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Proceedings of the regional peer review on Advice on Arctic Cod (*Boreogadus saida*) Bycatch Limits in Northern Shrimp Fisheries in the Canadian Arctic

**July 3-4, 2019
Winnipeg, Manitoba**

**Chairperson: Eva Enders
Editor: Sheila Atchison**

Fisheries and Oceans Canada
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Winnipeg, Manitoba R3T 2N6

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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SUMMARY

Incidental bycatch and discard of non-targeted species occur in many fisheries. An objective of an Ecosystem Approach to Fisheries Management is to control incidental mortality of non-targeted species. Arctic Cod (*Boreogadus saida*) is a ubiquitous species occurring in a wide range of habitats in the Arctic. Given this widespread distribution and tendency to form large aggregations, it is a common bycatch species in various northern fisheries including the Northern and Striped Shrimp fisheries in the Eastern Canadian Arctic.

A regional science peer-review was held July 3-4, 2019 in Winnipeg, Manitoba, to provide advice on a sustainable overall bycatch limit of Arctic Cod (in tonnes) for the Eastern and Western Assessment Zones (EAZ and WAZ) and Shrimp Fishing Area 1 as well as establishing suitable references to indicate when that mortality is unacceptable. Fisheries and Oceans Canada (DFO) Science was also asked to consider the current “move away” provision on commercial licenses. The meeting included participants from DFO Resource Management and Science as well as the Nunavut Wildlife Management Board and the Nunavik Marine Region Wildlife Board.

This proceedings report summarizes the relevant discussions from the peer-review meeting and presents revisions to be made to the associated Research Document. The Proceedings, Science Advisory Report (SAR), and the supporting Research Document (herein reviewed as a working paper) resulting from this advisory meeting will be published on the [DFO Canadian Science Advisory Secretariat Website](#).

INTRODUCTION

A Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS), regional peer-review meeting was held on July 3-4, 2019 at the Freshwater Institute in Winnipeg, Manitoba. In 2017 and 2018, the Northern and Striped Shrimp fishery in the Eastern Canadian Arctic experienced higher than normal bycatch rates of Arctic Cod (*Boreogadus saida*). The purpose of the meeting was to review available data for the area and provide advice to DFO Resource Management on sustainable Arctic Cod bycatch limits for these areas. DFO Science was also asked to review current methods for in-season mitigation of Arctic Cod bycatch.

The Terms of Reference, including the objectives for the science review (Appendix 1), were developed in response to a request for Science Advice from DFO Resource Management. Participants included DFO (Science, Resource Management), Nunavut Wildlife Management Board, and the Nunavik Marine Region Wildlife Board (Appendix 2).

OPENING DISCUSSION

The meeting Chair welcomed participants and described the role of CSAS in the provision of DFO peer-reviewed Science Advice. Participants introduced themselves and described the expertise that they brought to the discussion. It was noted that participants were invited because of their technical expertise on the topic and not as representatives of particular institutions. The Chair reviewed the Agenda (Appendix 3) and the Terms of Reference for the meeting, highlighted the objectives, and identified the expected products from the review. One working paper and three background documents were circulated to participants in advance of the meeting, these documents served as the basis for the review. The objectives of the working paper were to review the biology, ecology, and distributional patterns of Arctic Cod in Davis Strait; estimate Arctic Cod biomass; and to estimate the mortality of Arctic Cod from fishery bycatch. The working paper will be updated and published as a CSAS Research Document and will form the basis of the SAR.

Participants were reminded that everyone at the meeting was expected to participate and to contribute fully to the discussions. Sheila Atchison (DFO Science) was identified as rapporteur for the meeting. The conclusions and advice resulting from this review will be published as a CSAS Science Advisory Report.

PRESENTATIONS

OVERVIEW OF ISSUE AND REQUEST FOR SCIENCE ADVICE

Presenter: Leigh Edgar

DFO Resource Management has requested Science Advice on sustainable bycatch removals of Arctic Cod in anticipation that this information may be used to develop Conditions of Licence for each area, and ensure that any removals of a bycatch species are sustainable, recognizing that Arctic Cod is an important forage species in Northern waters. In the Eastern and Western Assessment Zones (EAZ and WAZ) there are quotas for two species of commercially harvested shrimp, *Pandalus borealis* (Northern Shrimp) and *P. montagui* (Striped Shrimp). In Shrimp Fishing Area 1 (SFA1) there is a quota for *P. borealis*. Each species undergoes a stock assessment and allocation process, where applicable. Only these two species can be retained, all other species caught must be returned to the water, including Arctic Cod.

Management measures exist in the Conditions of License to reduce bycatch, including move away provisions, gear requirements (e.g., Nordmore exclusion grates), and prohibiting the retention of bycatch in the EAZ, WAZ, and SFA1. Bycatch provisions and mid-season mitigation measures were reviewed. It was noted that bycatch is undesirable to industry as both sorting the discard and move away provisions require time and effort, and incur financial costs.

Arctic Cod bycatches increased in 2017 in SFA1 and 2018 in WAZ. DFO Resource Management requested science input on an urgent basis with the intention of ensuring catches of Arctic Cod did not pose a conservation risk and to allow fishing to continue.

SFA1 is considered a lower risk area as the Total Allowable Catch (TAC) of shrimp has never been fully taken due to low fishing pressure. The TACs in the EAZ and WAZ are almost always fully fished. The TAC in the WAZ for 2019/2020 had not been established at the time of the meeting but could be higher than in 2018/19, which may increase the potential for Arctic Cod bycatch. Higher catches of Arctic Cod have not occurred in the EAZ, however, given its location between WAZ and SFA1, advice is also being sought for this area.

As there is no stock assessment information available for Arctic Cod, the need for further scientific study of Arctic Cod populations is necessary. The scarcity of science information on Arctic Cod and the need for assurance that Arctic Cod removals are sustainable underscores that more data collection on the species is required.

The presenter outlined managements current questions for Science:

- What is a sustainable amount of Arctic Cod bycatch in each area?
- Is it possible for Science to provide one number (i.e., of tonnes of Arctic Cod bycatch) for management to set sustainable bycatch levels by?
- Is it possible to predict both geographically and inter-/intra-annually where large aggregations of Arctic Cod will occur?

Comments and questions

The process for creating and amending Conditions of Licence was discussed for each area. Arctic Cod was added to groundfish regulations in 1984, likely to protect young Atlantic Cod (*Gadus morhua*), which are the same size. However, Arctic Cod is not considered strictly a groundfish or pelagic species. Like Capelin (*Mallotus villosus*), they are benthopelagic.

A participant asked why there was such a high variance in Arctic Cod seen from year to year and from tow to tow? A discussion about inter- and intra-annual variation in Arctic Cod abundance ensued. A participant reminded the group that large catches don't reflect abundance as this species aggregates in the summer months.

BACKGROUND DOCUMENT: ARCTIC COD (*BOREOGADUS SAIDA*) BYCATCH IN SHRIMP FISHING AREAS 1-3: 1979-2018

Presenter: Wojciech Walkusz

This report builds on historical bycatch data published to 2009 (Siferd 2010). In order to maintain consistency with historical reports this document uses Shrimp Fishing Areas (SFAs) instead of management areas. Briefly, SFA3 covers almost the same area as the WAZ with the exception of a corner of its eastern border that falls within SFA2. SFA2 covers the area of the EAZ, with the exception of the aforementioned corner.

This report has two main objectives:

1. Examine whether there is a correlation between fishing effort and bycatch rates

2. Estimate the annual standing stock biomass of bottom-dwelling Arctic Cod

The presenter described the methods including the three data types used and their limitations. For objective 1, Arctic Cod bycatch data and Northern and Striped Shrimp catch data were used from at-sea observers and fishery logs, both of which are considered fishery-dependent data. For objective 2, data from two DFO scientific surveys, the multi-species stock assessment of Greenland Halibut (*Reinhardtius hippoglossoides*) and the Northern Shrimp Research Foundation (NSRF) survey of *Pandalus borealis* and *P. montagui*, were used. The author noted that these surveys are not directly comparable as they differ in depth, gear used, and areas covered. It was also noted that data availability varies between regions; specifically, SFA1 is data sparse because of remoteness and ice coverage, and SFA1 is not assessed by DFO, instead stock assessments are conducted by Greenland under the Northwest Atlantic Fisheries Organization (NAFO) umbrella.

Figures showing correlations between Shrimp catch and Arctic Cod bycatch were shown, with positive correlations in SFA1 and 3 (WAZ) and no correlation in SFA2 (EAZ). Figures showing the estimated standing stock biomass index of bottom-dwelling Arctic Cod in each area were also shown.

The presenter discussed the movement of Arctic Cod within a geographic area. An unpublished paper from the Beaufort/Bering Sea shows both passive (larval) and active movement of Arctic Cod across an area of 400 km. As Arctic Cod is a benthic-pelagic population and DFO scientific surveys are conducted as benthic snapshots, the author(s) agree that the biomass values calculated herein are most likely underestimated as they do not include pelagic biomass estimates. Lengths (as a proxy for age class) are not tracked on the DFO scientific surveys, though some length data will be collected during the 2019 NSRF survey.

Nordmore grates are required during commercial fishing to prevent all biota larger than shrimp from entering the trawl. Arctic Cod size correlates with grate size and it was estimated that the grates would disproportionately catch small bottom dwelling adults, approximately 60 mm. Nordmore grates are not used in scientific surveys where all demersal fish sizes are collected. Neither commercial nor scientific efforts survey the pelagic portion of the water column.

The presenter discussed the inter- and intra-annual variability of Arctic Cod biomass within a geographic area. Forage fish species such as Arctic Cod go through years of high and low abundance and it was hypothesized that the high bycatch from 2017/2018 may be reflecting high recruitment years; however, high Arctic Cod biomass in 2017/18 may also be due to other factors such as population movement or range expansion.

Comments and questions

As the background document was not published at the time of the meeting, participants offered suggestions for improvement. It was suggested that an indication of effort (e.g., number of fishers) be added to the figures in the document. The suggestion was also made to include confidence intervals on graphs of standing stock biomass index estimates. Participants agreed that this would help illustrate the variance and comparability of the data between regions. The group also agreed that adding the calculations used to estimate biomass in the document would clarify the assumptions and methods.

A participant asked whether hydroacoustic work is done on the NSRF survey. The author answered that some equipment is available but as fishing efforts are not ground truthed, the data collected could not be analyzed. Additionally, there is no way to conduct pelagic tows during a groundfish survey, thus excluding an important component of the Arctic Cod biomass.

A participant asked if there has been a study to evaluate which sizes of fish pass through the Nordmore grate. A brief discussion ensued where participants agreed that they are not aware of any such study. It was acknowledged that large fish such as Redfish (*Sebastes* sp., Greenland Halibut (*Reinhardtius hippoglossoides*), skates (Family: Rajidae), etc. are excluded by the grate but that the catch/avoidance of other small bodied fish has not been evaluated. A discussion regarding the selectivity of the Nordmore grate followed. The hypothesis is that the shrimp trawl catches recently descended maturing Arctic Cod that are not large enough to be sieved out by Nordmore grate. A participant wondered if this age class were allowed to mature whether they would be avoided resulting in a reduction of Arctic Cod bycatch. However, Nordmore grate size selectivity and data required to evaluate such impacts was not discussed.

A discussion on sustainable levels of biomass removal of Arctic Cod ensued. Participants agreed that a static assessment makes it difficult to tell whether a high-abundance year is due to a year-class effect, the result of population movement, or range expansion. Additional population, life history, and environmental information is needed to attempt predictions. This is further complicated by Climate Change induced variations. A participant suggested that since Arctic Cod is a keystone species, an ecosystem model (Ecopath) may provide some advice; however, the limited data currently available would prevent the model from providing robust conclusions.

WORKING PAPER: ASSESSMENT OF POTENTIAL IMPACTS OF BYCATCH MORTALITY ON THE ARCTIC COD (*BOREOGADUS SAIDA*) POPULATIONS FROM THE NORTHERN SHRIMP (*PANDALUS BOREALIS*) AND STRIPED SHRIMP (*PANDALUS MONTAGUI*) FISHERIES IN SHRIMP FISHING AREAS (SFA) 1, 2, AND 3

Presenter: Wojciech Walkusz

This working paper has three main objectives:

1. Review the biology, ecology, and distributional patterns of Arctic Cod
2. Estimate the biomass of Arctic Cod needed to support the Davis Strait ecosystem
3. Estimate the mortality of Arctic Cod from fishery bycatch

Review:

Arctic Cod is considered a pivotal species in the Arctic marine ecosystem as it moves large quantities of energy from lower trophic levels to higher trophic levels. Arctic Cod biomass is distributed unevenly through the water column and research from the Beaufort Sea (Walkusz et al. 2013) has shown that there is a large amount of biomass 'hidden' in the pelagic zone. An echogram of hydroacoustic work done in the Beaufort Sea was shown, illustrating aggregations of Arctic Cod distributed throughout the water column separated by size class (i.e., larval and juvenile fish near the top of the water column and age 1+ near the bottom of the water column), highlighting the large amounts of biomass in the pelagic zones as well as the different habitats used throughout its lifecycle.

Arctic Cod is not an obligate groundfish species, it is benthopelagic and the lack of data on the pelagic biomass in Davis Strait presents a challenge when estimating biomass or impacts of bycatch mortality on this species. Current biomass estimates calculated using either DFO scientific surveys or fishery-dependent data are biased as these datasets only represent Arctic Cod from near-bottom aggregations. Furthermore, commercial fishing only collects a portion of the near-bottom aggregations as Nordmore grates only allow a portion of the size classes to be caught (i.e., approximately 60 mm). It is unknown what, if any, effect size selectivity of the Nordmore grate might have on the population.

Currently, hydroacoustic work is not conducted on NSRF or NAFO surveys; however, it is a viable method with which to study Arctic Cod aggregations throughout the water column. Hydroacoustic work requires dedicated personnel to operate and maintain equipment, ground-truth data, and edit backscatter data to produce biomass estimates.

Biomass estimate:

As Arctic Cod transfers large quantities of energy from lower trophic levels to higher trophic levels, the biomass of Arctic Cod in a system can be derived by estimating the energy required to sustain predator populations in the area. Using a conservative assumption that 10% of the estimated marine mammal population in the area (NIRB 2018) consume Arctic Cod as a proportion of their diet the author estimated that approximately 500,000 t of Arctic Cod would be consumed annually. Other predators such as migrants (i.e., incidental marine mammals), sea birds, and fish were not accounted for. Consumption modelling of capelin, a similar forage fish, from Newfoundland region suggest 1-2 million t of Capelin are required to sustain higher trophic levels (Bundy et al. 2000), lending support to this preliminary estimate. These consumption estimates are crude as population estimates and diet data are lacking for numerous higher trophic level species.

It was noted that this ecosystem supports a higher abundance and diversity of Arctic Cod predators than other areas (e.g., Beaufort Sea). It was also noted that Arctic Cod bycatch is not retained by fishing vessels and gets discarded, thus, the energy is not removed from the ecosystem.

Fishing mortality estimate:

Using the above Arctic Cod biomass estimate based on marine mammal predator populations, the author estimated that the mortality from commercial fishing bycatch was less than 0.1% of the stock annually. It was noted that 0.1% is the highest catch in the historical dataset and is calculated using the 500,000 t estimate, meaning that the exploitation rate of Arctic Cod is likely underestimated. Natural mortality data is not available for this area.

Comments and questions

A participant noted the assumption that a small percent of the Arctic Cod biomass is being taken as bycatch but small shifts in mortality can result in large impacts to a population (or in predator population, e.g., seabirds).

A participant asked how quickly migration through water column (i.e., pelagic larva/juvenile to demersal adult) happens. The author replied that it is unknown when or why Arctic Cod descend or at what rate. The hypothesis is that once they are large enough they migrate in a school (blanket migration) and that the settlement time for fishes is based on size rather than age and fish in general settle quickly (few days or weeks).

A participant added that seabird energy requirements should be included in estimate of Arctic Cod predation as there are large populations along Baffin Island, and that there are seabird population estimates for the area available. Changes in Arctic Cod population may impact seabird populations.

A participant mentioned that the Capelin population is expanding northward. The hypothesis is that Capelin is lower energy food source, which may cause cascading issues for predators. This is a major consideration for ecosystem-level energetics.

BACKGROUND DOCUMENT: NATIONAL GUIDANCE RELATED TO BYCATCH AND DISCARDS

Presenter: Wojciech Walkusz

Bycatch and bycatch discards are recognized within Canada and internationally as a management and conservation issue. This DFO guidance document provides a flow chart outlining methods for assessing the sustainability of bycatch rates using available data; however, it was demonstrated that not enough data are available on the Arctic Cod population in the SFAs to complete the flow chart.

The presenter outlined two major data gaps that preclude the use of this document: 1) missing pelagic biomass and 2) lack of life history information including estimates of natural mortality. The presenter suggested using “indirect natural mortality” and a discussion on potential methods for estimating Arctic Cod mortality ensued. Participants discussed estimating instantaneous natural mortality using a dedicated survey located in a separate area from commercial fishing to gather size at age data.

Comments and questions

A participant suggested that some potential funds could be applied for from the Nunavik Marine Region Wildlife Board for Arctic Cod research. This meeting highlighted the need for dedicated research on this species and need for dedicated Arctic Cod research has been discussed with upper management.

Participants decided that without further data this document could not be used to assess the sustainability of Arctic Cod bycatch in the shrimp fishing areas.

BACKGROUND DOCUMENT: CONDITIONS OF LICENSE

Presenter: Leah Edgar

The presentation went directly to discussion and questions.

Comments and questions

The group discussed management measures in the Northern Shrimp fishery, including bycatch provisions in the Conditions of Licence, mandatory discarding of bycatch, and the use of the Nordmore grate, which is an exclusion device designed to minimize bycatch. The bycatch provisions are in place for a conservation purpose; however, given the absence of stock information for Arctic Cod, its important role in the ecosystem and the need to ensure the Northern Shrimp fishery is sustainably managed, the need for more Science Advice, including the outcomes of this science meeting, are needed to help inform management measures, potentially including the Conditions of Licence.

A discussion on provisions for pelagic fish in other areas followed. Pelagic species have different life histories than groundfish (e.g., higher mortality, shorter life span), which may make it possible to take more pelagic fish as bycatch. However, because of the energy they transfer between ecosystem components, the risk to the ecosystem may be higher. The concern was raised that separating Arctic Cod license provisions from groundfish license provisions might result in a doubling of the overall Arctic Cod biomass bycatch.

Management measures, including move away provisions were discussed. The group agreed that more data is needed to properly assess and comment on limits for Conditions of Licence, and that DFO Resource Management could use the current information provided here to inform

their decisions. Additionally, these data deficiencies preclude a reasonable and precautionary estimate for a single tow or overall annual bycatch limit.

A participant noted that the Northerners have a major interest in marine mammals, that the interconnectedness of Arctic Cod and marine mammals is understood, and that Arctic Cod is crucial to Inuit subsistence, tradition, and food security.

DISCUSSION

DRAFTING AND REVIEW OF SUMMARY BULLETS

Once the presentations were finished participants drafted and discussed bullet points summarizing the meeting rationale, objectives, and outcomes. A copy of the draft bullets was provided to each participant for review and the bullets were finalized on the second day of the meeting.

Participants discussed terminology regarding the areas. As this advice is for DFO Resource Management, participants agreed that the SAR should use EAZ, WAZ, and SFA1 to match current management terminology.

Ecosystem models were discussed. Models exist for areas surrounding Davis Strait and the need for modeling exercises, baseline data to input into models, and research into model efficacy was agreed upon.

A discussion regarding the benefits and limitations of logbook and observer data ensued. It was agreed that this data is useful and valid to Science.

SCIENCE ADVISORY REPORT

Participants discussed the “Risk Analysis” section of the working paper and agreed to change the title of the section to “Discussion”. Participants discussed the two separate biomass estimates made in the working paper and decided to add a section listing the limitations, uncertainties, and assumptions. Participants also noted that good work has been done with limited data.

The working paper was then accepted by the group as a Research Document and as the basis of the SAR. Headings, subheadings, and general information to be included in each section was reviewed by participants. The SAR will be led by Wojciech Walkusz. Timelines for publishing the SAR were reviewed and the Chair noted that timelines will likely be longer because of document approvals process. DFO Resource Management was concerned with timelines as fishing is opening as soon as next week, however, information from this meeting can be used when setting Conditions of Licence following approval of the SAR.

MANAGEMENT

DFO Resource Management re-iterated their desire for Science to provide a single Arctic Cod bycatch limit per area; however, they understand that Science is unable to provide exact numbers at this time. Despite inconclusive information and given the high Arctic Cod biomass in northern waters, higher bycatches in the Northern Shrimp fishery do not seem to be a conservation concern, but caution was still advised in establishing limits.

The impacts of changing Conditions of Licence on industry and on communities were discussed. The provisions for making those changes was also discussed including consultations with the Boards and industry, and the evaluation of economic impacts. The discussion highlighted the need for ongoing monitoring and reporting from industry as well as the need for scientific data to inform management decisions.

FUTURE MONITORING AND RESEARCH

Future monitoring and research priorities were discussed with attention to key pieces of data that are currently missing and would be necessary to provide advice to management including life history data. Participants agreed that core data such as life history data (e.g., age/size relationships, age at maturity) and habitat usage (e.g., locations of spawning, rearing, refugia), as well as data on population dynamics (e.g., mortality, seasonal movements, year class events) are necessary to provide sound evidence-based advice.

Predictors and drivers of aggregations and distributions were discussed, with predictors being of particular importance to management. Developing linkages between oceanographic features and Arctic Cod spatial and temporal distribution is also of interest to Resource Management and a priority for Science.

Participants agreed that a dedicated research program on Arctic Cod is required and necessary for proper assessment of this species and management of the fishery. This work requires dedicated personnel focused on this species and working with additional technical knowledge (e.g., hydroacoustics).

Participants agreed that a workshop to set research plans and priorities is necessary.

CONCLUDING REMARKS AND NEXT STEPS

The Chair reviewed the objectives.

It was agreed that the three reports would be completed based on the comments provided and discussions from the meeting. The documents will be sent to all participants for review before they are finalized.

Participants were thanked for their input into the discussion and the meeting was adjourned.

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APPENDIX 1. TERMS OF REFERENCE

ADVICE ON ARCTIC COD (*BOREOGADUS SAIDA*) BYCATCH LIMITS IN NORTHERN SHRIMP FISHERIES IN THE CANADIAN ARCTIC

Regional Peer Review – Central and Arctic Region

July 3–4, 2019

Winnipeg, MB

Chairperson: Eva Enders

Context

Incidental bycatch and discard of non-targeted species occur in many fisheries. An objective of an Ecosystem Approach to Fisheries Management is to control incidental mortality of non-targeted species. Arctic Cod (*Boreogadus saida*) is a ubiquitous species occurring in a wide range of habitats in the Arctic. Given this widespread distribution and tendency to form large aggregations, it is a common bycatch species in various northern fisheries including the Northern and Striped Shrimp fisheries in the Eastern Canadian Arctic.

Fisheries and Oceans Canada (DFO) Resource Management has requested DFO Science to provide advice on a sustainable overall bycatch limit of Arctic Cod (in tonnes) for the Eastern and Western Assessment Zones (EAZ and WAZ) and Shrimp Fishing Area 1 as well as establishing suitable references to indicate when that mortality is unacceptable. In providing the requested advice, DFO Science is asked to consider the current “move away” provision on commercial licenses.

Objectives

The objectives of the peer review are to:

- Assess historical trends in Arctic Cod bycatch in the Northern and Striped Shrimp fisheries in the EAZ, WAZ, and Shrimp Fishing Area 1 (SFA 1);
- Recommend the amount of Arctic Cod bycatch that can be sustainably removed in the EAZ, WAZ, and SFA 1 in relation to historical bycatch levels and subsequent impact on the population;
- Recommend annual Arctic Cod bycatch limits for each the EAZ, WAZ, and SFA 1; and
- Review methods for in-season mitigation of Arctic Cod bycatch (DFO [2012] and Conditions of License).

Expected Publications

- Science Advisory Report
- Proceedings
- Research Document

Expected Participation

- Fisheries and Oceans Canada (DFO) (Science and Fisheries Management)
- Nunavut and Nunavik Wildlife Management Boards
- Academia

APPENDIX 2. LIST OF PARTICIPANTS

Name	Organization/Affiliation
Atchison, Sheila (Rapporteur)	DFO Science, Central and Arctic Region
Deslauriers, David	DFO Science, Central and Arctic Region
Edgar, Leigh	DFO Resource Management, Ottawa
Enders, Eva (Chair)	DFO Science, Central and Arctic Region
Friesen, Sheri	DFO Resource Management (sitting in for Tyler Jivan)
Giles, Amber	Nunavut Wildlife Management Board, Commercial Fisheries File
Moshenko, Robert	Nunavik Marine Region Wildlife Board
Murphy, Hannah	DFO Science, Newfoundland and Labrador Region
Paulic, Joclyn	DFO Science, Central and Arctic Region
Tallman, Ross	DFO Science, Central and Arctic Region
Thompson, Susan	DFO Science, National Capital Region
Walkusz, Wojciech	DFO Science, Central and Arctic Region

APPENDIX 3. MEETING AGENDA

Arctic Cod (*Boreogadus saida*) Bycatch Limits in Northern Shrimp Fisheries in the Canadian Arctic

July 3–4, 2019

Large Seminar Room, Freshwater Institute, Winnipeg, MB

Chair: Eva Enders

Day 1 – Wednesday, July 3, 2019

- 9:00 a.m. Welcome and Introductions (Chair)
- Participant Introductions - Please be prepared with a few sentences about the expertise you bring to the table
 - Terms of Reference and Meeting Objectives
 - Review Agenda
 - Overview of CSAS Peer Review Process
- 9:30 a.m. Overview of Issue and Request for Science Advice (L. Edgar)
- 10:00 a.m. Questions and Discussion
- 10:15 a.m. BREAK
- 10:30 a.m. Background Document: Arctic Cod (*Boreogadus saida*) Bycatch in Shrimp Fishing Areas 1-3: 1979-2018 (W. Walkusz)
- 10:45 a.m. Questions and Discussion
- 11:00 a.m. Working Paper: Assessment of potential impacts of bycatch mortality on the Arctic Cod (*Boreogadus saida*) populations from the Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*Pandalus montagui*) fisheries in Shrimp Fishing Areas (SFA) 1, 2 and 3 (W. Walkusz)
- 11:15 a.m. Questions and Discussion
- 12:00 p.m. LUNCH
- 1:00 p.m. Background Document: National Guidance Related to Bycatch and Discards (W. Walkusz)
- 1:30 p.m. Background Document: Conditions of License (L. Edgar)
- 1:45 p.m. Questions and Discussion
- 2:30 p.m. BREAK
- 2:45 p.m. Discussion and Drafting of Summary Bullets
- 4:00 p.m. Day 1 Wrap-up

Day 2 – Thursday, July 4, 2019

- 9:00 a.m. Review Day 1 (Chair)
- 9:15 a.m. Review of Summary Bullets
- 10:00 a.m. BREAK
- 10:15 a.m. Discuss and Draft Uncertainties

11:00 p.m. Discuss Future Monitoring and Research
12:00 p.m. LUNCH
1:00 p.m. Review Draft Science Advisory Report
2:30 p.m. BREAK
3:00 p.m. Concluding Remarks (Chair)
3:30 p.m. Meeting Complete – THANK YOU!