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Région de Terre-Neuve et du Labrador

Proceedings of the Regional Advisory Process for Atlantic Cod in Subdivision 3Ps, Newfoundland and Labrador Region

Compte rendu du processus de consultation régionale concernant la morue de l'Atlantique dans la sous-division 3Ps de la région de Terre-Neuve-et-Labrador

**October 25-28th and November 10th, 2011
St. John's, NL**

**Du 25 au 28 octobre et le 10 novembre 2011
St. John's, Terre-Neuve-et-Labrador**

**Dr. M. Robin Anderson
Meeting Chair**

**Dr. M. Robin Anderson
Président de réunion**

January 2013

Janvier 2013

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Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may 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. Le compte rendu peut aussi faire l'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 contenues dans le présent rapport puissent être inexactes ou propres à induire en erreur, elles sont quand même reproduites aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considérée 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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TABLE OF CONTENTS

SUMMARY

A regional advisory process for the Atlantic Cod in Subdivision 3Ps was held from October 25-28th, 2011 at the St. John's Convention Centre, St. John's NL and November 10th, 2011 at the NWAFC, St. John's, NL. This assessment was held to provide detailed advice to the Minister on the status of the stock and the implications of a possible cod fishery on this stock in 2012/13 and to assist in developing a rebuilding plan for 3Ps cod.

Participants included DFO staff from Science (Newfoundland and Labrador), Ecosystems and Fisheries Management (Newfoundland and Labrador), Ecosystems Management (Newfoundland and Labrador), the province of Newfoundland and Labrador, the fishing industry, Environmental Non-Government Organizations (ENGOs), academia and a science representative from IFREMER (France).

These proceedings contain a summary of presentations and other documentation available during the meeting as well as summaries of the related discussions. Also included in these proceedings are the terms of reference (Appendix 1), meeting agenda (Appendix 2), and list of participants (Appendix 3) for the meeting.

Additional information on the assessment is available in the CSAS Research Document series and the Science Advisory Report produced from this meeting.

SOMMAIRE

Un processus de consultation régionale concernant la morue de l'Atlantique dans la sous-division 3Ps a eu lieu du 25 au 28 octobre 2011 au Centre des congrès de St. John's (Terre-Neuve-et-Labrador) et le 10 novembre 2011 au Centre des pêches de l'Atlantique nord-ouest de St. John's (Terre-Neuve-et-Labrador). Cette évaluation a eu lieu dans le but de prodiguer des conseils détaillés au Ministre quant à l'état du stock et quant aux répercussions sur ce stock d'une pêche à la morue possible en 2012-2013, et d'aider à concevoir un plan de rétablissement de la morue dans la sous-division 3Ps.

Parmi les participants, mentionnons le personnel de la Direction des sciences (Terre-Neuve-et-Labrador), de la Gestion des écosystèmes et des pêches (Terre-Neuve-et-Labrador) et de la Gestion des écosystèmes (Terre-Neuve-et-Labrador) de Pêches et Océans Canada, la province de Terre-Neuve-et-Labrador, l'industrie de la pêche, des organisations non gouvernementales de l'environnement, des représentants du milieu universitaire et un représentant scientifique de l'Institut français de recherche pour l'exploitation de la mer (France).

Le présent compte rendu résume les présentations ainsi que les autres documents présentés pendant la réunion et synthétise les discussions tenues à propos de ceux-ci. Sont également inclus le cadre de référence (annexe 1), l'ordre du jour de la réunion (annexe 2) et la liste des participants à la réunion (annexe 3).
D'autres renseignements sur l'évaluation se trouvent dans la série des documents de recherche et dans l'avis scientifique du Secrétariat canadien de consultation scientifique produits à la suite de cette réunion.

INTRODUCTION

The status of NAFO Subdivision 3Ps cod was last assessed in October, 2010. The current assessment is requested by Fisheries and Aquaculture Management (1) to provide the Minister with detailed advice on the status of the stock and the implications of a possible cod fishery on this stock in 2012/13 and (2) to assist in developing a rebuilding plan for 3Ps cod. To this end, regional scientists, fisheries managers and representatives from the fishing industry, the province, academia and ENGOs met in St. John's from October 25th to 28th and reconvened briefly on November 10th.

MEETING PROCEEDINGS

RECENT OCEAN CLIMATE VARIABILITY IN NAFO DIVISION 3P – POTENTIAL INFLUENCES ON THE DISTRIBUTION AND ABUNDANCE OF ATLANTIC COD (E. COLBOURNE, E. MURPHY, P. PEPIN, G. MAILLET)
Presenter: Gary Maillet, DFO Science, NL Region

Abstract

Oceanographic information collected during the spring DFO Multi-Species Surveys and Atlantic Zone Monitoring (AZMP) Missions indicated that near-bottom temperatures throughout NAFO subdivision 3Ps along with areas east of the Banks continued to warm in 2011. Sea surface temperatures during winter 2011 were the highest on record extending back to the mid-1980's. The extent of the cold immediate layer (CIL is defined as <0ºC water) on St. Pierre Bank has declined steadily since 2008 and was near-zero in 2011. The distribution of cod in relation to bottom temperature based on survey catch data indicates movement onto the Banks, in contrast to preference for the warmer slope waters during years when large incursions of cold-fresh water from the eastern Newfoundland Shelf impact this area. Changes in bottom water temperatures significantly correlate with cod abundance in 3Ps based on time-series extending back to the early 1980's. A composite index of the environment incorporating various physical and biological indices was at the lowest level in 2011 along the southeast Grand Banks. Changes in the composite environmental index were also associated with zooplankton biomass and indicate the potential influence of the environment on levels of secondary productivity on the southern Grand Banks.

References:
CSAS Res Doc 2011_074
NAFO SCR Doc 11-016

Discussion

Frank et al. (2011) attributes the increase of cod on the Scotian Shelf to the recovery of the zooplankton and forage species. Data used in that study came from the Continuous Plankton Recorder (CPR) program. In NL Region we have been doing retrospective analysis and from 1991 to current time there is good information. However, analysis for the current year for the zooplankton from the CPR is not completed.

For the effect of environment on productivity of cod, we are producing secondary production and compensatory indices (environmental composites). There is no link being made between secondary productivity and cod.

Lack of ice cover in recent years contributes to changes in Sea Surface Temperature (SST) in this area, including the Gulf and Northeast Shelf. It was recommended that this be presented at the next assessment.

The relevance of this information to the current assessment was questioned. It would be useful to know if there is any information here suggesting that the future productivity of this stock will be different. For example, is there an increase in recruitment associated with the timing and large size of the spring bloom in 2010?

Potential Research Recommendations:
Investigate within survey characteristics that may indicate potential for year effects.
Investigate link between environmental conditions and recruitment for this stock
Determine the coherence between the oceanographic conditions on St. Pierre Bank transects and Grand Banks and Station 27 to evaluate the applicability of the longer oceanographic time series (St. 27 and Grand Banks) to 3Ps

Reference:
Frank, K. T., B. Petrie, J. A. D. Fisher & W. C. Leggett, 2011 Transient dynamics of an altered large marine ecosystem. Nature 477 :86–89.

3PS COD FISHERY
Presenter: Robin Smith, DFO FAM, NL Region

Abstract

An overview of the 3Ps cod fishery was provided outlining the license conditions, monitoring program and the small fish protocol used for that area. There was also a review of the Total Allowable Catch (TAC) for the past seven years and how it was allocated. A further breakdown was given for the fixed and mobile gear fleet and further by individual vessel size. A summary of Groundfish licenses for less than 65' fleet broken into Core and Non-Core by fleet size was also given. A review of closed times for spawning purposes and the mixing of the stocks in 3Ps(a) was presented. An overview of the fishery also included the number of active enterprises, landings, and the percentage of quota taken by gear type and fishing areas by month for the 2011 season.

Discussion

Forty percent of the Total Allowable Catch (TAC) was taken by October of 2010. It was not clear if this was in a particular sector and it was suggested that this may be due to market prices. For Fortune Bay (inshore fishery) the timing of the fishery is in the Fall. It was suggested that a plot of the trends of when quota is taken would be useful to see anomalies over time and to indicate changes that may occur. Monthly landings by area were produced for previous 3Ps Regional Advisory Processes. An update for 2011 was requested.

In an effort to understand the reliability of catch information, dockside monitoring was discussed. The definition of 100% Dockside Monitoring Program assumes that each landing is counted. However, this likely happens for approximately 80% of the landings. Sometimes, the dockside observation company may only call and get the information from a particular fisher.

The application and monitoring of the Small Fish Protocol was discussed. However, the Small Fish Protocol has not been used recently. The representative of the offshore industry noted there were small fish in Fortune Bay area this year and extremely high catches of mackerel.

A participant asked about the link between Capelin and cod in the fishery noting declines in capelin in the area in recent years. It was stated that there is no current information for Capelin in 3Ps.

ASSESSMENT OF COD IN NAFO SUB-DIVISION 3PS
Presenter: John Brattey, DFO Science, NL Region

Abstract

An overview of the status of the 3Ps cod stock was provided. Several sources of information were used to assess the status of cod in NAFO Subdivision 3Ps. A detailed review of the DFO 2011 bottom-trawl multi-species survey, trends in commercial landings, and standardized CPUE of the <35' fleet logbooks were the focus of this presentation.

A review of commercial fisheries indicated that catches by Canada and France combined for the 2009/10 and 2010/11 management years were 8,900 t and 7,810 t, respectively. The TAC was 11,500 t for the both management years, but as a result of reduced prices, reduced effort and fewer fish available to some fleet sectors, only 77% of this TAC was harvested in 2009/10 and only 68% in 2010/11. This pattern of catch is atypical. Catch-at-age indicated a more compact distribution compared to recent years; 80% of the catch (by numbers) in 2010 were from ages 5-8 with fewer older fish in the catch.

Updated Catch per unit of effort (CPUE) information was available for Canadian vessels <35'. Return rates of this logbook have been low in recent years, with approximately 50% of the <35' fleet catch accounted for in the logbook database. Estimated gillnet catch rates declined sharply from 1998 to 1999, and have subsequently remained relatively constant at a much lower level. The line-trawl CPUE has declined since 2006 and in 2011 was slightly below the time-series average.

Research vessel surveys are conducted annually in spring and provide fishery-independent data on the status of the resource. After several years of generally consistent declines in both survey abundance and biomass, survey results indicate a considerable increase in 2008-2010, particularly in abundance, followed by a substantial decline in 2011. Recent trends are strongly influenced by catches of the 2006 year class which were very strong at young ages (1-4). Furthermore, although survey indices are at times highly variable, the rapid one-year increase in survey biomass between 2008 and 2009 (138%) is not biologically possible. Hence, the 2008 and/or 2009 results are subject to a "year-effect", an atypical survey result that can be caused by a number of factors which may be unrelated to absolute stock size. The biomass and abundance estimates from the 2011 survey are much lower than the 2010 level. The distribution of cod in 2011 was relatively widespread, though the survey indices are greatly influenced by relatively large catches around/on Burgeo Bank and also in the Halibut Channel.

Previous assessments noted that the 2006 year-class appeared to be relatively strong in the RV surveys at both ages 1-4 (in the 2007-2010 surveys, respectively). The 2011 abundance index for the 2006 year class remains above average, but is not as strong as indicated at ages 1-4. Further, catches of this year-class were distributed across a large portion of the surveyed area. Biological sampling of research vessel catches indicates that current mean length and weight at age are average or slightly below average. Data on cod condition (liver index), available since 1994, indicate that cod are in relatively poor condition in recent years (2008-10) but close to average in 2011. Estimates of proportion mature-at-age indicate that a high proportion of the 2006 year class is mature at age 5, and hence this year class comprises an unusually high

proportion of the survey estimates of total spawning biomass due in part to low abundance of older ages in the population.

Relative year-class strength for the 1994-2009 cohorts was estimated from age 1-4 data from both the DFO survey data and an industry survey (which terminated in 2005). Results indicated that the 1997, 1998 and 2006 year-classes were much stronger than all other year-classes. Among recent year-classes 2007 is weaker than average. The 2008-2009 year-classes are slightly above average but are based on few data.

Discussion

Catch

Changes in weights-at-age for older fish compared to pre moratorium observations may be a function of current gears used in the fishery. The Canadian catch is gillnet dominated with some otter trawl. The opposite is true for the French catch.

There was a discussion about the drop in return rates for Science logbooks for <35 vessels. Currently, less than 50% of harvesters are sending the <35 vessel fleet logbook back. The groundfish logbooks for <35 vessels are returned to Science Branch. There is no compliance protocol in place, which differs from most other logbook programs. The >35 vessel logbook is administered through the Statistics branch and if vessels are not compliant they receive a reminder. There are about 6000 vessels in the <35 vessel fleet in the Newfoundland region. FFAW had meetings with 600 harvesters in the Fall of last year to emphasize the importance of the logbook program. Mandatory logbook return was included in the condition for license last year. It is anticipated that compliance for the coming year will improve with these measures. DFO RV trawl survey

It appears that the distribution of 3Ps cod has changed since the early 90's when high concentrations in the bays were noted. The majority of the 3Ps stock now seems to be well represented by the research vessel survey. The caveats about stock distribution included in previous Science Advisory Reports may no longer be necessary.
The possibility of a year effect in either 2008 or 2009 (possibly both) was noted.

Biological Information

The condition of fish and age-at-maturity in relation to population and environmental observations (SSB, temperature, spawning time, prey availability, etc.) were discussed. Condition was low in 2008-10 but close to average for 2011.

It is too early to determine reliable estimates for 2010 year class strength or for the mortality on 2009-10. However there is no evidence to suggest that natural mortality is different than 0.2.

Skipped spawning is common in 3Ps cod. The frequency of this will influence population estimates. However, it is not currently being quantified.

Research recommendation:
Determine the frequency of skip spawning. This can be done histologically for fish caught during the survey.

UPDATE SENTINEL SURVEY RESULTS IN NAFO SUBDIVISION 3PS FOR 2011
Presenter: Dawn Maddock Parsons, DFO Science, NL Region

Abstract

Unstandardized catch rates for Sentinel Surveys in NAFO subdivision 3Ps were updated for 2010 and preliminary results were given for 2011. Gillnet catch rates (weekly average number of fish per net) in the most recent years remained low compared to 1996-98 catch rates. Catch rates in small mesh gillnet remained low. Since 2000, Length frequencies of cod caught in small mesh gillnet showed fewer fish at the two size modes (36-44 cm and 52-56 cm) that this gear catches. Linetrawl catch rates (weekly average number of fish per 1000 hooks) increased from 2000 and showed an increase in the number of fish at the 44-54 cm size range from 2002 to 2004. Linetrawl catch rates have been lower than those in 1995-1997 since 2000, but have shown a slightly increasing trend.

Trends in liver and gutted body condition show a seasonal cycle, with condition declining over the winter and early spring, and increasing again over the summer once spawning occurs. Annually trends in condition have varied over the time series but declined from 2007-09. In 2010, condition improved and was similar to those observed in 2008. Both length and weight at age have declined in fish age 5 and older since the early part of the time series.

By-catch information was presented as total number of fish caught incidentally in sentinel gear for each year. In gillnet, American plaice, winter flounder and redfish were the main by-catch species, while linetrawl caught a wider range of species including mainly plaice, redfish, wolfish, skate, pollock and haddock.

Discussion

No discussion immediately followed this presentation.

STANDARIZED SENTINEL CATCH RATES
Presenter: Dawn Maddock Parsons, DFO Science, NL Region

Abstract

Sentinel catch rates were also standardized and modeled to account for seasonal and site effects. These standardized catch rates were presented for gillnet and linetrawl control locations. Age aggregated catch rates from sentinel surveys were higher in the early part of the time series for both gillnet and linetrawl, declined over the mid to late 1990s and have remained lower since then. In 2010, both linetrawl and gillnet standardized catch rates were below the series average. In the age dis-aggregated standardized catch rate series, cohorts in recent years have been weaker than stronger cohorts in the past (1989, 1997-1998 in particular). In the linetrawl, however, the 2004 year-class has tracked fairly well at age 3, 4 and 5. The 2006 year-class appeared in the gillnet at age 3 in 2009, but was less than average in the linetrawl. In 2010, the 2006 year-class was not particularly strong in either gillnet or linetrawl.

Discussion

No discussion immediately followed this presentation.

TAGGING INFORMATION FOR 3PS COD RAP OCTOBER 2011
Presenter: John Brattey, DFO Science, NL Region

Abstract

Cod tagging in NAFO Subdiv. 3Ps was continued during 2008-2011, but coverage has been reduced compared with previous years, and cod have only been tagged in Placentia Bay inshore (3Psc) in the past four years (2008-2011). Annual exploitation rates (= % harvested) were estimated for 2008-2010 based only on cod tagged in Placentia Bay. The numbers of tags returned were adjusted by annual estimates of tag reporting rate based on a high-reward tagging study. The single tag reporting rate for the inshore of 3Ps during 2010 was 0.72 and has averaged 0.78 during 1997-2010. The numbers of tagged cod available for capture at the time of the fishery each year was estimated after accounting for initial tagging mortality, tag loss, assumed natural mortality (M=0.2), and recaptures in preceding years adjusted by the tag reporting rate. The estimates are influenced by the sizes of cod tagged due to selectivity of commercial fishing gear and larger cod (>60 cm) tend to be more readily selected by gillnets than smaller ones. The exploitation rates for 2010 based on cod >60 cm at tagging averaged 35 % (F=0.43) and for cod >65 cm averaged 32% (F=0.39). Only 68% of the TAC was taken in 2010. To investigate whether lower estimates of exploitation rates for longer time at liberty were due to the assumed value of M being too low, exploitation rates were recomputed with M=0.3 and M=0.4; this raised the estimates for long times at liberty but did not eliminate the reduction. The distribution of recaptures indicated some movement of cod from 3Ps into southern 3L during summer but the numbers of tag returns from 3L has been very low (zero in 2008 and 2009 and only 7/205 in 2010). The low catch of cod in southern 3L during 2010 (~200 t) and low return of 3Ps-tagged cod from 3L suggest that exploitation of migrant Placentia Bay cod in southern 3L is not a significant issue; most of the exploitation is taking place locally within unit area 3Psc.

Discussion

The applicability of the 3Psc tagging information for representing the 3Ps cod stock as a whole was discussed. There is no offshore tagging on-going at this time. Well over 90% of tags are recaptured in Placentia Bay (even 3 years later).

It was suggested that the exploitation rate may have gone up because there are fewer fish in the system to catch.

The tagging data and the sentinel indices have not been used in the assessment model. They can however be used to provide an independent assessment of population behaviour and mortality to compare with the model outputs. Early in these programs, there was concern that the concentrations of cod in the bays would limit the applicability of these findings to the larger area. However, with the decline in the bay subcomponents it was thought that these findings provide valuable information for the stock as a whole.

The reliability of the pre-moratorium catch statistics was discussed. An understanding of the reliability of pre-moratorium commercial catch data is essential for determining reference points. This is the only piece of information we have to tell us how productive this stock was in the past.

If reference points are produced incorporating the post-moratorium commercial data a sensitivity analysis could be done to see how a multiplier would change the reference points.

Other information required to use the data from 1979 to 1990 include the age structures (weight-at-age) for those years. This information may be available from ICNAF archives.

These tagging analyses imply that there may be a selectivity issue. The longer the fish are at liberty the more widely they are dispersed. Why is the 2008 value (captured in 2010) lower than the 2009 and 2010? It was suggested the analysis be redone for groups of 50-65 cm and >60 cm. This table could be tag loss or tagging mortality (i.e., high mortality for the 2008 >65 cm fish). All fish were tagged in the inner part of Placentia Bay. Maybe the last year is more representative of the random tagging.

The percentage of tags returned for 2009 and 2010 is about 70%.

HARVEST RATES (MODIFIED – GROUPED FISH CM)
Presenter: John Brattey, DFO Science, NL Region

Abstract

Annual harvest rates based on recaptures of tagged cod released in Placentia Bay during 2008-2010 were recomputed using different assumed values for the instantaneous rate of natural mortality (M=0.2, 0.3, and 0.4 per year). The initial analyses (M=0.2) showed that exploitation rates were often lower for tagged cod with longer times at liberty. The purpose of the reanalyses was to investigate whether a higher assumed value of M would be more appropriate. Higher assumed values of M would lower the numbers of tagged fish available for recapture and increase the estimates of harvest rates for longer times at liberty. The reanalyses was conducted for tagged cod grouped in 5 cm length increments, but higher assumed values for M did not completely eliminate the declining trend. Close inspection of the results indicates that the declining trend was most notable among the largest cod (>65 cm) tagged in 2008 and recaptured in 2010 when they would have been approx 10-15 cm larger. In that year sample size was lowest (N=81 for cod >65 cm) and tagging was conducted at only two sites (compared with >10 during 2009 and 2010). The decline in harvest rates with time at liberty for the 2008 tagging may have been due to a combination of lower selectivity of the largest cod by gillnets and small sample size.

Discussion

The comment was made that larger fish do not gillnet really well which may be an advantage as the larger fish are the spawners. The gillnet selectivity peaked at 78 cm. The conclusion after this new grouping was that it still needs more thought. Other work being done does not give the sense that fish are just dispersing out wider.

There was not a big sample size in 2008. Three hundred and fifty fish greater than 50 cm were tagged. The information presented factored in tag loss. It was decided that some text around this would be included in the SAR.

ENVIRONMENTAL REGULATION OF CAPELIN IN THE NORTHWEST ATLANTIC
ALEJANDRO D. BUREN, MARIANO KOEN-ALONSO, FRAN MOWBRAY, BRIAN NAKASHIMA, GARRY STENSON, PIERRE PEPIN, NEIL OLLERHEAD
Presenter: Alejandro Buren, Memorial University of Newfoundland

Abstract

During the early 1990s the Northwest Atlantic underwent extensive ecosystem changes. In the case of capelin, these changes included a major reduction in acoustic offshore abundance estimates, reduced size and age at maturity, reduced somatic condition and delayed spawning. Invoking metabolic reasoning, the timing of spawning has been explained by a combination of fish length and temperature conditions during February to June, while the drivers modulating the biomass trajectory have remained elusive. The initiation of the spring bloom in the Newfoundland Shelf is determined by light availability and seasonal sea ice dynamics. Using data from 1980-2010, we study the relationship between sea ice, capelin biomass and timing of spawning to explore the hypothesis that capelin dynamics are environmentally regulated through food availability. We found that simple models with a break in 1991 and sea ice as modulator account for more than 80% of the variability in peak spawning date and more than 90% of the variability in capelin biomass. We predict biomass levels during the 1970s and found good agreement with estimates based on advisory models of sequential capelin abundance. Our results support the hypothesis that bottom-up control mechanisms may be at play. Given capelin's role as key forage species in this ecosystem, these findings are particularly relevant as they provide an avenue to explore the potential impacts of climate change on ecosystem productivity.

Discussion

Discussion ensued about the environmental drivers for 3Ps cod. Are they likely to be similar to the northern stocks? How are they affected by the observations of scarce capelin and/or abundant grey seals?

TELEPHONE QUESTIONNAIRE – 3PS 2010 COD FISHERY
Presenter: Harvey Jarvis, FFAW

Abstract

To provide an overall perspective of stock status the FFAW has been conducting surveys of 3Ps Fish Harvesters in the under 65 foot fleet annually since the mid 1990's. The most recent survey was conducted between February 1 and 12, 2011 and it collected information on the 2010-11 fishing season.

Prospective survey participants are selected at random from all 3Ps resident fish harvesters licensed to catch cod. The number of prospective participants was determined by using a survey and sampling protocol that is designed to produce a result that has a 95% confidence interval, + or - 5%, 19 times out of 20.

The total sample size for the February 2011 survey was 203, 133 of those participated in the survey, 7 declined and 63 could not be reached.

The average age of survey participants was 53 and the average number of years of fishing experience was 31. Of the total number of participants, 80% were in the under 35ft fleet, 12% were in the 35 to 45 foot fleet and 8% in the 45 to 65 foot fleet.

Discussion

Harvesters reported an increase in the abundance of grey seals particularly in Fortune Bay. They were also concerned about commercial fisheries for bait herring and increased rates of seal worm infection. The rates of infection have increased by 10-20% per year, however, they remain lower than those for the Scotian Shelf and southern Gulf.
There seems to be a decrease in landings this year in the inshore that may be related to good fisheries for crab and whelk and other sources of income.

OFFSHORE
Presenter: Mike O' Connor, Icewater Harvest

Abstract

Fish harvesters in the >35 ft vessel sector, during the 2010 -11 fishing season saw a decline in the abundance of older (larger) fish in the offshore catch, down from the previous winter season. They also saw evidence of the reasonably strong 2006 year-class in their catches. On average catch rates in the offshore fishery were good but there were fewer sea-days with very high catch rates. Competition with fixed gear vessels for traditional offshore fishing grounds and variable weather conditions were factors affecting reduced catch rates. The number of fishing trips for cod by the offshore sector by mobile vessels greater than 33m during January and February were limited by labour disruptions.

Discussion

As a whole January and February are the best fishing times in the Halibut Channel. The fish are smaller and catch rates are lower in comparison to previous years.

Catch of small fish was due to availability and not market driven. It was felt by industry that the 97 and 98 year class in the fishery lasted a longer time than expected, however, they are not seeing them anymore.

The concentration of fish in the Halibut Channel has gone down over time.

MODELING APPROACHES

A VPA-BASED MANAGEMENT STRATEGY FOR 3PS COD
Presenter: Joanne Morgan and Peter Shelton, DFO Science, NL Region

Abstract

3Ps cod has a long catch history that is not currently included in the assessment. Reference points based only on recent (depleted) stock history are not likely to reflect real limits of stock productivity or targets for maximizing yield. To include a longer period in the calculation of reference points an ADAPT was fit to catch and survey data for 3Ps cod. Catch numbers at age from 1959-2009 were included. The survey indices were the offshore survey from 1983-1996 and the inshore-offshore index from 1997 to 2009. Based on these results a segmented regression was fit to the stock recruit data to estimate Fmsy and Bmsy based reference points. Long term average weights and maturities were used while the partial recruitment vector was averaged over the period since the moratorium. Bmsy was estimated to be 91 000 t of SSB and Fmsy 0.38. Recent SSB is estimated to have been near or below 40% Bmsy while F has been near or above Fmsy. The results of this process could be used in simulation testing of a

feedback harvest control rule (HCR) through management strategy evaluation and then apply in "autopilot" mode. This HCR could be based on survey trends so annual assessments are not required. MSE requires operating models for testing against but not a single "best" assessment model.

Discussion

The uncertainties surrounding the data used for this analysis and the constraints arising for the model were discussed. Landings are greater than the Sum of Products (SOP) in some years. An internal filter of 20% was used on the analysis for age length keys. Any more than that is rounded. The ICES standard is anything >10% SOP indicates a problem.

Reliability of catch statistics remains a problem.
The 1983-1995 survey occurred at various times. This would affect the 4Rs and 3Pn cod in the 3Ps area. The main impact would be on the estimates of q in the 1983-92 period. Since 1995 the survey has been timed to represent 3Ps cod.

The difference between the early years and the current period was discussed. Is the change in the population the result of a fishery or environmental effect? There will be a meeting in December in Ottawa that will discuss this topic. Can the model take this into consideration with respect to the recovery? Not currently because it would have to model potential changes in productivity into the future. Projections for taking 25 and 50% of annual surplus production as yield can be made with this model if it is accepted by the meeting.

This is a VPA model with catch (stock recruit model fit was run from 1983 on-wards). The option for using statistical catch at age to improve the model was discussed. The stock recruit curve has a poor fit. This may be due to recent low recruitment. Other factors that may be affecting the fit include skip spawning, lower success rates for smaller spawners and a decrease in duration of spawning for smaller individuals raising the likelihood of a mismatch with availability of larval prey. The influence of the observed changes in age-at-maturity on the recovery potential of the stock is not known. The model presented here uses the long term average. Options for different stock recruit curves and the most suitable one for this stock were discussed.

ESTIMATES OF STOCK SIZE FROM SURVEY RESULTS: SURVEY-BASED (SURBA) ASSESSMENT (N.G. CADIGAN AND B.P. HEALEY)
Presenter: Noel Cadigan, DFO Science, NL Region

Abstract

Recent assessments of 3Ps cod have applied cohort models to age-disaggregated results from DFO RV surveys. The model (Cadigan, 2010) assumes that total mortality can be decomposed into an age and year effects. Updated estimates of stock size using survey data from 1983-2011 indicate that following a steep decline in spawning biomass (SSB) from 2004-2009, survey SSB has increased in 2010 and 2011.

A revised model was presented in which total mortality was decomposed into an assumed value for natural mortality (0.2) and separable fishing mortality which could be estimated using age and year-effects. In this "separable F" model, results were similar to those from the "separable Z" model, though the probability that SSB was below the limit reference point (LRP; BRecovery=SSB1994) is higher in recent years. For the separable F model, the probability that SSB2011 is below the LRP is 0.19.

A sensitivity analysis of model fit for several values of M is presented, and indicates that the model fits best when M=0 (i.e. a separable Z model). Thus, some discussion is required on the choice of model for projections of various management scenarios, and also for the model used to underpin exploration of MSY reference points.

Discussion

There has been a change in maturity for some cohorts.

To deal with the missing 2006 survey, the survey is given a value but has been given a zero weight in the model.

How does this feed into management advice? Management commented that the three year projection results from the last years assessment was useful (i.e., increase ssb with status quo Z).

The question was raised about using standardized effort in the model and management methods (effort regulated)? The comment was made that effort could be harder to estimate than catch. Catch is easier to have prior to the moratorium. The catches for >65' fleet have daily hail and verified dockside monitoring. For the offshore it was felt by industry that the catch data cannot really be improved.

PROJECTIONS OF SURBA ESTIMATES OF SSB (N.G. CADIGAN AND B.P. HEALEY)
Presenter: Brian Healey, DFO Science, NL Region

Abstract

Three-year projections were undertaken for both formulations of the SURBA model (separable F and separable Z). Projection inputs were taken as recent averages. Total or fishing mortality (as appropriate) over 2011-2013 was assumed to be constant at either 80%, 90%, 100%, 110% and 120% of current values.

Results indicate that SSB will increase in 2012 due to the recruitment of the relatively strong 2006 year class, and that the probability of being below the LRP in 2012 is low. However, there are subsequent declines in both total biomass and spawning biomass in 2013 and 2014.

Consideration is given to why projections from the current assessment are more pessimistic than those from the previous assessment. Revisions to recent recruitment within the assessment period suggest weaker prospects for projected SSB in the near-term.

Discussion

There was a question as to why the projection uses the geometric mean instead of the arithmetic mean. In SURBA, everything is done on the log scale and the arithmetic mean of the logged values is the geometric mean.

The most recent estimate of SSB and recruitment is the most uncertain. Longer term projections require a closer examination of recruitment. For SSB this is not an issue but for total biomass it may be relevant.

PRELIMINARY INVESTIGATION OF DERIVING MSY REFERENCE POINTS FROM THE SEPARABLE-F SURBA MODEL
Presenter: Noel Cadigan, DFO Science, NL Region

Abstract

With the assumption that natural mortality equals 0.2, SURBA can be used to estimate fishing mortality and to derive MSY reference points. Preliminary investigations demonstrated that the stock-recruitment relationship is poorly defined by the SURBA estimates of relative SSB and recruitment. Bootstrapping the Beverton-Holt stock-recruit model demonstrated that uncertainty in MSY reference points is large. There is evidence of autocorrelation in stock-recruit residuals, and this should also be accounted for when deriving MSY reference points.

The form of the stock-recruit model also had large impacts on MSY reference points.

Discussion

There will be large effects on MSY reference points depending on the stock-recruit models. A Beverton - Holt (B-H) stock-recruit model was used here. This was questioned as to why not use best practices to determine the model fit. It was suggested the one parameter model be tried first before the two parameter model (B-H) in the SURBA. Currently the stock-recruit model is estimated outside of the assessment model. Doing so within the assessment model may reduce some of that uncertainty. More data might reveal the stock-recruit relationship. Alternatively, more than one curve might fit best at different times.

Further work to improve the preliminary SURBA model could also include adding age-composition; using the Cameron RV surveys to go back in time and using the landings data (if could be reliably established). It was also recognized that the issues pointed out with the assessment model are not specific to SURBA.

The question of comparing the outputs of the two models arose. Common currencies for the ADAPT and SURBA would be required to do this. The suggestion was made to plot the sentinel, SURBA, and VPA and present it at the meeting.

Discussion of which model was appropriate ensued. Further discussion of the ADAPT model was suspended to focus on the SURBA model as questions on reliability of the catch data still need to be answered before the ADAPT can be used.

Discussion ensued about which SURBA to use (separable Z or separable F). Separable F has a poorer fit however it does allow the determination of F/FMSY and B/BMSY. Also, the separable F model is more ecologically/biologically relevant. Total mortality for some years may not be as low as SURBA is suggesting. The validity of the assumption for this version of the model that natural mortality (M) = 0.2 was also discussed.

Discussion ensued as to whether the meeting could present the preliminary reference points from the separable F SURBA model with the caveats about the uncertainties and the selection model. There was concern that the model used might not be the best approach and had not been peer reviewed. Bmsy estimates from this model would be for the swept area and not the 3Ps area. We lack the biomass information to assess against Bmsy. Historical data would be helpful if reliability is known. The ratio of B/Bmsy could be used because this provides stock status relative to the reference points. Similarly, F/FMSY could be provided.

It was pointed out that estimates of mean F are double the current Fmsy. This means that managers would have to cut the catch in half.

A plot of the projections relative to the stock reference points was requested so that participants could see how the model output related to the status of the stock.
The mortality used for the projections was calculated on 2009-11 when mortality was high. The 2006 year class is not included in this value. So when this cohort commences spawning it may change the estimates of mortality.

Several participants suggested that in assessment models usually comment on mortality averaged over age 5-10 not 6-12. It was done 5-10 in ADAPT and other assessment models. Results from the current analysis will be reported by averaging mortality for ages 5-10.

PLOTS OF STANDARDIZED INDICES AT AGE
Presenter: Joanne Morgan, DFO Science, NL Region

A simple analysis was conducted to examine the consistency between the various analyses that were attempting to monitor population trends. The catch per unit effort (CPUE) at age for sentinel gillnet and linetrawl, and the population numbers at age estimated from VPA and SURBA were each standardized to their time series mean for each age. For the purposes of this analysis, the results for the sentinel survey after 2000 were used. These were compared by plotting the time series of results from each source by age and by conducting correlations by age.

The VPA and SURBA results were correlated at every age (1983-2010). The gillnet and linetrawl surveys only correlated with the VPA at one age. Although the sentinel indices were not correlated with the VPA or SURBA results the plots indicated some consistency and the lack of correlation may be related to the short time series used for the sentinel indices. Because the different time series were of different lengths and each was standardized to its entire time series mean, this could have also affected the results.

CONCLUSIONS OF THE MODELING DISCUSSION

A VPA model and a SURBA model were presented. Components of these models were discussed as were the limitations associated with the data and assumptions used to generate them. The VPA model was withdrawn from further discussion as an alternative to the SURBA model for this current assessment. Further consideration was given to two formulations of the SURBA model: one with variable Z and one with variable F where M (natural mortality) is assumed to be 0.2.

The terms of reference for the meeting requested the determination of reference points FMSY and BMSY for the 3Ps cod stock. Following discussion of the various concerns and limitations of the VPA model relating to reliability of the early (pre 1990) catch statistics, the stock recruit curve and the poor fit for recent observations, the meeting determined that relative reference points, F/FMSY and B/BMSY could be developed from the variable F formulation of the SURBA model. These relative reference points for each year of the research survey could then be plotted against the limits in the DFO PA approach to determine current status and trends for this stock.

Extension of the research survey to 3Ps as a whole could possibly be done using swept area however; given the uncertainties surrounding the model, the data and approach this was not determined at this time.

Concerns were raised about the uncertainties in the information used to generate these reference points and about the appropriate stock-recruit relationships to use. **Participants agreed that a thorough peer review of the modeling approach and its application to 3Ps cod was required to ensure the quality and reliability of the scientific advice.**

General consensus of the meeting participants was that the results of these modeling exercises and analyses are preliminary and require further research and review before they can be presented definitively as a conclusion of the meeting. Therefore we are unable to reach a conclusion at this time regarding reference points FMSY and BMSY. **We strongly recommend that this question be referred back to Science for further research.**

RESEARCH RECOMMENDATIONS

*Improve models for 3 Ps cod population analysis (required to provide peer-reviewed models to estimate BMSY and FMSY)
- reliability of information
- age structure and size at age for older data (ICNAF information)
    - use of Cameron surveys
    - consider statistical catch at age
- appropriate recruit/spawner relationship
- selection of ages to use in model
- applicability of M = 0.2 for this stock
- influence of autocorrelation

*Reliability of catch statistics
- extend approach of Bousquet et al (2010) to 3Ps cod
- monitoring and observer coverage
- improved design of coverage to provide statistically appropriate information***

Tagging throughout area to provide inshore and offshore information***

Incorporation of information from tagging and sentinel programs into model evaluation
- how sentinel dynamics reflect stock as a whole ***

Percentage of skip spawners in the population
- influence of environmental conditions***

Relationships to environmental variables
- recruitment and primary and secondary productivity***
- role of prey (capelin), predators (grey seals), parasites***
- coherence of information from AZMP results for Grand Banks and St. Pierre Bank to apply longer term datasets to analysis
- other environmental drivers
    - influence of ice in the Gulf or Grand Banks***
    - outflow from St. Laurence***

Within survey characteristics that indicate year class effects

* highest priority topics requiring immediate attention
*** items that require longer – term study and/or new data.

References

Bousquet, N., Cadigan, N., Duchesne, T., and Rivest, L.-P. 2010. Detecting and correcting underreported catches in fish stock assessment: trial of a new method. Can. J. Fish. Aquat. Sci. 67: 1247-1261.

APPENDIX 1: TERMS OF REFERENCE

Atlantic Cod in Subdivision 3Ps
Newfoundland and Labrador Regional Advisory Process
October 25th – 28th, 2011
St. John's, Newfoundland and Labrador

Chairperson: Dr. Robin Anderson, DFO Science, NL Region

Context

The status of NAFO Subdivision 3Ps cod was last assessed in October, 2010. The current assessment is requested by Fisheries and Aquaculture Management (1) to provide the Minister with detailed advice on the status of the stock and the implications of a possible cod fishery on this stock in 2012/13 and (2) to assist in developing a rebuilding plan for 3Ps cod.

Objectives

- Assess and report on the current status of the 3Ps cod stock. In particular, assess current spawning biomass, total (age 3+) biomass, exploitation rate, natural mortality and biological characteristics (including age composition, size at age, age at maturity, and distribution). Describe these variables in relation to historic observations.
- Further to the previous assessment, analyze recent year class strength relative to previous observations, as it relates to long term growth and sustainability of the stock.
- To the extent possible with available information, provide information on the strengths of year-classes expected to enter the exploitable populations in the next 1-3 years.
- Highlight major sources of uncertainty in the assessment, and where appropriate, consider alternative analytical formulations of the assessment.
- Assess the implications on the stock by fishing at selected Total Allowable Catch (TAC) levels: 10,000 t, 11,500 t, 13,000 t, and 15,000 t.
- Report on results of tagging and the distribution of this stock in other areas (eg., 3L/3Pn).
- Identify the following reference points: Fmsy, Bmsy.
- Based on the accepted assessment and assumptions associated with long-term projections, advise on the time frame required to reach Bmsy under various projections of catch and/or fishing mortality. Such catch projections should consider the following options if possible: taking 50%, 25%, and 0% of annual surplus production as yield.

Products

A Science Advisory Report (SAR) and associated Research Document(s) will be produced. A Proceedings will record the meeting discussions.
Participation

DFO Science, and Ecosystem and Fisheries Management
Provincial Department of Fisheries and Aquaculture
Non-Governmental Organizations
Industry Representatives
Academia
Aboriginal Groups

APPENDIX 2: PROPOSE AGENDA

Alcock Room, St. John's Convention Centre,
50 New Gower Street, St. John's, NL
October 25-28, 2011

Chairperson: Dr. Robin Anderson

Tuesday, October 25 (0900-1700)

Opening/Chair remarks (0900)	R. Anderson
Introductions/Work plan/ ToRs	R. Anderson
Oceanographic update	G. Maillet
Fisheries regulations and review of 2010/11 fishery season; 2011/2012 season to date	R. Smith
Oceanographic update	G. Maillet

Catch and Survey Trends

- Catch   J. Brattey/ B. Healey
    - Catches and catch-at-age
    - <35 ft Logbook data, catch rate index

- Survey   J. Brattey/ B. Healey/ J. Morgan
    - Biomass/Abundance updates
    - SSB
    - Age composition, size at age (length, weight and condition), age at maturity
    - Distribution
    - Recruitment index

- Sentinel Program   D. Maddock-Parsons
    - Data overview & standardized index

Tagging Update	J. Brattey

Wednesday, October 26

Industry perspective (Offshore sector)	M. O'Connor
Environmental regulation of capelin in the Northwest Atlantic	A. Buren
FFAW questionnaire update	H. Jarvis
VPA / PA / BMSY	J. Morgan/ P. Shelton
SURBA/ BMSY	N. Cadigan/ B. Healey

Thursday, October 27 (am)

Time-to-MSY projections (Framework Document)   N. Cadigan / All

Thursday October 27 (pm) – Friday October 28   ALL

SAR Drafting

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