Fisheries and Oceans Canada | Pêches et Océans Canada
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Quebec Region

Canadian Science Advisory Secretariat
Science Advisory Report 2025/024

ASSESSMENT OF GREEN SEA URCHIN (*STRONGYLOCENTROTUS DROEBACHIENSIS*) STOCKS IN THE ESTUARY AND NORTHERN GULF OF ST. LAWRENCE IN 2024

CONTEXT

The Fisheries Management Branch of Fisheries and Oceans Canada (DFO) requested scientific advice on the status of Green Sea Urchin stocks in the Estuary and northern Gulf of St. Lawrence (ENGSL) for the management of these stocks during the 2025 to 2027 fishing seasons.

This Science Advisory Report is from the regional peer review of April 1-2, 2025 on the Estuary and Northern Gulf of St. Lawrence Green Sea Urchin (*Strongylocentrotus droebachiensis*) 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

- Since there are no indicators or reference points for the urchin stocks, their status cannot be assessed as per the Fishery Decision-Making Framework Incorporating the Precautionary Approach.
- Mean catch per unit effort (CPUE) values during the 2022-2024 period were higher than the reference means in subareas 8D (2018-2021) and 8E (2003-2021), but lower than the reference mean in subarea 9-1 (2004-2021).
- According to the data from the fishery-independent survey, mean densities of legal-sized urchins were high in subarea 9-1, and have remained fairly stable since 2016.

Trends

- Even in the absence of stock status indicators, the available data suggest that stocks in all actively fished areas (subareas 8D, 8E, 9-1, and area 11) have been relatively stable in recent years.
- Stock trends in fishing areas 1 to 7, 9 (except for subarea 9-1), 10, and 12 to 14 are unknown, as these areas have not been fished, or have only been lightly fished, since the late 1990s.

Ecosystem and Climate Change Considerations

- The Green Sea Urchin is one of the most important structuring elements of the coastal Saint Lawrence ecosystem. Its close relationship with aquatic vegetation, including seaweeds,

influences ecosystem productivity and the availability of critical habitats for many marine species.

- Bottom water temperatures where urchins are harvested in the Estuary and Gulf of St. Lawrence are increasing, as is the abundance of crustacean predators such as lobster and rock crab. However, these ecosystem changes and their impacts on the productivity of urchin stocks have not been quantified, and data are not available at the appropriate spatial and temporal scales to assess the impact on the stocks.

Stock Advice

- The current removal levels in area 11 and subareas 8D, 8E and 9-1 do not appear to pose a significant risk to urchin stocks in the short term, given the relative stability of the densities of legal-sized individuals from the survey, CPUE values from the fishery, and the size structures in landings from recent years. In addition, the species has a wide distribution, while the fishery is only concentrated in certain areas.

BASIS FOR ASSESSMENT

Assessment Details

Year Assessment Approach was Approved

2008 (DFO 2008)

Assessment Type

Full assessment

Most Recent Assessment Date

1. Last full assessment: 2022 (DFO 2022)
2. Last interim year update: N/A

Stock Assessment Approach

1. Broad category: data-poor
2. Specific category: index-based (trends in empirical indices; most data are fishery dependent)

Stock Structure Assumption

The Green Sea Urchin occurs in all boreal and Arctic marine regions (Scheibling et al. 2020). Despite differences in the genetic structure of urchins in the Northeast and Northwest Atlantic and the Pacific, there is no evidence that the populations in the Northwest Atlantic, including those in Canadian waters, are genetically distinct (Addison and Hart 2004). Although the Green Sea Urchin is widely distributed across the ENGSL, the fishery for this species is concentrated in small, very localized areas, as are the available data. This assessment is therefore structured by fishing area or subarea.

Reference Points

- Limit reference point (LRP): N/A
- Upper stock reference point (USR): N/A

- Removal reference (RR): N/A
- Target reference point (TRP): N/A

Data

- Landings: 1991-2024
- Fishing effort: 2002-2024
- Fishery-independent survey in subarea 9-1 (DFO: 2008, 2010; Agence Mamu Innu Kakussesht (AMIK): 2016, 2019, 2024)
- Dockside sampling: 2010-2024

ASSESSMENT

Stock status and trends in subareas 8D and 8E

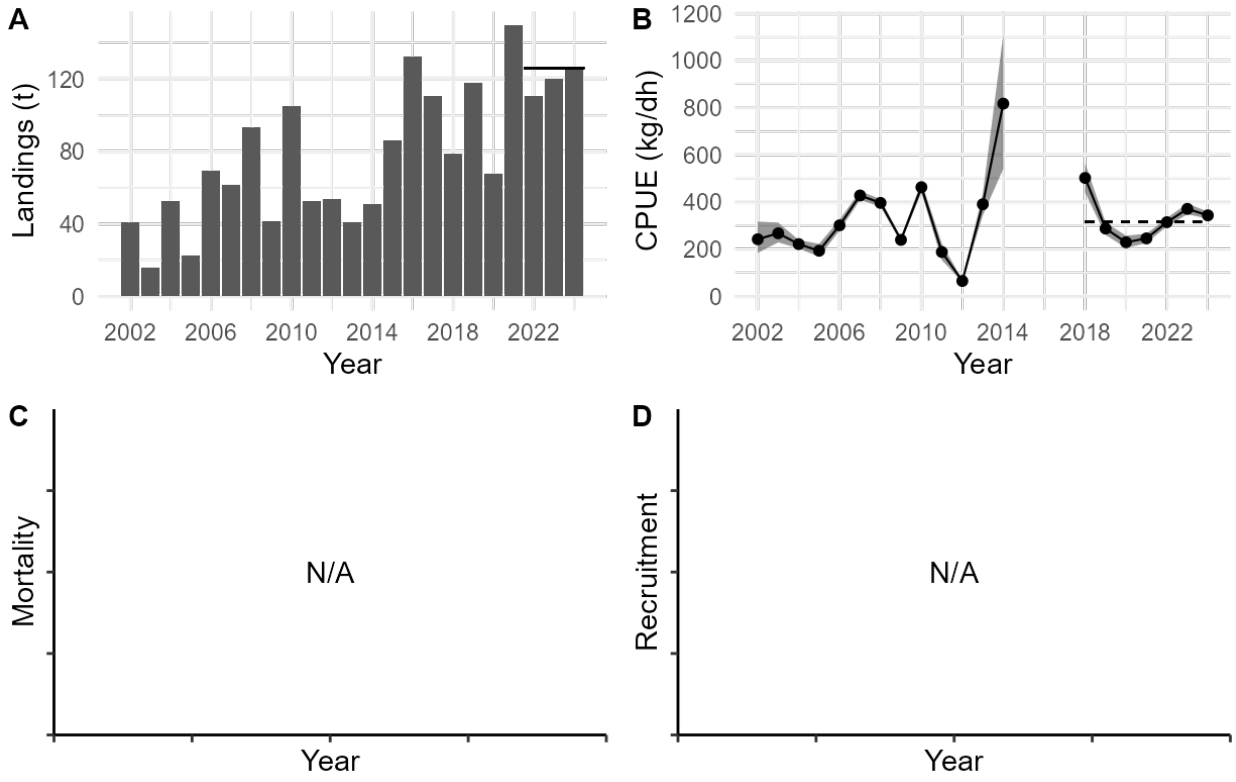

Figure 1. Subarea 8D. (A) Annual landings (t) and total allowable catch (TAC) (126 t; horizontal line); (B) Mean annual CPUE (kg/diver-hour [dh]) and associated 95% confidence intervals. The dashed horizontal line represents the reference mean CPUE between 2018 and 2021. (C) Fishing mortality is not available (N/A). (D) Recruitment is not available (N/A).

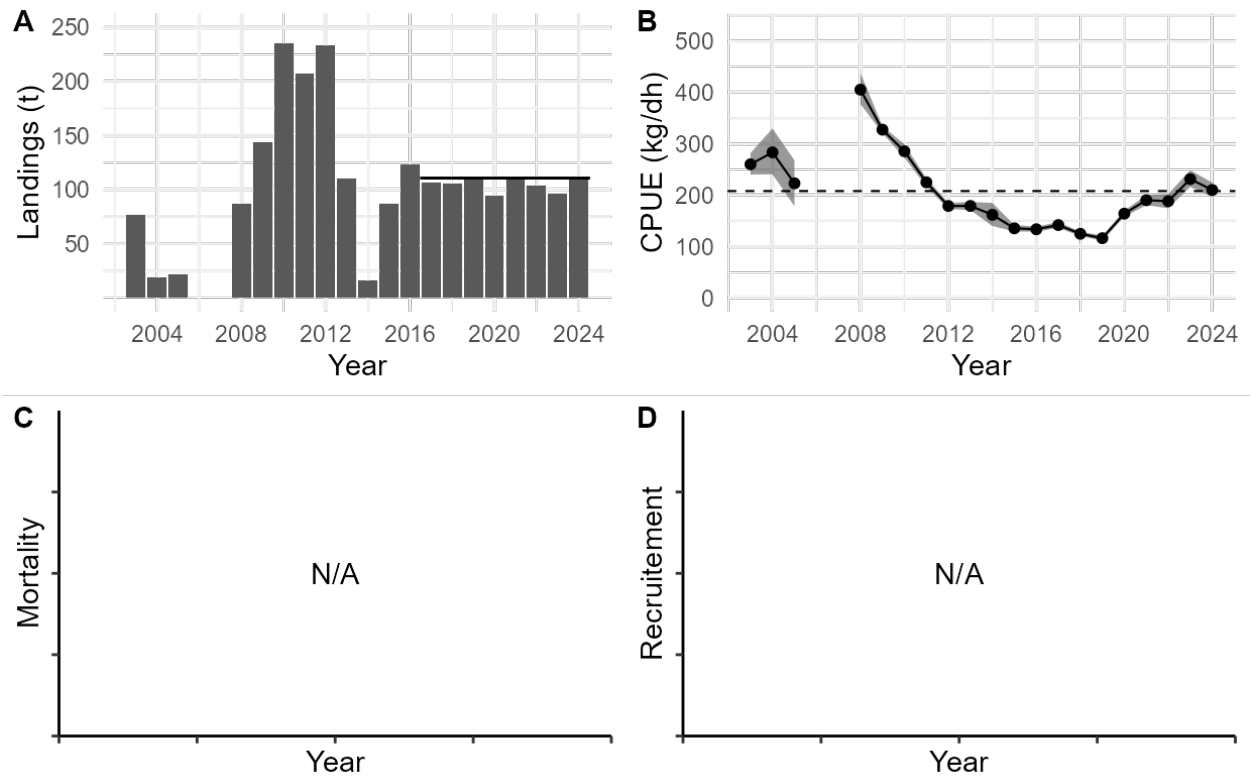

Figure 2. Subarea 8E. (A) Annual landings (t) and total allowable catch (TAC) (110.7 t; horizontal line); (B) Mean annual CPUE (kg/dh) and associated 95% confidence intervals. The dashed horizontal line represents the reference mean CPUE between 2003 and 2021. (C) Fishing mortality is not available (N/A). (D) Recruitment is not available (N/A).

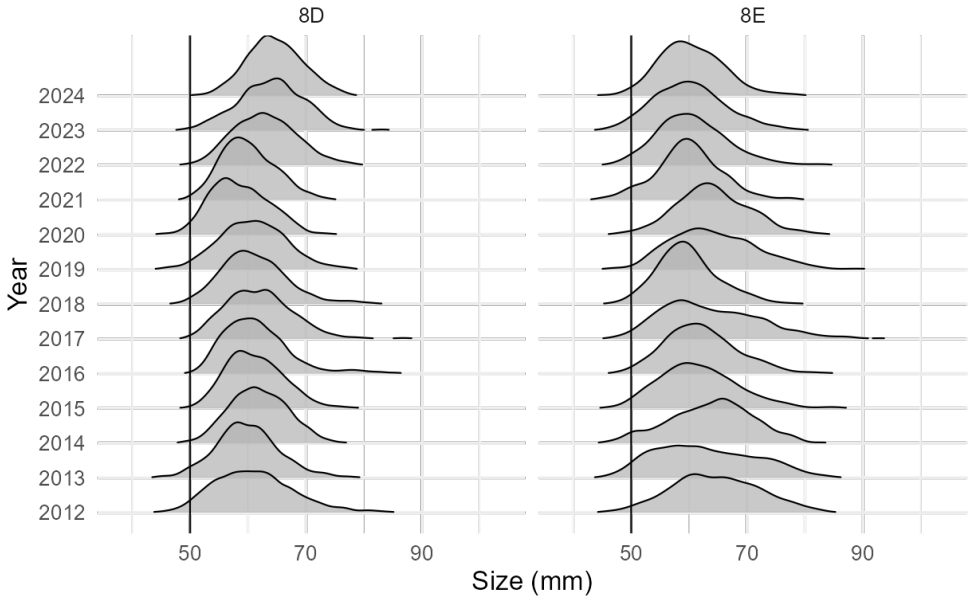

Figure 3. Distribution of test diameters (mm) of Green Sea Urchins from the DFO dockside sampling program for subareas 8D and 8E. The vertical line represents the legal size of 50 mm.

Catch per unit effort (CPUE)

The commercial CPUE is calculated from logbook data and can be influenced by the management measures in effect, weather conditions, harvesters' experience, and market factors. Therefore, it serves as an index of the fishery's performance but does not appear to be a good indicator of stock status. Nevertheless, this metric could provide information on the risk of local depletion when combined with data on the spatial distribution of the fishery and the size structure of the catch in the fishery.

In subareas 8D and 8E, CPUE values have been increasing since 2019-2020. The mean annual CPUE in subareas 8D (343 kg/dh) and 8E (210 kg/dh) during the 2022-2024 period are comparable to the mean annual values in the corresponding reference periods, i.e. 2018-2021 for 8D (316 kg/dh) and 2003-2021 for 8E (208 kg/dh) (Figures 1 and 2).

Size structure

The size structure of the Green Sea Urchins measured in subareas 8D and 8E showed little interannual variation and no clear trend was observed. On average, the percentage of sublegal-sized individuals (less than 50 mm) in landings was less than 5% (Figure 3).

Current status

The status of Green Sea Urchin stocks in subareas 8D and 8E is uncertain due to the absence of stock status indicators. However, the current removal levels should not pose any significant risks in the short term, given the relative stability of CPUE values in both subareas in recent years and the size structure in the landings, as well as the fact that the species is widely distributed, while the fishery is concentrated in certain areas.

Stock status and trends in area 9

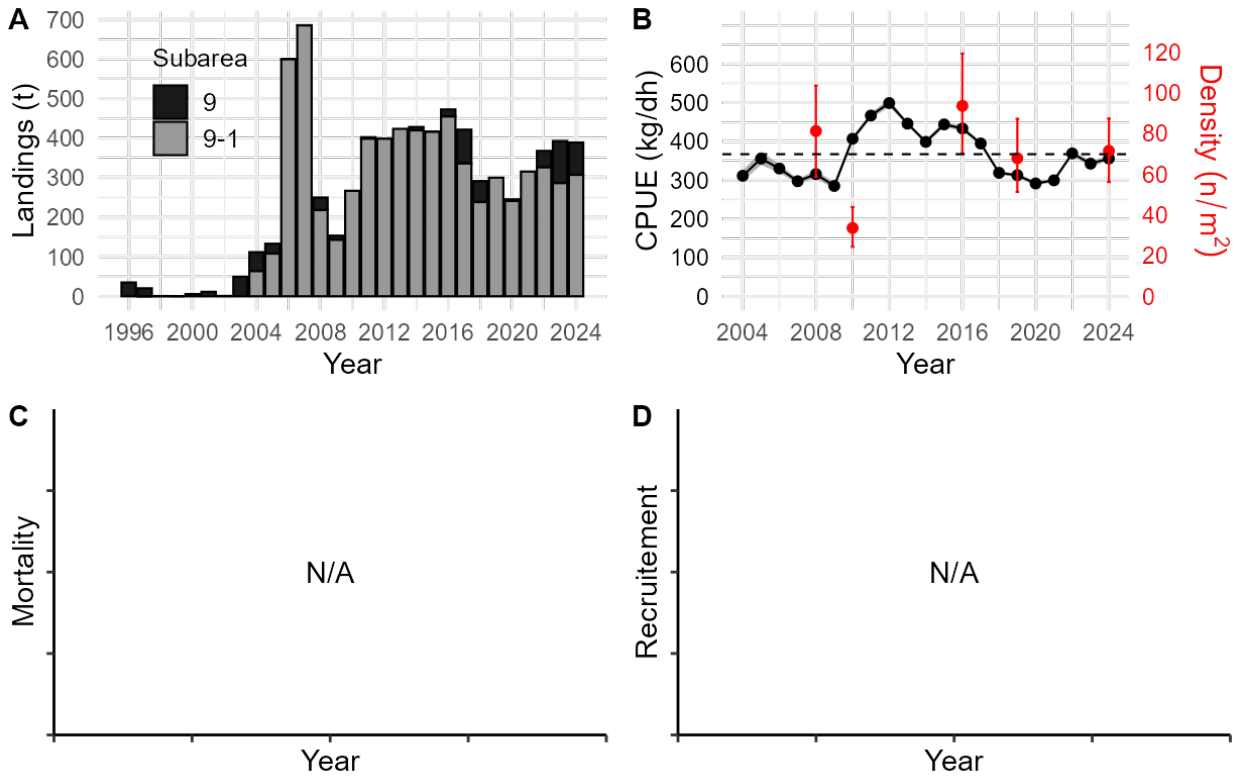

Figure 4. (A) Annual landings (t) in area 9 and subarea 9-1. (B) Mean annual CPUE (kg/dh) in subarea 9-1 and associated 95% confidence intervals (solid line). The dashed horizontal line represents the reference mean CPUE between 2004 and 2021. Mean densities (n/m²) of urchins larger than the legal size of 50 mm come from the fishery-independent survey; the associated 95% confidence intervals are shown in red. (C) Fishing mortality is not available (N/A). (D) Recruitment is not available (N/A).

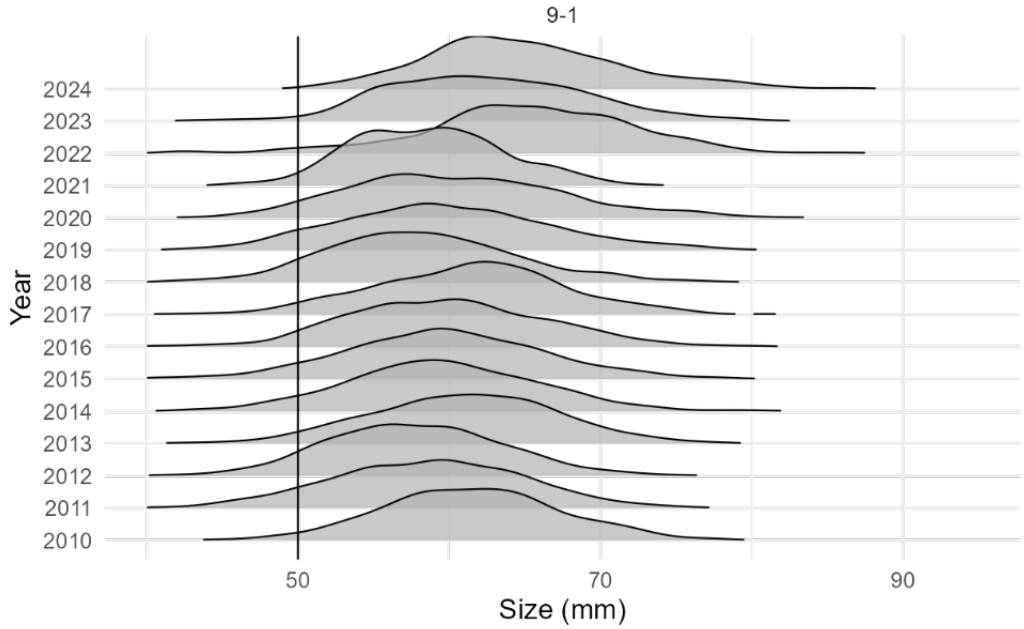

Figure 5. Distribution of test diameters (mm) of Green Sea Urchins from the DFO dockside sampling program in subarea 9-1. The vertical line represents the legal size of 50 mm.

Densities

Based on the overall data in the fishery-independent survey from subarea 9-1, mean densities of legal-sized urchins were high and have been relatively stable since 2016 (Figure 4).

Catch per unit effort (CPUE)

The commercial CPUE is calculated from logbook data from subarea 9-1, and can be influenced by the management measures in effect, weather conditions, harvesters' experience, and market factors. Therefore, it serves as an index of the fishery's performance but does not appear to be a good indicator of stock status. Nevertheless, this metric could provide information on the risk of local depletion when combined with data on the spatial distribution of the fishery and the size structure of the catch in the fishery.

CPUE values have been increasing since 2020. The mean annual CPUE value during the 2022-2024 period (356 kg/dh) is comparable to the reference mean (2004-2021; 367 kg/dh) (Figure 4).

Size structure

The size structure of Green Sea Urchins measured in subarea 9-1 showed little interannual variation and no clear trend was observed. On average, the percentage of sublegal-sized individuals (less than 50 mm) in landings is less than 5% (Figure 3).

Current status

The status of Green Sea Urchin stocks in fishing area 9 and subarea 9-1 is uncertain due to the absence of reference points. However, the current removal levels should not pose any significant risks in the short term, given the relative stability of densities of legal-sized individuals in the survey, CPUE values, and the size structure of landings in recent years, as well as the fact that the species is widely distributed, while the fishery is concentrated in certain areas.

Stock status and trends in area 11

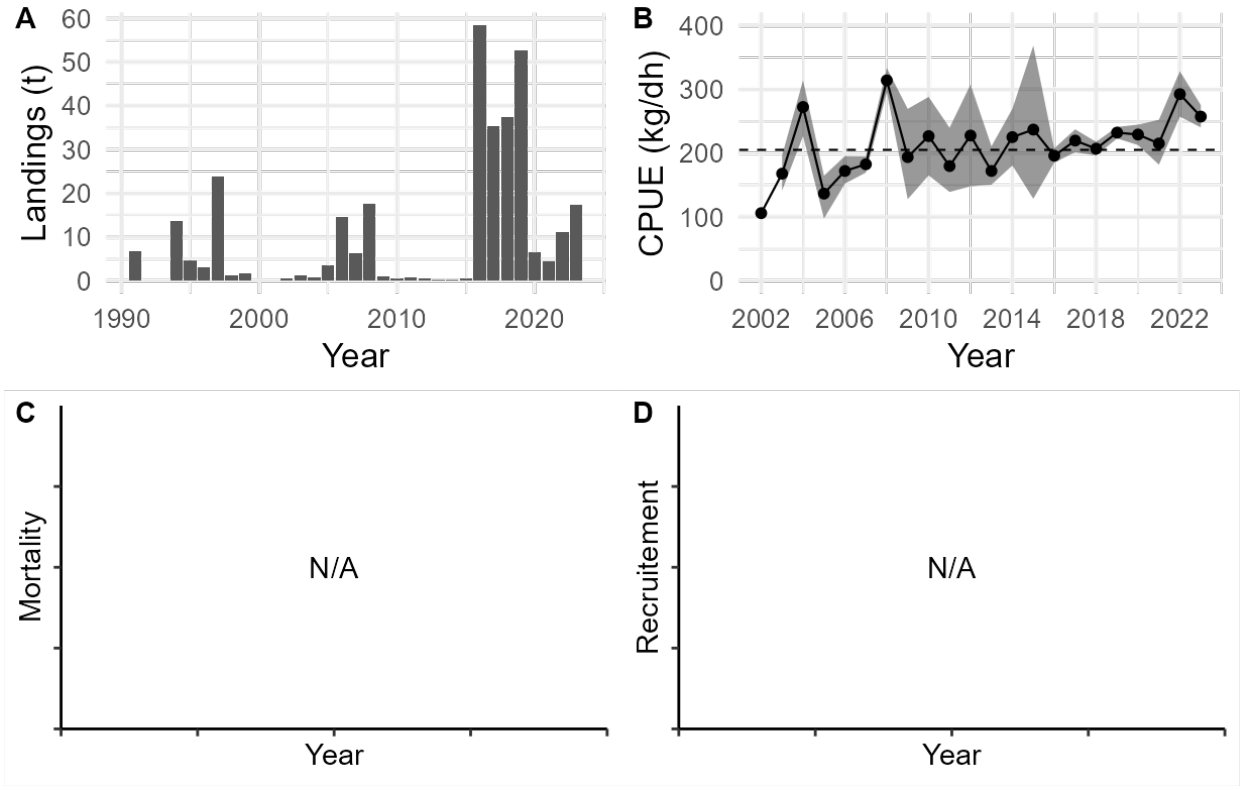

Figure 6. (A) Annual landings (t) in area 11. (B) Average annual CPUE values (kg/dh) and associated 95% confidence intervals. The dashed horizontal line represents the reference mean CPUE between 2002-2021. (C) Fishing mortality is not available (N/A). (D) Recruitment is not available (N/A).

Catch per unit effort (CPUE)

The commercial CPUE is calculated from logbook data, and can be influenced by the management measures in effect, weather conditions, harvesters' experience, and market factors. Therefore, it serves as an index of the fishery's performance but does not appear to be a good indicator of stock status. Nevertheless, this metric could provide information on the risk of local depletion when combined with data on the spatial distribution of the fishery and the size structure of the catch in the fishery.

CPUE values have been increasing since 2016. The mean annual CPUE during the 2022-2023 period (275 kg/dh) was greater than the reference mean (2002-2021; 206 kg/dh) (Figure 6).

Current status

The status of Green Sea Urchin stocks in fishing area 11 is uncertain due to the absence of indicators. However, the removal levels observed to date should not pose any significant risks in the short term, given the relatively stable CPUE.

History of management measures and landings

The management units for Green Sea Urchins are divided into 14 fishing areas. However, only areas 8, 9, 10, and 11 are currently exploited and are managed under conservation harvesting plans (CHPs).

From 1991 to 2005, annual landings in Quebec were low, ranging between 7 t and 188 t (Figure 7) but, since 2010, have remained above 400 t, peaking at 804 t in 2016. Landings have been reported in areas 3, 7, 10, 11, 12, and 14 since 1991, but have been intermittent or small. Overall, since 2006, between 88.0% and 99.9% of landings in Quebec have come from areas 8 and 9, with the largest proportion from subarea 9-1. In 2024, the fishery in area 8 was granted commercial status; along with area 9, these are the only urchin fishing areas with commercial fishery status (dive fishing only), while the fisheries in the other areas are still in the exploratory phase.

In subarea 8D, the fishery data from logbooks before 2018 are missing or uncertain. Mean annual landings between 2022 and 2024 were 119 t, which is greater than the mean for the 2018-2021 reference period (103 t) (Figures 1 and 7).

Landings in subarea 8E were relatively low and sporadic before 2008, increased to the highest values in the time series between 2010 and 2012, and then subsequently declined in 2013 and 2014. Since 2015, they have stabilized to a certain extent, due to the creation of subareas in area 8 and the establishment of various management measures. Mean annual landings in subarea 8E during the 2022-2024 period were 103 t, which is below the reference mean of 111 t (2003-2021) (Figures 2 and 7).

Most of the landings in area 9 come from subarea 9-1. Although landings remained low between 1996 and 2003, they subsequently increased significantly, reaching a peak of 685 t in 2007. After declining sharply, they then rose slightly in 2009, and have been fairly stable since then. Mean annual landings of 306 t were recorded in subarea 9-1 during the 2022-2024 period, which is below the reference mean of 325 t (2004-2021) (Figures 4 and 7).

In area 11, landings were low and sporadic between 2002 and 2015. In 2016, they peaked at nearly 58 t and then declined, stabilizing at around 40 t until 2019. However, landings have dropped sharply in this area since then. Mean annual landings in 2022 and 2023 (there was no fishery in 2024) were 14 t, which is greater than the reference mean of 12 t (2002-2021).

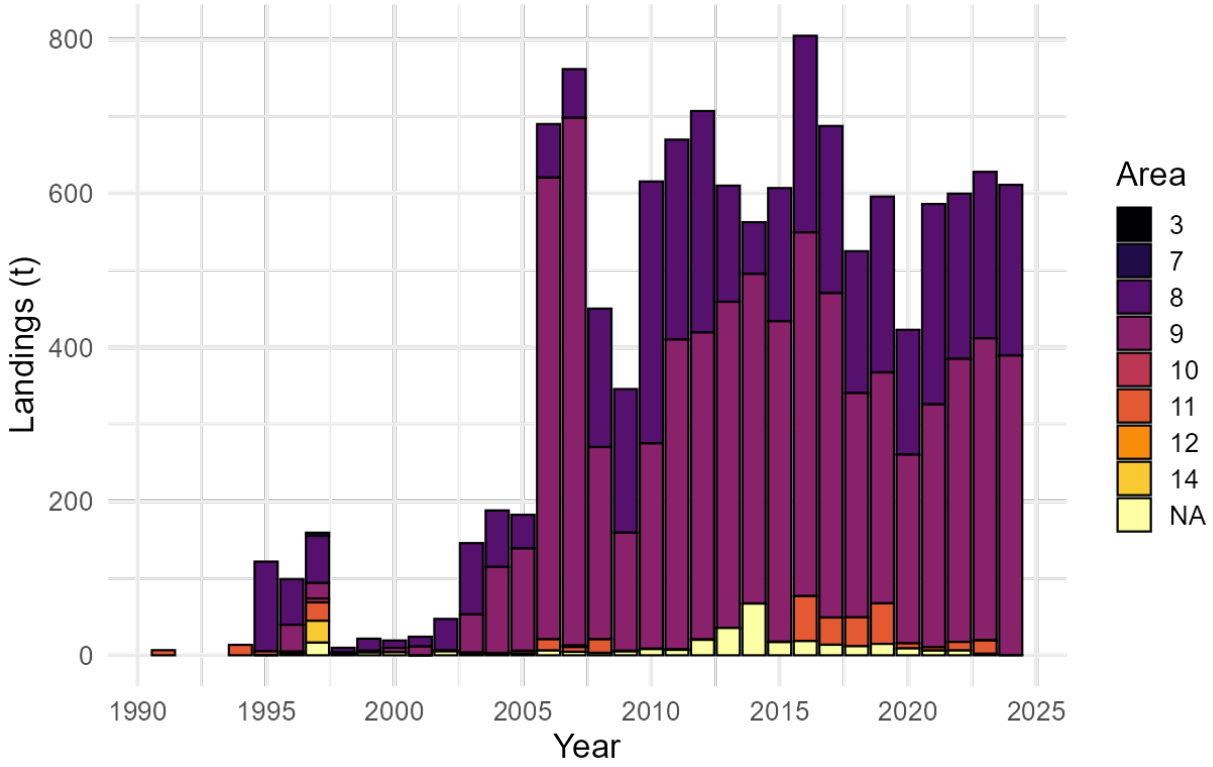

Figure 7. Annual green sea urchin landings (t) in all Quebec fishing areas.

Ecosystem and Climate Change Considerations

The Green Sea Urchin is one of the key structuring elements of coastal ecosystems in the Northwest Atlantic. It plays a key role in the distribution and abundance of aquatic vegetation. Intense grazing of seaweeds by urchins influences ecosystem productivity and the availability of critical habitats for many marine species (Ling et al. 2015, Scheibling et al. 2020).

Green Sea Urchins have a certain degree of local adaptation to environmental conditions (temperature, salinity, and dietary preferences). However, the warmer water temperatures resulting from climate change could alter the species' distribution, as well as reduce larval survival rates, and increase rates of predation by crustaceans (Scheibling et al. 2020). Ocean warming also influences the productivity and distribution of the seaweeds on which urchins feed (Smale 2020). Urchin distribution and productivity may also be affected by rapid salinity changes, hypoxic conditions, and the dynamics of wave- and ice-induced coastal erosion (Scheibling et al. 2020).

The Estuary and Gulf of St. Lawrence are experiencing warmer bottom water temperatures, reduced ice volumes in winter, and increased numbers of crustacean predators such as lobster and rock crab (Bernier et al. 2023, Blais et al. 2023, Galbraith et al. 2024). However, these ecosystem changes and their effects on the productivity of urchin stocks have not been quantified.

Mass mortalities of urchins caused by infection by the amoeboid pathogen *Paramoeba invadens* have not been reported yet in the ENGSL, but have occurred in adjacent regions (Miller and Nolan 2000, Scheibling et al. 2020). The impacts of climate change on the distribution of this pathogen and the future vulnerability of urchins to the threat are uncertain.

SOURCES OF UNCERTAINTY

Given the absence of fishery-independent indicators for almost all fishing areas, the scientific advice provided on the Green Sea Urchin is dependent on the quality of the data from logbooks and commercial catch sampling. The paucity of information from the commercial fishery means that the analyses based on these data have little statistical power to detect changes.

The fishery catch rates (CPUE) used to assess stock status may be influenced by various factors such as harvesters' behaviour, technological advances, current management measures, market factors, and environmental variability. In addition, hyperstability can bias estimates by keeping CPUE values artificially high when abundance is actually declining. Consequently, CPUE should be considered an index of fishery performance rather than a stock status indicator (Miller and Nolan 2000).

No information is available on urchin bycatch in other directed fisheries or on the impact of at-sea discards. Urchin mortality resulting from these activities, including discards from all sources, is unknown, as is the magnitude of the removals under provincial sea urchin permits.

Natural mortality rates (*M*), fishing mortality rates (*F*), recruitment, the demographic structures of populations, and relative abundance indices for the species in the ENGSL are not known due to a lack of data.

The extent and magnitude of the overlap in distribution of, and the hybridization between, the Green Sea Urchin (*S. droebachiensis*) and the Pale Sea Urchin (*S. pallidus*) in the Estuary and Gulf of St. Lawrence are also unknown (Swan 1962, Addison and Hart 2005, Addison and Kim 2018, Addison and Kim 2022).

LIST OF MEETING PARTICIPANTS

Name	Affiliation	April 1st	April 2nd
Belley, Rénald	DFO – Science	x	x
Bermingham, Tom	DFO – Science	x	x
Bouchard, Donald	Première Nation Essipit	x	x
Boulay. Catherine	DFO – Fisheries Management	x	x
Cervello, Gauthier	DFO – Science	x	-
Chamberland, Jean-Martin	DFO – Science	x	x
Chevarie, Marie-France	Fisher	x	-
Couillard, Catherine	DFO – Science	x	x
Cyr, Charley	DFO – Science	x	x
Desgagnés, Mathieu	DFO – Science	x	x
Finley, Monica	DFO – Fisheries Management	x	x
Gendreau, Yanick	DFO – Science	x	x
Gianasi, Bruno	DFO – Science	x	x
Loboda, Sarah	DFO – Science	x	x
Marcil, Catherine	DFO – Science	x	x
Ouellet, Roger	Fisher	x	-
Ouellette-Plante, Jordan	DFO – Science	x	x
Quiros, Amanda	Agence Mamu Innu Kakussesht	x	-
Rivard, Julie	DFO – Science	x	x
Roy, Marie-Josée	DFO – Fisheries Management	x	x
Roy, Stéphanie	DFO – Science	x	x
Roy, Virginie	DFO – Science	x	x
Sigouin, Évelyne	Association de gestion halieutique autochtone Mi'gmaq et Wolastoqey	x	-

Name	Affiliation	April 1st	April 2nd
Small, Daniel	DFO – Science	x	-
Smith, Andrew	DFO – Science	x	x
Tamdrari, Hacène	DFO – Science	x	x
Thériault, Raynald	Fisher North Shore	x	-
Turgeon, Samuel	Parks Canada	x	x
Vanier, Caroline	DFO – Science	x	-

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Center for Science Advice (CSA)
Quebec Region
Fisheries and Oceans Canada
Maurice Lamontagne Institute
850 route de la mer
Mont-Joli, QC
G5H 3Z4

E-Mail: dfo.csaquebec-quebeccas.mpo@dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas-sccs/

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