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#### **Newfoundland and Labrador Region**

### **Proceedings of the regional peer review of the 3Ps Cod and Witch Flounder Stock Assessment, Newfoundland and Labrador Region 2013**

**October 15-18, 2013  
St. John's NL**

**Chairperson: Earl Dawe  
Editors: Danny Ings and Eugene Lee**

Science Branch  
Fisheries and Oceans Canada  
PO Box 5667  
St. John's, NL, A1C 5X1

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## **Foreword**

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

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## SUMMARY

A meeting of the Newfoundland and Labrador Regional Peer Review Process on the status of Atlantic Cod (*Gadus morhua*) and Witch Flounder (*Glyptocephalus cynoglossus*) stocks in NAFO Subdivision 3Ps was held October 15-18, 2013 at Murray's Pond Fishing and Country Club in Portugal Cove-St. Philips, Newfoundland. The assessment was held to provide detailed advice to the Minister on the status of the stocks in order to inform the management decisions for the 2014 fishing season.

Participants included DFO staff from Science (Newfoundland and Labrador), Ecosystems and Fisheries Management (Newfoundland and Labrador), the province of Newfoundland and Labrador, the fishing industry, Centre for Fisheries Ecosystems Research, and a science representative from IFREMER (France).

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

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

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## **Compte rendu de la réunion d'examen régional par les pairs sur l' évaluation des stocks de morue et de plie grise dans 3Ps, région de Terre-Neuve-et-Labrador (2013)**

### **SOMMAIRE**

Une réunion du processus régional d'examen par les pairs de la région de Terre-Neuve-et-Labrador sur l'état des stocks de morue franche (*Gadus morhua*) et de plie grise (*Glyptocephalus cynoglossus*) dans la sous-division 3Ps de l'Organisation des pêches de l'Atlantique Nord-Ouest (OPANO) a eu lieu du 15 au 18 octobre 2013 au Murray's Pond Fishing and Country Club, à Portugal Cove-St. Philips (Terre-Neuve-et-Labrador). L'évaluation visait à prodiguer des conseils détaillés au Ministre sur l'état des stocks afin d'éclairer les décisions de gestion pour la saison de pêche de 2014.

Parmi les participants, mentionnons le personnel de la Direction des sciences (Terre-Neuve-et-Labrador) et de la Gestion des écosystèmes et des pêches (Terre-Neuve-et-Labrador) de Pêches et Océans Canada, la province de Terre-Neuve-et-Labrador, l'industrie de la pêche, le Centre for Fisheries Ecosystems Research et un représentant scientifique de l'Institut français de recherche pour l'exploitation de la mer (France).

Le présent compte rendu résume les présentations ainsi que les autres documents présentés pendant la réunion et synthétise les discussions tenues à propos de ceux-ci. Sont également inclus le cadre de référence (annexe 1) et la liste des participants à la réunion (annexe 2).

D'autres renseignements sur l'évaluation se trouvent dans la série des documents de recherche et dans l'avis scientifique du Secrétariat canadien de consultation scientifique produits à la suite de la réunion.

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## **INTRODUCTION**

The status of the Northwest Atlantic Fisheries Organization (NAFO) Subdivision 3Ps Cod was last assessed in October 2012 (DFO 2013). The main objectives were to evaluate the status of the stock and to provide scientific advice concerning conservation outcomes related to various fishery management options. The current assessment was requested by Fisheries and Aquaculture Management to provide the Minister with detailed advice on the status of the stock in order to inform the management decisions for the 2014 fishing season.

The status of the Witch Flounder stock in NAFO Subdivision 3Ps was last assessed in 2005 (DFO 2005). The current assessment was requested by Fisheries and Aquaculture Management to provide the Minister with advice to inform the management decisions for the 2014 fishing season.

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## MEETING PROCEEDINGS

### PHYSICAL OCEANOGRAPHIC CONDITIONS IN NAFO DIVISION 3P DURING 2013 – POTENTIAL INFLUENCES ON ATLANTIC COD (*GADUS MORHUA*)

**Presenter:** Eugene Colbourne, DFO Science, NL Region

#### Abstract

Oceanographic data from NAFO Division 3P during the spring of 2013 are examined and compared to previous years and the long-term (1981-2010) 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, bottom temperatures moderated and have been warming during the past decade reaching two standard deviations above normal in 2011 and 2012 before decreasing to one standard deviation above normal in 2013.

The extent of  $<0^{\circ}\text{C}$  water on St. Pierre bank decreased to near-zero in 2011 and has continued at low levels into 2013. The areal extent of bottom water with temperatures  $>3^{\circ}\text{C}$  has remained relatively constant at about 50 % of the total 3P area, although actual temperature measurements show considerable inter-annual variability. Bottom temperatures in deeper water of the Laurentian and Hermitage Channels show slight negative anomalies but remained relatively warm with values in the  $3^{\circ}\text{C}$ - $5^{\circ}\text{C}$  range. Deeper slope waters on Southeastern St. Pierre Bank were exceptionally warm in 2012-13 with values reaching  $7^{\circ}\text{C}$ - $10^{\circ}\text{C}$ .

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  $<0^{\circ}\text{C}$  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 and in more recent years larger catches became more widespread over St. Pierre Bank as cold ( $<0^{\circ}\text{C}$ ) water disappeared from the area. In general, cod tend to prefer the warmer ( $2^{\circ}\text{C}$ - $5^{\circ}\text{C}$ ) 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 presenter was asked for clarification on the distribution of warm/cold waters in the deep channels versus along the slope. This led to a brief explanation on the composition and layering of water masses in the deep channels.

There was a discussion on the apparent lack of cod in areas with temperatures above  $5^{\circ}\text{C}$ - $6^{\circ}\text{C}$ . The question was posed whether there is an upper thermal limit for cod but no information was provided on this. Also, the comment was made that maybe larger fish would occur in the warmer water. The discussion evolved to consider whether water temperature had an influence on catchability for the survey. It was pointed out that there are a number of known year effects in this survey time-series but other influences such as infrequent, but very large catches and concentrations of fish also affect between year differences in the survey results.

The presenter commented that on the NL shelf there is only a weak association between number of recruits and water temperature but how this relates to 3Ps is unknown.

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## **Fish Community Trends For 3Ps**

**Presenter:** Mariano Koen-Alonso, DFO Science, NL Region

### **Abstract**

3Ps is not a closed ecosystem; influences from surrounding ecosystems are not negligible. There is a clear warming signal in this region; since the early 1990s, bottom temperature during the spring survey has been increasing at an average rate around 3 % per year. Although ecosystem trends in the 1980s and early 1990s are potentially confounded with changes in the RV survey (e.g. timing, sampling effort, survey gear), still it seems clear that the fish community declined during the mid 1980s and early 1990s. This decline was also accompanied by a decrease in the average fish size.

Overall, the biomass and abundance of the fish community has increased since the mid 1990s. Increases in biomass have been moderate, while increases in abundance have been more clear and led by planktivore species like sandlance, and to a lesser extend herring. Since 1995, the average fish size as indicated by the biomass/abundance (BA) ratio at the fish functional group level has shown ups and downs, without a consistent trend. The decline in BA ratio at the overall fish community level in recent years can be explained by changes in community composition, like the observed increases in planktivores. Among piscivores, Atlantic cod is the dominant species in this functional group. Its dominance seems to have been relatively higher during the early 2000s, but is showing a relative dip in the mid-late 2000s. During the early 2010s, dominance of cod seems to be increasing among piscivores, but other gadoids (e.g. silver hake) also seem to be increasing within this functional group. Among medium benthivores, witch flounder biomass level has shown very little change since the mid 1990s. This group has been dominated by yellowtail flounder since the mid 2000s. It is also worth noting that lumpfish was an important component of this functional group in the mid 1990s, but has been virtually absent in recent years. In terms of diets, there is limited information for 3Ps. The available data for cod suggests that this predator has a highly variable diet in this region. The preliminary data for 2013 indicates a spring diet dominated by sandlance, snow crab and toad crab.

The observed warming of this system, together with recent increases of “warmer-water” species like sandlance, silver hake, and pollock suggests that this ecosystem could be undergoing structural changes. Until the extent and magnitude of these changes can be properly evaluated, management with higher than normal risk-aversion is advisable.

### **Discussion**

Comments were made on the decreasing biomass in the early part of the time-series 1983-1994. Then, in the Campelen series there is an increase in planktivores (sandlance). There was some discussion on changes in biomass of individual species comprising the piscivores (cod, silver hake, pollock, turbot) and medium benthivores (witch flounder, yellow tail (increased greatly since 2001), lumpfish, and sculpin). The relationship between stomach content data and community structure was considered.

Clarification was provided on the specific strata that were included in the analyses as some strata were added to the survey over time while other strata were only surveyed infrequently. In particular, the number of sets in 2005 was not consistent with other analyses to be presented.

The performance of the survey gear in catching small fish was discussed. It was explained that for small planktivores the current trawl (Campelen) is pretty good but less so in earlier years with the Engels gear. The survey timing change was noted as well. With the availability of capelin unknown and the low percentage of capelin in the diet, the meeting considered if conclusions could be made about the importance of capelin to cod. The presenter explained

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that the survey timing change and the low amount of diet sampling in 3Ps makes it difficult to make strong statements about capelin in the cod diet. Capelin is thought to be a driver for other species, but it is not so clear for cod. It was pointed out that in at least one year, 1997, capelin comprised a high proportion in the diet but there were few cod sampled by the survey in that year. It was generally thought that capelin were more important in the past and recently, abundance of capelin locally was low. Noting that a strong year-class of cod followed the year with high capelin in the diet of cod, there was discussion on the nutritional value of capelin versus snow crab. Large gaps in the diet sampling prevented much detailed consideration of this. It was concluded that there is evidence that capelin are a better food source for cod, but whether availability of capelin influences 3Ps cod is a difficult question and we do not have a good handle on it. A potential predator influence was also discussed. Harp seals do not occur in this area but Grey seals are present. Little is known about how much they move into the area. Whether competitors are an issue in addition to predation was discussed and reference was made specifically to potential increases in haddock abundance. It was explained that any increase in haddock abundance was very little. It was noted that a full assessment of haddock would occur this winter. Cannibalism was discussed with respect to the low abundance of cod in the diet recently but there was high recruitment in 2012. It was noted to be prevalent during 1988-95. The possibility of a size range issue to explain this was raised because there are few large fish now. Discussion continued on the main drivers for the system and the complexity of the ecosystem and whether this area is experiencing a poor feeding regime compared to other areas, because crab is prominent in the area recently. Variability in diet may indicate less than optimal feeding conditions, but this is mostly speculative.

As the detailed information in the presentation was not available in for previous assessments of the stock, it was agreed that text on the subject would be included in the Science Advisory Report (SAR).

## **ATLANTIC COD**

### **Review of the Fishery**

**Presenter:** David Coffin, Fisheries and Aquaculture Management, DFO, NL Region

#### **Abstract**

An overview of the 3Ps cod fishery was provided outlining the license conditions, gear requirements, monitoring program and the small fish protocol for the area. There was a review of the Total Allowable Catch (TAC) for the past nine years and how it was allocated. A further breakdown of the allocations was given for the fixed and mobile gear fleets and by individual vessel size. A summary of groundfish licenses for the less than 65 foot (<65') fleet, broken into Core and Non-Core by fleet size, was provided. A review of closed times was presented, including the 3Ps spawning closure, and the mixing closure to protect Northern Gulf cod while they are in 3Ps. An overview of the fishery included the number of active enterprises, landings, and the percentage of quota taken by gear type and fishing areas by month for the 2012 season. An overview of the 2013-14 pilot program to re-allocate unused cod quota to active enterprises was provided.

#### **Discussion**

It was noted that only 42 % (760 of 1700 t) of the quota for France was taken so far this year matching data from Newfoundland. The largest percentage of the quota was taken by the 35 and 65 foot boats but no one could explain why these fleets were the most active.

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There were problems with a lack of interest in buying cod in many areas so the catch was down in 2013. There were some comments on the pilot project to promote the full utilization of the 3Ps cod quota.

## **Assessment of Cod in NAFO Sub-Division 3Ps**

**Presenter:** Brian Healey, DFO Science, NL Region

### **Abstract**

An overview of the status of the 3Ps cod stock was provided. Several sources of information were used to assess the status of cod in NAFO Subdivision 3Ps. A detailed review of the DFO 2013 bottom-trawl multi-species survey, trends in commercial landings, and standardized CPUE of the <35' fleet logbooks were the focus of this presentation.

A review of commercial fisheries indicated that catches by Canada and France combined for the 2012-13 management year was 4,800 t. This is approximately 42 % of the TAC (11,500 t).

Updated catch per unit of effort (CPUE) information was available for Canadian vessels <35'. Return rates of this logbook have been low in recent years, with approximately 50 % of the <35' fleet catch accounted for in the logbook database. Gillnet catch rates from logbooks of vessels <35' have been stable since 1999, though the 2012 estimate is the lowest in the time-series. Linetrawl catch-rates decreased over 2006-10, and have subsequently been relatively stable near the time-series average.

Research vessel surveys are conducted annually in spring and provide fishery-independent data on the status of the resource. After several years of generally consistent declines in both survey abundance and biomass, survey results indicate a considerable increase after 2007, particularly for abundance. The 2013 survey estimate of abundance is the highest in the 1983-2013 time-series. Survey biomass has also increased over the past few years, with the 2013 survey just above average. Recent trends are strongly influenced by catches of juvenile fish which are less influential to the survey biomass estimate. Although the distribution of cod in 2013 survey catches was relatively widespread, the 2013 survey indices are heavily influenced by a relatively large catch on Burgeo Bank.

Examination of the age-distribution of survey catches in 2013 indicated relatively large numbers of age 2-4 cod. In addition, for several year-classes, the abundance index in 2013 was higher than that of 2012 for the same cohort – which is impossible, indicating the potential presence of a year-effect. Biological sampling of research vessel catches indicates that current mean length and weight at age are average or below average. Data on cod condition (liver index), available since 1994, indicate that in 2013 cod condition was improved. Estimates of proportion mature-at-age indicate that a high proportion of the 2006 and later year-classes are mature. These fish then comprise a relatively large proportion of the survey estimates of total spawning biomass due in part to low abundance of older ages (i.e. older than those that have matured earlier) in the population.

Relative year-class strength was estimated from age 1-4 data from the DFO survey. Results indicated that the 1997, 1998, 2006, and 2009 year classes were much stronger than all other year-classes. The 2011 year class is presently five-times the average level, but is based on observations at ages 1 and 2 only.

### **Discussion**

It was clarified that there are still landings to be expected for this stock during the quota year.

Discussion on why the 2006 year-class wasn't showing up in the fishery was revisited.

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There was discussion on CPUE for gillnets. CPUE was relatively flat for an extended period although some high year classes were known during the time-series. The use of number of nets as the appropriate effort component of CPUE was questioned. It was explained that different proxies for effort were considered in the past and thought to make little difference in the results. Only relatively short soak times were observed previously, but it was not known whether typical soak times had changed over time. Changes in the distribution of effort were also discussed. There was more segregation of gear types by area in the past so changing patterns in gear use may be important, but the meeting concluded that on the whole it would be expected to see something different (i.e. not flat) in the CPUE series.

There were comments about the utility of looking at the residuals from the CPUE model. There is so much data that it would be difficult to see much from them, but it was agreed that this would be reconsidered. It was explained that there are non-location effects, but this was accounted for in the model. The amount of variation explained by the model was requested.

Clarification was requested on year effects for the survey. It was explained that it could be due to a number of things such as environmental effects. Year effects observed in 3Ps were not due to double counting where fish may move during the survey period. It was also pointed out that year effects were related to high single sets rather than highly concentrated age  $x$  fish followed by dispersed age  $x+1$  in the next year.

Clarification was also provided on how mortality ( $Z$ ) was calculated; it includes size selective mortality and fishing mortality. Also, additional information was provided on how recruitment was estimated from age groups not expected to have high fishery impacts.

There was discussion on the 2006 year-class that seems to have fizzled out. It was pointed out that the mortality estimates presented don't really apply to this year-class. Spatial differences inshore versus offshore were considered. The strong 2009 year-class was mentioned (four data points) as comparable to the 1997 year-class. Further discussion was delayed until the Survey-based cohort (SURBA) model and retrospective analyses were presented.

There was a question on the timing of the survey and whether there were fish distributional changes that could have affected survey results. It was noted that the within season pattern of sampling was always the same. The meeting heard that an influence of Gulf of St. Lawrence Cod was unlikely and didn't influence the one large set on Burgeo Bank in 2012 as this set was composed of many age classes, not just age ones. Also, there was no evidence from distributional data that Gulf fish spread into the area as age ones and twos; so it was concluded that there were no data to support that Gulf cod migrations or spread of young recruits had an influence on the assessment findings.

It was questioned why there was a sudden increase/change in percent maturity. Many possible reasons were given including sampling level. Also, in the most recent years there are only the young individuals of those cohorts sampled so the sudden decline would be expected. These findings will be modified over the next few years as more data are collected on recent cohorts. Another possible influence provided was that fishing different gears in different areas could affect maturity levels and how we see them.

The meeting considered how to treat text on uncertainty in the catchability/year effect. Statements could be made in the SAR but this topic is somewhat covered by bullets on the SURBA model. A50 (age at 50 % maturity for females) does influence the spawning stock biomass (SSB) calculation and text in the SAR already covers this aspect. The age composition within the SSB was also discussed.

It was noted that there was an increase in the liver index but no changes were seen in the weight at age. The presenter would have to check whether these indices were sample size weighted. Results could be influenced by more emphasis on younger fish recently that have

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slightly higher mean weight compared to the oldest fish with comparatively poor weights. Also, it was pointed out that the sentinel data does not show the same trends in the indices, and sampling in the sentinel extends from June to January so the annual cycle of the indices can be followed.

**Potential recommendation:** Analyze the logbook data for the over 35 foot (>35') fleet. Concern was expressed that data from the logbooks for >35' fleet was not available for the meeting but the logbook return rate for this fleet was probably 100 %. It was explained that lack of time and resources prevented those analyses for this meeting. There was agreement to put higher priority on analyzing this data next year as it hasn't been looked at in a while.

## **Developing Standardized Catch Rates For Atlantic Cod In 3Ps Using Observer Data**

**Presenter:** Danny Ings, DFO Science, NL Region

### **Abstract**

Information collected by observers on Canadian vessels fishing for cod (1997-2012) was reviewed for the potential to create a standardized catch rate index. Data exploration indicated substantial variations in observer coverage over time and amongst unit areas, as well as by fleet sector. Although the proportion of the landings observed is low for most years and areas, data from gillnets, linetrawls and otter trawls generally support that recent catch rates are among the lowest in the times series (1997 to 2012). Observer deployments are not random and are often target specific management issues. Therefore, the utility of further explorations may be limited.

### **Discussion**

There was a question on whether the observer deployments were random. The meeting was informed that observer effort is often directed toward specific monitoring priorities by Conservation and Patrol.

It was noted that there are observer data available for vessels from the Maritimes Region in addition to those analyzed and presented from Newfoundland. However, these data were mostly directed for species other than Cod and as this was a preliminary analysis, data outside of Newfoundland were not included at this point. There were plans to include French and Maritimes data in future analyses. Later, analyses such as General Linear Models (GLM) or Generalized Linear Models (GLIM) would be explored for this data to address the spatial aspects of the data.

There were comments on comparing the observer data to the logbooks data (<35' fleet) presented earlier. Only general comparisons were made in preparing for the meeting and some matches were noted but this was just a cursory analyses.

## **Updated Sentinel Survey Results In Nafo Sub-Division 3Ps For 2012**

**Presenter:** Dawn Maddock Parsons, DFO Science, NL Region

### **Abstract**

Unstandardized catch rates for Sentinel Surveys in NAFO subdivision 3Ps were updated for 2012 and preliminary results were given for 2013. Gillnet catch rates (weekly average number of fish per net) in the most recent years remained low compared to 1996-98 catch rates. Catch rates in small mesh gillnet remained low. Since 2000, length frequencies of cod caught in small mesh gillnet showed fewer fish at the two size modes (36-44 cm and 52-56 cm) that this gear catches. Linetrawl catch rates (weekly average number of fish per 1000 hooks) increased from 2000 and showed an increase in the number of fish at the 44-54 cm size range from 2002 to

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2004. Linetrawl catch rates have been lower than those in 1995-97 since 2000, but showed a slightly increasing trend from 1999-2008. Since then, catch rates in linetrawl declined and have been below the series mean for the last 4 years.

Trends in liver and gutted body condition show a seasonal cycle, with condition declining over the winter and early spring, and increasing again over the summer once spawning occurs. Annually, trends in condition varied over the time series, but declined from 2007-09. In 2010, condition improved and was similar to those observed in 2008, however in 2011 and 2012, condition declined once more.

## **Discussion**

The discussion followed the next presentation.

## **Standardized Sentinel Catch Rates**

**Presenter:** Dawn Maddock Parsons, DFO Science, NL Region

### **Abstract**

Sentinel catch rates were also standardized and modeled to account for seasonal and site effects. These standardized catch rates were presented for gillnet and linetrawl control locations. Age aggregated catch rates from sentinel surveys were higher in the early part of the time series for both gillnet and linetrawl, declined over the mid to late 1990s and have remained lower since then. In 2012, both linetrawl and gillnet standardized catch rates were below the series average. In the age dis-aggregated standardized catch rate series, cohorts in recent years have been weaker than stronger cohorts in the past (1989, 1997-98 in particular). In the linetrawl, however, the 2004 year-class has tracked fairly well at ages 3-6. The 2006 year-class appeared in the gillnet catch at age 3 in 2009, but was less than average in the linetrawl.

### **Discussion**

Clarification was provided regarding the smaller number of aged fish from gillnets which was due to less fish being caught by gillnets rather than just fewer otoliths available or aged. Every fish was aged if possible.

## **Report on Results of Tagging and the Distribution of the Stock in Other Areas**

**Presenter:** Don Power for John Bratney, DFO Science, NL Region

### **Abstract**

Cod tagging in NAFO Subdiv. 3Ps was continued. During 2008-11 tagging coverage was restricted to Placentia Bay (3Psc); however, coverage was expanded in 2012 to include Fortune Bay (3Psb) and in 2013 to include Fortune Bay and Hermitage Bay (3Psa). Total numbers of tagged cod released have increased from 963 in 2011 to  $\geq 2,000$  in 2013. Annual exploitation rates (= % harvested) were estimated for 2008-12 based only on cod tagged in Placentia Bay; cod tagged in other areas were released during the fishery and not sufficiently dispersed to determine harvest rates in the year of release. The numbers of tags returned were adjusted by annual estimates of tag reporting rate based on a high-reward tagging study. The single tag reporting rate for the inshore of 3Ps during 2012 was 0.78 and has averaged 0.78 during 1997 - 2010. The numbers of tagged cod available for capture at the time of the fishery each year was estimated after accounting for initial tagging mortality, tag loss, assumed natural mortality ( $M=0.2$ ), and recaptures in preceding years adjusted by the tag reporting rate. The estimates are influenced by the sizes of cod tagged due to selectivity of commercial fishing gear and larger cod ( $>60$  cm) tend to be more readily selected by gillnets than smaller ones. The exploitation rates for 2012 based on cod  $>60$  cm at tagging averaged 20 % ( $F=0.22$ ). Only 42 %

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(approx.) of the TAC was taken in 2012; if the full TAC was taken harvest rates would clearly have been substantially higher. The distribution of recaptures indicated some movement of cod from 3Ps into southern 3L during summer, but the numbers of tag returns from 3L has been very low (14 during 2008-13). The low catch of cod in southern 3L during 2012 (~200 t) and low return of 3Ps-tagged cod from 3L suggest that exploitation of migrant Placentia Bay cod in southern 3L is not a significant issue; most of the exploitation is taking place locally within unit area 3Psc.

## **Discussion**

There was a question on whether the tag return on the 4RS line is real. It was agreed that it was real and it was noted that it was collected in the same year as it was deployed so it doesn't appear in some of the other plots and analyses.

Is exploitation rate in Placentia Bay representative of other areas? There was speculation on the amount of exploitation that would occur if all of the TAC was taken and with the exploitation rates from Placentia Bay applied, it would amount to 40 %. The text in the SAR specifies that this exploitation rate comes from 3Psc only. It was suggested that there should be a comment on the variability in exploitation (i.e.: explain why there are such changes in the recent years). It was noted that there have been some changes in the timing of the fishery in recent years but no one is sure that this is affecting results. A discussion ensued on the assumptions for tagging (constant tag loss, mortality, and return rate) and we do not have the ability to fully evaluate the validity of assumptions associated with tagging in each year and in each area. Catch has not changed much in recent years but exploitation rates were rather variable. It was suggested that trends in exploitation rates from tagging were useful but it may not be meaningful to look at the year to year differences in rates. In terms of reporting results, the annual range should be given without reference specifically to the previous year. The meeting concluded that there was no reason to question any of the basic assumptions about tagging.

## **Estimates of Stock Size From Survey Results: Survey-Based (Surba) Assessment, With Short-Term Projections**

**Presenter:** Brian Healey, DFO Science, NL Region

### **Abstract**

Recent assessments of 3Ps cod have applied cohort models to age-disaggregated results from DFO RV surveys. The model (Cadigan, 2010) assumes that total mortality can be decomposed into age and year effects. Assumptions about survey selectivity are required to relate survey observations to the model estimates. This model applies a 'flat-top' assumption (i.e. fish equally selected above a given age). Updated estimates of stock size using survey data from 1983-2013 indicate since 2009, SSB has increased considerably and in 2013 is 64 % above the  $B_{lim}$  (biomass limit reference point) level. These improvements are due to the combined effect of lower total mortality and higher recruitments.

Three year projections were undertaken, with projection inputs taken as recent averages. Five projection scenarios were considered, with total mortality over 2014-16 fixed constant at one of: 80 %, 90 %, 100 %, 110 % and 120 % of current values (defined as most recent three year average).

Projection results indicate that SSB will continue to increase under all scenarios. Projection scenarios indicate that the 2014 SSB will remain stable or increase slightly from the 2013 estimate. However, by 2016, results indicate SSB will increase to about 3 to 4 times the LRP. The particularly large increase in SSB projected from 2015 to 2016 is highly uncertain, being heavily influenced by the very large preliminary estimate for the 2011 year-class.

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## Discussion

There was a question about the effect of not having weight-at-age data for the commercial catch going forward. It was agreed that past results could be reviewed to help determine this. The meeting was told that usually, there were no large changes between years but the effects of a large cohort for example could be seen.

There were some comments comparing/contrasting SURBA with virtual population analysis (VPA). SURBA has penalties that ensure smoothing and catchability has to be externally applied, unlike VPA.

There was a question on why there are so many effects in the residual plots. The SURBA model smooths out the ups and downs so this is to be expected and is a means of handling the year effects. A trial run from last year was described that did not use any shrinkage. Also noted was that these effects were tested somewhat during initial model development. Overall, there was little change in the conclusions for the model output between runs with or without shrinkage.

There was a discussion on whether  $B_{lim}$  should be changed because recent lower values were observed followed by some recovery. Recent values were not much lower than those used in setting  $B_{lim}$  originally and the overall effect would be small. It was agreed that it was probably too early to consider changing  $B_{lim}$  as further data is required to document the recovery, and the recent low  $B_{lim}$  estimates are subject to change as more data are available from future surveys. There was also a comment that generally, there is some support for also including consideration of the productivity levels in selecting  $B_{lim}$ .

Another concern with the model was that there is very low commercial catch but the  $z$  (total mortality value) in SURBA is relatively high. Someone questioned why mortality estimates were high when only 42 % of quota is taken. It was commented that this was probably not sustainable unless other things are compensating for the high mortality. In the 1990s there were poor year-classes but the mortalities were very low which helped the population through the period. It was concluded that there would be concerns about the effects of taking the full TAC with the current mortality levels observed.

There was a short discussion on whether weighted population mortality values should be used. Arithmetic average was used in the past to calculate mortality estimates for ages 5-10. This was the first time that population weighting was done for the stock and there was support from the meeting for continuing with this approach.

Clarification was given on testing SURBA results with various ratios of the extended survey (inshore and Placentia Bay) to offshore only strata to determine the effects of including additional inshore coverage post 1996.

There was discussion on how much emphasis should be placed on the age one estimates for the 2012 year-class. The lead biologist had done some work on comparing the effects of high values for age one fish on SURBA results in the present year and concluded that they were not that influential. Last year, when catches of age one fish were also high, there was not much mention of them in the SAR because there was only one data observation on the year-class. Its strength was subject to change with further data and the trawl does not sample this size/age class well. At this point it was left open for further discussion when bullets are being finalized.

It was noted that in recent years, all estimates for age ones were revised upwards with subsequent data but one might expect some ups/downs. It was noted that this pattern of upward revisions did not hold in the past though. It was stressed that it will be a number of years before these age ones are recruited into the fishery.

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The meeting was asked whether there was utility in using catch curves for the data but it was noted that catch curve analyses would probably have a tough time dealing with the year effects within the 3Ps data.

The effects of the large 2011 year-class values on SURBA projections were discussed. It was suggested that the text include caution on the projections for 2016 as there are opportunities for reducing the year-class strength as more years of data are collected and year-classes that were previously thought to be strong at age one have not always appeared strong in the fishery.

### **Telephone Questionnaire – 3Ps Cod Fishery**

**Presenter:** Johan Joensen, FFAW, NL

**Abstract.** No abstract provided.

#### **Discussion**

Only the last year of data from the questionnaire was presented and the presenter was asked to present the trends over time in the next assessment. The presenter was new to the data analysis and did not have time to prepare an extended version.

There was a comment that spatial differences in the results were influenced by St. Pierre Bank fishers not seeing many small fish. This may be due to mostly gillnet use on the Bank that would not pick up many small fish seen in other areas that use other gears. Sample size was also low for fishers on St. Pierre Bank.

### **Offshore Cod Fishery Perspective**

**Presenter:** Mike O'Connor, Icewater Harvesting Inc., NL

A verbal update was provided for the offshore fishery. No abstract provided.

#### **Discussion**

Comments were made addressing why only 18 % of quota was taken. They included management issues and severe competition, and also, fish were mostly small, although there were pockets of larger fish in deeper waters.

There was a discussion on changing the format and where to put the industry perspective in the SAR. It was agreed that one section would be written that included input from the inshore, offshore and the St. Pierre and Miquelon fishers together.

### **Perspective of St. Pierre and Miquelon Inshore Fishers**

**Presenter:** Caroline Fontaine, Organization Professionnelle des Artisans Pecheurs de Saint Pierre et Miquelon

A verbal update was provided on the inshore fishery based in St. Pierre and Miquelon. No abstract provided.

#### **Discussion**

No discussion followed.

### **Bullets Preparation**

There was a suggestion that tagging data should be presented for Placentia Bay and other areas separately next year but it was agreed that this may lead to biased estimates. There was concern about extrapolating from Placentia Bay to the entire stock area and it was agreed that the text would clearly state the location of tagging sites.

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There was a proposed bullet on water temperature and the ecosystem drafted and discussed, based on presentations by E. Colbourne and M. Koen-Alonso, but it was dropped. The discussion centred on the amount of diet data that was available, referencing the large gaps in the time series. Also, species listed in the proposed bullet as warm water species were not new to the system and have been observed in some abundance in the past. There was also discussion on how to interpret text advising management to be highly risk adverse because of the structural changes ongoing. Due to the various concerns with the available information, this bullet was dropped.

A bullet on management was considered. There was discussion on whether a bullet would be useful in applying the Harvest Control Rule (HCR), but the meeting was informed that it was not yet signed off by the Minister. Measures important for the HCR were discussed and it was agreed that there was enough information provided in the other bullets and the text of the SAR to cover the needs of management with respect to the HCR such that a specific bullet was not warranted.

## **WITCH FLOUNDER**

### **Assessment of Witch Flounder In NAFO Sub-Division 3Ps**

**Presenter:** Dawn Maddock Parsons, DFO Science, NL Region

#### **Abstract**

Landings of Witch Flounder (*Glyptocephalus gynoglossus*) in NAFO Subdivision 3Ps have been variable since 1974, ranging from 200 to 4200 t. During 1986-1993 catches were relatively stable and averaged around 1000 t annually. Landings declined subsequently and for the past 10 years, landings averaged 375 t, well below the 650 t TAC. The main directed fishery is prosecuted by offshore otter trawlers complemented by a near-shore Danish seine fishery. In some years, by-catch of American Plaice in the Witch Flounder-directed otter trawl fishery reached 100 % of the witch catch, and in the last five years has ranged from 10 % to 75 %. By - catch of American Plaice was not high in the Danish seine component of this fishery (averaging only 5 % in the past 10 years). Although DFO RV survey indices have been highly variable since 1983, survey biomass and abundance indices have remained near the 1983-2013 average in the past 10 years. During recent years (2008-13), the survey biomass index is, on average, about 85 % of the 1984-2013 average. Size structure observed in this stock in both the commercial fishery and the RV surveys are comparable to those reported in past assessments. Geographic distribution has remained consistent since 1983, except during the early to mid-1990s when fish disappeared from the 83-193 m depth zone coincident with extremely cold sea bottom water temperatures. There has been no aging of Witch Flounder for assessment purposes since 1994 and tracking cohorts through size distributions from the survey series is difficult for this slow growing flatfish. The abundance of 16-30 cm Witch Flounder, in the RV survey has been variable over 1997-2013, but showed above average values for 2002-04 and 2009-11. Although it is unclear how the abundance of this size group relates to abundance of spawning fish or fishable size witch in subsequent years, there has been no trend in this pre-recruit index.

#### **Discussion**

There was a discussion on why the TAC was not taken.

There was a discussion on the lower biomass values after 1993 relative to the earlier period, noting that there was a change in survey timing in 1993. Whether this was influenced by sampling less aggregated fish when the survey timing changed to later in the year could not be determined by the meeting.

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There was a discussion on using the catch to survey biomass ratio and the suggestion that this should be a bullet or a research recommendation. It was noted that this may not be useful because fishery catches are localized but the RV survey data is much more widespread. No information is available on fish movement to inform how large an area the catch is affecting so it would be difficult to limit the analyses of RV data to a particular area for comparisons with the catch. The suggestion was withdrawn.

The previous SAR had an Industry Perspective Section and it was agreed to work the information provided into a fishery section.

### **Offshore Perspective on the Witch Flounder Fishery**

**Presenter:** Mike O'Connor, Icewater Harvesting Inc., NL

A verbal update was provided for the offshore fishery. No abstract provided.

#### **Discussion**

Some of the long-used vessels were sold or decommissioned and regulations on fishing have changed with respect to cod by-catch and American Plaice and cod spawning closures. The meeting heard that there has been interest in catching the TAC in both directed and by-catch fisheries, but problems for the industry persist. Efforts to contract vessels from other areas have been problematic because the appropriate size vessels are not available. Also there are inefficiencies because smaller (100 ft) than normal vessels are used and the crews are not experienced in fishing in this area. Restrictions also mean that they have to move often. The decline in the Danish seine fleet may be due to problems with by-catch of redfish that has limited their participation. There was discussion on the timing of aggregations and it was noted that the timing has changed somewhat from February to March in recent years. The fishery targets fish aggregations and catches could be lower when fish are not aggregated.

It was noted that there was no fishing in much of the area where there were good catches in the survey (i.e. in the Halibut Channel). Whether there was information from tagging studies to aid in understanding fish distributions outside of survey periods was questioned, but none were available. It was concluded that the distribution of fishing effort was probably influenced greatly by regulations to prevent the by-catch of cod.

### **REFERENCES CITED**

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- DFO. 2013. Stock Assessment of NAFO Subdivision 3Ps Cod. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/078.
- DFO. 2005. Stock Assessment on Subdivision 3Ps Witch Flounder. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2005/050.

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## **APPENDIX I: TERMS OF REFERENCE**

### **3Ps Cod and Witch Flounder Stock Assessment**

#### **Newfoundland and Labrador Regional Peer Review Process**

**October 15-18, 2013**

**St. John's, NL**

**Chairperson:** Earl Dawe

#### **Context**

The status of the Northwest Atlantic Fisheries Organization (NAFO) Subdivision 3Ps Cod was last assessed in October 2012 (DFO 2013). The main objectives were to evaluate the status of the stock and to provide scientific advice concerning conservation outcomes related to various fishery management options. The current assessment is requested by Fisheries and Aquaculture Management to provide the Minister with detailed advice on the status of the stock in order to inform the management decisions for the 2014 fishing season.

The status of the Witch Flounder stock in NAFO Subdivision 3Ps was last assessed in 2005 (DFO 2005). The current assessment is requested by Fisheries and Aquaculture Management to provide the Minister with advice that will inform the management decisions for the 2014 fishing season.

#### **Objectives for the 3Ps Cod Assessment:**

- Provide an ecosystem overview (e.g., environment, predators, prey) for the stock area.
- Assess and report on the current status of the 3Ps Cod stock. In particular, assess current spawning biomass relative to baseline conservation thresholds (Blim), total (age 3+) biomass, exploitation rate, natural mortality, total mortality, and biological characteristics (including age composition, size at age, age at maturity, and distribution). Describe these variables in relation to historic observations.
- Further to the previous assessment, analyze recent year class strength relative to previous observations, as it relates to long term growth and sustainability of the stock.
- To the extent possible with available information, provide information on the strengths of year-classes expected to enter the exploitable populations in the next 1-3 years.
- Provide annual projections to 2016 based on the assessment of trends in the abundance index, biomass index and other stock indicators, including associated risk analyses. Specifically, these analyses will include an assessment of the trends in the stock and in the risks compared to Blim.
- Highlight major sources of uncertainty in the assessment, and where appropriate, consider alternative analytical formulations of the assessment.
- Assess the implications on the stock of fishery removals ranging from 5000t to 15,000t, at 2500t intervals.
- Report on results of tagging and the distribution of this stock in other areas (e.g., 3L/3Pn)

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### **Objectives for the 3Ps Witch Flounder Assessment:**

- To update the status of the 3Ps Witch Flounder stock since the last assessment based on commercial landings (overall and by unit area and gear type) and updated DFO Research Vessel information for Witch Flounder (including trends in abundance, biomass, distribution and length frequency data).
- To the extent possible with available data, provide information on management options for Witch Flounder in subdivision 3Ps for 2014-2016.

### **Expected Publications**

- Two Science Advisory Reports
- Proceedings
- Research Document(s)

### **Participation**

- Fisheries and Oceans Canada (DFO) (Science, Fisheries and Aquaculture Management)
- Fishing Industry
- IFREMER (French Research Institute for Exploitation of the Sea)
- Provincial Department of Fisheries and Aquaculture (DFA)
- Academia or Academics
- Aboriginal communities/organizations
- Non-government organizations

### **References**

- DFO. 2013. Stock Assessment of NAFO Subdivision 3Ps Cod. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/078.
- DFO, 2005. Stock Assessment on Subdivision 3Ps Witch Flounder. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2005/050.

## APPENDIX II: LIST OF PARTICIPANTS

Name	Affiliation	E-mail	Telephone
Earl Dawe (Chair)	DFO Science	<a href="mailto:earl.dawe@dfo-mpo.gc.ca">earl.dawe@dfo-mpo.gc.ca</a>	709-772-2076
Jim Meade (CSA Office)	DFO Science	<a href="mailto:james.meade@dfo-mpo.gc.ca">james.meade@dfo-mpo.gc.ca</a>	709-772-3332
Bev Sheppard	Harbour Grace Shrimp Co	<a href="mailto:bsheppard@hgsc.ca">bsheppard@hgsc.ca</a>	709-596-8000
Sherrylynn Rowe	MI-CFER	<a href="mailto:sherrylynn.rowe@mi.mun.ca">sherrylynn.rowe@mi.mun.ca</a>	709-778-0318
Dave Coffin	DFO-FAM	<a href="mailto:david.coffin@dfo-mpo.gc.ca">david.coffin@dfo-mpo.gc.ca</a>	709-772-2916
Brian Healey	DFO Science	<a href="mailto:brian.healey@dfo-mpo.gc.ca">brian.healey@dfo-mpo.gc.ca</a>	709-772-8674
Dawn Maddock-Parsons	DFO Science	<a href="mailto:dawn.parsons@dfo-mpo.gc.ca">dawn.parsons@dfo-mpo.gc.ca</a>	709-772-7703
Danny Ings	DFO Science	<a href="mailto:danny.ings@dfo-mpo.gc.ca">danny.ings@dfo-mpo.gc.ca</a>	709-772-4179
Eugene Colbourne	DFO Science	<a href="mailto:eugene.colbourne@dfo-mpo.gc.ca">eugene.colbourne@dfo-mpo.gc.ca</a>	709-772-6106
Michael O'Connor	Icewater	<a href="mailto:MCOconnor@eastlink.ca">MCOconnor@eastlink.ca</a>	902-275-5118
Gary Maillet	DFO Science	<a href="mailto:gary.maillet@dfo-mpo.gc.ca">gary.maillet@dfo-mpo.gc.ca</a>	709-772-7675
Bill Brodie	DFO Science	<a href="mailto:bill.brodie@dfo-mpo.gc.ca">bill.brodie@dfo-mpo.gc.ca</a>	709-772-3288
Don Power	DFO Science	<a href="mailto:don.power@dfo-mpo.gc.ca">don.power@dfo-mpo.gc.ca</a>	709-772-4935
Joel Vigneau	IFREMER Science	<a href="mailto:joel.vigneau@ifremer.fr">joel.vigneau@ifremer.fr</a>	(+33)231515600

<b>Name</b>	<b>Affiliation</b>	<b>E-mail</b>	<b>Telephone</b>
Caroline Fontaine	Organisation Professionnelle des Artisans Pecheurs de Saint Pierre et Miquelon	<a href="mailto:OPPECHE@cheznoo.net">OPPECHE@cheznoo.net</a>	00508410545
Eugene Lee	DFO Science	<a href="mailto:eugene.lee@dfo-mpo.gc.ca">eugene.lee@dfo-mpo.gc.ca</a>	709-772-6282
Rick Rideout	DFO Science	<a href="mailto:rick.rideout@dfo-mpo.gc.ca">rick.rideout@dfo-mpo.gc.ca</a>	709-772-6975
Mariano Koen-Mariano	DFO Science	<a href="mailto:mariano.koen-alonso@dfo-mpo.gc.ca">mariano.koen-alonso@dfo-mpo.gc.ca</a>	709-772-2047
Tom Dooley	NL Department of Fisheries and Aquaculture	<a href="mailto:tomdooley@gov.nl.ca">tomdooley@gov.nl.ca</a>	709-729-0335
Johan Joensen	FFAW	<a href="mailto:JJoensen@ffaw.net">JJoensen@ffaw.net</a>	709-576-7276
Monty Way	FFAW	<a href="mailto:mway@ffaw.net">mway@ffaw.net</a>	709-634-0277
Dennis Slade	Icewater	<a href="mailto:dtslade@iceswaterseafoods.com">dtslade@iceswaterseafoods.com</a>	709-463-2445
Wayne Masters	Fish Harvester, Red Harbour	<a href="mailto:pwmasters@personainternet.com">pwmasters@personainternet.com</a>	709-279-3029
Dan Baker	Fish Harvester, Hr. Breton	<a href="mailto:Danbaker63@hotmail.com">Danbaker63@hotmail.com</a>	709-885-2047
Brian J. Careen	Fish Harvester, St. Bride's	Not Provided	709-227-4239
Alfred Fitzpatrick	Fish Harvester, Lamaline	<a href="mailto:alfredfitzpatrick@hotmail.com">alfredfitzpatrick@hotmail.com</a>	709-857-2069
Marie Vaugeois	DFO Science	<a href="mailto:marie.vaugeois@dfo-mpo.gc.ca">marie.vaugeois@dfo-mpo.gc.ca</a>	Not Provided

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<b>Name</b>	<b>Affiliation</b>	<b>E-mail</b>	<b>Telephone</b>
Hilary Rockwood	MI-CFER	<a href="mailto:hilary.rockwood@mi.mun.ca">hilary.rockwood@mi.mun.ca</a>	709-753-2424
Jackie Baker	FFAW	<a href="mailto:JBaker@ffaw.net">JBaker@ffaw.net</a>	Not Provided
Steve Walsh	DFO Science	<a href="mailto:steve.walsh@dfo-mpo.gc.ca">steve.walsh@dfo-mpo.gc.ca</a>	709-765-0799
Don Stansbury	DFO Science	<a href="mailto:Don.stansbury@dfo-mpo.gc.ca">Don.stansbury@dfo-mpo.gc.ca</a>	709-772-2559