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Proceedings of the Regional Advisory Meeting on the Assessment of the Gulf of St. Lawrence (4RST) Atlantic halibut

March 16-17, 2021
Virtual meeting

Chairperson: Bernard Sainte-Marie
Editor: Sonia Dubé

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September 2021

Canada

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 outlines the proceedings of the regional peer review meeting on the assessment of the Gulf of St. Lawrence (4RST) Atlantic halibut stock. This meeting, which was held virtually via Zoom on March 16-17, 2021 brought together about sixty participants from science, management, first nations and industry. These proceedings detail the essential parts of the presentations and discussions held during the meeting, as well as the recommendations and conclusions made.

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 that is conducted at the Maurice Lamontagne Institute in Mont-Joli. This document consists of the proceedings of the meeting held on March 16-17, 2021 via the Zoom platform (virtual meeting), on the assessment of the Gulf of St. Lawrence (4RST) Atlantic halibut stock.

The objective of the meeting 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, with the ultimate goal being to provide a science advisory report on the management of the Gulf of St. Lawrence Atlantic halibut stock (4RST) for the 2021-22 and 2022-23 fishing seasons.

These proceedings report on the main points discussed in the presentations and deliberations stemming from the activities of the regional stock assessment committee. The regional peer review meeting 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 framework for this meeting (Appendices 1 and 2). The proceedings also list the recommendations made by the meeting participants.

ASSESSMENT

Meeting Chair Bernard Sainte-Marie welcomed the participants. He went over the objectives of the peer review and how it would proceed, and presented the terms of reference and the meeting agenda (Appendix 3). Attendees were then asked to introduce themselves. The assessment biologist, Mathieu Desgagnés, reviewed the summary of the last Science Advisory Report (winter 2019) and presented some information on the biology of the Atlantic halibut, including its distribution in the Gulf of St. Lawrence (GSL) in relation to depth and temperature. It appears that Atlantic halibut are tolerant of relatively high temperatures and avoid the cold intermediate layer. In summer, they are distributed across the GSL in two depth ranges (20–50 m and 100–300 m) and display a certain degree of summer site fidelity. In winter (December to April), they are generally found in deep channels and their vertical ascents in the water column seem to be associated with spawning behaviour. There is no recent size-at-age relationship. However, different cohorts have been observed, and it was estimated that it takes Atlantic halibut 10 years from larval settlement to attain commercial size (85 cm).

COMMERCIAL FISHERY

The data used for the commercial fishery assessment come from landing statistics (NAFO, Gulf quota reports), zonal interchange format files (ZIFF) (logbooks, purchase slips, dockside verification program), at-sea observers and dockside sampling. Landings of Atlantic Halibut have been increasing since the early 2000s and have reached the highest values since 1960. For the 2019–2020 and 2020–2021 management years, preliminary landings were 1,383 t and 1,229 t, respectively. The catch per unit effort in the directed longline fishery for Atlantic halibut increased from an average of approximately 100 kg/1,000 hooks in the early 2000s to approximately 560 kg/1,000 hooks in 2020—the highest value in the historical series. The size of landed halibut has been increasing, and the average weight of a landed halibut doubled between 2006 and 2020.

- For Division 4R, a gap was noted in the availability of information on landings with catch position and fishing effort. This could be partly explained by the fact that captains of small vessels (< 35') do not complete a logbook.
- As a result, a portion of the Gulf is not as well represented. It should be kept in mind that this gap contributes uncertainty to the assessment.
- It was noted that Management was already looking into this issue.

TRAWL SURVEYS

Other data used for the assessment come from fishery-independent surveys (DFO surveys: northern and southern Gulf; mobile sentinel survey program in the northern Gulf). Values of the abundance index for commercial-sized Atlantic halibut (> 85 cm), based on scientific bottom trawl surveys in 2019 and 2020, are among the highest of the time series. The abundance index of pre-recruit Atlantic halibut (65–85 cm) based on scientific bottom trawl surveys has been high since 2007.

LONGLINE SURVEY AND TAGGING

Four years (2017–2020) of Atlantic halibut longline surveys with tagging were completed following two pilot projects (2014 and 2016). In total, 125 longline fishing stations were sampled (including five exploratory stations), and spaghetti tags were installed. Mr. Desgagnés presented the sampling protocol and suggested the use of guidelines to standardize fishing practices during surveys in order to standardize data and reduce uncertainty. The results were then presented. The preliminary analysis of the mark-recapture data suggests a low exploitation rate.

- Everyone agreed on the possibility of extending the survey between August 15 and October 15.
- Some participants felt that adjusting the protocol to correspond to local sunrise and sunset times, in order to reduce night fishing, would penalize some regions by allowing them less time to cover all of the stations.
- It was noted that the removal of areas introduces a bias into the survey, due to usage conflicts. This bias remains difficult to assess.
- Again regarding the standardization of fishing practices during the longline survey (leader spacing, hook size, type and quantity of bait), industry participants felt that this could be difficult to achieve in reality. For example, the performance of some types of bait may vary between regions.
- The biologist expressed concern regarding the level of confidence to be placed on exploitation rate estimates, given the short time series and irregular return rate of tags.
- Questions were raised among the participants regarding how to improve the tag return rate. Some comments were made relating to how information was communicated to fishers, which could be improved. An industry representative said that he would follow up with industry members. A suggestion was made to explore other avenues of information collection, such as photo transfers.

LIMIT REFERENCE POINT: EMPIRICAL APPROACH AND SURPLUS PRODUCTION MODEL

In order to identify a limit reference point (LRP), Mr. Desgagnés presented the first approach, which is empirical. He discussed the advantages and disadvantages of using the different data series[1] in establishing the LRP. He suggested using the combined NUE index from the DFO surveys (nGSL and sGSL). The LRP is set at the average of the best three years prior to 2004. According to this approach, the Atlantic halibut stock in 4RST is in the healthy zone.

For the second approach, Mathieu Boudreau presented a population dynamics model (biomass surplus production model). He gave an overview of the model (data used, model fit), then presented the results. This approach also suggests that the Atlantic halibut stock in 4RST is healthy. However, Mr. Boudreau pointed out the reasons why this approach had been rejected by the scientific committee, including the absence of a linear relationship between the trend observed in the abundance indices used and the spawning stock biomass. Certain aspects would also need to be refined: use of a Leslie matrix model to estimate the intrinsic rate of increase (r), simulation of an age-structured population.

- Participants felt that a reflection process was needed to make a decision on the preferred approach for establishing an LRP, which is expected by Fisheries Management is waiting for in order to define limits and targets to assess stock status and develop commercial harvest control rules.
- It was noted that, as it stands, the empirical approach is still too arbitrary. None of the abundance indicators are a satisfactory or even relative measure of the spawning biomass. With regard to the surplus production model, it displays an inconsistency between the data used in the model and abundance of the resource. It was agreed that the surplus production model was probably not the ideal model.
- It seemed that the main gaps identified were related to data and the amount of confidence placed in it.
- However, some participants would like an LRP to be identified in order to move forward with the precautionary approach, even if it means reviewing the LPR in the future. Others felt that the uncertainty of the data was still too significant and that there was a risk of setting the reference point too low.
- It was noted that new information, such as on maturity and growth, could be included in future modelling. Catch rates in the fixed sentinel survey could also provide information on larger individuals.
- Finally, the LRPs presented were not retained. Everyone was of the opinion that further work was needed to achieve a more robust LRP. Management representatives supported this comment and would like it to be a priority.
- A consensus was reached among participants that a work plan needed to be developed quickly to identify an LRP within two years.

[1]CPUE of DFO surveys (nGSL and sGSL), NUE of DFO surveys (nGSL and sGSL), standardized commercial CPUE, longline survey abundance index.

SATELLITE TAGGING PROJECT IN THE GULF OF ST. LAWRENCE

Paul Gatti presented the results of a satellite tagging study conducted in 4RST (2013–2019). The purpose of this research was to study the spatio-temporal distribution and movements of Atlantic halibut in the GSL, identify spawning areas and examine the spatial structure of the population. The results confirm the presence of seasonal migrations between slope areas (summer) and deep channels (winter), winter spawning in deep channels (January–March), as well as a mixing of adults during reproduction, which suggests weak population differentiation in the Gulf, despite a certain degree of fidelity by spawners to separate summering areas. Complementary analyses are under way (genetic, otolith microchemistry and larval drift).

- It was noted that potential winter spawning areas in the GSL channels overlap with areas that could be targeted by a directed fishery for redfish.
- Some questions were raised concerning possible exchanges with the southern stock, particularly 4T and 4Vn. Continuation of the tagging project would make it possible to provide more detailed information on potential mixing.
- Participants noted a certain degree of summer site fidelity.

EGG AND LARVAL DRIFT RESEARCH PROJECT

Christiane Dufresne's presentation focused on experiments involving numerical simulations of egg and larval drift. Objectives included locating potential nursery areas and examining a regional ocean circulation model for the Gulf. The simulations were found to be more sensitive to particle density but poorly sensitive to the radius of release and thickness of release. It would be valuable to further investigate egg density and buoyancy (still not well known), which are factors that may have a major impact on the final position of egg and larval drift, and therefore, nursery areas.

- It was pointed out that it is very likely that the cold intermediate layer presents a barrier to eggs and larvae that are considered bathypelagic.
- It was noted that it would be valuable to continue with simulations for other spawning sites by varying the seawater density, given its influence on the final position of eggs and larvae.
- The warming of deep channels was considered to have a potential impact on egg incubation time and larval development. It would be valuable to more closely examine the impact of climate change on these early developmental stages.

SUMMARY OF THE ASSESSMENT

The biologist presented a summary of the information. To date, there is no measurement or modelling of absolute biomass for this stock. Some available indicators make it possible to track relative abundances but none of these indicators is a satisfactory or even relative measure of spawning biomass. Some available indicators also make it possible to track stock productivity, namely recruitment levels.

Thus, there is moderate evidence and high consistency among sources of evidence that the status of the stock is currently at a historically high level and, although the upper stock reference point has not been defined for this stock, it is very likely that it is in the healthy zone.

- With respect to the previous wording, it should be clarified that no reference points (or LRP) have been identified. The wording would be adjusted later.

- Some industry members were somewhat disappointed with the information summary, considering the amount of effort invested over the past few years, particularly in the longline survey. However, the wording primarily concerns the uncertainty associated with the stock status, and it was agreed that the stock is healthy.
- Some industry participants wanted to include a reference to the stock trajectory, stating that it is at the highest level in the series.
- It was further noted that a longer time series for the longline survey could lead to a more robust indicator, and therefore, more robust evidence.
- It would be important to clearly explain what is meant by “moderate” evidence in the science advisory report.

There is robust evidence and high consistency among sources of evidence that recruitment to the fishery remains high. There is limited evidence and high consistency among sources of evidence that the exploitation rate has generally remained below the rate of biomass increase during the last 10 years, which would explain the increase in biomass of halibut over 85 cm.

It is as likely as not that maintaining current harvest levels will result in a decline in stock status. The results of this assessment do not allow the identification of a removal threshold, beyond which a decline in biomass becomes likely.

- The above wording was new and seemed to cause confusion. Some clarifications were made regarding the likelihood scale (source: *Intergovernmental Panel on Climate Change*).
- Some participants felt that the wording “as likely as not” was very arbitrary. Some of them suggested referring to “unlikely” instead, which corresponds to a lower percentage probability. The wording would be adjusted later.

CONCLUSION

INTERIM YEAR

The participants agreed to rule the status of the Atlantic halibut stock for two years (science advisory report for the 2021–22 and 2022–23 fishing seasons). The next stock assessment is scheduled for winter 2023.

RESEARCH

A number of research issues were raised:

- Continuing the work on the longline survey to standardize data and reduce uncertainty;
- To that end, encouraging the standardization of fishing practices during the longline survey;
- Exploring new approaches to identify an LRP and a monitoring indicator;
- Review of catch rates in the fixed sentinel survey;
- Development of a stock assessment model;
- For the longer term, identification of a harvest reference point (target F);
- Assessment of mortality related to the handling and release of halibut captured in the commercial fishery;
- Tagging of halibut in the redfish fishery and collection of related information;

- Genetic study in progress on the Gulf population structure;
- Development of local expertise in halibut otolith age reading;
- Update of maturity ogives;
- Assessment of tag return rates;
- Satellite tagging and geolocalization project (presented in the review);
- Egg/larval drift modelling (presented in the review);
- Review of the impact of halibut fisheries (bycatch, baits, etc.) on the ecosystem;
- Collection of data on halibut in the winter trawl survey;
- Continuation of the work on halibut population structure and movements (e.g. link between 4T and 4Vn) to better assess the potential effect of different fisheries on the 4RST stock;
- Assessment of the impact of climate change on the early developmental stages. Possibility of linkage with the egg/larval drift modelling project by conducting further simulation work;
- Investigation of seal predation.

HIGHLIGHTS AND ADVICE

The key points were presented, and commented on by participants. Comments concerning stylistic rewording were not reported.

- The key point on the pre-recruit abundance index of the trawl surveys was simplified by noting only that it has been high since 2007.
- A decision was made to remove the key point on the limit reference point and to address it only in the science advisory report.
- Regarding the key point summarizing the stock status, several participants felt that it would be inappropriate to speak of a healthy zone, since no reference points have been identified. It would simply be stated that there is moderate evidence and high consistency among sources of evidence that the status of the stock is currently at a historically high level.
- One key point was added to state that the precautionary approach and reference points are under development.
- With respect to the key point on the exploitation rate, it was agreed that there is limited but highly consistent evidence that the exploitation rate has generally remained below the rate of biomass increase throughout the last 10 years, which would explain the increase in biomass of Atlantic halibut > 85 cm.
- In the conclusion of the summary, there is good reason to believe that current harvesting levels would not result in a decline of stock status. It was agreed to use the term “unlikely” instead of “as likely as not.” The meeting was closed with the statement that the results of this assessment are insufficient to identify a harvest threshold above which a decrease in biomass becomes likely.

In conclusion:

It is unlikely that maintaining current harvest levels will result in a decline in stock status. The results of this assessment do not allow the identification of a removal threshold, beyond which a decline in biomass becomes likely.

APPENDIX 1 – TERMS OF REFERENCE

Assessment of the Gulf of St. Lawrence (4RST) Atlantic halibut

Regional Peer Review - Quebec Region

March 16-17, 2021
Virtual meeting

Chairperson: Bernard Sainte-Marie

Context

The directed Atlantic halibut fishery is mainly carried out by fixed-gear vessels using longline. Atlantic halibut is also caught as by-catch in other fisheries, in particular the Greenland halibut fishery. To protect the population's reproductive potential, this fishery is subject to several management measures including a total allowable catches (TAC).

At the request of the Fisheries Management Branch, a full stock assessment is conducted every two years. The purpose of the assessment is to provide the Minister with detailed advice on the status of the stock in order to inform management decisions for the 2021-22 and 2022-23 fishing seasons.

Objectives

Provide scientific advice on the status of the Atlantic halibut stock in NAFO Divisions 4RST. This advice shall include:

- A description of the biology of Atlantic halibut and its distribution;
- An oceanographic and environmental overview for the stock area. If possible, this information should be integrated into the advice;
- An assessment of the resource status of Atlantic halibut in 4RST, including abundance, recruitment, exploitation rate, and biological characteristics based on:
  - Analysis of the commercial fishing data including landing statistics, logbooks and commercial at-sea and dockside sampling program;
  - Analysis of data from the DFO annual research trawl survey and sentinel fisheries;
  - Analysis of data from the longline survey and tagging project carried out in collaboration with industry;
- Identification of a Limit Reference Point for this stock, and a report on stock status relative to the LRP.
- Determination of a process to provide advice in the form of an update during the interim years between full assessments, and the identification of indicators that may trigger a full stock assessment in place of an update;
- Evaluation of the impact of maintaining and changing current harvest levels;
- Identification of major sources of uncertainty in the assessment
- Identification of research priorities for the next 5 to 10 years based on the assessment needs.

Expected Publications

- Science Advisory Report on the Atlantic halibut in the Gulf of St. Lawrence (4RST)
- Proceedings
- Research Document

Expected Participation

- Fisheries and Oceans Canada (DFO) (Science and Fisheries Management sectors)
- Fishing industry
- Provincial Government representatives
- Indigenous Organizations
- External experts

APPENDIX 2 – LIST OF PARTICIPANTS

Name	Affiliation	March 16	March 17
Bélanger, Michel	MAPAQ	x	x
Belghith, Khaled	UQAR	x	x
Benoit, Hugues	DFO – Science	x	x
Bermingham, Tom	DFO – Science	x	x
Bernier, Denis	DFO – Science	x	-
Bois, Samantha	ACPG	x	x
Boudreau, Mathieu	DFO – Science	x	x
Boulanger, Marie-Pier	ISMER/UQAR	x	-
Bourbonnière, Jean-Patrick	DFO – Science	x	x
Bourdages, Hugo	DFO – Science	x	x
Bourbonnière, Jean-Patrick	DFO – Science	x	x
Brassard, Claude	DFO – Science	x	x
Cantin, Guy	DFO – Science	x	x
Carruthers, Erin	FFAW	x	x
Chabot, Denis	DFO - Science	x	x
Chlebak, Ryan	DFO - Science Ottawa	x	x
Cyr, Charley	DFO - Science	x	x
Denis, Marcel	ACPG	x	x
Desgagnés, Mathieu	DFO - Science	x	x
Dubé, Sonia	DFO - Science	x	x
Dufresne, Christiane	UQAR	x	-
Dumont, Dany	UQAR	x	x
Duplisea, Daniel	DFO - Science	x	x
Dwyer, Shelley	DFO – Fisheries Management NL	x	x
Fisher, Jon	FMI – MUM	x	x
Ferguson, Louis	Union des pêcheurs des Maritimes	x	x
Fronton, Fanny	INRS	x	-
Gatti, Paul	FMI – MUM	x	-
Gauthier, Charlotte	UQAR	x	x
Giffin, Melanie	PEI Fishermen's Assoc.	x	x
Hardy, Magalie	DFO – Fisheries Management Quebec	x	x
Karbowski, Chelsey	Oceans North Canada	x	-
Knickle, Craig	MCPEI	x	x
Langelier, Serge	AMIK	x	-
Lapierre, Daniel	DFO – Fisheries Management Gulf	x	x
Laurie, Isabel	DFO - Science	x	-
Le Bris, Arnaud	FMI – MUM	x	-
Loboda, Sarah	DFO - Science	x	-
Loomis, Way	FFAW	x	x
Lussier, Jean-François	DFO - Science	x	x
MacDonald, Michael	PEI Fishermen's Assoc.	x	-
MacMillan, Robert	PEI Department of Fisheries and Communities	x	x
Mugridge, Adam	Government of Nova Scotia	x	x
Nadeau, Paul	LNSFA	x	-
Ouellette-Plante, Jordan	DFO - Science	x	-
Palais, Elodie	UQAR	x	x
Paquet, Frédéric	DFO - Science	x	x
Pelletier, Claude	DAAF-NB	x	x
Pomerleau, Corinne	DFO - Science	x	-
Pond, Nancy	DFO – Fisheries Management NL	x	x

Name	Affiliation	March 16	March 17
Robert, Dominique	UQAR	x	x
Roux, Marie-Julie	DFO - Science	x	-
Sainte-Marie, Bernard	DFO - Science	x	x
Sandt-Duguay, Emmanuel	AGHAMM	x	-
Senay, Caroline	DFO - Science	x	x
Simard, Émilie	DFO - Science	x	x
Spingle, Jason	FFAW/UniFor	x	x
Tilley, Anna	Province of NL	x	x
Van Beveran, Elisabeth	DFO - Science	x	x
Vascotto, Kris	AGC	x	x

APPENDIX 3 – AGENDA

Assessment of the 4RST Atlantic halibut stock

Chair: Bernard Sainte-Marie

Rapporteure : Sonia Dubé

March 16-17, 2021

Zoom virtual meeting

Time	Subject	Presenter	Duration
Day 1: Tuesday, March 16, 2021			
8:30	Introduction	B. Sainte-Marie	10 min
8:40	Presentation of participants	B. Sainte-Marie	10 min
8:50	Summary of the last advice	M. Desgagnés	10 min
9:00	Terms of Reference	B. Sainte-Marie	10 min.
9:10	Biology and distribution	M. Desgagnés	30 min
9:40	Fishery statistics	M. Desgagnés	30 min
10:10	Break		15 min
10:25	Scientific survey, mobile gear	M. Desgagnés	45 min
11:10	Scientific survey, longline	M. Desgagnés	60 min
12:10	Lunch		60 min
1:10	Limit reference point	M. Boudreau et M. Desgagnés	60 min
2:10	Stock status	M. Desgagnés	60 min
3:10	Break		15 min
3:30	Research work: satellite tagging and geolocation	P. Gatti	15 min
3:45	Research work: modeling egg/larval drift	C. Dufresne	15 min
4:00	End of day 1		
Day 2: Wednesday, March 17, 2021			
8:30	Summary of day 1	B. Sainte-Marie	10 min

Time	Subject	Presenter	Duration
8:40	Identification of incertainties and research priorities	M. Desgagnés	30 min
9:10	Summary of advice	B. Sainte-Marie and participants	90 min
10:40	Break		15 min
10:55	Revision of the scientific advisory report	B. Sainte-Marie and participants	
4:00	End of day 2		