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CERT

Comité d'évaluation des ressources transfrontalières

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TRAC

Transboundary Resource Assessment Committee

Proceedings 2004/01

Transboundary Resources Assessment Committee (TRAC)

Report of Meeting Held
15 – 17 June 2004

Hachey Conference Centre
St. Andrew's Biological Station
St. Andrew's, New Brunswick, Canada

Meeting Chairpersons

R. O'Boyle
Fisheries and Oceans Canada
Bedford Institute of Oceanography
Dartmouth, Nova Scotia
Canada

W. Overholtz
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Mass.
USA

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FOREWORD

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 mis-leading, 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 15 – 17 June 2004 in St. Andrew's, New Brunswick, Canada to review updated assessments (through 2003) of Eastern Georges Bank, Eastern Georges Bank haddock, and Georges Bank yellowtail flounder, and to consider a number of related scientific issues. Results of the meeting will be used by the Transboundary Management Guidance Committee (TMGC) in developing management guidance for the 2005 fishing year for these transboundary resources.

RESUME

Un réunion du Comité d'évaluation des ressources transfrontalières (CERT) s'est tenue du 15 au 18 juin 2004 à St. Andrew's (Nouveau-Brunswick), au Canada. On y a examiné les évaluations des stocks de morue de 5Zjm, d'aiglefin de 5Zjm et de limande à queue jaune de 5Zhjmn, et étudié diverses questions scientifiques connexes. Le Comité d'orientation de la gestion des stocks transfrontaliers (COGST) examinera les résultats de cette réunion dans le cadre de ses délibérations au sujet des activités de gestion de la pêche de 2005 dans la région transfrontalière du Canada et des États-Unis sur le banc Georges.

INTRODUCTION

TRAC Co-chairs, R. O'Boyle and W. Overholtz, welcomed participants (Appendix 1) and noted that the first TRAC meeting was held in 1998. Since then, both the TRAC process and its products have evolved (Appendix 2 describes the current process). The TRAC receives its remit and terms of reference from the Transboundary Management Guidance Committee (TMGC). The TRAC review process is two tiered; annual assessment reviews are undertaken between more intensive, periodic benchmark reviews. The initial benchmarks for Eastern Georges Bank cod, Eastern Georges Bank haddock and for Georges Bank yellowtail flounder were conducted in 1998. Subsequent benchmarks for cod and herring were performed in 2002 and 2003, respectively.

At its 2004 meeting, the TRAC has been tasked with reviewing the application of the benchmark assessment frameworks to the available fisheries and survey data (through 2003 and spring 2004, respectively) for the transboundary stocks of cod, haddock and yellowtail on Georges Bank. While comments on the performance of the frameworks are welcomed, the intent is not to change any of the frameworks at this meeting. Framework concerns will be specifically addressed at future benchmark meetings.

The Co-chairs noted that the TRAC produces three different types of documents: (1) Transboundary Stock Status Reports [TSRs]; (2) TRAC Reference [Stock Assessment] Documents; and (3) a TRAC Proceedings document [which summarizes the meeting discussions].

Participants were reminded (a) that the TRAC is a forum for scientific review; (b) that management issues would not be considered; and (c) that the TRAC deliberations and conclusions would not be finalized until the TSRs had been made public.

The Terms of Reference and Agenda for the 2004 meeting are provided in Appendices 3 and 4, respectively. The meeting adjourned ahead of schedule on 17 June, rather than on 18 June as initially planned. During the meeting, each working paper was presented by one of the authors, followed by a plenary discussion of that paper. Rapporteurs documented these discussions for the Proceedings. For yellowtail flounder, discussion also occurred on planning for a benchmark review in 2005. Potential topics to be considered in a benchmark review are listed in Appendix 5.

In preparation for this meeting, Canadian scientists met with fishermen in Yarmouth, Nova Scotia on 18 May 2004. The minutes of the May meeting are provided in Appendix 6.

5Zjm COD

Working Paper: Hunt, J.J., B. Hatt, and L. O'Brien. 2004. Population Status of Eastern Georges Bank Cod (Unit Areas 5Zj,m) for 1978 – 2005. TRAC Working Paper 2004/02.

Rapporteur: D. Clark

Presentation Highlights

Information from the 2003 Canadian and USA Eastern Georges Bank cod fisheries was presented, as well as recent DFO and NMFS research vessel survey indices of cod abundance, biomass, and population status. Reported landings of cod in 2003 from Unit Areas 5Zjm totaled 3,365 metric tons (t), an increase of about 600 t from 2002. No changes were observed in the spatial and temporal distribution of the 2003 fishery, compared to recent years. The 1998 year class at age 5 dominated (38%) the 2003 catch. Estimates of cod discards in 1996-2003 in the Canadian scallop fishery (based on scallop fishing effort) were included within the Canadian catches for the first time.

Survey indices were presented from the NMFS fall 2003 and spring 2004 surveys, and from the DFO spring 2004. Abundance indices of cod in the NMFS fall 2003 survey were much lower than those in fall 2002 (which were very high) but were similar to those seen in the recent past. The DFO spring 2004 survey index remained low and similar to that in 2003. NMFS spring 2004 survey indices were sharply higher than in 2003. In both the NMFS and DFO 2004 spring surveys, substantial numbers of small (<20 cm) cod were caught.

The assessment results indicated that the adult biomass (age 3+) had declined from 18,700 t in 2001 to 13,900 t at the beginning of 2004. Recruitment since the 1998 year class has been less than 2 million fish (at age 1) and the 2002 year class appears to be the lowest on record. Fishing mortality increased slightly in 2003 (F= 0.28) and has been above F_{ref} (=0.18) since 1995. Assuming a total catch in 2004 of 1,300 t (equal to the 2004 TAC), the catch projection indicates a combined Canada/USA yield at F_{ref} in 2005 of about 1,100 t . At this yield level, there is greater than a 50% chance of a decline in adult biomass between 2005 and 2006.

Discussion

The estimate of cod discards in 2003 by the Canadian scallop fleet is higher than indicated at the industry presentation made in Yarmouth because effort in the scallop fishery is now calculated in hours (not days), and hours fished/day increased in 2003. Discards from the scallop fleet were not included in the catch at age since the age composition of these fish has not yet been determined. Prior to 1995, cod landed by scallop gear were included. Since 1996, however, the Canadian offshore scallop fishery has not been permitted to retain cod and their cod catches have thus been discarded. Cod discard estimates for 1996-2000 were based on eight observed trips during 1994-1998, while discard estimates for 2001-2003 were based on 12 observed trips accomplished during 2001-2002. Observer coverage is required for the scallop fleet if reliable estimates are to be derived. Proper accounting of discards against quota is complicated when discards have not been included in the analysis.

The impression of the Canadian groundfish fishing industry is that catch rates of cod are fairly stable and should be indicative of improved biomass as the fleet is trying harder each year to avoid cod. This comment was made by both fixed and mobile gear.

Weights-at-age of cod in the DFO spring surveys have been low since about 1990. The reasons for this are not clear, but ageing does not appear to be a problem. Weights-at-age increased in the 2003 and 2004 surveys (although this was not reflected in the figure shown during the meeting). However, the average weight of age 1 in the 2004 survey was very low. This may reflect fall-spawned cod, but could also be due to late spring spawning in 2003. Bimodality in length is uncommon in age groups 1 and 2, and fall spawning (if it occurs at all) is usually not significant.

The mean date of the DFO survey has become earlier in recent years and the 2004 survey was the earliest in the time series. A corresponding trend in cod maturity was observed in the survey data. The impact that this might have on condition factor was discussed but the trend in mean maturity stage does not appear to have influenced condition factor.

The distribution of cod catches in the DFO survey was discussed in detail. No standard metric of distribution is included in the assessment. Subjectively, the distribution of cod catches in the 2004 survey is not inconsistent with past years; however, large catches seemed to have occurred farther east and south than in the 'average' distribution. No survey hauls were made in 2004 made in one area that traditionally has had high catch rates; however, it is not clear if that high average density region had been heavily influenced by a single large tow. A suggestion was made that 10 years should be the minimum time period for determining background distributions. Differences in age-specific spatial distributions were mentioned as possible confounding factors.

The 2004 NMFS spring survey catch per tow index was much higher than recent spring survey indices. This was due to several above-average tows spread across strata. No sensitivity analysis was conducted to determine the impact of the high survey index (unlike that done when a single large tow resulted in a high survey value in the NMFS fall 2003 survey). However, the high spring 2004 index may still reflect a year effect, as catch-at-age values increased for many age groups in the 2004 survey.

With respect to the use of expanding symbol plots of survey catch, it was recommended that (in the future) the area of the circle - rather than the diameter - be indicative of abundance so as to provide for a more intuitive and understandable visual effect.

The 2003 year class at age 1 was abundant in both the NMFS spring and DFO surveys, and appears similar in strength to the 1985 and 1990 year classes at age 1. Despite the low weight-at-age of the 2003 cohort, it was decided that some discussion of the potential impact of this year class on biomass trajectory should be included in the stock status outlook.

Commercial fishery catch rates have been quite stable in recent years. It was suggested that fleet catch rates be presented and compared to fishable biomass values to assess whether the rates can be considered as indicative of abundance.

The longline survey catch index (catch/1500 hooks) declined in 2003 to the 2001 level from a high in 2002. The longline index does not include all boxes fished, only some standard set of boxes, consistent with the protocol determined in the benchmark. The impression of industry was that there was little, if any, decline in survey catches of cod between 2002 and 2003. Some boxes fished in 2003 (with good cod catches) were not included in the standard set. Some follow-up with survey participants is warranted.

As with the commercial catch rates, it was recommended that in the future a plot be provided comparing cod catch rates with the longline survey indices (along with the research vessel survey indices) to show whether the data reflect consistent trends.

The ADAPT VPA residuals are primarily positive in recent years for age groups 3-5, but negative in earlier years. An obvious retrospective pattern is not evident, except in age 1 recruitment, which tends to be initially underestimated. The two recruitment retrospective plots appeared inconsistent and were subsequently checked, thereby resolving the apparent discrepancy.

The magnitude and protocol for bias adjustments was discussed. The bias adjustment is consistent with the benchmark formulation. The bias adjustment is made in the terminal year population numbers, and the VPA run back using catch and M (assumed 0.2). The bias adjustments were not considered substantial.

The forecasted decline in adult biomass between 2005 and 2006 is based on the assumption that the 2003 year class is relatively small. This assumption should be noted, given that the 2004 survey indices of this cohort (at age 1) suggest that this year class may be average or better. For medium-term projections, it was proposed that the average recruitment level during the last decade be used. This is consistent with the existing period of low recruitment and low adult biomass. Concern was raised about using an average because there appears to be a downward trend in recruitment during the last decade, but the 2003 year class presently appears to be large. The decadal recruitment average was selected as the best resolution.

The probability of 10% and 20% biomass increases in 2006 need to be included in the probability plot. The current analyses suggest that these probabilities are very low.

The age 2 stock size estimate in the terminal year has a very high error, is poorly resolved, and has a large impact on the projections. It is clearly a small year class, as reflected in the surveys, but how low is not well determined.

5Zjm HADDOCK

Working Paper: Van Eeckhaute, L., and J. Brodziak. 2004. Assessment of Haddock on Eastern Georges Bank. TRAC Working Paper 2004/03.

Rapporteur: S. Gavaris

Presentation Highlights

The combined Canada/USA catch in 2003 was 8,431 t, about a 1,000 t more than in 2001 or 2002. Catches used in the assessment now include estimated discards of haddock in the Canadian sea scallop fishery during 1996 to 2003. The discards were estimated using data from observed scallop trips, combined with effort data from the scallop fishery. Prior to 1996, the scallop fishery was allowed to land all groundfish species.

The Canadian catch in 2003 was 6,789 t, a slight (approximately 200 t) increase from 2002. The USA catch in 2003 was 1,564 t, 650 t higher than in 2002. Nearly all of the USA catch was taken by otter trawl vessels. Otter trawlers also accounted for the highest portion of the Canadian landings, although longline catches were substantial. Canadian gillnetters caught few haddock.

The Canadian catch at age for 2003 was developed using samples from both port and at-sea observers. USA length and age sampling improved in 2003 over recent years, but additional lengths from adjacent areas were used to augment the length frequency distributions. Age-length keys for the first quarter were augmented using DFO survey data and Canadian fishery ages were used to augment the sample data from the second, third and fourth quarters.

Within-reader ageing tests for the DFO reader showed good agreement, but some differences were detected in DFO versus NMFS age readings. However, since the overall agreement was satisfactory, it was felt that these differences would not adversely affect the assessment results. Tracking of good year classes was consistent in the catch-at-age matrices of the two countries, thereby supporting this assumption.

All survey indices indicated an outstanding 2003 year class, comparable in strength to the 1963 year class. The 2003 year class at age 0 was widely distributed throughout the 5Zjm survey area, consistent with the historic distribution of other large year classes. In recent years, weights-at-age showed a declining trend for older ages. A slight decline in condition factor has also been observed for larger haddock.

Using the ADAPT framework, a VPA analysis of the catch at age was conducted and calibrated with the three research survey series. Bootstrap bias adjustments were then made to the parameter estimates. No retrospective trends were apparent. The results were consistent with those in previous assessments and accepted by the Committee.

Fishing mortality in 2003 (F_{2003} = 0.16) remained below F_{ref} (= 0.26) and the population age structure includes a good representation of older fish, although the stock is clearly dominated by

the very strong 2003 year class. Adult biomass (ages 3+) at the beginning of 2004 was 76,000 t, the highest in 30 years, and well within the range observed during 1931 to 1955 when the stock was more productive. A risk projection to determine probabilities for the 2005 catch was performed as well as a medium forecast to the beginning of 2009. Assuming that the combined USA/Canada TAC of 15,000 t is caught in 2004, a total TAC of 26,000 t in 2005 would result in a neutral risk (50%) that the fishing mortality rate in 2005 will exceed F_{ref}. A 2005 catch of 23,000 t would result in a lower risk (approximately 25%) of exceeding F_{ref}. In the medium term projections, assuming $F= F_{ref}$ and average annual recruitment, catches in 2006 and 2007 increase substantially (96,000 t and 177,000 t, respectively) - as does adult biomass (500,000 t in 2006 and 550,000 in 2007) - due to the outstanding 2003 year class (905 million fish at age 1). A robust regression analysis was used to predict the strength of the 2003 year class using survey indices and VPA estimates of age-1 abundance during 1969-2002. This analysis confirmed that the 2003 year class is exceptional, although its magnitude may be somewhat lower than the VPA estimate.

Discussion

USA catches in 2003 were 1,564 t (approximately 19% of the total 2003 catch of 8,431 t), about 50% higher than in 2002. Sampling of the USA catch improved in 2003 but still remained low. Therefore, age length keys from the DFO survey and 2003 Canadian fishery were used to augment age length keys from the USA fishery. The 2003 fishery catch-at-age matrix was not directly compared to the projection from the previous assessment, but was considered as qualitatively consistent. The 2000 and 1998 year classes dominated the 2003 catch, although the 2000 year class was not as well represented in the USA fishery as in the Canadian fishery. This was attributed to the seasonality of the USA fishery, in which most of the catch occurred during the first half of the year.

In previous haddock assessments, large discarding events have been accounted for when they have occurred. In recent years, discarding by the USA and Canadian groundfish fisheries has been considered to be at low background levels and has therefore not been estimated. The Canadian sea scallop fishery catches small amounts of haddock that until 1995 were reported in the landings. Since 1996, the Canadian scallop fishery has not been permitted to retain haddock, and thus haddock have been discarded. Annual estimates of these discards during 1996-2003 were provided this year, but were not incorporated in the assessment prompting a question about whether/when discard estimates would be fully utilized. In the future, the size composition of these discards will be investigated to potentially allow the incorporation of the discard data into the catch-at-age and the assessment. However, given the relatively low estimates of haddock discards in the Canadian sea scallop fishery, it is not anticipated that the inclusion of these discards will substantially alter the assessment. It will be important however, to monitor for discards as the exceptional 2003 year class recruits to the fisheries. Measures should be taken to avoid waste of this year class by discarding.

Weights-at-age in both the catches and surveys have declined in recent years. However, examination of weight-at-length data showed only a modest reduction in condition factor. It was therefore recommended that the trends in length at age be investigated, as well as any associations with population abundance. An anomaly in weight-at-age that occurred during the

1990s had been attributed to the faster growing 1989-1991 year classes and was subsequently confirmed as a year class effect. It was noted that the flesh of the fish appeared firmer in the June 2004 Canadian fishery catch and it was speculated that this might be due to later spawning of haddock in 2004. When maturity data from the NMFS spring survey become available, this hypothesis could be examined.

Canadian commercial CPUE data were reported but not used as an index of abundance due to changes in fishing practices associated with changes in TACs and management measures. The Canadian CPUE index is based on a selected subset of vessels but the recent stability in the index is not consistent with some fisherman's experience. As such, the subset of vessels should be examined to determine if it is representative of the current fleet.

The calibration of the VPA followed the established framework. As in previous assessments, F for age 8 was calculated as the population weighted average for ages 4-7 (in the 4^{th} quarter of each year as the VPA was conducted using quarterly catch at age data). A "flat topped" partial recruitment pattern was observed for haddock versus a "domed-shaped' pattern observed for cod. A rationale was requested. Haddock growth tends to slow down at older ages and adult haddock of all ages appear to be congregated. Cod growth tends to continue at older ages; larger, older cod are available to be caught by the winter fishery but do not appear to be available to the summer fishery. These growth and behavioral patterns may contribute to differences in fishery selectivity and availability between cod and haddock.

The calibration framework does not apply any weighting to the indices, although this has been investigated in earlier assessments. It was suggested that weighting of indices might be examined again during the next haddock benchmark review.

The calibration framework derives risk analyses and confidence intervals (CIs) using a bias-corrected percentile bootstrap technique. For consistency, the VPA point estimates are calculated from the bias adjusted terminal year population estimates. The magnitude of the bias correction on the 4+ F was requested.

The three survey indices of the 2003 year classes are the largest in each series. As these are outside the range of past observations, concern was expressed about the robustness of the assumed proportional calibration relationship between the indices and VPA stock size estimates. Furthermore, the abundance estimate of the 2003 year class is very imprecise. Independent investigations confirmed that this year class is very strong, but its magnitude may be somewhat smaller than the VPA estimate. Some caution should therefore be considered when evaluating the catch projections and risk analyses. The high survival of larvae and juveniles in 2003 may have been associated with a west to southwestward wind stress occurring during the spawning season. On the Scotian Shelf, recent strong haddock recruitment has been linked to plankton abundance.

It was agreed that the projections should be revised using the average partial recruitment pattern observed during 1999-2003. Recruitment over the previous decade (excluding the 2003 year class) has averaged about 20 million fish at age 1. Biomass has been increasing and is now in a new stanza where recruitment has averaged about 40 million at age 1. Medium term projections

were therefore performed assuming both the 20 million and 40 million average recruitment options.

5Zhjmn YELLOWTAIL

Assessment Reviews

Working Paper: Legault, C.M., and H.H. Stone. 2004. Stock Assessment of Georges Bank (5Zhjmn) Yellowtail Flounder for 2004. TRAC Working Paper 2004/05.

Rapporteur: J. Neilson

Presentation Highlights

Input data for the assessment of Georges Bank yellowtail flounder were reviewed and information presented on both the Canadian and USA commercial fisheries in 2003 (*e.g.* spatial/temporal patterns, landings, size composition, port and at-sea sampling results, number- and weight-at-age, etc.). New information was presented on the estimation of yellowtail discards in the Canadian offshore scallop fishery during 1996-2003 based on bycatch ratios calculated from observed trips prorated by scallop effort data. However, the discard estimates were not included in the Canadian yellowtail flounder catch-at-age owing to a lack of information on the size composition of the discards. The Canadian fishery in 2003 harvested yellowtail primarily in the 33-44 cm length range, while the USA fishery proportionately captured more large fish (33-52 cm). Age 3 and 4 fish (2000 and 1999 year classes) dominated the US catches (accounting by number for 38% and 27%, respectively, of the US total), while age 2 and 3 fish (2001 and 2000 cohorts) dominated the Canadian catches (accounting for 38% and 42%, respectively, of the Canadian total). Although not used in VPA calibration, a standardized catch rate series for Canadian mobile gear was updated and compared to the DFO spring survey biomass index for stratum 5Z2 (*i.e.*, for the Canadian portion of the Bank < 90 m). Canadian mobile gear catch rates markedly declined in 2000 and 2001, and remained low through 2002 and 2003.

Yellowtail flounder abundance and biomass indices from the DFO and NMFS research vessel surveys were presented and discussed along with the spatial distribution of survey catches and survey size compositions by sex and survey strata. All three surveys indicated an increase in abundance from 1995 to 2002 and a decline afterwards, with the DFO and NMFS spring surveys showing further declines in 2004. The 2000 year class (age 3) was dominant in the 2003 DFO/NMFS spring surveys, but was much less prominent at age 4 in the 2004 spring surveys. The 2001 year class at age 2 was dominant in the NMFS 2003 fall series and also at age 3 in the 2004 DFO and NMFS spring surveys. The 2003 NMFS sea scallop survey index of yellowtail flounder showed a slight decline in the abundance of age 1 yellowtail.

The VPA (ADAPT) and surplus production model (ASPIC) formulations were the same as in the 2003 assessment. Sensitivity analyses were conducted using the VPA and an alternative forward projecting age-based model (ASAP). The sensitivity analysis results were intermediate between the current low abundance indicated by ADAPT and the high abundance indicated by ASPIC.

Retrospective analyses updated with the ADAPT results indicated a more pronounced retrospective pattern than in previous assessments and showed a strong tendency to underestimate F on ages 4-5 and to overestimate spawning stock biomass (SSB) and age 1 recruitment. The impact of this pattern on abundance and F was consistent back to 1994. The trajectories of F, SSB and recruitment are now considerably different than those from recent assessments beginning in 2001. Large negative residuals were associated with the 2004 DFO and NMFS spring survey indices (ages 1-6+) and the NMFS 2003 fall survey indices (ages 4-6+). Concern was expressed that these residuals significantly affect estimates of current abundance.

Overall, the 2004 assessment indicates lower abundance and higher Fs for the same age groups than the results from the 2003 assessment. Age 1+ VPA population biomass at the beginning of 2004 (24,000 t) was at a lower level than predicted last year (42,000 t) and considerably lower than the total biomass estimated from the surplus production model (70,000 t). Similarly, the estimated spawning stock biomass in 2003 (16,000 t) is much less than predicted last year (32,000 t). Although recruitment has improved relative to the mid-1990s, with several good year classes since 1996, current estimates of year class strengths are much lower than last year. The 1997 year class is now estimated to be of only moderate strength (age 1 abundance of 22 million *vs.* 28 million in the 2003 assessment and 59 million in the 2002 assessment) and the 2001 year class (the strongest since the 1980 cohort) is now estimated to be 35 million fish at age 1 (*vs.* 44 million fish in the 2003 assessment). The proportion of older fish (ages 4+) in the population has increased only very slightly and younger fish (ages 1 and 2) still predominate. This scenario is inconsistent with the perception of recent low exploitation. However, fishing mortality since 1994 on fully recruited age groups (age 4+) is now higher than previously estimated and has not been below F_{ref} (= 0.25) since at least 1973. F on age 3 has not decreased proportionately and is currently at a level higher than F_{ref}. Assuming that the 2004 total TAC (7,900 t) is harvested, that recruitment in 2004 and 2005 is equal to the recent 5-year average (27 million fish at age 1), and that the selectivity pattern in the 2005 fishery is equal to the recent 5-year average, the combined Canada/USA 2005 catch at F_{ref} would be about 4,000 t. Under this scenario, adult (age 3+) biomass is expected to increase from 16,000 t in 2004 to 21,000 t in 2006. Alternative assessment models using different fishery selectivity assumptions forecast a higher 2005 TAC than 4,000 t, but not as high as the 2004 TAC (7,900 t). If the retrospective pattern observed in the VPA continues and reflect the true situation, the estimated 2005 catch quota of about 4,000 t will generate a higher fishing mortality rate than the target of F_{ref}.

Working Paper: Applegate, A.J. 2004. Is a Flat-Topped Partial Recruitment Vector the Appropriate Assumption for Georges Bank Yellowtail Flounder? TRAC Working Paper 2004/07.

Rapporteur: J. Neilson

Presentation Highlights

The spatial distribution (by size and age) of yellowtail flounder in US spring and fall bottom trawl surveys was examined to investigate a potential source of the strong retrospective pattern in the ADAPT VPA, which assumes a flat-topped selection pattern in the commercial fishery. Due to the two year-round USA closed areas on Georges Bank and the relatively localized movements of yellowtail flounder, a dome-shaped selection pattern could emerge due to age-specific differences in vulnerability to fishing.

Survey catches were post-stratified and analyzed by 10 km bands surrounding the boundaries of Closed Area I and Closed Area II, both implemented year-round in December 1994. The survey catches were also classified by time period, before (1968-1993 spring, 1963-1993 fall) and after (1996 – 2003) enactment of the closures. Data from 1994 and 1995 were excluded to reduce the influence of the transition.

Based on fall survey data, the mean size of yellowtail flounder inside the Closed Areas increased about seven cm (equivalent to an increase in age from two to four years old) since the closures have been in place (*i.e.*, between 1996 and 2003). Outside the closed areas, the mean size of yellowtail since 1996 has been nearly identical as before the closures. Ratios of survey swept area abundance, by age, for areas open to fishing suggest a dome-shaped selection pattern (peaking at age 3) in the fall.

Based on spring survey data, only a one cm increase in mean size of yellowtail has occurred inside the closed areas since 1996. Larger yellowtail flounder occurred inside the Closed Areas both before (1968-1993) and after (1996-2003) the closed areas were enacted. Spring survey swept area abundance estimates indicate a flat-topped selectivity pattern. More analyses are needed to understand the effect of the seasonal change in vulnerability by age, which may partially contribute to the retrospective pattern.

Discussion on Both Working Papers

The estimated discards of yellowtail flounder in the Canadian scallop fishery are high compared with those in the USA sea scallop fishery. Comparability of the Canadian gear rigging was discussed and it was noted that the USA sea scallop fleet uses a larger mesh "twine-top" than does the Canadian fleet.

The percentage of trips covered by observers in the Canadian sea scallop fishery was discussed. One trip per month was observed, but overall, the percent coverage was quite low. It was pointed out that the strengths of the conclusions concerning discarded amounts are based on the coverage. Biased coverage was raised as a possibility, and a question was posed on how

observers were assigned to trips. The possibility of an "observer effect" was noted. Only 18 observed trips are available between 1994 and 2002, so data are very sparse with respect to conducting detailed analyses.

Given the uncertainties in the catch, the issue was raised as to how discards might best be accounted for in future assessments? It was noted that there is a need to decompose the uncertainties into random and systematic sources, and models could account for random aspects (for example, allow for error in catch in age). For systematic sources, it was suggested to obtain estimates if at all possible. In this regard, the TRAC recommendation for consistent and credible observer coverage of the scallop fishery may help. Within the Canadian system, commercial catches are reasonably well reported and it is assumed that no systematic biases exist.

Regarding sampling, a question was asked if differences in fishery catch at size between Canada and the USA could be attributed to differences in the sex composition of the catches. This issue was not resolved, but the possibility could not be dismissed. The difference in the size composition between the two countries was noted last year as well. Yellowtail may be somewhat more mobile than previously appreciated, but age and sex related aspects of yellowtail movement are not yet well understood. Industry representatives noted differences in sex composition of the catch as the fishing season progresses. Trends in weight-at-age were observed in the Canadian fishery (increasing since late 1990s), particularly at older ages. This trend in weight-at-age was not reflected in another figure showing length-at-age, but it was noted that the source of the information shown in the two figures was not the same. The desirability of examining similar data from the research vessel surveys was highlighted. It was also requested that changes in weight-at-age be depicted on a proportional basis. Finally, it was observed that the large change in weight-at-age for the oldest age groups may reflect that older fish are now building up the plus group.

Participants then focused on the research survey information, and noted that noisy data prevent easy tracking of cohorts. Positive signals from surveys do not follow the sequential pattern expected from cohorts passing through a population, and year effects can explain recent increases as readily as the passage of strong cohorts. However, various participants noted that the heterogeneous distribution of yellowtail flounder, even during times of high abundance, causes the survey indices to be noisy relative to other species. The absence of older fish in all three surveys was noted (absolute magnitude). In the NMFS surveys where sampling intensity is often low, it may not be advisable to examine year-by-year results closely for coherence of strong or weak cohorts. However, even within the DFO survey series there is no indication of an increase in older ages. This is inconsistent with the view that the abundance of older fish is increasing. It seems as if the consistency of cohorts cannot generally be well established from the available age-specific survey indices.

A question was raised about whether the USA fishery has changed its distribution. In reply, it was noted that the USA fishery distribution has been stable since 1994. As such, the increased number of large fish in US catches cannot be attributed to changes in the spatial/temporal distribution of the USA fishery.

The relative contribution of survey strata was raised as a key point. Currently, NMFS stratum 16 contributes to the bulk of the overall stock index. Implications on estimates of resource distribution used for the USA/Canada sharing agreement were briefly discussed, and the possibility of modifying survey tow allocations within strata was raised.

Adequacy of the population models was discussed. ASPIC results seemed problematic, with many model iterations failing to converge. Meeting participants gave less weight to ASPIC noting that it may be a few years before this simple two parameter model captures recent declines in the available indices. In considering other alternative models, it is important to evaluate the consequences of model formulations that assume higher abundance of older age groups (*i.e.,* dome-shaped availability). Consistency with survey results was suggested as a useful topic for the 2005 benchmark assessment.

The retrospective pattern in fishing mortality was discussed. It was noted that the retrospective pattern only goes back six years and a question was asked if a longer series would give a different impression. Work completed during the discussion suggested that the pattern is not consistent further back in time. Possible reasons offered for the retrospective pattern were fairly substantial discarding and closed area effects. It was noted that the magnitude of biomass decline was such that discarding is not likely to be a complete explanation.

Considering the range of options available, it was noted that the ADAPT approach (flat partial recruitment) is not the most pessimistic plausible formulation, given the serious retrospective problem. However, it was also noted that the available data do not well support the assumption of flat-topped partial recruitment. Evidence for domed-shaped selectivity was extensively discussed. It was agreed that while the evidence either way is equivocal, imposition of Closed Area II may have had significant impacts on fishery availability and may have contributed to a dome-shaped partial recruitment pattern.

Given the range in assessment and projection results, the meeting participants considered how best to proceed. ASPIC projections were rejected because the TRAC has in previous years discounted the results of projections using this method. Discussions focused on ASAP and ADAPT results. The standard VPA projection model indicates a yield of about 4000 t in 2005 fishing at F_{ref} and alternative models giving TACs in 2005 ranging as high as 7000 t. A reasonable upper bound is similar to the catch last year and possibly as low as 4000 t. While there is a lot of uncertainty concerning the 4000 t level, plausible model options generally indicated that the fishery removals should be less than the 2003 removals.

It was concluded that assessment uncertainties did not justify inclusion of the plot showing projection risk analyses in the status report. There is, however, a need to highlight the retrospective problem that is apparent in the analyses.

It was noted that the current assessment models are constrained by the last benchmark completed for this resource, and such approaches now appear to require revision in the next benchmark scheduled for 2004/2005 (see below).

Planning for Yellowtail Flounder Assessment Framework Review

Rapporteur: C. Legault

Discussion regarding the upcoming benchmark assessment for yellowtail flounder consisted of two parts. The first part was a partial listing of topics that should be covered. It was agreed that the principal scientists from both countries would collaborate to produce a complete list of topics, ranked by order of importance. The second part of the discussion focused on procedural issues, particularly the number and timing of meetings. It was agreed that two meetings should occur for the benchmark assessment. The first meeting would be held in the fall of 2004 and focus on data issues. The second meeting would be held in the spring of 2005 (prior to the TRAC assessment meeting) and focus on modeling issues. Given the number of meetings that participants are involved in, consideration was made for having the first meeting via conference call (although this was not a final decision). The model formulation agreed upon at the second benchmark meeting will be applied in the 2005 TRAC assessment.

SURVEY BIOMASS DISTRIBUTION

Working Paper: Murawski, S., and S. Gavaris. 2004. Computation of Allocation Shares for Canada and USA of Cod, Haddock and Yellowtail Flounder on Georges Bank. TRAC Working Paper 2004/01.

Rapporteur: L. O'Brien

Presentation Highlights

Development of consistent management by Canada and USA for the transboundary resources of cod, haddock and yellowtail flounder on Georges Bank led to a sharing allocation proposal. The proposal was founded on agreement about the management units, the principles upon which allocation shares would be determined, and the computational formulae. It was agreed that for the purpose of developing a sharing proposal, the management unit for cod and haddock would be limited to only the eastern portion of Georges Bank and the management unit for yellowtail flounder would comprise the entire Georges Bank east of the Great South Channel. Two principles were incorporated in the sharing proposal. It was affirmed that fishermen are entitled to the resources that occur in their nation's respective waters and recognition was given to traditional involvement and investment in development of a fishery. Computational formulae that account for historical utilization and that adapt to shifts in resource distribution were developed, with a phase-in period for increasing weight being attributed to resource distribution. The resource utilization was based on reported landings for the period 1967-1994. Resource distribution is determined by using a smoothing procedure on the NMFS and DFO survey results and is updated annually.

Discussion

The working paper was presented to the TRAC to document the allocation procedure as agreed upon by the TMGC, to formally present the methodology of the procedure to the TRAC, and to

present the most current data used in determining the 2005 fishing year allocations.

The catch taken by the distant water fleets (DWF) in the 1960s and 1970s was not considered in the calculation of resource utilization by the USA and Canada during 1967-1994. The spatial distribution of the DWF catch would provide an estimate of the loss of production of each of the stocks to both the USA and Canada. The DWF catch could potentially be partitioned to either country; however, the detailed catch locations are not readily available, although some information is available in diaries maintained by the Russian fleet.

Only total biomass removals were considered when setting the utilization ratio. Fishing practices of each country were not considered, although both countries have been using similar mesh sizes since 1967. Discards were not considered either, as this would be giving credit for not landing fish.

The TMGC discussed several different time periods for determining resource utilization. The compromise was the period 1967-1994. Landings taken since the Hague Line was enacted in October 1984 were included. However, the USA was not penalized for lower landings as a result of the implementation of Closed Areas I and II in December 1994.

The TMGC considered several methods to account for fluctuations and sampling variation in the annual estimate of total biomass removals for each of the three transboundary groundfish stocks. Time series models were not used due to a lack of a time pattern in the data, and regression models were not selected because the analysis would impose a model on the data. LOESS smoothing was applied because no assumption needs to be made about trends in the data. The smoothing was done on the annual average rather than on the individual surveys, which are highly variable and would have required potentially different transformations for each survey.

By using the percentage of biomass captured on either side of the boundary line by each of the surveys, the issue of differences in gear selectivity was avoided.

Although the most recent DFO and NMFS spring survey data are now available, they cannot be used because the technique is based on the average of all 3 annual surveys. This is not an issue, since the addition of one survey would not substantially change the smoothed estimate.

SPECIES COMPOSITION IN CANADIAN FISHERIES

Working Paper: Van Eeckhaute, L., and S. Gavaris. 2004. Determination of Discards of Georges Bank Cod from Species Composition Comparison. TRAC Working Paper 2004/04.

Rapporteur: Jon Brodziak

Presentation Highlights

Allusions to discarding of cod in the traditional groundfish fisheries on Georges Bank continue to exist, despite the use of a variety of techniques by the Canadian fleet (including gear modification and alteration of fishing locations) to achieve an appropriate species mix in the catch. To detect discarding and to determine the total catch of cod, species comparison (ratio of cod to haddock plus pollock) were compared between unobserved landings and landings from trips where an observer was on board. Factors expected to affect the species composition include fishing ground location, season and fleet. Species composition showed great variability, but persistent effects for zone, quarter and fleet were detected. A landings multiplier (defined as the ratio of the observed species composition to the unobserved species composition) is needed to multiply the unobserved landings to obtain the total catch of cod. While location, season and fleet affected the species composition, the landings multiplier, which reflects discarding practices, did not exhibit persistent patterns for either location or season. Accordingly, annual fleet specific multipliers for longliners and otter trawlers less than 65 feet were derived using an ANOVA on ln species composition and assuming a multiplicative process. As the landings multipliers for longliners fluctuated around unity (1.0), discarding could not be detected. The landings multipliers for otter trawlers were about 1.5 in 1997, 1998 and 1999, suggesting that substantial discarding had occurred in those years, but since 2000 the multiplier has fluctuated around 1.0.

Discussion

This working paper described an approach using species composition to estimate potential discards on unobserved fishing trips in the Canadian groundfish fishery where cod and haddock are caught together. In this approach, it is assumed that differences in species composition between observed and unobserved trips reflect the magnitude of unobserved discards. It was noted that catchabilities of both cod and haddock differ by fishing fleet (gear sector) and that both species are not necessarily caught in proportion to abundance. Given increasing haddock TACs and decreasing cod TACs in recent years, the relative importance of discarding has probably changed in recent years.

In general, species composition of fishery catches are affected by fishing grounds, season, and fishing fleet. Fishing fleets that harvest cod and haddock can differ in fishing gear, tonnage class, and also whether vessels participate in the Canadian temporary vessel replacement program (TVRP). Under this program, fishing vessels can have a different quota share and species mix.

Fishery catch and observer data were analyzed from 1995-2002, by quarter. Fishing trips were aggregated into five zones (A-E) on eastern Georges Bank. Trips with either no catch of cod, or no catch of haddock and pollock, were excluded from the analyses to eliminate irrelevant data. In addition, trips with small catches of cod, haddock, and pollock (total of less than 1 t) were excluded because these trips exhibit high variation in species composition.

Exploratory analyses were conducted to investigate patterns in species composition. Box-whisker plots of ratios of cod to haddock and pollock catches were compared between observed and unobserved trips to detect differences or discrepancies between observed and unobserved trips and evaluate heterogeneity. Trip data were stratified into distinct spatio-temporal cells; some cells had missing data. One conclusion of the exploratory analyses was that species composition is highly variable. However, it was apparent that almost all cod were caught in zones A and B. These zones had the highest observer coverage. In contrast, very little cod was caught in the directed pollock fishery. There was higher observer coverage on otter trawl vessels over 65 ft versus under 65 ft, and the gillnet fleet had inadequate observer coverage. Observer coverage in 1995 was inadequate and non-representative, and thus this year was excluded from subsequent analyses.

An ANOVA was conducted on otter trawl and longline data from zones A and B for 1996-2002. The goal was to estimate a landings multiplier (M) that could be used to calculate discards for each fishery component and area, assuming the multiplier was significantly different from unity (1.0). Positive ratios were judged to be significant if the 68% confidence interval about the landings multiplier did not include 1. An initial ANOVA analysis was conducted on log-transformed data using fleet, zone, and compound factors (zone*quarter), and indicated that the factors of source and zone*quarter had a significant effect on species composition. The ratio of cod to haddock plus pollock was found to be higher in the shallow water in zone B and non-TVRP vessels also had a higher ratio. Based on the estimated cod landings multiplier, a TVRP effect could not be detected. This suggested that the TVRP and non-TVRP data should be pooled. Similarly, no difference was detected between otter trawl tonnage classes 1 and 2 versus tonnage class 3. This suggested that the data could be pooled across tonnage classes. No patterns were discernable by quarter and zone, and evidence for discarding after 1999 was weak (M was not significantly different from unity).

A second multiplicative analysis was conducted on the pooled data to estimate landings multipliers. For longline vessels there was no evidence of discarding, as the multiplier was not significantly different from unity. For otter trawl vessels discarding was detected during 1997-1999, but estimated landings multipliers were not significantly different from unity during 1996 and 2000-2002. Cod discards were estimated to be 428 t, 273 t, and 253 t in 1997, 1998 and 1999, respectively. Overall, the analysis showed that there was great variability in species composition due to many factors. It was also concluded that with 10% observer coverage, there was a limited ability to stratify the data and that low sample sizes may produce unreliable discard estimates.

The TRAC discussed the analysis and offered several comments. Given that Canadian fishery regulations do not allow discarding, there was a general discussion as to the most cost effective way to monitor the fisheries. It was suggested that targeting methods to improve coverage would

be positive. While it appeared that species composition ratios differed between observed and unobserved trips, it was suggested that the composition could change due to many factors, including discarding. The method assumes that positive differences imply discarding, while inherent variation could lead to both positive and negative differences. Having an observer onboard may also affect where a vessel fishes on a trip. It was suggested that nonparametric methods might be applied to provide a check on the robustness of results. The next step in the process of incorporating cod discards into the assessment is to evaluate the size composition of discards so that these can be added to the catch-at-age.

AGEING STUDIES

Working Paper: Stone, H.H., P. Perley, and S. Gavaris. 2004. Ageing Studies on Georges Bank Yellowtail Flounder with an Example of the Iterative Age Length Key Method Applied to NMFS Survey Ages. TRAC Working Paper 2004/06.

Rapporteur: L. Van Eeckhaute

Presentation Highlights

After a brief review of the conclusions from earlier studies on the age estimation of Georges Bank yellowtail flounder using otolith thin sections (described in CSAS Res. Doc 2002/076), results were presented from more recent studies comparing age interpretations within and between labs (DFO, NMFS,CEFAS) from stained otolith sections and from scales and otolith sections from the same fish. Although staining may improve the clarity of some growth rings, it is not very helpful for age determination. The staining plus smooth cuts made by the CEFAS Accutom cutting machine enhances the appearance of splits and checks in the otolith section and may lead to overageing. Agreement between NMFS and DFO age readers was lower than in 2002 and reflects the poor clarity of marks and resultant subjectivity in determining ages from otolith sections and scales. Failure to achieve good agreement between labs when different structures are used (*i.e.*, scales by NMFS, thin sections by DFO) results from differences in the interpretation of growth patterns in these structures. Without age validation to provide age confirmation for otolith sections, there is no way of knowing whether the age interpretations are correct. Agreement between age readings for the primary DFO ager was 61% for all ages, and 68-73% for ages 1-4. Whether this is acceptable for assessment purposes remains to be determined. There was higher within lab agreement for the more experienced NMFS ager.

An alternative approach for generating survey abundance indices was examined using the iterative age length key (IALK) method of Kimura and Chikuni. This method combines an age length key and distribution mixture methods for resolution of lengths to ages. In the first step, mean age at length and mean length at age were examined to determine consistency in age interpretation across years in the NMFS spring and fall surveys. Following this, growth templates were developed for ages 1-6+ using combined survey abundance at length, by age, for 1999-2003. The growth templates were then iteratively used to generate age-length keys, which then were applied to abundance at length data from the 1999-2003 surveys to generate age-specific indices. Compared to the standard age-length keys, the IALK method resulted in higher

levels of abundance for age groups 5 and 6+ in the NMFS and DFO spring surveys. This scenario would be expected when exploitation is low, as reduced fishing mortality should result in an increase in the abundance of older fish. The IALK method applied to NMFS fall survey also generated higher levels of abundance for age groups 5 and 6+ for 2003 compared to the conventional ALK, but there was a problem fitting the growth template to the catch at size, with age 4 showing a sharp decline in 2000. The low numbers of fish at 45 cm in the 2000 fall survey results in fewer fish at age 4 and more at age 5 when the IALK is applied. The fall survey growth template also showed considerable overlap between ages 3-5, which may be difficult to separate out using the IALK method. Fall survey abundance at length data are quite variable due to low sample sizes, and possibly more difficult to fit to the growth template.

It is not clear if the IALK approach will be a viable option for generating reliable age-specific abundance indices from the surveys. There is a need to explore smoothing of the growth template by either using more years of survey data (*i.e.,* extend back further than 1999) or applying a LOESS method. Alternatively, one could also look at a growth templates based on all surveys combined to track seasonal progression of growth

Discussion

The iterative approach was supported as a robust method suited to the type of situation observed for yellowtail. The method allows pooling of several years of length-at-age data to obtain a growth template. A more modern approach suggested was the use of the 'stock synthesis' method. However, some views were expressed that the resolution of length composition to age composition was best done outside the calibration model. These options were briefly discussed and could be explored for the benchmark assessment. Although other issues that need to be pursued for the benchmark assessment (*e.g.*, spatial aspects), ageing error could be fairly easily modelled and should be examined.

Although there were significant differences in age readings between labs, within lab differences in ageing of yellowtail were low and suggest a potential for ageing to be performed at the St. Andrew's Biological Station. Validation of ageing data for this species is very desirable (there is currently some validation of scale ages, but nothing for otoliths). One of the objectives of the NMFS cooperative yellowtail tagging project is to validate ageing. The lower agreement between labs suggests that interpretation of ageing structures is not consistent.

It was noted that a significant trend exists in mean length-at-age for yellowtail and that this should be investigated more closely and mentioned in the research document.

The iterative ALK method could be pursued further for the benchmark assessment. The option to increase the number of ages in the plus group (*e.g.*, from 6+ to 4+) may not solve the ageing issues in the assessment as difficulties still exist with the interpretation of younger ages.

Working Paper: Sutherland, S., N. Shepherd, N. Munroe, V. Silva, and J. Burnett. 2004. Precision Exercises Associated with 2004 TAWG Production Ageing. TRAC Working Paper 2004/08.

Rapporteur: L. Van Eeckhaute

Presentation Highlights

A brief summary of the DFO/NMFS ageing workshop for 5Zjm cod, haddock and pollock (which took place in January 2004) was presented by L. Van Eeckhaute. Workshop discussions focused on the interpretation of the annotated files of the ageing structures in order to compare DFO and NMFS age readings and determine the reasons for discrepancies. For several years now, DFO has had a procedure for within and between age reader (DFO/NMFS) testing and reporting of results. The working paper presented at the TRAC presented within NMFS lab test results. Guidance was sought on where these results should be reported. Guidance was also sought on a venue for documenting the ageing workshop. The NMFS between reader test results were generally satisfactory for cod and haddock, but not as favourable for yellowtail.

Discussion

The ageing workshop should be documented in a TRAC Proceeding Document, with details included in appendices. Test results should be reported routinely from both labs in the assessment documents. Some guidelines are needed so that ageing tests are representative and include the whole spectrum of lengths for each species with adequate numbers of structures available for comparison. Modelling of ageing errors should be put on the agenda for benchmark assessments and all issues prioritized at the first benchmark meeting. Although t-tests of ageing bias can be conducted, what is really needed is an understanding of the level of bias, as this has important implications in the assessment.

COMPARATIVE FISHING EXPERIMENT

Rapporteur: J. Hunt

Joe Hunt presented a summary of plans by DFO to address proposed changes in vessels and, potentially research trawls, to conduct surveys. Most notable of these changes is the replacement of the CGS *Alfred Needler* by the CGS *Teleost* in conducting the annual DFO survey of Georges Bank. The *Teleost* is a substantially larger vessel and a significant vessel effect on trawl catches is anticipated. Side-by-side trawling experiments will probably be conducted during the February 2005 Georges Bank survey as a first step in determining vessel conversion factors. Determining a gear effect may not be required if the Western IIA research trawl is maintained as the standard.

NMFS is presently reviewing design possibilities for its new research trawl, and replacement of the R/V *Albatross IV* by the R/V *Henry B. Bigelow* is expected take place in the next 1-2 years. These developments, along with DFO changes, could result in a compounded uncertainty for

survey indices of abundance. It would be highly desirable to have one or more years of overlap between changes to ensure that individual effects can be modeled to facilitate interpretation of the survey indices.

Appendix 1. List of Participants

Name	Address	Telephone	Fax	E-mail
Cory Aldous	DFO/SABS	(506) 529-5880	(506) 529-5862	aldousc@mar.dfo-mpo.gc.ca
Chris J. Allen	DFO Science, Ottawa	(613) 990-0105		allenc@dfo-mpo.gc.ca
Andrew Applegate	New England Fisheries Management Council	(978) 465-0492		aapplegate@nefmc.org
Jon Bradziak	NMFS, Woods Hole	(508) 495-2365	(508) 495-2393	Jon.brodziak@noaa.gov
Donald Clark	DFO/SABS	(506) 529-5908	(506) 529-5862	clarkd@mar.dfo-mpo.gc.ca
Ron Cronk	NBDAFA	(506) 662-7026	(506) 662-7030	
Claude d'Entremont	Inshore Fisheries/TMGC	(902) 762-2522	(902) 762-3464	inshore@inshore.ca
Stratis Gavaris	DFO/SABS	(506) 529-5912	(506) 529-5862	gavariss@mar.dfo-mpo.gc.ca
Jorgen Hansen	DFO Management, Dartmouth	(902) 426-9046	(902) 426-9683	hansenj@mar.dfo-mpo.gc.ca
Bette Hatt	DFO/SABS	(506) 529-5920	(506) 529-5862	hattb@mar.dfo-mpo.gc.ca
Joe Hunt	DFO/SABS	(506) 529-5893	(506) 529-5862	huntjj@mar.dfo-mpo.gc.ca
Chris Legault	NMFS, Woods Hole	(508) 495-2025	(508) 495-	Chris.Legault@noaa.gov
Bob Mohn	DFO/BIO	(902) 426-4592	(506) 529-5862	mohnr@mar.dfo-mpo.gc.ca
Tim Nickerson	SFIFA	(902) 768-2535	(902) 768-2259	
Robert O'Boyle (Co-Chair)	DFO/BIO	(902) 426-3526	(902) 426-5435	oboyler@mar.dfo-mpo.gc.ca
Loretta O'Brien	NMFS, Woods Hole	(508) 495-2273		Loretta.obrien@noaa.gov
Bill Overholtz (Co-chair)	NMFS, Woods Hole	(508) 495-2256	(508) 495-	William.overholtz@noaa.gov
Michael Power	DFO/ SABS	(506) 529-5881	(506) 529-5862	Powermj@mar.dfo-mpo.gc.ca
Clary Reardon	N.S. Agriculture & Fisheries	(902) 424-0349	(902) 424-1766	reardon@gov.ns.ca
Mark Showell	DFO/BIO	(902) 426-3501	(902) 426-1506	showellm@mar.dfo-mpo.gc.ca
R. Kent Smedbol	DFO/SABS	(506) 529-5976	(506) 529-5862	smedbolk@mar.dfo-mpo.gc.ca
Rob Stephenson	DFO/SABS	(506) 529-5882	(506) 529-5862	stephensonr@mar.dfo-mpo.gc.ca
Heath Stone	DFO/SABS	(506) 529-5880	(506) 529-5862	stonehg@mar.dfo-mpo.gc.ca
Lou VanEeckhaute	DFO/SABS	(506) 529-5938	(506) 529-5862	Van-eeckhautel@mar.dfo-mpo.gc.ca
Evan Walters	SFIFA	(902) 637-3276	(902) 637-3270	sfifa@eastlink.ca
Tom Warren	NMFS, Gloucester	(978) 281-9347	(978) 281-9130	Thomas.Warren@noaa.gov

Appendix 2. TRAC Process and Documents

Overview

Since 1998, the Transboundary Resources Assessment Committee (TRAC) has reviewed stock assessments produced by the Transboundary Assessment Working Group (TAWG) and projections necessary to support management activities for shared resources across the USA Canada boundary in the Gulf of Maine-Georges Bank region. These assessments are necessary to advise decision makers on the status of these resources and likely consequences of policy choices. When TRAC was established, it was recognized that its work and documentation would evolve in order to adapt to new realities and would build on experience. Most significantly, the formation of the Transboundary Management Guidance Committee (TMGC) in 2000 and the recent development of arrangements for consistent management of cod, haddock and yellowtail on eastern Georges Bank have placed new demands on the TRAC process and for TRAC documentation. The purpose here is to describe the TRAC process and the documents necessary to fulfill requirements in the near future.

Process

Oversight of Process: NMFS and DFO will appoint one person each to act as TRAC co-chairs. The co-chairs will administer the TRAC review process and the publication of product documents and schedule TRAC review meetings. They may chair TRAC review meetings or delegate by agreement.

Formulation of the Remit: The remit is a succinct statement of the analyses and review that is requested of the TRAC. The TMGC, in consultation with the TRAC co-chairs, will draft the remit. The remit would outline the required products of the TRAC along with the timelines.

Preparation of Assessments: The TRAC co-chairs will designate co-experts, one from NMFS and one from DFO, for each management unit reviewed at TRAC. The co-experts are responsible for coordinating data preparation, leading the conduct of analyses, facilitating the preparation of working papers for TRAC and their presentation at TRAC. TRAC may also invite and review assessment analyses conducted by others, including non-NMFS and non-DFO staff.

Review of Assessments: The TRAC employs a two-tiered review process in which each of the stocks periodically undergoes an intensive peer review of the assessment model and assumptions. This is termed a benchmark assessment review. The benchmark assessment framework is applied as required, generally on an annual schedule, to provide the peer reviewed assessment of the resource status to fisheries managers. This is simply termed an assessment review. It is considered preferable to conduct benchmark assessment reviews during meetings dedicated to that task rather than in conjunction with an assessment review. The aim is to conduct benchmark assessment reviews well enough in advance of assessment reviews to permit incorporation of a new framework in the assessment.

Peer review of a benchmark assessment framework involves evaluation of the technical aspects surrounding analysis of fisheries data and requires participation of local technical experts as well

as those solicited from the international community to bring particular knowledge and experience to the table. As well, stakeholders with particular insights into interpretation of the data being considered are required. The mandate of a benchmark review meeting is to reach consensus on a framework to be applied for determination of stock status and to fully document that framework in the Proceedings. The benchmark assessment framework will not subsequently be re-evaluated until progress on the science warrants. Generally several years of additional information are required before another benchmark review is justified. TRAC, through the TRAC co-chairs, would recommend to the TMGC when framework reviews are warranted. The TMGC would consult with the TRAC co-chairs to establish the schedule for a benchmark assessment review. NMFS and DFO commit to supporting participation at each benchmark assessment review by at least two scientists that are not employed in the USA Northeast Region and the Canadian Maritimes Region.

The mandate of the assessment peer review is to appropriately apply the benchmark assessment framework to fishery, survey and biological data acquired since the last assessment in order to elucidate the current status of the stock. Participation in this process by both assessment scientists and stakeholders with particular insights into the fisheries and stocks being evaluated is encouraged to foster interpretation, communication and understanding of the results.

Communication of TRAC Results: The TRAC co-chairs (or their designees) are responsible for presentation of the TRAC results, e.g. TSRs, highlights of proceedings, summaries of new analyses, etc., to the TMGC. TRAC co-chairs and stock co-experts may be called upon by the TMGC to make presentations at public consultations.

Documents

TRAC Reference Document*:* These documents would provide the documentation of the scientific and technical information used in the assessments, including the assessment results. Information would be presented on current and future stock status, as well as catch projections. The documents would be based on the analyses conducted and reflect the working papers, discussions and consensus views reached by the TRAC. The documents will be externally reviewed (prior to finalization and publication) by one or more scientists from both the DFO and NMFS. These reviews will be coordinated by the TRAC co-chairs. DFO will undertake and pay for the required translation into French of the abstracts of the Reference Documents.

TRAC Transboundary Status Report*:* These reports would provide the consensus summary of the TRAC on stock status and future resource outlook. Status will be provided (where possible) with respect to any agreed (US/Canada common) harvest and biomass reference points, and risks will be identified with harvest levels that exceed F reference points and/or generate biomass declines. Subsequent to the TRAC meeting, the reports will be reviewed for readability, accuracy and completeness. Any suggested revisions must be approved by the TRAC co-chairs. The final reports will be submitted to the TMGC and published on the both the TRAC and Canadian Science Advisory Secretariat Websites. DFO will undertake and pay for the French translations of these reports.

TRAC Proceedings: This series would document TRAC meeting terms of reference and participation and consolidate the record of deliberations into a single source. The deliberations would include brief presentation highlights of the working papers, e.g. an abstract, along with a report of the ensuing discussion. Subsequent to the TRAC meeting, the reports will be reviewed by meeting participants for accuracy and completeness. As well, editorial reviews will be conducted for readability. Any suggested revisions must be approved by the TRAC co-chairs. TRAC Proceedings will be published on both the TRAC and Canadian Science Advisory Secretariat Websites. DFO will undertake and pay for the required translation into French. Technical descriptions of working paper methods and analyses are generally not incorporated but when included in the proceedings they will be placed in appendices, as these do not require translation.

All documents would be available at a TRAC website and mirrored by servers in both countries. Documents will satisfy DFO and NMFS corporate identity programs by including multiple logos and identifiers. Web sites will comply with respective DFO and NMFS standards for appearance and presentation. DFO will undertake and pay for the required translation of web content into French.

Appendix 3. Meeting Terms of Reference

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 and research surveys and characterize the uncertainty of estimates.

- For a range of values for total catch in 2005, estimate the risk that
    - the 2005 fishing mortality rate would exceed 0.18 (cod), 0.26 (haddock) and 0.25 (yellowtail flounder) respectively
    - the biomass at the beginning of 2006 would not achieve a 0%, 10% or 20% increase compared to the beginning of 2005 (Eastern Georges Bank cod only).

- Conduct medium term forecasts assuming that the stocks are exploited at constant fishing mortalities of 0.18 (cod), 0.26 (haddock) and 0.25 (yellowtail flounder) during 2005-2008, and provide the catches and beginning year biomasses (total and spawning stock) in 2005, 2006, 2007 and 2008, and also the beginning year biomasses in 2009.

- Develop an initial plan for the work required in support of the Georges Bank yellowtail flounder benchmark review. Consider schedule for cod and haddock benchmark reviews.

- Review plan for DFO comparative fishing experiment in February 2005.

- Review report from Ageing Workshop.

- Other matters.

Appendix 4. Meeting Agenda

15 June 2004 – Tuesday

08:30 – 09:00 Welcome and Introduction (Chair)
09:00 – 10:00 Survey biomass distribution (Murawski, Gavaris)
10:00 – 12:00 Eastern Georges Bank cod (O'Brien, Hunt)

12:00 – 13:00 Lunch

13:00 – 15:00 Eastern Georges Bank haddock (Brodziak, Van Eeckhaute)
15:00 – 17:00 Species composition in Canadian fisheries (Van Eeckhaute, Gavaris)

16 June 2004 – Wednesday

08:30 – 10:30 Georges Bank yellowtail flounder (Legault, Stone)
10:30 – 11:30 Planning for yellowtail flounder benchmark review (Legault, Stone)
11:30 – 12:00 Benchmark schedule (Chair)

12:00 – 13:00 Lunch

13:00 – 14:00 Report from Ageing Workshop (Van Eeckhaute)
14:00 – 15:00 Comparative fishing experiment (Hunt)
15:00 – 17:00 Report Preparation

17 June 2004 – Thursday

08:30 – 12:00 Further considerations and Report Review

12:00 – 13:00 Lunch

13:00 – 17:00 Further considerations and Report Review

18 June 2004 – Friday

08:30 – 12:00 Further considerations and Report Review
12:00 Adjournment

Appendix 5. Topics to be Considered in Benchmark Assessment

The following 5 themes are to be addressed in a benchmark assessment. Characteristic elements associated with these themes are identified for illustration and as a guide. This is not intended as an exhaustive or exclusive list of elements. In any benchmark, not all themes may be subjected to evaluation. Similarly, emphasis may be given to only some elements of a theme. The extent of evaluation of a theme or element is defined by the terms of reference of the benchmark assessment. However, the basis of accepted practice for all themes and elements should be documented. For example, the information on management unit definition may not be re-evaluated if there are not new data or analyses, but a summary of previous deliberations should be given.

1. **Definition of the Management Unit**
   Stock structure and complexity elements
   - Distribution and movement
   - Morphometrics and meristics
   - Growth

   Management consideration elements
   - governance institutions
   - political boundaries
   - administrative convenience

2. **Estimation of Contemporary State**
   Typically this is stated in terms of the population abundance at the beginning of the period following the terminal period for which removals are available. This may be derived by analyzing information from the fishery together with information on trends in abundance. Alternatively, it may be obtained as a summary of a multitude of indicators that have been established to relate to abundance.
   Fishery elements
   - Removals
   - Size and age composition
   - Weight at age

   Abundance/mortality trend elements
   - Surveys
   - Fishery CPUE
   - Tagging

   Estimation elements
   - Model dynamics, assumptions and formulation used to integrate information
   - Observation and/or process error assumptions
   - Uncertainty and consistency (retrospective) of results

3. **Characterization of Productivity to Determine Harvest Strategy**
   Typically this culminates in identification of undesirable states for quantities of interest for fisheries management such as exploitation rate or abundance. Fishing mortality based strategies are common. The analysis may be based on characterizing the response of yield to

exploitation and the associated biomass implications. Alternatively, it may be based on establishing break points for the historically observed range.

Process elements

- Growth (size at age, condition, etc.) and maturation
- Partial recruitment to the fisheries
- Natural mortality
- Stock biomass and recruitment
- Contrasts with related stocks and species
- Patterns of change in demographic parameters
- Linkages of environmental factors to stock productivity

Estimation elements

- Model dynamics, assumptions and formulation
- Observation and/or process error assumptions
- Derivation of candidate reference points or decision break points
- Uncertainty of results

4. Procedure for Projection to Evaluate Tactics

Process elements

- Growth and maturation
- Partial recruitment to the fisheries
- Natural mortality
- Recruitment

Procedure elements

- Projection calculations
- Incorporating uncertainty and stochasticity
- Evaluation of tactics if candidate tactics (e.g. TAC) are identified

5. Guidance on Activities

Specification on assessment procedure during interim years and recommended timing of subsequent benchmark, recognizing that unusual events may trigger a benchmark prematurely. Identification of key issues for assessment and recommended research.

Appendix 6. Minutes of Public Meeting in Yarmouth, NS, 18 May 2004

The purpose of the public meeting was to review 2003 and 2004 survey and fishery observations in relation to what they indicate about stock status and how they can be interpreted for 2005 advice. Summaries of available information were presented by DFO. An overview of the role and the process involving the Transboundary Management Guidance Committee was also presented by DFO. The discussions are summarized below.

General Issues

Question: Would the discard analysis be accepted by the US?
Canada and the US are required to account for all catches of cod, haddock and yellowtail flounder and both will be presenting analysis for review at TRAC.

Comment: Fishermen wondered if there was information on scallop fishing activity in the area and during times when cod catch rates were highest. There may be an association between concentration of cod and scallop fishing.

Question: Which vessel would be available for the survey?
The Needler is expected to be available for the February 2005 survey of Georges Bank.

5Zjm Haddock

Question: Is the decline in weight at age a concern and what is the cause?
There were no differences in weight at length (plumpness or condition) but differences appeared in the weights at age for older fish. It may be speculated that increased fish density may be resulting in competition for food, but this is not confirmed and seems to be contradicted by the plumpness.

5Zjm Cod

Comment: Longline fishermen experienced good catch rates of cod.
Specific gear sectors have different perceptions about fish abundance because their selectivity is particular to a gear type. Gill net gear and longline gear were dominated by age 4 and age 5 fish in 2003 while for mobile gear, fish from age 3 to age 5 dominated the catch. As year classes of varying strength pass through the fishery, the fishable biomass available to each gear will be different.

Question: Could the lower weights at age for cod be caused by a lower water temperature?
The water temperature was variable but without any continuing trend on Georges Bank.

Question: Is there a correlation between cod and haddock recruitment?
There has been some synchrony between good year classes of cod and haddock but not all the time. If conditions were good for haddock, it may also be better for cod resulting in improved recruitment for both.

Comment: There appears to be an imbalance between haddock and cod with cod presently at low abundance.
US fishery records back to the 1930s suggest that haddock has generally been dominant in this area. The apparent dominance of cod during the 1970's to the early 1990's may have been due to the depleted state of the haddock resource.

5Zhjmn Yellowtail

Question: What does the tagging show about migration?
With low fishing effort in the Closed Area II, and also due perhaps to low return rate of Canadian tags by US fishermen, it is not possible to comment on movement from the Canadian side to the US side. Several tags from yellowtail tagged on the US side have been returned by Canadian fishermen. The Special Access Program in Closed Area II during 2004 would have observer coverage and may result in some returns.

Question: Will the decline in survey indices result in a lowered quota?
The analyses have not been completed. Interpretation of age structure remains problematic as once yellowtail get to a certain age there is considerable overlap in size.

TMGC

Question: How is the sharing formula updated?
TRAC will evaluate the distribution of cod, haddock and yellowtail from the surveys each year. The updated distribution is used by TMGC along with the fixed historical utilization to arrive at the sharing percentages for that year. Quota overruns from the previous year would be deducted on a one per one basis.

Question: What about essential fish habitat?
Canada and the US are committed to consistent management. At present we have agreed on a common harvesting strategy. TMGC will consider the full suite of ecosystem concerns.

Question: What is the cod quota for 2004?
The US quota is 300 mt and the quota for Canada is 1000 mt for a combined quota of 1300 mt.

Question: Will the US respect the cod quota.
The US has given every indication that they will take the necessary measures to stay within the agreement. For example, a Special Access Program for haddock in Closed Area II was denied because of concerns about catching too much cod.

Participants

Name	Affiliation	Fax	e-mail or Tel. #
Heath Stone	DFO Science, SABS	506-529-5862	StoneH@mar.dfo-mpo.gc.ca; 506-5295880
Bette Hatt	DFO Science, SABS	506-529-5862	HattB@mar.dfo-mpo.gc.ca; 506-529-5920
Joseph Hunt	DFO Science, SABS	506-529-5862	HuntJJ@mar.dfo-mpo.gc.ca; 506-529-5938
Lou Van Eeckhaute	DFO Science, SABS	506-529-5862	Van-EckhauteL@mar.dfo-mpo.gc.ca; 506-529-5893
Stratis Gavaris	DFO Science, SABS	506-529-5862	GavarisS@mar.dfo-mpo.gc.ca; 506-529-5912
Claude d'Entremont	Inshore Fisheries Ltd.	902-762-3464	inshore@inshore.ca; 902-762-2522
Steven Corkum	Yarmouth Sea Products	902-742-7721	902-645-2417
Peter Burnie	Mariner's Choice	902-245-5025	Mariner2@ns.sympatico.ca
Craig d'Entremont	Seafreez/GEAC	902-762-4015	cdentremont@seafreez.com; 902-648-7744
Kyle Smith	All Star Fisheries	902-637-1764	902-637-3610
Adlai Cunningham	Sea Star Seafoods Ltd	902-745-2129	adlai@seastarseafoods.com; 902-745-2925
Dick Stewart	Atlantic Herring Co-op	902-742-1287	902-742-9101
Denny Morrow	NSFPA	902-742-1620	fishpackers@klis.com; 902-742-6168
Gregory Nickerson	K & N Fisheries	902-768-2385	knfish@plt.com; 902-768-2478
Daniel LeBlanc	BCD Fisheries Ltd.	902-769-0117	902-769-7122
Ray Belliveau	Charlesville Fisheries	902-762-3158	902-762-2405
Ronnie Newell	SWFQGA	902-745-1080	ronnienewell@eastlink.ca; 902-745-2230
Ronald Walkins	SWFRA	902-745-2632	swfra@auracom.com; 902-745-2632
Jorgen Hansen	DFO - Dartmouth		HansenJ@mar.dfo-mpo.gc.ca; 902-426-9046
Carol Davis	VCF6A	902-742-4884	Cameron.30@ns.sympatico.ca; 902-742-9879
Gam Davis	VCF6A	902-742-4884	Cameron.30@ns.sympatico.ca; 902-742-9879
Roger Atwood	SFIFA		902-637-2764
Troy Waybret	SFIFA	902-945-2112	twaybret@eastlink.ca; 902-745-1576
Russell W. Atkinson	Fisherman	902-745-0313	902-745-2541
Gilbert Donaldson	DFO Science, Port Sampler, Yarmouth		donaldsong@mar.dfo-mpo.gc.ca; 902-742-0895
Victor Wolfe	SCCFA	902-656-2075	902-656-2062
Tim Nickerson	SFIFA	902-768-2259	902-768-2535
Evan Walters	SFIFA	902-637-3270	sfifa@klis.com;
Sheldon O'Donnell	SFIFA	902-745-2799	902-745-2799
Brian Giroux	SFMGFA		SFmobile@fox.nstn.ca