New England Fishery Management Council
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To: Tom Nies, Executive Director

From: Scientific and Statistical Committee

Date: January 16, 2018

Subject: Overfishing levels (OFLs) and acceptable biological catch (ABC) recommendations for Atlantic halibut for fishing years 2018-2020.

The SSC met via conference call on December 18, 2017 to address the following term of reference (TOR):

Review the 2017 Atlantic halibut Operational Assessment and work of the Groundfish Plan Development Team (PDT). Taking into account the Council's Risk Policy Statement, provide the OFL and an ABC for Atlantic halibut for each year 2018, 2019, and 2020 that will prevent overfishing, and achieve rebuilding if needed, consistent with the Council's ABC control rule for groundfish stocks

To address this TOR, the SSC considered the following information:

A.1 The Council's Risk Policy Road Map (2016), that includes the Risk Policy Statement and Implementation Plan
A.2 Draft Halibut Assessment Report for 2017, December 1, 2017
A.3 Draft summary of how the assessment ToRs were addressed, December 2017
A.4 Memo from the Groundfish PDT to SSC re candidate Atlantic halibut OFLs/ABCs for FY2018-FY2020, Dec. 15, 2017
A.5 Presentation: Overview of the 2017 Atlantic halibut Assessment
A.6 Presentation: Groundfish PDT Report
A.7 Peer review report (December 15, 2017)
A.8 Addendum to assessment report

During the 2015 operational assessment process for groundfish, the peer review panel rejected the operational assessment for halibut. The NEFMC contracted Dr. Paul Rago to conduct an analysis to allow for the development of catch advice for the current specification-setting period in the absence of an approved benchmark assessment. Dr. Rago proposed a method that uses catch, discards, and survey information to develop catch advice. In addition to providing estimates, Dr. Rago did numerous simulation and comparative analyses to show the stability and uncertainty inherent in the method. Additionally, the analysis produced parameter estimates, which allows the results to be used in a forecasting mode. The SSC was appreciative for all the work done on Atlantic halibut by Dr. Rago.

An ad hoc subcommittee of the SSC reviewed the Halibut Assessment Report. The Review Panel concluded that the First and Second Derivative (FDS) approach is the best scientific information available with which to base catch advice for the US stock of Atlantic halibut, and that the FSD approach is scientifically valid as a basis for catch advice (i.e., to determine an ABC). Performance of the FDS method for setting catch limits was tested by simulation on known data and by comparison with two other halibut stocks with age-structured assessments.

During the discussion, the SSC considered uncertainties that exist for this stock in addition to those accounted for in the analysis. The discussion was informed by both Dr. Rago's presentation and analysis document, the PDT's presentation and report, and the peer review document. As noted in 2015, stock structure and stock identity for Atlantic halibut remains an area that needs further research, but the management area also may not be a unit stock. The stock structure and identity comment was made during the 2015 review by the SSC as well.

The selection of indices to be used in the analysis was also highlighted as an area that needs further consideration and contributed to uncertainty in the analysis. The main reason for this uncertainty is that fishery dependent data do not cover the full range of the stock, so how the information is used needs to be carefully considered in an effort to capture important signals that may be localized in nature. Evidence suggests that the halibut stock straddles the U.S.-Canada boundary, and that the population's distribution might be shifting into Canadian waters as temperatures rise. If that is the case, then stock dynamics estimated using only data from U.S. waters will be incomplete. **The SSC recommends investigating halibut stock structure and distribution to improve the management of this species.**

The assumptions about discard mortality was another area of focus by the SSC. Dr. Rago's analysis used gear specific discard mortality estimates. Some of the estimates came from research specific to halibut in this area and the gear in question, but in other cases the data were dated or not specific to halibut. In particular, gillnet discard mortality was estimated at 30%, and this was one of the more indirect assumptions in the analysis. These assumptions impact not only the direct estimates of removals but also can have unaccounted for dynamic impacts, for instance if the dynamics of the halibut fishery change such as if the relative proportion of halibut discarded in the trawl fishery were to decrease, it could have implications for halibut management. Another related uncertainty had to do with the current management program, which is thought to encourage high-grading. High-grading for legal-sized fish is believed to occur in the trawl and gillnet fisheries. If the population expands, this could change discarding rates by gear, which could run counter to the assumptions on discard mortality by gear type used in the analysis. **The SSC recommends additional research on discard mortality to improve the analysis in the future.**

Another important assumption and uncertainty in the management plan for halibut is the state harvest assumption. The predominant state harvester of halibut is the State of Maine. Preliminary Maine 2017 data suggests that the landings were lower than assumed in the PDT's 2017 bridge year estimate. Despite this, the PDT still recommended using the 2017 bridge year estimate in the projections, as the final CY2017 data is not yet available. **The SSC concurred with the PDT recommendation to keep the bridge year assumption as it had been set previously**. The

analysis developed by Dr. Rago provides one year projections. Holding the quota constant in the out-years is a source of uncertainty because the catch advice could be lower or higher depending on the catch and survey values that occur during the projection years.

Based on the information reviewed, the SSC recommends that the stock be classified as overfished. Despite trends in the fishery independent data that appear to be moving in a positive rebuilding direction, the overall picture is still that the population appears to be lower than it was historically. The SSC notes that the overfishing status is unknown, which aligns with both Dr. Rago's comments and the PDT advice. The analysis that was conducted does not allow for a determination of the overfishing status as an OFL cannot be determined using this method.

The SSC recommends an ABC for FY2018 – 2020 of 137 mt. This ABC should be held constant for the three-year specification period. As noted by the PDT, this ABC will be decreased to account for Canadian catch by 33 mt. There are two assumed parameters that are needed for the generation of catch advice, called Kp and Kd. These parameters relate to the proportional rate of change (Kp) and the derivative of change (Kd) from the data used for the trend portion of the analysis. From the simulation analysis done by Dr. Rago, the optimal levels for these two parameter assumptions were to set Kp = 0.75 and Kd = 0.5, therefore the catch advice noted above uses those parameter values. These assumed parameter values create a median trade-off between loss of yield from being overly precautionary and risk of damage to the stock by increasing harvest too quickly and impacting the stocks ability to rebuild. Additionally, the SSC wished to provide an analysis of uncertainty along with their specific catch advice. Bootstrap analyses of the forecasted analysis indicates that the 80% confidence interval for the catch advice ranges from 121 mt to 154 mt.

The SSC concluded by complementing Dr. Rago, the peer review committee, and the PDT for turning this information around quickly to meet management needs for this species.

Summary of SSC recommendations

1. **OFL is unknown for this stock.**
2. **ABC should be set at 137 mt for FY2018 – 2020.** The uncertainty around this catch advice ranges from 121 – 154 mt.
3. **The existing bridge year assumption should be kept despite indications that 2017 harvest may be lower than projected.**
4. **Future research recommendations were made including:**
    a. **Investigating stock structure and how this may impact population dynamics.**
    b. **Investigating species and gear specific discard mortality to improve the data poor approach for setting catch advice used for this specification setting process.**

Table 1. OFL and ABC levels for the specification period of 2018 – 2020 for 20 groundfish stocks including Atlantic halibut.

Stock	OFL 2018	ABC 2018	OFL 2019	ABC 2019	OFL 2020	ABC 2020
GB cod	3,047	2,285	3,047	2,285	3,047	2,285
GOM cod	938	703	938	703	938	703
GB Haddock	94,274	73,114	99,757	73,114	100,825	73,114
GOM Haddock	16,954	13,131	16,038	12,490	13,020	10,186
GB Yellowtail Flounder	unknown	300	unknown	300	-	-
SNE/MA Yellowtail Flounder	90	68	90	68	90	68
CC/GOM Yellowtail Flounder	662	511	736	511	848	511
American Plaice	2,260	1,732	2,099	1,609	1,945	1,492
Witch Flounder	unknown	993	unknown	993	unknown	993
GB Winter Flounder	1,083	855	1,182	855	1,756	855
GOM Winter Flounder	596	447	596	447	596	447
SNE/MA Winter Flounder	1,228	727	1,228	727	1,228	727
Acadian Redfish	15,451	11,552	15,640	11,785	15,852	11,942
White Hake	3,885	2,971	3,898	2,971	3,916	2,971
Pollock	51,680	40,172	53,940	40,172	57,240	40,172
Northern Windowpane Flounder	122	92	122	92	122	92
Southern Windowpane Flounder	631	473	631	473	631	473
Ocean Pout	169	127	169	127	169	127
Atlantic Halibut	**unknown**	**137**	**unknown**	**137**	**unknown**	**137**
Wolffish	120	90	120	90	120	90