New England Fishery Management Council
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MEMORANDUM

DATE: January 7, 2020

TO: Scientific and Statistical Committee

CC: Groundfish Committee

FROM: Groundfish Plan Development Team

SUBJECT: **ABCs for GB haddock, GOM haddock, American plaice, and pollock**

The Groundfish Plan Development Team (PDT) met on January 6, 2020 by webinar to discuss the Council's decision to remand back to the Scientific and Statistical Committee (SSC) the acceptable biological catches (ABC) for Georges Bank (GB) haddock, Gulf of Maine (GOM) haddock, American plaice, and pollock for fishing years 2020 through 2022.

This memo highlights the PDT's discussion of risk – biological, economic, and social and also includes two supporting analysis as attachments: 1) an overview of the SSC's use of constant ABCs and 2) economic impacts analysis using the Quota-Change model (QCM) which is run for the sector program (sectors) in the commercial groundfish fishery. Please see the PDT memo to the SSC, dated October 10, 2019 (as revised on 10/15/19) for additional information not repeated within this memo, including projections at 75%F_{MSY}.[1]

Attendance: Jamie Cournane, Ph.D., Dan Caless, Kevin Sullivan, Melissa Errend, Robin Frede, Liz Sullivan, Greg DeCelles, Ph.D., Paul Nitschke, Matt Cutler, Ph.D., Emily Keiley, Mark Grant, Tim Cardiasmenos, and Terry Stockwell.

Audience : Jackie Odell, Libby Etrie, Rick Bellavance, George Lapointe, Terry Alexander, Meredith Mendelson, Fred Serchuk, Mike Waine, and Maggie Raymond

PDT discussion summary – biological, economic and social risk

1. General Discussion

The PDT discussed biological, economic, and social risk when comparing the SSC's ABCs under a constant quota approach (as recommended by the SSC at its October 2019 meeting) versus those projected at 75%F_{MSY} (part "a" of the ABC control rule for groundfish). The PDT

[1] Located at : https://s3.amazonaws.com/nefmc.org/A.8-GF-PDT-memo-to-SSC-re-FY2020-FY2022-Groundfish-OFLs-ABCs_20191001-REVISED.pdf

recognizes that three-year projections are routinely provided, but the third year of the projection is typically a placeholder and may not be the best year to use for catch advice- as in the constant quota approach. Further, the third year of the projection is usually the most uncertain, because it is informed by relatively little survey data and relies the most heavily on the assumed recruitment in the projection. An alternative to using the lowest catch from the three-year projections (including the 3rd year placeholder) is to limit the constant catch estimate to the lowest of the first two specification years. If this method is considered, then one should ensure the projections do not suggest a biological risk of overfishing in the placeholder third year through the implementation of higher catch from year two. In addition, an overview of the use of the constant approach by the SSC is provided (see Attachment 1).

Biological Risk – Biological risk of either the constant quota approach or 75%F_{MSY} quota approach appears to be low based on overall stock status for these four stocks. Based on the 2019 assessments, GB haddock, GOM haddock, American plaice, and pollock are rebuilt, not overfished, and overfishing is not occurring.

The PDT updated Wiedenmann and Jensen's projection performance work (2018[2]), and this preliminary evaluation suggests recent projections are performing better for 3 of the 4 stocks (other groundfish stocks were not evaluated as part of this exercise) (Figure 1). For American plaice, GOM haddock and pollock an update of a comparison of F/F_{MSY} to catch/OFL ratios since Wiedenmann and Jensen suggests the projections were working reasonably well. GB haddock estimates appear to be less so with higher F/F_{MSY} ratios relative to catch/OFLs ratios. Part of the improved performance may be attributed to adjustments that were made to the projection assumptions. For example, changes were subsequently made to the GB haddock projection to improve estimations of reductions in growth and selectivity for strong year classes. Perhaps updating the assessment and catch advice more often in recent years has also contributed to improved performance. In this preliminary evaluation, the PDT did not examine the potential impact of the revised MRIP data on these findings (GOM haddock and pollock) or evaluate performance in years when the quotas changed in-season due to NMFS actions (GOM haddock and pollock in some years).

The true biological risk is more difficult to quantify. The projections and assessment would suggest there is little biological difference between the constant quota and the 75%F_{MSY} quota projections. However, past experience and analysis have shown that the assessments and projections underestimate the true uncertainty. This is evident from historical observance of stock assessment and projection estimates through the output control system since 2010 (see catch performance plots in Groundfish PDT presentation, as an example). In addition, the overall improvements in overfishing status among groundfish stocks are likely due to the culmination of many different factors such as fishery multispecies stock interaction constraints, changes in 20 groundfish assessments/projections through time among stocks, historical OFL/ACL decisions among stocks, and other factors.

[2] See: Wiedenmann, J. and O. P. Jensen. 2018. Uncertainty in stock assessment estimates for New England groundfish and its impact on achieving target harvest rates. *Canadian Journal of Fisheries and Aquatic Sciences*, 75(3): 342-356. Available at <https://www.nrcresearchpress.com/doi/pdf/10.1139/cjfas-2016-0484>

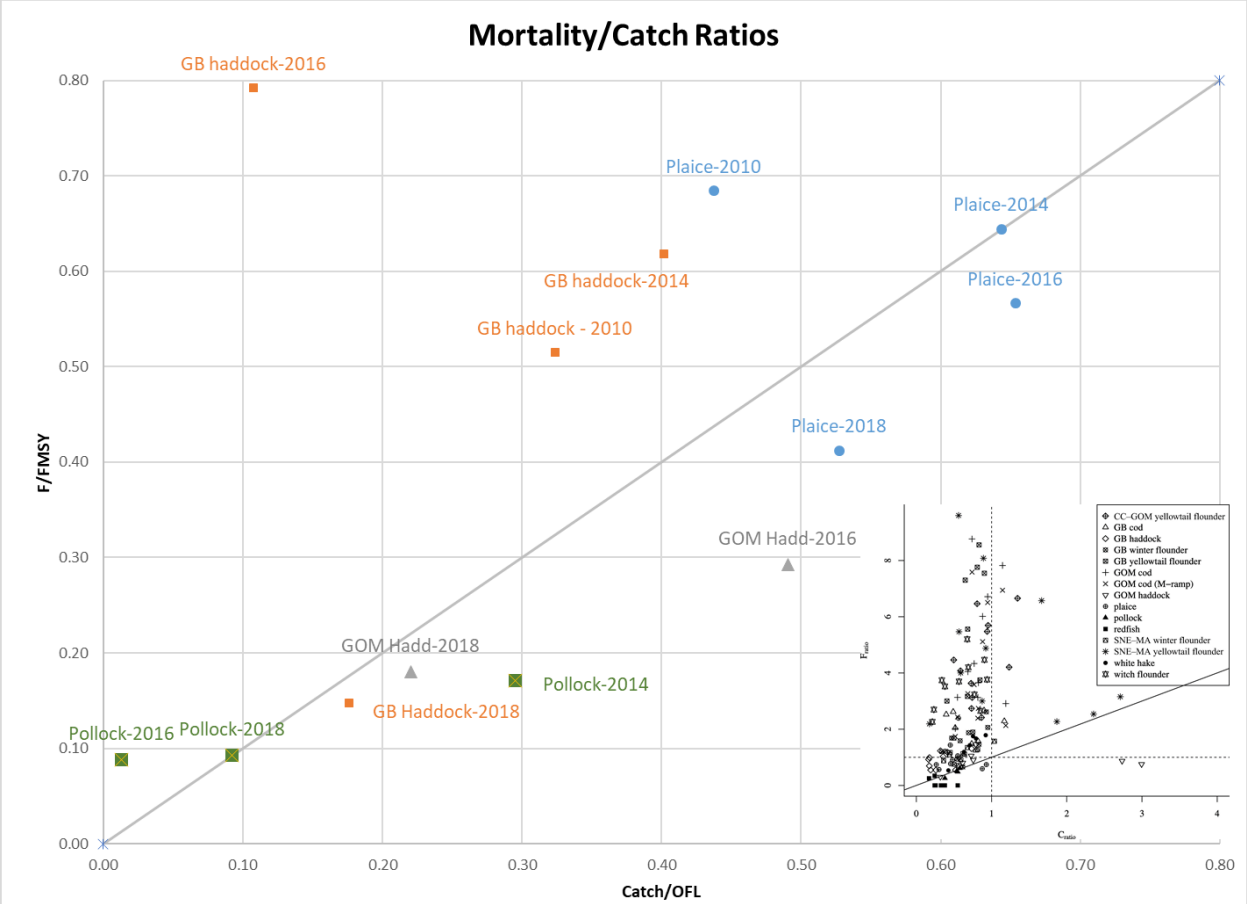

Figure 1- Updated projection performance work for four groundfish stocks, inset from Wiedenmann and Jensen 2018 (*Figure 1- Annual estimates by stock of the F_{ratio} (calculated as F_{obs}/F_{targ}) as a function of the C_{ratio} (calculated as C_{obs}/C_{targ}). The dashed vertical and horizontal lines at 1 separate the plot space to highlight when catches and F were above or below the target, respectively. The solid black line is the 1:1 line, with values above or below the line indicating the achieved F is disproportionately high or low for a given catch ratio, respectively.*)

Economic Risk - According to the QCM results, the predicted utilization by sectors for all four of these stocks are constrained by multiple groundfish stocks with low annual catch limits (ACL). There are essentially no differences in QCM predictions when comparing the constant quotas with 75%F_{MSY} quotas (see Attachment 2). The differences in the projected catch of each stock are within the range of statistical uncertainty and not significant (Table 1). The confidence interval from Table 6 (see Attachment 2) indicates this for the stocks in question, namely that for pollock and GB haddock, the difference in predicted revenues are relatively small compared to the model uncertainty. The difference in predicted revenue for GB haddock would be approximately $33,069 if average price was $1/lb (realized average price in 2018 was $0.96), while the 95% confidence interval was approximately $ +/- 1.2 million. For pollock, the difference in predicted revenue is a $4,000 difference (2018 average price $0.82), while the 95% confidence interval was +/- $300,000. Therefore, these differences are not considered to be meaningful (not significant).

Table 1- QCM predicted sector catch (mt) for four groundfish stocks under constant quota and 75% F_{MSY} based quota in fishing year 2020.

Stock	Predicted Catch - constant quota	Predicted Catch - 75%F_{MSY}	Difference
GB Haddock	4,445	4,430	15mt less
GOM Haddock	2,735	2,735	none
Plaice	1,104	1,104	none
Pollock	2,935	2,943	8mt greater

Social Risk – While there are no overall differences in QCM predicted sector fishery-wide revenue, there may be some distributional impacts if quotas increase or decrease, depending on the extent that any given port or fishing community depends on the stocks in question and if the assumptions of the QCM are not fully met. In addition, social impacts are more likely to be positive when there is better trust in the management process, such as when decisions are guided by best available science. Trust among fishery participants is already low, so this would be a possible opportunity to increase trust among fishery stakeholders by ensuring that the appropriate steps are followed as outlined by the Council's own current ABC control rule for groundfish. Alternatively, in the past, industry has requested stability in quotas – which a constant quota approach could provide.

Results from the NEFSC Social Sciences Branch's Crew Surveys (2012 and 2018 survey waves) suggest that commercial groundfish crew are significantly more likely than crew in other fisheries to be dissatisfied with the predictability of their earnings and less likely to trust management to make the right decisions (Table 2). Additionally, commercial groundfish crew are significantly more likely than crew in other fisheries to believe the rules and regulations change too quickly and that they are too restrictive (Table 3). These results indicate that while the stability of quotas could provide greater predictability in terms of earnings, there is also much room for improvement for management to increase trust in the process among stakeholders.

Table 2- Crew Satisfaction with predictability of earnings, 2012 and 2018 Crew Surveys.

	Groundfish Crew	Other Crew	Total Crew
	N (%)	N (%)	N (%)
Total	105 (100%)	732 (100%)	837 (100%)
Very satisfied	0 (0%)	32 (4%)	32 (4%)
Satisfied	23 (22%)	312 (43%)	335 (40%)
Neutral	20 (19%)	160 (22%)	180 (22%)
Dissatisfied	39 (37%)	160 (22%)	199 (24%)
Very dissatisfied	21 (20%)	66 (9%)	87 (10%)
Don't know/No answer	2 (2%)	2 (<1%)	4 (<1%)

***t* = 5.97, p<.001**

Survey question: How satisfied or dissatisfied are you with the following items relating to the job of fishing? [The predictability of your earnings]

Table 3- Trust in management among crew, 2012 Crew Survey Version 1 only.

	Groundfish Crew	Other Crew	Total Crew
	N (%)	N (%)	N (%)
Total	13 (100%)	59 (100%)	72 (100%)
"Do not trust managing authorities"			
Strongly agree	7 (54%)	17 (29%)	24 (33%)
Agree	6 (46%)	21 (36%)	27 (38%)
Neutral	0 (0%)	11 (19%)	11 (15%)
Disagree	0 (0%)	7 (12%)	7 (10%)
Strongly disagree	0 (0%)	2 (3%)	2 (3%)
Don't know/No answer	0 (0%)	1 (2%)	1 (1%)

***t* = 2.28, p<.01**

Survey question: Please indicate the extent to which you agree or disagree with the following statements regarding the most recent federal government-led fisheries management process you participated in. [I do not trust the managing authorities to make the right decision when it comes to regulating fisheries.]

2. Biological and economic risk information on a stock-by-stock basis

In addition to the general discussion, the PDT offers some complementary biological and economic risk information on a stock-by-stock basis:

- Georges Bank haddock
    - Biological – The projection performance work suggests uncertainty is not fully being captured. This may in part be due to the difficulty is estimating year-class strength, and perhaps changes in life history traits such as weight-at-age. This would be the case regardless of constant quota or that at 75%F_{MSY}.
    - Economic – The QCM results suggests no real difference in the predicted catches, and appears to be within margin of error.

- Gulf of Maine haddock
    - Biological – The projection performance work suggests it is performing relatively well (with points above and below the line). The 2019 assessment indicated the retrospective pattern is in the "other direction" – bias correction leads to increases in SSB and decreases in F (which is somewhat unique among groundfish assessments).
    - Economic – The QCM results suggests no real difference. The recreational bioeconomic model for GOM haddock and GOM cod predicted catches is also unlikely to show differences, since it is driven by the low GOM cod quota.
- American plaice
    - Biological – The projection performance work suggests it is performing relatively well (with points above and below the line). There is suggestion of a strong 2013 year-class.
    - Economic – The QCM results suggest no difference, but industry correspondence suggests in some cases there could be distributional benefits – for example some possible reduction in the leasing costs to catch plaice (i.e., increases in the potential sector contribution, PSC). Additionally, if landings value is higher, there could be some additional benefits – which would likely be the case for either scenario (constant versus 75%F_{MSY}).
- Pollock
    - Biological – The projection performance work suggests it is performing relatively well (with points above and below the line). There are indications of a strong 2013 year-class and some stronger earlier ones, but since 2013 there have been declines in recruitment.
    - Economic – The QCM results suggests no real difference in the predicted catches, and appears to be within the margin of error.

Attachment 1

Overview of Scientific and Statistical Committee's use of Constant Acceptable Biological Catches (ABCs) for Northeast Multispecies (Groundfish) Stocks

January 3, 2020

1. This summary of the Scientific and Statistical Committee's (SSC) use and discussion of constant Acceptable Biological Catches (ABCs) since the adoption of the Annual Catch Limit (ACL) requirements in Amendment 16 (A16) is provided for reference. The first ABCs/ACLs were developed in 2009 for the 2010 fishing year. The focus in this paper is on the years when specifications were set for most groundfish stocks. There are some years when a benchmark assessment led to ABCs for a small number of stocks. They are only discussed if considered relevant to the constant ABC issue. The focus is on stocks with an analytic assessment since early in this process it was determined that the projection methodology for the AIM or other empirical models was not appropriate. The summary is provided in chronological order of SSC meetings.

2. **2009**: In 2009 the SSC met to recommend ABCs for fishing years (FY) 2010-2012. **Projected ABCs** were used for all stocks with analytic assessments. The constant ABC approach was not used for any of these stocks.

3. **2010**: After the pollock ABC was set for 2010 using the AIM model, a new analytic assessment was performed in early 2010. Based on this assessment, the NMFS modified the 2010 pollock ABC through an emergency action. The SSC considered the results of this new assessment in the fall ABCs for FYs 2011-2014 were **based on the projection output**. While the constant ABC approach was not used, the ABCs varied only slightly over the three-year time period.

4. **2011**: As part of A16, the original plan was that stock assessments would not be performed for all groundfish stocks every two years. The Plan Development Team (PDT) and the SSC explored alternative ways to set ABCs for the period FYs 2012-2014. This work led to the initial concern over of the poor performance of stock projections. The SSC strongly recommended new stock assessments rather than alternative catch-setting approaches. The NEFSC agreed to conduct stock assessments in 2012.

5. **2012**: There were three SSC meetings in 2012 to address groundfish ABCs and control rules. Over the course of these meetings, the SSC discussed projection performance based on the February 2012 Operational Assessments and recommended groundfish ABCs. The SSC's report written in September 2012 concluded:

> *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 four stocks: the three yellowtail flounder stocks and witch flounder. A constant ABC was also used for Atlantic wolffish, but this was because the Data Poor Working Group recommended against using projections for this stock. Detailed reasons are provided for each of these stocks below. This was the first time the SSC used a constant ABC approach. It was justified based on specific issues for four of the five stocks. In summary:

a. Georges Bank (GB) yellowtail flounder: An ABC was provided for 2013-2014. The SSC provided three possible ABCs with different levels of a probability of overfishing.
b. Southern New England/Mid-Atlantic (SNE/MA) yellowtail flounder: The SSC developed a new biomass Status Determination Criteria which indicated the stock was fully rebuilt. The long term 75%FMSY catch was used rather than applying this mortality target to the biomass in each year because "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." This **constant ABC** was lower than the catch associated with 75%FMSY in 2013-2015. The SSC commented that future ABCs could be set using 75%FMSY if recruitment remained low, confirming a change in stock productivity.
c. Cape Cod/Gulf of Maine (CC/GOM) yellowtail flounder: The initial appearance of a retrospective pattern raised concern. The projection indicated a large increase in stock size in 2014 and 2015. Because of the additional uncertainty raised by the retrospective pattern, the **constant ABC** was set at the FY 2013 projected value for three years.
d. Witch flounder: The most recent recruitment estimate was large but uncertain. The **constant ABC** was set at the 2013 value using Frebuild for three years.

6. **2013**: The SSC met three times in 2013 to discuss issues related to groundfish ABCs. In January, ABCs for Gulf of Maine (GOM) cod, GB cod, and SNE/MA winter flounder were developed. In August, ABCs for white hake and GB yellowtail flounder were developed. The SSC discussed rebuilding plans for two stocks in May and considered a revision to the GOM haddock ABC in November (changes were not recommended).

a. GOM cod: This was the first time the SSC considered the M=0.2 and Mramp models for GOM cod. The SSC recommended two alternative **constant ABCs** – 1249 mt and 1550 mt – resulting from these models.
b. GB cod: The SSC recommended a three-year **constant ABC** set at the projected value for 2013. In addition to concerns over general groundfish projection performance, the SSC expressed concerns over the truncated age structure, changes in species distribution, and low SSB as reasons for their recommendation.
c. White hake: The SSC considered a constant ABC recommendation but instead used the **projected value** at 75%FMSY for all three years. "This decision was made not because the concerns discussed above have diminished, but rather because, unlike GOM cod and SNE/MA winter flounder, that status of white hake is good. Therefore, the consequences of either concern are less in the near-term."

7. **2014**: The SSC met three times to discuss groundfish ABCs.
    a. GOM haddock: The SSC adopted the **projected ABCs** for the three-year period. While the PDT recommended a constant ABC approach, the SSC noted the strong stock status, SAW/SARC approval of the model, and an upcoming operational assessment. These factors led the SSC to conclude there was a low risk of overfishing if the final model was later determined to be optimistic.
    b. GB yellowtail flounder: The SSC recommended a 2015 ABC based on an estimate of average survey biomass. This was the first year the empirical approach was used.
    c. Pollock: The SSC recommended a **constant ABC** approach based on 75%FMSY, holding the ABC constant at the 2015 value. The SSC noted uncertainties associated with the selectivity and data weighting, as well as the unknown cause of the retrospective pattern.
    d. GB winter flounder: The SSC noted the stock was not overfished but was rebuilding. The SSC did not deviate from the default control rule and **recommended ABCs that increased** over the 2015-2017 period. They noted that an operational assessment was planned for 2015 and the ABCs could be adjusted if necessary.
    e. GOM cod: The SSC recommended a **constant ABC** that was 75% of the OFL. The ABC was held constant in recognition of the difficulties in making projections at low stock sizes and the update assessment scheduled for 2015.
    f. GOM Winter Flounder: The SSC recommended a **constant ABC** based on the fact projections were not available for index-based stock assessments.

8. **2015**: All nineteen groundfish stocks were assessed in an Operational Assessment. The SSC report notes:

> *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.*

Recommendations are summarized in the table below. The table notes refer to the original SSC report. Of the twelve stocks with analytic assessments and associated projections, the SSC recommended a **constant ABC for eight and a changing ABC for four**. In general, the constant ABC was not used for stocks in good status. The exception was GB haddock where the SSC was concerned about the reduced growth and uncertain size of the 2013 cohort.

Excerpt from 2015 SSC Report

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} × projected 2017 biomass with reduced growth & 2013 cohort (constant)	See additional discussion
GOM haddock	75%F_{MSY} × 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} × 2016 projected biomass (111mt) (constant)	See additional discussion
CC/GOM yellowtail flounder	75%F_{MSY} × 2016 projected biomass (constant)	Natural mortality assumption not consistent with other yellowtail stocks.
Plaice	75%F_{MSY} × projected biomass	Used projected catch for 2017 and 2018 despite retrospective due to good stock status.
Witch flounder	75%F_{MSY} × 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} × 2016 projected biomass (constant)	See additional discussion
GOM winter flounder	75%F_{MSY} × 30+ cm biomass (constant)	Stock does not appear to be responding to catches << ABC
SNE/MA winter flounder	75%F_{MSY} × 2017 projected biomass (constant)	See additional discussion
Redfish	75%F_{MSY} × 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} × projected biomass	ABC in 2017 and 2018 decrease from 2016 value.
Pollock	75%F_{MSY} × 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} × kg/tow (constant)	Recent catches exceed ABCs in some years

Southern windowpane flounder	75%F_{MSY} × kg/tow (constant)	Recent catches exceed ABCs in some years
Ocean pout	75%F_{MSY} × kg/tow (constant)	Stock does not appear to be responding to catches << ABC
Halibut	75% × (2015 OFL + 6% for 5Y) (constant)	See additional discussion
Wolffish	75%F_{MSY} × 2014 exploitable biomass (constant)	Projections not accepted for this stock at the benchmark.

9. **2016**: The SSC discussed several issues related to projections and groundfish control rules in 2016.

a. Witch Flounder. At the request of the Council, the SSC reconsidered the ABC for witch flounder. The Council requested a new ABC that accepted a higher amount of risk than the default control rule. The SSC suggested an increased ABC, but recommended it be held constant for three years: "The SSC is recommending a **constant ABC** for the next three years to be consistent with recent catch advice for other stocks, whereby we generally followed the projections and allowed the ABC to increase through time for stocks that are not overfished, but held the ABC constant to increase the buffer between OFL and ABC for stocks that are overfished."

b. Control rules: In June 2016 the SSC discussed groundfish control rules and projections. With respect to projections the SSC noted it adopted an ad hoc control rule in 2015 that "…called for use of projected biomass in all years for which catch advice is being provided when the assessment concluded that the stock is not overfished, but use of the lowest catch in the projection for all three years when the stock is deemed to be overfished." The SSC discussed whether projections should be related to assessment quality or whether they should be used at all. Ultimately the SSC concluded that "…continued analysis of the benefits and risks of using projections under different circumstances is warranted." Later that year the SSC recommended a review of groundfish control rules.

10. **2017**: The SSC developed recommendations for witch flounder after a benchmark assessment, and for other groundfish stocks after an operational assessment. The witch flounder benchmark adopted an empirical approach. The rationale for the 2017 ABCs is shown in the table below (note that this table does not include recommendations for four index-based stocks that are not relevant to this summary). The table notes refer to the original SSC report. Of the eleven stocks with analytic assessments and associated projections, **a constant ABC was recommended for seven and a changing ABC for four**. In general, changing ABCs were recommended when stock status was good. The most notable exceptions were GB haddock and pollock, where the SSC recommended a constant ABC.

Excerpt from 2017 SSC Report

Table 1. Summary of approaches used to develop ABC recommendations, changes from status quo ABCs and other notes. "(constant)" means the 2018 ABC recommendation remains unchanged for 2019 and 2020.

Stock	ABC Approach	Notes
GB cod	Plan-B smooth; OFL = recent catch x recent survey trend, ABC = 75%OFL (constant)	See detailed notes above
GOM cod	OFL = average of two FMSY projections from two models (m=0.2 and Mramp assuming M=0.4 in the projection), ABC=75%OFL (constant)	See detailed notes above
GB Haddock	75%FMSY projection which incorporates reduced growth and adjustments to selectivity for the large 2013 year class (constant)	2013 cohort believed to be better estimated so not adjusted
GOM Haddock	75%FMSY projection	New recreational dead discard estimate used
GB Yellowtail Flounder	Exploitation rate applied to average swept-area biomass estimates from three surveys (constant)	Dispensed with at Sept 2017 Council meeting
SNE/MA Yellowtail Flounder	Average of 75%FMSY projection and 75%OFL from plan-B smooth (constant)	See detailed notes above
CC/GOM Yellowtail Flounder	75%FMSY projection (constant)	See detailed notes above
American Plaice	75%FMSY projection	See detailed notes above
Witch Flounder	Exploitation rate applied to 3 year average swept-area biomass estimates using two surveys in each year (constant)	See detailed notes above
GB Winter Flounder	75%FMSY projection (constant)	See detailed notes above
GOM Winter Flounder	75%FMSY X 30+cm biomass from survey area swept	See detailed notes above; Incorporates new estimate of Q from the sweep
SNE/MA Winter Flounder	Average of 3 years of catch	See detailed notes above
Acadian Redfish	75%FMSY projection	Used projected catch for 2017 & 2018 despite retrospective due to good stock
White Hake	75%FMSY projection	ABC in 2018 - 2020 decrease from 2016 value
Pollock	75%FMSY projection (constant)	See detailed notes above
Northern Windowpane Flounder	75%FMSY × 3 year average kg/tow (constant)	See detailed notes above

11. **2019**: The SSC made recommendations for the groundfish stocks assessed in an operational/management track assessment. The SSC recommended a **constant ABC for all nine stocks that had an analytic assessment** with associated projections. This reflected a change in the approach used for American plaice, GOM haddock, and white hake. Of these three stocks, only white hake had a change in status.

12. **Discussion**:

a. The SSC's use of constant ABCs evolved over the period 2012-2019. First used in 2012, notable was the statement of the SSC's use of this approach in 2015. Recognizing that it had been inconsistent in the application of this adjustment, in 2015 the SSC said "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." Even the 2015 ABCs deviated from this general approach in the case of GB haddock and pollock – two stocks that were not overfished - but the SSC explained its decisions based on stock-specific assessment uncertainties. The 2019 ABC recommendations were the first time the SSC applied the approach to all stocks, regardless of stock status.

b. Based on this review of past SSC reports, the 2019 SSC report could be corrected to account for past SSC decisions. For example, the report stated "As it has done in the past, the SSC recommends constant ABCs for stocks with analytical assessments that demonstrated strong retrospective patterns." The approach was also used for stocks that did not use a retrospective adjustment (GOM cod, GB haddock, GOM haddock - 2015) and was not used for some stocks that did (American plaice, white hake, redfish). The SSC also said that the 2019 decision on plaice was consistent with previous decisions for this stock. The constant ABC approach was not used for plaice before 2019.

Attachment 2

Quota Change Model Prediction for 2020 Groundfish Fishing Year

Methods

The Quota Change Model (QCM) is used to analyze the impacts of each combination of measures on the sector portion of the groundfish fishery, which comprised 99% of commercial groundfish landings and revenues during the 2018 groundfish fishing year (FY2018). The QCM is a Monte Carlo simulation model that selects from existing records the trips most likely to take place under new regulatory conditions. To do this, a large pool of actual trips is created from a reference data set. The composition of this pool is conditioned on each trip's utilization of allocated ACE, under the assumption that the most likely trips to take place in the FY being analyzed are those fishing efficiently under the new sector sub-ACLs. The more efficiently a trip uses its ACE, the more likely that trip is to be drawn into the sample pool. ACE efficiency is determined by the ratio of ACE expended to net revenues on a trip, iterated over each of the 17 allocated stocks. Operating profits are calculated as gross revenues minus trip costs minus the opportunity cost of quota, where trip costs are estimated using observer data and quota opportunity costs are estimated from a model of inter-sector lease price and quantity data (details on the methods can be found in Murphy et al. 2018).

After the sample pool has been constructed, trips are pulled from the pool at random, summing the ACE expended for the 17 allocated stocks as each trip is drawn. When one stock's ACE reaches the sector sub-ACL limit, no further trips from that broad stock area are selected. The model continues selecting trips until sector sub-ACLs are achieved in all three broad stock areas or, alternatively, if sub-ACLs are reached for one of the unit stocks, the trip selection process ends for all broad stock areas at once[1]. This selection process forms a "synthetic fishing year" and a number of years, typically 500, are drawn to form a model. Median values and confidence intervals for all draws in a model are reported.

By running simulations based on actual fishing trips, the model implicitly assumes that:

- stock conditions, fishing practices and harvest technologies existing during the data period are representative;
- trips are repeatable;
- demand for groundfish is constant, noting that fish prices do vary between the reference population and the sample population, but this variability is consistent with the underlying price/quantity relationship observed during the reference period;
- quota opportunity costs and operating costs are both constant; and,
- no transaction costs and perfect information. ACE flows seamlessly from lesser to lessee such that fishery-wide caps can be met without leaving ACE for constraining stocks stranded.

[1] The model does not currently incorporate sector's ability to convert cod and haddock quota from the "east" (US/CA area) to the "west" allocations. Instead, it assumes that initial east and west allocations are fixed with no conversion.

Because the fishery is modeled as a whole, allocations to individual sectors are not considered.

These assumptions will surely not hold—fishermen will continue to develop their technology and fishing practices to increase their efficiency, market conditions will induce additional behavioral changes, and fishery stock conditions are highly dynamic. Fuel prices and other operating costs may change due to larger economic shifts or shore-side industry consolidation.

The net effect of the constraints imposed by these assumptions is unclear. The selection algorithm draws mainly from efficient trips[2]—if fishermen make relatively less efficient trips the model estimates will be biased high. Fishermen, however, are generally good at their job, and through a combination of technological improvement (gear rigging, equipment upgrades, etc.) or behavioral modifications, they are likely to improve on their ability to avoid constraining stocks. If fishermen are able to make these adjustments, the model predictions will be biased low. Furthermore, the model will under-predict true landings and/or revenues if stock conditions for non-constraining stocks improve, if demand for groundfish rises, or if fishing practices change and fishermen become more efficient at maximizing the value of their ACE. Conversely, the model will over-predict true landings and/or revenues if stock conditions of non-constraining stocks decline, markets deteriorate, or fishing costs increase. Importantly, the model will over-predict landings and revenues if stock conditions for constraining stocks improve substantially and/or fishermen are unable to avoid the stock—in this circumstance, better than expected stock conditions will lead to worse than anticipated fishery performance. The opposite is also true—if a stock predicted to be constraining to the fishery becomes easier to avoid due to technological or behavioral improvements in targeting, or due to declining stock conditions, the model will under-predict revenues.

The model is intended to capture fishery-wide behavioral changes with respect to groundfish sub-ACL changes, and groundfish catch is maximized by the constrained optimization algorithm. Catch of non-groundfish stocks on groundfish trips are captured in the model, but not explicitly modeled, such that constraints on other fisheries are not incorporated. Groundfish vessels on groundfish trips form the unit of measurement for this analysis. Many groundfish fishermen are involved in other fisheries and groundfish trip revenues may represent anywhere from 100% to a small fraction of total revenues for individual fishing businesses impacted by these regulations.

Each year the QCM is updated to reflect regulations and on-the-water conditions. In FW47, FW51, and FW53 the QCM drew from the most recent fishing year for which a full year of data was available. To better capture contemporary stock conditions, operating costs and fishing practices, trips from two fishing years were used in FW55 (FY2014 through November FY2015) and FW56 (FY2015 through November FY2016). The model for FY2015 and FY2016 over-predicted groundfish revenues and this may have been due to the additional partial-year of trips included in the sample pool—the model was able to draw in more efficient trips than the fishery

[2] Since the prediction for FY2015 (FW55), a parameter has been added to the QCM to select a small number of inefficient (often negative net revenue) groundfish trips. In general, model predictions of effort (trips and days absent) have been closer to realized effort since the addition of this parameter.

was able to realize. For FW57 and FW58, trips were drawn from a sample pool constructed from one FY of data, in this case FY2016 for FW57 and FY2017 for FW58.

Likewise, for FW59, the sample pool was constructed using data from one FY (2018). As the anticipated groundfish closed areas for FY2020 are the same as those which occurred during FY2018, there was no need to filter out trips to certain areas from the selection pool. At-sea monitoring (ASM) was assumed to be fully subsidized for FY2020. That is, the condition of a trip being observed/unobserved has no explicit effect on its ability to be chosen into the selection pool.[3]

To understand the QCM's ability to predict groundfish fishery catch and revenues, we offer a retrospective of the models' performance. The model was developed during FY2011 to make predictions for FW47 (FY2012) and has been used in analyzing the impacts of all subsequent groundfish management actions that included ACL changes for the groundfish fishery. Table 1 summarizes the performance of the QCM in predicting revenues and costs on sector groundfish trips since FY2015. Information on the performance of the QCM during earlier years (FY2011-FY2014) can be found in Groundfish FW58. Groundfish revenues were slightly over predicted for FY2015 (+4.8%), FY2016 (8.9%), and FY2017[4] (+7.4%). For FY2018, the over-prediction was more substantial (+19.2%), driven in part by a decrease in groundfish ex-vessel prices for FY2018. Total revenues were under-predicted for FY2015 (-6.8%) and FY2016 (-5.1%), followed by over-predictions for FY2017 (+6.5%) and FY2018 (+16.3%). Cost predictions, in percentage terms, have generally been less accurate than revenue predictions. Operating costs were only slightly over-predicted for FY2017 (+7.0%), but predicted operating costs were over 25% more than realized operating costs for FY2015, FY2016, and FY2018. Quota costs were under-predicted for FY2015 (-32.0%), FY2016 (-40.4%), and over-predicted for FY2017 (27.8%) and FY2018 (121.7%).

[3] In the reference year (FY2018) unobserved trips were found to be slightly more quota efficient than observed trips, meaning the synthetic fishing years produced by the QCM for FY2020 would have lower observer coverage rates than was realized in FY2018. In prior years (FY2014-2017), this phenomenon of unobserved trips being more quota efficient than unobserved trips was not realized.

[4] Predictions made in FW56 for FY2017 were affected by the suspension of operations for the Northeast Fisheries Sector (NEFS) 9 on November 20, 2017. Under the terms of this suspension, NEFS 9 was not permitted to utilize or lease out their remaining quota, leaving a portion of the total available sector sub-ACL stranded (i.e., unable to be leased or caught because the sector could not operate).

Table 1- QCM predictions, FY2015-2019, 2018 dollars (millions)

	FY2015		FY2016		FY2017		FY2018		FY2019
	Predicted[5]	Realized	Predicted[6]	Realized	Predicted[7]	Realized	Predicted[8]	Realized	Predicted[9]
Groundfish Revenue	60.2	57.5	56.4	51.8	50.9	46.7	58.9	49.4	54.7
Total Revenue	77.7	83.3	74.3	78.3	73.5	70.1	83.9	72.1	78.0
Operating Cost	23.9	16.6	17.9	14.1	13.5	13.0	15.6	12.5	14.6
Sector Cost	1.7	2.0	2.0	1.7	1.7	1.8	1.7	2.0	1.9
Quota Cost	6.4	9.4	6.1	10.2	7.1	9.4	12.0	5.4	7.5
Operating Profit	45.7	55.3	48.4	52.4	51.2	46.0	54.5	52.2	53.9

[5] FW53, reference pool=FY2013

[6] FW55, reference pool=FY2014-15 (full year FY2014, FY2015 through Oct. 2015)

[7] FW56, reference pool=FY2015-16 (full year FY2015, FY2016 through Nov. 2016) ; FY2017 prediction incorporating Sector NEFS IX stranded quota

[8] FW57, reference pool=FY2016

[9] FW58, reference pool=FY2017

Results- Alternative 1/No Action ACLs for FY2020

Predicted groundfish revenue for FY2020 is $46.0M, representing an $8.7M decrease from the FY2019 prediction in FW58, and a $3.4M decrease from the FY2018 realized value of $49.4M (Table 2). Total gross revenues from groundfish trips for FY2020 is $65.2M. This represents a $12.8M decrease from the FY2019 prediction of $78.0M, and a $6.9 decrease from the FY2018 realized value of $72.1M.

At the stock-level (Table 3), witch flounder is predicted to be a constraining stock under No Action ACLs. Other stocks with high utilization rates include plaice, white hake, GOM cod, and GB cod east. The four stocks with highest predicted ex-vessel value (GB haddock west, GOM haddock, plaice, and redfish) are not predicted to have high rates of utilization in FY2020.

At the port-level (Table 4), many of the major groundfish ports have lower predicted values for FY2020 than were predicted for FY2018 or FY2019. Gloucester is predicted to be the top groundfish port ($11.7M), with ~25% of ex-vessel value in the sector groundfish fishery. Boston is predicted to be the second highest grossing port ($11.3M), followed by Portland ($7.4M), and New Bedford ($6.8M).

By vessel length (Table 5), vessels >75'+ are predicted to generate ~50% of sector groundfish revenue in FY2020. Vessels in the 50 to <75' category are predicted to generate ~35% of sector groundfish revenue, and vessels in the 30' to <50' category are predicted to generate ~15%.

Table 2- Summary of realized FY2018 and predicted FY2019 and FY2020 revenues and costs for the sector portion of the commercial groundfish fishery, real dollars (millions, 2018)

Option	Groundfish Gross Revenues	Total Gross Revenues	Operating Cost	Sector Cost	Quota Cost	Operating Profit	Days Absent
FY2018 Realized	49.4	72.1	12.5	2.0	5.4	52.2	10,952
FY2018 Prediction (FW57)	58.9	83.9	15.6	1.7	12.0	54.5	14,762
FY2019 Prediction (FW58)	54.7	78.0	14.6	1.9	7.5	53.9	13,900
FY2020 Prediction (Alt 1/No Action)	46.0	65.2	11.7	1.8	5.2	46.5	10,209
FY2020 Prediction (Alt 2)	48.9	69.9	12.5	1.9	5.4	50.2	10,907
FY2020 Prediction - FY2018 Realized	*-0.5*	*-2.2*	*0.0*	*-0.1*	*0.0*	*-2.0*	*-45*

Table 3-Alternative 1/No Action stock-level catch and revenue predictions with 5% and 95% confidence intervals, nominal dollars (millions). Stocks are presented in order of FY2020 predicted ex-vessel value.

Stock	Sub-ACL (mt)	Predicted Catch (mt)	Predicted Utilization	FY20 Prediction	p(5%) Revenue	p(95% Revenue)	FY19 Predicted Revenue	FY18 Predicted Revenue	FY18 Realized Revenue
GB Haddock West	61,815	3,892	6.3%	6.7	5.8	7.7	7.1	7.7	7.3
GOM Haddock	6,700	2,767	41.3%	6.2	5.7	6.6	6.8	6.3	5.7
Plaice	1,337	1,105	82.6%	5.0	4.7	5.3	7.3	4.8	7.9
Redfish	11,060	4,477	40.5%	4.9	4.3	5.5	5.9	5.9	6.0
Pollock	37,152	2,742	7.4%	4.5	4.2	4.9	6.0	5.4	6.4
White Hake	2,714	2,085	76.8%	4.3	4.1	4.7	5.9	4.4	5.8
GB Cod West	1,832	731	39.9%	3.1	2.9	3.3	2.5	3.1	3.0
Witch Flounder	831	831	100.0%	2.9	2.8	2.9	2.9	2.8	2.7
GB Winter Flounder	742	390	52.6%	2.8	2.3	3.4	3.5	3.0	4.6
GOM Cod	378	300	79.2%	1.6	1.4	1.7	1.8	1.6	2.0
SNE Winter Flounder	444	248	55.8%	1.4	1.1	1.6	2.7	1.4	2.6
GB Haddock East	5,213	579	11.1%	1.0	0.7	1.4	0.7	1.0	1.3
GOM Winter Flounder	337	98	29.1%	0.6	0.5	0.6	0.9	0.5	1.0
CC/GOM Yellowtail Flounder	377	183	48.5%	0.4	0.4	0.4	0.8	0.4	1.3
GB Cod East	65	52	80.0%	0.2	0.2	0.3	0.3	0.5	0.4
GB Yellowtail Flounder	125	22	17.3%	0.1	0.0	0.1	0.1	0.1	0.2
SNE/MA Yellowtail Flounder	25	9	35.0%	0.0	0.0	0.0	0.1	0.0	0.1

Table 4- Alternative 1/No Action groundfish species revenue prediction by port, with 5% and 95% confidence intervals and average fish prices on groundfish trips, nominal dollars (millions).

State/Port	FY20 Prediction	p(5%) Revenue	p(95% Revenue)	Avg. Price	FY19 Prediction	FY18 Prediction
Massachusetts						
Gloucester	11.7	10.7	12.8	0.8	14.6	14.0
Boston	11.3	10.3	12.3	1.1	13.5	13.2
New Bedford	6.8	5.9	7.8	1.3	8.1	13.2
Chatham	0.4	0.3	0.4	1.65	0.6	0.4
Other MA ports	3.7	3.1	4.3	1.28	4.3	3.4
Maine						
Portland	7.4	6.4	8.6	0.8	9.2	8.3
Other ME ports	1.8	1.6	2.0	1.71	2.1	2.0
New Hampshire (all ports)	1.6	1.4	1.7	1.24	1.6	2.2
Rhode Island						
Point Judith	1.0	0.8	1.2	1.46	1.4	1.3
Other RI ports	0.3	0.2	0.5	1.54	0.3	0.4
Connecticut (all ports)	0.1	0.1	0.1	1.21	0.1	0.1
New Jersey (all ports)	0.0	0.0	0.1	1.81	0.0	0.0
New York (all ports)	0.0	0.0	0.0	0.17	0.1	0.5

Table 5- Alternative 1/No Action groundfish species revenue predictions by vessel size category, with 5% and 95% confidence intervals, nominal dollars (millions).

Vessel Length Category	FY20 Prediction	p(5%) Revenue	p(95% Revenue)
75'+	23.0	21.2	24.8
50'to<75'	16.2	15.1	17.4
30'to<50'	6.7	6.2	7.2
<30'	0.0	0.0	0.1

Results- Alternative 2, Revised ACLs for FY2020

Predicted groundfish revenue for FY2020 is $48.9M, representing a $5.8M decrease from the FY2019 prediction in FW58, and a $0.5M decrease from the FY2018 realized value of $49.4M (Table 2). Total gross revenues from groundfish trips for FY2020 is $69.9M. This represents an $8.1M decrease from the FY2019 prediction of $78.0M, and a $2.2 decrease from the FY2018 realized value of $72.1M. Operating profit predictions for FY2020 are also lower than predictions from the previous two years, as well as the realized FY2018 value. A major contributor to a lower predicted value for FY2020, as compared to the previous two FY predictions from the QCM, is a decline in ex-vessel prices. FY2018 (the input year for the FY2020 prediction) exhibited lower groundfish prices for nearly every groundfish stock as compared to FY2016 and FY2017. These price decreases are likely the product of a multitude of factors including, but not limited, to changes in landings, changes in market categories, and a shift in consumer demand.

At the stock-level (Table 6), a number of stocks which would have lower sector sub-ACLs under Alternative 2, relative to FY2019, are predicted to have high rates of utilization in FY2020. Among these stocks, in decreasing order of predicted ex-vessel value, are white hake, GB winter flounder, GB cod west, GOM cod, and SNE/MA yellowtail flounder. The four stocks with highest predicted ex-vessel value (GB haddock west, GOM haddock, redfish, and plaice) are not predicted to have high rates of utilization in FY2020. In general, predicted FY2020 ex-vessel value at the stock level are comparable to realized FY2018 values, with the caveat that FY2018 prices are incorporated into the FY2020 predictions.

At the port-level (Table 7), many of the major groundfish ports have lower predicted values for FY2020 than were predicted for FY2018 or FY2019. Gloucester is predicted to be the top groundfish port ($12.5M), with ~25% of ex-vessel value in the sector groundfish fishery. Boston is predicted to be the second highest grossing port ($11.6M), followed by New Bedford ($8.1M), and Portland ($7.4M).

By vessel length (Table 8), vessels >75'+ are predicted to generate ~50% of sector groundfish revenue in FY2020. Vessels in the 50 to <75' category are predicted to generate ~35% of sector groundfish revenue, and vessels in the 30' to <50' category are predicted to generate ~15%.

The results presented here are under the inclusion of all action items (Options A2, B2, C2, D2, and E2) under Alternative 2. The QCM was also run under Options B1 and E1. Under Option B1, there would be no reallocation of quota for GOM cod and GOM haddock between the recreational and commercial fisheries. Under Option B1, the sector sub-ACL for GOM cod would be 287mt (as opposed to 267mt under Option B2) and the sector sub-ACL for GOM haddock would be 7,621mt (as opposed to 6,939mt under Option B2). While GOM cod was consistently predicted to be a constraining stock for FY2020, groundfish revenue under Option B1 as predicted to be very similar to Option B2. Under Option E1, the sector groundfish fishery would have a 2mt sub-ACL for SNE/MA yellowtail flounder (as opposed to 12mt under Option E2). Sector groundfish revenue was predicted to be ~$1.0M lower from the $48.9M prediction in Table 2.

Table 6- Alternative 2 stock-level catch and revenue predictions with 5% and 95% confidence intervals, nominal dollars (millions). Shaded stocks would have decreased sector sub-ACLs under Alternative 2 relative to FY2019. Stocks are presented in order of FY2020 predicted ex-vessel value.

Stock	Sub-ACL (mt)	Predicted Catch (mt)	Predicted Utilization	FY20 Prediction	p(5%) Revenue	p(95% Revenue)	FY19 Predicted Revenue	FY18 Predicted Revenue	FY18 Realized Revenue
GB Haddock West	52,335	4,445	8.5%	7.6	6.5	8.8	7.1	7.3	7.7
GOM Haddock	6,939	2,735	39.4%	6.1	5.6	6.5	6.8	5.7	6.3
Redfish	11,173	4,855	43.5%	5.3	4.7	6.0	5.9	6.0	5.9
Plaice	2,574	1,104	42.9%	5.0	4.6	5.3	7.3	7.9	4.8
Pollock	13,803	2,935	21.3%	4.6	4.3	5.0	6.0	6.4	5.4
White Hake	2,004	1,843	92.0%	4.0	3.7	4.3	5.9	5.8	4.4
GB Winter Flounder	501	498	99.4%	3.6	3.0	3.7	3.5	4.6	3.0
GB Cod West	851	826	97.1%	3.5	3.1	3.7	2.5	3.1	3.0
Witch Flounder	1,275	872	68.4%	2.9	2.7	3.1	2.9	2.8	2.7
SNE Winter Flounder	462	311	67.3%	1.7	1.4	2.0	2.7	1.4	2.6
GOM Cod	267	267	99.9%	1.4	1.4	1.4	1.8	2.0	1.6
GB Haddock East	16,084	704	4.4%	1.2	0.8	1.7	0.7	1.3	1.0
GB Cod East	185	135	73.0%	0.6	0.4	0.9	0.3	0.4	0.5
GOM Winter Flounder	272	95	35.0%	0.5	0.5	0.6	0.9	1.0	0.5
CC/GOM Yellowtail Flounder	651	178	27.4%	0.4	0.4	0.4	0.8	1.3	0.4
GB Yellowtail Flounder	93	28	29.7%	0.1	0.1	0.2	0.1	0.2	0.1
SNE/MA Yellowtail Flounder	12	12	99.8%	0.0	0.0	0.0	0.1	0.1	0.0

Table 7- Alternative 2 groundfish species revenue prediction by port, with 5% and 95% confidence intervals and average fish prices on groundfish trips, nominal dollars

State/Port	FY20 Prediction	p(5%) Revenue	p(95% Revenue)	Avg. Price	FY19 Prediction	FY18 Prediction
Massachusetts						
Gloucester	12.5	11.4	13.7	0.8	14.6	14.0
Boston	11.6	10.3	12.8	1.1	13.5	13.2
New Bedford	8.1	7.0	9.2	1.3	8.1	13.2
Chatham	0.5	0.4	0.7	1.7	0.6	0.4
Other MA ports	3.7	3.1	4.3	1.29	4.3	3.4
Maine						
Portland	7.4	6.3	8.7	0.8	9.2	8.3
Other ME ports	1.8	1.6	2.0	1.76	2.1	2.0
Rhode Island						
Point Judith	1.2	1.0	1.5	1.43	1.4	1.3
Other RI ports	0.4	0.2	0.7	1.54	0.3	0.4
New Hampshire (all ports)	1.4	1.3	1.6	1.29	1.6	2.2
New Jersey (all ports)	0.3	0.1	0.5	2.08	0.0	0.0
Connecticut (all ports)	0.2	0.2	0.2	1.21	0.1	0.1
New York (all ports)	0.0	0.0	0.0	0.17	0.1	0.5

Table 8- Alternative 2 groundfish species revenue prediction by size class, with 5% and 95% confidence intervals, nominal dollars (millions)

Vessel Length Category	FY20 Prediction	p(5%) Revenue	p(95% Revenue)
75'+	25.4	23.4	27.3
50'to<75'	16.8	15.4	18.0
30'to<50'	6.7	6.3	7.2
<30'	0.0	0.0	0.1

Results- Alternative 2, Revised ACLs for FY2020 under 75%FMSY criteria in setting ABCs for GB haddock, GOM haddock, plaice, and pollock

Under the 75% FMSY criteria for these four groundfish stocks, aggregate revenue is unchanged from the Alternative 2 results presented during the Dec. Council meeting (Table 2: $48.9M groundfish revenue and $69.9M total revenue). None of the four stocks being re-evaluated is predicted to be constraining in FY2020 (Table 9), with plaice having the highest rate of utilization among the four. All groundfish stocks have predicted revenues within $0.1 million of Table 6 values. Predicted values by port (Table 7) and predicted values by vessel length category (Table 8) remain unchanged.

Table 9: QCM predicted catch and utilization rates for four groundfish stocks under constant and 75% FMSY control rules.

Stock	Proposed sector sub-ACLs (constant)	Predicted Catch	Utilization Rate	Sector sub-ACLs (75% FMSY)	Predicted Catch	Utilization Rate
GB Haddock	52,335	4,445	8.5%	103,849	4,430	4.3%
GOM Haddock	6,939	2,735	39.4%	11,918	2,735	22.9%
Plaice	2,574	1,104	42.9%	2,889	1,104	38.2%
Pollock	13,803	2,935	21.3%	23,830	2,943	12.4%