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Canadian Science Advisory Secretariat
Quebec Region | Science Advisory Report 2023/035

ASSESSMENT OF THE NORTHERN GULF OF ST. LAWRENCE (3PN, 4RS) ATLANTIC COD STOCK IN 2022

Atlantic cod (Gadus morhua) by E. Klimoff, Vladykov, 1955.

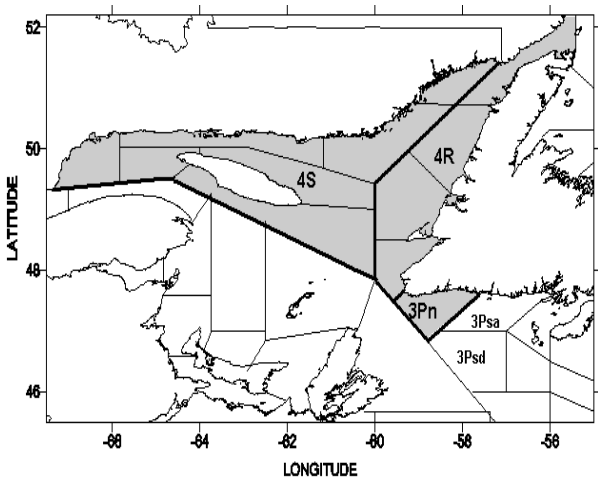

Figure 1. Cod stock management area in the Northern Gulf of St. Lawrence (3Pn, 4RS).

Context :

A total allowable catch (TAC) has been in place since the expansion of the Canadian exclusive fishing zone to 200 nautical miles from the coast in 1977. Initially set at 55,000 t for the Atlantic cod stock in the northern Gulf of St. Lawrence (nGSL, NAFO subdivision 3Pn and divisions 4R and 4S, Figure 1), the TAC subsequently reached a maximum of 100,000 t from 1983 to 1985. Until 1992, this stock was fished by the Canadian fleet with mobile and fixed gear and by some foreign fleets with mobile gear. The directed commercial fishery was subject to moratorium on three occasions, 1994-1996, 2003 and 2022. Since 1997, landings have been made exclusively by the Canadian fleet and mostly using fixed gear (gillnets, longlines and handlines). A recreational fishery is allowed for this stock.

Since 1990, the spawning stock biomass of 3Pn4RS cod has been in the critical zone. In 2010, the Committee on the Status of Endangered Wildlife in Canada designated as endangered cod from the Laurentian North population (3P4RS), which includes 3Pn4RS cod.

The management of this resource is carried out mainly by the imposition of an annual TAC. Several other management measures are also applied, including regulation of the amount and type of fishing gear, closure of areas during spawning and during winter (3Pn), observer coverage, dockside monitoring, minimum size, bycatch monitoring and rules for the recreational fishery.

Since 2012, the assessment of this stock has taken place every two to four years and is based principally on data from commercial fisheries, sentinel programs (fixed and mobile gear) and the DFO August survey.

This Science Advisory Report is from the February 23 and 24, 2023 meeting on the assessment of northern Gulf of St. Lawrence (3Pn, 4RS) Atlantic cod stock. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

SUMMARY

- For the 2021-2022 fishing season, the total allowable catch was 1,000 t, which corresponded to an available commercial fishing allocation of 641 t. For the 2022-2023 season, there was no directed Atlantic cod commercial fishery. Preliminary landings, including bycatch and sentinel surveys catches, totaled 677 t in 2021-2022 and 132 t in 2022-2023.
- Recreational fishing was authorized in 2022 for a maximum of 39 days distributed between June and October (variable according to the zones). There is no reporting of removals from this fishery.
- The abundance index from the DFO research survey was above the series mean and increasing since 2020. The 2018 cohort, which has been observed annually in the survey since 2019, appears to be the most abundant since the early 1990s.
- The abundance and biomass indices from the sentinel trawl survey have been declining since the recent peak in 2020. They are now below their series mean.
- The longline (summer) and gillnet indices of the sentinel surveys were below their respective series mean in 2022.
- In 2022, cod condition was particularly poor, especially in division 4S, and at levels where increased natural mortality has been observed in the past.
- A new model was developed during the review of the northern Gulf of St. Lawrence cod assessment framework that took place in 2021 and 2022. This new model was used for the first time during the current assessment.
- Fishing mortality, for which the estimate is based on reported or inferred catches, was low in 2021 and even lower in 2022, specifically at the lowest level since the 2003 moratorium. However, natural mortality has been at high levels for at least a decade. It is likely that part of this natural mortality is in fact made up of unaccounted fishing mortality.
- A precautionary approach limit reference point (LRP), based on long-term stock trends in stock spawning biomass (SSB), was adopted at a value of 71,970 t. Other reference points using the same framework as the LRP have been proposed, including the upper stock reference point (USR, 143,939 t), the target reference point (TRP, 179,924 t), and the removal reference (Flim, 0.49). Given the high natural mortality, a limit reference point on total mortality should be considered.
- For 30 years, SSB has been at low levels. The SSB estimate for 2022 (42,906 t) was in the critical zone and corresponded to 60% of the LRP.
- Three-year SSB projections with recorded catch scenarios from 0 to 1,500 t were made. With these scenarios, the probability that the SSB increased went from 0.51 to 0.45. The high rate of natural mortality explained these modest prospects, which were projected despite significant recruitment to the adult biomass of the strong 2018 cohort.
- An examination of stock productivity revealed that the stock had surplus production for the majority of years since 1995 and would likely have grown in the absence of commercial and recreational fisheries.

INTRODUCTION

Biology

The 3Pn4RS Atlantic cod stock is distributed in the northern portion of the Gulf of St. Lawrence (GSL, Figure 1). 3Pn4RS cod have long been known to undertake annual migrations. In winter, high concentrations are found in the deep waters of subdivision 3Pn. In the spring (April-May), cod begin their northward migration and initiate spawning in the Port-au-Port peninsula area, on the west coast of the island of Newfoundland. Cod then continue to disperse across coastal and mid-water areas of western Newfoundland and the middle and lower north shore of Quebec through the summer. These migrations are associated with the seasonal warming of the water and the availability of food (DFO 2003).

3Pn4RS cod are distributed during the summer at depths ranging from about 50 m to more than 500 m. However, most cod occur between 50 and 150 m.

In general, 3PnRS cod begin to spawn at the end of March, and spawning activity intensifies in May and continues until June (Ouellet 1997). Larger cod begin spawning earlier than smaller cod, release larger eggs, and have more spawning events in a spawning season (Trippel 1995). Cod eggs are bathypelagic and disperse with the currents. Eggs incubated at 0 °C hatch in about 40 days; hatching occurs sooner in warmer waters (Templeman 1981; Ouellet 1997). Upon reaching a total length of approximately 30-60 mm, juvenile cod move to demersal habitats where structures help them hide from predators (Rose 2018).

Cod are generalists predators. Recent sampling carried out in the summer indicated that cod < 30 cm fed mainly on zooplankton (mainly hyperiids of the genus *Themisto* sp.), shrimp (mainly northern shrimp [*Pandalus borealis*]) and fish (mainly capelin [*Mallotus villosus*]) (Ouellette-Plante et al. 2020). Cod measuring 30 to 55 cm are more piscivorous, such that the importance of zooplankton was greatly reduced in favour of fish, in particular redfish (*Sebastes* spp.) and capelin, as well as shrimp. The diet of cod ≥ 55 cm consisted mainly of fish, and redfish were the most important prey.

Cod are preyed upon by several predators throughout their development; at the egg and larval stage by pelagic species, such as Atlantic herring (*Clupea harengus*) and Atlantic mackerel (*Scomber scombrus*), and at the juvenile and adult stage they are consumed by species such as Atlantic halibut (*Hippoglossus hippoglossus*), white hake (*Urophycis tenuis*) and several species of seals and odontocetes. Cannibalism is also observed.

Oceanographic and ecosystem overview

Since 2009, the deep waters of the GSL have been warming with inward advection from Cabot Strait (Galbraith et al. 2023). The deep water layer (>150 m) originates from the entrance of the Laurentian Channel, where the waters of two currents, the Labrador Current (cold, less saline, highly oxygenated) and the Gulf Stream (warm, more saline, low oxygen) mix resulting in water for which the temperature, salinity and dissolved oxygen (DO) will vary according to the relative contribution of each current. Water temperatures above 7 °C have been recorded since 2012 in the GSL near the Cabot Strait and have occupied a significant proportion of deep waters in recent years, including those where cod overwinter. At 150 m depth, the average water temperature in the GSL reached one of the highest values of the series in 2022. During the summer, cod live closer to the cold intermediate layer (CIL), a layer of water formed by the surface layer of the previous winter. In recent years, there has been a decrease in volume and an increase in temperature of the CIL.

In 2020, the DO concentration in the deep water layer of the Cabot Strait was the second lowest value of the 2002–2020 series (Blais et al. 2021). A further decrease in DO in the deep water layer of the GSL over the next few years is expected.

The demersal community of the nGSL was dominated by demersal fish (cod, redfish) until the early 1990s. Following their collapse, the biomass of several species, including northern shrimp, increased. Since the mid-2010s, there has been a significant increase in deepwater redfish (*Sebastes mentella*) and Acadian redfish (*S. fasciatus*).

The impact of seal predation on survival rates for 3Pn4RS cod is somewhat uncertain, but has likely been less important than that for the neighboring southern GSL cod stock (NAFO 4T and 4Vn [November to April]), where the grey seal (*Halichoerus grypus*) are locally much more abundant (Swain et al. 2019). However, recent aerial surveys noted a considerably increased presence of grey seals on Brion Island (Magdalen Islands, Mosnier et al. 2023). Since some of these seals occasionally feed in the nGSL according to telemetry work, the level of predation on 3Pn4RS cod may have increased in recent years.

Fishery

Prior to 1977, there was no annual TAC for the 3Pn4RS cod stock and annual landings ranged from 58,237 t (1972) to 105,465 t (1970, Figure 2). Following the extension of the exclusive Canadian fishing zone to 200 nautical miles from the coast in 1977, an initial TAC of 55,000 t was set. Both landings and annual TACs then increased until the early 1980s when a maximum of 106,080 t was landed in 1983. The stock subsequently collapsed and there have since been three directed commercial fishing moratoria: 1994–1996, 2003[1] and 2022. Before the 2022 moratorium on directed cod fishing, the annual TAC for the previous three years was 1,000 t, corresponding to an available fishing allocation of 641 t. Preliminary landings for 2021-2022 and 2022-2023 are 677 and 132 t respectively.

Since reopening in 1997 after the first moratorium (1994–1996), the directed cod fishery has been undertaken almost exclusively using fixed gear, i.e. gillnets and longlines. A directed commercial fishery using bottom-trawls is not permitted. Gillnets are principally used in divisions 4RS, whereas longlines are principally used in subdivision 3Pn.

Excluding moratorium years and disregarding cod landings where the target species was not specified, on average 90% of 3Pn4RS cod landings have originated from the directed cod fishery (Figure 3). Over the past ten years (2013–2022), the majority of cod landings that were caught as bycatch were from fisheries targeting Atlantic halibut, Greenland halibut and redfish, averaging approximately 111 t per year.

[1] The 2003 moratorium is the only one of the three where recreational cod fishing was also prohibited.

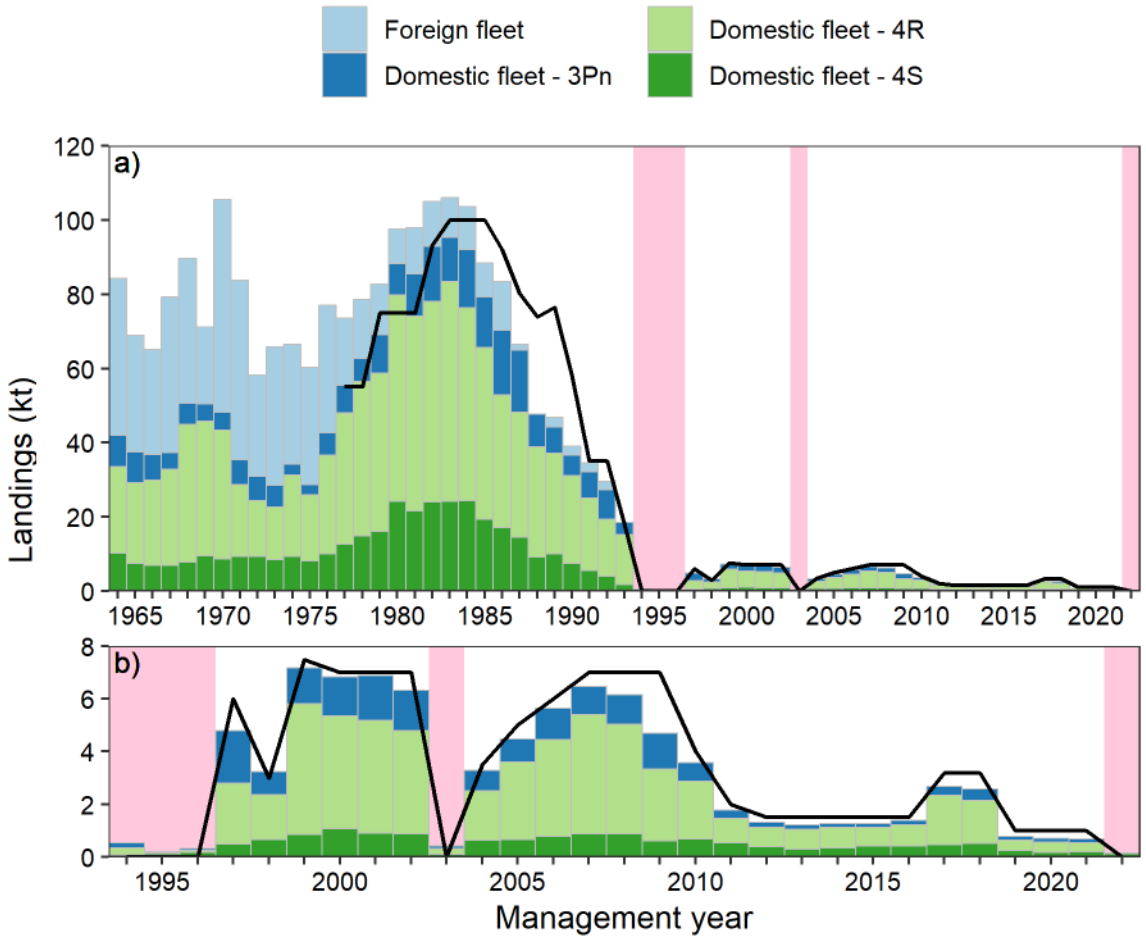

Figure 2. Annual landings of 3Pn4RS Atlantic cod and total allowable catch (TAC, black line) by management year. The complete series is presented in a) and the period 1994–2022 in b). Moratorium years are shaded in pink. Until 1998, the management year corresponded to the calendar year. Since 1999, the management year has begun on May 15 of the current year and ended on May 14 of the following year.

Since the introduction of the Nordmore grid in the shrimp fishery beginning in 1993, cod catches in this fishery have been small, comprising mainly of small individuals (<30 cm, i.e. cod 1-2 years old).

Unlike the commercial fisheries for which landings are well monitored, there is little information on catches in the recreational groundfish fishery that includes cod to allow a detailed understanding of its impact on the 3Pn4RS cod stock. Although there is regulatory monitoring of compliance with authorized daily bag limits, no monitoring of catches and discards (e.g. length frequencies, landed weights) is carried out. Estimates of landings based on different assumptions varied between approximately 150 and 900 t annually for the last ten years (Ouellette-Plante et al. 2022). In 2022, recreational fishing was authorized for a maximum of 39 days between June and October (variable according to the zones).

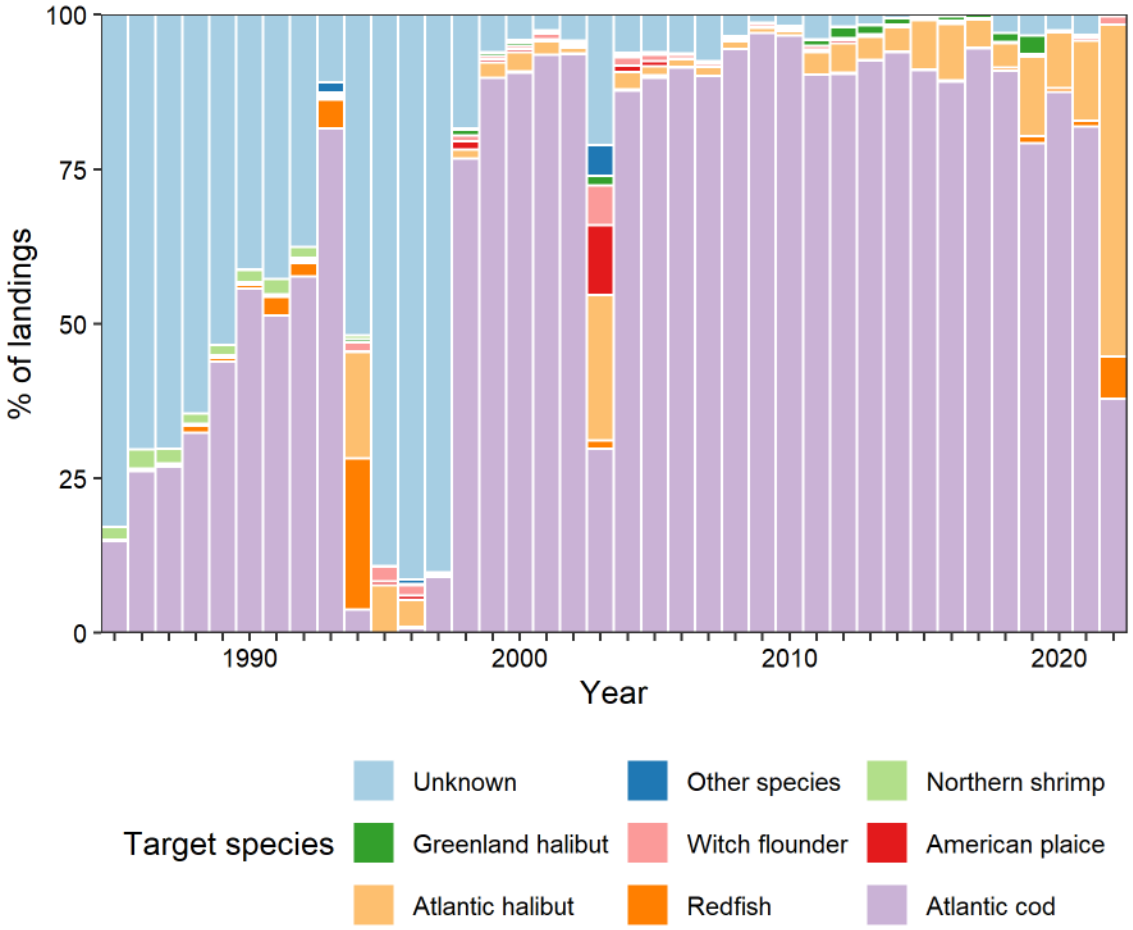

Figure 3. Percentage of annual cod landings by species targeted in the fishey for the period 1985-2022.

ASSESSMENT

Source of information

The status of the 3Pn4RS cod stock is assessed using age-specific information including, commercial fishery catches (landings, numbers at age), abundance indices from the DFO August bottom-trawl survey (1984–2022), the sentinel fixed gear program (gillnet, longline-summer and longline-fall indices, 1995–2022) and the sentinel mobile gear survey (bottom trawl, 1995–2022), as well as data on maturity from the cod reproductive potential survey (2002–2022) and cod condition data.

Condition data

The Fulton condition index (Ktot) from the DFO August survey is estimated using the total weight of cod, which is inevitably influenced by the level of stomach fullness and gonad development. From 2010 to 2017, the index was generally decreasing (Figure 4). From 2018 to 2020, Ktot increased to values close to the historical average and then fell significantly in 2021 and 2022 to the lowest values observed for the different series. Spatially, cod in 4S have generally had lower Ktot values than those from 4R. In 2022, this difference between NAFO divisions was much more pronounced.

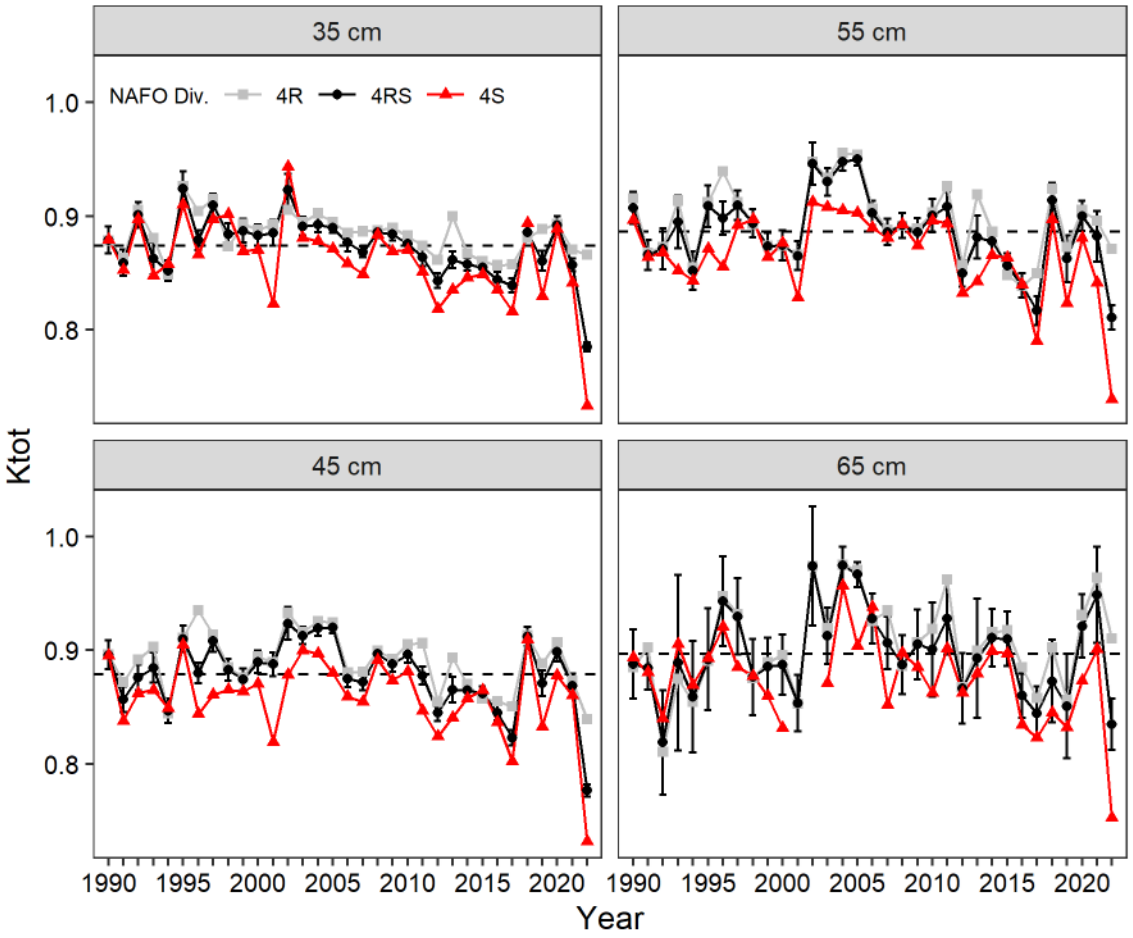

Figure 4. Condition of cod sampled during the DFO August survey, by NAFO division. Each point represents the annual mean (± 95% CI for the 4RS series only) of the Fulton condition index (Ktot). The horizontal hatched line represents the average of the 4RS 1990–2022 series. Based on Dutil et al. (1995), Ktot values > 1, between 0.7 and 1 and < 0.7 represent cod in excellent, good and critical condition respectively.

DFO August survey

DFO has conducted a bottom trawl survey in the nGSL each August since 1984. Coastal strata were added to the survey design in 1990. To maintain the integrity of the time series, a series excluding these strata is calculated for the data from 1984 to 2022 and a second series including these strata is calculated for the period 1990-2022. Both series for cod mean numbers per tow declined significantly between 1991 and 1993 (Figure 5). Following the moratorium from 1994 to 1996, these indices recovered slightly until the end of the 1990s. Subsequently, the indices were mainly below their historical averages until 2013 (2014 for the series with reduced strata), with an unusual peak in 2003 (moratorium year). From 2015 to 2019, the two indices fluctuated around the series' averages. Since 2020, the two indices have been above average and increasing. In general, the values for the index using the reduced series of strata are almost always smaller than those for the series that includes the broader suite of strata. This difference is explained by the inclusion in the latter index of shallow strata in which cod concentrations are generally higher than average.

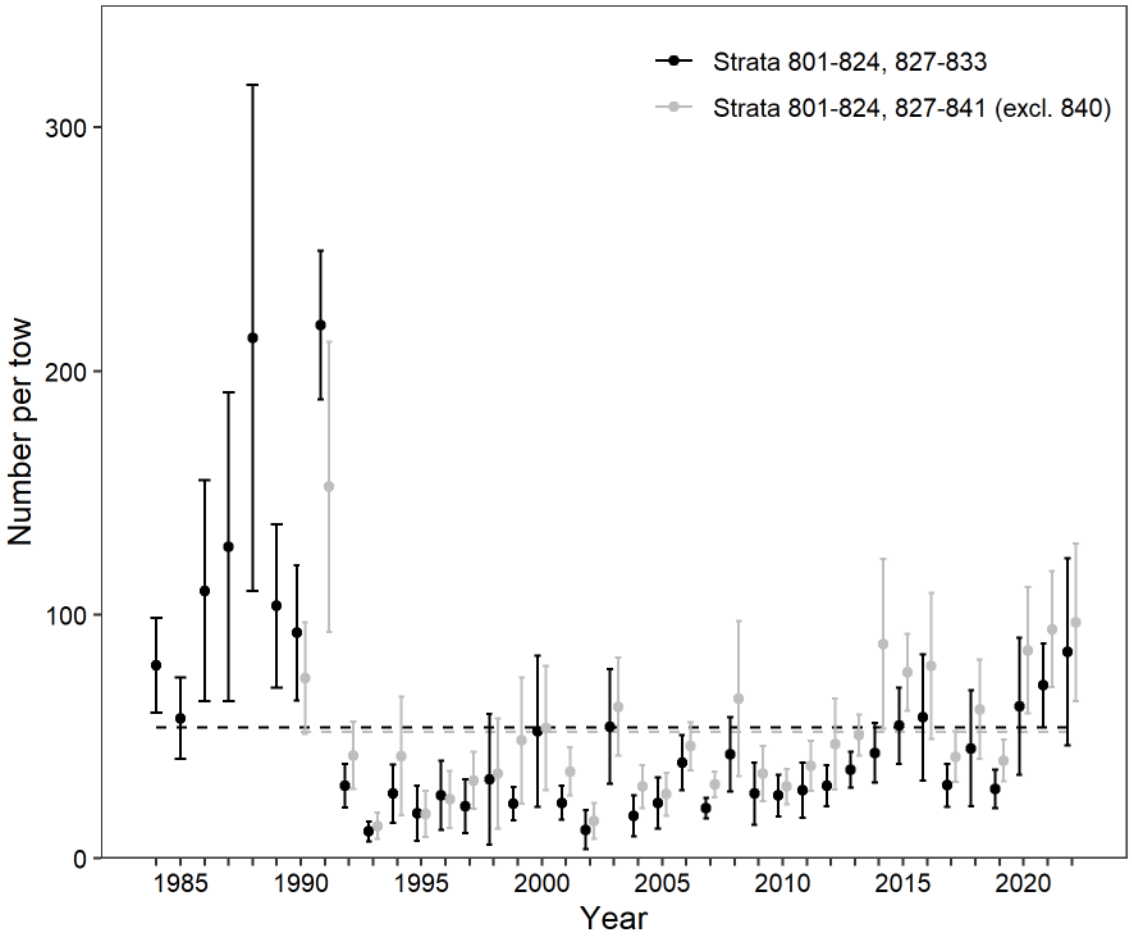

Figure 5. Age-aggregated abundance index with 95% confidence intervals for cod from the DFO August survey for 1984-2022 based on the reduced suite of strata (black dots) and for 1990-2022 based on all consistently sampled strata (grey dots). The stratum numbers are indicated in the legend. The dashed horizontal lines represent the average of each series (1984–2022 and 1990–2022).

The spatial distribution of cod along the west coast of Newfoundland (4R division) remained similar over the 1990–2022 period (Figure 6), while in the western Gulf (4S division) there was a gradual decline between the periods 1990–1995 and 2002–2007. After 2007, there was an increase in abundance in 4S division, particularly north and west of Anticosti Island.

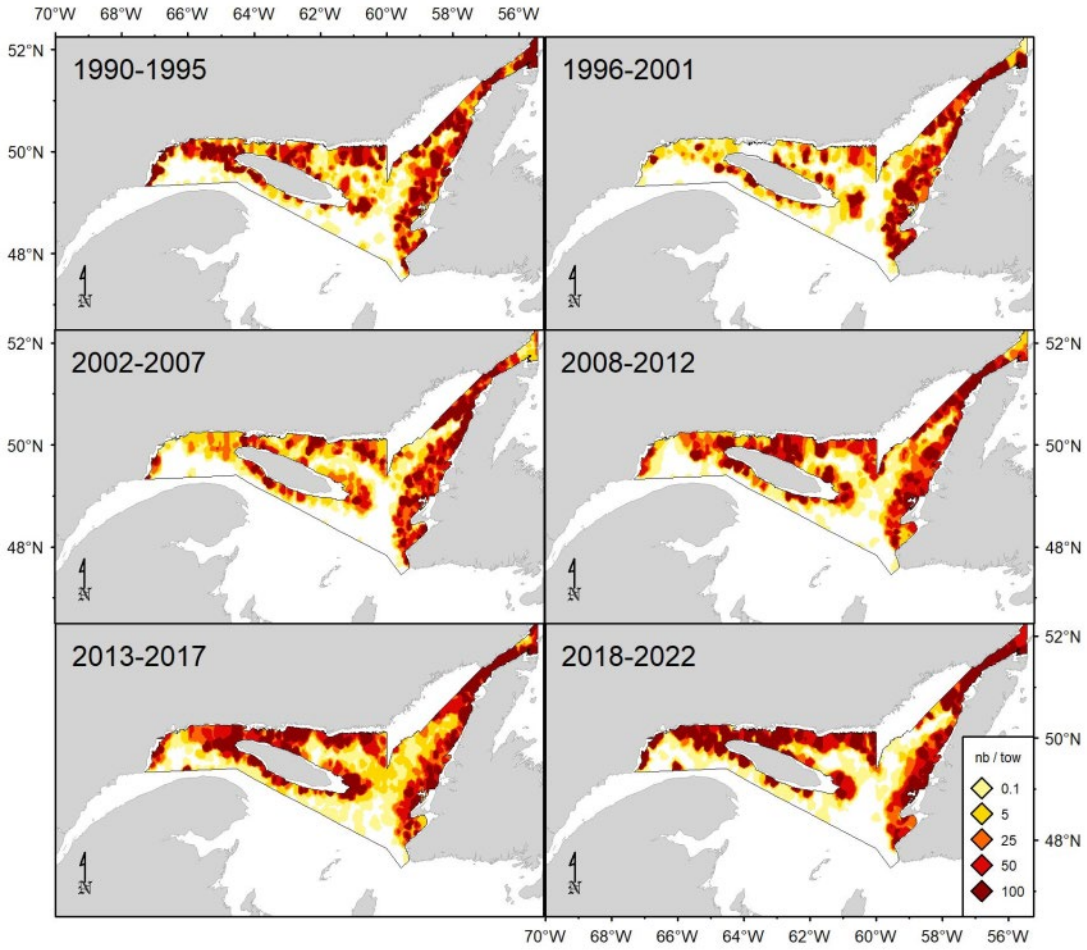

Figure 6. Distribution of cod catch rates (number per 15 min tow) in the DFO August survey in NAFO divisions 4RS.

In 2022, there were two modes in the length frequency distribution from the DFO August survey, one for cod measuring 10 to 20 cm (juveniles) and another for 30 to 42 cm (2018 cohort). Abundances were well above the series average for these two length ranges (Figure 7). The abundance of larger cod has decreased over the past two years to slightly below the historical average.

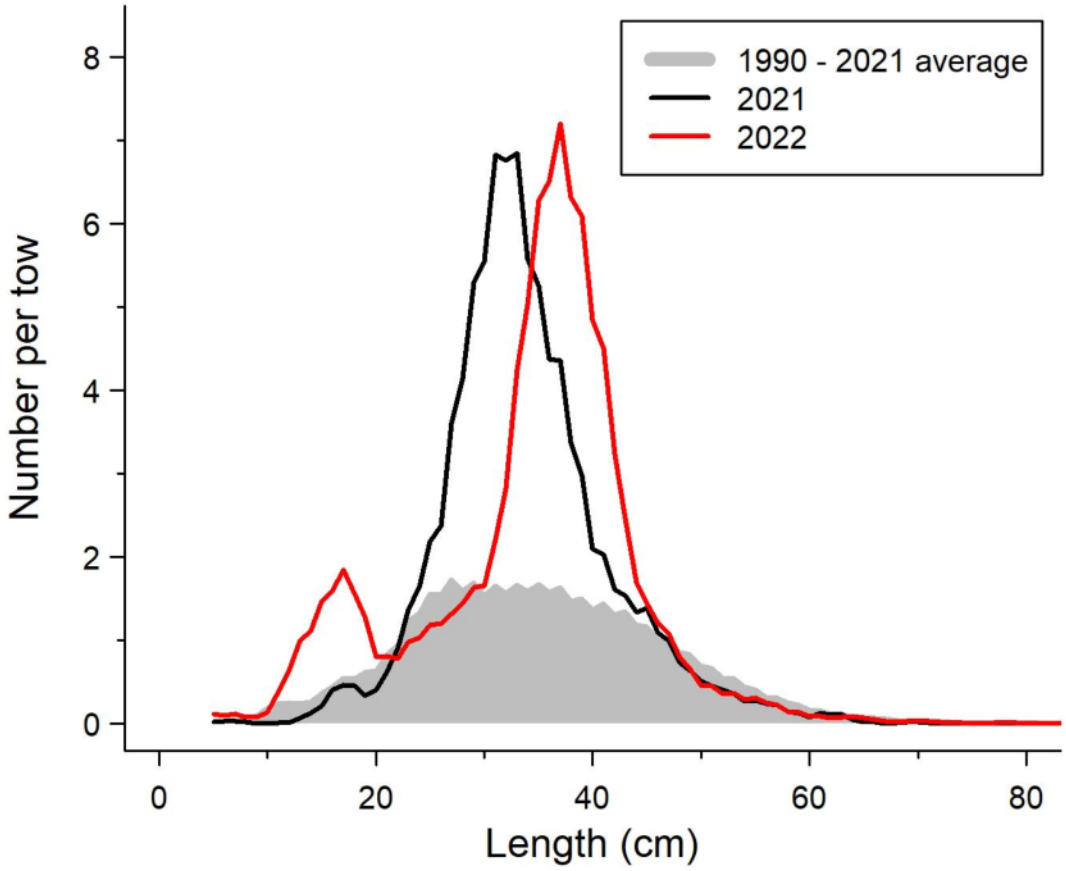

Figure 7. Cod length frequency distributions (mean number per 15 min tow) from the DFO August survey in NAFO divisions 4RS.

Mobile gear sentinel fishery (bottom trawl)

Mean numbers and weights per tow from the mobile sentinel survey do not show a clear trend over the period 1995–2015, but have been declining since the recent peak in 2020 (Figure 8). In 2022, they were both below their series average.

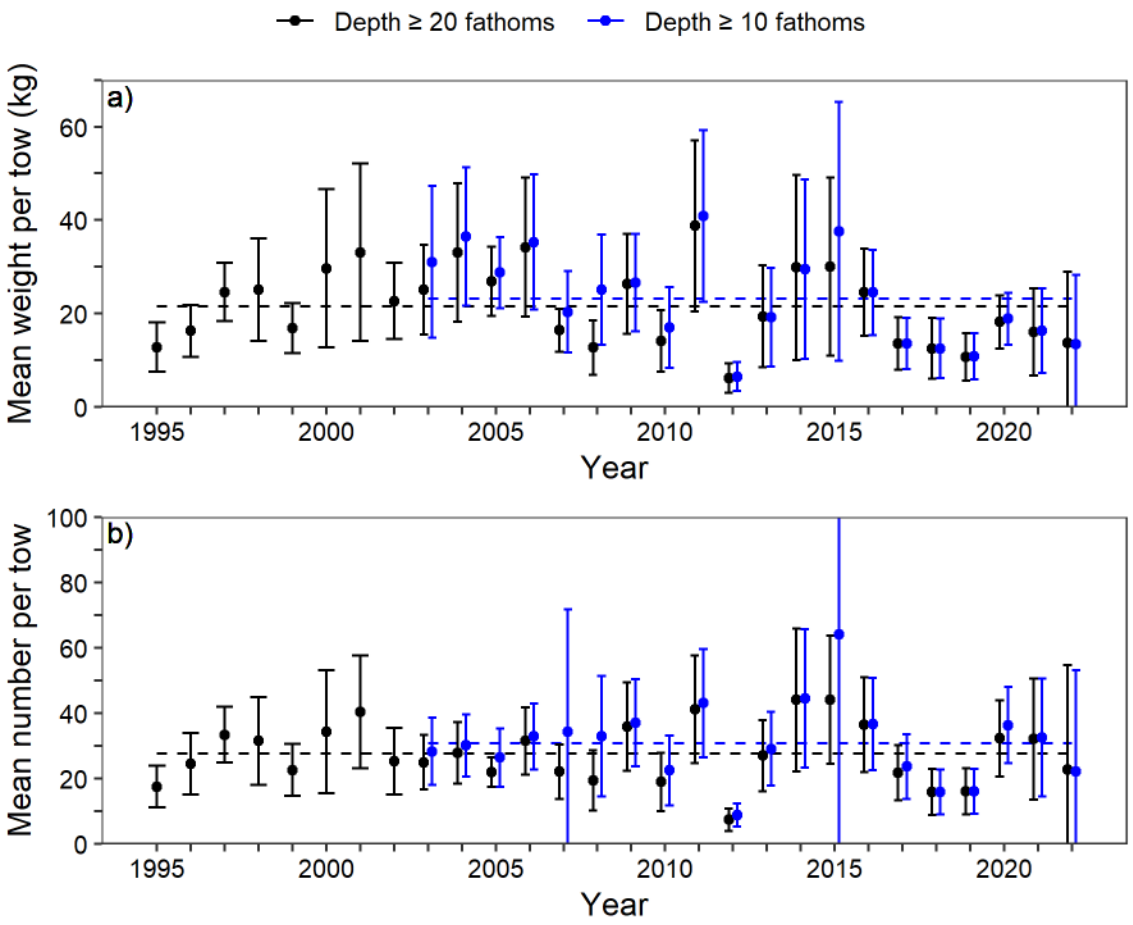

Figure 8. Mean weight a) and number b) per tow in the July mobile gear sentinel survey for the two series considered in the assessment. Error bars represent the 95% confidence intervals. The dashed line represents the average of each series (1995–2022 and 2003–2022).

Fixed gear sentinel fishery (longline and gillnet)

The summer sentinel longline abundance index has varied over the series, with an upward trend from 1995 to 2006, followed by a decline until 2010, before rising two years in a row and generally declining since (Figure 9). In 2022, the index was below the average for the series at values approaching those of the early 2000s.

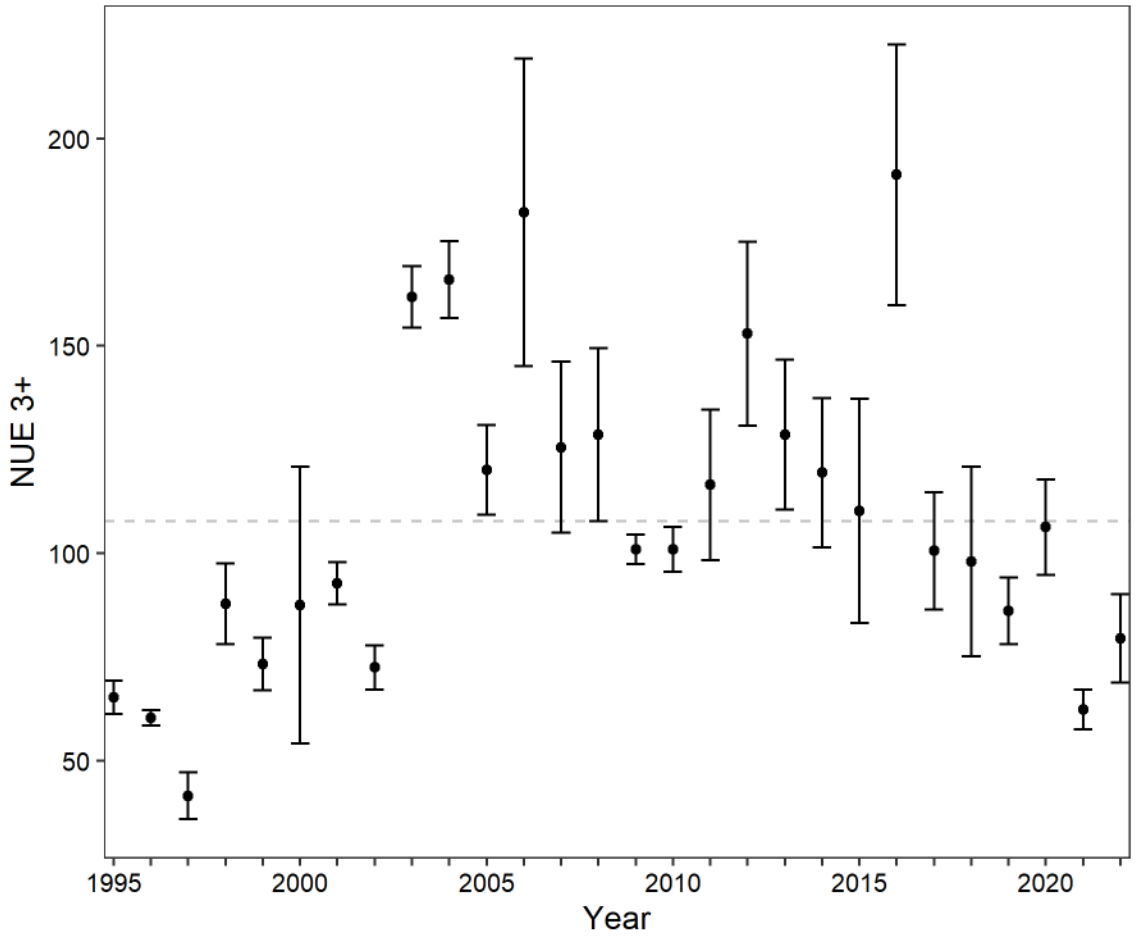

Figure 9. Age 3+ aggregated summer abundance index (number per unit effort [NUE], per 1,000 hooks) with 95% confidence intervals for the Sentinel longline program, 1995–2022. The hatched horizontal line represents the average of the 1995–2022 series.

The sentinel gillnet abundance index also fluctuated considerably during the series (Figure 10). After a period of increase from 1995 to 2006, it has generally fluctuated around the series average thereafter.

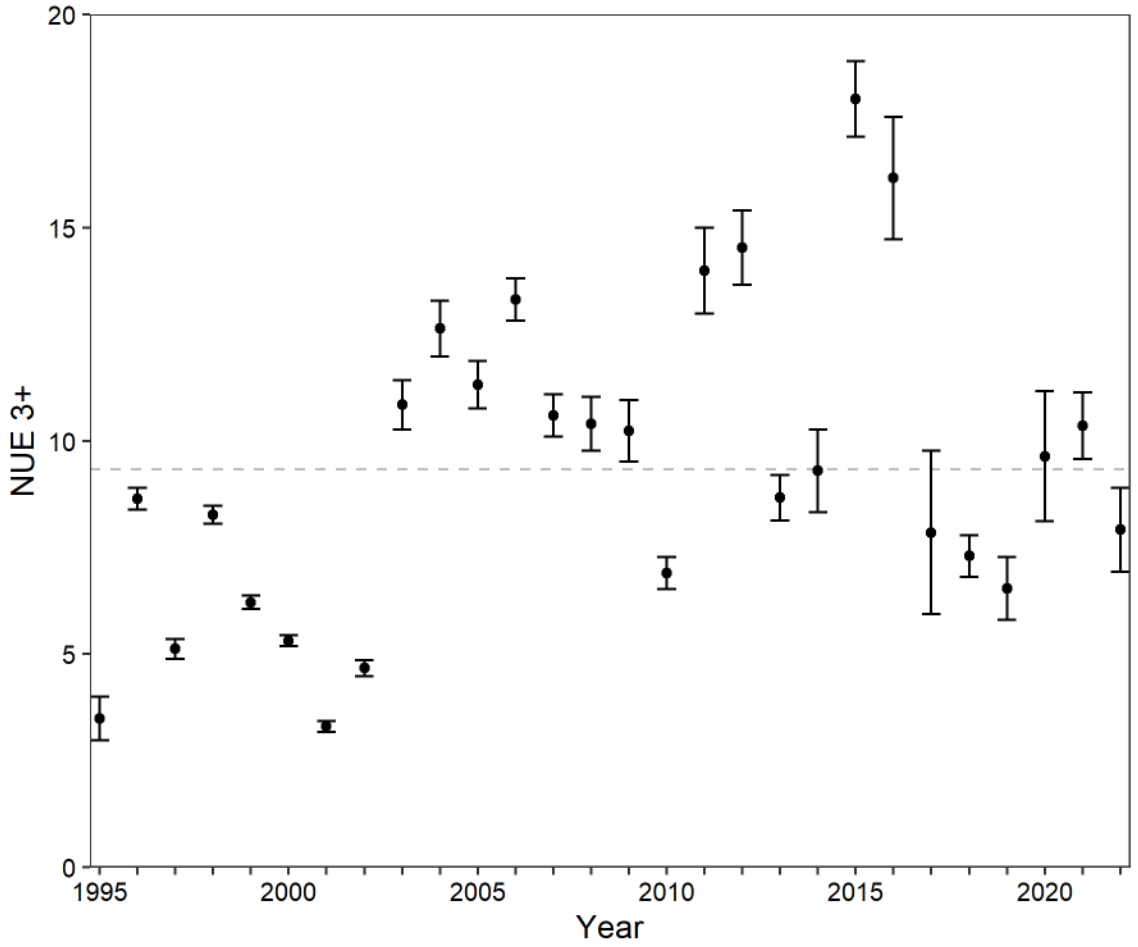

Figure 10. Age 3+ aggregated abundance index (number per unit effort [NUE], per net) with 95% confidence intervals for the Sentinel gillnet program, 1995–2022. The hatched horizontal line represents the average of the 1995–2022 series.

Assessment model

A new assessment model was developed during the review of the northern Gulf of St. Lawrence cod assessment framework that took place in 2021 and 2022. This new model, which is fitted to abundance indices at age from the DFO August survey and various sentinel surveys, as well as catch-at-age in the fishery, allows estimation of age-specific trends in natural mortality and fishing mortality. It was first used for the February 2023 assessment.

Recruitment, defined as the number of two-year-old fish, has fluctuated around the 1991-2022 average since 1991 (Figure 11). The cohort born in 2018 and quantified by the model for the first time at two years of age in 2020 is estimated to be the most abundant since 1990, while the abundance of the two most recent cohorts is closer to the average. Based on the most recent maturity ogive, cod from the 2018 cohort started to contribute to the spawning biomass in 2021 and more significantly in 2022.

The spawning stock biomass (SSB) has increased slightly since a recent low in 2019, but was still near the average of the last 25 years in 2022, with a value of 42,906 t (Figure 12). The recent increase is lower than expected given the arrival of the large 2018 cohort, which appears to result from a high total mortality rate for cod aged 4+ (Figure 13).

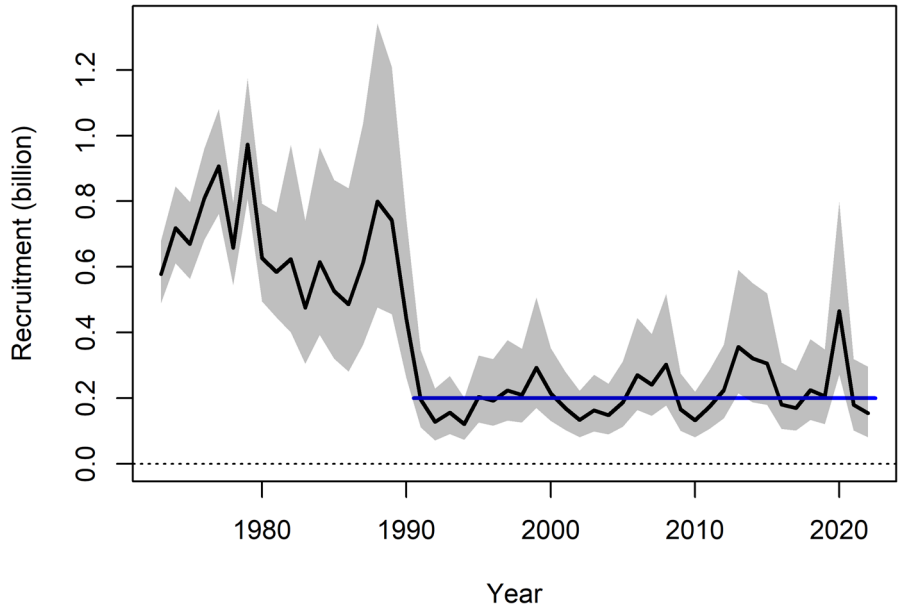

Figure 11. Estimated recruitment at age 2 (black line) with 95% confidence intervals (grey polygon) as well as the mean for the period from 1991 to 2022 (horizontal blue line).

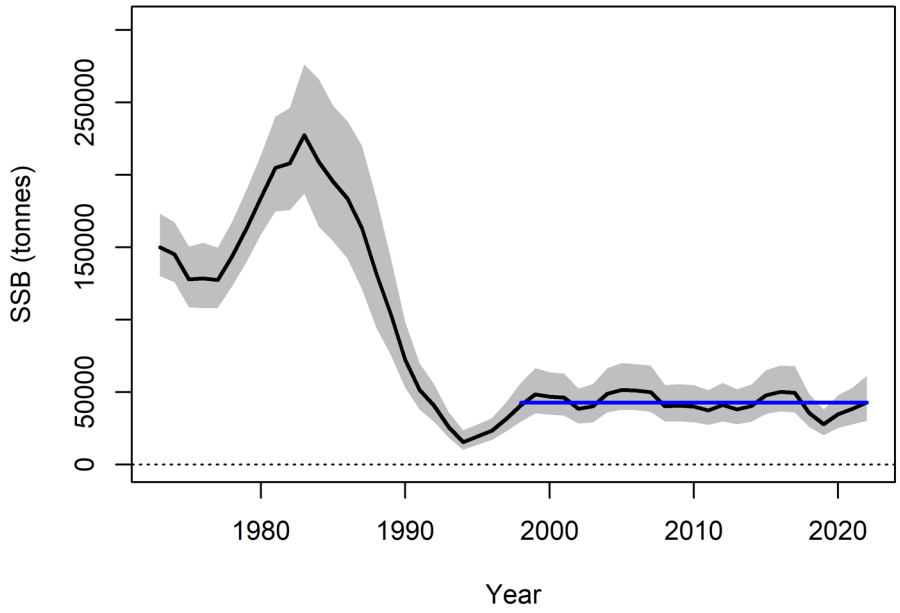

Figure 12. Estimated spawning stock biomass (SSB; black line) with 95% confidence intervals (grey polygon) as well as the mean for the period 1998-2022 (horizontal blue line).

Total mortality, which includes mortality caused by fishing and natural mortality, has fluctuated considerably over time and has repeatedly reached very high levels since the end of the 1980s, although the amplitude of the fluctuations differs between ages (Figure 13). Peaks in mortality are estimated for the beginning of the 1990s, around 2002, and at the end of the 2000s and 2010s. According to estimates from the model, the contribution of fishing mortality to the total mortality has decreased over the decades and would be insignificant recently. However, several lines of evidence indicate that natural mortality, for which current estimates are very high,

includes an unaccounted fishing mortality component. The main evidences are covariance between the fluctuations in fishing mortality and natural mortality, the natural mortality which tended towards values considered typical for the stock in 2003 during a moratorium on all directed fisheries and the fact that removals by the recreational fishing are not well taken into account by the assessment and could be significant. The magnitude of the contribution of unaccounted fishing to natural mortality is currently unknown.

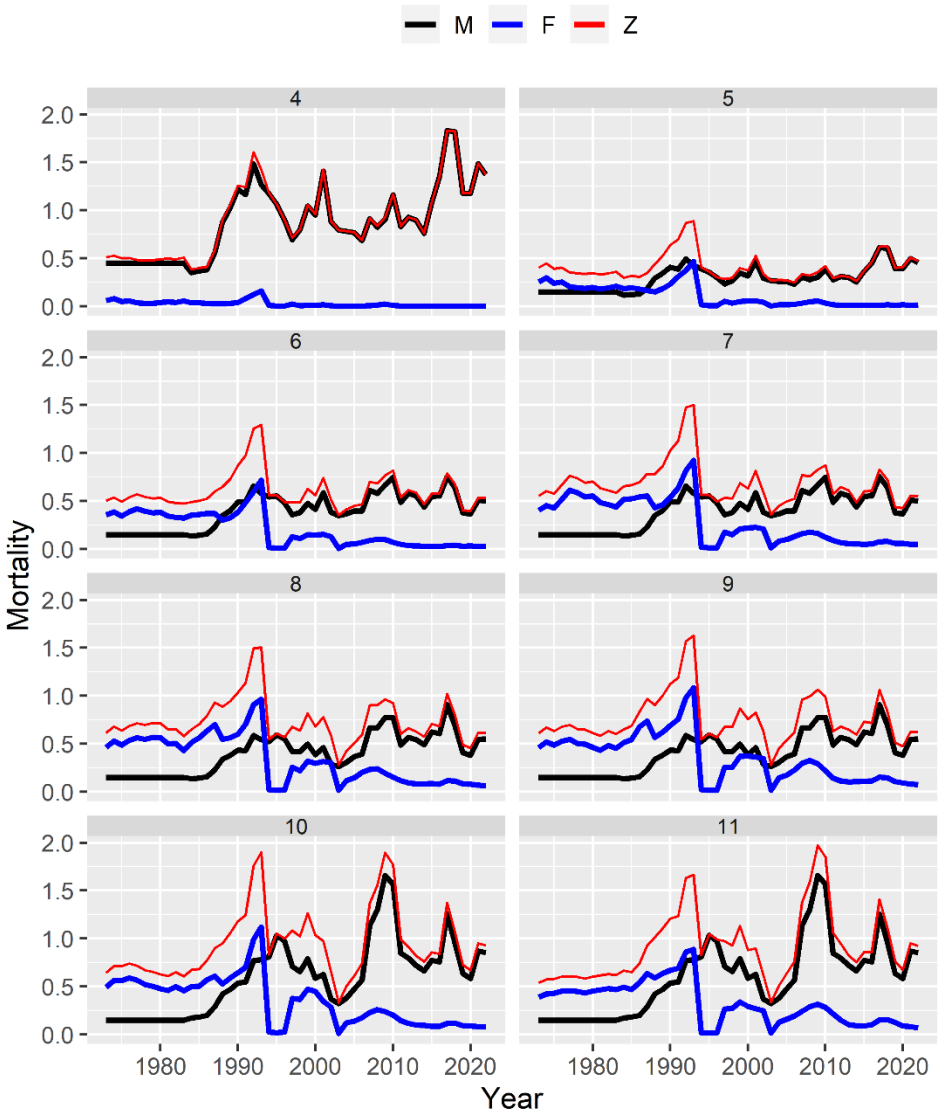

Figure 13. Trends in natural (M), fishing (F) and total (Z) mortality rates, by age (individual panels), estimated by the assessment model. For ages 2 and 3, the values of M are considered fixed in the model and the estimated F rates are very small, therefore the trends for these ages are not shown in the graph. The panel for age 11 represents ages 11 and up.

Given the recent high level of natural mortality estimated by the model, projections indicate that the stock will not increase in the next three years (probability of increase of 0.51) despite the increased contribution of the 2018 cohort to SSB and even in the absence of fishing (recorded

fishing mortality equal to zero). A slight stock decline is projected for a total annual allowable catch of 1,500 t (0.45 probability of increase).

Reference points

During the review of the framework, an assessment model starting in 1966 was fitted in order to better understand the long-term productivity and dynamics of the stock (extended model). The twenty-year period from 1966 to 1985 was identified as one during which the stock may have been exploited at a fishing rate equivalent to a maximum sustainable yield rate and the stock would have fluctuated around a biomass equivalent to that associated with such a rate of exploitation. Therefore, the average SSB for this period was proposed as the target reference point (TRP), corresponding to a value of 179,924 t (Figure 14). Following the guidelines proposed by the decision-making framework for fisheries integrating the DFO precautionary approach (DFO 2009), an upper stock reference point equivalent to 80% of this value was proposed (USR = 143,939 t), and a limit reference point equivalent to 40% of this value was adopted during the peer review (LRP = 71,970 t). According to this scheme, the SSB of the stock in 2022 was at 60% of the LRP and therefore in the critical zone.

Under the extended model approach, the average fishing mortality rate (6-9 year old cod) for the period 1966-1985 was proposed as the removal reference (Flim = 0.49). Given that the natural mortality estimated by the model has increased significantly compared to this reference period, that its estimate seems to incorporate unaccounted fishing mortality and that the total mortality rate limits the productivity of the stock in a fishing context, a limit reference point on total mortality should be considered for the management of this cod stock.

Surplus production

An examination of the components of stock productivity (recruitment, growth and mortality) was undertaken based on the outputs of the assessment model. This analysis revealed that the stock had surplus production for the majority of years since 1995 and would likely have increased in the absence of commercial and recreational fisheries.

Outlook

Three-year SSB projections based on scenarios for reported catch ranging from 0 to 1,500 t were undertaken using the new model. Under these scenarios, the probability of SSB increasing ranged from 0.51 (0 t) to 0.45 (1,500 t). The high rate of natural mortality explained these modest prospects despite significant recruitment to the adult biomass of the strong 2018 cohort.

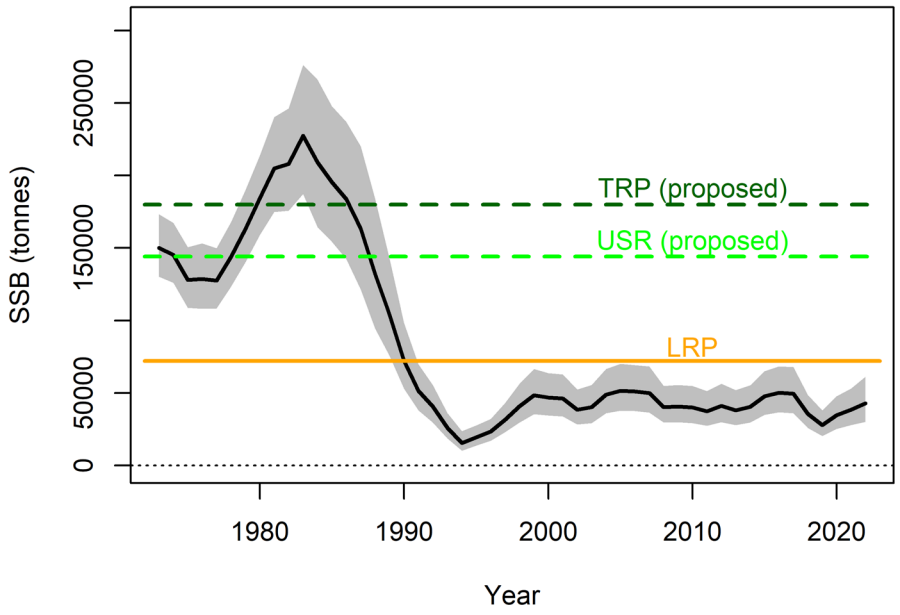

Figure 14. Estimated spawning stock biomass (SSB; black line) with 95% confidence intervals (grey polygon) as well as proposed target (TRP, 179,924 t) and upper (USR, 143,939 t) reference points, and the limit reference point (LRP, 71,970 t).

Sources of uncertainty

Several uncertainties exist for this stock. First, there is no monitoring of landings (quantities, sizes and weights) and discards in the recreational fishery. Since the directed commercial fishery was closed in 2022, it is likely that the recreational fishery accounts for a significant portion of current actual removals. The difficulty in estimating it contributes to high values of natural mortality in the new assessment model, the estimate of which would include an unaccounted fishing mortality component, the magnitude of which is currently unknown. In addition to recreational fishing, this unaccounted component would also combine unaccounted discards at sea, unreported commercial fishing and depredation.

The poor condition of cod observed in 2022 raises several questions with respect to the probable causes and especially the consequences for the population. This decrease in condition should be studied in more detail over the next few years. In particular, the effect of changing oceanographic and ecological conditions in the nGSL, particularly in terms of water temperature and DO content, as well as the availability of prey and potential competition with redfish, require more research.

Finally, the acquisition of additional data over the next few years should improve the estimates of the 2018 cohort's abundance, its survival and its contribution to SSB.

CONCLUSION

This assessment indicates that the northern Gulf of St. Lawrence Atlantic cod stock remains in the critical zone according to the precautionary approach. The SSB estimate for 2022 (42,906 t) represents 60% of the LRP (71,970 t) adopted at this assessment. According to the precautionary approach, removals from all sources should be as low as possible in order to promote the recovery of the SSB.

Assessment schedule

Since 2012, the assessment of 3Pn4RS cod has taken place every two to four years. Given that the stock displays dynamics that generally vary smoothly over time and given the availability of reliable indicators of abundance from the DFO August survey, a detailed stock assessment at this frequency is probably not required. A full assessment undertaken every five years, with updates in interim years, should be considered, as is the case for cod from the southern GSL stock. The biomass index of cod ≥ 43 cm from the DFO August survey has been identified as an indicator of SSB, and would constitute the main element of an update in interim years.

LIST OF MEETING PARTICIPANTS

Name	Affiliation	February 23	February 24
Andrushchenko, Irene	DFO – Science	-	x
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Benoît, Hugues	DFO – Science	x	x
Bois, Samantha	ACPG	x	x
Bourbonnière, Jean-Patrick	DFO – Science	x	-
Bourdages, Hugo	DFO – Science	x	x
Boudreau, Mathieu	DFO – Science	x	x
Brûlé, Caroline	DFO – Science	x	x
Carruthers, Erin	FFAW-Unifor	x	-
Chabot, Denis	DFO – Science	x	-
Chamberland, Jean-Martin	DFO – Science	x	x
Chavarria, Caroline	DFO – Science	x	x
Chlebak, Ryan	DFO – Science	x	x
Collier, Frank	LNSFA	x	x
Cyr, Charley	DFO – Science	x	x
Dennis, Olivia	Province of N.L.	x	x
Desgagnés, Mathieu	DFO – Science	x	x
Desjardins, Christine	DFO – Science	x	-
Dubé, Sonia	DFO – Science	x	x
Duplisea, Daniel	DFO – Science	x	x
Dwyer, Shelley	DFO – Resource Management	x	x
Hardy, Kevin	LNS fisher	x	x
Hardy, Magalie	DFO – Resource Management	x	x
Hawkins, Laurie	DFO – Resource Management	x	x
Isabel, Laurie	DFO – Science	x	-
Labbé-Giguère, Stéphanie	DFO – Resource Management	x	x
Lussier, Jean-François	DFO – Science	x	x
Martin, Lucas	UQAR	x	x
Monger, Julie	LNSFA	-	x
Nadeau, Paul	LNSFA	-	x
Ouellette-Plante, Jordan	DFO – Science	x	x
Rayner, Gemma	Oceans North	x	x
Regular, Paul	DFO – Science	x	x
Ricard, Daniel	DFO – Science	x	x
Senay, Caroline	DFO – Science	x	x
Smith, Andrew	DFO – Science	x	x
Solberg, Abe	FFAW-Unifor	x	x

Name	Affiliation	February 23	February 24
Turcotte, François	DFO – Science (reviewer)	x	x
Vascotto, Kris	AGC	x	x
Way, Loomis	FFAW-Unifor	x	x

SOURCES OF INFORMATION

This Science Advisory Report is from the regional peer review of February 23 and 24, 2023 on the assessment of the Northern Gulf of St. Lawrence (3Pn, 4RS) Atlantic cod stock. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

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