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Proceedings of the Regional Peer Review Assessment of the Quebec North Shore (4S) herring stocks in 2018

Meeting date : March 15, 2019
Location : Mont-Joli, Qc

Co-Chairpersons: Martin Castonguay and Marie-Julie Roux
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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

This document contains the proceedings from the regional peer review meeting discussing the 4S herring stocks. This review process was held on March 15, 2019 at the Maurice Lamontagne Institute in Mont-Joli. This meeting gathered about forty participants from sciences, management and industry. This proceedings contains the key points of the presentations and discussions that occurred, and reports the recommendations and conclusions that were presented during the review

INTRODUCTION

The Quebec Region of Fisheries and Oceans Canada (DFO) is responsible for assessing several stocks of fish and invertebrate species harvested in the Estuary and Gulf of St. Lawrence. Most of these stocks are periodically assessed as part of a regional advisory process conducted at the Maurice Lamontagne Institute in Mont-Joli. This document consists of the proceedings of the meeting held on March 15, 2019, on the assessment of the North Shore of Quebec (4S) herring stocks.

The objective of the review was to determine whether there are any changes in the resource's status and whether management plans need to be adjusted based on the chosen conservation approach, the ultimate goal being to formulate a Science Advisory Report on the management of herring stocks in Quebec's North Shore (4S) for the 2019–2020 fishing seasons.

This proceedings reports on the main points of the presentations and deliberations that arise from the regional stock assessment committee's activities. 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. Accordingly, 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 list the recommendations made by meeting participants.

CONTEXT

Meeting co-chairperson Martin Castonguay welcomed the participants. He went over the peer review objectives and agenda. Marie-Julie Roux co-chaired the meeting. The participants introduced themselves. The biologist in charge of the review, Kim Émond, highlighted the work of her collaborators and presented the outline of the meeting and the Terms of reference. Ms. Émond briefly reviewed the highlights of the latest Science Advisory Report (2017) and provided some information on the biology of the species, which included spring spawners and fall spawners. Preliminary results of work on stomach contents of herring in the Gulf of St. Lawrence were presented. Euphausiids (krill) represent the main prey, which is consistent with current knowledge of the species, although other groups would also be important (eg copepods).

Tagging studies clearly illustrate the movements of herring as well as exchanges between 4S and 4R and, to a more limited extent, with 4T. Angela Fuentes-Pardo presented the results of a genetic study on the structure of the herring population in the Northwest Atlantic. This study reveals two divergent patterns: a temporal pattern related to seasonal reproduction (spring and fall) and a spatial pattern related to latitude. The most influential environmental variable for the latitudinal pattern is the winter water temperature.

- Otolith chemistry also reveals a different signature between spring and fall herring spawners.
- The issue of population structure is raised in terms of impact on the herring stock assessment. Many questions remain unresolved for now. A better understanding of this structure in the future could lead to a reconsideration and improvement of the evaluation framework.

RESOURCE ASSESSMENT

COMMERCIAL FISHERY

The biologist presented an overview of the fishery and the landing statistics by area and by fishing gear type as well as their temporal and spatial distributions. Despite a TAC of 4,000 t, herring landings on Quebec's North Shore have decreased by 38% since 2016, reaching 2,501 t in 2018, their lowest level since 2011. Almost all landings were made in the eastern end of unit area 4Sw.

- In addition to the management measures put in place in 2017 and 2018, participants mentioned the poor weather conditions that prevailed and that may have affected fishing yields.
- It is stated that landings are spatially concentrated in 4Sw given the proximity of the markets (plant) and a concentration of herring in this unit area.
- It was recalled that there is little information on bait fishery.
- The decline of landings in western 4S is questioned, which could be related to the lack of markets and lower concentrations of herring.

BIOLOGICAL INDICATORS

The catch at age and the key biological indicators were presented. Since 2008, herring catches have been largely dominated by fall spawners. Unlike in 2016 and 2017 when catches of the fall spawning herring stock were dominated by fish older than 9 years, catches in 2018 were mainly composed of 5 to 9 years old fish. Catches of the spring spawning herring stock in 2017 and 2018 were mostly composed of 4- and 5-year old fish. Based on the age composition in the catches, no important recruitment has been observed since 2000 in fall spawners. A relatively large year-class appeared in spring spawners in 2013.

- The origin of the samples depends on the fishery, so they are mainly from 4Sw. Some participants stated that the indices before and after 2010 would be difficult to compare given the significant changes in this fishery (spatial, temporal, gear type). Thus, the existence of a bias was discussed.
- Given the small sample size for spring spawners, caution was advised in interpreting the results. However, there is more confidence in the data on fall spawners.
- A concern was raised about the recruitment index used (proportion of four-year-old fish in catches). It is known that this is a relative index. It was suggested to use the average of several year-classes.
- Questions were raised about the absence of the largest fish in the length frequencies, which could be the result of an effect of sampling, and, therefore, of the fishery.
- It was noted that some indices were presented in a form that makes it possible to examine the relationship with environmental variables.
- With regard to the growth-at-age graph, which raised some questions, it was proposed to refer instead to size at age.
- For Fulton's condition index calculated between May and November, it was recommended to reduce the period considered. It was suggested to select a fixed period and compare it from year to year. It would also be interesting to check whether length has an effect on the condition index, which could explain the interannual variations.

- It was suggested that the confidence intervals for the following two graphs be reviewed: maturity at total length and maturity at age.

ENVIRONMENTAL EFFECTS

Pablo Brosset's presentation aimed to examine how the physical environment (temperature) and biological environment (timing and amount of plankton) influence the recruitment, growth and body condition of 4S herring. The variables tested and the methodology used were briefly presented. The results indicate primarily that the biological variables are essential to explain the variability in herring recruitment. The abundance of *Calanus finmarchicus* is essential for the productivity indices of both spawning groups (especially spring spawners). The early timing of the plankton is important, in addition to the amount of food for spring herring recruitment. The environmental triggers for spring and fall herring recruitment in 4S are consistent with the results for 4R and 4T.

- A few clarifications were made on the methodology.
- Given the uncertainties previously raised about growth and body condition, only recruitment results were presented.
- It would be interesting to go back in time to verify the model's predictive power, which could be done in the future.

MULTIDISCIPLINARY SURVEY CATCHES

The biologist briefly presented the information on herring catches in the multidisciplinary surveys, including maps of herring catch distribution in the July mobile sentinel fisheries and herring occurrence probability maps from the Teleost survey.

ACOUSTIC SURVEY

An acoustic survey covering the entire coastal area of 4S was carried out for a second time in the fall of 2018. For spring spawners, the total biomass index was estimated at 2,473 t, while that of fall spawners was estimated at 19,950 t. The total biomass index in 2018 is similar to that estimated in 2016. Unlike in 2016, when the highest biomasses were observed in the western part of area 4S, the highest biomasses in 2018 were observed in 4Sw, at the eastern end of the area. Six acoustic surveys were carried out between 2009 and 2018 in unit area 4Sw. After a significant decrease from 2010 to 2016, the biomass index for spring and fall spawners increased in 2018.

- In the representation of all strata, it was noted that the scales are very different between the years (2016 and 2018). For that reason, the results were then presented on a stratum-by-stratum basis.
- When selecting strata for the acoustic survey, we ensure that we have a good level of representation of the fishing pattern in order to obtain good coverage near the coasts.
- With respect to questions on how to illustrate the biomass, it was mentioned that the current approach provides a finer image within each stratum, although the image is truncated on the boundary between the strata.
- Questions were raised on how to interpret the biomass index in 4Sw given the various sources of uncertainty. One thing is certain: we must remain cautious before talking about an abundance index. In addition, the proportion of spring spawners is probably underestimated.

- Questions were also raised about the possibility of moving up the survey.

CONCLUSION

INTERIM YEAR

The next assessment is scheduled for winter 2021, with no update until then. The next 4S acoustic survey will be conducted fall 2020.

SOURCES OF UNCERTAINTY

The main sources of uncertainty are raised:

- Stock structure of divisions 4S and 4R;
- Biomass index from the acoustic survey;
    - Survey timing;
    - Survey capturability.

A reflection is underway to find a survey that allows a better estimate of biomass;

- Representativeness of commercial and scientific sampling (acoustic survey);
- Proportion of spring spawning stock;
- Lack of information on bait fishery.

FUTURE RESEARCH WORK

The work considered to be a priority by participants aims to:

- Review the stock structure in Divisions 4S and 4R
- Continue the biannual acoustic survey (to be reviewed)
- Improve commercial and scientific sampling during the acoustic survey
- Improve the estimate of the acoustic biomass index
- Develop and integrate the ecosystem approach
- Determine the location of spring and fall spawning areas
- Review the method of classifying spring and fall spawners. Genetics could be very useful
- Improve the agreement rate for age estimates between the two otolith readers, especially for ages 9 and up
- Assess the possibility of collecting data, using a camera, from the Teleost survey
- Review the acoustic survey done in oceanography for krill

HIGHLIGHTS AND RECOMMENDATIONS

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

- In the highlight on landings, it was suggested to explain the observed decrease in context (management measures, weather conditions) and to verify the percentage decrease (49%).

- With regard to recruitment, the 2013 year-class was described as being relatively large among spring spawners. It was added that the 2013 year-class appeared in the 2018 fishery. The members agreed that no significant recruitment had been observed among fall spawners since 2000.
- Given the uncertainty raised about the overall stock productivity index, the members decided to exclude this fact.
- After discussion, the members decided to keep the highlight on the distribution of the highest biomasses observed in 4S (west in 2016 and east in 2018).
- It was decided to refer to the proportion of spring spawners only in the text of the advisory report.
- In the highlight on the monitoring of cohort development, primarily through the commercial fishery, the need for a small spring fishery (May–June) in order to keep better track of spring spawning cohorts was noted.
- The members discussed how to word the recommendation. Given the uncertainty, there is little justification for referring specifically to unit area 4Sw. Science agreed that maintaining the TAC at the status quo should allow the stock to maintain or increase based on current understanding of the stock status.

The wording of the recommendation clearly reflects the consensus among the participants. It reads as follows:

Given the understanding of the status and productivity of the stock, maintaining the TAC at status quo should allow to maintain or increase the stock.

APPENDIX 1 - TERMS OF REFERENCE

Assessment of the Quebec North Shore (4S) herring stocks

Regional Peer Review - Quebec Region

March 15, 2019
Mont-Joli, Quebec

Chairpersons: Martin Castonguay and Marie-Julie Roux

Context

Since 1992, the Quebec North Shore (NAFO Division 4S) herring stocks are managed using a preventive Total Allowable Catch (TAC) of 4,000 t due to the lack of scientific information to establish a formal TAC. The TAC is allocated, irrespective of the spawning stock (spring and fall). Between 1984 and 2010, herring landings averaged 476 t per year. Since 2011, catches have significantly increased, reaching or exceeding the TAC.

A first series of acoustic surveys was conducted in 2009, 2010, 2011 and 2013 on the Lower North Shore of Quebec (unit area 4Sw). A second series of surveys covering the whole 4S zone was initiated in 2016. When this series will be long enough, it will allow the use of an analytical assessment of the two spawning groups of the Quebec North Shore herring stocks and the establishment of limit reference points that would make it possible to develop a strategic framework for fisheries consistent with the precautionary approach.

The last assessment of the two herring spawning stocks in 4S dates back to 2017. The Fisheries and Aquaculture Management Branch has requested a scientific advice on these stocks for the 2019 and 2020 fishing seasons.

Objective

Provide a scientific advice of the spring and fall spawning herring stocks in NAFO Division 4S (Quebec North Shore) for the 2019 and 2020 fishing seasons. This advice shall include:

- An evaluation of the status of the herring stocks, based on:
    - commercial fishery statistics following the 2017 and 2018 seasons (overall distribution of landings, breakdown by unit area, month and fishing gear);
    - an update of the main biological indicators (age structure, maturity, condition, etc...) from sampling commercial data;
    - sentinel catches and index of dispersion calculated from the Teleost catches;
    - results of the 4Sw unit area acoustic surveys in 2009, 2010, 2011, 2013 and the whole 4S zone in 2016 and 2018.
- The determination of the process to provide advice during the interim years, including a description of conditions that may warrant a full stock assessment earlier than originally planned;
- The identification and prioritization of research projects to be considered for the future.
- Perspectives and/or recommendations for 2019 and 2020 based on available data.

Expected Publications

- Science Advisory Report
- Proceedings

- Research Document

Participation

- Fisheries and Oceans Canada (Science and Fisheries Management sectors)
- Fishing industry
- Provincial representatives
- Academia
- Aboriginal communities/organizations
- Environmental non-governmental organizations

APPENDIX 2- LIST OF PARTICIPANTS

Name	Affiliation
Beaudoin, Tony (tel)	Fisher
Benoît, Hugues	DFO Science
Bernier, Denis	DFO Science
Boudreau, Mélanie	DFO Science
Bourdages, Hugo	DFO Science
Brassard, Claude	DFO Science
Brosset, Pablo	DFO Science
Castonguay, Martin	DFO Science
Chamberland, Jean-Martin	DFO Science
Comtois, Sophie	DFO Science
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