Pêches et Océans Canada | Fisheries and Oceans Canada
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Quebec Region

Canadian Science Advisory Secretariat
Science Advisory Report 2025/029

ASSESSMENT OF THE ESTUARY AND NORTHERN GULF OF ST. LAWRENCE (AREAS 13–17, 12A, 12C AND 16A) SNOW CRAB (*CHIONOECETES OPILIO*) STOCKS IN 2024

CONTEXT

Advice was requested by Fisheries and Oceans Canada (DFO) Fisheries Management on the status of snow crab stocks in the Estuary and northern Gulf of St. Lawrence (areas 13–17, 12A, 12C and 16A). The resource is assessed annually to determine whether changes in its status justify altering the conservation approach and management plan.

This Science Advisory Report is from the regional peer review of February 11-13, 2025 on the Estuary and Northern Gulf of St. Lawrence (Areas 12A, 12C, 13, 14, 15, 16, 16A and 17) Snow Crab (*Chionoecetes opilio*) Stocks Assessment in 2024. 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

- In 2024, the combined index was below the historical average for areas 14, 16, 17 and 16A, similar to that for Area 12C, and above the historical average for areas 15 and 13.
- The lack of reference points for stocks in areas 13–17, 12C and 16A prevents assessment of their status under the Fishery Decision-making Framework Incorporating the Precautionary Approach.
- In Area 12A, biomass indicators placed the stock at the lower boundary of the cautious zone in 2024 according to the precautionary approach, following an extended period in the critical zone since 2014.

Trends

- Between 2023 and 2024, the combined index declined in areas 17 (-32%), 16 (-8%), 16A (- 38%) and 14 (-31%), remained stable in Area 12C (+2%), and increased in areas 13 (+11%) and 15 (+13%).
- In Area 12A, commercial biomass indicators under the precautionary approach increased significantly between 2023 and 2024, after remaining at consistently low values since 2014.

Ecosystem and Climate Change Considerations

- Over the past 15 years, warming waters have mainly led to a reduction in suitable thermal habitats for adults and juveniles in the westernmost areas, while habitat gains have been observed in the easternmost areas.

- Rising water temperatures could influence the distribution, productivity, growth and size-at-terminal moult of snow crab in Quebec's coastal waters. The impacts could vary significantly across fishing areas.

Stock Advice

- Snow crab abundance, which is cyclical in nature, appears to still be on the upswing in areas 12C, 13 and 15, with high recruit abundance observed in post-season surveys in 2024. In Area 13, residual abundance was high, especially in the portion along the north shore. These observations suggest that a proportional increase in removals in 2025, relative to the combined index, should not pose a risk to the resource in these areas in the short term.
- Following a decade in the critical zone, the stock in Area 12A reached the lower boundary of the cautious zone for the first time in 2024. Therefore, a conservative harvesting approach should be maintained in 2025.
- In Area 16, recruit abundance decreased in 2024, while residual abundance increased. The substantial rise in pre-recruits suggests that recruitment to the fishery could potentially increase over the medium term (≥ 2 years). However, the average size of commercial crabs declined to below the historical average. Until a stronger upturn in recruitment occurs, a conservative harvesting approach is recommended, based on the direction and strength of the combined index for 2025.
- The sharp decline in the combined index in areas 14, 17 and 16A suggests a substantial reduction in residual abundance and/or the abundance of recruits in the upcoming fishing season. These declines in commercial abundance, along with smaller average sizes of commercial crabs, indicate that removals should be significantly reduced in 2025 to alleviate fishing pressure.

BASIS FOR ASSESSMENT

Assessment Details

Year Assessment Approach was Approved

December 2014 for areas 13–17, 12C and 16A (DFO 2015) and December 2023 for Area 12A (DFO 2024, Loboda et al. in prep.[1])

Assessment Type

Full assessment

Most Recent Assessment Date

1. Last Full Assessment: February 14 to 16, 2024 (DFO 2024)
2. Last Interim-Year Update: N/A

[1] Loboda, S., Lévesque, I., and C. Juillet. In prep. Review of Biomass and Abundance Indices and Proposed Reference Points for Snow Crab (*Chionoecetes opilio*) in Area 12A. DFO Can. Sci. Advis. Sec. Res. Doc.

Stock Assessment Approach

1. Broad category: Index-based (trends in empirical indices only)
2. Specific category: Index-based (including fishery-dependent and fishery-independent indices)

Stock Structure Assumption

An analysis of fishing indicators and physical condition data suggests the potential presence of six biological production units in the Estuary and northern Gulf of St. Lawrence (Sainte-Marie et al. 2005). However, a genetic study of Atlantic stock structure revealed no spatial structure in the Atlantic as a whole (Puebla et al. 2008). Despite these findings, assessment units will continue to be aligned with the current fisheries management area boundaries.

Reference Points

	17	16	15	14	13	16A	12C	12A
Limit Reference Point (LRP)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2
Proposed Upper Stock Reference (USR) Point	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4
Removal Reference (RR)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Target Reference Point (TRP)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Data

- Commercial landings (1983–2024)
- Fishery logbooks (catch, effort, catch per unit effort and distribution of effort) (1984–2024)
- Abundance indices from post-season surveys using commercial traps (1994–2024)
- Abundance indices from DFO trawl surveys conducted in Sainte-Marguerite Bay (1989–2024), the Estuary and the Lower North Shore (1992–2024)
- At-sea and dockside sampling (carapace width and condition) (1996–2024)
- Bottom water temperatures recorded in the Atlantic Zone Monitoring Program (1990–2024)

ASSESSMENT

Stock status and trends in Area 17

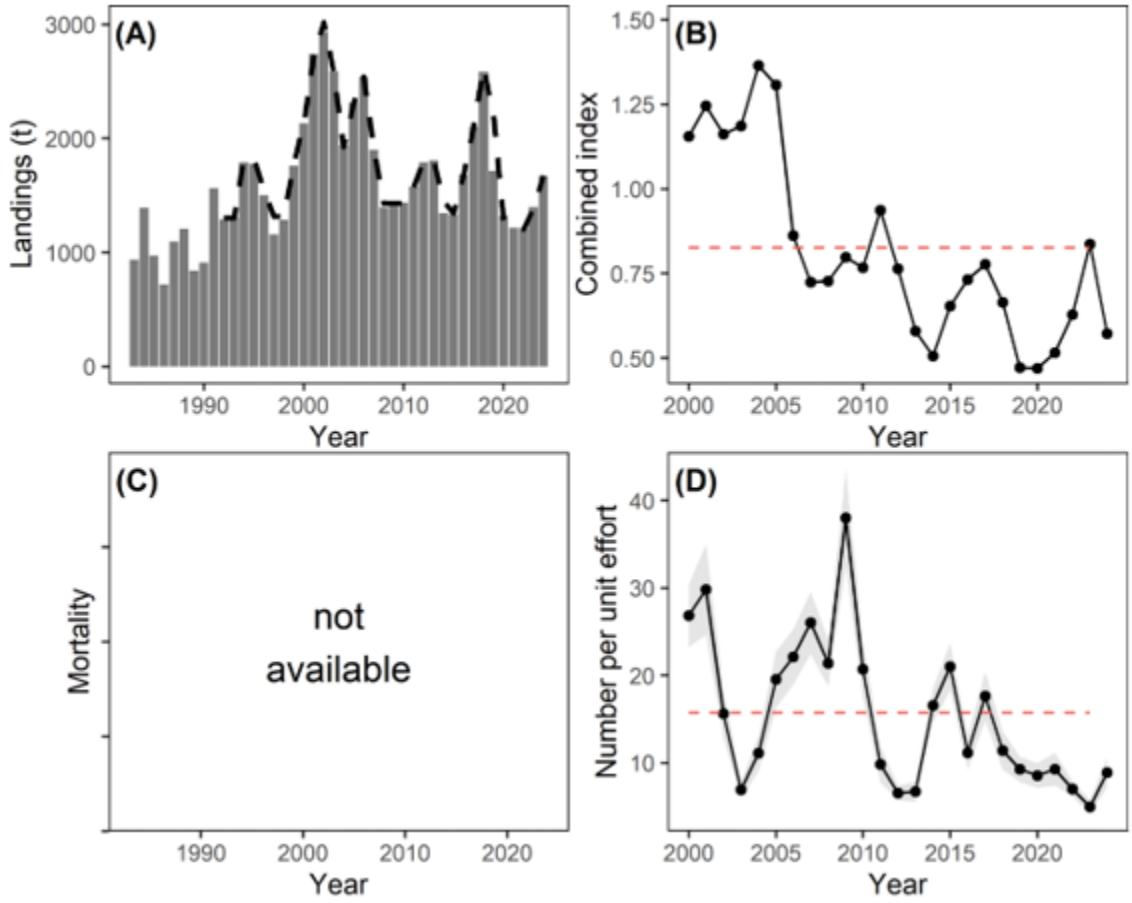

Figure 1. Area 17: (A) Landings (grey bars) and total allowable catch (TAC; black dotted line); (B) combined index and historical average (red dotted line); (C) fishing mortality (data not available); and (D) average number of pre-recruits per unit effort (+/- 95% confidence interval) based on post-season surveys, along with the historical average (red dotted line).

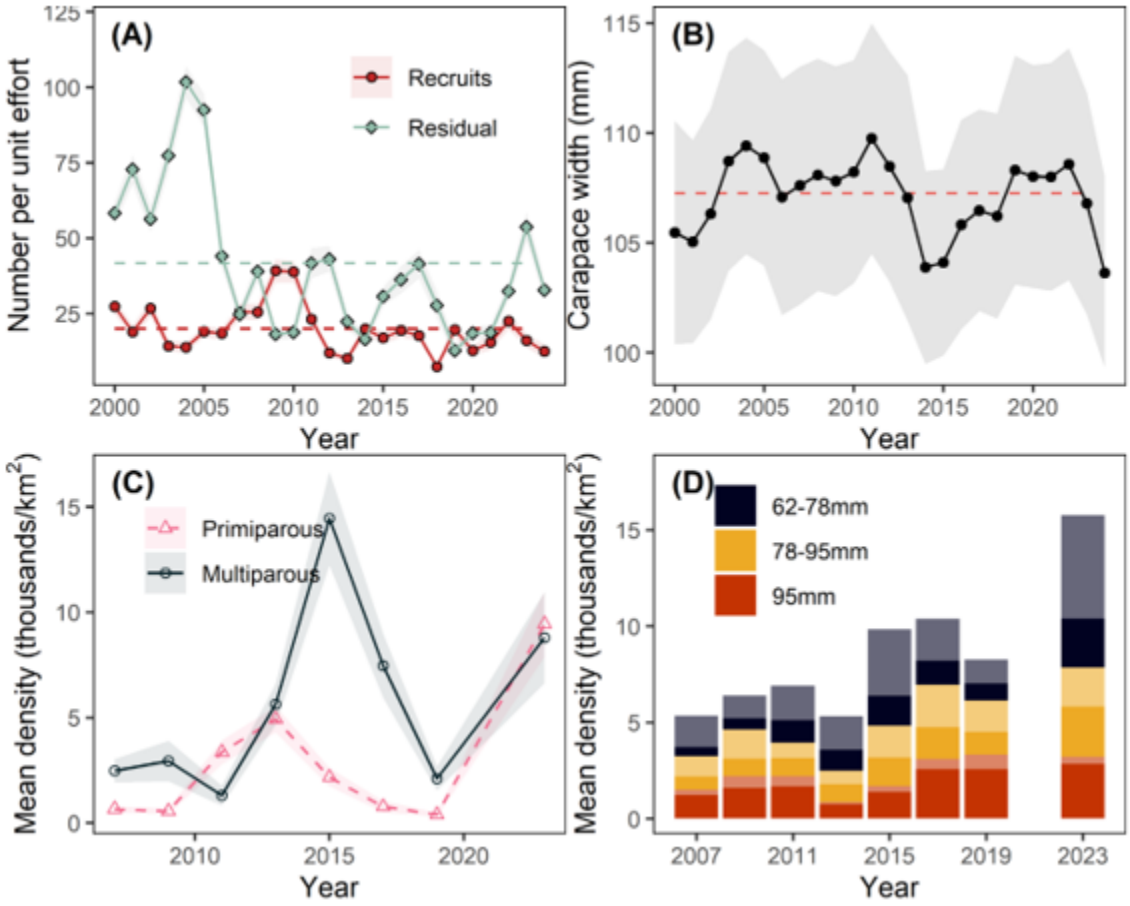

Figure 2. Area 17: (A) Average numbers per unit effort (+/- 95% confidence interval) for recruits (red) and residual abundance (green) estimated from post-season surveys with their corresponding historical averages (dotted line); (B) average width of legal-sized male crabs during the post-season survey (+/- standard deviation) and historical average (red dotted line); (C) densities (in thousands per km^2, annual average +/- standard deviation) of primiparous (pink dotted line) and multiparous (solid black line) females; and (D) densities of adult males (which have undergone their terminal moult; solid colour) and adolescents (lighter colour by size class) in the 62–78 mm (black), 78–95 mm (yellow) and over 95 mm (orange) size classes in DFO trawl surveys in the St. Lawrence Estuary.

Landings

After reaching a low point between 2021 and 2022, landings have been increasing since 2022. They rose further in 2024 (+20%), reaching 1,671 tonnes (t) (TAC: 1,674 t; Figure 1A).

Exploitable biomass index

After dropping to its lowest recorded value in 2020, the combined index increased until 2023 before declining again in 2024 (-32%) (Figure 1B). In 2024, the combined index remained below the historical average.

Recruitment

In 2024, the number of pre-recruits in the post-season survey increased by 79%, but levels remained very low and below the historical average (Figure 1D).

Abundance

According to the post-season survey, recruit abundance declined in 2024 (-23%) and is below the historical average (Figure 2A). The decrease was especially significant in the portion along the South Shore, whereas the portion along the North Shore exhibited an increase (Loboda et al. in prep[2]). Residual abundance also trended downward (-39%) and is below the historical average (Figure 2A). The densities of primiparous and multiparous females obtained in the 2023 trawl survey in the Estuary were significantly higher than in 2019 (Figure 2C). However, the abundance of primiparous females declined in 2024, according to the post-season survey results (Loboda et al. in prep[2]). A high abundance of adolescents measuring 62–78 mm observed in the 2023 trawl survey suggests potential for increased recruitment to the fishery beginning in 2026 (Figure 2D). Nevertheless, recruitment levels remain uncertain given the high proportion of sublegal-sized male crabs undergoing their terminal moult.

Average size of commercial crabs

Between 2019 and 2022, the average width of legal-sized crabs exceeded the historical average, but by 2024 had declined to the lowest value in the series (Figure 2B). Since the average size of commercial-sized crabs is below historical average, a given weight of removals corresponds to a larger number of individuals.

Current status

The sharp decline in the combined index reflects a steep decrease in recruits and residual abundance in the upcoming season. The decline in commercial abundance was accompanied by a decrease in the average size of commercial crabs. These observations suggest that removals should be significantly reduced in 2025 to alleviate fishing pressure.

[2] Loboda, S. Cervello, G., and I. Lévesque. In prep. Status of Snow Crab (*Chionoecetes opilio*) Stocks in the Estuary and Northern Gulf of St. Lawrence (Areas 13–17, 12A, 12B, 12C and 16A) in 2024. DFO Can. Sci. Advis. Sec. Res. Doc.

Stock status and trends in Area 16

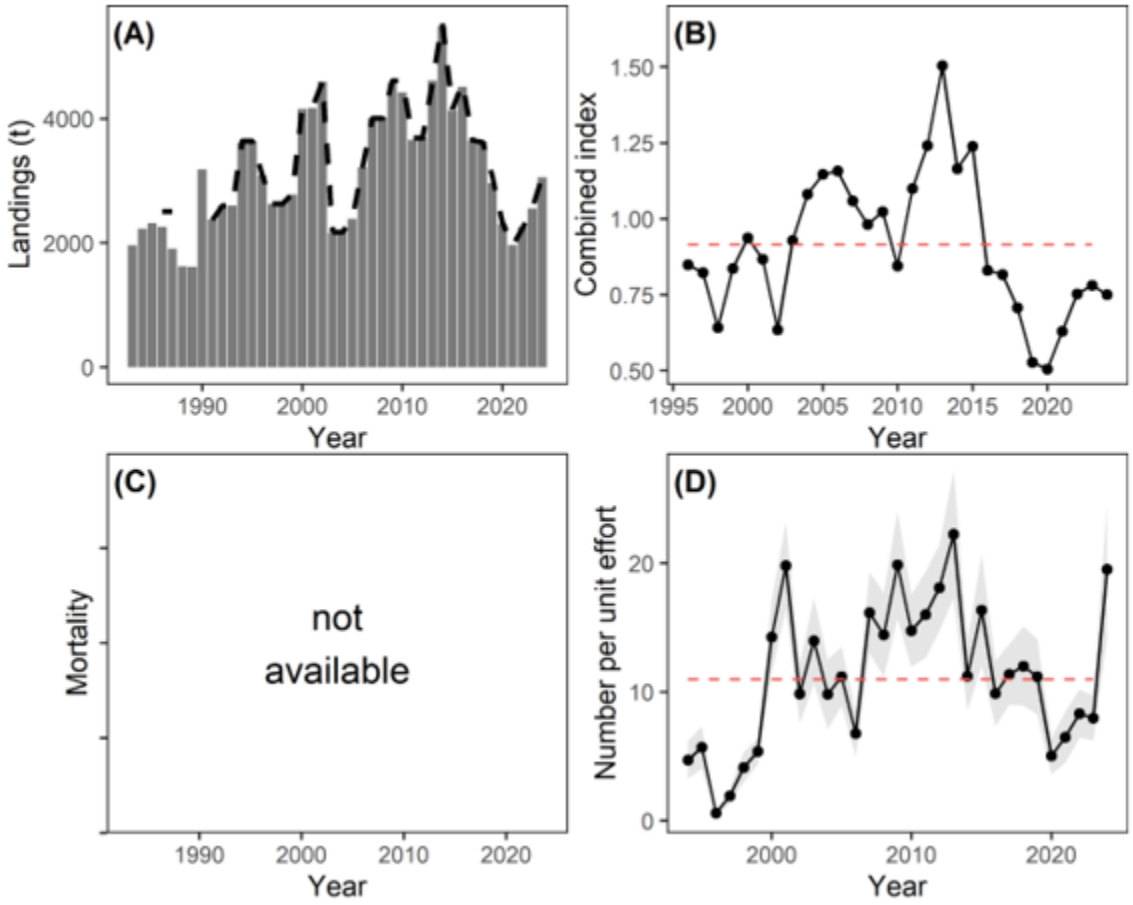

Figure 3. Area 16: (A) Landings (grey bars) and total allowable catch (TAC; black dotted line); (B) combined index and historical average (red dotted line); (C) fishing mortality (data not available); and (D) average number of pre-recruits per unit effort (+/- 95% confidence interval) based on post-season surveys and historical average (red dotted line).

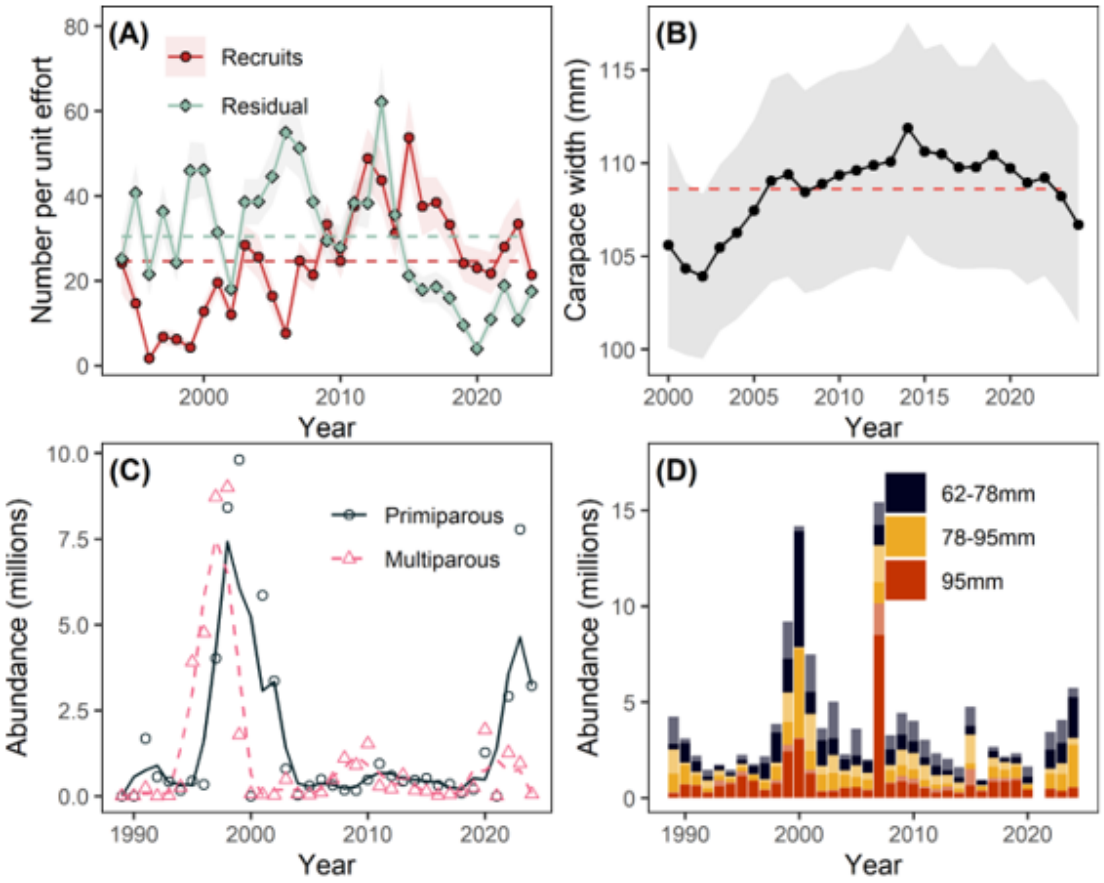

Figure 4. Area 16: (A) Number of recruits (red) per unit effort and residual abundance (green; +/- 95% confidence interval) estimated from post-season surveys and their corresponding historical averages (dotted line); (B) average width (+/- standard deviation) of legal-sized male crabs measured during the post-season survey and historical average (red dotted line); (C) abundance of (in millions, shown as a three-year moving average (line), and raw data (points) for, primiparous (pink dotted line) and multiparous (solid black line) females; and (D) densities of adult males (which have undergone their terminal moult; solid colour) and adolescents (lighter colour by size class) in the 62–78 mm (black), 78–95 mm (yellow) and over 95 mm (orange) size classes in the DFO trawl survey in Sainte-Marguerite Bay, near Sept-Îles.

Landings

After record landings of 5,481 t in 2014, landings declined until 2021 to 1,963 t (Figure 3A). Since then, they have gradually increased, reaching 3,052 t in 2024, which is close to the TAC, set at 3,068 t.

Exploitable biomass index

The combined index, which reached its lowest value in 2020, subsequently increased until 2023. It declined by 8% in 2024 (Figure 3B) and is below the historical average.

Recruitment

The number of pre-recruits increased sharply in 2024 (+145%), to among the highest values in the time series (Figure 3D). This suggests that recruitment to the fishery could increase in the medium term (≥ 2 years). However, recruitment levels remain uncertain, owing to the high proportion of male crabs undergoing their terminal moult before reaching legal size.

Abundance

Following two consecutive years of increases, the abundance index for recruits derived from the post-season survey declined sharply in 2024 (-36%) to below the historical average (Figure 4A). Residual abundance is increasing (+63%), but still lags behind the historical average. According to the DFO trawl survey in Sainte-Marguerite Bay, the density of multiparous females decreased in 2024 after peaking in 2023 (Figure 4C). The density of primiparous females has been declining for several years, indicating the end of a previous pulse of mature females.

Average size of commercial crabs

The average width of legal-sized adult males decreased for the second year in a row and remains below the historical average (Figure 4B). Since the average size of commercial-sized crabs is below historical average, a given weight of removals corresponds to a larger number of individuals.

Current status

Recruit abundance declined in 2024, while residual abundance increased. The significant rise in pre-recruits suggests a potential medium-term (≥ 2 years) increase in recruitment to the fishery. However, the average size of commercial crabs has decreased, and remains below the historical average. Until a stronger upturn in recruitment occurs, a conservative harvesting approach is recommended, based on the direction and strength of the combined index for 2025.

Stock status and trends in Area 15

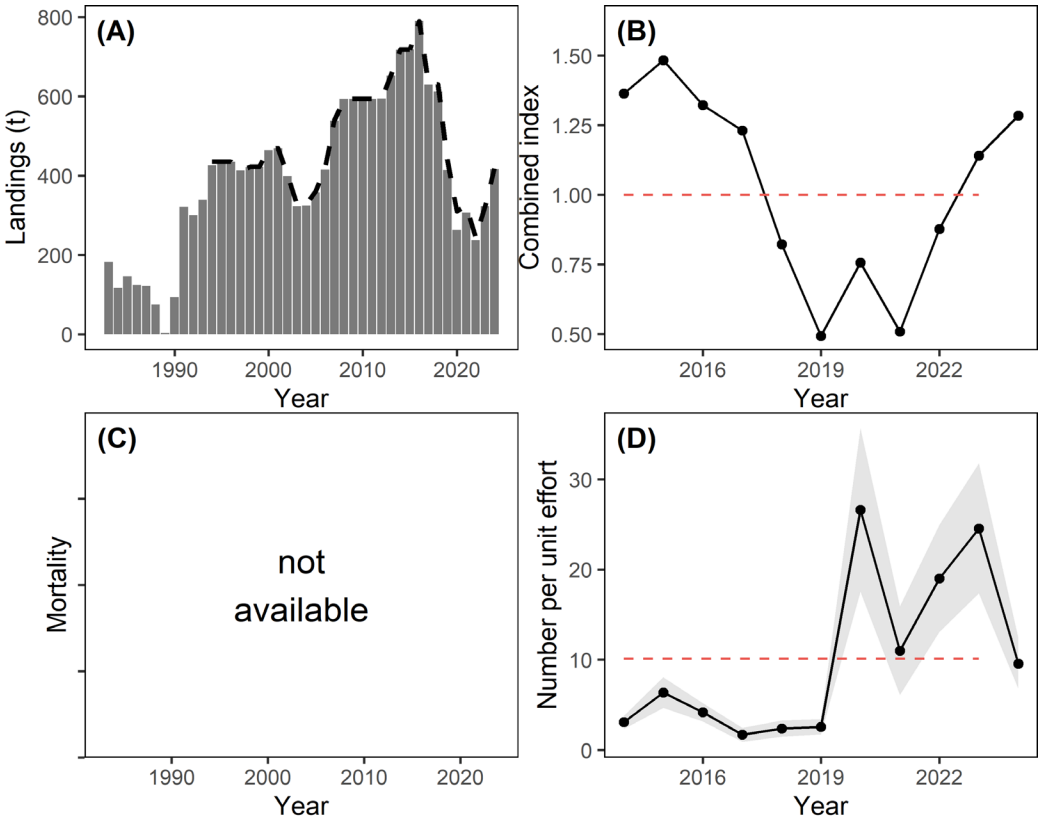

Figure 5. Area 15: Landings (grey bars) and total allowable catch (TAC; black dotted line); (B) combined index and historical average (red dotted line); (C) fishing mortality (data not available); and (D) average number of pre-recruits per unit effort (+/- 95% confidence interval) based on post-season surveys, shown with the historical average (red dotted line).

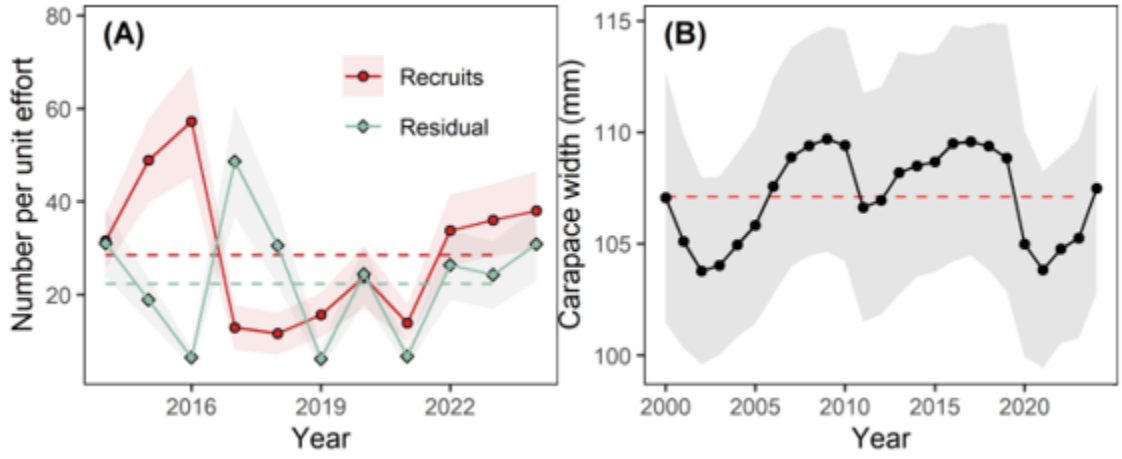

Figure 6. Area 15: (A) Number of recruits (red) per unit effort and residual abundance (green; +/- 95% confidence interval) estimated from post-season surveys and their corresponding historical averages (dotted line); (B) average width (+/- standard deviation) of legal-sized male crabs measured during the post-season survey and historical average (red dotted line).

Landings

After peaking at 791 t in 2016, landings fell until 2022, reaching 237 t. Since 2022, landings have been on the rise, increasing by 29% in 2024 to 416 t, close to the TAC of 418 t (Figure 5A).

Exploitable biomass index

The combined index, which has been rising since 2021, increased by 13% in 2024 and is above the historical average (Figure 5B).

Recruitment

After a four years of values above the historical average, pre-recruit abundance declined sharply in 2024 (-61%) and is slightly below the historical average (Figure 5D).

Abundance

For the third consecutive year, the abundance index for recruits derived from the post-season survey is stable (+5%) and above the historical average (Figure 6A). Residual abundance is on the rise (+27%) and is also above the historical average (Figure 6A).

Average size of commercial crabs

The width of legal-sized males increased in 2024 and is above the historical average (Figure 6B).

Current status

Snow crab abundance, which is cyclical in nature, appears to still be on the upswing, with a high abundance of recruits recorded in the post-season survey in 2024. These observations suggest that a proportional increase in removals in 2025, relative to the combined index, should not pose a risk in the short term.

Stock status and trends in Area 14

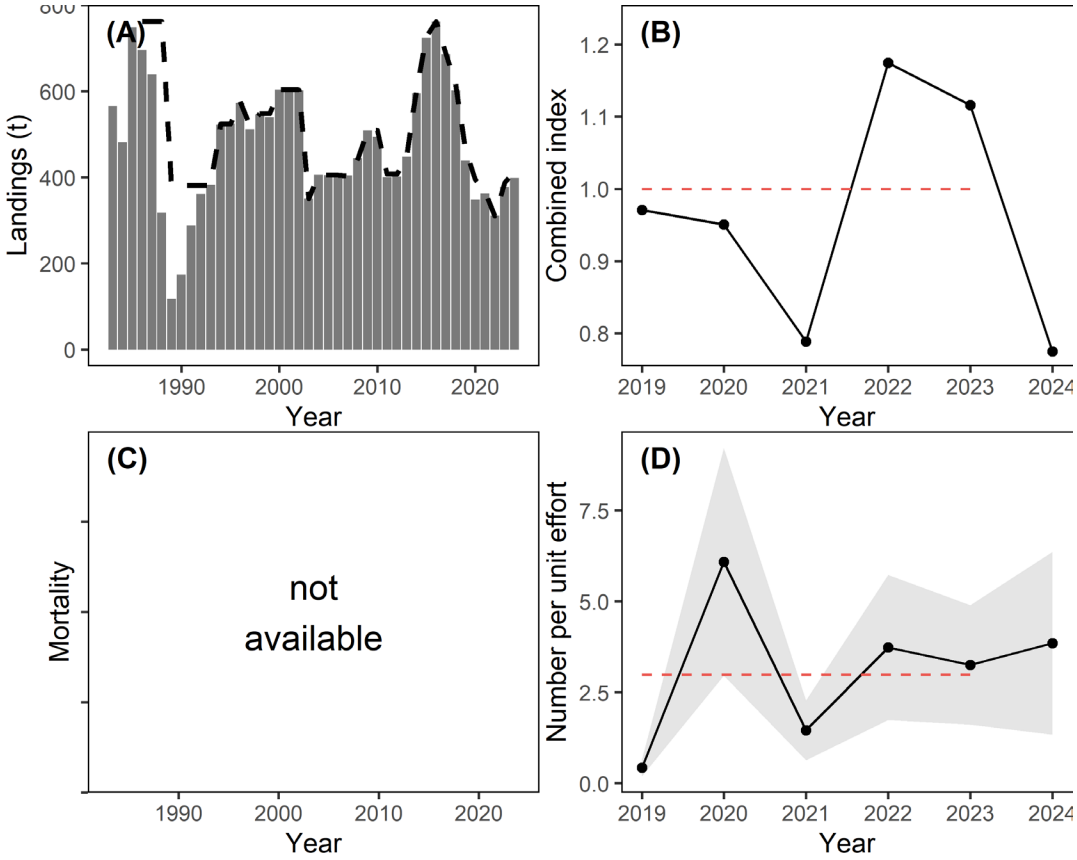

Figure 7. Area 14: (A) Landings (grey bars) and total allowable catch (TAC; black dotted line); (B) combined index and historical average (red dotted line); (C) fishing mortality (data not available); and (D) average numbers per unit effort for pre-recruits (+/- 95% confidence interval) based on post-season surveys, shown with the historical average (red dotted line).

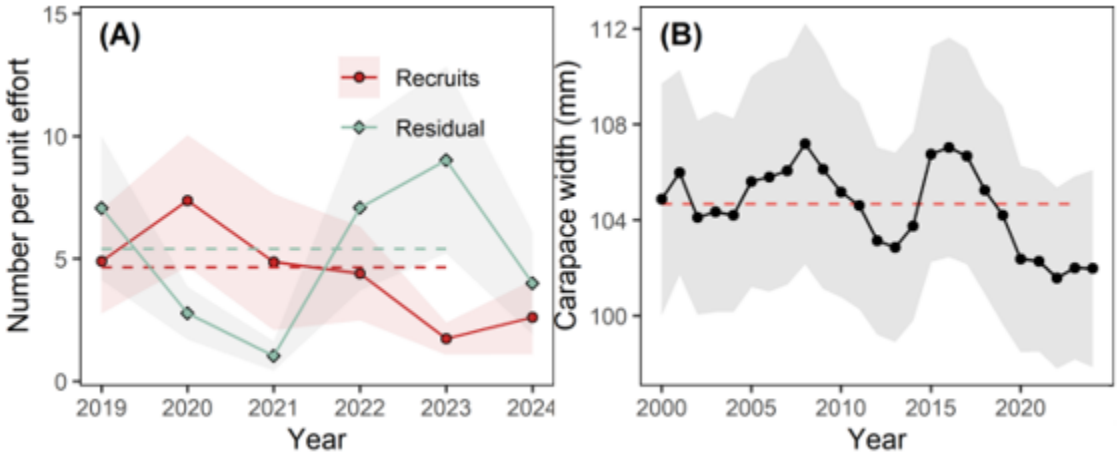

Figure 8. Area 14: (A) Number of recruits (red) per unit effort and residual abundance (green; +/- 95% confidence interval) estimated from post-season surveys, along with their corresponding historical averages (dotted line); (B) average width (+/- standard deviation) of legal-sized male crabs measured during the post-season survey and historical average (red dotted line).

Landings

After reaching a record high of 762 t in 2016, landings declined until 2022, when they dropped to 310 t. Since then, landings have been on the rise, with a slight increase of 6% in 2024 to 399 t, close to the TAC of 415 t (Figure 7A).

Exploitable biomass index

The combined index, which had been high for two years, fell sharply in 2024 (-31%), the lowest recorded value since the start of the time series (Figure 7B).

Recruitment

Pre-recruit abundance increased slightly (+19%) in 2024 and has been above the historical average for the past three years (Figure 7D).

Abundance

The abundance index for recruits in the post-season survey rose sharply in 2024 (+51%), but remains among the lowest values in the series, below the historical average (Figure 8A). Residual abundance declined sharply (-56%) and is below the historical average.

Average size of commercial crabs

Very low values were recorded for the width of legal-sized males; these values have been among the lowest values in the time series for the past five years (Figure 8B). Since the average size of commercial-sized crabs is below historical average, a given weight of removals corresponds to a larger number of individuals.

Current status

The sharp decline in the combined index results from a significant decrease in residual abundance in the upcoming fishing season. Declines in commercial abundance have been accompanied by low mean values for the size of commercial crabs. These observations suggest that removals should be substantially reduced in 2025 to alleviate fishing pressure.

Stock status and trends in Area 13

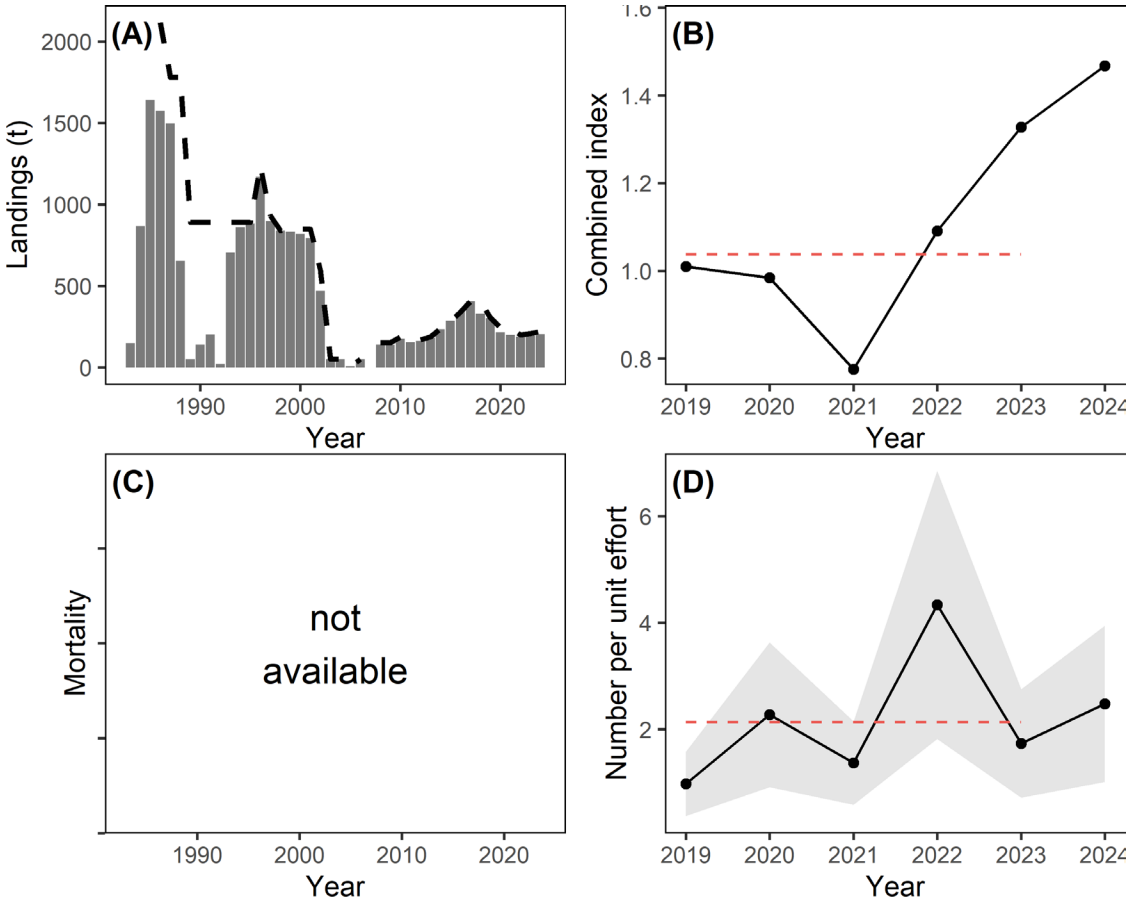

Figure 9. Area 13: (A) Landings (grey bars) and total allowable catch (TAC; black dotted line); (B) combined index and historical average (red dotted line); (C) fishing mortality (data not available); and (D) average numbers per unit effort for pre-recruits (+/- 95% confidence interval) based on post-season surveys, shown with the historical average (red dotted line).

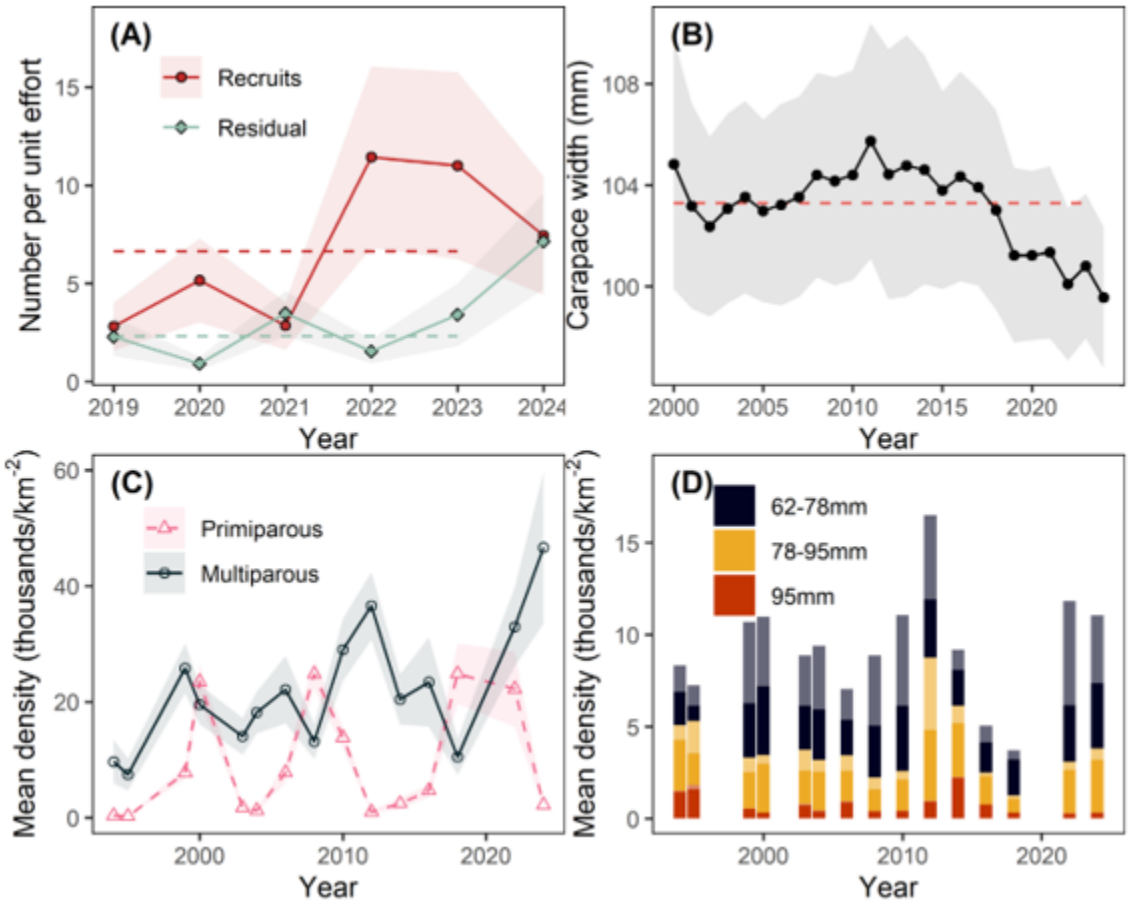

Figure 10. Area 13: (A) Number of recruits (red) per unit effort and residual abundance (green; +/- 95% confidence interval) estimated from post-season surveys, along with their corresponding historical averages (dotted line); (B) average width (+/- standard deviation) of legal-sized male crabs measured during the post-season survey and historical average (red dotted line); (C) densities (in thousands per km^2, annual average +/- standard deviation) of primiparous (pink dotted line) and multiparous (solid black line) females; and (D) densities of adult males (which have undergone their terminal moult; solid colour) and adolescents (lighter colour by size class) in the 62–78 mm (black), 78–95 mm (yellow) and over 95 mm (orange) size classes, in the DFO trawl survey on the Lower North Shore (east of Area 14 and north of Area 13).

Landings

Following the 2003–2007 moratorium, landings gradually increased to 406 t in 2017, before declining to 188 t in 2022. Since then, landings have remained relatively stable, reaching 204 t in 2024, close to the TAC of 220 t (Figure 9A).

Exploitable biomass index

The combined index has been rising since 2021, with an 11% increase in 2024, and is at its highest value since 2019 (Figure 9B).

Recruitment

Pre-recruit abundance increased (+43%) in 2024 (Figure 9D) and is now above the historical average. Despite interannual fluctuations, the long-term trend shows a slight increase in pre-recruit abundance since 2019.

Abundance

The abundance index for recruits, which reached high values in 2022 and 2023, decreased by 32% in 2024, but still remained above the historical average (Figure 10A). Residual abundance increased significantly (+110%), reaching its highest level since 2019 (Figure 10A). According to the DFO trawl survey in 2024, densities of multiparous females are high, while those of primiparous females are low, suggesting that the pulse of primiparous females is over (Figure 10C). In addition, abundance values for 62–78 mm adolescent males remain high in 2024, suggesting that recruitment to the fishery could increase in the medium term (Figure 10D). In the northern part of Area 13, the cycle appears to be at the beginning of an upswing. However, the increase in sublegal-sized adults (62–78 and 78–95 mm size classes) indicates that a sizeable proportion of males are undergoing an early terminal moult, thereby reducing commercial productivity (Figure 10D). Overall, these indicators suggest that recruitment to the fishery could remain stable in the medium term.

Average size of commercial crabs

Since 2019, the average size of commercial crabs has remained low and below the historical average. In 2024, it declined further to reach its lowest value in the time series (Figure 10B). Since the average size of commercial-sized crabs is below historical average, a given weight of removals corresponds to a larger number of individuals.

Current status

Snow crab abundance, which is cyclical in nature, appears to still be on the upswing, with recruit abundance again remaining high in 2024. Residual abundance was also high, particularly on the North Shore. These observations suggest that a proportional increase in removals in 2025, relative to the combined index, should not pose a risk in the short term.

Stock status and trends in Area 12C

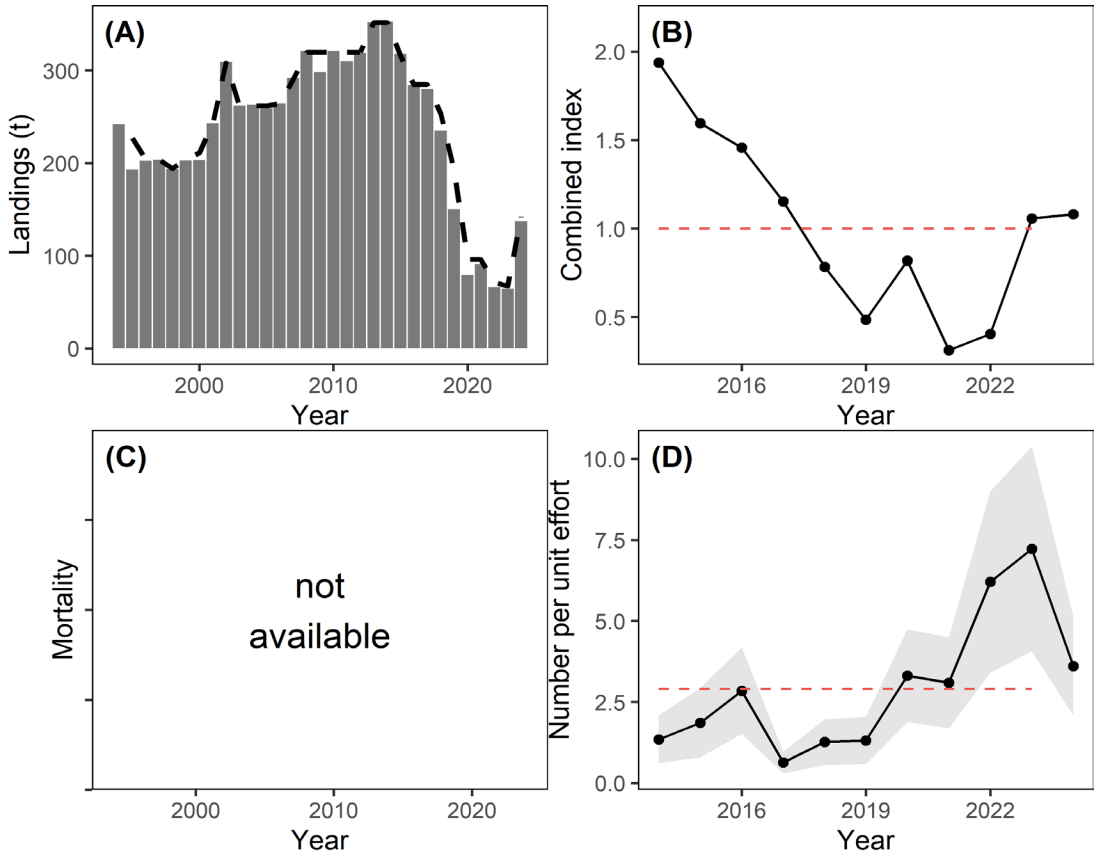

Figure 11. Area 12C: (A) Landings (grey bars) and total allowable catch (TAC; black dotted line); (B) combined index and historical average (red dotted line); (C) fishing mortality (data not available); and (D) average numbers per unit effort for pre-recruits (+/- 95% confidence interval) based on post-season surveys, shown with the historical average (red dotted line).

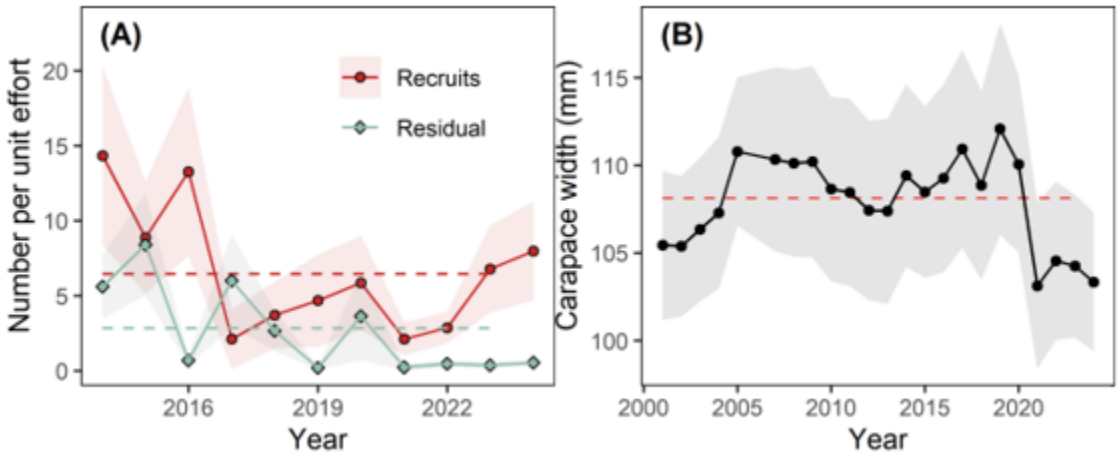

Figure 12. Area 12C: (A) Number of recruits (red) per unit effort and residual abundance (green; +/- 95% confidence interval) estimated from post-season surveys, with their corresponding historical averages (dotted line); (B) average width (+/- standard deviation) of legal-sized male crabs measured during the post-season survey and historical average (red dotted line).

Landings

After reaching a record high of 353 t in 2014, landings declined steadily until 2023, reaching the lowest value in the time series (64 t). In 2024, they increased sharply (+115%) to 137 t, a level close to the TAC of 142 t (Figure 11A).

Exploitable biomass index

The combined index, after reaching its lowest value in 2021, rose dramatically in 2023, and remained stable in 2024 (+2%), at slightly above the historical average (Figure 11B).

Recruitment

Pre-recruit abundance declined sharply in 2024 (-50%), but remained above the historical average (Figure 11D).

Abundance

The abundance index for recruits in the post-season survey increased in 2024 (+18%) for the third consecutive year (Figure 12A) and was slightly above the historical average. Although residual abundance also increased in 2024 (+51%), the value was still among the lowest in the time series.

Average size of commercial crabs

For the past four years, the average size of legal-sized males has been among the lowest in the time series, remaining below the historical average (Figure 12B). Since the average size of commercial-sized crabs is below historical average, a given weight of removals corresponds to a larger number of individuals.

Current status

Snow crab abundance, which is cyclical in nature, appears to still be on the upswing, with recruit abundance remaining high in 2024. This suggests that a proportional increase in removals in 2025, relative to the combined index, should not pose a risk in the short term.

Stock status and trends in Area 16A

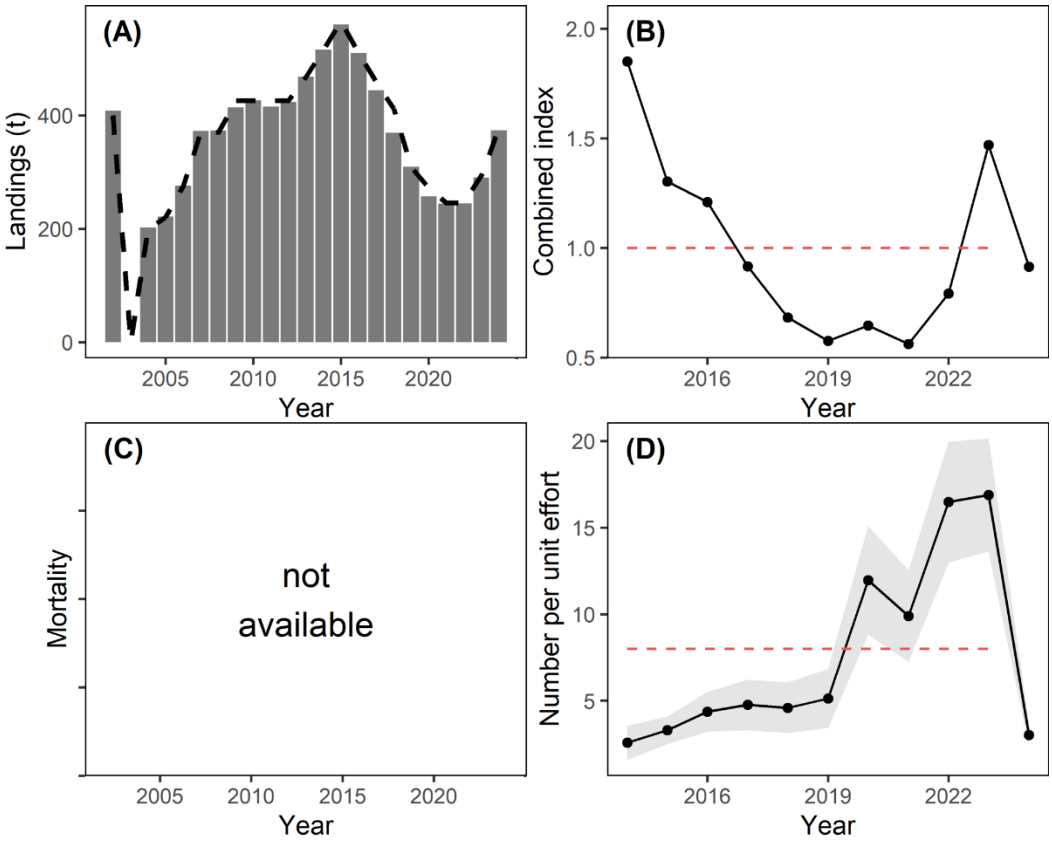

Figure 13. Area 16A: (A) Landings (grey bars) and total allowable catch (TAC; black dotted line); (B) combined index and historical average (red dotted line); (C) fishing mortality (data not available); and (D) average numbers per unit effort for pre-recruits (+/- 95% confidence interval) based on post-season surveys, along with the historical average (red dotted line).

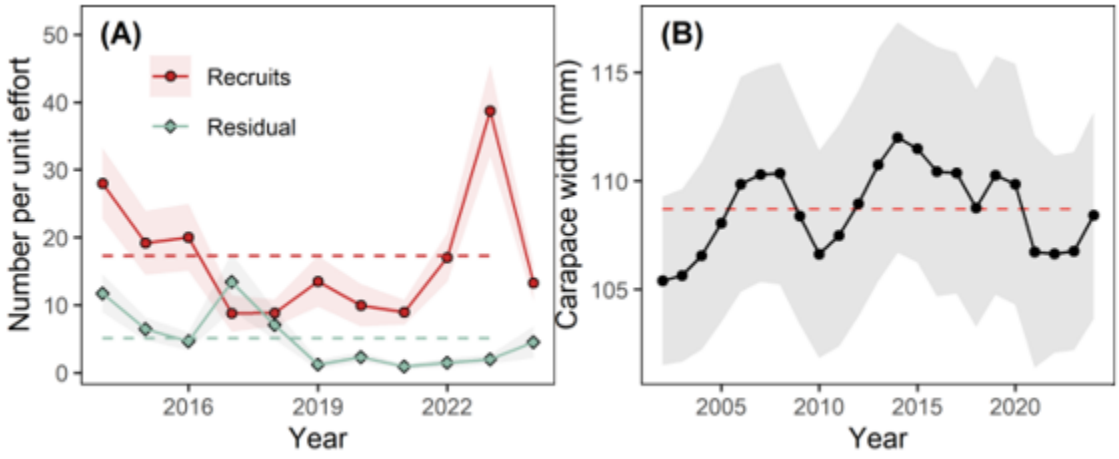

Figure 14. Area 16A: (A) Number of recruits (red) per unit effort and residual abundance (green; +/- 95% confidence interval) estimated from post-season surveys with their corresponding historical averages (dotted line); (B) average width (+/- standard deviation) of legal-sized male crabs from the post-season survey, along with the historical average (red dotted line).

Landings

After reaching a record level of 560 t in 2015, landings declined until 2021–2022, falling to 244 t. Since 2022, landings have been increasing, rising by 29% in 2024 to 373 t, close to the TAC of 376 t (Figure 13A).

Exploitable biomass index

The combined index, which has been increasing since 2021, fell by 38% in 2024 and is now below the historical average (Figure 13B).

Recruitment

Pre-recruit abundance, which was high in 2022–2023, plummeted by 82% in 2024 and is now below the historical average, as well as being among the lowest values in the time series (Figure 13D).

Abundance

Residual abundance increased significantly in 2024 (+127%), but remains slightly below the historical average (Figure 14A). However, the abundance index for recruits declined sharply in 2024 (-66%).

Average size of commercial crabs

After three years of stagnation at low levels, the average size of legal-sized males increased in 2024 to near the historical average (Figure 14B).

Current status

The sharp decline in the combined index results from a significant decrease in recruit abundance in the upcoming fishing season. This suggests that removals should be significantly reduced in 2025 to alleviate fishing pressure.

Stock status and trends in Area 12A

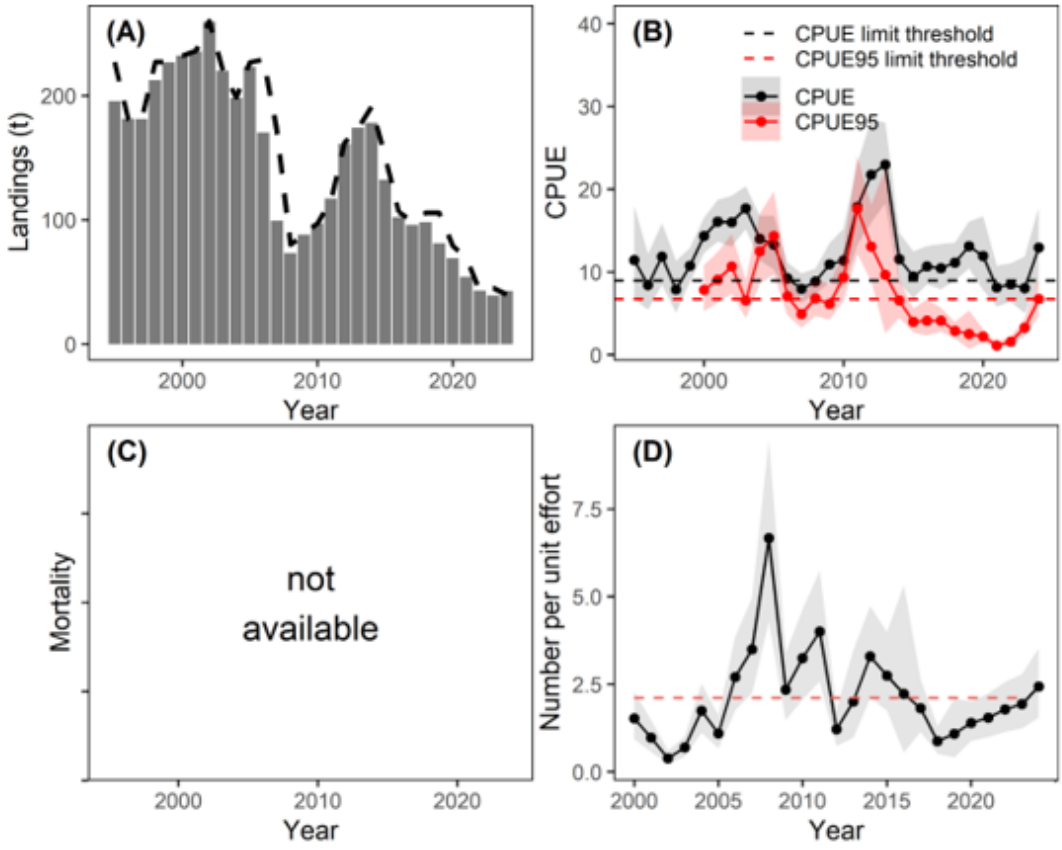

Figure 15. Area 12A: (A) Landings (grey bars) and total allowable catch (TAC; black line); (B) commercial CPUE and CPUE95 from the post-season survey (+/- 95% credibility interval) and their corresponding limit reference levels; (C) fishing mortality (data not available); and (D) average number of pre-recruits per unit effort (+/- 95% credibility interval) in the post-season surveys, along with the historical average (red dotted line).

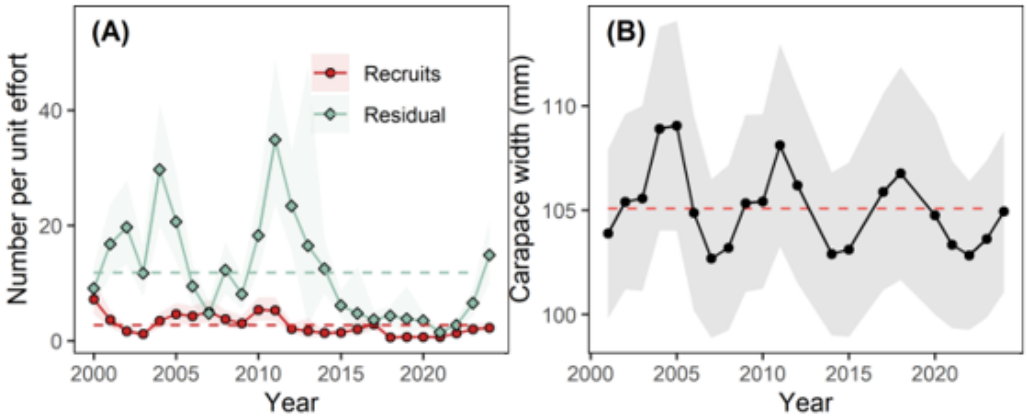

Figure 16. Area 12A: (A) Number of recruits (red) per unit effort and residual abundance (green; +/- 95% confidence interval) estimated from post-season surveys with their corresponding historical averages (dotted line); (B) average width (+/- standard deviation) of legal-sized male crabs measured during the post-season survey and historical average (red dotted line).

Landings

After peaking in 2014, landings declined until 2023, reaching 39 t. In 2024, landings increased by 9% to 42 t, slightly exceeding the TAC of 40 t (Figure 15A).

Exploitable biomass index

The standardized catch per unit effort (CPUE) in the commercial fishery, which had declined between 2020 and 2021, rose sharply in 2024, with a very high probability (98%) of exceeding the established limit threshold level (Figure 15B). The standardized CPUE95 derived from the post-season survey also increased significantly in 2024, after a decade of being below the limit reference level. The probability that the 2024 CPUE95 will exceed the limit threshold level is moderately high (51% probability).

Recruitment

The pre-recruit abundance index has continued to increase for the sixth consecutive year and now exceeds the historical average (Figure 15D).

Abundance

For the third consecutive year, residual abundance increased sharply in 2024, surpassing the historical average (Figure 16A). Recruit abundance also increased and is slightly below the historical average (Figure 16A).

Average size of commercial crabs

The average size of legal-sized males continued to increase in 2024 and is slightly below the historical average (Figure 16B).

Current status

Overall, stock status indicators for Area 12A are positive, allowing a transition into the cautious zone after a decade in the critical zone. However, without a rebuilding plan and defined targets (DFO 2021), a conservative approach to removals should be maintained in 2025.

Ecosystem and Climate Change Considerations

During the summer, snow crab distribution is linked to the thickness and temperature of the cold intermediate layer, which serves as the species' habitat during its benthic life stage. In recent years, a warming of the surface layer and the deep-water layer has been observed in the Gulf of St. Lawrence, with record temperatures recorded in 2022 (Galbraith et al. 2023). These warmer conditions, both above and beneath the cold intermediate layer, along with a reduction in ice cover, may lead to a reduction in the area of thermal habitat for snow crab and affect its distribution and abundance (Émond et al. 2020).

Increases in water temperature in the Estuary and Gulf of St. Lawrence in recent years have led to a reduction in suitable thermal habitat for adult snow crab in areas 12A, 12C, 15, 16A, 16 and 17 (Figure 17B). Conversely, a slight increase in the availability of this habitat has been observed along the north shore of Area 13. For juveniles, a decreasing trend in the availability of suitable habitat has been observed in areas 16 and 17, while an increase in this habitat has been observed in areas 13, 15 and 16A (Figure 17A).

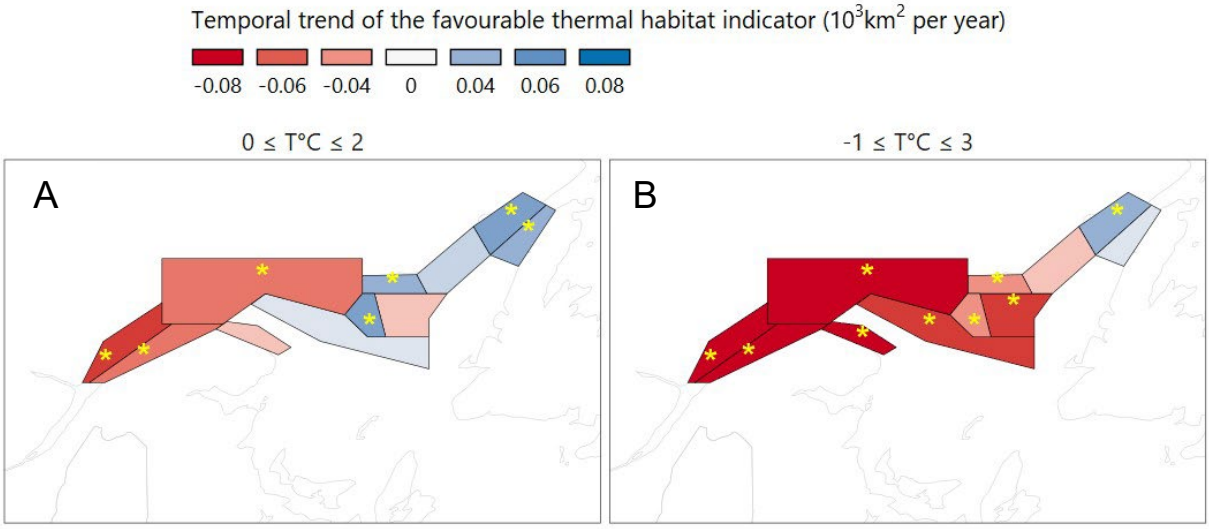

Figure 17. Temporal trends in the favourable thermal habitat index for (A) for juvenile snow crab (<12 mm) and (B) adult snow crab during the 1990–2024 period. Note that, for the portion of Area 13 along the North Shore and Area 14, the trends shown are based on the 1994–2024 period owing to an absence of temperature data for this area in some years. The asterisk indicates that the statistical model with a linear temporal trend was chosen over a null model, following model selection.

The length of the pelagic larval development stages and larval survival rates are related to surface water temperatures (mainly in spring and summer). In addition, egg incubation time, crab growth and size at terminal moult are dependent on the water temperature in the areas on the seabed where crabs develop (Burmeister and Sainte-Marie 2010; Mullowney and Baker 2021). A reduction in available habitat could lead to local concentrations of crabs in certain areas, intensifying density-dependent effects, such as the effects of intraspecific competition. Consequently, the distribution and productivity of snow crab stocks could shift in response to changes in temperature in the different water layers. The impact of warming waters on crab stock productivity and distribution is a major concern, and impacts could be quite different depending on the region and the area concerned and the number of years with significant warming.

SOURCES OF UNCERTAINTY

Under an indicator-based approach, the quality of scientific advice depends mainly on the accuracy of the parameters obtained from sampling and the subsequent analyses.

Commercial fishing indices

Information obtained from logbooks and purchase slips completed during the fishing season directly affects the accuracy of the parameters derived from these data. The selectivity of traps and catchability of crabs can vary depending on a number of factors: the type of trap used and its volume and mesh size, the amount and quality of bait, the soak time (which can vary with the fishing strategies employed) and environmental conditions. The standardization approach used for the commercial CPUE index was established in 2003 to provide a comparable index each year, controlling for some of these factors that influence selectivity (Bourdages and Dufour 2003). However, the method used to standardize the CPUE (except in areas 12A and 12B) has not been substantially modified in nearly 20 years, despite major changes observed in

the fishing season (start and length of season) and the type of traps used by most fishers, as well as the increase in the number of new fishers in some areas. To address the various biases observed in the analytical methods, a review of the standardization method is needed in the short term. Even with CPUE standardization, the phenomenon of hyperstability in the commercial CPUE—where CPUE values can remain high despite a decline in overall biomass—continues to be evident in the snow crab fishery, making biomass indicators derived from commercial fishery data less reliable than those derived from independent survey data.

Fishery-independent surveys

Whether trawl surveys conducted by DFO or post-season surveys conducted by the industry, fishery-independent snow crab surveys in the Estuary and northern Gulf of St. Lawrence provide limited spatial coverage. Some types of fishing gear are better suited to certain seafloor areas than others, which directly influences the spatial coverage of the surveys. The undersampling of certain depth ranges may therefore skew estimates of the abundance of the different size classes, introducing bias into the assessment of resource status in specific fishing areas. In addition, during post-season trap surveys, the presence of adult intermediate-shell crabs on the seabed can affect the catchability of adolescents and recruits, directly influencing estimates of recruitment to the fishery. In addition, standardization of the post-season survey abundance indicators should be reviewed to integrate data from different trap types, a factor that is currently not taken into account.

Biology and ecology of crabs

The unique biological characteristics of snow crab can also introduce uncertainty into scientific advice. For example, variability in size-at-terminal moult affects carapace condition and the catchability of crabs in the fishery. A high incidence of early terminal moult has recently been observed in several management areas, complicating forecasts of recruitment to the fishery. In addition, there is spatial misalignment between the biological and management units for snow crab in the Estuary and northern Gulf of St. Lawrence. Although snow crab in the Canadian Atlantic is considered a single genetic stock, assessing the resource at the level of specific management areas increases the risk of producing inaccurate advice.

LIST OF MEETING PARTICIPANTS

Name	Affiliation	Feb. 11	Feb. 12	Feb. 13
Beaudry-Sylvestre, Manuelle	DFO – Science	x	x	x
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Bois, Samantha	Association des capitaines propriétaires de la Gaspésie	x	x	x
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Pinette, Majoric	Première nation de Pessamit	x	-	x
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Rail, André	Fisher Area 16	-	-	x
Ransom, Glen	Fisher Lower North Shore	-	x	x
Rowsell, Austin	Fisher Lower North Shore	x	x	x
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Sandt-Duguay, Emmanuel	Association de gestion halieutique autochtone Mi'gmaq et Wolastoqey	x	x	x
Sean-Fortin, David	DFO – Science	x	x	x
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Tamdrari, Hacène	DFO – Science	x	x	x
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Tucker, Jane	Fish, Food and Allied Workers	x	x	x
Vanier, Caroline	DFO – Science	x	x	x
Vigneault, Guy	Shipek	-	-	x

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