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Comité d'évaluation des ressources transfrontalières

Comptes rendus 2012/01

TRAC

Transboundary Resources Assessment Committee

Proceedings 2012/01

Proceedings of the Transboundary Resources Assessment Committee for Eastern Georges Bank Cod and Haddock, and Georges Bank Yellowtail Flounder

Report of Meeting held 26-29 June 2012

Stephen H. Clark Conference Room Woods Hole Laboratory Northeast Fisheries Science Center Woods Hole, Massachusetts, USA

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http://www.mar.dfo-mpo.gc.ca/science/TRAC/trac.html

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FOREWARD

The purpose of these proceedings is to archive the activities and discussions of the meeting, including research recommendations, uncertainties, and to provide a place to formally archive official minority opinions. As such, interpretations and opinions presented in this report may be factually incorrect or misleading, but are included to record as faithfully as possible what transpired at the meeting. No statements are to be taken as reflecting the consensus of the meeting unless they are clearly identified as such. Moreover, additional information and further review may result in a change of decision where tentative agreement had been reached.

AVANT-PROPOS

Le présent compte rendu fait état des activités et des discussions qui ont eu lieu à la réunion, notamment en ce qui concerne les recommandations de recherche et les incertitudes; il sert aussi à consigner en bonne et due forme les opinions minoritaires officielles. Les interprétations et opinions qui y sont présentées peuvent être incorrectes sur le plan des faits ou trompeuses, mais elles sont intégrées au document pour que celui-ci reflète le plus fidèlement possible ce qui s'est dit à la réunion. Aucune déclaration ne doit être considérée comme une expression du consensus des participants, sauf s'il est clairement indiqué qu'elle l'est effectivement. En outre, des renseignements supplémentaires et un plus ample examen peuvent avoir pour effet de modifier une décision qui avait fait l'objet d'un accord préliminaire.

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ABSTRACT

The Transboundary Resources Assessment Committee (TRAC) met during 26-29 June 2012 in Woods Hole, Massachusetts, USA, to review updated assessments (through 2011) of Eastern Georges Bank cod, Eastern Georges Bank haddock, and Georges Bank yellowtail flounder and to consider a number of related scientific issues. Results of these assessments will be used by the Transboundary Management Guidance Committee (TMGC) in developing management guidance for the 2013 fishing year for these transboundary resources.

RÉSUMÉ

Le Comité d'évaluation des ressources transfrontalières (CERT) s'est réuni du 26 au 29 juin 2012 à Woods Hole (Massachusetts), aux États-Unis, pour examiner les évaluations actualisées (jusqu'en 2011) concernant la morue de l'est du banc Georges, l'aiglefin de l'est du banc Georges et la limande à queue jaune du banc Georges, et pour étudier diverses questions scientifiques connexes. Les résultats de ces évaluations seront utilisés par le Comité l'orientation de la gestion des stocks transfrontaliers (COGST) pour formuler un avis sur l'orientation à donner à la gestion de ces ressources transfrontalières pour l'année de pêche 2013.

INTRODUCTION

The Transboundary Resources Assessment Committee (TRAC) co-chairs, L. O'Brien and T. Worcester, welcomed participants (Appendix 1) to the June 2012 TRAC assessment of Eastern Georges Bank cod (*Gadus morhua)*, Eastern Georges Bank haddock (*Melanogrammus aeglefinus)* and Georges Bank yellowtail flounder (*Limanda ferruginea)*. The TRAC was established in 1998 to undertake joint US / Canada assessments of resources in the Georges Bank transboundary region. Cod, haddock and yellowtail flounder were the first species to be assessed by the TRAC, followed by Atlantic herring (*Clupea harengus)*, spiny dogfish (*Squalus acanthias)* and Atlantic mackerel (*Scomber scombrus)*. The TRAC Terms of Reference (ToR) received prior approval from the Canada / US Steering Committee, the Northeast Regional Coordinating Council (NRCC), the Gulf of Maine Advisory Committee (GOMAC), and the Transboundary Management Guidance Committee (TMGC).

Participants were reminded that the TRAC review process is two tiered, with assessment updates typically undertaken between more intensive benchmark reviews. A new benchmark for Eastern Georges Bank cod was recently established in April 2009 and the benchmarks for Eastern Georges Bank haddock and yellowtail flounder were established in 1998 and 2005 respectively, with assessments conducted annually since then.

The ToR and agenda for the meeting are provided in Appendix 2 and Appendix 3, respectively. During the meeting, each working paper was presented by one of the authors and then followed by a plenary discussion of that paper. Rapporteurs documented these presentations and discussions for the Proceedings.

In preparation for this meeting, Canadian scientists met with fishermen in Yarmouth, NS. Comments from that meeting are provided in Appendix 4. The US scientists were unable to meet with fishermen prior to the TRAC meeting this year to discuss Eastern Georges Bank cod and haddock; however, an industry meeting was held to discuss Georges Bank yellowtail flounder. The audio files from the meeting, along with a number of presentations, are available at http://www.nero.noaa.gov/nero/hotnews/gbytf/.

Draft ToR for the 2013 TRAC are provided in Appendix 5.

EASTERN GEORGES BANK COD AND HADDOCK, AND GEORGES BANK YELLOWTAIL FLOUNDER ASSESSMENTS

TRAC Presentation: Allocation Shares

Working Paper: Update of allocation shares for Canada and the USA of the transboundary resources of Atlantic cod, haddock and yellowtail flounder on Georges Bank through fishing year 2013. TRAC Working Paper 2012/01.

Presenter: K. Clark

Presentation Highlights

Development of consistent management by Canada and the US for the transboundary resources of Atlantic cod, haddock and yellowtail flounder on Georges Bank led to a sharing allocation proposal. The proposal was founded on agreement about management units, principles upon which allocation shares would be determined, and computational formulae. For

the purposes of developing a sharing proposal, agreement was reached that the transboundary management unit for Atlantic cod and haddock would be limited to the eastern portion of Georges Bank (Fisheries and Oceans Canada (DFO) Statistical Unit Areas 5Zj and 5Zm; USA Statistical Areas 551, 552, 561,and 562). The management unit for yellowtail flounder would include Georges Bank east of the Great South Channel (DFO Statistical Unit Areas 5Zh, 5Zj, 5Zm and 5Zn; USA Statistical Areas 522, 525, 551, 552, 561 and 562). Two principles were incorporated in the computational formulae of the sharing proposal to account for both historical utilization, based on reported landings during 1967 through 1994, and temporal changes in resource distributions, determined from National Marine Fisheries Service (NMFS) and DFO survey results that are updated annually. From 2010 onward, utilization will account for 10% and distribution 90% of the sharing formula.

The resource distributions in 2011, integrated over the NMFS and DFO surveys and after the smoothing algorithm was applied, were, for Atlantic cod: 87% Canada, 13% USA, for haddock: 63% Canada, 37% US and for yellowtail flounder: 63% Canada, 37% US. The allocations for the 2013 fishing year, updated with these resource distributions, resulted in shares for Atlantic cod of 84% Canada and 16% US, shares for haddock of 62% Canada and 38% US, and shares for yellowtail flounder of 57% Canada and 43% US.

Discussion

Most of the discussion centered around results shown in Figure 6 of the document, concerning the proportion of Georges Bank (GB) yellowtail flounder on the US versus Canadian side of the boundary. For 2011, observed annual percentage suggests 86% of the GB yellowtail stock is in the US and 14 % in Canada. However, the LOESS smoothing algorithm results in only 37% in the US and 63% in Canada. This discrepancy is counterintuitive and the TRAC needs to provide an explanation of how this is occurring.

Issues related to this topic had also been discussed during a recent (May 23, 2012) GB Yellowtail Flounder Working Group meeting in New Bedford (presentation by Chris Legault). The smoothed trend depends on a combination of the data (survey indices from DFO, and NMFS Spring and Fall surveys), and the smoother span value, which determines how much of the time series is used to calculate each point (e.g. a span of 0.3 uses 30% of the data). The lower the smoother span value, the closer the smoothed line will follow the data because fewer points are being used to calculate the average. The end value in the series will always be the most uncertain. The smoothing span in the sharing agreement is 0.3 and combined with the 1979-2011 data (33-year moving window) as accepted by the TMGC (TMGC 2002, attachment 9). The result is a low value in the US proportion of GB yellowtail in 2011. Although this seems to contradict the observed data, the smoother is operating correctly.

Excluding the large tows did not have a significant impact on the sharing agreement, while downweighting the DFO survey in 2008 and 2009 changed the agreement a little. The group agreed that the survey data should not be adjusted for this TRAC.

As a way forward, there was consensus that the TRAC should be proactive and make a proposal to the TMGC to form a Working Group to re-evaluate the use of the LOESS smoother, or some alternative method, for determining annual allocations. The timeline for this would be in the next 2 years. After further discussion it was agreed that while the method used to determine percentage biomass may need to be re-investigated, the TRAC would wait to see if the TMGC wanted to undertake such an analysis.

TRAC Presentation: Eastern Georges Bank Haddock Assessment
Working Paper: Assessment of eastern Georges Bank haddock for 2012. TRAC Working Paper 2011/06.
Presenter: L . Van Eeckhaute
Rapporteur: J. Blaylock and T. Worcester

Presentation Highlights

The total catch of eastern Georges Bank (EGB) haddock in 2011 was 12,655 mt of the 22,000 mt combined Canada/USA quota. The 2011 Canadian catch decreased from 16,592 in 2010 to 11,247 mt while the USA catch in 2011 was 1,409 mt, a 36% decrease compared to the 2010 catch of 2,201 mt. Haddock discards from the Canadian scallop fishery and the USA groundfish fishery were estimated at 15 and 87 mt, respectively. Catches are declining as the outstanding 2003 year class moves through the fishery.

The population age structure displays a broad representation of age groups, reflecting improving recruitment and lower exploitation since 1995. The spatial distribution patterns observed during the most recent bottom trawl surveys were similar to the average patterns over the previous ten years. There has been a general decline in weights at age since the late 1990s. The 2003 year class appears to have reached its maximum growth potential. Fish condition exhibits a declining trend since about 2001 and declined to its lowest value in 2011 and, except for 2009, has been below the series average since 2003. Adult biomass indices from all surveys show large declines and are at very low levels.

Following are the results from the Virtual Population Analysis (VPA) that used the same formulation as the 2011 assessment. Adult population biomass (ages 3+) has increased from near an historical low of 10,400 mt in 1993 to 86,400 mt in 2003. It decreased to about 62,200 mt at the beginning of 2005 but subsequently tripled to a record-high 172,700 mt in 2009, higher than the 1931-1955 maximum of about 90,000 mt. In 2012, the adult biomass decreased to 70,700 mt. The tripling of the adult biomass after 2005 was due to the exceptional 2003 year class, currently estimated at 328 million age 1 fish. The current estimate for the 2010 year class is outstanding at 589 million age 1 fish, consistent with last year's estimate, which would make it the largest in the assessment time series. The preliminary estimate for the 2011 year class is 105 million age 1 fish. Except for the strong 2000 and 2011 year classes and the exceptional 2003 and 2010 year classes, recruitment has fluctuated between 2.1 and 29.4 million since 1990. Fishing mortality was 0.14 in 2011. The current assessment does not display a retrospective bias.

Two 2013 catch projections and risk analyses were presented using the results from the VPA. One projection used a partial recruitment on the 9+ group equal to 1, consistent with the F_{ref} and the value used the previous year but inconsistent with the model results. The additional projection used a partial recruitment of 0.3 on the 9+ group, a value that was consistent with the model results. Since the 2003 year class at age 10 would be a substantial component of the 2013 catch, the choice of partial recruitment on the 9+ group, would be very influential. These projections resulted in catches of 17,500 mt (PR9+=1) and 10,200 mt (PR9+=0.3). Biomass in 2014 is expected to increase substantially for any of the catch scenarios considered due to the influence of the exceptional 2010 year class.

A 'variant' of the benchmark assessment was presented which included age 9 and a 10+ group in the catch at age to allow calibration of the VPA with the age 9 DFO and NMFS spring survey

indices. It produced higher Fs and lower biomass than the benchmark model, but the residual pattern for age 9 was problematic. Results, however, do indicate that adult biomass may be lower than the benchmark model estimate.

Discussion

The US did not catch its quota of haddock from eastern Georges Bank in 2011 because of restricted access to two large closed areas. US discards for age group 1 in the second half year of 2011 were very high (227,121 mt), possibly due to high catches of skates that plugged up the nets. This did not occur in Canadian waters where fewer age group 1 fish were caught even though Canadians were using a smaller mesh size. US discards from the midwater trawl are estimated to be minimal.

Survey data for DFO and NMFS spring surveys were grouped for ages 3-8 (instead of using a 3+ group) because survey indices for calibration are only available up to age 8. In the past, the use of 3+ as the oldest group would have been acceptable because very few fish older than 8 were observed. However, this is not the case anymore as a significant number of fish in the 9+ age group are currently being caught.

For projections, the 2003-2011 average partial recruitment (PR, weighted by population numbers) was used in an effort to include the partial recruitment from the large 2003 year class for non-2010 year classes. This is a deviation from the protocol, but the TRAC felt that partial recruitment for the 2010 year class was most important to estimate correctly in the projections.

It was observed that not including the 2003 year class values resulted in PRs that were significantly higher than what was observed for the 2003 year class. Some of the PRs were suspected to have high error as they came from very small year classes. As an example, the average PR for age 3 for 2007 to 2011 was much higher than the PR for the 2003 year class at the same age.

The model formulation resulted in a PR of 0.3 for the 9+ age group. It is not clear what process would explain this dome-shaped PR as haddock are not strong swimmers and cannot out swim the trawl. An alternative (variant) model was run to explore this question. This variant model resulted in higher Fs, lower biomass and domed PR for ages 9 and the 10+ group.

It was suggested that different runs could be done to help clarify the dome PR versus PR=1 for the plus group, such as:

1) Backwards estimation
2) Use of an average of ages 7 and 8 for age 9

Later in the meeting, an approach using the F_{ratio} method to calculate F on the 9+ group using 2 time blocks (2003-2011) and (1969-2002) was demonstrated. The two time blocks were used because the benchmark model assessment indicated a change in PR after 2002. However, this formulation didn't work as expected. Other runs were attempted, but none were considered helpful.

There was some further discussion about the need for consistency between the assessment and the projections, as well as what was used in the development of the reference points. It was agreed that the benchmark formulation would continue to be used but a consistent PR (0.3 for the 9+ group) would be used for the projections. This is different from what was agreed to last year. It was also agreed that additional text should be included in the Transboundary Status

Report (TSR) to highlight this change. It was acknowledged that F_{ref} was based on a PR of 1, but as this was a negotiated value (not a model-based value), it could not be changed at this time.

Some industry participants were not happy with this approach, as they did not feel that the domed PR had been adequately explained.

The need for a new benchmark was discussed. It was suggested that a benchmark before 2014 would not be helpful.

TRAC Presentation: Preliminary Analyses of Eastern Georges Bank Cod Natural Mortality
Presenter: Y. Wang
Rapporteur: K. Curti and J. Blaylock

Presentation Highlights

Uncertainties in natural mortality for ages 6+ and consequent model uncertainty was raised at the 2009 benchmark assessment meeting, and it was stated that the strong 2003 year class would be able to shed light on M at older ages when it passed through the fishery and surveys. This analysis provides some preliminary results on natural mortality of EGB cod.

Calculated total mortality (Z) from the 2003 year class is high, 2.25 (from DFO survey), 1.36 (from NMFS spring survey) and 1.46 (from fishery catch). Calculated Z for ages 6+ from cohort tracking for both survey and catch data indicate that Zs have remained high and the covariance analysis also showed the same temporal trend. Zs appear higher for ages 6+ compared to ages 4-5. However, relative Fs, where constant survey catchability is assumed over the time series, indicate a rapid decline beginning in the mid 1990s. The discrepancy between relative Fs and survey Zs is reflected in the diagnostics as a strong retrospective bias.

A random walk analysis, which assumes different M for ages 1-5 and ages 6+, shows a clear increase of M for ages 6+ since the mid 1990s. Another VPA analysis, which is very similar to the "split M 0.5" model except that M at ages 6+ was estimated since the mid 1990s, results in high coefficients of variation (CVs) associated with high M estimation and low CVs with lower values of M estimation.

Length at age data from DFO surveys has shown a decrease in size at age. The growth parameter L_{inf} from the fitted von Bertalanffy function is decreasing and fish condition (Fulton's K = weight/length^3) is decreasing since the mid 1990s. Condition was calculated using DFO and NMFS spring data separately, and indicated a significant decline in both surveys. Maturity analysis showed decreased length at maturity for both males and females despite no obvious changes in age at maturity.

Stratified bottom temperature data from the 3 surveys are variable and no temporal trend is evident.

Discussion

A question was asked about whether the Fulton's K plots should be centered at 1 so that the deviations from the norm are plotted. It was clarified that the intent was just to display changes

in condition over time (i.e. the trend over time is being highlighted rather than the annual variation from the norm).

It was asked what the mechanism for a dramatic change in natural mortality on the older fishes might be, particularly as related to a change in condition, which might be expected to impact all ages. A mechanism has not been proposed, but this could be explored further at a benchmark review.

Temperature trends from the survey do not seem to match the trends published in the US Ecosystem Applications report. Consequently, the strata/seasons used to calculate average temperature should be investigated. Bottom temperature from only the NMFS survey may not be the best approach for determining temporal trends.

Despite reductions in fishing pressure since 1994, there does not appear to be a reduction in F in the results from the VPA. Is the change in fishing mortality shown here due to the split in the survey time series? Change in F is partly due to the change in survey catchabilities resulting from splitting the survey time series.

The surveys do not show an expansion of the age-structure, which is what would be expected if the relative Fs reflect the true fishing mortality. The M 0.2 run shows a reduction in F, but not as great as in the M 0.5 run.

It was asked whether it might be possible for the TRAC to indicate in the TSR that one model is more likely than the other. The thoughts of the TRAC co-chairs were that TRAC could make efforts to be very explicit in the advice provided based on the results of the assessment (compared to last year) without picking one model over the other. The TRAC recommended a benchmark to review alternative models.

TRAC Presentation: Eastern Georges Bank Cod Assessment

Working Paper:	Assessment of eastern Georges Bank cod for 2012. TRAC Working Paper 2012/04.
Presenter:	Y. Wang
Rapporteur:	J. Blaylock and T. Worcester

Presentation Highlights

The combined 2011 Canada/USA catches were 1,037 mt with a quota of 1,050 mt, including 221 mt of discards. The 2006 year class was dominant in the fishery. The 2003 year class was estimated as the strongest year class since 2000 from previous years' assessments, but made little contribution to the 2011 fishery catch, very little catch to the 2012 DFO survey, and no catch to the 2012 NMFS spring survey. Initial indications for the 2010 year class were promising from the 2010 and 2011 NMFS fall surveys. All 3 survey catches were still among the lowest in the time series and weights at age as well as fish condition from both survey and fishery continued to be at lower levels than the mid 1990s. The contribution to the catch of fish older than age 7 has been small in recent years.

The "split M 0.2" and "split M 0.5" benchmark model formulations were used to provide status determination. Age 3+ biomass was estimated at 2,845 mt from the "split M 0.2" model and 4,192 mt from the "split M 0.5" model in 2012; it is less than 10% of biomass in 1978 and the second lowest in the time series according to both models. The 2011 fishing mortality at ages 4-

9 was 0.49 and 0.28 from the "split M 0.2" and the "split M 0.5" model, respectively, the lowest values in the times series. F has been consistently above F_{ref} = 0.18. Since 2000, the 2003 year class is the highest recruitment estimated by either model (excluding 2010). The initial estimates of the 2010 year class are 4.0 million from the "split M 0.2" model and 4.8 million from the "split M 0.5" model. However, the uncertainties on the 2010 year class were high. Both the 2003 and 2010 year classes were less than half of the average (about 10 million) during 1978-1990, when the productivity was considered to be higher. Recruitment for the other recent year classes was low. Resource productivity is currently very poor due to low recent recruitment and low weights-at-age.

The retrospective shows a tendency to overestimate 3+ and underestimate F in recent years, and the pattern appeared the strongest in 2012. Considering both models, under the rho adjusted split M=0.2 assumption, a 50% probability of not exceeding F_{ref} implies catches less than 400 mt and of less than 775 mt under the rho adjusted split M=0.5 assumption. Achieving a 20% increase in spawning stock biomass (SSB) between 2013 and 2014 implies catches less than 575 mt under the rho adjusted split M=0.2 scenario and of less than 400 mt under the rho adjusted split M=0.5 scenario.

Discussion

Assessment Data Inputs

Commercial fishery inputs: There were some questions about the difference in the length frequencies between some of the Canadian observer and portside samples. The differences had to do with vessels that were directing for cod versus vessels that were directing for haddock (especially for June and November).

It was also asked whether there was more uncertainty in the Canadian longline or otter trawl landings. The DFO methodology for estimating longline discards was questioned when there was lower observer coverage for this fleet. However, whether targeted trips were included or excluded did not appear to impact the results, as there were no discards using either approach. It was noted that the Canadian industry is not allowed to discard. The DFO methodology used to estimate cod discards relies on differences between the haddock to cod ratio for observed and unobserved trips.

Survey data inputs: It was noted that there have been other year classes that disappeared from the survey once they reached 8 or 9 years old; some were year classes from the beginning of the time series, and some were recent. However, it was mentioned that the comparison should be done among year classes of similar magnitude.

It was suggested that it would be helpful to include a table that presents the mean length-at-age for each year in next year's research document.

Assessment Model

It was clarified that F_{ref} has not been recalculated for the two current assessment models. It was suggested that a new F_{ref} might be required since the current F_{ref} is based on different assumptions than are being used in the assessment. This will be examined at the next benchmark meeting.

It was noted that the "split M=0.5" model may be more consistent with the effort trend, but it is not correct to say that it is more consistent with the catch trend.

The estimation of the 2010 year class appears to be driven by the NMFS fall survey, since the other surveys (NMFS spring and DFO) do not indicate that the cohort is very strong. It was noted that age 0 tuning indices are not used in this VPA formulation. A sensitivity run was recommended to check the uncertainties of the 2010 year class estimation. The VPA runs which have either "no 2011 fall survey" or "no 2012 DFO survey", show that the median value of the 2010 year class from both runs lie in the 95% confidence interval when all the 3 surveys are used, but the wide confidence ranges for both models confirm the uncertainties with the 2010 year class estimation.

There does not appear to be much difference in the catchability coefficients (q) between the NMFS 1978-1981 versus 1982-1993 spring survey (Figure 27 in the document - q plots). The splitting is related to the fact that there is no conversion factor available for cod when two different trawl nets, Yankee #41 for 1978-1981 and Yankee #36 for other years, were used.

It was noted that survey catchability could be greater than 1 if there is herding or if the survey numbers derived from good cod habitat are expanded to areas/habitats that are not cod habitat. However, it is not clear that there are other cod stocks where q is 2-4, or greater. In the Northern Gulf of St. Lawrence assessment, they went back to using number/tow indices rather than swept area estimates, although the reason for this was not clear.

There were some questions about gear monitoring. Gear monitoring has been done for a long time, but there is more detailed monitoring in more recent years. DFO surveys are not adjusted based on gear monitoring.

It was asked whether there is possibly more of a selectivity dome in the fishery than this model is permitting, and whether it is possible that age 9 fish could have a lower selectivity. It was noted that past discussions at the 2009 benchmark meeting concluded that it wasn't dome shaped.

Projections and Risk Analysis

The mean fishery weight at age 9 in 2013 (Table 26) does not seem biologically possible, i.e. it is not possible to go from 6.32 at age 8 to 9.68 at age 9. The biomasses at age 9 and 10 become very important in terms of spawning stock. Outliers could be due to poor sampling, and it is important to be able to make appropriate inferences from limited sampling data. It was suggested that growth curves could be used to estimate weights for older fish that are not well sampled. Mid-year weight-at-age and weight samples could be calculated based on when in the year they were collected, but low sampling will likely be an issue. It may be possible to look at years that were well sampled (e.g. 1989, 1993, 2000). It was suggested that there may be more catch in November compared to July in the past. It was suggested that it might be possible to address this issue using a Bayesian approach – looking at growth increments instead of a growth curve, but this issue will need to be prioritized with the other issues. It was not clear how uncertain each average weight-at-age value was or whether confidence intervals might be informative.

The number of fish at age 9 in 2013 is small; however, it is important to get the weight at age correct even though it will not impact the estimate of SSB.

The 2010 year class will highly influence catch advice, as it accounts for approximately half of the catch in all four projections and accounts for a large proportion of the biomass increase between 2013 and 2014. Efforts should be focused on the uncertainty in this year class. All results are conditional on this year class, which is an uncertain estimate. It was recommended that the TSR include text related to the uncertainty in the strength of the 2010 year class.

T. Nies presented a file showing uncertainty on recruits. This showed that the recruitment estimates that are driving the projections are highly uncertain. There was some sentiment that the assessments have been under-representing the uncertainty in stock growth.

A suggestion was made to run a projection using the lower 10^{th} percentile values of the 2010 year class to assess uncertainty in projections. The results show how much uncertainty is associated with the 2010 year class and indicate that the fall survey is not the only source of uncertainty. This supports the previously discussed point that a warning should accompany the projected stock sizes, which are highly dependent on this year class. The group agreed that, even at the lower 10^{th} percentile value, the 2010 year class is still large compared to others for this stock.

It was asked whether there is a way to do a historic retrospective analysis to get an idea of how often the year classes disappear. It would be nice to know the initial estimate of the 2003 year class (see Figure 30 in document), and what our current estimate is as an indication of how well the assessment has performed with year class estimation in the past. This was not done at the meeting because the initial value of recruitment was fixed and not estimated in the VPA.

Irrespective of the model, recruitment has been poor, though there may be some glimmer of hope in the 2010 year class. For the next year, management should be conservative because the stock is in poor condition. However, the two models do give very different options, and managers need to pick a number.

When there are two candidate models (say models A and B), a sensitivity/risk analysis should be conducted to evaluate what happens if model A is picked and model B is actually correct, and vice versa. The risk of exceeding F_{ref} and probability of seeing an increase in stock size can both be evaluated, i.e. some assessment of the risk associated with the different options should be included. It should be clear which options are robust.

It was noted that F has consistently been above F_{ref}. If the 2010 results had been retro-adjusted, the catch advice for 2011 might have been better, and F might have been closer to F_{ref}. It was not clear how much lower the catch would have needed to be to not exceed F_{ref}.

There was discussion about the reason for applying the Mohn's rho correction. While the correction will over-correct sometimes, no correction will always under-correct. Intuitively, if catch is lowered (i.e. with Mohn's rho correction) then F would get closer to F_{ref}. A sensitivity analysis showed that if the 2011 catch advice had been based on the rho adjusted projection from the 2010 assessment, F in 2011 would be have been much lower. It was a coincidence that F from the "split M 0.5 model" was exactly F_{ref} after the correction. The adjustment also results in increased biomass, i.e., we are more likely to get growth if we use a rho-adjusted projection for catch advice.

There was some concern for scenarios where biomass is decreasing (because of the loss of big year classes) even when F=0. EGB cod is not at a stable level so catch advice should be risk adverse. The harvest strategy of the TMGC is to aim for F_{ref} and rebuild biomass if necessary.

However, what should be done in cases where biomass can't be increased should also be addressed. Under F=0 scenario, the SSB in 2014 is expected to increase 30-40% from 2013 for the 2 models.

A comment was made about how the discussion was 'flipping between two objectives'. It would be better to present results in terms of TAC instead of F_{ref} or catch; a summary table is needed in the TSR.

The group agreed that the TRAC needs to advise that this stock needs stock growth.

Group consensus is to recommend a cod benchmark assessment for next year. Natural mortality should be evaluated in the benchmark.

TRAC Presentation: **Yellowtail Flounder Age Data Collected on NEFSC Scallop Survey**
Working Paper: Examination of yellowtail flounder ages in NEFSC scallop survey: can age-length keys be borrowed from other surveys? TRAC Working Paper 2012/02.
Presenter: C. Legault
Rapporteur: J. Blaylock

Presentation Highlights

The NEFSC scallop survey has provided a tuning index for age 1 yellowtail flounder in the TRAC assessment for many years. The age 1 yellowtail flounder are identified by length in the scallop survey. Recently, attempts have been made to include all ages from the survey by using age-length keys from the NEFSC spring and fall surveys in the same year as a given scallop survey. This approach has been questioned due to growth of yellowtail during the year. In 2011, scales were collected during the NEFSC scallop survey. This provided an opportunity to compare the resulting indices at age from age-length keys generated directly from the NEFSC scallop survey with age-length keys generated from the NEFSC spring and fall surveys. Results indicate that using only the NEFSC spring survey age-length key provides the best match to direct application of the age-length key derived from the scallop survey. Application of the NEFFSC spring survey age-length key is recommended to create tuning indices for all ages of Georges Bank yellowtail flounder from the NEFSC scallop survey.

Discussion

The scallop survey occurs in June and uses a dredge. In this assessment, only age 1 yellowtail flounder were identified from lengths in the scallop survey; however, there is a suggestion to use the scallop survey for all ages for the benchmark. Regarding growth compared to the other NEFSC surveys, the scallop survey matches up with the spring survey; significant growth occurs between the summer and fall.

TRAC Presentation: Stratification for Estimation of Yellowtail Flounder Discards

Working Paper: An alternative stratification to estimate yellowtail flounder discards in the US scallop fishery. TRAC Working Paper 2012/05.

Presenter: C. Legault

Rapporteur: J. Blaylock

Presentation Highlights

Previous TRAC assessments have estimated yellowtail flounder discards in the US sea scallop fishery by half year without using any spatial stratification. However, observer coverage and bycatch rates can differ substantially between general "open" areas and rotationally fished areas known as "access areas". The non-spatial TRAC estimates of yellowtail discards were compared to those obtained by spatially stratifying between open and access areas, but without temporal stratification. The estimates from the two approaches were similar with the exception of two years with relatively low sampling coverage (2000 and 2001). Differences in assessment model results between the two discard estimation methods were negligible. The non-spatially stratified method used by the TRAC is, therefore, adequate for assessment purposes, while the non-temporally but spatially stratified approach may be useful for quota monitoring. Fine spatio-temporal resolution of discard estimation requires high levels of observer coverage.

Discussion

Two methods were used to calculate yellowtail flounder discards: (1) the standardized bycatch reporting methodology (SBRM) approach currently used by TRAC, with temporal stratification by half year without spatial stratification, and (2) a spatially-stratified approach (by Closed Area I, Closed Area II, and Open areas) without intra-annual temporal stratification. Both methods gave similar results except for 2000 and 2001 because of low observer coverage in those years.

It should be noted that the SBRM does not preclude spatial stratification. However, database limitations and low observer coverage at the finer spatial scale do not allow for adequate discard estimation at the open/closed area stratification level at this time.

There was some discussion about whether the use of different methods in the yellowtail assessment (SBRM) versus that used by the Scallop Plan Development Team PDT for quota monitoring (spatially-stratified) is an issue. The group agreed that it is not the role of the TRAC to instruct the Scallop PDT how to monitor the catch.

There was consensus that discard estimation in the current assessment should proceed as in the previous assessment. Based on adequate observer coverage in the last decade, there is no apparent evidence of bias in discard estimates used in the GB yellowtail assessment. The SBRM method estimates are appropriate at this time; however, any differences between these and estimates from the spatially-stratified approach should be monitored in the future.

TRAC Presentation: Maturity and Fecundity of Yellowtail Flounder from Study Fleet
Presenter: D. McElroy
Rapporteur: J. Blaylock

Presentation Highlights

Maturation

Yellowtail flounder female gonad samples were collected during routine marine resource surveys conducted by the NEFSC, covering all three US stock areas. Collections occurred during spring 2009-2011 aboard the *F/R/V Henry B. Bigelow*. Comparative maturity assignments were made between 'at sea' assignments and those made using gonad histology criteria. Histological protocols and criteria were modified from those established by McBride et al. (2012) for winter flounder. Maturity ogives were fitted to the logistic model using binary coding (0 = immature, 1 = mature) and SAS programming (i.e., PROC LOGISTIC). These parameters were also estimated and plotted with 95% confidence limits using a generalized linear model (GLM) of binomial data in R (R version 2.9.2 (2009-08-24) Copyright © 2009 The R Foundation for Statistical Computing).

Most of the at-sea maturity determinations agreed with the gonad histology maturity determinations (93%). The more problematic mismatches were three immature females that were categorized at sea as resting, a mature class. Mis-identification of such fish will cause more uncertainty in maturity schedule estimates, but this does not appear to be a significant problem in terms of effect on parameter estimates (see below). Other mis-classifications were uncommon, and they are likely the result of the small amount of tissue prepared for histology and examined for specific oocyte stages. Such discrepancies between mature, participatory classes are considered minor, as they do not affect estimation of spawning stock biomass.

Preliminary maturity schedules estimated from the available gonad histology data were similar to that measured at sea. Median length at female maturity (L50) occurred within a narrow length range, 27.7-29.6 cm TL, for all three stocks. Median age at female maturity (A50) differed between stocks, being youngest in the southern New England/Mid-Atlantic (2.0 yr, n=329, based on at sea measurements; 2.0 yr, n=49, based on histology), medium on Georges Bank (2.2 yr, n=569; 2.4, n=49), and oldest in Cape Cod Bay/Gulf of Maine (2.7 yr, n=541; 2.6 yr, n=41). In sum, comparisons between the methods (histology vs. macroscopic) do not suggest problems in estimating maturity schedules for yellowtail flounder in the northeast US in recent years (2009-2011).

The few errors evident in the data point to continued training by way of regular maturity workshops using fresh fish. These occur regularly after the first three legs of the spring and the fall resource surveys. Although pair-wise comparisons do not suggest a problem in the at-sea maturity assignments, it is still concerning that age 1 fish are collected so infrequently in the fishery-independent surveys. This limits the ability to define the maturity schedule and monitor if it is changing over time.

Length-mass Regressions

Seasonal patterns in length-mass regressions were compared for yellowtail flounder with reference to spawning patterns. Results were also compared to similar earlier work by Lux (1969). Yellowtail flounder were obtained monthly from December 2009 through April 2011, with additional fish collected March through May 2012. Fish were collected primarily by commercial

fishing vessels participating in the Northeast Fishery Science Center, Northeast Cooperative Research Program's (NEFSC-NCRP) Study Fleet. Supplemental samples were acquired from NEFSC-NCRP field research studies and the Massachusetts Division of Marine Fisheries and NEFSC trawl surveys. The majority of fish (n = 1847) were processed in the laboratory with 1 mm and 0.1 g precision, and a small number (n=40) were processed at sea with 1 mm and 1 g precision. Parameters were determined using least-squares linear regressions of log-transformed length and mass data, and log base 10 was used to allow for comparison to parameters reported by Lux (1969).

Quarterly regression parameters for the GB stock were generally lower than the other stocks, and differed among stocks in which quarter had the highest and lowest estimates of mass at length. Mass was highest just prior to or during the peak spawning period and was lowest in the post-spawning recovery period. Differences among the stocks reflected differences in the timing of spawning, with the earliest spawning in Southern New England (SNE) and the latest spawning in the Gulf of Maine (GOM). Differences in mass at length among seasons increased with fish length, due to both the increasing proportion of mature fish and increasing proportion of females at larger sizes.

Comparison of regressions from the present study with those utilized in the assessment currently (biannual regressions, based on Lux 1969) indicated lower mass at length in the present data. This could reflect temporal changes in the condition of fish and reproductive investment. It may also result from differences in sampling, as Lux (1969) included a high proportion of SNE yellowtail in the samples.

Quarterly sampling of length-mass data would better represent the seasonal dynamics in these parameters, which are strongly influenced by the timing of spawning when gonad mass may be in excess of 30% of the body weight. Parameter estimates from surveys which occur at fixed times each year could be biased if interannual shifts in the timing of spawning occur. Quarterly sampling of the commercial fishery would provide more accurate tracking of interannual changes in these dynamic parameters, and also account for the changes in these measures due to the timing of spawning, relative condition of the fish, and reproductive investment. More accurate length-mass parameters would help to reduce over- or under-estimation of fish mass, which has implications for biomass, numbers, and mass at age calculations utilizing these parameters.

Fecundity

Preliminary yellowtail fecundity estimates are provided for females sampled from all three US stock areas and across two years. Yellowtail flounder were obtained monthly from December 2009 through April 2011, which covered two spawning seasons (2010 and 2011). Fish were collected primarily by commercial fishing vessels participating in the NEFSC-NCRP Study Fleet. Supplemental samples were acquired from NEFSC-NCRP field research studies and the Massachusetts Division of Marine Fisheries trawl survey. Determinate fecundity methods and sampling criteria were used including the autodiametric method with protocols modified from those developed for winter flounder (McElroy et al. 2012). Potential annual fecundity (PAF) was analyzed relative to both fish length and age. Stock and year were added to regression models as main effects and interactions, and compared to a base model using AIC model analysis. The final accepted model was the one with lowest AICc value, and analyses were conducted with "R" (v. 2.14.1, R Foundation for Statistical Computing) and the AICcmodavg package.

PAF increased with fish size and age, and the relationships varied across the stocks and years. The final model included stock and year as interaction terms ($\Delta AICc \geq 12.8$). Females from SNE typically had the highest PAF at size and those from GOM the lowest; although individual variation was high. Fish from the GB stock exhibited the greatest variation between years, with higher fecundity at size in 2010 than 2011. In 2010 estimates of PAF at size for a fish from GB were more similar to the other stocks, but in 2011 fish from GB had fecundity below both other stocks. Patterns of which year had higher fecundity were not synchronized among the stocks. This and previous studies (one from SNE and two from the Grand Bank) of yellowtail flounder fecundity indicate lower fecundity at higher latitudes. Continued sampling of more years is required to verify these patterns and determine the stock- and year-specific environmental and physiological factors influencing fecundity.

Gunderson Method of Estimating M

Gunderson and Dygert (1998) and Gunderson (1980; 1997) reported a relation between gonadosomatic index (GSI) of mature females just prior to spawning and estimates of M measured for as many as 28 stocks of fish. In particular, Gunderson (1997) proposed that the equation, $M = 1.79 \cdot GSI$, could be used to predict M. This approach was applied to yellowtail flounder as an alternative, independent estimate of M.

Yellowtail flounder were obtained monthly from December 2009 through April 2011. Fish were collected primarily by commercial fishing vessels participating in the NEFSC-NCRP Study Fleet. Supplemental samples were acquired from NEFSC-NCRP field research studies. GSI was calculated as: GSI= GM / (BM-GM), where GM is gonad mass, BM is total body mass. Gunderson (1997) also accounted for the mass of stomach contents when data were available. Therefore, an alternate GSI estimate was calculated adjusting the BM by a mean (stock-specific) stomach content proportion. The Gunderson (1997) method limited analysis to fish with fully developed gonads, prior to hydration and commencement of spawning. Consequently, we used gonad histology to select fish close to but prior to any spawning, those with oocytes in the germinal vesicle migration (GM) stage, as recommended by Gunderson (1997). This stage occurs after the more lengthy process of vitellogenesis and prior to the highly dynamic final oocyte maturation (includes hydration); therefore, the GM stage is the most appropriate for evaluating maximal pre-spawning reproductive investment.

Mean GSI in the GM stage was similar for females from the three stocks (GOM=0.16, GB=0.18, SNE=0.18). The range in GSI estimates was comparable among stocks, and 95% CI's were widest for GB fish (0.13 – 0.23). Stomach contents had little effect on estimates of GSI at peak development for this species (GSI differed < 0.01). These GSI values resulted in a mean estimate of M for GB fish of 0.32 (0.23-0.42, 95% CI), which was similar to mean estimates for GOM, 0.28 (0.23-0.33), and SNE, 0.32 (0.26-0.38). Sample sizes overall were low (n=34), given the strict histological criteria used to select fish for this estimate. The GSI estimates for GM stage fish are intermediate to (and well bounded by) GSI estimates at earlier and later stages of development with larger sample sizes, providing support for these as realistic estimates. However, these estimates do not take into account assumptions and variability made in the determination of the original M-GSI relationship. These estimates of M should be further compared and validated with other independent approaches.

Discussion

Length-weight Analysis

Biannual length-weight regression results indicate that study-fleet fish larger than about 33 cm weigh less than fish of the same length studied by Lux (1969), and that fish of the same length weigh less in the second half of the year than the first. The inter-annual difference in weight is most likely due to changes in spawning condition (pre- versus post-spawn). Although there are limited samples at larger sizes, it is expected that the differences would still be real if confidence intervals were added to the regression plot.

A majority of Lux's 1969 samples came from SNE, with the remainder from GB (17,498 samples total, only 200+ from GB). All of Lux's samples were from otter trawl gear. In addition, Lux analyzed the data for males, females, and combined; it is possible that the sex ratio of the samples was different between Lux and NEFSC (probably more females in the NEFSC study). Differences in the length-mass regressions among stock areas, quarters, sexes, and studies can be attributed to a large extent to reproductive dynamics as the gonad can represent from <1% to >30% of the body mass.

Members of the industry indicated that processors in New Bedford area are seeing low yield of yellowtail filets recently, particularly from Georges Bank yellowtail. While a large filet would usually weight about 6 oz., they are now only 4-5 oz. It is unclear why this is occurring, but the fish are said to look 'really sick', and fungus on the liver has been observed. There is a sentiment that competition with skates is causing this poor condition in yellowtail flounder.

Fecundity

Fecundity of 37 cm fish was calculated from regression. There are small sample sizes at small lengths. Increased fecundity scales with body size (almost isometric).

Reproductive Effort as Predictor of Natural Mortality: the Gunderson Method

Use of the Gunderson method results in an estimate of M = 0.32 (0.23-0.42) for GB yellowtail. However, this is based on a small sample size (n=6) and a lot depends on the Gunderson relationship. There was consensus that there are many caveats concerning this estimate of M. While it does provides a 'ballpark' estimate of M, is also has weak predictive power.

TRAC Presentation:	**Georges Bank Yellowtail Flounder Assessment**
Working Paper:	Stock assessment of Georges Bank yellowtail flounder for 2012. TRAC Working Paper 2010/03.
Presenter:	C. Legault
Rapporteur:	T. Worcester

Presentation Highlights

The combined Canada/US yellowtail flounder (*Limanda ferruginea*) catch remained essentially the same at 1,160 mt in 2010 and 1,169 mt in 2011. Recruitment continues to be poor, with the most recent cohort estimated to be the lowest in the time series at 3.0 million age 1 fish, and the most recent ten years all below the average of the assessment time series. Although spawning stock biomass and adult (age 3+) beginning year biomass have both increased for the past six

years, to 4,600 mt and 4,500 mt in 2011, respectively, both are below the average of the assessment time series. The fishing mortality rate for fully recruited ages 4+ was estimated to be 0.31 in 2011, and has been above the F_{ref} of 0.25 for the entire time series. The Split Series formulation exhibited a strong retrospective pattern this year. If this pattern continues, the 2011 fishing mortality rate is expected to increase from 0.31 to 0.62 while the 2011 spawning stock biomass is expected to decrease from 4,600 mt to 1,700 mt in future assessments.

The Split Series formulation was approved at the last benchmark assessment and is used to estimate current stock size and fishing mortality. In recent years catches based on this model have not reduced fishing mortality below F_{ref} and have not had the expected effect on age 3+ biomass or SSB. If the 2013 catch quota is set based on this model, this pattern of failing to achieve management objectives seems likely to continue given the model's retrospective pattern. TRAC recommends not basing the 2013 catch quota on these unadjusted model projection results.

In light of the increased magnitude of the retrospective bias in the Split Series VPA, five sensitivity analyses were considered to address the retrospective bias to characterize the uncertainty and risk in catch advice. Alternative projections were conducted to examine the possible impact of this retrospective pattern on catch advice by a number of approaches. Both the Split Series and Single Series models had their population abundance at the start of 2012 adjusted based on the Mohn's rho for spawning stock biomass. These projections had much lower catch advice in 2013 compared to the unadjusted projections. Alternative "fixes" to the retrospective pattern were employed by increasing recent catch, natural mortality, or both. These models and projections resulted in similar catch advice to the retrospective adjusted Split Series and Single Series results. The catch advice is robust to how these inconsistencies in the data are treated and gives support to the management advice for this stock

To achieve both high probability that F will be less than F_{ref} and that adult biomass will increase, a 2013 quota of approximately 200 mt would be required. A quota of 400-500 mt implies that either F will be below F_{ref} for only one of the five sensitivity analyses or the adult biomass will increase from 2013 to 2014 for the other four. Thus, a 2013 quota of 400-500 mt has both positive and negative aspects. Due to the assumption used for the 2011 year class in the projections (geometric mean of recent ten years), the increase in adult biomass will be optimistic if the 2011 year class is as poor as the recent year classes.

Discussion

Canadian catch was very low in 2011. Quotas were added to licenses, but many fishermen did not switch gears to go after yellowtail because haddock was more profitable. The limited effort looking for yellowtail was directed towards areas of historical abundance rather than on where they have been found recently in the surveys or as bycatch in other fisheries. The scallop fleet caught very little yellowtail, in part due to fishing in different areas and avoiding identified areas of high densities of spawning yellowtail (i.e. 'closed' boxes).

It was not clear whether there has been a change in the distribution of US effort to avoid small age 2 yellowtail (possible response to management measures).

Last year, TRAC recommended only using a 5-year geometric mean for cod recruitment, but a 10-year geometric mean is being used for yellowtail. This might not be a good approach at present. The sensitivity analysis of the impact of recruitment on catch and biomass indicated that changing the value for recruitment didn't change catch much, but it did change the biomass.

A caveat should be noted in the TSR. In the US, more emphasis is placed on SSB than total biomass, so it was asked what the impact might be on SSB since a large proportion of fish mature at age 2. It was noted that it shouldn't make a big difference. It was not clear whether changing recruitment would change the slope or the shape of the line. Since SSB is calculated part way through the year, changes in SSB from one year to the next reflect impacts from parts of two years, which makes interpretation of changes more difficult than Jan-1 biomass.

There was some discussion of a possible mechanism for the mismatch between model and data. If all one looks at is the survey indices, the picture isn't too bad. It is the lack of age structure that seems to be the problem. This prompted some questions about validation of the aging. The aging has been verified previously.

It was asked whether there is anything that suggests problems with the survey, if one assumes a constant catchability of the survey, catch by strata analyses show that stratum 16 contains most of the biomass. This includes Closed Area II, which is not available for the fishery and crosses the Hague Line. There may be an increasing proportion of the stock in the closed area. Spatial structuring could be a mechanism that is unaccounted for. However, given that cod has retrospective while haddock does not, and yellowtail has a retrospective but winter flounder doesn't, it doesn't seem as though the retrospective problem is entirely related to spatial issues (i.e. retrospective not just seen in more sessile species).

It was noted by an industry representative that yellowtail in the closed area (from scallop bycatch) seem to be in better shape. The explanation provided by fishermen is related to the presence of skate. (Editor's note: This is based on the assumption of skate competing with yellowtail for prey, and that few skate are in the closed area, thus the yellowtail flounder are in better condition.)

It was asked if there are enough length frequencies taken from the scallop survey/fishery to determine whether it's different from the other areas. It was clarified that there is no evidence of a big batch of older/bigger fish in the closed area. Yellowtail flounder do move all over the bank.

There was concern expressed that it would be hard to explain the results of the assessment to fishermen and the public. The retrospective and residual patterns have gotten worse, but TRAC is not prepared to throw the model results out entirely. There is a need to use the benchmark model available to provide advice. Fixes that might be applied at this assessment (e.g. rho adjustment) might not work in the future. However, it was agreed that the unadjusted model results could not be supported – this would not be good advice. It was agreed that, within the current framework, this was the best that could be done. It was agreed to use the current model to provide stock status but not to use the unadjusted model projection results for catch advice.

If one compares the fishery catch at age from the 2010 TRAC projection with the 2011 TRAC projection and the 2012 observations, there are some similarities in ages 1-4. The biggest discrepancies seem to be with ages 5-6, with the observed values well below both projections. It was asked why the fishery did not catch these fish that were projected to be available. It was noted that this unexplained disappearance of old fish is a source of the retrospective pattern.

Discussion ensued on what might be possible to resolve within a benchmark review. There are some serious questions that need to be resolved. For example, there is concern with survey qs over 1 (ages 3+). There is no good mechanism to explain these high catchabilities. When the survey series isn't split, catchabilities are less than 1, but this results in other problems. Also, it is unclear why there is a domed PR in the DFO survey. This could be an impact of the survey

not catching any age 6 fish in the large tow during 2008. There needs to be a better understanding of what's happening in the environment. There may be important factors that are not being measured and that are not being captured in the model. Assumptions of the model may not match the biology of the species. It was asked whether there might be some other mechanism that is being aliased with the proposed fixes (e.g. older ages migrating out of the area). Condition is declining and has been for the last decade; however, as with haddock, this is a decline in the condition of all ages and not just the older fish. A benchmark requires a lot of time and new information. The benchmark could provide an opportunity to explore different models to look at the data in a new way. The assessment team has pushed the VPA model as far as they can, so it may be time to try a new modeling approach. However, there is no guarantee that a new model would resolve the issues with yellowtail.

There was a report released recently which suggests that, in data poor situations with high uncertainty and poor stock condition, catch should be reduced by about 50%. There are several indicators that the yellowtail stock is in poor condition. Past catch of yellowtail has been about 1,200 mt, so this would suggest a reduced catch of 600 mt (or some alternative proportion of average catch from some agreed to timeframe). This report was based on expert judgment. Details of the report and its recommendations would have to be clarified for TRAC to use this as a basis for advice. It was suggested that, given uncertainties, catch should not be reduced so dramatically in a single year, but this causes problems in the US where legislation required ending overfishing immediately.

It was agreed that the whole sensitivity table (Table 22 in working paper) would be presented in the TSR, along with the starting biomass and F. These help to describe the uncertainty in the model results.

OTHER BUSINESS

There was some discussion about working paper security versus transparency. The US process allows for full access of the public to working papers before meetings. There is some confusion of US industry participants about the TRAC guidelines for working papers. It was agreed that issues of working paper access would be resolved by the TRAC co-chairs, before the next TRAC meeting.

There was also some discussion about the speed of the document approval and publication process after the TRAC meetings. It was agreed that efforts would be made to streamline this process to increase the speed of posting.

RECOMMENDATIONS

- A benchmark assessment for eastern Georges Bank cod was recommended to address the issues identified in this update (Appendix 6).
- A benchmark assessment was suggested for eastern Georges Bank haddock within the next few years given the length of time since the previous benchmark and the recent expanding age structure that includes dominant cohorts.

CONCLUSIONS

The chairs of the meeting thanked participants for attending this year's TRAC assessment of Eastern Georges Bank cod, Eastern Georges Bank haddock and Georges Bank yellowtail flounder. The TRAC status reports for each of these species would be finalized in the coming weeks, based on the discussion of the meeting, and they would be made available to participants in French and English on the TRAC website. The TRAC status reports would be presented in the autumn to the Transboundary Management Guidance Committee. Working papers were expected to be modified as recommended by this meeting, and published as TRAC Reference Documents in the coming months.

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APPENDICES

Appendix 1. List of Participants

Name	Affiliation
O'Brien,Loretta (Co-Chair)	NMFS, NEFSC
Worcester,Tana (Co-Chair)	DFO, BIO
Alade, Larry	NMFS, NEFSC
Blaylock, Jessica	NMFS, NEFSC
Brooks, Liz	NMFS, NEFSC
Butterworth, Doug	University of Cape Town
Clark, Kirsten	DFO, SABS
d'Entremont, Alain	Scotia Harvest Seafoods
d'Entremont, Claude	Inshore Fisheries
Deroba, Jon	NMFS, NEFSC
Docherty, Verna	DFO-Fisheries Management
Ford, Travis	NMFS, RO
Heil, Sarah	NMFS, RO
Hooper, Fiona	NEFMC
Karp, Bill	NMFS, NEFSC
Kellogg, Chris	NEFMC
Legault, Chris	NMFS, NEFSC
Maguire, J-J.	NEFMC SSC
McElroy, David	NMFS, NEFSC
Miller, Tim	NMFS, NEFSC
Nickerson, Tim	TMGC
Nieland, Julie	NMFS, NEFSC
Nies, Tom	NEFMC
Nitschke, Paul	NMFS, NEFSC
Odell, Jackie	Northeast Seafood Coalition
Odlin, Jim	NEFMC
Palmer, Mike	NMFS, NEFSC
Pierce, David	MASS DMF
Rago, Paul	NMFS, NEFSC
Serchuk,Fred	NMFS, NEFSC
Shepherd, Gary	NMFS, NEFSC
Terceiro,Mark	NMFS, NEFSC
Van Eeckhaute, Lou	DFO, SABS
Wang, Yanjun	DFO, SABS
Weinberg, Jim	NMFS, NEFSC
Wigley, Susan	NMFS, NEFSC

Appendix 2. Terms of Reference

Transboundary Resources Assessment Committee
Assessment of Georges Bank Cod, Haddock and Yellowtail

June 26-29, 2012

Woods Hole

TERMS OF REFERENCE

Context

The TRAC annually obtains requests for harvest advice on transboundary resources from the Transboundary Management Guidance Committee (TMGC).

For the following resources:

Eastern Georges Bank cod
Eastern Georges Bank haddock
Georges Bank yellowtail flounder

- Apply the benchmark assessments to report on the status of the stocks, updating results for the latest information from fisheries, including discard estimates, and research surveys and characterize the uncertainty of estimates.

- Describe any adjustments to benchmark assessment models applied during the TRAC including impacts on advice given to TMGC.

- Evaluate and quantify, if possible, scientific uncertainty of the assessment output (stock status determination and catch projection), discussing current practices of characterization and alternative methods of evaluation.

- Provide sensitivity analyses to account for retrospective bias on stock biomass and fishing mortality estimates for cod, haddock, and yellowtail flounder.

- For a range of total catch values in 2013, estimate the risk that the 2013 fishing mortality rate would exceed 0.18 (cod), 0.26 (haddock) and 0.25 (yellowtail flounder) respectively. Include a table showing the 2013 catches corresponding to low (25%), neutral (50%) and high (75%) probability that the F would exceed 0.18 (cod), 0.26 (haddock) and 0.25 (yellowtail flounder) respectively.

- For a range of total catch values in 2013, estimate the risk that the biomass at the beginning of 2014 would not achieve a 0%, 10% or 20% increase compared to the beginning of 2013.

- Review the biomass distribution relative to the U.S./Canada boundary, updating results with the 2011 survey information, and apply the allocation shares formula.

- Document the source of F_{ref} for cod and haddock and determine the suitability in light of changes in the fishery, biological characteristics, and current assessment methods. Recommend revision to F_{ref} if needed.

- Draft terms of reference for the 2013 TRAC assessment of cod, haddock and yellowtail.

- Other matters.

Expected Publications

TRAC Transboundary Status Reports the eastern Georges Bank cod and haddock, and Georges Bank yellowtail flounder management units.
TRAC Reference Documents for eastern Georges Bank cod and haddock, and Georges Bank yellowtail flounder management units.
TRAC Proceedings of meeting discussion

Participants

DFO Maritimes scientists and managers
NMFS Northeast Region scientists and managers
Canadian and U.S. fishing industry
U.S. State and Canadian Provincial (NB and NS) representatives
NEFMC representatives
Scientific and Statistical Committee (SSC) representatives

Appendix 3. Meeting Agenda

Transboundary Resources Assessment Committee
Assessment of Eastern Georges Bank Cod, Eastern Georges Bank Haddock, and Georges Bank Yellowtail Flounder

Stephen H. Clark Conference Room
NEFSC Woods Hole Laboratory

26-29 June 2012

AGENDA

Note: Allocation of Biomass was presented before the haddock assessment

26 June 2012 – Tuesday

9:00 – 9:15	Welcome and Introduction (Co-Chairs)
9:15 – 10:30	Update of EGB Haddock Data Inputs – commercial fishery & surveys Application of the Benchmark Formulation for EGB Haddock Projections and Assessment Advice for EGB Haddock
10:30 – 10:45	Break
10:45 – 12:00	GB EGB Haddock continued EGB Cod review of mortality indicators
12:00 – 1:00	Lunch
1:00 – 3:00	Update of EGB Cod Data Inputs – commercial fishery & surveys Application of the Benchmark Formulation for EGB Cod
3:00 – 3:15	Break
3:15 – 5:00	Projections and Assessment Advice for EGB Cod Allocation Shares for 2013

27 June 2012 – Wednesday

8:30 – 10:30	Results of Yellowtail Ageing Experiment from US scallop survey Alternative Estimation of Yellowtail Discards in US scallop fishery Yellowtail Maturity update Update of GB Yellowtail Data Inputs – commercial fishery & surveys
10:30 – 10:45	Break

10:45 – 12:00 Application of the Benchmark Formulation for GB Yellowtail
Projections and Assessment Advice for GB Yellowtail

12:00 – 1:00 Lunch

1:00 – 3:00 YT continued
Report Preparation (EGB Haddock)

3:00 – 3:15 Break

3:15 – 5:00 Report Preparation continued

28 June 2012 – Thursday

8:30 – 12:00 Report Preparation (Yellowtail) continued

12:00 – 1:00 Lunch

1:00 – 3:00 Report Review

3:00 – 3:15 Break

3:15 – 5:00 Report Review

29 June 2012 – Friday

9:00 – 1:00 Final Report Review
Development of 2011 TRAC cod/haddock/yellowtail Terms of Reference
Other Business (as required)

Appendix 4. 2012 DFO Pre-Assessment Meeting

Comments from TRAC Pre-Assessment Meeting
June 11, 2012, Yarmouth, Nova Scotia

5Zjm Haddock

The bycatch limit for the US mid-water trawl fishery for herring was increased from 2% to 5% in 2011. A request was made to DFO Science to find out if the bycatch of haddock actually reached the 5% level in this fishery last year.

USA fishermen were reported to have caught 2-year old cod and haddock in 2012 west of Closed Area II in the middle of the bank indicating high abundance. Small cod and haddock were retained because they were tangled in the meshes.

Very large year classes of haddock have not grown as quickly as smaller ones, which can have important consequences for projections. An example was provided on the influence of a small error in weight at age on projection results.

It was suggested by an industry member that various scenarios for catch projections should be explored in this year's assessment as catches are expected to decline substantially but then will come up again as the 2010 year class recruits to the fishery. Industry expressed concern over this potential large reduction followed by a subsequent large increase. More stability in the quota from year to year is desirable from an industry standpoint. It was explained that TMGC's harvest strategy is to fish at F_{ref} which is not a constant catch strategy. US regulations do not allow them to recommend a quota which is expected to exceed F_{ref}. Science noted that there is evidence from survey data that suggests M has increased on age 8 (and older) haddock and this may need to be addressed in the projections.

It was pointed out that in this year's TRAC Terms of Reference, there is a requirement to update the F_{ref} YPR calculation for haddock using current WAA, PR, maturity and M = 0.2 to reflect recent changes in growth and partial recruitment to the fishery.

Initial reports from the 2012 haddock fishery on Georges are that catches and catch rates have been low, but the bank has just recently opened so it may be a bit early in the season to tell if the situation has deteriorated from last year. In the past, catch rates have been lower at the beginning of the fishing season but generally improve as the season progresses.

Cod

There is a requirement to check the 2011 cod discard estimates for Canadian fixed gear. The discard amounts for the 2011 fishery were very low and will have little influence on CAA calculations.

The 2010 year class appears to be strong in the 2010 and 2011 NMFS fall surveys but not in the DFO survey (due to differences in seasonal distribution patterns). Industry was questioning whether the seasonal distribution had actually shifted to the western part of the bank in the spring of 2012, and if the spring survey distributions (DFO and NMFS) would reveal such a pattern. This concern is based on the reported catches of small cod by the US fishery in the centre of the bank this year.

Industry commented that longline gear may be more efficient than bottom trawl as a means of surveying cod populations when abundance is low.

Industry commented that they were getting a relatively good yield from cod and that condition may not be as bad as indicated from trends in Fulton's K (especially in 2011) based on length and weight data collected from the survey during the winter. Cod were reported to be less "slinky" than haddock from last year's fishery. There were reports of improved condition for sea scallop and lobster this year which was also apparent for cod, haddock and yellowtail flounder condition based on 2012 DFO survey data. This may be related to the warmer water temperatures observed on the bank this winter.

This year, DFO Science is planning to collect new information on gutted weight in addition to length from cod sampled at dockside (port samples) and use this data to further investigate changes in condition.

Yellowtail Flounder

There are plans to conduct an exploratory fishery again this year for yellowtail flounder on Georges Bank (as was done in 2011) with all participating vessels carrying at-sea observers. It was noted that in 2011, exploratory fishing operations were not conducted in the region around Corsair Canyon but were mainly focused in the "Yellowtail Hole" area. Only 3 vessels were involved in this operation last year.

The USA scallop fishery now has a requirement to retain yellowtail > 33 cm TL but none were reported in the landings for 2011 from this fishery.

The DFO and NMFS survey distributions of yellowtail indicates a recent shift to the southern flank, as indicted by more sets with catches in the lower part of stratum 5Z4.

Participants:

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Appendix 5. 2013 TRAC Assessment Draft Terms of Reference

Transboundary Resources Assessment Committee
Assessment of Eastern Georges Bank Cod, Haddock and Georges Bank Yellowtail

June, 2013
St. Andrews, NB

TERMS OF REFERENCE

Context

The TRAC annually obtains requests for harvest advice on transboundary resources from the Transboundary Management Guidance Committee (TMGC).

For the following resources:
Eastern Georges Bank cod
Eastern Georges Bank haddock
Georges Bank yellowtail flounder

- Apply the benchmark assessments to report on the status of the stocks, updating results for the latest information from fisheries, including discard estimates, and research surveys and characterize the uncertainty of estimates.

- Describe any adjustments to benchmark assessment models applied during the TRAC including impacts on advice given to TMGC.

- Evaluate and quantify, if possible, scientific uncertainty of the assessment output (stock status determination and catch projection), discussing current practices of characterization and alternative methods of evaluation.

- Provide sensitivity analyses to account for retrospective bias on stock biomass and fishing mortality estimates for cod, haddock, and yellowtail flounder, if appropriate.

- For a range of total catch values in 2014, estimate the risk that the 2014 fishing mortality rate would exceed F_{ref} values, i.e. 0.18 (cod), 0.26 (haddock) and 0.25 (yellowtail flounder) respectively. Include a table showing the 2014 catches corresponding to low (25%), neutral (50%) and high (75%) probability that the F would exceed F_{ref}.
-
- For a range of total catch values in 2014, estimate the risk that the biomass at the beginning of 2015 would not achieve a 0%, 10% or 20% increase compared to the beginning of 2014.

- Review the biomass distribution relative to the US/Canada boundary, updating results with the 2012 survey information, and apply the allocation shares formula.

- For Georges Bank yellowtail flounder, update the US biomass reference point (SSBmsy) from the benchmark assessment results

- For Georges Bank yellowtail, conduct preliminary scoping of alternative modeling approaches to address retrospective bias observed in the current benchmark assessment

- Draft terms of reference for the 2014 TRAC assessment of cod, haddock and yellowtail.

- Other matters.

Expected Publications

TRAC Transboundary Status Reports the eastern Georges Bank cod and haddock, and Georges Bank yellowtail flounder management units.
TRAC Reference Documents for eastern Georges Bank cod and haddock, and Georges Bank yellowtail flounder management units.
TRAC Proceedings of meeting discussion

Participants

DFO Maritimes scientists and managers
NMFS Northeast Region scientists and managers
Canadian and U.S. fishing industry
U.S. State and Canadian Provincial (NB and NS) representatives
NEFMC representatives
Scientific and Statistical Committee (SSC) representatives

Appendix 6. 2013 Eastern Georges Bank Cod Benchmark Draft Terms of Reference

Transboundary Resources Assessment Committee

Benchmark Assessment of Eastern Georges Bank Cod

Spring 2013

TERMS OF REFERENCE

Context

The TRAC was established in 1998 to peer review assessments of transboundary resources in the Georges Bank area and thus to ensure that the management efforts of both Canada and USA, pursued either independently or cooperatively, are founded on a common understanding of resource status. While stock assessment results are needed routinely to serve the management system, it is not practical to evaluate the assessment approach each time the assessment is conducted. Instead, reviews of the assessment approach (benchmark assessments) are conducted periodically, generally at a separate meeting. The previous two TRAC benchmark reviews for cod were conducted in February 2002 and in January 2009 (data meeting) and April 2009 (model meeting).

At present, the USA assessment for the whole of Georges Bank is conducted independently from the TRAC assessment of eastern Georges Bank. There is some concern that differing assessment approaches may make reconciliation of results difficult.

Objectives

This meeting will have two objectives 1) To review the assessment framework for the Eastern Georges Bank cod management unit (5Zjm for Canada). The agreed benchmark model formulation would be used in the June 2013 TRAC for 5Zjm cod. 2) Discuss criteria for timing of and allowable changes to TRAC benchmark model assessments.

- Review tagging data for application in stock assessment particularly with respect to estimation of natural mortality.
- Examine relevant ecological and biological data such as, but not limited to, growth, maturity, fecundity, recruitment, environmental factors, and trophic interactions to estimate natural mortality.
- Explore a full range of pertinent assessment methods for estimating current abundance and exploitation rate, in particular, to address the issue of retrospective bias.
- Calculate fishing mortality reference points based on agreed assessment approach.
- Formulate projection procedures for harvest advice based on agreed assessment approach.

- Assess stock dynamics to investigate potential changes in stock productivity

- Discuss criteria to determine 1) when a benchmark assessment should be conducted and 2) what degree of modification is acceptable to make to a benchmark model formulation during an update assessment.

Expected Publications

TRAC Proceedings, which will document the details of the benchmark
TRAC Reference Documents

Participants

DFO Maritimes scientists and managers
NMFS Northeast Region scientists and managers
Canadian and USA fishing industry
USA State and Canadian Provincial representatives
NEFMC representatives