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Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2023/039

Quebec Region

Proceedings of the Regional Peer Review of the Assessment of the northern Gulf of St. Lawrence (3Pn, 4RS) Atlantic Cod stock

**February 23-24, 2023
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.

Published by:

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

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



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Department of Fisheries and Oceans, 2023
ISSN 1701-1280

ISBN 978-0-660-67976-1 Cat. No. Fs70-4/2023-039E-PDF

Correct citation for this publication:

DFO. 2023. Proceedings of the Regional Peer Review of the Assessment of the northern Gulf of St. Lawrence (3Pn, 4RS) Atlantic Cod stock; February 23-24, 2023. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2023/039.

Aussi disponible en français :

MPO. 2023. Compte rendu de l'examen par les pairs régional sur l'évaluation du stock de morue franche du nord du golfe du Saint-Laurent (3Pn, 4RS); du 23 et 24 février 2023. Secr. can. des avis sci. du MPO. Compte rendu 2023/039.

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SUMMARY

This document outlines the proceedings of the regional peer review meeting on the assessment of the northern Gulf of St. Lawrence (3Pn, 4RS) cod stock. This meeting, which was held on February 23-24, 2023 at the Maurice Lamontagne Institute in Mont-Joli, as well as by videoconference, brought together about thirty participants from science, management, industry and environmental non-governmental organizations. 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 outlines the proceedings of the meeting on the assessment of the northern Gulf of St. Lawrence (3Pn, 4RS) cod stock held on February 23-44, 2023 at the Maurice Lamontagne Institute, with remote participation via videoconference for some participants.

In July 2022, Fisheries and Oceans Canada announced the closure of the northern Gulf of St. Lawrence Atlantic cod directed commercial fishery for one year and announced that the decision would be reassessed prior to the 2023-24 season. This assessment was requested by the Fisheries Management Branch to guide management decisions for this stock for the next management cycle. Finally, since a new assessment model has just been accepted during a framework assessment meeting, a review of the reference points of the precautionary approach is required, especially since they will be critical inputs to the development of the next rebuilding plan for this stock.

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

Caroline Senay, chair of the meeting, welcomed the participants, went over the objectives of the peer review and how it would proceed, then presented the terms of reference and the agenda. The stock was last assessed in the winter of 2019. She reminded everyone that a review of the assessment framework had been conducted at two meetings in 2021 and 2022. The first meeting focused on the available data and their statistical treatment, while the second meeting looked at the development of a new assessment model.

Jordan Ouellette-Plante, stock assessment biologist, began the meeting by highlighting the contribution of his many collaborators. He presented some data on cod distribution and biology (migration, reproduction, growth, diet, predation). He summarized the current oceanographic conditions, stating that cod were currently found in warmer, less oxygenated water. He briefly described the changes observed in marine communities. Different condition indices (Fulton, hepatosomatic index, fullness index, length-weight relationship, growth curve) were used to assess the condition of cod. In 2022, the condition of the species was particularly poor, especially in Division 4S, and was at levels where increased natural mortality had been previously observed in the natural environment and in the laboratory.

- Participants questioned the resilience of cod to changing oceanographic conditions that can affect digestion, growth and survival. Cod were described as moderately sensitive to hypoxia and capable of developing certain adaptive strategies that may be associated with biological costs.

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- Participants wonder about the difference observed in the condition of cod in 2022 between 4S and 4R. It would be interesting to have a finer resolution of fishing indices and environmental conditions between 4R and 4S.
 - It seems difficult to pinpoint the exact causes of the poor condition in some recent years and especially in 2022, although certain hypotheses were raised by participants: density-dependency effect, hypoxic conditions, availability of prey including small redfish, shrimp and capelin. Capelin would not be as important as a prey species in the northern Gulf as in cod populations east of Newfoundland.

FISHERY

The commercial fishery context and the key management measures were presented. In recent years, 60% of the landings from this fishery, which is conducted with gillnets and longlines, have come from 4R. Vessels from Newfoundland under 35 feet in length and from Quebec under 45 feet in length accounted for most of the landings (70%) in 1999–2021, excluding 2003 (the year of the moratorium). In July 2022, the directed Atlantic cod commercial fishery in the northern Gulf of St. Lawrence (nGSL) was closed for a year.

For the 2021-2022 fishing season, the total allowable catch was 1,000 t, which corresponded to an available commercial fishing allocation of 641 t. For the 2022-2023 season, there was no directed Atlantic cod commercial fishery. Preliminary landings, including bycatch and sentinel surveys catches, totaled 677 t in 2021-2022 and 132 t in 2022-2023. The main bycatches in the directed cod fishery are Atlantic halibut, Greenland halibut and redfish.

Recreational fishing was authorized in 2022 for a maximum of 39 days distributed between June and October (variable according to the zones). There is no reporting of removals from this fishery.

- It was clarified that catches-at-age data allowed landings to be broken down by age.
- It was noted that the CPUE and fishing effort had become less and less representative of directed cod fishery activities. It was a challenge to obtain logbooks, even though licence conditions required keeping a logbook.
- It was mentioned that this information was not directly input into the model, although it was useful.
- An issue involving at-sea observer coverage in 4R was noted.
- It was clarified that the figure on the history of landings included data from the commercial and sentinel fisheries. The slide heading was misleading and would be corrected.

SCIENTIFIC SURVEYS

The abundance index from the DFO research survey was above the series mean and increasing since 2020. The 2018 cohort, which has been observed annually in the survey since 2019, appears to be the most abundant since the early 1990s. The abundance and biomass indices from the sentinel trawl survey have been declining since the recent peak in 2020. They are now below their series mean. The longline (summer) and gillnet indices of the sentinel surveys were below their respective series mean in 2022.

While total mortality trends (Z) were very similar in the fixed-gear and mobile-gear surveys, the range was much wider in the fixed-gear surveys. Sources of unreported landings (discards in the groundfish and shrimp fisheries, recreational fishing) were also incorporated in the model. For the recreational fishery, the same values as those in 2020 were used, as no other

information was available. With the closure of the commercial fishery, recreational landings were believed to be certainly greater than commercial landings.

- Questions were raised about the apparent absence of cohorts between the strong cohorts in the 1980s and in 2018 in the figure showing length frequencies obtained in the DFO research survey.
- It was clarified that, when there were changes in the vessels used in the DFO research survey, comparative missions were carried out to determine and apply correction factors.
- It was reported that, in the mobile-gear sentinel survey, data from shallow water strata surveyed in Newfoundland had been integrated in 2003 and onward.
- It was pointed out that the landed values for the recreational fishery used for 2021 and 2022, which, in the model, were supposed to correspond to 253.7 t for the lower limit and 600 t for the upper limit, were the same as in 2020.

ASSESSMENT MODEL

A new model was developed during the review of the northern Gulf of St. Lawrence cod assessment framework that took place in 2021 and 2022. This new model was used for the first time during the current northern Gulf cod assessment.

Hugues Benoît reviewed the individual weight-at-age data used in the model. The model used two types of annual weight-at-age data. Beginning-of-year stock/survey weights (SW) were used to estimate the population biomass from estimated numbers at age, while commercial fishery weights (CW) were used to calculate the predicted landings (t) from estimated numbers at age.

Total catch weight and age composition were modelled separately. Catches before 2006 were considered more accurate and precise and those after 2006, more variable. There was some uncertainty associated with the unreported catches in the recreational fishery.

As for the results, it was noted that, after 1998, the biomass of cod aged 2+ and spawning stock biomass (SSB) fluctuated without a clear trend being ascertained. Beginning in 2015, the biomass of cod aged 2+ declined before increasing again from 2019 to 2020 with the arrival of the 2018 cohort, declining slightly thereafter. Beginning in 2017, the SSB also declined, but began to slowly increase again in 2019. The 2018 cohort, estimated to be at age 2 in 2020, represented the largest recruitment since 1990. The abundance of the two subsequent cohorts was thought to be comparable to the 1990–2022 average. Four larger cohorts have emerged since 1995. They have not generally resulted in significant increases in biomass or in numbers of older cod, and only in moderate increases in the biomass of mature fish. Average fishing mortality for ages 4-6 and 6-9 peaked in the early 1990s; reached gradually lower peaks around 2000, at the end of the 2000s and in 2018; and then declined thereafter. These values reflected the observed catches (input) and, since 2006, estimated additional catches (censored). Since the early 1990s, age-specific fishing mortality has tended to increasingly target older ages. In most years since 2010, the fishery has targeted fish aged 9+. Natural mortality (M) for all ages has fluctuated at high values in most years since the mid-1990s. In 2003 (the year of the moratorium), a decline in mortality was observed, reaching values comparable to historical levels. M then increased, peaking in the late 2000s and again around 2018, especially in older fish. Since 2020, an increase in M has been observed for most ages, which accounts for almost all of total mortality, unlike in the 1970s and early 1980s. M has also been observed to roughly fluctuate with the TAC since the 2000s.

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- Participants were reminded that this model had been examined in detail and accepted at the 2022 peer review.
 - There were questions about the model's sensitivity to priors. The topic had already been discussed at the assessment framework review in 2022.
 - Participants were reminded that the shallower strata had been added to the DFO research survey in 1991 and to the sentinel bottom-trawl survey in 2003. Adjustments had been made to account for the changes in survey coverage.
 - Participants wondered why the fishery had targeted more fish aged 9+ after 2010. This may reflect the selectivity of the fleet and the availability of fish that age.
 - Since the 2000s, a relationship between the TAC and M has been observed, which appears to indicate the presence of unaccounted-for catches (under-reporting and/or depredation). When the fishing effort was controlled, it seemed easier to control mortality. Separating M and F is not as easy. At lower TAC levels or in the event of a moratorium, M could be estimated more accurately.
 - The industry expressed reservations about the extent of unaccounted-for catches.
 - Questions were raised about the censored model, which also had limits. Participants noted that, if there were space in the model to choose between M or F , with wide bounds for a possible F , the model would tend to favour a constant F . It seemed that the model would put everything into M without differentiation, but that remained to be assessed more accurately. Since F influenced other parameters, this was a problem. With fairly robust survey data, total mortality (Z) would be generalized, without distinguishing between M and F . The censored catch approach may not be ideal for distinguishing between the two sources of mortality (M and F) and should be examined by running simulations. There was a sensitivity to the bounds chosen.
 - However, participants said that the model's ability to estimate Z was already beneficial.
 - Nevertheless, the model itself remained robust. A number of the participants considered the conclusions to be logical. There did appear to be unaccounted mortality (discards, depredation, recreational fishing) included in natural mortality. It seemed important to pay special attention to this aspect in the rebuilding plan.

Hugues Benoît continued his presentation by discussing model fitting. The DFO survey caught all ages reasonably well, much like the sentinel bottom-trawl survey did for ages 3+. Younger fish were not easily caught in the three fixed-gear sentinel surveys, especially the gillnet survey. Corrections were made for cod availability to the two bottom-trawl surveys due to less coverage by the DFO surveys before 1990 and by the sentinel bottom-trawl surveys before 2003 (ages 2-3). The model fit to the abundance indices at age reasonably well. There were no strong patterns in residuals suggesting model misspecification. The large 2018 cohort was not evident in the abundance indices obtained from the fixed-gear sentinel surveys, partly because of low catchability, but also because this cohort seems to be more prevalent in the waters farther offshore in 4RS, which affects its availability to the sentinel trawl survey. The fishery catch composition estimated by the model fit the input catch composition well. The model tends to poorly estimate the contribution to an age when the input proportion varied strongly interannually.

A seven year peel showed little sensitivity for average F , and no bias based on Mohn's rho, either for spawning stock biomass and recruitment or for M , except that there was some sensitivity in the last year or two of an assessment, but no significant bias, meaning that the

occurrence and extent of overestimates and underestimates were comparable. Thus, estimates of M in the final assessment year needed to be interpreted with caution, but the long-term trends seemed reliable in the context of the model.

- In general, there were no notable patterns, and the retrospective analyses looked good.
- As seen in the assessment framework review, by applying a prior on catchability, it seemed that the model would try to bring it back to the value of 1. Values greater than 1 appeared to indicate that something else was at work, possibly related to unaccounted-for catches.

PROJECTIONS

Three-year projections (10,000 simulations) by the fitted model were carried out for four catch scenarios (0, 500, 1,000 and 1,500 t) based on the following conditions and assumptions: maturity-at-age; 2022 stock/survey and commercial fishery weights for the next three years; estimated average fishery selectivity for 2020–2022; recruitment generated from the 2022 estimate assuming the age and year correlations estimated in the model; natural mortality also generated from the 2022 estimate assuming the age and year correlations estimated in the model. The above parameters and the estimated abundance for 2022 were simulated using the model parameter estimates and the covariance matrix. Since M was the principal component of Z and was not well estimated in the terminal year of the assessment, the projections were somewhat uncertain.

With these scenarios, the probability that the SSB would increase over the next two years fell from 0.51 for a 0-t catch scenario to 0.45 for a 1,500-t catch scenario in the fishery. The high rate of natural mortality could explain these modest growth prospects, which had been projected by the model despite the significant recruitment of the strong 2018 cohort to the adult biomass.

- For the long-term projections, it would be advisable to include unaccounted-for catches that fell outside the bounds.
- It would be important to consider the uncertainty in the long-term projections in the rebuilding plan.
- In the scenarios presented, some participants could not see the positive effect that closing the recreational fishery would have. It was difficult to determine the proportion of M assigned to the recreational fishery. Other participants mentioned that the scenario without removals (quotas) included the recreational fishery, although to do so correctly, part of M would need to be attributed to this fishery.

LIMIT REFERENCE POINT AND PRECAUTIONARY APPROACH

Modifications to the assessment model would require revising the limit reference point (LRP), and possibly determining other elements of a precautionary approach: upper stock reference (USR) point, target reference point (TRP), removal reference (F_{lim}) and harvest control rules. An LRP is required for the rebuilding plan for this stock and must be produced by April 2024.

A LRP, based on long-term stock trends in stock spawning biomass (SSB), was adopted at a value of 71,970 t. Other reference points have been proposed, including the upper stock reference point (USR, 143,939 t), the target reference point (TRP, 179,924 t), and the removal reference (F_{lim} , 0.49). Given the high natural mortality, a limit reference point on total mortality should be considered.

For 30 years, SSB has been at low levels. The SSB estimate for 2022 (42,906 t) was in the critical zone and corresponded to 60% of the LRP. An examination of stock productivity

revealed that the stock had surplus production for the majority of years since 1995 and would likely have grown in the absence of commercial and recreational fisheries.

- It was agreed that there was no clear Allee effect for this stock.
- Participants had questions about the options for determining the LRP, given that the stock-recruit relationship was difficult to use. The best option was to go back in time to get an idea of this stock's productivity and to use proxies related to estimated biomass in the past, during a period considered representative of a sustainable fishery.
- Participants thought the extended model was more appropriate for establishing the LRP.

FACTORS AFFECTING PRODUCTIVITY

Hugues Benoît briefly discussed the environmental factors affecting productivity. In particular, one effect on fish condition, natural mortality, maturity and individual weight, was observed in association with the cold-water period (1985–1995). Natural mortality was associated with the cold-water period. Various factors could affect recruitment, although the evidence for these factors was weak: the physiological condition of adults, the abundance of pelagic fish that are major predators of cod eggs and larvae, and below-average bottom temperatures that may have contributed to higher juvenile mortality. Although grey seal predation was not currently considered significant in the nGSL (compared to the sGSL), density-dependent expansion and a range shift into the nGSL due to the reduced winter ice cover could increase the incidence of grey seals in the ecosystem.

- Genetic studies suggested that nGSL cod were a different stock from sGSL cod, with the Laurentian Channel serving as a natural barrier.

CONCLUSION

INTERIM YEAR

The assessment of nGSL cod has generally taken place every two years. However, Hugues Benoît suggested another option that could be discussed with Management. He mentioned, among other things, that even if the assessment of 3Pn, 4RS cod was supposed to occur on a two-year cycle, a longer period between assessments might also be viable given the generally regular dynamics of the stock (slow dynamics). Estimating the SSB requires annual information on age composition and assessment model fitting, which uses resources that could otherwise be allocated to research to better understand the factors affecting the stock, and is not necessarily possible every year. Instead, he suggested using the biomass index for cod ≥ 43 cm, which roughly corresponds to the SSB. While it is not a perfect proxy, it does follow SSB fluctuations and, therefore, could serve as an indicator during the interim years of the assessment. The performance of this index would have to be reviewed periodically, especially if there was a significant change in average SSB. A trigger for a full assessment would be based on a deviation from the projected/anticipated value, and a 50% deviation was suggested. The deviation chosen would have to take into account the uncertainty in the index (average CV = 24%).

- Science supported the suggested approach. A longer period between assessments would allow other very useful work for assessment to be carried out.
- It was agreed that the work related to the rebuilding plan would allow the next steps to be determined.

SOURCES OF UNCERTAINTY

Various sources of uncertainty were raised:

- Cod condition in 2022 (diet, hypoxia);
- Size of the 2018 cohort;
- Importance of recreational fishing;
- Composition of M (natural factors, unreported catches [including recreational and discards], depredation);
- At-sea observer data;
- Accessibility of logbook data.

RESEARCH PROJECTS

The following research was identified for the future:

- Rebuilding plan;
- 2024 reproductive potential survey for cod;
- Migration in the Strait of Belle Isle;
- Cod condition monitoring (FSCP);
- Tagging program (especially recreational fishing) (FSCP);
- Acoustic tagging;
- Winter survey;
- Publication on 3Pn4RS cod diet;
- Genetic structure.

HIGHLIGHTS AND RECOMMENDATION

Highlights were presented, and participants offered their comments. Those related to stylistic rewording were not reported.

- In the key point on the TAC, it was clarified to include commercial fishing and bycatch, as well as sentinel survey catches.
- In the key point on the recreational fishery, participants agreed that catches were not reported in this fishery.
- In the key point on the poor condition of cod, it should be specified that this is mainly in Division 4S.
- In the key point on natural mortality, it should be specified that natural mortality had been at high levels for at least a decade. Participants felt confident enough to have the point state that part of this natural mortality likely consisted of unaccounted fishing mortality.
- In the key point on the precautionary approach, participants, after a discussion, decided not to round off the LRP, USR and TRP values. F_{lim} was to stand for removal reference. The following sentence was to be added: Given the high natural mortality, an LRP on total mortality should be considered.

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- The key point on projections must be reworded to clarify the information.
 - In the key point on surplus production, “in the absence of commercial and recreational fisheries” must be specified.
 - Participants decided not to include a highlight on the rebuilding plan.

The participants agreed on the following wording of the **conclusion**:

For 30 years, the SSB was at low levels. The estimated SSB for 2022 (42,906 t) was in the critical zone and corresponded to 60% of the LRP.

APPENDIX 1 - TERMS OF REFERENCE

Assessment of the Northern Gulf of St. Lawrence (3Pn, 4RS) Cod Stock in 2022 Regional Peer Review – Quebec Region

February 23-24, 2023
Mont-Joli, QC

Chairperson: Caroline Senay

Context

The last full assessment for the northern Gulf of St. Lawrence Atlantic cod stock (3Pn, 4RS) was in February 2019 (Brassard et al. 2020; DFO 2019a,b). It determined the stock to be deep in the critical zone at 10% of the Limit Reference Point (LRP). Since then, annual updates of stock status indicators have been conducted and indicated no major changes in the stock status (DFO 2020, 2021, 2022a).

In parallel, a review of the assessment framework for this stock was completed in order to obtain a new assessment model. Held in two sessions, the first one focused on the available data and their statistical treatment (Benoît et al. 2021, 2022; DFO 2022b; Ouellette-Plante et al. 2022a,b) and the second one focused on the development of a new assessment model.

In July 2022, Fisheries and Oceans Canada announced the closure of the northern Gulf of St. Lawrence Atlantic cod directed commercial fishery for one year and announced that the decision would be reassessed prior to the 2023-24 season. The February 2023 assessment was requested by the Fisheries Management Branch (FM) to provide detailed advice on the status of the northern Gulf of St. Lawrence Atlantic cod stock in order to guide management decisions for this stock for the next management cycle. Finally, since a new assessment model has just been accepted, a review of the reference points of the precautionary approach is required, especially since they will be critical inputs to the development of the next rebuilding plan for this stock.

Objectives

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

- An oceanographic and environmental overview for the cod stock area;
- Description of the cod fishery including landings, fishing effort, catch per unit effort, biological data and cod by-catches in other fisheries;
- Analysis of data from the DFO annual research trawl survey and sentinel fisheries with mobile gears (July) and fixed gears (gillnets and longlines);
- Analysis of biological indicators related to the condition, growth and maturity;
- An analysis derived from the new assessment model to identify stock trends in spawning stock abundance, recruitment and mortality;
- Analysis of trends of a number of indicators relevant to abundance, productivity and fishing mortality;
- Establishing the LRP from the Precautionary Approach.

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- Provide guidance on the Precautionary Approach Upper Reference Point (URP) and the Fishing Mortality Limit Reference Point (F_{lim}).
 - Spawning stock biomass projections for 2023 and 2024 based on the new assessment model relative to the new LRP and to potential harvest scenarios provided by the FM;
 - Assessment of the main factors affecting the productivity of the stock over the last four decades;
 - 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;
 - Highlight major sources of uncertainty in the assessment.
 - Identification and prioritization of research projects to be considered for the future.

Expected Publications

- Science Advisory Report
- Proceedings
- Research Document

Expected Participation

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

References

- Benoît, H.P., Brassard, C., Carruthers, E., and Nadeau, P. 2021. [Results of a questionnaire to commercial harvesters on historical and current unaccounted catches of Atlantic cod in NAFO areas 3Pn4RS](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2021/067. vi + 36 p.
- Benoît, H.P., Ouellette-Plante, J., Yin, Y., and Brassard, C. 2022. [Review of the assessment framework for Atlantic cod in NAFO 3Pn4RS: Fishery independent surveys](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2022/049. xiii + 130 p.
- Brassard, C., Lussier, J-F., Benoît, H, Way, M. and Collier, F. 2020. [The status of the northern Gulf of St. Lawrence \(3Pn, 4RS\) Atlantic cod \(*Gadus morhua*\) stock in 2018](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2019/075. x + 117 p.
- DFO. 2019a. [Assessment of the Northern Gulf of St. Lawrence \(3Pn, 4RS\) Atlantic Cod Stock in 2018](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2019/032.
- DFO. 2019b. [Proceedings of the regional peer review of the assessment of the northern Gulf of St. Lawrence \(3Pn, 4RS\) Atlantic cod stock; February 21-22, 2019](#). DFO Can. Sci. Advis. Sec. Proceed. Ser. 2019/012.
- DFO. 2020. [Update of stock status indicators for northern Gulf of St. Lawrence \(3Pn, 4RS\) Atlantic cod in 2019](#). DFO Can. Sci. Advis. Sec. Sci. Resp. 2020/007.

-
- DFO. 2021. [Update of stock status indicators for northern Gulf of St. Lawrence \(3Pn, 4RS\) Atlantic Cod in 2020](#). DFO Can. Sci. Advis. Sec. Sci. Resp. 2021/006.
- DFO. 2022a. [Update of stock status indicators of Atlantic cod in the northern Gulf of St. Lawrence \(3Pn, 4RS\) in 2021](#). DFO Can. Sci. Advis. Sec. Sci. Resp. 2022/009.
- DFO. 2022b. [Proceedings of the regional advisory meeting of the assessment framework for the northern Gulf of St. Lawrence \(3Pn4RS\) Atlantic Cod—Part 1: review of data input; April 21–22 and May 12, 2021](#). DFO Can. Sci. Advis. Sec. Proceed. Ser. 2022/008.
- Ouellette-Plante, J., Benoît, H.P. and Brassard, C. 2022a. [Review of the NAFO 3Pn4RS Atlantic cod assessment framework: commercial and recreational fisheries catch and tagging program data](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2022/033. v + 57 p.
- Ouellette-Plante, J., Van Beveren, E., Benoît, H.P. and Brassard, C. 2022b. [Details of catchR, an R package to estimate the age and length composition of fishery catches, with an application to 3Pn4RS Atlantic cod](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2022/015.

APPENDIX 2 - LIST OF PARTICIPANTS

Name	Affiliation	Febr. 23	Febr. 24
Andrushchenko, Irene	DFO – Science	-	X
Beaudry-Sylvestre, Manuelle	DFO – Science	X	X
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Bois, Samantha	ACPG	X	X
Bourbonnière, Jean-Patrick	DFO – Science	X	-
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Chamberland, Jean-Martin	DFO – Science	X	X
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Desjardins, Christine	DFO – Science	X	-
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Hardy, Magalie	DFO – Fisheries management	X	X
Hawkins, Laurie	DFO – Fisheries management	X	X
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Nadeau, Paul	LNSFA	-	X
Ouellette-Plante, Jordan	DFO – Science	X	X
Rayner, Gemma	Oceans North	X	X
Regular, Paul	DFO – Science	X	X
Ricard, Daniel	DFO – Science	X	X
Senay, Caroline	DFO – Science	X	X
Smith, Andrew	DFO – Science	X	X
Solberg, Abe	FFAW	X	X
Turcotte, François	DFO – Science (reviewer)	X	X
Vascotto, Kris	Atlantic Groundfish Council	X	X
Way, Loomis	FFAW	X	X

APPENDIX 3 – AGENDA

Assessment of the northern Gulf of St. Lawrence (3Pn, 4RS) cod stock in 2022

Regional Peer Review – Quebec Region

February 23-24, 2023

February 23, 2023

Time (EST)	Subject	Presenter
8:30	Introduction and round table	C. Senay
9:00	Context of the assessment review framework	J. Ouellette-Plante
9:05	Biology and ecosystem	J. Ouellette-Plante
9:50	Fishery and bycatch	J. Ouellette-Plante
10:30	<i>Health break</i>	
10:45	Scientific surveys	J. Ouellette-Plante
11:30	<i>Lunch break</i>	
12:30	Scientific surveys \ model	J. Ouellette-Plante / H. Benoît
14:00	<i>Health break</i>	
14:15	Model	H. Benoît
15:45	Day wrap up	C. Senay

February 24, 2023

Time (EST)	Subject	Presenter
8:30	Limit reference point and proposals for other PA elements	H. Benoît
10:00	Model projections	H. Benoît
10:30	<i>Health break</i>	
10:45	Review of the science advice summary	All
11:30	<i>Lunch break</i>	
12:30	Review of the science advice summary	All
14:30	<i>Health break</i>	
14:45	Interim year process	J. Ouellette-Plante

Time (EST)	Subject	Presenter
15:15	Future work	J. Ouellette-Plante
15:35	Word from the chairperson	C. Senay
16:00	End of meeting	