NUNAVUT WILDLIFE MANAGEMENT BOARD
Agenda: Regular Meeting 002-2024
June 26, 2024
Gjoa Haven, Nunavut

	No:	Item:	Tab:	Presenter:	Maximum Time
9:00 - 9:02 AM	1	Open Meeting		Chairperson	2 Minutes
9:02 - 9:04 AM	2	Declaration of Conflict of Interest		Chairperson	2 Minutes
9:04 - 9:05 AM	3	Agenda: Review and Approval of RM002-2024	1	Chairperson	1 Minute
9:05 - 10:00 AM	4	Request for an NWMB Decision to Approve the Department of Fisheries and Oceans Canada's "Recovery Strategy for Cumberland Sound Beluga"	2	Fisheries and Oceans	55 Minutes
10:00 - 10:15 AM		**BREAK**			15 Minutes
10:15 - 11:00 AM	4	Request for an NWMB Decision to Approve the Department of Fisheries and Oceans Canada's "Recovery Strategy for Cumberland Sound Beluga"	2	Fisheries and Oceans	45 Minutes
11:00 - 12:00 PM	5	Request for Decision and Advice on the Department of Fisheries and Oceans Canada's Precautionary Approach Frameworks for Northern and Striped Shrimp in the Western and Eastern Assessment Zones	3	Fisheries and Oceans	1 Hour
		LUNCH			1 Hr & 15 Min
1:15 - 1:45 PM	6	Request for Decision to Approve or Not Approve Adding the Thorny Skate to Schedule 1 of the *Species at Risk Act* as a species of *Special Concern*	4	Fisheries and Oceans - Environment & Climate Change Canada	30 Minutes

1:45 - 2:15 PM	7	Request for NWMB's View on their Aurthority to Approve Plans to Designate a Stock as a 'Major Fish Stock' under the Fish Stocks Provisions	5	Fisheries and Oceans	30 Minutes
	8	Adjournment of RM002-2024			

SUBMISSION TO THE
NUNAVUT WILDLIFE MANAGEMENT BOARD
FOR

Information: **Decision: X**

Issue: Fisheries and Oceans Canada (DFO) is requesting a decision to approve the "Recovery Strategy for Cumberland Sound Beluga (*Delphinapterus leucas*)".

Background:

- In May 2001, Cumberland Sound Beluga were assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Threatened. This population was included in Schedule 1 of the *Species at Risk Act* (SARA) in May 2017.

- As required under the federal *Species at Risk Act* (SARA) for species listed as Threatened, a recovery strategy was developed (Appendix A). A summary of the document can be found in Appendix B.

- The recovery strategy identifies a description of the critical habitat for the Cumberland Sound Beluga. Three areas of critical habitat have been identified, which are all used by Cumberland Sound Beluga seasonally. Under SARA, critical habitat must be legally protected within 180 days after the recovery strategy or action plan that identified the critical habitat is included in the Species at Risk Public Registry.

- Article 5.2.34 (d) (i) of the Nunavut Agreement states that the Nunavut Wildlife Management Board (NWMB) shall, at its discretion, approve plans for management, classification, protection, restocking or propagation, cultivation or husbandry of particular wildlife, including endangered species.

- DFO is now ready to post the final recovery strategy on the public registry (marked as proposed until the Board makes a decision) and is asking the NWMB to approve the document before it is posted as final.

Consultations

- An early draft of the recovery strategy was completed in 2005, in anticipation of listing, and involved: members of the Pangnirtung Hunter and Trappers Association (HTA), NWMB, Qikiqtaaluk Wildlife Board (QWB), and Nunavut Tunngavik Inc (NTI). A Cumberland Sound Beluga Recovery Team was formed with DFO and representatives from these organizations.

- Over ten meetings were held in Pangnirtung over the years with community members and representatives of the Nunavut organizations. This included a meeting in 2010 to identify critical habitat.

- A virtual meeting was held with the Pangnirtung HTA in April 2022 to go over the final draft of the proposed recovery strategy and get approvals before it was posted as proposed on the Species at Risk public registry. Changes and additions suggested by the HTA were incorporated into the final draft of the recovery strategy.

- On January 22, 2023, the draft recovery strategy was posted on the Species at Risk public registry for a 60 day public comment period, in English, French and Inuktitut. An information

email was sent to the NWMB, Nunavut Inuit Wildlife Secretariat, QIA, QWB, Government of Nunavut, NTI, and Pangnirtung HTA informing them of the upcoming posting two weeks in advance. A second email was sent on the date of the posting.

- No comments were received from groups in Nunavut during the public comment period. No comments were received that changed the content of the recovery strategy.

Recommendations:
The NWMB review the updated “Recovery Strategy for Cumberland Sound Beluga (*Delphinapterus leucas*)” and provide any comments and its decision to DFO

Prepared by:
Christine Lacho, Species at Risk Biologist, DFO, Ontario and Prairie Region, Winnipeg

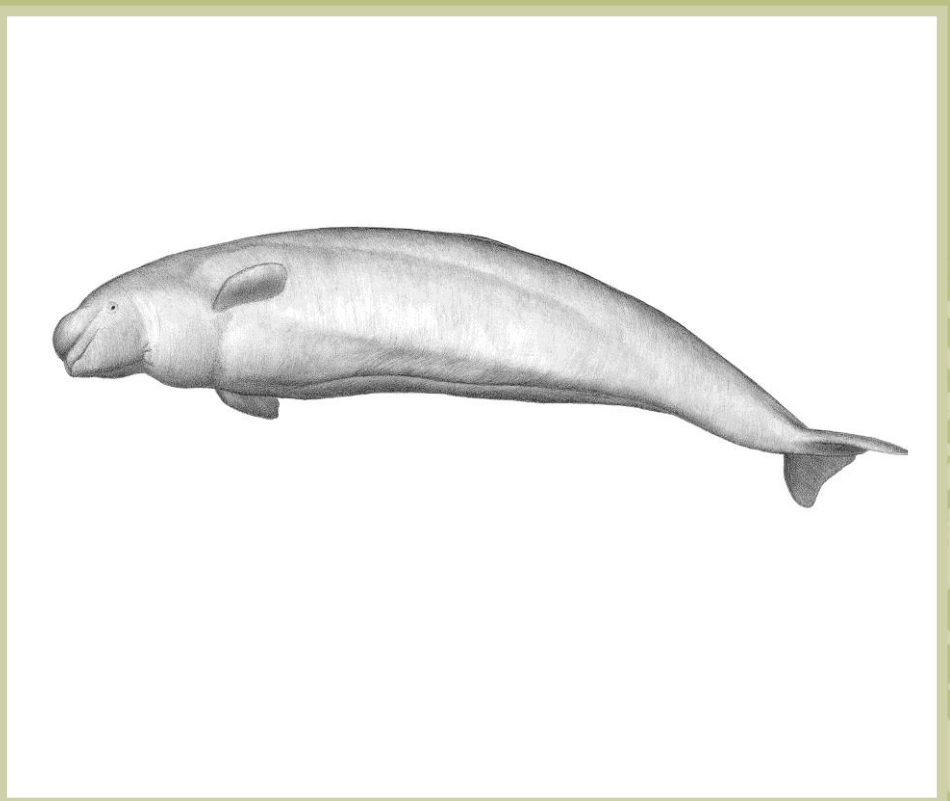
Date:
May 2024

Proposed

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Beluga Whale (*Delphinapterus leucas*), Cumberland Sound population, in Canada

Beluga Whale



2024

Canada

Recommended citation:

Fisheries and Oceans Canada. 2024. Recovery Strategy for the Beluga Whale (*Delphinapterus leucas*), Cumberland Sound population, in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. vii + 51 pp.

For copies of the progress report, or for additional information on species at risk, including Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, recovery strategies, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk Public Registry.

Cover illustration: © Gerald Kuehl

Également disponible en français sous le titre
« Programme de rétablissement du béluga (*Delphinapterus leucas*), population de la baie Cumberland, au Canada »

ISBN ISBN to be included by SARA Responsible Agency
Catalogue no. Catalogue no. to be included by SARA Responsible Agency

Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for the protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for species listed as extirpated, endangered, or threatened and are required to report on progress 5 years after the publication of the final document on the Species at Risk Public Registry, and every subsequent 5 years, until the recovery strategy is no longer required under SARA or the species' recovery is no longer feasible.

The Minister of Fisheries and Oceans is the competent minister for the Cumberland Sound Beluga (*Delphinapterus leucas*) and has prepared this recovery strategy, as per section 37 of SARA. It has been prepared in cooperation with the Pangnirtung Hunters and Trappers Association (HTA), the Qikiqtaaluk Wildlife Board (QWB), and the Nunavut Wildlife Management Board (NWMB), as per subsection 39(1) of SARA.

As stated in the preamble to SARA, success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Fisheries and Oceans Canada (DFO), or any other jurisdiction alone. The cost of conserving species at risk is shared amongst different constituencies. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Cumberland Sound Beluga, and Canadian society as a whole.

This recovery strategy will be followed by 1 or more action plans that will provide information on recovery measures to be taken by DFO and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this recovery strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

Acknowledgments

This document was prepared on behalf of the Cumberland Sound Beluga Recovery Team by S.A. Stephenson (DFO, Species at Risk Program, Ontario and Prairie Region).

Members of the Team acknowledge the support of their organizations during the preparation of the strategy: the Pangnirtung Hunters and Trapper Association, Qikiqtaaluk Wildlife Board, Nunavut Wildlife Management Board, Nunavut Tunngavik Incorporated (NTI), and DFO.

The following participants of the Regional Advisory Process and of the Recovery Planning Workshop held in Pangnirtung in March 2002 are thanked for their contribution of knowledge and experiences, and for helping to make a start on drafting the recovery strategy: Jaypetee Angmarlik, Susan Cosens, Karen Ditz, Josée Galipeau, Patt Hall, Lazarusee Ishulutaq, Abraham Kaunak, Mosesie Keenainak, Livee Kulluarlik, Mathewsie Maniapik, Laimee Nakashuk, Jooeelee Papatsie, and Pierre Richard.

Recovery Team members have included: Leopa Akpalialuk (Pangnirtung HTA), Tracy Allison (DFO), Tara Bortoluzzi (DFO), Holly Cleator (DFO), Karen Ditz (DFO), Winston Fillatre (DFO), Josée Galipeau (NWMB), Patt Hall (DFO), Joannie Ikkidluak (QWB), Paul Irngaut (NTI), Lazarusee Ishulutaq (Pangnirtung HTA), Abraham Kaunak (QWB), Daisy Keenainak (Pangnirtung HTA), Stephan Kilabuk (NTI), Livee Kulluarlik (Pangnirtung HTA), Chris Lewis (DFO), Jeff MacDonald (DFO), Noah Mosesee (Pangnirtung HTA), Laimee Nakashuk (Pangnirtung HTA), Mosesee Nuvaqiq (Pangnirtung HTA), Keith Pelley (DFO), Peterosie Qappik (Pangnirtung HTA), Pierre Richard (DFO), Adam Schneidmiller (NWMB), and Sam Stephenson (DFO).

The Recovery Team is thankful for the administrative support of Moe Keenainak and Leona Nakashuk (Pangnirtung HTA), and Solomon Awa and Tom Demcheson (QWB). Louisa Angmarlik (Pangnirtung HTA), Martine Giangioppi (DFO), and Patt Hall (DFO), provided assistance with recording, taking notes, and facilitating the workshop/meetings. Jonah Kilabuk provided Inuktitut translation and interpretive services at various times throughout the process. Innirvik Support Services, Andrew Dialla, and Naimee Kilabuk Bourassa also provided translation services when needed.

Numerous other individuals from Pangnirtung HTA, QWB, NWMB, NTI, and DFO have participated in meetings and reviewed drafts of the recovery strategy over the years. These individuals are thanked for their contributions to the development of the strategy.

Executive summary

The Cumberland Sound population of Beluga Whale (*Delphinapterus leucas*) (hereafter abbreviated as CSB) was listed as threatened under the *Species at Risk Act* (SARA) in April 2017. In 2020, during the drafting of the recovery strategy, COSEWIC reassessed CSB as endangered. Consequently, this recovery strategy may be amended at a future date if the listed SARA status under Schedule 1 changes. This recovery strategy is part of a series of documents for this species that are linked and should be taken into consideration together; including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Report (COSEWIC 2004), a recovery potential assessment (DFO 2005a), and 1 or more actions plans (to come). Recovery of CSB has been determined to be biologically and technically feasible, but will take a considerable length of time; possibly in excess of 100 years.

The Beluga Whale is a toothed whale characterised by a blunt head, slight beak, fat, stocky body, and lack of a dorsal fin. Newborn calves range from light to dark mottled grey in colour. Juveniles gradually lighten in colour as they age until they become almost pure white at, or shortly after, the age of sexual maturity of approximately 10 to 14 years of age. CSB was identified as a unique population in 2004 due to genetics, contaminant and movement data (COSEWIC 2004).

The primary current threat to CSB is the Inuit subsistence harvest. The latest population estimates and modelling data strongly suggest that a reduced harvest level will be required to achieve population recovery. Other potential threats, and activities that may impede CSB recovery include: noise and disturbance, pollution, and commercial fisheries that may compete for beluga prey. Killer Whale (*Orcinus orca*) predation, ice and tidal entrapment, disease/parasites, and environmental changes are among the natural limiting factors which may delay recovery or cause a decline in the population.

The population and distribution objective (section 6) for CSB is to protect, maintain and recover the population to levels that are self-sustaining such that the population is increasing to a stable size that is large enough to resist stochastic events and persist over the next 2 generations (that is, long-term ≥30 years).

To meet the population and distribution objective, the recovery strategy takes into consideration the uncertainty associated with current knowledge of CSB and its environment. The strategic approaches proposed to meet the population and distribution objective are to:

- manage the harvest for the recovery of CSB
- increase knowledge of the biology, seasonal distribution, abundance, and habitat requirements of CSB
- identify and protect all CSB critical habitat as soon as possible
- increase knowledge of how threats affect CSB survival so that these threats can be prioritized and avoided, eliminated, or mitigated to the extent possible

A description of the broad strategies to address threats to the species' survival and recovery, as well as research and management approaches needed to meet the population and distribution objective, are included in section 7. These will help inform the development of specific recovery measures in 1 or more action plans. An action plan relating to this recovery strategy will be produced within 5 years of this final recovery strategy being posted on the SARA Public Registry.

Using available data, critical habitat has been identified to the extent possible (section 8). The schedule of studies outlines the research required to further identify critical habitat to help achieve the population and distribution objective.

The recovery strategy provides the exemption that the summer and winter Greenland Halibut fishery may use long-lines, and their use will continue to be authorized under section 7 of the *Fisheries Act*.

Recovery feasibility summary

Recovery of CSB is believed to be biologically and technically feasible. The following feasibility criteria have been met for the species:

1. Are individuals of the wildlife species that are capable of reproduction available now or in the foreseeable future to sustain the population or improve its abundance?

    Yes. There are currently a sufficient number of individuals capable of reproduction to sustain the population or improve its abundance (DFO 2005a). Local[1] and scientific knowledge suggests that CSB are capable of reproducing at a level that will permit recovery. Hunters report seeing, on a regular basis, cows with young calves. Calves were seen in aerial photographs taken in Clearwater Fiord in 2017. A recent study (DFO 2022) has identified 2 genetically distinct populations of Beluga in Cumberland Sound. However, further study is needed to determine whether the two populations correspond to 2 visually distinguishable stocks[2] described by local hunters. Beluga from the 2 populations cannot be distinguished visually during aerial abundance surveys. Spatial or temporal characteristics associated with the populations that could allow selective harvesting of the 2 populations in Cumberland Sound have also not yet been identified (DFO 2022). Based on information currently available, these 2 populations can only be assessed as a single stock.

2. Is sufficient suitable habitat available to support the species or could it be made available through habitat management or restoration?

    Yes. Degradation or loss of habitat in Cumberland Sound is not considered to be a threat to the species. Local knowledge suggests that CSB habitat has changed little since pre-whaling times, therefore it is currently understood that sufficient suitable habitat is available now and in the foreseeable future to accommodate an increase in the CSB population to recovery levels.

3. Can significant threats to the species or its habitat be avoided or mitigated?

    Yes. The subsistence harvest is under quota of 41 whales per year and a Fisheries Management (FM) management plan is being developed by the Cumberland Sound Beluga Working Group using co-management methods required in Nunavut and using the most recent scientific information and local knowledge. The subsistence harvest under the current quota is considered a high risk threat to CSB (DFO 2016; DFO 2019). According to DFO's population estimate based on the most recent surveys, a model estimated that a quota of 0, 14, or 20 whales per year would result in a 0%, 25%, and 50% probability of decline, respectively, for CSB within 10 years (DFO 2019). A sustainable subsistence harvest would not pose a threat to species' recovery.

    Predation by Killer Whales (*Orcinus orca*), and possible threats from climate change and contaminants, are difficult to control or mitigate, and the degree to which they affect species' recovery is unknown, although presumably low. Other possible threats such as

[1] Local knowledge in this recovery strategy is geographically distinct to Cumberland Sound, and represents Inuit knowledge and the perspectives of hunters and trappers of the Pangnirtung community.
[2] A stock refers to a management unit defined geographically and temporally that may include more than one population if they overlap during the management or harvest season (DFO 2022).

noise, disturbance and pollution can be mitigated to a large extent at the local level and are also considered a low level of concern. Conflicts with commercial fisheries are minimal and should be monitored locally and, if required, measures should be taken to prevent the reduction of food resources for CSB.

4. Do recovery techniques exist to achieve the population and distribution objective or can they be developed within a reasonable timeframe?

Yes. Recovery techniques already exist including harvest management, “no hunting and harassment” zones, and population monitoring. There are techniques available to address human impacts (for example, overharvest, noise disturbance, pollution) that will allow the population to recover.

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1. Introduction

The Cumberland Sound Beluga Whale (*Delphinapterus leucas*) (hereafter abbreviated as CSB) was listed as threatened under the *Species at Risk Act* (SARA) in May 2017. In 2020, during the drafting of the recovery strategy, COSEWIC reassessed CSB as endangered. Consequently, this recovery strategy may be amended at a future date if the listed SARA status under Schedule 1 changes.

This recovery strategy is part of a series of documents regarding CSB that should be taken into consideration together, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Report (COSEWIC 2004), COSEWIC 2020 reassessment[3] and the Science Advisory Report from the Recovery Potential Assessment (RPA) (Fisheries and Oceans Canada [DFO] 2005a), and the subsequent action plan(s), to be prepared within 5 years of this final recovery strategy being posted on the SARA Public Registry. A recovery strategy is a planning document that identifies what needs to be done to arrest or reverse the decline of a species. It sets objectives and identifies the main areas of activities to be undertaken for the species. Detailed planning is done at the subsequent action plan stage.

The RPA is a process undertaken by DFO Science to provide the information and scientific advice required to implement SARA, relying on the best available scientific information, data analyses and modeling, and expert opinions. For more detailed information beyond what is presented in this recovery strategy, refer to the COSEWIC status report, COSEWIC 2020 reassessment, and the RPA science advisory report.

[3] The 2020 COSEWIC assessment considers beluga in Cumberland Sound as 1 population.

2. COSEWIC species assessment information[4]

Date of assessment: November 2020

Common name (population): Beluga Whale (Cumberland Sound population)

Scientific name: *Delphinapterus leucas*

COSEWIC status: Endangered

Reason for designation: This is a small population with a restricted range, heavily reduced by commercial whaling in the past. While whales from this population continue to be harvested for subsistence, recent models suggest that reported removals are not sustainable. There are also concerns related to fishery removals of Greenland Halibut, a prey item for this population of belugas.

Canadian occurrence: Nunavut, Arctic Ocean

Status history: The Southeast Baffin Island-Cumberland Sound population was designated endangered in April 1990. In May 2004, the structure of the population was redefined: the Southeast Baffin Island animals (formerly part of the Southeast Baffin Island-Cumberland Sound population) were included as part of the "Western Hudson Bay population, 2004 designation". The newly defined "Cumberland Sound population" was designated threatened in May 2004. Status re-examined and designated endangered in November 2020.

[4] The species' current classification on Schedule 1 of the *Species at Risk Act* is based on the 2004 assessment.

Date of assessment: May 2004

Common name (population): Beluga Whale (Cumberland Sound population)

Scientific name: *Delphinapterus leucas*

COSEWIC status: Threatened

Reason for designation: Numbers of Belugas using Cumberland Sound have declined by about 1,500 individuals between the 1920s and present. The population decline is believed to have been caused by hunting by the Hudson Bay Company into the 1940s and by the Inuit until 1979. Hunting has been regulated since the 1980s. Current quotas (41 in 2003) appear to be sustainable. Concerns have been raised about increased vessel traffic and the associated noise of outboard motors, as well as fishery removals of Greenland Halibut, a food source of Belugas.

Canadian occurrence: Cumberland Sound, Nunavut

Status history: The Southeast Baffin Island, Cumberland Sound population was designated endangered in April 1990. In May 2004, the structure of the population was redefined and named “Cumberland Sound population”, and the Southeast Baffin Island animals were included as part of the Western Hudson Bay population. Status re-examined and designated as threatened in May 2004. Last assessment based on an updated status report.

3. Species status information

Global status: The Beluga is globally secure, although some populations are clearly depleted and require further conservation measures (Jefferson et al. 2010). Beluga are listed under other programs such as the International Union for Conservation of Nature (IUCN) Red List which listed the entire species as near threatened in 2008. There is no individual IUCN status ranking for the CSB population.

Canadian status: CSB has not yet been ranked by NatureServe Canada. The entire population occurs within Canada in Nunavut in the area of Cumberland Sound. It was classified as threatened by COSEWIC in 2004 and listed as threatened under SARA in May 2017. In November 2020, COSEWIC reassessed the CSB population as endangered.

Upon listing as a threatened species in 2017, CSB became protected wherever it is found by section 32 of SARA:

> “No person shall kill, harm, harass, capture or take an individual of a wildlife species that is listed as an extirpated species, an endangered species or a threatened species.” [subsection 32(1)]
>
> “No person shall possess, collect, buy, sell or trade an individual of a wildlife species that is listed as an extirpated species, an endangered species or a threatened species, or any part or derivative of such an individual.” [subsection 32(2)]

Subsection 83(3) of SARA provides that the general prohibitions of SARA do not apply to a person who is engaging in activities in accordance with conservation measures for wildlife species under a land claims agreement.

Under sections 73 and 74 of SARA, the competent minister may enter into an agreement or issue a permit authorizing a person to engage in an activity affecting a listed wildlife species, any part of its critical habitat, or its residences.

4. Species information

4.1 Species description

Belugas are toothed whales (*Odontocete*) characterised by a blunt head, slight beak, fat, stocky body, and lack of a dorsal fin (figure 1). Newborn calves range from light to dark mottled grey in colour. Juveniles gradually lighten in colour as they age until they become almost pure white at, or shortly after, the age of sexual maturity (Sergeant 1973; Heide-Jørgensen and Teilmann 1994). Belugas are most commonly found in Arctic waters, but they also occur in sub-Arctic waters. In Cumberland Sound, adult females and males reach mean lengths of 362 cm (11.9 ft) and 428 cm (14 ft), respectively (Brodie 1971) and weigh from 800 to 1,000 kg (1,750 to 2,200 lbs). Females typically reach sexual maturity between 8 to 14 years, and males somewhat older at 12 to 14 years (Brodie 1971; Doidge 1990; Heide-Jørgensen and Teilmann 1994; Stewart 1994a; Stewart 1994b). Stewart et al. (2006) have shown that Beluga tooth growth layer groups form annually, not biannually as was previously thought, and therefore, the ages given herein for sexual maturity have been adjusted accordingly.

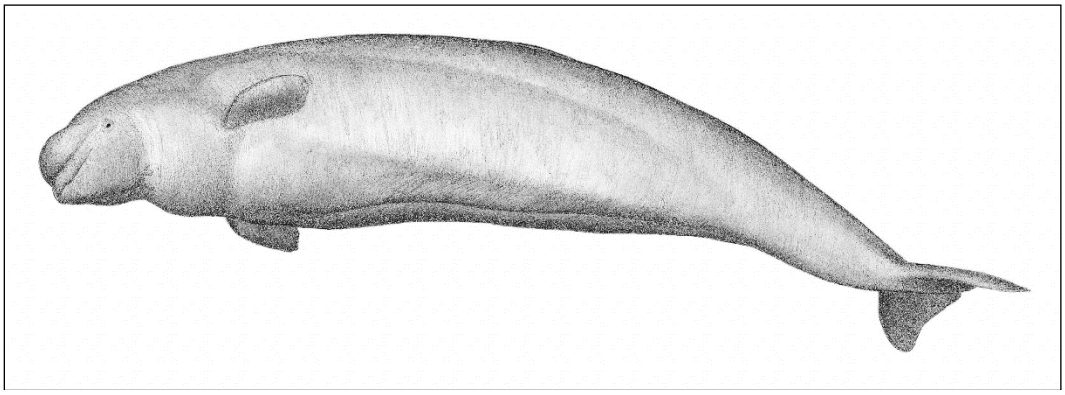

Figure 1. Beluga Whale (*Delphinapterus leucas*). © G. Kuehl.

Local knowledge regarding CSB suggests the peak in mating appears to occur in May, with calves being born in late July or early August (Kilabuk 1998). However, Béland et al. (1990) suggest that the peak calving time is not well established nor easily observed for Belugas, as it occurs offshore during the late spring migration. Calving in estuaries, in early summer, has been postulated (Sergeant 1973), but detailed studies in at least 2 Canadian estuaries have never recorded a calving event (Caron and Smith 1990; Smith et al. 1994). Nonetheless, hunters from Pangnirtung mention that in the past, females were sometimes seen calving in Shark Fiord (figure 2). While waiting on islands in the area, it was often possible for hunters to witness calving and then harvest the newborn immediately thereafter, if there was need for this resource. Females about to calve were observed to separate from the main pod and travel back

to the pod following calving. Calving was observed in July (Pangnirtung Hunters and Trappers Association [HTA] pers. comm. 2018).

The calving interval for beluga is estimated on average to be 1 calf born every 3 years (Brodie 1971; Matthews and Ferguson 2015) and calves may nurse for up to 3 years (Matthews and Ferguson 2015). The gestation period is about 14.5 months (Brodie 1971), although Pangnirtung hunters report that CSB females may give birth annually (Kilabuk 1998). An approximate maximum rate of increase of 4% per year was predicted for the population in the absence of hunting (Richard 2013). A population model using survey estimates from 1990 to 2017 and reporting annual harvests from 1960 to 2017 suggests a maximum growth rate of 3% per year (DFO 2019). Sources of natural mortality may include predation by Polar Bears (*Ursus maritimus)* (Smith 1985) and Killer Whales (*Orcinus orca*) (Byers and Roberts 1995; Sheldon et al. 2003), ice or tidal entrapments (Porsild 1918; Freeman 1968) and, possibly, disease (Nielsen pers. comm. 2018). Although Polar Bear predation has not been documented in Cumberland Sound, hunters report harvesting Belugas that exhibit scars from Polar Bear claws which point to failed attempts at predation (Pangnirtung HTA, pers. comm. 2018).

According to local knowledge (Kilabuk 1998: Stewart 2001), in the springtime, CSB are found at the floe edge, preying mainly on Arctic Cod (*Boreogadus saida*) and Greenland Halibut (*Reinhardtius hippoglossoides*) (also known as Turbot) (Kilabuk 1998). Some hunters also report that shrimp are eaten in the spring and early summer, as these are noted in the stomach contents of harvested whales (Pangnirtung HTA, pers. comm. 2018). Using stable isotopes, Marcoux et al. (2012) determined that from March to September, CSB primarily eat Arctic Cod and Capelin (*Mallotus villosus*). Fatty acid profiles of CSB blubber from 1980 to 2010 indicated there has been an increasing consumption of Capelin and a reduction in Arctic Cod in the summer months (Watt et al. 2016). Shallow, short dives in the summer seem to indicate foraging on Capelin, while deeper, longer dives in autumn and winter possibly indicate foraging on deeper prey such as Arctic Cod and Greenland Halibut, consumption of which would be important for amassing energy reserves (Watt et al. 2016).

4.2 Population abundance and distribution

A total of 7 Canadian Beluga populations have been identified based mainly on their summer distributions and genetic differences Beaufort Sea, St. Lawrence Estuary, Ungava Bay, eastern Hudson Bay, western Hudson Bay, High Arctic Baffin Bay, and Cumberland Sound (COSEWIC 2004).

Prior to the commencement of commercial harvesting in 1868, there were an estimated 8,500 CSB (Alvarez-Flores 2005). As a result of the commercial harvesting, the population declined substantially until 1966 when commercial harvesting ended after removing at least 14,079 whales (Stewart 2018). There is little doubt that these commercial harvests, and not subsistence harvests by the Inuit, were the primary cause of the decline of CSB (COSEWIC 2004, 2020). Aerial surveys conducted in the western end of Cumberland Sound (including Clearwater Fiord) in the autumn of 1979, and the summers of 1980, 1985 and 1986, produced surface index counts of about 400 to 600 Belugas (Brodie et al. 1981; Richard and Orr 1986). Since a surface index only counts those whales seen at, or near, the surface of the water and does not include animals diving below the surface that cannot be seen by aerial survey observers, it is not a means to accurately estimate population size.

Dive data obtained from Belugas tagged in other parts of Nunavut (Heide-Jørgensen unpubl. data) were used to estimate the number of diving animals during 1999 surveys (Richard 2013), resulting in a population estimate of 1,960 Belugas (90% confidence limits [CL]=1,594 to 2,409). A Bayesian model estimated the 2002 population size to be 2,018 individuals (95% CL=1,553 to 2,623), or 24% of its estimated historical population size (DFO 2005a).

An aerial survey planned for 2005 was not completed due to inclement weather conditions, while large confidence intervals made the 2009 abundance estimate unreliable (estimate of 788 [confidence interval (CI)=310 to 1,679]) (Richard 2013). A 2014 aerial survey using visual and photographic methods yielded a population estimate of 1,151 individuals (95% CI=761 to 1,744) (Marcoux et al. 2016). The 2014 survey was carried out over an 8 day period in August and included multiple surveys of Clearwater Fiord and the north and western portion of Cumberland Sound where most CSB are known to congregate at that time of year (DFO 2016). The survey also included the south and west side of the Sound to Kikiktaluk Island (figure 2). A 2 part aerial survey carried out from July 29 to August 3, 2017 and August 4 to August 12, 2017, included Clearwater Fiord and extended as far south as Moodie Island (figure 2); farther than the 2014 survey. The 2017 survey yielded a weighted average estimate of 1,381 whales (95% CI=1,270 to 1,502) (DFO 2019).

Based on the best information at the time, the CSB subsistence quota was set at 41 whales per year in 2005 (DFO 2005b). However, examination of the 4 aerial surveys of CSB (from 1990 to 2014) show sequential abundance estimates that cannot be explained by known dynamics of Beluga populations (Marcoux and Hammill 2016). The large increase in estimated population size observed between the 1990 and 1999 surveys is not biologically possible. The severe decline implied by the 1999 and 2009 population estimates is only possible if mortality was substantially larger (~180 CSB/year) than is presently reported by the Inuit harvest or there are other important sources of mortality that were not taken into account (Richard 2013). Therefore, the setting of a quota of 41 CSB per year in 2005 was meant to be sustainable, but several recent assessments have shown that those levels of harvest are not sustainable.

More recently, a population model was developed with an updated series of survey estimates from 1990 to 2017 and reported annual harvests from 1960 to 2017 to estimate current abundance and determine trends in population dynamics. The model estimated that a total allowable landed catch (TALC) of 0, 14, or 20 CSB per year would result in a 0%, 25%, and 50% probability of decline, respectively, in the CSB population in 10 years (DFO 2019).
Local hunters speak of 2 types of Belugas that inhabit Cumberland Sound that they distinguish by size and behaviour (Kilabuk 1998). Groups of smaller sized Belugas are reported to first appear at the floe edge in April. They are later seen in Nettling and Kangillo fiords along with the regular Cumberland Sound whales. These whales are somewhat thinner and the adults are white. The texture of their blubber, or maktaq, is soft. A recent study (DFO 2022) has identified 2 genetically distinct populations of Beluga in Cumberland Sound. However, further study is necessary to see if the 2 genetic populations correspond to the 2 physically distinguishable stocks described by local hunters. Herds of larger Belugas arrive at the floe edge in late April and May and eventually move to the Clearwater Fiord area for the summer. In spring, their outer skin layer is yellow and just starting to shed.

In late June and early July, large groups of CSB migrate in ice leads along the southwestern coast of Cumberland Sound to their main summering area in and near Clearwater Fiord at the top of the Sound (figures 2 and 3). Some whales are found in bays along the southern side of the Sound until early fall. Early surveys suggested that from mid-July to mid-September, the major summer aggregation of CSB were limited to the Clearwater Fiord area where they

occupied the Ranger River estuary and adjacent bays where they reportedly fed infrequently on a variety of fish and invertebrates (COSEWIC 2004). There is some evidence that older CSB of both sexes either inhabit different areas or feed on more benthic species than younger CSB (Marcoux et al. 2012). CSB leave the Clearwater Fiord area in late August through September and move back along the southwest side of Cumberland Sound. Based on satellite tagging studies, CSB spend most of their time near the centre of the Sound in late autumn, diving to depths of 300 m or more, likely to feed on deep water species such as Greenland Halibut (Richard and Stewart 2008) (figure 4). In early winter, CSB move to the eastern end near the mouth of Cumberland Sound and remain in open water areas (polynyas) until the following spring.

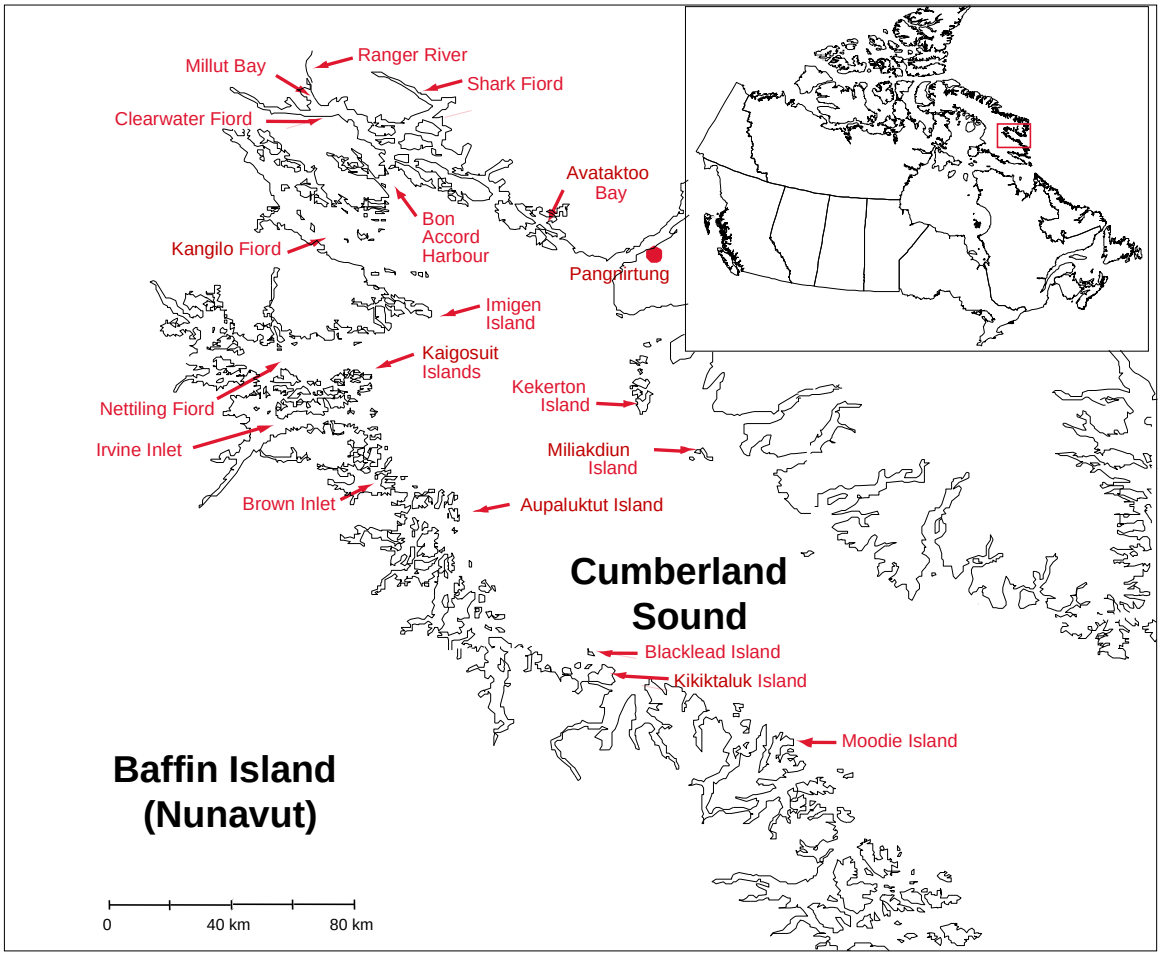

Figure 2. Locations of place names in Cumberland Sound mentioned in the text.

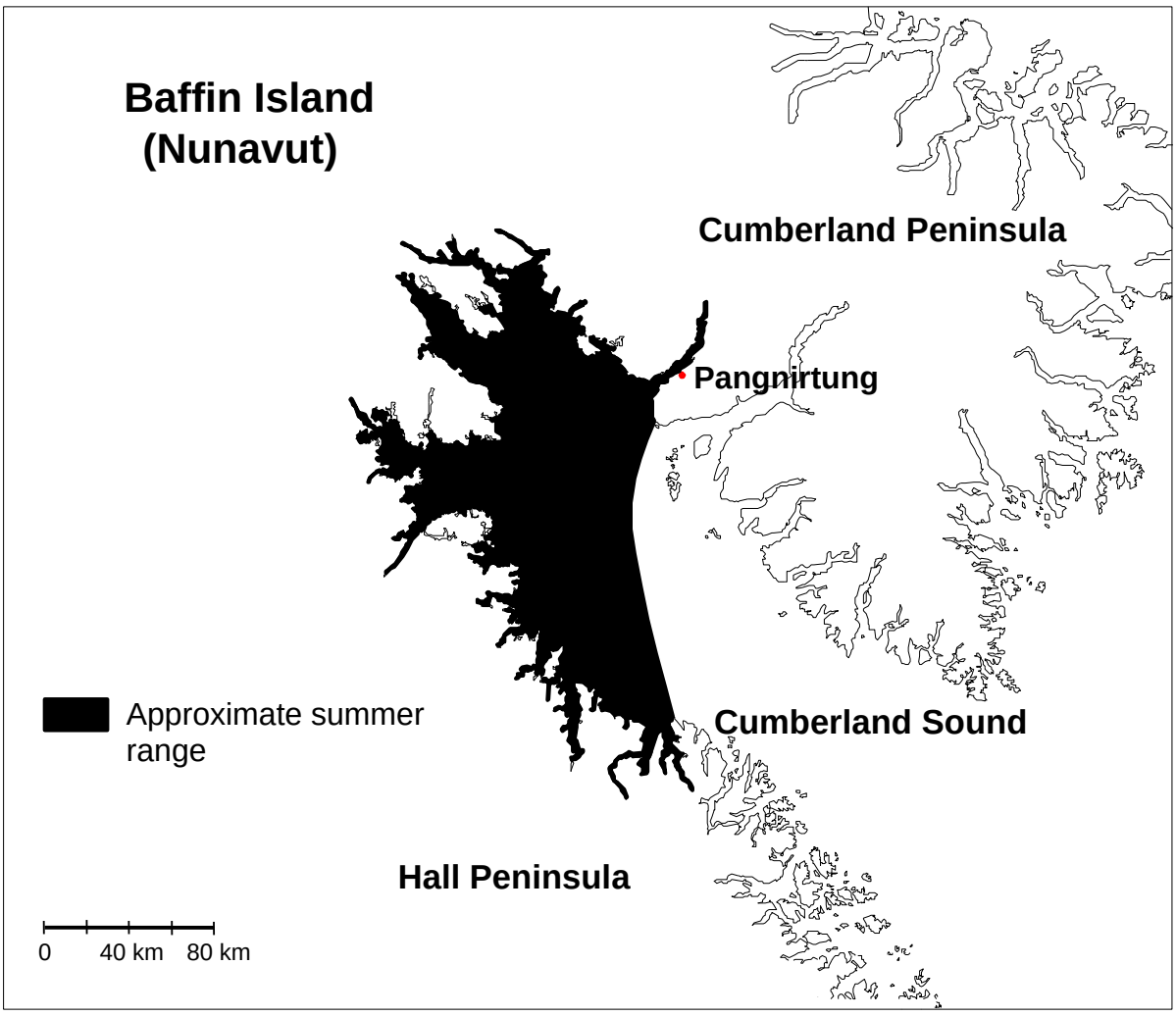

Figure 3. Distribution of Cumberland Sound Beluga during summer.

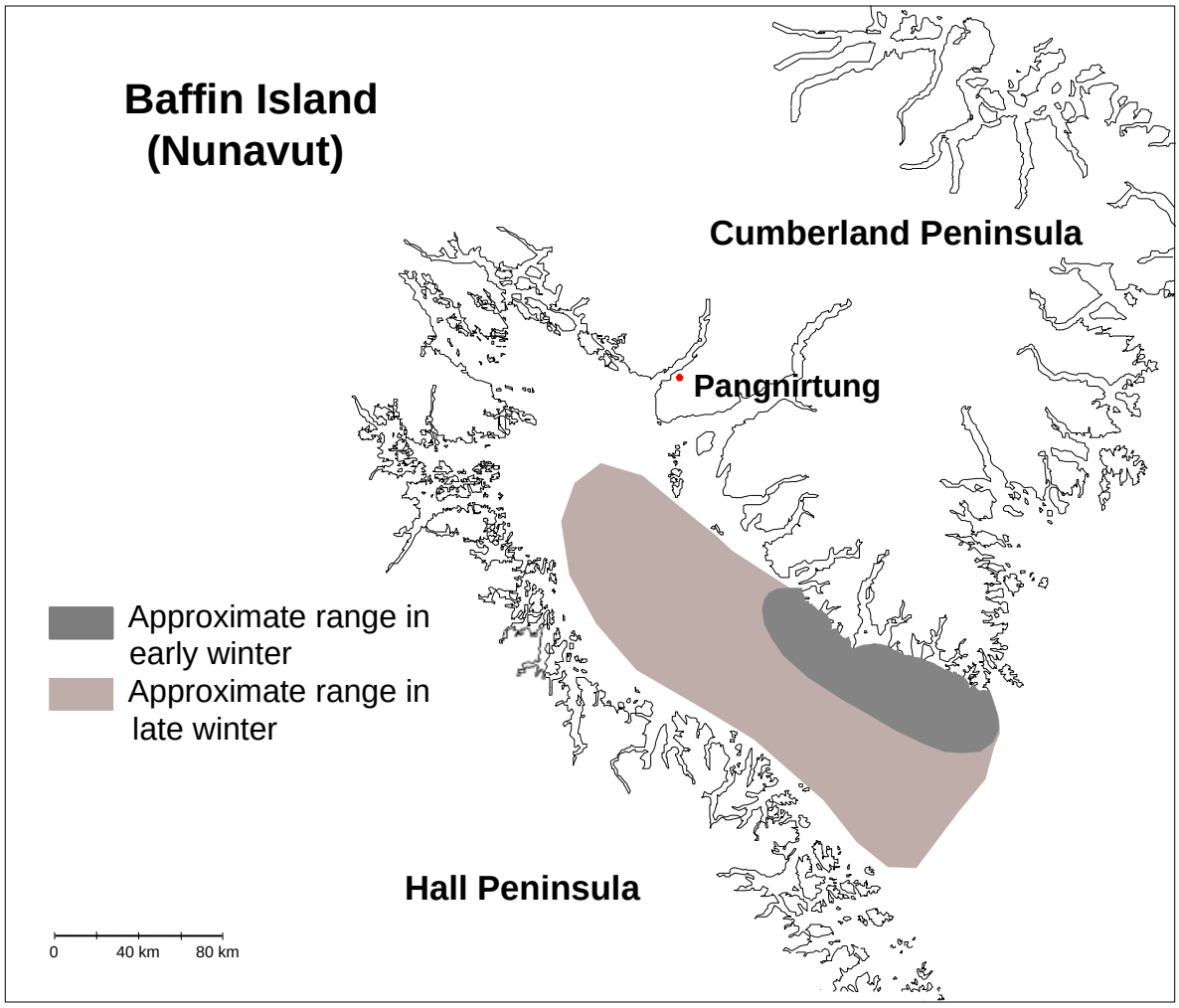

Figure 4. Distribution of Cumberland Sound Beluga during early and late winter.

During the summer, Pangnirtung hunters also report Belugas being present in Nettiling Fiord and southward in the bays and coastal waters of the southwestern side of Cumberland Sound (figure 3). Like the early floe edge whales, some of these Belugas are smaller in size and thinner than the Clearwater Fiord whales. It is unclear whether these whales are the same animals as the small whales seen at the floe edge in April, but their maktaq reportedly tastes the same (Kilabuk 1998). There are reportedly far fewer of the smaller whales than the larger ones. The appropriateness of using morphology to distinguish or differentiate Beluga populations has been questioned (for example, Luque and Ferguson 2010; Harwood et al. 2014), and therefore, these whales may all belong to the same population. However, it is possible that these smaller whales are from another population, such as Hudson Bay, and overwinter near the mouth of Cumberland Sound and are simply slow in leaving the area after ice breakup. Pangnirtung hunters suggest that most of these whales leave Cumberland Sound by the end of July and, therefore, would only be seen if aerial surveys were flown near the mouth of the Sound earlier in the year. As previously mentioned, genetic analysis of CSB has revealed 2 distinct genetic populations, but further research is necessary to see if these 2 stocks correspond to the 2 different physically distinct stocks. Comparison of genetic samples taken from the larger versus smaller sized Belugas may help determine whether these 2 types of Belugas represent different stocks and their degree of relatedness, if any.

4.3 Needs of the species

The CSB uses different habitat depending on the season. Habitat use by CSB can be described physiographically, biologically, and by sea ice features that characterize use. A residence, as defined under SARA, is not applicable to CSB because it does not have any known dwelling place similar to a den or nest that is occupied or habitually occupied by 1 or more individuals during all or part of its life cycle.

4.3.1 Physiographic features that characterize Beluga habitat use

Cumberland Sound is a large, wide inlet with maximum depths in excess of 1,000 m, with large fiords on the northeast and eastern side which are in excess of 100 m in depth, while southern and western areas are much shallower, have a wider shelf (IBCAO 2012) and a more complex shoreline. Throughout the year, CSB can be found in areas of variable depths. In the summer (July to August), CSB predominantly occupy Clearwater Fiord centering on Millut Bay, or “Midlurialik” as it is called locally (Richard and Stewart 2008) (figure 2). It has been suggested that estuaries serve as beach rubbing or moulting sites for Belugas, or that they provide shelter from predators. The water discharged from the Ranger River into Millut Bay is colder than sea water, and may possess some benefits for the moulting process. Clearwater Fiord is the only calving place in Cumberland Sound known to hunters (Kilabuk 1998) and is the only location of its kind on the southeast Baffin coast. CSB occupy the fiord for several weeks every summer. In late summer or early fall (late August to early September), they leave Clearwater Fiord for deeper waters, migrating to feeding areas along the southwestern shore. CSB used to leave Clearwater Fiord later in the year, sometimes October, when there were more Killer Whales present (Kilabuk 1998). With Killer Whale numbers recently increasing, CSB may again begin leaving the area later to avoid these predators. Changing temperatures may also be delaying CSB movement from Clearwater Fiord.

The west end of Cumberland Sound and a large portion of the southern part of the Sound have a wide shelf and gentle slope that reaches a depth of approximately 400 m (Richard and Stewart 2008). The bays located there are relatively shallow when compared to depths in most of the Sound. These areas contain small numbers of Belugas seasonally and some animals have been known to become trapped, typically in the fall, in bays that have a shallow sill at their entrance. They remain trapped in these bays until high tides provide a chance to exit. Occasionally, a humane harvest occurs when animals seem unable to leave independently or ice makes escape impossible (Stewart 2018).

Research suggests that CSB have a preference for certain water depths and that this preference varies seasonally (Richard and Stewart 2008). Data for an entire year is not available, although preliminary tagging data in 1998 to 1999 and from September to November 2008 revealed that in September, CSB preferred to use waters between 100 m and 300 m deep whereas in October and November, CSB preferred deeper waters ranging in depths of between 200 m and 500 m (Richard and Stewart 2008).

4.3.2 Biological features that characterize Beluga habitat use

In Cumberland Sound, Belugas have access to a variety of prey at differing depths. The most common marine fishes in the area are Arctic Cod and Greenland Halibut. Other species present include Capelin, Greenland Cod (*Gadus ogac*), Snail fish (*Liparis* spp.), Arctic Alligatorfish

(*Ulcinia olrikii*) and several species of Sculpins (*Gymnocanthus* spp. and *Myoxocephalus* spp.). A variety of benthic invertebrate prey are also available.

It is unknown if CSB are targeting particular prey species or are feeding opportunistically, although there is some evidence for targeted feeding (Marcoux et al. 2012). Capelin seems to be increasing in both abundance in the Sound (Marcoux et al. 2012), and proportionally in the diet of CSB (Watt et al. 2016). During the summer when they are found within Clearwater Fiord, belugas rarely feed. Brodie (1970 and 1971) reported that stomachs at this time of year were often empty, but the few that did contain contents mainly had consumed a variety of benthic organisms. Belugas have been seen feeding in the Sound and near the mouth of Kangilo Fiord in the fall (Kilabuk 1998).

4.3.3 Sea ice features that characterize beluga habitat use

During winter months, ice covers much of Cumberland Sound. At that time of year, CSB are vulnerable to the risk of losing access to open water, so they seek out areas where the ice conditions are more dynamic and large areas remain open. The coastal shelf of Cumberland Sound is covered with landfast ice (ice attached to the shoreline) throughout the winter, with heavy pack ice (large pieces of shifting, floating ice packed together) covering most of the remainder of the Sound. CSB survive the winter in ice leads and polynyas where open water provides access to air.

The largest polynya is located near the mouth of Cumberland Sound, close to the Cumberland Peninsula. Several smaller polynyas that are kept open by tidal currents occur at the mouths of several bays and fiords around the Sound. In months when winter ice is forming rapidly, the northeast polynya along the Cumberland Peninsula provides the least risk of ice entrapment. Belugas trapped in ice are susceptible to predation by Polar Bears, starvation, and suffocation if the ice does not break open to release the whales. Large ice entrapment events are, however, thought to be infrequent in the Sound (Richard and Stewart 2008). Elders of Pangnirtung speak of an ice entrapment of approximately 100 CSB in 1956 on the west side of the Sound and another entrapment of more than 35 CSB in Irvine Inlet (no date given) (Richard and Stewart 2008) (figure 2).

An ice lead also forms along the northern margin of fast ice when northwest winds displace pack ice (Richard and Stewart 2008). The size of the lead varies, but can also narrow or close completely with strong winds. CSB do not appear to use it in the winter, but hunters report that this lead is occupied by CSB in early spring (Kilabuk 1998).

4.3.4 Limiting factors of habitat

Like most toothed whales, it is believed that Belugas have a slow reproductive rate which leads to a slow potential population growth rate. Many CSB, especially females and their calves, return to the same nursery areas annually. This summer site fidelity could be a limiting factor if these sites were subject to disturbance. In 1985, the Pangnirtung HTA recognized the importance of Clearwater Fiord and nearby Shark Fiord (figure 2) to CSB in summer by banning harvesting in those areas (Richard and Pike 1993), thereby protecting them from disturbance.

5. Threats and limiting factors

5.1 Threat assessment

Apart from subsistence harvesting pressures, there are no other significant anthropogenic threats to this population (COSEWIC 2004; DFO 2005a; DFO 2005b). Table 1 lists the threats known or suspected of having a negative effect on CSB, and the level at which they occur. Appendix C describes the threat assessment categories used in the table. Known and suspected threats were ranked with respect to likelihood and impact and were combined to produce an overall risk of the threat. A certainty level was also assigned to the overall threat level, which reflected the lowest level of certainty associated with either the threat likelihood or threat impact.

Table 1. Population level threat assessment for the Cumberland Sound Beluga. See appendix C for a detailed definition of descriptions used in this table.

Threats	Overall risk of threat	Occurrence	Frequency	Extent
Subsistence harvesting	High	Current	Continuous	Narrow
Acoustic disturbance	Low	Current	Recurrent	Broad
Commercial fisheries	Low	Current	Recurrent	Extensive
Pollution	Low	Anticipatory	Recurrent	Narrow

5.2 Description of threats

Subsistence harvest

The subsistence harvest is the only human activity which is known to remove whales from the CSB population. Under the current quota, the subsistence harvest is considered a high risk threat to CSB (DFO 2016; DFO 2019). As such, a well managed harvest which provides information on the number of whales struck and lost during the harvest, as well as samples collected from harvested whales (for example, length, sex, genetic, and contaminant samples) can contribute valuable knowledge essential in managing this population. Ongoing accurate knowledge on the number of CSB, their habitat use, and life history is important to properly manage a continuing harvest. Pangnirtung hunters believe there are virtually no whales struck and lost in the hunt, as CSB are only harvested early in the summer when they are very fat and hunters have never seen a fat whale sink. When whales first arrive and are harvested, they are very fat, but become thinner later in the year (Pangnirtung HTA pers. comm. 2018). DFO's population model (2019) estimated a struck and lost and non-reporting rate of 36%.

Some hunters believe that an increased harvest would not pose a threat to recovery of CSB as local knowledge suggests the population is continuing to recover. After 20 years of a quota and no increase in the number of CSB available to harvest, many Inuit feel that they should be

allowed to manage the Cumberland Sound stock for a similar length of time using traditional methods of wildlife management. Additionally, some Elders of Pangnirtung believe that while they were willing to respect the DFO quota, a growing population of younger hunters may not be so willing to accept the quota and push for a greater role in management as outlined in the *Nunavut Lands Claim Agreement* (1993). DFO continues to collect data on the population from aerial surveys and samples collected by hunters during the harvest. Based on analysis of this data, the subsistence harvest under the current quota is considered a high risk threat to CSB (DFO 2016; DFO 2019). Ongoing, accurate knowledge on the number of CSB, their habitat use, and life history is important to properly manage a continuing harvest while still allowing for recovery.

Wildlife in Nunavut is co-managed with local, regional, territorial and federal partners. Quotas are first approved by the Nunavut Wildlife Management Board and then reviewed by the Minister of Fisheries and Oceans Canada. At the recommendation of the Southeast Baffin Beluga planning committee a quota of 35 CSB was established for the 1991 to 1992 season and was increased to 41 for the 2002 to 2003 season (DFO 2002). The quota has been maintained at 41 CSB using DFO Variation Orders and is monitored by the Pangnirtung HTA. The quota was established using the best available information at the time (DFO 2005b) and is controlled by Pangnirtung HTA hunting rules and bylaws.

The annual quota of 41 whales was previously believed to be sustainable and not a threat to recovery, provided the harvest remained properly controlled (for example, not over-harvested, few if any struck and lost animals) and no additional unknown mortality occurred (DFO 2002). Between 1992 and 2001, Pangnirtung hunters landed an average of 36.5 Belugas annually, although this number does not include any struck and lost whales, nor those that were harvested opportunistically and for humane reasons when becoming entrapped by ice (DFO 2002). Stewart (2018) suggested that from 2002 to 2016 the quota of 41 whales was met or exceeded in all years except 2015, where the presence of summer ice limited the harvest to only 18 whales. There were 2 aerial surveys to estimate CSB abundance in 2017; to estimate current abundance and determine trends in population dynamics, a population model was developed using the series of survey estimates from 1990 to 2017 and reported annual harvests from 1960 to 2017. The model estimated that a Total Allowable Landed Catch (TALC) of 0, 14, or 20 CSB per year would result in a 0%, 25%, and 50% probability of decline, respectively, in the CSB population in 10 years (DFO 2019). Under the current quota, the model estimated a 96% probability of population decline in ten years.

The principles of conservation set out in the *Nunavut Lands Claim Agreement* (1993) guide harvest management and are consistent with requirements of the *Marine Mammal Regulations* and SARA. A Fisheries Management (FM) management plan will be developed with the Cumberland Sound Beluga Working Group, including the community of Pangnirtung to guide the conservation and sustainable use of the fishery and to ensure the harvest is conducted safely and effectively. The FM management plan is not a SARA legal instrument but will assist with achieving recovery goals.

Acoustic disturbance

Belugas rely on sound production and reception to navigate, communicate, locate breathing holes, and hunt in dark or murky waters. Loud external noise could result in hearing damage, avoidance of preferred areas during foraging or travel, and, possibly, deterrence of some activities. Excessive noise can prevent Belugas from carrying out vital functions and would,

therefore, constitute the destruction of critical habitat. Although the threshold level of acoustic disturbance that would destroy CSB critical habitat is currently unknown, scientific literature from the United States National Marine Fisheries Services (NMFS 2003) has established the threshold level of disturbance for marine mammals at 120 dB from continuous sources and 160 dB from pulse sources. The threshold for physical damage to hearing is set at 180 dB. These thresholds are given as an indication only, and can vary according to factors such as sound frequency or oceanographic conditions.

Local knowledge suggests that noise from motorized boats was considered to be the main factor causing a decline in numbers of whales seen at outpost camps and in all of Cumberland Sound (Kilabuk 1998). Kilabuk (1998) suggested that noise disturbances were causing whales to expend energy in avoiding boats, resulting in a decline in the oiliness of their blubber. More recently, hunters report that Belugas normally lose fat during the summer as a result of eating less, not only as a response to noise, although it should be noted that noise may also be driving Belugas from preferred feeding sites.
Tourism boats are increasing in many, but not all, parts of the Arctic during the summer months (for example, Lasserre and Têtu 2015). Some Inuit are concerned about the unregulated operation of an increasing number of large tour ships and associated smaller boats attempting to approach whales closely. The presence of tour boats could potentially have an adverse effect on CSB feeding or in calving and nursery areas such as Clearwater Fiord, although there are currently none operating in the area. The *Marine Mammal Regulations* under the *Fisheries Act* define and prohibit disturbance of marine mammals and describe the legal approach distances from marine mammals. The recent *Marine Mammal Regulations* amendments governing human activities affecting marine mammals were published in the *Canada Gazette, Part II* on July 11, 2018.

In 2013 and 2017, Turbot allocations in the Nunavut waters of the Northwest Atlantic Fisheries Organization divisions 0A and 0B increased significantly (Nunatsiaq News 2017). The development of these fisheries in Baffin Bay and Davis Strait has resulted in increased vessel traffic in Cumberland Sound. Ship traffic may remain at its current level, but could also increase as the harbour at Pangnirtung undergoes further development and the fish plant expands. Currently, fishing by large vessels (that is, greater than 19.8 m) in Cumberland Sound is prohibited. Belugas can react to the noise of large ships at distances of up to 20 km or 30 km (12 to 18 miles) (Cosens and Dueck 1993).

In addition to boat noise, hunters report that CSB also react to a variety of noises including low flying aircraft and footsteps or snowmobiles at the floe edge (Kilabuk 1998). Hunters have also reported increased submarine traffic in Cumberland Sound and local changes in CSB distribution in response to these vessels (Kilabuk 1998).

Overall, the threat posed to the recovery of CSB due to noise is currently considered low (DFO 2005b).

Commercial fisheries

Development of an inshore Turbot fishery in summer has begun in Cumberland Sound. Although the use of gill nets in the Greenland Halibut fishery seems unlikely due to DFO's ongoing commitment to not authorize the use of gill nets in Cumberland Sound, the potential for entanglement of Belugas (and other whales) should be carefully considered if gill nets are to be allowed (DFO 2009). DFO currently authorises only using long-lines (DFO 2008a). There is a

potential for competition over prey species (for example, Turbot and shrimp) possibly eaten by Belugas, but this competition is speculative and unproven at this time (DFO 2005b). While the current fishery for Turbot in Cumberland Sound does not pose any concern for CSB, the amount of Turbot and other species required by CSB is unknown. However, as the CSB population is currently much smaller than it was historically, any reduction in prey availability would probably have to be significant to affect this population.

Pollution and contaminants

Pangnirtung residents have reported that dumping at sea appears to be widespread in the waters between Greenland and Baffin Island and may be increasing. Localized pollution from a sewage outfall in the waters near Pangnirtung had been a source of local concern. A sewage treatment plant went into operation in April 2004 and was improved and expanded in 2014. Threats from pollution are considered low (DFO 2005b).

Arctic marine predators such as Beluga, which are near the top of the Arctic marine food chain, can accumulate relatively high levels of persistent halogenated organic contaminants and heavy metals. Belugas that reside in the waters of southeast Baffin Island have some of the highest levels of organochlorines of any reported to date in the Canadian Arctic, although the levels in Cumberland Sound samples are lower than those from Kimmirut and Iqaluit (Stern et al. 2005). Since the early 1980s, concentrations of some of the major persistent organic pollutants in the environment have stabilised or declined, while concentrations of other contaminants currently in use are low but have increased (Law et al. 2003). Mercury and other heavy metals have been found in Beluga samples from Cumberland Sound (Wagemann et al. 1996; Lockhart et al. 2005). More studies are needed to assess the potential effects of all contaminants and their synergistic effects on the health of Belugas, the Inuit that consume them, and the fish (as well as other species) that both utilize for food.

5.3 Limiting factors assessment

Limiting factors are potential ecological impacts which may take place during the recovery process and could slow the speed or success of recovery. These can be predicted as possible impacts/events, but cannot be controlled. Table 2 lists the limiting factors known or suspected of having a negative effect on CSB and their recovery.

Like the threats above, known and suspected limiting factors were ranked with respect to their likelihood of occurrence and impact. The likelihood and impact categories were then combined to produce an overall risk level. A certainty level was also assigned to the overall threat level, which reflected the lowest level of certainty associated with either the likelihood or impact.

Table 2. Population level limiting factors assessment of the Cumberland Sound Beluga. See appendix C for a detailed definition of descriptions used in this table.

Limiting factor	Overall risk of limiting factor	Occurrence	Frequency	Extent
Predation by Killer Whales	Low	Current	Recurrent	Restricted
Entrapment and stranding	Low	Current	Recurrent	Restricted

Disease and parasites	Unknown	Current	Recurrent	Narrow

5.4 Description of limiting factors

Among limiting factors, both scientific and local knowledge indicate that the environment in the eastern Arctic is changing; it is no longer as cold for as long as it used to be and rare weather events may occur at unpredictable times. Therefore, climate change has a great potential to have a cumulative effect on most, if not all, of the limiting factors identified, by allowing them to occur for longer periods of time or in novel areas. Positive effects of climate change might include a temporary period of greater prey availability or quality, as primary productivity increases with warmer temperatures, while negative effects might include a greater risk of predation from Killer Whales due to reduced periods of sea ice (DFO 2009). Continued monitoring is required in order to better understand the effects of climate change on CSB.

Predation by Killer Whales

Hunters from Pangnirtung have noticed an increasing number of Killer Whales in Cumberland Sound over the past 35 years. Beginning in 2019, hunters from Pangnirtung observed a greater number of Killer Whales than usual and observed them more often, sometimes in areas such as Clearwater Fiord, where they had previously been rarely, if ever, observed. The concern of an increasing number of Killer Whales accessing Belugas in non-typical areas, probably for an extended period of time due to a longer ice-free season, suggests to the Pangnirtung HTA that actions may need to be taken to lower Killer Whale numbers in Cumberland Sound.

Predation by Killer Whales is perhaps the single most limiting natural factor capable of having a negative effect on the size of the CSB population. More Killer Whales could result in higher mortality of CSB (table 1). Many years ago, hunters saw evidence of Killer Whale attacks on Belugas such as pieces of Beluga maktaq and viscera floating in the water (Ferguson et al. 2012). Killer Whales, which are almost twice the size of Belugas and travel and hunt in pods, are able to successfully kill adult Belugas. Historically, when there were more Killer Whale present in Cumberland Sound than until perhaps recently, CSB used to leave Clearwater Fiord late in the year, sometimes in October, presumably to avoid contact with the Killer Whales (Kilabuk 1998). However, with Killer Whale numbers increasing to historic levels, as well as a longer ice free period allowing Killer Whales to remain in Cumberland Sound for a longer period, CSB may again be leaving Clearwater Fiord later in the year in an attempt to avoid these predators. Warming temperatures could also be delaying the departure of CSB from Clearwater Fiord.

The exact number of Belugas taken annually by Killer Whales in Cumberland Sound is unknown (DFO 2005b). Killer Whales are known to be present in Cumberland Sound only during the open water season when sea ice no longer presents a danger to their prominent dorsal fin. There is a concern that due to a warming climate, less ice cover will make it easier for Killer Whales to prey on CSB for a longer period of time each year. Distribution, movement, and population size of the Northwest Atlantic/Eastern Arctic population of Killer Whales is largely unknown, but may number only 250 individuals (COSEWIC 2008), with only a small number of these entering Cumberland Sound in any given year.

Entrapment and stranding

Local hunters report that CSB occasionally become trapped by ice or receding tides for varying lengths of time (Kilabuk 1998). For example, in the late 1950s many whales became entrapped in the ice southeast of Aupaluktut Island (Pangnirtung HTA pers. comm. 2008) (figure 2). In September 2001, 3 whales became stranded in a bay at Avataktoo and were unable to free themselves during the following extreme high tides. Of these 3 whales, 2 were killed and landed, while 1 was killed and lost (Stewart 2018). The HTA also herded approximately ten whales out of the Tajagiaq Bay area in early October 2005, to prevent them from being completely entrapped (Stewart 2018).

When Beluga Whales become trapped in shallow water during tidal occurrences or by ice in fall or early winter in an area far from other openings in the ice, they have little or no chance of escape and usually die from predation, suffocation, or starvation. How often this occurs and the possible effect of climate change on the frequency of these events is unknown. Large ice entrapment events are thought to be infrequent in the Sound (Richard and Stewart 2008). However, elders of Pangnirtung speak of an ice entrapment of approximately 100 CSB in 1956 on the west side of the Sound and another entrapment of more than 35 CSB in Irvine Inlet (no date given) (Richard and Stewart 2008) (figure 2). An “Action Plan for Trapped Whales” was developed by DFO and the Pangnirtung HTA in 2001 to guide monitoring of trapped whales and possible humane harvests. This plan was used to respond to entrapment reports in 2005, 2006, 2007, 2009, and 2010. However, details on the number of whales trapped, harvested, or rescued are largely missing and some ice or tidal entrapments and harvests may not have been reported to DFO. The number of trapped animals that perish annually may have a large impact on success of recovery approaches.

Disease and parasites

Serological surveys of Belugas looking for the presence of viruses and bacteria have revealed that sporadic infections of influenza A have occurred in Canadian populations, although whales from Cumberland Sound were found to be unaffected (Nielsen et al. 2001a). No distemper antibodies were detected in any Canadian Belugas tested (Nielsen pers. comm. 2018). Canadian Belugas, including CSB, are infected by a form of Brucella that is specific to marine mammals. All species of Brucella are known to cause reproductive failure in infected animals, although the full extent of its effect on Canadian belugas, and specifically, CSB, has not yet been determined (Nielsen et al. 2001b).

While these results suggest that CSB are not currently threatened by disease, infectious diseases can cause mortality or affect reproduction over the longer term (Young 1994; Nielsen et al. 2001c). For this reason, monitoring should continue (that is, through blubber sample collection) to assist in detecting the onset of an infection that could be harmful to CSB, and any sick whales should be reported to DFO.

6. Population and distribution objective

Population and distribution objectives establish, to the extent possible, the number of individuals and the geographic distribution that is necessary for the recovery of the species. The long-term population and distribution objective for CSB is:

- to protect, maintain and recover the population of CSB Whales to levels that are self-sustaining such that the population is increasing to a stable size that is large

enough to resist stochastic events and persist over the next 2 generations (that is, ≥30 years)

To meet the objective of this recovery strategy, harvest sustainability must be addressed as harvest is the primary current threat to the species. In addition, the self-sustaining levels described in the recovery objective may support a sustainable Inuit harvest. Consideration should also be given to new information received through local knowledge and science advice/expertise, as well as the uncertainty associated with current knowledge of the CSB with regards to biology, abundance, seasonal distribution, and habitat requirements.

The size of the CSB population prior to commercial whaling is estimated to have been 8,465 whales (DFO 2005a). Early in the recovery planning process (2002), the Recovery Team chose a recovery target of 5,000 whales, which represents approximately 70% of the population based on the historical population size. A population of 5,000 belugas could sustain a harvest of 100 whales per year, which would meet the projected future needs of the local community. The median time period over which the population was estimated to be able to reach 5,000 whales was 80 years (DFO 2005a), assuming a starting population greater than 2,000 whales. However, it is now understood that reaching a population size of 5,000 cannot be achieved at current harvest levels based on the most recent population estimates (DFO 2019).

The latest population model (DFO 2019), created using survey estimates from 1990 to 2017 and reported harvests from 1960 to 2017, estimated a population of 2,884 whales in 1960 (95% CI=1,849 to 3,725) which has declined to an estimated population of 1,090 in 2018 (95% CI=617 to 1,864). Using this model, there is a 96% probability that the current harvest quota of 41 CSB will result in a continued population decline over 10 years (DFO 2019). A harvest of 0, 14, or 20 CSB per year is predicted to result in a 0%, 25%, or 50% probability of decline in the Cumberland Sound population over the next ten years (DFO 2019).

A recent study (DFO 2022) has identified 2 genetically distinct populations of Beluga in Cumberland Sound. However, further study is necessary to see if the 2 genetic populations correspond to the 2 physically distinguishable stocks described by local hunters. Beluga from the 2 populations cannot be distinguished visually during aerial abundance surveys. Spatial or temporal characteristics associated with the populations that could allow selective harvesting of the 2 populations in Cumberland Sound have also not yet been identified (DFO 2022). Based on information currently available, these 2 populations can only be assessed as a single stock.

It is recognized that an increase in CSB deaths due to other factors including Killer Whale predation, contaminants, disease, ice and tidal entrapment, net entanglement, and bycatch is possible and could change the time required to achieve a self-sustaining population, although the immediacy and severity of these threats or limiting factors, while presumed to be low, are still not fully understood (DFO 2005a).

7. Broad strategies and general approaches to meet the objective

Cumberland Sound has been identified as one of several areas of high biological importance and productivity in the Arctic, based on the presence of several species and species groups (for example, birds, fishes, seals) (Stephenson and Hartwig 2010). Bowhead Whale (*Balaena mysticetus*), which is identified as “special concern” on Schedule 1 of SARA, as well as the Narwhal (*Monodon monoceros*), Killer Whale, and Atlantic Walrus (*Odobenus rosmarus*) that

have all been assessed by COSEWIC as “special concern” are found in Cumberland Sound. In contrast to CSB, however, Bowhead Whale, Narwhal and Killer Whale overwinter in areas outside the Sound. Narwhal overwinter in coral areas in central Davis Strait, while Killer Whale migrate south each fall, away from ice covered areas. Bowhead feed on zooplankton, unlike Belugas which feed on fish and large invertebrates. Atlantic Walrus are different in that they can leave the water and may also migrate great distances in the winter. These and other differences highlight the diverse management requirements and dissimilar habitat requirements that these 4 mammal species have when compared to Belugas. For these reasons, a single species approach to recovery is most suitable for CSB. Appendix A outlines the possible effects of an increased CSB population on the environment and on species common to Cumberland Sound.

7.1 Actions already completed or currently underway

- The Pangnirtung HTA and hunters have maintained a “no hunting and harassment” zone in Clearwater Fiord and Shark Fiord (figure 2) since the mid-1980s
- A co-management plan was developed for Southeast Baffin Belugas[5] by representative local Inuit organizations and DFO in May 1994 (Planning Committee for Co-Management of Southeast Baffin Beluga, 1994). The plan contained recommendations related to harvesting practices and quotas, the integration of Inuit and scientific information and concerns, filling knowledge gaps, establishing zoning systems to guide land - and water -use activities, and promoting education and public awareness. It was recommended that a special standing committee be created to oversee implementation of the plan. A local knowledge study of Southeast Baffin Belugas was published in 1998 (Kilabuk 1998). This report included local knowledge provided by Pangnirtung hunters on seasonal changes in distribution, movements, and behaviour of Belugas
- Genetic analyses of Beluga Whale populations in Nunavut showed that Pangnirtung samples differed from Kimmirut using both haplotypes and microsatellites, while Iqaluit samples had intermediate genetic characteristics between Pangnirtung and Kimmirut (de March et al. 2002)
- Genetic and contaminants profiles and satellite tracking data collected since the late 1980s have shown that most Belugas hunted in Cumberland Sound are distinct from those hunted near Iqaluit and Kimmirut (de March et al. 2002; Richard 2010). Consequently, in 2004 the Southeast Baffin Beluga population was separated into the CSB population in Cumberland Sound, and the remaining whales in Iqaluit and Kimmirut were added to the Western Hudson’s Bay population
- Twenty Belugas were tagged with satellite-linked time-depth recorders/transmitters from 1998 to 1999 and from 2007 to 2008 to track their movements, habitat use, and diving habits. Transmitters gave their positions from late August or early September until November to May, depending on the tag. All of the whales remained in Cumberland Sound during their period of transmission suggesting that they all winter in Cumberland Sound. Unfortunately, due to tag failure, no year round movements were obtained for any tagged Belugas and confirmation of annual habitation within Cumberland Sound was not verified (Richard and Stewart 2008; Richard 2010)
- A 2014 survey showed a lower number of CSB (1,151) than previous surveys (Marcoux et al. 2016). An aerial survey conducted in the summer of 2017 resulted in an estimate of 1,381 Belugas (DFO 2019)

[5] The Southeast Baffin Belugas included CSB before the reassessment into 2 designatable units in 2004.

- A new model using population estimates from 1990 to 2017 and reporting annual harvests from 1960 to 2017 estimated a population of 2,884 whales in 1960 (95% CI=1,849 to 3,725) which declined to 1,090 whales in 2018 (95% CI=617 to 1,864) (DFO 2019);
- A photographic field program in Clearwater Fiord to identify individual whales as well as census the number of females with calves was completed using drones in the summer of 2019
- Since the Pangnirtung HTA approved the 2002 NWMB/DFO quota of 41 CSB, co-management partners have continued work toward community-based management of a sustainable harvest. A Cumberland Sound Beluga Working Group was re-convened in 2019 to advance the development of a FM management plan to achieve a sustainable Beluga harvest that is compatible with the recovery of the species. The Working Group is comprised of co-management partners, including the Pangnirtung HTA and elders, Qikiqtaaluk Wildlife Board (QWB), Nunavut Tunngavik Incorporation (NTI) and Nunavut Wildlife Management Board (NWMB), and DFO representatives
- DFO has implemented the NWMB decision to not allow the use of gillnets in the commercial Turbot fishery in Cumberland Sound, to minimize the risk of entanglement of non-directed species, including CSB

7.2 Strategic direction for recovery

Strategic approaches proposed to address the identified threats and to guide appropriate research and management activities to meet the population and distribution objective are discussed under the broad headings of:

1. management activities
2. research
3. monitoring and assessment
4. stewardship and outreach

Specifically, these 4 approaches will:

- manage the subsistence harvest on a sustainable basis and establish guidelines for these activities as needed
- conduct research on the CSB population by studying its biology, ecology, and environment
- continue to identify, monitor, assess, and protect CSB habitat in Cumberland Sound and monitor human activities to assess ongoing and newly emerging threats, and communicate the need for and the content of this recovery strategy to promote understanding and support within the community, Nunavut, and elsewhere (table 3)

Each strategy has been designed to address information deficiencies that might otherwise inhibit species conservation; to assess, mitigate or eliminate specific threats to the species; or to contribute to species' recovery. These strategies are summarized by approach in table 3, which lists them in order of priority, and will be further described and developed in a species at risk action plan.

Table 3. Recovery planning table for the Cumberland Sound Beluga (CSB).

Activity	Broad strategy	Threat or knowledge gap addressed	Priority[6]	General description of research and management approaches
1	Management activities	Subsistence harvest	High	• Develop a Fisheries Management (FM) management plan to manage the harvest on a sustainable basis and establish guidelines for these activities • The Cumberland Sound Beluga Working Group (CSB-WG) comprising co-management partners meets at least 3 times a year to develop a FM management plan for the recovery and management of CSB. The FM management plan will be based on local knowledge and science • The CSB-WG will establish goals, principles and objectives for the FM management plan, as well as review and enhance the present harvest-based monitoring program, and identify harvest monitoring indicators (that is, number of Beluga struck and landed, and struck and lost, during hunts) • Increase awareness and education on safe hunting techniques via support for community-led harvest training initiatives
2	Research	Refine population abundance estimates	High	• Update and improve estimation of population size using standardized survey techniques • Investigate the use of new methods to estimate population abundance • Continue population modeling and risk analysis. • Document hunter observations • Continue research on genetic diversity and stock discrimination, including continued research on the 2 genetic populations identified and whether they correspond to the 2 visually distinct populations identified by local harvesters
3	Research	Incomplete biological knowledge	High	• Conduct studies on foraging dynamics • Conduct satellite tagging • Collect tissue samples from hunters and analyse to determine key life history parameters • Document hunter observations and use hunter collected samples

[6] High, medium, and low are equivalent to urgent, necessary and beneficial (respectively).

4	Monitoring and assessment	Habitat use	High	• Identify and refine the location of important winter and spring habitats • Develop an understanding of why certain areas are important for CSB, and establish appropriate protective measures for each area of the sound as required
5	Monitoring and assessment	Environmental/natural threats	Medium	• Continue to monitor and assess all potential environmental threats (for example, effects of climate change, Killer Whales)
6	Monitoring and assessment	Human induced threats	Low	• Continue to investigate and assess all potential threats resulting from human activities (for example, noise) and implement guidelines as appropriate • Continue research on effects of heavy metals and halogenated organic contaminants on CSB health • Mitigate potential threats from local pollution as needed • Assess and mitigate potential threats from exploratory and commercial fisheries (for example, fishing gear entanglements)
7	Stewardship and outreach	Public understanding of recovery strategy	High	• Produce communication, education and outreach materials about the recovery strategy and CSB • Develop and implement communication programs by the community of Pangnirtung and Fisheries and Oceans Canada • Continue ongoing communication with local hunters through the CSB-WG, development of the FM management plan, and maintain subsequent updates through a communications plan

7.3 Narrative to support the recovery planning table

Management activities (activity 1): New or revised management actions are necessary to protect CSB and their habitat, and support their recovery. Such actions will assist in reducing or eliminating identified threats.

In 2019, co-management partners met in Pangnirtung to review the 2019 Science Advisory Report (DFO 2019). Hearing the results of the 2017 survey which showed a declining population, it was agreed upon by all participants that CSB are a priority and that the Cumberland Sound Beluga Working Group would be re-convened to address the management of CSB in relation to conservation, recovery and sustainable harvest. The working group has met 8 times from 2019 to March 2021 in a mixture of in-person meetings and conference calls due to the COVID-19 pandemic. The next step of recovery planning will be the development of an action plan which should include the development and implementation of a FM management plan, including any changes to harvesting methods or levels (quota). The action plan and FM management plan will be developed collaboratively with co-management partners. Engagement and support from the community are required for successful development and implementation of the FM management plan.

The existing quota was established in 2002 and the no harvesting zone was established by the Hunters and Trappers Association (HTA) for Clearwater and Shark fiords in 1985 in their bylaws. Increased education of hunters on the importance of reporting numbers of struck and lost whales, as well as the total number harvested, is required as this information assists in calculating accurate harvest mortality, population estimates and to understand population trends. Population modeling and risk analysis have been undertaken, but these are needed on an ongoing basis to estimate the probability of and rate of recovery of the population at various harvest levels. Monitoring of CSB health can, in part, be attained through the ongoing development of and participation in a community monitoring plan to collect tissue samples from annual harvests and share genetic analysis results with the community. Tissue samples are useful in providing the genetic material required to help resolve the issue of whether or not there is more than 1 stock of Belugas in Cumberland Sound.

Research (activity 2 to 3): Knowledge must form the basis of any recovery efforts for CSB. Currently, some information on CSB is speculative and relies on limited or inferred information from other populations. Information gaps exist regarding basic life history, population structure, abundance, genetic diversity, seasonal distribution, and habitat requirements. These questions need to be addressed to refine the recovery strategy and ensure that the population is adequately protected.

Monitoring and assessment (activity 3 to 6): Once baseline information has been collected, regular monitoring will be necessary to determine changes in CSB distribution and abundance, as well as to describe the availability of critical habitat once completely identified. Ongoing monitoring of population size and status using both science and local methods is needed to measure the rate of population recovery over time, to update population models, and to ensure that appropriate harvest management and conservation strategies are in place. Aerial surveys provide a quantitative measure of population trend, while Inuit observations provide a more qualitative measure of population size, growth, and CSB demographics. Continued use of both scientific and hunter collected information will be needed to refine knowledge of Beluga biology and general life history in Cumberland Sound. The Pangnirtung HTA has indicated a need for

additional tracking studies, not limited to, but especially during the winter months, to aid in the identification of important habitats and movement of Belugas, possibly out of Cumberland Sound to other areas, at various times of the year.

Identification of all important and critical habitat for CSB is a necessary component of recovery planning. While some critical habitat has been identified, most habitat identified so far provides only seasonal use. Why CSB return to specific areas annually has not yet been determined except in the broadest sense (for example, ice free area in winter, freshwater input). More research is needed on habitat use and foraging behaviour and at times of year when, and in areas where, it is often difficult to observe Belugas. Overall, habitat does not appear to be limiting for CSB.

Some limiting factors that may affect the recovery of CSB are environmental and/or more globally based (for example, climate change and disease) and, therefore largely cannot be directly controlled. However, changes observed in the environment can be noted and reported and may help with the recovery planning and monitoring of CSB. Potential threats are the result of human activities and many can be monitored and managed (for example, noise and disturbance, commercial fisheries, and subsistence harvest).

The collection of local observations and knowledge can identify human activities and environmental changes that are taking place in the waters of Cumberland Sound. These observations will aid in developing a better understanding of the probable results of those changes on CSB and to the ecosystem in which they live. Licensing of new exploratory, open water marine fisheries in Cumberland Sound should be assessed in light of CSB recovery. Spills and dumping of garbage and ballast/bilge water and oil can be dealt with under existing legislation. Consideration of new tourism activities which could intrude on important CSB habitat during certain times of the year also need to be carefully assessed prior to approval.

Stewardship and outreach (activity 7): Public education is essential through stewardship and outreach to gain acceptance of, and compliance with, the overall objective of the recovery strategy. Public support can be gained through increased awareness of this recovery strategy and involvement in stewardship programs.

The success of recovery and management actions depends on the continued involvement and support of Pangnirtung residents which, in turn, depends on their understanding of the threats to the recovery of the CSB, as well as the actions being taken to help the population recover. The Recovery Team recognizes the need for a communications program that will help to educate and inform the residents of Pangnirtung about the biology of CSB, the need to monitor potential threats and environmental conditions, and the need to support and participate in specific recovery and management actions intended to aid recovery, as well as communicating all progress made towards CSB recovery. The Cumberland Sound Beluga Working Group will also develop and implement a communications plan to ensure the community is informed on issues and plan development related to recovery, sustainable use, and management of CSB and their habitat.

7.3.1 Additional information needed about the species

Additional information is needed on CSB to accurately identify recovery objectives and activities for this population. This information includes:

- their population growth rate (for example, senescence, longevity, survival of age classes) and trends

- their reproductive growth rate (age of first reproduction, inter-birth interval, nursing duration) and trends
- their seasonal cycle of feeding activities and relationship to lifetime body growth rate and reproduction
- the level of threat that Killer Whales pose to this population
- how often ice or tidal entrapments occur in Cumberland Sound and the possible effect of climate change on the frequency of these events
- overall health trends over time: if, how, and to what extent contaminants, pollution, disease, noise and disturbance, and commercial fisheries affect the population

The preamble to SARA includes the statement that "The Traditional Knowledge of the Aboriginal peoples of Canada should be considered in the assessment of which species may be at risk and in developing and implementing recovery measures." To help in achieving success of recovery goals and plans, efforts to include Inuit Qaujimajatuqangit should continue and should be drawn from the Pangnirtung HTA through supported and meaningful engagement and consultation throughout the recovery process. The Pangnirtung HTA has recently stated that much of the local knowledge available, for example, Kilabuk (1998), is now very outdated due to changes in the climate and predators like Killer Whale, which in turn affect how Beluga now behave and move within Cumberland Sound. It will be up to the HTA to collect this information and ensure the knowledge learned can provide useful guidance in all elements of the recovery process. The HTA is encouraged to utilize programs such as the SARA managed Aboriginal Fund for Species at Risk program and similar funding sources to help collect and apply this information.

8. Critical habitat

8.1 Identification of the species' critical habitat

Critical habitat is defined in SARA as:

> "…the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in a recovery strategy or in an action plan for the species." [subsection 2(1)]

SARA defines habitat for aquatic species at risk as:

> "… spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be reintroduced." [subsection 2(1)]

Under SARA, critical habitat must be legally protected within 180 days after the recovery strategy or action plan that identified the critical habitat is included in the Species at Risk Public Registry. It is anticipated that the critical habitat identified in this recovery strategy will be protected by a Critical Habitat Order made by the Minister of Fisheries and Oceans, which will trigger the prohibition in section 58(1) against the destruction of any part of the critical habitat. For CSB, critical habitat is identified to the extent possible using the best available information. It is believed that the areas identified as critical habitat provide the functions, features, and attributes necessary to support the species' life cycle processes and to achieve the species' population and distribution objective.

The entire area inhabited by the CSB is relatively small (9,000 km^2) (COSEWIC 2004). However, because CSB numbers are considered to have once been much larger than the present numbers and because few physical changes or marine industrial developments have taken place within the Sound, it is unlikely that habitat availability would, in the short term, limit recovery. No scientific information is available to demonstrate a reduction in range (DFO 2005b) or habitat loss (Richard 1991) and, based on local knowledge, the range of the population does not appear to have changed from its recent historical range, at least since the 1950s (DFO 2005b). The schedule of studies in section 8.2 outlines the activities required to further refine the identification of the critical habitat that is necessary to achieve the population and distribution objective.

CSB do not have a known dwelling place similar to a den or nest that is occupied or habitually occupied by 1 or more individuals during all or part of their life cycles; hence, the concept of “residence” as defined in SARA does not apply.

8.1.1 General description of the species’ critical habitat

Based on available information, 3 areas of critical habitat are identifiable at this time; all are used by CSB only seasonally. Clearwater Fiord is the only known calving area for this population (Kilabuk 1998). The area is used for beach rubbing/moulting, primarily near the mouth of the Ranger River. More work needs to be done to identify the physical traits of beaches used for rubbing and whether or not some areas are preferred over others. Almost all members of the population can be found within Clearwater Fiord in July and August. This area also serves as a predator refugia and a probable resting and socializing area.

A large area of varied habitats with complex shorelines exists on the western side of the Sound and is used by CSB as the population migrates between Clearwater Fiord and the polynya area near the mouth of the Sound. The access to deeper water and the varied coastline should provide habitats for, and access to, suitable prey sources. The complex coastline of islands and bays on the western shore may also serve as a possible refuge from Killer Whales. That CSB sometimes are trapped by ice or low tide in the bays of this area illustrates how much even the nearshore areas are used. The only certainty is that belugas use this area every year, so there are some features here that attract them and keep them in this area even when other open water areas are available.

The polynya/pack ice area near the mouth of Cumberland Sound is used every winter by all members of the population, as it provides the only area of open water throughout the winter. Local knowledge suggests that this is the mating area of CSB (Kilabuk 1998). It may also be the primary feeding and foraging area for the population. Belugas spend more time in this single area than elsewhere and it is known that Belugas are fatter in the spring than in the fall (Stewart et al. 1995), although this may, in part, be due to a lack of long distance movement during this time. Therefore, while difficult to determine with existing data, it appears that the polynya is a critical habitat, not only for overwintering, but also for feeding.

There are 2 other areas near the north end of Cumberland Sound that harbour aggregations of CSB for short periods of time (approximately June to July) seem to act primarily as staging areas prior to movement to regularly used habitat, may be critical habitats (DFO 2009), but at this time the areas are poorly defined. Not enough information is known about their features, functions, or attributes to identify them as critical habitat, and it may be that CSB spend time in these areas simply because they are waiting for ice to melt prior to entering preferred areas.

Further research is required to improve understanding of the temporal and spatial use of these areas to more clearly establish their importance for this Beluga population.

8.1.2 Information and methods used to identify critical habitat

Critical habitat has been identified based on a high level of occurrence of the species within the boundaries identified in section 8.1.3. The identified areas contain the biophysical features and attributes, as well as the functions they support, described in table 4, that are necessary for the species' survival and recovery. There is currently insufficient information to quantify the levels of many of the attributes listed in table 4 that are required to support the features and functions of critical habitat. For example, the density, quantity, quality, and kind of forage needed to support CSB is unknown. The descriptions of the attributes in table 4 will be refined in the future, as additional information becomes available.

Critical habitat was identified using local Inuit observations about locations of congregations of CSB and timing of movements (for example, Kilabuk 1998) and the results of scientific studies, including satellite linked tracking and aerial surveys (for example, DFO 2009). With exceptions, Inuit observations are often opportunistic and are limited to only a few specific areas, and usually only during the same season of each year. Similarly, aerial surveys have typically been restricted to July and August, even if over a large portion of the Sound. Satellite tracking has been based on a small number of tagged whales over only a short period, therefore making the identification of critical habitat difficult. Identification of critical habitat was also facilitated by identifying processes, features, and attributes that CSB are known to seek out to carry out their life processes (for example, sufficient quality and quantity of forage fish species and invertebrates which comprise CSB diet). These habitats can shift and are seasonal so that CSB must move around to take advantage of them.

8.1.3 Identification of critical habitat: geographic and biophysical information

Geographic information

There are 3 critical habitat areas have been identified (figure 5) and are geographically delineated below. Depending on annual variations in climate, there is some variation in the length and extent of use of these areas. Specifically, these areas are:

1) Clearwater Fiord from, typically, late July to September is a nursery and moulting area on rubbing beaches and possible calving area. This is the only known freshwater estuary used by CSB on the entire southeast Baffin coast and, therefore, it exhibits very distinctive features such as substrates suitable for beach rubbing/moulting and a large freshwater input (Ranger River). CSB are generally thinner when they leave Clearwater Bay, as opposed to when they enter (Kilabuk 1998), strongly suggesting that this is not an important feeding area. Clearwater Fiord can be demarcated as that area north of a line extending from 67°15'33"W to 66°29'18"N east to 67°09'44"W to 66°29'12"N

2) The west side of Cumberland Sound is occupied from late September to November and again in May through June. This large area is used primarily for feeding and a migration route for travelling between Clearwater Fiord and the wintering areas of the polynya, but may also be an important refuge from possible Killer Whale predation due to the irregular shoreline and numerous islands. Therefore, while this area is identified as critical habitat, it requires more refinement to properly describe its features and function. It is defined by a line running from

67°15'52"W to 65°38'40"N, east to 66°44'W to 65°38'40"N, south east to 65°31'23"W to 64°53'40"N, and then west to the mainland at 65°54'53"W to 64°53'40"N

3) The polynya surrounded by pack ice areas that occurs off the southeastern tip of the Cumberland Peninsula is used by CSB from November to April (overwintering area). This polynya occurs annually in the same general area, but its location and size is not static depending on winds, ocean currents, and winter severity. CSB utilize this area only during the winter months and leave this area with more body fat than when they enter, suggesting the high quality and abundance of forage in this area. This area can be roughly defined as beginning at a point at 64°54'28"W to 65°20'30"N, running west to 65°40'00”W to 65°20'30"N, southeast to 64°15'00”W to 64°40'00”N, east to 63°20'00”W to 64°40'00”N and then north to 63°28'38"W to 64°58'52"N

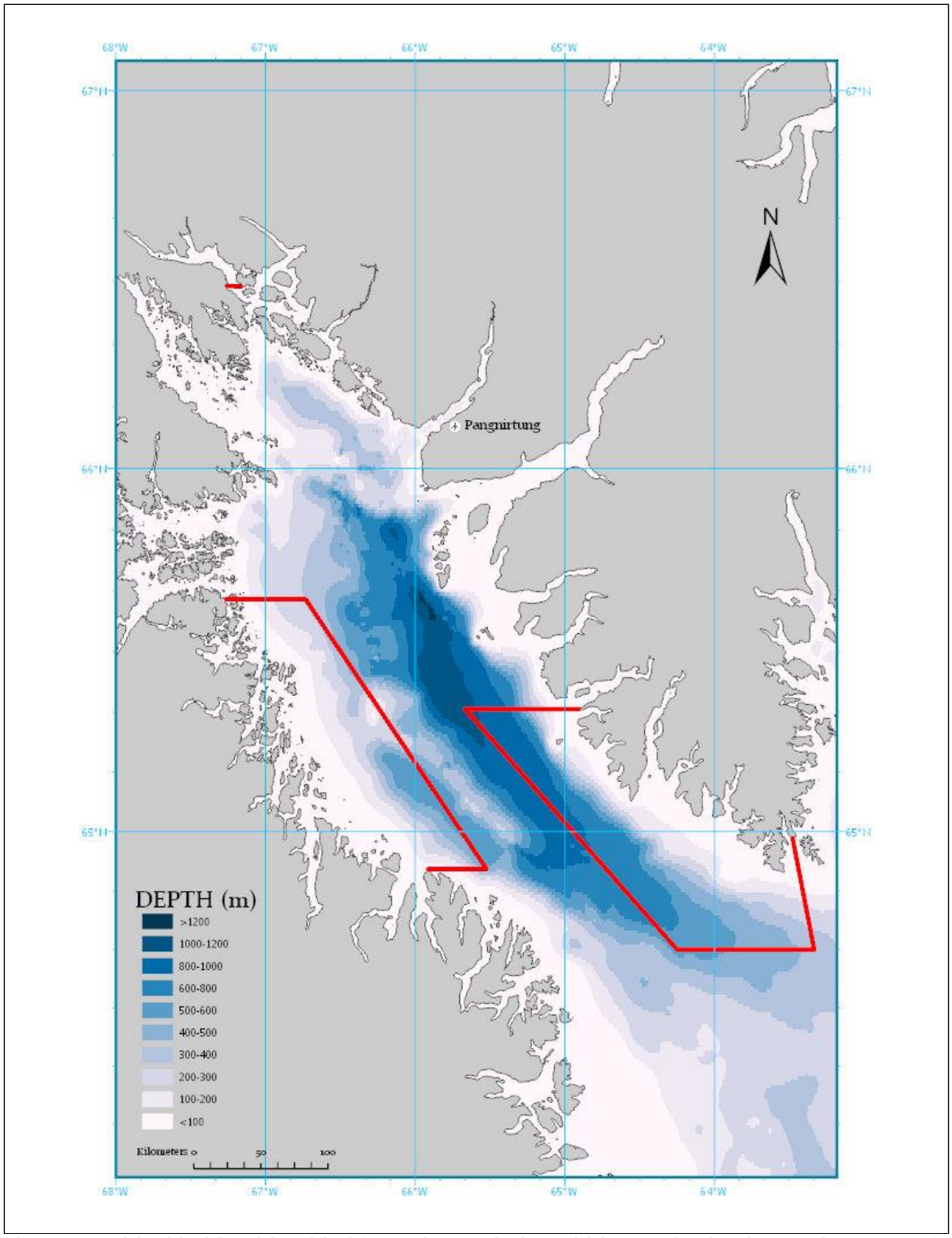

Figure 5. Critical habitat identified for Beluga Whales within Cumberland Sound. See text for description of areas. Bathymetric data from International Bathymetric Chart of the Arctic Ocean (IBCAO) (2012).

Biophysical functions, features and attributes

The areas identified as critical habitat (figure 5) are those that the Recovery Team and DFO consider to be of high quality or potential high quality for the species, and constitute the habitat requirements deemed necessary for species' survival and recovery. These areas are used for calving, nursing, beach rubbing, moulting, feeding and foraging, socializing, reproduction, resting, predator refugia, migration, and over-wintering, and all areas are used only seasonally.

Seasonal distribution and movement patterns of CSB seem to be strongly associated with the availability of their preferred prey, primarily Arctic Cod, but also Greenland Halibut and Capelin. Habitats that are important for the survival or recovery of CSB appear to be those that provide for profitable foraging on these key prey species, including the acoustic and physical space required to successfully pursue and capture prey. This is probably important in the polynya area, where some believe that the selection of overwintering areas has as much to do with bathymetric features that attract prey and forage as the extent of ice cover (Hauser et al. 2018). Hunters state that CSB leave the polynya area fatter than they are at any other time of the year, which seems to attest to the abundance of forage in the area (Kilabuk 1998).

An activity that is strictly associated with a particular geographic location is beach rubbing which is associated with moulting by CSB, which only takes place within Clearwater Fiord. Whether or not the sites where rubbing takes place are specific in nature, such as in the confluence of the Ranger River, or whether CSB can use all areas of the fiord for beach rubbing is currently unknown. Further study is required to observe CSB during this period and document where this activity is taking place, and to further refine the description of attributes of these beaches.

Table 4 summarizes the best available knowledge of the functions, features, and attributes for each life stage within the 3 areas identified above and in figure 5 (refer to section 4.3 "Needs of the species" for further details). Note that not all attributes in table 4 must be present in order for a feature to be identified as critical habitat. If a single feature as described in table 4 is present and capable of supporting the associated function(s), that feature is considered critical habitat for the species. The descriptions of the attributes in table 4 will be refined in the future as additional information becomes available.

There is currently insufficient information to quantify the levels of many of the attributes listed in table 4 that support the features and functions of critical habitat. For example, the size range of substrates and exact locations of rubbing beaches in Clearwater Fiord are unknown. Additionally, although it is assumed that either Arctic Cod or Greenland Halibut remain the primary prey species of CSB, the majority of CSB stomach samples have been collected during spring or summer when the Inuit harvest occurs; therefore, their year round diet is not well understood. Thus, it is possible that other, perhaps seasonally important, prey species may be identified in the future. Broad studies on identifying additional habitats that are important to CSB and to better understand threats to critical habitat are included in section 8.2.

Appendix D illustrates monthly home range locations from September 2008 to May 2009 of CSB, as obtained from studies of 20 CSB tagged between 1998 to 1999 and 2007 to 2008 (P. Richard, DFO, unpub. data) and shows the seasonal use of these areas. These results remain preliminary, as some monthly maps are based on only 1 tagged CSB and the time/location intervals plotted vary.

Table 4. Summary of the biophysical functions, features, and attributes of critical habitat necessary for the survival or recovery of all life stages of Cumberland Sound Beluga (CSB).

Function[7]	Feature(s)[8]	Attribute(s)[9]
Feeding and foraging Calving, nursing Overwintering Predator refugia	Availability of sufficient forage species Physical space Acoustic environment Water quality	Sufficient quality and quantity of all fish species and invertebrates, including Arctic Cod, Greenland Halibut and Capelin, to provide for profitable foraging that comprise part of CSB diet. Unimpeded physical space and natural conditions surrounding individual whales which allow for normal behaviours. As an indication only: avoid activities that bring vessels closer than 100 m to Beluga Whales as per *Marine Mammal Regulations* (schedule VI, item 1). Anthropogenic noise levels that are sufficiently low so as to not result in loss of habitat availability by interfering with social signalling, communication, ability to detect predators or ability to echolocate prey. As an indication only: <120 dB continuous sound <160 dB pulse sound. Water quality of a sufficient level so as not to result in loss of function. As an indication only: water quality of sufficient level to support those fish species that are part of CSB diet.
Reproduction Socializing Resting Migration	Physical space Acoustic environment	Unimpeded physical space and natural conditions surrounding individual whales which allow for normal behaviours. As an indication only: avoid activity that brings vessels closer than 100 m to Beluga Whales as per *Marine Mammal Regulations* (schedule VI, item 1). Anthropogenic noise levels that are sufficiently low so as to not result in loss of habitat availability by interfering with social signalling, communication, ability to detect predators or ability to echolocate prey. As an indication only: <120 dB continuous sound <160 dB pulse sound.

[7] Function: A life cycle process of the listed species taking place in critical habitat (for example, spawning, nursery, rearing, feeding, and migration).
[8] Feature: Features describe the essential structural component that provide the requisite function(s) to meet the species' needs. Features may change over time and are usually composed of more than 1 part, or attribute. A change or disruption to the feature or any of its attributes may affect the function and its ability to meet the biological needs of the species.
[9] Attribute: Attributes are measurable properties or characteristics of a feature. Attributes describe how the identified features support the identified functions necessary for the species' life processes.

Function[7]	Feature(s)[8]	Attribute(s)[9]
Beach rubbing/ moulting Socializing	Rubbing beach Acoustic environment	Physical habitat of proper size with rocks/gravel substrate for rubbing. Anthropogenic noise levels that are sufficiently low so as to not result in loss of habitat availability by interfering with social signalling, communication, ability to detect predators or ability to echolocate prey. As an indication only: <120 dB continuous sound <160 dB pulse sound.

8.2 Schedule of studies to identify critical habitat

To clearly establish the biological functions, features, and attributes of the habitats used seasonally by CSB would require considerable research investment in several areas (table 5). Such studies would likely require a decade or more to complete (Richard and Stewart 2008) and require significant community collaboration for identifying suitable scientific methods to address these questions.

Table 5. Schedule of Studies to further define critical habitat for the Cumberland Sound Beluga (CSB).

Description of activity	Rationale	Timeline
Study feeding ecology, including body condition, stable isotopes and fatty acid analysis of CSB and their prey, with biopsy samples and stomach analysis at different places and times of the year	Determines seasonal feeding patterns and periods when greatest energy (fat) storage occurs	Ongoing
Use satellite telemetry to delineate foraging activity, overwintering locations, track migratory movements and overall areas of high seasonal occurrence	Determines seasonal feeding patterns by location and depth to understand types and accessibility to prey to refine identification of feeding and overwintering location(s) as well as important migratory corridors and timing of use	2021 to 2030
Undertake extensive fish and macro-invertebrate studies of Cumberland Sound	Determines seasonal and spatial distribution of key CSB prey which may suggest why specific areas are being used seasonally, and identify areas of possible competition with existing or developing commercial fisheries	2021 to 2030
Undertake studies to identify rubbing beach locations and describe substrates and freshwater input in area	Determines critical habitat of rubbing beaches as well as distribution of these locations in Clearwater Fiord	2021 to 2030
Document ice and tidal entrapment events and correlate them to environmental predictors	Determines late autumn use of some areas and provides data for recovery models	Ongoing

8.3 Examples of activities likely to result in the destruction of critical habitat

Under SARA, critical habitat must be legally protected within 180 days of being identified in a final recovery strategy or action plan. For CSB critical habitat, it is anticipated that this will be accomplished through a SARA Critical Habitat Order made under subsections 58(4) and (5), which will invoke the prohibition in subsection 58(1) against the destruction of any part of the identified critical habitat.

Environment and Climate Change Canada (2016) describes destruction of critical habitat in the following manner:

> Destruction of critical habitat would result if any part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from single or multiple activities at 1 point in time or from cumulative effects of 1 or more activities over time.

The list of activities is neither exhaustive nor exclusive and has been guided by the threats described in section 5 of this recovery strategy based on known human activities likely to occur in and around critical habitat of the species. The absence of a specific human activity at this time does not preclude or restrict the Department's ability to regulate that activity under SARA. Furthermore, the inclusion of an activity does not result in its automatic prohibition and does not mean the activity will inevitably result in destruction of critical habitat. Every proposed activity must be assessed on a case by case basis and site specific mitigation will be applied where it is reliable and available. Where information is available, thresholds or limits have been identified for critical habitat attributes to better inform management and regulatory decision making. In many cases, knowledge of the population and the thresholds of tolerance of its critical habitat to disturbance from human activities is lacking and must be acquired. In the case of physical space, as an example, the 100 m buffer identified in the *Marine Mammal Regulations* (schedule VI, item 1) for any unspecified whale, dolphin, or porpoise should be used as an interim minimum vessel approach distance for fishers and tourists which may still allow for the continuation of normal Beluga behaviour without disturbance. The approach distances in the *Marine Mammal Regulations* do not affect Inuit hunting and fishing rights, so this guideline does not affect the harvesting of CSB.

There are activities that could affect the use or function of areas of critical habitat (table 6). Some activities may impact critical habitat, whether or not whales are present in the area while some activities may impact critical habitat only when CSB are present. Activities affecting critical habitat have been identified as the following:

- vessel approach, anchoring in vicinity of rubbing beaches, activities that prevent approach of whales to rubbing beaches, that displace or disrupt rubbing behaviour or activities that displace whales from over-wintering area, short-term disturbances resulting from noise and the physical presence of boats (fishing or tourist) can disrupt or prevent whales from completing essential life processes by masking echolocation and communication (Lien 2001) and physically keep CSB out of preferred areas. Possible future increased commercial fishing or unregulated tourism activity, as opposed to the current infrequent, local boater, in part made possible by improved harbour facilities at Pangnirtung, could increase the amount of boat traffic in Cumberland Sound. An increase in both the amount and seasonal duration of the level of noise and physical disturbance, can affect the use of critical habitat by CSB

- digging, drilling, or earth removal in Clearwater Fiord or other shore based activities could alter freshwater input or change the nearshore habitats and substrates enough to cause CSB to move their beach rubbing activities elsewhere or be unable to complete them. Such activities could introduce silt into the water and restrict visibility, and cover or remove important areas which might directly affect CSB (for example, rubbing beaches) or prey. This could be particularly harmful in Clearwater Fiord, especially in the area of the Ranger River, where freshwater input may assist the moulting process

- while seismic activities are not a primary issue at this time, any seismic surveys, primarily due to their duration in an area and the volumes generated (for example, Richardson et al. 1995), could keep CSB away from their critical habitat and possibly cause hearing damage. Even proposed seismic surveys outside Cumberland Sound could potentially affect CSB activities, depending on duration and timing

- sewage treatment plant activities, dumping at sea of deleterious substances and contaminants pose a threat to CSB as discussed in section 5.1. While pollution from residential sources is minimal due to a small population, industrial and long range deposition of contaminants are a much greater concern. As high trophic level, long lived animals, with a very limited area of occupancy, CSB are particularly vulnerable to persistent bio-accumulating toxins that settle in their fatty tissues as they feed on contaminated prey. The introduction of additional contaminants is, therefore, a threat to CSB critical habitat

- the threat of an oil spill or introduction of other toxic material (from drilling activities or ocean dumping, possibly though accidents) within the areas of critical habitat pose a risk to the health of CSB and also have the potential to make their critical habitat uninhabitable for an extended period of time

It is important to note that the possibility of any particular activity (or cumulative effects from any activities) resulting in the permanent or temporary degradation of critical habitat depends on the nature of the activity, geographic extent, seasonal timing, duration, intensity, and adequacy of appropriate mitigation measures. As an example, it is believed that some activities, such as a seismic program, could take place in the polynya region of the northeastern Sound during the summer months without affecting CSB or their use of this area during the winter. There are mitigation measures and best management practices that can often be used in association with some of the activities described above, which, if implemented properly, would allow for activities to occur without destroying or preventing CSB from using critical habitat.

Table 6. Examples of activities likely to result in the destruction of critical habitat of the Cumberland Sound Beluga (CSB).

Threat	Activity	Effect pathway	Function[10] affected	Feature[11] affected	Attribute[12] affected
Acoustic and physical disturbance	Vessel traffic (for example, from fishing or tourism activity) Seismic surveys Shore based activities that could alter freshwater input or nearshore habitat and substrates such as by digging, drilling, or earth removal Activities that result in alteration of rubbing beaches through siltation Vessel approach distance (< 100 m) Vessel anchoring in vicinity of or landing on rubbing beaches Activities that prevent approach of whales to rubbing beaches, that displace or disrupt rubbing behaviour or activities that displace whales from overwintering areas	Noise resulting in masking of communication and echolocation Noise or physical disturbance resulting in disruption of behaviour or displacement from preferred habitat (for example, foraging areas, overwintering habitat) Geophysical disturbance resulting in loss of function	Feeding and foraging Beach rubbing, calving, nursing Overwintering Predator refugia Moulting Reproduction, socializing, resting Migration	Acoustic environment Rubbing beach Physical space	Anthropogenic noise levels that are sufficiently low so as not to result in loss of habitat availability by interfering with social signaling, communication, ability to detect predators or ability to echolocate prey (As an indication only: <120 dB continuous sound <160 dB pulse sound) Physical habitat of proper size and within freshwater influence to allow for beach rubbing behaviour

[10] Function: A life-cycle process of the listed species taking place in critical habitat (for example, spawning, nursery, rearing, feeding and migration).
[11] Feature: A feature describes the essential structural component that provides the requisite function(s) to meet the species' needs. Features may change over time and are usually comprised of more than 1 part, or attribute. A change or disruption to the feature or any of its attributes may affect the function and its ability to meet the biological needs of the species. Not all features will have the proper attributes to function as habitat.
[12] Attribute: Attributes are measurable properties or characteristics of a feature. Attributes describe how the identified features support the identified functions necessary for the species' life processes.

Threat	Activity	Effect pathway	Function[10] affected	Feature[11] affected	Attribute[12] affected
					Unimpeded physical space and natural conditions surrounding individual whales which allow for normal behaviours (that is, ≥ 100 m as required by the *Marine Mammal Regulations* (schedule VI, item 1) under the *Fisheries Act*)
Pollution and contaminants	Point and non-point source pollution (noise pollution, sewage treatment plant activities and dumping at sea) Release of deleterious substances	Loss of water quality Loss of, or reduction in, forage/prey quality or quantity	Feeding and foraging Reproduction, socializing, resting	Water quality Availability of sufficient forage species	Water of sufficient quality to support forage or prey which comprise CSB diet

9. Measuring progress

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objective. Specific progress towards implementing the recovery strategy will be measured against actions outlined in subsequent action plans.

Every 5 years, the success of the recovery strategy implementation will be measured against the following performance indicators:

- increase in the number of CSB
- increase in the identification, description, location, and protection of critical habitat (until such time as it is believed that all critical habitat has been identified)
- assessment of biological characteristics indicating good overall health of CSB (for example, body growth, reproductive health, lack of disease)
- a sustainable subsistence harvest which provides data for managing and monitoring stock recovery (for example, number of whales landed, number of whales struck and lost, biological samples or data on the harvest, observations of ice or tidal entrapments)
- all existing, new, or emerging human threats and natural, limiting factors identified during the 5 year period are monitored, their overall effects on the population are determined and, where possible, mitigated to lessen their effect on CSB

10. Activities permitted by the recovery strategy

Subsection 83(4) of SARA allows for certain activities to be exempt from the general prohibitions of SARA, provided the activities are permitted in recovery strategies, action plans or management plans and the person is also authorised under an Act of Parliament to engage in that activity. Subsection 83(4) can be used as an exemption, to allow activities which have been determined to not jeopardize the survival or recovery of the species.

An ongoing winter commercial fishery for Greenland Halibut using long-lines has taken place in Cumberland Sound since 1986 (usually January to May) when the ice is safe for travel (DFO 2008b). In some years, the harvest in the winter fishery has declined due to poor ice conditions and reduced fishing effort (DFO 2008a). An open water summer fishery (July to September) for Greenland Halibut, primarily to attempt to take the balance of the winter quota, takes place only infrequently using long-lines (DFO 2008a).

Long-line gear poses a low risk of entanglement or bycatch for Beluga (DFO 2008a) and the summer and winter Greenland Halibut fishery using long-lines is permitted by this recovery strategy and will continue to be authorized under section 7 of the *Fisheries Act*. Gill nets, which pose a greater risk of entanglement to Beluga, are not permitted by this recovery strategy and will not be authorized under the *Fisheries Act* (DFO 2008a).

11. Statement on action plans

SARA’s approach to recovery planning is a 2 part approach, the first part being the recovery strategy and the second part being the action plan. An action plan contains specific recovery measures or activities required to meet the objective outlined in this recovery strategy.

An action plan relating to this recovery strategy will be produced within 5 years of the final recovery strategy being posted on the SARA Public Registry.

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Appendix A: effects on the environment and other species

In accordance with the Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals (2010), *Species at Risk Act* (SARA) recovery planning documents incorporate strategic environmental assessment (SEA) considerations throughout the document. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or achievement of any of the Federal Sustainable Development Strategy's goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies and critical habitat identified may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself (see recovery planning table under section 7.2), but are also summarized below in this statement.

Cumberland Sound Beluga (CSB) were estimated to number close to 8,500 animals prior to 1920, so it is anticipated the ecosystem could accommodate a large increase from current numbers without suffering any detrimental effects. As the CSB prey base once supported substantially more whales than are present today, it is expected that the prey base can support a larger Beluga population although other consumers (for example, Seals, Narwhal, Killer Whales and the Inuit people) may now also have increased their take of the same prey species. Increased numbers of CSB will benefit the Inuit of Pangnirtung by allowing a larger harvest to satisfy their needs. An increase in the number of CSB might also result in increased availability of prey for Killer Whales or Polar Bears.

Appendix B: record of cooperation and consultation

To aid in the recovery of this population and in anticipation of possible *Species at Risk Act* (SARA) listing, the Cumberland Sound Beluga Recovery Team was formed in September 2002. Representatives from the Pangnirtung Hunters and Trappers Association (HTA), the Nunavut Wildlife Management Board (NWMB), the Qikiqtaaluk Wildlife Board, Nunavut Tunngavik Incorporated, and Fisheries and Oceans Canada (DFO) participated on the Team during the process. Recovery Team meetings were ongoing during 2002 to 2005 and an initial strategy was presented to the NWMB in 2005. The Pangnirtung HTA requested revisions to the strategy which were made in 2008. Meetings to discuss a revised strategy occurred in February 2010 and again in February 2011 with Pangnirtung HTA executives and members of the Recovery Team. A penultimate revision of the recovery strategy was prepared after the 2017 SARA listing of the population and sent to the Pangnirtung HTA for comment in February 2018. Other interested Nunavut organizations were also sent the draft recovery strategy for comment. A meeting was held with Pangnirtung HTA executives in June of 2018 when further revisions were made to this strategy. A final meeting to review this recovery strategy prior to posting on the SARA Public Registry was held via teleconference with Pangnirtung HTA executives in April 2022.

Residents of Pangnirtung, including members of the HTA, were first consulted on a possible SARA listing of the Cumberland Sound Beluga (CSB) in November 2004. The NWMB was informed of the results of these consultations in early 2005.

The Governor in Council decided not to make a decision on possible listing of CSB under schedule 1 of SARA in August 2006 to allow further engagement with the NWMB to ensure that future listing decisions were made in full consideration of the views of Inuit. By mid-2008, “A Memorandum of Understanding to harmonize the designation of rare, threatened and endangered species under the Nunavut Land Claims Agreement and the listing of wildlife species at risk under the *Species at Risk Act*” was completed between the Minister of Environment, the Minister of Fisheries and Oceans, and the NWMB, and consultations on the recovery strategy began again.

In June 2008, DFO sent a second consultation letter to the Pangnirtung HTA explaining why there had been a delay in the listing process, describing what new science information was available, and asking whether they supported listing of CSB. The Ministers of Environment and Fisheries and Oceans, taking into account the local knowledge and scientific advice available on the status of the population, and the position of the NWMB, made the recommendation to the Governor in Council that the population should be listed.

The proposed listing decision was made public in the *Canada Gazette, Part I* in August 2016 . CSB was listed as Threatened on May 3, 2017.

Additional Indigenous, stakeholder, and public input will be sought through the publication of the proposed document on the Species at Risk Public Registry for a 60-day public comment period. Comments received will inform the final document.

Appendix C: threat assessment categories

Likelihood of Occurrence	Definition
Known or very likely to occur	There is a 91% to 100% chance that this threat is or will be occurring.
Likely to occur	There is a 51 to 90% chance that this threat is or will be occurring.
Unlikely	There is a 11 to 50% chance that this threat is or will be occurring.
Remote	There is a 10% or less chance that this threat is or will be occurring.
Unknown	There are no data or prior knowledge of this threat occurring now or in the future.

Level of Impact	Definition
Extreme	Severe population decline (for example, 71 to 100%) with the potential for extirpation.
High	Substantial loss of population (31 to 70%) or threat would likely jeopardize the survival or recovery of the population.
Medium	Moderate loss of population (11 to 30%) or threat may jeopardize the survival or recovery of the population.
Low	Little change in population (1 to 10%) or threat is unlikely to jeopardize the survival or recovery of the population.
Unknown	No prior knowledge, literature, or data to guide the assessment of threat severity on population.

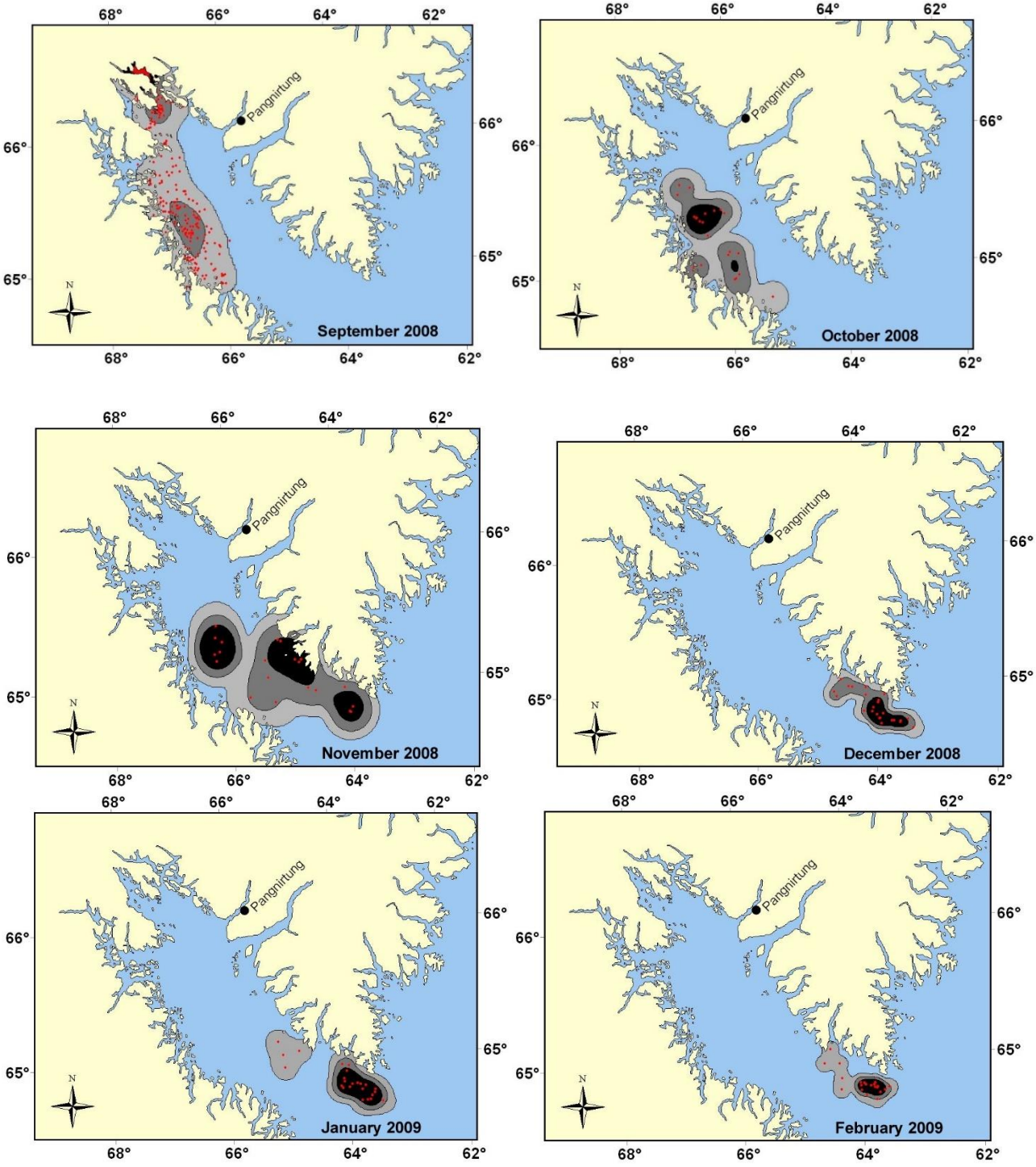
Causal Certainty	Definition
Very high	Very strong evidence that threat is occurring and the magnitude of the impact to the population can be quantified. Population decline or jeopardy to survival or recovery is anticipated.
High	Substantial evidence of a causal link between threat and population decline or jeopardy to survival or recovery.
Medium	There is some evidence linking the threat to population decline or jeopardy to survival or recovery.
Low	There is a plausible link with limited evidence that threat is leading to a population decline or jeopardy to survival or recovery.
Very low	There is a theoretical link with no evidence that the threat is leading to a population decline or jeopardy to survival or recovery.

Threat Occurrence	Definition
Historical	A threat that is known to have occurred in the past and negatively impacted the population.
Current	A threat that is ongoing, and is currently negatively impacting the population.
Anticipatory	A threat that is anticipated to occur in the future, and will negatively impact the population.

Threat frequency	Definition
Single	The threat occurs once.
Recurrent	The threat occurs periodically, or repeatedly.
Continuous	The threat occurs without interruption.

Threat extent	Definition
Extensive	71 to 100% of the population is affected by the threat.
Broad	31 to 70% of the population is affected by the threat.
Narrow	11 to 30% of the population is affected by the threat.
Restricted	Less than 10% of the population is affected by the threat.

Appendix D: monthly home range of Cumberland Sound Beluga: September 2008 to May 2009



Appendix D: continued.

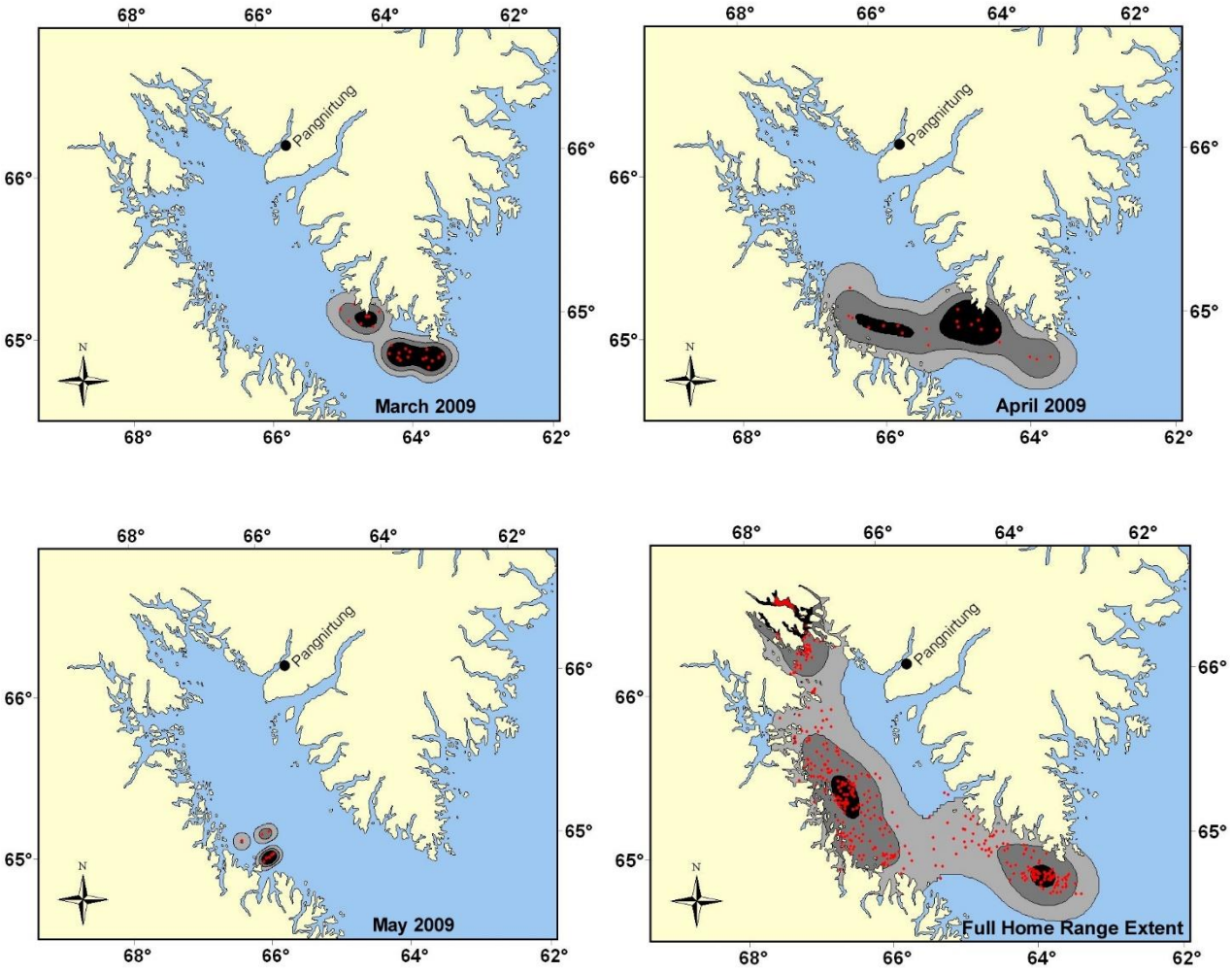


Figure 6. Monthly home range of Cumberland Sound Beluga from September 2008 to May 2009. Red dots represent the estimated locations of individual whales. The darker the shading, the more likely whales were to be in the area.

Summary of the Recovery Strategy for the Cumberland Sound Beluga

The Cumberland Sound Beluga (*Delphinapterus leucas*) was listed as threatened under the *Species at Risk Act* (SARA) in May 2017. As required under SARA, when a species is listed as threatened, a recovery strategy must be prepared. A recovery strategy is a planning document that identifies what needs to be done to stop or reverse the decline of a species. In 2020, during the drafting of the recovery strategy, the Committee on the Status of Endangered Wildlife in Canada reassessed the Cumberland Sound Beluga as endangered. Consequently, the recovery strategy may be amended at a future date if the listed SARA status under Schedule 1 changes.

The Beluga Whale is a toothed whale characterised by a blunt head, slight beak, fat, stocky body, and lack of a dorsal fin. Newborn calves range from light to dark mottled grey in colour. Juveniles gradually lighten in colour as they age until they become almost pure white at, or shortly after, the age of sexual maturity of approximately 10 to 14 years of age. The Cumberland Sound population of Beluga Whale was identified as a unique population in 2004 due to genetics, contaminant and movement data. Local Inuit knowledge and recent genetic studies have confirmed that there are two genetically distinct populations of Beluga Whale in Cumberland Sound, however based on information currently available, these two populations can only be assessed as a single stock. This recovery strategy may be amended at a future date if new information becomes available.

Subsistence harvest has been identified as the primary threat to Cumberland Sound Beluga. The subsistence harvest is under quota of 41 whales per year and a Fisheries Management (FM) management plan is being developed by the Cumberland Sound Beluga Working Group including the community of Pangnirtung to guide the conservation and sustainable use of the fishery and to ensure the harvest is conducted safely and effectively. The FM management plan is not a SARA legal instrument but will assist with achieving recovery goals. Other potential threats, and activities that may impede Cumberland Sound Beluga recovery include: noise and disturbance, pollution, and commercial fisheries that may compete for beluga prey. Killer Whale (*Orcinus orca*) predation, ice and tidal entrapment, disease/parasites, and environmental changes are among the natural limiting factors which may delay recovery or cause a decline in the population.

The population and distribution objective for Cumberland Sound Beluga is to protect, maintain and recover the population to levels that are self-sustaining such that the population is increasing to a stable size that is large enough to resist stochastic events and persist over the next 2 generations (that is, long-term ≥30 years).

To meet the population and distribution objective, the recovery strategy takes into consideration the uncertainty associated with current knowledge of Cumberland Sound Beluga and its environment. The strategic approaches proposed to meet the population and distribution objective are to:

- manage the harvest for the recovery of Cumberland Sound Beluga
- increase knowledge of the biology, seasonal distribution, abundance, and habitat requirements of Cumberland Sound Beluga
- identify and protect all Cumberland Sound Beluga critical habitat as soon as possible
- increase knowledge of how threats affect Cumberland Sound Beluga survival so that these threats can be prioritized and avoided, eliminated, or mitigated to the extent possible

A description of the broad strategies to address threats to the species' survival and recovery, as well as research and management approaches needed to meet the population and distribution objective, are included in section 7 of the recovery strategy. These will help inform the development of specific recovery measures in 1 or more action plans. An action plan relating to this recovery strategy will be produced within 5 years of the final recovery strategy being posted on the SARA Public Registry.

Using available data, critical habitat has been identified to the extent possible (section 8 of the recovery strategy). Critical habitat is defined in SARA as the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified in a recovery strategy or action plan for the species. Under SARA, critical habitat must be legally protected within 180 days after the recovery strategy or action plan that identified the critical habitat is included in the Species at Risk Public Registry. It is anticipated that the critical habitat identified in this recovery strategy will be protected by a Critical Habitat Order made by the Minister of Fisheries and Oceans, which will trigger the prohibition in section 58(1) against the destruction of any part of the critical habitat. Based on available information, three areas of critical habitat are identifiable at this time; all are used by Cumberland Sound Beluga only seasonally. These areas are: Clearwater Fiord, the western side of Cumberland Sound, and the polynya/pack ice area near the mouth of Cumberland Sound. A description of critical habitat, including a figure showing the locations is included in section 8 of the recovery strategy. The schedule of studies outlines the research required to further identify critical habitat to help achieve the population and distribution objective.

Every 5 years, the success of the recovery strategy implementation will be measured against the following performance indicators:

- increase in the number of Cumberland Sound Beluga
- increase in the identification, description, location, and protection of critical habitat (until such time as it is believed that all critical habitat has been identified)
- assessment of biological characteristics indicating good overall health of Cumberland Sound Beluga (for example, body growth, reproductive health, lack of disease)
- a sustainable subsistence harvest which provides data for managing and monitoring stock recovery (for example, number of whales landed, number of whales struck and lost, biological samples or data on the harvest, observations of ice or tidal entrapments)
- all existing, new, or emerging human threats and natural, limiting factors identified during the 5 year period are monitored, their overall effects on the population are determined and, where possible, mitigated to lessen their effect on Cumberland Sound Beluga

Subsection 83(4) of SARA allows for certain activities to be exempt from the general prohibitions of SARA, provided the activities are permitted in recovery strategies, action plans or management plans and the person is also authorised under an Act of Parliament to engage in that activity. Subsection 83(4) can be used as an exemption, to allow activities which have been determined to not jeopardize the survival or recovery of the species. The recovery strategy provides the exemption that the summer and winter Greenland Halibut fishery may use long-lines, and their use will continue to be authorized under section 7 of the *Fisheries Act*. Subsection 83(3) of SARA provides that the general prohibitions of SARA do not apply to a person who is engaging in activities in accordance with conservation measures for wildlife

species under a land claims agreement, and therefore exemptions are not required for these activities.

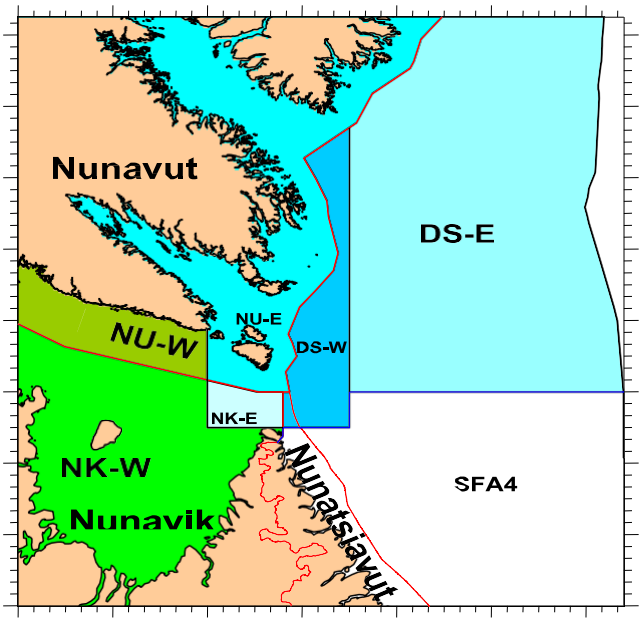
SUBMISSION TO THE
NUNAVUT WILDLIFE MANAGEMENT BOARD
AND NUNAVIK MARINE REGION WILDLIFE BOARD

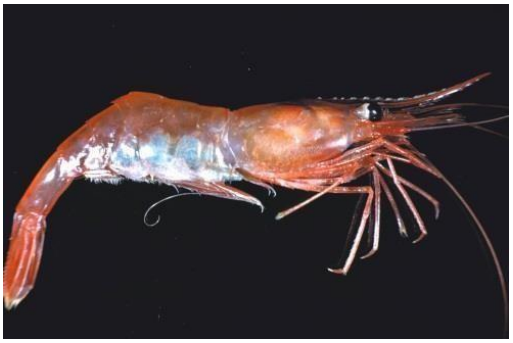
FOR

Information: **Decision: X** **Recommendation: X**

Issue: Precautionary Approach Frameworks for Northern (*Pandalus borealis*) and Striped (*P. montagui*) Shrimp in the Western and Eastern Assessment Zones

Map:
Blue areas – Eastern Assessment Zone (EAZ)
Green areas – Western Assessment Zone (WAZ)





Northern shrimp (*Pandalus borealis*)

Striped shrimp (*Pandalus montagui*)

Background

In August 2024, Fisheries and Oceans Canada (DFO) submitted an information note to the Nunavut Wildlife Management Board and Nunavik Marine Region Wildlife Board (the Boards) to provide background and updates on the development of Precautionary Approach (PA) Frameworks that will guide fisheries management for *P. montagui* and *P. borealis* in the Western Assessment Zone (WAZ), and the update of existing PA Frameworks for these species in the Eastern Assessment Zone (EAZ). A map is at Appendix 1.

The primary components of the PA Framework are: **Reference points** to define stock status zones (Healthy, Cautious and Critical) and **Harvest Decision Rules** (HDRs).

The Limit Reference Point (LRP), which delineates the Cautious and Critical Zones, was developed through a Canadian Science Advisory Secretariat (CSAS) peer review process led by DFO Science in 2020 (Appendix 2). As provided in previous briefings to the Boards, development of the Upper Stock Reference (USR) point and HDR components of the PA Frameworks was undertaken through two channels: the Northern Precautionary Approach Working Group (NPAWG) established in November 2020; and more recently through an industry-led working group of the Northern Shrimp Advisory Committee (NSAC) established in February 2023. A detailed report of the conclusions and recommendations of the industry-led working group was distributed to NSAC in January 2024 (Appendix 3).

Work has concluded and recommended PA Frameworks for *P. borealis* and *P. montagui* in the EAZ and WAZ, respectively, are now available for consideration by the Boards. This briefing note seeks Board decisions and recommendations, as appropriate, to adopt PA Frameworks for these stocks to guide fisheries management decision making, starting in the 2024-25 fishing season.

Upon approval of HDRs for EAZ and WAZ fisheries, DFO will seek decisions and recommendations to amend season bridging provisions for allocations to Nunavut and Nunavik fishing interests in these areas. A review of season bridging protocols is underway and further engagement with Nunavut and Nunavik industry is needed to finalize recommendations. Given that the season bridging pilot project for Nunavut and Nunavik allocations has been in place since 2018, and that some entities have expressed that the current protocol is restrictive, the Department intends to provide some flexibility to carry forward requests in Davis Strait, barring the absence of any conservation concerns. The Department also notes that the *P borealis* in NU/NKE became part of the season bridging protocol when the bycatch designation was removed in 2020, however no specific amounts for either Nunavut or Nunavik season have been identified.

Recommended Precautionary Approach Framework

NPAWG began its work to develop PA Frameworks for EAZ and WAZ stocks in November 2020. NPAWG membership included Nunavut and Nunavik industry (and/or representatives

thereof), as well as Board staff. In February 2023 an industry-led working group of NSAC was established, chaired by the Nunavut Fisheries Association to further advance this work. Representatives of Nunavut industry were active members in this working group.

Through these efforts, complete PA Frameworks for *P. borealis* and *P. montagui* in the EAZ and WAZ are presented below. *DFO recognizes that the PA Framework(s) serves to guide fisheries management decision making using a precautionary approach, and that Minister and co-management partner discretion would remain in annual decision making (e.g. setting of TAC levels).*

Reference Points

Limit Reference Points (LRPs) **–** The LRP is based on biological criteria and is the outcome of a CSAS peer review process led by DFO Science. This research outcome does not require management action but generates an information base used to inform future wildlife management.

New LRPs for WAZ stocks and updates to the previous LRPs for EAZ stocks were developed through CSAS peer review in the spring of 2020, at 40% of the geometric mean of female spawning stock biomass (SSB) over a productive period ("40% level"). These calculations are consistent with guidance in the DFO PA Policy. A copy of the Science Advisory Report (2020/053) was provided to the NWMB and NMRWB for December 2020 and March 2021 Board meetings and is at Appendix 2. These LRPs are presented for the respective stocks in Tables 1 and 2.

Table 1. Reference points for *Pandalus borealis* and *Pandalus montagui* in the Eastern Assessment Zone (EAZ).

Reference Point	Description	***Pandalus borealis***	***Pandalus montagui***
Limit Reference Point (LRP):	40% of the geometric mean of female spawning stock biomass (SSB) over the productive period (2009–2019) for EAZ, a proxy for BMSY, DFO (2020).	15,800 t	3,100 t
Upper Stock Reference (USR):	*Proposed* at 80% of the geometric mean of female spawning stock biomass (SSB) over the productive period (2009–2019) for EAZ, a proxy for BMSY, DFO (2020).	31,600 t	6,100 t

Table 2. Reference points for *Pandalus borealis* and *Pandalus montagui* in the Western Assessment Zone (WAZ).

Reference Point	Description	***Pandalus borealis***	***Pandalus montagui***
Limit Reference Point (LRP):	40% of the geometric mean of female spawning stock biomass (SSB) over the productive period (2014–2019) for WAZ, a proxy for BMSY, DFO (2020).	4,100 t	12,300 t
Upper Stock Reference (USR):	*Proposed* at 80% of the geometric mean of female spawning stock biomass (SSB) over the productive period (2014–2019) for WAZ, a proxy for BMSY, DFO (2020).	8,200 t	24,600 t

Upper Stock Reference (USRs) Points **–** The USR is developed by fisheries management in consideration of the most recent science advice and input from stakeholders.

In December 2023, the NSAC industry-led working group recommended to **establish USRs for EAZ and WAZ stocks at the 80% level.** Details of the working group's deliberations on the USR level are at Appendix 2.

The rationale to establish USRs at the 80% level includes accepting DFO Science proposed levels from the CSAS peer review in 2020 (Tables 1 and 2) and achieving consistency with USRs established for other Shrimp Fishing Areas (SFAs) in the stock complex (SFAs 4-6). Further, USRs at the 80% level would establish a larger Cautious zone than those previously considered (i.e. 70%), allowing more time for reaction to signals of potential stock decline. The working group's recommendation was contingent upon adoption of a HDR that would smooth responses to annual biomass signals (see HDRs below) to offset potentially negative socio-economic impacts of a USR at the 80% level.

Harvest Decision Rules (HDRs) **–** HDRs provide details on target harvest (exploitation) rates and possibly other management procedures in each of the Healthy, Cautious and Critical zones. HDRs and management actions vary in relation to the reference points (i.e. LRP and USR), by affecting the target exploitation rate.

In December 2023, the industry-led working group recommended to **adopt the '2-Step HDR' for EAZ, WAZ** (and SFAs 4-6) **stocks**, beginning in the 2024-25 fishing season**.** It was also recommended that a review of the HDR's performance relative to stated objectives be undertaken at minimum, every five years. Details of the working group's deliberations of this and other candidate HDRs are in Appendix 3.

Supporting rationale for the 2-Step HDR includes its ability to limit (smooth) response to year-to-year survey biomass signals that may be reversed in the following year. The 2-Step HDR provides the timeliest response to (upward and downward) biomass trends which serve socio-economic and conservation objectives, respectively. It was also a priority for industry stakeholders to have a consistent HDR applied across fisheries in the broader stock complex of the EAZ, WAZ and SFAs 4-6. Lastly, this HDR was considered easier to comprehend/communicate than other candidate

HDRs, facilitating greater transparency.

The ‘2-Step HDR’ is described generally herein and summarized at Table 3.

‘2-Step HDR’: The recommended HDR calculates an initial target TAC by applying a target exploitation rate (ER) (20% in the Healthy zone; sloped ER from 10-20% in the Cautious zone) to the most recent estimate of exploitable (fishable) biomass (FB). Rather than pursue the full magnitude of the change between the initial target TAC and the previous year TAC, the approach directs to pursue only 50% of this change to set the TAC.

The approach considers whether FB is increasing or decreasing to guide actions in years following. In the event of increasing FB, the HDR directs to either finish the remainder of the TAC change to the previous year target (Finish option) or pursue 50% of the change to the current year initial target TAC- whichever yields the higher TAC. In the event of decreasing FB, the HDR directs to either finish the remainder of the TAC change to the previous year target (Finish Option) or pursue 50% of the change to the current year initial target TAC, whichever yields the lower TAC.

Further, the HDR sets maximum ERs for the Healthy and Cautious zones of 1.5 times the target ER. Accordingly the maximum ER in the Healthy zone is 30%, while the maximum ER in the Cautious Zone is 1.5 x the target (slope) ER. If these maximum ERs are not respected, the TAC is set to the maximum ER.

The 2-Step approach would not apply to stocks in the Critical zone, where annual TAC is set to a maximum ER of 10% of the current estimate of FB.

Table 3. Summary of the 2-Step Harvest Decision Rule for *Pandalus borealis* and *Pandalus montagui* in the Eastern and Western Assessment Zones.

Stock Status	Spawning Stock Biomass (SSB)	Harvest Decision Rule	
Healthy	Above the USR	• The target ER will be 20% of exploitable biomass. • The maximum ER will be 1.5x target ER (i.e. 30%).	• Pursue 50% of the change between the initial target TAC (i.e. applying the target ER) and the previous year TAC. • In subsequent years, either finish the remainder of the TAC change to the previous year target, or pursue 50% of the change to the current year initial target catch. ▪ Consider whether FB is increasing (select higher TAC) or decreasing (select lower TAC) to guide management action. • Ensure maximum ER is respected.
Cautious	Between the USR and LRP	• The target ER will be scaled linearly (slope) from 20% of exploitable biomass at the USR, to 10% ER at the LRP. • The maximum ER will be 1.5x target (slope) ER.	
Critical	At or below the LRP	• The maximum ER will be 10% of exploitable biomass.	

Consultation

On February 5, 2024, DFO presented the candidate USRs and HDRs to NPAWG for consideration. A summary of discussion is at Appendix 4. **No concerns were raised by NPAWG, who supported USRs at the 80% level and application of the 2-Step HDR for EAZ and WAZ stocks, beginning in the 2024-25 fishery.**

Subsequently, DFO sought NSAC endorsement of the recommended USRs and HDR in a dedicated Technical Session on February 23, 2024. A summary of discussion is at Appendix 5. **NSAC endorsed establishing USRs at the 80% level and application of the 2-Step HDR for EAZ and WAZ stocks, beginning in the 2024-25 fishery.**

Nunavut and Nunavik industry (and/or representatives thereof) participated in both consultation opportunities. The February 5, 2024, NPAWG meeting was attended by NWMB staff only; NMRWB staff were unavailable. Staff from both the NWMB and NMRWB attended the NSAC Technical session.

NSAC continued to support application of the new 2-step HDR to set 2024-25 TAC levels at the April 3-4, 2024, meeting in St. John's, NL. A request for Board decisions and recommendations on 2024-25 TAC levels for EAZ and WAZ stocks has been submitted under

separate cover, and illustrates application of the 2-step HDR.

Marine Stewardship Council (MSC) Implications

Adoption of PA Frameworks for *P. borealis* and *P. montagui* in the EAZ and WAZ, more specifically, the adoption of reference points, would satisfy an outstanding condition for MSC certification for these fisheries.

Recommendation

DFO recommends that the Boards adopt the PA Frameworks presented herein for *P. borealis* and *P. montagui* in the EAZ and WAZ, respectively. Adoption of these PA Frameworks constitutes an amendment to the integrated fisheries management plan, and would include adoption of reference points as well as HDRs for the respective stocks.

Summary of the Request

DFO is seeking from the NWMB and NMRWB for *P. borealis* and *P. montagui*, respectively:

1. Decisions to adopt the PA Frameworks for these stocks in the Nunavut/Nunavik East management units (EAZ). Similarly, decisions to adopt the PA Frameworks for these stocks in the Nunavut/Nunavik West management units (WAZ).

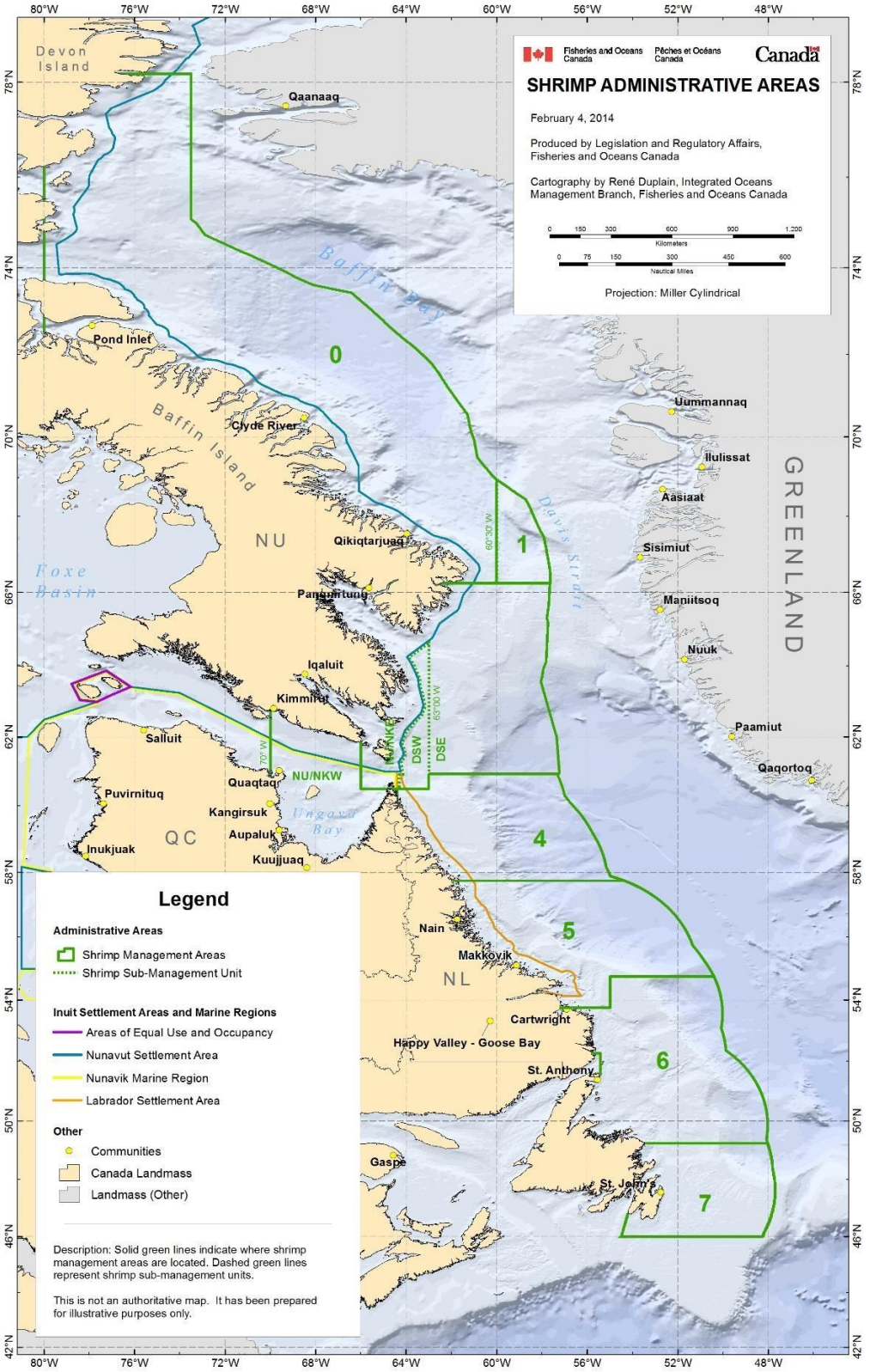
2. Recommendations to adopt the PA Frameworks in the management of these stocks in waters outside the settlement areas in the broader WAZ and EAZ (including the Davis Strait management units).

DFO recognizes that the PA Framework(s) serves to guide fisheries management decision making using a precautionary approach, and that Minister and co-management partner discretion would remain in annual decision making (e.g. setting of TAC levels).

Prepared by: Leigh Edgar**,** Fisheries Resource Management, Fisheries and Oceans Canada

Date: April 30, 2024

Appendix 1


Fisheries and Oceans Canada
Pêches et Océans Canada
Canada
SHRIMP ADMINISTRATIVE AREAS
February 4, 2014
Produced by Legislation and Regulatory Affairs, Fisheries and Oceans Canada
Cartography by René Duplain, Integrated Oceans Management Branch, Fisheries and Oceans Canada
Kilometers
Nautical Miles
Projection: Miller Cylindrical
Legend
Administrative Areas
Shrimp Management Areas
Shrimp Sub-Management Unit
Inuit Settlement Areas and Marine Regions
Areas of Equal Use and Occupancy
Nunavut Settlement Area
Nunavik Marine Region
Labrador Settlement Area
Other
Communities
Canada Landmass
Landmass (Other)
Description: Solid green lines indicate where shrimp management areas are located. Dashed green lines represent shrimp sub-management units.
This is not an authoritative map. It has been prepared for illustrative purposes only.
Devon Island
Baffin Bay
Baffin Island
Foxe Basin
Davis Strait
GREENLAND
NU
QC
NL
Qaanaaq
Pond Inlet
Clyde River
Qikiqtarjuaq
Pangnirtung
Iqaluit
Kimmirut
Salluit
Quaqtaq
Puvirnituq
Kangirsuk
Aupaluk
Inukjuak
Kuujjuaq
Ungava Bay
Nain
Makkovik
Cartwright
Happy Valley - Goose Bay
St. Anthony
Gaspe
St. John's
Uummannaq
Ilulissat
Aasiaat
Sisimiut
Maniitsoq
Nuuk
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76°W
72°W
68°W
64°W
60°W
56°W
52°W
48°W
78°N
74°N
70°N
66°N
62°N
58°N
54°N
50°N
46°N
42°N

Fisheries and Oceans Canada | Pêches et Océans Canada
Ecosystems and Oceans Science | Sciences des écosystèmes et des océans

Central and Arctic Region

Canadian Science Advisory Secretariat
Science Advisory Report 2020/053

SCIENCE ADVICE ON LIMIT REFERENCE POINTS FOR NORTHERN SHRIMP (*PANDALUS BOREALIS*) AND STRIPED SHRIMP (*PANDALUS MONTAGUI*) IN THE EASTERN AND WESTERN ASSESSMENT ZONES

*Top: Northern Shrimp (*Pandalus borealis*)*
*Bottom: Striped Shrimp (*Pandalus montagui*)*
Photo: Fisheries Oceans Canada, Newfoundland and Labrador Region.

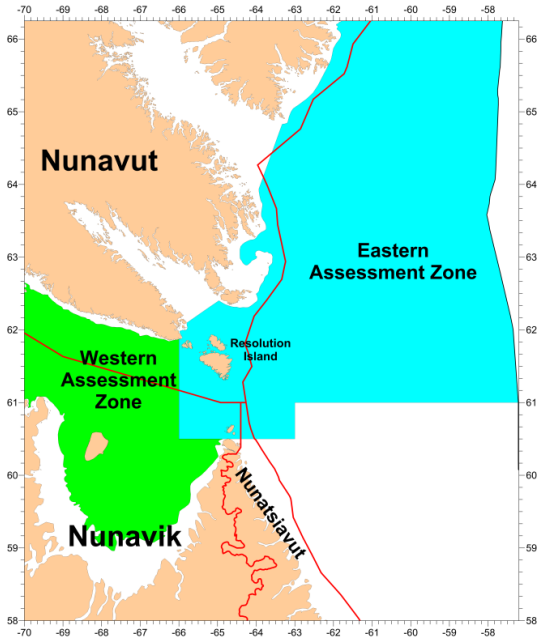

Figure 1. Eastern and Western Assessment Zones for shrimp fisheries in Arctic Region. Boundaries of the Nunavut, Nunavik and Nunatsiavut land claim areas are shown in red.

Context:

Fisheries and Oceans Canada's Fishery Decision-Making Framework Incorporating the Precautionary Approach describes a framework where reference points and harvest decision rules are used to make fisheries management decisions. The limit reference point (LRP) represents the stock status below which serious harm is likely occurring to the stock. The LRP is established based on biological criteria by Fisheries and Oceans Canada (DFO) Science. The Upper Stock Reference (USR) divides the Healthy Zone from the Cautious Zone and is established by DFO Resource Management in consultation with co-management partners, provincial and territorial governments, industry, and DFO Science, to enact harvest decision rules.

*Since the reorganization of the Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*P. montagui*) surveys conducted in the Arctic Region in 2014, the joint DFO-Northern Shrimp Research Foundation survey has covered the Western Assessment Zone (WAZ) and Eastern Assessment Zone (EAZ) survey areas annually with the same ship and gear (DFO 2020a). LRPs for the WAZ were developed in 2013, however, the restart of the time series in 2014 means they are no longer valid (DFO 2018a). Data points acquired since the new survey began will therefore be used to establish new reference points for*

the WAZ. Reference points will also be updated for the EAZ since the original points were calculated from only three surveys (Siferd 2015), which no longer correspond to the assessment area boundaries (DFO 2019a).

DFO Resource Management has requested that Science establish LRPs consistent with the Precautionary Approach (PA) framework for Northern Shrimp and Striped Shrimp in order to determine the point below which serious harm may be occurring to the stock (i.e., the Critical Zone), and propose an USR. This Science Advisory Report is from the May 12–13, 2020 Meeting on Science Advice on Limit Reference Points for Northern Shrimp, Pandalus borealis, *and Striped Shrimp,* Pandalus montagui*, in the Eastern and Western Assessment Zones. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.*

SUMMARY

- The Precautionary Approach (PA) Framework for the Eastern Assessment Zone (EAZ) was established in 2009 on the basis of 3 years of survey data and the results of the *Precautionary Approach Workshop on Canadian Shrimp and Prawn Stocks and Fisheries* (DFO 2009b). The Western Assessment Zone (WAZ) PA Framework was deferred because of changes to the survey design in 2014 that reset the survey time series. The goals of this meeting were to establish the Limit Reference Point (LRP) and propose an Upper Stock Reference point (USR) for the WAZ and update the existing reference points for the EAZ.
- LRPs for Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*P. montagui*) in both the WAZ and EAZ are newly established as 40%, and the proposed USRs as 80%, of the geometric mean of the spawning stock biomass (SSB) index. These calculations are consistent with guidance in the DFO PA Policy.
- In the WAZ, the newly established LRPs for Northern Shrimp (4,100 t) and Striped Shrimp (12,300 t) are based on a 6-year time series (2014–2019). Similarly, a newly proposed USR is provided for each species (8,200 and 24,600 t, respectively).
- In the EAZ, the updated LRP for Northern Shrimp (increase to 15,800 from 6,800 t) and the proposed USR (increase to 31,600 from 18,200 t) are based on an 11-year time series (2009–2019). Re-calculation of the LRP and proposed USR for Striped Shrimp in the EAZ resulted in 3,100 t (increase from 2,300 t) and 6,100 t (no change), respectively.
- The LRPs and proposed USRs are based on the best available scientific information, but do not incorporate environmental or ecosystem factors into their calculations. Information pertaining to these metrics are lacking.
- The PA reference points for the WAZ and EAZ should be re-examined when a population model is developed or relationships between stock productivity and environmental or ecosystem factors are sufficiently developed to inform stock assessments.

BACKGROUND

Canadian Precautionary Approach Framework and Limit Reference Points

In 2009, Fisheries and Oceans Canada (DFO) published the Sustainable Fisheries Framework that provides the basis for ensuring Canadian fisheries are conducted in a manner which supports conservation and sustainability. The framework is comprised of a number of policies for the conservation and sustainable use of fisheries resources including "A Fishery Decision-Making Framework Incorporating the Precautionary Approach" (DFO 2009a). The Precautionary

Approach (PA) Policy applies where decisions on harvest strategies or harvest rates for a stock are taken to determine Total Allowable Catch (TAC) or other measures to control harvests. This is the case for Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*P. montagui*) stocks.

There are three components to the general decision framework for the PA:

1. Reference points and stock status zones;
2. Harvest strategy and harvest decision rules; and,
3. The need to take into account uncertainty and risk when developing reference points and developing and implementing decision rules.

The first component of the PA framework, reference points and status zones, is the subject of this advisory report. The PA is divided into three stock status zones: the Healthy, Cautious and Critical Zones (Figure 2). The Upper Stock Reference (USR) divides the Healthy Zone from the Cautious Zone and the Limit Reference Point (LRP) divides the Cautious Zone from the Critical Zone.

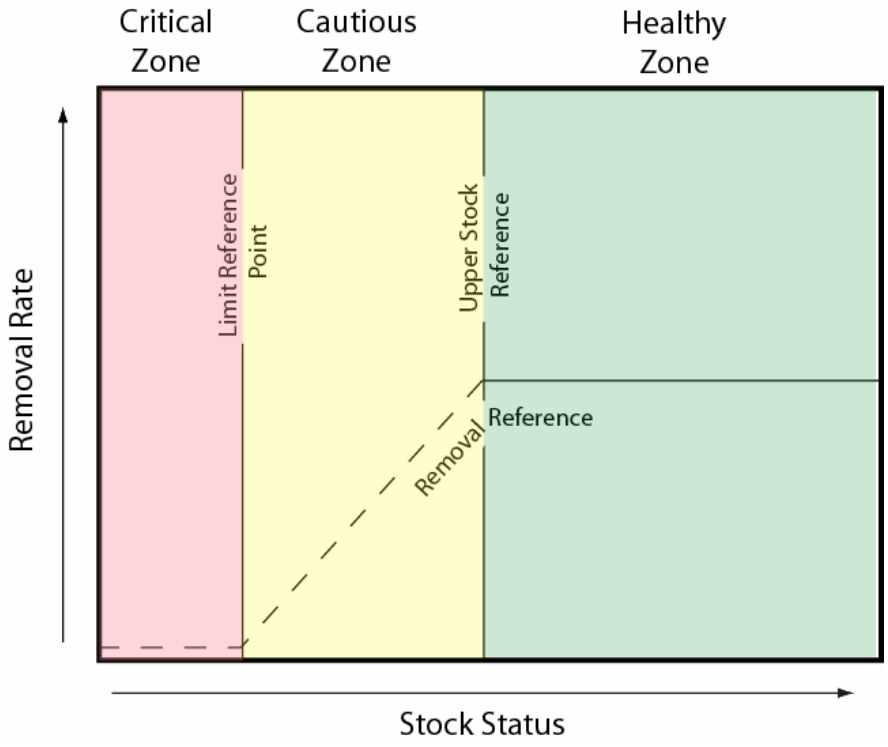

Figure 2. Elements of DFO's PA framework (from DFO 2009a).

The LRP is defined as the stock status *below which serious harm is being done to the stock*. However, a challenge in setting an LRP is identifying the threshold of where and when '*serious harm*' occurs to the stock. This threshold is approximated based on the best available information, below which validation is exactly the situation to be avoided. LRPs are based on biological criteria and are established by DFO Science. In the Critical Zone, conservation/biological considerations are meant to be the primary drivers for management decision-making (as opposed to socio-economic factors) and there is to be no tolerance for preventable declines as the primary goal is to rebuild the stock out of the critical zone. Management actions pertaining to this zone are to promote stock growth and removals are to be kept to the lowest possible level regardless of the stock trajectory.

When establishing an LRP, the guidelines advise choosing a stock metric that can account for changing productivity, generally the spawning stock biomass. An LRP should be determined by accounting for periods of high and low productivity over as long a time-series as possible, and based on the best information available on stock biology and fishery characteristics while acknowledging limitations of the data. However, in some cases there may be insufficient information on which to base choices of stock-specific precautionary reference points and harvest rules. In these instances, DFO has a guideline of 40% LRP and 80% USR. The PA Policy states:

> "In cases where insufficient stock-specific information is available, these reference points may be considered as the best available guidance for management and for assessing the stock in relation to sustainability. Actual reference points for a stock may use other metrics and be set lower or higher than these references but should be demonstrably appropriate for the stock and be consistent with the intent of the PA."

Furthermore, while reference points should be reviewed periodically, neither the timeframe nor the triggers for review are specified in the PA Policy. Given that reference points have not been previously proposed for Northern Shrimp and Striped Shrimp in the Western Assessment Zone (WAZ; Figure 1) and that the current reference points in the Eastern Assessment Zone (EAZ) have been in place since 2009 (DFO 2009b), Resource Management has requested a review of the LRPs, and their rationales, to be carried out for these stocks.

Species Biology

Northern Shrimp is found in the Northwest Atlantic from Baffin Bay to the Gulf of Maine, while Striped Shrimp is found from Davis Strait south to the Bay of Fundy.

Both species of shrimp are protandric hermaphrodites. They function as males early in their lives then change sex and reproduce as females for the remainder of their lives. Females usually produce eggs once a year in the late summer-fall and carry them, attached to their abdomen, through the winter until the spring, when they hatch. Newly hatched shrimp spend three to four months as pelagic larvae. At the end of this period they settle at the bottom and take up the life style of the adults.

Recent research by Le Corre (2019, 2020) on the connectivity of management units via shrimp larval drift found that virtually the entire population of Northern Shrimp along the Canadian Atlantic coast (from Baffin Bay to the Scotian Shelf) is connected through larval drift processes with variable retention success in a given management zone. Also, larval drift was found to promote genetic homogeneity in areas with strong currents (Jorde et al. 2015). These findings improved our understanding of recruitment mechanisms and may in the future help to inform management of Canadian shrimp stocks.

Shrimp lifespan is uncertain but shrimp in the north are thought to live five to eight years. Growth rates and maturation are likely slower in the northern populations.

Fishery

The fishery began in the late 1970s in what is known as shrimp fishing area (SFA) 1. Exploratory fishing expanded into what is now the Davis Strait-East management unit (previously known as SFA 2) and then to areas southeast of Resolution Island in Hudson Strait. Quotas in these areas were based on fishery performance and not scientific survey data. In the mid-1990s, the fishery moved southeast of Resolution Island in SFA 2, where the main fishery

remains to date. Implementation of the Nunavut Agreement in 1999 shifted the main fishery east of the Nunavut Settlement Area.

Currently, the fishery in the EAZ and WAZ is managed by a TAC which is divided into individual quotas for 17 offshore licence holders and special allocations for Nunavut and Nunavik fishing interests. Changes to the management of the fishery in what were SFAs 2 and 3 created new SFAs and Management Units beginning with the 2013/14 fishing season (Figure 2). Nunavut Wildlife Management Board (NWMB) and Nunavik Marine Region Wildlife Board (NMRWB) advise on the allocation of quotas to Nunavut and Nunavik fishing interests, respectively. All fishing to date has been conducted by large vessels (> 100' overall length) with 100% At-Sea-Observer coverage.

Fishing gear in the EAZ and WAZ consists of single and, more recently, twin shrimp trawls requiring a minimum codend mesh size of 40 mm and separator grate (maximum 28 mm bar spacing). Since 2003, the management year has been April 1 to March 31. The fishing season is limited by the extent of sea ice, and is conducted between May and December in most years.

Northern Shrimp has been the main commercial species throughout the history of the shrimp fishery in this area. Historically, most of the harvest of Striped Shrimp occurred as by-catch in the directed Northern Shrimp fishery. Directed fishing for Striped Shrimp has become more important especially with quotas available in the Nunavut-West and Nunavik-West management units beginning with the 2013/14 fishing season.

Fishery catch per unit effort (CPUE) data are not considered to reflect stock status. Commercial fishing locations are not broadly distributed; fishing vessels target areas of high density. A mix of two shrimp species are disproportionally caught in the fishery and the composition of the two species in the catch determines which species is designated as directed, which biases CPUE calculations. Throughout the history of the fishery, economic factors (e.g., fuel prices, market price of shrimp) have influenced when and where the species are caught. In the EAZ, commercial vessel performance has changed over the years to target each species to achieve cleaner catches of just one species. Renewed effort in the WAZ is relatively recent. In some years, cleaner catches can be similarly achieved in the WAZ, however that varies in relation to the distribution of the two species.

ASSESSMENT

This is an assessment of LRPs for both Northern Shrimp and Striped Shrimp in the EAZ and WAZ (Figure 1). These two species have overlapping distributions, particularly in the Resolution Island area, resulting in an overlap of their fisheries. The total removal, both directed catch and by-catch, of each species is considered in the assessment.

DFO plans and the Northern Shrimp Research Foundation (NSRF) conducts annual surveys of the EAZ (Resolution Island Study Area; RISA-W, RISA-E and SFA 2EX) and WAZ (SFA 3) survey areas (Figure 3). Both species in the EAZ and WAZ were last assessed in 2019 (DFO 2019a) and updated in 2020 (DFO 2020a). Survey data in the EAZ are available for the period of 2006–2019, however, the first three years are not considered comparable with the rest of the series because of poor trawl performance, incomplete sampling coverage, and inconsistent timing, vessels, and gear (DFO 2018a). Therefore the first three years of data are excluded, and only 2009–2019 data are evaluated for the EAZ.

The WAZ (Figure 1) was surveyed biennially by DFO from 2007–2013. However, results could not be combined with the EAZ survey results because the surveys used different gear and occurred at different times of year. This prevented a comprehensive evaluation of the

distributions of shrimp and a more practical look at broader stock assessment over a larger spatial scale. In 2014, the NSRF was commissioned to take over the survey of the WAZ so that it is sampled in conjunction with the EAZ as a means to maintain consistent methods among management units. This action started a new time series for the WAZ. In 2019, the WAZ was surveyed for the sixth year in the new time series. The advice contained herein marks the first occasion that LRPs have been developed in the WAZ.

Fishable and female spawning stock biomass (SSB) indices from scientific surveys form the basis of this assessment. Fishable biomass is based on male and female shrimp from the surveys with a carapace length greater than 17 mm; this represents shrimp that are large enough to be retained in commercial trawls. SSB is based on all female shrimp from the surveys regardless of size. Fishery data are used to determine the observed exploitation rate index, calculated as catch from the reporting records (Canadian Atlantic Quota Report; CAQR) divided by the fishable biomass index from the same year. The potential exploitation rate index is calculated to represent the exploitation rate if the entire TAC is taken. Bootstrapped 95% confidence intervals are included for each of the indices.

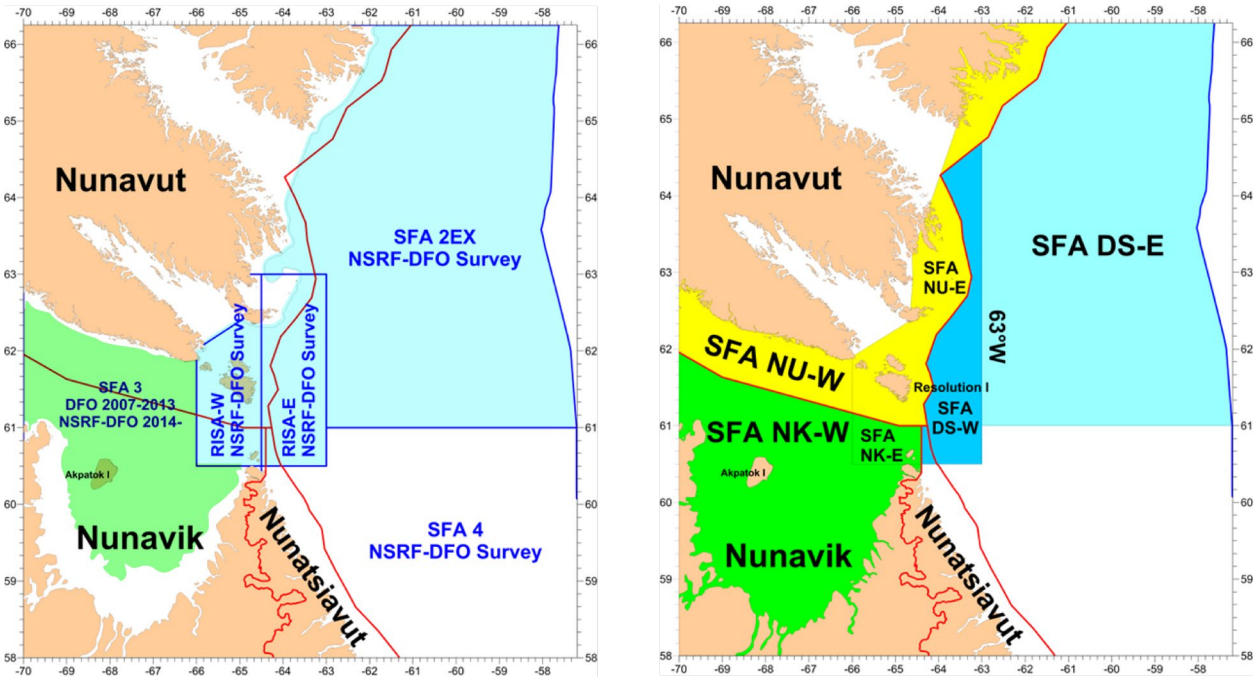

Figure 3. Locations of NSRF survey areas (left panel) within the Eastern (blue) and Western (green) Assessment Zones and the management units (right panel) referred to in this report. Shrimp Fishing Area (SFA), Exploratory (EX), Resolution Island Study Area (RISA), East (E), West (W), Nunavut (NU), Nunavik (NK) and Davis Strait (DS). Red lines show the borders of the Nunavut, Nunatsiavut and Nunavik Land Claims Areas.

For each assessment zone and shrimp fishery an LRP based on 30% and 40% of the SSB index was explored (Walkusz and Atchison 2020). Currently, a 30% LRP is being applied as a reference point by the Northwest Atlantic Fisheries Organization (NAFO) for the Northern Shrimp stock in SFA 1, which is adjacent to the EAZ. This was noted but not considered in-depth during a two-day workshop in 2008 among DFO-Science, DFO-Resource Management, co-management partners and stakeholders in an attempt to establish LRPs in these shrimp fisheries (2009b). Additionally, LRPs and the USRs were adopted at 30% and 80%, respectively, of the geometric mean of female SSB for both Northern and Striped Shrimp in

other southern SFAs. The SSB was deemed to be a suitable proxy for B_{MSY}. The contributing factors leading to the use of 30 and 80% were three years of survey data (2006–2008) in Shrimp Fishing Area 2, and that it was consistent with the approach taken by NAFO. LRPs have since gone unchanged in the EAZ (Siferd 2015).

Adopting a 30% LRP as part of the 2020 process would be consistent with NAFO approach and how shrimp fisheries are managed in the Newfoundland and Labrador Region. However, the use of a 30% LRP is unsubstantiated for the WAZ and EAZ based on the best available scientific information for these particular fisheries (Walkusz and Atchison 2020). Furthermore, an LRP of 40% is suggested in the DFO PA Policy (DFO 2009a) for instances of data deficiency and uncertainty. Establishing LRPs based on 40% average SSB for the WAZ and the EAZ was determined to be the best way forward based on the information available and recent decreases in stock productivity in southern SFAs (e.g., SFAs 4–6, DFO 2019b; SFAs 13–15, DFO 2019c). Uncertainty remains with respect to biomass variability as it relates to environmental conditions (e.g., temperature). Patchy shrimp population distributions have led to occasional large catches and fluctuations and increased variance in biomass estimates for each of the assessment zones in different years. Other SFAs have longer data sets and can justify using 30% LRPs, while the WAZ and EAZ have shorter data sets, large fluctuations in biomass indices and a lack of stock trends. Furthermore, Striped Shrimp in the EAZ appear to have recovered from biomass levels equivalent to an SSB level near the 40% LRP; below this point the ability of the stocks to recover is unknown (DFO 2020b). Similarly, it is not known to what extent Northern Shrimp can recover from below their lowest recorded biomass levels (comparatively higher than Striped Shrimp in the EAZ). When the PA framework for the EAZ was initially established using 30% LRPs, the reference points were based on three years of data, the geographic area of SFA 2 and a different survey range. It was recommended that the initial EAZ PA framework be revised as soon as possible (DFO 2020b). One of the potential options would be to move to a dynamic LRP, which follows the pattern of the stock. Since information on shrimp stocks is limited in the WAZ and EAZ, a fixed LRP is recommended. The PA framework may be revised in the future when more data on variables affecting shrimp stocks in the WAZ and EAZ become available.

The recommended reference points follow DFO's PA Policy (2009a) and include new data to update existing LRPs in the EAZ and establish new LRPs in the WAZ. The geometric mean of SSB was used as a proxy for B_{MSY}. Furthermore, this framework suggests a starting point for calculating USRs. Accordingly, the LRPs and proposed USRs were calculated at 40% and 80%, respectively, of the geometric mean of SSB for both Northern and Striped Shrimp (Figures 4 and 5).

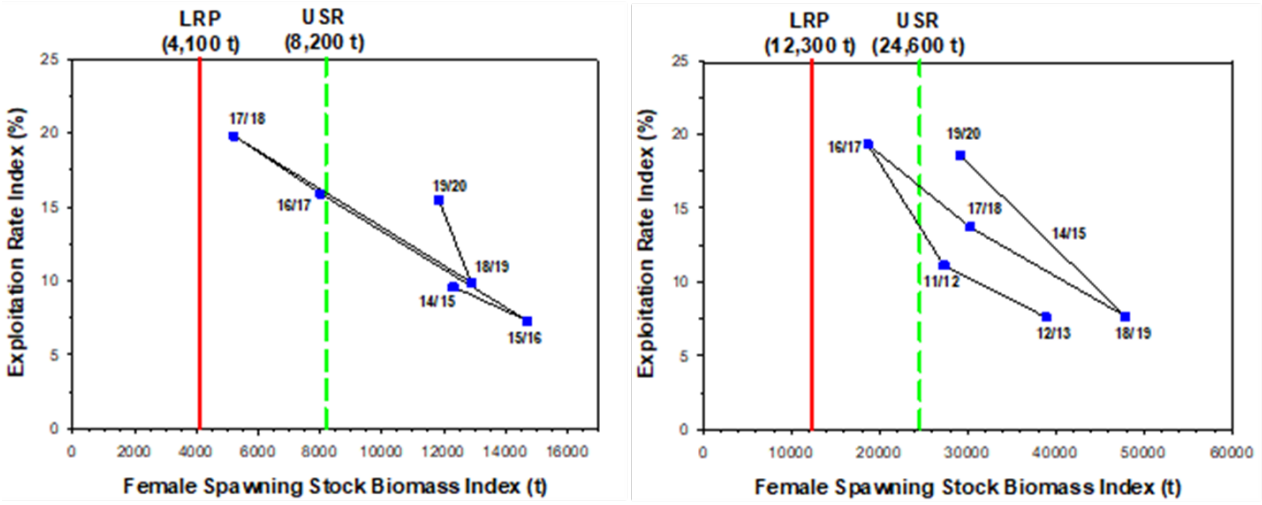

Figure 4. Newly established LRPs for Northern Shrimp (left) and Striped Shrimp (right) in the WAZ. The LRP (red line) is calculated as 40% of the geometric mean of the SSB index and the proposed USR (dashed green line) calculated as 80% of the geometric mean of the SSB index. Blue symbols are annual stock status values, numbers indicate the fishing season.

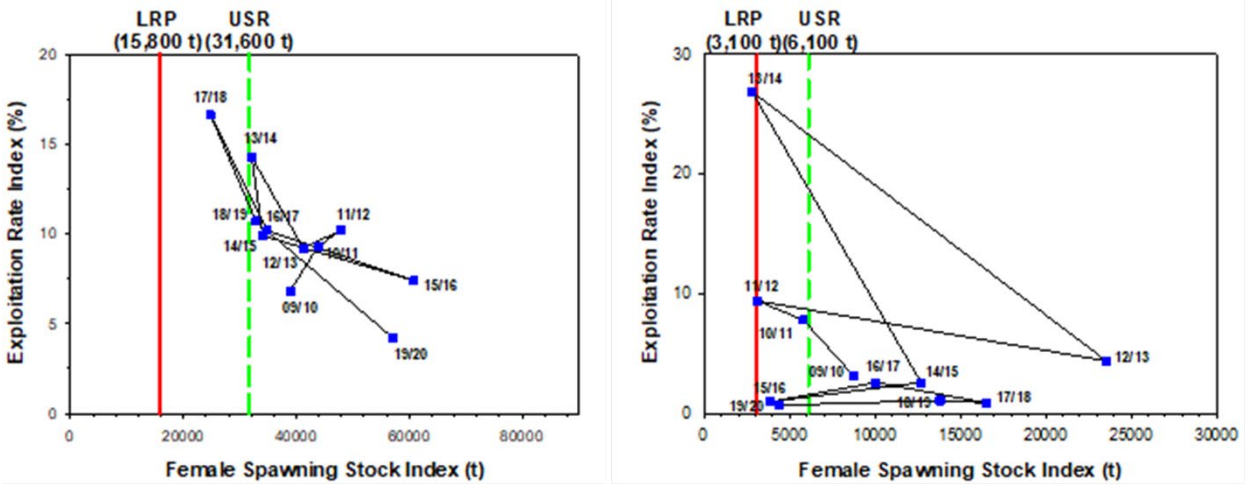

Figure 5. Updated LRPs for Northern Shrimp (left) and Striped Shrimp (right) in the EAZ. The LRP (red line) is calculated as 40% of the geometric mean of the SSB index and the proposed USR (dashed green line) calculated as 80% of the geometric mean of the SSB index. Blue symbols are annual stock status values, numbers indicate the fishing season.

Sources of Uncertainty

The sources of uncertainty that were not quantitatively incorporated into the establishment of LRPs for Northern and Striped Shrimp stocks in the WAZ and EAZ, include:

- Despite having data on temperature preferences of the two shrimp species, the distribution, availability and dynamics of preferred habitats is lacking. Future efforts should focus on moving towards an Ecosystem Approach to Fisheries Management to address knowledge gaps and drivers of stock variability, such as: larval drift related to the connectivity between management zones (stocks), habitat spatiotemporal variability, and ecosystem linkages

(e.g., predator-prey interactions, oceanographic drivers). The lack of environmental information contributes to uncertainty.

- Given the short time series and the lack of observed trends, it is not feasible to identify periods of high productivity upon which to base reference points (as suggested in the DFO PA Policy).
- Trawls used in the survey are known to have a catchability less than one but the exact value is unknown. Therefore, the survey is an index of biomass and not an absolute estimate of the total biomass.
- Catch data are known; however, the total fishery-induced mortality is unknown (landed catch plus incidental mortality from trawling). Exploitation rates are a relative index rather than absolute.
- Survey of all stocks is completed in the middle of the fishing season. It is uncertain how much of the TAC has already been taken while the survey is ongoing. Results may be confounded by the timing of the survey and the concurrent level of harvest.
- It is uncertain to what extent these stocks have the capacity to recover from low levels of biomass. High biomass variability exhibited in these stocks can lead to their positioning within the proposed Cautious Zone of this PA framework. A longer time series and a better understanding of the drivers of stock variability may inform recovery potential.
- The stocks' natural mortality, including multi-species linkages, is currently unknown.
- Factors that may cause shrimp productivity to change are poorly understood within the WAZ and EAZ. For example, it is uncertain to what extent larval drift exists between these assessment zones, and to what extent shrimp productivity is impacted by their movements.
- Stocks of both species in both assessment zones exhibit relatively large inter-annual variability in biomass and no trends have been observed. The drivers leading to this variability are poorly understood.
- Northern and Striped Shrimp have populations spanning both assessment zones and their relative distributions are likely to change inter-annually. The stock structure of each species within and between assessment zones is unresolved. For example, it is possible there are multiple populations of the same species within a single assessment zone.
- DFO has recently discovered that a portion of what was previously identified as *P. montagui* from the Gulf and Scotian Shelf (Division 3PS) are in fact *Dichelopandalus leptocerus*. There remains uncertainty about whether this species has recently migrated to this area or may have been misidentified for several years. The same may be true in more northern areas including the WAZ and EAZ.

CONCLUSIONS AND ADVICE

The work described here represents new and updated science advice on reference points for the Northern and Striped Shrimp fisheries in the WAZ and EAZ. The advice is based on a traditional approach of calculating SSB from shrimp trawl surveys, and explores a time series of fishery-independent data. Data used to assess these fisheries are limited and highly variable, and currently no trends in stock status have been observed. Striped Shrimp in the EAZ have demonstrated an ability to recover from 40% of the SSB, the LRP, below which the ability of these stocks to recover is uncertain. Therefore, we recommend a PA consistent with DFO (2009a) that reflects insufficient stock-specific information: 40% LRP and 80% USR, with

respect to the geometric mean SSB index. These reference points represent the best available scientific information and constitute advice to management for assessing the stock in relation to sustainability.

In the WAZ, the newly established LRP and the proposed USR for Northern Shrimp and Striped Shrimp are based on a 6-year time series (2014–2019; Table 1). In the EAZ, the updated LRP and the proposed USR for Northern Shrimp and Striped Shrimp are based on an 11-year time series (2009–2019; Table 1).

Table 1. Established Limit Reference Points (LRPs) and proposed Upper Stock Reference points (USRs) for Northern Shrimp and Striped Shrimp in the Western Assessment Zone and Eastern Assessment Zone. Spawning stock biomass is reported in tonnes. Previous reference points are provided in parentheses.

Species	Western Assessment Zone		Eastern Assessment Zone	
	LRP	USR	LRP	USR
Northern Shrimp (*Pandalus borealis*)	4,100	8,200	15,800 (from 6,800)	31,600 (from 18,200)
Striped Shrimp (*Pandalus montagui*)	12,300	24,600	3,100 (from 2,300)	6,100 (no change)

The PA reference points for the WAZ and EAZ should be re-examined when a population model is developed or relationships between stock productivity and environmental or ecosystem factors are sufficiently developed to inform stock assessments.

OTHER CONSIDERATIONS

In general, management of key forage species, such as shrimp, under an ecosystem approach, requires the adoption of a conservative approach with lower fishing mortality reference points and higher biomass reference points than would be considered under a single species management approach.

In cases where insufficient stock-specific information is available, DFO's PA Policy (2009a) suggests reference points that may be considered as the best available guidance for management and for assessing the stock in relation to sustainability. The 40% LRP and 80% USR provided as guidance are the results of reviews and meta-analyses across a wide variety of fish stocks. However, it is uncertain to what extent this standard can be applied to shrimp fisheries. Here, 40% LRP and 80% USR of the geometric mean SSB index have been used to inform reference points for shrimp fisheries in the WAZ and EAZ without demonstrable validation of stock productivity. Indeed, most larvae released in any management area end up as functioning adults in another management area (in other words, most adults in any management area originated elsewhere; Le Corre et al. 2020). This in and of itself is evidence that the SSB index within an individual management area does not provide a defensible measure of the future health within any individual management area.

The PA reference points in both the WAZ and EAZ are based on the best available scientific information and need to be re-evaluated with new and/or alternative methodologies when data are available to corroborate the advice contained herein. Actual reference points for a stock may use other metrics and be set lower or higher than these references but should be justified for the

stock and consistent with the intent of the PA. Ideally, more robust LRPs and associated PA frameworks should be considered by Science and Resource Management when additional data are available.

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SOURCES OF INFORMATION

This Science Advisory Report is from the May 12–13, 2020 Meeting on Science Advice on Limit Reference Points for Northern Shrimp, *Pandalus borealis*, and Striped Shrimp, *Pandalus montagui*, in the Western and Eastern Assessment Zones. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

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Aussi disponible en français :

*MPO. 2020. Avis scientifique sur les points de référence limites pour la crevette nordique (*Pandalus borealis*) et la crevette ésope (*Pandalus montagui*) dans les zones d'évaluation est et ouest. Secr. can. de consult. sci. du MPO, Avis sci. 2020/053.*

Appendix 3

[SUMMARY - Report of Northern Shrimp Advisory Committee (NSAC) Ad Hoc Working Group (Page 3; Page 20)]

[Page 3]

1.0 USRs for Pandalus borealis and P. montagui in the WAZ and EAZ

Background

In DFO's Precautionary Approach (PA) Framework, the Upper Stock Reference (USR) defines the boundary between the Healthy and Cautious Zones. The decision where to set the USR rests with Fisheries Management, in consultation with industry. Science Branch has recommended setting the USR at 80% of the Bmsy for Northern and Striped shrimp stocks, respectively, in the WAZ and EAZ. The Bmsy proxy is currently based on the geometric mean of the SSB index for the available time series (Science Advisory Report 2020/053).

In 2020, DFO established a PA Working Group (PAWG) representative of fishing interests as well as management boards to advise on the matter of USRs. Industry representatives observed that the USR concept is merely notional for shrimp assessment units that are arbitrary relative to observed stock dynamics, particularly for those in the WAZ and EAZ where the biomass indices fluctuate significantly without trend. On this basis, it is the view of industry that unless there is a declining trend, the USR simply imposes punitive (reduced) harvest rates during years when the SSB drops into the Cautious Zone and returns into the Healthy Zone soon after. Nonetheless, DFO requires this structure as a matter of policy in implementation of a complete PA Framework.

The outcome of discussions through the PAWG was overall support for a USR established at the 70% level in order to lessen the scope of this punitive impact. USRs at the 70% level for Northern and Striped shrimp stocks in the WAZ and EAZ were subsequently recommended for decisions and recommendations to the Nunavut Wildlife Management Board and Nunavik Marine Region Wildlife Board, as appropriate. The wildlife management decisions deferred any decision on USRs until such time as the full suite of PA Framework components could be available for decision.

Discussion

The issue of the 70% USRs in the WAZ and EAZ arose during the ad hoc NSAC Working Group's consideration of candidate HDRs. The consensus of industry representatives was that LRPs and USRs for all the assessment units within the shrimp stock complex should be consistent at 30% and 80% respectively of the Bmsy proxy, pending the development of more appropriate assessment units and a better understanding of stock dynamics in the respective areas. This position was also expressed in the context of the same HDRs being proposed across management units.

Recommendation

It is recommended that NSAC consider endorsement of the USR at the 80% level for *P. borealis* and *P. montagui* in the WAZ and EAZ, contingent upon adoption of the same HDRs for all management units.

[Page 20]

4.0 Harvest Decision Rules (HDRs) for Pandalus borealis and Pandalus montagui in the WAZ, EAZ and SFAs 4, 5 and 6

Conclusions

Meeting the suite of objectives:

- The Working Group does not support the 1-Step approach because it underperforms other Candidate HDRs relative to the socioeconomic objectives linked to total yield/value and improved interannual stability. Its fast responsiveness to interannual (sometimes false) survey signals may also result in an overreaction, with large 1-year TAC increases likely to contribute to biomass decline, and large 1-year TAC decreases creating socio-economic duress without any offsetting conservation benefit.

Fluctuating biomass without trend:

- The Base TAC approach provides greater stability with higher socio-economic return than the 2-Step approach, with little to no apparent conservation cost.

Responsiveness to biomass trend:

- Where a decreasing trend is apparent, the 2-Step approach provides more timely response than the Base TAC, which better meets conservation objectives.

- Where an increasing trend is apparent, the 2-Step approach provides more timely response than the Base TAC, which better meets the socio-economic objectives.

Miscellaneous:

- The Base-TAC has a maximum ER cap of 1.5*target ER in the Healthy Zone, and 1.25*target ER that is applied after an initial year in the Cautious zone. During the ~10-year retrospective period, the maximum ER would have been used 5 times for (declining) borealis stocks, excluding SFA6 where it was used twice during its dramatic decline (following its dramatic increase) to its relatively stable current level.

- The 2-step method has a maximum ER cap of 1.5*target ER, in both the Healthy and Cautious Zones. In reality, the actual ER is always at or lower than the target ER in an increasing biomass scenario. During the ~10-year retrospective period, the maximum ER would have been used only twice for (declining) borealis stocks, excluding SFA6 where it was used 5 times during its dramatic decline (following its dramatic increase) to its current, relatively stable level.

- Over the retrospective time series, the average ER for the Base-TAC was higher than the 2-Step ER for all borealis stocks except the WAZ where it was virtually identical; the difference ranging from 0.16 percentage points in the EAZ to 1.88 in SFA4. The difference between the 2-Step and 1-Step for all borealis stocks ranged from 0.66 percentage points in SFA4 to 1.54 points in the EAZ.

- The 2-Step method appears to be somewhat easier to comprehend/communicate than the Base-TAC approach, and thus facilitates greater transparency.

Recommendation

It is recommended that NSAC endorse the 2-Step Harvest Decision Rule, for consistent application in SFAs 4, 5, 6, EAZ and WAZ, effective April 1, 2024, to be reviewed by NSAC at least every 5-years at which point its performance would be reviewed relative to the stated objectives, subject to (a) an exceptional circumstance being encountered, or (b) an assessment model(s) being adopted for one or more assessment units.

APPENDIX 4

SUMMARY OF DISCUSSION (FINAL)

NOTE: This is intended to be a high-level summary that identifies key points and areas of discussion. It is not intended to serve as meeting minutes.

Group: Northern Precautionary Approach Working Group (NPAWG) +
Date: February 5, 2024
Location: Virtual_Zoom
Key Topic(s):

- Harvest Decision Rules (HDRs) for *Pandalus borealis* and *P. montagui* in the Eastern and Western Assessment Zones (EAZ & WAZ) and Shrimp Fishing Areas (SFAs) 4, 5 and 6
- Upper Stock Reference Points (USRs) for *P. borealis* and *P. montagui* in the EAZ and WAZ

Participants:

Sherry Glynn, Fish, Food and Allied Workers Union (FFAW)
Bruce Chapman, Canadian Association of Prawn Producers (CAPP)
Angela Burridge, Government of Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture (Gov NL)
Alastair O'Rielly, Northern Coalition (NC)
Derek Butler, Nunavut Fisheries Association (NFA)
Brynn Devine, Oceans North
Christopher Mitchelmore, St. Anthony Basin Resources Inc. (SABRI)
Newman Coish, Fogo Island Co-op
Ann-Julie Cote & Rabia Sow, Quebec Ministry of Agriculture, Fisheries and Food (Gov QC)
Leigh Gustafson, Nunavut Wildlife Management Board (NWMB)
Robert Coombs, Nunatukavut Community Council
Tony Wright, Makivvik

Courtney D'Aoust, DFO Resource Management (RM) National Capital Region (NCR)
Leigh Edgar, DFO RM NCR (Chair)
Brian Lester, DFO RM NCR
Dirk Algera, DFO RM NCR
Nicholas Duprey, DFO Science
Susan Thompson, DFO Science
Nicolas LeCorre, DFO Science
Wojciech Walkusz, DFO Science
Samantha Fulton, DFO Science
Martin Henri, DFO RM NL
Christi Friesen, DFO RM Arctic
Jeff Adam, DFO RM Arctic

Meeting Summary:

➢ Welcome and Opening Remarks

- A round of introductions occurred and participants were informed that the meeting was being recorded for note-taking purposes.
- The Chair noted invitation to the session had been extended beyond NPAWG members to include southern fleets/interests given implications of HDRs for setting Total Allowable Catch (TAC) in SFAs 4-6.
- Participants were reminded of the *NSAC Industry Working Group Report_Dec 2023* as a key supporting material for the meeting, distributed to the Northern Shrimp Advisory Committee (NSAC) on January 15, 2024.
- A meeting Agenda was outlined with no comment.

➢ Recall: NPAWG 2020

- DFO RM recalled the scope and purpose of NPAWG first established in 2020:
  - To develop a **New* Precautionary Approach (PA) Framework for *P. borealis* and *P. montagui* in the WAZ, and update a previous PA Framework for these species in the EAZ.
- DFO RM reviewed progress made by NPAWG on USRs for EAZ & WAZ stocks, such that:
  - NPAWG supported USRs at 70% of the geometric mean of the Spawning Stock Biomass (SSB) index for the available time series.
  - USRs were presented to wildlife co-management boards in June 2021 for decisions and recommendations, as appropriate, but were rejected until such a time as the full PA Framework for these stocks, including HDRs, could be available.
- DFO RM recalled an industry-proposed HDR termed "50% or Finish" tabled in early 2022 and establishment of an industry-led working group following the February 2023 NSAC meeting.
  - The working group, among other things, would seek to advance work on USRs and HDRs ahead of the 2024-25 fishery.
  - The working group's report was submitted to the NSAC Chair in December 2023 (*NSAC Industry Working Group Report_Dec 2023)*.

➢ Upper Stock Reference (USR) Points (EAZ and WAZ)

- DFO RM revisited rationale for NPAWG support of USRs @70% level from Feb 2021:
  - Participants discussed a lower USR as a means to lessen the socio-economic impact of reduced harvest rates once a stock enters the Cautious zone, especially in cases where stocks experience high interannual fluctuation.
  - CAPP raised that a lower USR would be an important mitigation tool under current HDRs that respond to year-to-year biomass signals.
  - NC recalled that USRs @70% were seen to offset Limit Reference Points (LRPs) developed by DFO Science @ 40% level in 2020.
  - Further, it was important to industry representatives that reference points be consistent across SFAs in the broader stock complex.

- **DFO RM sought NPAWG+ views on the recommendation to establish the USR @ the 80% level (Dec 2023).**
  - Participants acknowledged this would align with DFO Science-recommended USRs from 2020 and achieve consistency in USRs across other SFAs in the stock complex (i.e. SFAs 4-6). Further, this approach would create a wider Cautious zone providing more time to respond to biomass decline signals.
  - CAPP, NC and NFA reiterated support for a higher USR. This was contingent upon adoption of a candidate HDR that would see more smoothed response to annual biomass signals.

Key outcome: No concerns were presented by NPAWG+ in regards to USRs @ 80% level; it was understood that NPAWG+ supported USRs @ 80% level for EAZ and WAZ stocks.

➢ Harvest Decision Rules (HDRs) (EAZ, WAZ, SFAs 4-6)

- DFO RM presented 3 candidate HDR that were deliberated and analyzed by the industry working group (as presented in *NSAC Industry Working Group Report_Dec 2023*).
- DFO RM reviewed key objectives adopted by the industry working group to guide their discussions and evaluate candidate HDRs, including but not limited to:

- Compatibility with the PA, mitigation of socio-economic impacts of fluctuating stocks, predictability and ease of comprehension/communication.
- No additional objectives were suggested or offered by NPAWG+ participants.

- DFO RM reminded participants that HDRs would serve to guide management decisions, but that in all cases Minister discretion would remain.

Option 1: 1-Step

- DFO RM presented the main steps to calculate TAC using Option 1.
  - This option was most similar to current HDRs in Annex I of the Integrated Fisheries Management Plan for Northern shrimp (2018).
- This option was <u>not supported</u> by the industry working group (*NSAC Industry Working Group Report_Dec 2023*).

Option 2: Base-TAC (5 years)

- DFO RM presented the main steps to calculate TAC using Option 2.
- This option was developed in-house by DFO building upon previous NPAWG discussions (2020-22):
  - Base TAC was specifically designed for application the EAZ and WAZ where stocks have been observed to show high interannual fluctuation in biomass indices.
- Participants discussed maximum exploitation rates (ER) proposed for the Cautious zone (1.5 or 1.25x target ER), which consider the number of years in the zone, or equally, a climb from the Critical zone.
- DFO RM clarified that the resulting ER of applying the (dynamic) Base TAC was always considered relative to the most recent science advice (estimate of Fishable Biomass (FB)).
- NPAWG+ discussed that Option 2 provides the greatest stability in cases of high fluctuating biomass signals (EAZ & WAZ).

Option 3: 2-Step

- DFO RM presented the main steps to calculate TAC using Option 3.
  - This option was an evolution of the industry proposal (50% or Finish) tabled in 2022.
- Participants discussed the ability of this approach to limit response to year-to-year survey signals that may be reversed in the following year.
- NPAWG+ discussed that Option 3 provides the most timely response to (upward and downward) biomass trends while still achieving a smoothing effect.

Discussion of (NSAC) Industry Working Group recommendations:

- DFO RM highlighted retrospective analysis conducted on all 3 candidate HDR options, presented in great detail in the *NSAC Industry Working Group Report_Dec 2023*.
  - DFO RM reminded participants that retrospective analysis was not dynamic such that there is no way to measure or demonstrate the potential effect (if any) the candidate HDRs would have had on biomass over time.
  - Further, it would be important to assess the recommended HDR over several years when/if a population model became available.
- NPAWG+ discussed that potential ERs of candidate HDRs were lower than those observed in other cold-water jurisdictions (e.g. North-Pacific and North-Atlantic)).
  - DFO Science cautioned against direct comparisons to these ERs; citing different surveys, as well as ecosystem dynamics (i.e. productivity, connectivity) in those systems.

- CAPP pointed to relative values of MSY in the order of magnitude of 35%, and that approaching or exceeding this value on a short term basis could be acceptable.

- **DFO RM sought NPAWG+ views on the industry working group recommendation that Option 3 (2-Step) be applied as a consistent HDR be applied for all SFAs.**
  - CAPP, NC and NFA reiterated support for the 2-Step (50% or Finish) approach beginning in the 2024-25 fishing season, subject to the availability of a population model which could suggest a need to adjust this approach.
  - Members of the industry working group confirmed the expectation that, notwithstanding Minister discretion, the HDR be adopted on a longer-term basis with recommended review in 5 years.
- DFO RM staff stated support for Option 3 (2-Step) in absence of any significant concerns that might be raised through the NSAC technical session; this was echoed by DFO Science staff who had no oppositions to this HDR approach, noting similarities with Option 2 (Base TAC).

Key outcome: No concerns were presented by NPAWG+ in regards to HDR Option 3 (2-Step) and its application to all SFAs, beginning in the 2024-25 fishing season.

➢ Season Bridging

- DFO RM briefly linked development of season bridging provisions to HDRs, such that a degree of caution or restraint should be applied (e.g. capping or reducing bridging amounts) as a stock falls below its USR.
- DFO RM acknowledged a number of industry proposals to amend bridging provisions for the offshore fleet, as well as Nunavut and Nunavik special allocations.
  - DFO RM will schedule a dedicated call to further season bridging to further these discussions. Participants encouraged that a call be scheduled as soon as possible.

➢ Next Steps

- DFO RM committed to prepare and distribute a Summary of Discussion from February 5 session.
- DFO RM confirmed a technical session of NSAC would be scheduled in the next 3-4 weeks (February 23, 2024)
  - NPAWG+ members were encouraged to participate in this second consultation opportunity on the topics of USRs and HDRs.
- DFO RM clarified that decisions would be sought from wildlife management boards, as appropriate, to establish USRs and adopt HDRs for EAZ and WAZ stocks into 2024.

- **The Chair offered a written feedback period on the two priority topics (USRs and HDRs). This feedback period would conclude February 14, 2024.**
  - *No written feedback was submitted.*

APPENDIX 5

SUMMARY OF DISCUSSION (FINAL)

NOTE: This is intended to be a high-level summary that identifies key points and areas of discussion. It is not intended to serve as meeting minutes.

Group: Northern Shrimp Advisory Committee (NSAC)_Technical Session
Date: February 23, 2024
Location: Virtual_Zoom
Key Topic(s):

- Harvest Decision Rules (HDRs) for *Pandalus borealis* and *P. montagui* in the Eastern and Western Assessment Zones (EAZ & WAZ) and Shrimp Fishing Areas (SFAs) 4, 5 and 6
- Upper Stock Reference Points (USRs) for *P. borealis* and *P. montagui* in the EAZ and WAZ

Meeting Summary:

➢ Welcome and Opening Remarks

- Todd Williams, NSAC Chair, informed participants that the meeting was being recorded for note-taking purposes and that on-screen materials would be provided following the meeting.
- The Chair highlighted two key topics for the technical session, namely: USRs (EAZ and WAZ stocks) and HDRs (EAZ, WAZ and SFAs 4-6).
  - Objectives of the technical session would be to seek NSAC views on these elements of the PA Framework, considering working group recommendations.
  - If possible, the Chair sought to achieve NSAC endorsement of these elements to support Minister and co-management partner decision-making.
- Participants were reminded of the *NSAC Industry Working Group Report_Dec 2023* and *Draft Summary of Discussion_Northern PA Working Group+_Feb 5, 2024* as key supporting materials for the meeting, distributed in advance.
- DFO RM confirmed the February 23 technical session would not replace the NSAC full-day meeting scheduled for April 3, 2024, but rather serve to advance more technical discussions.
- A meeting Agenda was outlined with no comment.

➢ Recall: Working Group Progress

- DFO RM recalled the scope and purpose of Northern Precautionary Approach Working Group (NPAWG) first established in 2020.
  - To develop a **New* Precautionary Approach (PA) Framework for *P. borealis* and *P. montagui* in the WAZ, and update a previous PA Framework for these species in the EAZ.
- DFO RM recalled previous NPAWG support for USRs at 70% of the geometric mean of the Spawning Stock Biomass (SSB) index for the available time series.
  - USRs were presented to wildlife co-management boards in June 2021 for decisions and recommendations, as appropriate, but were rejected until such a time as the full PA Framework for these stocks, including HDRs, could be available.
- DFO RM recalled the industry-proposed HDR termed “50% or Finish” tabled in early 2022 and establishment of an industry-led working group following the February 2023 NSAC meeting.

- The working group, among other things, would seek to advance work on USRs and HDRs ahead of the 2024-25 fishery.
- The working group's report was submitted to the NSAC Chair in December 2023 (*NSAC Industry Working Group Report_Dec 2023)* and distributed to NSAC on January 15, 2024.

Key Outcome: NPAWG+ was reconvened on February 5, 2024, to consider Industry Working Group analysis and recommendations ahead of NSAC.

- **NPAWG+ provided no opposition/concern with respect to the recommended USRs and HDR for these fisheries.**

➢ Upper Stock Reference (USR) Points (EAZ and WAZ)

- **DFO RM presented the Industry Working Group recommendation to endorse USRs @ 80% level.** Supporting rationale was discussed to include:
  - Alignment with USRs recommended by DFO Science through the Canadian Science Advisory Secretariat in 2020.Achieve consistency with USRs established for other SFAs in the stock complex (SFAs 4-6)
  - USRs @ 80% level would establish a larger cautious, allowing more time for reaction to signals of potential stock decline.
- DFO RM highlighted that this USR recommendation was contingent upon adoption of a HDR that would see more smoothed response to annual biomass signals.
  - This contingency was emphasized by NC, recalling higher Limit Reference Points (LRP) for EAZ and WAZ stocks (@ 40% level) compared to SFAs 4-6.
- Participants were reminded that USRs for EAZ and WAZ stocks would be presented to co-management partners (NWMB and NMRWB) for decision and recommendation, as appropriate.

Key Outcome: NSAC endorsed the recommendation to establish the USR @ the 80% level for *P. borealis* and *P. montagui* in the EAZ and WAZ.

➢ Harvest Decision Rules (HDRs) (EAZ, WAZ, SFAs 4-6)

- **DFO RM presented 3 candidate HDR that were deliberated and analyzed by the industry working group (as presented in *NSAC Industry Working Group Report_Dec 2023*).**
- DFO RM reviewed key objectives adopted by the industry working group to guide their discussions and evaluate candidate HDRs, including but not limited to:
  - Compatibility with the PA, mitigation of socio-economic impacts of fluctuating stocks, predictability and ease of comprehension/communication.
  - No additional objectives were suggested or offered by NSAC participants.
- DFO RM reminded participants that HDRs would serve to guide management decisions, but that in all cases Minister discretion would remain.

Option 1: 1-Step

- DFO RM presented the main steps to calculate TAC using Option 1.
  - This option was most similar to current HDRs in Annex I of the Integrated Fisheries Management Plan for Northern shrimp (2018).
- This option was <u>not supported</u> by the industry working group (*NSAC Industry Working Group Report_Dec 2023*).

Option 2: Base-TAC (5 years)

- DFO RM presented the main steps to calculate TAC using Option 2.
- This option was developed in-house by DFO building upon previous NPAWG discussions (2020-22):
  - Base TAC was specifically designed for application the EAZ and WAZ where stocks have been observed to show high interannual fluctuation in biomass indices.
  - DFO RM explained maximum exploitation rates (ER) proposed for the Cautious zone (1.5 or 1.25x target ER), which consider the number of years in the zone, or equally, a climb from the Critical zone.
  - DFO RM clarified that the resulting ER of applying the (dynamic) Base TAC was always considered relative to the most recent science advice (estimate of Fishable Biomass (FB)).
  - DFO RM highlighted that Option 2 provides the greatest stability in cases of high fluctuating biomass signals (EAZ & WAZ).

Option 3: 2-Step

- DFO RM presented the main steps to calculate TAC using Option 3.
  - This option was an evolution of the industry proposal (50% or Finish) tabled in 2022.
- Participants discussed the ability of this approach to limit response to year-to-year survey signals that may be reversed in the following year.
- DFO RM highlighted that Option 3 provides the most timely response to (upward and downward) biomass trends while still achieving a smoothing effect.

Discussion of (NSAC) Industry Working Group recommendations:

- DFO RM highlighted retrospective analysis conducted on all 3 candidate HDR options, presented in great detail in the *NSAC Industry Working Group Report_Dec 2023*.
  - DFO RM reminded participants that retrospective analysis was not dynamic such that there is no way to measure or demonstrate the potential effect (if any) the candidate HDRs would have had on biomass over time.
    Further, it would be important to assess the recommended HDR over several years when/if a population model became available.
- **DFO RM presented the Industry Working Group recommendation that NSAC endorse Option 3 (2-step) as a consistent HDR for all areas (EAZ, WAZ, SFAs 4-6), beginning in the 2024-25 fishery.**
  - CAPP, NC and NFA reiterated their support for this approach.
  - Representatives of Nova Scotia Department of Fisheries and Clearwater Seafoods expressed support for Option 3.
  - DFO RM noted that endorsement of Option 3 would satisfy the Industry Working Group's contingency on adoption of USRs @ 80% level for EAZ and WAZ stocks (see above).
- DFO RM clarified that the 2-Step HDR could be first implemented in 2024, such that:
  - The most recent estimates of FB (*pending CSAS peer-review*) survey would be used to calculate an initial target TAC in the respective SFAs.
  - The 2024-25 TAC would pursue 50% of the change to the initial target from the 2023-24 level.
  - In the subsequent years, decisions to apply the remainder the TAC change ('Finish') or pursue 50% of a *new* initial target TAC would depend on observed increases or decreases in FB.

Key outcome: NSAC endorsed HDR Option 3 (2-Step) and its application to all SFAs (EAZ, WAZ, SFAs 4-6), beginning in the 2024-25 fishing season.

➢ Next Steps

- DFO RM noted that TAC scenarios would apply the endorsed HDR (Option 3) to guide 2024-25 management discussions at the NSAC meeting April 3, 2024.
- CAPP and NFA requested that the Chair seek a Ministerial decision to adopt the HDR ahead of the April NSAC meeting.
  - The Chair confirmed that preliminary signal checks from senior officials would be possible in advance of April 3, but that stand-alone Ministerial approval of HDRs for these fisheries was unlikely given briefing schedules and pending decisions.
- DFO RM confirmed that decisions would be sought from wildlife management boards, as appropriate, to establish USRs and adopt HDRs for EAZ and WAZ stocks into 2024.
- Participants inquired about preparations to release 2024-25 interim quotas and renew licenses ahead of the Easter weekend.
  - DFO RM confirmed intent to release interim quotas at appropriate levels to facilitate fishing by April 1, with the exception of SFA 6.
  - CAPP requested consideration to severe ice conditions that might limit fishing in SFAs 4 and 5 in decisions not to release interim quotas in SFA 6.
- DFO RM committed to prepare and distribute a Summary of Discussion from February 23 technical session.

Participants :

Angela Burridge, Government of Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture (Gov NL)
Claude Pelletier, Government of New-Brunswick Department of Agriculture, Aquaculture and Fisheries (Gov NB)
Ralph Heighton, Government of Nova Scotia Department of Fisheries and Aquaculture (Gov NS)
Ann-Julie Cote, Quebec Ministry of Agriculture, Fisheries and Food (Gov QC)
Bruce Chapman, Canadian Association of Prawn Producers (CAPP)
Alastair O'Rielly, Northern Coalition (NC)
Derek Butler, Nunavut Fisheries Association (NFA)
Brynn Devine, Oceans North
Christopher Mitchelmore, St. Anthony Basin Resources Inc. (SABRI)
Leigh Gustafson, Nunavut Wildlife Management Board (NWMB)
Frankie Jean-Gagnon, Nunavik Marine Region Wildlife Board (NMRWB)
Genevieve Myles & Vincent Dupuis, Association des Capitaines Propriétaires de la Gaspésie (ACPG)
Carey Bonnell, Ocean Choice International
Greg Simpson, Mersey Seafoods
Brent MacNamara, Newfound Resources Ltd.
Ben Davis, Torngat joint Fisheries Board
Catherine Boyd, Clearwater Seafoods
Derrick Dalley, Ueushuk Fisheries Ltd.
George Russell, NunatuKavut Community Council
Gilbert Linstead, Labrador Shrimp Co.
Jeff Simms, M.V. Osprey Ltd.
Jim Goudie, Deputy Minister, Land and Natural Resources, Nunatsiavut Government (DM LNR (NG))
Keith Watts & Ron Johnson, Torngat Fish Producers Co-operative Society Ltd.
Mark Quinlan, Newfoundland Resources Ltd. (NRL)
Philip Quinlan, Labrador Fishermen's Union Shrimp Company Ltd. (LFUSCL)
Renae Butler, Association of Seafood Producers (ASP)
Surendra

Courtney D'Aoust, DFO Resource Management (RM) National Capital Region (NCR)
Todd Williams, DFO RM NCR (Chair)

Leigh Edgar, DFO RM NCR
Brian Lester, DFO RM NCR
Dirk Algera, DFO RM NCR
Elysabeth Theberge, DFO RM NCR
Nicholas Duprey, DFO Science
Nicolas LeCorre, DFO Science
Wojciech Walkusz, DFO Science
Samantha Fulton, DFO Science
Daniel Enright, DFO Science
William Coffey, DFO Science
Martin Henri, DFO RM NL
Jeff Adam, DFO RM Arctic

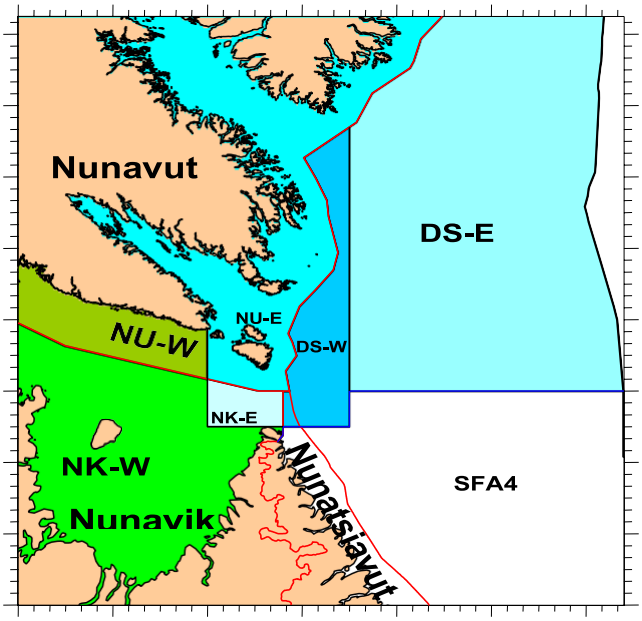
SUBMISSION TO THE
NUNAVUT WILDLIFE MANAGEMENT BOARD
AND NUNAVIK MARINE REGION WILDLIFE BOARD

FOR

Information: **Decision: X** **Recommendation: X**

Issue: Total Allowable Catch levels for Northern (*Pandalus borealis*) and Striped (*Pandalus montagui*) Shrimp for the 2024-25 season in the Western and Eastern Assessment Zones

Map:
Blue areas – Eastern Assessment Zone
Green areas – Western Assessment Zone



Northern shrimp (*Pandalus borealis*)

Striped shrimp (*Pandalus montagui*)

Background

Fisheries and Oceans Canada (DFO) submitted a briefing note to the Nunavut Wildlife Management Board (NWMB) and the Nunavik Marine Region Wildlife Board (NMRWB) (the Boards) *For Information* in March 2024 to mark an upcoming request for their decisions and recommendations on: *Total Allowable Catch levels for Northern (Pandalus borealis) and Striped (Pandalus montagui) Shrimp in the Western and Eastern Assessment Zones for the 2024-25 season.*

This briefing note presents the Boards with the information necessary to provide decisions and recommendations to the Minister of Fisheries and Oceans Canada for 2024-25 fisheries in the WAZ and EAZ. Science results from the 2023 DFO-Northern Shrimp Research Foundation multi-species survey are now available with science advice from the Canadian Science Advisory Secretariat (CSAS) peer review process from the week of February 6, 2024, provided at Appendix 1.

A meeting of the Northern Shrimp Advisory Committee (NSAC) occurred on April 3-4, 2024. A summary of these consultations is provided at Appendix 6.

New Precautionary Approach (PA) Frameworks for Northern and Striped shrimp in the WAZ and an update to the current PA Frameworks in the EAZ have been recently developed. These PA Frameworks have been submitted to the NWMB and NMRWB for decision and recommendation, as appropriate, under separate cover. This briefing note presents the status of Northern and Striped shrimp stocks and TAC scenarios in the context of the recommended Frameworks and illustrates application of the recommended Harvest Decision Rules (HDRs).

Recognizing that fishing may begin in the EAZ and WAZ as early as May, decisions and recommendations are requested as soon as possible. In keeping with past practice, DFO expects to release interim allocations within the settlement areas at levels previously approved by the NWMB, NMRWB and the Minister in 2019, to support fishing as soon as conditions permit.

WESTERN ASSESMENT ZONE (WAZ)

Fishery Profile

The fishery for *P. borealis* and *P. montagui* in the WAZ operates April 1 – March 31. Harvesting activity commences as early as June, subject to ice conditions. Both are directed stocks in the WAZ.

The WAZ is divided into two management units, Nunavut West (NU-W) and Nunavik West (NK-W) (see map). These management units are located entirely within the Nunavut Settlement Area (NSA) and Nunavik Marine Region (NMR), respectively. The NWMB and NMRWB make decisions on management measures within their respective land claim areas and may make recommendations for adjacent management units.

P. borealis and *P. montagui* allocations in the NU-W management unit have been allocated to Nunavut fishing interests. Similarly, allocations in the NK-W management unit have been allocated to Nunavik fishing interests. Although no formal sharing arrangement exists, harvest level decisions in NU-W and NK-W have historically resulted in equal distribution of the overall TAC for each stock. A standing joint decision made by the NWMB and NMRWB on July 13, 2022, supports harvesting of these species in either management unit, regardless of land claim boundaries.

A historical quota profile for the WAZ is provided at Appendix 4.

Science Advice

Ten years of data are now available in the time series for the WAZ (2014-2023). A summary of the CSAS peer review process to update the status of the stocks that occurred in February 2024 is at Appendix 1. Stock status indicators for *P. borealis* and *P. montagui* in the WAZ for the past four years (2020-2023) are at Appendix 2.

P. borealis and *P. montagui* stocks have shown signs of high volatility, with no clear indication of mechanisms driving year-to-year fluctuations in biomass. Currently, DFO Science cannot detect trends for either stock.

For ***P. borealis***, the 2023 survey indicates a Fishable Biomass (FB) decrease of 25.1% from the 2022 survey. The Spawning Stock Biomass (SSB) was similar (-1.2% change) to the previous year's survey. *[FB 17,919t; SSB 15,713t]*

For ***P. montagui***, the 2023 survey indicates a FB decrease of 35.6% from the 2022 survey. The SSB also decreased by 34.9% from the previous year's survey. *[FB 67,425t; SSB 39,745t]*

2024-25 Management Considerations

For ***P. borealis***, the current SSB is in the Healthy Zone, at 192% of the recommended USR.

The 2023-24 TAC was 4,788t. A rollover of the TAC in 2024-25 would result in a potential ER of 26.7%. Application of the recently developed 2-Step HDR would yield a TAC of 4,186t (-12.6%) with a potential ER of 23.4% (see calculation at Appendix 5). Maintaining the 20% ER from last year would result in a TAC of 3,584t, a 25.1% decrease in TAC. No HDRs are established yet in the WAZ. Scenarios are illustrated below, for consideration.

Scenario *(P. borealis)*	TAC	ER	% change in TAC from previous year
Rollover TAC	4,788t	26.7%	0%
Proposed 2-Step HDR *(recommended)*	4,186t	23.4%	-12.6%
Maintain ER	3,584t	20.0%	-25.1%
Current HDR	*No HDRs established for WAZ.*		

For ***P. montagui***, the current SSB is in the Healthy Zone, at 162% of the recommended USR.

The 2023-24 TAC was 17,282t. A rollover of the TAC in 2024-25 would result in a potential ER of 25.6%. Application of the recently developed 2-Step HDR would yield a TAC of 15,384t (-11%), with a potential ER of 22.8% (see calculation at Appendix 5). Maintaining the 16.5% potential ER from last year would result in a TAC of 11,125t, a 35.6% decrease in TAC. No HDRs are established yet in the WAZ. Scenarios are illustrated below, for consideration.

Scenario *(P. montagui)*	TAC	ER	% change in TAC from previous year
Rollover TAC	17,282t	25.6%	0%
Proposed 2-Step HDR *(recommended)*	15,384t	22.8%	-11.0%
Maintain ER	11,125t	16.5%	-35.6%
Current HDR	*No HDRs established for WAZ.*		

Recommendation: It is recommended that the Boards apply the proposed 2-Step HDR to set the overall TAC (combined for NU-W and NK-W) for *P. borealis* and *P. montagui*, respectively. Details of this HDR and calculation method are presented under separate cover.

The 2-Step HDR was endorsed by NSAC, which supports its consistent application throughout the fishery, including in the WAZ for the 2024-25 fishing season. Application of this HDR reflects a step-wise approach in response to the observed decline in biomass for both species, while yielding ERs that are considered appropriate for Healthy Zone stocks (23.4% and 22.8%, respectively). Further, the proposed ERs would be below the maximum 30% ER for the healthy zone, in accordance with the 2-Step HDR.

Other key considerations in setting the TAC may include historic catch levels for the respective stocks, and industry's capacity to prosecute the full extent of substantial TAC increases.

Summary of Request

Western Assessment Zone:

1. Decisions on harvest levels for *P. borealis* and *P. montagui* in the NU-W (within the NSA) and NK-W (within the NMR) management units, respectively.

2. Recommendations on the overall TAC for *P. borealis* and *P. montagui* in the WAZ.

Summary of requested decisions and recommendations, WAZ.

Area (Management Unit)	***P. borealis***	***P. montagui***
NSA (NU W)	Harvest level decision NWMB *(Recommendation NMRWB)*	Harvest level decision NWMB *(Recommendation NMRWB)*
NMR (NK W)	Harvest level decision NMRWB *(Recommendation NWMB)*	Harvest level decision NMRWB *(Recommendation NWMB)*
TOTAL (WAZ)	*TAC recommendation (combined total of decisions) NWMB and NMRWB*	*TAC recommendation (combined total of decisions) NWMB and NMRWB*

EASTERN ASSESMENT ZONE (EAZ)

Fishery Profile

The fishery for *P. borealis* and *P. montagui* in the EAZ operates April 1 – March 31. Harvesting activity typically commences in May/June, subject to ice conditions.

The EAZ is divided into four management units, Nunavut East (NU-E), Nunavik East (NK-E), and the offshore Davis Strait West (DSW) and Davis Strait East (DSE) areas (see map). These management units are located partially within and adjacent to the NSA and NMR. The NWMB and NMRWB make decisions on management measures within their respective land claims areas and may make recommendations for the adjacent Davis Strait management units. *P. borealis* is a directed species in the EAZ (all management units). *P montagui* is a directed species in NU/NK-E and utilized by the offshore fleet as bycatch in the Davis Strait.

P. borealis and *P. montagui* allocations in the NU-E management unit have been allocated to Nunavut fishing interests. Similarly, allocations in the NK-E management unit have been allocated to Nunavik fishing interests. Although no formal sharing arrangement exists, DFO observes a long-standing distribution of allocations between NU-E and NK-E management units at 80-20 per cent for *P. borealis*; and approximately 70-30 per cent for *P. montagui*. A standing joint decision made by the NWMB and NMRWB on July 13, 2022, supports harvesting of these species in either management unit, regardless of land claim boundaries.

P. borealis allocations in the Davis Strait management units have been to the offshore fleet with special access to Nunavut fishing interests. Nunavik fishing interests have special access in Davis Strait West only.

There are no pre-existing arrangements for the distribution of quota between management units in the EAZ. However, allocation of quotas between the settlement areas (NU/NK-E) and the offshore Davis Strait areas must distribute fishing effort throughout the Zone and avoid concentrated effort in a single productive area (e.g. Resolution Island).

A historical quota profile for the WAZ is provided at Appendix 4.

Science Advice

Fifteen years of data are now available in the time series for the EAZ (2009-2023). A summary of the CSAS peer review process to update the status of the stocks that occurred in February 2024 is at Appendix 1. Stock status indicators for *P. borealis* and *P. montagui* in the EAZ for the past four years (2020-2023) are at Appendix 3.

P. borealis and *P. montagui* stocks have shown signs of high volatility, with no clear indication of mechanisms driving year-to-year fluctuations in biomass. DFO Science cannot detect trends for either stock at this time.

For ***P. borealis***, the 2023 survey indicates a FB increase of 30.6% from the 2022 survey. The SSB also increased by 37.4% from the previous year's survey. *[FB 48,216t; SSB 32,659t]*

For ***P. montagui***, the 2023 survey indicates the FB was similar (-1.3% change) to the 2022 survey. The SSB decreased by 34.5% from the previous year's survey. *[FB 14,137t; SSB 6,829t]*

2024-25 Management Considerations

For ***P. borealis***, the current SSB is in the Healthy Zone, at 103% of the recommended USR.

The 2023-24 TAC was 7,383t. A rollover of the current TAC in 2024-25 would result in a potential ER of 15.3%. Application of the recently developed 2-Step HDR would yield a TAC of 8,513t with a potential ER of 17.7% (see calculation at Appendix 5). Maintaining the target 20% ER from last year would result in a TAC of 9,643t, a 30.6% increase in TAC. The current HDR would generally suggest a 15% TAC increase to 8,490t (potential ER 17.6%). Scenarios are illustrated below, for consideration.

Scenario *(P. borealis)*	TAC	ER	% change in TAC from previous year
Rollover TAC	7,383t	15.3%	0%
Proposed 2-Step HDR	8,513t	17.7%	+15.3%
Maintain ER	9,643t	20.0%	+30.6%
Current HDR	8,490t	17.6%	+15.0%

For ***P. montagui***, although there was a decline in SSB, the current SSB is in the Healthy Zone, at 112% of the recommended USR. FB remained similar to the previous year.

The TAC was set at 840t from 2014 to 2020, with a series of increases towards 2,100t in 2023-24. A rollover of the current TAC in 2024-25 would result in a potential ER of 14.9%. Application of the recently developed 2-Step HDR would yield a TAC of 2,464t with a potential ER of 17.4% (see calculation at Appendix 5). Maintaining the 14.7% ER from last year would result in a slight TAC decrease to 2,078t. The current HDR would generally suggest a 15% TAC increase to 2,415t (potential ER 17.1%). Scenarios are illustrated below, for consideration.

Scenario *(P. montagui)*	TAC	ER	% change in TAC from previous year
Rollover TAC	2,100t	14.9%	0%
Proposed 2-Step HDR	2,464t	17.4%	+17.3%
Maintain ER	2,078t	14.7%	-1.0%
Current HDR	2,415t	17.1%	+15.0%

For the Boards' consideration: At the Northern Shrimp Advisory Committee Meeting in April, 2024, in discussing TACs and quotas for *P. Montagui* in the EAZ, the offshore fleet noted that in Davis Strait (where they hold a bycatch designation for *P. Montagui*) they require 920t in order to be able to prosecute their *P. borealis* allocations.

Recommendation: It is recommended that the Boards apply the proposed 2-Step HDR to set the overall TAC (combined for Davis Strait East/West, NU-E and NK-E) for *P. borealis* and *P. montagui*, respectively. Details of this HDR and calculation method are presented under separate cover.

Application of the 2-Step HDR would reflect a step-wise approach in response to the observed increase in biomass for *P. borealis*, and partially pursue a target 20% ER for *P. montagui*. This HDR was endorsed by NSAC, which supports its application in the EAZ for the 2024-25 fishing season. Applying this HDR would yield ERs that are considered conservative for Healthy Zone stocks (17.7% and 17.4%, respectively). Further, the proposed ERs would be below the maximum 30% ER for the healthy zone, in accordance with the 2-Step HDR.

Summary of Request

Eastern Assessment Zone:

1. Decisions on harvest levels for *P. borealis* and *P. montagui* in the NU E (within the NSA) and NK E (within the NMR) management units, respectively.

2. Recommendations on the distribution of the TAC for *P. borealis* between the Davis Strait management units (DS W and DS E). Recommendations on *P. borealis* allocations in Davis Strait management units.

3. Recommendations on the overall TAC for *P. borealis* and *P. montagui* in the EAZ, respectively.

Summary of requested decisions and recommendations, EAZ.

Area (Management Unit)	***P. borealis***	***P. montagui***
NSA (NU E)	Harvest level decision NWMB *(Recommendation NMRWB)*	Harvest level decision NWMB *(Recommendation NMRWB)*
NMR (NK E)	Harvest level decision NMRWB *(Recommendation NWMB)*	Harvest level decision NMRWB *(Recommendation NWMB)*
DS E	TAC distribution and allocation recommendation NWMB & NMRWB	TAC recommendation NWMB & NMRWB
DS W	TAC distribution and allocation recommendation NWMB & NMRWB	
TOTAL (EAZ)	*TAC Recommendation NWMB & NMRWB*	*TAC Recommendation NWMB & NMRWB*

Prepared by: Leigh Edgar, Fisheries Resource Management, Fisheries and Oceans Canada

Date: April 26, 2024

Fisheries and Oceans Canada | Pêches et Océans Canada
Ecosystems and Oceans Science | Sciences des écosystèmes et des océans

Arctic Region
Ontario and Prairie Region

Canadian Science Advisory Secretariat
Science Response 2024/017

UPDATE OF STOCK STATUS INDICATORS FOR NORTHERN SHRIMP, *PANDALUS BOREALIS*, AND STRIPED SHRIMP, *PANDALUS MONTAGUI*, IN THE EASTERN ASSESSMENT ZONE, FEBRUARY 2024

CONTEXT

Fisheries and Oceans Canada (DFO) Resource Management (RM) has requested Science advice on the status of the two species of shrimp, Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*Pandalus montagui*) in the waters adjacent to Nunavut and Nunavik. Both species in the Eastern Assessment Zone (EAZ) were last fully assessed in 2023 (DFO 2023). Full assessments are carried out every two years with stock status updates in the intervening years. The next full assessment is scheduled for 2025. This assessment follows the framework developed in 2007 for Northern Shrimp off Labrador and the northeastern coast of Newfoundland (DFO 2007). The Limit Reference Point (LRP) was updated and an updated Upper Stock Reference point (USR) was proposed in 2020 (DFO 2020). A series of fishery-independent surveys and fishery data formed the basis of the current assessment.

This Science Response Report results from the regional peer review of February 6, 2024 on the Stock Update of Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*P. montagui*) in the Eastern Assessment Zone and Western Assessment Zone, February 2024. (IFMP). Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

SCIENCE ADVICE

Status

- The *P. borealis* stock in the Eastern Assessment Zone (EAZ) is currently above the established LRP (15,800 t). Based on the proposed USR of 31,600 t, the stock would be in the Healthy zone of the Precautionary Approach (PA) Framework with a 58.8% probability.
- The *P. montagui* stock in the EAZ is currently above the established LRP (3,100 t). Based on the proposed USR of 6,100 t, the stock would be in the Healthy zone of the PA Framework with a 66.7% probability.

Trends

- Fishable biomass and spawning stock biomass indices varied without trend from 2009–2023 for both *P. borealis* and *P. montagui* in the EAZ.

Ecosystem and Climate Change Considerations

- Environmental and climate change considerations were not updated or reviewed during this Science Response Report.

- Fluctuations in the Northwest Atlantic ocean climate have potential impacts on the availability of optimal Pandalid habitat and/or predator-prey interactions in the EAZ. These potential impacts on Pandalid shrimp productivity have not yet been quantified for shrimp stocks in the EAZ or incorporated into the assessment (DFO 2023).
- *Pandalus borealis* and *P. montagui* are distributed broadly over the Northwest Atlantic Ocean. The associated assessment areas, including the EAZ, Western Assessment Zone (WAZ), and Shrimp Fishing Areas (SFAs) 4–7, are connected through larval dispersal, but rates of exchange of adults are less understood. The strong linkages between EAZ, WAZ, and SFA 4 need to be considered to interpret fluctuations in biomass within and among assessment areas, even within the same year (DFO 2023).

Stock Advice

- The assessment framework for *P. borealis* and *P. montagui* stocks in the EAZ does not provide forward-looking advice. A full stock assessment is planned in 2025.
- The spawning stock biomass index for *P. borealis* in the EAZ moved out of the Cautious zone into the proposed Healthy zone in 2023 and is currently considered to be in a healthy state.
- The spawning stock biomass index for *P. montagui* in the EAZ remained in the proposed Healthy zone in 2023 and is currently considered to be in a healthy state.

BASIS FOR ASSESSMENT

Assessment Details

Year Assessment Approach was Approved

This assessment follows the framework developed in 2007 for Northern Shrimp off Labrador and the northeastern coast of Newfoundland (DFO 2007).

Assessment Type

Interim Year Update

Most Recent Assessment Date

1. Last Full Assessment: February 2023 (DFO 2023)
2. Last Interim Year Update: January 2022 (DFO 2022)

Assessment Approach

1. Broad category: Index-based
2. Specific category: Index-based (Fishery-independent indices)

The assessment follows the framework established by DFO (2007); catch data from scientific surveys are spatially expanded to produce an abundance index for the fishable biomass (FB) and female spawning stock biomass (SSB). Both male and female shrimp with a carapace length greater than 17 mm are considered in the calculation of the FB index, while female shrimp of any size form the basis of the SSB index. A detailed description of the survey history, survey design, and biomass calculations can be found in Fulton et al. (2024).

Stock Structure Assumption

Stock overview information: For both *P. borealis* and *P. montagui*, the EAZ is a management-based stock unit and does not represent a biological unit.

Reference Points

Reference points are presented in Table 1.

Table 1. Reference points for Pandalus borealis *and* Pandalus montagui *in the Eastern Assessment Zone.*

Reference Point	Description	*Pandalus borealis*	*Pandalus montagui*
Limit Reference Point (LRP):	40% of the geometric mean of female spawning stock biomass (SSB) over the productive period (2009–2019) for EAZ, a proxy for BMSY, DFO (2020).	15,800 t	3,100 t
Upper Stock Reference (USR):	Proposed at 80% of the geometric mean of female spawning stock biomass (SSB) over the productive period (2009–2019) for EAZ, a proxy for BMSY, DFO (2020).	31,600 t	6,100 t
Removal Reference (RR):	N/A	-	-
Target (TRP):	N/A	-	-

Data

- Northern Shrimp Research Foundation (NSRF) annual trawl survey (2009–2023)
- Commercial catches from Atlantic Quota Monitoring System (AQMS)

Data changes:

- Commercial catch data for 2023 is considered incomplete as the season is not officially closed until March 31, 2024. Data were pulled on January 24, 2024.
- Commercial catch data for 2022 were updated on January 24, 2024.

ASSESSMENT

Historical and Recent Stock Trajectory and Trends – *P. borealis*

Fishery

Catch has varied without trend around 6,000 t from 1997 through 2023/24 (Figure 1a, Table 2). The total reported catch for 2023/24, based on the AQMS, as of January 24, 2024, was 6,188 t; 83.8% of the 7,383 t TAC.

Biomass

Both the FB and SSB indices varied without trend from 2009–2023. The FB in 2023 (48,216 t; Figure 2a) increased (30.6%) relative to the 2022 value but remained below both the long term mean (2009–2022; 61,213 t) and reference period mean (2009–2019; 62,849 t). The SSB in 2023 (32,659 t; Figure 1b) also increased (37.4%) relative to the 2022 value but remained below both the long term mean (2009–2022; 38,875 t) and reference period mean (2009–2019; 39,459 t).

Exploitation

Both the reported and potential exploitation rates were at or above the long term mean (2009–2022). As of January 24, 2024, the reported exploitation rate index for 2023/24 was 12.8% with 83.8% of the total allowable catch (TAC) taken (Figure 2b). Should the entire 2023/24 TAC of 7,383 t be taken, the exploitation rate index would be 15.3%.

Current Outlook

The *P. borealis* stock in the EAZ is currently above the established LRP (15,800 t) and proposed USR (Figure 2c). Should the USR be established at the proposed level of 31,600 t suggested by Fisheries and Oceans Canada's (DFO's) Science sector (i.e., 80% of the geometric mean of the SSB index; DFO 2020), the stock in 2023 would be in the Healthy zone of the PA Framework with a 58.8% probability

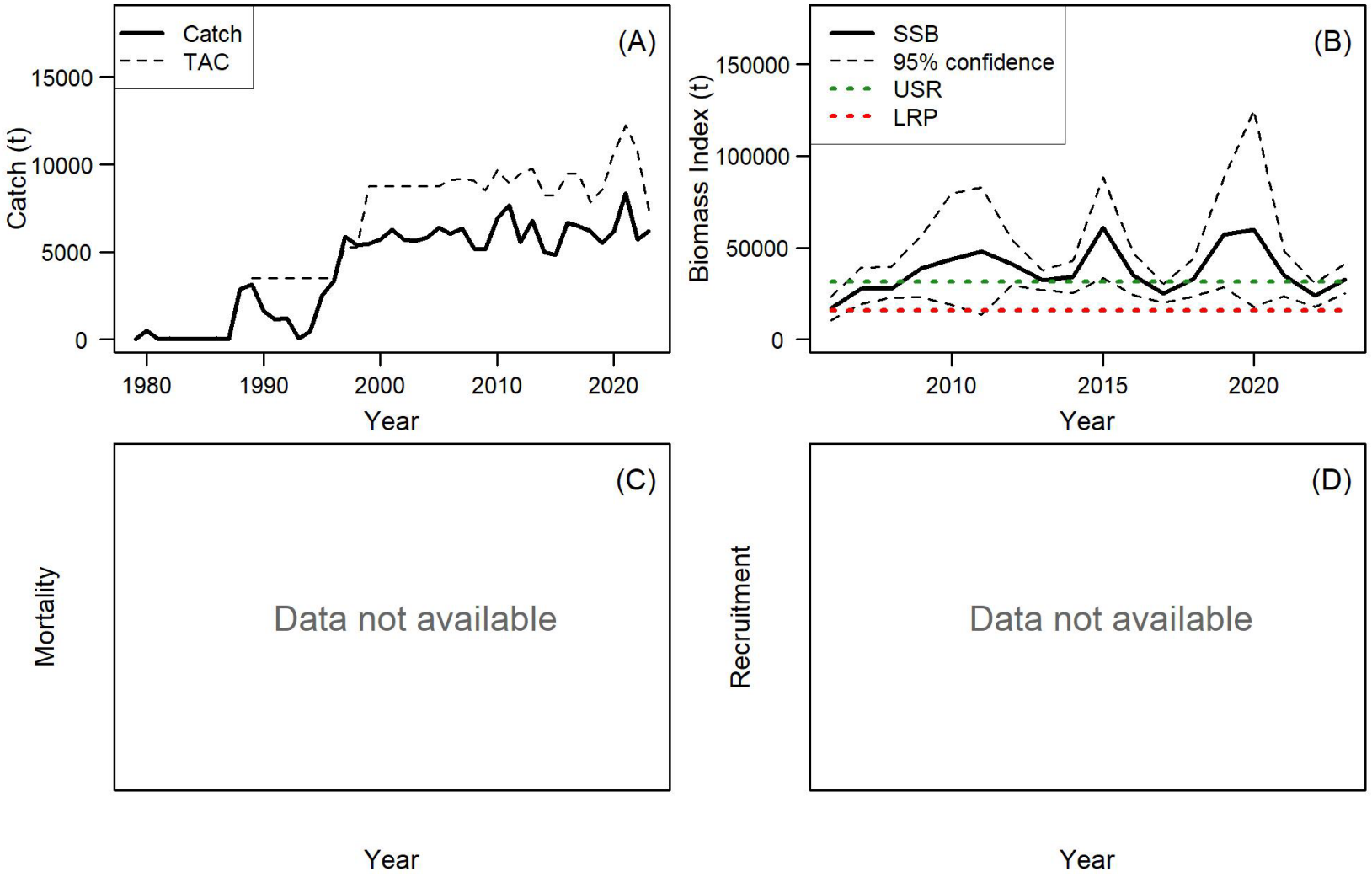


Figure 1. Pandalus borealis *in the Eastern Assessment Zone. (A; top left) Catch (as of January 24, 2024) and Total Allowable Catch (TAC), (B; top right) Spawning Stock Biomass (SSB) in relation to the Limit Reference Point (LRP; 15,800 t) and (proposed) Upper Stock Reference (USR; 31,600 t), (C; bottom left) Fishing Mortality, (D; bottom right) Recruitment.*

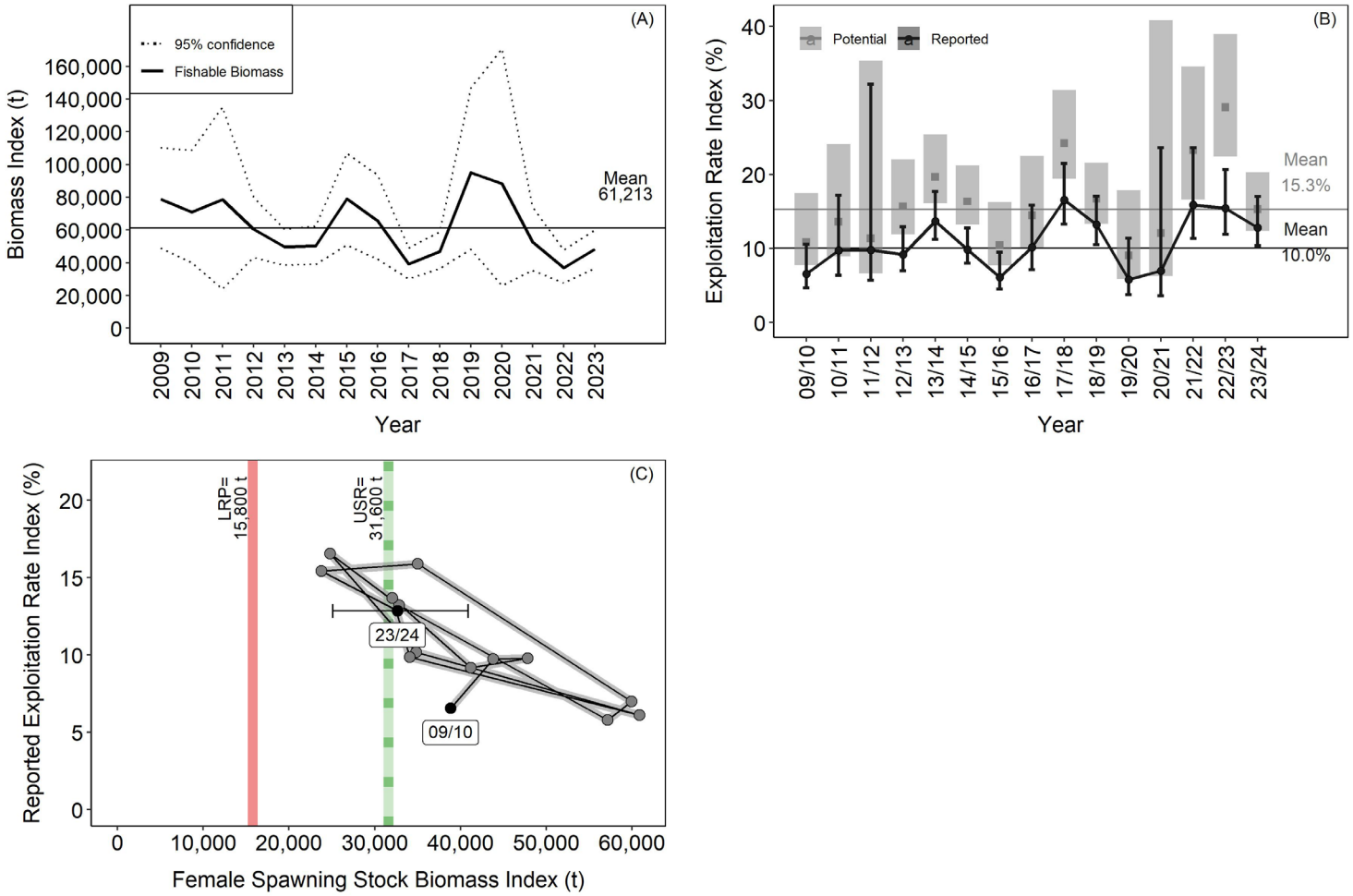


Figure 2. Pandalus borealis *in the Eastern Assessment Zone. (A; top left) Fishable Biomass Index, horizontal lines are long-term (2009–2022) geometric means. (B; top right) Exploitation rate indices for management years 2009/10–2023/24 at the reported rate based on the total catch (solid black line) and at the potential rate if the TAC was fully harvested (grey shading) as of January 24, 2024. Error bars based on bootstrapped 95% confidence ranges of the fishable biomass and horizontal lines are long-term (2009–2022) geometric means. (C: bottom left) Female spawning stock biomass (SSB) and reported exploitation rate in relation to the Limit Reference Point (LRP; 15,800 t) and (proposed) Upper Stock Reference (USR; 31,600 t).*

Historical and Recent Stock Trajectory and Trends – *P. montagui*

Biomass

Both the FB and SSB indices varied without trend from 2009–2023. The FB in 2023 (14,137 t; Figure 4a) was similar (-1.3% change) to the 2022 value and remained above both the long term mean (2009–2022; 12,525 t) and reference period mean (2009–2019; 11,715 t). The SSB in 2023 (6,829 t; Figure 3b) declined (-34.5%) relative to the 2022 value and fell below both the long term mean (2009–2022; 8,405 t) and reference period mean (2009–2019; 7,644 t).

Fishery

Total catch in 2023/24 was 173 t, 8.24% of the 2,100 t TAC (Figure 3a). Catch statistics in 2023/24 are preliminary and based on the AQMS data as of January 24, 2024.

Exploitation

As of January 24, 2024, the reported exploitation rate index for 2023/24 was 1.22% with only 8.24% of the total allowable catch (TAC) taken (Figure 4b). Should the entire 2023/24 TAC of 2,100 t be taken, the exploitation rate index would be 14.9%.

Current Outlook

Despite a decline in SSB, the *P. montagui* stock in the EAZ is currently above both the established LRP (3,100 t) and the proposed USR (6,100 t; Figure 4c). Should the USR be established at the proposed level of 6,100 t (i.e., 80% of the geometric mean of the SSB; DFO 2020), the stock in 2023 would be in the Healthy zone of the PA Framework with a 66.7% probability.

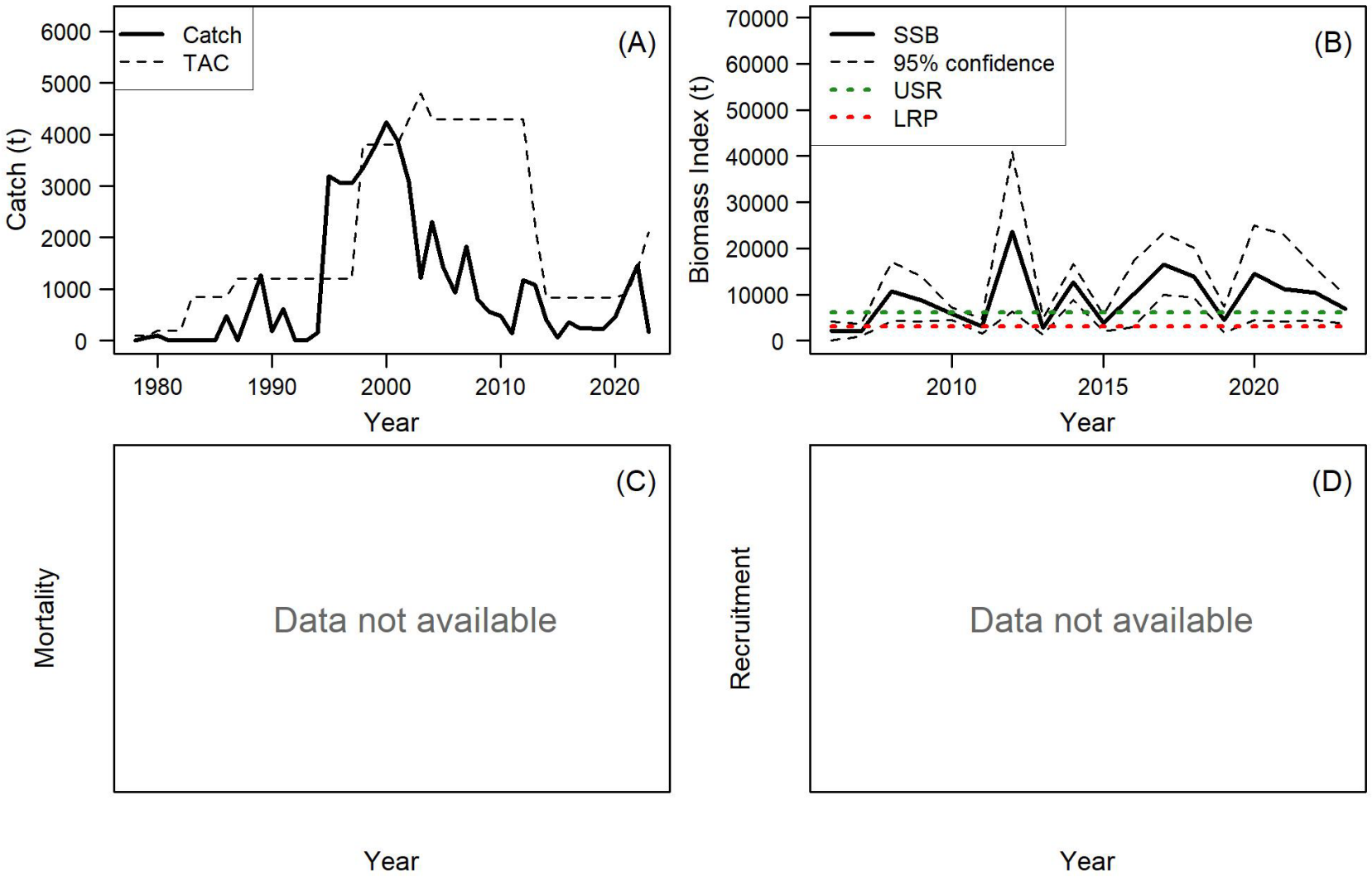


Figure 3. Pandalus montagui *in the Eastern Assessment Zone. (A; top left) Catch (as of January 24, 2024) and Total Allowable Catch (TAC), (B; top right) Spawning Stock Biomass (SSB) in relation to the Limit Reference Point (LRP; 3,100 t) and (proposed) Upper Stock Reference (USR; 6,100 t), (C; bottom left) Fishing Mortality, (D; bottom right) Recruitment.*

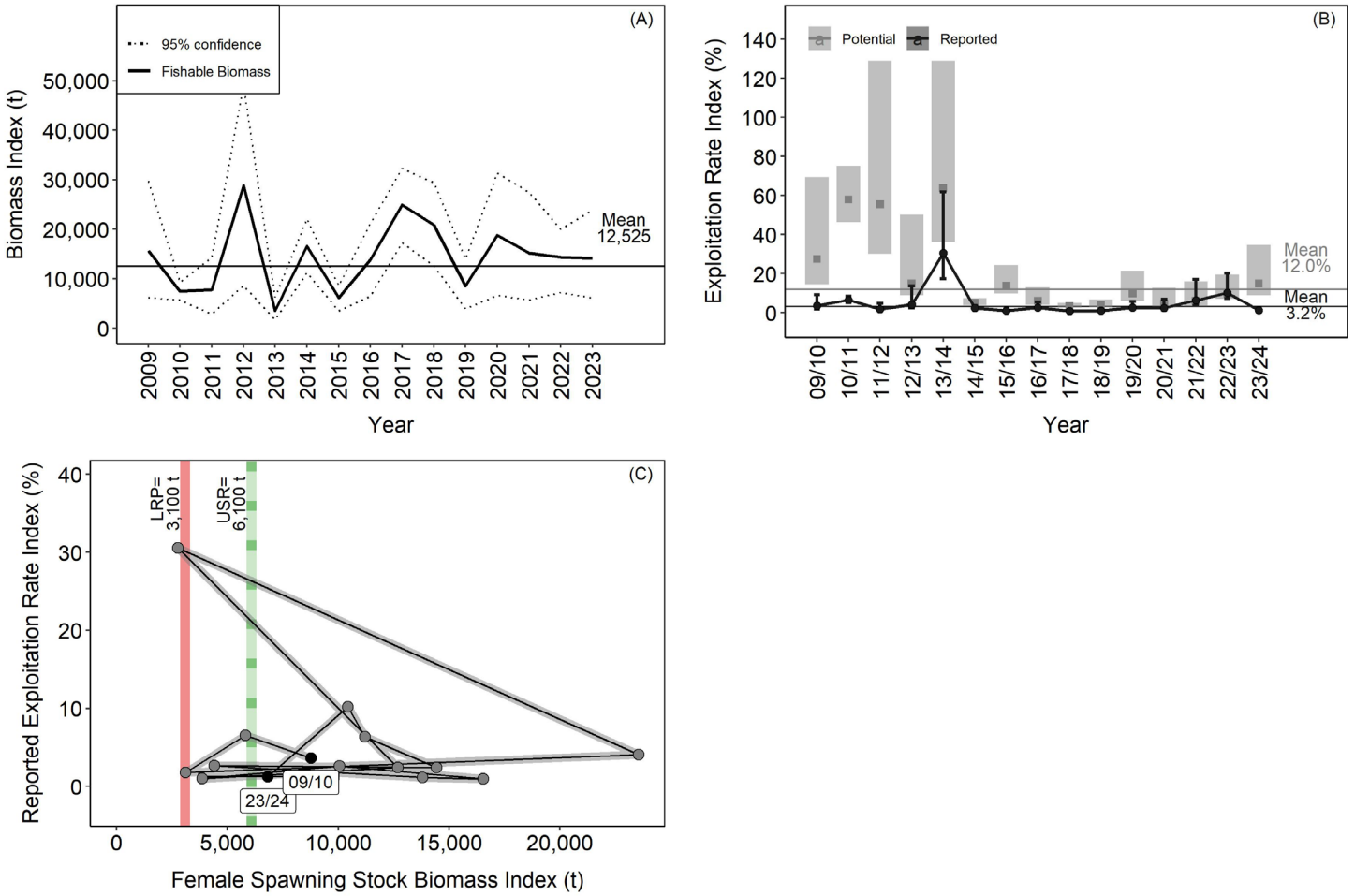


Figure 4. Pandalus montagui *in the Eastern Assessment Zone. (A: top left) Fishable Biomass Index, horizontal lines are long-term (2009–2022) geometric means. (B: top right) Exploitation rate indices for management years 2009/10–2023/24 at the reported rate based on the total catch (solid black line) and at the potential rate if the TAC was fully harvested (grey shading) as of January 24, 2024. Error bars based on bootstrapped 95% confidence ranges of the fishable biomass and horizontal lines are long-term (2009–2022) geometric means. (C: bottom left) Female spawning stock biomass (SSB) and reported exploitation rate in relation to the Limit Reference Point (LRP; 3,100 t) and (proposed) Upper Stock Reference (USR; 6,100 t).*

History of Landings

Table 2. Nominal reported catches (t) for the Eastern Assessment Zone for Pandalus borealis *and* Pandalus montagui*. Catch based on AQMS as of January 24, 2024. Catches for 2023/24 are considered preliminary.*

Year	Eastern Assessment Zone	
	P. borealis	***P. montagui***
2023/24	6,188	173
2022/23	5,691	1,460
2021/22	8,359	965
2020/21	6,165	447
2019/20	5,508	225
2018/19	6,198	234
2017/18	6,488	233
2016/17	6,667	358
2015/16	4,816	59
2014/15	4,972	401
2013/14	6,793	1,075
2012/13	5,555	1,173
2011/12	7,687	135
2010/11	6,908	483
2009/10	5,159	564
2008/09	5,184	808
2007/08	6,359	1,832
2006/07	6,028	925
2005/06	6,387	1,427
2004/05	5,842	2,301
2003/04	5,617	1,217
2002/03	5,695	3,081
2001/02	6,275	3,867
2000/01	5,718	4,238
Avg 1995–99	4,533	3,288
Avg 1990–94	904	190
Avg 1985–89	1,211	470
Avg 1979–84	93	28

Projections

Projections or simulations have not been developed for this assessment as it is index-based and data driven.

Ecosystem and Climate Change Considerations

Environmental and climate change considerations were not updated or reviewed during this Science Response Report. The following information is a summary taken from the last full assessment (Fulton et al. 2024).

It is believed that the habitat available to shrimp is shaped, to a great extent, by the oceanographic conditions present in the area. Fluctuations in the Northwest Atlantic ocean climate have potential impacts on the availability of optimal Pandalid habitat and/or predator-prey interactions in the EAZ. These potential impacts on Pandalid shrimp productivity have not yet been quantified for shrimp stocks in the EAZ or incorporated into the assessment.

Shrimp are known to be an important food source for a number of predator species, e.g., Greenland Halibut (*Reinhardtius hippoglossoides*), American Plaice (*Hippoglossoides platessoides*), Atlantic Cod (*Gadus morhua*), skates (Rajidae) and redfish (*Sebastes* spp.). The amount of shrimp consumed by these predators varies in response to predator stock size and movement within and between assessment areas. Work is ongoing to quantify the impact of these predators on the shrimp stocks in the EAZ to determine the importance of predator-prey dynamics on shrimp biomass variability over the years.

Pandalid shrimp can disperse through various mechanisms but larval dispersion with currents may be a main driver for shrimp movement (Le Corre et al. 2020). It is also known that adult shrimp can move in the water column (particularly males) and be carried away with the currents, thus this mechanism also contributes to shrimp dispersal. The two assessment areas, EAZ and WAZ, along with SFA 4 farther south and SFA 0 and SFA 1 to the north, have no physical boundaries between them and are considered interconnected. The extent of shrimp exported/imported between these areas remains unknown for both larval and adult stages, however, it could be one of the important drivers of year-to-year variability observed in any particular assessment area over time.

SOURCES OF UNCERTAINTY

Typically survey trawl length (i.e., bottom contact) is calculated using trawl sensor data to determine when each trawl starts and stops fishing. In 2023 the primary trawl sensor data were unavailable for 2/3 of the survey trawls, therefore bottom contact time was estimated for the missing trawls (52 of 173 trawls in the EAZ had their data estimated). This estimation was calculated using a regression between bottom contact times measured by CTD (Conductivity, Temperature, Depth sensor) and the primary trawl sensor for the trawls where both were measured. Although this calculation deviates from the typical approach, it is not expected to impact the outcome of the assessment.

Hudson Strait is a highly dynamic system with strong tidal currents and mixing. With speeds up to five knots, the strong currents could result in quick shifts in shrimp distribution and catchability. Shrimp could be transported great distances in a relatively short period of time in and out of the WAZ, EAZ, and SFA 4 to the south. This is most likely the cause of the wide fluctuations in biomass observed within and among assessment areas, even within the same year. Assessing only a subset of a larger population is a source of uncertainty in determining the true status of a resource.

Experimental work done by DFO in 2007 in the Resolution Island area suggests that survey results may be affected by the tidal cycle. In order to reduce the impact of the tidal currents, the surveys were conducted near neap tides as much as possible. However, the survey is conducted around the clock, so strong tidal currents would still be present and may result in either an over- or underestimate of biomass.

Trawls used in the survey are known to have a catchability coefficient less than one but the exact value is unknown. Therefore, the survey is an index of biomass and not an absolute estimate of the total biomass. Catch is known; however, the total fishery-induced mortality is

unknown (landed catch plus incidental mortality from trawling). Thus, exploitation rates are a relative index rather than absolute.

Four research vessels (Cape Ballard, Aqviq, Kinguk, Katsheshuk II) have been used throughout the time series in the EAZ. Expert opinion was that, given the similarity in the ships' dimensions and use of standardized gear, the relative catchability would be consistent among vessels. However, this assumption has not been empirically tested.

LIST OF MEETING PARTICIPANTS

Name	Organization/Affiliation
Sheila Atchison (Chair)	DFO – Science, Ontario and Prairie Region
Samantha Fulton (Science Lead)	DFO – Science, Ontario and Prairie Region
Wojciech Walkusz	DFO – Science, Ontario and Prairie Region
Daniel Enright	DFO – Science, Ontario and Prairie Region
Krista Baker	DFO – Science, Newfoundland and Labrador Region
William Coffey	DFO – Science, Newfoundland and Labrador Region
Nicholas Le Corre	DFO – Science, Newfoundland and Labrador Region
Susan Thompson	DFO – Science, National Capital Region
Nicholas Duprey	DFO – Science, National Capital Region
Jeff Adam	DFO – Resource Management, Arctic Region
Courtney D'Aoust (written review)	DFO – Resource Management, National Capital Region
Dirk Algera	DFO – Resource Management, National Capital Region
Chantelle Sawatzky	DFO – Science, Ontario and Prairie Region
Kayla Gagliardi (CSAS Support)	DFO – Science, Ontario and Prairie Region
Joclyn Paulic (CSAS Support)	DFO – Science, Ontario and Prairie Region
Julie Marentette (FSAR/FSRR Support)	DFO – Science, National Capital Region

SOURCES OF INFORMATION

DFO. 2007. Assessment Framework for Northern Shrimp (*Pandalus borealis*) off Labrador and the northeastern coast of Newfoundland; 28-30 May 2007. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2007/034.

DFO. 2020. Science Advice on Limit Reference Points for Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*Pandalus montagui*) in the Eastern and Western Assessment Zones. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2020/053.

DFO. 2022. Update of stock status indicators for Northern Shrimp, *Pandalus borealis*, and Striped Shrimp, *Pandalus montagui*, in the Western and Eastern Assessment Zones, January 2022. DFO Can. Sci. Advis. Sec. Sci. Resp. 2022/013. (Erratum: February 2022).

DFO. 2023. Assessment of Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*Pandalus montagui*) in the Eastern and Western Assessment Zones, February 2023. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2023/013.

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Arctic Region
Ontario and Prairie Region

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Science Response 2024/016

UPDATE OF STOCK STATUS INDICATORS FOR NORTHERN SHRIMP*, PANDALUS BOREALIS*, AND STRIPED SHRIMP, *PANDALUS MONTAGUI*, IN THE WESTERN ASSESSMENT ZONE, FEBRUARY 2024

CONTEXT

Fisheries and Oceans Canada (DFO) Resource Management (RM) has requested Science advice on the status of the two species of shrimp, Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*Pandalus montagui*) in the waters adjacent to Nunavut and Nunavik. Both species in the Western Assessment Zone (WAZ) were last fully assessed in 2023 (DFO 2023). Full assessments are carried out every two years with stock status updates in the intervening years. The next full assessment is scheduled for 2025. This assessment follows the framework developed in 2007 for Northern Shrimp off Labrador and the northeastern coast of Newfoundland (DFO 2007). A new Limit Reference Point (LRP) was established and a new Upper Stock Reference point (USR) was proposed in 2020 (DFO 2020). A series of fishery-independent surveys and fishery data formed the basis of the current assessment.

This Science Response Report is from the February 6, 2024 regional peer review on the Stock Update of Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*P. montagui*) in the Eastern Assessment Zone and Western Assessment Zone, February 2024. (IFMP). Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

SCIENCE ADVICE

Status

- The *P. borealis* stock in the Western Assessment Zone (WAZ) is currently above the established limit reference point (LRP; 4,100 t). Based on the proposed upper stock reference (USR) of 8,200 t, the stock would be in the Healthy zone of the Precautionary Approach (PA) Framework with a 99.3% probability.
- The *P. montagui* stock in the WAZ is currently above the established LRP (12,300 t). Based on the proposed USR of 24,600 t, the stock would be in the Healthy zone of the PA Framework with a 98.4% probability.

Trends

- Fishable biomass and spawning stock biomass indices varied without trend from 2014–2023 for both *P. borealis* and *P. montagui* in the WAZ.

Ecosystem and Climate Change Considerations

- Environmental and climate change considerations were not updated or reviewed during this Science Response Report.
- Fluctuations in the Northwest Atlantic ocean climate have potential impacts on the availability of optimal Pandalid habitat and/or predator-prey interactions in the WAZ. These potential impacts on Pandalid shrimp productivity have not yet been quantified for shrimp stocks in the WAZ or incorporated into the assessment (DFO 2023).
- *Pandalus borealis* and *P. montagui* are distributed broadly over the Northwest Atlantic Ocean. The associated assessment areas, including the Eastern Assessment Zone (EAZ), WAZ, and Shrimp Fishing Areas (SFAs) 4–7, are connected through larval dispersal, but rates of exchange of adults are less understood. The strong linkages between EAZ, WAZ, and SFA 4 need to be considered to interpret fluctuations in biomass within and among assessment areas, even within the same year (DFO 2023).

Stock Advice

- The assessment framework for *P. borealis* and *P. montagui* stocks in the WAZ does not provide forward-looking advice. A full stock assessment is planned in 2025.
- The spawning stock biomass index for *P. borealis* in the WAZ remained in the proposed Healthy zone in 2023 and is currently considered to be in a healthy state.
- The spawning stock biomass index for *P. montagui* in the WAZ remained in the proposed Healthy zone in 2023 and is currently considered to be in a healthy state.

BASIS FOR ASSESSMENT

Assessment Details

Year Assessment Approach was Approved

This assessment follows the framework developed in 2007 for Northern Shrimp off Labrador and the northeastern coast of Newfoundland (DFO 2007).

Assessment Type

Interim Year Update

Most Recent Assessment Date

1. Last Full Assessment: February 2023 (DFO 2023)
2. Last Interim Year Update: January 2022 (DFO 2022)

Assessment Approach

1. Broad category**:** Index-based
2. Specific category: Index-based (Fishery-independent indices)

The assessment follows the framework established by DFO (2007); catch data from scientific surveys are spatially expanded to produce an abundance index for the fishable biomass (FB) and female spawning stock biomass (SSB). Both male and female shrimp with a carapace length greater than 17 mm are considered in the calculation of the FB index, while female

shrimp of any size form the basis of the SSB index. A detailed description of the survey history, survey design, and biomass calculations can be found in Fulton et al. (2024).

Stock Structure Assumption

Stock overview information: For both *P. borealis* and *P. montagui*, the WAZ is a management-based stock unit and does not represent a biological unit.

Reference Points

Reference points are presented in Table 1.

Table 1. Reference points for Pandalus borealis *and* Pandalus montagui *in the Western Assessment Zone.*

Reference Point	Description	*Pandalus borealis*	*Pandalus montagui*
Limit Reference Point (LRP):	40% of the geometric mean of female spawning stock biomass (SSB) over the productive period (2014–2019) for WAZ, a proxy for BMSY, DFO (2020).	4,100 t	12,300 t
Upper Stock Reference (USR):	Proposed at 80% of the geometric mean of female spawning stock biomass (SSB) over the productive period (2014–2019) for WAZ, a proxy for BMSY, DFO (2020).	8,200 t	24,600 t
Removal Reference (RR):	N/A	-	-
Target (TRP):	N/A	-	-

Data

- Northern Shrimp Research Foundation (NSRF) annual trawl survey (2014–2023)
- Commercial catches from Atlantic Quota Monitoring System (AQMS)

Data changes:

- Commercial catch data for 2023 is considered incomplete as the season is not officially closed until March 31, 2024. Data were pulled on January 24, 2024.
- Commercial catch data for 2022 were updated on January 24, 2024.

ASSESSMENT

Historical and Recent Stock Trajectory and Trends – *P. borealis*

Fishery

Total catch in 2023/24 was the highest in the current time series at 2,080 t, 43.4% of the 4,788 t TAC (Figure 1a). Catch statistics in 2023/24 are preliminary and based on the AQMS data as of January 24, 2024.

Biomass

Due to a change in survey methodology, the 2014 survey began a new time series. Thus, the 2023 survey was the tenth survey in the new time series. Since the start of the new series, both the FB and SSB indices varied without trend. The FB in 2023 (17,919 t; Figure 2a) decreased (-25.1%) relative to the 2022 value falling below both the long term mean (2014–2022; 20,398 t) and reference period mean (2014–2019; 18,223 t). The SSB in 2023 (15,713 t; Figure 1b) remained very similar (-1.2% change) to the 2022 value and was above both the long term mean (2014–2022; 11,831 t) and reference period mean (2014–2019; 10,243 t).

Exploitation

Both the reported and potential exploitation rates were the highest observed in the time series. As of January 24, 2024, the reported exploitation rate index for 2023/24 was 11.6% with 43.4% of the total allowable catch (TAC) taken (Figure 2b). Should the entire 2023/24 TAC of 4,788 t be taken, the exploitation rate index would be 26.7%.

Current Outlook

The *P. borealis* stock in the WAZ is currently above the established LRP (4,100 t) and proposed USR (Figure 2c). Should the USR be established at the proposed level of 8,200 t suggested by Fisheries and Oceans Canada's (DFO's) Science sector (i.e., 80% of the geometric mean of the SSB index; DFO 2020), the stock in 2023 would be in the Healthy zone of the PA Framework with a 99.3% probability.

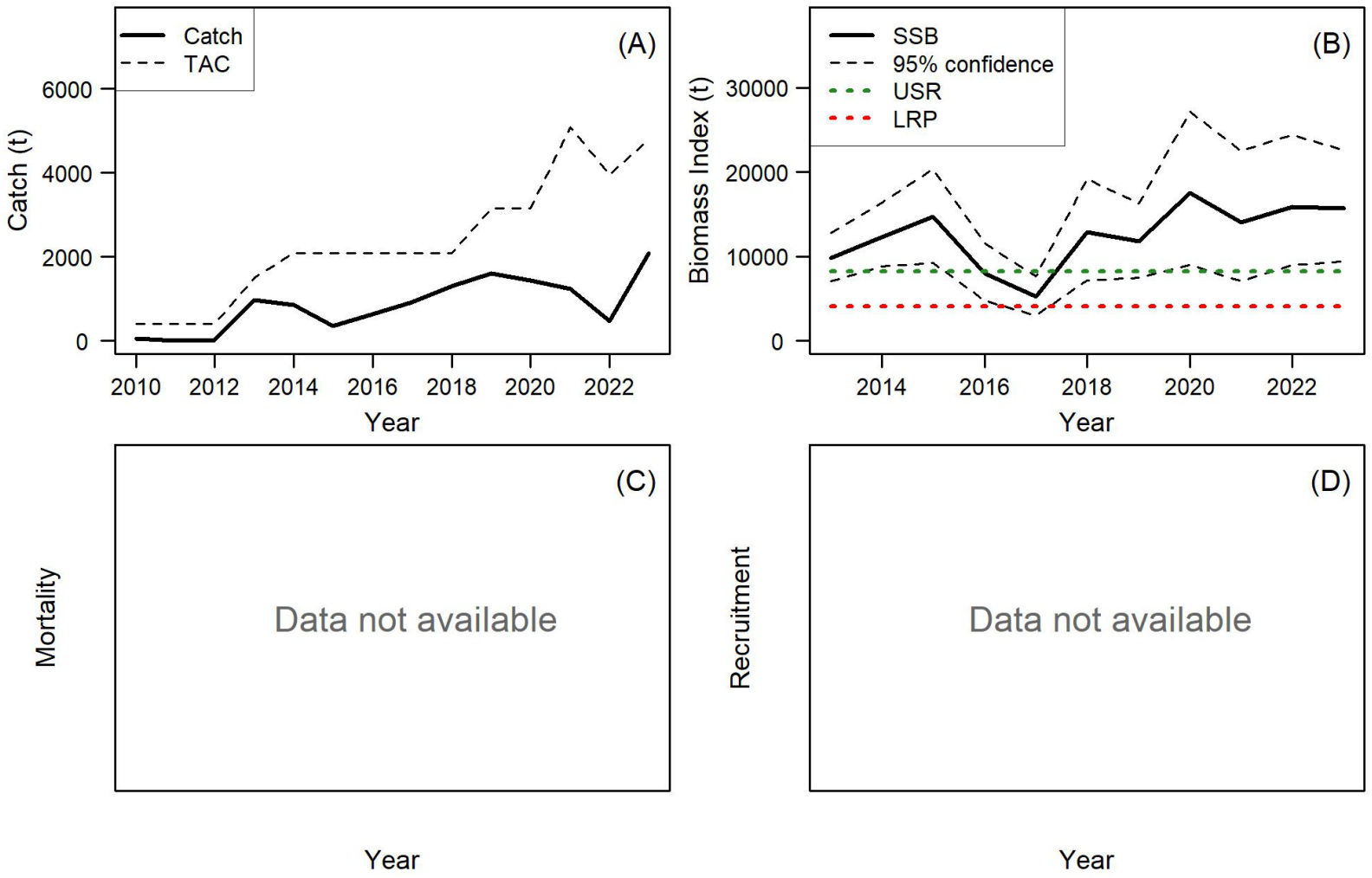

Figure 1. Pandalus borealis *in the Western Assessment Zone. (A; top left) Catch (as of January 24, 2024) and Total Allowable Catch (TAC), (B; top right) Spawning Stock Biomass (SSB) in relation to the Limit Reference Point (LRP; 4,100 t) and (proposed) Upper Stock Reference (USR; 8,200 t), (C; bottom left) Fishing Mortality, (D; bottom right) Recruitment.*

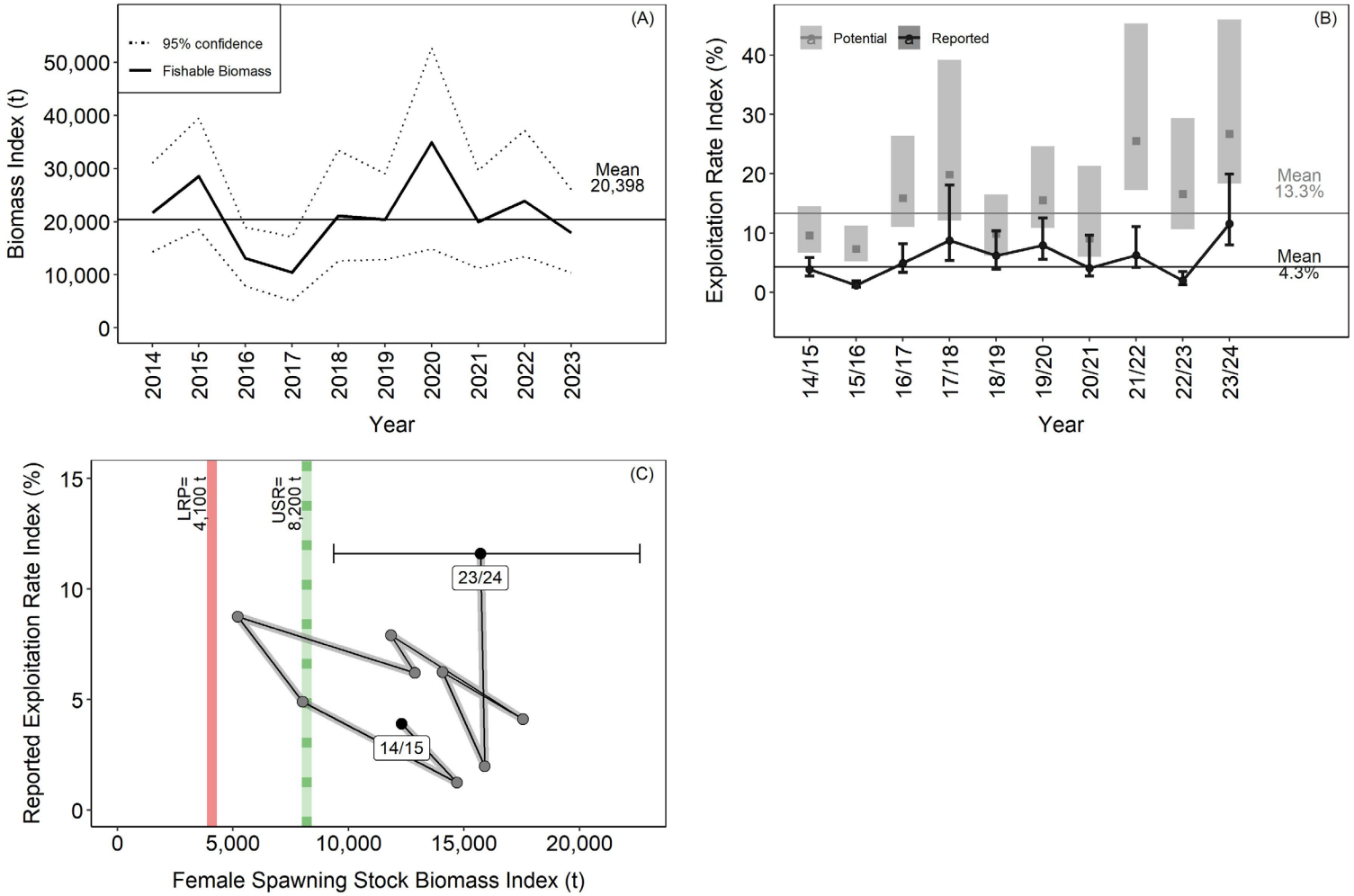

Figure 2. Pandalus borealis *in the Western Assessment Zone. (A; top left) Fishable Biomass Index, horizontal lines are long-term (2014–2022) geometric means. (B: top right) Exploitation rate indices for management years 2014/15–2023/24 at the reported rate based on the total catch (solid black line) and at the potential rate if the TAC was fully harvested (grey shading) as of January 24, 2024. Error bars based on bootstrapped 95% confidence ranges of the fishable biomass and horizontal lines are long-term (2014–2022) geometric means. (C: bottom left) Female spawning stock biomass (SSB) and reported exploitation rate in relation to the Limit Reference Point (LRP; 4,100 t) and (proposed) Upper Stock Reference (USR; 8,100 t).*

Historical and Recent Stock Trajectory and Trends – *P. montagui*

Fishery

Total catch in 2023/24 was 7,194 t, 41.6% of the 17,282 t TAC (Figure 3a). Catch statistics in 2023/24 are preliminary and based on the AQMS data as of January 24, 2024.

Biomass

Both the FB and SSB indices varied without trend from 2014–2023. The FB in 2023 (67,425 t; Figure 4a) decreased (-35.6%) relative to the 2022 value but remained above both the long term mean (2014–2022; 60,454 t) and reference period mean (2014–2019; 56,079 t). The SSB in 2023 (39,745 t; Figure 3b) also declined (-34.9%) relative to the 2022 value but remained above both the long term mean (2014–2022; 33,365 t) and reference period mean (2014–2019; 30,698 t).

Exploitation

As of January 24, 2024, the reported exploitation rate index for 2023/24 was 10.7% with 41.6% of the total allowable catch (TAC) taken (Figure 4b). Should the entire 2023/24 TAC of 17,282 t be taken, the exploitation rate index would be 25.6%.

Current Outlook

Despite a large decline in SSB, the *P. montagui* stock in the WAZ is currently above both the established LRP (12,300 t) and proposed USR (24,600 t; Figure 4c). Should the USR be established at the proposed level of 24,600 t (i.e., 80% of the geometric mean of the SSB; DFO 2020), the stock in 2023 would be in the Healthy zone of the PA Framework with a 98.4% probability.

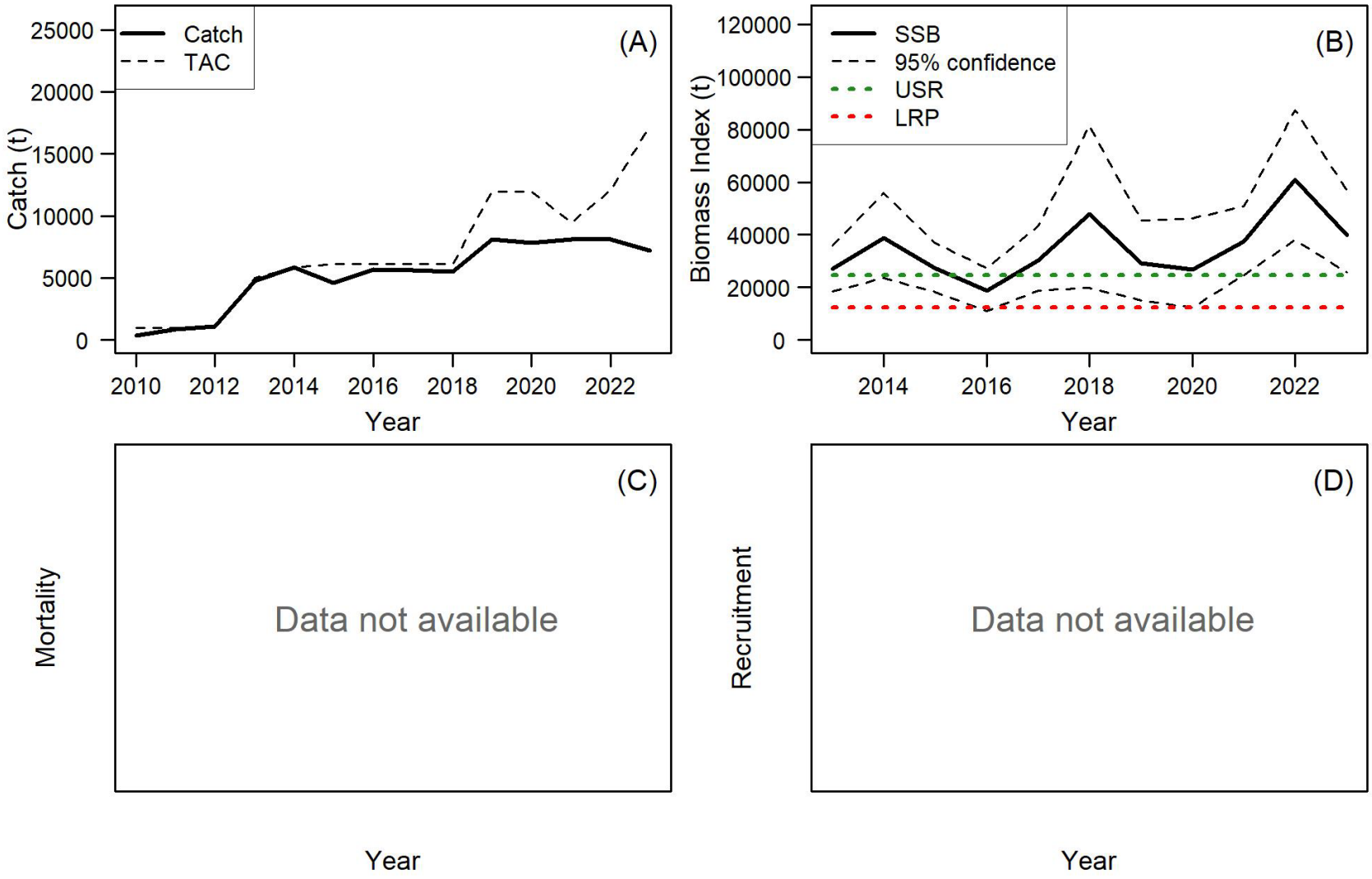

Figure 3. Pandalus montagui *in the Western Assessment Zone. (A; top left) Catch (as of January 24, 2024) and Total Allowable Catch (TAC), (B; top right) Spawning Stock Biomass (SSB) in relation to the Limit Reference Point (LRP; 12,300 t) and (proposed) Upper Stock Reference (USR; 24,600 t), (C; bottom left) Fishing Mortality, (D; bottom right) Recruitment.*

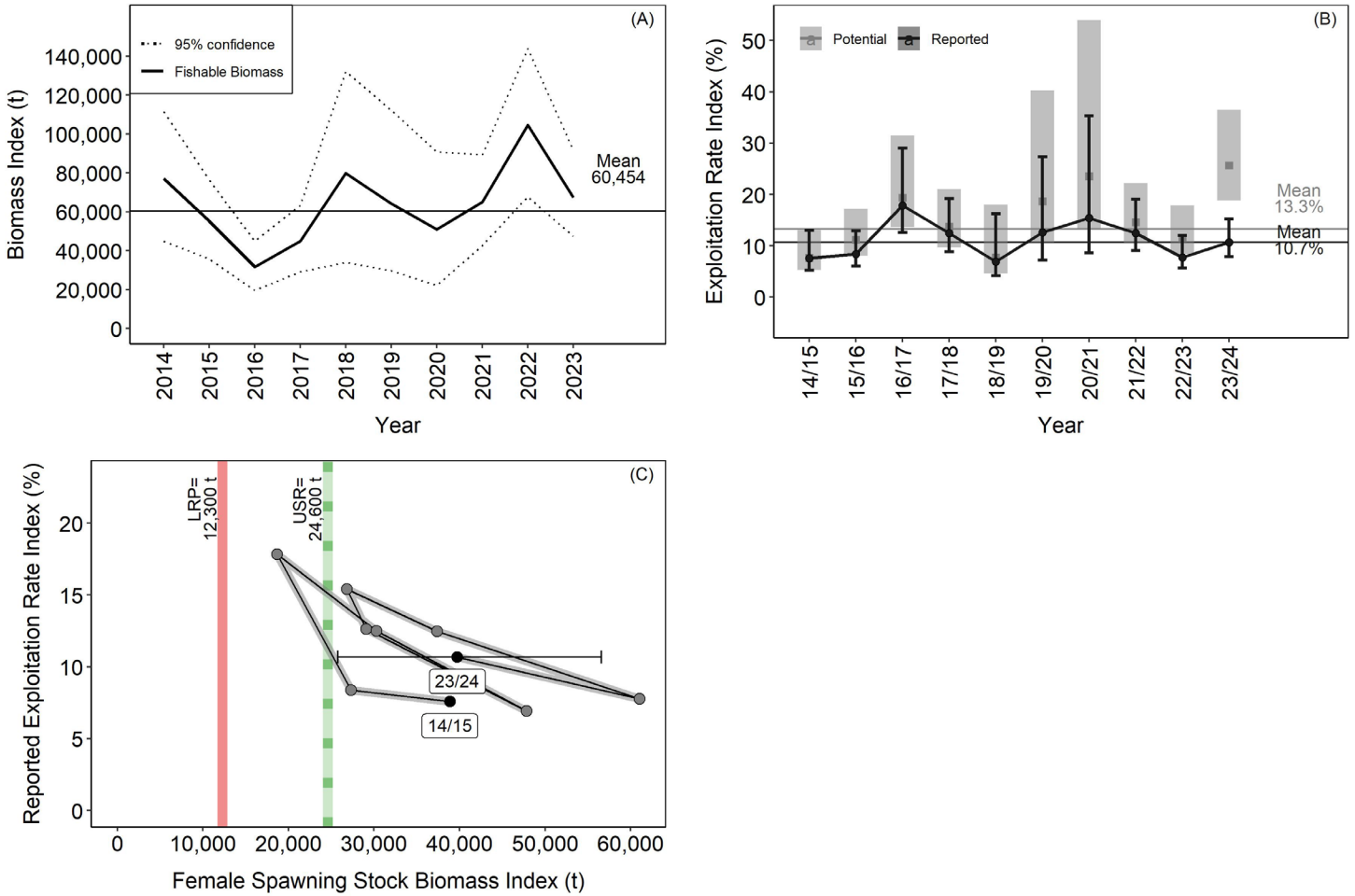

Figure 4. Pandalus montagui *in the Western Assessment Zone. (A: top left) Fishable Biomass Index, horizontal lines are long-term (2014–2022) geometric means. (B: top right) Exploitation rate indices for management years 2014/15–2023/24 at the reported rate based on the total catch (solid black line) and at the potential rate if the TAC was fully harvested (grey shading) as of January 24, 2024. Error bars based on bootstrapped 95% confidence ranges of the fishable biomass and horizontal lines are long-term (2014–2022) geometric means. (C: bottom left) Female spawning stock biomass (SSB) and reported exploitation rate in relation to the Limit Reference Point (LRP; 12,300 t) and (proposed) Upper Stock Reference (USR; 24,600 t)*

History of Landings

Table 2. Nominal reported catches (t) for the Western Assessment Zone for Pandalus borealis *and* Pandalus montagui*. Catch based on AQMS as of January 24, 2024. Catches for 2023/24 are considered preliminary.*

Year	Western Assessment Zone	
	P. borealis	***P. montagui***
2023/24	2,080	7,194
2022/23	475	8,128
2021/22	1,245	8,106
2020/21	1,438	7,841
2019/20	1,612	8,114
2018/19	1,307	5,531
2017/18	918	5,609
2016/17	643	5,660
2015/16	353	4,616
2014/15	847	5,836
2013/14	973	4,775
2012/13	13	1,105
2011/12	0	857
2010/11	57	345
2009/10	0	0
2008/09	0	0
2007/08	0	0
2006/07	0	0
2005/06	-	0
2004/05	-	0
2003/04	-	0
2002/03	-	0
2001/02	-	0
2000/01	-	0
Avg 1995–99	-	0
Avg 1990–94	-	1
Avg 1985–89	-	5
Avg 1979–84	-	5

Projections

Projections or simulations have not been developed for this assessment as it is index-based and data driven.

Ecosystem and Climate Change Considerations

Environmental and climate change considerations were not updated or reviewed during this Science Response Report. The following information is a summary taken from the last full assessment (Fulton et al. 2024).

It is believed that the habitat available to shrimp is shaped, to a great extent, by the oceanographic conditions present in the area. Fluctuations in the Northwest Atlantic ocean climate have potential impacts on the availability of optimal Pandalid habitat and/or predator-prey interactions in the WAZ. These potential impacts on Pandalid shrimp productivity have not yet been quantified for shrimp stocks in the WAZ or incorporated into the assessment.

Shrimp are known to be an important food source for a number of predator species, e.g., Greenland Halibut (*Reinhardtius hippoglossoides*), American Plaice (*Hippoglossoides platessoides*), Atlantic Cod (*Gadus morhua*), skates (Rajidae) and redfish (*Sebastes* spp.). The amount of shrimp consumed by these predators varies in response to predator stock size and movement within and between assessment areas. Work is ongoing to quantify the impact of these predators on the shrimp stocks in the WAZ in order to determine the importance of predator-prey dynamics on shrimp biomass variability over the years.

Pandalid shrimp can disperse through various mechanisms but larval dispersion with currents may be a main driver for shrimp movement (Le Corre et al. 2020). It is also known that adult shrimp can move in the water column (particularly males) and be carried away with the currents, thus this mechanism also contributes to shrimp dispersal. The two assessment areas, EAZ and WAZ, along with SFA 4 farther south and SFA 0 and SFA 1 to the north, have no physical boundaries between them and are considered interconnected. The extent of shrimp exported/imported between these areas remains unknown for both larval and adult stages, however, it could be one of the important drivers of year-to-year variability observed in any particular assessment area over time.

SOURCES OF UNCERTAINTY

Typically survey trawl length (i.e., bottom contact) is calculated using trawl sensor data to determine when each trawl starts and stops fishing. In 2023 the primary trawl sensor data were unavailable for 2/3 of the survey trawls, therefore bottom contact time was estimated for the missing trawls (all 68 trawls in the WAZ had their data estimated). This estimation was calculated using a regression between bottom contact times measured by CTD (Conductivity, Temperature, Depth sensor) and the primary trawl sensor for the trawls where both were measured. Although this calculation deviates from the typical approach, it is not expected to impact the outcome of the assessment.

Hudson Strait is a highly dynamic system with strong tidal currents and mixing. With speeds up to five knots, the strong currents could result in quick shifts in shrimp distribution and catchability. Shrimp could be transported great distances in a relatively short period of time in and out of the WAZ, EAZ, and SFA 4 to the south. This is most likely the cause of the wide fluctuations in biomass observed within and among assessment areas, even within the same year. Assessing only a subset of a larger population is a source of uncertainty in determining the true status of a resource.

Trawls used in the survey are known to have a catchability coefficient less than one but the exact value is unknown. Therefore, the survey is an index of biomass and not an absolute estimate of the total biomass. Catch is known; however, the total fishery-induced mortality is unknown (landed catch plus incidental mortality from trawling). Thus, exploitation rates are a relative index rather than absolute.

Three research vessels (Aqviq, Kinguk, Katsheshuk II) have been used throughout the time series in the WAZ. Expert opinion was that, given the similarity in the ships' dimensions and use of standardized gear, the relative catchability would be consistent among vessels. However, this assumption has not been empirically tested.

LIST OF MEETING PARTICIPANTS

Name	Organization/Affiliation
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Daniel Enright	DFO – Science, Ontario and Prairie Region
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William Coffey	DFO – Science, Newfoundland and Labrador Region
Nicholas Le Corre	DFO – Science, Newfoundland and Labrador Region
Susan Thompson	DFO – Science, National Capital Region
Nicholas Duprey	DFO – Science, National Capital Region
Jeff Adam	DFO – Resource Management, Arctic Region
Courtney D'Aoust (written review)	DFO – Resource Management, National Capital Region
Dirk Algera	DFO – Resource Management, National Capital Region
Chantelle Sawatzky	DFO – Science, Ontario and Prairie Region
Kayla Gagliardi (CSAS Support)	DFO – Science, Ontario and Prairie Region
Joclyn Paulic (CSAS Support)	DFO – Science, Ontario and Prairie Region
Julie Marentette (FSAR/FSRR Support)	DFO – Science, National Capital Region

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APPENDIX 2

Table 1. Stock status indicators and total allowable catch for *P. borealis* and *P. montagui* in the WAZ (2021-22 to 2024-25).

	2021-22	**2022-23**	**2023-24**	**2024-25**
Total Allowable Catch (TAC) (t)	5,090	3,958	4,788	*TBD*
% Change TAC	60.9	-22.2	21.0	*TBD*
Fishable Biomass (FB)*	34,929[1]	19,967[1]	23,939	17,919
Spawning Stock Biomass (SSB)*	17,555	14,083	15,899	15,713
Potential Exploitation Rate	14.6	19.8	20.0	*TBD*
% Change FB	71.4	-42.8	19.9	-25.1
% Change SSB	48.2	-19.8	12.9	-1.2

	2021-22	**2022-23**	**2023-24**	**2024-25**
Total Allowable Catch (t)	9,470	12,096	17,282	*TBD*
% Change TAC	-20.9	27.7	42.9	*TBD*
FB*	50,911	65,026	104,737	67,425
SSB*	26,811	37,398	61,058	39,745
Potential Exploitation Rate	18.6	18.6	16.5	*TBD*
% Change FB*	-20.8	27.7	61.1	-35.6
% Change SSB*	-7.8	39.5	63.3	-34.9

**Biomass indices reflect the prior year's survey (e.g. 2024-25 indices are reflective of the Fall 2023 survey).*

[1] FB value updated 2023, affects associated potential ER.

APPENDIX 3

Table 1. Stock status indicators and total allowable catch for *P. borealis* and *P. montagui* in the EAZ (2021-22 to 2024-25).

	2021-22	**2022-23**	**2023-24**	**2024-25**
Total Allowable Catch (TAC) (t)	12,251	10,732	7,383	*TBD*
% Change TAC	15.0	-12.4	-31.2	*TBD*
Fishable Biomass (FB)*	88,361	52,617[1]	36,911	48,216
Spawning Stock Biomass (SSB)*	59,935	35,000	23,771	32,659
Potential Exploitation Rate	13.9	20.4	20.0	*TBD*
% Change FB	-7.1	-40.5	-29.8	30.6
% Change SSB	4.9	-41.6	-32.1	37.4

	2021-22	**2022-23**	**2023-24**	**2024-25**
Total Allowable Catch (t)	965	1,400	2,100	*TBD*
% Change TAC	14.9	45.1	50.0	*TBD*
FB*	18,802	15,225	14,325	14,137
SSB*	14,437	11,200	10,428	6,829
Potential Exploitation Rate	5.1	9.2	14.7	*TBD*
% Change FB*	121.1	-19.0	-5.9	-1.3
% Change SSB*	227.0	-22.4	-6.9	-34.5

**Biomass indices reflect the prior year's survey (e.g. 2024-25 indices are reflective of the Fall 2023 survey).*

[1] FB value updated 2023, affects associated potential ER.

APPENDIX 4

Species	Management unit_Fleet/Interest	2020/21 Quota	2021/22 Quota	2022/23 Quota	2023/24 Quota
P. borealis	DSW_Offshore	5,250	5,250	4,884	3,360
	DSE_Offshore	1,000	1,150	1,008	693
	DSE_Nunavut	1,604	1,845	1,616	1,112
	DSW_Nunavut	1,778	2,753	2,155	1,483
	DSW_Nunavik	197	305	239	165
	NU-E_Nunavut	659	758	664	456
	NK- E_Nunavik	165	190	166	114
	TOTAL	***10,653***	***12,251***	***10,732***	***7,383***
P. montagui	NU-E_Nunavut	301	346	574	820
	NK-E_Nunavik	129	148	252	360
	DS E/W_Offshore (bycatch)	410	471.5	574	920
	TOTAL	***840***	***965.5***	***1,400***	***2,100***
P. borealis	NU-W_Nunavut	1,582	2,545	1,976	2,394
	NK-W_Nunavik	1,582	2,545	1,976	2,394
	TOTAL	***3,163***	***5,090***	***3,958***	***4,788***
P. montagui	NU-W_Nunavut	5,988	4,735	6,048	8,641
	NK-W_Nunavik	5,988	4,735	6,048	8,641
	TOTAL	***11,975***	***9,470***	***12,096***	***17,282***

APPENDIX 5

The following table shows application of the proposed 2-Step HDR, for each respective stock.

EAZ Borealis									
SSB	**FB**	**Initial target ER (based on Zone) Healthy: 20%**	**Initial target TAC**	**Previous Year TAC**	**Difference (2023 TAC to 2024 Initial target TAC)**	**50% of the Change in TAC (Tonnage)**	**Calculated 2024-25 TAC**	**2024-25 Potential ER**	**Does this exceed Max 1.5* Target ER? (Y/N)**
32,659	48,216	20%	9,643.2	7,383	2,260.2	1,130.1	8,513.1	17.7%	No

EAZ Montagui									
SSB	**FB**	**Initial target ER (based on Zone) Healthy: 20%**	**Initial target TAC**	**Previous Year TAC**	**Difference (2023 TAC to 2024 Initial target TAC)**	**50% of the Change in TAC (Tonnage)**	**Calculated 2024-25 TAC**	**2024-25 Potential ER**	**Does this exceed Max 1.5* Target ER? (Y/N)**
6,829	14,137	20%	2,827.4	2100	727.4	363.7	2,463.7	17.4%	No

WAZ Borealis									
SSB	**FB**	**Initial target ER (based on Zone) Healthy: 20%**	**Initial target TAC**	**Previous Year TAC**	**Difference (2023 TAC to 2024 Initial target TAC)**	**50% of the Change in TAC (Tonnage)**	**Calculated 2024-25 TAC**	**2024-25 Potential ER**	**Does this exceed Max 1.5* Target ER? (Y/N)**
15,713	17,919	20%	3,583.8	4,788	-1,204.2	-602.1	4,185.9	23.4%	No

WAZ Montagui									
SSB	**FB**	**Initial target ER (based on Zone) Healthy: 20%**	**Initial target TAC**	**Previous Year TAC**	**Difference (2023 TAC to 2024 Initial target TAC)**	**50% of the Change in TAC (Tonnage)**	**Calculated 2024-25 TAC**	**2024-25 Potential ER**	**Does this exceed Max 1.5* Target ER? (Y/N)**
39,745	67,425	20%	13,485	17,282	-3,797	-1,898.5	15,383.5	22.8%	No

APPENDIX 6

Consultation Summary: Northern Shrimp Advisory Committee (April 3-4, 2024)
2024-25 Total Allowable Catches for Northern and Striped Shrimp in the WAZ and EAZ

A meeting of the Northern Shrimp Advisory Committee (NSAC) took place on April 3, 2024. The Department held a post-meeting with Indigenous participants on April 4, 2024. Meetings were well attended by groups that have direct interests in the WAZ and EAZ, namely:

- Nunavut Wildlife Management Board (NWMB)
- Nunavik Marine Region Wildlife Board (NMRWB)
- Nunavut Fisheries Association (NFA)
- Torngat Fish Producers Co-Op
- Qikiqtaaluk Corporation (QC)
- Northern Coalition (NC)
- NunatuKavut Community Council (NCC)
- Innu Nation
- Torngat Joint Fisheries Board (TJFB)
- Nunatsiavut Government (NG)
- Baffin Fisheries Coalition (BFC)
- Makivvik Corporation
- Labrador Fishermen's Union Shrimp Company

Other participants at NSAC included representatives of the offshore and inshore fleet, individual licence holders, provincial government representatives, and Oceans North (non-governmental organization).

The Department sought views on Total Allowable Catches (TACs) for *Pandalus borealis* and *P. montagui* in the EAZ at the main NSAC table, with discussions on WAZ TACs reserved for the Indigenous post-meeting. DFO reminded NSAC participants of the NWMB and NMRWB's (the Boards') decision-making role in WAZ, and decision and recommendation role in the EAZ.

The Department encouraged Nunavut and Nunavik industry to make their views on TACs known to their respective Boards as part of the decision making process on 2024-25 TACs for Northern and Striped shrimp in the WAZ and EAZ.

2024-25 Total Allowable Catches:

During discussions on the EAZ and WAZ at the NSAC meeting, there was support for the application of the 2-step HDR to calculate 2024-25 TACs for *P. borealis* and *P. montagui*, in both the EAZ and WAZ.

- ***Eastern Assessment Zone:*** DFO presented an illustrative 2024-25 TAC of 8,513 for *P. borealis* and 2,464t for *P. montagui*.

- ***Western Assessment Zone:*** DFO presented an illustrative 2024-25 TAC of 4,186t for *P. borealis* and 15,384t for *P. montagui*.

Management Measures:

Discussion of NK-E and NK-W (EAZ-WAZ) boundary

- Makivvik Corporation revisited a request to amend the management unit lines between NK-E and NK-W, or another means to address challenges in accessing large shrimp aggregations situated on the management line.
  - DFO underlined the implications of changing a management unit that also defines distinct stock assessment areas (i.e. divides EAZ and WAZ).
  - Such a change would present a need for re-calculation of biomass over the time series, with implications on survey design for both species.
  - Further, DFO Science noted that the aggregation of the resource around the management unit/stock assessment boundary may not reflect a permanent tendency of the stock and it remains unclear whether this issue will persist as the stock fluctuates.
  - The group discussed the appropriateness of a working group to address this issue, with mixed support. Northern Coalition pointed to an ongoing process to review the appropriateness of current assessment units and to gain a better understanding of stock dynamics in the respective areas, which could contribute to and inform further discussion on this matter.

Discussion of EAZ-SFA 4 boundary

- TJFB proposed the formation of an industry-led working group to undertake a comprehensive ("10-year") review and reflection on the implications of the boundary lines dividing the EAZ (DSW) with the northern boundary of Shrimp Fishing Area (SFA 4), and changes made in 2013.
  - TJFB called for meaningful engagement in such a working group from access holders, DFO Science and Resource Management.
  - Torngat Fish Producers Co-Op supported such a working group and review, noting no access to the EAZ for Nunatsiavut interest as a longstanding concern.
  - Other representatives did not support the establishment of a working group, noting this issue may not be appropriate for a full working group given the scope is limited to certain proponents.
  - The NSAC Chair noted potential limitations to internal DFO resources to engage in such a working group given additional priorities for this fishery over the coming year (e.g. model development, potential for Management Strategy Evaluation). The NSAC Chair committed to preparing a document to serve as a historical summary of this boundary issue to establish a common understanding. This draft would be circulated to the Committee for information.

<u>Access and Allocations:</u>

EAZ *P. montagui*

- CAPP supported applying the proposed 2-step HDR to set the overall TAC to help reduce fluctuations from the erratic nature of the fishery.
- Further, CAPP indicated the offshore fleet requires an allocation of 920t in the Davis Strait East/West (DSE/W) management units, and offered this could be implemented as a bycatch 'allowance'.
    - It was proposed that this allowance represent a 'soft limit' that could be exceeded without implication to the directed *P. borealis* fishery in these areas. The allowance would be static to promote year-to-year stability.
    - CAPP added that the allowance request has been made for 3 years in a row now such that the risk of reaching a hard limit and unduly affecting the direct fishery remains.
    - CAPP confirmed that it would be willing to forgo an increase in the offshore bycatch quota in DSE/W that could be available under a higher TAC in 2024-25 (and future seasons) should DFO and co-management partners support conversion from a quota to an allowance.
    - CAPP suggested that where additional *P. montagui* quota was available beyond 920t for the broader EAZ, the remainder of the TAC could be allocated in NU/NK E, but that the opposite would also be true, in that when the TAC goes down, the reduction would come from the NU/NKE management units.
    - DFO recalled that co-management boards have authority to set harvest levels inside the NU/NK-E management units; establishing a bycatch allowance 'off-the-top' of the overall TAC for the EAZ would involve subsequent decisions from the Boards on the remaining quota.

- Northern Coalition, Makivvik Corporation and NFA suggested a need to consult more on the concept of a bycatch allowance for the offshore fleet in DSE/W, but were in principal supportive of the idea. The group indicated its interest in pursuing this discussion further with the offshore fleet.

Season bridging:

Season bridging was not raised at the NSAC table on April 3 due to time constraints, but was raised at the Indigenous meeting on April 4. DFO outlined that season bridging is currently available for the directed *P. borealis* quota in the EAZ and the *P. montagui* quota in the WAZ.

- DFO reminded the group that the Nunavut and Nunavik Boards make decisions inside settlement areas and that those decisions are needed to be able to modify the Integrated Fisheries Management Plan (IFMP) season bridging provisions that are applicable in the settlement areas.
- DFO noted that considering the timing of the next NWMB and NRWMB meetings, implementing any changes to the season bridging protocol for EAZ and WAZ is not expected to occur this year.
- DFO indicated since the pilot project was implemented for NU and NK entities in 2018, there have been calls from NU and NK industry to revisit various aspects of the protocol. The Department has committed to the Boards that it would complete the PA Framework for *P. borealis* stocks, including harvest decisions rules, before addressing season bridging. Given that a decision to modify season bridging is unlikely for this year, and

that *P. borealis* in the EAZ is in the healthy zone, the Department will be flexible in its assessment of any season bridging requests in Davis Strait. It was noted that Baffin Fisheries Coalition is disadvantaged in its ability to carry forward uncaught quota in Davis Strait compared to the other entities, which have additional bridging flexibility accrued via their offshore licences. The Department will maintain communication with Boards' staff on any requests and outcomes. DFO will continue discussions with Nunavut and Nunavik entities, as well as the offshore fleet .

- It was recommended to inform the Boards in the season bridging update that the current season bridging protocol for NU and NK is restrictive and to provide some interim allowances to be somewhat consistent with the southern areas.
- The Department will work generally with the offshore fleet and Nunavut and Nunavik industry to develop a season bridging protocol that respects and responds conservation and socio-economic considerations, and specifically with Nunavut and Nunavik entities for season bridging for NU and NK allocations. Issues to be addressed include amounts for carry forward and bridging for when the stock is in the Healthy, Cautious or Critical zones, deadlines, and applicable stocks.

POTENTIAL LISTING OF THORNY SKATE UNDER THE SPECIES AT RISK ACT (SARA)

Environment Climate Change Canada and
Fisheries and Oceans Canada

Nunavut Wildlife Management Board meeting

June 2024

SARA Listing Process

- The Committee on the Status on Endangered Wildlife in Canada (COSEWIC) provides species assessments to the Minister of Environment and Climate Change (MECC).
- The Minister of Fisheries and Oceans (MFO) is the competent minister for aquatic species* and determines the extent of public consultations necessary to inform the listing decision.
- MFO then conducts consultations and uses the results to inform the listing advice for the species.
- MECC shares the proposed listing recommendation with the relevant Wildlife Management Boards and requests their approval.
- MECC then recommends to the Governor in Council to either list the species under Schedule 1 of SARA, not list the species under Schedule 1, or refer the species back to COSEWIC for further consideration or information.

*Except on lands or in waters administered by Parks Canada.

Species Assessment Overview

- Thorny Skate was assessed by COSEWIC in 2012 as **Special Concern.**
- Special Concern status attributed to population declines and range contractions within the southern part of their range.
- In contrast, the abundance of individuals in the northern part of their range has been increasing.
- Thorny Skate can be found in Nunavut, Quebec, Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, and the Atlantic, and Arctic oceans.

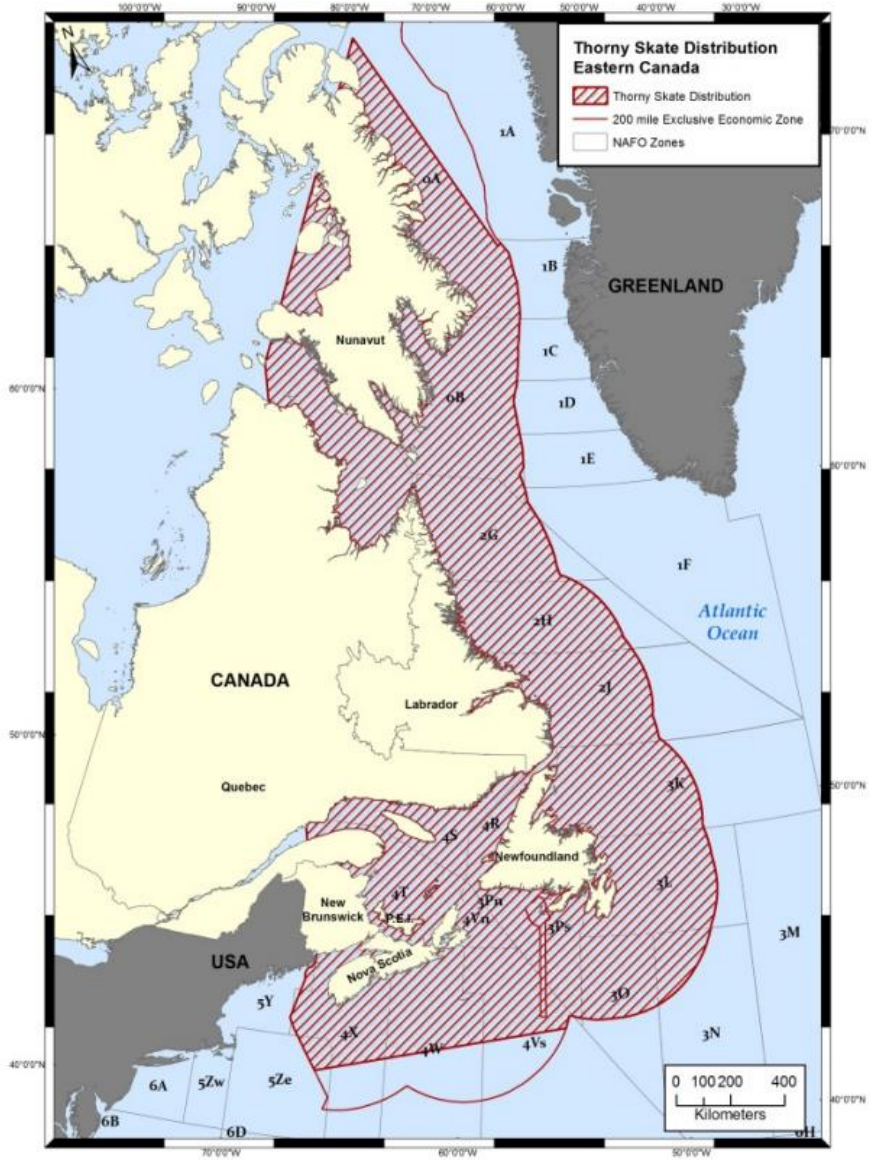

Figure 1. Distribution of Thorny Skate in Canada

(COSEWIC. 2012. COSEWIC assessment and status report on the Thorny Skate Amblyraja radiata in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 75 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm)).

Thorny Skate Biology and Threats

Biology:

- Large bottom dwelling skate (found in a wide variety of depths (18-1200m)) distributed continuously from Baffin Bay south to Georges Bank, including the Gulf of St Lawrence
- Slow growing, late maturing species, reaching maturity at 11 years with a lifespan of 16-20 years

Threats & Limiting Factors:

- Mortality in both directed and bycatch fisheries is likely important but has not been directly linked to declines
- Predation by gastropods, marine fish, and marine mammals is likely

Figure 2. Specimens of mature and juvenile female Thorny Skates. (COSEWIC. 2012. COSEWIC assessment and status report on the Thorny Skate Amblyraja radiata in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 75 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm))

Engagement and Consultation Summary

- Consultation Efforts:
  - Consultations took place in 2015
  - Noticed published in English, French and Inuktitut in *Nunatsiaq News*
  - Consultation products were sent to:
    - 7 Hunters and Trappers Organizations
    - Qikiqtaaluk Wildlife Board
    - Nunavut Inuit Wildlife Secretariat
    - Nunavut Tunngavik Inc.
    - 5 Fishing industry groups
    - Government of Nunavut, Division of Fisheries and Sealing
- Consultation check-ins were completed in 2023

Figure 3. Illustration of a mature Thorny Skate (DFO).

Engagement and Consultation Summary

- Consultation results:
  - Government of Nunavut responded stating that they do not support listing
  - No other comments were received during consultations from groups within the territory of Nunavut
  - No comments were received during the consultation check-ins from within the territory of Nunavut

Proposed Listing Recommendation

- On the advice of the Minister of Fisheries and Oceans, the Minister of Environment and Climate Change is considering recommending that the species be listed as Special Concern under Schedule 1 of SARA.
- If Thorny Skate were to be listed as Special Concern, SARA prohibitions would not come into effect.
- Listing would require the development of a SARA Management Plan within 3 years.

Comments and Questions

SUBMISSION TO THE

NUNAVUT WILDLIFE MANAGEMENT BOARD

FOR

Information: **Decision:** *X*

Issue: A decision is needed to approve/not approve adding Thorny Skate to Schedule 1 of the *Species at Risk Act* (SARA) as a species of Special Concern.

Background:

The Thorny Skate was assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as a species of Special Concern in 2012. Article 5.2.34 (d) (i) of the *Nunavut Agreement* states that the NWMB shall, at its discretion, approve SARA listing recommendations for species found within their area of responsibility.

The best available information for listing for Thorny Skate as Special Concern under SARA was shared with the Board on DATE . This package for Thorny Skate included the communication pieces used during community consultations, a summary of the consultations that took place within the Nunavut Settlement Area, the COSEWIC Executive Summary for Thorny Skate, the Cost Benefit Analysis of listing Thorny Skate as a species of Special Concern, and the Response Statement from the Minister of the Environment and Climate Change on the COSEWIC assessment.

COSEWIC is an independent advisory panel to the Minister of Environment and Climate Change that meets twice a year to assess the status of wildlife species at risk of extinction. Their criteria for the Special Concern designation can be found here in subsection Special Concern (following Section E): https://www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding/listing-process/quantitative-criteria-guidelines-status-table-2.html. A species of Special Concern is a wildlife species that may become Threatened or Endangered because of a combination of biological characteristics and identified threats.

Species listed as Special Concern are not subject to SARA prohibitions, and there is no requirement to identify or protect critical habitat; however, a SARA management plan must be prepared within three years of listing. A management plan is a document that identifies the conservation activities and other measures needed to ensure that a species of special concern does not become Threatened or Endangered. Management Plans are developed in cooperation and collaboration with Wildlife Management Boards, Indigenous organizations, and others to the extent possible.

Recommendation:

The NWMB approve addition of Thorny Skate to Schedule 1 of the *Species at Risk Act* (SARA) as a species of Special Concern.

Prepared by:

TBD

Date:

.

Mr. Daniel Shewchuck
Chairperson
Nunavut Wildlife Management Board
P.O. Box 1379
Iqaluit, NU
X0A 0H0

Dear Mr. Shewchuck,

I am writing to you concerning the potential addition of Thorny Skate to Schedule 1 of *the Species at Risk Act* (SARA). Thorny Skate has been assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Special Concern.

On the advice of the Minister of Fisheries, Oceans and the Canadian Coast Guard, the Minister of Environment and Climate Change is considering recommending to Governor in Council that this species be added as Special Concern to Schedule 1 of SARA. I am therefore writing to request the Nunavut Wildlife Management Board's decision on this potential addition, in accordance with the *Nunavut Agreement*, Articles 5.2.34 (f) and 5.3.16. We have also sent a letter requesting the decision of the Nunavik Marine Region Wildlife Board (NMRWB) in accordance with the *Nunavik Inuit Land Claims Agreement* (NILCA).

To support your decision-making, please find attached a "best available information" package, prepared by Fisheries and Oceans Canada. The package includes information on the species, SARA, and a summary of consultation responses received from Canadians.

Additionally, as part of obligations under both the *Nunavut Agreement* and the NILCA, the Minister of Environment and Climate Change must respond within 60 days to listing decisions rendered by the NWMB and NMRWB. Given that the two boards may not be able to provide decisions concurrently, and the Minister must take both decisions into account before finalizing his recommendation and responding, we ask for your agreement to vary the deadline by which a response from the Minister is required. We propose that a revised deadline for the Minister to accept or reject the boards' decisions be **120 days** after both boards' decisions have been received. Please let us know your response to this request at your earliest convenience.

Please send both your response to the request to vary the Ministerial response deadline, as well as your decision regarding the potential addition of Thorny Skate to Schedule 1 of SARA as a species of Special Concern, to the Honourable Steven Guilbeault, Minister of the Environment and Climate Change, and copy myself and Ms. Erin Groulx, Director Integrated Species at Risk (erin.groulx@dfo-mpo.gc.ca).

I appreciate the Board's ongoing participation in the conservation of species at risk.

Sincerely,

_____

Sarah Wren
Director, Species at Risk Implementation, Wildlife Management Division
Canadian Wildlife Service
Environment and Climate Change Canada

c.c. Nicole Bouchard
A/Director General, Biodiversity Management
Fisheries and Oceans Canada

Erin Groulx
Director, Governance & Listing
Fisheries and Oceans Canada

Thorny Skate: DFO Listing Consultation Summary

Summary of Consultations Within the Territory of Nunavut

Consultation Efforts:

- A public notice in English, French and Inuktitut was placed May 29, 2015 in *Nunatsiaq News*. This notice also appeared online on the *Nunatsiaq News* website and remained visible for two weeks.
- Consultation products were sent to:
    - 7 Hunters and Trappers Organizations (HTOs)
    - Qikiqtaaluk Wildlife Board
    - Nunavut Inuit Wildlife Secretariat
    - Nunavut Tunngavik Inc.
    - 5 Fishing industry groups
    - Government of Nunavut, Division of Fisheries and Sealing
- An initial email with copies of the factsheet and questionnaire were sent to all HTOs in advance of the consultation period advising them that DFO would be asking their opinion on listing. Hard copies of all information were sent in May to all HTOs, Inuit organizations and industry groups. An email notifying HTOs of the ad in Nunatsiaq News and that the Public Registry could be used for making comments was sent in late May. Additional hard copies of the same information were sent in June 24 and July 20. A consultation reminder was emailed to all HTOs on June 19 and reminder of the conclusion of consultations was emailed to all HTOs in early August.
- Consultation check-ins for Thorny Skate were completed in 2023.

Consultation Results:

NUNAVUT TERRITORIAL GOVERNMENT

- **Do not support listing:**

The Government of Nunavut's Department of Environment, Fisheries and Sealing Division: Does not support listing, stating that the available data does not suggest any particular risk to the species in Nunavut and the government has already supported efforts to reduce bycatch. Furthermore, they indicated that listing would hinder the development of the fishing industry in the territory. They deemed listing as unnecessary and suggested that more specific research would be preferred.

COSEWIC
Executive Summary

Thorny Skate
Amblyraja radiata

Wildlife Species Description

Amblyraja radiata, commonly known as Thorny Skate in English and Raie épineuse in French, is a relatively large skate, reaching up to 110 cm long on the Grand Banks. It varies among regions in size, body proportions, growth, and age at maturity. It is distinguished from other skates in the northwest Atlantic by a row of 11-19 large thorns running down the middle of its back and along the tail. It is usually brown although younger individuals may have darker spots.

Distribution

Thorny Skate are found on both sides of the Atlantic, from Iceland south to the English Channel in the eastern Atlantic, and from Greenland to South Carolina in the western Atlantic. In Canada, it is distributed continuously from Baffin Bay, Davis Strait, Labrador Shelf, Grand Banks, Gulf of St. Lawrence, Scotian Shelf and Bay of Fundy to Georges Bank, over a wide range of depths. For this assessment, this distribution is considered as a single designatable unit extending from Baffin Bay south to Georges Bank and including the Gulf of St. Lawrence.

Habitat

Thorny Skate live on the bottom over a wide range of depths (primarily 18-1200 m) and typically in water temperatures of 0° to 10°C. They can be found on a variety of bottom types including sand, gravel, mud and broken shells.

Biology

The average age at maturity is 11 years and the fish live for 16-20 years. They lay 6-40 eggs per year. Little is known about their predators but it is likely that their egg capsules are eaten by gastropods, whereas juveniles and adults may be eaten by marine mammals and fishes.

Population Sizes and Trends

The most recent minimum estimate of population size in all Canadian waters is approximately 188.5 million individuals, approximately 63 million of which are mature. In southerly regions, mature individuals have declined by 63% to 97% since the 1970s, whereas numbers have increased recently in the middle and northern parts of their range. Declines have also occurred in the abundance of immature individuals over parts of their range.

Threats and Limiting Factors

Catches of Thorny Skate in some commercial fisheries are likely an important limiting factor but this has not been directly linked to the declines, the most severe of which have occurred in spite of reduced fisheries. Recovery in the southern part of their range may be due to increased mortality by predators. Catches in Canadian waters have declined since the mid-1990s with the closure of the skate fishery on the Scotian Shelf, reduction of catches in the Grand Banks fisheries and general reduction in fisheries where the fish are taken as bycatch.

Protection, Status and Ranks

Thorny Skate has been designated as a “Species of Concern” by the National Marine Fisheries Service in the United States. They are designated as “vulnerable” globally on the IUCN Red List. There is a directed fishery for this species on the Grand Banks that straddles Canada’s 200-mile limit, managed under quota by the Northwest Atlantic Fisheries Organization (NAFO). The portion of the total allowable catch allocated to Canada is managed as a licensed fishery under the *Fisheries Act*. A mixed fishery for Thorny Skate and Winter Skate (*Leucoraja ocellata*) on the eastern Scotian Shelf is presently under moratorium.

Thorny Skate (2013) - Response Statement

January 3, 2013

Common Name: Thorny Skate
Scientific Name: Amblyraja radiata

Status assessment by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC):
Special Concern

How the Minister of the Environment intends to respond to the assessment: The Minister of Fisheries and Oceans will undertake consultations with the governments of Quebec, Newfoundland and Labrador, New Brunswick, Nova Scotia, Prince Edward Island and Nunavut, the Nunavut Wildlife Management Board, the Hunting, Fishing and Trapping Coordinating Committee, the Torngat Joint Fisheries Board and the Nunavik Marine Region Wildlife Board, Aboriginal peoples, stakeholders, and the public on whether or not the Thorny Skate should be added to the List of Wildlife Species at Risk (Schedule 1) under the Species at Risk Act as Special Concern. The Minister of the Environment will forward the COSEWIC assessment of the Thorny Skate to the Governor in Council upon completion of consultations.

Once a species has been assessed as at risk by COSEWIC, further steps must be undertaken before it is added to Schedule 1 of the Species at Risk Act. For more information on this process, please view The Species Listing Process Under SARA.

Reason(s) for status designation provided by COSEWIC: These slow-growing, late-maturing fish have undergone severe population declines over the southern part of their distribution, including range contractions. The southern declines have continued in spite of a reduction in fishing mortality. In contrast, the abundance of mature individuals in the northern part of their range has been increasing, approaching abundance levels observed at the beginning of surveys (mid-1970s). Thus, while the species as a whole does not meet the criteria for a Threatened status, declines and range contractions in the south are causes for concern.

Occurrence: Quebec, Newfoundland and Labrador, New Brunswick, Nova Scotia, Prince Edward Island, Nunavut, Arctic Ocean, Atlantic Ocean

Competent Minister(s):
Minister of Fisheries and Oceans
Minister responsible for the Parks Canada Agency

Province(s) and territory (territories) to be consulted:
Quebec, Newfoundland and Labrador, New Brunswick, Nova Scotia, Prince Edward Island, Nunavut

Applicable federal legislation: When the species is found within national parks of Canada or other lands administered by the Parks Canada Agency, it is protected or managed under the Canada National Parks Act or through measures or management tools available to the Parks Canada Agency under other legislation.

Conservation activities underway: Skates are managed as a group rather than by species. There is a NAFO managed stock in 3LNO with a total allowable catch in place. There are directed skate fisheries in 3NO and 3Ps with management measures in place such as competitive quotas, season dates, gear restrictions (e.g. minimum mesh size, hook size), trip limits, at-sea observer coverage, dockside monitoring and by-catch limits. In all other areas or in fisheries targeting other species there are by-catch limits and skates may be returned to the water. All discards must be recorded in logbooks, and additionally when at-sea observers are present, skate discards are also recorded by the observers. Beginning in April 2013, license conditions will require all thorny skate caught in NAFO divisions 4VWX+5 to be returned to the water. DFO conducts annual research vessel surveys to monitor the abundance and distribution of numerous marine species, including thorny skate. These surveys form the basis of monitoring their status. Landings and data collected by fishery at-sea observers form the basis of monitoring fishing activities.

Cost-Benefit Analysis
Thorny Skate (*Amblyraja radiata*)

The purpose of this analysis is to examine the incremental costs and benefits to Canadians that result from listing Thorny Skate as special concern under the federal *Species at Risk Act*.

If Thorny Skate is added to the List of Wildlife Species at Risk as a species of special concern, it would not be subject to the general prohibitions under the *Species at Risk Act* (SARA). However, Fisheries and Oceans Canada (DFO) would be required to develop and implement a future management plan for the species in an effort to ensure that it does not become threatened or endangered due to human activity. The management plan would be developed in cooperation with affected governments, wildlife management boards, Indigenous organizations, and any other organizations or persons affected by the management plan. As the general prohibitions under SARA do not apply to species of special concern, the benefits and costs of adding Thorny Skate to List of Wildlife Species at Risk are likely negligible and result primarily from the use, development, and implementation of a management plan.

A benefit following a potential listing of Thorny Skate under Schedule I of SARA would be the demonstration of DFO's continuing commitment to conserving Canada's species at risk, and upholding the department's SARA mandate as well as international commitments. Non-use benefits derived by Canadians would include knowledge that the species exists (existence value) and that the species will be available for future generations to enjoy (bequest value). Self-sustaining and healthy ecosystems with their various elements in place, including species at risk, would also contribute positively to the livelihoods and the quality of life for all Canadians. Additionally, if the species was listed, a management plan by the Department that could include research, education, outreach, monitoring, and reporting activities would be developed.

The potential costs and benefits following a potential listing of Thorny Skate remain uncertain at this time. However, as there would be no SARA prohibitions associated with listing as special concern, it is anticipated that costs would be minimal.

SUBMISSION TO THE
NUNAVUT WILDLIFE MANAGEMENT BOARD
AND NUNAVIK MARINE REGION WILDLIFE BOARD

FOR

Information: **Recommendation:** **Decision: X**

Issue: Request for Boards view on their authority to approve plans to designate a stock as a 'major fish stock' under the Fish Stocks provisions.

Background

The inclusion of the Fish Stocks provisions (FSP) was one of the amendments made to the *Fisheries Act* (ss. 6.1-6.3) in 2019. The FSP are intended to help ensure Canada's major fish stocks are managed sustainably and only apply to major fish stocks identified in Schedule IX of the *Fishery (General) Regulations* (FGR) (s. 6.3). The full text of the FSP can be found in Appendix 1 of this note.

At present, the FSP apply to 30 fish stocks across Canada. These stocks were added to the list of major fish stocks in Schedule IX of the FGR on April 4, 2022. To date, no stocks located in Nunavut or Nunavik have been identified as major fish stocks in Schedule IX. A definition of 'major fish stock' is not included in the *Fisheries Act* or FGR. Thus far, DFO has identified major fish stocks using similar criteria as those used to identify a stock as part of DFO's annual *Sustainability Survey for Fisheries*. Criteria include stocks that are part of an economically or culturally important fishery, amongst others. The rate at which additional stocks will be added to the list of major fish stocks will be influenced by whether the stock has a Limit Reference Point, the completeness of its precautionary approach (PA) framework, and other economic, cultural and/or ecological considerations, as well as capacity to develop fisheries management measures and rebuilding plans concurrently.

If a stock located in the Nunavut Settlement Area (NSA) or Nunavik Marine Region (NMR) is identified as a major fish stock through its addition to Schedule IX of the FGR, the FSP would apply to that stock. All ongoing wildlife management of the identified stock would continue to operate within the Board-Minister decision-making process outlined in the relevant land claim agreement(s), the *Nunavut Agreement* and *Nunavik Inuit Land Claims Agreement*, that are paramount to the *Fisheries Act* in cases of conflict or inconsistency.

Through this submission, DFO is looking to confirm the process to identify major fish stocks that are located wholly or partially in the NSA and/or NMR in a manner that respects the roles and authorities of the Nunavut Wildlife Management Board (NWMB) and Nunavik Marine Region Wildlife Board (NMRWB) (the Boards). DFO has had preliminary discussions on this topic with

staff from the Boards and from these discussions it was determined that requesting views from the Boards through a joint process would add clarity. Specifically, DFO is requesting the Boards' view of whether their respective land claims agreements afford them decision-making authority to approve plans to designate co-managed stocks as major fish stocks through an amendment of Schedule IX of the FGR.

Summary of the Request

As referenced in sections 6.1-6.3 of the *Fisheries Act*, and as per Schedule IX of the FGR, DFO is seeking the views of the NWMB and NMRWB on their authorities to approve plans to designate a stock as a 'major fish stock'.

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Date: May 16, 2024

Appendix 1

[Text from the Fish Stocks provisions, ss. 6.1-6.3 of the *Fisheries Act*]

Fish Stocks

Measures to maintain fish stocks

6.1 (1) In the management of fisheries, the Minister shall implement measures to maintain major fish stocks at or above the level necessary to promote the sustainability of the stock, taking into account the biology of the fish and the environmental conditions affecting the stock.

Limit Reference Point

(2) If the Minister is of the opinion that it is not feasible or appropriate, for cultural reasons or because of adverse socio-economic impacts, to implement the measures referred to in subsection (1), the Minister shall set a limit reference point and implement the measures to maintain the fish stock above that point, taking into account the biology of the fish and the environmental conditions affecting the stock.

Publication of decision

(3) If the Minister sets a limit reference point in accordance with subsection (2), he or she shall publish the decision to do so, within a reasonable time and with reasons, on the Internet site of the Department of Fisheries and Oceans.

Plan to rebuild

6.2 (1) If a major fish stock has declined to or below its limit reference point, the Minister shall develop a plan to rebuild the stock above that point in the affected area, taking into account the biology of the fish and the environmental conditions affecting the stock, and implement it within the period provided for the in the plan.

Amendment

(2) If the Minister is of the opinion that such a plan could result in adverse socio-economic or cultural impacts, the Minister may amend the plan or the implementation period in order to mitigate those impacts while minimizing further decline of the fish stock.

Endangered or threatened species

(3) Subsection (1) does not apply if the affected fish stock is an endangered species or a threatened species under the *Species at Risk Act* or if the implementation of international management measures by Canada does not permit it.

Publication of decision

(4) If the Minister amends a plan in accordance with subsection (2) or decides not to make one in accordance with subsection (3), he or she shall publish the decision to do so, within a reasonable time and with reasons, on the Internet site of the Department of Fisheries and Oceans.

Restoration measures

(5) In the management of fisheries, if the Minister is of the opinion that the loss or degradation of the stock's fish habitat has contributed to the stock's decline, he or she shall take into account whether there are measures in place aimed at restoring that fish habitat.

Regulations

6.3 The major fish stocks referred to in sections 6.1 and 6.2 are to be prescribed by regulations.