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Proceedings of the regional peer review of the assessment of the northern Gulf of St. Lawrence (3Pn, 4RS) Atlantic cod stock

Meeting Dates: February 21-22, 2019

Location: Mont-Joli, QC

Chairperson: Caroline Senay

Editor: Sonia Dubé

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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 meeting held within the regional Assessment of the northern Gulf of St. Lawrence (3Pn, 4RS) Atlantic cod. This review process was held on February 21-22, 2019 at the Maurice Lamontagne Institute in Mont-Joli. This meeting gathered thirty-five participants from the science sector, the management sector and industry. These proceedings contain the key points of the presentations and discussions that occurred, and report 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 February 21-22, 2019, on the assessment of the northern Gulf of St. Lawrence (3Pn, 4RS) Atlantic cod stock.

The objective of the review was to determine whether there were 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 northern Gulf of St. Lawrence (3Pn, 4RS) Atlantic cod stock for the 2019 and 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 chairperson Caroline Senay welcomes the participants and goes over the peer review objectives and agenda. After the participants introduce themselves, stock assessment biologist Claude Brassard begins the meeting by highlighting the contribution of his collaborators. He presents the terms of reference for the review and the summary of the last [scientific advice](#).

Mr. Brassard presented a brief portrait of the oceanographic conditions, stating that the observed warming of the deep waters of the Gulf of St. Lawrence does not apply to the Mécatina trough. He briefly described the changes observed in marine communities (plankton, fish, invertebrates, gray seals) and presented some data on the distribution and migration of cod as well as its biology (reproduction, growth, feeding, predation, relationship length-weight, condition indices).

- The increase in the gray seal population as a predator raises serious concerns within the industry.
- Some clarifications on the decrease of *Calanus finmarchicus* were made.
- Industry representatives report significant sightings of capelin in 2018.
- The Fulton index of sentinel fishery data for 2017 and 2018 indicates low values in summer, however, participants are reassured by the rise in the Fulton index before winter. The variability observed in 2017 and 2018 may be related to the small sample size.
- While surveys do not accurately estimate the abundance of age 0+ cod, the 2018 cohort appears to be abundant.

RESOURCE ASSESSMENT

FISHERY

Before presenting the commercial landings, Mr. Brassard mentioned that the number of recreational fishing days has increased and the distribution in the season has changed since 2016. In 2018, there were 39 recreational fishing days. This fishery's catches are unknown.

- Industry representatives did not appear to be particularly concerned about recreational fishery, which would not represent a significant tonnage according to them.
- However, there is agreement to integrate this lack of information into sources of uncertainty.

Starting in 2017-2018, the total allowable catch increased from 1,500 t to 3,185 t, which corresponds to a fishing allocation of 2,769 t. Preliminary landings totaled 2,670 t in 2017-2018 and 2,515 t in 2018-19. In 2017, the commercial longline fishery performance index remained above the series average, while it declined and was situated at the average level for the gillnet fishery. The performance index of the commercial longline fishery in Quebec has remained above the series average since 2015.

- It was noted that the TAC has doubled from 2017-2018 and is considered to have been reached, although not all landings are currently recorded in the available data and are considered preliminary.
- It was agreed that the majority of cod landings come from the directed cod fishery.

ABUNDANCE INDEX

Abundance indices come from four surveys:

- 1) DFO survey;
- 2) mobile gear sentinel survey;
- 3) longline sentinel survey;
- 4) gillnet sentinel survey.

The standardized catch rates of the longline and gillnet sentinel fishing programs declined in the last two years. In 2018, the longline index was below the series average and the gillnet index was close to the average. DFO's research survey abundance index was above average from 2014 to 2016 and decreased in 2017. In 2018, it increased slightly and was comparable to the series average. In 2018, the sentinel trawl survey abundance index was the second lowest value since 1995.

- Given the use of data from 4 different surveys, several clarifications are made to the graphs.
- In the fixed gear sentinel surveys, participants noted a decrease for all age groups.
- In the DFO survey, it appears that observations of cod over 13 years old remain marginal.

EMPIRICAL ESTIMATION OF MORTALITY AND EXPLOITATION RATE

Hugues Benoît presented the work that made it possible to empirically estimate the total mortality of 3Pn and 4RS cod as well as the exploitation rate. Total mortality trends are very similar between surveys (DFO survey, longline and gillnet sentinel surveys). The increase in total mortality in the early 1990s caused the collapse of the stock. This mortality was high in the late 2000s and has increased rapidly recently. For all age groups, the exploitation rate was high during the collapse of the stock and very low during the moratorium of the 1990s and 2003, and

since 2010-2011. This rate has recently increased with the TAC increases. Despite a low exploitation rate, total mortality is found to be high, indicating an increase in natural mortality, which includes unreported catches (from recreational fishing or other fisheries), predation and disease. Results suggests that unreported catches would be an important part of natural mortality.

- Seal predation is repeatedly cited by participants to explain the increase in recent natural mortality.
- Participants raised a possible correspondence between mortality changes and condition index, environmental conditions and capelin abundance. There was agreement that there are several things that can happen.
- It is proposed to integrate the mobile sentinel survey to this empirical estimate.
- According to the results of this work, the total mortality (as well as the natural mortality) is currently high.

POPULATION STRUCTURE

Geneviève Parent presents the preliminary results of a recent genetic study (2017), based on 8,371 genetic markers and 616 individuals. The first results suggest the existence of two populations of cod, that of the Gulf and that of the North (Labrador and Newfoundland), but also the presence of temporal variations in the distribution.

- It is apparent that these new findings may change how we consider stock in the assessments.
- Genetic differentiation between populations would not be great and it is possible that they will breed together. We will eventually try to determine at what point the groups become distinct.
- In future analyses, it is specified that the cod that spawn in the Gulf will be examined to determine their genetic signature. Samples from 3Ps will also be analyzed.
- It is recalled that tagging studies also report movement between the interior and the exterior of the Gulf.

VIRTUAL POPULATION ANALYSIS AND PROJECTION

The components of the Virtual Population Analysis (VPA) were presented along with the results. The spawning stock biomass (SSB) estimated from the VPA model declined the past two years to the lowest values in 20 years (11,774 t in 2019). This decrease would be attributable to high total mortality. Natural mortality estimated from comparisons of VPA adjustments to data is increasing, it had a value of 0.7 for 2014-2018. The estimated exploitation rates from the VPA and the tagging program doubled since the last evaluation in 2016. In 2018, they were 0.18 and 0.21, respectively.

For 2020 and 2021, projections of annual harvests of 300 t and 1,500 t indicate a slight decrease in SSB with a probability greater than 75% and 85%, respectively. These estimates are greatly influenced by that of natural mortality estimate.

- Some methodological clarifications were made.
- The empirical estimate of total mortality, independent of the model, is found to corroborate trends in the increase in estimates of fishing mortality and natural mortality estimated by the VPA.

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- There is agreement that natural causes of mortality include unrecorded fishing mortality and predation by Gray and Harp seals. However, their importance remains unknown. It is mentioned that the low productivity of the stock could also be related to environmental factors.
 - It is suggested to use "recruitment rate" rather than "survival rate", so as not to be confused with the mortality rate. The recruitment rate (at age 3) does not appear to be problematic for the population, but participants wonder what happens next when young cod age. High mortality in older fish appears to be the main factor limiting the increase in SSB.
 - Despite minor SSB retrospective patterns, the VPA is considered valid because it remains in the critical zone.
 - Sources of uncertainty include the fact that projections are very sensitive to the natural mortality value. Some participants would like to be able to judge this sensitivity on their own.
 - Participants recommend documenting the different sources of natural mortality.

CONCLUSION

FUTURE RESEARCH WORK

Several research works for the future are mentioned:

- Estimation of landings by recreational fishery;
- Continuing work on the reproductive potential of cod (FSCP) in 2020;
- Monitoring of Cod Condition (FSCP);
- Continuing work for the tagging program (FSCP) in 4R;
- Pilot project on tagging in 4S and survival rate measurement;
- Development of new stock status indices (DFO survey and fixed gear sentinel survey);
- Genomic project (population genetic) 3Pn, 4RS vs 4T, 2J3KL and 3Ps;
- Acoustic tagging in the Strait of Belle Isle, FFAW.

INTERIM YEAR

Participants agreed to provide an advice for two years (scientific advice for 2019 and 2020 fishing seasons). The next stock assessment is scheduled for the winter of 2021. For the interim year, the science response will be based on landings and abundance indices from the DFO survey and sentinel fisheries. The assessment framework is expected to be reviewed in 2019-2020.

HIGHLIGHTS AND RECOMMENDATION

The highlights were presented and the participants comment on them. Some highlights have been restructured, others have been alleviated. Comments having to do with stylistic rewording are not reported.

- In the TAC highlight, it should be noted that the fishing allocation available is 2,769 t.

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- With respect to recreational fisheries, it is advisable to stick to the facts by simply saying that the number of days has increased in 2018. It should be noted that the catches of this fishery are unknown.
 - When it comes to longliners, it is understood to specify "from Quebec".
 - With respect to abundance indices, participants agreed on the correct wording for each index. One highlight is for fixed gear survey, another for mobile survey.
 - For the highlight on SSB from the VPA, it is important to specify the magnitude of the decline in the last two years, noting that SSB is among the lowest values since the last 20 years. After discussion, it was decided to include in the summary the exact value estimated by the model, i.e. 11,774 t in 2019.
 - A natural mortality highlight was then incorporated, including the results of the VPA and the empirical estimation, which are consistent. Participants decided to include the causes of mortality in the highlight, namely, unaccounted fishing mortality and seal predation (Gray and Harp). After discussion, it is decided to add that the importance of each of these causes is unknown.
 - In the highlight on exploitation rates, it is important to emphasize the magnitude of the increase in 2018.
 - In the last highlight, "according to the precautionary approach" was specified.

Thus, the conclusion is as follows:

The SSB estimate for January 2019 is situated in the critical zone and represents only 10% of the limit reference point. According to the precautionary approach, harvests from all sources should be as low as possible to promote spawning biomass recovery.

APPENDIX 1 – TERMS OF REFERENCE

Assessment of the northern Gulf of St. Lawrence (3Pn, 4RS) Cod Regional Peer Review - Quebec Region

February 21-22, 2019
Mont-Joli, QC

Chairperson: Caroline Senay

Context

Landings in cod fishery in the northern Gulf of St. Lawrence are primarily from fixed gear (handlines, longlines and gillnets). The resource is managed mainly by annual TACs (total allowable catches) and a series of other management measures.

At the request of the fisheries management Branch, resource assessment is done every two years. The purpose of the review is to determine whether changes have occurred in the status of the resource that would justify adjustments to the management plan based on the retained conservation approach.

Objective

Provide scientific advice on cod stock status in the northern Gulf of St. Lawrence (3Pn, 4RS). This advice shall include:

- Description of the biology of northern Gulf cod and its distribution;
- A summary of oceanographic conditions in the Gulf;
- Description of the cod fishery including landings, fishing effort, catch per unit effort, biological data and cod by-catches in other fisheries;
- A review of other potential sources of information concerning fishing activities and complementary to official statistics;
- Analysis of data from the DFO annual research trawl survey in August and sentinel fisheries with mobile gears (July) and fixed gears (gillnets and longlines);
- Analysis of biological indicators related to the condition, growth and maturity;
- A sequential population analysis (SPA) to derive trends in terms of spawning stock, recruitment and fishing mortality;
- Analysis of trends of a number of indicators relevant to abundance, productivity and fishing mortality;
- Projections for 2019 and 2020 based on the assessment of trends in the abundance index and other stock indicators compared to baseline conservation thresholds (limite reference point);
- 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;
- Identification and prioritization of research projects to be considered for the future.

Expected publications

- Science Advisory Report on the northern Gulf of St. Lawrence (4RST) cod
- Proceedings
- Research Document

Participation

- Fisheries and Oceans Canada (DFO) (Science and Fisheries Management sectors)

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- Fishing industry
 - Provincial representatives
 - Aboriginal communities/organizations
 - External expert

APPENDIX 2- LIST OF PARTICIPANTS

Name	Affiliation	February 21	February 22
Benoit, Hugues	DFO - Science	X	X
Bernier, Denis	DFO - Science	X	-
Bourdages, Hugo	DFO - Science	X	X
Brassard, Claude	DFO - Science	X	X
Cerqueira, Andy	MAPAQ	X	X
Chabot, Denis	DFO - Science	X	-
Couillard, Jean-Pierre	ACPG	X	-
Cyr, Charley	DFO - Science	X	-
Denis, Marcel	ACPG	X	X
Dennis, Bill	FLR – Prov. of NL	X	X
Desgagnés, Mathieu	DFO - Science	X	X
Dubé, Sonia	DFO - Science	X	X
Dufresne, Yvon	DFO - Science	X	X
Duplisea, Daniel	DFO - Science	X	X
Emond, Kim	DFO - Science	X	X
Folliot, Benjamin	Dalhousie University	X	X
Gauthier, Johanne	DFO - Science	X	X
Huard, Georges	ACPG	X	-
Hurtubise, Sylvain	DFO - Science	X	-
Karowski, Chelsey	Oceans North Canada	X	X
Lubar, John	DFO – Resource Management	X	X
Lussier, Jean-François	DFO - Science	X	X
Méhot, Chantal	DFO – Science	X	-
Nadeau, Paul (tél)	APBCN	X	X
Nozères, Claude	DFO - Science	X	X
Ouellette-Plante, Jordan	DFO - Science	X	X
Parent, Geneviève	DFO - Science	-	X
Plourde, Stéphane	DFO - Science	X	X
Roux, Marie-Julie	DFO - Science	X	-
Sandt-Duguay, Emmanuel	AGHAMM	X	X
Senay, Caroline	DFO - Science	X	X
Simms, Jason	DFO – Resource Management	X	X
Spingle, Jason	FFAW/UniFor	X	X
Trottier, Steve	DFO - Resource Management	X	X
Van Beveren, Elisabeth	DFO - Science	X	X
Vascotto, Kris	AGC	X	X