Fisheries and Oceans Canada | Pêches et Océans Canada
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Canadian Science Advisory Secretariat
Quebec Region | Science Response 2024/011

UPDATE OF STOCK STATUS INDICATORS FOR THE NORTHERN GULF OF ST. LAWRENCE ATLANTIC COD STOCK (3PN, 4RS) IN 2023

Context

The last assessment of Atlantic cod (*Gadus morhua*, referred to *cod* hereinafter) from the northern Gulf of St. Lawrence (NAFO[1] subdivision 3Pn and divisions 4RS) took place in February 2023 (DFO 2023a). Although the frequency of full assessments has not been formally established following the adoption of a new assessment model in 2021-2022, an update of key stock indicators is necessary in interim years to determine whether changes have occurred since the last assessment. The next full assessment of this stock is planned for winter 2025.

The 3Pn4RS cod stock is one of the 30 major stocks covered by the fish stocks provisions that came into force by regulation on April 4, 2022. This stock is in the critical zone of the precautionary approach since 1990 and a new rebuilding plan is being developed. This Science Response will take into account the most recent information on the status of the stock and will inform the implementation of the rebuilding plan and the management approach for the 2024/25 fishing season.

This Science Response Report results from the regional peer review of January 25, 2024 on the Update of Stock Status Indicators for the Northern Gulf of St. Lawrence Atlantic Cod Stock (3Pn, 4RS) in 2023.

Background

The indicators used to monitor the state of the stock in interim years are: landings from the commercial fishery, the biomass and abundance indices from the bottom trawl survey carried out by Fisheries and Oceans Canada (DFO) in the northern Gulf of St. Lawrence (NAFO 4RS divisions) and the indices of the sentinel fishing program with mobile gear (bottom trawl) and fixed gear (longline and gillnet) carried out in NAFO subdivision 3Pn and divisions 4RS (DFO 2023a).

Description of the fishery

The directed commercial cod fishery was closed in 2022/23 and in 2023/24. For a second consecutive year, reported landings of cod came from sentinel fisheries and fisheries targeting other species. As of December 12, 2023, preliminary landings of cod totalled 112.1 t for the 2023/24 season (Figure 1), of which 49.8% came from fishing activities aimed at Atlantic halibut (*Hippoglossus hippoglossus*).

[1] Northwest Atlantic Fisheries Organization.

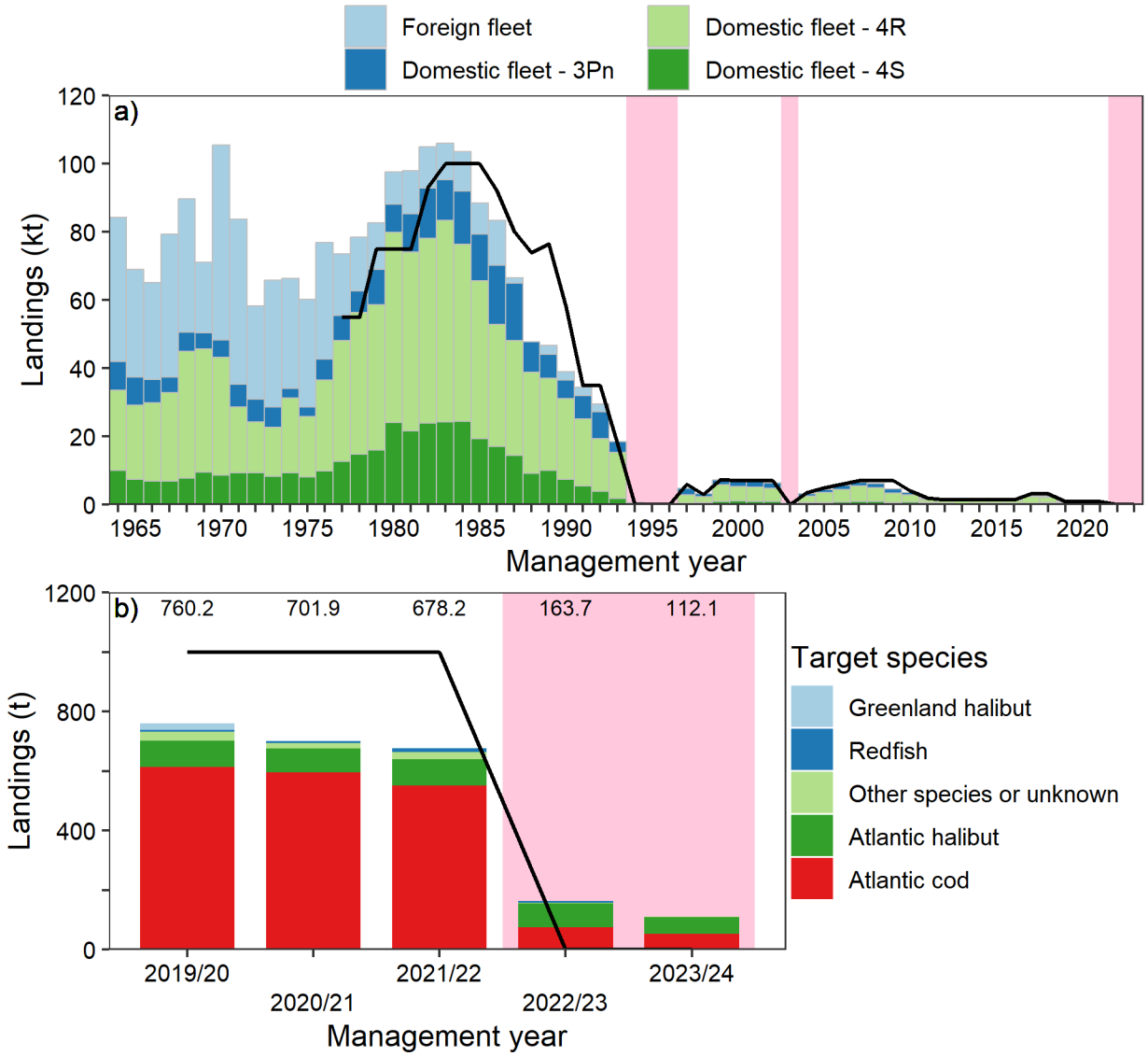

Figure 1. Reported annual landings (kt) of 3Pn4RS Atlantic cod and total allowable catch (TAC, black line) by management year. The complete series by fishing fleet is shown in a). In b), annual landings (t) are broken down according to the targeted species for the last five management years. Annual landings are provided above the bars. 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.

As in 2022, the 2023 recreational fishing season was 39 days spread between June and October (variable depending on the area, Figure 2). The individual daily bag limit for groundfish (including cod) was five fish. For Newfoundland and Labrador only, the maximum boat limit when three or more people are fishing was 15 groundfish (including cod). 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 showed values of the order of 150 to 900 t annually during the period 2011–2020 (Ouellette-Plante et al. 2022). Since directed commercial fishing has been

closed since 2022, it is likely that landings from recreational fishing currently constitute a significant portion of total 3Pn4RS cod landings.

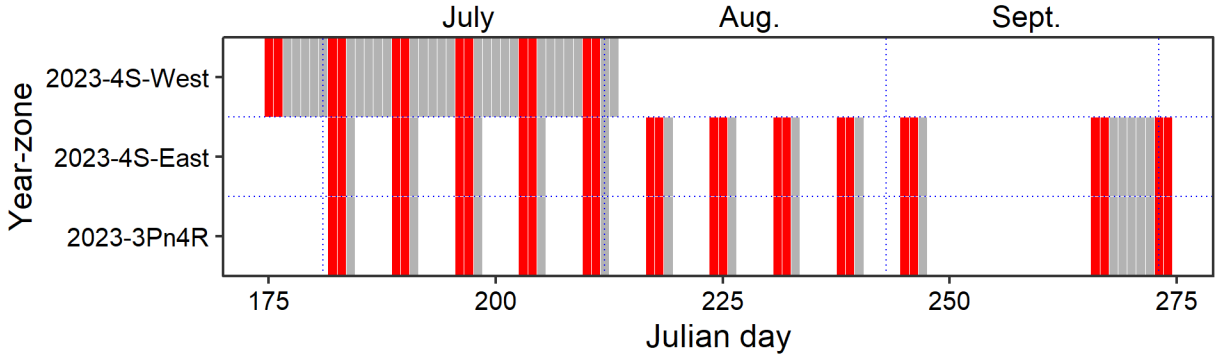

Figure 2. 2023 recreational groundfish fishing season. Cells in red are weekend days while those in gray are weekdays. Zone 4S-West corresponds to the sector between Pointe-des-Monts and Natashquan and zone 4S-East to the sector between Natashquan and Blanc-Sablon.

Analysis and Response

Stock status indicators

DFO August survey (4RS)

Since 1984, DFO has carried out a bottom trawl survey annually in August in the northern Gulf of St. Lawrence. 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 data from 1984 to 2023 and a second series including them is calculated for the period 1990-2023. In 2023, operational issues with the CCGS[2] *John Cabot* meant that the time at sea to cover the study area was reduced by more than a third. For 3Pn4RS cod, these issues have led to reduced sampling in coastal areas (i.e. fewer trawling stations) in addition to the absence of sampling in the Strait of Belle Isle sector, all sectors where this species is found. For year-stratum combinations where fewer than two successful random tows were made, the multiplicative model was used to impute capture rates to them (Bourdages et al. 2023).

After three years, during which the DFO August survey abundance index (all sizes combined) was increasing (2020-2022), the index decreased by 63-71% in 2023 (depending on series considered) and is now below the series average, at values similar to those observed in 2019 (Figure 3).

The 2018 cohort first mentioned in the 2019 assessment (DFO 2019) and followed since due to its high abundance, does not appear to have increased in size in 2023 (Figure 4). Indeed, this cohort generated a mode of capture in the size range 30 to 42 cm in 2022. This mode did not progress in 2023 and its overall contribution to stock abundance was reduced and is now found at values lower than the average of the time series. No signs of new recruitment was detected in 2023.

[2] Canadian Coast Guard ship.

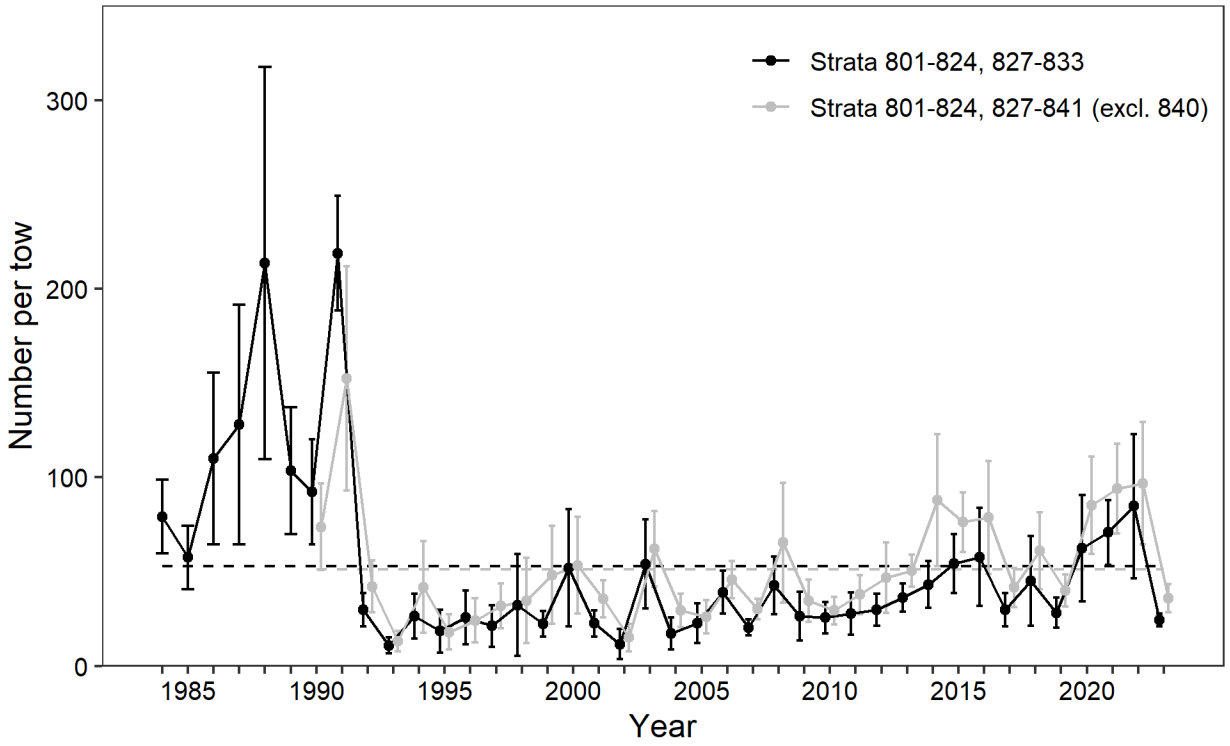

Figure 3. Abundance index with 95% confidence intervals for cod from the DFO August survey for 1984-2023 based on the reduced suite of strata (black dots) and for 1990-2023 based on all consistently sampled strata (grey dots). The stratum numbers are indicated in the legend. The dashed horizontal lines represent the average of each series (1984–2023 and 1990–2023).

The Fulton condition index (Ktot), estimated from the individual total weight of cod measured during the DFO August survey, was particularly low in 2022, especially in division 4S. A connection was made between these condition levels and those observed in the past and for which increased mortality had been observed. With the marked decline in the importance of the 2018 cohort in 2023, it is possible that poor cod condition observed in 2022 may have contributed to increased natural mortality between the 2022 and 2023 DFO August surveys. In 2023, Ktot has increased for most length class and NAFO division combinations, but remained low in 4S (Figure 5). In general, 4S cod presented Ktot values generally lower than those of 4R, and for a second consecutive year, this difference between NAFO divisions was still more pronounced than it historically has been throughout the series.

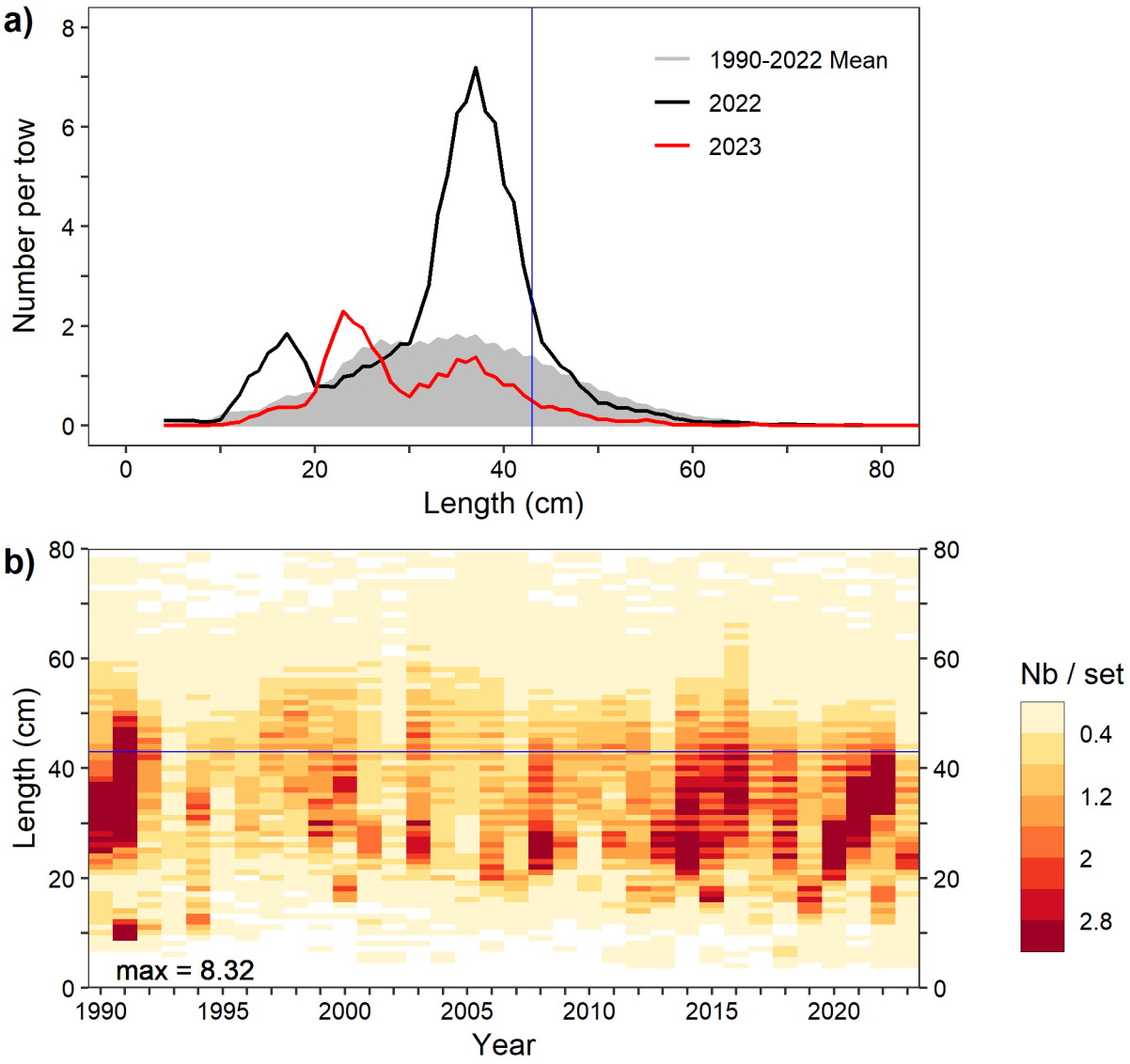

Figure 4. Cod length frequency distributions (mean number per 15 min tow) from the DFO August survey in NAFO divisions 4RS and based on all consistently sampled strata. In a), the 1990-2022 series average and individually for the years 2022 and 2023 are shown. In b), annual length frequencies are provided for each year of the series in a format allowing cohort tracking. A blue line at 43 cm is provided since the spawning stock biomass (SSB) is approximated using an index using cod ≥ 43 cm for years where a full analytical assessment is not conducted.

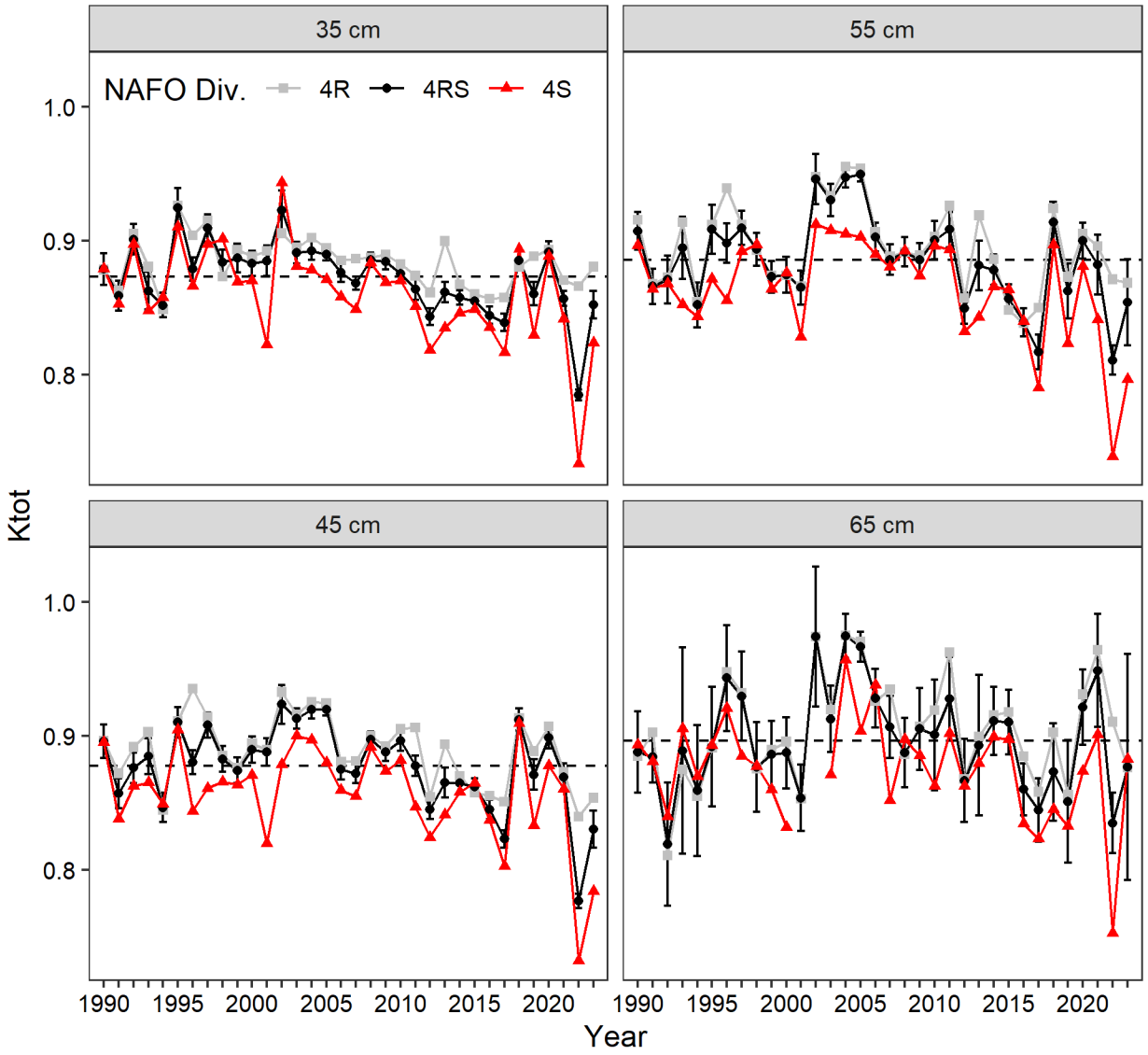

Figure 5. Condition of cod sampled during the DFO August survey, by NAFO division. Each point represents the annual mean (with 95% confidence intervals for the 4RS series only) of the Fulton condition index (Ktot). The horizontal hatched line represents the average of the 4RS 1990–2023 series. According to Dutil et al. (1995), Ktot values > 1, between 0.7 and 1 and < 0.7 represent cod in excellent, good and critical condition respectively.

The smoothed index (LOESS type) of cod biomass ≥ 43 cm from the DFO August survey was identified as an indicator of spawning stock biomass (SSB) for years when a complete analytical assessment of the stock is not achieved (interim years, Benoît and Ouellette-Plante 2023; DFO 2023a). In 2023, the SSB indicator is estimated at 9,525 t, which still places the stock in the critical zone according to the precautionary approach. This is a significant reduction, since during the 2023 assessment, the SSB was estimated by the model at nearly 42,906 t, or 60% of the limit reference point (LRP) of the precautionary approach.

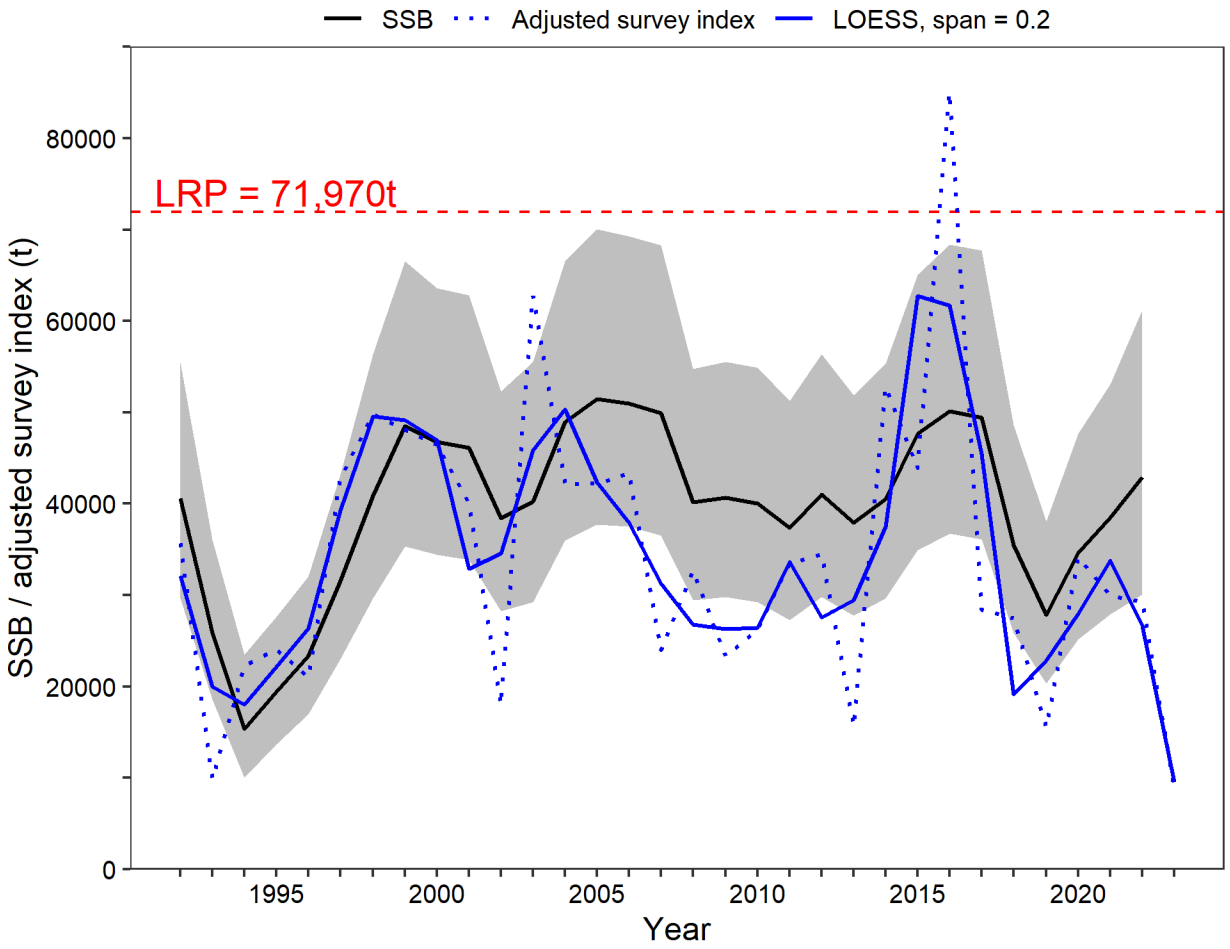

Figure 6. Model estimated spawning stock biomass (SSB; black line with 95% confidence interval), and the adjusted DFO August survey biomass index for cod ≥ 43 cm (dotted blue line) along with a LOESS type smooth of the adjusted index using a span of 0.2 (solid blue line).

Sentinel fisheries program – mobile gear (3Pn, 4RS)

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 decreasing since 2020 (Figure 7). In 2023, they were both below their series average and at some of the lowest values observed during the series.

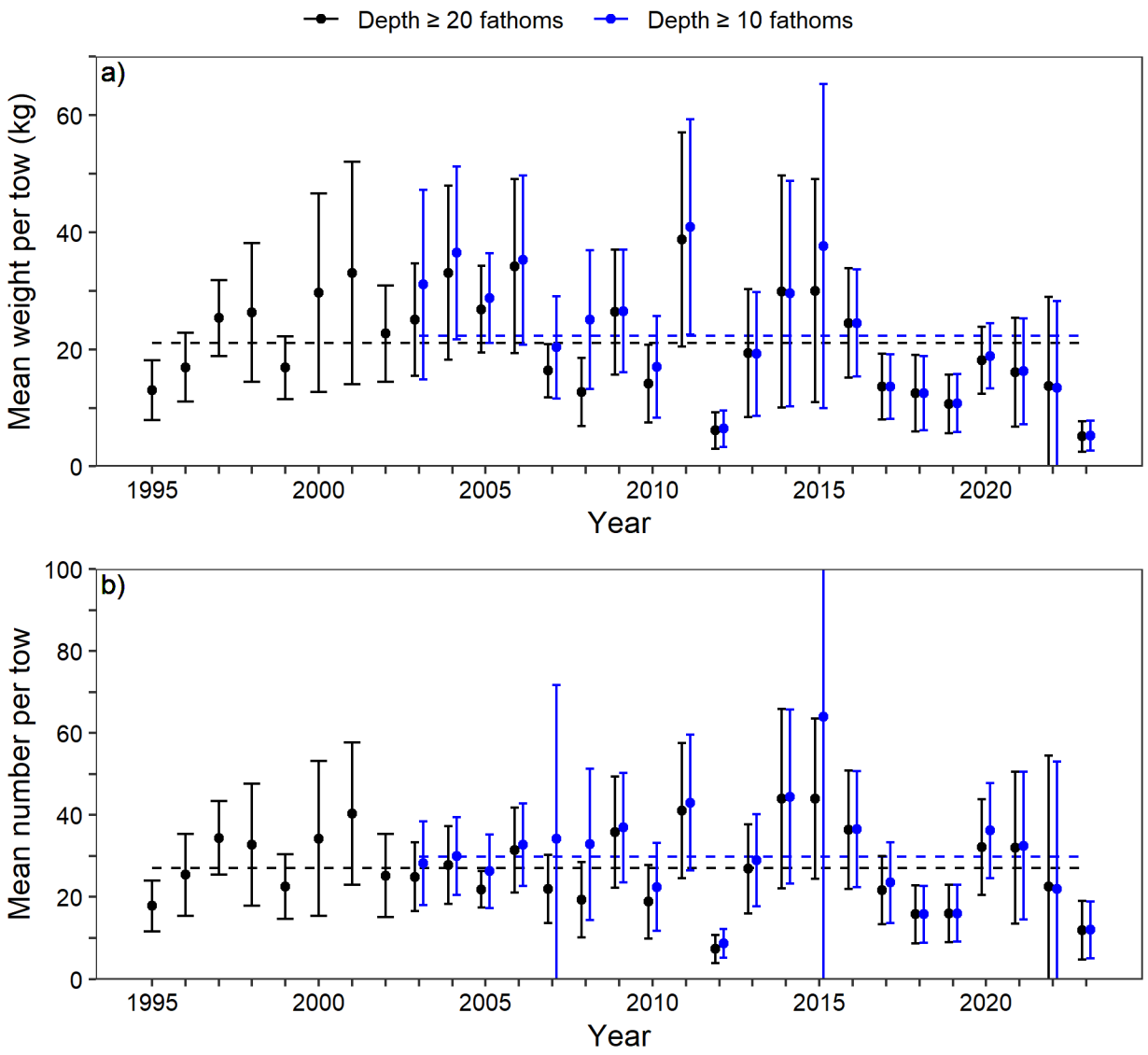

Figure 7. Mean a) weight and b) number of cod per tow in the July mobile gear sentinel survey for the two series considered in the assessment. From 1995 to 2002, the survey involved only strata with depths ≥ 20 fathoms. Starting in 2003, three strata of depth 10–20 fathoms were added. Error bars represent the 95% confidence intervals. The dashed line represents the average of each series (1995–2023 and 2003–2023).

Sentinel fisheries program – fixed gear (3Pn, 4RS)

The summer sentinel longline abundance index has varied over the series, with an upward trend from 1995 to 2006, and has generally been decreasing since then (Figure 8a). In 2023, the index was below the average for the series at values approaching those of the early 2000s.

The summer sentinel gillnet abundance index also fluctuated considerably over the course of the series (Figure 8b). After a period of increase from 1995 to 2006, it has generally fluctuated around the series average thereafter. A decline has been observed over the last two years. In 2023, the index was at values similar to what was observed in the early 2000s.

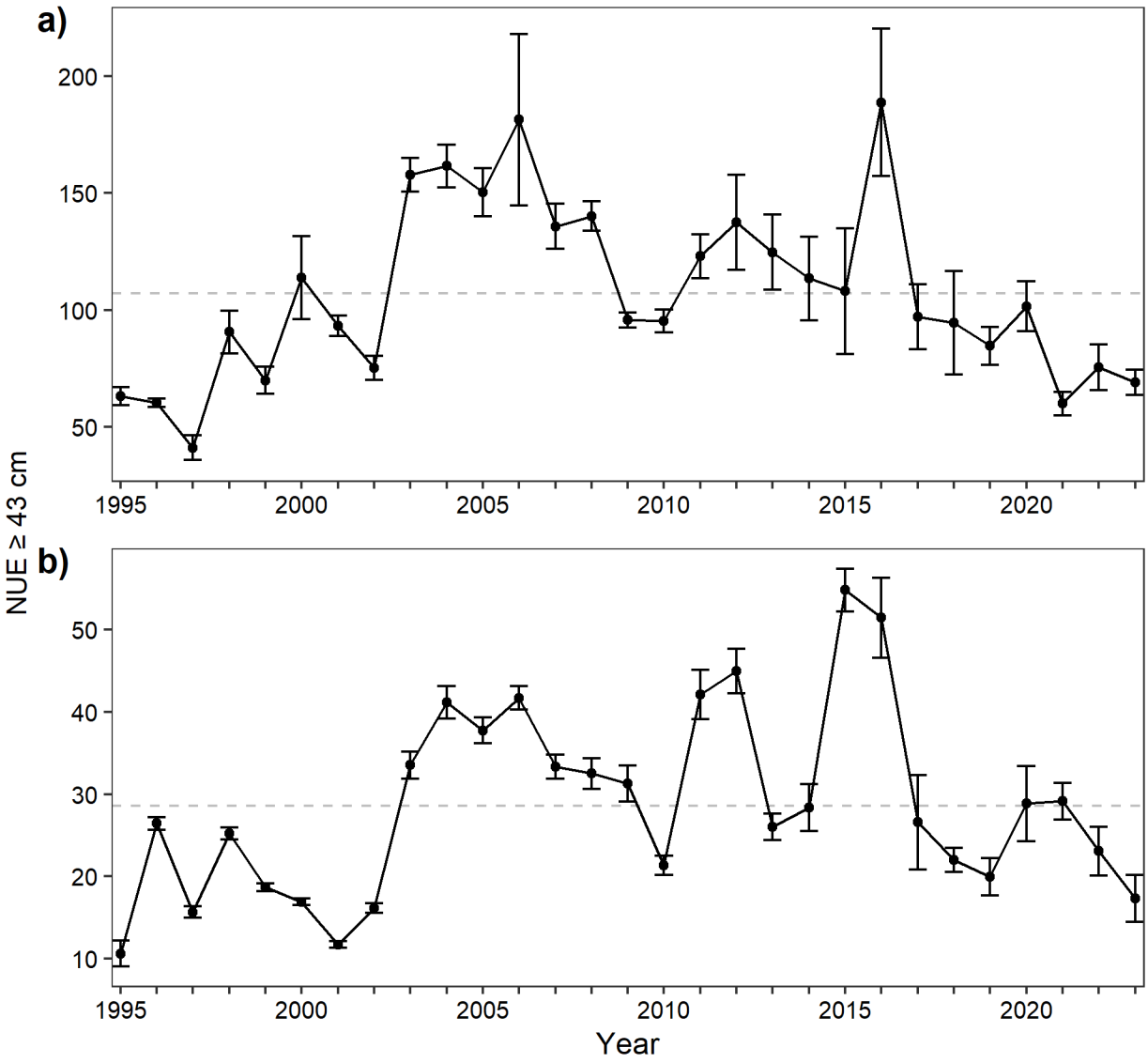

Figure 8. Summer abundance index from the sentinel survey with a) longline and b) gillnet, aggregated at length for individuals ≥ 43 cm during the period 1995–2023. The number per unit effort (NUE) is expressed per 1,000 hooks and per gillnet, and the 95% confidence interval is provided. The hatched horizontal line represents the average of the 1995–2023 series. 2023 data is preliminary.

Conclusion

As with other stocks of commercially fished demersal species, the 3Pn4RS cod stock appears to have experienced a significant decline in 2023 (DFO 2023b, 2024). The 2018 cohort, the most abundant observed at age 2 since the early 1990s (DFO 2023a), experienced a marked decline in 2023 and the growth of these cod appears to have been very weak.

Although the DFO August 2023 survey presents uncertainty regarding the results obtained given the operational challenges encountered with the CCGS *John Cabot*, general downward trends observed with the sentinel surveys using mobile gear (carried out 1 month before the

DFO August survey) and fixed gear (carried out in a more coastal area) support the decrease in the stock observed in 2023.

This update indicates that the stock of Atlantic cod in the northern Gulf of St. Lawrence remains deep in the critical zone according to the precautionary approach. Therefore, in order to promote the recovery of the stock, removals from all sources should be as low as possible.

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