Appendix I

SSC's Recommendations on ABCs for the Northeast Multispecies Fishery

#2

New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
C. M. "Rip" Cunningham, Jr., *Chairman* | Paul J. Howard, *Executive Director*

To: Paul J. Howard, Executive Director
From: Scientific and Statistical Committee
Date: 24 September 2012

Subject: Groundfish ABC for FY2013-2015

The Scientific and Statistical Committee (SSC) met on three occasions to address groundfish catch recommendations.

During the first meeting (March 28, 2012), the SSC was asked to:

2. Discuss the performance of projections for groundfish stocks based on the February 2012 groundfish assessment updates.
3. Review assessments and develop FY 2013and FY 2014 ABC recommendations for redfish, Georges Bank haddock, Gulf of Maine /Georges Bank windowpane flounder, Southern New England /Mid-Atlantic windowpane flounder, ocean pout, wolffish and halibut.

During the second and third meetings (August 24 and September 13, 2012), the SSC was asked to:

1. The SSC is asked to develop Overfishing Limit (OFL) and Acceptable Biological Catch (ABC) recommendations for Northeast Multispecies stocks as specified below. Specifications for GOM cod and GB Cod will be determined after SARC 55 is conducted this fall. OFL and ABC recommendations for other stocks were determined by the SSC at earlier meetings.
2. ABC recommendations are to be based on the fishing mortality strategies approved by the Council in Amendments 13 and 16 and related management actions. Status determination criteria should be used that are specified in Amendment 16 or subsequent actions, or that will be implemented through FW 48 consistent with the recommendations of recent SARCs. The general control rule for groundfish stocks that has been adopted is:
   "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 FMSY.
   b. If fishing at 75% of FMSY 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 (Frebuild).
   c. For stocks that cannot rebuild to BMSY 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-bycase recommendations from the SSC."

3. GB yellowtail flounder: Provide a range of ABCs for 2013-2014 that will meet management objectives and that will result in a low to neutral risk of exceeding FMSY (F=0.25).
4. Review the SARC-54 advice on a biomass target for SNE/MA yellowtail flounder. Provide advice on a process to reconcile the two biomass targets identified by the SARC review panel.
5. At its March meeting, the SSC directed the Plan Development Team to consider three approaches for setting ABCs because of concerns that the stock projections were not performing well. Consider the PDT's report on this issue and whether alternative approaches to setting the ABCs should be used for FY 2013- 2015.
6. Provide ABC recommendations for the following Northeast Multispecies stocks for FY 2013 – 2015.
    SNE/MA yellowtail flounder
    GOM haddock
    CC/GOM yellowtail flounder
    Witch flounder
    Plaice
7. Provide an ABC recommendation for white hake for FY 2013. A benchmark assessment is planned for early 2013, but an ABC is needed for the start of the fishing year on May 1 and none has been previously approved. There aren't any ABC carry-over provisions in the Northeast Multispecies FMP. There is no assessment update available.

In order to meet these terms of reference, the SSC considered the following:

1. Groundfish Plan Development Team memo to the SSC dated March 20, 2012
2. Groundfish Plan Development Team memo to the SSC dated August 14, 2012
3. Northeast Fisheries Science Center Reference Document 12-06. Assessment of Data Updates of 13 Northeast Groundfish Stocks through 2010
4. 54th Northeast Regional Stock Assessment Workshop Assessment Summary Report
5. 54th Northeast Regional Stock Assessment Workshop Report (draft)
6. Transboundary Resources Assessment Committee Status Report 2012/01. Georges Bank Yellowtail Flounder
7. Transboundary Resources Assessment Committee Reference Document 2012/02 Stock Assessment of Georges Bank Yellowtail Flounder for 2011
8. Pope, J.G. 1983. Analogies to the Status Quo TACs: Their nature and variance. Canadian Special Publication in Aquatic and Fishery Sciences. 66: 99-113
9. Two presentations from the Groundfish Plan Development Team on projection performance
10. Presentation from lead analyst on George Bank yellowtail flounder
11. Presentation from lead analyst on SNE/MA yellowtail flounder
12. Presentations from Groundfish Plan Development Team on stock specific projections

The SSC reviewed material provided by the PDT regarding the performance of historical projections for the Northeast Multispecies FMP stocks. The presentations by Tom Nies and Paul Nitscke as well as the groundfish PDT report were clear and concise, facilitating the catch advice discussion. Overall, the projections were biased high, meaning the projected stock increased more than the realized stock. This resulted in catches at or below recommended ABCs having fishing mortality rates above what was expected from the projections. For some stocks, this resulted in overfishing occurring despite the fishery catching less than the recommended ABC. The SSC reiterates its concern with medium term projections for these stocks and recommends conducting assessments more regularly so that projections are for shorter periods into the future. The SSC agrees with the

PDT concern regarding this historical performance, but felt this single analysis was insufficient to justify changing the default control rule for all the groundfish stocks. Changing the default control rule should involve a longer term and more systematic process than time allowed. Instead, the SSC examined each stock on a case-by-case basis to see if there was any reason to change from the default control rule. Reasons were found for five of the stocks: the three yellowtail flounder stocks, witch flounder, and Atlantic wolffish. Detailed reasons are provided for each of these stocks below. The 75%Fmsy control rule was applied for the remaining stocks with analytical assessments; the two haddock stocks, American plaice, redfish, and Atlantic halibut, and the three stocks with the index based assessments; the two windowpane stocks and ocean pout. The stocks with index based assessments held the 2013 OFL and ABC values constant for the three years following the default control rule for stocks with index based assessments.

Table 1 presents the OFL and ABC values for all 20 stocks in the Northeast Multispecies FMP for completeness. The three winter flounder stocks and pollock had OFL and ABC values set previously by the SSC. The two cod stocks do not have OFL or ABC values because both have benchmark assessments scheduled for SARC 55 (December 2012). The white hake OFL and ABC for 2013 were set to the values in 2012 because an update assessment was not available and there were no indications from fishery or survey data that any major changes had occurred since the 2012 values were set. White hake has a benchmark assessment scheduled for SARC 56 (February 2013), which will provide the basis for setting OFL and ABC for FY2014-2015.

Technical Notes on Specific Stocks:

- **Georges Bank yellowtail flounder** was updated during TRAC 2012. The SSC used the results of the 2012 TRAC assessment to formulate its recommendations. The assessment method used in recent years (the split series VPA) indicates that the stock is overfished, that overfishing is occurring, and that recent recruitment is weak. However, the assessment exhibited a stronger retrospective pattern this year than last year. The ratio of catch over survey biomass decreased substantially in 1995 and has remained low since, while estimates of total mortality from the survey have remained high. There are no positive signs that the stock is rebuilding. Based on the assessment results and associated uncertainties, the SSC recommends no directed fishery and no increase in bycatch. This recommendation reflects the poor performance of catch advice in recent years relative to reducing the fishing mortality rate below the desired target. In response to the Council's request for a range of ABCs (including US and Canadian catch) that will meet management objectives and that will result in a low to neutral risk of exceeding F_{MSY}, the SSC recommends that:

  1. A catch limit of 200 mt in 2013 is expected to have a low probability of overfishing and is expected to allow the stock to increase ("To achieve both a high probability that F in 2013 will be less than F_{ref} and that adult biomass will increase, a 2013 quota of approximately 200 mt would be required." TRAC 2012)
  2. A catch limit of 400-500 mt is expected to have greater probability of overfishing and allow some rebuilding ("A quota of 400-500 mt implies that either F will be below F_{ref} in 2013 in only one of the five sensitivity analyses or the adult biomass will increase from 2013 to 2014 for the other four." TRAC 2012). This is similar to the basis of the SSC advice for 2012.
  3. The catch associated with unintentional bycatch may exceed 500 mt, but total removals should be less than the 2012 ABC (1,150 mt) to account for the recommended removal of a directed fishery. This ABC of 1,150 mt should be considered a backstop measure only. If there is no directed fishery and measures are taken to reduce bycatch as much as possible,

then fishing mortality would be expected to be below Fmsy. If this low F results in a catch above 500 mt, it would be de facto evidence that the uncertainty in this stock assessment is greater than described by the sensitivity analyses conducted in the TRAC. Thus, this ABC is appropriate only when management measures are implemented that have a high probability in resulting in low fishing mortality rates. This advice is based on the difficulty of setting quota levels based on highly uncertain stock assessment results.

- **Southern New England-Mid Atlantic yellowtail flounder** had a benchmark assessment as part of SARC 54 (June 2012). The assessment of this stock was not questioned, but the SSC discussed the biomass biological reference point (BRP) because the SARC recommended two separate values. One BRP was based on using all the recruitment estimates from the stock assessment with two stanzas associated with different stock sizes (denoted two stanza recruitment). The other BRP was based on using only recent (since 1990) recruitment estimates from the assessment to reflect a change in productivity of this stock (denoted recent recruitment). Projections associated with these two BRPs were nearly identical for FY13 but diverged as years were added to the projections. The SSC considers the recent recruitment BRP the more appropriate reference point because the low recruitment has persisted for more than two decades and high recruitment has been observed in the past at spawning stock biomass similar to those observed during the recent period. Using this BRP, the stock is fully rebuilt. The SSC did not want to recommend fishing at a rate that would cause catches to increase suddenly then decrease as the stock is fished down to the new biomass BRP. So instead, the SSC selected the long term 75%Fmsy catch as the ABC for all three projection years (which is lower than the catch associated with fishing at 75%Fmsy in years 2013-2015). This should allow an examination of how recruitment responds to low fishing mortality rates for a number of years. If the recruitment does considerably increase for multiple years, then the biomass BRP should be updated. While if the recruitment remains low, this will confirm the change in productivity of this stock, and the stock ABC can be set in the future based on applying 75%Fmsy to the extant stock abundance.
- **Cape Cod-Gulf of Maine yellowtail flounder** was updated during the groundfish update assessment review in February 2012. This updated assessment exhibited a retrospective pattern, while the previous assessment did not. To account for the retrospective pattern, the stock abundance at age was reduced at the start of the projections, which assumes whatever mechanism caused the retrospective pattern will continue in the future. The standard projections using the 75%Fmsy control rule resulted in relatively large increases in catch in FY2014-2015 relative to FY2013. The SSC thought the new retrospective pattern, even with the adjustment for starting stock size, was an additional source of uncertainty for this stock, so the SSC set the FY2014 and 2015 ABC values equal to the FY2013 ABC. This results in a larger buffer between OFL and ABC in years 2014 and 2015 than would have occurred from the default control rule to account for the additional uncertainty associated with this stock assessment.
- **Witch flounder** was updated during the groundfish update assessment review in February 2012. The most recent recruitment estimate was estimated to be one of the largest in the time series. Sensitivity projections which reduced the size of this year class resulted in much lower ABC because this stock is in a rebuilding plan and the $F_{rebuild}$ was much lower with the lower recruitment. As in all assessments, the most recent recruitment estimate is highly uncertain. The impact of large versus small cohorts in the projections differs though, with large cohorts having disproportionate impact on $F_{rebuild}$ calculations. To account for this source of uncertainty in the assessment, the SSC set the 2014 and 2015 ABC to the 2013 ABC, which was calculated by applying the $F_{rebuild}$ in 2013. This resulted in a larger buffer between the OFL and ABC in years 2014 and 2015 than the application of the default control rule of $F_{rebuild}$ in each year.

- **Atlantic wolffish** was updated during the groundfish update assessment review in February 2012. This stock did not have a calibration coefficient available to relate the Bigelow and Albatross survey time series due to insufficient numbers of this fish caught during the calibration experiment. Instead, a calibration from ocean pout was used because it has a similar body shape and habitat as wolffish. The assessment results were sensitive to the choice of the calibration. To account for this additional uncertainty, the SSC set the FY2014 and 2015 ABC equal to the FY2013 ABC, which was calculated by applying 75%Fmsy in 2013. This resulted in a larger buffer between the OFL and ABC in years 2014 and 2015 than the application of the default control rule in each year.

The SSC recommends:

1. **The overfishing limits (OFL) and acceptable biological catches (ABC) for 2013-2015 by stock in Table 1.**
2. **Based on the assessment results and associated uncertainties in the Georges Bank yellowtail fishery assessment, the SSC recommends no directed fishery and no increase in bycatch for this stock.**
3. **Updated assessments for all the groundfish stocks in the Northeast Multispecies Fishery Management Plan should be conducted as soon as possible.**

Table 1. Overfishing limits (OFL) and acceptable biological catches (ABC) in metric tons for years 2013-2015 for the groundfish stocks in the Northeast Multispecies Fishery Management Plan. The four stocks in grey font (three winter flounder stocks and pollock) are included for information purposes only, these OFL and ABC values were set previously by the SSC. For the three US/CA stocks (GB cod, GB haddock, and GB yellowtail flounder), the values shown are total amounts, the US amounts will be lower due to the US/CA sharing agreement.

	2013		2014		2015		Remarks
Stock	OFL	ABC	OFL	ABC	OFL	ABC	
GB cod							TBD after SARC 55
GOM cod							TBD after SARC 55
GB haddock	46,185	35,783	46,268	35,699	56,293	43,606	75%Fmsy
GOM haddock	371	290	440	341	561	435	75%Fmsy
GB yellowtail flounder		200-1,150					range of objectives, 2014-2015 TBD after TRAC 2013-2014
SNE/MA yellowtail flounder	773	700	773	700	773	700	long term 75%Fmsy held constant (ref point uncertainty)
CC/GOM yellowtail flounder	713	548	936	548	1,194	548	2013 75%Fmsy held constant (retrospective uncertainty)
Plaice	2,035	1,557	1,981	1,515	2,021	1,544	75%Fmsy
Witch flounder	1,196	783	1,512	783	1,846	783	2013 Frebuild held constant (recruitment uncertainty)
GB winter flounder	4,819	3,750	4,626	3,598			set previously based on SARC 52 assessment
GOM winter flounder	1,458	1,078	1,458	1,078			set previously based on SARC 52 assessment
SNE/MA winter flounder	2,637	697	3,471	912			set previously based on SARC 52 assessment
Redfish	15,468	10,995	16,130	11,465	16,845	11,974	75%Fmsy
White hake	5,306	3,638					rollover 2012, 2014-2015 TBD after SARC 56
Pollock	20,060	15,600	20,554	16,000			set previously based on SARC 50 assessment
N windowpane	202	151	202	151	202	151	75%Fmsy held constant (index assessment)
S windowpane	730	548	730	548	730	548	75%Fmsy held constant (index assessment)
Ocean pout	313	235	313	235	313	235	75%Fmsy held constant (index assessment)
Atlantic halibut	164	99	180	109	198	119	75%Fmsy
Atlantic wolffish	94	70	94	70	94	70	2013 75%Fmsy held constant (calibration uncertainty)

New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
C. M. "Rip" Cunningham, Jr., *Chairman* | Paul J. Howard, *Executive Director*

To: Paul J. Howard, Executive Director
From: Scientific and Statistical Committee
Date: December 13, 2012

Subject: Georges Bank Yellowtail Flounder OFL for FY2013-2015

The Scientific and Statistical Committee (SSC) met on November 19, 2012 to address the following term of reference from the Council:

Provide the Council with an overfishing limit for Georges Bank yellowtail flounder for their (the SSC's) ABC recommendation #3 (included below) by the December 20 Council meeting.

The ABC recommendation referenced in the term of reference read as follows:

3. The catch associated with unintentional bycatch may exceed 500 mt, but total removals should be less than the 2012 ABC (1,150 mt) to account for the recommended removal of a directed fishery. This ABC of 1,150 mt should be considered a backstop measure only. If there is no directed fishery and measures are taken to reduce bycatch as much as possible, then fishing mortality would be expected to be below Fmsy. If this low F results in a catch above 500 mt, it would be de facto evidence that the uncertainty in this stock assessment is greater than described by the sensitivity analyses conducted in the TRAC. Thus, this ABC is appropriate only when management measures are implemented that have a high probability in resulting in low fishing mortality rates. This advice is based on the difficulty of setting quota levels based on highly uncertain stock assessment results.

Background Information
The SSC considered the following the following documents in its deliberations:

1. DRAFT Memo from SSC to Paul Howard re Northeast Multispecies ABCs for FY 2012-2014
2. Sept. 24. 2012 Memo from SSC to Paul Howard re Northeast Multispecies ABCs for FY 2012-2014
3. November 16, 2012 Memo from Council Staff to SSC re GB Yellowtail Flounder Overfishing Limit
4. TRAC Status Report for GB Yellowtail Flounder 2012
5. Stock Assessment of Georges Bank Yellowtail Flounder for 2012, TRAC Ref Doc 2012/02

The SSC concluded that the OFL for Georges Bank yellowtail flounder is **unknown** at present. The SSC reached this conclusion because the ABC recommendation of 1,150mt is not based on the 2012 assessment and instead represents a status quo ABC in the face of an unknown OFL. The TRAC assessment produced a wide range of catch projections using defensible model configurations. These varied widely, lowering confidence in any individual outcome and resulting in the SSC being

unable to agree upon a single OFL value derived from one or a combination (e.g., average) of the approaches used. Furthermore, a retrospective pattern, which was present in the previous TRAC assessment, became stronger in the current assessment, resulting in less confidence among the SSC in the model outcomes.

Although the SSC was not comfortable with the assessment outcomes as a basis for providing catch advice, it should be noted that the range of information provided by the assessment did help the SSC understand the nature of uncertainties in the assessment. Moreover, the SSC noted that having had a Committee member serve as a liaison to the TRAC during the assessment process helped the TRAC provide information that helped the SSC better understand uncertainty. However, in the future it would be helpful for the TRAC to directly estimate OFL if possible, even if it is not needed in the Canadian management arena, to remove ambiguity surrounding its value in the U.S. management process.

Also, the SSC recognized that having its liaison to the TRAC chair the initial deliberation on the ABC for Georges Bank yellowtail flounder compromised his ability to convey insights on the TRAC process. Therefore, those roles should be separated in the future.

The SSC reiterates the advice that there should be no directed fishery and no increase in bycatch of Georges Bank yellowtail flounder in light of the high uncertainty and concern that the stock is at low levels relative to its potential productivity. The SSC advised that an ABC of 1,150 mt should only be considered a backstop measure and, "Thus, this ABC is appropriate **ONLY** (emphasis added) when management measures are implemented that have a high probability in resulting in low fishing mortality rates."

Finally, the SSC expressed appreciation for the efforts of Groundfish PDT Chair Tom Nies and Groundfish PDT member Fiona Hogan for developing a series of potential OFL options on very short notice. Those options provided extremely valuable starting points for SSC deliberations and accelerated a difficult decision.

The overfishing limit (OFL) for Georges Bank yellowtail flounder is <u>unknown</u> at present.

New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
C. M. "Rip" Cunningham, Jr., *Chairman* | Paul J. Howard, *Executive Director*

To: Paul J. Howard, Executive Director
From: Scientific and Statistical Committee
Date: January 29, 2013

Subject: **Georges Bank cod, Gulf of Maine cod and Southern New England/Mid-Atlantic winter flounder ABCs for FY2013-2015**

The SSC met on January 23, 2013 to address the following terms of reference (TOR):

1. The SSC is asked to develop Overfishing Limit (OFL) and Acceptable Biological Catch (ABC) recommendations for Northeast Multispecies stocks as specified below.

2. ABC recommendations are to be based on the fishing mortality strategies approved by the Council in Amendments 13 and 16 and related management actions. Status determination criteria should be used that are specified in Amendment 16 or subsequent actions, or that will be implemented through FW 48 consistent with the recommendations of recent SARCs. The general control rule for groundfish stocks that has been adopted is:

3. "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 FMSY.
    b. If fishing at 75% of FMSY 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 (Frebuild).
    c. For stocks that cannot rebuild to BMSY 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."

4. GOM cod: Provide an OFL and ABC for 2013-2015 that will prevent overfishing and that is consistent with the default ABC control rule. This stock is currently subject to a formal rebuilding program and the ABC should be based the default ABC control rule. Should SARC 55 determine that this stock is overfished and cannot rebuild by 2014, a revised rebuilding plan will be implemented at the beginning of FY 2014.

5. GB cod: Provide an OFL and ABC for 2013-2015 that will prevent overfishing and that is consistent with the default ABC control rule. This stock is currently subject to a formal rebuilding program and the ABC should be based on the default ABC control rule.

6. SNE/MA winter flounder: Provide an OFL and ABC for 2013-2015 that will prevent overfishing and that is consistent with alternative management strategies that will be considered by the Council.

7. The following documents are provided for the SSC's review:
    a. Groundfish Plan Development Team memo to the SSC dated January 16, 2013
    b. 55th Northeast Regional SAW Assessment Summary Report http://www.nefsc.noaa.gov/publications/crd/crd1301/
    c. 55th Northeast Regional SAW and Reviewer Reports from Cadigan, Casey and Holmes (4 reports total) http://www.nefsc.noaa.gov/saw/saw55/
    d. 55th Northeast Regional SAW Assessment Reports for GOM Cod and GB Cod http://www.nefsc.noaa.gov/SAW-Public/
    e. 52nd Northeast Regional Stock Assessment Workshop Assessment Summary Report http://www.nefsc.noaa.gov/publications/crd/crd1111/index.html (includes SNE/MA Winter Flounder)
    f. 52nd Northeast Regional Stock Assessment Workshop Report http://www.nefsc.noaa.gov/saw/saw52/crd1117.pdf (includes SNE/MA Winter Flounder)

Georges Bank cod

The PDT presented two ABC alternatives to the SSC. The first method applies 75% of the F_{MSY} proxy to the projected biomass, resulting in values of 2,506mt for 2013, 2,732mt for 2014, and 3,172mt for 2015. The second method applies 75% of the F_{MSY} proxy to the projected biomass in 2013 and then retains that value for 2014 and 2015. **The SSC favors the second option: ABC should not exceed 2,506mt for 2013-2015.** This recommendation was based on several factors.

Repeated experiences in recent years demonstrate poor performance of stock projections. Projections often deviate substantially from updated perceptions of stock dynamics revealed by later assessments, and this problem increases further into the future from the starting year of the projection. Therefore, while there is some confidence in estimated biomass in the first year of the projection, 2013, rapid deviations mean that confidence is much lower for 2014 and especially 2015. In fact, the SSC's preference is to only provide ABCs for 2013 and 2014. While the SSC recognizes the rationale for setting a 2015 ABC at this stage as a placeholder in case circumstances do not allow it to be set later, the SSC cautions against basing fisheries management on data that is several years old (i.e., basing the ABC in 2015 on data no more recent than 2011).

Deviations between projections and stock performance have recently tended toward over-optimistic expectations of stock growth. Despite ACLs set with uncertainty buffers and catch below those ACLs, later assessments often reveal continued overfishing. Instead of adjusting ABC based on optimistic projections of future stock growth, holding catch constant provides an additional buffer against that outcome.

In addition to significant concerns about the performance of stock and catch projections, other issues raised include:

- During public comment at the SSC meeting, several industry members highlighted that fish have been hard to find, especially over the past year, despite ample ACE being available and high prices for cod.
- Age structure of GB cod has been severely truncated since the mid-1990s. Older and larger cod spawn more frequently, produce disproportionately more eggs per spawn, and have higher egg quality and juvenile survival. These attributes are not captured by the assessment, and could cause underestimation of the effects of a loss of the older age groups.
- Distribution of cod through time has seen a consistent shift north and eastward, which might be changing availability of fish to the fleet.
- Spawning stock biomass is very low and close to the origin of the stock-recruitment relationship, where predator traps and other ecological phenomena can reduce per-capita reproductive rates.

Industry members also commented that the federal government has issued a disaster declaration for the groundfish fishery, which specifies that poor stock status persists despite adherence to catch limits. This suggests that other factors are inhibiting recovery, and that these factors need to be better understood and, where possible, mitigated. Therefore, the SSC urges greater attention to conditions and processes that affect stock dynamics beyond those typically captured by the assessment and ABC-setting process. See below for further discussion of this issue.

Gulf of Maine cod

The PDT presented two ABC alternatives to the SSC. Both adopt a constant catch approach. The first is based on 75% of the F_{MSY} proxy applied to the 2013 biomass projected from the base model in the assessment, resulting in a value of 1,249mt for 2013-2015. The second is based on the M-ramp model and sets the value of 1,550mt as the ABC for 2013-2015 based on F declining from 0.27 in 2013 to the F_{MSY} proxy in 2015 due to projected increase in the stock. This second constant catch ABC has F less than the F_{MSY} proxy under the M=0.2 model for all three years. **The SSC agreed with the PDT that the preferred ABC for 2013-2015 should not exceed 1,249mt, but also includes the second alternative of ABC not to exceed 1,550mt for 2013-2015 in our recommendation for reasons outlined below.**

The PDT preferred the first approach given the overfished state of the stock and the comparatively small economic differences predicted between the two options. However, the PDT noted that economic impacts looming for the groundfish fishery due to a series of ACL cuts in 2013 and beyond might mean that even small differences in economic outcomes will be significant. The SSC agreed with the PDT's evaluation of the two options, and noted that both alternatives appropriately use the assessment outcomes and account for scientific uncertainty. An ABC of 1,550mt is the maximum the SSC endorses based on the PDT analysis, but urges the Council to consider the 1,249mt alternative in order to conserve the stock and enhance the likelihood of rebuilding. Furthermore, although the SSC has serious concerns about the status of the stock which motivate the preference for ABC=1,249mt, we also recognize that either value represents a substantial reduction in recent harvest, and is expected to promote rebuilding more than recent level of catch have allowed.

The GOM cod assessment took an important step that was welcomed by the SSC in presenting two models to help understand stock dynamics. The potential value of considering multiple models with

comparable performance and plausibility has been discussed by the SSC in the past, and reviewing both models in the course of this decision provided additional insights and understanding of the nature and extent of uncertainty. However, presenting two models also introduced new difficulties into the deliberations and development of ABC advice. Two models converged to common estimates of SSB, F and recruitment in the terminal year so projections began from a common starting point, but the implications of ABC alternatives differed between subsequent projections from the two models.

Consideration of the M-ramp model also raised important and unresolved questions. It is unclear whether the increase in M to 0.4 assumed for the M-ramp model will be persistent or ephemeral, i.e., whether or not M will return to the longer term estimate of 0.2, and the base model assumed no change at all. The SARC panel determined that, if M has increased, an eventual return to 0.2 is likely given that it is more consistent with inherent life history traits of cod (growth, longevity, maturity) and that the mechanism for the increase is not clear. Therefore, fishing mortality targets used in the projections from either model were based on reference points that assumed M=0.2.

In addition to the approaches adopted during the assessment and PDT analysis, the SSC discussed two other aspects of the potential shift in the mortality regime, one related to policy and the other related to science. The policy discussion focused on the implications of the National Standards guidance for the methods used. Again, based on SARC recommendations, the increased natural mortality was not carried through to the overfishing definition or the rebuilding target. The SARC recommendation might not be consistent with NS1 guidelines that, "*MSY is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological, environmental conditions…*" However, elsewhere it is stated that, "*Some short-term environmental changes can alter the current size of a stock or stock complex without affecting the long-term productive capacity of the stock or stock complex*." Therefore, depending upon the interpretation of the terms "prevailing" and "short-term", it may or may not be necessary to apply different F values to biomass projected from the two models in determining catch advice.

There was disagreement within the SSC about whether the M-ramp model's increase in the natural mortality rate should lead to an increase or a decrease in the target fishing mortality rate. The SSC was unable to resolve this difference in directional change of target fishing mortality rate during the meeting. The discussion raised larger scientific questions about the nature and implications of regime shifts, similar to those raised in the discussion about both GB cod and SNEMA winter flounder, questions that require urgent attention and resolution (see below).

<u>Southern New England/Mid-Atlantic winter flounder</u>
The PDT presented two ABC alternatives to the SSC. Both adopt a constant catch approach. The first adopts an ABC of 2,000mt for 2013-2015, which keeps F within 75% of F_{MSY} in 2013 and within $F_{rebuild}$ thereafter. The second adopts an ABC of 1,676mt, which is the long-term yield expected if 75% of F_{MSY} is maintained indefinitely and recruitment follows more recent trends rather than the longer term trend used in the assessment. The PDT recommended the latter alternative, and **the SSC agreed that ABC for 2013-2015 should not exceed 1,676mt**.

The primary impetus for this decision is a clear pattern in the stock-recruitment residuals, wherein actual recruitment for 1999-2010 has been consistently below recruitment predicted by the Beverton-Holt model used in the assessment. Residuals should be distributed more or less evenly on either side of the predicted relationship if the relationship still holds. A persistent bias in one direction

suggests that something in the environment has changed or that the model fit is too poor to use for predictions.

Other recommendations

As noted above, the SSC had some discomfort with setting ABCs for 2015 given poor performance of some recent assessments, low confidence in projections, rapid and incompletely understood changes in the ecosystem, and socio-economic impacts of our catch advice. We felt compelled to meet the terms of reference provided by the Council, but also to caveat our advice appropriately. However, we strongly urge the Council, NOAA, NRCC and other institutions in the science and management system to do everything possible to provide updated information in the form of new update or benchmark assessments, survey data, catch information, and other research results within 2014 so that the 2015 ABCs can be revisited and possibly adjusted if appropriate.

This information will not, however, resolve overarching questions about changes in the ecosystem, and especially whether there has been a persistent regime shift, questions that were a component of SSC discussions of all of these stocks. In fact, similar questions have been raised in other SSC deliberations. For example, our initial ABC advice for silver hake included unanswered questions about whether there has been a fundamental change in productivity, which resulted in the substantial increase in the ABC relative to historical catch trends. Also, our review of the GOM cod analyses provided by Drs. Butterworth and Rademeyer in March 2012 raised question about how far back in time an assessment should go if a regime shift has taken place, since the earliest years will be most dissimilar from the new regime. A series of scientific publications over the past decade provide evidence for a possible regime shift, and the extreme temperatures and resultant changes in species' distributions and behavior provides more immediate and tangible evidence that the system might be behaving in a fundamentally different way than in the past.

Therefore, we recommend that processes be initiated at the regional or, preferably, national level to accomplish three primary objectives. First, identify the key metrics and threshold values of those metrics that define when a regime shift has taken place. Second, evaluate data against those thresholds to determine if a regime shift has taken place in the Gulf of Maine/Georges Bank/Southern New England region, or if one is underway. Third, determine appropriate management responses for when a regime shift is determined to have taken place.

The SSC recognizes that progress was made on the proposed work plan to address cod management units. However, the SSC reiterates its previous recommendation that "There should be a comprehensive evaluation of scientific information on cod population structure and its management implications, including the possibility of revising management units. This evaluation should occur in time to be taken into account in the next management cycle, beginning with the 2014 fishing year."

Summary of recommendations

1. **The ABC for Georges Bank cod for 2013, 2014 and 2015 should not exceed 2,506mt. The associated OFLs are 3,279 mt, 3,570 mt, and 4,191 mt for FY 2013-2015, respectively.**
2. **The preferred ABC for Gulf of Maine cod for 2103, 2014 and 2015 should not exceed 1,249mt, but the Council might also consider alternative values not to exceed 1,550mt depending upon its risk tolerance. The OFLs associated with the 1,249 mt constant catch ABC are 1,635 mt, 1,966 mt, and 2,705 mt for FY 2013-2015, respectively, while the OFLs associated with the 1,550 mt constant catch ABC are 1,635 mt, 1,917 mt, and**

2,639 mt for FY 2013-2015, respectively. Both sets of OFLs are based on the M=0.2 model.

3. **The ABC for Southern New England/Mid-Atlantic winter flounder for 2013, 2014 and 2015 should not exceed 1,676mt. The associated OFLs are 2,732 mt, 3,372 mt, and 4,439 mt for FY 2013-2015, respectively.**
4. **Updated information to re-evaluate 2015 ABCs should be produced within 2014.**
5. **A regional or national process to better define regime shifts, develop metrics for when they occur, and determine management strategies as a result is urgently needed.**

Summary of 2013-2015 OFLs and ABCs for Georges Bank cod, Gulf of Maine cod, and Southern New England/Mid-Atlantic winter flounder (all values in metric tons, mt).

	2013		2014		2015	
	OFL	ABC	OFL	ABC	OFL	ABC
Georges Bank cod	3,279	2,506	3,570	2,506	4,191	2,506
Gulf of Maine cod – preferred	1,635	1,249	1,966	1,249	2,705	1,249
Gulf of Maine cod – alternative	1,635	1,550	1,917	1,550	2,639	1,550
SNEMA winter flounder	2,732	1,676	3,372	1,676	4,439	1,676