ASAP model from the 2021 Haddock Research Track Assessment for 1977-2021 (1977 is the first year catch-at-age is available). Maturity was from the 1977-2021 time series average, assumed natural mortality $M=0.2$, and SSB weights-at-age use Rivard calculation. Commercial and recreational catches were for ages 1-9+ with Weights at Age (WAA) estimated from the most recent 5-year average. A combined commercial and recreational fleet was modeled with three selectivity blocks (at-age) 1977-1988, 1989-2004, 2005+. For the surveys, selectivity was freely estimated at-age (fixed 4+ (spring), 6+ (fall)) and catchability was fixed over time.

The NEFSC Bottom Longline Survey (BLLS) was included as an exploratory model in addition to the NEFSC Bottom Trawl Survey data, as recommended by the GOM Haddock Research Track Review Panel. The configuration of the BLLS model was identical to the Base model, with the addition of the BLLS survey. BLLS selectivity was freely estimated at-age and fixed for ages 6+ (spring) and 5+ (fall).

A Bridge run was prepared to compare the 2019 Management Track (MT) model with the 2021 Research Track (RT) model with the updated 2022 MT original base model and base+BLLS. Model estimates of SSB, F, and recruits were comparable.

*The Panel spent significant time discussing whether to include the BLLS in this assessment. While the Panel agreed the BLLS provided additional useful information with the model providing a good fit for the BLLS survey results, overall diagnostics suggested it degraded the quality of the model. It increased Mohn's rho increased from 0.30 in the 2022 base model to 0.48 in the BLLS model, which was a doubling of the rho from the 2021 RT model. Ultimately, the Panel agreed to **recommend** the BLLS not be included in the 2022 MT model but be reconsidered in the next assessment once 2 more years of data were available.*

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

This TOR was satisfactorily addressed.

Retrospective adjustments were not made to the model. Spawning stock biomass (SSB) in 2021 was estimated to be 16,528 mt which is 270% of the biomass target (SSB_{MSY} proxy = 6,123 mt). The 2021 fully selected fishing mortality was estimated to be 0.375 which is 111% of the overfishing threshold proxy (F_{MSY} proxy = F_{40%} = 0.338).

Based on this updated assessment, the stock's status is not overfished and overfishing is occurring.

5. Conduct short-term stock projections when appropriate.

This TOR was satisfactorily addressed.

Short term projections of median total fishery yield and spawning stock biomass for Gulf of Maine haddock were conducted based on a harvest scenario of fishing at the F_{MSY} proxy between 2023 and 2025. Recruitment was sampled from a cumulative distribution function of model estimated age-1 recruitment from 1977-2019. The age-1 estimate in 2022 was generated from the geometric mean of the 1977-2021 recruitment series. The annual fishery selectivity in the projections was the terminal selectivity from the assessment model. The time-invariant maturity ogive and projected mean weights at age derived from a state-space growth model were used in the projections. Retrospective adjustments were not applied in the projections.

The estimated catch for 2022 is 3,912 mt, which results in catch advice of 2,515, 2,552, and 2,434 mt for 2023-2025, respectively.

*The Panel discussed whether to use the recent 2-year average or the state-space growth model predictions for estimates of WAA in projections. The growth model tracks growth curves of cohorts to predict future WAA and results in lower projections of WAA in the future than the 2-year average with lower projected catch in 2023-2024 and higher SSB. Based on the growth model fits to catch weights and SSB weights, the Panel **recommended** using the growth model for WAA in the projections.*

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

This TOR was partially addressed in that the Research Track Peer Review Panel recommendations on the Bottom Longline Survey and the Weights -At Age analysis were fully addressed by the assessor. Other items remaining to be dealt with by the assessor include consideration of variable M values to incorporate age and system variability (including the effect on management advice), and the appropriateness of the F_{40%} proxy. Remaining research from the Review Panel including the generation of testable hypotheses to explain recruitment variability in the Gulf of Maine (including an updating of the fall bloom relationship to recruitment) are not the responsibility of the assessor.

Research recommendations from this Panel included:

- *The BLLS should be reconsidered for inclusion in the assessment in the next MT assessment, once 2 more years of data are available.*
- *This stock should be considered for evaluation using a state-space framework, which could provide insight into the rapid decline in biomass. The Panel suggested that Gulf of Maine haddock may be included as a case study in the State-Space Modeling Research Track effort to be convened soon.*
- *Low Port sampling of landings is a problem for this and many other stocks. NMFS should either return this sampling to pre 2109 levels or consider data from observer sampling.*

Pollock

The 2022 assessment of the pollock (*Pollachius virens*) stock updates the 2019 ASAP assessment (NEFSC 2022²⁰) with additional commercial and recreational fishery catch data, research survey indices of abundance, and biological reference points through 2021. Stock projections have been updated through 2025.

The Panel concluded that the 2022 assessment update for pollock fulfilled the recommendations of the AOP, is technically sufficient to evaluate stock status and provide scientific advice and meets the Terms of Reference for the stock's assessment. The assessment represents Best Scientific Information Available (BSIA) for this stock for management purposes.

Assessment Terms of Reference

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

This TOR was satisfactorily addressed.

Commercial and recreational discards, landings, and age composition were updated through 2021. Total removals in 2021 were estimated to be 4,522 mt which represents 24% of the sub-ACL for the stock (18,549 mt).

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.

Spring and fall tow-specific swept area bottom NEFSC trawl survey indices as well as survey maturities, and weights at age were updated through 2021 (2020 surveys were not conducted).

²⁰ NEFSC. 2022. Operational Assessment of 14 Northeast Groundfish Stocks Updated Through 2018. US Dep Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 22-06; 227 p.

Panel recommended continued research into survey selectivity including the satellite tagging project and pollock swimming speed studies that could help support or refute the dome shaped selectivity. Consideration should also be given to splitting the Albatross IV and Bigelow survey indices.

3. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) as possible (depending on the assessment method) for the time 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 assessment results and projections, 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 backup assessment approach that would serve as an alternative for providing scientific advice to management if the analytical assessment were to not pass review

This TOR was satisfactorily addressed.

The most recent benchmark assessment of the pollock stock was in 2010 as part of the 50th Stock Assessment Review Committee (NEFSC 2010²¹), which includes a full description of the ASAP model formulations. Two population assessment models were brought forward from the 2019 operational assessment: the base model (dome-shaped survey selectivity), which is used to provide management advice; and the flat-topped survey selectivity model (flat sel), which is included for the sole purpose of demonstrating the sensitivity of assessment results to survey selectivity assumptions. A bridge run comparing the 2019 and 2022 base models (2-Fleet Start year 1970) with the latter updated to the 2021 terminal year was run and showed that the 2013 year class was smaller than estimated in the 2019 assessment (and reduced terminal year SSB with little effect on F).

The analyst further considered four permutations of these models: 1-Fleet versus 2-Fleet and Start Year 1970 versus 1981. The 1-Fleet 1970-Start-Year model was selected as the 2022 base model, because the 1-Fleet model improved model convergence, and there was no significant improvement in model fit or performance to justify dropping the first 11 years of data from the assessment. A base model was obtained by fine-tuning the 1-Fleet 1970-Start-Year model to improve RMSE for each set of residuals.

The base model assumes dome-shaped fishery and survey selectivities, and this results in a cryptic biomass of older fish that cannot be confirmed by the fishery or surveys. A sensitivity model with flat-top survey selectivities was carried forward through reference point calculations and short-term projections to evaluate model sensitivity to selectivity assumptions (Flat-top selectivity = selectivity for ages 6+ fixed at 1.0). Note that the flat sel

²¹ NEFSC. 2010. 50th Northeast Regional Stock Assessment Workshop (50th SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 10-17; 844 p.

sensitivity model is only to be used as a sensitivity analysis and is not to be used for catch advice.

*The Panel **recommended** that the one fleet model beginning in 1970 with dome shaped selectivity was the better model. It has the lowest AIC and retrospective pattern; the 1970 start date provides more historic data; and the model tuning further improved the retrospective pattern.*

Concern was, however, expressed about selecting selectivity time blocks based on visual inspection of residuals. Without some external forcing mechanism (e.g., a management measure or fishery shift) this introduces significant uncertainty into the selectivity function.

Also, the tuning process which relaxed the CV on the surveys and catch while tightening the CV on discards seemed counterintuitive, given discards are generally less well known than the catch or survey data.

The model results of SSB are very sensitive to the starting year (1970 ~ 1981) and to the selectivity assumptions (domed ~ flat), which indicate the scale of the model estimated stock size can be problematic. The % of fish of age 9+ in the CAA and survey age compositions are high based on the bubble plots. The estimated SSBs of age 9+ are higher than 40-60% of the stock's total SSB over the years even when flat selectivity was used. Future stock assessment may consider increasing the age of the plus group to see whether it can solve the scaling difficulty.

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

This TOR was satisfactorily addressed.

No retrospective adjustments were made to the model results. Spawning stock biomass (SSB) in 2021 was estimated to be 175,573 mt under the base model and 85,109 mt under the flat sel sensitivity model which is 191 and 150% (respectively) of the biomass target, an SSB_{MSY} proxy of SSB at $F_{40\%}$ (92,130 and 56,817 mt). The 2021 age 5 to 7 average fishing mortality (F) was estimated to be 0.052 under the base model and 0.092 under the flat sel sensitivity model, which is 22 and 39% (respectively) of the overfishing threshold, an F_{MSY} proxy of $F_{40\%}$ (0.235 and 0.237).

The stock is not overfished and overfishing is not occurring.

5. Conduct short-term stock projections when appropriate.

This TOR was satisfactorily addressed.

Short term projections of median total fishery yield and spawning stock biomass for pollock were conducted using AGEPRO and based on a harvest scenario of fishing at an F_{MSY} proxy of $F_{40\%}$ between 2023 and 2025. Recruitments were sampled from a cumulative distribution function derived from ASAP estimated age 1 recruitment between 1970 and 2019. Recruitments in 2020 and 2021 were not included due to uncertainty in those estimates. The annual fishery selectivity, natural mortality, maturity ogive, and mean weights used in projections are the most recent 5-year averages. No retrospective adjustments were made.

The estimated catch for 2022 is 3,959 mt, which results in catch advice of 19,614, 17,546, and 16,249 mt for 2023-2025, respectively.

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.

The analyst has successfully responded to four significant sets of recommendations from the 2019 review.

*This Panel **recommended** research into:*

- *Survey selectivity including the satellite tagging and pollock swimming speed studies that could help support or refute the dome shaped selectivity*
- *Splitting the FSV Albatross IV and FSV Bigelow survey indices.*
- *Increase the age of the plus age group.*

Appendix A. Summary of Assessment Oversight Panel Meetings for September 2022 Management Track Stock Assessments

The NRCC Assessment Oversight Panel (AOP) met to review the operational stock assessment plans for ocean pout, Atlantic wolffish, Georges Bank winter flounder, Gulf of Maine winter flounder, Cape Cod/Gulf of Maine yellowtail flounder, southern New England/mid-Atlantic yellowtail flounder, northern and southern monkfish, Georges Bank haddock, Gulf of Maine haddock, Atlantic halibut, witch flounder, white hake and pollock stocks on May 23-24, 2022. The AOP also met on August 3, 2022 to review the assessment plan for American Plaice, which underwent a Research Track peer review in July 2022. Four assessments were recommended for Level 1 Reviews (Direct Delivery) and these assessments will undergo an internal review before being delivered to the appropriate management body. The assessments for stocks/species recommended for Level 2 and 3 peer reviews will be reviewed during a meeting September 19-23, 2022.

The AOP consisted of:

Russell W. Brown, Ph.D. (AOP Chair), Northeast Fisheries Science Center, Woods Hole, Massachusetts. (5/23, 5/24, 8/3)

Gary Nelson, Ph.D., representing the Atlantic States Marine Fisheries Commission, Massachusetts Division of Marine Fisheries. (5/23, 5/24, 8/3)

Lisa Kerr, Ph.D., Chair of the NEFMC Scientific and Statistical Committee, Gulf of Maine Research Institute. (5/23, 5/24, 8/3)

Paul Rago, Ph.D., Chair of the MAFMC Scientific and Statistical Committee, NOAA Fisheries (retired). (5/24, 8/3)

Michael Wilberg, Ph.D., vice-chair of the MAMFC Scientific and Statistical Committee, University of Maryland. (5/23)

Meeting Details:

These meetings were guided by the NRCC-approved stock assessment guidance documents. Three background documents were provided to the Panel: (1) an updated prospectus for each stock; (2) an overview summary of all the salient data and model information for each stock; and (3) the NRCC Guidance memo on the Operational Assessments. Prior to the meeting, each assessment lead prepared a proposal for their Management Track Assessment. The proposal reflected the research track or most recent assessment results, the peer review panel Summary Report results and any initial investigations conducted for the management track assessment.

At the meeting, each assessment lead gave a presentation on the data to be used, model specifications (if applicable), evaluation of model performance, the process for updating the Biological Reference Points, the basis for catch projections, and an alternate assessment approach if their analytical assessment was rejected by the peer review panel.

Major Recommendations for Review of Individual Stocks:

In general, the AOP approved the plans presented, but recommended several points of emphasis to the recommended review levels as summarized below. AOP guidelines can be found in the [stock assessment process document](#).

Stock	Lead	Review Level	Rationale and Comments
Ocean Pout	Charles Adams	Level 1 - Direct Delivery	Rationale: Little impact of swept area adjustments on survey indices, low biomass could result in variable survey indices. Concern about the reliability of the discards.
Atlantic Wolffish	Charles Adams	Level 1 - Direct Delivery	Rationale: Little impact of swept area adjustments on survey indices, low biomass could result in variable survey indices; AOP requested that the longline survey indices be presented with the assessment; some concern length frequency data.
Georges Bank Winter Flounder	Alex Hansell	Level 2 - Expedited Review	Rationale: VPA assessment update with little change to the previous assessment, major retrospective pattern in previous assessment.
Gulf of Maine Winter Flounder	Paul Nitschke	Level 2 - Expedited Review	Rationale: Little change proposed to the assessment methods, little impact of the swept area adjustments on the NEFSC survey indices; missing survey in 2020 is problematic and the panel would recommend investigating other averaging approaches.
Atlantic Halibut	Dan Hennen	Level 2 - Expedited Review	Rationale: There was a large increase in the 2020 Canadian catch attributable to increased targeting by their longline fishery. We encourage investigation of the U.S. longline and any Canadian indices of abundance. There is sufficient investigation planned in the assessment methods to warrant a Level 2 review.
Witch Flounder	Susan Wigley	Level 1 - Direct Delivery	Rationale: Witch Flounder currently uses an empirical approach to provide management advice. The NEFSC bottom trawl surveys will be updated to include swept area adjusted

Stock	Lead	Review Level	Rationale and Comments
			abundance and biomass surveys. 2020 survey values missing due to Covid will be treated as missing in the application of the empirical approach.
Monkfish - North	Jon Deroba	Level 2 - Expedited Review	Rationale: Revise discard estimation method from simple ratio to combined ratio method to make this consistent with SBRM and other stocks. No longer manually remove some “extreme” discard observations. Make the stat areas that define each management area consistent among landing and discard calculations. Reconsider discard mortality assumption of scallop dredge based on Weissman et al. 2021.
Monkfish - South	Jon Deroba	Level 2 - Expedited Review	Rationale: Revise discard estimation method from simple ratio to combined ratio method to make this consistent with SBRM and other stocks. No longer manually remove some “extreme” discard observations. Make the stat areas that define each management area consistent among landing and discard calculations. Reconsider discard mortality assumption of scallop dredge based on Weissman et al. 2021.
Georges Bank Haddock	Liz Brooks	Level 2 - Expedited Review	Rationale: Research Track completed earlier in 2022. Swept area adjustments to survey indices are within the confidence bounds of the survey estimates. Some changes to the projection methodology vs. the VPA based projections done in AgePro.
Gulf of Maine Haddock	Charles Perretti	Level 3 - Enhanced Review	Rationale: The analyst plans to follow up on recommendations from the Research Track peer review to include the Bottom Longline Survey as a

Stock	Lead	Review Level	Rationale and Comments
			survey index and to develop a quantitative model that accounts for cohort strength to replace the averaging of Weights at Age over recent years in the projection approach.
Cape Cod/Gulf of Maine Yellowtail Flounder	Larry Alade	Level 1 - Direct Delivery	Rationale: Scheduled for a Research Track assessment in 2024. One of the last remaining VPAs. Few changes will be implemented. Missing survey data were evaluated and concerned about the retrospective.
Southern New England/Mid-Atlantic Yellowtail Flounder	Chris Legault	Level 2 - Expedited Review	Rationale: Scheduled for a Research Track assessment in 2024. Catch and survey indices are likely to remain very low. The analyst plans to explore fleet selectivity and other aspects to tune the ASAP model and explore cold pool indices relative to current recruitment to determine appropriate years to use projections.
White Hake	Kathy Sosebee	Level 3 - Enhanced Review	Rationale: Update all fishery and survey data through 2021. For 2020 CAA, use pooled Age Length Key as done for half 2 2003 since no survey age data. Potentially add ASMFC shrimp survey (include new age data) and bottom longline surveys either using spring and fall bottom trawl ages or direct ages.
Pollock	Brian Linton	Level 3 - Enhanced Review	Rationale: Use new area swept-based NEFSC spring and fall survey indices. Evaluate use of a historical recreational catch series (1970-1980). Use current ASAP base and sensitivity model configurations. Evaluate new assessment starting year of 1981. Evaluate use of a single fishery fleet (commercial + recreational). Update base and sensitivity model BRPs using 2010 SAW 50 SSBR

Stock	Lead	Review Level	Rationale and Comments
			F _{40%} and SSB at F _{40%} projection approach
American Plaice	Larry Alade	Level 2 - Expedited Review	<p>Rationale: A Research Track stock assessment for American Plaice was peer reviewed in July 2022 (less than 3 weeks before the AOP meeting). New sources of data included 2020 and 2021 landings estimated through the Catch Assessment and Monitoring System (CAMS) and discards will be derived using CAMS generated landings and discard ratios generated using recent observer data.</p> <p>Projections will be done internally within WHAM, which will result in internally consistent input data. The alternative approach will be an ASAP type model (without random effects) that can be implemented within the WHAM framework.</p>

Individual Stock Discussion Summaries:

Ocean Pout (AOP Lead: Michael Wilberg)

Recommendation: Level 1 (Direct Delivery)

Ocean pout is assessed using the relative exploitation rate following the accepted assessment in the 2008 GARM, and its most recent status was overfished but overfishing not occurring. The assessment uses the catch divided by the 3-year moving average of the NEFSC Spring Trawl Survey. Catch is prohibited, so all catch is from discards. Projections are not done for this stock, and there is no alternate assessment approach. Recent years discards are estimated using the total CAMS catch and discard ratios from NEFOP. Recreational discards are not included as they are considered negligible. The survey indices had only very minor changes from the swept area adjustments. The stock appears to be at low biomass, which could result in variable survey indices.

The management track assessment will go through 2021. There are no proposed changes to analyses, but two data streams have changes in how they are calculated: the NEFSC Spring Trawl Survey Index and the discarded catch. These changes in processing the data streams are expected to have minor effects, but they could result in larger changes than anticipated. In particular, the lack of NEFOP sampling during part of 2020 has the potential to affect the estimate of discards. The direction and magnitude of that effect would depend on whether the period for which samples are not available is different from the rest of the period over which discards are calculated. Additionally, the 2020 NEFSC Spring Trawl Survey index is not

available, and a two-year moving average will be used for the years impacted by that year. Therefore, the AOP recommends a **Level 1 (Direct Delivery)** review.

Atlantic Wolffish (AOP Lead: Lisa Kerr)

Recommendation: Level 1 (Direct Delivery)

Wolffish is currently assessed using a forward projection model known as SCALE (Statistical Catch At Length) which tunes to size and age data from trawl survey recruitment and adult indices, total catch, and catch size distributions along with overall growth information. The model was approved by the 2008 Northeast Data Poor Stocks Working Group (NDPSWG) and last updated in 2020. The model features one fishery fleet with one selectivity block and four survey indices (NEFSC spring recruitment, and NEFSC fall and spring and MADMF adult indices). The most recent stock status was overfished but overfishing is not occurring. In 2010, there was a change to a no possession limit for wolffish, so catch is from discards since that time. The NDPSWG deemed projections unreliable for this stock assessment and they are not conducted.

The management track assessment will update data for this stock through 2021. There are no proposed changes to the model, but two data streams (i.e., NEFSC Trawl Survey and the discarded catch) have changes in how they are calculated and Covid-19 disruptions resulted in missing surveys and reduced observer and port sampling of catch data in 2020. The NEFSC has adopted swept area biomass calculations of indices and the impact of the adjustment to the NEFSC trawl survey data was reported to be minimal for wolffish. The most recent years discards (2020 and 2021) will be estimated based on discard ratios calculated as usual based on observer data and the CAMS derived fleet landings. The missing 2020 survey data will be treated as missing in the assessment (i.e., not imputed). The Panel expressed concern regarding the sufficiency of length frequency data in 2020 due to reduced observer coverage and how that could impact the assessment. The lead analyst noted that SCALE allows for missing length data and there are previous years with missing data. In addition, there is a general deficiency of data for this stock which would make it challenging to do much analytically about this issue. The AOP suggested that Bottom Longline Survey indices for wolffish be provided along with the assessment. The backup assessment approach is a Plan B loess smooth of NEFSC spring and fall adult indices. The uncertainty introduced by using ocean pout calibration and integration of newly published sex specific growth parameters were discussed but won't be addressed in this management track due to time limitations.

This management track assessment will update data through 2021 and include a new survey index as additional information for consideration outside of the assessment. The AOP recommended a **Level 1 (Direct Delivery)** review for wolffish with the opportunity for an update from the analyst on any identified data or model issues at the August AOP meeting.

Georges Bank Winter Flounder (AOP Lead: Gary Nelson)

Recommendation: Level 2 (Expedited Review)

The current assessment method for Georges Bank Winter Flounder is a VPA model that includes age-specific US and Canadian landings and discards, and age-specific trawl indices (NEFSC fall, NEFSC spring and CA DFO spring surveys). The proposed work for the 2022 management track assessment includes updating all landings, discards and the survey data, and performing OFL and ABC projections at F_{MSY} for 2024-2026. The landings and discards will be updated via

the CAMS system and the old NEFSC indices will be replaced with new NEFSC area-swept indices.

The AOP discussed the potential impact of the missing survey indices in 2020, data deficiencies with sampling and CAMS system estimates on the assessment. Comparisons between the new and old indices and between the 2019 AA and CAMS landings and discards were not provided, so members were uncomfortable concluding that the changes would have limited impacts on assessment results. In addition, the last VPA had a large retrospective bias and members expressed concern that low samples of data for characterizing catch-at-age could exacerbate the bias. Based on those concerns, the Panel elevated the assessment to a **Level 2 (Expedited)** review.

Gulf of Maine Winter Flounder (AOP Lead: Gary Nelson)

Recommendation: Level 2 (Expedited Review)

The current assessment method is an index-based approach that uses catch and estimates of 30+ cm biomass from three non-overlapping fall trawl surveys (MENH, MDMF, NEFSC). The proposed work for the 2022 management track assessment is to update the fall surveys and catch through 2021. The plan proposes to replace the NEFSC standardized trawl index with the new area-swept adjusted index. In addition, catch data will be assembled using the new CAMS automated system.

The AOP discussed three primary issues with the proposed assessment update. The AOP was concerned about the impact that COVID restrictions in 2020 had on sampling activities (e.g., MRIP intercept sampling, observer coverage, etc.) from which estimates of landings and discards are made, and they wondered what biases could occur in the estimations. The AOP discussed the impact of the missing survey indices in 2020 on the calculation of catch advice because it is usually computed by using the average of two recent fall surveys; therefore, members worried about potential instability in the updated estimate using only one year (2021). Also, the AOP conferred that, although differences between NEFSC's new area-swept index and the old index appear minor, some unanticipated changes in the results could occur. Based on those discussions, the Panel agreed to elevate this assessment to a **Level 2 (Expedited)** review.

Atlantic Halibut (AOP Lead: Paul Rago)

Recommendation: Level 2 (Expedited Review)

Atlantic halibut catches limits are based on an index method that combines trends in several measures of relative abundance to adjust recent catches on a regular basis. The method is known as the First and Second Derivative (FSD) method because it adjusts catches using a linear combination of the slope and rate of change in slopes of abundance indices. The catch in year $t+1$ is estimated as the product of the adjustment rate and the catch in year t . The abundance indices are the NEFSC fall bottom trawl survey and discard ratios for gillnet and trawl fleets in the Northeast. No biological reference points for Atlantic halibut in the US are available.

Application of the model in 2022 is complicated by a major change in the Canadian fishery in 2020. The total catch used in the original model includes catches in Canada from Stat Area 5. Shackell et al. (2021) reports the ongoing recovery of halibut but the recovery in Canadian waters may be occurring more quickly. Tagging analyses reported in Rago (2018) suggest regular movement of Atlantic halibut between US and Canada.

The sharp increase in landings in Canadian waters and declining indices in the US poses a dilemma for application of the current FSD model. Canada's increase in landings is driven by results of a DFO assessment that increased the quota. This assessment is likely to have indices that are trending upward in contrast to US indices which appear to be either level or slightly decreasing. Nonetheless, the slightly lower FSD multiplier, when multiplied by the increased total catch, results in a large increase in potential US catch. The appropriateness of this calculation was discussed but not resolvable during the AOP meeting.

The Panel suggested that an investigation of the basis for the increase in Canadian landings would be useful. Comparisons of US index trends with Canadian indices of abundance might also be useful. The assessment lead will also investigate the applicability of the Cooperative Longline survey in the Gulf of Maine in the FSD model. The assessment lead also proposes to modify and align some of the Stat Areas with survey areas but does not plan to redefine stock areas. In view of the potential changes in the model framework and addition of a new index, the Panel recommended a **Level 2 (Expedited)** review for Atlantic halibut.

Witch Flounder (AOP Lead: Russ Brown)

Recommendation: Level 1 (Direct Delivery)

Witch Flounder currently uses an empirical approach to provide management advice. It is a unit stock, so is less dependent on CAMS approaches to allocate catch to separate stock areas. The NEFSC bottom trawl surveys will be updated to include swept area adjusted abundance and biomass surveys. 2020 survey values missing due to Covid will be treated as missing in the application of the empirical approach. It was noted that the age structure of the population continues to be truncated and the analyst will include supplement data in the data portal that is not directly used in the empirical analysis. The panel concluded that a **Level 1 (Direct Delivery)** review was warranted.

Northern and Southern Monkfish (AOP Lead: Gary Nelson)

Recommendation: Level 2 (Expedited Review)

The current assessment method for the northern and southern Monkfish stocks is the index-based method known as "PlanBsmooth" that uses fishery landings and discards, and NEFSC fall, spring and summer survey indices. The proposed work for the 2022 management track assessment includes updating all landings, discards and the survey data through 2021 (the spring survey will be updated through 2022). The landings will be updated via the CAMS system and a new method for estimating discards will be examined. Also, the old NEFSC indices will be replaced with new NEFSC area-swept indices and methods for dealing with the missing 2020 survey values will be explored. Additionally, the discard mortality assumption of Monkfish in scallop dredges will be re-examined, how extreme discard observations are handled will be changed, and adjustments to statistical areas that define the managements will be made consistent.

The main discussion of the AOP pertained to the proposed exploration of imputing missing survey values. One member wondered what the potential outcome would be and suggested that including an additional year further back in time might help with stability of resulting catch advice. The analyst responded that, based on earlier simulations examining biases in the PlanBsmooth method, catch advice should be fairly robust with a missing year, but he will try the suggested method. The AOP panel agreed that a **Level 2 (Expedited)** review is appropriate for the proposed changes.

Georges Bank Haddock (AOP Lead: Russ Brown)

Recommendation: Level 2 (Expedited Review)

A Research Track Assessment for Haddock was completed earlier in 2022. The assessment will be updated through 2021 and utilize a WHAM state space model to develop estimates of recruitment, biomass, and fishery mortality. In the Research Track, the working group and analyst demonstrated extensive bridge building from VPA to ASAP, and from ASAP to WHAM (Research Track TOR #4). The panel was concerned that this is one of the first implementations of WHAM, uncertainty about the change in the scale of the catch advice, and about reduced sampling in recent years. On this basis, the panel recommended a **Level 2 (Expedited)** review for this stock.

Gulf of Maine Haddock (AOP Lead: Russ Brown)

Recommendation: Level 3 (Enhanced Review)

A Research Track Assessment for Haddock was completed earlier in 2022. The assessment will be updated through 2021 and utilize an ASAP model to develop estimates of recruitment, biomass, and fishery mortality. The analyst plans to follow up on recommendations from the Research Track peer review to include the Bottom Longline Survey as a survey index and to develop a quantitative model that accounts for cohort strength to replace the averaging of Weights at Age over recent years in the projection approach. Based on these proposed changes to the assessment methodology the AOP concurred with the analyst recommendation that the management track update should receive a **Level 3 (Enhanced)** review.

Cape Cod/Gulf of Maine Yellowtail Flounder (AOP Lead: Lisa Kerr)

Recommendation: Level 1 (Direct Delivery)

Cape Cod-Gulf of Maine (CC/GOM) yellowtail flounder is assessed using a VPA that was approved in 2008 at GARM III and was last updated in 2019. The model includes a single fishery fleet and fall and spring time series from three fishery independent surveys (NEFSC, MADMF, and MENH trawl surveys). This assessment has retrospective issues and adjustments were made to the model results. The most recent stock status is not overfished and overfishing is not occurring.

Two data streams (i.e., NEFSC trawl survey and landings) have changes in how they are calculated and Covid-19 disruptions resulted in missing surveys and reduced observer and port sampling of catch data in 2020. The NEFSC has adopted swept area biomass calculations of indices and the impact of the adjustment to the NEFSC trawl survey data is minimal for CC/GOM yellowtail flounder. The transition from AA tables to CAMS is not anticipated to have a significant impact based on a 2019 data comparison. The missing survey data will be treated as missing in the assessment (i.e., not imputed). An initial analysis of the impact of missing survey data on the performance of the VPA suggests the impact will be minimal.

This management track assessment will update all fishery and survey data through 2021 and use the current VPA model configuration with no changes. Projections will be calculated and BRPs will be updated using the prescribed approach without changes. The analyst will perform a comparison of population size between the cooperative research twin trawl catchability study and the VPA model estimates. The alternative assessment is an empirical approach which applies catchability estimates from the twin trawl study to expand survey catch/tow to absolute biomass from Bigelow Spring and Fall survey estimates.

There are no major changes to the assessment model or the types of data incorporated in the model. The analyses of impacts of changes in data streams and missing data suggest that these will have minimal impact. The AOP recommended a **Level 1 (Direct Delivery)** review for CC/GOM yellowtail flounder with the opportunity for an update on any identified data or model issues at the August AOP meeting. The last management track assessment cited concerns about the uncertainty and retrospective patterns in this stock assessment. This is one of the last remaining assessments that applies the VPA approach and it is scheduled for a Research Track Stock Assessment in 2024. Major changes will be addressed at that time with a likely change in model type.

Southern New England/Mid-Atlantic Yellowtail Flounder (AOP Lead: Paul Rago)
Recommendation: Level 2 (Expedited Review)

The current assessment model for SNEMA YT is based on an ASAP model, accepted in 2012 at SAW 54 and last updated in 2019. The model features an age dependent M, single fleet fishery, and three fishery independent surveys. Six selectivity blocks are used to model the stock from 1973 to 2018. The most recent selectivity block began in 2002. The stock is severely depleted, at about 10% of the $\frac{1}{2} B_{MSY}$ level, but overfishing is not occurring. Recruitment has been low and both reference points and projections are based on R estimates from 1990 onward.

The pandemic resulted in loss of both spring and fall bottom trawl surveys in 2020 and reductions in observer coverage. Funding issues reduced port sampling efforts. There are no recreational landings. Bottom trawl estimates will now use swept area per tow measurements to improve accuracy. Slight changes in overall means have been observed, but the variances of estimates tend to be large, overwhelming potential differences in scale. There does not seem to be any significant trend towards higher or lower values given adjustments for swept area. Landings estimates by stat area, previously based on the AA method, are expected to change only slightly as a result of the new CAMS approach. The new estimates of landings will not have any effects on estimates of discards but might be important in some instances in the future. Discard estimates are scaled by multiplying discard:kept ratios by total landings, which will change when CAMS rather than AA based estimates are used.

The lead analyst has proposed to re-examine the selectivity blocks and other settings to improve model performance. The potential effects of swept area-adjusted survey indices will also be examined. Several recent publications in the literature have illustrated the utility of state-space models to estimate effects of environmental factors on stock dynamics. In particular, increases of the cold pool index (i.e., warmer) in the mid-Atlantic are associated with lower recruitment. These results cannot be directly included in the current model but they may be used to refine the range of years used to define “recent” recruitment. Such a change, if justifiable, would alter both the biological reference points and abundance projections.

Given the potential effects of changes in selectivity blocks and the consideration of state space model results to inform the current assessment, the AOP recommended a **Level 2 (Expedited)** review for SNEMA YT.

White Hake (AOP Lead: Lisa Kerr)
Recommendation: Level 3 (Enhanced Review)

White Hake is currently assessed using the ASAP model which was accepted in 2013 at SAW 56 and was last updated in 2019. The model extends back to 1963 and includes one fishery fleet with two selectivity blocks and two trawl survey indices (NEFSC fall and spring). Catch at age information is not well characterized for this stock due to possible misidentification of species in the commercial and observer data, particularly in early years, low sampling of commercial landings in some years, and sparse discard length data. Pooled age length keys (ALKs) have been used during periods with deficient age data. The current status is overfished and overfishing is not occurring. This assessment has retrospective issues and adjustments were made to the model results.

Two data streams (i.e., NEFSC Trawl Survey and landings) have changes in how they are calculated and Covid-19 disruptions resulted in missing surveys and reduced observer and port sampling of catch data in 2020. The NEFSC has adopted swept area biomass calculations of indices and the impact of the adjustment to the NEFSC trawl survey data will be reported for white hake. The impact of the transition from AA tables to CAMS for white hake will be documented based on a 2019 data comparison. The missing survey data will be treated as missing in the assessment (i.e., not imputed) and a pooled ALK will be used for 2020 CAA for commercial landings.

The management track assessment will update all fishery and survey data through 2021. In addition, two new indices will be considered in the management track, the ASMFC shrimp survey and the Bottom Longline Survey. The current ASAP model configuration will be used with the additional indices. The analyst will explore the model sensitivity to use of pooled ALKs. The biological reference points will be updated using approach prescribed through SAW 56 and projections will be performed assuming catch in 2022 is equal to the PDT provided 2022 landings. The alternative assessment plan is LOESS smoothing of both NEFSC surveys indices to infer future catch increase. Age information as an important source of uncertainty for this stock. Ageing was completed for white hake from the shrimp survey, however, there is still a need for observer ages and from the bottom longline survey.

This management track assessment will involve substantial changes, including the potential addition of a new survey index. The AOP agreed with the analyst's suggestion of a **Level 3 (Enhanced)** review for this stock.

Pollock (AOP Lead: Paul Rago)

Recommendation: Level 3 (Enhanced Review)

Pollock is currently assessed with an ASAP model that relies on dome shaped selectivity patterns for both the fishery and surveys. To ensure model convergence, the selectivity of oldest fish is fixed. The double dome model creates a "cryptic" biomass that cannot be estimated by survey data or captured by the commercial fishery.

Assessment scientists, managers, and even some harvesters have expressed concerns about the validity of the base (i.e., double-domed) model. An alternative model, which includes the same data but assumes a flat-top selectivity for survey indices, is used for comparison. Estimates of exploitable biomass from the base model compare favorably to the estimates from the sensitivity model (with a flat-top selectivity pattern for the survey).

The change from AA to CAMS appears to have little effect (0.1% increase) for 2019 comparison. Similarly, the use of a variable area per tow estimator appears to have little effect on the annual mean abundance estimates.

Commercial and recreational fisheries are modeled separately using data from 1970 to present. However, recreational catch before the start of the MRFSS program is assumed to be zero. To eliminate this inconsistency, a revised starting year of 1981 is proposed. The assessment lead also suggested pooling of recreational and commercial landings. This would eliminate the need to specify two selectivity patterns for these fleets. However, there may be some conflating of selectivity patterns because recreational catches historically occurred inshore and on smaller fish (so called harbor pollock). The joint effects of changing the starting year, combining the recreational and commercial catches into a single fleet, and inherent instability of the base model are likely to require significant exploration of alternative model runs. After consideration of the number of changes, and their potential interactive effects, the Panel concurred with the lead scientist's recommendation for a **Level 3 (Enhanced)** review.

American Plaice (AOP Lead: Russell Brown)

Recommendation: Level 2 (Expedited Review)

The Research Track stock assessment for American Plaice was peer reviewed in July 2022 (less than 3 weeks before the AOP meeting). A state space WHAM model informed by data through 2019 was tabled by the Management Track and accepted by the CIE peer review panel. New sources of data included 2020 and 2021 landings estimated through the Catch Assessment and Monitoring System (CAMS) and discards will be derived using CAMS generated landings and discard ratios generated using recent observer data. Model diagnostics for the assessment through 2019 were well behaved and the retrospective pattern was relatively insignificant (no retrospective adjustments are anticipated). Projections will be done internally within WHAM, which will result in internally consistent input data. The alternative approach will be an ASAP type model (without random effects) that can be implemented within the WHAM framework. As a result of these proposed changes, the AOP concurred that this assessment should receive a **Level 2 (Expedited)** review.

AOP Meeting Conclusions:

The AOP met on May 23-24, 2022 to review the stock assessment plans for 14 stocks and on August 3, 2022 for one stock scheduled for the September 2022 Management Track cycle. The panel concluded that Level 1 reviews (Direct Delivery) were warranted for ocean pout, Atlantic wolffish, witch flounder, and Cape Cod/Gulf of Maine yellowtail flounder; Level 2 reviews (Expedited Review) for Georges Bank winter flounder, Gulf of Maine winter flounder, Atlantic halibut, northern and southern monkfish, Georges Bank haddock, Southern New England/mid-Atlantic yellowtail flounder and American Plaice; and Level 3 reviews (Enhanced Review) for Gulf of Maine haddock, white hake, and pollock. The Level 2 and 3 reviews will occur during the September 2022 Management Track Peer Review scheduled for September 19-22, 2022. Changes in the required review level would be triggered by a Northeast Fisheries Science Center request to increase the review level for a given stock. The AOP could concur to increase the review level via email or request to reconvene the AOP panel to have further discussions with the stock assessment lead. Any need to reconvene the panel would be a publicly announced

meeting and any subsequent changes to the review level would be publicized to assessment partners and stakeholders.

Appendix 1. Meeting participants (names only, no call-in numbers)

Lisa Kerr, AOP (NEFMC SSC)

Gary Nelson, AOP (ASMFC)

Mike Wilberg and Paul Rago, AOP (MAFMC SSC)

Russ Brown, AOP Chair (NEFSC)

Michele Traver, NEFSC Assessment Process Lead

Alex Dunn, NEFSC

Alex Hansell, NEFSC

Andrew Jones, NEFSC

Angela Forristall, NEFMC

Benjamin Levy, NEFSC

Brian Linton, NEFSC

Cate O'Keefe, Fishery Applications Consultant

Charles Adams, NEFSC

Charles Perretti, NEFSC

Chris Kellogg, NEFMC

Chris Legault, NEFSC

Christopher Maguire, Nature Conservancy

Daniel Hennen, NEFSC

Gareth Lawson, Conservation Law Foundation

Jamie Cournane, NEFMC

Janice Plante, NEFMC

Jean-Jacques Maguire, NEFMC SSC

Jennifer Couture, NEFMC

John Pappalardo, NEFMC member, Cape Cod Commercial Fishermen's Alliance

Jon Deroba, NEFSC

Julie Nieland, NEFSC

Katherine Sosebee, NEFSC

Kelley Whitmore, MA DMF

Kiersten Curti, NEFSC

Larry Alade, NEFSC

Libby Etrie, NEFMC member, Northeast Sector Service Network, Inc.

Liz Brooks, NEFSC

Liz Sullivan, GARFO

Maggie Raymond, Associated Fisheries of Maine

Melissa Sanderson, Cape Cod Commercial Fishermen's Alliance
Paul Nitschke, NEFSC
Peter Melanson - Protech AIS
Rachel Feeney, NEFMC
Rebecca Peters, ME DMR
Rick Bellavance, NEFMC Vice Chair, RI Party and Charter Boat Association
Robin Frede, NEFMC
Spencer Talmage, GARFO
Steve Cadrin, SMAST
Susan Wigley, NEFSC
Tara Dolan, MA DMF
Thomas Nies, NEFMC Executive Director
Tracey Bauer, ASMFC

Key:

NEFSC - Northeast Fisheries Science Center
GARFO - Greater Atlantic Regional Fisheries Office
NEFMC - New England Fishery Management Council
MAFMC - Mid-Atlantic Fishery Management Council
ASMFC - Atlantic States Marine Fisheries Commission
SMAST - University of Massachusetts School of Marine Science and Technology
MA DMF - Massachusetts Division of Marine Fisheries
ME DMR - Maine Department of Marine Resources

SSC - Scientific and Statistical Committee

Appendix B. Management Track Stock Assessment Terms of Reference

1. Estimate catch from all sources including landings and discards.
2. Evaluate indices used in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.).
3. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) as possible (depending on the assessment method) for the time 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 assessment results and projections, 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 backup assessment approach that would serve as an alternative for providing scientific advice to management if the analytical assessment were to not pass review
4. Re-estimate or update the BRP's as defined by the management track level and recommend stock status. Also, provide qualitative descriptions of stock status based on simple indicators/metrics (e.g., age- and size-structure, temporal trends in population size or recruitment indices, etc.).
5. Conduct short-term stock projections when appropriate.
6. Respond to any review panel comments or SSC concerns from the most recent prior research or management track assessment.

* Major changes from the previous stock assessment require pre-approval by the Assessment Oversight Panel.

Appendix C. September 2022 Management Track Peer Review meeting attendees.

NEFSC - Northeast Fisheries Science Center
GARFO - Greater Atlantic Regional Fisheries Office
NEFMC - New England Fisheries Management Council
MAFMC - Mid-Atlantic Fisheries Management Council
DFO - Department of Fisheries and Oceans (Canada)
SMAST - University of Massachusetts School of Marine Science and Technology
MA DMF - Massachusetts Division of Marine Fisheries
ME DMR - Maine Department of Marine Resources
NC DMF - North Carolina Division of Marine Fisheries

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*Richard Merrick - Chair*  
*Matt Cieri - Panel*  
*Cate O'Keefe - Panel*  
*Yan Jiao - Panel*

Russ Brown - NEFSC  
Michele Traver - NEFSC

Alan d'Entremont - Scotia Harvest Inc., TMGC Canadian co-chair  
Alex Dunn - NEFSC  
Alex Hansell - NEFSC  
Angela Forristall - NEFMC  
Bill Devoe - ME DMR  
Brian Linton - NEFSC  
Carl Wilson - ME DMR  
Charles Adams - NEFSC  
Charles Perretti - NEFSC  
Chris Kellogg - NEFMC  
Chris Legault - NEFSC  
Dan Hennen - NEFSC  
Dave McElroy - NEFSC  
Dave Richardson - NEFSC  
Gareth Lawson - Conservation Law Foundation  
Gary Nelson - MA DMF  
Jackie O'Dell - Northeast Fisheries Coalition  
Jamie Cournane - NEFMC  
Jason Didden - MAFMC  
Jennifer Couture - NEFMC  
Jon Deroba - NEFSC  
Jonathon Peros - NEFMC  
Joseph Powers - NOAA (retired)  
Julie Nieland - NEFSC  
Kathy Sosebee - NEFSC

Kelly Whitmore - MA DMF  
Kiersten Curti - NEFSC  
Kris Vascotto - Atlantic Groundfish Council, Executive Director  
Larry Alade - NEFSC  
Libby Etrie - Northeast Sector Service Network, Inc.  
Liz Brooks - NEFSC  
Liz Sullivan - GARFO  
Melanie Griffin - MA DMF  
Mark Terceiro - NEFSC  
Paul Nitschke - NEFSC  
Rachel Feeney - NEFMC  
Rebecca Peters - ME DMR  
Rick Bellavance - RI Party and Charter Boat Association  
Robin Frede - NEFMC  
Spencer Talmage - GARFO  
Steve Cadrin - SMAST  
Susan Wigley - NEFSC  
Tara Dolan - MA DMF  
Tara Trinko Lake - NEFSC  
Tim Miller - NEFSC  
Tom Nies - NEFMC, Executive Director  
Tracey Bauer - NC DMF  
Xavier Mouy - NEFSC  
Yanjun Wang - DFO

## Appendix D. Realized Agenda for September 2022 Management Track peer review

Monday, September 19, 2022

| <b>Time</b>             | <b>Stock</b>                                     | <b>Lead</b>                                        |
|-------------------------|--------------------------------------------------|----------------------------------------------------|
| 9 a.m. - 9:15 a.m.      | Welcome/Logistics/Conduct of Meeting             | Michele Traver, Russ Brown, Richard Merrick, Chair |
| 9:15 a.m. - 10 a.m.     | Input Data Changes Discussion/Questions          | Russ Brown Review Panel                            |
| 10 a.m. - 11 a.m.       | GOM Winter flounder Discussion/Questions         | Paul Nitschke Review Panel                         |
| 11 a.m. - 11:15 a.m.    | Break                                            |                                                    |
| 11:15 a.m. - 12:15 p.m. | George Bank winter flounder Discussion/Questions | Alex Hansell Review Panel                          |
| 12:15 p.m. - 12:30 p.m. | Discussion/Summary                               | Review Panel                                       |
| 12:30 p.m. - 12:45 p.m. | Public Comment                                   | Public                                             |
| 12:45 p.m. - 1:45 p.m.  | Lunch                                            |                                                    |
| 1:45 p.m. - 2:45 p.m.   | Atlantic halibut Discussion/Questions            | Dan Hennen Review Panel                            |
| 1:45 p.m. - 3:45 p.m.   | Georges Bank haddock Discussion/Questions        | Liz Brooks Review Panel                            |
| 3:45 p.m. - 4 p.m.      | Break                                            |                                                    |
| 4 p.m. - 4:15 p.m.      | Discussion/Summary                               | Review Panel                                       |
| 4:15 p.m. - 4:30 p.m.   | Public Comment                                   | Public                                             |
| 4:30 p.m.               | Adjourn                                          |                                                    |

Tuesday, September 20, 2022

| <b>Time</b>             | <b>Stock</b>                                                                  | <b>Lead</b>                            |
|-------------------------|-------------------------------------------------------------------------------|----------------------------------------|
| 9 a.m. - 9:05 a.m.      | Welcome/Logistics                                                             | Michele Traver, Richard Merrick, Chair |
| 9:05 a.m. - 10:30 a.m.  | White hake                                                                    | Kathy Sosebee                          |
| 10:30 a.m. - 10:45 a.m. | Break                                                                         |                                        |
| 10:45 a.m. - 12 p.m.    | White hake cont.<br>Discussion/Questions                                      | Kathy Sosebee<br>Review Panel          |
| 12 p.m. - 12:15 p.m.    | Discussion/Summary                                                            | Review Panel                           |
| 12:15 p.m. - 12:30 p.m. | Public Comment                                                                | Public                                 |
| 12:30 p.m. - 1:30 p.m.  | Lunch                                                                         |                                        |
| 1:30p.m. - 3:30 p.m.    | Monkfish (North and South)<br>Discussion/Questions                            | Jon Deroba<br>Review Panel             |
| 3:30 p.m. - 3:45 p.m.   | Break                                                                         |                                        |
| 3:45 p.m. - 4:45 p.m.   | Southern New England/Mid-Atlantic yellowtail flounder<br>Discussion/Questions | Chris Legault                          |
| 4:45 p.m. - 5 p.m.      | Discussion/Summary                                                            | Review Panel                           |
| 5 p.m. - 5:15 p.m.      | Public Comment                                                                | Public                                 |
| 5:15 p.m.               | Adjourn                                                                       |                                        |

Wednesday, September 21, 2022

| <b>Time</b>             | <b>Stock</b>                                        | <b>Lead</b>                            |
|-------------------------|-----------------------------------------------------|----------------------------------------|
| 9 a.m. - 9:05 a.m.      | Welcome/Logistics                                   | Michele Traver, Richard Merrick, Chair |
| 9:05 a.m. - 10:30 a.m.  | Gulf of Maine haddock                               | Charles Perretti                       |
| 10:30 a.m. - 10:45 a.m. | Break                                               |                                        |
| 10:45 a.m. - 12 p.m.    | Gulf of Maine haddock cont.<br>Discussion/Questions | Charles Perretti<br>Review Panel       |
| 12 p.m. - 12:15 p.m.    | Discussion/Summary                                  | Review Panel                           |
| 12:15 p.m. - 12:30 p.m. | Public Comment                                      | Public                                 |
| 12:30 p.m. - 1:30 p.m.  | Lunch                                               |                                        |
| 1:30p.m. - 3:30 p.m.    | Pollock                                             | Brian Linton                           |
| 3:30 p.m. - 3:45 p.m.   | Break                                               |                                        |
| 3:45 p.m. - 4:45 p.m.   | Pollock cont.<br>Discussion/Questions               | Brian Linton                           |
| 4:45 p.m. - 5 p.m.      | Discussion/Summary                                  | Review Panel                           |
| 5 p.m. - 5:15 p.m.      | Public Comment                                      | Public                                 |
| 5:15 p.m.               | Adjourn                                             |                                        |

Thursday, September 22, 2022

| <b>Time</b>             | <b>Stock</b>                            | <b>Lead</b>  |
|-------------------------|-----------------------------------------|--------------|
| 9:30 a.m. - 11 a.m.     | American plaice<br>Discussion/Questions | Larry Alade  |
| 11 a.m. - 11:15 a.m.    | Discussion/Summary                      | Review Panel |
| 11:15 a.m. - 11:30 a.m. | Public Comment                          | Public       |
| 11:30 a.m. - 12 p.m.    | Key Points/Follow ups                   | Review Panel |
| 12 p.m. - 1 p.m.        | Lunch                                   |              |
| 1 p.m. - 5 p.m.         | Report Writing                          | Review Panel |