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Proceedings of the Maritimes Region Science Advisory Process on the Assessment of Atlantic Halibut on the Scotian Shelf and Grand Banks

Compte rendu de la réunion tenue dans le cadre du Processus consultatif scientifique de la Région des Maritimes pour l'évaluation du flétan de l'Atlantique du plateau néo-écossais et des Grands Bancs

November 16-17, 2010

16-17 novembre 2010

Bedford Institute of Oceanography
Dartmouth, Nova Scotia

Institut océanographique de Bedford
Dartmouth (Nouvelle-Écosse)

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Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings include research recommendations, uncertainties, and the rationale for decisions made by the meeting. Proceedings also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

Avant-propos

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. En outre, il fait état de données, d’analyses ou d’interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenus dans le présent rapport puissent être inexacts ou propres à induire en erreur, ils sont quand même reproduits aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considéré en tant que reflet des conclusions de la réunion, à moins d’indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l’information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

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SUMMARY

A Maritimes Science Advisory Process to assess Atlantic Halibut on the Scotian Shelf and Grand Banks was held November 16-17, 2010, at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia. Participants included Department of Fisheries and Oceans (DFO) Science Branch and Resource Management Division, fishing industry, aboriginal organization representative, and invited reviewers. The assessment and advice presented at this meeting will be used in the management of the Atlantic Halibut fishery on the Scotian Shelf and Grand Banks.

SOMMAIRE

Un processus consultatif scientifique de la Région des Maritimes pour l'évaluation du flétan de l'Atlantique du plateau néo-écossais et des Grands Bancs a été tenu les 16 et 17 novembre 2010 à l'Institut océanographique de Bedford, à Dartmouth, en Nouvelle-Écosse. Parmi les participants, on retrouvait des représentants de la Direction des sciences et de la Division de la gestion des ressources du ministère des Pêches et des Océans (MPO), ainsi que de l'industrie de la pêche, des organismes autochtones et des examinateurs invités. L'évaluation et les conseils issus de cette réunion seront appliqués à la gestion de la pêche au flétan de l'Atlantique du plateau néo-écossais et des Grands Bancs.

INTRODUCTION

After welcoming participants (Appendix 1) to the meeting the chair (T. McIntyre) provided a brief description of the meeting. She noted that the last assessment of the Scotian Shelf and Grand Banks Atlantic Halibut stock was conducted in November of 2009. During this meeting the new model that has been developed would be applied in the assessment to provide advice on the stock status.

The chair indicated to everyone that the objectives in the Terms of Reference (Appendix 2) for the meeting had been used to frame the agenda. The objectives for the meeting were as follows:

- Review all current removals, including surveys and commercial by-catch of Atlantic Halibut.
- Review recent catch rate and distribution trends from the Atlantic Halibut industry survey.
- Review and evaluate biological and fishery information on 3NOPs4VWX+5Zc Atlantic Halibut stock status and characterize the uncertainty of the results.
- Review the current exploitation rate using the new assessment model.
- Identify candidate reference points for 3NOPs4VWX+5Zc Atlantic Halibut and evaluate the current status of the stock in relation to these reference points.
- Evaluate the consequences of different harvest levels during the 2011/12 fishery on stock abundance and exploitation rate.

The agenda was then reviewed (Appendix 3).

The chair noted to the participants that it is important to attend and contribute to the review during the entire meeting because the points agreed to at the meeting and the advice provided through the Science Advisory Report will be final at the end of the meeting. Questions were welcomed for clarification during presentations, but participants were asked to hold questions for discussion until breaks in the presentations.

Finally, a round of introductions was made and the chair introduced the formal reviewers invited to participate in the assessment meeting, Jae Choi (DFO) and Brad Hubley (DFO).

PRESENTATIONS AND DISCUSSION

Removals – Fisheries and Survey Data

Working Paper: Trzcinski, K.M., S.L. Armsworthy, S. Wilson, R.K. Mohn, and S.E. Campana. 2010. A Framework for the Assessment of the Scotian Shelf and Southern Grand Banks Atlantic Halibut Stock. CSA Working Paper 2010/20.

Presenter: K. Trzcinski

Presentation Highlights

Landings data was presented, pointing out the division between Canadian and foreign landings and longline versus otter trawl fisheries. Since the 1960s, the proportion of landings has largely been from Canadian longline fisheries.

The catch at length was estimated using observer and port sample data from the longline and otter trawl fisheries. The construction of the catch at length was a multi-step process (described in the working paper), the quality of which depends on the temporal and spatial distribution of

the sampling. The data used during the construction of the catch at length was presented and the steps were described. The final product of the process for input to the model was a catch at length for males and females.

Discussion

It was noted that the female length frequencies vary significantly between years. A question was asked as to whether this was a function of the analytical approach or a pattern observed in raw frequency distributions? A presentation of raw length frequency distributions later in the meeting showed that there is not much bump-up from the observer data, since observers/port-side monitoring measures 90-100% of the halibut catch.

The data showed a lot of large females in the catch, 2007 in particular. The question was asked why are there more females in the water, are they preferentially caught, or are females heavier at age? By number, the proportion of male and females in the catch is similar, the proportion by weight differs.

Indices of Abundance

Working Paper: Trzcinski, K.M., S.L. Armsworthy, S. Wilson, R.K. Mohn, and S.E. Campana. 2010. A Framework for the Assessment of the Scotian Shelf and Southern Grand Banks Atlantic Halibut Stock. CSA Working Paper 2010/20.

Presenter: K. Trzcinski

Presentation Highlights

The DFO groundfish research vessel survey (RV survey) and the halibut survey were used as indices of abundance. The RV survey catches mainly small halibut (40-50 cm) below the legal size limit, while the halibut survey is the key source of information on a broader size range of halibut (50-230 cm). The area expanded total number of halibut caught per year in the RV survey is used as an index of abundance. The RV survey also has length data for males and females. Catch rates from this index have increased since 2002 with 2010 being the highest record in the 40 year time series.

The catch rates from the halibut survey show wide annual variation in station coverage. Three generalized linear model (GLM) analyses were done to standardise the catch rate, all three showing similar increasing trends with a slight decrease in 2010. The GLM using all stations that were completed in 5 or more years was used as an index of abundance in the assessment model.

Discussion

A request was made to provide more detail on the methods of standardization of the halibut survey catch rates in the Research Document. It was pointed out that there are other factors besides station effect that could affect catch rates – gear saturation by other fish, temperature, soak time. The problem with addressing these effects is that after accounting for station effects there is not much variation left and the model becomes very complex very fast. Would treatment of the stations as a random effect give flexibility to add other effects? It was suggested that a discussion of how to improve the design of the survey would be very valuable at another meeting.

A discussion occurred about what could be causing the variance between fixed stations – habitat, changes in water temperature? Industry representatives in attendance were asked to comment on what kinds of environmental factors they see that can cause higher catch rates at a particular location. It was noted by one industry representative that in 2008 total catch was 37,000 t compared to in 2009-2010 when only 11,000 t of halibut were caught. It was noted that there were also changes in the TAC at this time.

A meeting participant asked what the indices look like by NAFO division rather than the greater stock area. There is variation between NAFO divisions but the assessment model needs an index that is representative of the whole area. It was suggested that a graph that shows indices by select NAFO divisions may be helpful in the future.

Overview of Halibut Growth

Working Paper: Trzcinski, K.M., S.L. Armsworthy, S. Wilson, R.K. Mohn, and S.E. Campana. 2010. A Framework for the Assessment of the Scotian Shelf and Southern Grand Banks Atlantic Halibut Stock. CSA Working Paper 2010/20.

Presenter: K. Trzcinski

Presentation Highlights

Lengths are very important inputs to model, so growth rates by sex is important to know. Up to 5-10 years of age, males and females grow at similar rate. After 10 years of age, females grow at quicker rates than males. Based on length versus age distributions, you can convert your landings by length into age distributions for landings by years. There is not much growth rate variation over time, but some variation by area or fishing gear type (at age).

Discussion

Sexual dimorphism is usually due to sex choice. Do halibut have complicated mating rituals? Are there certain times of year when one should not disturb the species? Very little information exists on spawning location and spawning activity for halibut. DFO is working with industry to improve our understanding, but it is challenging since the management area is so large.

Is there much evidence for discrete location(s) for spawning of flatfish or is it more general? Depends on species, but many have large spawning windows. It was noted that fishermen do not report spawning activity of halibut, as they do with other fish such as cod. This suggests that halibut may spawn over prolonged periods of time, so there are no noticeable changes between seasons.

Is there any information on age of maturity? There is no published information on what size the fish reach age of maturity in the management unit. It was agreed that this is an important biology and it is on the research agenda to analyse the maturity at length and/or maturity at age pilot study data and develop a research program.

Model - Methods

Working Paper: Trzcinski, K.M., S.L. Armsworthy, S. Wilson, R.K. Mohn, and S.E. Campana. 2010. A Framework for the Assessment of the Scotian Shelf and Southern Grand Banks Atlantic Halibut Stock. CSA Working Paper 2010/20.

Presenter: K. Trzcinski

Presentation Highlights

An assessment model framework review was undertaken in June 2009, with external reviewers Devora Hart (National Marine Fisheries Service) and Bill Clark (International Pacific Commission on Halibut). The model is a length-based age-structured model fitted to the length composition in the catch and the abundance indices from the RV survey and the halibut survey. It converts lengths to ages using the growth data. The dynamics of the model are aged based – recruitment, maturity, selectivity, fishing and natural mortality occur at age. The model predicts catch rate in the abundance indices and length frequencies that would be observed in the catch. The estimates from the model are spawning stock biomass (SSB), recruitment (R), and fishing mortality (F). Changes to the model have occurred since the June 2009 meeting in terms of its output. Since June the focus has been on fixing the halibut database, work on the catch at length frequency distributions, and testing the model.

Discussion

Comments were made about the use of a general growth curve for the model. This might be fine, but for small fish it might not be appropriate due to the difference in the growth curve from longline gear versus otter trawl gear. The approach to using 2 different growth curves was explored but there was not a lot of time to make headway on this and would require some extrapolation of younger ages or a rewrite of the model.

Concerns were stated that if you have incorrect catch at age (because of differences in fishing type), this error can propagate and grow further down the model as you predict recruitment at age. It would be nice to see a sensitivity run. We need to note that this could be giving us wrong results and the magnitude of the error is unknown. The length at age chart is biased at young ages, as otter trawls remove a greater range of fish sizes at younger ages. When this scales up to total landings, errors can occur. One could argue that otter trawl is more reflective of younger aged fish in population since it doesn't preferentially remove only the larger of the young fish (as occurs with longline). It was agreed that clear recruitment events will be smeared because of misappropriate binning of ages but overall they are all accounted for.

One reviewer declared that we are splitting hairs here. Intuition is that the error is small. This was not agreed to by the participant who raised the discussion – we don't know what affect this error can have and this needs further investigation in the future.

Model – Results and Diagnostics

Working Paper: Trzcinski, K.M., S.L. Armsworthy, S. Wilson, R.K. Mohn, and S.E. Campana. 2010. A Framework for the Assessment of the Scotian Shelf and Southern Grand Banks Atlantic Halibut Stock. CSA Working Paper 2010/20.

Presenter: K. Trzcinski

Presentation Highlights

The model was tested using simulation data. The model did a good job at reproducing the patterns in the simulation data giving confidence in the model. Model results were presented showing selectivity by the various surveys and fishing gears at age. Selectivity in the longline fishery was broken down by sex.

Model provides estimates of biomass (B), spawning numbers (S), and recruits (R) through time. SSB versus recruitment plot is important for reference points.

Exploitation (F) varies between male (0.15) and females (0.3).

The residual proportions at length were reported for females in the RV survey, females in the longline fishery, and for the otter trawl fishery. There are some patterns in the LL fishery residuals that indicate that the model is underestimating large catches. Appear to be underestimating 5-6 year olds and over estimating 7-11 year olds. This may indicate some trouble with the selectivity patterns. The model has trouble dealing with the dynamics of data at length. Having different growth data for the OT and LL fisheries for young fish would change the residuals. Length at age for the different gear types may help the model.

Discussion

Concerns were raised about the assumption in the model that above a certain age the selectivity becomes constant. What is the effect that selectivity above a certain age is not constant? Evidence of selectivity at age has been looked at using VPA, but is hard to estimate. The point was made that not testing different assumptions of selectivity versus age does not tell us what the variation in output would be – the current single assumption may paint a misguided picture for managers, particularly since larger fish are your spawning stock. But if we said that the selectivity was not flat topped, we would be making the assumption that the larger fish in the population are not captured. The tagging data, size at capture and release, provides agreement with the flat top assumption.

It might be helpful to see what the sensitivity of the model is to different assumptions about the flat top selectivity. Maybe a soak time experiment would help.

The theory behind not catching larger fish by otter trawl is that they swim away from the net. What is theory behind longline? A participant responded to this by stating that if you have longer soak times and can keep the bait on, you have greater chance of catching large fish. Another participant followed up that if you leave longline gear out you catch larger (older fish). No incentive to catch the older fish because they are worth less. It was pointed out that longline log books can tell you if longer soak times catch larger fish by looking at the length versus age frequency distributions. Another participant stressed that caution be exercised when using soak times on industry survey fixed stations, since the fixed stations are largely on poor bottoms

where bait does not stay on the hooks. Soak time may make a difference in the commercial index stations because bottom conditions are better.

The question was raised again as to why we are catching males and females of equal proportion by number, but this proportion differs by weight (higher catch of females by weight)? We are catching more females of older ages – it becomes a combined size and age answer, not just size or age. A reviewer commented that the divergence between male and female longline exploitation rate in late-2000s is worth tracking, as this may be a model error. It was also pointed out that it is important to keep track of the divergence in F between the sexes. This could be real or could be a model issue.

It was asked if the level of effort varies from year to year and is this accounted for in the model? No this is not, as data in longline fishing records is poor. Variability in exploitation in time can be reflective of the number of observers for that year, which is dependent on fishing effort for that year.

It was noted that natural mortality of 0.1 in model seems low – what is rationale for this value? It is based on longevity and the Pacific Halibut Commission uses this value. The participant noted that Pacific halibut are different fish and questioned whether this is a good reason to use this number? An attempt was made to estimate M from data, but this was difficult. The participant felt that M=0.1 is still quite low. M=0.15 is likely more realistic. Hoenig estimates M by looking at age based on 1% of catch rather than looking for oldest fish caught.

Why is growth rate in males and females so different? Difficult to determine with limited data available.

It was pointed out that the exploitation graph should show total exploitation line and not just presented by longline and otter trawl.

During discussion of the variance of the model outputs the certainty in the outputs was questioned. The research document should include new variance run data. It was noted that the error bounds are extremely small. The cause may be fixed values in model (e.g. selectivities), which causes underestimates in variance. A suggestion was made that instead of fixing values, may want to assign a variance about the fixed values – but what is a suitable range of variance about fixed value parameters that can not be estimated in practice to begin with.

Model – Comparisons and Conclusions

Working Paper: Trzcinski, K.M., S.L. Armsworthy, S. Wilson, R.K. Mohn, and S.E. Campana. 2010. A Framework for the Assessment of the Scotian Shelf and Southern Grand Banks Atlantic Halibut Stock. CSA Working Paper 2010/20.

Presenter: K. Trzcinski

Presentation Highlights

A comparison of the Catch at Length (CAL) model used in this assessment was made with a VPA backwards projecting model and a Catch at Age (CAA) forward projecting model. All three models show a similar trend in SSB and F over time with a better convergence in the past 20 years. This is positive for using the current CAL model.

Overall, the stock appears to be in a more productive state with an increase recruitment to the fishery and a high SSB.

Discussion

It was noted that this is a positive sign that catch models are converging on a similar answer in recent years (attributed to better observer data). Can the model be used to forecast catch for the next few years? This is possible, but it is dependent on a lot of assumptions that would need to be agreed upon (e.g. Mean recruitment or recent recruitment levels). The projections are also computer processing intensive – CAL code has to be developed and tested.

A participant asked why the CAL model showed a similar value in the late-2000s to prediction made in mid-1990s? A comparison to two other model outputs was made where recent estimates are still much lower than mid-1990s estimates. No quick answer. A comment was made that the model convergence in recent times is astounding – this is a great result. We shouldn't worry too much about model divergence in past, since we did not have good data and made strong assumptions about this period.

A suggestion was made to try splitting CAA by sexes. It was also pointed out that the model length frequency is a main driver, so selectivity is very important.

It was noted that around 1990, the data suggests a change in state variables or ecosystem shift (as catch models converge) –has F and M changed during this period? What is the cause of this change and why is the model showing increased population productivity since this time period? It was suggested that it could be explained by searching for environmental covariates.

K. Trzcinski and his team were complemented for development of a complex model and analysis of a tough data set.

Tagging Data Analysis

Working Paper: den Heyer, C., C. Schwarz, and K. Trzcinski. 2010. Atlantic Halibut Fishing Mortality Estimated from Tagging on the Scotian Shelf and the Southern Grand Banks. CSA Working Paper 2010/19.

Presenter: C. (Nell) den Heyer

Presentation Highlights

In 2006, Fisheries and Oceans Canada (DFO) and the Atlantic Halibut Council (AHC) began the Halibut All Sizes Tagging (HAST) program to estimate exploitation rate and evaluate the distribution of halibut within the Scotian Shelf southern Grand Banks management unit. More than 2,000 halibut were double tagged with t-bar anchor tags, during the DFO-industry halibut surveys between 2006 and 2008. As of 26 August 2010, 409 of these halibut were recaptured and reported. The HAST study is an example of a band-recovery experiment. The models in this paper follow a similar development to Hoenig et al. (1998a&b), but also incorporate tag loss. We assume that survival after tagging and tag reporting are constant and that fishing mortality is equally spread over the year. We also estimate instantaneous fishing mortality for each cohort in the first year after release to allow newly tagged animals to mix with the population. Most tag loss occurs in the first year of release. Based on the multiyear models with incomplete mixing and two parameters to describe tag retention, tag loss is estimated at 17%/year in the first year and 9%/year in the second and subsequent years. Assuming 90% tag reporting and 80%

survival from tagging, instantaneous natural mortality (M) for halibut that were greater than 81 cm was estimated to be 0.26 (SE=0.08), and instantaneous fishing mortality (F) was estimated to be 0.20 (SE=0.04) in 2007, 0.29 (SE=0.04) in 2008, and 0.21 (SE=0.04) in 2009.

Discussion

A question of clarification was asked regarding surface area of NAFO divisions. The surface area only constitutes shelf area in each division.

It was pointed out that the cumulative tag loss figure is not cumulative – the figure looks off because of the decline in cumulative tag loss over time. The data collected are the cumulative tag loss therefore because of variability in the data one may see a decline in cumulative tag loss.

A participant asked how the loss of two tags was calculated? It was calculated as a function of one tag loss probability. It is difficult to say if this is a good assumption, but a good first order estimate.

The question was asked as to the effect of over tagging in divisions of low exploitation? It may possible to incorporate some form of spatial analysis in the future to explore this effect.

It was pointed out during the discussion that the tagging study produced similar F values as the assessment CAL model, although M is twice as high. It is good news that tagging study F's are similar to result of the CAL model. Should be cautious about similar F results to CAL model because M results of tagging study are higher. K. Trzcinski to do a run with M=0.2.

It was noted that fishermen are only paid for one tag, even if the fish they catch has two tags on it. So fishermen may not bother turning in both tags, which may affect F. This will be looked at to see if it changes F.

A question was asked about the potential effect on model results due to the possibility of unreported tags collected in the Gulf? The 100$ cash reward is offered to fishermen from the Gulf, therefore, there is no reason to expect a different rate for reporting in the Gulf.

Exploring Reference Points and Consequences of Different Harvest Levels

Working Paper: Trzcinski, K.M., S.L. Armsworthy, S. Wilson, R.K. Mohn, and S.E. Campana. 2010. A Framework for the Assessment of the Scotian Shelf and Southern Grand Banks Atlantic Halibut Stock. CSA Working Paper 2010/20.

Presenter: R. Mohn

Presentation Highlights

The presentation was noted to be about exploring reference points, not proposing. Productivity is the key question to determine what we can remove.

The VPA model presented by R. Mohn showed a SSB of 5,000 ton for the stock, F approximately 0.3, limit reference point (LRP) of 0.4, upper reference point (URP) of 0.8, and an MSY of 1.6. MSY could be higher because only looked at first 15 ages. The tools exist to define a harvest control rule. The current assessment model can give us SSB and F but the code is not yet written to provide projections from the assessment model. Caution should be

exercised in interpreting medium to longterm projections because uncertainty increases with time.

Mohn and Trzcinski models were run separate from each other.

Discussion

It was discussed that the TOR requested candidate reference points, which will not be addressed at this meeting and the next assessment meeting is in a few years time. How do we proceed towards candidate reference points? If Resource Management and Industry need to plan what to do with surplus how do they proceed in absence of candidate reference points. Both Mohn and Trzcinski models produce estimates of MSY, which can be used now and revised as models improve.

Resource Management has plans to establish precautionary reference points for all fisheries and will propose candidate reference points that can be revised as information improves. In addition, reference points do not have to be model based (e.g. can use Bmin – lowest point where stock recovered from).

One of the reviewers stated that we have to be careful how far out we project the candidate reference points, because we do not know the potential effects of reaching carry-capacity and environmental changes (e.g. changes in water temperature).

Concern was expressed that if the meeting concludes to use Mohn's model numbers, why did the lion's share of the meeting focus on the Trzcinski model – we need to know more details of Mohn's model if we are going to rely on his numbers. It would be preferable to take the state variables from the Trzcinski model and feed it in to Mohn's model to get at the reference point.

Mohn and Trzcinski were asked to use output from the Trzcinski model and put it into Mohn's model to produce the reference points for the stock. There was agreement to do this work for Day 2, but there will be no variance around the point estimates and projections cannot be produced at this stage. This would at least allow FAM and Industry to adopt an interim reference point.

Reference Points

Presenter: R. Mohn

This presentation was a follow-up to the request from Day 1 to produce reference points from the Mohn model using output from Trzcinski model. The results were a MSY of 1.524, SSB MSY of 4.908, FMSY of 0.361. Reference points would be estimated as a limit reference point equal to 40% BMSY and the upper stock reference point equal to 80% BMSY. The FMSY is high which is predicated on a M of 0.1. The SSB for 2009 was estimated to be 6.5. This is good news when comparing to the SSB MSY of 4.9, and it is expected to grow. Calculating the same parameters using the Trzcinski model would follow the same steps and process but it is a different software environment. There would be differences in the results because Mohn's model does not parameterize selectivity in the same way but the difference would be minimal and might not be noticeable. It is not possible to use the Mohn model in this process to provide projections. At this time we can make a statement that projections of the stock can be made from the recruitment seen in the RV survey. These results were accepted by all participants at the meeting.

Review of the SAR

Biology

It was asked whether there are plans to determine maturity ogives? There is not enough data at this time. Research recommendation was made to develop a program to collect the necessary data.

Fishery

It was pointed out that communication of the landings versus the TAC in years where landings are higher than the TAC is not clear. In these years it was due to the fact that the landings from the survey were risk managed above the TAC. The text was re-worded to properly describe this. Also, the foreign landings are not clearly defined in the table under 3NO, but it was felt that the figure clearly illustrated the proportion of foreign landings.

Indices

A comment was made that in the future it might be advisable to pay attention to other indices, not just RV, because the RV is more of an index of recruitment rather than stock status. Also, not sure if GLM is the best analysis to standardize the survey catch.

It was pointed out that it is key to identify the RV survey as a recruitment index. This is important for eco-certification.

It was pointed out that the exploitation of females reported in the research document should be monitored overtime. This could give a better indication of things to respond to if there are changes over time.

Reference Points

A section was written at the meeting to describe the reference points determined and a figure was inserted to illustrate the Harvest Control Rule and the LRP and USR.

Sources of Uncertainty
This section was rewritten to note the following sources of uncertainty:

- Generation of CAL model ignored differences in size at age between gear types.
- Natural mortality was assumed to be 0.1 but may have been higher and/or variable throughout the time series.
- Tag loss, possible that the rate of tag loss was overestimated.
- Catch sampling before 1988 was limited which has introduced uncertainty into the early part of the model.
- Environmental factors, and the influence on catch rates and stock productivity, were not considered.

The question was asked about the level of comfort around the general conclusion that there is no mixing between the stock as it is defined and surrounding areas? Should it be included in the uncertainties that we don't know the extent, if any, of mixing between US and Canadian stocks and between halibut in the Gulf and the Scotian Shelf? The question was responded to that we don't know anymore about mixing between these areas than what is stated about tag returns in the tagging paper. It is not felt to create a level of uncertainty that we should be concerned with in the work that has been presented.

RECOMMENDATIONS AND NEXT STEPS

The main recommendation made was to develop the model code to generate reference points and projections. It was also recommended for the next assessment to try running the model using a M of 0.15. It was suggested that it may be helpful in the future to explore different selectivity patterns. It was noted that consideration might be given to other indices of abundance in the future, not just the RV as the main index for the model. The exploitation of females overtime was suggested as something to use as an indicator of change, something to respond to in the future.

Research recommendations that were made included the consideration of soak time and temperature as factors that can control catch rate. A soak time experiment would be necessary to develop to explore this recommendation. Also, it was commented on several times during the meeting that more even sampling over the year is necessary to help increase the collection of life history data to help develop maturity schedules for this stock.

The chair noted that Science Advisory Report would be edited at an editorial meeting, and published on the Canadian Science Advisory Secretariat (CSAS) website as soon as possible. The working paper was accepted, and it would be published as a Research Document. The proceedings of the meeting would be prepared at some later date and posted to the CSAS website

Appendix 1. Participants List

Name	Affiliation
Anderson, Sean	Dalhouise University
Boudreau, Cyril	NS Fisheries and Aquaculture
Bower, Don	DFO Maritimes / PED
Boyd, Catherine	Clearwater Seafoods
Campana, Steve	DFO Maritimes / PED
Chapman, Bruce	Groundfish Enterprise Allocation Council
Choi, Jae	DFO Maritimes / PED
Courtney, Robert	North of Smokey-Inverness South Fishermen's Assn. (NOSFA)
Curran, Kristian	DFO Maritimes / OHSAR
Davignon-Burton, Tania	DFO Maritimes / PED
Dedrick, Gerry	Shelburne Co. Quota Group
den Heyer, Nell	DFO Maritimes / PED
Docherty, Verna	DFO Maritimes / FAM
Dorey, Anna	DFO Maritimes / PED
Forget, Marie-Hélène	DFO Maritimes / ERD
Fowler, Mark	DFO Maritimes / PED
Hubley, Brad	DFO Maritimes / PED
Hurley, Peter	DFO Maritimes / PED
Joyce, Warren	DFO Maritimes / PED
McIntyre, Tara	DFO Maritimes / PED
McMillan, Jim	DFO Maritimes / PED
Mohn, Robert	DFO Maritimes / PED
Murphy, Bill	Fisherman's Market International Inc.
Nicholas, Hubert	Unama'ki Institute of Natural Resources (UINR)
Rennehan, George	NS Fixed Gear Assn. 45'-64' / MG < 65 ITQ
Sheppard, Beverly	Harbour Grace Shrimp Co. Ltd.
Smith, Sean	DFO Maritimes / PED
Themelis, Daphne	DFO Maritimes / PED
Trzcinski, Kurtis	DFO Maritimes / PED
Wilson, Scott	DFO Maritimes / PED

Appendix 2. Terms of Reference

Assessment of Atlantic Halibut on the Scotian Shelf and Southern Grand Banks (Div. 3NOPs4VWX+5Zc)
Maritimes Region Science Advisory Process

George Needler II Boardroom
Bedford Institute of Oceanography (BIO)
Dartmouth, Nova Scotia

DATES
16-17 November 2010

CHAIR
Tara McIntyre

TERMS OF REFERENCE

Context

Since the implementation of the industry initiated Halibut long line survey in 1998, halibut stock status has been largely based on catch rate trends from this survey. Recently, exploitation rate has been estimated from tagging data. A new assessment model has been developed and will be applied to Atlantic Halibut data and used to provide advice in support of the 2010 fishery.

Objectives

- Review all current removals, including surveys and commercial by-catch of Atlantic Halibut.
- Review recent catch rate and distribution trends from the Atlantic Halibut industry survey.
- Review and evaluate biological and fishery information on 3NOPs4VWX+5Zc Atlantic Halibut stock status and characterize the uncertainty of the results.
- Review the current exploitation rate using the new assessment model.
- Identify candidate reference points for 3NOPs4VWX+5Zc Atlantic Halibut and evaluate the current status of the stock in relation to these reference points.
- Evaluate the consequences of different harvest levels during the 2011/12 fishery on stock abundance and exploitation rate.

Outputs

CSAS Science Advisory Report
CSAS Proceedings of the discussion of meetings
CSAS Research Document

Participation

DFO Science
DFO FAM

Nova Scotia and New Brunswick provincial representatives
Fishing industry
Aboriginal communities / organizations
Non-Government Organizations (NGOs)

Appendix 3. Agenda

Assessment of Atlantic Halibut on the
Scotian Shelf and Southern Grand Banks (Div. 3NOPs4VWX+5Zc)
Maritimes Region Science Advisory Process

George Needler II Boardroom
Bedford Institute of Oceanography (BIO)
Dartmouth, Nova Scotia

16-17 November 2010

DRAFT AGENDA

16 November 2010 – Tuesday

9:00 – 9:15	Introduction (Chair)	
9:15 – 10:15	Presentation and review of: - all current removals, including surveys and commercial bycatch of halibut - indices of abundance - fishery and biological information	Kurtis Trzcinski
10:15 – 10:30	Break	
10:30 – 12:00	Presentation of model ▪ Methods ▪ Results - exploitation rate - estimates of fishing mortality - estimates of population abundance	Kurtis Trzcinski
12:00 – 1:00	Lunch (not provided)	
1:00 – 2:00	Continued presentation of model results and discussion	Kurtis Trzcinski
2:00 – 3:00	Presentation of tagging paper - exploitation rate from tagging data	Nell den Heyer
3:00 – 3:15	Break	
3:15 – 4:45	Presentation of proposed candidate reference points and evaluate consequences of different harvest levels during the 2011/12 fishery on stock abundance and exploitation rate.	Bob Mohn

17 November 2010 – Wednesday

9:00 – 9:15	Review of Day One (Chair)
9:15 – 10:15	Review of Science Advisory Report (SAR)
10:15 – 10:30	Break
10:30 – 12:00	Finish Review of SAR