Fisheries and Oceans Canada | Pêches et Océans Canada

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Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2019/025

Quebec Region

Proceedings of the Regional Peer Review meeting on the Assessment of the Gulf of St. Lawrence (4RST) Greenland halibut stock

February 20-21, 2019
Mont-Joli, QC

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January 2020

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.

Published by:

Fisheries and Oceans Canada
Canadian Science Advisory Secretariat
200 Kent Street
Ottawa ON K1A 0E6

http://www.dfo-mpo.gc.ca/csas-sccs/
csas-sccs@dfo-mpo.gc.ca

ISSN 1701-1280

Correct citation for this publication:

DFO. 2020. Proceedings of the Regional Peer Review meeting on the Assessment of the Gulf of St. Lawrence (4RST) Greenland halibut stock; February 20-21, 2019. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2019/025.

Aussi disponible en français :

MPO. 2020. Compte rendu de l'examen régional par des pairs sur l'évaluation du stock de flétan du Groenland du golfe du Saint-Laurent (4RST); 20-21 février 2019. Secr. can. de consult. sci. du MPO, Compte rendu 2019/025.

SUMMARY

This document outlines the proceedings of the regional peer review meeting on the assessment of the Gulf of St. Lawrence (4RST) Greenland halibut stock. This meeting, which was held on February 20-21, 2019 at the Maurice Lamontagne Institute in Mont-Joli brought together about fifty participants from science, management 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.

CONTEXT

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 outlines the proceedings of the meeting on the assessment of the Gulf of St. Lawrence (4RST) Greenland halibut held on February 20-21, 2019.

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 Greenland halibut stock (4RST) for the 2019 and 2020 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.

INTRODUCTION

Meeting chairperson Hugues Benoit welcomes the participants. He goes over the peer review objectives and agenda. After the participants introduce themselves, stock assessment biologist Johanne Gauthier begins the meeting by highlighting the contribution of her collaborators. She presents the agenda. Some data on the biology, habitat and distribution of Greenland Halibut are presented. The Gulf of St. Lawrence population is considered an isolated stock of the North West Atlantic. Ms. Gauthier also raises some ecosystem considerations. Deepwater warming and oxygen depletion in the Gulf of St. Lawrence could lead to habitat loss and deterioration of habitat quality for Greenland Halibut. In addition, the arrival of three exceptionally strong cohorts of redfish (2011-2013) could increase interspecific competition. These conditions are not expected to improve in the short term.

Jordan Ouellette-Plante and Claude Nozères presented the results of a turbot diet study, which was based on a stomach fullness index as a function of different variables (period, length class, area). A higher feeding intensity was observed in 2018, with capelin as the main prey. Redfish was of increased importance to the turbot diet during the period from 2015 to 2017. Turbot under 20 cm had the highest feeding intensity, regardless of the period (2004–2009, 2015–2017, 2018, 2004–2018). Feeding intensity did not vary significantly between the Estuary and northern Gulf areas. However, the turbot diet in the Estuary was focused more on invertebrates, while fish accounted for most of the intake in the northern Gulf. A comparison of turbot and redfish diets showed that fish was playing an increasing role as prey for turbot, while invertebrates were more important for redfish.

- Participants noted the species' minimal response to environmental changes. The turbot seems to be remaining in the same habitat, despite deep-water warming. Participants wondered about the factors that could keep the turbot in this habitat (substrate, prey, avoidance of predation).

- This species' tolerance to hypoxia was also noted, although metabolic effects can already be detected. Early-stage fish would be more sensitive to hypoxia. It was noted that there could be a combined effect with rising water temperatures.
- In addition to changes in ocean currents, pollution (e.g. excess nitrogen) was also mentioned as possibly contributing to hypoxia.
- At this point, it is still difficult to predict how the species will adapt to future climate changes.
- It was pointed out that the synchrony between the winter spawning period and what happens in the spring can affect turbot abundance.
- According to participants, there is little likelihood of redfish consuming turbot larvae, since their habitats differ. However, a return of redfish could affect turbot through competition for common prey (e.g. shrimp).

ASSESSMENT OF THE RESOURCE

FISHERY

Ms. Gauthier presents the portrait of the Greenland halibut fishery in 4RST. It is a fishery dominated by fixed gear, where 99% of the catch comes from gillnets. Commercial fishery statistics and biological data from the commercial catch sampling program are presented as well as bycatch.

The total allowable catch (TAC) for Greenland Halibut in the Gulf of St. Lawrence was reduced by 25% in 2018-2019 following fourteen years at 4,500 t. Landings totaled 1,496 t (preliminary as of December 31, 2018), well below the fishing allocation of 2,813 t. These landings are the lowest of the last 16 years. Across the Gulf, gillnet fishing effort has been stable since 2015 and below the series average. In 2018, fishing effort increased in northern Anticosti and Esquiman while decreasing in the western Gulf.

The commercial fishery performance index for the entire Gulf shows a downward trend, with a 48% decrease in 2018 from the 2014-16 peak, reaching the low values observed at the beginning of the series. In 2018, the Northern Anticosti and Esquiman indices improved relative to the lowest values of 2017.

- According to industry representatives, the decline in the performance index (CPUE) is associated mainly with turbot movement. Some believe that the turbot moves to follow its prey (e.g. capelin), particularly in shallower waters, with the result that turbot is harder to catch. Along with socioeconomic issues, this observation could partly explain the decrease in the number of fishers. Therefore, some fishers are moving to other fisheries.
- In addition, catches in 2018 were said to have occurred later in the season, as illustrated by the daily CPUE graph for the western Gulf. Higher values were observed at the end of the season.
- Industry members did not think that the increase in CPUE in Anticosti was related to biomass that had accumulated over the previous three years, during which there had been no directed turbot fishery in the area.
- The participants did not seem overly concerned by the fact that females accounted for more than 80% of the catch in 2018, as a similar situation in the past has never prevented the arrival of new cohorts.

- There is a significant data gap for 4R (Esquiman), especially since captains of small vessels (<35') do not complete a logbook. It was also mentioned that DFO data for the Newfoundland Region are provided at a later time.
- The ratio of bycatch to turbot catches was found to be lower in 2018 than in 2017, which relates to the decrease in turbot in 2018 and the increase in bycatch in 2017.
- There was agreement on the need to minimize turbot bycatch in other fisheries, such as the small turbot caught by shrimp fishers, as well as unaccounted mortality. This mortality can be caused by a prolonged soak time that results in the loss of dead fish falling from gillnets before they are lifted or by the presence of scavengers such as hagfish.

DFO AND THE MOBILE GEAR SENTINEL SURVEYS

Ms. Gauthier reviews the data from the DFO scientific survey (nGSL and sGSL) and the scientific mobile sentinel survey. The biomass indices for fish over 40 cm from DFO's mobile surveys and the sentinel fisheries program show a downward trend over the past decade. These decreases are 62% and 77% respectively, compared to the peak observed in the mid-2000s. The biomasses estimated in 2018 were similar to those of 2017. The 2013 cohort, abundant at 1 year, has displayed a lower than expected growth rate. The abundance of this cohort has declined significantly and its contribution to the fishery could be much smaller than expected. The abundance of the 2017 cohort was above average in 2018.

- It was noted that the improvement in the Fulton index (body condition factor) cannot be related solely to the abundance of capelin in 2018. This index must be considered over a longer period.
- Although the fishery took place later in 2018 (western Gulf), the data from the 2018 research surveys were deemed to remain comparable to the data in the series.
- It was thought that the growth deficit observed for the 2013 cohort could be related to adverse environmental conditions and to intra- and inter-specific competition.
- According to industry representatives, the decline in abundance observed in 2018 is partly attributable to turbot movement, particularly in shallower waters. However, it was noted that all of the surveys tend to be in agreement and that they sample shallower waters, where there are normally few or no Greenland halibut.

EXPLOITATION RATE

The exploitation rate (landings versus biomass) is presented by fishing sector and for the 4RST. At the Gulf scale, the exploitation rate indicator has remained near the series average in 2018. This indicator is decreasing in the western Gulf area and increasing in northern Anticosti and Esquiman.

PRECAUTIONARY APPROACH

Ms. Gauthier briefly describes the proposed precautionary approach. The Gulf of St. Lawrence Greenland Halibut stock status indicator was in the cautious zone of the proposed precautionary approach in 2018. During the winter 2018 peer review, an upper stock reference (USR) was proposed by the Science Sector. Fishery managers at DFO, with support from the Science Sector, will be holding consultations with the fishing industry and other stakeholders to adopt he USR. Harvest control rules for adjusting catches with respect to the reference points are also being developed during these consultations.

INTERIM YEAR

The Greenland Halibut stock assessment is planned on a two-year cycle. The indicators used to monitor the status of the stock are landings and abundance indices from the DFO survey. The element that could trigger a re-assessment is a decrease of more than 30% in the biomass index of fish >40 cm in the DFO survey when this biomass is in the caution or critical zone defined according to the precautionary approach. The next assessment is scheduled for the winter of 2021.

RESEARCH PROJECTS

An overview of the various Greenland Halibut research projects is carried out. The list of projects is presented below.

- Integrated management tools for sustainable exploitation of Greenland halibut throughout eastern Canada 2015-2018. NSERC-Strategic – Laval University, ISMER, UQAC, DFO, Bernatchez, L., Audet, C., Tremblay, Sirois, P., et Lambert, Y.
- Effect of temperature and ocean acidification on the physiology and hypoxia tolerance of Greenland halibut. SPERA and ACCASP, D. Chabot.
- Conditioning stock exploitation advice to climate change with only moderate data and process knowledge. Duplisea, D. E., Roux, M.- J., Hunter, K., and Rice, J.
- Pilot Project of the Demersal Science section to Work on the Ecosystem Approach and Greenland Halibut
- Determination of length at sexual maturity for turbot by histological studies. 2019.
- Development of population dynamic model. Partnership OFI Module H - DFO – Dalhousie University. Benjamin Folliot – Joanna Mills Flemming
- Development of a precautionary approach - DFO Management-DFO Science – Fishers

SCIENCE ADVISORY REPORT REVIEW

The science advisory report is reviewed by participants and the main points raised are briefly reported by section.

Introduction section - Overview of oceanographic conditions and the ecosystem

- The main suggestion is to focus on conditions that may directly affect Greenland Halibut. Generalities will be included in the research document.
- In relation to the decline in turbot and shrimp, it should be said that this decline was preceded by an increase.
- It is suggested to talk about a "potential" competition with redfish.
- A draft of this section will be re-circulated by email.

Introduction section - Biology

- It is proposed to move egg information upstream of this section.
- It is suggested to refer to sexual dimorphism, without going into details.
- It is agreed that capelin is the dominant species in the Greenland Halibut diet, without giving more information.

- It was decided to delete the historical perspective on Greenland Halibut land use in conjunction with data from the DFO survey of the southern Gulf of St. Lawrence, which began in 1971. Include sGSL survey data in the figure on the biomass of fish over 40 cm.
- It is important to mention that despite the ecosystem changes observed (temperature increase and decrease in oxygen), Greenland Halibut is always found at the same depths.

Introduction section – Fishery

- It is felt that there are too many details regarding the TAC. The information should be included in the research document.
- The justification should be provided for a full assessment. This information is included in the *Assessment schedule and trigger for a full assessment during an interim year* section of the Science Advisory Report.
- It was decided to keep the information on the decrease in the number of fishers, mentioning the factors involved.

Resource assessment section - Commercial fishery fishing effort and catches

- The reduction of effort needs to be contextualised.

Resource assessment section – Commercial fishery performance

- We are sticking to an overall analysis, but we will mention that there was a different seasonal fishing pattern in the western Gulf in 2018.

Resource assessment section – Biological data

- We will not repeat information on sexual dimorphism

Resource assessment section - Biological data - Recruitment

- The expected average growth should be indicated.

Resource assessment section - Biological data – Growth and size structure

- Horizontal lines of expected sizes of July sentinel survey for Greenland Halibut at age 1, 2 and 3 should be reviewed in Figure 10. These lines represent expected sizes for turbot in August. We will calculate the expected sizes for July in order to modify the figure.

Resource assessment section - Biological data - Condition

- Reference will be made to the mass arrival of juvenile redfish between 2011 and 2013.
- In the last sentence, remove: "reflects the condition ... at age 1".

Resource assessment section – Stock status indicators

- Figures 13 and 15 provide the same information. Figure 13 will be replaced by the figure of biomass indices for fish greater than 40 cm, combining information from DFO surveys (nGSL and sGSL) and sentinel fisheries.
- Should the 40 cm be adapted to the current condition in terms of reproductive biomass? This 40 cm represents the portion of the population that will be available to the fishery the year following the assessment.
- It is suggested to further explore the increase in fish abundance > 40 cm which has not materialized. This point will be dealt with in sources of uncertainty.

Resource assessment section – Precautionary approach and Reference points

- It is proposed to refer to the research document.

Resource assessment section - Assessment schedule and trigger for a full assessment during an interim year

- This point is retained.

Resource assessment section - Sources of uncertainty

- Changes in the ecosystem should be cited here as a source of uncertainty.
- It is suggested to add the unrecorded mortalities associated with soak time and hagfish.
- The slowdown in observed growth is also a source of uncertainty.
- It is also mentioned that Greenland Halibut could spend more time in the water column, which could affect catchability.
- It is mentioned that other models, taking into account the various sources of uncertainty, can be explored.
- It may be worth mentioning that research priorities have been targeted in relation to the various sources of uncertainty, without listing them in detail.

Conclusion and Advice section

- It is suggested to specify that the slowdown in growth concerns the 2013 cohort.
- In the last sentence mentioning that a reduction in the exploitation rate seems necessary to stop the decline in the stock, the term "stop" is considered a too strong.
- Instead of talking about a "worrying" situation, we could say that the stock is in the cautious zone.

Other considerations section

- There is agreement that bycatch is close to the historical average.
- Table 2 is retained.

The science advisory report was modified based on these comments and the English and French versions were distributed to participants on February 27, 2019, seeking comments by March 4, 2019. Subsequently, the document was modified to reflect comments and the meeting chair felt that a consensus had been reached for the SAR.

CONCLUSION

HIGHLIGHTS AND ADVICE

The highlights are presented and the participants comment on them. Comments related to stylistic reformulation are not reported.

- In the first highlight, it should be noted that the TAC has decreased by 25%.
- In the highlight on the performance index, it is suggested that area-specific data be provided, while retaining the information on the 48% decline in 2018. Information on

seasonal changes in the western Gulf should be included in the text of the advisory report and not in the highlights.

- The highlight on the biomass indices for fish over 40 cm from the scientific surveys is reviewed and there is agreement for: "The biomass indices for fish over 40 cm from DFO's mobile surveys and the sentinel fisheries program show a downward trend over the past decade. These decreases are 62% and 77% respectively, compared to the peak observed in the mid-2000s. The biomasses estimated in 2018 were similar to those of 2017."
- With regard to the precautionary approach, since the industry has not yet accepted the upper stock reference, it is suggested to refer only to the point of 2018. The term "in development" is replaced by "proposed".
- In the highlight on ecosystem conditions, reference should be made to the arrival of large cohorts of redfish (2011-2013), which could potentially increase interspecific competition, without specifying that it occupies a similar ecological niche.
- As for the outlook, the highlight is simplified to go straight to the point and there is agreement that a reduction in the exploitation rate may be necessary to promote stock recovery. We avoid talking about worrying outlook.

The conclusion is as follows:

Given the stock status indicators and ecosystem conditions, a reduction in the exploitation rate may be necessary to promote stock recovery.

APPENDIX 1- TERMS OF REFERENCE

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

Regional Peer Review - Quebec Region

February 20-21, 2019
Mont-Joli, QC

Chairperson: Hugues Benoit

Context

The Gulf of St. Lawrence (4RST) Greenland halibut (also called black turbot, or more commonly turbot) fishery is mainly conducted by boats equipped with gillnets, whose home ports are located in Quebec or on the west coast of Newfoundland. In order to protect the population's reproductive potential, this fishery is subject to several management measures including the control of catches by a total allowable catches (TAC).

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 Greenland halibut stock status in NAFO Divisions 4RST. This advice shall include:

- Description of the biology of Greenland halibut and its distribution;
- A summary of oceanographic conditions in the Gulf;
- Analysis of the commercial fishing data including landings, fishing effort, catch per unit effort, biological data and Greenland halibut by-catches in other fisheries;
- Analysis of data from the DFO annual research trawl survey in August and mobile sentinel fisheries program;
- Analysis of fishing effort distribution according to Greenland halibut abundance distribution;
- Identification of reference points consistent with the precautionary approach;
- Analysis of by-catch from directed fisheries for Greenland halibut
- Perspectives for 2019 and 2020 based on available indicators;
- 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 priorization of research projects to be considered for the future.

Expected Publications

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

Participation

- Fisheries and Oceans Canada (DFO) (Science and Fisheries Management sectors)
- Fishing industry
- Provincial representatives
- Aboriginal communities/organizations

APPENDIX 2- LIST OF PARTICIPANTS

Name	Affiliation	February 20	February 21
Benoit, Hugues	DFO - Science	x	x
Boucher, Jean-René	RPPNG/OPFGQ	x	x
Bourdages, Hugo	DFO - Science	x	x
Brassard, Claude	DFO - Science	x	-
Brulotte, Sylvie	DFO - Science	x	x
Cantin, Guy	DFO - Science	x	-
Cerqueira, Andy	MAPAQ	x	x
Chabot, Denis	DFO - Science	x	-
Cléton, Mélanie	ISMER/UQAR	x	-
Cyr, Charley	DFO - Science	x	-
Denis, Marcel	ACPG	-	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	-
Duplisea, Daniel	DFO - Science	x	x
Dupuis, Mario	RPPNG	x	x
Emond, Kim	DFO - Science	x	-
Folliot, Benjamin	Dalhousie University	x	x
Gauthier, Johanne	DFO - Science	x	x
Gauthier, Pierre	DFO - Science	x	-
Gilbert, Denis	DFO - Science	x	-
Gosselin, Benjamin	ISMER/UQAR	x	-
Huard, Georges	ACPG	x	x
Hurtubise, Sylvain	DFO - Science	x	-
Karbowski, Chelsey	Oceans North Canada	x	x
Landry, René	Snow crab fisher Area 17	x	-
Larochelle, Mia	DFO – Fisheries management Québec	x	-
Lubar, John	DFO – Fisheries management NL	x	x
Marquis, Marie-Claude	DFO - Science	x	x
Nadeau, Paul (tél)	APBCN	x	x
Nozères, Claude	DFO - Science	x	-
Ouellette-Plante, Jordan	DFO - Science	x	x
Plourde, Stéphane	DFO - Science	x	x
Robert, Dominique	ISMER/UQAR	x	-
Roux, Marie-Julie	DFO - Science	x	-
Sandt-Duguay, Emmanuel	AGHAMM	x	x
Sainte-Marie, Bernard	DFO - Science	x	-
Senay, Caroline	DFO - Science	x	x
Simms, Jason	DFO – Fisheries management NL	x	x
Smith, Andrew	DFO - Science	x	-
Spingle, Jason	FFAW/UniFor	x	x
Talbot, Héléna	DFO - Science	x	-
Tremblay, Claude	DFO - Science	x	-
Trottier, Steve	DFO – Fisheries management Québec	x	x
Vallée, Daniel	RPPNG	x	x