



ASSESSMENT OF NORTHERN SHRIMP (*PANDALUS BOREALIS*) AND STRIPED SHRIMP (*PANDALUS MONTAGUI*) IN THE EASTERN AND WESTERN ASSESSMENT ZONES, FEBRUARY 2023



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

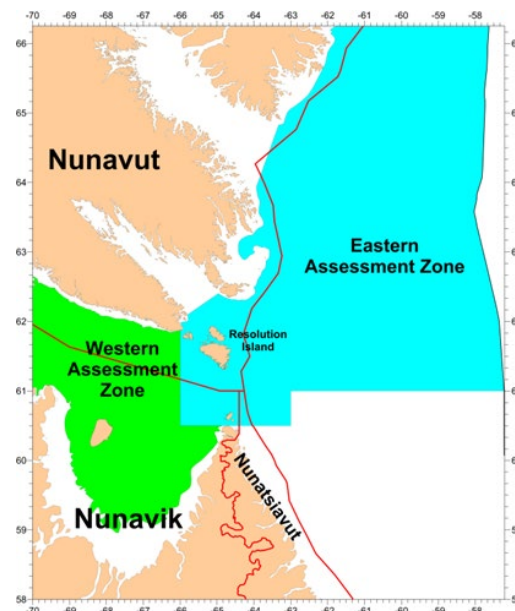


Figure 1. Eastern and Western Assessment Zones. Boundaries of the Nunavut, Nunavik and Nunatsiavut land claims areas are shown in red.

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 and Western Assessment Zones (EAZ and WAZ) were last fully assessed in 2021 (DFO 2021) with a stock status update in 2022 (DFO 2022). 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). Updates of Reference Points for the EAZ and establishment of new Reference Points for the WAZ took place in 2020 (DFO 2020).

A series of fishery-independent surveys and fishery data formed the basis of the current assessment.

This Science Advisory Report is from the February 15–16, 2023 regional peer review on the Stock Assessment of Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*P. montagui*) in the Eastern Assessment Zone and Western Assessment Zone for the 2023-24 fishing season. Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available.

SUMMARY

- The last full assessment was completed in 2021. This assessment has updated the stock status for *Pandalus borealis* and *P. montagui* in the Eastern Assessment Zone (EAZ) and Western Assessment Zone (WAZ), to incorporate survey and fishery data from the last two years. Limited predator-prey information, potential redfish competition, and oceanographic data were reviewed for additional ecosystem context.
- *Pandalus borealis* and *P. montagui* are distributed broadly over the Northwest Atlantic Ocean. The associated assessment areas, including the EAZ, WAZ and Shrimp Fishing Area 4 (SFA4), are connected through larval dispersal, but rates of exchange of adults are less understood. These linkages need to be considered to interpret fluctuations in biomass within and among assessment areas, even within the same year.
- The ocean climate in the NW Atlantic experiences fluctuations at decadal time scales, with potential impacts on availability of optimal Pandalid habitat and/or predator-prey interactions in the EAZ/WAZ. In 2022, bottom temperatures in the EAZ were lower than the 2006–2021 average for the first time since 2017, but they remained relatively high in the WAZ after the record high in 2021.
- The emergence of a large biomass of juvenile redfish in the EAZ over the last three years may have indirect (competition) and/or direct (future predation) impacts on the shrimp population. The magnitude and duration of these impacts are unknown.
- In both the EAZ and WAZ the stocks are currently assessed relative to established Limit Reference Points (LRPs) and previously proposed Upper Stock Reference points (USRs) in accordance with DFOs Precautionary Approach (PA) Framework.

Eastern Assessment Zone – *Pandalus borealis*

- Total catch varied without trend around 6,000 t from 1997 through 2022/23. Catch statistics in 2022/23 are preliminary.
- The fishable biomass index in 2022 declined to the lowest value in the time series (36,911 t). This was below both the long term mean (2009–2021; 63,642 t) and reference period mean (2009–2019; 62,849 t).
- The female spawning stock biomass index (SSB) in 2022 declined to the lowest value in the time series (23,771 t). This was below both the long term mean (2009–2021; 40,374 t) and reference period mean (2009–2019; 39,459 t).
- Both the reported and potential exploitation rates were the highest in the time series. The reported exploitation rate index for 2022/23 was 19.4% with 67% of the Total Allowable Catch (TAC) taken. Should the entire 2022/23 TAC of 10,732 t be taken, the potential exploitation rate index would be 29.1%.
- *Pandalus borealis* stock in the EAZ is currently above the established LRP (15,800 t), but below the proposed USR. Based on the proposed USR of 31,600 t, this would place the stock in the Cautious zone with a 98.3% probability.

Eastern Assessment Zone – *Pandalus montagui*

- Total catch in 2022/23 was 1,419 t, 101.4% of the 1,400 t TAC. Catch statistics in 2022/23 are preliminary.

- The fishable biomass index in 2022 was 14,325 t. This was above both the long term mean (2009–2021; 12,397 t) and reference period mean (2009–2019; 11,715 t).
- The female spawning stock biomass index (SSB) in 2022 was 10,428 t, above both the long term mean (2009–2021; 8,267 t) and reference period mean (2009–2019; 7,644 t).
- The reported exploitation rate index for 2022/23 was 9.9% with 101.4% of the TAC taken.
- *Pandalus montagui* stock in the EAZ is currently well above the established LRP (3,100 t) and the proposed USR (6,100 t). This would place the stock in the Healthy zone with a 93.1% probability.

Western Assessment Zone – *Pandalus borealis*

- Total catch in 2022/23 was 318 t, which is 8.0% of the 3,958 t TAC. Catch statistics in 2022/23 are preliminary.
- The fishable biomass index in 2022 was 23,939 t. This was above the long term mean (2014–2021; 19,994 t) and reference period mean (2014–2019; 18,223 t).
- The female SSB index in 2022 was 15,899 t, above both the long term mean (2014–2021; 11,402 t) and reference period mean (2014–2019; 10,243 t).
- The reported exploitation rate index for 2022/23 was 1.3% with 8.0% of the TAC taken. Should the entire 2022/23 TAC of 3,958 t be taken, the potential exploitation rate index would be 16.5%.
- *Pandalus borealis* stock in the WAZ is currently well above the established LRP (4,100 t) and the proposed USR (8,200 t). This would place the stock in the Healthy zone with a 98.8% probability.

Western Assessment Zone – *Pandalus montagui*

- Total catch in 2022/23 was 11,195 t, which is 92.6% of the 12,096 t TAC. Catch statistics in 2022/23 are preliminary.
- The fishable biomass index in 2022 was 104,737 t and was the highest in the time series. This is well above the long term mean (2014–2021; 56,440 t) and reference period mean (2014–2019; 56,079 t).
- The female SSB index in 2022 was 61,058 t, above both the long term mean (2014–2021; 30,937 t) and reference period mean (2014–2019; 30,698 t).
- The reported exploitation rate index for 2022/23 was 10.7% with 92.6% of the TAC taken. Should the entire 2022/23 TAC of 12,096 t be taken, the potential exploitation rate index would be 11.5%.
- *Pandalus montagui* stock in the WAZ is currently well above the established LRP (12,300 t) and the proposed USR (24,600 t). This would place the stock in the Healthy zone with a > 99.9% probability.

BACKGROUND

This document provides an overview of the assessment for *P. borealis* and *P. montagui* in the Eastern (EAZ) and Western (WAZ) Assessment Zones (Figure 1). The two species have overlapping distributions, particularly in the Resolution Island area, resulting in an overlap of

their fisheries. The assessment follows the framework established by DFO (2007); catch data from scientific surveys is spatially expanded to produce an abundance index for the fishable (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 fishable biomass, 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. in prep.¹). Stock updates were last provided in 2022 (DFO 2022) and the last full assessment was conducted in 2021 (DFO 2021). Since the last full assessment, new data from the 2021 and 2022 Northern Shrimp Research Foundation (NSRF) surveys of the EAZ and WAZ are included.

Fisheries in the Eastern and Western Assessment Zones are managed pursuant to an Integrated Fisheries Management Plan (2018). Reference points aligned with DFO's Precautionary Approach Framework (DFO 2009) were set for the EAZ in 2009, but later updated when more survey data was available (DFO 2020). For both species of shrimp in the EAZ, the Limit Reference Point (LRP) was set at 40% of the geometric mean of the SSB for 2009–2019; 15,800 t for *P. borealis* and 3,100 t for *P. montagui*. The Upper Stock Reference (USR) was proposed by Science at 80% of the geometric mean of the SSB (2009–2019); 31,600 t for *P. borealis* and 6,100 t for *P. montagui*. Reference Points for the WAZ were developed in 2012, however, they were not implemented because 2014 was the start of a new survey time series. In 2020, new Reference Points were developed for the WAZ using the same proxies as for the EAZ and a time series covering 2014–2019 (DFO 2020) (LRP = 4,100 t for *P. borealis* and 12,300 t for *P. montagui*; proposed USR = 8,200 t for *P. borealis* and 24,600 t for *P. montagui*). Reference period mean values used in this assessment correspond to 2009–2019 and 2014–2019 period in the EAZ and WAZ, respectively.

In addition to an index of abundance from the scientific survey, fishery data are used to determine the observed and potential exploitation rate indices. Observed (reported) exploitation rates are calculated as catch from the reporting records (Atlantic Quota Management System; AQMS) divided by the fishable biomass index from the same year. Potential exploitation rates assume the entire quota was removed. The total removal, both directed catch and reported by-catch, of each species is considered in the assessment.

ASSESSMENT

The fishery catch, biomass indices, exploitation rate indices and current outlook using the precautionary approach are presented below for each species and assessment area. Although not quantified, other linkages need to be considered to interpret fluctuations in biomass within and among assessment areas, even within the same year. *Pandalus borealis* and *P. montagui* are distributed broadly over the Northwest Atlantic Ocean. The associated assessment areas, including the EAZ, WAZ and Shrimp Fishing Area 4 (SFA4), are connected through larval dispersal, but rates of exchange of adults are less understood.

¹ Fulton, S., Walkusz, W., Atchison, S., and Cyr, F. In preparation. Information to support the 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. Res. Doc.

Eastern Assessment Zone – *P. borealis*

Fishery

Catch has varied without trend around 6,000 t from 1997 through 2022/23 (Figure 2b, Table 1). The total reported catch for 2022/23, based on the AQMS, as of January 20, 2023, was 7,145 t, 66.6% of the 10,732 t TAC.

Biomass

The fishable biomass index in 2022 declined to the lowest value in the time series (36,911 t; Figure 2a, Table 2). This was below both the long term mean (2009–2021; 63,642 t) and reference period mean (2009–2019; 62,849 t). The female spawning stock biomass index (SSB) in 2022 also declined to the lowest value in the time series (23,771 t; Figure 2a, Table 2). This was below both the long term mean (2009–2021; 40,374 t) and reference period mean (2009–2019; 39,459 t).

Exploitation

Both the reported and potential exploitation rates were the highest in the time series. The reported exploitation rate index for 2022/23 was 19.4% with 66.6% of the Total Allowable Catch (TAC) taken (Figure 2c). Should the entire 2022/23 TAC of 10,732 t be taken the potential exploitation rate index would be 29.1%.

Current Outlook

The *P. borealis* stock in the EAZ is currently above the established LRP (15,800 t), but below the proposed USR (Figure 2d). Should the USR be established at the proposed level of 31,600 t suggested by Fisheries and Oceans Canada (DFO) Science sector (i.e., 80% of the geometric mean of the SSB index; DFO 2020), this would place the stock in the Cautious zone of the PA Framework with a 98.3% probability.

Eastern Assessment Zone – *P. montagui*

Fishery

Total catch in 2022/23 was 1,419 t, 101.4% of the 1,400 t TAC (Figure 3b, Table 1). Catch statistics in 2022/23 are preliminary and based on the AQMS data as of January 20, 2023.

Biomass

The fishable biomass index in 2022 was 14,325 t (Figure 3a, Table 3). This was above both the long term mean (2009–2021; 12,397 t) and reference period mean (2009–2019; 11,715 t). The female spawning stock biomass index in 2022 was 10,428 t, above both the long term mean (2009–2021; 8,267 t) and reference period mean (2009–2019; 7,644 t).

Exploitation

The reported exploitation rate index for 2022/23 was 9.9% with 101.4% of the TAC taken (Figure 3c).

Current Outlook

The *P. montagui* stock in the EAZ is currently well above the established LRP (3,100 t) and the proposed USR (6,100 t; Figure 3d). Should the USR be established at the Science Sector proposed level of 6,100 (i.e., 80% of the geometric mean of the SSB; DFO 2020), the stock in 2022 would be placed well in the Healthy zone of the PA Framework with a 93.1% probability.

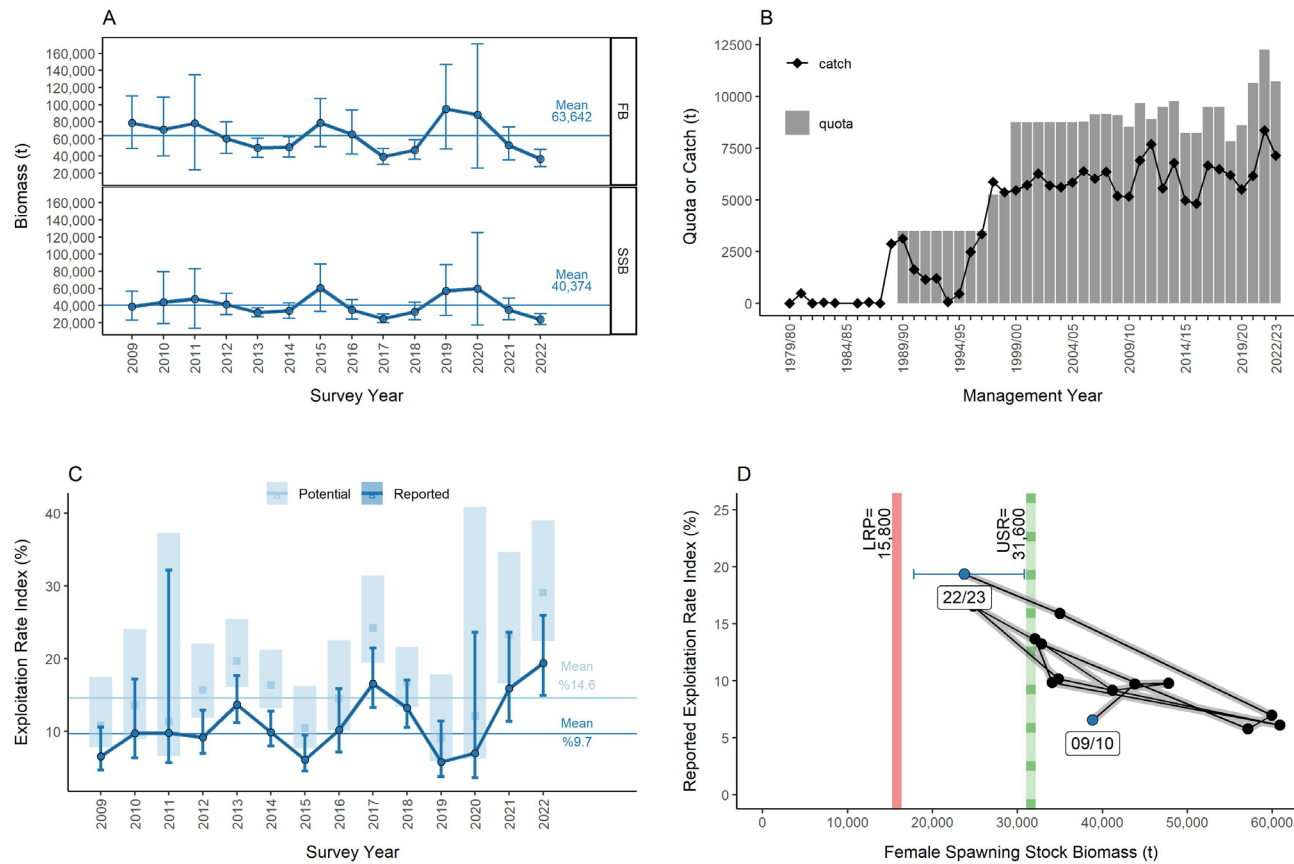


Figure 2. *Pandalus borealis* in the Eastern Assessment Zone: A: Fishable (FB, top) and female spawning stock biomass (SSB; bottom) indices for the survey years 2009–2022. Error bars are bootstrapped 95% confidence range and horizontal lines are long term (2009–2021) geometric means; B: Total Allowable Catch (grey bars) and reported catch from DFO harvest records (black line). Harvest records may be incomplete for 2022/23 (data as of January 20, 2023); C: Exploitation rate indices for management years 2009/10–2022/23 at the reported rate based on the total catch (blue line) and at the potential rate if the TAC was fully harvested (blue shading). Error bars based on bootstrapped 95% confidence ranges of the fishable biomass and lines are long term (2009–2021) geometric means; D: Female spawning stock biomass and reported exploitation rate in reference to Limit Reference Points (LRPs) calculated using the proxy developed in DFO (2020). Dashed green line indicates the proposed Upper Stock Reference (USR) and the solid red line indicates the LRP, each referring to the 80% and 40%, respectively, of the geometric mean of the female spawning stock biomass indices from the 2009–2019 surveys. Since the USR has not been formally accepted, final location of the dashed line is yet to be determined.

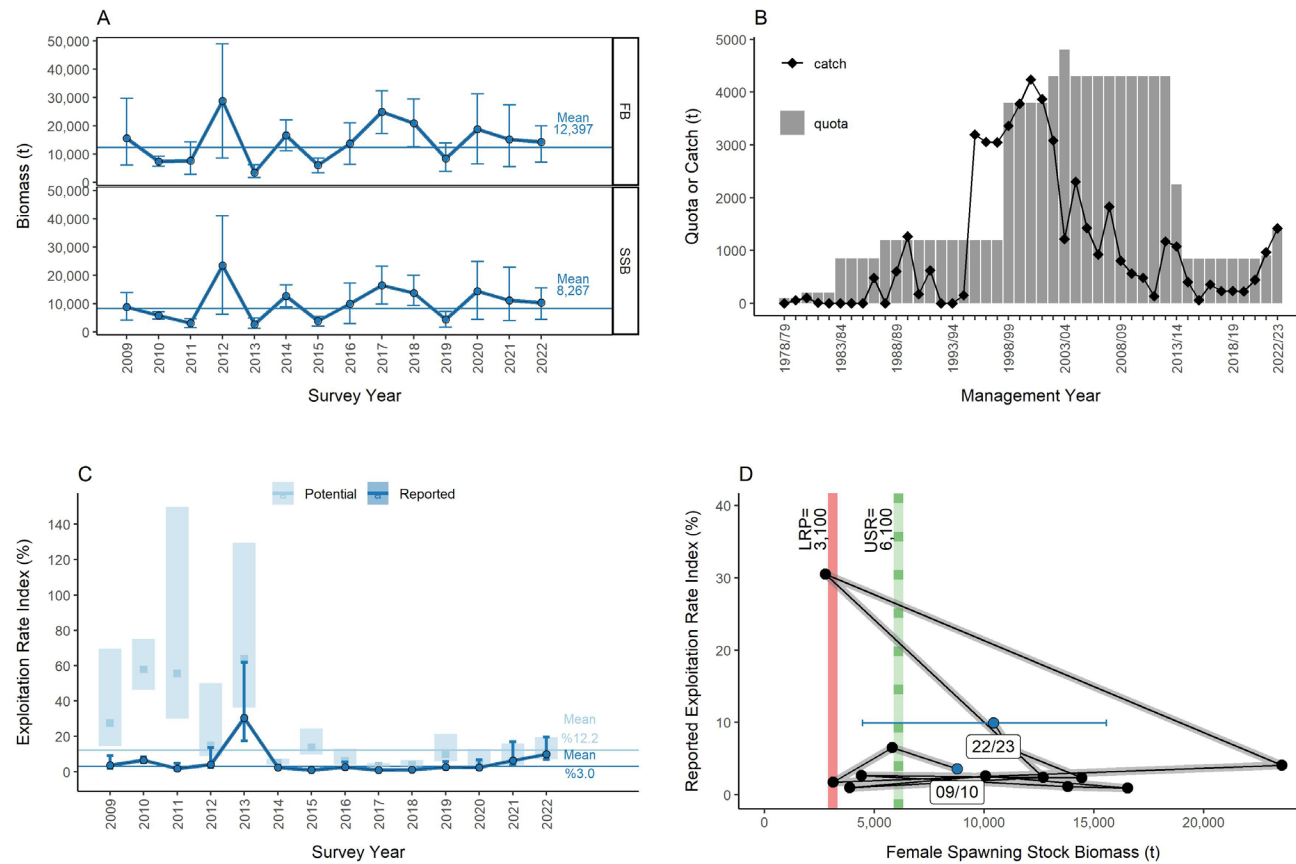


Figure 3. *Pandalus montagui* in the Eastern Assessment Zone. A: Fishable (FB, top) and female spawning stock biomass (SSB; bottom) indices for the survey years 2009–2022. Error bars are bootstrapped 95% confidence range and horizontal lines are long term (2009–2021) geometric means; B: Total Allowable Catch (grey bars) and reported catch from DFO harvest records (black line). Harvest records may be incomplete for 2022/23 (data as of January 20, 2023); C: Exploitation rate indices for management years 2009/10–2022/23 at the reported rate based on the total catch (blue line) and at the potential rate if the TAC was fully harvested (blue shading). Error bars based on bootstrapped 95% confidence ranges of the fishable biomass and lines are long term (2009–2021) geometric means; D: Female spawning stock biomass and reported exploitation rate in reference to Limit Reference Points (LRPs) calculated using the proxy developed in DFO (2020). Dashed green line indicates the proposed Upper Stock Reference (USR) and the solid red line indicates the LRP, each referring to the 80% and 40%, respectively, of the geometric mean of the female spawning stock biomass indices from the 2009–2019 surveys. Since the USR has not been formally accepted, final location of the dashed line is yet to be determined.

Western Assessment Zone – *P. borealis*

Fishery

Total catch in 2022/23 was 318 t, which is 8.0% of the 3,958 t TAC (Figure 4b, Table 1). Catch statistics in 2022/23 are based on the AQMS, as of January 20, 2023.

Biomass

Due to a change in survey methodology, the 2014 survey began a new time series. Thus, the 2022 survey was the ninth survey in the new time series. Since the start of the new series both the fishable biomass and SSB indices varied without a trend. The fishable biomass index in 2022 was 23,939 t (Figure 4a, Table 4). This was above the long term mean (2014–2021; 19,994 t) and reference period mean (2014–2019; 18,223 t). The female SSB index in 2022 was 15,899 t, above both the long term mean (2014–2021; 11,402 t) and reference period mean (2014–2019; 10,243 t).

Exploitation

The reported exploitation rate index for 2022/23 was 1.3% with 8.0% of the TAC taken (Figure 4c). Should the entire 2022/23 TAC of 3,958 t be taken, the potential exploitation rate index would be 16.5% (Figure 4c).

Current Outlook

The *P. borealis* stock in the WAZ is currently well above the established LRP (4,100 t) and the proposed USR (8,200 t; Figure 4d). Should the USR be established at the proposed level (i.e., 80% of the geometric mean of the SSB index; DFO 2020), this would place the stock in the Healthy zone of the PA Framework with a 98.8% probability.

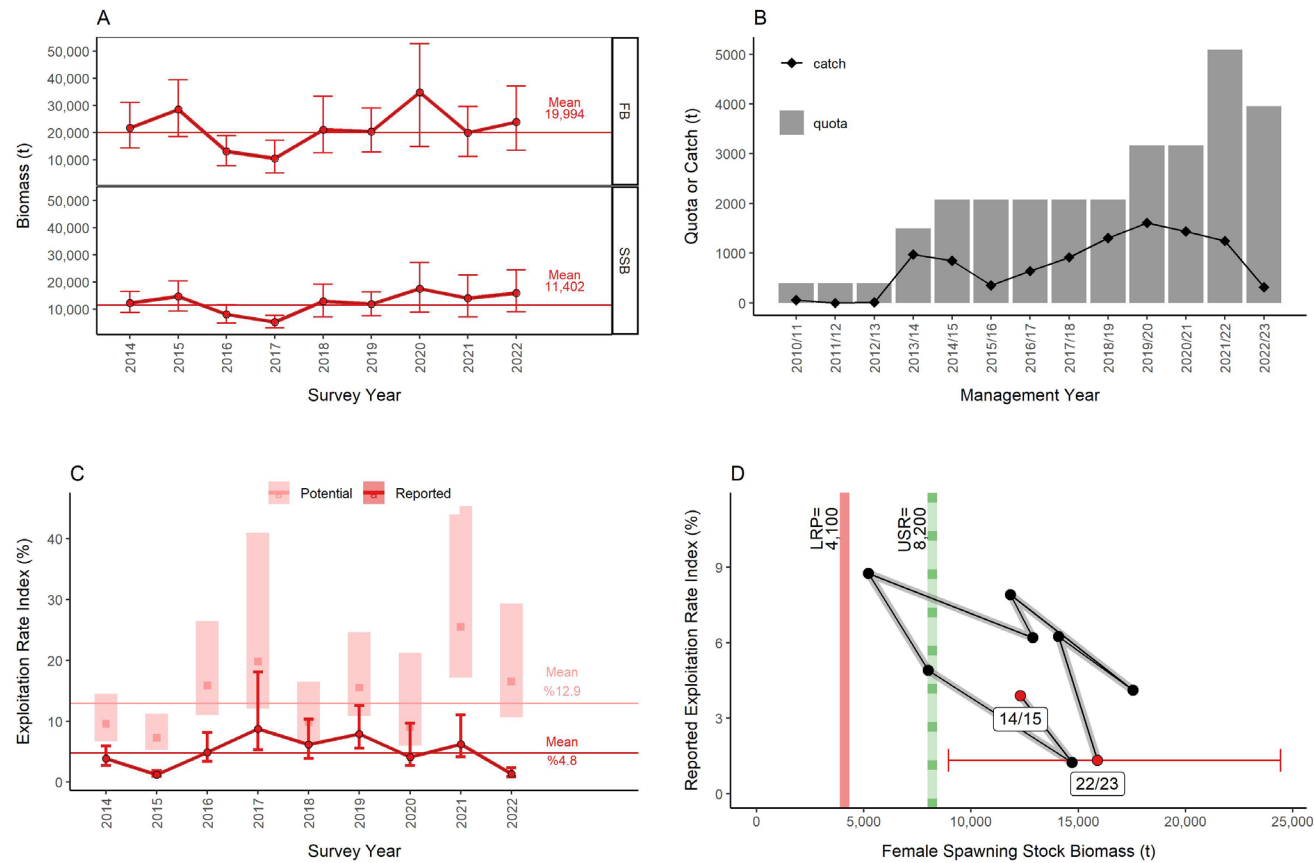


Figure 4. *Pandalus borealis* in the Western Assessment Zone. A: Fishable (FB, top) and female spawning stock biomass (SSB; bottom) indices for the survey years 2014–2022. Error bars are bootstrapped 95% confidence range and horizontal lines are long term (2014–2021) geometric means; B: Total Allowable Catch (grey bars) and reported catch from DFO harvest records (black line). Harvest records may be incomplete for 2022/23 (data as of January 20, 2023); C: Exploitation rate indices for management years 2010/11–2022/23 at the reported rate based on the total catch (red line) and at the potential rate if the TAC was fully harvested (red shading). Error bars based on bootstrapped 95% confidence ranges of the fishable biomass and lines are long term (2014–2021) geometric means; D: Female spawning stock biomass and reported exploitation rate in reference to Limit Reference Points (LRPs) calculated using the proxy developed in DFO (2020). Dashed green line indicates the proposed Upper Stock Reference (USR) and the solid red line indicates the LRP, each referring to the 80% and 40%, respectively, of the geometric mean of the female spawning stock biomass indices from the 2014–2019 surveys. Since the USR has not been formally accepted, final location of the dashed line is yet to be determined.

Western Assessment Zone – *P. montagui*

Fishery

Total catch in 2022/23 was 11,195 t, which is 92.6% of the 12,096 t TAC and the highest reported catch in the time series (Figure 5b, Table 1). Catch statistics in 2022/23 are based on the AQMS, as of January 20, 2023.

Biomass

Due to a change in survey methodology, the 2014 survey began a new time series. Thus, the 2022 survey was the ninth survey in the new time series. Since the start of the new series, the fishable biomass and SSB indices varied without trend. The fishable biomass index in 2022 was 104,737 t and was the highest in the time series (Figure 5a, Table 5). This is well above the long term mean (2014–2021; 56,440 t) and reference period mean (2014–2019; 56,079 t). The female SSB index in 2022 was 61,058 t, above both the long term mean (2014–2021; 30,937 t) and reference period mean (2014–2019; 30,698 t).

Exploitation

The reported exploitation rate index for 2022/23 was 10.7% with 92.6% of the TAC taken (Figure 5c). Should the entire 2022/23 TAC of 12,096 t be taken, the potential exploitation rate index would be 11.5%.

Current Outlook

The *P. montagui* stock in the WAZ is currently well above the established LRP (12,300 t) and the proposed USR (24,600 t; Figure 5d). Should the USR be established at the proposed level (i.e., 80% of the geometric mean of the SSB index; DFO 2020), the stock in 2022 would be placed within the Healthy zone of the PA Framework with a > 99.9% probability.

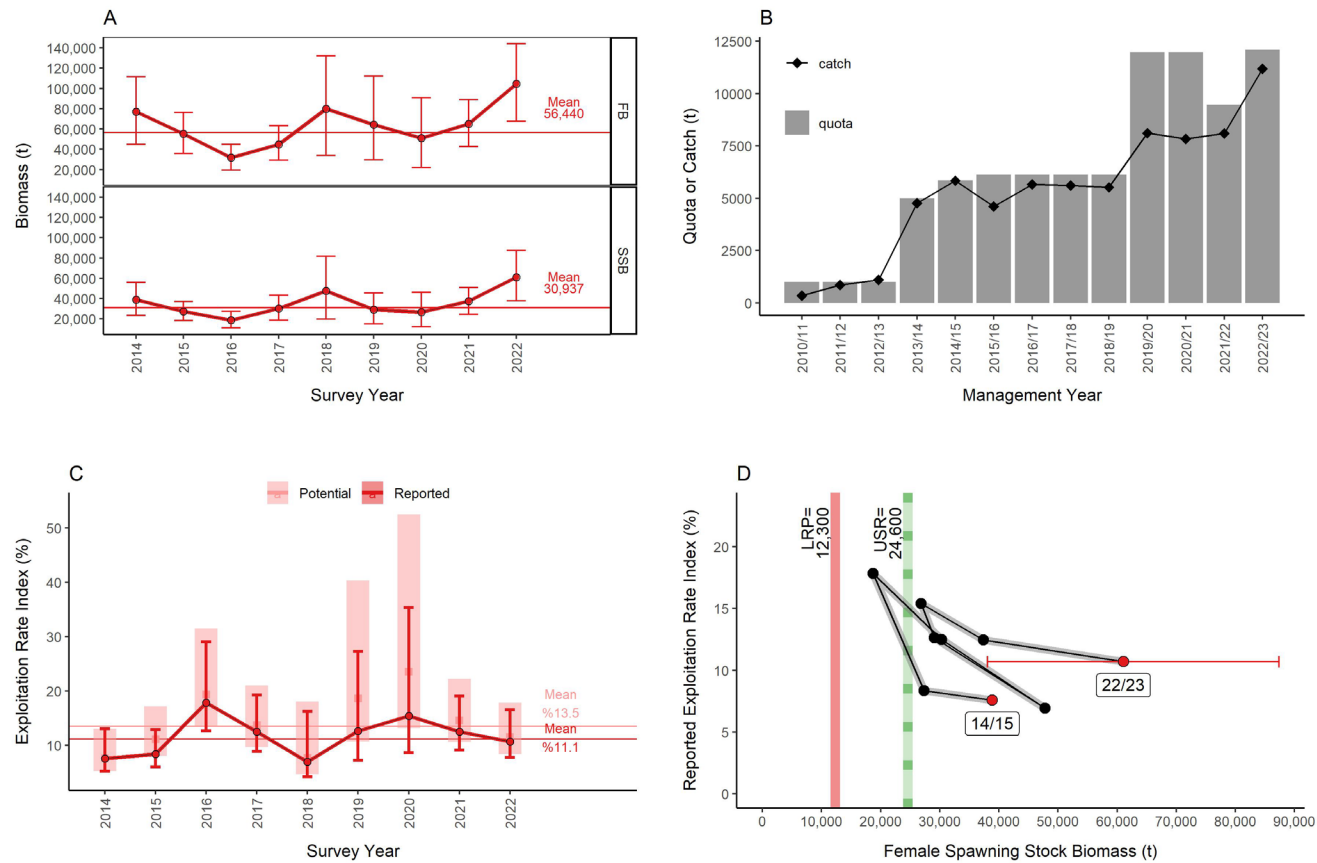


Figure 5. *Pandalus montagui* in the Western Assessment Zone. A: Fishable (FB, top) and female spawning stock biomass (SSB; bottom) indices for the survey years 2014–2022. Error bars are bootstrapped 95% confidence range and horizontal lines are long term (2014–2021) geometric means; B: Total Allowable Catch (grey bars) and reported catch from DFO harvest records (black line). Harvest records may be incomplete for 2022/23 (data as of January 20, 2023); C: Exploitation rate indices for management years 2010/11–2022/23 at the reported rate based on the total catch (red line) and at the potential rate if the TAC was fully harvested (red shading). Error bars based on bootstrapped 95% confidence ranges of the fishable biomass and lines are long term (2014–2021) geometric means; D: Female spawning stock biomass and reported exploitation rate in reference to Limit Reference Points (LRPs) calculated using the proxy developed in DFO (2020). Dashed green line indicates the proposed Upper Stock Reference (USR) and the solid red line indicates the LRP, each referring to the 80% and 40%, respectively, of the geometric mean of the female spawning stock biomass indices from the 2014–2019 surveys. Since the USR has not been formally accepted, final location of the dashed line is yet to be determined.

Ancillary Ecosystem Information

It is believed that the available shrimp habitat is shaped, to a great extent, by the oceanographic conditions present in the area. The ocean climate in the NW Atlantic experiences fluctuations at decadal time scales, with potential impacts on availability of optimal Pandalid habitat and/or predator-prey interactions in the EAZ/WAZ. In 2022, bottom temperatures in the EAZ were lower than the 2006–2021 average for the first time since 2017, while in the WAZ, they remained higher than the average after the record high observed in 2021. Additionally, other drivers of stock variability are poorly understood and research is needed on foraging (e.g., water column productivity estimates), predation (e.g., gut contents of shrimp predators), and ecosystem tracers (e.g., stable isotopes and fatty acids to connect various food chain elements). The emergence of a large biomass of juvenile redfish in the EAZ over the last three years has been identified as one such driver that may have indirect (competition) and/or direct (future predation) impacts on the shrimp population. The magnitude and duration of these impacts are currently not known. Quantification of *P. montagui* and *P. borealis* as a prey species in the EAZ and WAZ is ongoing. A qualitative overview of gut data from six predator taxa collected between 2018 and 2021 provided a preliminary look at potential trends in predator size and species that may consume higher proportions of Pandalid shrimp. This information can be used to inform ongoing data collection in order to target specific questions instead of the current exploratory approach.

Sources of Uncertainty

Due to challenges with vessel logistics, the number of stations sampled in the 2022 NSRF survey was reduced. A reduction in number of sets fished occurred in the WAZ. Although the minimum of two sets per strata was achieved, the reduction of samples in areas of high variability impacts the characterization of sample variance and resulting confidence intervals.

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 SFA4 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 and 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.

Research Recommendations

- Re-calculate *P. borealis* and *P. montagui* total biomass for the entire study area by combining EAZ/WAZ/SFA4 to investigate the difference in biomass index confidence intervals when the index is computed as separate zones vs. over the entire area;
- Investigate *P. montagui* and *P. borealis* total biomass time series for potential relationships between assessment areas (EAZ/WAZ/SFA4) for evidence of local scale biomass export/import between the zones over time;
- Continue to investigate potential predator-prey dynamics by continuing collection of samples in 2023, processing existing samples (from 2020–2022), analyzing existing data sets (from 2018–2021), and publishing compiled data (from 2019/20);
- Quantify juvenile redfish impact on shrimp stock through estimates of redfish biomass, their feeding preferences, and their role in the food web;
- Continue to collect ancillary environmental data (Project funding obtained, moorings deployed in summer 2022, and data retrieval set for summer 2023).

CONCLUSIONS AND ADVICE

Eastern Assessment Zone – *P. borealis*

The *P. borealis* stock in the EAZ is currently above the established LRP (15,800 t), but below the proposed USR. Based on the proposed USR of 31,600 t, this would place the stock in the Cautious zone with a 98.3% probability. Should the entire 2022/23 TAC of 10,732 t be taken the potential exploitation rate index would be 29.1%.

Eastern Assessment Zone – *P. montagui*

The *P. montagui* stock in the EAZ is currently well above the established LRP (3,100 t) and the proposed USR (6,100 t). This would place the stock in the Healthy zone with a 93.1% probability. Based on the 2022/23 TAC of 1,400 t, the exploitation rate index was 9.9% with 101.4% of the TAC taken.

Western Assessment Zone – *P. borealis*

The *P. borealis* stock in the WAZ is currently well above the established LRP (4,100 t) and the proposed USR (8,200 t). This would place the stock in the Healthy zone with a 98.8% probability. Should the entire 2022/23 TAC of 3,958 t be taken the potential exploitation rate index would be 16.5%.

Western Assessment Zone – *P. montagui*

The *P. montagui* stock in the WAZ is currently well above the established LRP (12,300 t) and the proposed USR (24,600 t). This would place the stock in the Healthy zone with a > 99.9% probability. Should the entire 2022/23 TAC of 12,096 t be taken the potential exploitation rate index would be 11.5%.

OTHER CONSIDERATIONS

In general, management of key forage species, such as shrimp, under an ecosystem approach requires adoption of a conservative approach with lower fishing mortality reference points and

higher biomass reference points than those that would be adopted under a single species management approach. Management considerations should refer to the IFMP for Northern and Striped shrimp (DFO 2018) for options of exploitation rates.

The PA reference points for *P. borealis* and *P. montagui* were updated in May 2020 (DFO 2020), providing the established LRPs and proposed USRs that are used in this report. It is important to note that the proposed USRs are still under consideration through the consultative process within the Northern Precautionary Approach Working Group (NPAWG) and will not be considered established until that process is complete.

LIST OF MEETING PARTICIPANTS

Name	Organization/Affiliation
Joclyn Paulic (Chair)	DFO Science, Ontario and Prairie Region
Kayla Gagliardi (Rapporteur)	DFO Science, Ontario and Prairie Region
Sheila Atchison	DFO Science, Ontario and Prairie Region
Samantha Fulton (Science Lead)	DFO Science, Ontario and Prairie Region
Wojciech Walkusz	DFO Science, Ontario and Prairie Region
Krista Baker	DFO Science, Newfoundland and Labrador Region
William Coffey	DFO Science, Newfoundland and Labrador Region
Fredrick Cyr	DFO Science, Newfoundland and Labrador Region
Nicolas Le Corre	DFO Science, Newfoundland and Labrador Region
Nicholas Duprey	DFO Science, National Capital Region
Mary Thiess	DFO Science, National Capital Region
Courtney D'Aoust	DFO Resource Management, National Capital Region
Christi Friesen	DFO Fisheries Management, Arctic Region
Tomas Schmidt (Written Review Only)	Marine Institute Memorial University of Newfoundland
Emma Corbett	Government of Newfoundland and Labrador
Alastair O'Reilly	Northern Coalition
Derek Butler	Nunavut Fisheries Association
Bruce Chapman	Canadian Association of Prawn Producers
Frankie Jean-Gagnon	Nunavik Marine Region Wildlife Board

SOURCES OF INFORMATION

This Science Advisory Report is from the February 15–16, 2023 regional peer review on the Stock Assessment of Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*P. montagui*) in the Eastern Assessment Zone and Western Assessment Zone for the 2023-24 fishing season. 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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MPO. 2023. *Évaluation des stocks de crevette nordique (Pandalus borealis) et de crevette ésope (Pandalus montagui) dans les zones d'évaluation est et ouest, février 2023. Secr. can. des avis sci. du MPO. Avis sci. 2023/013.*