



# STOCK STATUS UPDATE OF BROWNS BANK NORTH SCALLOPS (*PLACOPECTEN MAGELLANICUS*) FOR THE 2024 FISHING SEASON

## Context

Advice on the status of the Browns Bank North Scallop stock is requested annually by Fisheries and Oceans Canada (DFO) Resource Management to help determine an annual total allowable catch (TAC, meat weight) in support of the fishery. The purpose of this report is to update the status of Browns Bank North Scallop with data from the fishery (January 1 to December 31) and the 2023 DFO Maritimes Offshore Scallop Survey (hereafter referred to as the 'survey') to provide science advice for the management of the 2024 fishery.

This stock status update uses the assessment framework accepted during the peer-reviewed Regional Advisory Process of 2011 for Browns Bank North (Hubley et al. 2011). Updates have been conducted annually since 2014 with the exception of 2021, which did not occur because the 2020 survey was cancelled due to challenges associated with the COVID-19 pandemic (DFO 2022).

This update for the Scallop fishery on Browns Bank pertains to the northern part of the bank. Browns Bank South has separate management measures.

This Science Response reports results from the regional peer review of February 13, 2024, on the Stock Status Update of Offshore Scallop: Browns Bank North and Georges Bank 'a'.

## Analysis and Response

The location of Browns Bank North and the other Offshore Scallop Fishing Areas (SFAs) is provided in Figure 1. The 2023 TAC was 200 tonnes (t) for Browns Bank North and total reported landings were 202 t (Figure 2). Based upon preliminary analysis of the 2023 fishery and survey data, an interim TAC of 150 t was set in December 2023 for the 2024 Browns Bank North fishery.

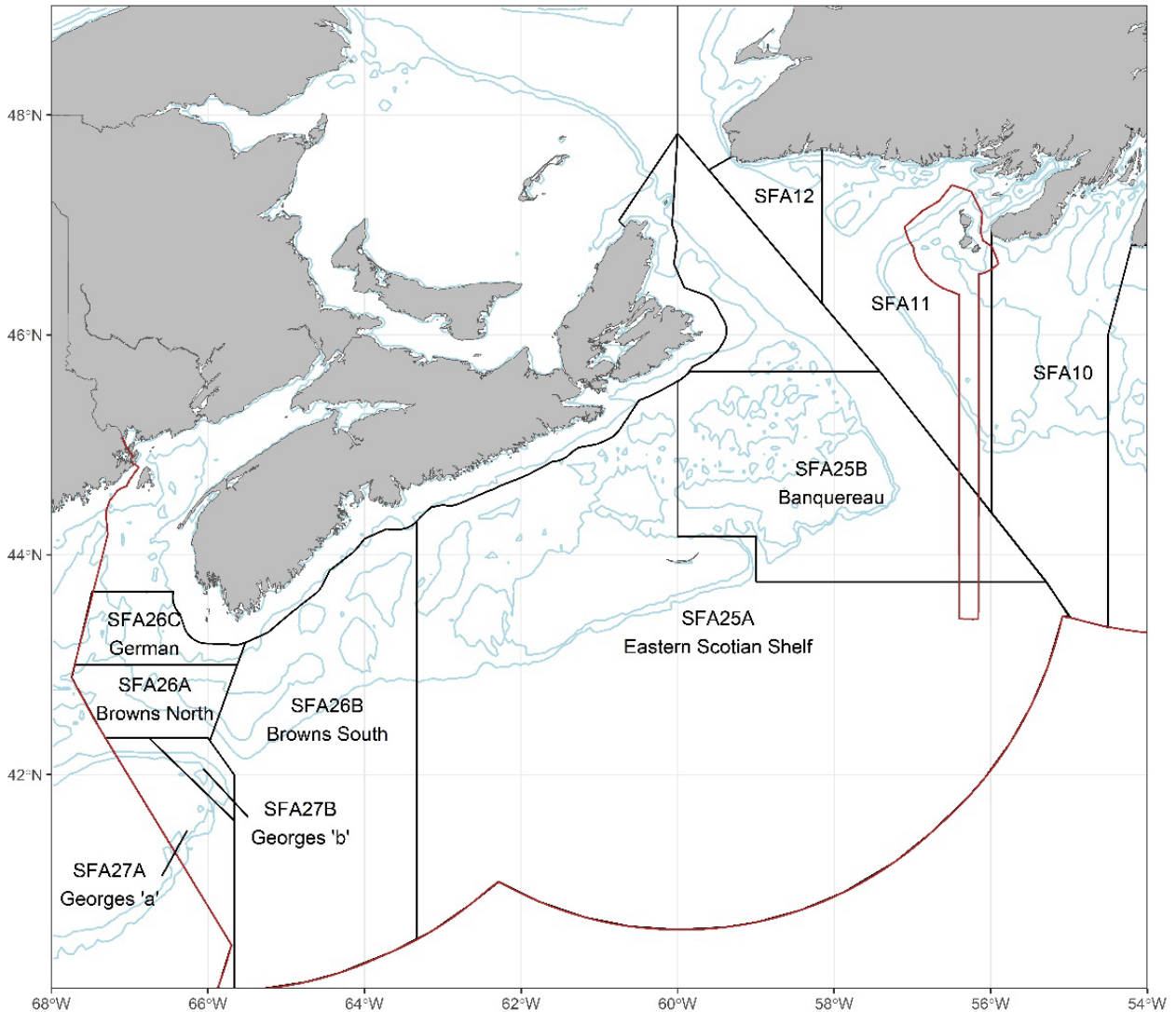


Figure 1. Map showing the offshore Scallop Fishing Areas (SFAs) 25–27 used for management purposes in the Maritimes region.

Science advice is provided for this stock using a Bayesian state-space modified delay difference assessment model that integrates both fishery and survey data and is described in Hubley et al. (2014). The model fit to the survey estimates of fully-recruited ( $\geq 95$  mm shell height) biomass, recruit (85–94.9 mm shell height) biomass, and fishery catch per unit effort [CPUE, kg/(hour-metre)] are shown in Figure 3. Estimates of fully-recruited biomass in 2023 and projections of fully-recruited biomass for 2024 under various catch scenarios are presented for this stock (Table 1 and Figure 4). Reference points had been proposed for the fishery in 2012 (Smith and Hubley 2012) but were not adopted.

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. This approach has been used to address missing information for other Scallop stocks (e.g., Nasmith et al. 2016).

**Indicator of Stock Status**

The modelled median fully-recruited biomass is estimated to be 3,392 t in 2023 (Figure 4), which is below the long-term median of 4,725 t. The 2022 estimate was 3,200 t. The median recruit biomass is estimated to be 99 t in 2023, which is below the long-term median biomass of 347 t. The 2022 estimate was 157 t. The long-term median calculations (1991–2022) exclude the current year (2023) estimates.

The forecasted fully-recruited biomass for 2024 is 3,282 t. This forecast accounts for fisheries removals (171 t) occurring after the survey in 2023, and assumes:

- a catch of 150 t (the interim TAC),
- the condition of Scallop in 2024 will be unchanged from 2023 (17.3 g/dm<sup>3</sup>), and
- that natural mortality in 2024 will be unchanged from 2023 (0.07).

This represents an estimated 4% decrease in fully-recruited biomass from 2023 to 2024.

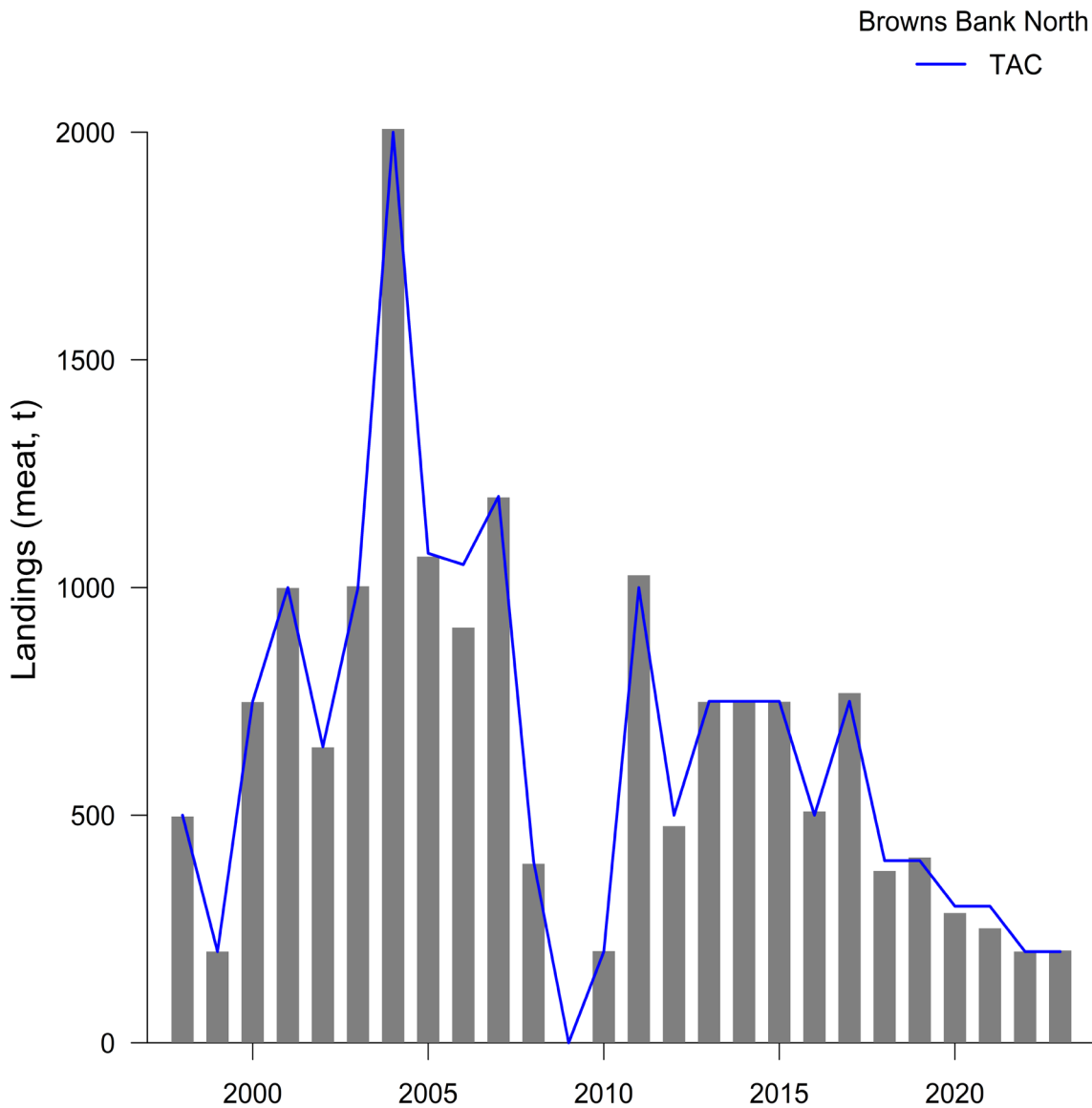


Figure 2. Landings of Scallop meats (tonnes) from Browns Bank North between 1998 and 2023. The blue line represents total allowable catch (TAC), in tonnes. Prior to 1998, landings from Browns Bank North were combined with Browns Bank South.

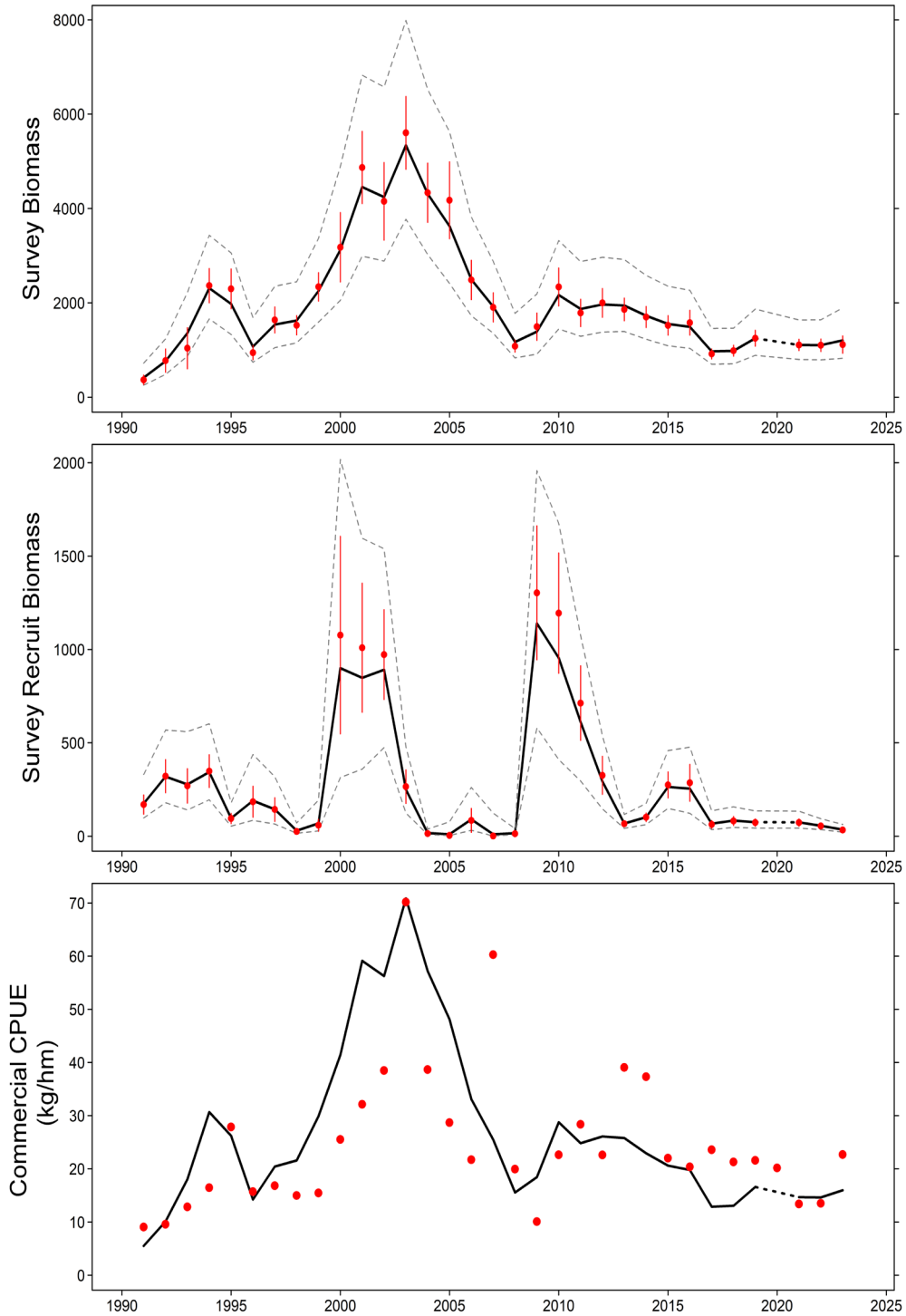


Figure 3. Summary of model results and inputs for fully-recruited survey biomass (top panel, in tonnes), recruit survey biomass (middle panel, in tonnes) and commercial CPUE (bottom panel, in kg/hour-metre) for Browns Bank North. The solid black line is the model estimate and the red circles represent observed values from the survey and the fishery. A black dashed line is used from 2019–2021 as there were no survey or model results for 2020. For the survey data, the vertical lines represent the standard error associated with the observed values and the grey dashed lines represent the modelled 95% credible intervals.

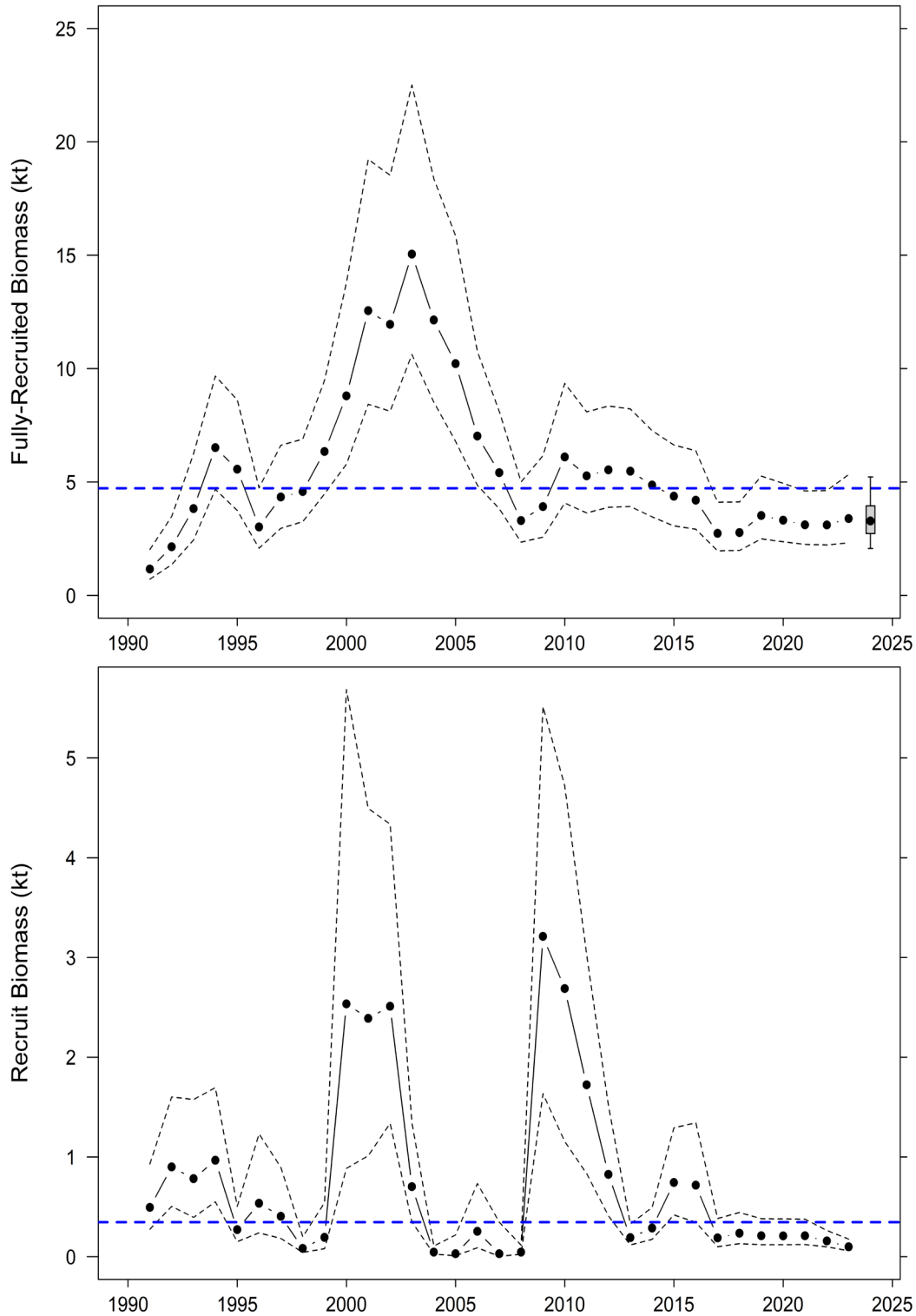


Figure 4. Biomass estimates (kilotonnes) for fully-recruited (top panel) and recruit (lower panel) scallops from the stock assessment model fit to the Browns Bank North survey and commercial data. Dashed lines are the upper and lower 95% credible limits. The blue horizontal dashed line represents the long-term (1991-2022) median biomass. The forecasted fully-recruited biomass for 2024, assuming a catch of 150 t, is displayed as a box plot with median (●), 50% credible limits (box) and 80% credible limits (whiskers).

Table 1. Catch scenarios for Browns Bank North in 2024 in terms of exploitation rate (proportional) and expected changes in fully-recruited biomass. Potential catches in 2024 are evaluated in terms of the probability of a decline in biomass. These probabilities account for uncertainty in the biomass forecasts.

Catch (t)	Exploitation Rate	Probability of Biomass Decline	Expected Change in Biomass (%)
50	0.06	0.51	-1
100	0.08	0.54	-2
150	0.09	0.56	-4
200	0.10	0.58	-5
250	0.12	0.60	-7
300	0.13	0.62	-8
350	0.14	0.65	-10
400	0.16	0.66	-11
450	0.17	0.69	-13
500	0.19	0.71	-14

**Special Considerations for 2024 Fishing Season**

In the 2023 Scallop Survey of Browns Bank North, scallop condition (meat weight given shell height) was the highest observed in the time series (Figure 5). Although fully-recruited scallop abundance decreased by 29% from 2022 to 2023 on Browns Bank North, condition increased by 29%, leading to an increase in the survey biomass index of 1% in 2023 (Figure 3). The science advice framework for projecting next year’s biomass uses the condition from the current year (2023). Therefore, if scallop condition declines in 2024, the catch scenarios presented in this document will overestimate the actual biomass (Table 1, Figure A1). Given that condition has driven the 2023 biomass increase, is well above historically observed values (Figure 5), recruitment in 2023 was below the long-term median (Figure 3), and a change in scallop condition of this magnitude between successive years has only been observed once before (2018 to 2019), caution is advised when setting the removal limits for 2024.

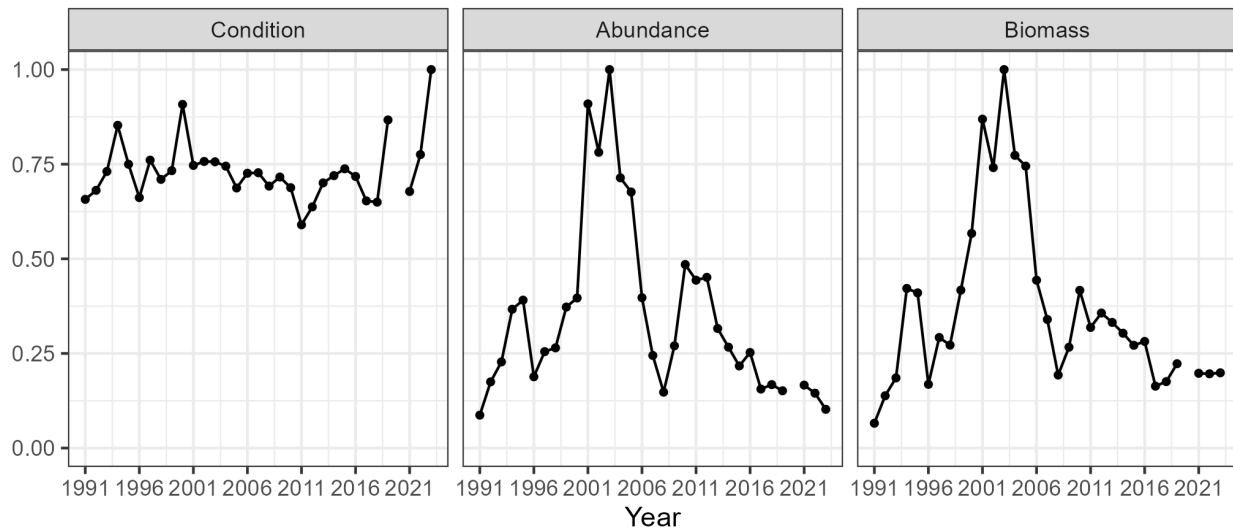


Figure 5. Survey indices of scallop condition, fully recruited abundance, and biomass presented as proportions relative to the time-series maximum for Browns Bank North from 1991 to 2023. There was no survey in 2020.

## Conclusions

Catch scenarios ranging from 50 t to 500 t were examined and are presented in Table 1, assuming condition and natural mortality remain unchanged from 2023. All catch scenarios in Table 1 are projected to result in decreases in fully-recruited biomass, with a probability of biomass decline ranging from 0.51 (50 t) to 0.71 (500 t). The change in biomass varied from -1% to -14% for the catch scenarios presented (Table 1). Catch of 150 t (the 2024 interim TAC) results in an exploitation rate of 0.09 and an expected 4% decrease in biomass (Table 1). Given that condition has driven the 2023 biomass increase, condition is well above historically observed values, recruitment in 2023 was below the long-term median, and a change in scallop condition of this magnitude between successive years has only been observed once before on Browns Bank North, caution is advised when setting the removal limits for 2024.

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Date: 23 February 2024

## Sources of Information

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## Appendix

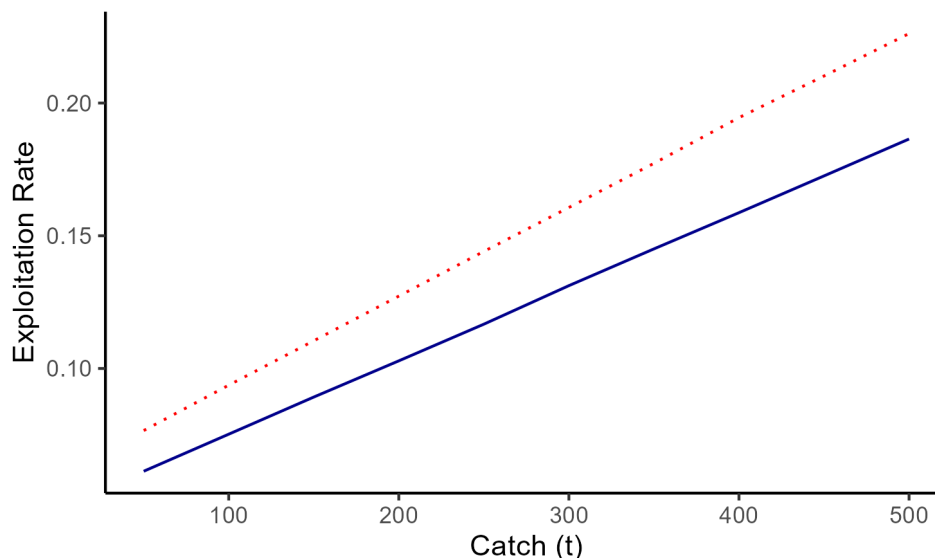


Figure A1. The exploitation rates predicted for different catch scenarios for Browns Bank North in 2024 under different assumptions of scallop conditions: unchanged from current year (blue), or using 2022 condition (dotted red).

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ISSN 1919-3769

ISBN 978-0-660-71178-2 Cat. No. Fs70-7/2024-022E-PDF

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Correct Citation for this Publication:

DFO. 2024. Stock Status Update of Browns Bank North Scallops (*Placopecten magellanicus*) for the 2024 Fishing Season. DFO Can. Sci. Advis. Sec. Sci. Resp. 2024/022.

*Aussi disponible en français :*

MPO. 2024. Mise à jour sur l'état du stock de pétoncle géant (*Placopecten magellanicus*) du nord du banc de Browns pour la saison de pêche 2024. Secr. can. des avis sci. du MPO. Rép. des Sci. 2024/022.