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Proceedings of the Regional Peer Review on the Assessment of the Atlantic Mackerel in Subareas 3 and 4

March 4, 2014

Maurice Lamontagne Institute

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Foreword

The purpose of these Proceedings is to document the key activities and 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 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

This document contains the proceeding from the meeting held within the regional assessment of the Atlantic Mackerel in Subareas 3 and 4. This review process was held on March 4th, 2014 at the Maurice Lamontagne Institute in Mont-Joli. This meeting gathered about thirty participants from sciences to management to industry. This proceeding contains the essential parts of the presentations and discussions held and relate the recommendations and conclusions that were presented during the review.

SOMMAIRE

Ce document renferme le compte rendu de la réunion tenue dans le cadre du processus régional d'évaluation du maquereau bleu des sous-régions 3 et 4. Cette revue, qui s'est déroulée le 4 mars 2014 à l'Institut Maurice-Lamontagne à Mont-Joli, a réuni une trentaine de participants des sciences, de la gestion et de l'industrie. Ce compte rendu contient l'essentiel des présentations et des discussions qui ont eu lieu pendant la réunion et fait état des recommandations et conclusions émises au moment de la revue.

INTRODUCTION

The Quebec Region of the Department of Fisheries and Oceans (DFO) is responsible for assessing the stocks of several exploited fish and invertebrate species in the Estuary and Gulf of St. Lawrence. Most of these stocks are assessed periodically within a regional advisory process, which is conducted at the Maurice Lamontagne Institute in Mont-Joli. This document consists of the proceedings of the meeting held on March 4, 2014 on the assessment of the Atlantic Mackerel in subareas 3 and 4 (Canada's east coast).

The objective of the review was to determine whether there were any changes in the resource's status and whether adjustments were required to the management plans based on the chosen conservation approach, the ultimate goal of which is to provide scientific advice on managing the Atlantic Mackerel in subareas 3 and 4 for the 2014 and 2015 fishing seasons.

These proceedings report on the main points discussed in the presentations and deliberations stemming from the activities of the stock assessment regional committee. The regional review is a process open to all participants who are able to provide a critical outlook on the status of the assessed resources. In this regard, participants from outside DFO are invited to take part in the committee's activities within the defined terms of reference for this review (Appendices 1 and 2). The proceedings also mention recommendations made by the meeting participants.

CONTEXT

Meeting chairperson Martin Castonguay welcomes the participants. He goes over the peer review's objectives and agenda. After the participants introduce themselves, stock assessment biologist François Grégoire begins the review by highlighting the contribution of his collaborators. He displays the meeting agenda and briefly reviews the highlights of the last Science Advisory Report (2012). He reminds the participants that at the time of the last assessment, several indices were down (catches, spawning stock biomass, average age, egg survey) and that neither recruitments nor fishing mortality were high. The 2012 Science Advisory Report recommended not exceeding 9000 t in catches for the 2012 and 2013 seasons. However, a TAC of 36,000 t, corresponding to that in the United States, was assigned.

ASSESSMENT OF THE RESOURCE

COMMERCIAL FISHERY

The biologist presents landing statistics by country (Canada, United States), province, division and fishing gear along with catch distribution maps. In 2013, the decline in catches continued, and as in recent years, the highest proportion of catches was made on the west coast of Newfoundland and Labrador (more specifically, in Bonne Bay).

Commercial landings reported in NAFO subareas 3 and 4 declined sharply in recent years. Between 2005 and 2010, they went from 54,621 t to 38,753 t before reaching 11,400 t in 2011, 6,468 t in 2012 and 7,431 t in 2013. American landings (commercial and recreational) in NAFO subareas 5 and 6 also dropped sharply in recent years. Between 2005 and 2010, they went from 43,220 t to 10,635 t before reaching 1,463 t in 2011, 6,019 t in 2012 and 5,250 t in 2013.

- Upon hearing of this alarming information regarding commercial landings, some participants express concern about the pressure exerted by the recreational fishery, where it seems that unrecorded catches in recent years are still high.

NOVA SCOTIA OBSERVER PROGRAM

Data from the Nova Scotia Observer Program are presented. They give an idea about catches made in the past by foreign fleets. Current catches recorded by this program also provide additional information regarding the presence of the species in non-traditional fishing areas. The participants have no comments.

GROUNDFISH MULTIDISCIPLINARY SURVEY

The biologist briefly presents information on mackerel bycatches in the groundfish multidisciplinary surveys conducted annually on the Scotian Shelf. A decline in catches and catch sizes is also observed. The participants have no comments.

BIOLOGICAL INDICATORS

The biologist presents catches-at-age and key biological indicators (condition factor, average size, growth, length, and age at 50% maturity). Age at 50% maturity has varied little over the years. However, length at 50% maturity has varied and, in most cases, is above the minimum authorized catch length of 250 mm (which is not based on mackerel biology). The fact that catches can target immature fish represents additional pressure on the stock. The mackerel's condition tends to follow annual variations in the temperature of the cold intermediate layer (CIL). The species' condition has worsened since 2009 and the value measured in 2013 is among the lowest in the series.

- Given the collapse of the stock, the participants strongly suggest increasing the minimum authorized length and applying the small fish protocol developed for mackerel. A representative from Management agrees to follow up on this.
- Several participants also consider intervening in the bait and recreational fisheries a priority. Direct sales at sea among fishers are also discussed.
- In conclusion, the biologist mentions that in addition to the drop in landings over the years, the size of mackerel fished by all fishing gear has also decreased. Only small mackerel are currently fished.

ECOSYSTEM CONSIDERATIONS

The biologist points out that ecosystem considerations were integrated in this review, as is done in Europe when Northeast Atlantic mackerel is assessed. To this effect, four subjects are explored: 1) A similarity analysis applied on abundances of fish larvae collected in the southern Gulf of St. Lawrence between 1998 and 2012; 2) Detection of common trends in abundances of fish larvae collected there between those two years; 3) Thickness of the layer $\geq 8^{\circ}\text{C}$ in relation to current Northern Gannet status; and 4) Effect of environmental variations on Gulf of St. Lawrence (GSL) mackerel stock dynamics.

Stéphane Plourde discussed this topic in greater detail. The purpose of the study was to: 1) Describe the changes in environmental, physical and biological conditions in the GSL; 2) Identify the cause-effect relationships between zooplankton physical conditions and dynamics; and 3) Determine the impact of environmental variations on different GSL mackerel stock dynamics indicators: spawning condition (K_{june}), improvement of condition during the summer ($K_{\text{sept/june}}$), recruitment success (R) and spawning stock biomass (SSB).

- According to the participants, the outcomes of the work on fish larvae collected in the southern Gulf of St. Lawrence between 1998 and 2012 must be evaluated with caution given that several factors may cause a bias (the lag in the 2010 mission, very limited

samples, etc.). However, it is stated that these factors are discussed in the research document.

- Some participants make a few comments with regard to the study presented by Mr. Plourde.
 - They note a temporal distortion between some series used, namely fishing mortality (F) and spawning stock biomass (SSB), where no lag was applied in the data.
 - Moreover, the models whose objective is to explain the SSB are of no use when it comes to fully separating what is understood by recruitment (R) and fishing mortality (F) from what is understood by variations that impact natural mortality and growth (environmental variations and ecological interactions). This is because no data related to F and R have been removed in order to focus on the other explanatory variables because units of different dimensions in relation to F (instantaneous value), R (proportion) and SSB (absolute value) are used. Therefore, to improve the model, using raw recruitments and catches instead of F, or working with annual biomass variations, is recommended.
 - Using standardized historical series is a viable option except when a problem arises in the case of some variables where the value cannot fall below zero (e.g., R). This will cause a bias in the anomaly comparison. No negative anomaly can ever remain as such in the case of a fixed zero.
 - In keeping with several points raised, Mr. Plourde says that modelling may be streamlined. In this Science Advisory Report, the decision is to exclude the results related to SSB and to keep only the results having to do with the condition (K_june, K_sept/june) and with recruitment success (R).
 - Overall, the participants say that this work represents a very good example of an ecosystem approach to fisheries.
- Therefore, the key finding from this work is the following: Condition in June and improvement in mackerel condition in the summer, both of which seem associated with the temperature of the CIL and the abundance and phenology of key copepod species, have trended downward since 2003 and 2009, respectively. Mackerel recruitment success seems to be favoured by high abundances and early development of the copepod *Calanus finmarchicus*.

EGG SURVEY

The biologist presents the results obtained for the 2012 and 2013 egg surveys. This index declined sharply between 1993 and 1998. After an increase related to the arrival of the large 1999 year-class, the index again fell as of 2002, reaching its lowest values in the series in 2005, which reflects the collapse of the stock.

SEQUENTIAL POPULATION ANALYSIS AND PROJECTIONS

A sequential population analysis (SPA) was used to assess stock abundance and fishing mortality. The biologist provides some explanations regarding methodology, namely how natural mortality (M) was calculated in order to complete the M-at-age matrix (M is no longer fixed; it is calculated based on an empirical relationship using parameters from a growth model).

The SPA, calibrated by the egg abundance index, shows that mackerel spawning stock biomass has declined since the mid-2000s and reached a historic low in 2013. According to the SPA, this decline in biomass was caused by fishing mortality levels several times higher than sustainable historic levels. Two previous biomass declines associated with large fishing mortality increases

had never caused such a dramatic drop in the stock. The stock is likely in a recruitment overfishing situation.

According to projections from the analytical assessment that are based on average sustainable fishing mortality for the period of 1968 to 1992, annual catches in 2014 and 2015 should not exceed 800 t.

- Since a tendency to over assess abundance and recruits is observed (this tendency is not observed in total or spawning stock biomasses), as stated by the biologist, an adjustment factor to make projections was applied.
- It is stated that the fishing mortality (F) value used to make the projections corresponds to the average F in the 1968-1992 period of stability (0.087). It is indicated that the value of F corresponding to maximum sustainable yield (F_{MSY}) (0.238) does not seem realistic within the context of a collapsed stock.
- The biologist is a bit uncomfortable with making projections without taking into account unregistered bait and recreational fisheries and direct sales at sea among commercial fishers. However, the main message is still the same: there is a collapse in mackerel stocks.
- In the past, it is recalled that Science had expressed some concerns about the egg index decline in the 2000s. However, fishing pressure remained high, causing the stock collapse.

HIGHLIGHTS AND RECOMMENDATION

The highlights are presented and the participants comment on them. Comments having to do with stylistic rewording are not recorded.

- Developing one highlight from the findings from the work on the effect of environmental variations on Gulf of St. Lawrence mackerel stock dynamics is suggested. The information underlying this fact should be in the text of the Science Advisory Report. To address this, an "Ecosystem Considerations" section will be included.
- It is agreed to state in the highlights that the decline in the egg survey index reflects the collapse of the stock.
- In the highlight stating the cause of the biomass decline, indicating that it was caused by fishing mortality levels "several times higher" than sustainable historic levels is highly recommended. It is agreed that the stock's level is so low that recruitment cannot be generated, but that this is mainly due to overfishing, not to lack of recruitment.
- Added to this highlight is the fact that the stock is likely in a recruitment overfishing situation. It is agreed to develop this concept in the Report text.
- To highlight the priority actions aimed at rebuilding the stock, the recommendation is reworded by inserting the points discussed that received unanimous support.
- The need to develop a precautionary approach is also brought up.

The participants' final recommendation is as follows:

Given the stock's critical status, priority is given to rebuilding: 1) According to projections based on an average sustainable fishing mortality from the analytical assessment, annual catches in 2014 and 2015 should not exceed 800 t; and 2) Given the stock's current status, it is even more important to be familiar with and to control bait and recreational fisheries.

APPENDIX 1- PARTICIPANT LIST

Name	Affiliation
Archambault, Diane	DFO Science
Benchabane, Samio	MAPAQ
Bernier, Denis	DFO Science
Bourdages, Hugo	DFO Science
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Castonguay, Martin	DFO Science
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Girard, Linda	DFO Science
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Savenkoff, Claude	DFO Science
Simm, Jason	DFO Fisheries and Aquaculture
Trottier, Steeve	DFO Science

APPENDIX 2 - TERMS OF REFERENCE

ASSESSMENT OF ATLANTIC MACKEREL IN SUBAREAS 3 AND 4

Regional Peer Review - Quebec Region

March 4, 2014
Mont-Joli, Quebec

Chairperson: Martin Castonguay

Context

In the Maritime Provinces, in Newfoundland and in Quebec (NAFO Subareas 3 and 4), over 15,000 commercial fishermen participate in the Atlantic mackerel fishery. This fishery takes place mainly inshore using gillnets, jiggers, handlines, seines and traps. The type of gear used varies by region and time of the year. During the 1980s and 1990s, landings by Canadian fishermen were rather stable and averaged around 22,000 t per year. However, there has been a significant increase since the early 2000s, reaching a record high of 54,621 t in 2005 due to the marked increase in fishing effort by small and large seiners on the east and west coasts of Newfoundland (Divisions 3KL and 4R) and the presence in the population of a very important year-class (1999). The average landings of the 2006-2010 period were 43,464 t. They were followed by a severe drop reaching 11,288 t in 2011 and 6,468 t in 2012. Canadian landings of Atlantic mackerel are underestimated because some logbooks from the bait fishery are not filled and there are direct sales at sea from that fishery. In addition, neither catches in the recreational fishery, which occurs during summer months all along the Atlantic coast, nor the discards of small mackerel are recorded. The abundance of the spawning stock of Atlantic mackerel is calculated using data collected from an egg survey which occurs annually in the southern Gulf of St. Lawrence.

The last Atlantic mackerel assessment of NAFO Subareas 3 and 4 was conducted in 2012. The Fisheries and Aquaculture Management Branch has requested a scientific advice on Atlantic mackerel in Canadian waters for the 2014 and 2015 fishing seasons. The objective of the review is to determine whether changes that have occurred in the stock status necessitate adjustments to management plans based on the conservation approach used.

Objectives

Provide a scientific advice on the management of the Atlantic mackerel in NAFO Subareas 3 and 4 (Canada's east coast) for the 2014 and 2015 fishing seasons. This advice will include:

- An assessment of the status of Atlantic mackerel, based on:
 - an analysis of the commercial fishery statistics following the 2012 and 2013 seasons (overall distribution of landings, breakdown by province, NAFO Division, fishing gear, etc...);
 - an analysis of the by-catches from the research groundfish surveys conducted on the Scotian Shelf;
 - a discussion on the quality of the fishery statistics and a review of the main sources of uncertainty;

-
- an analysis of the biological data collected in the main port of landings by port samplers or at sea by observers (size structure and calculation of biological indicators);
 - ecosystem and environmental considerations;
 - presentation of the results of a separable VPA (in the event that an analytical assessment can be performed) based on the Canadian catch at the age and the index from the egg survey. These results will include fishing mortalities, abundance and spawning biomasses, reference points, trajectory of the stock, and predictions of the 2014 and 2015 catches under different fishing mortalities scenarios.
 - Specific elements related to the update of the relevant data to the management of Atlantic mackerel such as:
 - Identification of indicators and triggers for the years without a formal stock assessment;
 - Identification and prioritization of research projects to be considered for the future;
 - Perspectives and/or recommendations for 2014 and 2015 based on available data.

Expected Publications

- 1 Science Advisory Report
- 1 Proceedings
- Research Documents

Participation

- Fisheries and Oceans Canada (DFO) Science and Fisheries Management (Ottawa, Gulf, Quebec, Maritimes, and Newfoundland)
- Provinces
- Aboriginal communities
- Fishing industry