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**Proceedings of the Newfoundland and  
Labrador Regional Advisory Process  
for 3Ps Cod**

**November 5-9, 2007  
The Gazebo, Clovelly Golf Club  
Stavanger Drive, St. John's NL**

**Meeting Chairperson  
Geoff Evans**

**Editor  
D.B. Atkinson**

**Compte rendu du Processus de  
consultation régional de Terre-Neuve-  
et-Labrador sur la morue de 3Ps**

**Du 5 au 9 novembre 2007  
The Gazebo, Clovelly Golf Club  
Promenade Stavanger, St. John's  
Terre-Neuve-et-Labrador**

**Président de réunion  
Geoff Evans**

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**March 2008**

**Mars 2008**

## **Foreword**

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

## **Avant-propos**

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

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## **SUMMARY**

A Meeting of the Newfoundland and Labrador Regional Advisory Process (RAP) on Groundfish was held 5 - 9 November 2007 in St. John's, Newfoundland and Labrador. An assessment of the stock status of 3Ps cod was carried out based on questions posed in the Terms of Reference (ToR) prepared jointly by Fisheries and Aquaculture Management and Science. As part of the process, an overview of environmental conditions in the 3Ps area during 2007 was presented. Participants included DFO staff from Science (NL and Quebec regions) and Fisheries and Aquaculture Management (NL Region) branches, representatives of the fishing industry (inshore harvesters, a representative from the offshore industry and the FFAW), France, and representatives of the government of Newfoundland and Labrador. The meeting rapporteur was D.B. Atkinson.

These proceedings contain a summary of working papers and PowerPoint presentations as well as summaries of the related discussions. Also included as appendices are the ToR, a list of participants and a list of all working papers and PowerPoint presentations available during the meeting. There were no research recommendations arising from the meeting. The Proceedings do not necessarily exactly follow the chronological order of discussions but are organized to match the flow of the presentations and topics discussed.

Additional information on the 2007 assessment of 3Ps cod is available in the CSAS research document series and Science Advisory Report.

## **SOMMAIRE**

Une réunion du Processus de consultation régional de Terre-Neuve-et-Labrador a eu lieu du 5 au 9 novembre 2007 à St. John's, Terre-Neuve-et-Labrador. On a procédé à une évaluation de l'état du stock de morue de 3Ps en fonction des questions posées dans le cadre de référence élaboré conjointement par les secteurs de la Gestion des pêches et de l'aquaculture et des Sciences. Dans le cadre du processus, on a présenté un survol des conditions environnementales observées dans la zone 3Ps en 2007. Au nombre des participants figuraient des représentants du secteur des Sciences du MPO (Régions de Terre-Neuve-et-Labrador et du Québec) et du secteur de la Gestion des pêches et de l'aquaculture (Région de Terre-Neuve-et-Labrador), des représentants du secteur des pêches (pêcheurs côtiers, pêche hauturière et FFAW), la France et des représentants du gouvernement de Terre-Neuve-et-Labrador. Le rapporteur de réunion était D.B. Atkinson.

Le présent compte rendu contient un résumé des documents de travail et des présentations PowerPoint ainsi que des sommaires des discussions connexes. Sont également joints en tant qu'annexes le cadre de référence, une liste des participants ainsi qu'une liste de tous les documents de travail et des présentations PowerPoint données au cours de la réunion. Aucune recommandation en matière de recherche n'a été formulée pendant la réunion. Le compte rendu ne suit pas nécessairement l'ordre chronologique exact des discussions, mais coïncide avec les présentations et les sujets discutés.

Des renseignements supplémentaires sur l'évaluation de la morue de 3Ps de 2007 sont disponibles dans la série des documents de recherche et dans l'avis scientifique du SCCS.





## INTRODUCTION

A Meeting of the Newfoundland and Labrador Regional Advisory Process (RAP) on Groundfish was held 5 - 9 November at Clovelly Golf Course, Stavanger Drive, St. John's, NL to carry out an assessment of the status of 3Ps cod.

The meeting began at 0900 on November 5 2007. Participants were welcomed by the Chairperson (Geoff Evans, Marine Systems Ecologist, Aquatic Resources Division, Science Branch, DFO, NL Region) who gave a brief overview of the assessment process. It was indicated that the context of the meeting would be based upon the Terms of Reference (ToR) (Appendix I) that contain specific requests for information. Also, the Science Advisory Report (SAR) will be documented as requested in the ToR. The Chair invited all participants to participate fully in all discussions but also requested that all participants respect the confidentiality of discussions until such time as the SAR is released to the public.

The Chair noted that no specific agenda would be available and the meeting process was therefore quite flexible. His assumption was that everyone was at the meeting to reach conclusions regarding stock status.

The Chair introduced Dale Richards, the meeting coordinator and acknowledged the work of Nadine Wells prior to Dale's return. He also noted that Bruce Atkinson would serve as rapporteur. Introductions were then made around the table.

The list of participants is given in Appendix II. Not all participants attended all sessions of the meeting.

Research Recommendations are addressed in Appendix III and a list of working papers and PowerPoint presentations is provided in Appendix IV.

## MEETING PROCEEDINGS

In the absence of a formal agenda, the meeting proceeded with presentations as they were available followed by specific associated discussions. This was followed by discussion of the objectives as outlined in the ToR, then extensive general discussion of all of the various data sources and their interpretation in the context of stock status. Lastly, discussion of text for the various sections of the SAR took place (bullets, sources of uncertainty, stakeholder perspectives, conclusions and advice, remainder of text). Also, during the meeting a presentation on an exploratory statistical catch-at-age analysis was presented. This was for information only as work is only preliminary but it may have value in the future. This too is reported on in the proceedings.

## FISHERIES AND AQUACULTURE MANAGEMENT PERSPECTIVES

**Presenter – Kim Penney (DFO – FAM)**

*Presentation Title: Conservation Harvesting Plan (CHP): 3Ps Cod by Kim Penney*

SUMMARY:

Fisheries and Aquaculture Management (FAM) was asked to provide an overview of the 3Ps Groundfish Conservation Harvesting Plan (CHP), with a concentration on cod and the changes in the CHP from 2005 to 2006. The management cycle for 3Ps cod is briefly described highlighting the various steps in the process as well as the timing of their occurrence. The development process for the CHP is described as well as its key elements

and general provisions. The reduction in TAC for 3Ps cod was identified as the major change between 2005 and 2006; the TAC was reduced from 15,000 t in 2005 to 13,000 t in 2006 and maintained at 13,000 t for 2007. As a result, IQs were reduced accordingly, and by-catch restrictions were implemented on some fleets as per the Hearn Report. It was noted that the wording for 2007 license conditions had changed somewhat from previous years in order to address SARA issues.

FAM will consult with industry during community-based meetings and the advisory process early in 2008 to discuss the new CHP for the upcoming fishing season as well as new provisions such as IFMP Renewal as part of an overall Sustainability Framework. More community-based meetings will occur in 2007 due to complaints regarding too few meetings in 2006.

The presentation also includes information regarding long term objectives, management objectives and Integrated Fisheries Management Plans (IFMP) renewal.

#### DISCUSSION:

Why is it mandatory to land fish <45 cm caught in long lines as part of the small fish protocols? The harvester feels that these fish can survive if released from this gear. FAM representatives agreed that this could be a topic for discussion during the upcoming consultation meetings.

How many closures have there been due to small fish catch exceeding 15%? The information was not available for the meeting but could be obtained easily if required.

Questions were posed regarding details of the gillnet tagging program and how the information is maintained. Tags are issued by the FRC and records are also maintained by that group. FAM representatives were not clear on how the records are kept. It was agreed that these data may be useful in getting information on ghost fishing. A harvester reported that fishers are fined if tags are lost but not reported.

3Pn fishers are still active in 3Ps. Also, some 3L fishers still have overlap privileges in 3Ps but larger vessels are restricted to bycatch only.

## OCEANOGRAPHIC CONDITIONS IN 2007

**Presenter – Eugene Colbourne (DFO – Science)**

*Presentation Title: Ocean Climate Variability in NAFO Division 3P during 2007 - potential influences on the Distribution and Abundance of Atlantic Cod by E. Colbourne and E. Murphy*

#### ABSTRACT:

Oceanographic data from NAFO Division 3P during the spring of 2007 are examined and compared to previous years and the long-term (1971-2000) average. Temperature measurements on St. Pierre Bank show anomalous cold periods in the mid-1970s and from the mid-1980s to mid-1990s. Beginning in 1996 however, temperatures moderated, decreased again during the spring of 1997 and returned to normal values during 1998. During 1999 and 2000 temperatures continued to increase, reaching the highest values observed since the late 1970s in some regions. During 2001-2003 however, temperatures cooled significantly to values observed during the mid-1990s with the average temperature during the spring of 2003 the coldest in about 13 years. Temperatures during both 2004 and 2005 warmed considerably over 2003 values to 1°C above normal in some areas. The aerial extent of <0°C bottom water during 2003 increased to the highest in about 13 years but

decreased during 2004 and 2005 to <10%, the lowest since 1988. On St. Pierre Bank bottom water with temperatures <0°C almost completely disappeared during the warm years of 1999, 2000, 2004 and 2005. During the spring of 2007 however, near-bottom temperatures decreased to below normal values in many areas particularly on St. Pierre Bank, where the area of <0°C water increased to near 30%. The aerial extent of bottom water with temperatures >3°C has remained relatively constant at about 50% of the total 3P area, although actual temperature measurements show considerable inter-annual variability. The most evident trend in the numbers of cod caught per set during the multi-species surveys was the high number of zero catches in the <0°C water on St. Pierre Bank and regions to the east of the Bank, mainly from 1985 to 1998 but also from 2001 to 2003. During 1999 and 2000 larger catches became more wide spread over St. Pierre Bank as cold (<0°C) water disappeared from the area. In general, cod tend to prefer the warmer (2°- 6°C) portion of the available habitat with a slightly warmer preference based on weight than on total numbers. Finally, variations in the estimated abundance and biomass of cod from the RV surveys in strata with water depths <92 m are significantly correlated with bottom temperatures for that depth range, indicating a potential climate effect on cod distribution in this area.

#### DISCUSSION:

The results might appear to suggest that the stock was declining in 2007. In fact, the analysis just suggested a relationship between survey estimates and water temperature. The survey data would be looked at in more detail later during the meeting.

### COMMERCIAL FISHERY INFORMATION

#### Catches and Catch-at-Age

#### **Presenter – John Bratley (DFO – Science)**

*WP Title: Assessment of the Cod (Gadus morhua) stock in NAFO Subdiv. 3Ps, November 2007 by J. Bratley, B. P. Healey, M. J. Morgan, E. F. Murphy, D. Parsons, D. Power, and J.-C. Mahé (+others??)*

*Presentation Title: Assessment of the Cod (Gadus morhua) stock in NAFO Subdiv. 3Ps in November 2007 by J. Bratley, B. P. Healey, M. J. Morgan, E. F. Murphy, D. Parsons, D. Power, and J.-C. Mahé (+others??)*

#### ABSTRACT:

Scientific information available to determine the status of the cod stock in NAFO Subdiv. 3Ps off the south coast of Newfoundland for the November 2007 assessment included a time series of reported landings from commercial fisheries (1959 - March 2007). Annual landings prior to the moratorium were typically in the 30,000 t to 60,000 t range, but declined rapidly during the late 1980's and a moratorium was in place during 1993-1997. The fishery reopened in May 1997 with a TAC of 10,000 t, and this was increased briefly to 20,000 t in 1998 and to 30,000 t in 1999, but was subsequently reduced to 15,000 t during the period 2001/2002 to 2005/2006, and to 13,000 t during 2006/2007 and 2007/2008. In 2006/07, total reported landings were 13,169 t, mostly (78.4%) from the fixed gear sector. The total includes a recreational fishery catch of 42 t, and a French catch of 1,916 t, approximately 1,361 t of which was caught by otter trawlers and the remainder (555 t) by fixed gear, particularly gillnets. The fishery was still in progress at the time of the assessment and complete information on catch rates and age compositions from 2007/2008 fishery was not available. During 2006/2007, most of the catch was taken by gillnets and landings comprised a range of ages (mostly 5-9 year olds). The 1997 and 1998 year-classes were well represented in the

catch during 2003-2006. Cod ages 8 and 9 were strongly represented in otter trawl catches during 2006, whereas ages 5-8 were well represented in line trawl catches. Two strong year-classes (1997 - 1998) have been well represented in the catch throughout 2003 – 2006.

#### DISCUSSION:

'Inshore' catches refer to those taken in 3Psa,b,c and 'offshore' catches are those from the remaining areas of 3Ps. The 2007 landings data were only to October 1, and the 2007 first quarter catch-at-age was not yet available.

The catch information showed some similarities to the catches of cod in the northern Gulf. There is a shift to more of a gillnet fishery during summer. Also, age 8 seemed dominant in catches from both areas in 2006. It was suggested that this should be kept in mind during discussions with fishers as the industry picture of the resource could be biased since they were fishing the best gear at the best time of year.

Although age 8 dominated, there was good representation of ages 5, 6 and 7 as well as age 9. With 4-5 year-classes well represented, it didn't appear to be an unhealthy stock. The high numbers of age 8 are probably related to the higher price being paid for larger fish.

Were there any changes in the mesh size in gillnets? Industry participants were not sure about any overall changes but did point out that mesh size depends on area fished as well as size of fish and price. While there hasn't always been a better price for larger fish, there was in 2007. One harvester did indicate that he had moved to larger mesh in 2007.

Scientists indicated an ongoing concern with dumping and discarding of smaller fish due to the price differentials (highgrading). There are stories that circulate from time to time but at present there is no way to quantify how extensive the practice might be. The FRCC recommended, back in 2000, that this be examined but to date nothing has been done.

The FFAW representative commented that 5<sup>1</sup>/<sub>2</sub> inch mesh catches smaller fish than 6<sup>1</sup>/<sub>2</sub> inch mesh. Discarding is a serious issue but is not widespread and the differences seen are due to changes in mesh size depending on fish size and economics.

#### **Science Logbooks**

**Presenter: Brian Healey (DFO – Science)**

*Presentation Title: Science Logbooks, <35' Vessels by Brian Healey*

#### ABSTRACT:

Commercial logbook data over 1997-2006 for the small vessel (<35') sector were summarized by geographic location and gear type. A time-series of unstandardized catch rates for each area indicated that gillnet catch rates in 2006 are generally stable (compared to 2005) in most areas. Current gillnet catch rates in all areas were substantially lower than at the beginning of the time series. Line trawl catch rates for 2006 in the Francois to Burgeo area were the highest in the time series, as were the catch rates along most of the south coast and into Fortune Bay. Line trawl catch rates were also high in Placentia Bay, although there was relatively low line trawl effort in this area.

The logbook data were modeled using a generalized linear model to produce a time series of standardized catch rates by removing spatial and temporal effects. Current gillnet catch rates are substantially lower than those in 1997 and 1998, whereas line trawl catch rates have been increasing over 2004-2006 and in 2006 were the highest over the 1997-2006 time period. Concerns have been expressed that a decreasing proportion of the logbooks appear to be returned, and consequently, the proportion of catch being analyzed is decreasing.

## DISCUSSION:

Why is the number of records eliminated based on the selection criteria increasing? It seems to be due to a combination of incomplete information from fishers combined with the approach used by keypunchers to enter uncertain data. There is a place for inclusion of latitude and longitude but not many fishers provide this detail. It was pointed out that it is only the inshore data that are used for the analyses. The offshore data are not included and as a result about 45% of the available data are not used. A fisher noted that a good proportion of the <35 foot fleet now go offshore and if latitude and longitude are not recorded, he can see a problem in separating out information but didn't understand why fishers wouldn't enter this information.

Additional discussion took place on the issue of the information being provided. The FFAW representative indicated that it was not the monitors' job to ensure the entries were done properly. He suspected that there is a lot of fishing offshore and Area 10 or 11 may be entered because there is nothing for the offshore.

Overall returns were reported to be about 60 – 70%. When there was an initiative in 2006 to enhance return rates, there was an increase.

It was agreed that the information in the logbooks required additional investigations to see what other details provided may be useful in allowing a larger portion of the data to be used. Until then, the concern continues that any analyses are based on a gradually declining amount of data. At present the only way to include all of the data would be to do an overall analysis for 3Ps in total but that approach would have its own set of problems.

### **Commercial Logbooks**

**Presenter: Dawn Maddock-Parsons (DFO – SCI)**

*Presentation Title: Commercial >35' catch per unit effort by Dawn Maddock-Parsons.*

#### ABSTRACT:

Commercial data from the large vessel logbooks (1998-2006) were summarized to produce annual median catch rate for the three main gear types used (gillnet kg/net, long line kg/1000 hooks and otter trawl kg/hr). Otter trawl (>100') catch rates show a decreasing trend from 1999 to 2005 and an increase in 2006. Gillnet catch rates (primarily in <65') show decreasing trends in some unit areas with an increase evident in some unit areas in 2006. Long line trends are similar to gillnet catch rates. Distribution plots of the catches were also presented and concentration of fishing effort was evident in several areas.

The majority of the data in the ZIF database were accounted for in the catch and effort database (85-90%) in terms of total amount of cod caught in 3Ps by vessels over 35'. There were some discrepancies noted when data were grouped by vessel length, in that the commercial catch and effort database contained more data in several years than ZIF (up to 18% more), but this may be the result of how the vessels were classified in each case.

#### DISCUSSION:

Although the total catch for 2006 was >7000 tonnes, the total shown in the table 1 was only 3930 tonnes. The 2006 information is for Canada – Newfoundland only and does not include catch information from either the Maritimes or France.

The FAM definition of 'cod directed' is used, although the specific definition was not provided.

The ACON plots of tonnes/set did not include the 2007 data as these were only preliminary at present.

Interpretation of the offshore line trawl and gillnet catch rates was difficult because the cod were often taken as bycatch in other fisheries. It would be a concern if there were consistent downward trends, but this not the case. The data are too variable to detect any meaningful signal.

The representative of the FFAW pointed out that all of the different catch rate data show a big spike in 1997, 1998 and 1999 followed by a decline. He considered this to be the result of a 'perfect storm' whereby the relatively strong 1989 year-class came along and was protected due to the moratorium. It had the opportunity to grow without exploitation. This was an unusual situation that accounted for the exceptionally high catch rates when the fishery reopened. He therefore considered the high catch rates to be an anomaly that should be ignored.

### **Fish Harvester Questionnaire**

#### **Presenter – Harvey Jarvis (FFAW)**

*Presentation Title: 2007 Fish Harvester Questionnaire (3Ps Resident Cod License Holders) by Harvey Jarvis, Angela Tucker, Diane Power, Jackie Baker, Janette Pennell, Lilly Rideout and Paula Rosa-Bian*

#### **ABSTRACT:**

The Fish Food and Allied Workers Union, in an attempt to provide a perspective that represents the overall view of all 3Ps cod license holders, conducted a telephone questionnaire of fish harvesters from October 22nd to October 25th, 2007. Prospective participants were selected at random from a list of 3Ps resident cod license holders. Based on the calculation used to determine sample size and the number of participants the results are thought to be 95% accurate + or - 5%, nineteen times out of twenty.

A total of 169 (17%) of 3Ps resident license holders participated in the survey.

Harvesters said that catch rates during 2007 were about the same as or better than 2006. Harvesters said that during 2007, cod were distributed throughout the area and condition was good. Harvesters feel that capelin and squid abundance are at low levels and are continuing to decline. Mackerel abundance is good and increasing and there was no clear consensus on herring abundance.

#### **DISCUSSION:**

The telephone survey results are not directly comparable to the earlier mail-outs.

There was also discussion of harvester observations related to sizes of fish caught in relation to time of fishing. Prior to the moratorium there was more fishing in the winter and larger fish were taken. With fishing more concentrated in summer and fall, there are smaller fish.

There is no clear explanation why tag return rates seem to be declining both in 3Ps and on the northeast coast.

## RESEARCH INFORMATION

### Research Vessel Surveys

#### Presenter – John Bratley (DFO – Science)

*WP Title: Assessment of the Cod (Gadus morhua) stock in NAFO Subdiv. 3Ps, November 2007 by J. Bratley, B. P. Healey, M. J. Morgan, E. F. Murphy, D. Parsons, D. Power, and J.-C. Mahé (+others??)*

*Presentation Title: Assessment of the Cod (Gadus morhua) stock in NAFO Subdiv. 3Ps in November 2007 by J. Bratley, B. P. Healey, M. J. Morgan, E. F. Murphy, D. Parsons, D. Power, and J.-C. Mahé (+others??)*

#### ABSTRACT:

Scientific information available to determine the status of the cod stock in NAFO Subdiv. 3Ps off the south coast of Newfoundland for the November 2007 assessment included a time series (1973-2007) of abundance and biomass indices from Canadian winter/spring research vessel (RV) bottom trawl surveys. DFO Research Vessel (RV) biomass and abundance indices were revised at the current assessment to include data from inshore strata that have been surveyed since 1997. These indices have been variable in the recent time period with no clear trend. Previous assessments reported RV indices from the offshore strata only. The offshore biomass index is variable, but declined from the mid-1980s to the lowest values observed during the early 1990s. Values for the post-moratorium period have been higher than those of the early 1990s, but not as high as those of the 1980s. The offshore biomass index in 2007 was 35,000 t, substantially less than the 2005 survey estimate (46,000 t). The 2006 survey was not completed. The survey augmented by the inshore strata is now ten years old and for the first time indices from this augmented survey were presented. The biomass index from the augmented survey shows similar values to the old (offshore) index and is variable with no clear trend. Mortality (age 5 -11) inferred from the revised DFO RV survey indices varied without trend with an average of 30% annually (1997-2007) indicating that fishing mortality does not appear to be excessive. New information on recruitment from the 2007 DFO RV survey is consistent with the previous (2006) assessment and indicates that year-classes produced during 2000-2004 are weaker than the 1997-98 year-classes. The augmented RV survey caught relatively large numbers of 1 yr olds in 2007 and these were widely distributed across the surveyed area, except in the western (Burgeo) portion.

#### DISCUSSION:

A fisher asked how long fish aged 1 might be. When told they were about 12-15 cm, he responded that fish this size had been seen in the harbour during the summer of 2007.

All of the data suggest that the 2000 year-class is very weak, but that age 1 fish (2006 year-class) were relatively abundant and widespread in both the inshore and offshore strata.

Age 1 fish were not present in the Burgeo Bank area in 2007. This lack of small fish could have been the result of no migration from the northern Gulf since a study had demonstrated that smaller cod remain in the Gulf over winter.

The research vessel data series seems to track year-classes but is quite noisy.

## **ACON Plots of Research Survey Catches**

**Presenter – Karen Dwyer (DFO – Science)**

*Presentation Title: ACON Plots of Age Aggregated and Age Disaggregated Distributions from the 2007 Research Vessel Survey by Karen Dwyer*

### **ABSTRACT:**

Spatial distribution of catches of cod during the 2007 survey was examined for all ages combined and separately for ages 1-8. As in other years, the age aggregated plot of distribution shows cod were widespread throughout the Subdivision 3Ps area, with the main concentrations in the Halibut Channel, Burgeo Bank, the outer portion of Fortune Bay and on the northwest of St. Pierre Bank.

Catches of age 1 cod (2006 year-class) were larger in 2007 than in 2005, and distributed widely throughout the Subdiv. 3Ps area, both inshore and offshore, especially between the 100 m and 200 m depth contours.

Younger cod (<4 yrs) were widely dispersed throughout the 3Ps area especially on the Banks but older cod were more abundant in Fortune Bay, in deeper channels, and on Burgeo Bank. There are some catches of older fish (ages 6-8), with the largest set outside Hermitage Bay.

### **DISCUSSION:**

Based on the plots, the observed increase in older fish may be due to one large inshore catch.

Water temperatures on St. Pierre Bank were cooler than normal in 2007, consistent with the observation that there were a lot of smaller fish but fewer larger. A hard copy of the plots was made available to fishers.

## **Sentinel Survey Data – Unstandardized**

**Presenter – Dawn Maddock-Parsons (DFO – Science)**

*Presentation Title: Sentinel Surveys 1995-2007: Catch per unit effort in NAFO subdivision 3Ps by Dawn Maddock-Parsons*

### **ABSTRACT:**

Sentinel enterprises continued to collect catch rate and biological information on inshore 3Ps cod resources in 2006 and 2007. Gillnet catch rates (weekly average number of fish per net) in the most recent years remained low compared to 1996-1998 catch rates. Catch rates in small mesh gillnet remained low. 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 since 2000. Line trawl 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. In 2005, line trawl catch rates declined, but increased in 2006 and preliminary results indicate line trawl catch rates remain high in 2007.

### **DISCUSSION:**

Should early years be dropped from the presentation in order for the plots to be clearer? It was agreed that this could be done in the future but the contrast in the data over time would be lost. The contrast in the data has not been reflected in perceived changes in the population. It was agreed that while the presentations could be modified so as to be clearer, it was best to continue including the first 4 years of data. Ways of presenting the data that are as informative as possible are important.



A harvester observed that Sentinel continues to be conducted in shallower water whereas bait fish such as capelin are not showing up in these shallow waters in recent years and the fishery is generally being conducted deeper than where Sentinel sites are. It was thought that this could affect catch rates seen in Sentinel as fish could be deeper generally.

The value of the information from the 3¼ inch mesh gillnets was questioned since there is only limited sampling. It was countered that this is the only indicator of younger fish in the Sentinel work. Although the data are spotty, the locations have been fairly consistent over time. In addition, there is no extra work involved since the smaller mesh is fished along side the larger (5½ inch).

Some of the sites have 'zero' observations in 2007 because they are fished later and the analyses only include data up to October 1.

### **Sentinel Survey Data – Standardized**

**Presenter – Dawn Maddock-Parsons (DFO – Science)**

*Presentation Title: Standardized Sentinel Catch Rates by Dawn Maddock-Parsons*

ABSTRACT:

Sentinel data were standardized and modeled to produce indices for 5½” gillnet and line trawl. The gillnet indices were high in 1995-1997 decreased to 2000 and have remained low since then. Line trawl indices were highest in 1995 and 1996, decreased to 1999 and have remained relatively stable since. The index-at-age data do not track cohorts well in recent years. Residuals were examined and patterns in residuals were not different from those presented for previous assessments. Results of the standardization were similar to the unstandardized sentinel results.

DISCUSSION:

The FFAW representative clarified that the 'early' years, while having the highest catch rates, are not necessarily the years with the best data.

In the standardized data analysis, the only signal is a drop in the first few years of data followed by a fairly flat series. It was noted that the decline was less for line trawls than for gillnets.

### **Sentinel Survey Data - Selection Criteria for Standardization**

**Presenter – Dawn Maddock-Parsons (DFO – Science)**

*Presentation Title: Selection Criteria by Dawn Maddock-Parsons*

ABSTRACT:

The selection criteria, as agreed at a meeting in Rimouski in 1999, were presented. A concern is that Regional differences in how gear is used weren't considered and that traditional fishing practices and times vary from location to location. In 3Ps there are a significant number of sets fished in June with gillnet but these are currently excluded from analyses. It was proposed that June should be included and results including June were presented. The trend in gillnet catch rates over time does not change significantly with the new analysis that includes June data although there are some differences in the earliest years. Line trawl soak times were also examined but since the normal soak time in 3Ps is < 12 hours, it is proposed that this be kept as the selection cut-off criterion.

DISCUSSION:

A harvester reported that June is an important time for fishing with gillnets in his area.

Reference was made to the discussion of this same issue during the 2J3KL cod RAP in spring of 2007. The documentation from the Rimouski meeting does not clearly describe the reason for excluding June data.

The FFAW representative pointed out that June is an important time in 2J3KL and the same is true in 3Ps and there is no reason to exclude these data.

Discussion continued to focus on speculation as to why the decision was made to exclude the June data but it was agreed that for the analysis of Sentinel gillnet data from 3Ps there is no reason to exclude June and information from June should be included in the future. It was also agreed to continue with the 12-hour cut-off for line trawl soak time.

### **Tagging**

**Presenter: John Bratney (DFO – SCI)**

*WP Title: An update of exploitation rates and movement patterns of cod in NAFO Subdiv. 3Ps based on tagging studies by John Bratney and Brian Healy*

*Presentation Title: An update of exploitation rates and movement patterns of cod in NAFO Subdiv. 3Ps based on tagging studies by John Bratney and Brian Healy*

#### **ABSTRACT:**

This document updates results from a multi-year tagging study of Atlantic cod (*Gadus morhua*) in NAFO Subdiv. 3Ps, initiated during spring 1997. No new tagging has been conducted in the inshore of 3Ps during 2004-2006, but tagged cod were released in the offshore of 3Ps (3Psg/h), with the assistance of industry, during December 2004 and 2005. Estimates of exploitation for cod tagged in each region in each year were computed using methods reported in our previous documents. Estimates of short-term tagging mortality, tag loss, and reporting rate were obtained and are incorporated into the estimation. Given that no tagging has been conducted inshore since 2003, and the tagged cod are mostly now at least seven years old, the estimates given here for inshore tagging pertain to year-classes produced prior to 1999, i.e. 7+ cod. Based on analysis of returns of high-reward (\$100) and standard reward (\$10) tags it appears that tag reporting rates during 2006 were lower than those in previous years. Among cod tagged in Placentia Bay (3Psc) the mean annual estimate of exploitation for 2006 was 25%. For cod tagged in Fortune Bay (3Psb) the estimate for 2006 was 12.6%, marginally higher than in recent years, with tag returns indicating considerable movement of cod between Fortune Bay and Placentia Bay. For cod tagged in 3Psd (Burgeo Bank) the estimate for 2006 was 2.2%, with no substantial change in recent years. The mean annual estimate of exploitation for cod tagged in offshore areas (3Psh) for 2006 was 5.2%, similar to the 2005 value (5.6%), but lower than estimates for inshore areas in spite of offshore landings of >7,000 t. Small numbers of cod tagged in 3Ps were recaptured in adjacent management areas during 2006 (i.e. inshore 3L and 3Pn4R), but the results do not suggest that extensive migration outside the stock area took place, or that exploitation of these cod in neighbouring areas was high. Tagging was resumed in the inshore of 3Ps (3Psa, b, c) during 2007 with approximately 3,400 tagged cod released; data from these new experiments should provide useful new information about exploitation rates in the 2008/09 management year.

## DISCUSSION:

Tagging on Burgeo Bank takes place in April, sometimes at the same time as the research vessel survey and sometimes separately. The age ranges selected for determination of mortalities are not set arbitrarily. Specific criteria are used such as not using fish tagged more than 3 years since sample sizes are small. There are some exceptions when tagging was done in November as this was late in the year and most of the fishery was completed.

Catch data were not used in calculation of the exploitation rates but were only provided for information purposes. Also, although it is probably possible to calculate errors associated with the mean exploitation rates, this has not been done.

Tagging data provide information on movement as well as exploitation rates. There are indications that mixing does not occur in some areas but overall there is quite a bit of mixing although not as much as might be expected. There does seem to be quite a bit of inshore residency. There was an attempt to look at this with the model but interpretation was difficult. One thing does seem clear – mixing in the inshore area west of the Burin Peninsula seems different from other areas with there being no apparent movement of fish to the area from Halibut Channel.

It was argued that the plots indicating positions of tagging as well as recovery are difficult to interpret because of possible overlaying of points as well as inability to understand the proportions that move because of differences in local effort. Debate then centred on how to interpret the numbers returned. For example if 100 fish are tagged offshore and get 10 returns inshore then know that at least 10% moved inshore but that is all.

One harvester indicated that based on his own experience he agreed with the interpretation of the tagging results regarding movements of fish.

## OTHER ANALYSES OF COMMERCIAL AND RESEARCH DATA

### FLEDA

**Presenter – Noel Cadigan (DFO – Science)**

*Presentation Title: FLEDA of catch and indices 3Ps cod RAP, 2007 by Noel Cadigan*

#### ABSTRACT:

FLEDA is an R package, part of the FLR suite, for exploratory data analysis (EDA) of the data available for stock assessment. These procedures were applied to 3Ps cod catch-at-age, and catch-at-age by gear type. The procedures were also applied to the DFO RV survey (offshore index strata, and inshore strata fished since 1997), the GEAC survey, and the Sentinel gillnet and line trawl catch rates.

The strength of the 1989 and 1997-1998 year-classes was apparent in age-composition analyses of all indices, and at most or all ages. The results showed that overall, line trawl caught smaller fish than gillnet and otter trawl, and that the otter trawl caught larger fish. However, in many years the age composition of gillnet and otter trawl catches were similar, which was not an anticipated result.

A comparison of DFO RV survey catches in inshore strata revealed that mean number per tow for ages 1 and 2 were higher than in the offshore index strata. In most years catch rates at older ages were higher in the offshore strata than in the inshore strata, but 2004 and 2006 were exceptions. Internal consistency diagnostics for the RV survey index based on offshore

strata only were better than diagnostics for the survey index based on inshore and offshore strata.

Total mortality (Z) calculations during 1997-2006 for the DFO RV inshore+offshore index varied annually with no trend. The average Z was 0.35 for ages 5-11. Note that the lack of a survey in 2006 created some difficulties in computing Z's. The solution used was to compute a 2-year Z for 2005 to 2007, and prorate this mortality to an annual basis for 2005 and 2006. Z's for 1997-2004 from the GEAC survey averaged 0.64. In the inshore, Z's for 1997-2004 and ages 5-8 from the Sentinel line trawl index averaged 0.59 but showed a decreasing trend since 2001. Mortalities computed from the Sentinel gillnet index at ages 5-8 do not reflect true mortality because of the selectivity of this gear type, but the trend has generally decreased since 1997.

#### DISCUSSION:

All of the analyses indicated that the 2000 year-class was relatively weak. In contrast, the 1989 year-class is still clearly evident at age 14 and was well represented over time with catches by all gear types.

A harvester commented that it was interesting that the 1999 and 2000 year-classes appear weak. He pointed out that in those years there was only a poor sign of older fish in his area, possibly due to cold water. He asked whether the cold water may have affected spawning. No answer was provided.

A plot of the product of mid-year weights times catch-at-age showed a discrepancy between reported catches and calculated catch weight for 1998. The possible reasons for this were discussed extensively. One complication is that the catch-at-age and weight-at-age data are based on calendar years while the quota is set for a TAC year of April 1 – March 31 of the following year. There is a need to examine the discrepancies more closely as there appears to be some sum-of-product issues that should be resolved.

It was believed that changing mesh sizes (increasing) could occur as a stronger year-class moved through and this would tend to mask a dome. Also, the use of larger mesh offshore when cod is taken as bycatch in fisheries directing at other species such as white hake and monkfish could mask a dome.

The small catch of age 1 fish by line trawls in 2006 appears 'large' only in comparison with even smaller catches in every other year.

There were additional discussions regarding the interpretation of the results. There was low correlation of cohort strength measured at different ages. Better correlations were expected with the research vessel survey data when the inshore strata were added, but this did not happen. The reasons for this lack of improvement were not known.

The calculations of total mortality (Z) from the offshore strata fished by the research vessel suggested that fishing mortality (F) is approximately equal to natural mortality (M – assumed to be 0.2) and this is a reasonable level of fishing mortality. That these F's were lower than those calculated from the catches may be suggestive of a domed Partial recruitment.

Is it possible to tease out more information from the data using models such as a Z-model and YC model to see if there are inconsistencies e.g., look at GLM's rather than patterns in graphs alone? The presenter was not sure that much more would be learned. He suggested that the use of these sorts of models would be just another way of looking at the same thing.

## **Year-class Strengths**

**Presenter: Noel Cadigan (DFO – SCI)**

*Presentation Title: Year class strength from some indices, 3Ps cod RAP, 2007 by Noel Cadigan*

### **ABSTRACT:**

A common method to estimate year-class strength is to fit a general linear model (GLM) to multiple survey indices for younger ages (e.g., 1-4), with a year-class (YC) effect (the parameter of interest) and an age effect to account for age-dependent catchability of the survey. The model basically assumes that the survey indices are proportional to YC strength, and the constant of proportionality is the same each year. Young fish in a survey are usually not exploited much by the fishery and if natural mortality is constant over time or has a stationary distribution in a statistical sense then indices for these ages are suitable to use in a YC-strength model. Indices are usually log transformed in an attempt to accommodate the assumptions of the GLM.

In this presentation an alternative Generalized Linear Mixed Model (GLMM) is used to better model the stochastic nature of survey indices and provide more reliable estimates of YC strength. A problem with the log transformation approach above is when some zeros occur in the indices. GLMM's can directly accommodate zeros and transformations are not necessary. The more important potential advantage of a GLMM for 3Ps cod is the ability to treat YC strength parameters as random, and to include random year effects which seem to be prevalent in the stratified random bottom-trawl survey indices available for this stock. GLM's are known to provide highly variable estimates of the size of very recent and early YC's for which less survey information is available. The approach that has been used for 3Ps cod is to exclude YC's with fewer than two observations; however, treating YC strength parameters as random may be a reasonable way to use all survey information but reduce the variability of estimates of very recent and early YC's. Also, year effects could be incorrectly interpreted by the GLM approach as YC-strength signals, especially when the number of observations for a YC is small. Including a random year effect may be a way to control this type of error.

GLM and GLMM's were fitted individually to the DFO RV Campelen-adjusted offshore survey indices for 1983-2007 (ages 1-4, excluding 1-2 prior to 1996), the DFO RV Campelen indices for the inshore+offshore for 1997-2007 (ages 1-4), the DFO RV Campelen indices for the inshore for 1997-2007 (ages 1-4), and the GEAC survey indices for the offshore for 1997-2005 (ages 2-4).

It was demonstrated that GLMM's have the potential to provide less variable estimates of the very recent and early YC strength's, and also provide a mechanism to account for year effects when estimating YC strength. However, results are very preliminary, and future research including simulation analyses is required before GLMM's could be recommended for estimating YC strength.

### **DISCUSSION:**

The purpose of the analyses was to focus on what problems may exist in fitting the data.

It was interesting that the model did not indicate that the 1989 year-class was particularly strong but it did have good survival because of the moratorium. Also, although VPA's in past years suggested a gradual decline in recruitment over time, one of the models suggested recruitment had been pretty stable.

There is a need to understand this type of modeling before using it but the work did indicate the need to look at these sorts of things when developing year-class models. It is important to

separate the 2 sources of variability, year effects and cohort effects, and to better understand these.

**Presenter: Brian Healey – (DFO – SCI)**

*Presentation Title: Year-Class Strength of 3Ps Cod from Index Data by Brian Healey*

**ABSTRACT:**

The relative strength of year-classes recruiting to the fishery was estimated from all recent survey series. Estimates were produced using a generalized linear model with year-class and age effects. Abundance data from RV surveys, sentinel surveys and an industry survey at ages 1-4 (where available) were analyzed. Results produced independently for each survey indicated that relative strength estimated from the GEAC survey, the RV survey and the Sentinel Linetrawl index were generally consistent. Estimates of relative year-class strength from the inshore portion of the RV survey and the Sentinel Gillnet index were inconsistent from those listed previously, but the estimated year-class strength effect was not statistically significant for either of these two indices. Residuals from these models highlighted several year-effects in various surveys.

**DISCUSSION:**

Discussion focused on whether adding the inshore strata had made much difference. The two analyses seemed to compare generally but there were some differences. Overall, there was fair consistency between results using GEAC survey information, Sentinel line trawl data and the research survey data that included both inshore and offshore strata. However, the variabilities were quite different.

The 2007 data were not included because there is only one age available (age 1) for the 2006 year-class.

It was agreed that the final composite analysis should be done using the GEAC survey data (1998-2005) and research vessel survey data including both inshore and offshore strata (1997-2005, 2007). Results of analysis of the Sentinel line trawl data should be presented separately.

## **GENERAL DISCUSSION OF ASSESSMENT – PART 1**

The Chair opened the discussions by asking participants for their views on what all of the information presented might mean with regard to stock status. Discussion from that point was wide ranging.

There was considerable discussion pertaining to the research survey results and their interpretation. It was pointed out that in many years the research vessel indices were dominated by catches from a single stratum. Years when no stratum dominated might in fact be the 'anomalous' ones. It was asked how this should be handled but no answers were forthcoming.

It was proposed and accepted that the new combined research vessel index using both inshore and offshore strata should be used even though the time series was short.

Is the new index a reflection of the entire stock? A harvester expressed concerns and doubts about the research surveys. He pointed out that the surveys don't show many fish older than age 6 and don't show much of what is caught in the fishery. He argued that most of the fish found during the surveys are not yet entered into the fishery. The Chair explained that the

observed results are influenced by selectivity of the gear used and most attention should be paid to the trends rather than the numbers-at-age in any one year.

The Chair pointed out that it was important to have a logical argument for or against the idea that the research vessel index is reflecting stock size. If there is no argument against that possibility then it follows that one might question why there isn't a model; saying 'not done' shouldn't be a good excuse.

While the research vessel index reflects what is going on within the area surveyed, it doesn't necessarily reflect what is going on in unsurveyed areas. This led to discussion of 3Ps cod in the context of a 'stock' or a number of 'stock components'. It was argued that a single message of the overall stock would not be consistent with the different views from different areas. For example, based on line trawl logbook and Sentinel data, the west seems to be doing better than the east. Based on tagging, F is low in the west, higher in Placentia Bay and very low offshore (although there may be some interpretation issues with the offshore tagging analyses). It was countered that overall, the trends seem to be flat over recent time.

The offshore industry representative felt that the assessment should be of 3Ps as a whole rather than getting into debate about possible sub-components. He suggested that this stock, like others, is 'full of warts' and the need is to make the best of what is available. He felt that it was outside the bounds of the meeting to look at sub-components since this was not part of the ToR. The Chair countered that the requests in the ToR were written as 'objectives' rather than 'instructions' and as such they should be interpreted as the information permits.

A harvester pointed out that cod tagged in Halibut Channel moved to the head of Placentia Bay. His fishery is classed as being in Placentia Bay but he sees tags from both Halibut Channel and Fortune Bay. He asked how one might draw a line subdividing the area.

Discussion then moved on to sequential population analysis (SPA) and the fact that no SPA was available for review during this meeting. During the 2006 assessment, there were no GEAC or DFO survey indices for 2006 and the Sentinel data were flat without trend (except in the earliest years). It was argued that overall the indices were doing different things so it was not possible to determine a reasonable SPA. It was pointed out that although the last GEAC survey was in 2005, there was a DFO survey in 2007 and the 'new' research vessel index and Sentinel indices are all approximately flat so there didn't seem to be as much inconsistency now as there was in 2006.

Attendees were reminded that in 2006 a number of single index runs were carried out. While ADAPT didn't indicate many differences, there were with differences between runs with XSA. This was reported in the 2006 Proceedings.

It remains difficult to determine the most appropriate partial recruitment vector and this has resulted in separate analyses using flat-topped and domed recruitment in the past. This resulted in two sets of projections and it was asked how useful this approach has been to managers since no advice could be provided regarding which recruitment shape was most likely correct.

There was discussion of a possible a research recommendation to work toward development of a model to provide an assessment of the entire 3Ps area, but no conclusion was reached.

The Chair summarized the quandary that people feel they have a sense of what the stock is doing but don't have a model. He surmised that this seemed contradictory.

Discussion then moved on to discuss the six objectives in the ToR.

## **DISCUSSION OF OBJECTIVES IN TOR**

The Chair began by summarizing that for Objective 1 he felt, based on what he had heard, that the meeting should be able to say something about the stock as a whole but would be unable to provide specifics regarding numbers. His sense was that there has been nothing dramatic going on in the stock, either up or down, over the past few years based on the fact there are no trends in the indices.

Is the 'new' research vessel index useful or not, given that there may be significant amounts of cod in depths <30 fathoms in April, i.e., in shallower water than that surveyed, and that these amounts might be variable between years?

A harvester asked if this discussion meant that there was a possibility of using the research vessel survey data only? The Chair clarified that this was not the case at all and that all indices would be considered. The current discussion pertained only to the value of the research vessel indices.

The information in the presentation on oceanography was referenced in the context that research vessel indices seem to be linked to water temperatures. It was argued that until this is better understood, the research vessel indices should not be used for quantitative estimations. This reopened the discussions with regard to a lack of an SPA for this meeting.

One perspective put forward was that a bad model is better than no model. It was further proposed that one should be done with those indices felt to be useful with a flat-topped partial recruitment and then communicate the risk and uncertainties to managers. It was argued that although there are no trends in the recent data, ADAPT has a lot of statistics as part of its output, and these should be examined to determine if the model is good or not.

It was countered that the approach as suggested (looking at output statistics) was done during the 2006 assessment and the model was rejected. A counter was made that in 2006 there was no research vessel survey but there was one in 2007.

Participants were reminded that a recommendation arising from the 2006 RAP was that a Framework Meeting should be held. This has not taken place yet but at least the proposal to combine the inshore and offshore strata had been completed and although the 'new' series is short, it is not as short as that in some other instances. As such, an attempt at SPA modelling the research survey and catch data should be made.

In response it was argued that there is a need to come to some conceptual understanding of the proportion of the stock covered by the April surveys before using the research vessel index in an SPA. Industry representatives pointed out that a significant amount of cod overwinters in Placentia Bay inshore of the area surveyed and that these fish don't begin to move out until May. It was not possible to determine if there may be other inshore areas with significant amounts of cod not covered by the surveys. Although there has been tagging in the nearshore areas, it is not possible to determine the timing of their movements as no data are available before fishing starts and there is virtually no catch in April.

It was suggested that the issue was actually how constant this proportion might be from year to year. If it is a fairly constant fraction, then the actual proportion is less important assuming that it is not an extreme amount.

It was also suggested that since the Sentinel surveys cover such a small portion of the stock range, it is unclear what they are measuring.

It was then suggested to 'park' the modelling discussion. There are a number of issues to be resolved; what model, what assumptions regarding data, what assumptions regarding partial recruitment? It was argued that additional analyses are required before any numbers should



be put on the table. In any case, desirable or not, no VPA results were available for consideration at this meeting.

The offshore industry representative pointed out that industry's problem with the research vessel data is that they are biased toward smaller fish. It is their belief that the 15 min. tow duration is too short and that larger fish are able to avoid the trawl as a result. He suggested that this may not be an issue for science but there is an 'optics' issue with industry and therefore causes confusion.

The Chair summarized that there seemed to be a fair amount of support for the perspective that the 'new' research vessel index was the best available for the stock but asked what other indices participants would like to see as part of the assessment. A harvester argued that it is important to use information from industry itself such as the logbook data. He expressed the concern that science didn't have much faith in what industry was doing. The Chair responded that the issue was not one of 'faith' but that there are many things going on in the fishery such as changes in mesh size and seasons and it is difficult to sort these out and understand the links to stock size. He suggested that problems also exist with interpretation of the Sentinel data because it takes place shoreward of the area covered by the research surveys and includes catches of fish that are available to the fishery but not the research vessel. This might help explain some of the observed differences.

It was noted that if one was to present the research vessel indices as covering everything except fish very close to shore and Sentinel indices as representative of fish closer to shore, then the data would have to be presented as two separate and uncalibrated components. Discussion of this point suggested that it was one way to go as it would be difficult to combine the different indices but perhaps the Sentinel data have not been examined as closely as they should be. The problems seen were that there is no Sentinel in April, a period when there should be no mixing, and when Sentinel does occur, catches comprise a mixture of nearshore or inshore/offshore (in the research vessel context) fish whereas the research survey does not include the area of the nearshore fish.

It was questioned how there might ever be information obtained regarding the amount of fish in the nearshore. It was argued that this is a component of the stock that there is pretty well no information about.

Discussion once again turned to stock components. In the absence of information on the nearshore component, it is not possible to do a 'whole stock' assessment. It was suggested that the nearshore component might be low since if the two components were approximately the same size one would expect the indices to show the same thing but this is not the case. It was argued that the issue seems to be one of not being able to bring forward to managers information on a component(s) that may make up a significant proportion of the catch.

Some did not see the problem with bringing forward information on possible impacts of fishing on the various components. Others disagreed, arguing that it would not be useful to managers to suggest that the offshore is lightly exploited while the nearshore is heavily exploited. The Chair observed that for management to be told that the management of this stock is not monolithic would seem very important. It was questioned as to how one might separate out catches from different components.

Discussion on the issue of reporting on a 'whole stock' or by components continued with discussion of interpretations of the Z's from the research survey and Sentinel data. In addition, many of the previous points were re-raised and re-discussed. The Chair finally concluded that his feeling was that support for reporting by components was fading. The FFAW representative reiterated that the nearshore Placentia Bay component is quite large.

A research recommendation was proposed to do nearshore tagging in April when there was no mixing between the nearshore and remainder and again later when there was mixing so that exploitation rates could be compared. This was not agreed to.

It was finally agreed that the SAR would have a 'whole' or 'mostly whole' assessment along with a subcomponent section that includes information on the gillnet and line trawl Sentinel information.

Discussion then moved on to the second objective. What should be included when discussing year-class strengths; a longer or shorter time series? Should exclusion of age 2 information from the GEAC surveys be continued? Sentinel gillnet data are not used because they don't catch smaller fish.

The possibility of combining the various indices to derive one overall index of recruitment was discussed. Earlier in the meeting it had been agreed to present the index information separately and if they were combined for this analysis then there would be a contradiction. It was also argued that the indices were kept separate in the 2006 assessment. It was finally agreed to keep them separate and to use text in the SAR to describe trends as well as similarities/differences.

Objective 3 related to impacts of the catches. The Chair suggested that, in the absence of absolute estimates of stock size, it would not seem possible to comment on possible differences in impacts of removals of +/- 20% so perhaps the focus should be on differences between removals of '0' and 13,000 tonnes.

A harvester observed that based on what he was hearing; people seemed to be afraid to say what they think. He argued again that the research survey results are a total contradiction of what industry is seeing and couldn't understand it. The Chair once again tried to explain how science uses the survey data and reiterated that just because large numbers of older fish don't show up in research vessel catches doesn't mean that scientists don't believe they are present.

A harvester commented that there are a lot of age 1 fish based on the 2007 research survey results and that should be a good sign. It was countered that overall, catches were down in the 2007 survey compared to those in 2005.

The Chair observed that overall the survey indices do not seem to be going down and that no-one seemed to be expressing any alarm based on the 2007 research survey results. He suggested that perhaps a way forward might be to discuss whether 13,000 tonne catches have caused 'serious harm' to the stock, and what might the implications of this level of catch be over the next few years.

Without estimates of the fishable biomass, there could be no feedback to managers regarding the possible implications of fishing at 11,000 or 15,000 tonnes.

Discussion moved to an examination of the survey data and if it might be possible to make some adjustment to approximate the absolute biomass by applying some catchability values-at-age. For example, might some information be available from SPA's in previous assessments? It was argued that if one was going to use catchabilities from a model that was once believed, then why not just run the model with the updated data.

A question was raised as to what the meeting might be trying to achieve by adjusting the research vessel surveys. The Chair responded that there is a need to be sensitive to the concerns of harvesters regarding the survey's apparent inability to catch older fish, and if there is a desire to say something about the overall stock there is a need to adjust the surveys that at present are heavily weighted toward smaller fish. He also pointed out that,

with an aging population and an age-dependent catchability, the relation between survey biomass index and actual biomass would be changing over time. There was no resolution at this point as to what might be done.

The Chair asked participants if there was any information that would suggest recent catches had done 'serious harm'. It was pointed out that 'serious harm' in the context of the Precautionary Approach usually refers to harm to recruitment potential. Recruitment had been lower after 1998 but did this mean that 'serious harm' had been done? The possible answer was unclear. Previous assessments have indicated a gradual decline in recruitment through the 1980's but good recruitment in 1997 and 1998 before declining again. It was questioned how should this be interpreted.

The Chair indicated that the sense he was getting was that no-one was nervous about current fishing levels. This could possibly be due to the fact that not enough was known to be nervous but the question would be how to cast this in the context of the Precautionary Approach.

The representative of the offshore industry stated that based on what he had seen there was reason for nervousness. He regarded management of 3Ps cod to be one of inventory management that relies on recruitment. There are lots of age 1 fish based on the 2007 research survey that seems to be a glimmer of hope for the future but he is still nervous. The representative clarified that he didn't know if changes in catch of 2000 – 3000 tonnes would make a difference or not but considered that recruitment should be better than it is. He asked whether there might be an environmental component involved. He considered that management should be 'hard-nosed' and protect the observed recruitment so it will contribute to overall biomass over time. A comment was made suggesting that an extreme way to protect recruitment would be 'zero' fishing which was an option under Objective 3. The representative responded that there is a need to balance between people and their incomes and the resource. While he would not advocate cutting the TAC all together because the impacts would be disastrous, he would be willing to contemplate some decline to protect the spawning biomass.

An inshore harvester brought up that historically, reported catches were higher but a lot more was taken out of the stock than reported. He suggested there are better controls in place today and gear choices are better. He suggested that inshore harvesters are not nervous and they believe that a quota of 25,000 tonnes would not be a problem. It was countered that harvesters should be nervous because if they took a look at stocks surrounding 3Ps they would see that they have gone down due to poor recruitment.

The harvester noted that every year there is about the same catch rates with the same mesh size being used. So there must be fish going through the system and there are no gaps now and then. He is not sure how strong the year-classes are but considers them strong enough to maintain fixed gear catch rates.

The question was raised as to whether it might be possible to produce a productivity index. Management indicated that it is an important aspect of the advice from the RAP in helping them do their work.

Participants were unclear as to the meaning of the 4<sup>th</sup> objective. Management representatives were unclear as to the meaning and indicated that the objective must have come from Ottawa and not the region. It was agreed that it was essentially the same as the 3<sup>rd</sup> objective but worded more generally.

With regard to objective five, it was agreed to start with the 2006 SAR and what it had to say about uncertainties then proceed from there in drafting the SAR so as to address the objective.

It was agreed that the SAR would report on tagging and that would serve to address objective six. It was noted that the objective made reference to distribution of the 3Ps stock in other areas but there was no mention of possible impacts on other stocks when they were in 3Ps. It was pointed out that overall there is not much sign of exploitation of 3Ps cod in other areas. Migration doesn't seem to be a big issue regarding exploitation outside the 3Ps area or with regard to contamination of survey data with fish from other stocks.

## **GENERAL DISCUSSION OF ASSESSMENT – PART 2**

The Chair reminded participants that there was a need to produce bullets for the SAR and that they needed to be approved by everyone at the meeting so it would be best to produce these during the meeting.

The issue of possible 'adjustments' to the research survey data by accounting for catchabilities came up again. The Chair asked whether it might be possible to come up with some plausible options for catchability that might demonstrate whether there may be some serious issues or not. Discussion followed regarding possible scenarios for catchabilities to be used.

After discussion, it was agreed that adjustments to the research survey estimates would be done using two illustrative assumptions regarding catchabilities (dome and flat-topped). The results would be reviewed before reaching any conclusions regarding their value.

It was also agreed as part of the exercise to produce a stock/recruit plot.

It was the feeling of participants that fishers and scientists may not really be as far apart as the 2006 SAR suggested. A harvester clarified their perspectives. He stated that back in 1978 when the catch was 40,000 tonnes there were no restrictions on gears, etc. and there was lots of gear set back then in order to take that catch even though the stock was in bad shape. There was good sign during the 1980's but there was a decline due to French activity. Harvesters knew there was trouble back in 1992 and had no trouble with the moratorium when declared. When the fishery reopened, they saw no signs of small fish for the first few years but are seeing it now and that is why they see no reason to be nervous. He added that in the past a lot of traps were used and many small fish were caught. Now they are fishing specifically for larger fish and catch rates are being maintained so there must be constant recruitment. There is also a wide age range of fish present leading harvesters to be more optimistic than before the moratorium.

## **ADDITIONAL ANALYSES OF COMMERCIAL AND RESEARCH DATA**

### **Maturities and Weights-at-Age**

There was no specific presentation of the updated maturity and weights-at-age information. Although they had been recalculated, there were no apparent differences in trends. There had not been any work done yet to determine if there are differences in maturities when the data from all of the offshore and inshore strata are used compared to using data only from the index strata. The same comments applied to weights-at-age.

## **Year-class Strengths – Further Analysis**

**Presenter: Brian Healey (DFO – SCI)**

*Presentation Title: Year-Class Strength of 3Ps Cod from Index Data (Part 2) by Brian Healey*

ABSTRACT:

Using data from the two indices which have covered the majority of the stock area (RV survey and GEAC survey), it is possible to estimate the relative year-class strength for the 1994-2004 cohorts. Results indicate that the estimated year-class strength of the 1997 and 1998 year-classes are much stronger than any of the remaining cohorts which can be estimated.

DISCUSSION:

There was only limited discussion as the results were as expected based on the previous presentation.

## **Selectivity adjusted Biomass from Research Surveys**

This analysis was carried out as a result of discussions of the overall assessment and data in the context of the various objectives in the ToR that took place after all available presentations were reviewed on Day 2 of the meeting.

**Presenter: Noel Cadigan (DFO – SCI)**

*Presentation Title: Selectivity adjusted Biomass, and SR plots by Noel Cadigan*

ABSTRACT:

In most fish stock surveys, fish of different ages are not equally selected; however, this selectivity is difficult to quantify. Consequently, it is also difficult to interpret standard survey indices of age-aggregated quantities like total biomass and spawning stock biomass (SSB), because the indices may not represent a constant proportion of the stock over time. This is more problematic when the age-composition of the population has changed substantially, which seems to be the case for 3Ps cod.

In this presentation the effects of survey age-selectivity are explored using two scenarios. Survey catchability can be decomposed into a fully recruited survey effect and an age $\times$ survey effect. The age $\times$ survey effect, or relative selectivity ( $r_s$ ), is constrained to have a maximum of one. Two  $r_s$  functions were investigated: 1) flat, starting at 0.5 for age 1 and increasing linearly to 1.0 for ages  $\geq 6$ . 2) domed, starting at 0.5 for age 1 and increasing linearly to 1.0 at ages 6 and 7, then decreasing linearly to 0.1 at age 16. Mean (i.e. average over tows) survey biomass-at-age ( $\bar{B}_a$ ) was adjusted (i.e. divided) by these two  $r_s$  functions, and total (over ages) mean survey biomass ( $\bar{B}$ ) and mean SSB were then computed for the two scenarios. Note that  $\bar{B}_a$ ,  $\bar{B}$ , and mean SSB are average weights of different stock components on a per tow basis.

For each age,  $\bar{B}_a$  was computed by multiplying survey design-weighted mean number-at-age by the commercial weight-at-age. The unadjusted  $\bar{B}$  is based on different data than the more common survey design-weighted total biomass ( $\tilde{B}$ ) computed from survey weights-per-tow, even if  $\tilde{B}$  was prorated on a per-tow basis. However, the unadjusted  $\bar{B}$  was compared to  $\tilde{B}$  and the correspondence was very good in most years during 1997-2005. Although  $\tilde{B}$  is

usually reported in stock assessments, the close correspondence with  $\bar{B}$  suggests that it is reasonable to explore the effects of survey selectivity on biomass estimates using  $\bar{B}_a$ .

The main conclusion from this analysis is that, although quite variable, the two time-series of rs-adjusted  $\bar{B}$  and mean SSB did not suggest substantially different trends throughout 1997-2005. However, there were some differences; for example, in the 'domed' scenario mean SSB increased between 2004 and 2005 by 15%, whereas in the 'flat' scenario mean SSB decreased by 29% in those years.

#### DISCUSSION:

The assumption made was that catchability (q) was either flat-topped or dome or somewhere in between but a participant recalled that in 2005, the ADAPT analysis suggested an increasing q with increasing ages so the assumption may not be correct.

It was emphasized that the adjustments were made to account for different catchabilities at age rather than to adjust the total index. It was agreed that the selectivity issue is important because under the assumption of flat-topped, total biomass and spawning biomass appeared to be declining somewhat but with the dome, there seems to be a gradual increase.

#### **Stock – Recruit Plots**

This analysis was carried out as a result of discussions of the overall assessment and data in the context of the various objectives in the ToR that took place after all available presentations were reviewed on Day 2 of the meeting.

The analysis only examined age-aggregated data so it was not known if the peaks observed in some years were influenced by a single age.

#### **Presenter: Noel Cadigan (DFO – SCI)**

*Presentation Title: Selectivity adjusted Biomass, and SR plots by Noel Cadigan*

#### ABSTRACT:

Estimates of year-class strength for the 1997-2004 cohorts based on survey catches at younger ages were also plotted versus mean SSB from the two rs-scenarios previously described. No trends were apparent, perhaps in part because of the shortness of the time series.

#### DISCUSSION:

Do the SR plots suggest that fishing may have impaired productivity? This could not be determined; there may simply be low overall productivity. This would be similar to the view that in the past, productivity was such so as to be able to support generally higher catches for many years.

#### **GENERAL DISCUSSION OF ASSESSMENT AND SAR PREPARATION**

At this point in the meeting it was agreed that all of the information that would be forthcoming was now available.

There was some discussion as to how to proceed. A few comments were made regarding the research surveys and the amount of the stock actually surveyed. Also, the possible impact of fishing mortality on recruitment was again contemplated briefly and it was pointed out that recruitment is not just a function of fishing mortality. For example, the environment is also a factor.

The discussion that followed was related to examination of the 2006 SAR bullets and their reformulation or replacement based upon the data and analyses examined during this meeting.

The issue of the much shorter time series of research survey data arising from the 'new' index was discussed. Should there be mention in the SAR of the longer time series of information or is only the shorter series important? This was not resolved although it was agreed that the implications on not including the information from the earlier period needed to be carefully considered. (It was later agreed to include comparisons of the older/longer time series as well as the 'new' time series since this was a transition year and assessment.)

There was additional discussion regarding stock productivity. The Chair suggested again that if one looked at catches for many earlier years one might get the impression that the stock was more productive in the past. Others argued that nothing could be said about productivity and the only way of knowing what the impact of earlier catches compared to current the situation is would be to allow a much higher TAC for many years and see what happens. There was no agreement to make reference to productivity in the context of the historical catches versus those in recent years. As such this was not included.

Discussion of the bullets continued with regard to wordings and messages to be conveyed. From the discussion of year-class strengths, it was asked why there was no observed decline in Sentinel catch rates after the relatively strong 1997 and 1998 year-classes passed through the fishery. Either the year-class estimates are wrong or the Sentinel indices do not reflect stock size. This was not resolved.

There was also discussion of the Z's calculated from the research vessel data. It was agreed that they suggest that fishing mortality is approximately equal to the assumed natural mortality of 0.2 which isn't too bad. If selectivity of the research gear is actually domed, the Z's might be overestimated. There was then additional discussion as to what procedures were actually used in FLEDA. It was finally agreed that there could be many reasons to 'pick holes' in things but that overall it would seem reasonable to indicate the general picture which is that fishing mortality doesn't seem excessive. The tagging data from the offshore, although possibly having some problems, also suggests that fishing mortality is not excessive.

The remainder of the bullets were examined and wordings suggested as appropriate. It was agreed that the 'draft' bullets would be examined further at a later point in the meeting. The Chair indicated that the section of the SAR pertaining to industry views was not yet available and that it would be best to wait for this before developing any bullet on that matter.

There being no further points regarding bullets, discussion then moved on to look at sources of uncertainty. Again it was agreed to use the text from the 2006 SAR as a starting point. It was agreed that while there were many uncertainties, none were sufficient to be 'show stoppers'. It was agreed to be important to specifically indicate that the assessment was based on interpretation of indices rather than on outputs from SPA. In the current situation there is not necessarily more uncertainty but it is more difficult to quantify.

Additional discussion focussed on specific wording of the section as well as the ordering of the paragraphs (most important uncertainties first.) This included additional discussion of the research vessel indices (including selectivity issues) and their value, the proportion of nearshore fish to the stock total, SPA analysis and interpretation of the various indices. The agreed wording reflected the outcome of these discussions.

There was a discussion of the Precautionary Approach and how it might be best addressed in the SAR. It was suggested that since it hadn't been discussed at the meeting, it should not

be included in the SAR but the Chair felt that it was appropriate to open a discussion on the topic.

It was suggested that there is no information regarding Limit Reference Points for this stock but in the absence of an SPA, there would be no way to evaluate status against them anyway. It was agreed there should be a bullet in the SAR addressing the Precautionary Approach and this would be developed later in the meeting when the Precautionary Approach specialist was present.

It was noted that after the 2006 SAR was produced there was criticism from Ottawa that there was nothing specific in the SAR that gave a sense of what the scientists thought although there seemed to be an undercurrent of nervousness that wasn't expressed. The Chair believed that if that was correct, then things are different in 2007 as there is no indication of nervousness amongst scientists.

On the following day, discussion returned to the bullets as redrafted. The Chair asked whether there was concern that the summary now seemed to suggest that everything known about the stock comes from the most recent 10 years. After additional discussion regarding interpretation of the stock situation historically when it appeared to be able to support approximately 3 times the catch it was concluded that nothing would be said in the bullets but that the shorter term 'new' research vessel index would be shown along with the longer term 'older' index in the body of the document for comparison and to allow for transition to the new series.

Discussion took place once again regarding interpretation of Z's. It was argued that if estimates of fishing mortality are available, then it should be possible to determine an absolute estimate of exploitable biomass. It was countered that the fishing mortality presented in the SAR was an average and not just that for the most recent year. Furthermore, the estimated fishing mortality and the recorded catch are not for the same stock component.

The debate regarding the early decline seen in the Sentinel indices was reopened. The representative of the FFAW once again explained harvesters' perspective that the high catch rates seen in the first years were extraordinary and caused by the fact that the 1989 year-class had been protected by the moratorium. As such there should not be a lot of emphasis placed on these high catch rates and the decline that occurred. The Chair noted that the point had been accepted.

Some additional discussion took place regarding the mortality estimates from the research survey data as well as interpretation of the Sentinel data.

Discussion then moved on the review of the draft text representing the views of inshore harvesters as well as the offshore sector. It was agreed that these would be included in the SAR as written for the inshore sector and with a couple of modifications for the offshore sector portion.

## **DISCUSSION OF THE PRECAUTIONARY APPROACH**

The Fisheries and Aquaculture Management representative indicated that it would be useful to have perspectives related to the Precautionary Approach available for discussion during their meetings with industry.

It was noted that while there had been a preliminary  $B_{lim}$  available some time ago, in the absence of an SPA it was not possible to discuss things in that context. It was felt that at



present the Precautionary Approach and framework is prescriptive and the current information makes it impossible to deal with this.

The observation was made that a key principle of the Precautionary Approach is that the more uncertain we are the more we should back off but in reality it is more often that the more uncertain we are, we take a wait and see approach.

It was agreed that the objective requesting the consequences of catch options in the context of the Precautionary Approach can't be addressed with results of this assessment. It was also noted that the last assessment results that included an SPA suggested there had been recruitment overfishing although the reasons were not understood.

It was agreed that there was nothing in this assessment that would allow provision of advice in the context of the Precautionary Approach framework. The Chair suggested that a statement indicating that it was not possible to quantify the impacts of various catch levels would seem to cover things off without specifically mentioning the Precautionary Approach. There was general agreement with this but it was also agreed that a small piece dealing specifically with the Precautionary Approach would be drafted.

## **GENERAL DISCUSSION OF SAR PREPARATION – PART 2**

The Chair indicated a need to revisit the 'sources of uncertainty' section as well as review the draft piece on the Precautionary Approach. There would also be a need to see the draft text related to fishing mortality and how it links to the research vessel Z's. This should be looked at in conjunction with the bullets to ensure ideas flow from one to the other. He asked whether there were any tasks that had been overlooked.

There was no response so it was concluded that everything had been covered. Discussion moved on the 'sources of uncertainty'.

The discussion that followed focussed on specific wording of the text. It was agreed to move the section on scientific logbook catch rates from this section: it didn't contribute to the conclusions and hence didn't contribute to uncertainty about them.

A representative of the Province indicated that it was still unclear to him as to why an SPA had not been done. Participants indicated that the reasons one was not done in 2006 were spelled out in the meeting Proceedings. It was argued however that there have been changes this year. For example, there was a survey in 2007. The question was then posed as to how this should be handled in the SAR. One perspective was that the SAR should indicate that an SPA was not done 'for institutional reasons'. Another perspective was that it would not be particularly useful to say why in the SAR. This was not resolved one way or the other.

Discussion then returned to the Precautionary Approach and the short text proposed. After some modifications it was agreed that the text would appear in the SAR as both a bullet and text. The issue is that this assessment, as carried out, is outside the framework in place.

An industry representative asked whether uncertainties related to institutional issues (e.g., the lack of an SPA) were being passed along to industry. In response it was suggested that where the uncertainty comes from has no bearing on what to do with it.

Discussion moved back to the summary bullets; specifically the tagging information. It was agreed to convey the idea that, based on the tagging information, fishing mortality depends on area: the estimates from inshore tagging have generally been higher than the estimates from the research survey data.

Discussion continued, revisiting the uncertainties associated with offshore tagging as well as the estimation of Z's from the Sentinel line trawl data.

Although the Chair suggested the draft SAR be completed then circulated electronically for review and comment and that the meeting at its current location be considered complete, the author indicated a preference to look at a first draft in plenary and this was agreed to.

The author also sought direction on how to deal with a couple of issues: how to handle the GEAC surveys, and what figures to include for the DFO research surveys (it was agreed to show 'new' series along with the longer Campelen converted series overlapping).

The remainder of the meeting discussion was on the specific text and figures to be included in the SAR. It was agreed to delete any mention of the SPA as well as the 'science consideration' section. With regard to the Framework Meeting proposed during the 2006 RAP, it was argued that work is required on the indices before any such meeting takes place so there should not be any mention of such a meeting in the SAR. It was also agreed to strengthen the text regarding possible dumping and discarding.

After discussions concluded, the Chair indicated that the approach would be to complete the draft SAR incorporating changes as discussed then circulate it to participants for review and comment. It was agreed that an in-house review would be done first to ensure that agreed changes were captured properly.

The chair then asked whether there were any research recommendations arising from the meeting. There were none.

## **OTHER**

### **Statistical Catch-at-Age Analysis**

**Presenter: David Miller (DFO – SCI)**

*Presentation Title: Exploratory statistical catch at age analysis on 3Ps cod by David C. M. Miller, Peter A. Shelton, A. Jamie F. Gibson and M. Kurtis Trzcinski*

#### **ABSTRACT:**

Failure to achieve a quantitative assessment of 3Ps cod in 2006 led to provision of qualitative advice. This advice is likely to have less impact on decision-making than an accepted quantitative assessment. Although Virtual Population Analysis (VPA) based methods such as ADAPT may provide unsatisfactory fits to 3Ps cod data, significant and coherent year-class effects suggest that this is a relatively information-rich stock and if ADAPT fits are not satisfactory, alternative quantitative assessment approaches should be urgently considered. To this end we set up statistical catch at age analysis models to examine the pros and cons of this method applied to data for the 3Ps cod stock. Models were programmed using AD Model Builder. Statistical catch at age models are age-structured and apply a forward projection of population numbers at age over time. Commercial catch at age is not treated as exact in these models, unlike ADAPT. This could be an advantage in the case of 3Ps cod given unknown levels of misreporting and inconsistencies in the data for the earlier years. Selectivity for commercial catch and survey indices was estimated using a double half Gaussian curve, which allows for either domed or flat-topped F at age. Catchability (or scaling factor) is estimated independently of selectivity for the survey indices. ADMB optimises the model fit using an iterative process running through various phases to minimise a specified objective function value (OFV). The OFV is based on a number of likelihood values from commercial catches and survey indices and penalty values (to do with the

recruitment deviations and F values). These are each weighted before being added to the OFV. The results of three basic models are presented. Model A: commercial catch given a high weighting (ADAPT-like treatment of catch) and six survey indices used (RV Engels, RV Campelan in+off, Sentinel Gillnet and Linetrawl, GEAC industry survey, and AT Cameron survey); Model B: commercial catch given a lower weighting (greater allowance for observation error in catch) and the same six indices; and Model C: Commercial catch given a low weighting and only the RV Campelan in/offshore index used. These preliminary results show great potential for this method to provide quantitative advice in future assessments of this stock. The approach was found to be very flexible. It is capable of making full use of the rich data available for this stock. Another major benefit of this method is that stock-recruit relationships can be specified in the formulation of the model and PA reference points can thus be derived directly. Further work on 3Ps cod could involve treating some parameters as variables with prior distributions following a Bayesian approach.

#### DISCUSSION:

There was discussion of the summary comparisons of the catch-at-age analysis (CaAA) approach and ADAPT. Whereas the presentation suggested that CaAA was much more flexible than ADAPT, it was considered that there was quite a bit of flexibility with the adaptive *framework*. It was just that not many flexibilities have been exercised. CaAA does have an advantage in the way catch-at-age can be treated.

It was reported that people (e.g., US and ICES) seem to be moving away from ADAPT-like approaches and more towards CaAA approaches.

Additional technical discussions then followed dealing with a variety of issues such as weighting, identifying true versus local minima and interpretation of residual patterns as requiring additional adjustments versus possibly reflecting events happening on the water (e.g., selectivity adjustments versus reflecting discarding).

It was cautioned that one could do a lot of 'tweaking' but people must be careful not to 'over-tweak' and, in effect, 'cook' the assessment. It is common for working groups to discuss all parameters for input and how they should be treated.

## **APPENDIX I – Terms of Reference**

### **Meeting of the Newfoundland and Labrador Regional Advisory Process (RAP) on 3Ps Cod**

**The Gazebo, Clovelly Golf Club  
Stavanger Drive, St. John's NL  
November 5-9, 2007**

**Meeting Chairperson:** Geoff Evans, Marine Systems Ecologist, Aquatic Resources Division, Science Branch, DFO, NL Region.

## **TERMS OF REFERENCE**

### **Context**

The status of Subdivision 3Ps cod was last assessed in 2006. The current assessment is requested by Fisheries and Aquaculture Management 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 2007.

### **Objectives**

- Assess the current status of the stock as a whole. 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 and assess the implications of the year-classes subsequent to the relatively strong year-classes of 1997 & 1998 as it relates to the level of recruitment. To the extent possible with available information, provide information on the strengths (or relative strengths) of year-classes expected to enter the exploitable populations in the next 1-3 years.
- Consistent with the precautionary approach, consider the risk that fishing could do serious harm to the stock, including but not limited to assessing the implications of fishing at the following catch options: zero, 11,000t, 13,000t, and 15,000 t.
- In the event that an analytical model is not available to underpin the advice, the prospects for changes in stock biomass over a range of catch options should be considered, based on analysis of recent trends in abundance indicators in relation to recent removals (tempered by productivity factors noted above).
- Highlight major sources of uncertainty in the assessment, and where appropriate, consider alternative analytical formulations of the assessment.
- Report on results of tagging and the distribution of this stock in other areas (eg.3L/3Pn).

## **Products**

A Science Advisory Report (SAR) and associated research document(s) will be produced as a result of this meeting. Also, a proceedings report will be generated summarizing the decisions, recommendations and major points of discussion at the meeting.

## **Participation**

Participation will be solicited from the following:

- DFO Science, Oceans and Habitat Management, Fisheries and Aquaculture Management, and Policy & Economics (Newfoundland and Labrador and Quebec Regions)
- Provincial Government of Newfoundland and Labrador
- Scientists from St. Pierre, France
- Fish Food and Allied Workers Union
- Academia
- Non-Governmental Organizations
- Industry Groups

**APPENDIX II - Attendees – 3Ps Cod Regional Advisory Process (RAP)**

**November 5-9, 2007 (Gazebo, Clovelly Golf Club)**

<b><u>NAME</u></b>	<b><u>AFFILIATION &amp; ADDRESS</u></b>	<b><u>PHONE NO.</u></b>	<b><u>FAX NO.</u></b>	<b><u>E-MAIL</u></b>
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### **APPENDIX III - Research Recommendations**

There were no research recommendations arising from this meeting.



#### **APPENDIX IV - List of Working Papers and PowerPoint Presentations**

- Brattey, J., B. P. Healey, M. J. Morgan, E. F. Murphy, D. Parsons, D. Power, and J.-C. Mahé (+others??). Assessment of the Cod (*Gadus morhua*) stock in NAFO Subdiv. 3Ps, November 2007. Working Paper
- Brattey, J., B. P. Healey, M. J. Morgan, E. F. Murphy, D. Parsons, D. Power, and J.-C. Mahé (+others??). Assessment of the Cod (*Gadus morhua*) stock in NAFO Subdiv. 3Ps in November 2007. PowerPoint
- Brattey, John and Brian Healy. An update of exploitation rates and movement patterns of cod in NAFO Subdiv. 3Ps based on tagging studies. Working Paper
- Brattey, John and Brian Healy. An update of exploitation rates and movement patterns of cod in NAFO Subdiv. 3Ps based on tagging studies. PowerPoint
- Cadigan, Noel. FLEDA of catch and indices 3Ps cod RAP, 2007. PowerPoint
- Cadigan, Noel. Selectivity adjusted Biomass, and SR plots. PowerPoint
- Cadigan, Noel. Year class strength from some indices, 3Ps cod RAP, 2007. PowerPoint
- Colbourne, E. and E. Murphy. Ocean Climate Variability in NAFO Division 3P during 2007 - potential influences on the Distribution and Abundance of Atlantic Cod. PowerPoint
- Dwyer, Karen. ACON Plots of Age Aggregated and Age Disaggregated Distributions from the 2007 Research Vessel Survey. PowerPoint
- Healey, Brian. Science Logbooks, <35' Vessels. PowerPoint
- Healey, Brian. Year-Class Strength of 3Ps Cod from Index Data. PowerPoint
- Healey, Brian. Year-Class Strength of 3Ps Cod from Index Data (Part 2). PowerPoint
- Jarvis, Harvey, Angela Tucker, Diane Power, Jackie Baker, Janette Pennell, Lilly Rideout and Paula Rosa-Bian2007 Fish Harvester Questionnaire (3Ps Resident Cod License Holders). PowerPoint
- Maddock-Parsons, Dawn. Commercial >35' catch per unit effort. PowerPoint
- Maddock-Parsons, Dawn. Selection Criteria. PowerPoint
- Maddock-Parsons, Dawn. Sentinel Surveys 1995-2007: Catch per unit effort in NAFO subdivision 3Ps. PowerPoint
- Maddock-Parsons, Dawn. Standardized Sentinel Catch Rates. PowerPoint
- Miller, David C. M., Peter A. Shelton, A. Jamie F. Gibson and M. Kurtis Trzcinski. Exploratory statistical catch at age analysis on 3Ps cod. PowerPoint
- Penney, Kim. Conservation Harvesting Plan (CHP): 3Ps Cod. PowerPoint