



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 2022/030**

**Quebec Region**

### **Proceedings of the Regional Peer Review of the Assessment of the West Coast of Newfoundland (NAFO Division 4R) Herring (*Clupea harengus*) Stocks in 2022**

**March 1-2, 2022**  
**Virtual meeting**

**Chairpersons: Martin Castonguay and Elisabeth Van Beveran**  
**Editor: Sonia Dubé**

Maurice Lamontagne Institute  
Fisheries and Oceans Canada  
850, Route de la mer, P.O. Box 1000  
Mont-Joli, Québec, G5H 3Z4

---

## 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](mailto:csas-sccs@dfo-mpo.gc.ca)



© Her Majesty the Queen in Right of Canada, 2022  
ISSN 1701-1280  
ISBN 978-0-660-44423-9 Cat. No. Fs70-4/2022-030E-PDF

### Correct citation for this publication:

DFO. 2022. Proceedings of the Regional Peer review of the Assessment of the West Coast of Newfoundland (NAFO Division 4R) Herring (*Clupea harengus*) Stocks in 2022; March 1-2, 2022. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2022/030.

### ***Aussi disponible en français :***

*MPO. 2022. Compte rendu de l'examen régional par des pairs sur l'évaluation du stock de hareng de l'Atlantique (Clupea harengus) de la côte ouest de Terre-Neuve (division 4R de l'OPANO) en 2022; du 1<sup>er</sup> au 2 mars 2022. Secr. can. des avis sci. du MPO. Compte rendu 2022/030.*

---

---

## TABLE OF CONTENTS

SUMMARY .....	iv
INTRODUCTION .....	1
RESOURCE ASSESSMENT .....	1
COMMERCIAL LANDINGS .....	1
COMMERCIAL AND BIOLOGICAL SAMPLING .....	2
SIZE AT 50% MATURITY .....	2
UPDATE OF BIOLOGICAL INDICATORS AND EFFECT OF ENVIRONMENTAL CONDITIONS ON CONDITION .....	2
ACOUSTIC SURVEY .....	3
CONCLUSION .....	4
IDENTIFICATION OF FUTURE RESEARCH WORK .....	4
INTERIM YEARS .....	4
SCIENCE ADVISORY REPORT HIGHLIGHTS .....	4
APPENDIX 1 – TERMS OF REFERENCE .....	6
APPENDIX 2 – LIST OF PARTICIPANTS .....	8
APPENDIX 3 – AGENDA .....	9

---

## **SUMMARY**

This document contains the proceedings of the regional peer review meeting on the assessment of the West Coast of Newfoundland herring stocks (NAFO Division 4R). The meeting, which was held virtually via Zoom on March 1-2, 2022, brought together roughly 30 participants from science, management and the herring fishing industry. These proceedings describe the highlights of the meeting presentations and discussions and outline the recommendations and conclusions resulting from the review.

---

## INTRODUCTION

The Quebec Region of Fisheries and Oceans Canada (DFO) is responsible for assessing a number of fish and invertebrate stocks exploited in the Estuary and Gulf of St. Lawrence. Most of the stocks are periodically assessed as part of a regional peer review process held at the Maurice Lamontagne Institute in Mont-Joli. This document constitutes the proceedings of the West Coast of Newfoundland (NAFO Division 4R) herring stocks assessment meeting held virtually via Zoom on March 1-2, 2022.

The Resource Management and Aboriginal Fisheries Branch requested science advice on these stocks based on data collected during the 2020 and 2021 fishing seasons and acoustic surveys. The purpose of this review was to determine whether changes had occurred in the status of the resource that required adjustments to the management plan based on the conservation approach adopted. The ultimate objective was to provide science advice for the management of West Coast of Newfoundland (4R) herring stocks for the 2022 and 2023 fishing seasons.

These proceedings report on the main points discussed in the presentations and deliberations resulting from the activities of the regional stock assessment committee. Regional peer reviews are a process open to any participant who is able to provide a critical outlook on the status of the assessed resources. Consequently, participants from outside DFO are invited to take part in the committee's activities within the defined Terms of Reference for this review (Appendices 1 and 2). The proceedings also set out the recommendations made by the meeting participants.

## RESOURCE ASSESSMENT

The meeting was chaired by Martin Castonguay and Elisabeth Van Beveren. M. Castonguay went over the objectives and agenda of the science review, as well as the role of the participants. The terms of reference and agenda (Appendix 3) were presented. Participants were then asked to introduce themselves. The biologist responsible for the review, Kim Émond, began the meeting by thanking her collaborators. She presented the highlights of the latest Science Advisory Report. A review of the 4R herring stock assessment framework is planned for 2022–2023. The 4R stock consists of two groups of spawners: spring spawners (April–May) and fall spawners (August–September).

## COMMERCIAL LANDINGS

The biologist presented a short description of the fishery and the landing statistics by unit area, fishing gear and landing date, as well as the spatial distribution of the catches. Preliminary data indicate a total catch of 4,862 t of herring on the west coast of Newfoundland in 2020 and 3,074 t in 2021, with an annual total allowable catch of 20,000 t. The fishery has experienced difficulties due to a high incidence of herring under the legal size.

- It was emphasized that the abundance of small fish affected the efficiency of the fishery in 2020 and 2021. Therefore, the landings do not reflect reality. This abundance of small fish should diminish next year.
- Industry noted a significant increase in spring spawners in 2020 and 2021 that are likely to be recruited to the fishery soon.
- Industry members are observing changes in the ecosystem that warrant a later fishery.

---

## COMMERCIAL AND BIOLOGICAL SAMPLING

For each spawning group, proportions and numbers of individuals were presented for each year, as well as the spatial distribution of the samples, annual total length frequencies and catch-at-age. The proportion of spring spawners in landings increased from a low of 1.6% in 2014 to 89.6% in 2021. Landings of spring spawning herring in 2020 and 2021 were primarily composed of fish from the 2013 year-class (ages 7–8) and, to a lesser extent, fish from the 2017 year-class (ages 3–4). Landings of fall spawning herring in 2020 and 2021 consisted mainly of fish aged 9 years and over.

- It was noted that the number of samples processed in 2021 remained very low. However, the significance of the spring spawners cannot be denied. The graph of spring and fall spawning proportions clearly illustrates the increase in spring herring in the commercial catch since 2014. This is unprecedented, as industry representatives indicated.
- It was noted that most of the samples were from the fall fishery (October to December). Another part is from the August Teleost survey. For more details, please refer to the research document.
- It was noted that the Teleost survey appears to target larger fish compared with the acoustic survey. One more year is needed to detect the cohorts. This may affect the biomass estimate.

## SIZE AT 50% MATURITY

The mean fork lengths at which 50% of individuals were mature (L50) were 24.5 cm and 25.4 cm for spring and fall spawners, respectively. These values are above or near the current minimum size limit of 24.8 cm in the commercial fishery. The L50 of spring and fall spawning stocks has varied around the long-term mean since the 2000 year-class.

- Some participants indicated that the total length measurement appears to be more appropriate than the fork length, as provided for in the regulations. This subject could be discussed at the Advisory Committee meeting.
- There has been a decrease in size-at-age in both spawning groups since the 1990s, but that decrease is more evident in fall spawners. The same phenomenon is observed in Bay of Fundy herring and other fish species.

## UPDATE OF BIOLOGICAL INDICATORS AND EFFECT OF ENVIRONMENTAL CONDITIONS ON CONDITION

Age at 50% maturity (A50) was estimated at 4.85 years for spring spawners and 5.29 years for fall spawners. Both spawning stocks show a declining trend in mean length at age and weight at age since the early 1990s. A recruitment index was calculated from the age composition of the commercial catch, which allows us to see the dominant cohorts or recruitment strength. A relative condition index (Kn) was also estimated. Since 2014, this index has been below the series average for both spawning stocks.

As for the effect of environmental variables on the condition index (Kn), it was noted that the abundance of *Pseudocalanus* is the variable with the greatest effect in spring spawners. Small calanoids, such as *Pseudocalanus*, provide less energy than large calanoids. It appears that the current system is less favourable for the growth of spring spawners. For fall spawners, the abundance of *Calanus finmarchicus* (large calanoid) is the most influential variable. There is a positive relationship of Kn with the abundance of *C. finmarchicus*.

---

A cumulative index of stock productivity is used to integrate the available information ( $K_n$ , length at age 6, recruitment index) and describe temporal trends in herring stock productivity. Since the 2000s, this index has been in the negative anomalies in both spawning groups.

- Questions were raised about the recent increase in the A50. It may be prudent to review the data. With more samples from the fishery occurring primarily in the fall, the picture may change slightly. The A50 will be reassessed next year.
- After a review of possible sources of uncertainty related to the A50 (sample size, uneven representativeness of cohorts, no fish older than 4 years, time of year of survey), no significant differences were observed. Thus, the rise of the A50 seems to be real.
- The recruitment index remains relative and should be considered as an indication only. Care must be taken when comparing one year with another, considering certain changes over time (e.g., size-at-age, legal catch size).
- It was noted that the condition index is lower for fall spawners, which may be related to a difference in their life history and dynamics.
- It was mentioned that the decrease in herring size seems to be more related to changes in the environment than to a density-dependence effect.
- Participants stated that the abundance of *Pseudocalanus* would be favourable for larval stages but less favourable for older herring, because they are less energetically efficient. As for *Calanus hyperboreus*, its role seems to be less important.
- The results obtained for the cumulative indicator seem to reflect a change of regime for herring. A longer time series would provide a better overview. It would also be possible to integrate other indices into this cumulative indicator, notably those from the acoustic survey (e.g. proportion of young fish).

## ACOUSTIC SURVEY

In order to obtain an estimate of herring abundance, a series of fall (October–November) acoustic surveys was conducted (1991–2002, 2009–2021). Another series of summer (August) acoustic surveys began in 2019. The acoustic surveys estimated the highest biomass indices since the start of the survey in 2021 for spring spawners (122,145 t, 95% CI:  $\pm 18,299$  t) and in 2020 for fall spawners (226,005 t, 95% CI:  $\pm 31,942$  t). These values represent minimum estimates of the amount of fish available at the time of the survey.

The proportion of spring spawners in the summer and fall acoustic surveys increased from an average of 7.3% for the 2009–2017 period to an average of 44.6% in 2020 (summer: 44.8%; fall: 40.6%) and 51.5% in 2021 (summer: 22.9%; fall: 75.4%). The spring spawning herring biomass estimates from the 2020 and 2021 acoustic surveys consisted primarily of fish from the 2017 year-class (age 3–4). Estimates of fall spawning herring biomass from the acoustic survey were dominated by the 2016 year-class in 2020 (age 4) and 2021 (age 5). The summer 2021 acoustic survey was dominated by fish aged 8 years and older.

The ratio of the biomass fished to the highest biomass index estimated in the acoustic surveys was considered as an approximation of the maximum exploitation rate. In 2020 and 2021, the maximum exploitation rates for spring spawners were 1.1% (1.0% to 1.2%) and 2.4% (2.1% to 2.9%), respectively, and those for fall spawners were 1.7% (1.4% to 1.9%) and 0.2% (0.2% to 0.4%). If the TAC of 20,000 t had been caught in 2020–2021, the maximum exploitation rates would have been 4.5% to 15.6% (4.2% to 18.6%) for spring spawners and 1.2% to 6.8% (1.1% to 7.9%) for fall spawners.

- 
- It was noted that between 2020 and 2021 there was a change of vessel (CCGS Leim vs. RV Novus). New strata in the Strait of Belle Isle were covered in the last two years, which is considered very useful. In the fall, a significant biomass is observed there. We suspect more favourable conditions (e.g., food, temperature, current).
  - In connection with herring movement and distribution, it was mentioned that the results of an acoustic tagging study will eventually be presented. It was noted that the details of the different approaches will be reviewed at the assessment framework meeting.
  - With respect to the biomass index, it was recalled that there is a bias related to the interannual variability of the survey that can affect catchability (temporal variation in the survey and spatial coverage, change of vessel and fishing gear). This will also be addressed in the review of the assessment framework.
  - Considering these sources of uncertainty, the participants questioned the usefulness of the acoustic survey for stock assessment. Results cannot be compared from one year to the next. The index presented corresponds to a minimum biomass. Thus, the exploitation rates presented do not worry the participants.
  - The results from the acoustic survey seem to confirm the return of spring spawners. Conditions conducive to this return could possibly be explored further.

## **CONCLUSION**

### **IDENTIFICATION OF FUTURE RESEARCH WORK**

The purpose of the work deemed a priority by the members is to:

- Review the assessment framework (part 1: May 17–20, 2022);
- Better understand seasonal migration patterns of herring in the northern Gulf of St. Lawrence;
- Continue the experimental gillnet survey;
- Improve biological sampling during the acoustic survey;
- Review the method of classifying spring and fall spawners; and
- Improve the agreement rate for age estimates between the two otolith readers, especially for ages  $\geq 9$ .

### **INTERIM YEARS**

A review of the assessment framework will take place in 2022 and 2023. The next 4R herring stock assessment is scheduled for winter 2024.

### **SCIENCE ADVISORY REPORT HIGHLIGHTS**

The highlights were presented, and the participants commented on them. The participants changed some of the bullets by removing details they deemed unnecessary and adding details they deemed important.

- When the age composition of landings for spring and fall spawners is discussed, the ages of the cohorts present are specified, but percentages are not given. The same comment applies to the age composition for the acoustic survey.

- 
- With respect to the highlight on the L50, it is suggested that the L50 of spring and fall spawner stocks has varied around the long-term average since the 2000 year-class.
  - In the highlight on the 2021 biomass index estimate, it should be mentioned that these values represent a minimum estimate of the amount of fish available at the time of the survey. It was also proposed to add the confidence intervals.
  - The participants agreed that maintaining the TAC at the status quo should not pose a significant risk to the 4R herring stocks in the short term. Industry members had no doubt about this.

The key finding of the meeting was the following:

The evidence available through 2021 (low exploitation rates, catch-at-age in the commercial fishery and in acoustic surveys, age and length at maturity) indicates that maintaining the TAC at the status quo should not pose a significant risk to 4R herring stocks in the short term.

---

## APPENDIX 1 – TERMS OF REFERENCE

### Assessment of the West Coast of Newfoundland (NAFO Division 4R) herring (*Clupea harengus*) stocks in 2022

#### Regional Peer Review – Quebec Region

March 1-3, 2022

Virtual meeting

Chairpersons : Martin Castonguay and Elisabeth Van Beveren

#### Context

The herring fishery on the west coast of Newfoundland (NAFO Division 4R) is managed by a Total Allowable Catch (TAC) of 20,000 t applied to all catches without differentiating between spawning stocks. The allocation of the TAC among the different fleets is 55% for large purse seiners (vessel > 65'), 22% for small purse seiners (vessel < 65') and 23% for fixed gears.

A first series of acoustic surveys was conducted between 1991 and 2002. A second series of surveys was initiated in the fall of 2009 and continued until 2021. The data collected from these surveys are used to calculate biomass indices for the two spawning stocks.

The last assessment of the two herring spawning stocks in Division 4R was in 2020. During this meeting, the assessment model was rejected as the basis for the science advice, resulting in the rejection of the reference points and the precautionary approach. Biomass indices calculated from acoustic surveys are, along with commercial fishery data, the main source of information used to assess stock status.

The Fisheries and Aquaculture Management Branch has requested a scientific advice on these stocks for the 2022 and 2023 fishing seasons. The purpose of this review is to determine whether changes have occurred in the status of the stock that would require adjustments to the management plan based on the conservation approach adopted.

#### Objectives

Provide a scientific advice of the spring and fall spawning herring stocks in NAFO Division 4R (west coast of Newfoundland) for the 2022 and 2023 fishing seasons. This advice shall include: :

- Analysis of commercial fishery landings following the 2020 and 2021 fishing seasons;
- An update of the main biological indicators from commercial sampling data;
- Analysis of the biological characteristics of samples from the multidisciplinary survey in the estuary and northern Gulf of St. Lawrence;
- An estimation of the current size at 50% maturity (L50) of spring and fall spawning herring;
- Results of the 2020 and 2021 August and fall acoustic surveys;
- Analysis of the effect of environmental conditions on stock productivity (recruitment based on commercial fishery catch-at-age and condition index)
- The identification and prioritization of research projects to be considered for the future.
- Perspectives and/or recommendations on harvest levels for 2022 and 2023 fishing seasons based on available data.

---

**Expected publications**

- Science Advisory Report
- Proceedings
- Research document

**Experted Participation**

- Fisheries and Oceans Canada (Science and Fisheries Management sectors)
- Fishing industry
- Provincial representatives
- Academia
- Aboriginal communities/organizations
- Environmental non-governmental organizations

---

## APPENDIX 2 – LIST OF PARTICIPANTS

<b>Name</b>	<b>Affiliation</b>
Adamack, Aaron	DFO Science
Anderson, Samuel	Large seiner Gulf
Barry, David	Barry Group
Barry, Joe	Barry Group
Barry, William	Barry Group
Beaudry-Sylvestre, Manuelle	DFO Science
Boudreau, Mathieu	DFO Science
Boudreau, Mélanie	DFO Science
Bourne, Christina	DFO Science
Castonguay, Martin	DFO Science
Cawthray, Jenness	DFO Fisheries Management Ottawa
Cogliari, Karen	DFO Science
Comtois, Sophie	DFO Science
Cyr, Charley	DFO Science
Dionne, Hélène	DFO Science
Dooley, Kelley <sup>1</sup>	DFO Fisheries Management, Newfoundland and Labrador
Dubé, Sonia	DFO Science
Dunne, Erin	DFO Fisheries Management, Newfoundland and Labrador
Émond, Kim	DFO Science
Girard, Linda	DFO Science
Hawkins, Laurie <sup>1</sup>	DFO Fisheries Management, Newfoundland and Labrador
Joyce, Michael <sup>1</sup>	FFAW
Lehoux, Caroline <sup>1</sup>	DFO Science
Lévesque, Laurence	DFO Science
Munden, Jenna	Herring Science Council
Paquet, Frédéric	DFO Science
Plourde, Stéphane	DFO Science
Robert, Dominique	UQAR-ISMER
Rousseau, Shani	DFO Science
Scarratt, Michael <sup>1</sup>	DFO Science
Sullivan, Karl	Barry Group
Sutton, Jordan	DFO Science
Smith, Andrew	DFO Science
Tilley, Anna	Province of Newfoundland and Labrador
Van Beveren, Elisabeth	DFO Science

<sup>1</sup> Day 1 only

---

## APPENDIX 3 – AGENDA

### Assessment of the West Coast of Newfoundland (NAFO Division 4R) herring (*Clupea harengus*) stocks in 2022

March 1-3, 2022

Virtual meeting (Zoom)

Chairpersons : Martin Castonguay and Elisabeth Van Beveran

#### March 1<sup>st</sup>, 2022 – Tuesday

---

9:00	introduction and presentation of the participants	Chairperson
9:20	Terms of reference	Chairperson
9:25	Summary of the last Science Advisory Report	K. Émond
9:30	Landings	K. Émond
10:15	Commercial and biological (Teleost survey) sampling	K. Émond
11:00	Catch-at-age	K. Émond
11:15	<b>Break (lunch)</b>	
11:45	Estimation of the current size at 50% maturity (L50)	K. Émond
12:45	Update of biological indicators and effects of environmental conditions on condition and recruitment	K. Émond

---

#### March 2, 2022 – Wednesday

---

9:00	Summary of day 1	Chairperson
9:15	Acoustic survey in 4R	K. Émond
10:45	Break	
11:00	Identification and prioritization of research projects to be considered for the future	K. Émond
11:45	Review of science advice summary	All
13:00	Interim years	K. Émond
13:30	Conclusion	Chairperson

---

#### March 3, 2022 – Thursday

If necessary