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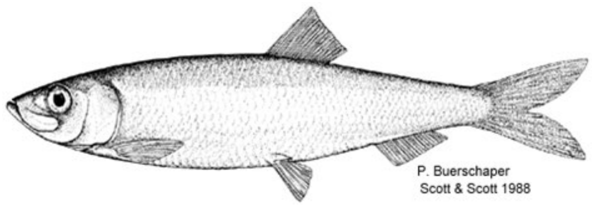
Newfoundland and Labrador Region

Canadian Science Advisory Secretariat
Science Advisory Report 2024/064

ASSESSMENT OF ATLANTIC HERRING IN NAFO DIVISION 3KLPS TO 2021



*Atlantic herring (*Clupea harengus*)*

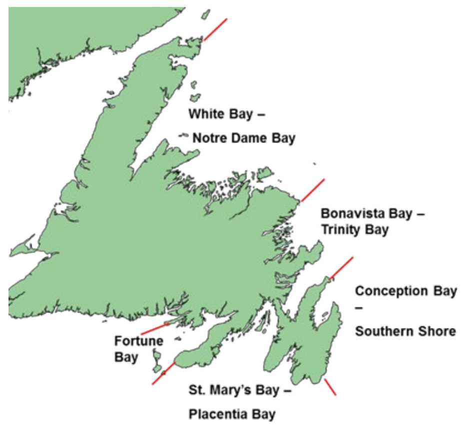


Figure 1. Map of Newfoundland east and south coast stock complexes

Context:

*Atlantic herring (*Clupea harengus*) occurring in the Northwest Atlantic Fisheries Organization (NAFO) Divisions 3KL and Subdivision 3Ps are managed as 5 stock complexes (Fig. 2): White Bay-Notre Dame Bay (WBNDB), Bonavista Bay-Trinity Bay (BBTB), Conception Bay-Southern Shore (CBSS), St. Mary's Bay-Placentia Bay (SMBPB), and Fortune Bay (FB). Herring are fished both commercially and for bait. In 2021 the combined Total Allowable Catch (TAC) for all stock areas was 14,342 t; approximately 2,500 t of herring were landed in the commercial fishery and 560 t through the bait fishery (bait estimate from Fisheries and Oceans Canada [DFO] Science telephone surveys). All 5 stock complexes are comprised of both spring and fall spawning herring. Historically spring spawners accounted for over 90% of all stocks, but spawning stock composition shifted in the 2000s and fall spawners became more prevalent, comprising up to 80% of the catch in some areas. As these components never fully separate, fisheries target mixed aggregations of spring and fall spawners.*

This Science Advisory Report is from the October 4-5, 2022, regional peer review on the Assessment of NAFO Subdivisions 3KLPs Herring. Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada (DFO) Science Advisory Schedule](#) as they become available.

SUMMARY

Overview

- During this assessment, stock status indices were updated for Bonavista Bay-Trinity Bay and Fortune Bay using data from the spring research gillnet program; the results of a similar short-term program in Placentia Bay were also presented. Results of recent acoustic surveys in White Bay-Notre Dame Bay, Bonavista Bay-Trinity Bay, St. Mary's Bay-Placentia Bay and Fortune Bay were reviewed. There was not enough recent data to provide an update for Conception Bay-Southern Shore.
- Inshore acoustic surveys of northeast and south coast herring stock complexes were used to produce biomass indices from 1983 to 2001. These surveys were reinstated in 2019 and the results were presented at this assessment.
- The ecosystems in the Newfoundland and Labrador (NL) bioregion continue to experience overall low productivity conditions, with total biomass well below pre-collapse (1980s) levels. While offshore ecosystem indicators (e.g., biomass trends, stomach content weights) in recent years appear to be improving, current levels are still below those of the mid 2010s. The overall picture for herring, with declines in the late 1980s and early 1990s and reduced productivity since, is generally consistent with the trends observed in offshore surveys.
- The NL climate experiences important fluctuations at decadal time scales, with potential impacts on ecosystem productivity and herring recruitment. Since 2018, a warming trend has been observed, with 2021 being one of the warmest years on record. Since the mid-2010s, there has been a general trend toward earlier spring blooms, returning to the long-term mean. Over the same time period there has been a change in the zooplankton community composition characterized by low abundance of large, energy-rich *Calanus* spp. copepods and high abundance of small copepod taxa in NAFO Divisions 3KLPs.
- There was an overall decline in average length-at-age of herring since the 1980s. Within this pattern of decline, there was an increase for most age classes from 2020 to 2021 with the notable exception of age 4s (2017 year class), which saw a sharp decrease. Length at 50% maturity (L50) of the 2017 year class was at a time-series low in 2021 while age at 50% maturity (A50) increased, returning to the relatively high levels observed through the late-2000s.

White Bay – Notre Dame Bay

- The commercial catch at age in 2021 had a high proportion of young (age 3–5) spring spawners. The acoustic survey biomass index for 2020 (13,219 t) was similar to what was observed in the last survey in 1998 but much lower than the 1980s; samples collected during the survey were comprised of small herring indicating potential strong recruitment.

Bonavista Bay – Trinity Bay

- Catch rates in the spring research gillnet program in Bonavista Bay-Trinity Bay increased substantially in 2021, after being well below the reference period (1990–2005) mean for the previous five years. This increase was driven by high catch numbers of age 4 herring, which also composed a high proportion of the commercial catch in 2021. The stock status index increased after decreasing in 2019 and 2020. The recruitment index (age 4 herring) was at a time-series high for both spring and fall spawners in 2021.
- The biomass index for Bonavista Bay-Trinity Bay derived from the fall 2019 acoustic survey (26,589 t) was similar to levels observed in the 1990s; however, the value from the fall 2021 survey (9,970 t) was the lowest value in the time series.

St. Mary's Bay – Placentia Bay

- Catch rates in the recent short-term research gillnet program in Placentia Bay were below the reference period mean from 2018 to 2021, but were slightly higher than those observed in the early 2000s. Age 4 herring comprised over 30% of the catch in 2021 and the recruitment index (age 4 herring) was above average for both spring and fall spawners.
- The biomass index from the winter 2021 St. Mary's Bay-Placentia Bay acoustic survey (2,407 t) was the second lowest in the time series, slightly higher than what was observed in 2000 (2,000 t). Both of these surveys took place in March and may have missed the over-wintering aggregations which were typically observed during past surveys completed in January-February.

Fortune Bay

- Catch rates in the spring research gillnet program in Fortune Bay increased slightly in 2020 but declined in 2021, remaining well below the reference period mean. The catch at age continued to be dominated by a single year class (2012) in 2019 and 2020, however age 4 herring (2017 year class) comprised over 30% of the catch in 2021. The stock status index declined in 2021 after a slight increase in 2020. The recruitment index (age 4 herring) in 2021 was above average.
- The biomass index for Fortune Bay (5,425 t), derived from the winter 2020 acoustic survey, was higher than the last survey index value in 2001 (3,452 t) but significantly lower than the two previous (18,885 t and 30,408 t in 1997 and 1999, respectively).

BACKGROUND

Stock Structure and Species Biology

Atlantic herring (*Clupea harengus*) in NAFO Divisions 3KL and Subdivision 3Ps are divided into 5 stock complexes: White Bay-Notre Dame Bay (WBNDB), Bonavista Bay-Trinity Bay (BBTB), Conception Bay-Southern Shore (CBSS), St. Mary's Bay-Placentia Bay (SMBPB), and Fortune Bay (FB). Herring also occur and are harvested in southern Labrador, however, the stock affinity of these fish is currently unknown. The 5 stock complexes were defined through tagging experiments in the late 1970s and early 1980s which found that herring aggregated into discrete spawning groups within bays each spring but mixed when moving between bays during summer feeding and migration to overwintering areas (Wheeler and Winters 1984). Stock complexes were delineated to account for those movements and intermixing for management purposes.

Historically, all Newfoundland herring stocks were dominated by spring spawners; however, fall spawner recruitment increased throughout the northwest Atlantic during the 2000s, causing a shift in spawning stock composition (Melvin et al. 2009). In Newfoundland, this shift was most prevalent on the northeast coast, with the proportion of fall spawners increasing through the early 2000s and peaking at almost 80% in 2014 in BBTB (Fig. 3). The change in spawning stock composition was not as significant in FB compared to other areas, where the proportion of fall spawners peaked at 35% in 2010 and remained below 20% most years (Fig. 3). Shifts in spawning stock composition have been linked to increasing temperature (Melvin et al. 2009) and changing plankton dynamics (Brosset et al. 2018); while Newfoundland herring recruitment is highly variable and believed to be influenced heavily by environmental conditions (Winters and Wheeler 1987), the exact drivers remain unclear.

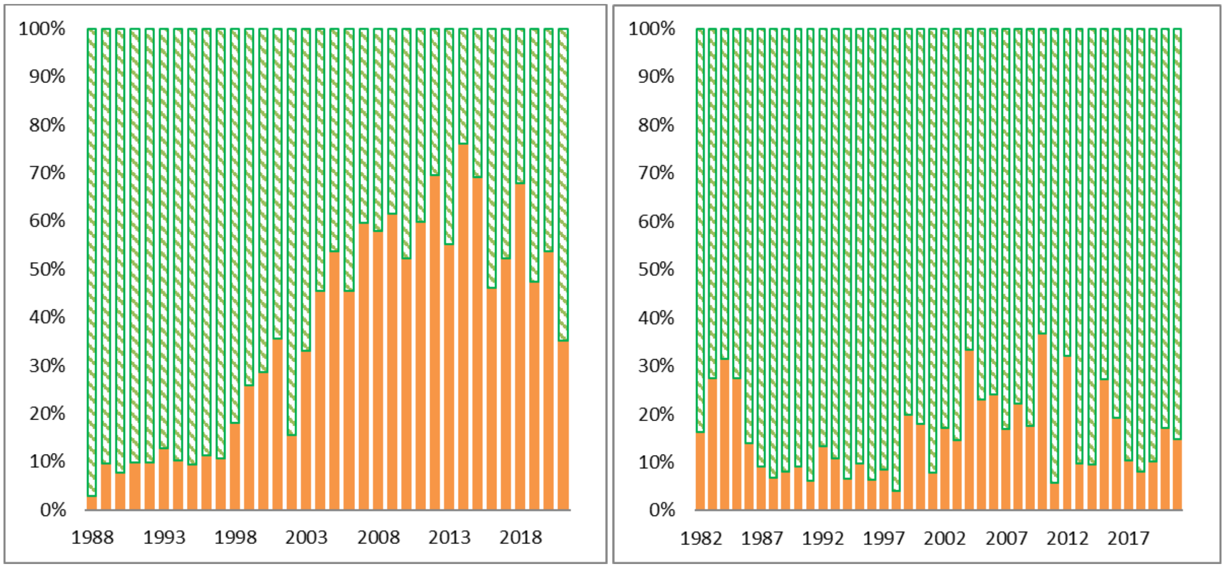


Figure 2. Proportion of spring (green/upper bars) and fall (orange/lower bars) spawning herring in the BBTB (left panel) and FB (right panel) research gillnet programs to 2021.

Ecosystem Information

Ecosystems in the NL bioregion were subject to overfishing from at least the 1960s to the 1980s. This fishing pressure, in conjunction with environmental changes, led to a regime shift in the early 1990s. The structure of these ecosystems changed, with the collapse of the groundfish community and capelin, a key forage species, and significant increases in shellfish, leading to a shellfish-dominated community structure on the Newfoundland Shelf (2J3K). These increases in shellfish did not compensate for the loss of groundfish biomass.

Consistent signals in the annual offshore multispecies surveys of groundfish rebuilding and a return to a groundfish-dominated community started in the mid 2000s, coinciding with modest improvements in capelin, and the beginning of the shellfish decline. The finfish biomass build-up plateaued in the early 2010s and showed declines around 2014–15. While some improvement has become apparent since the lows in 2016–17, current total biomass has yet to return to the 2010–15 level and remains well below the pre-collapse levels. Even though these recent signals appear promising, the ecosystems in the NL bioregion still remain at a low overall productivity state at the present time.

There has been a warming trend in the Newfoundland Climate Index on the Newfoundland Shelf since 2018, with 2021 being one of the warmest years on record (Cyr et al. 2022). Since the mid 2010s, there has been a general trend toward earlier spring blooms. In addition, there was a shift in the zooplankton community on the northeast Newfoundland Shelf and the Grand Banks around the mid 2000s characterized by a decrease in the abundance of large, energy-rich calanoid copepods (*Calanus finmarchicus*, *C. glacialis, C. hyperboreus*) concurrent with an important increase in the abundance of small copepod taxa such as *Pseudocalanus* spp., *Oithona* spp. and *Temora longicornis*. These changes in the size structure of copepod assemblages resulted in a general decrease in total zooplankton biomass, which has remained mostly below the long-term (1999–2020) average since 2010.

Overall ecosystem dynamics appear mostly driven by bottom-up mechanisms, likely associated with the availability of key forage species, like capelin and shrimp, and environmental conditions. The overall pattern of change observed at the broad ecosystem scale is generally coherent with the changes observed inshore with Atlantic herring, like declines in stock sizes since the late 1980s and early 1990s, and reduced sizes at age. This consistency further supports the hypothesis that ecosystem productivity in the NL bioregion is largely regulated by bottom-up processes.

Fishery

The combined TAC for all stock areas (3KLPs) in 2021 was 14,842 t, which includes commercial quotas and bait allocations. Commercial landings were only ~4,000 t and ~2,500 t in 2020 and 2021, respectively (Fig. 4), with most landings attributed to purse seines (with the exception of FB where there is no purse seine fishery). In 2021 there were very low landings in BBTB and none in CBSS, which can largely be attributed to a high percentage of small (commercially undersized) herring in those areas.

Age composition in the commercial fishery is determined using samples collected from processors which are allocated to a proportion of the catch – ideally one sample (55 herring) per 500 t of landings by gear, month and bay; however, when that is not possible a single sample may be allocated to several months, similar gear types, or adjacent bays. Collecting adequate samples was particularly challenging in recent years due to the COVID-19 pandemic and lower commercial landings. In both WBNDB and BBTB the commercial catch at age was well distributed in 2019 and 2020 across a broad range of age classes, but dominated by younger fish in 2021 – largely ages 3–5 in WBNDB, and almost 45% age 4 in BBTB. In CBSS the age distribution of the commercial catch was well distributed in 2020, and there was no fishery in this area in 2021. The catch at age was broadly distributed in SMBPB from 2019–21. In FB the commercial catch has been dominated by the 2012 year class in recent years, which comprised over 80% of the catch in 2020 and 2021.

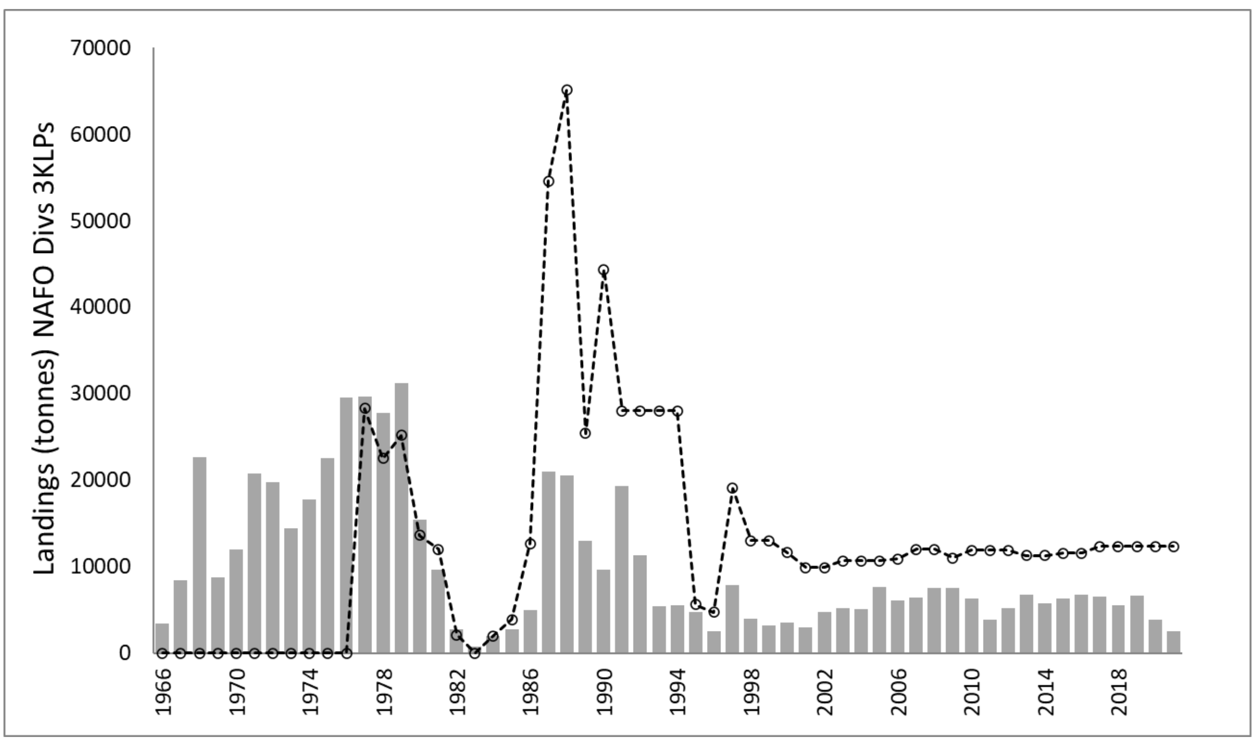


Figure 3. Commercial landings (tonnes) and total TAC (dashed line) for all stock areas combined from 1966 to 2021 (*note 3 of the most recent years' data is considered preliminary).*

Removals of herring also occur through the gillnet bait fishery. Bait fishers are required to record landings in mandatory logbooks; however, for the purposes of this stock assessment bait removal estimates were obtained through the annual Science bait fisher telephone survey, which provides a larger sample size of fishers than is currently available based on logbook return rates (n=41 in 2021). Of an estimated total 391 active bait fishers, 71 were contacted during the 2021 phone survey. The estimated bait removals in all stock areas combined in 2021 were below the bait allocations and accounted for a total of 560 t. Atlantic cod and other cod species comprised the majority of reported bycatch in 2021 (estimated ~1,600 kg in total).

ASSESSMENT

Biological Indicators

The length at age of spring spawning herring peaked in the late 1970s, declined through the 1990s, and stabilized in the early 2000s (Wheeler et al. 2009). The time series was updated to include fall spawners (from 1980s onwards) and it was found that there was no significant difference in length at age between spawning stock components. The stabilized trend in length at age continued in the 2010s; however, there was another potential decrease the early 2020s, which was most apparent in younger fish (<6 years) (Fig. 5). Although the decadal averages show an overall decline in length at age, there was an increase in length at age for most age classes from 2020 to 2021, with the notable exception of age 4s (Fig. 5).

The length and age at 50% maturity (L50 and A50) pooled by sex for spring spawners were updated using a generalized linear model (GLM) with a logit-link function in R (there was insufficient sample size to calculate the same metrics for fall spawners). Fish were grouped by age (2, 3 and 4) and year class. If there were less than 30 individuals in a group, the L50 for that cohort was not considered to be significant, and no estimates were calculated for groups with less than 10 individuals per group. Sample sizes were insufficient to provide estimates for each stock area for most years, but comparisons between years, when possible, did not show a significant difference, therefore all regions were combined. The L50 of the 2017 year class decreased significantly to a time-series low of 233 mm (total length) from 258 mm (total length) in 2013 (Fig. 6). This L50 estimate was similar to the estimate for the 1996 cohort (Fig. 6). The A50 increased from a time-series low in the late 1990s of less than 2.5 years to over 3.5 years in 2017, a value closer to what was observed during the 1980s (Fig. 6).

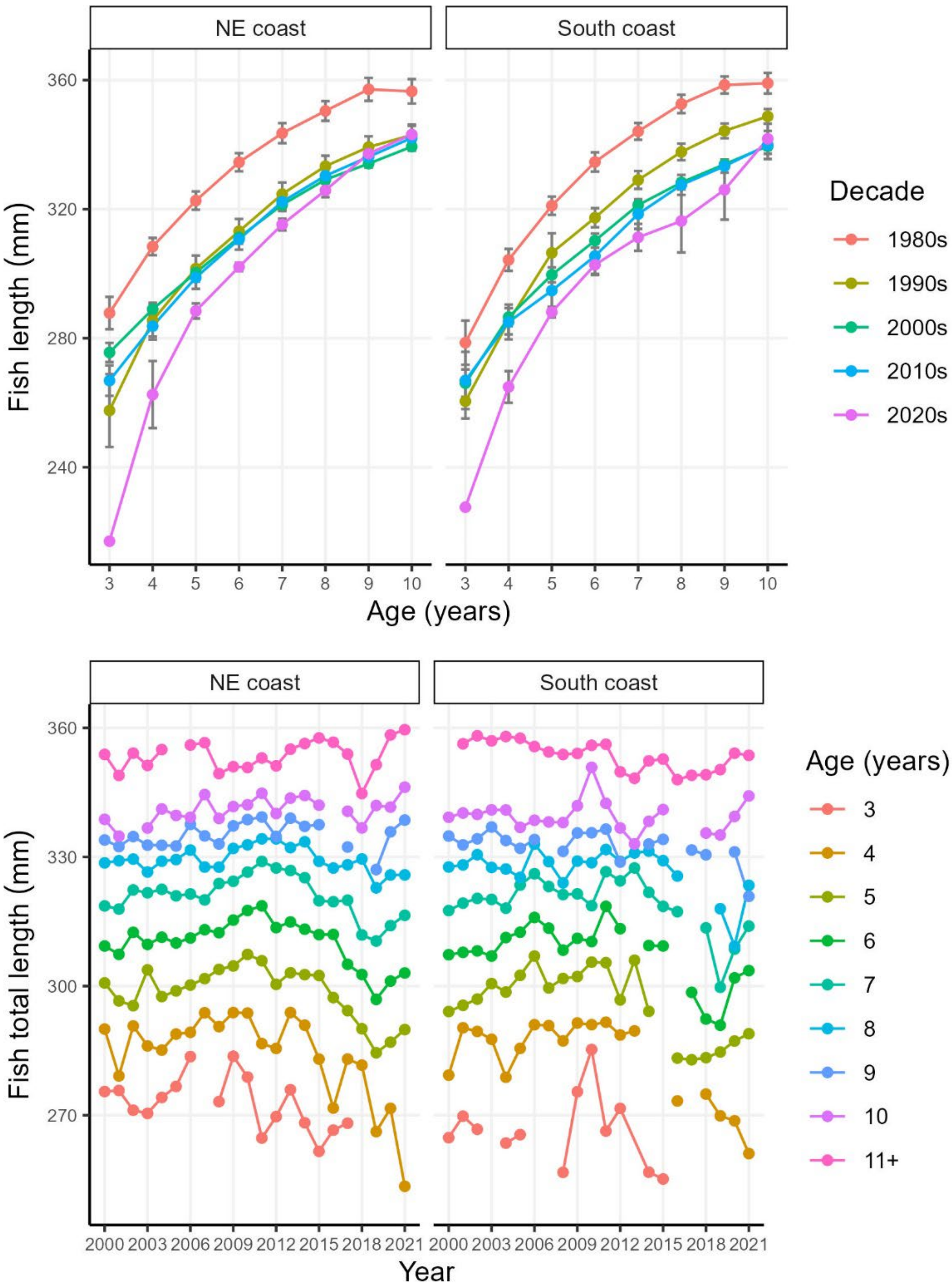


Figure 4. Mean length at age by decade (total length in mm) with error bars representing 95% confidence intervals (CIs) (upper panel) and by year (lower panel) for combined sexes and spawning stock components for the northeast (NE) and South coast stock areas.

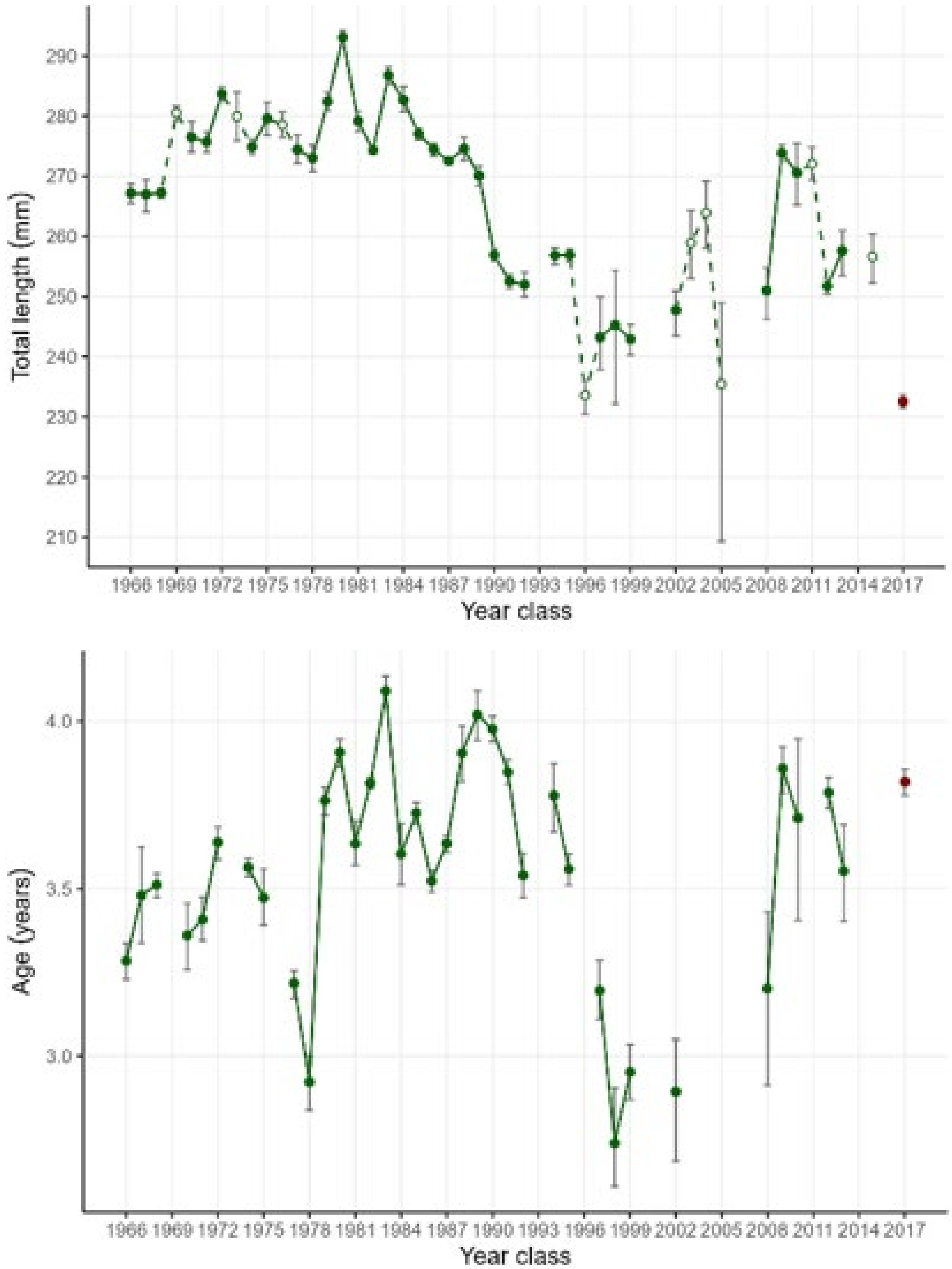


Figure 5. Length (L50, top panel) and Age (A50, bottom panel) at 50% maturity of spring spawners (total length in mm). Error bars correspond to 95% CIs while the red point corresponds to the most recent year class available (2017), solid green points to year classes with 30 or more fish, and hollow points to L50 values calculated with less than 30 fish (minimum 10) sampled in a group.

Research Gillnet Program

The spring research gillnet (RGN) program has been conducted in BBTB and FB since the early 1980s; this program was previously run in other stock areas but discontinued for various reasons (Bourne et al. 2015). A similar program was reinstated in PB from 2018–22 as part of the Environmental Coastal Baseline project in that area and data collected were used to update the existing SMBPB time series. The RGN program provides a fishery-independent index of abundance of primarily commercial-sized fish (age 4+), with 4 fishers contracted per bay to fish a standardized set of nets (5 different mesh sizes) for 45 days each spring. Fishers keep detailed logbooks and collect biological samples which are used to calculate catch rates, catch at age, and update stock status indices.

Catch rates in the BBTB RGN program increased significantly in 2021, well above the decadal and reference period (1990–2005) mean (Fig. 7). This dramatic increase was largely attributable to a single fisher in Trinity Bay who had exceptionally high daily catches in 2021. The catch at age in BBTB in 2021 was comprised of almost 70% age 4 herring (Fig. 8). The recruitment rate (*ln* of age 4 catch rate) of the 2017 year class was at a time-series high for both spring and fall spawners (Fig. 9).

In SMBPB the RGN program occurred from 1982 to 2012 in both bays, and in PB only from 2018–22. Recent catch rates in PB (2018–21) were below the reference period mean but slightly higher than those observed in the early 2000s (Fig. 7). The age distribution of the catch in 2021 was well distributed, with a strong age 4 (2017) year class comprising almost 35% of the catch (Fig. 8). The recruitment of the 2015–17 fall and 2017 spring year classes has been above average (Fig. 9).

In FB, RGN catch rates have been well below the reference period mean throughout the 2000s; the 2020 catch rate increased above the decadal mean but declined just below it again in 2021 (Fig. 7). The catch at age in FB has been sustained by a single year class throughout the 2000s, first by the 2002 cohort and in more recent years, the 2012 cohort (Bourne et al. 2018). However, in 2021 the age distribution was largely split between the 2012 (age 9) and 2017 (age 4) cohorts (Fig. 8). As with other areas, the recruitment of the 2017 year class was of above average strength in this area (Fig. 9). Fall spawner year class and recruitment strength are not evaluated in FB as they comprise a small percentage of the population and are poorly recruited to the spring RGN program.

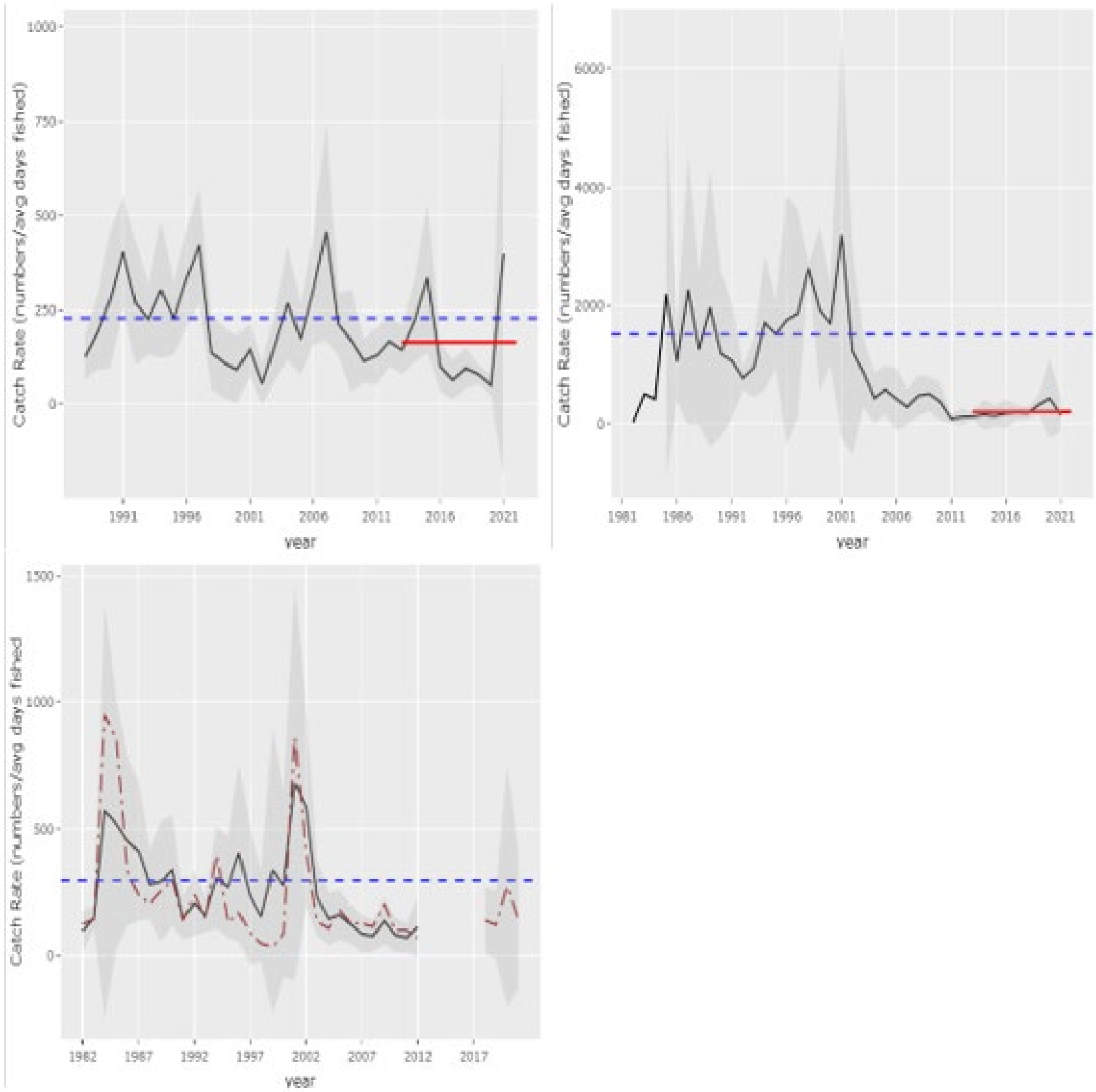


Figure 6. Combined catch rate (number of herring caught/average days fished) for the spring research gillnet program with reference period mean (1990–2005; broken blue line) and decadal mean (solid red line) in BBTB (top left panel), FB (top right panel) and SMBPB (bottom panel – note that the red broken line in this plot represents catch rates from PB only).

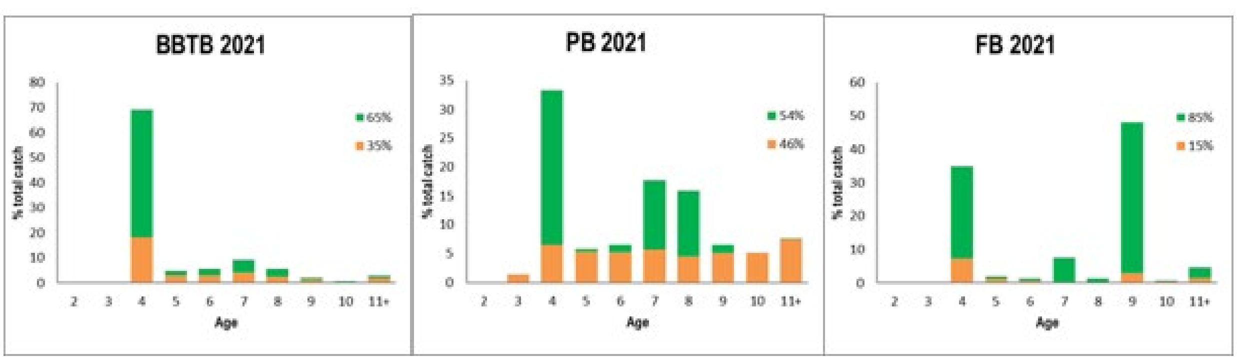


Figure 7. Catch at age in the 2021 spring research gillnet program in BBTB, PB and FB with percentage of spring (upper/green bars) and fall (lower/orange bars) spawners.

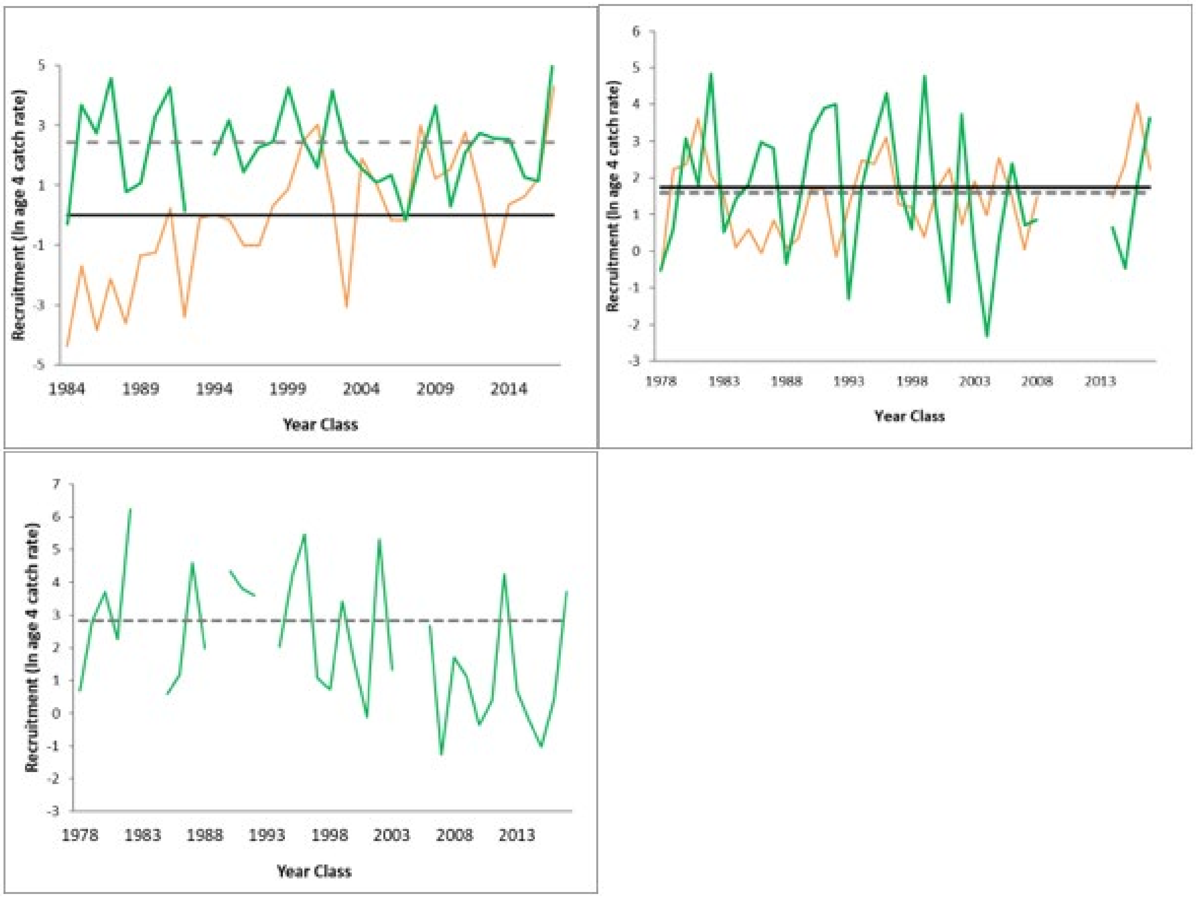


Figure 8. Recruitment rates (ln age 4 catch rate) of spring (green lines) and fall (orange lines) spawners in the spring research gillnet program and reference period (1990–2005) means (dashed line for spring spawners, solid for fall spawners) in BBTB (top left), SMBPB (top right – note rates for 2014–17 are PB only), and FB (bottom panel).

Acoustic Surveys

Inshore acoustic herring surveys were conducted annually on the northeast and south coasts of Newfoundland from the early 1980s to 2001, but were discontinued due to funding restrictions and difficulty locating and sampling herring in the late 1990s (Wheeler et al. 2010). Surveys were reinstated in 2019 to obtain a fishery-independent biomass index. This index, along with the RGN abundance index, will be used going forward in the development of Limit Reference Points (LRPs) for 3KLPs herring. Acoustic surveys are meant to target aggregations of overwintering herring and provide a biomass index that accounts for all sizes/ages encountered, whereas the RGN program was designed to intercept schools of herring during spring spawning migrations and provide an index of abundance of herring that are large enough to recruit to the smallest mesh size net (typically age 4). These indices are not directly comparable but are complementary, providing valuable information about these stock complexes and trends over time (Fig. 10).

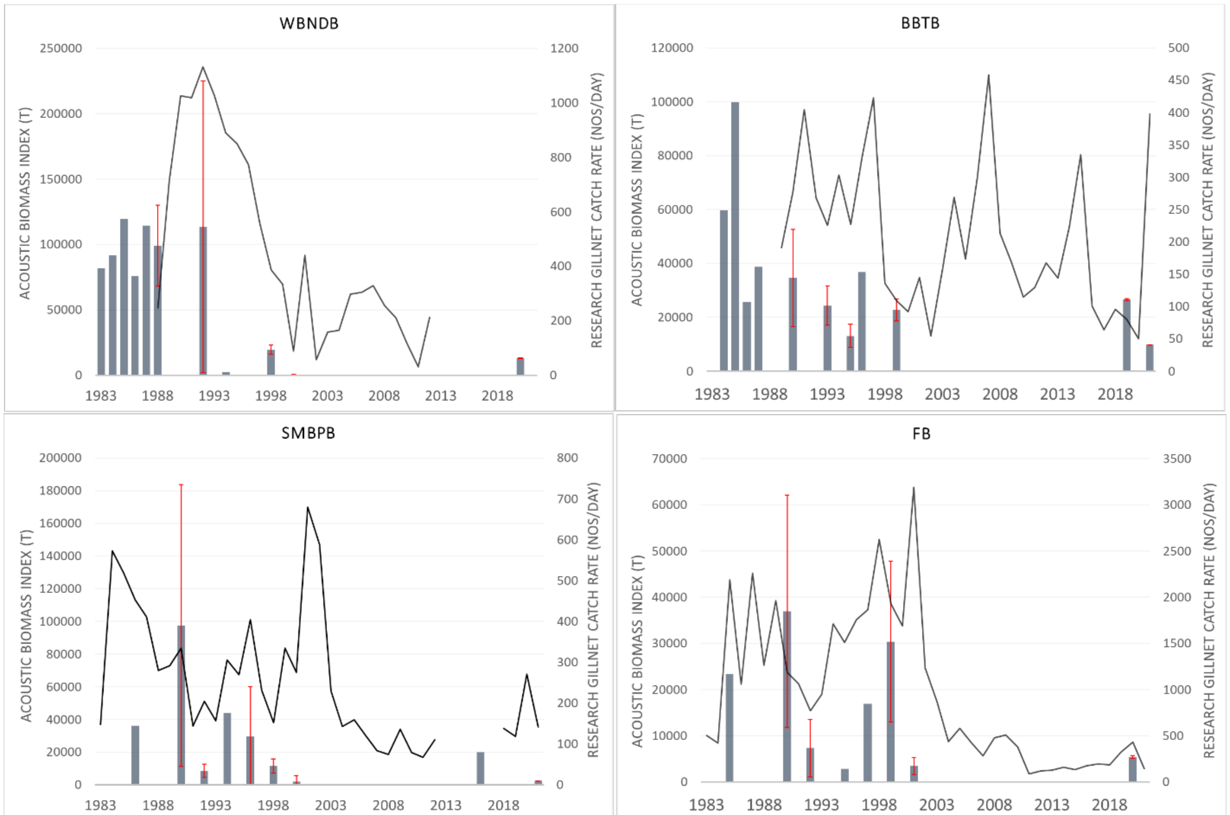


Figure 9. Herring acoustic biomass index (bars) and research gillnet catch rate index (lines) by stock area for spring and fall spawners combined. *The 2000 WBNDB biomass value is not visible on this plot (312 t) and the 2016 SMBPB acoustic survey value was for PB only; standard error estimates (red vertical lines) were not available for earlier surveys.*

Since 2019, a northeast coast stock complex has been surveyed each fall (BBTB 2019 and 2021 [Fig. 11], WBNDB 2020 [Fig. 12]) and a south coast complex each winter (FB 2020 [Fig. 12] and SMBPB 2021 [Fig. 13]), with the exception of 2022 when weather and COVID-19 related issues prevented the planned winter FB survey from going ahead. Acoustic survey timing is intended to intercept aggregations of overwintering herring. Survey design is consistent with that of previous (1983–2001) surveys to ensure continuity of the time series. Each stock area is divided into strata and transects are allocated based on historical herring density a rating of strata difficulty. Data is collected using a SIMRAD EK60 echo sounder with a split beam 120 kHz transducer that was operated from a towed body from 2019 to winter 2021 and mounted to the stabilizer fin of the chartered fishing vessel in fall 2021, which will be the method used going forward. Biological samples are collected during surveys using a purse seine or, when that gear cannot be deployed, hook and line. An underwater camera is also used when possible to verify species when fish aggregations are detected.

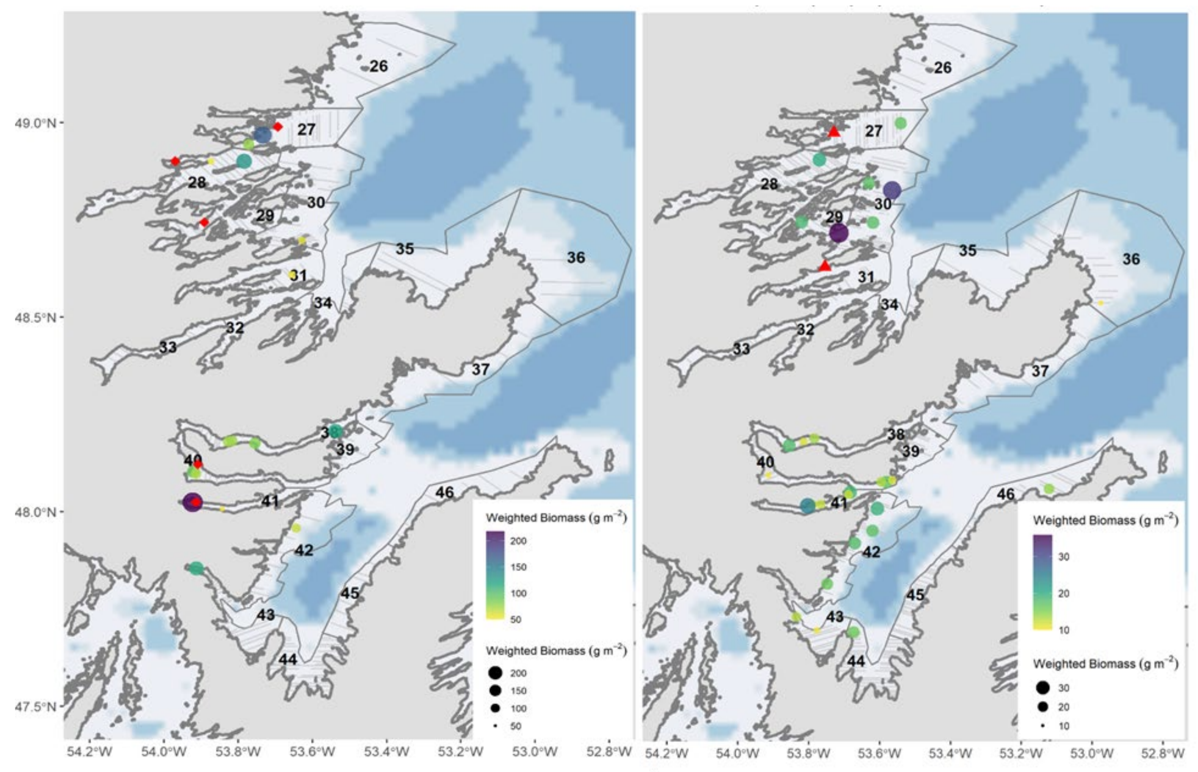


Figure 10. Survey strata and transects (grey lines), distribution of biomass estimated from acoustic backscatter (colored circles), and sample locations (red triangles = hook and line, red diamonds = purse seine) in BBTB fall inshore acoustic herring surveys in 2019 (left panel) and 2021 (right panel).

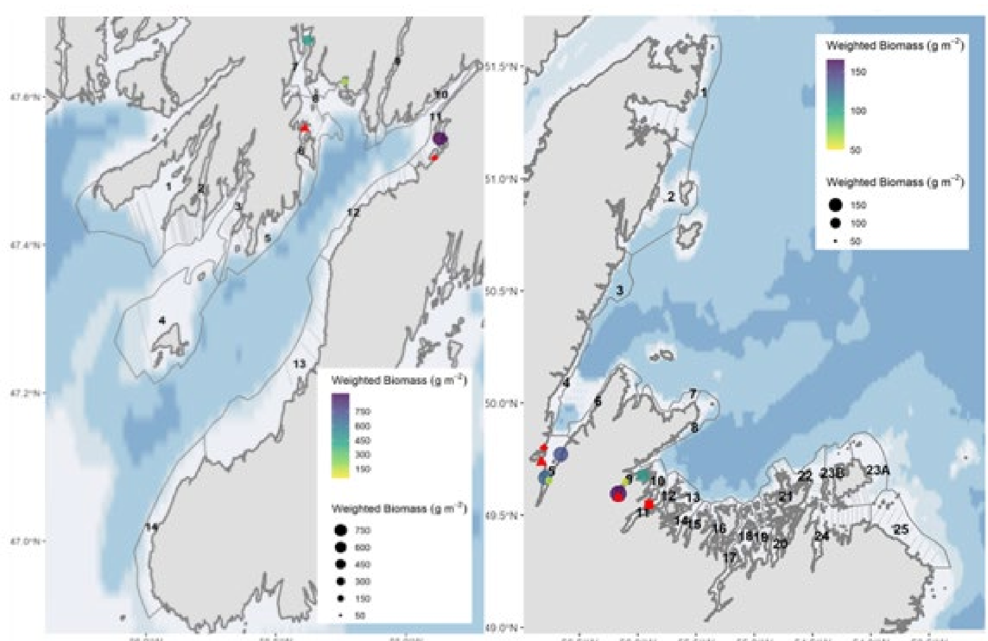


Figure 11. Survey strata and transects (grey lines), distribution of biomass estimated from acoustic backscatter (colored circles), and sample locations (red triangles = hook and line, red diamonds = purse seine, red circle = dip net) in winter 2020 FB survey (left panel) and fall 2021 WBNDB survey (right panel).

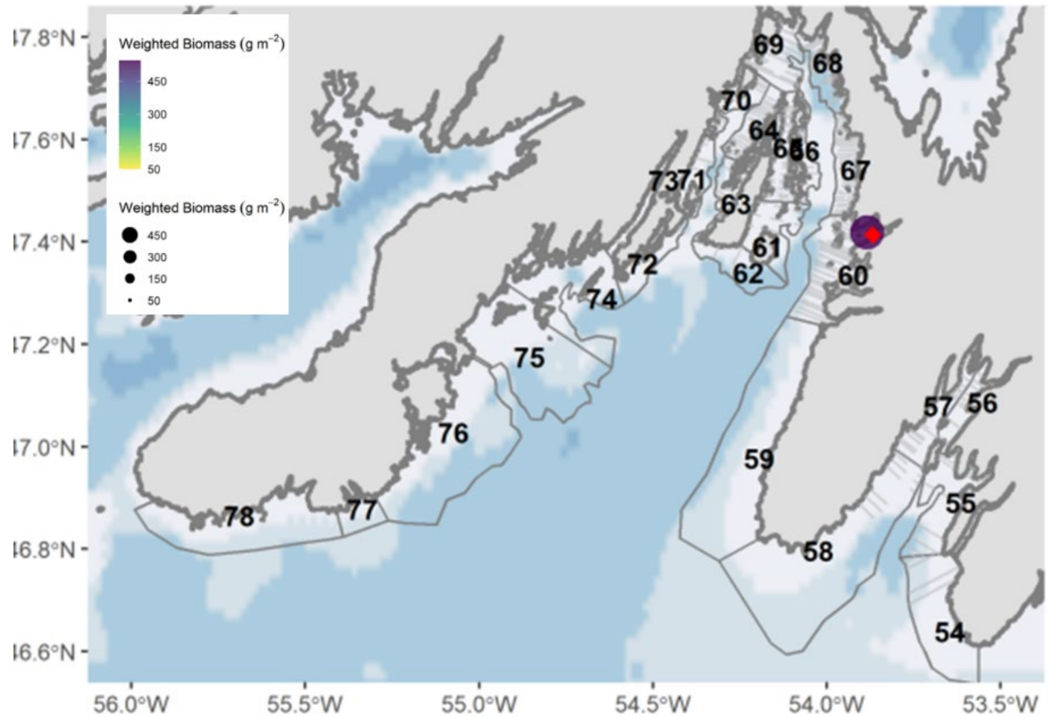


Figure 12. Survey strata and transects (grey lines), distribution of biomass estimated from acoustic backscatter (colored circles), and sample locations (red diamond = purse seine) in winter 2021 SMBPB inshore acoustic survey.

Biomass index values were calculated for each survey using a weight-based target strength function (Simmonds and MacLennan 2005; Benoit et al. 2008). It was difficult to obtain adequate samples of herring during most surveys due to challenges deploying the seine or sparse aggregations, therefore samples were applied to multiple strata. The biomass index for the fall BBTB 2019 survey was 26,589 t, whereas fall 2021 was 9,970 t, the lowest value in the time series (Fig. 10). The biomass index for the winter 2020 FB survey was 5,425 t, higher than the last survey completed in 2001 but significantly less than the two previous surveys (Fig. 10). The fall 2020 WBNDB survey biomass index value was 13,219 t, the third lowest of the time series (Fig. 10); however, the fish sampled were on average the smallest of the recent acoustic surveys, meaning abundance was relatively high in WBNDB compared to other stock areas. The biomass index for the 2021 winter SMBPB survey was 2,407 t, only slightly higher than the last full survey of the stock area (2,000 t in 2000), which was the lowest value of the time series (Fig. 10). However, the 2000 and 2021 surveys were delayed to March (typically they occurred in January or February), and it is possible that the delay in the survey timing was an issue for intercepting herring aggregations prior to spring spawning. A partial survey conducted in Placentia Bay in February 2016 had a biomass estimate closer to 20,000 t (Fig. 10).

Stock Status Index

The stock status index is calculated using three metrics from the spring RGN program: overall catch rates as a percentage of the reference period (1990–2005) mean, catch rates of ages 7–10 as a percentage of the reference period mean, and the number of mature year classes above the reference period mean. Each metric is scored and all three are equally weighted to calculate the stock status index value. In BBTB, this is done for both spring and fall spawners, then the values are weighted according to the proportion of each spawning component in the catch to give a combined stock status value; in FB only spring spawners are used as fall spawner numbers are too low to provide reliable index values.

In BBTB, the stock status index increased after a slight decrease in 2020 (Fig. 14). This was largely driven by the strong age 4 (2017) year class which was recruiting to the fishery in 2021. In FB, the stock status index increased from 2016 to 2020, but declined again in 2021 (Fig. 14), due to decreased catch rates as there is only one strong year class in this area. The stock status index could not be updated for SMBPB given the break in the RGN time series and resulting lack of data on mature year class strength (catch rates are required to track cohorts through ages 4–11+); the index also could not be updated for WBNDB or CBSS since there is no longer a RGN program in either of these stock areas.

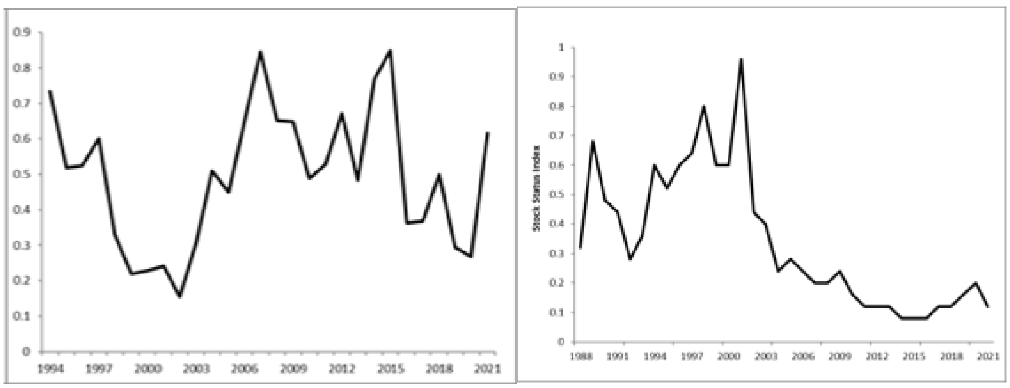


Figure 13. Stock status index for BBTB (left panel) and FB (right panel) based on catch rates and biological samples from the spring research gillnet program.

Sources of Uncertainty

In CBSS, the lack of a fishery independent index of abundance or biomass, and low commercial landings in recent years makes it impossible to provide a biological update or stock status evaluation for this stock area.

The inability to estimate population sizes/biomass and exploitation rates has precluded the calculation of reference points and limited the implementation of the precautionary approach in fisheries management decisions for 3KLPs herring; however, with the reinstation of acoustic surveys it is anticipated that new stock status evaluation methods and proposed LRPs will be produced for these stock complexes prior to the next (2024) assessment.

There is a commercial fishery in southern Labrador, however the stock affinity of those herring is currently unknown, and therefore no scientific advice can be provided at this time to fisheries managers for that area.

Collecting sufficient samples to calculate catch at age for the commercial fishery has been a challenge in recent years, consequently age distributions may not be representative of what is seen throughout the fishery (spatially and temporally).

Stock complexes were delineated using tagging studies in the late 1970s and early 1980s; migration patterns and stock boundaries may have changed since.

There continue to be challenges with obtaining samples during acoustic surveys due to size, behavior and location of herring. In some instances, there may be a mismatch between when surveys are conducted and the timing of herring migration/overwintering, which may result in an underestimate of the herring biomass index.

CONCLUSIONS AND ADVICE

The average length at age of herring in 3KLPs declined from the 1980s through the early 2000s, with the most rapid drop occurring between the 1980s and 1990s (Fig. 5). However, there was an increase in length for most age classes based on data from 2020 and 2021, with the notable exception of age 4s, which saw a sharp decrease (Fig. 5). The L50 of the 2017 year class was at a time-series low, while the A50 increased to a level not observed since the 1980s, suggesting slower growth in recent years (Fig. 6).

Fall spawner recruitment generally increased in the early 2000s with the exception of Fortune Bay and catches continue to be comprised of a nearly even mix of spring and fall spawners in most areas (Figs. 3, 8). Recruitment of the 2017 year class was above average in all three areas that have a RGN program (BBTB, PB and FB; Fig. 9). While evidence suggests that herring recruitment in the northwest Atlantic is driven by environmental conditions (Melvin et al. 2009, Brosset et al. 2018) and the NL Shelf ecosystem has experienced shifts in temperature and plankton community composition over the last several decades, the exact drivers of herring recruitment remain unknown and are a continuing topic of research.

Acoustic surveys were reinstated in 2019 using the same methodology as past surveys which took place from 1983 to 2001, allowing for continuation of the biomass index time series. Results from the 5 recent surveys showed biomass index values were low, with the exception of the 2019 BBTB survey which was comparable to values seen in the 1990s (Fig. 10). Going forward, these biomass indices will be incorporated into stock assessments to evaluate stock status and used in conjunction with other data sources to derive LRPs for 3KLPs herring.

White Bay – Notre Dame Bay

Biological samples from the commercial fishery indicated a broad age distribution with high proportions of young (age 3–5) herring in 2021. The biomass index value from the fall 2020 inshore acoustic survey was 13,219 t, similar to the survey in this area in 1998, but much lower than what was observed in the 1980s (Fig. 10). However, samples collected during fall 2020 were comprised of the smallest herring seen in any of the recent (2019–21) surveys, indicating potential high relative abundance and recruitment for this area.

Bonavista Bay – Trinity Bay

Two acoustic surveys were completed in BBTB in recent years: fall 2019 and fall 2021 (Fig. 11). While the 2019 survey had a biomass index value of 26,589 t, similar to levels observed in the 1990s, the biomass index from the 2021 survey was the lowest of the time series (9,970 t, Fig. 10). There was no obvious cause of the observed biomass decline between these acoustic surveys, and there was an opposite (increasing) trend seen in the 2021 RGN catch rate index (Figs. 7, 10).

The commercial catch at age in BBTB was well distributed in 2019 and 2020, but dominated by age 4 herring (over 40%) in 2021. Similarly, the catch at age in the RGN program in 2021 showed a strong age 4 cohort (Fig. 8) with the recruitment index of both spring and fall spawners at time-series highs (Fig. 9). The RGN catch rates in 2021 were significantly higher than recent years, again driven by catch rates of age 4 herring (Fig. 7). The stock status index, derived from the RGN program, increased in 2021 after decreasing in both 2019 and 2020 (Fig. 14).

Conception Bay – Southern Shore

There have been very low or no commercial landings in CBSS in recent years. Given that the only current data source for this area is biological samples from the fishery, there was insufficient data available for this assessment to update stock status or provide a biological update.

St. Mary's Bay – Placentia Bay

An acoustic survey of SMBPB conducted in winter 2021 produced a biomass index value of 2,407 t, the second lowest in the time series (Fig. 10). Both of the lowest biomass index values were from surveys conducted in March, which may be too late for intercepting over-wintering aggregations of herring.

A short-term RGN program was conducted in PB from 2018–22 (results to 2021 were available for this assessment). Catch rates from this program were below the reference period mean for the stock area, but slightly higher than those observed in the early 2000s (Fig. 7). Both the commercial fishery and RGN program catch at age were well distributed in 2019 and 2020, but the RGN catch was dominated (over 30%) by age 4 herring in 2021 (Fig. 8). The recruitment index for these age 4s was above average for both spring and fall spawners (Fig. 9). A stock status index could not be updated for this stock area given the break in the RGN time series.

Fortune Bay

An acoustic survey conducted in FB in winter 2020 produced a biomass index value of 5,425 t, the third lowest in the time series but slightly higher than the last survey conducted in 2001 (Fig. 10). Catch rates in the RGN program increased slightly above the decadal mean in 2020 but declined again in 2021, remaining well below the reference period mean (Fig. 7). Both the commercial fishery and RGN program catch at age have been dominated by the 2012 year class in recent years, however in 2021 over 30% of the RGN catch was comprised of age 4 herring (Fig. 8). The recruitment index for this age class was also above average (Fig. 9). The stock status index for this area declined in 2021 after a slight increase in 2020 – this is largely driven by catch rates given the lack of mature year classes in this area (Fig. 14).

LIST OF MEETING PARTICIPANTS

Name	Affiliation
Fran Mowbray	DFO-NL – Science
Julia Pantin	DFO-NL – Science
Christina Bourne	DFO-NL – Science
Dale Richards	DFO-NL – Centre for Science Advice
Eugene Lee	DFO-NL – Centre for Science Advice
Erin Dunne	DFO-NL – Resource Management
Jennes Cawthray	DFO-NCR – Resource Management
Aaron Adamack	DFO-NL – Science
Catie Young	DFO-NL – Science
Dwight Drover	DFO-NL – Science
Fred Paquet	DFO-Maritimes – Science
Hannah Murphy	DFO-NL – Science
Jordan Sutton	DFO-NL – Science

Name	Affiliation
Karen Cogliati	DFO-NCR – Science
Kelly Dooley	DFO-NL – Science
Kim Emond	DFO-Quebec – Science
Marc Legresley	DFO-NL – Science
Mariano Koen-Alonso	DFO-NL – Science
Mathieu Boudreau	DFO-Quebec – Science
Paula Lundrigan	DFO-NL – Science
Pierre Pepin	DFO-NL – Science
Robert Deering	DFO-NL – Science
Samantha Trueman	DFO-NL – Science
Sanaollah Zabihi-Seissan	DFO-NL – Science
Shani Rousseau	DFO-Quebec – Science
Shelly Lang	DFO-NL – Science
Emma Corbett	Gov NL - Fisheries, Forestry and Agriculture
Vanessa Byrne	Gov NL - Fisheries, Forestry and Agriculture
Erin Carruthers	Fish, Food and Allied Workers Union
Mike Dobbin	Fish, Food and Allied Workers Union
Tim Pilgrim	Fish, Food and Allied Workers Union
Trent Emberley	Fish, Food and Allied Workers Union
Jack Daly	Oceana Canada
Gemma Rayner	Oceans North

SOURCES OF INFORMATION

This Science Advisory Report is from the October 4-5, 2022, regional peer review on the Assessment of NAFO Subdivisions 3KLPs Herring virtual meeting. 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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Fisheries and Oceans Canada
PO Box 5667
St. John's, NL, A1C 5X1

E-Mail: DFONLCentreforScienceAdvice@dfo-mpo.gc.ca
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