Fisheries and Oceans Canada | Pêches et Océans Canada
Ecosystems and Oceans Science | Sciences des écosystèmes et des océans

Québec Region

Canadian Science Advisory Secretariat
Science Advisory Report 2025/014

UNITS 1 AND 2 REDFISH (*SEBASTES MENTELLA AND SEBASTES FASCIATUS*) STOCKS ASSESSMENT IN 2024

CONTEXT

The Fishery management sector of Fisheries and Oceans Canada (DFO) has requested science advice for Units 1 and 2 Redfish. Redfish consists of two different species and stocks: *Sebastes mentella* and *Sebastes fasciatus*. These stocks are distributed in the Gulf of St. Lawrence (GSL), as well as in the Laurentian Channel and Laurentian Fan. Unit 1 includes the Northwest Atlantic Fisheries Organization (NAFO) Divisions 4RST and from January to May Subdivisions 3Pn4Vn, whereas Unit 2 includes Subdivisions 3Ps4Vs, Subdivisions 4Wfgj, and from June to December Subdivisions 3Pn4Vn.

This Science Advisory Report is from the regional peer review of March 11-14th, 2025, on Units 1 and 2 Redfish (*Sebastes mentella* and *S. fasciatus*) 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

- The spawning stock biomass (SSB) of *S. mentella,* estimated in 2024 at 1,737 kilotonnes (kt) (1,386-2,089 kt, 95% CI), places the stock in the healthy zone of the precautionary approach (PA). This level corresponds to 6 times the proposed Upper stock reference point (USR).
- The SSB of *S. fasciatus,* estimated in 2024 at 190 kt (9-371 kt, 95% CI), would be slightly above the proposed USR and in the healthy zone. However, *S. fasciatus* stock status is uncertain, owing to evidence suggesting the SSB may currently be overestimated, but the magnitude of this overestimation is not quantified.

Trends

- Based on the Unit 1 survey, after an unprecedented increase from 2015 to 2019, the biomass of *S. mentella* larger than 22 cm, minimum regulatory size used to determine potential removals, substantially declined in the last five years, but was still among the highest values of the time series starting in 1984.
- The trend between 2018 and 2024 is unknown in Unit 2 due to the lack of reliable information. However, the biomasses of *S. mentella* larger than 22 cm estimated in 2018 and 2024 were above the value estimated in 2016. The 2024 value was the highest of the time series starting in 2000.
- The biomass of *S. fasciatus* larger than 22 cm in the Unit 1 survey was relatively stable and slightly above the average in the last three years.

- Based on the Unit 2 survey, the biomass of *S. fasciatus* larger than 22 cm declined from 2016 to 2018, and remained at a similar level in 2024, under the average of the time series. However, the trend between 2018 and 2024 is unknown in Unit 2 due to the lack of reliable information.
- No strong cohort of *S. mentella* and *S. fasciatus* has been observed since 2013.

Ecosystem and Climate Change Considerations

- The increase in water temperature in the GSL and the Laurentian Channel would affect the Redfish growth. According to laboratory experiments, exposition to temperatures above 5 °C would result in a decrease in growth rates.
- Density dependence, observed with the high abundance of Redfish, would negatively affect feeding intensity, condition, and somatic growth of Redfish.

Stock Advice

- According to various plausible natural mortality hypotheses, for the 2025-2026 fishing season, the potential removal median is 253 kt (range 80-291 kt) in Unit 1 and 115 kt (range 36-131 kt) in Unit 2 for *S. mentella*.
- For *S. fasciatus*, given the uncertainty in biomass estimates and species identification, and the assumptions underlying the method used, it is not possible to provide a reliable range of potential removals.
- Directing fishing towards greater depths may reduce catches of *S. fasciatus* in all fishing areas except the Laurentian Fan, where this species is found at greater depths.
- Given the low levels of recruitment and growth observed in recent years, even in the absence of fishing, Redfish biomass is expected to decrease in upcoming years due to natural mortality.

BASIS FOR ASSESSMENT

Assessment Details

Year Assessment Approach was Approved

February and March 2022 (DFO 2022, Senay et al. 2023)

Assessment Type

Full Assessment

Most Recent Assessment Date

1. Last Full Assessment for Units 1 and 2: February and March 2022 (DFO 2022, Senay et al. 2023)
2. Last Interim Year Update for Unit 1: January 2024 (DFO 2024, Senay and Duplisea 2024)

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

Genomic analyses of samples collected from 2001 to 2015 confirmed a pronounced genetic distinction between *S. mentella* and *S. fasciatus*, despite their morphological similarity (Benestan et al. 2021). A single genetic group of *S. mentella* and three genetic groups of *S. fasciatus* were identified in Units 1 and 2.

Reference Points

Reference points are derived from the Unit 1 survey.

- Limit Reference Point (LRP): SSB of 47 kt for *S. mentella* and 31 kt for *S. fasciatus*.
- Proposed Upper Stock Reference (USR): SSB of 281 kt for *S. mentella* and 178 kt for *S. fasciatus*.
- Removal Reference (RR): Not available.
- Target Reference Point (TRP): Not available.

Harvest Control Rule

There is no harvest control rule in place. However, potential removals are suggested for *S. mentella* based on estimates of natural mortality and biomass over 22 cm.

Data

- Redfish commercial landings (not available by species): 1953-2024 for Unit 1 and 1960-2024 for Unit 2.
- Ecosystemic survey in the Estuary and northern Gulf of St. Lawrence survey in Unit 1 (hereafter Unit 1 survey): 1984-2024.
- Unit 2 survey: Done by the industry in 2000, 2001, 2003, 2005, 2007, 2009, 2011, 2014, 2016, and 2018, and by the DFO in 2024.

For the first time, catch rates for Units 1 and 2 used in the assessment are standardized to the catchability of the CCGS *John Cabot* fishing a modified Campelen trawl. This slightly modifies biomass indices and reference points.

In both surveys, anal fin ray counts are recorded, which permits *post-hoc* attribution of Redfish catches into *S. mentella* and *S. fasciatus* (Senay et al. 2022). This method may currently overestimate *S. fasciatus*.

ASSESSMENT

Stock Status and Trends for *S. mentella*

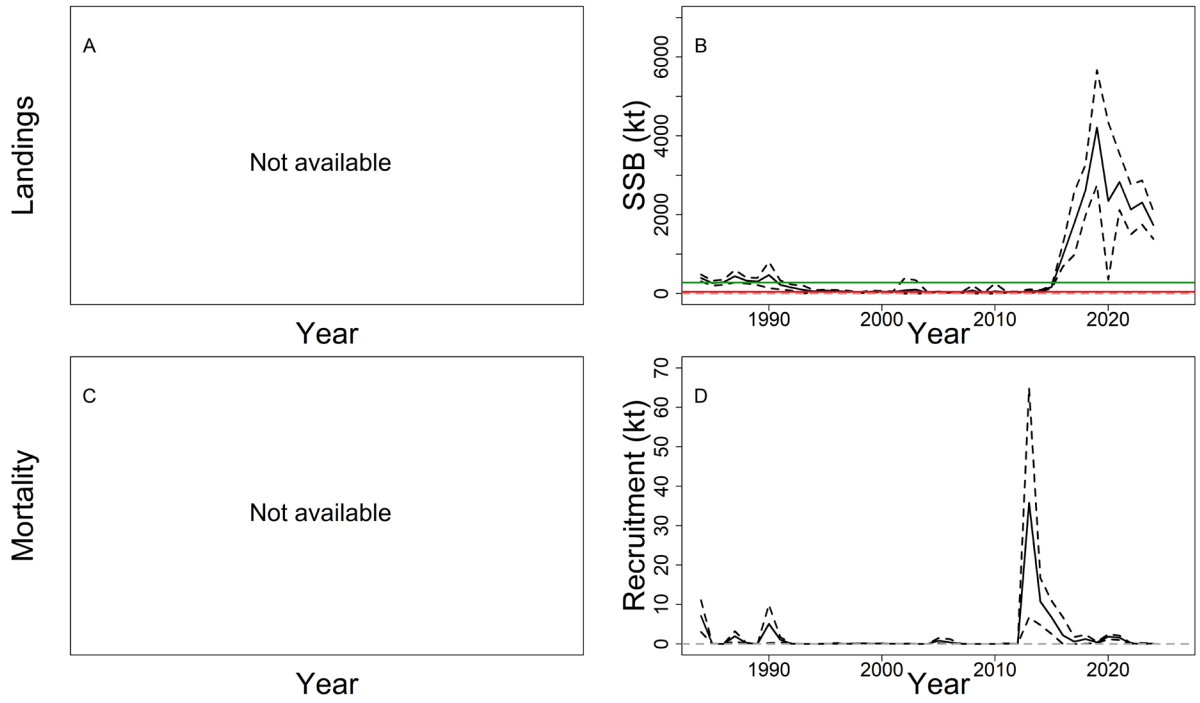

Figure 1. S. mentella (A) landings are not available at the species level, (B) SSB (kt) with 95% confidence intervals relative to the LRP in red and proposed USR in green, (C) fishing mortality is not available at the species level, (D) recruitment corresponds to biomass (kt) smaller than 11 cm with 95% confidence intervals. The 0 y-axis value are indicated by gray dashed lines.

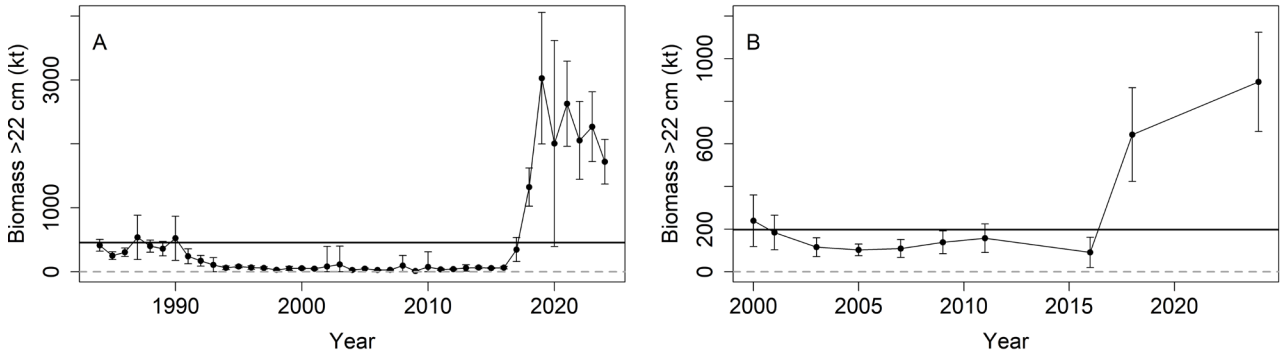

Figure 2. Minimal trawlable biomass (kt) of S. mentella larger than 22 cm with 95% confidence intervals in (A) Unit 1 and (B) Unit 2 surveys. Horizontal solid lines represent the average of the time series. The 0 y-axis value are indicated by gray dashed lines.

Biomass

Based on the Unit 1 survey, the biomass of *S. mentella* larger than 22 cm declined in the early 1990s (Figure 2A). Subsequently, biomass remained low until the arrival of the 2011-2013 cohorts that were first observed in the survey in 2013. After an unprecedented increase from

2015 to 2019, the biomass of *S. mentella* larger than 22 cm declined in the last five years, but was still among the highest values of the time series starting in 1984. In 2024, the biomass was estimated at 1,722 kt, which is among the highest values of the time series starting in 1984.

In the Unit 2 survey, from 2000 to 2016, the biomass of *S. mentella* larger than 22 cm was relatively stable and close to the average of the time series (Figure 2B). In 2018, the biomass increased above the average and a slightly higher value was estimated in 2024. The biomass in 2024 was estimated to 891 kt, corresponding to the highest value of the time series starting in 2000.

Recruitment

S. mentella annual recruitment success is variable, with large year classes observed at irregular intervals (Figure 1D). The 2011-2013 cohorts were the largest ever observed in the surveys. Since then, recruitment remained low. The modal length of these cohorts increased up to 25 cm in Unit 1 and 26 cm in Unit 2 in 2024, indicating a slower growth compared to the 1980 cohort.

Current Outlook

The SSB of *S. mentella,* estimated in 2024 at 1,737 kt (1,386-2,089 kt, 95% CI), places the stock in the healthy zone of the PA according to the LRP and proposed USR based on the Unit 1 survey (Figure 3B). This level corresponds to 6 times the proposed USR. The SSB decreased after 2020 but currently remains among the highest values of the time series.

Stock Status and Trends for *S. fasciatus*

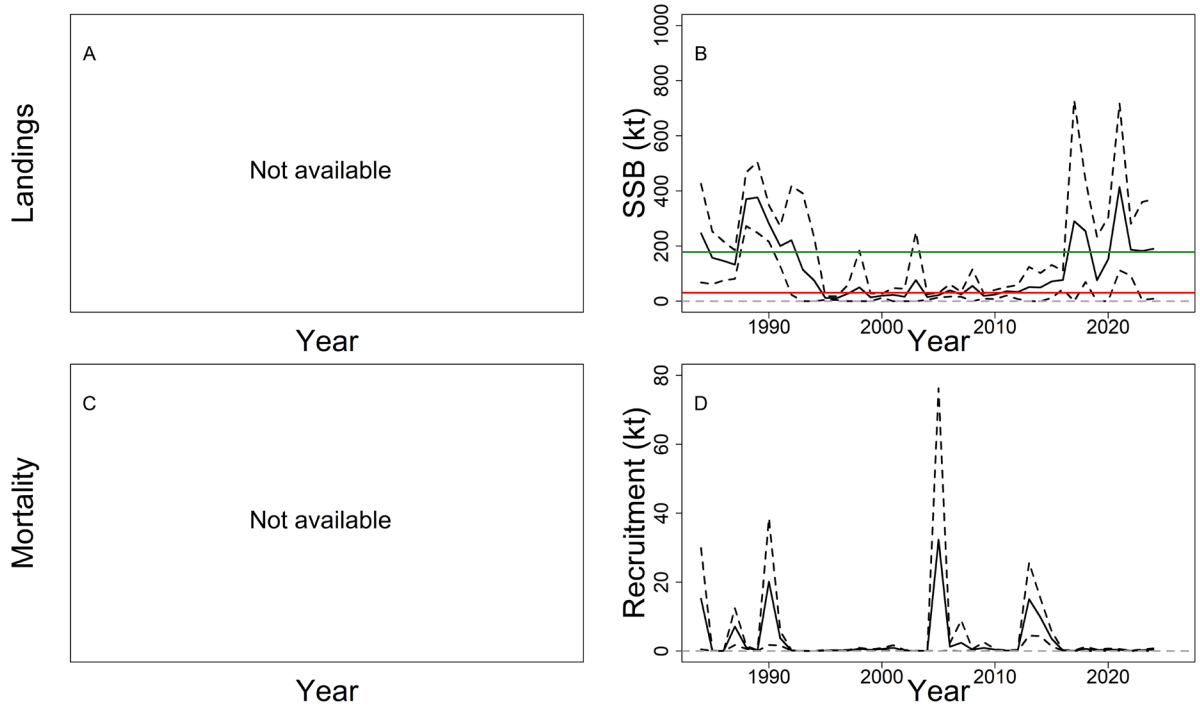

Figure 3. S. fasciatus (A) landings are not available at the species level, (B) SSB (kt) with 95% confidence intervals relative to the LRP in red and proposed USR in green, (C) fishing mortality is not available at the species level, (D) recruitment corresponds to biomass (kt) smaller than 11 cm with 95% confidence intervals. The 0 y-axis value are indicated by gray dashed lines.

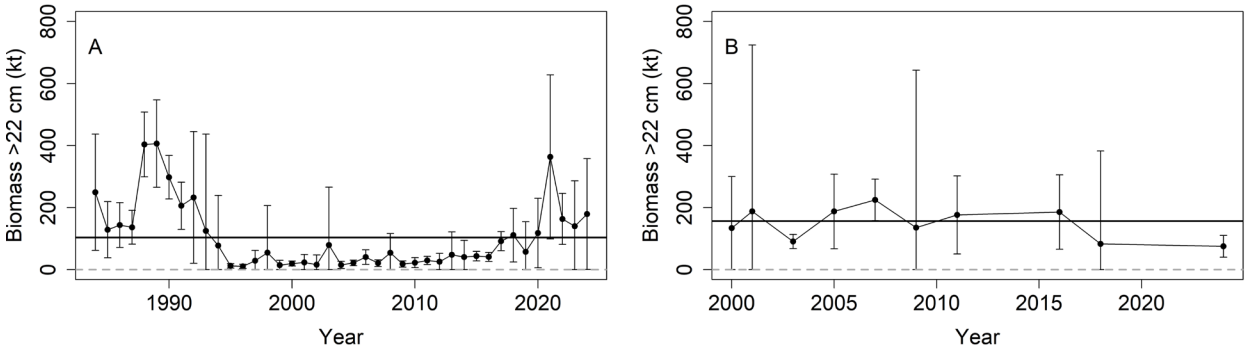

Figure 4. Minimal trawlable biomass (kt) of S. fasciatus larger than 22 cm with 95% confidence intervals in (A) Unit 1 and (B) Unit 2 surveys. Horizontal solid lines represent the average of the time series. The 0 y-axis value are indicated by gray dashed lines.

Biomass

Based on the Unit 1 survey, the biomass of *S. fasciatus* larger than 22 cm decreased in the early 1990s (Figure 4A). The biomass remained low until the 2011-2013 cohorts started being observed. The increase of biomass that followed was smaller than for *S. mentella*. The biomass of *S. fasciatus* larger than 22 cm in the Unit 1 survey was relatively stable and slightly above the average in the last three years. In 2024, the biomass of *S. fasciatus* larger than 22 cm was estimated at 179 kt, corresponding to a decrease compared to 2021.

In the Unit 2 survey, the biomass of *S. fasciatus* larger than 22 cm fluctuated close to the average from 2000 to 2016 (Figure 4B). The biomass decreased in 2018 and remained at a similar level in 2024, below the time series average. However, the trend between 2018 and 2024 is unknown in Unit 2 due to the lack of reliable information. In 2024, the biomass was estimated at 75 kt, the lowest value of the time series.

Recruitment

S. fasciatus annual recruitment success is variable (Figure 3D). After the recruitment of the 2011-2013 cohorts, which were smaller compared to those of *S. mentella*, recruitment remained low. *S. fasciatus* modal length was 25 cm in Unit 1 and 26 cm in Unit 2 in 2024.

Current Outlook

The SSB of *S. fasciatus,* estimated in 2024 at 190 kt (9-371 kt, 95% CI), would be slightly above the proposed USR and in the healthy zone (Figure 3B). However, *S. fasciatus* stock status is uncertain. Species identification method using anal fin rays risks overestimating the less abundant species, currently *S. fasciatus*. However, the extent of the overestimation is not quantified. The biases associated with this method could overestimate the SSB, the stock status, and its tolerance to substantial removals.

History of Landings

Landings have always been reported as Redfish given that *S. mentella and S. fasciatus* are morphologically similar. Therefore, landings cannot be disaggregated by species.

The Redfish fishery in Unit 1 has been characterized by three episodes of high landings (Figure 5A). Average annual landings were 43 kt between 1954-1956, 79 kt between 1965-1976, and 59 kt between 1987-1992. After a rapid decrease in landings in 1993 and 1994, a moratorium was declared in Unit 1 in 1995 and an index fishery was authorized in 1998. On

average, from 2010 to 2017, 470 t of Redfish were landed annually in Unit 1. In addition to the index fishery, an experimental fishery was established from the 2018-2019 to the 2023-2024 fishing seasons. During this period, landings were on average 2,200 t. In 2024, a commercial fishery was opened in Unit 1 with a total allowable catches (TAC) of 60,000 t. In 2024-2025, preliminary Redfish landings reached 2,964 t in Unit 1, as of March 17th 2025. The 2024-2025 fishing season continues until March 31st, 2025.

From 1960 to 1968, Unit 2 landings averaged 20,000 t and increased to a time series high of 58,200 t in 1971 (Figure 5B). Subsequently, landings declined around 8,100 t in 1984. Landings increased in the late 1980s and early 1990s. After reaching around 27,000 t in 1993, Redfish landings have declined. Between the 2006-2007 and 2023-2024 fishing seasons, landings fluctuated around an average of 4,500 t. In 2024-2025, preliminary Redfish landings reached 3,458 t in Unit 2. The 2024-2025 fishing season continues until March 31st, 2025.

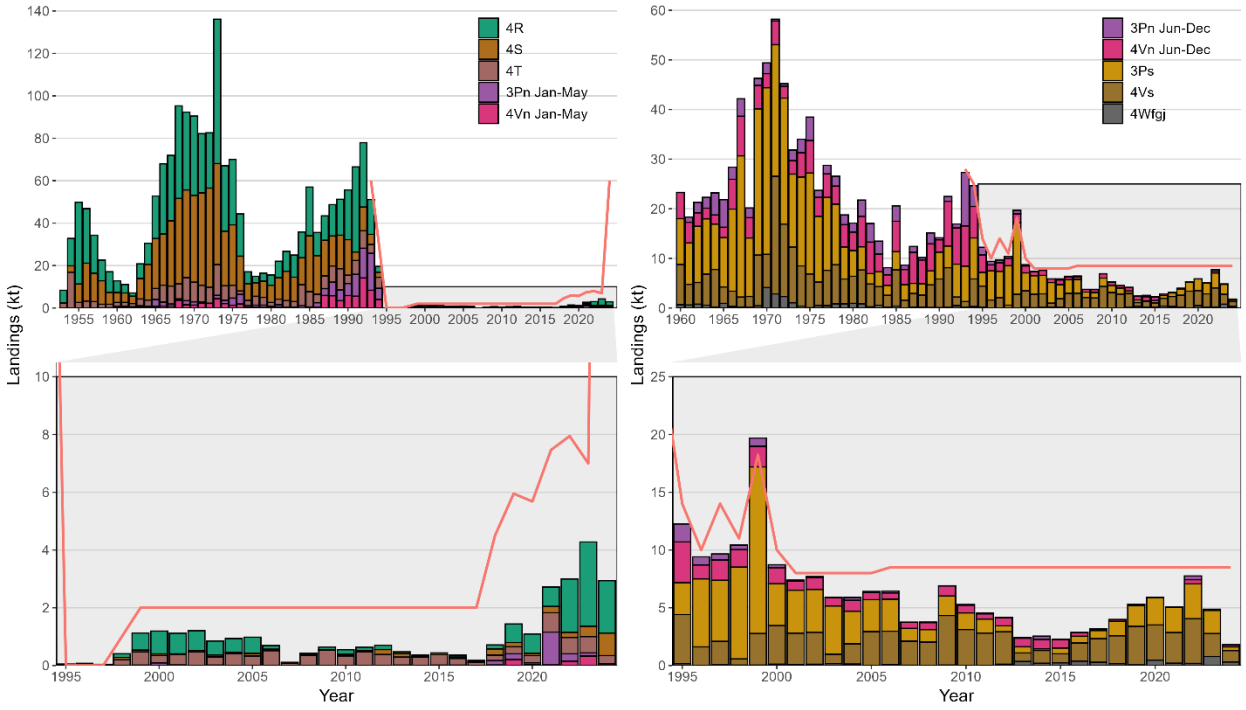

Figure 5. Annual Redfish landings per management year in Unit 1(left panels) and Unit 2 (right panels) per NAFO Division or Subdivision. Total allowable catches (TAC) are indicated by solid lines. Data include fisheries directed to all species. No Redfish directed fishery took place from 1995 to 1997 in Unit 1. The grey zones in the top panels are enlarged in the bottom panels. 2020 to 2024 values are preliminary.

Potential removals

A range of potential removals for the 2025-2026 Redfish fishing season in Unit 1 and in Unit 2 was determined based on the methods in Froese et al. (2016). The potential removal median is 253 kt (range 80-291 kt) in Unit 1 and 115 kt (range 36-131 kt) in Unit 2 for *S. mentella*. For *S. fasciatus*, given the uncertainty over biomass estimates and species identification, and the assumptions underlying the method used, it has not been possible to provide a reliable range of potential removals.

Directing fishing towards greater depths may reduce catches of *S. fasciatus* in all fishing areas except the Laurentian Fan, where this species is found at greater depths.

Potential removals should be updated annually with surveys conducted in Units 1 and 2 to cope with the expected decrease in biomass over the next few years.

Projections

In the absence of recruitment, growth, emigration, and immigration, the median and 75th percentile of fishing mortality (*F*) provided similar trajectories, with the biomass of *S. mentella* larger than 22 cm decreasing to less than 10% of the 2024 biomass in six years, compared to eight years with the 25th percentile of *F*, and nine years without fishing. These trajectories are uncertain given that the natural mortality and its relationships with Redfish biomass and future environmental conditions are unknown.

Ecosystem and Climate Change Considerations

Since 2009, the deep waters of the GSL and Laurentian Channel have been warming. Water temperatures above 7 °C have been recorded since 2012 in the GSL and Laurentian Channel. After a record in 2022, the waters in Cabot Strait cooled slightly but were still among the warmest of the time series in 2024. In recent years, concentrations of dissolved oxygen at 200 m, 250 m, and 300 m were well below normal everywhere along the Laurentian Channel.

Exposure to temperatures above 5 °C in laboratory experiments led to a decrease in growth rates of *S. fasciatus*, likely due to an increase in metabolic rate without an increase in food intake (Guitard et al. 2025). Given the morphological and physiological similarities between *S. fasciatus* and *S. mentella*, this experiment on *S. fasciatus* served as a model species to study the environmental responses of Redfish.

It has been observed that the feeding intensity of 20-30 cm Redfish between 2020 and 2024 was lower than the one observed during previous periods. In addition, the condition of Redfish over 20 cm is among the lowest ever observed since 1990. Density dependence, observed with the high abundance of Redfish, could therefore negatively affect feeding intensity, condition, and somatic growth of Redfish.

BYCATCH

In Unit 1, bycatch represented 1.7% of reported landings in the fishery directed to Redfish since 2018 as part of the index, experimental and in 2024 commercial fishery. The most common bycatch were Atlantic Halibut (*Hippoglossus hippoglossus*, representing 33.0% of the bycatch biomass), Atlantic Cod (*Gadus morhua*, 21.1%), White Hake (*Urophycis tenuis*, 18.8%), and Greenland Halibut (*Reinhardtius hippoglossoides*, 10.4%).

In Unit 2, bycatch represented 6.9% of reported landings in the commercial fishery directed to Redfish since 2018. The most common bycatch were Atlantic Halibut (42.0%), Atlantic Cod (16.2%), and White Hake (9.9%).

SOURCES OF UNCERTAINTY

Species identification method using anal fin rays risks overestimating the less abundant species, currently *S. fasciatus*. However, the extent of the overestimation is not quantified. The biases associated with this method could overestimate the SSB, the stock status, and its tolerance to substantial removals. Given the uncertainty over biomass estimates and species identification, and the assumptions underlying the method used, it has not been possible to provide a reliable range of potential removals for *S. fasciatus*.

The uncertainties surrounding natural mortality lead to a wide range of potential removals estimates and limit our understanding of the rate at which biomass is likely to decline in upcoming years.

Ensuring an appropriate survey in Unit 2 is a high priority. Issues with the implementation of the protocol developed by DFO and the industry for the Unit 2 survey in 2020, 2022, and 2024, preclude the use of the data, thereby limiting our understanding of stock trends and Redfish movements in recent years. The acoustics data collected during the survey should be investigated.

Research Recommendations

Genetic samples should be collected both in surveys and in the fishery to better determine biomass trends and species-specific harvest levels in the future. Work should continue to improve the accuracy of species composition estimates based on the anal fin ray counts identification method for our comprehension of past trends.

More work is needed to better understand the effects of changing ecosystemic conditions on Redfish life-history traits such as mortality, recruitment, maturity, longevity, and growth. Research initiatives aimed at understanding relationships between the increase in water temperature, decrease in dissolved oxygen and Redfish physiology (e.g., metabolism, growth), demographic rates (e.g., recruitment, mortality), and density-dependent processes, need to be maintained or initiated.

Given that the Redfish fishing effort may increase in upcoming years, data collection and research aiming to better understand the factors affecting the quantities and composition of bycatch are also a priority. This includes spatial and seasonal changes in fishing effort and the distribution of bycatch species, as well as the type and configuration of fishing gear, and the selectivity of size and species.

LIST OF MEETING PARTICIPANTS

Name	Affiliation	Mar. 11	Mar. 12	Mar. 13	Mar. 14
Baranova, Liliya	DFO – Fisheries Management	x	x	-	-
Beaudry-Sylvestre, Manuelle	DFO – Science	x	x	x	x
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Benoît, Hugues	DFO – Science	x	x	-	x
Bermingham, Tom	DFO – Science	x	x	x	x
Bernatchez, Claudio	DFO – Science	-	-	x	x
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Bourdages, Hugo	DFO – Science	x	x	x	x
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Duplisea, Daniel	DFO – Science	x	x	x	x
Fraser, Meghan	The Maritime Fishermen's Union	x	x	x	-
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Hardy, Magalie	DFO – Fisheries Management	x	x	x	x
Ings, Danny	DFO – Science	x	x	x	x
Isabel, Laurie	DFO – Science	x	x	x	-
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Mello, Luiz	DFO – Science	x	x	x	x
Mussels, Claire E.	DFO – Science	x	x	-	-
Ouellette-Plante, Jordan	DFO – Science	x	x	x	x
Parent, Geneviève	DFO – Science	x	x	x	x
Poissant, David	DFO – Science	x	x	x	x
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Rondeau, Marie-Maude	DFO – Science	x	x	-	-
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Senay, Caroline	DFO – Science	x	x	x	x
Sigouin, Evelyne	Association de gestion halieutique autochtone Mi'gmaq et Wolastoqey	x	x	-	-
Small, Daniel	DFO – Science	x	-	-	-
Smith, Andrew	DFO – Science	-	x	x	-
Spingle, Jason	Fish, Food and Allied Workers	x	x	x	x
Théberge, Elisabeth	DFO – Fisheries Management	x	x	x	-
Varkey, Divya	DFO – Science	x	x	x	-

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