



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Ecosystems and
Oceans Science

Sciences des écosystèmes
et des océans

Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2024/031

Maritimes Region

Proceedings of the Maritimes Regional Advisory Meeting of the Stock Assessment of Herring in Northwest Atlantic Fisheries Organization (NAFO) Fishing Areas 4VWX

Meeting date: March 31, 2022

Location: Virtual Meeting

Chairperson: Darek Moreau

Editors: Rabindra Singh and Tiffany Small

Fisheries and Oceans Canada
Maritimes Region
PO Box 1006, 1 Challenger Drive
Dartmouth, Nova Scotia B2Y 4A2

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



© His Majesty the King in Right of Canada, as represented by the Minister of the
Department of Fisheries and Oceans, 2024

ISSN 1701-1280

ISBN 978-0-660-72328-0 Cat. No. Fs70-4/2024-031E-PDF

Correct citation for this publication:

DFO. 2024. Proceedings of the Maritimes Regional Advisory Meetings of the Stock Assessment of Herring in Northwest Atlantic Fisheries Organization (NAFO) Fishing Areas 4VWX; March 31, 2022. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2024/031.

Aussi disponible en français :

MPO. 2024. Compte rendu de la réunion sur les avis scientifiques régionale de la région des Maritimes de l'évaluation des stocks de hareng des divisions 4VWX de l'Organisation des pêches de l'Atlantique Nord-Ouest (OPANO); le 31 mars 2022. Secr. can. des avis sci. du MPO. Série de comptes rendus 2024/031.

TABLE OF CONTENTS

SUMMARY.....	iv
INTRODUCTION	1
OBJECTIVES.....	1
MEETING WELCOME AND INTRODUCTIONS.....	2
COASTAL NOVA SCOTIA ACOUSTIC SURVEYS AND LANDINGS	2
LANDINGS AND AOCUSTIC SURVEYS FOR SWNS/BOF COMPONENT	3
SOUTHWEST NEW BRUNSWICK MIGRANT JUVENILES.....	5
LIMIT REFERENCE POINT FOR THE SWNS/BOF COMPONENT	5
MANAGEMENT STRATEGY EVALUATION	5
SUMMARY OF REBUILDING MANAGEMENT PROCEDURES.....	6
Review the extent to which IFMP and rebuilding goals are being met.....	6
REVIEW OF SAR SUMMARY BULLETS	6
REFERENCES CITED.....	8
APPENDIX A: AGENDA	9
APPENDIX B: TERMS OF REFERENCE.....	10
APPENDIX C: LIST OF PARTICIPANTS	12

SUMMARY

This March 31, 2022, peer-reviewed meeting on the stock assessment of 4VWX Herring follows a framework review conducted from 2019 to 2022 for the Southwest Nova Scotia/Bay of Fundy (SWNS/BoF) spawning component. The meeting used the 2022 management strategy evaluation framework to identify candidate management procedures that meet the conservation (rebuilding) objective and to determine whether exceptional circumstances have occurred using the 2021 fishery data. The stock status of the SWNS/BoF component was updated using the 2021 acoustic index of spawning stock biomass. Information on the other spawning components for the 4VWX Herring stock was also reported based on indicators used in the 2018 stock assessment. The meeting participants reviewed in detail the summary bullets in the draft Science Advisory Report. Participants in this meeting included Fisheries and Oceans (DFO) Science, DFO Ecosystem Management, Province of Nova Scotia, Province of New Brunswick, Aboriginal communities / organizations, industry, and non-governmental organizations.

INTRODUCTION

Atlantic Herring (*Clupea harengus*) is a pelagic species found on both sides of the North Atlantic. The Northwest Atlantic Fisheries Organization (NAFO) 4VWX management unit contains a number of Herring spawning areas. For the purposes of evaluation and management, the 4VWX Herring fisheries are divided into four components:

- Southwest Nova Scotia/Bay of Fundy (SWNS/BoF) spawning component (also '4WX' in management plan);
- Offshore Scotian Shelf banks spawning component;
- Coastal (South Shore, Eastern Shore and Cape Breton) Nova Scotia spawning component; and
- Southwest New Brunswick (SWNB) migrant juveniles.

The Georges Bank spawning component (5Z) is not included in this evaluation except to document Canadian fishing activity.

A framework review was conducted from 2019 to 2022 for the Southwest Nova Scotia/Bay of Fundy (SWNS/BoF) spawning component (Barrett 2023, Carruthers et al. 2023). This science advisory process used the 2022 management strategy evaluation (MSE) framework to identify candidate management procedures that meet the conservation (rebuilding) objective and to determine whether exceptional circumstances have occurred using the 2021 fishery data. The status of the SWNS/BoF component was compared to the limit reference point (LRP). Information on the other spawning components for the 4VWX Herring stock was also reported based on indicators used in the 2018 stock assessment (DFO 2018).

OBJECTIVES

The objectives of this meeting were to review and update biological and fishery information on 4VWX Herring stock status to assist with quota recommendations for 2022 fisheries, as required in the Integrated Fisheries Management Plan, including but not limited to:

- Evaluation of the indicators for the SWNS/BoF spawning component.
- Review and Update of information regarding the Offshore Scotian Shelf spawning component and Coastal Nova Scotia spawning component, including update survey results.
- Update of the Southwest New Brunswick migrant juvenile fishery component.
- Evaluation of the fishery with respect to the conservation LRP for the SWNS/BoF component.
- Review the runs of the predetermined candidate Management Procedure(s) (MP) simulation tests on the Reference Set of Operating Models for the SWNS/BoF component.
- Provide advice on the probability of rebuilding above the LRP over the projection period for each partner/stakeholder predetermined candidate MP when applied as a Harvest Control Rule for the SWNS/BoF component.
- Determine if exceptional circumstances have occurred for the SWNS/BoF component.
- Advise on recovery and rebuilding of 4VWX Herring, including a review of whether the goals of the rebuilding plan are being met.

MEETING WELCOME AND INTRODUCTIONS

Rapporteur: Tiffany Small

The Chair, Derek Moreau, started the meeting with a territorial acknowledgement recognizing the importance of the ancestral territory for which participants may be residing. Introductions started with a roundtable of all participants and the two reviewers, Drs. Mathew Cieri and Elisabeth Van Beveren. The Chair then laid out some ground rules for the meeting and encouraged participants on this Microsoft Teams (MS Teams) meeting to turn on their cameras when speaking. The Chair then briefly described the Canadian Science Advisory Secretariat (CSAS) peer review process and the use of the Scientific Advice for Government Effectiveness (SAGE) Principles and Guidelines. The Agenda (Appendix A) and the Terms of Reference (Appendix B) were reviewed. Participants in this meeting included Fisheries and Oceans (DFO) Science, DFO Ecosystem Management, Province of Nova Scotia, Province of New Brunswick, Aboriginal communities / organizations, industry, and non-governmental organizations (see Appendix C for list of participants).

Before the meeting proceeded, the Chair asked if there were any questions and a participant raised the concern of virtual meetings in the long-term and suggested in-person meetings will benefit the process as a whole. The Chair agreed but pointed out that the decision to remain online is beyond the control of DFO Science and that meetings will become face-to-face as soon as they are authorized.

A participant also inquired about additional reference documents that were produced for previous assessment, namely:

- Working Paper: Table and Figures for Evaluation of Northwest Atlantic Fisheries Organization (NAFO) Divisions 4VWX Herring
- Working Paper: Table and Figures of Herring Acoustic Surveys in Northwest Atlantic Fisheries Organization (NAFO) Divisions 4VWX

It was explained that due to the time commitment from the ongoing MSE, these documents were not prepared in time for distribution prior to this CSAS meeting but they are recommended to be provided to stakeholders at a later date.

COASTAL NOVA SCOTIA ACOUSTIC SURVEYS AND LANDINGS

Rapporteur: Tiffany Small

A. Debertain started his presentation on the acoustic surveys on the Coastal Nova Scotia (NS) Herring spawning components. At appropriate breaks in the presentation, the Chair paused to allow for questions and comments from reviewers and participants. A participant raised an observation where the mean length and weight in 2021 seem quite a bit larger than in 2020 and asked if the Target Strength (TS) could be calculated without the correct fresh weights. A. Debertain assured that the weight is not affected by freezing and the length is adjusted for freezing. Reviewer E. van Beveren mentioned that the survey coverage of the coastal NS spawning grounds appears to be sparse. A. Debertain agreed with this concern and mentioned that in the history of the surveys effort has not been taken into consideration in the estimates. This is due to the large area that is to be covered, and the small size of the coastal NS fleet. Additionally, the 10-day interval allows for turnover on the fishing ground even though double counting could be an issue, but so could undercounting.

After the presentation on Eastern Shore surveys, participants were concerned about surveys that occurred over several days without the 10-day interval. A consensus was made to count

surveys that met the 10-day interval and to apply this criteria to all gillnet fleet surveys to standardize the practice across the areas. A participant expressed concern about the absence of working documents prior to the meeting that may have provided historical context to why the surveys may have been done less than 10 days apart. Additionally, it was suggested that percentage of exploitation should be added to the working paper. There was a brief discussion on performing some comparative studies on the previously used FEMTO echosounders to the new Simrad EK80. Timing inconsistencies with the two vessels used to perform the surveys prevented any scientific conclusions. A more accurate method of calculating standard error (SE) was also presented and applied to 2020 and 2021, but will also need to be applied to the archival biomass assessments. A reviewer suggested that the survey time series should be presented in a summary table where past coverage could be easily interpreted. A. Debertin also mentioned that this could be done for the gillnet fleet data as well.

Next Eastern Shore landings based on allocation were presented. The allocation for 2022 will need to be modified given the newly agreed survey date interval. Little to no landings were recorded in Glace Bay and in the Bra d'Or Lakes. A participant raised a question about the exclusion of data on the Baccaro Box. Data were not prepared on this region for this meeting but will be provided at a later date and in the documents to be distributed to stakeholders.

LANDINGS AND AOCUSTIC SURVEYS FOR SWNS/BoF COMPONENT

Rapporteur: Tiffany Small

After the presentation on the SWNS/BoF Herring acoustic survey, the working relationship between DFO and the Herring Science Council (HSC) was acknowledged and openness to collaboration was acknowledged.

The identification of a drop ping error that occurs systematically on some of the survey vessels was raised where the ping rate is two seconds, instead of one ping every second, and occurred once every 5 to 10 minutes. The reviewers weighed in and suggested that because this error is systemic it will not impact the data accuracy of the biomass estimates obtained from the acoustic surveys.

When reviewing the landings data from the decadal average since 1970 it was noted that the SWNS/BoF purse seine fishing season was changed in 2019 to match the calendar year. A participant mentioned that the weir landings have always been reported based on the calendar year and it was only the purse seiners that switched and that the weir landings are not currently included in the SWNS/BoF stock component total landings. Another participant also noted that historically, the Offshore grounds were dominated by international fleets.

Two new technicians were hired this past year in the DFO Maritimes Region Herring Unit and age data were analyzed in conjunction with a historical reference check from a past DFO ager to ensure consistency between readers. One ager did not pass this check the first time but repeated and passed the second time around. The primary ager passed with results above 90% on reference checks. The two agers also compared with each other and within reader and passed the quality assurance and quality control checks for this year. One reviewer mentioned that an otolith swap with the Gulf of Maine Herring should be scheduled for this year to investigate discrepancies between United States (US) and Canadian agers. This suggestion was recommended to be added to the work plan for the Herring Unit. Moreover, another participant mentioned that the Unit should participate in different DFO regional meetings with groups that separate stocks by spawning type (i.e., spring vs. fall). In the interim, it was suggested to separate the catch-at-age by spawning ground (i.e., German Bank and Scots Bay). Brief discussions of developing an ageing workshop between DFO Maritimes and DFO

Gulf regions occurred and this was identified as a recommended future work planning consideration.

Participants noted that it was encouraging to see older ages of fish with weights slightly larger than in 2018. This could be due to many factors but participants reported some observations that lean towards more food availability. A reviewer commented the larger fish weights may be caused by biases present due to the fishery's shift in timing. A. Debertin suggested there should be an analytical model to standardize the weight-at-age data to avoid this bias. Another participant suggested that short-term trends be included in the additional documents that will follow this meeting. Again the comment of separating the spawning areas and providing SE on this metric would be helpful.

The next presentation was on the Scots Bay survey grounds. Clarification was sought on the maturity of fish < 23 cm in the samples associated with the acoustic surveys and it was confirmed that their gonads were developing and they were preparing to spawn. There were also observations noting a decrease in length at maturity in recent years. The survey start dates will be updated in the future documents as being the first day of the survey.

After reviewing the bubble plot for Scots Bay on size of biomass estimates versus survey timing, a participant noted that the largest biomass for this year was seen in the last survey which is uncommon relative to the rest of the time series.

The presentation continued with the acoustic surveys on German Bank. Modifications were suggested for the wording and it was also suggested that an explanation of the how the SE was calculated be provided in future supplementary documents. Other concerns around the turnover equation (14-day interval between surveys) were noted with the intent to continue the discussions in separate meetings.

A bubble plot for German Bank on size of biomass estimates versus survey timing were presented next. A reviewer commented that historically, Herring spawning goes much later than expected. It was acknowledged that the amount of survey effort has increased in recent years and that what is presented in the plot is adjusted (turnover) biomass so there may have been fish on the spawning ground though their biomass have been reduced to zero if they occurred less than 14 days apart. It was suggested by a participant that for comparison, both plots for adjusted biomass and actual biomass could be produced.

The acoustic surveys on the Seal Island component were next presented. A. Debertin acknowledged that the values will need to be updated using the new SE calculation and to incorporate the *ad hoc* survey that occurred for Seal Island.

After the presentation on the smaller spawning components, it was noted that the biomass estimates for Trinity Ledge will also need to be updated later to account for the 10-day minimum survey interval. There were some discussions about whether to include small fish (fish < 23 cm) in the Spectacle Buoy acoustic biomass estimates based on the fact that they were spawning fish. A suggestion to systematically discount the juveniles in all surveys was also noted.

The summary table outlining the spawning stock biomass (SSB) for the SWNS/BoF area was presented. Concern was raised about the variability observed in Scots Bay and to what degree this may impact the overall estimate when it is combined with the other stock components. A reviewer questioned if the current methodology for calculating biomass is appropriate for this study. A. Debertin shared this concern and mentioned that a thorough review of the best practices for processing the archived acoustic data is underway. A question was raised about incorporating the model discussed in previous MSE meetings with other data sources. However, a reviewer clarified that we do not have an accepted model, it is instead a methodology for testing harvest control rules which cannot be applied for status determination. Another reviewer

cautioned that there is a lot of uncertainty in the coverage whereas Scots Bay has a lot of effort and more variability compared to the other components. Other factors can also contribute to the variability including the parameters being used to calculate the TS. A reviewer suggested that the term “relative acoustic index” should be used to avoid confusion with the “absolute index”.

SOUTHWEST NEW BRUNSWICK MIGRANT JUVENILES

The presentation continued with an update on the SWNB migrant juveniles. A reviewer commented that there is a high likelihood that those fish caught in the weirs are of US origin. This was not the general consensus of the group as some participants believe that some juveniles may be of Canadian origin. Due to time constraints, the Chair limited the amount of comments and this resulted in a participant expressing concern for not enough time to thoroughly ask questions and comment on the presented material, bearing in mind that past meetings were multi-day events. The Chair acknowledged this concern and made note that this time format may not be suitable for the future meetings.

LIMIT REFERENCE POINT FOR THE SWNS/BOF COMPONENT

Currently, the fishery is determined to be in the critical zone of DFO Precautionary Approach Policy and the science advice is to limit the amount of removals in the fishery. Though there is a lot of variability in the fishery, the stock has been below the LRP for the past 4 years. A comment was made by a participant that in the past, the 3-year moving average was used to determine stock status because there was no model to address any of the error. The participant felt it was inappropriate to use the 3-year moving average as an index of abundance because it was not intended for that purpose. It was explained that the 3-year average is not the only consideration and other management measures are also examined. Concerns about variability were also expressed and it was explained that the variability in 2021 most likely comes from the nature of conducting transects over areas with low biomass then surveying over a school with really high biomass. A reviewer then questioned the method of combining the surveys across the survey area and suggested that DFO Science look into a better way to explore data analyses. Until there is a better understanding of immigration and emigration from each spawning ground, however, the present approach is being used. The second reviewer also mentioned that even in ideal survey circumstances, variability in spatial distribution will still exist and that should be clarified. Clarification was requested on the relative exploitation rate and this will be provided in the documents to be distributed to stakeholders.

MANAGEMENT STRATEGY EVALUATION

The presentation continued after a short break on the MSE-based science advice. The new MPs suggested by the participants at the last MSE meeting were presented. During a pause in the presentation to allow for questions, a reviewer questioned the inclusion of MPs that did not pass and it was explained that they were included at the request of industry. Clarification on the projections were addressed by T. Barrett. Concerns about the relationship between the weir catches and the SWNS/BoF Total Allowable Catch (TAC) were expressed and acknowledged but were outside of the scope of this meeting as they were addressed in the MSE framework CSAS review meeting. Clarification was also provided on the dot plots for each MP and the legend was explained. A participant questioned the methodology used to determine MP failure; however, it was explained that this was already discussed in the MSE framework CSAS review meeting and was outside the scope of this meeting. The participant expressed disagreement with the idea that this was already settled at a previous meeting.

SUMMARY OF REBUILDING MANAGEMENT PROCEDURES

After the summary was provided there was some discussion around what would happen if an MP indicating zero catch were approved, what the implications would be on the weir fishery. This, however, was a resource management question and outside the scope of this meeting.

A short presentation on determining if exceptional circumstances have occurred for the SWNS/BoF component based on the 2021 fishery data initiated some comments from participants regarding the broad variability in the projected acoustic index. The reason for the wide variability was that when the number of simulations were increased from the last MSE meeting (from 200 to 1,000), the 95th percentiles also increased. A participant questioned if there was a more informative method without needing an extreme value to trigger an exceptional circumstance. T. Barrett agreed and suggested that it may be beneficial to calculate the percentile rank of the observation instead of a strict cutoff of the 95th percentile. A reviewer also commented on the lack of using a modeled mean for the weight-aged projections and cautioned that there may be issues if the observed mean is used. Participants sought clarity on the exceptional circumstance of estimates of SSB from a secondary spawning ground in the SWNS/BoF stock area becoming significant in magnitude. It was emphasized that Brown's Bank be included in this analysis. The process to be followed if an exceptional circumstance were to be triggered was reviewed.

Review the extent to which IFMP and rebuilding goals are being met

After the presentation, wording modifications were suggested by participants and will be applied to the working document. Participants observed that the 3-year moving average SSB appeared stable in recent years (2016-2021) but the overall time series depicts a decreasing trend. It was noted by resource management that the IFMP was last finalized in 2020 and is up for review, emphasizing that it is an "evergreen" document that changes when appropriate. The data indicate that the objective of maintaining the 3-year moving average SSB above the LRP and rebuilding the herring resource to levels similar to 2001–2004 level are not being met. Suggestions were made to improve wording on limiting small fish removals. On the objective in the short-term rebuilding plans, there was general consensus that there should be more specificity on the management measures that are being met. Text on industry's monitoring of the removal of small fish and the implementation of their own management measures will be added to the document. It was also suggested to add that the analysis of the full time range was considered when determining if biomass was being maintained in each spawning component.

Participants offered suggestions to improve the clarity of the wording on the section on "Uncertainties." Uncertainties around acoustics were briefly discussed with mention of co-developing a direct identification program with Groundfish similar to what has been done in Norway but more data are needed. In the interest of time, the Chair recommended the meeting proceed with reviewing the summary bullets.

REVIEW OF SAR SUMMARY BULLETS

With the guidance of the Chair, participants reviewed the summary bullets and any edits or suggested changes were made directly in the document.

- Landings of the 2020 and 2021 fisheries did not exceed the TAC of 35,000 t for each year for SWNS/BoF component...
 - Suggestion to add the gear type in the bullet

-
- Although there is uncertainty associated with the acoustic estimates of spawning stock biomass (SSB)
 - Suggestion to be more specific about the timeline.
 - State uncertainties associated with the annual acoustic index.
 - Since 2018, the three-year moving average of SSB...
 - On this bullet it was suggested that reference be made to SSB as the acoustic index.
 - Trinity Ledge...
 - Review the effort over time period and note if there is consistent effort
 - Mention Trinity in an historical context.
 - Mention survey effort has been variable over time.
 - Some discussion on whether to keep this as a point or move to the text. Consensus was reached to keep the bullet and to add Seal Island as both areas were historically large spawning components that have not recovered.
 - Weight at age
 - Mention that weight at age increased for stages 1–2 and decreased for stages 5–6 since 1970.
 - It was suggested to include the observation of a slight increase in the last couple of years but the reviewers noted that two years does not indicate a trend, especially with the amount of variability that has been seen in this stock.
 - There was an observation noting that the weights of Ages 3 and 4 are at the lowest they have been in the entire time series. There was a suggestion to make a statement about the high catch of Age 2 or absence of Age 2 in previous document which may allude to a potential recruitment failure. A reviewer cautioned again that two consecutive years does not mean there is a trend; however, this does warrant to be documented. It was decided to add this point to the text rather than to the bullet.
 - Southwest New Brunswick Migrant Juveniles
 - Suggested mention of variability year-to-year affected by market effort and fish availability.
 - Probability of rebuilding and exceptional circumstances
 - There were discussions on whether or not the management procedures were compliant with the precautionary approach (PA).
 - A reviewer mentioned that it may be better to make a list of the MP's that passed and not the whole selection of MP used.

Following the review of the bullets, the Chair asked if participants were comfortable with the bullets as they have been edited herein and there were no comments.

The meeting concluded with the Chair acknowledging the participants willingness to engage in a respectful manner. It was noted that there was a lot of information to cover in a short time period and that the draft SAR from the meeting will be circulated by email. Participants expressed their appreciation for efforts of the Science Lead in presenting the material and the work that has been completed. A participant commented on the challenges of dealing with uncertainties and recognize that it is difficult to conduct science when there are so many uncertainties. Appreciation was expressed to industry for their dedication to the resource and acknowledgement was made of their respectful conduct when expressing concerns. A reviewer stated that some of the issues this stock faces have been seen outside of Canada, as well as

concerns with regard to the MSE process. The meeting ended with the Chair opening the group to provide written comments post-meeting even if they have already been expressed in meeting.

REFERENCES CITED

- Barrett, T.J. 2023. [Southwest Nova Scotia/Bay of Fundy Herring: Management strategy evaluation framework](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2023/061. iv + 25 p.
- Carruthers, T.R., Hordyk, A.R., Huynh, Q.C., Singh, R., and Barrett, T.J. 2023. [A framework for conditioning operating models for the Southwest Nova Scotia/Bay of Fundy spawning component of 4VWX Herring](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2023/022. v + 103 p.
- DFO. 2018. [2018 Assessment of 4VWX Herring](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2018/052.

APPENDIX A: AGENDA

Stock Assessment of Herring in Northwest Atlantic Fisheries Organization (NAFO) Fishing Areas 4VWX

Regional Peer Review – Maritimes Region
March 31st, 2022

Meeting Chair: Darek Moreau

09h30-10h00	
Opening Remarks	Lead: Darek Moreau
<i>Welcome, introductions, and review of CSAS process</i>	
10h00	
Presentation/Discussion	Lead: Allan Debertain
1) <i>Update of landings and acoustic survey indices for coastal and offshore spawning components</i> 2) <i>Update of SWNB migrant juvenile fishery.</i>	
12h00 – 12h30	
<i>Lunch Break</i>	
12h30	
Presentation/Discussion	Lead: Allan Debertain
3) <i>Update of landings and acoustic survey indices for SWNS/BoF component.</i> 4) <i>Evaluation of the fishery with respect to the conservation LRP for the SWNS/BoF component.</i> 5) <i>Probability of rebuilding above the LRP for projection period for selected MPs.</i> 6) <i>Evaluation of whether exceptional circumstances have occurred for SWNS/BoF</i> 7) <i>Review the extent to which IFMP and rebuilding goals are being met.</i>	
Wrap Up	Lead: Darek Moreau
17h00 – End of day	

APPENDIX B: TERMS OF REFERENCE

Stock Assessment of Herring in Northwest Atlantic Fisheries Organization (NAFO) Fishing Areas 4VWX

Regional Advisory Meeting – Maritimes Region

March 31, 2022
Virtual meeting

Chairperson: Darek Moreau

Context

Atlantic Herring (*Clupea harengus*) is a pelagic species found on both sides of the North Atlantic. The Northwest Atlantic Fisheries Organization (NAFO) 4VWX management unit contains a number of Herring spawning areas. For the purposes of evaluation and management, the 4VWX Herring fisheries are divided into four components:

1. Southwest Nova Scotia/Bay of Fundy (SWNS/BoF) spawning component (also '4WX' in management plan);
2. Offshore Scotian Shelf banks spawning component;
3. Coastal (South Shore, Eastern Shore and Cape Breton) Nova Scotia spawning component; and
4. Southwest New Brunswick (SWNB) migrant juveniles.

The Georges Bank spawning component (5Z) is not included in this evaluation except to document Canadian fishing activity.

A framework review was conducted from 2019 to 2022 for the Southwest Nova Scotia/Bay of Fundy (SWNS/BoF) spawning component (Barrett 2022¹, Carruthers et al. 2020²). This science advisory process will use the 2022 assessment framework to determine whether exceptional circumstances have occurred. The status of the SWNS/BoF component will be compared to the limit reference point (LRP; DFO 2012). The probability of rebuilding SWNS/BoF component above the LRP will be evaluated based on the MSE modeling framework. Stock status of the other spawning components for the 4VWX Herring stock will also be reported using indicators based on the 2018 stock assessment (DFO 2018).

Objective

Review and update biological and fishery information on 4VWX Herring stock status to assist with quota recommendations for 2022 fisheries, as required in the Integrated Fisheries Management Plan, including but not limited to:

- Evaluation of the indicators for the SWNS/BoF spawning component.

¹ Barrett, T.J. Southwest Nova Scotia/Bay of Fundy Herring: Management Strategy Evaluation Framework. DFO Can. Sci. Advis. Sec. Sci. Res. Doc. In Prep.

² Carruthers, T.R., Hordyk, A.R., Huynh, Q.C., Singh, R., and Barrett, T.J. A framework for conditioning operating models for the southwest Nova Scotia/Bay of Fundy spawning component of 4VWX Herring. DFO Can. Sci. Advis. Sec. Sci. Res. Doc. In Press.

-
- Review and Update of information regarding the Offshore Scotian Shelf spawning component and Coastal Nova Scotia spawning component, including update survey results.
 - Update of the Southwest New Brunswick migrant juvenile fishery component.
 - Evaluation of the fishery with respect to the conservation LRP for the SWNS/BoF component.
 - Review the runs of the predetermined candidate Management Procedure(s) (MP) simulation tests on the Reference Set of Operating Models for the SWNS/BoF component.
 - Provide advice on the probability of rebuilding above the LRP over the projection period for each predetermined candidate MP when applied as a Harvest Control Rule for the SWNS/BoF component.
 - Determine if exceptional circumstances have occurred for the SWNS/BoF component.
 - Advise on recovery and rebuilding of 4VWX Herring, including a review of whether the goals of the rebuilding plan are being met.

Expected Publication

- Science Advisory Report
- Proceedings

Participation

- DFO Science
- DFO Resource Management
- Indigenous organizations
- Industry (commercial fishing industry)
- Environmental non-governmental organizations
- External experts

References

DFO. 2018. [2018 Assessment of 4VWX Herring](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2018/052.

Clark, D.S., Clark, K.J., Claytor, R., Leslie, S., Melvin, G.D., Porter, J.M., Power, M.J., Stone, H.H., and Waters, C. 2012. [Limit Reference Point for Southwest Nova Scotia/Bay of Fundy spawning component of Atlantic herring, \(*Clupea harengus*\) \(German Bank and Scots Bay\)](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2012/025.

APPENDIX C: LIST OF PARTICIPANTS

Participants at the Maritimes Regional Peer-Review virtual meeting on Stock Assessment of Herring in Northwest Atlantic Fisheries Organization (NAFO) Fishing Areas 4VWX, March 31, 2022.

Name	Affiliation
Barrett, Tim	DFO Science, Maritimes Region
Cawthray, Jenness	DFO Fisheries Management, National Capital Region
Chandler, Alan	NS Department of Fisheries and Aquaculture
Cieri, Matthew (Reviewer)	State of Maine Department of Marine Resources
Collier, Lynn	DFO Science, Maritimes Region
Corey, Peter	Comeau Seafoods
Debertin, Allan (Lead)	DFO Science, Maritimes Region
d'Eon, Sherman	Cape Breeze Seafoods Ltd.
Depres, Lise	Comeau Seafoods
Deroba, Jon	National Oceanic and Atmospheric Administration - Northeast Fisheries Science
Doucette, Brandon	Turpentine Seiners Limited
Greenlaw, Michelle	DFO Science, Maritimes Region
Hatt, Terry	NB Department of Agriculture, Aquaculture and Fisheries
Hooper, Tony	Connors Brothers Clover Leaf
Kaiser, Tim	Scotia Garden Seafood Inc.
McIntyre, Tara	DFO Science, Maritimes Region
Mclsaac, Ian	Seafood Producers Association of Nova Scotia
Melvin, Gary	Herring Science Council
Mitchell, Lillian	Fundy North Fishermen's Association
Mitchell, Vanessa	Maritime Aboriginal Peoples Council - Maritime Aboriginal Aquatic Resources Secretariate
Moreau, Darek (Chair)	DFO Science, Maritimes Region
Munden, Jenna	Herring Science Council
Murphy, Chris	William R. Murphy Fisheries Ltd.
Murphy, Hannah	DFO Science, Newfoundland and Labrador Region
Derek Osborne	DFO Science, National Capital Region
Pardo, Sebastián	Ecology Action Centre
Quigley, Sara	DFO Fisheries Management, Maritimes Region
Reader, Jeffrey	DFO Fisheries Management, Maritimes Region
Saulnier, Billy	Comeau's Seafoods Limited
Saulnier, Brian	Seacrest Fisheries
Schleit, Katie	Oceans North
Singh, Rabindra	DFO Science, Maritimes Region
Small, Tiffany	DFO Science, Maritimes Region
Stephenson, Rob	DFO Science, Maritimes Region
Stirling, Roger	Seafood Producers Association of Nova Scotia
Townsend, Kathryn	Maritime Aboriginal Peoples Council - Maritime Aboriginal Aquatic Resources Secretariate
Turcotte, François	DFO Science, Gulf Region
van Beveren, Elisabeth (Reviewer)	DFO Science, Quebec Region
Walsh, Matt	Connors Brothers Clover Leaf
Wang, Yanjun	DFO Science, Maritimes Region
