



New England Fishery Management Council

50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116

Ernest F. Stockwell III, *Chairman* | Thomas A. Nies, *Executive Director*

To: Tom Nies, Executive Director
From: Scientific and Statistical Committee
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Subject: Overfishing levels (OFLs) and acceptable biological catch (ABC) recommendations for groundfish stocks for fishing years 2016-2018.

The SSC met on October 13 and 14, 2015 in Providence, Rhode Island, to address the following term of reference (TOR):

Review the 2015 Groundfish Operational Assessments and the work of the Groundfish PDT and provide the OFL and ABC for each year for fishing years 2016-2018 that will prevent overfishing and is consistent with the control rule.

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

1. Stock Assessment Update of 20 Northeast Groundfish Stocks through 2014, including the peer review reports for each stock (NEFSC, October 2015)
2. 2015 Groundfish Assessment Reports (NEFSC, September 2015) reports by stock available at this link: <http://www.nefsc.noaa.gov/groundfish/operational-assessments-2015/agenda.html>
3. 2015 Groundfish Assessment Reports (NEFSC, September 2015) assessment presentations by stock also available at this link: <http://www.nefsc.noaa.gov/groundfish/operational-assessments-2015/agenda.html>
4. Supplemental Information: Stock Assessment Support Information (SASINF) - use this link to access the database: http://www.nefsc.noaa.gov/saw/sasi/sasi_report_options.php
5. Memo from PDT to SSC re Groundfish OFLs/ABCs (October 9, 2015)
6. Presentation: Overview of the assessments (Paul Nitschke, NEFSC)
7. Presentation: Summary of groundfish assessments by stock with catch projections from the PDT (Paul Nitschke, NEFSC and Jamie Cournane, PhD, PDT Chair)
8. Murphy T, Kitts A, Demarest C, Walden J. 2015. 2013 Final report on the performance of the northeast multispecies (groundfish) fishery (May 2013 – April 2014). US Dept. Commerce, Northeast Fish Sci. Center Ref. Doc. 15-02; 106 p. use this link: http://www.nefsc.noaa.gov/read/socialsci/pdf/groundfish_report_fy2013.pdf

The Assessment Oversight Panel (AOP) met with the Chair of the integrated peer review panel and the lead scientists for each of the assessments on July 27, 2015 in Woods Hole to define the ‘rules of engagement’ for the operational assessments. This meeting clarified deviations from the most recent benchmark assessment for each stock that were considered sufficiently modest to be allowable

during the operational assessments, and those that were considered to be more substantial and therefore not allowable. This meeting also sought to improve consistency across the assessments, especially with respect to conditions under which a correction for retrospective patterns would be applied to the terminal year biomass or fishing mortality estimates. These rules, which were based on guidance from the NRCC and the judgment of the AOP, are as follows:

1. Update model runs and reference point estimates with limited changes to model configuration (i.e., no changes in M, selectivity, weighting, etc).
2. Exclusion of ASAP likelihood constants.
3. Revised criteria (TOGA) for NEFSC survey tow selection.
4. Apply the Mohn's Rho adjustment for retrospective biomass (7-year peel) if the adjusted estimate of biomass or fishing mortality is outside of the 90% confidence interval of the unadjusted estimate.
5. Consider changes to discards mortality rates based on new studies (GOM cod, halibut and wolffish).
6. Recommend a 'Plan B' approach to developing catch advice if the model fails (e.g., recent average catch).

The default control rule for groundfish as defined in recent amendments to the Northeast Multispecies FMP and other management actions is as follows:

"These ABC control rules will be used in the absence of better information that may allow a more explicit determination of scientific uncertainty for a stock or stocks. If such information is available - that is, if scientific uncertainty can be characterized in a more accurate fashion -- it can be used by the SSC to determine ABCs, these ABC control rules can be modified in a future Council action (an amendment, framework, or specification package):

- a. *ABC should be determined as the catch associated with 75% of F_{MSY} .*
- b. *If fishing at 75% of F_{MSY} does not achieve the mandated rebuilding requirements for overfished stocks, ABC should be determined as the catch associated with the fishing mortality that meets rebuilding requirements ($F_{rebuild}$).*
- c. *For stocks that cannot rebuild to B_{MSY} in the specified rebuilding period, even with no fishing, the ABC should be based on incidental bycatch, including a reduction in bycatch rate (i.e., the proportion of the stock caught as bycatch).*
- d. *Interim ABCs should be determined for stocks with unknown status according to case-by-case recommendations from the SSC."*

In recent years, the SSC has used one of the default options listed above in some instances, and applied other approaches tailored to particular elements of scientific uncertainty in others. The PDT used the outcomes of the operational assessments to develop OFL and ABC alternatives for the SSC to consider using one of the default approaches in the ABC control rule, approaches tailored for particular stocks in recent specification setting, or recommendations from the peer review panel. The SSC also developed new approaches for some stocks based on our evaluation of uncertainty and the attributes of the available science.

This report first provides discussion of more general issues addressed by the SSC, followed by expanded discussion of the approaches used for selected stocks. Table 1 then summarizes the approaches used to develop ABC recommendations for each stock and any pertinent notes on the approach utilized or other issues considered by the SSC. The OFL and ABC recommendations for each stock are provided in Table 2 under “Summary of recommendations”.

General issues

Process for the assessment and development of catch advice

The SSC applauds the efforts of the stock assessment scientists at NEFSC and the peer review panel in producing and evaluating such a large number of assessments in such a disciplined and efficient manner. If assessments are to be performed more regularly for the groundfish complex, such discipline and efficiency will be imperative. The SSC also found the data portal created for the operational assessments to be a valuable addition to the process. The portal increased transparency, and enabled SSC members and other stakeholders to more readily examine the data to explore questions of interest. The SSC also applauds the PDT for producing similarly clear and streamlined information on alternatives for catch advice for the SSC to consider. The PDT also provided summaries of recent catch performance which aided the SSC in their discussion of catch advice.

Retrospective patterns

Retrospective patterns remain a persistent problem in many, but not all, assessments. The operational assessments saw substantial retrospective patterns emerge for some stocks for which those patterns has previously been within acceptable limits, and increase for some stocks for which those patterns had already been deemed sufficient to warrant adjustments. In 2011, the SSC determined in its review of the Massachusetts Fisheries Institute report that adjustment of model outcomes in response to directional bias was an appropriate step to generate a better estimate. The SSC saw the development of a clear rule for when a retrospective adjustment would be applied as a positive step toward more consistent development of catch advice, despite the unforeseen complications that arose in applying this rule for Georges Bank cod and Southern New England/Mid-Atlantic yellowtail flounder.

However, the increased magnitude and prevalence of significant retrospective patterns since the 2011 review has caused some SSC members to question whether continued adjustments is a sound strategy, whether other more appropriate scientific responses can be developed, and whether management strategies (especially ABC control rules) can be developed that are robust to the unknown causes of retrospective patterns. The SSC recommends that a thorough re-examination of the appropriate scientific and management responses to retrospective patterns is warranted.

Projections

In addition to retrospective patterns evident in the later years of many assessments, forward projections of stock dynamics have proven to be overly optimistic in many cases, resulting in continued overfishing despite adherence to catch limits that were believed to be risk-averse when set. In recent years, the SSC has responded to that outcome by modifying the default control rule, most commonly through the use of constant catch limits that increase the uncertainty buffer through time rather than increasing ABCs to track the projected increases in biomass.

Developing catch advice based on the operational assessments caused the SSC to question whether its decisions about when to follow the projections and when to deviate from them have been consistent. For the current catch advice, the SSC generally used the projected biomass over all three

years if the stock is not below its overfishing threshold, but used only the one-year projection and then held the ABC constant if the stock is overfished. This decision reflects more severe implications of the uncertainties when a stock is at low biomass, and provides greater fishing opportunities when the stock is above its biomass threshold. Although the SSC feels this approach is defensible, a dedicated discussion about whether and when to use projected biomass is warranted, perhaps resulting in amendments to the default control rule, so that greater transparency and consistency can be brought to the management process.

Strong cohorts

In developing catch advice, the SSC responded in different ways to strong recent cohorts in different stocks detected by the operational assessments. Notably, the SSC decided to down-weight the strong 2013 cohort of Georges Bank haddock, and also assumed that density-dependent reduction in growth would occur, but decided not to down-weight the strong 2012 and 2013 cohorts of Gulf of Maine haddock. The fundamental difference between the recent recruitment patterns in these two stocks is that the 2013 cohort of Georges Bank haddock is several orders of magnitude greater than the next largest cohorts estimated in that assessment, whereas the Gulf of Maine haddock cohorts are on par with others estimated in that assessment. Furthermore, there is less evidence for density dependence of haddock in the Gulf of Maine than on Georges Bank.

Therefore, although there is both uncertainty and risk associated with potential overestimation of recent cohorts of Gulf of Maine haddock, the estimated stock dynamics fall within the bounds of previous observation and experience. Furthermore, the stock is well above B_{MSY} , which means the implications of overestimating these cohorts are less. The Georges Bank haddock stock is also well above its B_{MSY} , but the estimated recruitment event deviates so far from any previous experience that the implications of overestimation are at the very least unknown and potentially are quite significant.

Similar to the recommendation to revisit and formalize conditions under which stock projections should or should not be used, the SSC recommends that similar guidelines should be developed for the treatment of large cohorts near the end of an assessment time series. This might lead to additional amendments to the default control rule, and should bring greater transparency and consistency to the management process.

Directional change in productivity

For several, but not all, stocks, multiple indicators suggest directional, rather than stochastic, changes in productivity. Many of these changes are consistent with observed changes in the environment, notable water temperatures, pH, salinity and others. Directional changes in productivity have important implications for biomass targets, fishing mortality limits, rebuilding timelines, catch advice and other management strategies. These questions have arisen in the course of multiple assessments in recent years, as well as in the scientific literature, but have not yet been addressed or resolved in a thorough manner. A formal scientific consensus is needed on the nature and implications of directional environmental and productivity changes so that both scientific and management strategies can be adjusted accordingly.

The SSC notes that all of the issues discussed above should be considered in the development of a comprehensive risk policy.

Stock-specific issues

Georges Bank cod

The operational assessment model for Georges Bank cod was not accepted by the peer review panel due to major diagnostic issues, a substantial increase in the magnitude of the retrospective pattern (from 70% to 240%), and the fact that the adjusted biomass could not support the estimated 2015 catch in 24% of the projections. The peer review panel recommended an alternative method for developing catch advice that adjusts the ABC by the same magnitude as the recent three-year smoothed survey trend (-24%). The SSC adopted this recommendation. However, this approach is expected to result in a fishing mortality rate similar to the average of the last three years, a rate that so far has not led to rebuilding. Furthermore, the SSC notes that the magnitude of the survey trend is dependent upon the timeframe chosen. The 10-year trend is much flatter and would have resulted in a more modest reduction in the ABC, whereas the trend over the past 20 years or more becomes much steeper again and would result in a reduction comparable to the one recommended.

Gulf of Maine cod

The operational assessment for Gulf of Maine cod suggests that the steep decline in biomass observed from 2009-2013 might have been arrested. In both the M=0.2 and M-ramp models, 2014 biomass was approximately the same, and in fact was marginally greater, than 2013 biomass. The SSC cautions that a two-year trend in a model with considerable uncertainties for a stock at very low biomass should not be overstated. However, the assessment provides the first encouraging sign for the stock in several years.

The ABC recommendation of 500mt represents a 30% increase from the status quo ABC of 386mt. While offering this recommendation, the SSC questioned whether a 30% increase is warranted in the absence of a comparable increase in the survey trend, biomass estimate from the model, or other indicator. However, the SSC notes that the operational assessment does not account for effects of the 386mt ABC, given that it was implemented in 2015 and the terminal year of the assessment is 2014. Therefore, the apparent change in the stock trajectory might have been achieved by the previous ABC of 1,550mt for 2013 and 2014. The recent operational assessment is the first to provide insights into the effects of the 2013 and 2014 ABCs, given that the 2014 operational assessment did not include a full year of fishing under that ABC. Despite being an increase from the status quo ABC, the new ABC recommendation is 68% less than the 2013 and 2014 ABC. If the operational assessment is revealing positive effects of the 2013 and 2014 ABCs, then we can expect those effects to continue under the new recommendation. However, the SSC notes that the stock remains far away from its target biomass and sustained rebuilding over many years will be required to achieve the target.

Georges Bank haddock

The operational assessment suggests that the status of the Georges Bank haddock stock remains strong. In fact, the assessment detected an incoming cohort that is by far the largest ever observed in the stock. Previously, the 2003 and 2010 cohorts were on par with the largest observed, but the 2013 cohort is estimated to be an order of magnitude larger than those. The implications of a cohort of this magnitude for stock dynamics and development of catch advice are profound. In particular, assuming that this cohort is estimated accurately would result in more than doubling the status quo ABC, which itself is double MSY for the stock.

The SSC has reservations about both the accuracy of the estimate of this cohort, and its potential implications for catch advice, given that it far exceeds any recruitment event ever observed in the stock. Furthermore, there is evidence that the stock experiences density-dependent decreases in growth at high biomass which, if not accounted for, would result in a further overestimation of

biomass. Therefore, the SSC feels it is appropriate to down-weight the effects of this cohort in developing catch advice, while still increasing the ABC to reflect both the high biomass and increasing trajectory of the stock. To achieve this balance, the SSC recommends applying $75\%F_{MSY}$ to the projected biomass in 2017 incorporating density-dependent reduction in growth and down-weighting the 2013 cohort, and keeping the ABC constant at that level for 2016-2018. In offering this advice, the SSC expects that subsequent surveys in 2016 and 2017, and the scheduled operational assessment in 2017, will provide more insight into the magnitude of this cohort, enable stock dynamics to be better specified, and perhaps warrant an upward or downward adjustment.

Southern New England/Mid-Atlantic yellowtail flounder

Development of catch advice for the Southern New England/Mid-Atlantic yellowtail flounder stock was especially problematic for the SSC. The operational assessment revealed a retrospective pattern that increased substantially from the benchmark assessment (from 16% up to 106%). This should have resulted in an adjustment to the terminal year biomass per the 'rules of engagement' established by the AOP. However, an adjustment could not be applied because the resulting biomass could not support the estimated 2015 catch in many of the projections.

The AOP did not consider this contingency, and therefore did not develop guidelines for how the assessment and review panel should respond. A similar outcome emerged in the Georges Bank cod assessment, and was one of the reasons the review panel rejected the assessment. For Southern New England yellowtail flounder, the review panel accepted the assessment. Although these decisions are seemingly inconsistent, there were other important differences in the assessments. The magnitude of the retrospective bias for Southern New England/Mid-Atlantic yellowtail flounder (106%) was substantially less than for Georges Bank cod (240%). Also, the Southern New England/Mid-Atlantic yellowtail flounder assessment performed better than the Georges Bank cod assessment by other diagnostic measures.

Despite these differences, members of the review panel reported in personal communication to the SSC that it was uncertain how to proceed in these circumstances, and approved the assessment with significant reservations. Moreover, members of the review panel further reported in personal communication to the SSC that had clearer guidance on this contingency been provided, or had the Southern New England yellowtail flounder assessment decision been made after the Georges Bank cod decision, the outcome might have been different.

The SSC shares the reservations expressed by the review panel. There was disagreement within the SSC, however, about the most appropriate way to respond. Some members felt that an assessment that could not operate within the established 'rules of engagement' should not have passed peer review, that the peer review panel itself expressed concerns about its decision, and therefore that other methods for developing catch advice are needed. Other members felt that the 'rules of engagement' were not clear on how to respond to this particular contingency, the decision should therefore have been left to the judgment of the peer review panel, and the SSC should abide by the outcome of the peer review. Importantly, all members recognized the merits of both perspectives.

There was general agreement among the SSC, however, that the stock is showing troubling signs. In addition to the low biomass estimated by the assessment model, survey trends are generally declining over multiple time horizons. Therefore, the SSC agreed that a substantial reduction in catch is needed.

To achieve this reduction, the SSC recommends that ABC not exceed the average of the estimated 2015 catch (422mt) and the 2016 ABC recommendation that would result from the biomass projection from the assessment outcomes (111mt). This is a compromise approach that uses the assessment outcome as one bound for ABC advice, but does not adhere too strongly to those outcomes in light of the substantial uncertainties and procedural issues. Furthermore, the SSC recommends that this stock be moved to the research track to more thoroughly investigate and resolve the model performance issues and produce a better estimate of stock dynamics as soon as possible.

Georges Bank winter flounder and Southern New England/Mid-Atlantic winter flounder

The ABC for Southern New England/Mid-Atlantic winter flounder would have decreased from 2016 to 2017 before increasing in 2018 using the default control rule of $75\%F_{MSY}$. To account for the continued decline in recruitment for this stock, the ABC was held constant at the 2017 value for all three years 2016-2018.

Both of these stocks exhibited substantial decreases in estimates of biomass reference points, as well as long-term declines in recruitment. These trends suggest directional change in productivity of the stock, which have important implications for rebuilding expectations and management strategies. Whether the Gulf of Maine stock is exhibiting similar changes is unclear given the absence of an approved analytical assessment, and associated estimates of B_{MSY} and recruitment. However, the SSC recommends that previous efforts to identify environmental drivers of stock dynamics for all three winter flounder stocks be resumed to resolve these issues. The SSC also notes that both the NEFMC and ASMFC manage two of the three winter flounder stocks, creating opportunities to bring more resources and expertise to addressing the ongoing challenges in managing the species across its U.S. range.

Atlantic halibut

The peer review panel rejected the operational assessment for halibut due to a variety of diagnostic concerns. However, one important concern is whether the assumed stock definition adequately reflects contemporary conditions. Specifically, some evidence suggests that the halibut stock straddles the U.S.-Canada boundary, and that its distribution might be shifting more 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 and inaccurate. A new benchmark assessment for halibut is warranted, but the assessment should be preceded by a thorough re-examination of stock boundaries.

Table 1. Summary of approaches used to develop ABC recommendations, changes from status quo ABCs and other notes. “(constant)” means the 2016 ABC recommendation remains unchanged for 2017 and 2018.

Stock	ABC Approach	Notes
GB cod	Decrease OFL by recent survey trend (-24%) and set ABC at 75% of OFL (constant)	See additional discussion
GOM cod	75% of average of OFLs from the three models (constant)	See additional discussion
GB haddock	$75\%F_{MSY} \times$ projected 2017 biomass with reduced growth & 2013 cohort (constant)	See additional discussion
GOM haddock	$75\%F_{MSY} \times$ projected biomass	Recent strong cohort detected by the assessment, but correction is not warranted given its magnitude and observed stock trends.
GB yellowtail flounder	16% exploitation rate applied to average swept-area biomass estimates from three surveys (constant)	Retains status quo ABC for 2016 and 2017; recommendation developed by SSC on Sept. 1 and reported to Council on Sept. 30
SNE/MA yellowtail flounder	Average of estimated 2015 catch (422mt) and $75\%F_{MSY} \times$ 2016 projected biomass (111mt) (constant)	See additional discussion
CC/GOM yellowtail flounder	$75\%F_{MSY} \times$ 2016 projected biomass (constant)	Natural mortality assumption not consistent with other yellowtail stocks.
Plaice	$75\%F_{MSY} \times$ projected biomass	Used projected catch for 2017 and 2018 despite retrospective due to good stock status.
Witch flounder	$75\%F_{MSY} \times$ 2016 projected biomass (constant)	$F_{rebuild}$ not used given that projections suggest rebuilding is not possible when $F=0$; NS1 guidelines suggest 75% F_{MSY} in that case
GB winter flounder	$75\%F_{MSY} \times$ 2016 projected biomass (constant)	See additional discussion
GOM winter flounder	$75\%F_{MSY} \times$ 30+ cm biomass (constant)	Stock does not appear to be responding to catches \ll ABC
SNE/MA winter flounder	$75\%F_{MSY} \times$ 2017 projected biomass (constant)	See additional discussion
Redfish	$75\%F_{MSY} \times$ projected biomass	Used projected catch for 2017 & 2018 despite retrospective due to good stock status; Implications of sexual dimorphism warrant further investigation
White hake	$75\%F_{MSY} \times$ projected biomass	ABC in 2017 and 2018 decrease from 2016 value.
Pollock	$75\%F_{MSY} \times$ 2016 projected biomass (constant)	SSC concerns about used of domed selectivity function remain, therefore projections past 2016 not utilized
Northern windowpane flounder	$75\%F_{MSY} \times$ kg/tow (constant)	Recent catches exceed ABCs in some years
Southern windowpane flounder	$75\%F_{MSY} \times$ kg/tow (constant)	Recent catches exceed ABCs in some years
Ocean pout	$75\%F_{MSY} \times$ kg/tow (constant)	Stock does not appear to be responding to catches \ll ABC
Halibut	$75\% \times$ (2015 OFL + 6% for 5Y) (constant)	See additional discussion
Wolffish	$75\%F_{MSY} \times$ 2014 exploitable biomass (constant)	Projections not accepted for this stock at the benchmark.

Summary of recommendations

Table 2. OFL for each groundfish stock for fishing years 2016, 2017 and 2018, and the values that ABC should not exceed in each fishing year.

Stock	2016		2017		2018	
	OFL	ABC	OFL	ABC	OFL	ABC
GB cod	1,665	1,249	1,665	1,249	1,665	1,249
GOM cod	667	500	667	500	667	500
GB Haddock	160,385	77,898	258,691	77,898	358,077	77,898
GOM Haddock	4,717	3,630	5,873	4,534	6,218	4,815
GB Yellowtail Flounder	unknown	354	unknown	354	-	-
SNE Yellowtail Flounder	unknown	267	unknown	267	unknown	267
CC/GOM Yellowtail Flounder	555	427	707	427	900	427
Plaice	1,695	1,297	1,748	1,336	1,840	1,404
Witch Flounder	513	394	925	394	974	394
GB Winter Flounder	957	755	1,056	755	1,459	755
GOM Winter Flounder	1,080	810	1,080	810	1,080	810
SNE/MA Winter Flounder	1,041	780	1,021	780	1,587	780
Redfish	13,723	10,338	14,665	11,050	15,260	11,501
White Hake	4,985	3,816	4,816	3,686	4,733	3,622
Pollock	27,668	21,312	32,004	21,312	34,745	21,312
Northern Windowpane Flounder	243	182	243	182	243	182
Southern Windowpane Flounder	833	623	833	623	833	623
Ocean Pout	220	165	220	165	220	165
Halibut	210	158	210	158	210	158
Wolffish	110	82	110	82	110	82

- 1. A thorough examination of the appropriate scientific and management responses to retrospective bias is warranted**
- 2. Clear and consistent guidelines for treatment of strong cohorts and use of stock projections should be developed in order to ensure greater consistency and transparency in the development of catch advice.**
- 3. The nature of directional environmental change and its implications for stock productivity needs a thorough examination and scientific consensus so that appropriate analytical and management responses can be developed.**