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Maritimes Region

Canadian Science Advisory Secretariat
Science Advisory Report 2025/051

SFA 27A (GEORGES BANK 'A') SEA SCALLOP (*PLACOPECTEN MAGELLANICUS*) STOCK ASSESSMENT IN 2024

CONTEXT

The Fisheries Management Branch of Fisheries and Oceans Canada (DFO) has requested that the Scallop Fishing Area (SFA) 27A (Georges Bank 'a') Sea Scallop (*Placopecten magellanicus*) stock be assessed relative to reference points that are consistent with the DFO Precautionary Approach (DFO 2009), and provide harvest advice based on various potential catch levels for the 2025 fishery. This Science Advisory Report is from the May 15, 2025, regional peer review on the Assessment of Stock Status for Offshore Scallop (*Placopecten magellanicus*) on Georges Bank 'a' and Browns Bank North. 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 median fully-recruited biomass estimate in 2024 was 13,570 t (meats), with 0.76 probability of being above the upper stock reference (USR) and in the healthy zone.
- The median recruit biomass estimate in 2024 was 1,391 t, which is below the long-term median (1986–2023) of 3,428 t.
- In 2024 the estimated proportional exploitation rate (0.18) was below the removal reference (RR) of 0.25.

Trends

- Fully-recruited biomass has fluctuated within the healthy zone since the 2000s. Fully-recruited biomass decreased by 56% from 31,095 t in 2023 to 13,570 t in 2024.
- Recruit biomass fluctuated above the long-term median from 2008 to 2018, and has decreased since the historically high recruitment event in 2009. Recruit biomass was below the long-term median in 2024 and decreased by 72% from 2023.
- The estimated proportional exploitation rate has fluctuated below the RR since 2006. Exploitation increased in 2024 but was comparable to the past 20 years.
- The estimated natural mortality rates for both recruit and fully-recruited scallop have increased since 2019. In 2024, the estimated natural mortality of both size classes increased to 0.41, approaching the highest values observed in their respective time series.
- In 2024, scallop condition declined by 39% compared to 2023 and was below the long-term median. The decline from 2023 to 2024 was the largest decline in scallop condition between subsequent years in the time series.

Ecosystem and Climate Change Considerations

- Research vessel survey data from Canada and the United States suggest that predator abundance, notably sea stars (*Asterias spp.*) and crabs (*Cancer spp.*), has increased within areas of known scallop distribution. Aggregations of predators in areas of high scallop density contribute to increases in natural mortality.
- Observations of significant interannual changes in scallop condition in SFA 27A are likely driven by environmental variability.

Stock Advice

- Based upon preliminary analysis of the 2024 fishery and DFO Maritimes Offshore Scallop survey data, an interim total allowable catch (TAC) of 2,100 t (meats) was set for the 2025 SFA 27A fishery.
- A catch of 2,100 t would result in an expected 37% decrease in fully-recruited biomass. The probability that a catch of 2,100 t will result in the fully-recruited biomass remaining above the LRP is 0.93 and the probability remaining above the USR is 0.18.
- Catch of 2,100 t is estimated to result in an exploitation rate of 0.25 which is at the RR (0.25).

BASIS FOR ASSESSMENT

Assessment Details

Year Assessment Approach was Approved

2013 (DFO 2013, Hubley et al. 2014)

Assessment Type

Full Assessment

Most Recent Assessment Date

1. Last Full Assessment: 2013 (DFO 2013)
2. Last Interim Year Update: 2024 (DFO 2024a)

Assessment Approach

1. Broad category: Single stock assessment model
2. Specific category: Delay difference, biomass dynamics, state-space

Science advice is provided for this stock using a Bayesian state-space modified delay difference model that integrates both fishery and DFO Maritimes Offshore Scallop survey (hereafter referred to as the 'survey') data. Additional details on the assessment model can be found in Hubley et al. (2014).

Stock Structure Assumption

The Offshore Sea Scallop fisheries conducted on Georges Bank SFA 27 were split into SFA 27A (Georges Bank 'a') and SFA 27B (Georges Bank 'b') in 1998 based on productivity and historical fishing patterns (Figure A1). SFA 27A was identified as being more productive and

represents greater than 70% of the SFA 27 fishery. Stock reference points (USR, LRP, and RR) have been adopted for SFA 27A, while SFA 27B has separate management measures.

Reference Points

- Limit reference point (LRP): 30% of B_{MSY} proxy
- Upper stock reference (USR): 80% of B_{MSY} proxy
- Removal reference (RR): 0.25
- Target reference point (TRP): Not applied

SFA 27A LRP and USR reference points are based on 30% and 80% of the long-term mean modelled biomass from 1986 to 2009 (a proxy for B_{MSY}), which changes annually as new data are included in the model (Smith and Hubley 2012; Hubley et al. 2014). More details can be found in the Integrated Fisheries Management Plan (DFO 2024b).

Data

- DFO Maritimes Offshore Scallop Survey data (1986–2024)
- Commercial data (1986–2024)

In 2020, the DFO Maritimes Offshore Scallop Survey was cancelled due to challenges associated with the COVID-19 pandemic. The 2020 model inputs were imputed using the average of the 2019 and 2021 survey indices, except for growth, which used the long-term median from 1986–2019.

ASSESSMENT

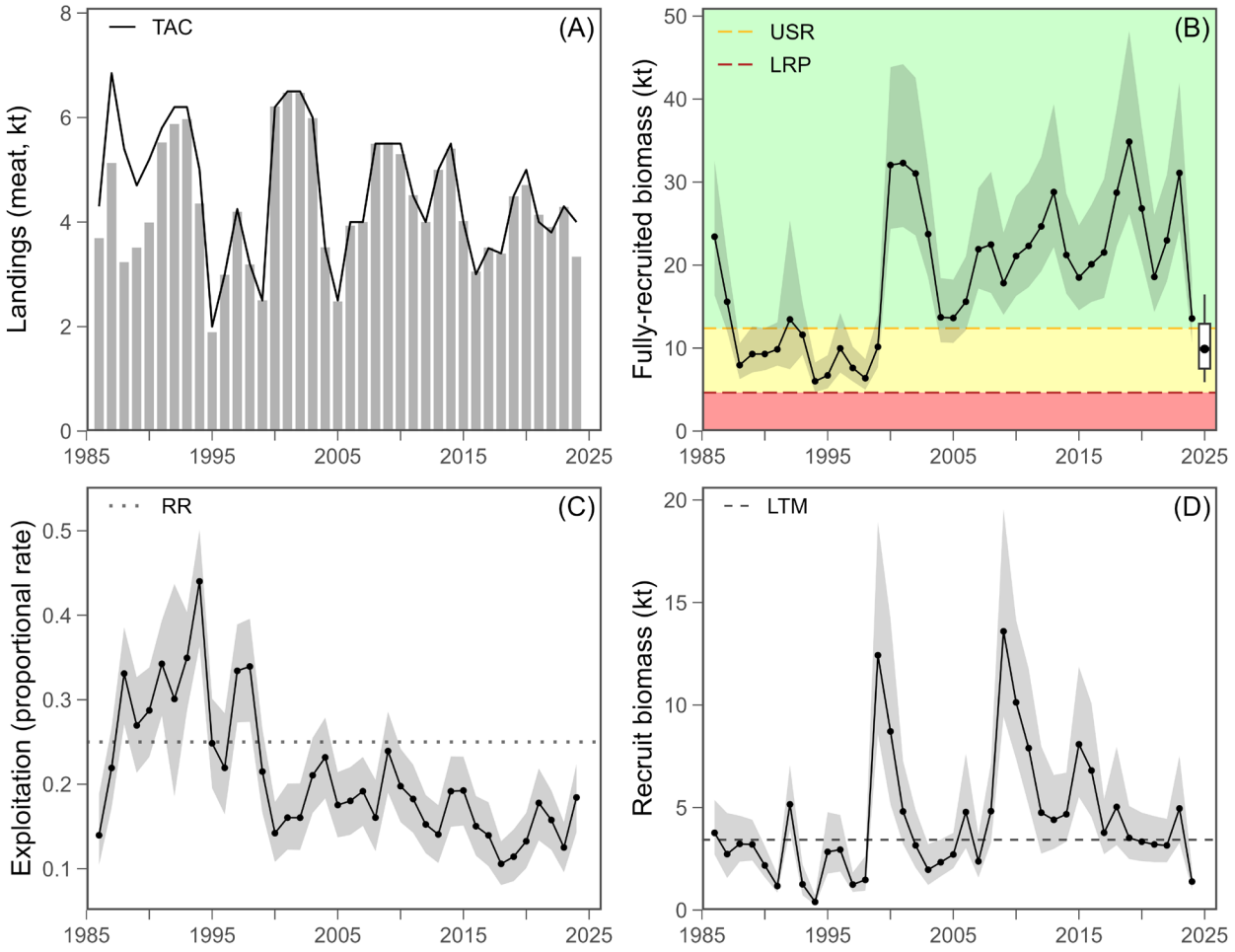

Figure 1. (A) Annual landings of scallop meats (kilotonnes, kt) from scallop fishing area (SFA) 27A between 1986 and 2024. The black solid line represents total allowable catch (TAC). (B) Mean model predicted biomass estimates (kt) for fully-recruited scallops (black solid line) from the stock assessment model fit to the SFA 27A survey and commercial data. The grey shaded region represents the upper and lower 95% credible intervals. Coloured zones (from top to bottom) represent the healthy (green), cautious (yellow) and critical (red) zones in relation to the limit reference point (LRP, red dashed line) and upper stock reference (USR, yellow dashed line). The forecasted fully-recruited biomass for 2025, assuming a catch of 2,100 t, is displayed as a box plot with median (black dot, •), 50% credible intervals (white box) and 80% credible intervals (black whiskers). (C) Estimated proportional exploitation rate (black solid line) in relation to the removal reference (RR) of 0.25 (grey dotted line). The grey shaded region represents the upper and lower 95% credible intervals. (D) Mean model-predicted biomass estimates (kt) for recruit scallops (black solid line) in relation to the long-term median (1986–2023, LTM) recruit biomass (grey dashed line). The shaded region represents the upper and lower 95% credible intervals.

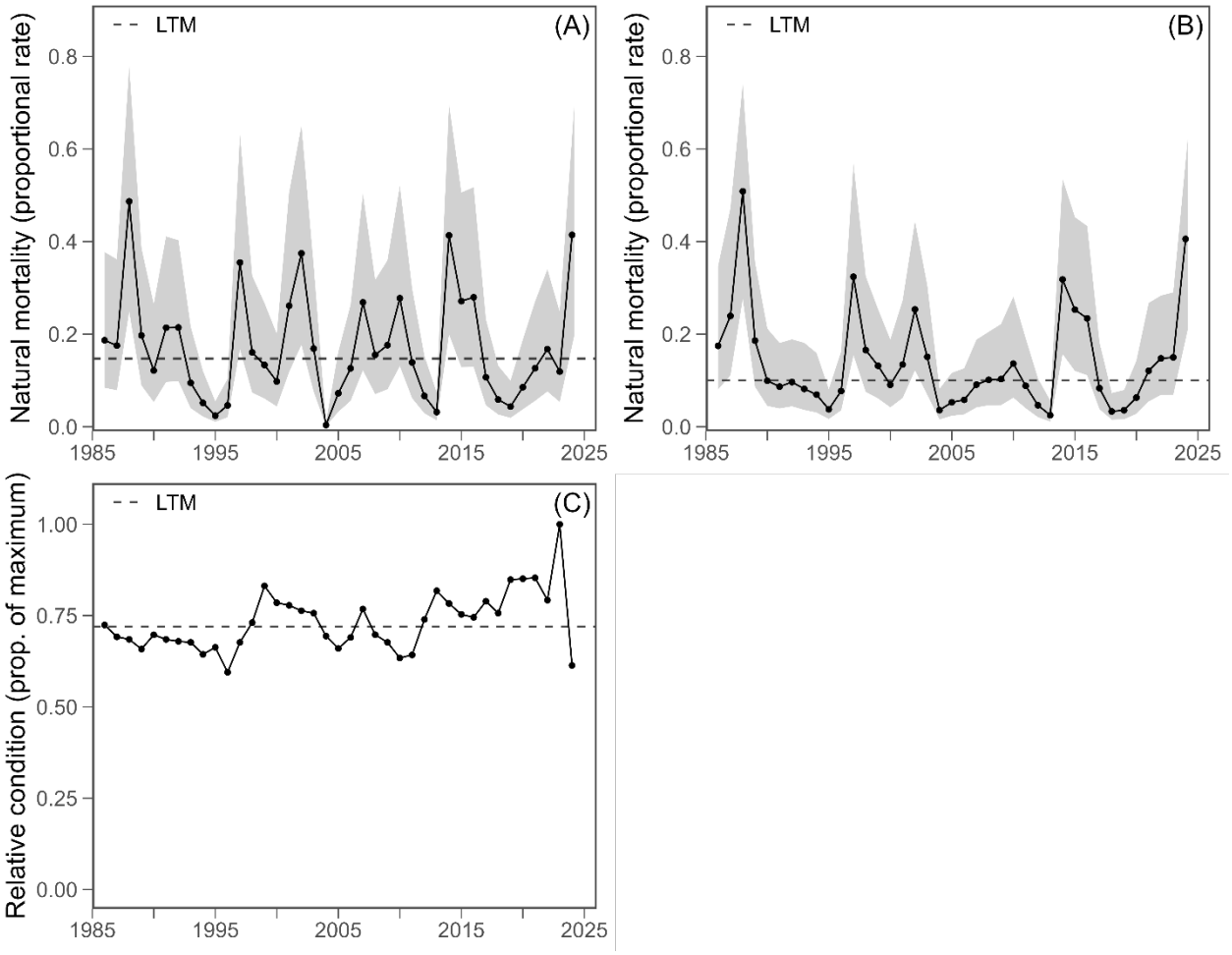

Figure 2. Estimated proportional natural mortality (black solid line) of recruit (A) and fully-recruited (B) scallop, in relation to respective long-term median (1986–2023, LTM) natural mortality rates (grey dashed line). The grey shaded regions represent corresponding upper and lower 95% credible intervals. (C) Survey index of scallop condition, presented as proportions relative to the time-series maximum, in relation to the long-term median (1986–2024) proportional value (grey dashed line).

Stock Status and Trends

Fully-recruited Biomass

Model estimated fully-recruited biomass has been variable and above the USR since 2000. Biomass increased between 2021 and 2023 but declined by 56% in 2024 from 31,095 t to 13,570 t (Figure 1B). The probability that biomass is currently above the USR and in the healthy zone is 0.76, and the probability that biomass is currently above the LRP is greater than 0.99.

Recruit Biomass

Following a period of relative stability near the long-term median of 3,428 t between 2019 and 2022, recruit biomass increased by 57% in 2023, before declining by 72% in 2024 to the lowest level observed since the 1990s (Figure 1D).

Natural Mortality

The estimated proportional natural mortality of recruit and fully-recruited scallop have fluctuated within consistent ranges (between 0.01–0.5 and 0.02–0.5 for recruit and fully-recruited scallops, respectively) throughout their respective time series. Elevated values occur approximately every 5–8 years for recruit and every 7–10 years for fully-recruited scallop (Figure 2). The estimated natural mortality rates for both recruit and fully-recruited scallop have been increasing since 2018–2019. The proportional natural mortality of recruit scallop increased from 0.12 in 2023 to 0.41 in 2024. The proportional natural mortality of fully-recruited scallop increased from 0.15 in 2023 to 0.41 in 2024. In 2024, the estimated natural mortality of both size classes approached the highest values observed in their respective time series.

Fishing Mortality

Estimated proportional exploitation rates have varied below the RR level of 0.25 since 2010 (Figure 1C). Over the past decade (2014–2024) proportional exploitation rates have varied within a relatively consistent range (between 0.1–0.2). Between 2023 and 2024, the estimated proportional exploitation rate was 0.18.

Condition

Scallop condition (meat weight given shell height) in 2023, as measured by the DFO Maritimes Offshore Scallop surveys of Georges Bank and Scotian Shelf, increased by 26% to the highest observed value in the time series. In 2024, condition decrease by 39% to the second lowest value in the time series, representing the largest decline in scallop condition between subsequent years in the time series.

Current Status

The 2024 median biomass estimate of 13,570 t is above the USR, with a 0.76 probability of being in the healthy zone.

History of Landings and Total Allowable Catch

Scallop landings have been monitored for Georges Bank (SFA 27) since 1984 (Figure 1A). The current monitoring structure began in 1998, when Georges Bank was divided into SFA 27A (Georges Bank 'a') and SFA 27B (Georges Bank 'b') for quota allocation purposes (DFO 2024). Table 1 shows the TAC, and associated TACs, for SFA 27A since the separation of Georges Bank.

A quota carry-forward guideline exists for SFA 27A. The 2024 TAC was 4,000 t. With quota carry-forward, the post reconciliation allocation for 2024 was approximately 4,007.9 t. Quota carry-forward has not been included in the 2025 interim TAC of 2,100 t.

Table 1. Annual total allowable catch (TAC) and Scallop landings (meats, weight in tonnes) by calendar year for SFA 27A from 1998 to 2024. TAC values are pre-quota reconciliation.

Year	1998–2015 Average	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	4,689	3,000	3,500	3,400	4,500	5,000	4,000	3,800	4,300	4,000
Landings	4,669	3,054	3,514	3,397	4,493	4,706	4,140	3,906	4,289	3,335

Projections

The projected fully-recruited biomass for 2025 is 8,605 t. This projection accounts for fisheries removals (727 t) occurring after the survey in 2024 and assumes:

- a catch of 2,100 t (the interim TAC set in December 2024);
- the condition of Scallop in 2025 will be unchanged from 2024 (13.2 g/dm³); and
- that proportional natural mortality of recruit and fully-recruited Scallops in 2025 will be unchanged from 2024 (both 0.41).

Catch scenarios ranging from 0 t to 3,000 t are presented in Table 2. All catch scenarios evaluated are projected to result in decreases in fully-recruited biomass, with a probability of biomass decline ranging from 0.79 with no catch to 0.92 for a catch of 3,000 t. The expected change in biomass varies from -26% to -42% for the catch scenarios examined. The probability that the stock biomass will be in the healthy zone (above the USR) is 0.3 in a no catch scenario, 0.18 for a catch of 2,100 t (the 2025 interim TAC), and 0.14 for a catch of 3,000 t. Catch of 2,100 t (the 2025 interim TAC) is projected to result in a proportional exploitation rate of 0.25 and an expected 37% decrease in fully-recruited biomass from 2024 to 2025.

Table 2. Decision table for the limit reference point (LRP) and upper stock reference (USR) for 1 year projections using catch scenarios ranging from 0 t to 3,000 t for scallop fishing area 27A. Potential catches in 2025 are evaluated in terms of the expected exploitation rate (proportional) and change in fully-recruited biomass, and the probability of a decline in biomass. These probabilities account for uncertainty in the biomass forecasts. The interim total allowable catch is marked with an asterisk (*).

Catch (t)	Exploitation Rate	Probability of Biomass Decline	Expected Change in Biomass (%)	Probability biomass will be below LRP	Probability biomass will be below USR
0	0.07	0.79	-26	0.03	0.70
500	0.11	0.82	-29	0.04	0.73
1000	0.16	0.85	-32	0.05	0.76
1500	0.20	0.87	-34	0.05	0.79
2000	0.24	0.89	-36	0.07	0.81
2100*	0.25	0.89	-37	0.07	0.82
2500	0.28	0.91	-39	0.08	0.84
3000	0.32	0.92	-42	0.10	0.86

Ecosystem and Climate Change Considerations

Sea scallops are largely sedentary molluscs and are susceptible to climate change stressors, such as, rising bottom temperatures and ocean acidification which affect scallop physiology and growth (Rheuban et al. 2018). Annual growth rates are calculated using a combination of scallop condition (meat weight given shell height) and expected shell growth. Large interannual shifts in condition have been shown to cause substantial increases in biomass estimates without corresponding increases in abundance (DFO 2024b). Observations of significant interannual changes in scallop condition are likely driven by variability in environmental conditions (Laing 2000, Liu et al. 2021). However, direct environmental monitoring and climate research are limited for SFA 27A and other Scotian Shelf stocks. As a result, potential effects are inferred from findings in other regions.

Shifts in predator distributions and increasing predator abundance in northern waters may also present emerging risks. Research survey data suggests that predator abundance, including sea stars (*Asterias spp.*) and crabs (*Cancer spp.*), has increased within areas of known scallop distribution, although the reasons for this are unclear. Aggregations of predators in areas of high scallop density may contribute to increases in natural mortality, particularly for pre-recruit (less than 85 mm shell height) sized scallops (Elner and Jamieson 1979, Barbeau and Scheibling 1994, Wong and Barbeau 2005). High densities of predators and dead scallops (clappers) observed in other regions reinforce the need for continued monitoring of the distribution and abundance of predators.

SOURCES OF UNCERTAINTY

Delay-difference models, and the predictions from these models, are known to respond more slowly than the actual changes in productivity when rapid changes occur (National Research Council et al. 1998, Jonsen et al. 2009), such as the observed changes in natural mortality and condition from 2023 to 2024. The basis for the science advice to management for 2025 assumes the 2024 proportional natural mortality estimates for recruit and fully-recruited scallops, and assumes no change in condition from 2024 to 2025. If natural mortality and/or condition change in 2025, the biomass projections (and consequent decision table probabilities) would be affected.

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SOURCES OF INFORMATION

Barbeau, M.A., and Scheibling, R.E. 1994. Behavioral mechanisms of prey size selection by sea stars (*Asterias vulgaris* Verrill) and crabs (*Cancer irroratus* Say) preying on juvenile sea scallops (*Placopecten magellanicus* (Gmelin)). Journal of Experimental Marine Biology and Ecology **180**(1): 103–136. doi:10.1016/0022-0981(94)90082-5.

DFO. 2009. A Fishery Decision-Making Framework Incorporating the Precautionary Approach.

DFO. 2024a. Stock Status Update of Georges Bank 'a' Scallops (*Placopecten magellanicus*) for the 2024 Fishing Season. DFO Can. Sci. Advis. Sec. Sci. Resp. 2024/023.

DFO. 2024b. Integrated Fisheries Management Plan: Offshore scallop, Maritimes Region, Fisheries and Oceans Canada.

DFO. 2013. Assessment of Georges Bank Scallops (*Placopecten magellanicus*). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2013/058.

Elner, R.W., and Jamieson, G.S. 1979. Predation of sea scallops, *Placopecten magellanicus*, by the Rock Crab, *Cancer irroratus*, and the American Lobster, *Homarus americanus*. Journal of the Fisheries Research Board of Canada. 36(5): 537–543. doi:10.1139/f79-077.

Hubley, P.B., Reeves, A., Smith, S.J., and Nasmith, L. 2014. Georges Bank 'a' and Browns Bank North scallop (*Placopecten magellanicus*) stock assessment. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/079: vi + 58 p.

Jonsen, I.D., Glass, A., Hubley, B., and Sameoto, J. 2009. Georges Bank 'a' scallop (*Placopecten Magellanicus*) framework assessment: Data inputs and population models. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/034: iv + 76 p.

Laing, Ian. 2000. Effect of Temperature and Ration on Growth and Condition of King Scallop (Pecten Maximus) Spat. *Aquaculture* 183, no. 3: 325–34..

Liu, Xiaohan, Emmanuel Devred, Catherine L. Johnson, Dave Keith, and Jessica A. Sameoto. 2021. Using Satellite Remote Sensing to Improve the Prediction of Scallop Condition in Their Natural Environment: Case Study for Georges Bank, Canada. Remote Sensing of Environment. 254: 112251.

National Research Council, Division on Earth, Life Studies, Ocean Studies Board, Commission on Geosciences, Resources, and Committee on Fish Stock Assessment Methods. 1998. Improving fish stock assessments. National Academies Press.

Rheuban, J.E., Doney, S.C., Cooley, S.R., and Hart, D.R. 2018. Projected impacts of future climate change, ocean acidification, and management on the US Atlantic sea scallop (*Placopecten magellanicus*) fishery. PLOS ONE 13(9): e0203536. Public Library of Science. doi:10.1371/journal.pone.0203536.

Smith, S.J., and Hubley, P.B. 2012. Reference points for scallop fisheries in the Maritimes Region. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/018: ii + 16 p.

Wong, M.C., and Barbeau, M.A. 2005. Prey selection and the functional response of sea stars (*Asterias vulgaris* Verrill) and rock crabs (*Cancer irroratus* Say) preying on juvenile sea scallops (*Placopecten magellanicus* (Gmelin)) and blue mussels (*Mytilus edulis* Linnaeus). Journal of Experimental Marine Biology and Ecology. 327(1): 1–21. doi:10.1016/j.jembe.2005.05.018

APPENDIX

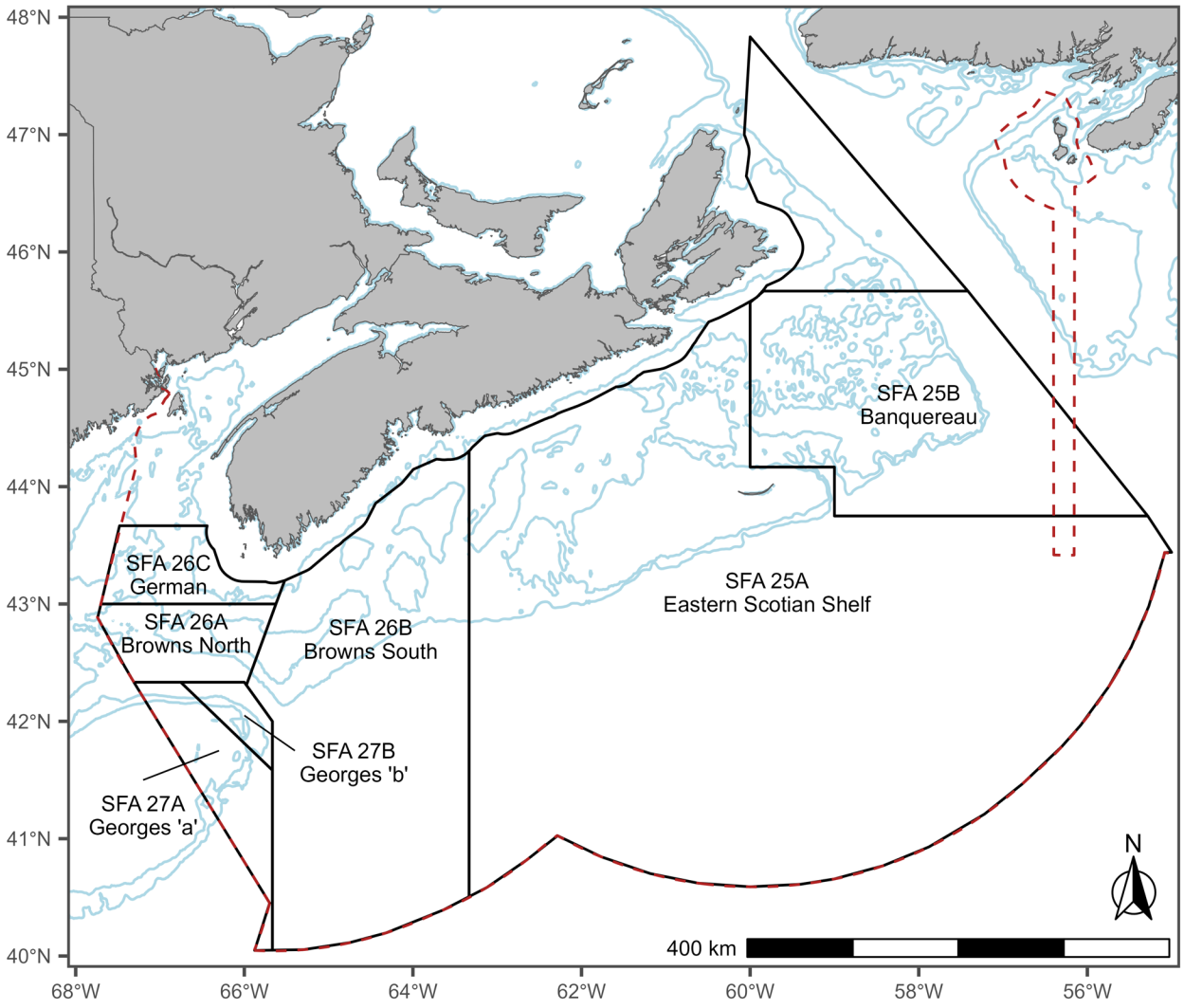

Figure A1. Offshore scallop fishing areas (SFAs) 25–27 used for management purposes in the DFO Maritimes Region. Bathymetry is shown as 50 m contours (blue lines), SFAs are outlined in black, and the Exclusive Economic Zone (EEZ) boundary is indicated by a red dashed line.

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Aussi disponible en français :

*MPO. 2025. Évaluation du stock de pétoncle géant (*Placopecten magellanicus*) de la ZPP 27A (zone « a » de Georges Bank) en 2024. Secr. can. des avis sci. du MPO. Avis sci. 2025/051.*