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Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2020/010

Maritimes Region

Proceedings of the Regional Peer Review of the Stock Assessment of NAFO Divisions 4VWX Herring

Meeting dates: April 11–12, 2018
Location: Dartmouth, NS

Chairperson: Jennifer Ford
Editor: Lottie Bennett

Bedford Institute of Oceanography
Fisheries and Oceans Canada
1 Challenger Drive, P.O. Box 1006
Dartmouth, Nova Scotia B2Y 4A2

May 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 of the Stock Assessment of NAFO Divisions 4VWX Herring. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2020/010.

Aussi disponible en français :

MPO. 2020. Compte rendu de l'examen par les pairs régional de l'évaluation des stocks de hareng dans les divisions 4VWX de l'OPANO. Secr. can. de consult. sci. du MPO, Compte rendu 2020/010.

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SUMMARY

A regional peer review meeting was held on April 11–12, 2018, at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia to assess the stock status of Herring in Northwest Atlantic Fisheries Organization Divisions 4VWX. As set out in the Terms of Reference, the focus of the meeting was to evaluate stock status of the southwest Nova Scotia/Bay of Fundy (SWNS/BoF) spawning component, review information regarding the offshore Scotian Shelf and coastal Nova Scotia spawning components and the southwest New Brunswick migrant juvenile fishery component, evaluate the use of the turnover acoustic survey biomass estimate, and to propose an Upper Stock Reference (USR). Participation in this meeting included DFO Science and Resource Management, provincial government, Aboriginal organizations, the fishing industry, environmental non-government organizations, and academic researchers.

In 2012, a conservation Limit Reference Point (LRP) for the SWNS/BoF Herring spawning component (German Bank and Scots Bay) was identified as the 2005–2010 average acoustic survey biomass (371,067 t). A 3-year running average of the combined acoustic estimates on German Bank and Scots Bay is used to determine the state of the stock in relation to the LRP. In 2017, this average decreased to the LRP for the first time since 2011.

During the 2014 assessment, it was noted that fish abundance could be over or under-estimated using the acoustic survey approach. The methodology to account for double-counting was reviewed and accepted. These results were used to revise the acoustic spawning stock biomass estimates for the entire time series, including the LRP.

Two USR proposals were discussed at the meeting. As no consensus was reached on either proposal, no USR recommendation was put forward from this meeting.

This proceedings document includes a summary of the presentations and is a record of the meeting discussions and conclusions. A Science Advisory Report and Research Documents resulting from this meeting will be published on the Canadian Science Advisory Secretariat's (CSAS) Website as they become available.

INTRODUCTION

Atlantic Herring (*Clupea harengus*) is a pelagic species found on both sides of the North Atlantic. The majority of Herring in the Northwest Atlantic Fisheries Organization (NAFO) Divisions 4VWX (herein referred to 4VWX Herring) mature and spawn at three to four years of age, then begin a pattern of spawning, over-wintering and summer feeding, which often involves considerable migration and mixing with members of other spawning components and stocks. Fishing primarily occurs on dense summer feeding, over-wintering, and spawning aggregations and has been dominated by purse seine, gillnet, weir, shutoff and trap.

The 4VWX management unit contains a number of spawning areas that are divided into four components: southwest Nova Scotia/Bay of Fundy (SWNS/BoF) spawning component, Offshore Scotian Shelf banks spawning component, coastal (South Shore, Eastern Shore and Cape Breton) Nova Scotia spawning component, and the southwest New Brunswick migrant juveniles.

The last peer reviewed stock assessment was conducted in March 2013 and was consistent with the stock framework adopted in January 2011. The last stock status update was completed in April 2017. As part of the regional peer review process, a Regional Advisory Process was held on April 11–12, 2018, at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia, to evaluate stock status of southwest Nova Scotia/Bay of Fundy spawning component, review information regarding the offshore Scotian Shelf and coastal Nova Scotia spawning components and the southwest New Brunswick migrant juvenile fishery component, evaluate the use of the turnover acoustic survey biomass estimate, and to propose an Upper Stock Reference (USR).

The meeting Chairperson, Jennifer Ford, introduced herself, followed by an introduction of meeting participants (Appendix 1). The Chair thanked meeting participants for attending the DFO Regional Peer Review Process, provided a brief overview of the Canadian Science Advisory Secretariat (CSAS) peer review process and invited participants to review the meeting Terms of Reference (Appendix 2) and Agenda (Appendix 3).

To guide discussions, four working papers had been prepared, three of which would be produced as research documents upon acceptance. The meeting Chair noted that the meeting Working Papers are intended for meeting discussion, and they are not to be used in any other forum, distributed, or cited. This Proceedings document constitutes a record of meeting discussions and conclusions, and any statements within should not be attributed as being consensus-based.

PRESENTATION AND DISCUSSION

HERRING ACOUSTIC SURVEYS IN NAFO DIVISON 4VWX

Working paper: Summary of 2015, 2016, and 2017 Herring Acoustic Surveys in Northwest Atlantic Fisheries Organization (NAFO) Divisions 4VWX. CSAM Working Paper 2018/06.

Science Leads: R. Singh, A. MacIntyre, J. Munden, A. Clay, D. Knox, and G.D. Melvin

Rapporteur: L. Bennett

Presentation Summary

Automated acoustic recording systems deployed on commercial fishing vessels were used to document the distribution and relative abundance of Atlantic Herring in the Bay of Fundy and coastal Nova Scotia area within NAFO Divisions 4VWX. During the years 2015–2017, regularly

scheduled surveys, at approximately 14 day intervals, were conducted on the main Herring spawning components, and the spawning stock biomass for each component was estimated by summing these results. Structured surveys were conducted each year from 2015–2017 in Scots Bay, German Bank and Trinity Ledge areas. Surveys were only conducted in the Spectacle Buoy area in 2017. In most cases, these surveys provided good coverage of the spawning areas consistent with established protocols.

The overall biomass estimate for Scots Bay, German Bank and Trinity Ledge (known as the SWNS/BoF stock) decreased slightly in 2015 to 385,564 t, decreased again in 2016 to 264,087 t and increased in 2017 to 325,900 t. The 2014 and 2015 estimates were above the long-term average, while the 2016 and 2017 biomass estimates were below. These estimates provide mixed indications with regards to the SWNS/BoF stock. The German Bank spawning biomass estimate has decreased at an average annual rate of 9% since 2011. The biomass of spawning fish estimated to be on Trinity Ledge from 2015 to 2016 is low relative to values observed in the early 2000s; however, there was a substantial increase in the Spawning Stock Biomass (SSB) on Trinity Ledge in 2017. While there are fluctuations occurring, the long-term trend in Scots Bay area is upward.

Biomass estimates from surveys of the coastal Nova Scotia spawning components for the Little Hope/Port Mouton, Halifax/Eastern Shore and Glace Bay areas were also examined. Between 4 and 10 surveys were completed each year in Little Hope/Port Mouton and Halifax/Eastern Shore, while no surveys were completed in the Glace Bay area. In 2015, a historic high was observed in Little Hope followed by a 57% decrease in 2016 and an 8% increase in 2017. The total spawning biomass estimate for the Halifax/Eastern Shore area increased substantially in 2015, decreased in 2016 and increase again in 2017.

Discussion

Acoustic Surveys of Southwest Nova Scotia/Bay of Fundy Spawning Components

The method used to calculate biomass estimates from the acoustic survey was discussed. Stock status evaluation of 4VWX Herring relies on the spawning stock biomass estimates derived from industry acoustic surveys. It was clarified that area backscatter is converted to the number of fish using the target strength (length dependent) of an individual fish. If length frequency samples are not collected or the fishing gear is selective, a 28 cm fish is used in the target strength calculation. The average weight of the fish is used to estimate the spawning stock biomass. The target strength is calibrated using international standard calibration protocols with a tungsten-carbide sphere of known target strength.

Acoustic Survey of Scots Bay and German Bank

The timing of surveys completed in Scots Bay and German Bank was discussed. As per the survey protocol, surveys are currently completed between 10–14 days of each other, and it was questioned why surveys were completed less than 10 days apart on German Bank. The timing of industry-based surveys is dictated by favourable weather conditions and perceived biomass of spawning Herring. Poor weather conditions on German Bank resulted in surveys that were not completed in accordance with the timeframes prescribed in the survey protocol. The concern of double counting of fish in surveys not completed in accordance with the survey protocol was highlighted. The content of this discussion is captured within the “Herring Biomass Turnover Rates” section within this proceedings document.

Surveys may be completed by industry in a short time frame to ensure a spawning wave is not missed. The survey protocol is designed to be flexible by allowing a larger biomass estimate

from a second survey completed within the ten day time frame to be used while disregarding the smaller biomass estimate from the previous survey.

ASSESSMENT OF 4VWX HERRING

Working paper: 2018 Evaluation of Northwest Atlantic Fisheries Organization (NAFO) Divisions 4VWX Herring. CSAM Working Paper 2018/07.

Science Leads: R. Singh, D. Knox, A. MacIntyre, and G.D. Melvin

Rapporteur: L. Bennett

Presentation Summary

The 2018 evaluation of 4VWX Herring considered the data from the 2014-2015, 2015-2016 and 2016-2017 quota years. Quota landings of Atlantic Herring (*Clupea harengus*) for each of the years were 49,204 tonnes (t), 50,012 t and 39,430 t, respectively. The total allowable catch for the SWNS/BoF component for the corresponding years was 50,000t, 50,000 t and 42,500 t, respectively. The SSB estimates decreased in 2016 and increased in 2017 to 6% below the long-term average and are at the lowest estimated levels since the surveys began. Fluctuations in the biomass estimates occurred in both Scots Bay and German Bank. Data on the fishery catch-at-age were presented. The proportion of the catch Age 5+ has decreased from the 2013 high of 35%.

Landings from the Offshore Scotian Shelf banks increased from the historical low of 58 t in 2014 to 3,955 t in 2017. Herring abundance in the DFO Summer Research Vessel Survey in 4VWX showed an increase in abundance in the last three years. This survey has not been considered indicative of overall abundance due to changes in catchability and an inability to track year-class for Herring. Landings in the gillnet and trap net fisheries along the coast of Nova Scotia increased from 2014 to 2017. In the Little Hope/Port Mouton area, the surveyed acoustic biomass increased to a historic high of 145,396 t (2015) followed by a decrease to 61,408 t (2016) and an increase to 66,815 t (2017), to be below the five-year average. There was a substantial increase in the surveyed acoustic biomass in the Halifax/Eastern Shore area in 2015. This was followed by a decrease in 2016 and increase in 2017, to be above both the 5-year average and the long-term average. No survey was completed near Glace Bay during the reporting period, and minimal landings of 4t were reported in 2016 only.

Landings in the New Brunswick weir and shut-off fishery decreased to a historic low of 146 t in 2015, increased to 4,060t in 2016, and then decreased to 2,102t in 2017. The fish caught in the New Brunswick weir and shutoff fishery were primarily juveniles; however, older fish were caught in the weirs in 2017, which is a departure from what was being caught in the recent years. The success of this passive trap fishery has been historically unpredictable and landings have declined markedly from the 1980s to present. Landings may not be indicative of abundance because catches are extremely susceptible to many factors in addition to abundance, including effort.

Discussion

Southwest Nova Scotia/Bay of Fundy Stock Component

There was a discussion on the observed changes in size of Age 2 and Age 3 Herring. It was questioned what was contributing to this change and whether Herring are spawning at an earlier age. There are a number of factors, including changes in the fishery and/or the environment, that could contribute to changes in size-at-age. It is currently assumed that 50% of Age 3 Herring spawn; however, it is unknown whether the observed decrease in weight-at-age impacts

spawning. It was recommended that an analysis of weight-at-age and maturity-at-length data be completed to determine if there has been a shift in the age of maturity. It was also noted that stomach content data is currently being collected and a preliminary evaluation of diet is being undertaken by the Herring assessment team to determine if diet may be contributing to the difference in size-at-age.

There was a discussion of results that suggest that the mean size of Herring has declined. In situations where length-frequency samples are not collected and the standard 28 cm is used in the target strength calculation, the abundance estimate is underestimated if the actual fish size is smaller than 28 cm. In addition, the decrease in Herring condition factor may cause the relationship between target strength and fish length to change. Participants suggested that condition factor be examined to establish whether it affects target strength.

Participants inquired whether mean length or weight for the different spawning areas has been calculated. It was clarified that catch-at-age is tracked for the major spawning grounds but the values have not been calculated for all the individual spawning areas.

Offshore Scotian Shelf Spawning Component

Given the proximity of the offshore and coastal fishing areas, participants questioned whether fish targeted within each fishing area are part of the same spawning component. Participants were concerned that the Offshore allocation may be too high, especially if the same spawning component are being targeted in the coastal area. While data from tagging studies (Mouland et al. 2003) are available, additional tagging and/or DNA research is needed to address this question.

General Comments

It was noted that the working paper would benefit from additional information concerning the methods used to complete the assessment.

One of the three conservation objectives within the Scotia-Fundy Herring Integrated Fisheries Management Plan is to prevent growth overfishing by continuing to strive for fishing mortality (*F*) at or below $F_{0.1}$. It was questioned whether $F_{0.1}$ was an appropriate reference point as it may be too high to accomplish the third conservation goal of maintaining ecosystem relationships. Until a modelled stock assessment approach is implemented, fishing morality levels cannot be evaluated. Currently, estimates of relative exploitation rates are calculated for different spawning grounds and the overall SWNS/BoF component from acoustic SSB estimates and landings from individual spawning areas. It was highlighted that a review of *F* levels was outside the scope of the assessment meeting and was recommended for review at the next Framework assessment meeting. Participants also noted that the stated conservation objectives apply to all spawning components; however, reporting on those objectives is only being completed for the SWNS/BoF spawning components. It was suggested that, moving forward, objectives for each different spawning component be considered.

Within the assessment, there are numerous sources of uncertainty that are difficult to quantify. For example, the decrease in the average weight of Herring may impact standard target strength. This bias could be reduced by adjusting the average weight of herring in the standard target strength equation. In addition, standard error may not be a suitable measure of variance as it indicates the spatial distribution of error, which is important when subsampling the population; however, in this assessment, the whole area is being sampled. It was recommended that the working paper consider the sources of uncertainty and the work completed to address them.

UPPER STOCK REFERENCE FOR THE SOUTHWEST NOVA SCOTIA/BAY OF FUNDY SPAWNING COMPONENT OF ATLANTIC HERRING

Working paper: Upper Stock Reference for the Southwest Nova Scotia/Bay of Fundy Spawning Component of Atlantic Herring (*Clupea harengus*). CSAM Working paper 2018/09

Science Lead: K. Clark

Rapporteur: L. Bennett

Presentation Summary

The Precautionary Approach (PA) provides guidance on setting reference points for fisheries management (DFO 2009). A harvest strategy compliant with the PA guidance includes a Removal Reference for three stock status zones (Healthy, Cautious, Critical) delineated by a Limit Reference Point (LRP) and an USR. Stock status is usually represented by SSB or a suitable proxy. Default LRP and USR based on biomass are defined as 40% Biomass at Maximum Sustainable Yield (B_{msy}) and 80% B_{msy}, respectively, with the LRP demarking the boundary between the Critical and Cautious zones and the USR demarking the boundary between the Cautious and Healthy zones. In the absence of this information, other approaches can be used to identify the LRP and USR.

The LRP for the SWNS/BoF Spawning Component was identified in 2012 as the 2005–2010 average acoustic survey value for German Bank and Scots Bay combined (Clark et al. 2012). The proposed USR is twice the LRP. If the methodology proposed in Melvin et al. (2014) was accepted for calculating the acoustic biomass on the spawning grounds, the revised LRP and USR are 316,313 t and 632,626 t, respectively.

Discussion

An alternative approach to doubling the LRP to establish an USR was suggested by industry. The current LRP was adopted in 2012 and is a proxy for SSB using the acoustic survey index period from 2005–2010, which was considered a lower level in the time series. The fishery does not have a quantitative model and establishing a USR by doubling the LRP was not considered consistent with how the LRP was established. Industry proposed using the highest level in the time series, the average of the acoustic survey biomass from 1999–2004, as the USR. This proposal would meet one of the short-term objectives of the Rebuilding Plan, which is to rebuild the herring resource to an interim target of the 2001–2004 SSB level. Using the updated spawning ground turnover rates, the proposed USR would be 424,000 t. The establishment of a target reference point, which would represent a target for rebuilding above the USR, was also suggested.

Aspects of both USR proposals were discussed. While SSB estimates are not available prior to 1999, it was noted that SSB values must have been higher than the average of the 1999–2004 time series, given the higher landings during that time. The 1999 SSB value reflects a period when the stock had experienced a decline. It was suggested that selecting a USR that is indicative of a period when the stock was declining is setting the reference point too low. It was also noted that the Rebuilding Plan does not indicate that the average 2001–2004 SSB be used as the USR; rather it was a short-term target and not the long-term goal. Alternatively, some participants indicated that SSB estimates prior to 1999 include values for spawning stocks that are no longer viable and are not included in the current survey design or SSB estimates. Using the highest SSB values in the time series ensures that values from comparable areas are being used. Given the current and expected changes in the ecosystem and environment, SSB values

from the recent past may be indicative of values that are realistic and achievable moving forward.

The use of a proxy for B_{msy} was discussed. Given the available data and lack of a B_{msy} estimate, it is unknown whether the current LRP and proposed USR reflect 40% and 80% B_{msy} of the population or what constitutes a healthy population given changing environmental conditions.

It was suggested that DFO guidance on developing reference points in response to changes in productivity regimes should be consulted and a sensitivity analysis be completed prior to establishing an USR.

No consensus was reached on the establishment of a USR. Both proposals (doubling the current LRP or using the average of the 1999–2004 time period) will be presented in the Science Advisory Report produced from this meeting, with a decision being reached at either the upcoming Herring framework or advisory committee meeting.

UPDATES ON HERRING RELATED RESEARCH

During the assessment meeting, the following presentations on Herring related research were provided. The results of studies that examined the genomic structure of Herring in the northwest Atlantic, temporal trends of genomic differentiation between spawning season components, results of plankton sampling on spawning grounds, and the long-term trends in the status of Herring in a Northwest Atlantic ecosystem were presented. The results of these research studies were not incorporated into this assessment.

Presenter	Title
A. Fuentes-Pardo	The Genomic Structure of Atlantic Herring in the Northwest Atlantic: Spatial and Spawning Season Components
Q. Kerr	Temporal Stability of Genomic Differentiation between Spawning Season Components in Atlantic Herring
D. Boyce	Long-term trends in the Status of Atlantic Herring in a Northwest Atlantic Ecosystem
J. Munden	Results of Plankton Sampling on Spawning Grounds

HERRING BIOMASS TURNOVER RATES

Working paper: Updated Herring Spawning Biomass Estimates for German Bank and Scots Bay Based on Spawning Ground Turnover Rates from Tag Returns. CSAM Working paper 2018/08

Science Lead: G. Melvin, R. Singh, R. Martin, and M.J. Power

Rapporteur: L. Bennett

Presentation

Acoustic biomass estimates based on turnover estimates presented at the Herring Assessment meeting in March 2013 and published in Melvin et al. (2014) were updated. In addition to updating the acoustic biomass estimates based on turnover to the current year (2017), the data and calculations used in 2013 were rechecked for accuracy and the biomass estimates amended where necessary. The acoustic biomass estimates were then analysed and presented

in a manner and format as was done in the acoustic summary document (Singh et al. 2016) including the determination of the three-year moving average and the Limit Reference Point.

Discussion

During the 2013 Herring assessment, it was noted that fish abundance could be over or under-estimated using the acoustic survey approach. The methodology to account for double-counting presented in Melvin et al. (2014) was reviewed. Mark-recapture methods were used to estimate the proportion of fish remaining on the spawning grounds relative to the elapsed time between surveys. This method was considered an improvement over the previous method since turnover rate is used as a continuous rather than a discrete process. There was concern with the error associated with the steep part of the slope of the regression plot of biomass versus days, especially within the first 7 days between surveys. As a result, there may be an overestimate bias with surveys occurring in short time frames. It was recommended that another tagging study be completed to determine if the estimates of turnover are still accurate. Implementation of turnover rates will not account for fish that have moved into an area, spawned, and left in between surveys. It was suggested the survey protocol be examined during the next framework.

Consensus was reached on using the Melvin et al. (2014) method, which revised the acoustic SSB for the entire time series, including the LRP. Participants acknowledge that this method could provide flexibility; however, there was agreement to retain the current survey protocol of 10–14 days between surveys.

It was suggested that the gonadal state be examined to estimate variability in spawning condition between surveys. To date a spawning wave indicator has not been identified.

Research Recommendations

The need for a new assessment framework for this stock was emphasised during the meeting. Throughout the meeting, suggestions for additional research were noted and are included in the following list. List order is not intended to imply order of priority.

- Commence work to evaluate whether Herring are spawning at an earlier age.
- Commence work to evaluate whether condition factor affects target strength.
- Commence work to evaluate whether fish within the offshore and inshore fishery comprise the same spawning component.
- Develop an analytical approach to stock assessment and to determining fishing mortality rather than a relative exploitation rate.
- Evaluate ecosystem considerations that may be contributing to decreases in weight-at-age.
- Evaluate fishing mortality levels and the ecosystem considerations that may affect them.
- Evaluate the timing between surveys in the current survey protocol.
- Complete a tagging study to determine if the turnover rates indicated in Mevin et al. (2014) continue to be accurate.
- Evaluate length-at-age of Herring in different spawning areas.

DOCUMENTS

It was agreed that the two working papers by Singh et al. (WP 2018/06 and WP2019/07) and the working paper by Melvin et al. (WP2018/08) should be published as Research Documents.

A Science Advisory Report (SAR) will also be published. All meeting products will be published on the Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat's (CSAS) Website as they become available.

This Proceedings document constitutes the record of meeting discussions, recommendations, and conclusions.

REFERENCES CITED

Clark, D.S., Clark, K.J., Claytor, R., Leslie, S., Melvin, G.D., Porter, J.M., Power, M.J., Stone, H.H., 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. iii + 14 p.

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APPENDICES

APPENDIX 1. LIST OF PARTICIPANTS

Name	Affiliation
Anderson, Sam	Fisher-Newfoundland - NAFO Div. 4R
Andrushchenko, Irene	DFO Science, Maritimes Region
Baker, Lori	Eastern Shore Fisherman's Protective Association.
Bennett, Lottie	DFO Science, Maritimes Region
Boyce, Daniel	Fisheries and Oceans Canada
Bundy, Alida	DFO Science, Maritimes Region
Chandler, Alan	Nova Scotia Department of Fisheries & Aquaculture
Clark, Kirsten	DFO Science, Maritimes Region
Clay, Allen	Femto Electronics Limited
Cook, Adam	DFO Science, Maritimes Region
Debertin, Allan	DFO Science, Maritimes Region
d'Entremont, Kim	Comeau's Sea Foods Limited
d'Eon, Glen	Southwest Seiners Co.
d'Eon, Sherman	Cape Breeze Seafoods Ltd.
Ford, Jennifer	DFO Science, Maritimes Region
Fry-Buchanan, Joy	Atlantic Herring Co-op / Full Bay Scallop Association.
Fuentes-Pardo, Angela	Dalhousie University
Grant, Heather	Ecology Action Centre
Hooper, Tony	Connors Bros. Clover Leaf
Hubley, Brad	DFO Science. Maritimes Region
Jayawardane, Aruna	Maliseet Nation Conservation Council
Kaiser, Tim	Scotia Garden Seafood Inc.
Kavanagh, Sana	Confederacy of Mainland Mi’kmaq
Kent, Donald	Eastern Shore Group
Kerr, Quentin	Dalhousie University
Kho, James	Dalhousie University
Landriault, Marc	Comeau Seafoods
Martin, Ryan	DFO Science, Maritimes Region
McDermid, Jenni	DFO Science, Gulf Region
Melvin, Gary	DFO Science, Maritimes Region
Mitchell, Vanessa	Maritime Aboriginal Peoples Council
Munden, Jenna	Herring Science Council
Murphy, Chris	William R. Murphy Fisheries Ltd.
Partington, Peter	Little Hope Fishermens Association
Perrier, Erika	Atlantic Policy Congress of First Nations Chiefs Secretariat
Robicheau, Lloyd	Eastern Shore Fisherman's Protective Assn.
Ruzzante, Daniel	Dalhousie University
Saulnier, Billy	Comeau's Sea Foods Limited
Saulnier, Brian	SeaCrest Fisheries
Saunders, Jennifer	DFO Resource Management, Maritimes Region

Name	Affiliation
Singh, Rabindra	DFO Science, Maritimes Region
Soomai, Suzuette	DFO Fisheries Management, Maritimes Region
Stirling, Roger	Seafood Producers Assn of Nova Scotia
Surette, Dwayne	DFO Conservation & Protection, Maritimes Region
Waters, Christa	DFO Fisheries Management, Maritimes Region

APPENDIX 2. TERMS OF REFERENCE

Terms of Reference

Assessment of Herring in NAFO Divisions 4VWX

Regional Peer Review-Maritimes Region

April 11–12, 2018
Dartmouth, NS

Chairperson: Jennifer Ford

Context

Atlantic Herring (*Clupea harengus*) is a pelagic species found on both sides of the North Atlantic. The majority of Herring in the Northwest Atlantic Fisheries Organization (NAFO) Divisions 4VWX (herein referred to 4VWX Herring) mature and spawn at three to four years of age, then begin a pattern of spawning, over-wintering and summer feeding, which often involves considerable migration and mixing with members of other spawning components and stocks. Fishing primarily occurs on dense summer feeding, over-wintering, and spawning aggregations and has been dominated by purse seine, gillnet, weir, shutoff and trap.

The 4VWX management unit contains a number of spawning areas that are divided into four components: southwest Nova Scotia/Bay of Fundy spawning component, Offshore Scotian Shelf banks spawning component, coastal (South Shore, Eastern Shore and Cape Breton) Nova Scotia spawning component, and the southwest New Brunswick migrant juveniles.

In support of the 2017/2018 and 2018/2019 fisheries, Fisheries and Oceans Canada (DFO) Maritimes Resource Management requested that DFO Science assess the status of the Herring in the 4VWX management unit. The last assessment of 4VWX Herring was conducted in 2015 using a new assessment framework followed by stock status updates in 2016 and 2017 (DFO 2015, DFO 2016, DFO 2017).

Objectives

The objectives of this Regional Advisory Process are:

- Evaluate the status of the southwest Nova Scotia/Bay of Fundy spawning component with respect to the conservation Lower Reference Point.
- Compile and review information regarding the offshore Scotian Shelf and coastal Nova Scotia spawning components and the southwest New Brunswick migrant juvenile fishery component.
- Evaluate the use of the turnover biomass estimate as the main index in assessing the southwest Nova Scotia/Bay of Fundy spawning component.
- Advise on the recovery and rebuilding of 4VWX Herring, specifically, a review of whether the goals of the rebuilding plan are being met.
- Propose an upper stock reference point for 4VWX Herring.
- Review reporting procedures to be used for stock status updates until the next peer reviewed stock assessment meeting.
- Review the assessment schedule, including guidelines for the monitoring of indicators and events that would trigger an earlier than scheduled assessment.

Expected Publications

Include a bulleted list with the types of publications that are expected to be produced from the peer reviewed stock assessment meeting.

- Science Advisory Report(s)
- Proceedings
- Research Document(s)

Expected Participation

- Fisheries and Oceans Canada (DFO) Science and Resource Management
- Provincial Government
- Aboriginal communities/organizations
- Herring Fishing Industry
- Academia

References

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APPENDIX 3. AGENDA

DRAFT AGENDA

Assessment of 4VWX Herring

Regional Peer Review – Maritimes Region

April 11–12, 2018

Lewis King Boardroom
Bedford Institute of Oceanography
Dartmouth, Nova Scotia

Chairperson: Jennifer Ford

DAY 1 (Wednesday, April 11, 2018)

Time	Topic
9:00–9:15	Welcome and Introductions
9:15–10:30	Nova Scotia / Bay of Fundy spawning component
10:30–10:45	Break (hospitality provided)
10:45–12:00	Offshore Scotian Shelf spawning component and coastal Nova Scotia and New Brunswick coastal components
12:00–1:00	Lunch (hospitality not provided)
1:00–1:45	Herring biomass turnover
1:45–3:15	Updates on Herring related research • The genomic structure of Atlantic Herring in the Northwest Atlantic: spatial and spawning season components • Temporal Stability of Genomic Differentiation between Spawning Season Components in Atlantic Herring • Long-term trends in the status of Atlantic Herring in a northwest Atlantic ecosystem • Results of plankton sampling on spawning grounds
3:15–3:30	Break (hospitality not provided)
3:30–4:15	Discussion
4:15–4:30	Wrap up

DAY 2 (Thursday, April 12, 2018)

Time	Topic
9:00–9:15	Recap of Day 1
9:15–10:30	Upper Stock Reference Level
10:30–10:45	Break (hospitality provided)
10:45–12:00	Assessment schedule, triggers, format of updates
12:00–1:00	Lunch (hospitality not provided)
1:00–3:00	Review of Science Advisory Report ctd
3:00–3:15	Break (hospitality not provided)
3:15–3:45	Review of Science Advisory Report ctd
3:45–4:00	Discussion and Wrap - Up