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Proceedings of the Regional Peer Review of the Stock Assessment of Eastern Scotian Shelf Shrimp in Shrimp Fishing Areas (SFAs) 13-15

**December 7, 2016
Dartmouth, Nova Scotia**

**Chairperson: Thomas Wheaton
Editor: Lottie Bennett**

Fisheries and Oceans Canada
Bedford Institute of Oceanography
1 Challenger Drive, PO Box 1006
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.

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Aussi disponible en français :

MPO. 2019. Compte rendu de l'examen régional par les pairs de l'évaluation du stock de crevettes de l'est du plateau néo-écossais dans les zones de pêche à la crevette (ZPC) 13 à 15; le 7 décembre 2016. Secr. can. de consult. sci. du MPO, Compte rendu 2019/003.

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SUMMARY

A regional peer review meeting was held on December 7, 2016, at the Bedford Institute of Oceanography in Nova Scotia to conduct an assessment of Eastern Scotian Shelf Shrimp in Shrimp Fishing Areas (SFAs) 13-15. The focus of the meeting was to review the science information on the status of the Eastern Scotian Shelf Shrimp stock to help determine a Total Allowable Catch (TAC) that is consistent with the management plan. Participation in this meeting included Fisheries and Oceans Canada (DFO), non-DFO scientists, First Nations and Aboriginal organizations, the fishing industry, and New Brunswick Department of Agriculture, Aquaculture and Fisheries.

Annual stock assessments were conducted for Eastern Scotian Shelf Shrimp until 2012, following which a biennial assessment schedule with interim year updates was initiated in 2013. Both assessment and update processes are based upon a full analysis of Shrimp stock indicators determined from the DFO-Industry survey, commercial landings, and environmental monitoring data. As predicted in recent assessments, the Eastern Scotian Shelf Shrimp stock has declined since 2014, as the 2007-2008 year-classes have now reached the end of their expected life span. Based on the precautionary approach as it is applied to Eastern Scotian Shelf Shrimp, the stock is in the Cautious Zone. Continuation of precautionary TAC reductions will help to maintain low exploitation rates and to protect more of the 2013 year-class until it can recruit to the spawning stock biomass.

This proceedings document is the record of the meeting discussions and conclusions.

INTRODUCTION

The Northern or Pink Shrimp (*Pandalus borealis*) is the only shrimp species of commercial importance in the Fisheries and Oceans Canada (DFO) Maritimes Region. The trawl fishery on the Scotian Shelf occurs primarily during late spring and early summer with some fishing during fall, in the deep offshore Shrimp “holes”, and on an inshore area near the Bad Neighbour Shoal. The main management tools are limits on the number of licenses and size of vessels used, minimum codend mesh size (40 mm), use of a Nordmøre separator grate, and a TAC. This fleet (about 16 active vessels) is divided into two sectors, a midshore sector consisting of vessels 65-100' Length Over All (LOA) based in New Brunswick in the Gulf Region, and an inshore sector consisting of vessels mainly <65' LOA based in the Maritimes Region. A trap fishery, currently consisting of 8 active vessels is restricted to Chedabucto Bay. All licenses except traps operate under Individual Transferable Quotas (ITQs). The fishery operates under an ‘evergreen’ management plan, which documents sharing agreements between fleet sectors.

Advice on the status of the Eastern Scotian Shelf Shrimp stock was requested to help determine a Total Allowable Catch (TAC) that is consistent with the management plan. The status of Eastern Scotian Shelf shrimp was last assessed in November 2014 (DFO 2015). A framework was completed in February 2015 (DFO 2016a) followed by a stock status update in December 2015 (DFO 2016b). Annual assessments are required because of rapid changes in abundance, variable recruitment to the population and fishery, and changes in the size of Shrimp available for harvest. The resource is near the southern limit of the species’ distribution where it is thought to be more vulnerable to significant and rapid declines, as has been observed in the adjacent Gulf of Maine stock.

After welcoming participants (Appendix 1) and doing a round of introductions, the meeting chairperson, Thomas Wheaton, provided a brief introduction to the meeting. It was noted that this was a science peer-review meeting, which means that it would be focussed on the review of science information rather than on the management implications of that information. While everyone was invited to participate fully in the discussion and contribute knowledge to the process, the intent was to deliver a scientifically defensible product. Following the Chair’s introduction, a brief overview of the Canadian Science Advisory Secretariat (CSAS) science advisory process was provided. The Terms of Reference for the meeting (Appendix 2) were reviewed, including the following objectives:

- Assess the overall status of Eastern Scotian Shelf shrimp (Shrimp Fishing Areas 13-15) as of the fall of 2016, including stock abundance and exploitation rate;
- Evaluate the consequences of different harvest levels during the 2017 fishery on stock abundance and exploitation rate;
- Update descriptive information related to the fishery, survey, biology, and ecosystem interactions of the target species; and
- Report on the bycatch of non-target species in observed trips in the 2015 and 2016 fishery, including the abundance of bycatch species relative to the amount of shrimp caught in the fishery that year and any notable changes in their occurrence relative to previous years.

The Agenda (Appendix 3) was reviewed and no additions were suggested. A working paper was provided to meeting participants for review ahead of the meeting.

This CSAS Proceedings document includes a presentation summary and constitutes the record of the meeting discussion and conclusions. A CSAS Research Document and Science Advisory Report resulting from this meeting will be published on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available

PRESENTATIONS AND DISCUSSION

ASSESSMENT OF EASTERN SCOTIAN SHELF SHRIMP IN SHRIMP FISHING AREAS (SFAS) 13-15

Working Paper: Eastern Scotian Shelf Shrimp 2016-2017. CSAM Working Paper 2016/20.

Presenters: Jeremy Broome

Rapporteur: Lottie Bennett

Presentation Summary

The science lead presented the data sources and methods used to complete the assessment as well as the abundance indices from the collaborative Industry-DFO survey, commercial fishery indices and bycatch, and other ecosystem indices that were incorporated in the traffic light assessment approach. Since 2014, the Eastern Scotian Shelf Shrimp stock has declined due to the 2007-2008 year-classes having reached the end of their expected life span. The precautionary approach as it is applied to Eastern Scotian Shelf Shrimp was presented, and it was noted that declines in spawning stock biomass place the stock in the Cautious Zone. Ecosystem characteristic indices suggest that present conditions on the Eastern Scotian Shelf are not favorable for shrimp. The overall mean traffic light indicator, which summarized a field of 24 unique indicators, declined in 2016 and remains in the yellow zone due to declines in indicators representing abundance, productivity, and ecosystem characteristics.

The results of the Age 1 (Belly-bag) abundance index were presented and it was noted that values for 2015 and 2016 were the lowest in the 15-year time-series, suggesting poor recruitment from the 2014 and 2015 year-classes.

Discussion

The distribution of catches within the inshore fishery area was discussed. The catches are shared between all three Shrimp Fishing Areas (SFAs) and for this assessment the portion of catches taken by each SFA within inshore stratum 17 were not accounted for. It is therefore not possible to determine which SFA had the majority of catches.

An error in the working paper was noted; the Maritimes (Standardised Nova Scotian) fleet Catch Per Unit Effort (CPUE) increased by 3%, rather than the 8% indicated in the working paper.

A meeting participant asked how bycatch is examined by fishery observers. Fishery observers remove and sort bycatch, which are typically quite small, for counting as the catch is being bagged. Bycatch is counted and is not subsampled.

There was a discussion on the distribution of catches from the DFO-industry survey. A meeting participant noted that a large number of the samples counted are taken from the edge of the strata. It was clarified that the figures presented in the meeting documentation do not delineate the strata as neither the coloured sections nor the lines on the figures mark the edge of the strata.

Meeting participants discussed the catch rate data presented in Figure 8 of the meeting documentation. It was noted that all the indicators are the lowest levels since 2001. The declines in catch per unit effort (CPUE) are driven by the 450 kg/h indicator and it was asked whether it was a better abundance indicator than the 250 kg/h indicator. The use of 450 kg/h versus the 250 kg/h indicator has previously been flagged as an issue to determine which is the most indicative of changes in the concentration of effort by the fleet.

A meeting participant asked whether potential increases of Redfish from the Gulf Region is considered in the predator index. This information is considered in the index; however it was agreed that the science lead would examine the data from the DFO Summer Research Vessel (RV) Survey for trends in Redfish abundance.

There was a discussion on the data used to estimate finfish abundance, which comes from the DFO Summer RV Survey. During the framework, it was agreed that the predator index would focus on a short list of species that have greater than 5% shrimp in their diet; however, it was noted during the framework that redfish stomachs turnout when brought to the surface, so using stomach contents as a proxy may not provide a complete picture due to partial regurgitation. Due to concerns associated with the impact of Redfish predation on shrimp abundance, it was recommended that all species with shrimp in their stomach contents should be considered within the predator index. The database on stomach content information, which is maintained by DFO, could be queried for this information.

The Coefficient of Variation (CV) in the DFO Summer RV Survey data is a measure of stock dispersion. It was noted that at intermediate stock levels, high and low levels of abundance are present and a high CV would be expected.

Meeting participants discussed the productivity indices. It was noted that the data on which the thresholds are based have changed since the 2015 Framework was developed. The removal reference and the spawning stock biomass reference points are based on 2000-2010 data, which was believed to represent a productive period for the stock. This change has been incorporated into the assessment and provides a more conservative and sensitive approach. As the thresholds are close together, triggering the Cautious and Critical zones occur quickly and may not be biologically relevant given the location of the zones.

A meeting participant asked about the inclusion of Age 4 males in the modal analysis, which is used to estimate survey population numbers. In the past, the modal analysis has not consistently differentiated the Age 4 cohort, which has appeared small and is contained in the Age 3 or 5+ estimates. For this reason, participants agreed that the zero estimate for the Age 4 cohort are not real zeros, and therefore should not be included in the analysis.

The belly-bag abundance index, which is used as an indicator of recruitment, was discussed. It was asked when the 2013 belly-bag samples are expected to be recruited into the fishery. The 2013 year class, which was first identified by high belly-bag index in 2014, was evident in the 2015 and 2016 main trawl survey and commercial samples, which suggests continued survival and growth of this cohort. The 2013 year class is expected to begin recruitment to the spawning stock biomass in 2018 but are currently present as males in the fishery samples.

There was a question about the abundance of Age 5 males in the fishery survey. Trends in shrimp size indices were consistent with expectations based on life history and growth rates for shrimp at moderate abundance (i.e. no evidence of slower growth or delayed sex transition that have occurred for this stock during periods with more abundant cohorts/high density). Age 5 males are abundant when the overall abundance of shrimp is high and transition timing is delayed. There is some uncertainty as to the actual age as the longevity of shrimp remains uncertain. Delayed transition time results in larger longer-lived females. It was noted that the link between temperature and female Shrimp size was outside the context of this meeting but should be explored further.

There was a discussion comparing the averages for the commercial count (Figure 14a) to the catch at length from commercial sampling (Figure 10). It was noted that in 2016, shrimp were smaller in size relative to the population than at any other time in the time series, although the commercial counts were down relative to 2015. The commercial count data was derived from

submitted log books. In 2016, the count data block in the log books were often not completed. It was discussed that the data in Figure 10 should be given more weight in the assessment than the commercial data.

Meeting participants discussed the provision of advice for the 2017 fishery. It was noted that there is a great deal of uncertainty in the information and this affects the way the science advice is provided. There were concerns raised over the status of the 2017 fishery. With a poor 2016 fishing year, there was a risk that Age 4 shrimp were caught and if this age class were caught in large numbers, this could lead to a loss of future recruitment. Previous advice has relied on looking at past scenarios to determine the management response. The current situation is similar to previous situations where the TAC was reduced. According to precautionary approach, when the spawning stock biomass and female exploitation indices fall within the Cautious Zones, fishing mortality is lowered. The proportional decrease in TAC in response to last year was considered extra cautious.

There was a discussion on the various TAC reduction scenarios. One possible scenario discussed was a 14% reduction in TAC, which equates to 2795 mt. Continuation of precautionary TAC reductions was advised to help maintain low exploitation rates and to protect the 2013 year class until it can recruit to the SSB. The agreed to interim TAC (1625 mt), was 50% of the previous years TAC (3250 mt).

Figure 2 shows the SSB index and female exploitation index for 2006-2016 relative to the lower and upper stock reference points. In 2016, this point was at the cusp of the cautious zone. Biological information should be considered to determine the relative risk.

The current biomass and age of the population is similar to the status in 2002-2003. At that time, the TAC was 3,000 mt total. It was noted that the 2013 year class is in the fishery, but has not yet been recruited to the spawning stock biomass. While there is a current upwards trend, temperatures are increasing. There was a question as to whether when the males transition to female in 2018, larger shrimp would be expected. It was noted that the last time a similar year class was seen, males took longer to transition and they lived longer. A meeting participant raised concerns with overly stressing the 2013 year class. It was suggested that at a minimum, as the impact of environmental changes cannot be quantified, the same approach that has been taken in the past is needed.

There was a discussion of the 2016 survey data, as this was a collaborative survey between industry and DFO. New gear was deployed, a grate angle sensor was installed, as well as a lift grate near the belly bag. It was determined that the data gained from the lift grate did not warrant compromising the belly bag. The catch data was consistent with expectations.

There was a discussion regarding the size of the error bars on the commercial count data and whether the larger error bars reflected an issue with the counts. Meeting participants also asked if there should be other considerations in addition to the TAC, given the current conditions in order to ensure the stock is protected. Timing of fishery may be a consideration, although there is uncertainty associated with fishing egg bearing females.

The distribution of the 2013 year class was discussed to determine if it is found everywhere or is there some spatial distribution between the SFAs. This information could be determined and it would be expected that the distribution would follow the same patterns as in the past.

There has been a quite sudden and unexpected decline in shrimp abundance in Newfoundland Region and there was some discussion among meeting participants whether this would provide any insight for this assessment. In Newfoundland, surveys are done by a DFO Vessel and industry catch rates are not considered in the stock assessment. Given the different survey approaches, it does not seem to be applicable for this assessment. The current survey in

Maritimes Region is designed to ensure standardization. Surveying randomized spots within the same zone provides good data on the actual state of the resource. Survey locations are selected based on bottom type and the ability to conduct a trawl. It is important that there is consistency for comparison purposes. It was noted that commercial data is used in this assessment and that both survey and commercial data are only reporting the 2013 year class coming.

It was observed that during the same time period as the reduction in shrimp abundance in Newfoundland, there was also an increase in groundfish stocks. There has also been an increase in groundfish abundance in the Maritime Region, shown in the snowcrab survey. It was noted that the snowcrab survey has a larger number of stations in 4VW than the RV Survey. The effect of groundfish on shrimp abundance may become more of an issue going forward and it may be important to examine the effects of groundfish predation.

There is uncertainty in the data with respect to temperature, as it is unknown how shrimp are responding to increased temperatures. More information is needed to understand the effect of mid-level and bottom temperature. Shrimp may be able to survive at 8-9°C if temperature changes are slow. It was noted that conditions have been warm for the last 3-4 years, but have been consistent in the area of interest. The warmer conditions are expected to be the result of the gulf current and the freshwater melt in Newfoundland.

There was a discussion on the survey design. A meeting participant questioned whether the survey is occurring in the same locations each year, whether it is possible that diminishing catches are due to movement of the shrimp. It was also noted that the size and age class is as important as the presence of shrimp. It was noted that only 15 survey locations remain the same every year. If the survey were found to not be a good index, then further examination would be needed. Meeting participants were cautioned that changing the survey would mean the loss of time series data. One option to amend the survey design that was suggested would be to increase the number of stations, which explains the variability in the results.

In response to a question about the status of the shrimp stock in the Gulf of Maine, meeting participants were informed that this stock has declined significantly.

REFERENCES CITED

- DFO. 2015. [Assessment of Northern Shrimp on the Eastern Scotian Shelf \(SFAs 13-15\)](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/004.
- DFO. 2016a. [Proceedings of the Regional Assessment of an Eastern Scotian Shelf Shrimp \(*Pandalus borealis*\) Framework; April 14-15, 2015](#). DFO Can. Sci. Advis. Sec. Proceed. Ser. 2016/002.
- DFO. 2016b. [Stock Status Update of Eastern Scotian Shelf Shrimp in Shrimp Areas \(SFAs\) 13-15](#). DFO Can. Sci. Advis. Sec. Sci. Resp. 2016/001.

APPENDICES

APPENDIX 1. LIST OF PARTICIPANTS

Name	Affiliation
Bennett, Lottie	DFO Science, Maritimes Region
Broome, Jeremy	DFO Science, Maritimes Region
Butler, Maureen	DFO Resource Management, Maritimes Region
Choi, Jae	DFO Science, Maritimes Region
Clark, Kirsten	DFO Science, Maritimes Region
Conrod, Scott	Atlantic Canadian Mobile Shrimp Association
Couture, John	Unama'ki Institute of Natural Resources
Covey, Michele	DFO Science, Maritimes Region
Davis, Donald	Waycobah Fisheries / Fisheries
Denny, Leonard	Eskasoni Fish & Wildlife Commission
Gaudet, Mario	Ministère de l'Agriculture, de l'Aquaculture et des Pêches du N.-B.
Gionet, Norbert	Crevettier, AGAG
Grover, Thomas	Atlantic Canadian Mobile Shrimp Assn.
Hardie, David	DFO Science, Maritimes Region
Keith, David	DFO Science, Maritimes Region
Lanteigne, Jean	Federation Regionale Acadienne des Peches Professionels
Roussel, Eda	Association des crevettiers acadiens du Golfe
Themelis, Daphne	DFO Science, Maritimes Region
Wheaton, Thomas	DFO Science, Maritimes Region

APPENDIX 2. TERMS OF REFERENCE

Stock Assessment of Eastern Scotian Shelf Shrimp in Shrimp Fishing Areas (SFAs) 13-15

Regional Peer Review – Maritimes Region

December 7, 2016

Dartmouth, NS

Chairperson: Thomas Wheaton

Context

The Northern or Pink Shrimp, *Pandalus borealis*, is the only shrimp species of commercial importance in the Fisheries and Oceans Canada (DFO) Maritimes Region. The fishery consists of 28 DFO Maritimes Region-based licenses (fished by 9 vessels in 2014), mostly less than 65 ft. length overall, and 14 DFO Gulf Region-based licenses (fished by 5 vessels in 2014) 65-100 ft. length overall. All mobile licenses have been under Individual Transferable Quotas (ITQs) since 1998. A competitive trap fishery with 14 licenses (7 active in 2014) is largely restricted to Chedabucto Bay. The fishery operates under an ‘evergreen’ management plan, which documents sharing agreements between fleet sectors. The status of Eastern Scotian Shelf shrimp was last assessed in November 2014 (DFO 2015). A framework was completed in February 2015 (DFO 2016a) followed by a stock status update in December 2015 (DFO 2016b).

Objectives

The objectives of this regional peer review process are:

- Assess the overall status of Eastern Scotian Shelf shrimp (Shrimp Fishing Areas 13-15) as of the fall of 2016, including stock abundance and exploitation rate.
- Evaluate the consequences of different harvest levels during the 2017 fishery on stock abundance and exploitation rate.
- Update descriptive information related to the fishery, survey, biology, and ecosystem interactions of the target species.
- Report on the bycatch of non-target species in observed trips in the 2015 and 2016 fishery, including the abundance of bycatch species relative to the amount of shrimp caught in the fishery that year and any notable changes in their occurrence relative to previous years.

Expected Publications

- Science Advisory Report
- Proceedings
- Research Document

Participation

- DFO Science
- DFO Resource Management
- Province of Nova Scotia and Province of New Brunswick
- Aboriginal communities/organizations
- Industry
- Other

References

- DFO. 2015. [Assessment of Northern Shrimp on the Eastern Scotian Shelf \(SFAs 13-15\)](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/004.
- DFO. 2016a. [Proceedings of the Regional Assessment of an Eastern Scotian Shelf Shrimp \(*Pandalus borealis*\) Framework; April 14-15, 2015](#). DFO Can. Sci. Advis. Sec. Proceed. Ser. 2016/002.
- DFO. 2016b. [Stock Status Update of Eastern Scotian Shelf Shrimp in Shrimp Areas \(SFAs\) 13-15](#). DFO Can. Sci. Advis. Sec. Sci. Resp. 2016/001.

APPENDIX 3. AGENDA

Maritimes Science Advisory Process on Eastern Scotian Shelf Shrimp

7 December 2016

Lewis King Boardroom
Bedford Institute of Oceanography (BIO)
Dartmouth, Nova Scotia

DRAFT AGENDA

7 December 2016

- 09:00 - 09:15 Welcome and Introduction (Chair)
- 09:15 - 10:00 Review of Assessment
- 10:00 - 10:15 Break
- 10:15 - 12:00 Review of Assessment (cont'd)
- 12:00 - 13:00 Lunch
- 13:00 - 15:00 Review of Science Advisory Report
- 15:00 - 15:15 Break
- 15:15 - 17:00 Review of Science Advisory Report (cont'd)