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Canadian Science Advisory Secretariat
Newfoundland and Labrador Region **Science Advisory Report 2025/025**

STOCK ASSESSMENT OF NEWFOUNDLAND AND LABRADOR ATLANTIC SALMON IN 2023 (SFA 1–14B)

*Image: Atlantic Salmon (*Salmo salar*).*

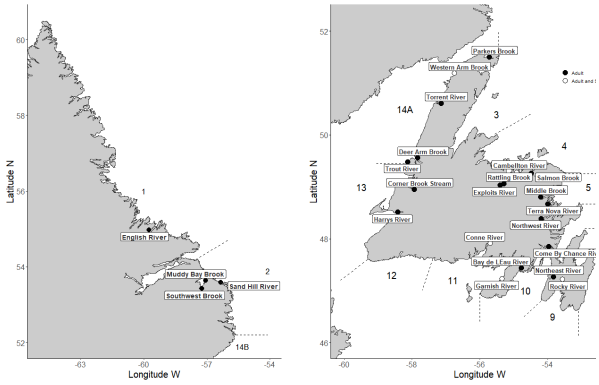

Figure 1. Map of Atlantic Salmon rivers monitored in the Newfoundland and Labrador Region in 2023 and approximate boundaries of Salmon Fishing Areas (SFAs) 1–14B.

CONTEXT

In Newfoundland and Labrador (NL), there are 15 Atlantic Salmon (*Salmo salar*) management areas, known as Salmon Fishing Areas (SFAs) 1–14B (Fig. 1). Within these areas there are 407 rivers known to contain wild Atlantic Salmon populations that are characterized by differences in life history traits, including freshwater residence time, timing of return migration, age at first spawning, and the extent of ocean migration.

The Fishery Decision-Making Framework Incorporating the Precautionary Approach (PA, Fisheries and Oceans Canada [DFO] 2015) identifies two reference points for managing fisheries stocks, the Limit Reference Point (LRP) and Upper Stock Reference (USR). As per the PA Framework, Atlantic Salmon stock status is assessed based on the proportion of the river-specific LRP and USR achieved. Conservation egg requirements for Atlantic Salmon were previously established for individual rivers in NL (SFA 1–14B). Conservation egg requirements are considered to be equivalent to an LRP. The USR is considered to be 150% of the LRP.

Status is also described in terms of trends in salmon returns (abundance prior to in-river exploitation), smolt production, and marine survival rates.

Annual comparisons are generally made to:

1. the previous generation average which corresponds to six years for most Newfoundland rivers and seven years for most Labrador rivers, and
2. the previous three generation average (16–18 years for most Newfoundland rivers and 19–22 years for most Labrador rivers).

This Science Advisory Report is from the February 27–29, 2024 regional peer review on the Stock Assessment of Atlantic Salmon in Newfoundland and Labrador. This report provides information regarding the status of Atlantic Salmon stocks in 2023 for SFAs 1, 2, and 14B (Labrador), and SFAs 3 to 14A (Newfoundland) (Fig. 1 and 2). Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

SUMMARY

- Twenty-four populations of Atlantic Salmon (*Salmo salar*) were monitored in 2023. Returning adult salmon were counted on 23 rivers using monitoring fences or fishways, and returns were estimated on one river using a combination of a fish counting fence and snorkel survey. Stock status was estimated for 19 monitored populations.
- In 2023, 16 rivers had sufficient time series data to compare adult returns to the previous generation. Of these 16, 12 showed declines in total returns with eight having declines over 30%. Twelve rivers had sufficient time series data to compare adult returns to the previous three generations. Of these 12, nine showed declines in total returns with seven having declines over 30%. This met the criteria to trigger a full stock assessment.
- Smolt abundance estimates were available for three of five Newfoundland rivers where monitoring occurs annually. Smolt abundance was below average on two of three rivers with estimates in 2023, and modelling suggests that smolt production has declined significantly over the past three generations on Rocky River (Salmon Fishing Area [SFA] 9), Conne River (SFA 11), and Western Arm Brook (SFA 14A).
- Marine survival is considered a major factor limiting the abundance of Atlantic Salmon in Newfoundland and Labrador (NL). Marine survival estimates for the 2023 adult return year were available for Rocky River (2.6%) in SFA 9 and Garnish River (1.1%) in SFA 11, both of which were at least 56% below average. Available data suggest that marine survival for Conne River salmon remains low (<2%).
- In 2023, estimated spawning escapements (eggs) on Labrador rivers were in the Critical Zone on Southwest Brook, Muddy Bay Brook, and Sand Hill River, and the Healthy Zone on English River. Of the 15 assessed rivers in Newfoundland, ten were in the Critical Zone, one was in the Cautious Zone, and four were in the Healthy Zone.
- Preliminary harvest estimates for the 2023 Labrador Indigenous and subsistence fisheries were inferred from logbooks and were 16% above the previous generation average and 17% above the three-generation average.
- Estimates of catch in the 2023 recreational Atlantic Salmon fishery were inferred from angler log returns and an angler phone survey. Estimates of angler effort, retained and released salmon were below the previous generation average in NL.
- Sea surface temperatures during the 2023 summer months were much warmer than normal on the NL shelf and Gulf of St. Lawrence. The last three years were the warmest in the NL region (2022 being the warmest).
- Average monthly July river temperature in Labrador was the highest on record (since 1994), with temperatures >25°C for 9.2% of July and 2.1% of August. In Newfoundland, temperatures were >25°C for 14% of July and 2.5% of August. Temperatures exceeding 25°C may have physiological and potentially lethal impacts on juvenile and adult Atlantic Salmon.

- Marine conditions over the past 3–5 years are indicative of improved productivity at the lower trophic levels across the NL bioregion. These include high nutrient inventories, earlier phytoplankton blooms, and above-normal abundance of both small and larger, more energy-rich *Calanus* spp. copepods.
- Marine ecosystem conditions indicated overall limited productivity of the fish community. Total biomass of the entire fish community remained below pre-collapse levels with minor recovery up to the early 2010s, followed by subsequent declines. In recent years (2019–23), ecosystem indicators have suggested that conditions could be improving from the lows in the mid-late 2010s.

BACKGROUND

Species Biology

There are 15 Atlantic Salmon (*Salmo salar*) management areas, known as SFAs 1–14B, in NL (Fig. 1 and 2). Within these areas there are 407 rivers known to contain wild Atlantic Salmon populations that are characterized by differences in life history traits, including freshwater residence time, timing of return migration, age at first spawning, and the extent of ocean migration. Juvenile Atlantic Salmon predominantly remain in freshwater habitats for three to four years in Newfoundland (>95% of samples taken since 2000) and four to five years in Labrador (>83% of samples taken since 2000) prior to undergoing smoltification and migrating to sea as smolts (DFO 2020a). Spawning populations in NL consist of varying proportions of small (fork length [FL] <63 cm) and large (FL ≥63 cm) adult salmon (DFO 2023a). For the majority of rivers in Newfoundland (SFAs 3–12 and 14A), small adult salmon are predominantly grilse (one-sea-winter [1SW] salmon), that have spent one year at sea before returning to spawn for the first time. For most monitored rivers in NL, small salmon are predominantly female (range of 60–92% across rivers). Large adult salmon in Newfoundland rivers are composed mainly of repeat-spawning grilse, which are either a consecutive or alternate spawning fish. In contrast, populations in Labrador (SFAs 1, 2, and 14B) and southwestern Newfoundland (SFA 13) consist of important large salmon components that contain maiden fish that have spent two (two-sea-winter [2SW]) or more years (multi-sea-winter [MSW]) at sea before returning to spawn. Run timing for returning salmon is influenced by climate conditions on the NL Shelf, occurring earlier in warmer years and later in colder years with low water temperatures and high amounts of inshore sea ice (Dempson et al. 2017).

Atlantic Salmon Fisheries

Indigenous Food, Social, and Ceremonial (FSC) fisheries for Atlantic Salmon occur in Labrador under communal licences. Labrador also has a resident fishery for Brook trout (*Salvelinus fontinalis*) and Arctic char (*Salvelinus alpinus*) with a permitted retention of three salmon bycatch. In Newfoundland, Miawpukek First Nation (MFN) holds a FSC communal salmon fishing licence, but has chosen not to harvest salmon under this licence since 1997 due to conservation concerns. Preliminary estimates of Atlantic Salmon harvest for 2023 are available in Table 1.

The 2023 recreational angling season fishery opened June 15 and closed September 15 for all Labrador rivers and opened on June 1 and closed September 7 for all Newfoundland rivers. The recreational Atlantic Salmon fishery is managed according to a river classification system, which is used to establish retention levels based on the health of individual salmon populations without jeopardizing conservation goals (Veinott et al. 2013). Seasonal retention limits were one fish on

Class 2 rivers and two fish on Class 4, 6, and unclassified rivers, with daily catch and release limits of three fish on Class 2, 4, 6, and unclassified rivers. When water temperatures reach or exceed 20°C for two to three days, recreational angling restrictions may be implemented on rivers to only allow angling in the morning (one hour before sunrise to 10:00 am) each day. This environmental protocol is in place to reduce angling pressure on migrating salmon during periods of high water temperature in efforts to reduce potential impacts on survival (Van Leeuwen et al. 2020, 2023, 2024).

ASSESSMENT

Reference Points

The PA (DFO 2015) identifies two reference points for managing fisheries stocks, the LRP and USR. The status of NL Atlantic Salmon populations are assessed relative to these two reference points, defined on the basis of estimated egg depositions. Conservation egg requirements for Atlantic Salmon were previously established for individual rivers in SFAs 1–2 in Labrador based on 1.9 eggs per m^2 of river rearing habitat; the Straits Area of Labrador [SFAs 14A–14B] based on 2.4 eggs per m^2 of river rearing habitat and 105 eggs per hectare of lake habitat; and Newfoundland [SFAs 3–13] based on 2.4 eggs per m^2 of river rearing habitat and 368 eggs per hectare of lake habitat (O'Connell and Dempson 1995; O'Connell et al. 1997; Reddin et al. 2006). The LRP and USR are set at 100% and 150% of the previously defined river-specific conservation egg deposition rate, respectively.

Estimates of egg depositions by small and large salmon spawners on monitored rivers in 2023 were derived and compared to each river-specific LRP and USR to designate a stock status zone for 19 of 24 monitored rivers. No stock status could be designated for Parkers River (SFA 14A) because there is no conservation egg requirement established for this watershed (Reddin et al. 2010). Counting fence washouts impacted seven monitored rivers in 2023, which resulted in four rivers having no stock status designations available. Contemporary estimates of adult salmon sex ratio obtained from DNA samples are used when calculating egg depositions for rivers where available (Robertson et al. 2024). Populations with estimated egg depositions below the river-specific LRP are in the Critical Zone, populations with estimated egg depositions above the USR are in the Healthy Zone, and those between the LRP and USR are in the Cautious Zone.

Methods

The 2023 status of Atlantic Salmon stocks within NL (SFAs 1–14B) was assessed using abundance data collected from 24 salmon monitoring facilities (fish counting fences and fishways; Fig. 1 and 2), an in-river snorkel survey (Harrys River in SFA 13), and estimates of effort, catch, and harvest from the recreational fishery (O'Connell et al. 1996, 1998; Dempson et al. 2012; Veinott and Cochrane 2015). No Atlantic Salmon rivers in SFAs 2, 6, 7, 8, 12, and 14B were monitored in 2023. Estimates of recreational angling effort, catch, and harvest were derived from angler log returns and a phone survey of nonrespondent anglers in November 2023 (Table 2 and 3, Fig. 3 and 4). Recreational angling effort is presented as rod days, defined as any full or partial day during which an angler fished. Exploitation rates in the recreational Atlantic Salmon fishery are calculated for specific rivers by dividing estimates of retained salmon by the total returns each year and multiplying by 100%. Recreational salmon catch estimates on monitored rivers were combined with counts of returning adults derived at counting facilities to estimate the total returns to the river (where estimates of downstream removals were available) and total spawners that escaped the recreational fishery. DFO Science assumes a catch and

release mortality rate of 10% when calculating estimates of total returns, total spawners and egg depositions (Van Leeuwen et al. 2020; Keefe et al. 2022; DFO 2023a). The estimated number of returns on each river in 2023 were compared to the average returns over the previous generation and three generation time periods. One generation is equivalent to approximately six years for populations in Newfoundland and seven years for populations in Labrador. Three generations correspond to 16–18 years for most Newfoundland rivers and 19–22 years for Labrador rivers. For all comparisons, changes of <10% are considered to be non-significant, and returns are reported as being similar to the comparative average. For rivers with sufficient time series data, time series of total returns were modelled over the previous three generations using a negative binomial generalized linear model (GLM) in R (MASS package; Venables and Ripley 2002). All modeling was executed in R (R Core Team 2023) using version 4.3.2.

Seven monitored rivers experienced counting fence washouts in 2023 with impacts to the quantity of data and the ability to designate a stock status for some populations. The affected rivers include: Campbellton River (SFA 4), Northwest River (SFA 5), Conne River (SFA 11), Garnish River (SFA 11), Deer Arm Brook (SFA 14A), Trout River (SFA 14A), and Parkers River (SFA 14A). For these rivers, salmon counts and estimates of returns, spawners and egg depositions are considered partial for 2023. For the rivers in SFAs 5 and 14A, limited daily count data in 2023 and/or historical time series make it very difficult to estimate the number of salmon that may have returned. A stock status was designated for Conne River, Garnish River, and Campbellton River in 2023 based on available data. To quantify the uncertainty around the number of salmon that may have been missed, a nonparametric bootstrap was applied to historical counting fence data for Garnish River (2015–22), Conne River (2006–22), and Campbellton River (2005–22).

Regional trends in adult Atlantic Salmon abundance on monitored rivers were assessed by combining and modeling time series of total returns across monitored rivers using a negative binomial GLM with a log link function, with year and river as factors (Dempson et al. 2004). The estimated marginal mean log abundance from this model is used as a Salmon Abundance Index, to examine temporal patterns in the relative abundance of Atlantic Salmon on monitored rivers simultaneously within the NL region. Estimates from this model should not be used to infer actual Atlantic Salmon abundance in the NL region. Returns were modelled separately for Newfoundland since 1992 and Labrador since 1998, the years that commercial moratoriums began in each area. The estimated marginal mean log abundances (+/- standard errors) were presented for each year for NL. The error bars represent variability in counts across monitored rivers which differed by orders of magnitude (Table 4).

The abundance of out-migrating Atlantic Salmon smolts was monitored on five rivers in Newfoundland in 2023 (Fig. 2). Time series of smolt abundance on all rivers except Garnish River were modelled over the previous three generations with a negative binomial GLM using the MASS package in R (Venables and Ripley 2002). Estimates of marine survival in the adult return year are calculated for monitored rivers with smolt and adult counting facilities by dividing the small salmon return estimate in $year_i$ by smolt abundance in $year_{i-1}$ and multiplying by 100%. As returns of small salmon include a portion of repeat spawners, estimates of marine survival from smolt to maiden 1SW salmon will be slightly less than the numbers reported in this report. Trends in marine survival over the previous three generations were modelled for each river using beta GLM using the betareg package in R (Cribari-Neto and Zeileis 2010).

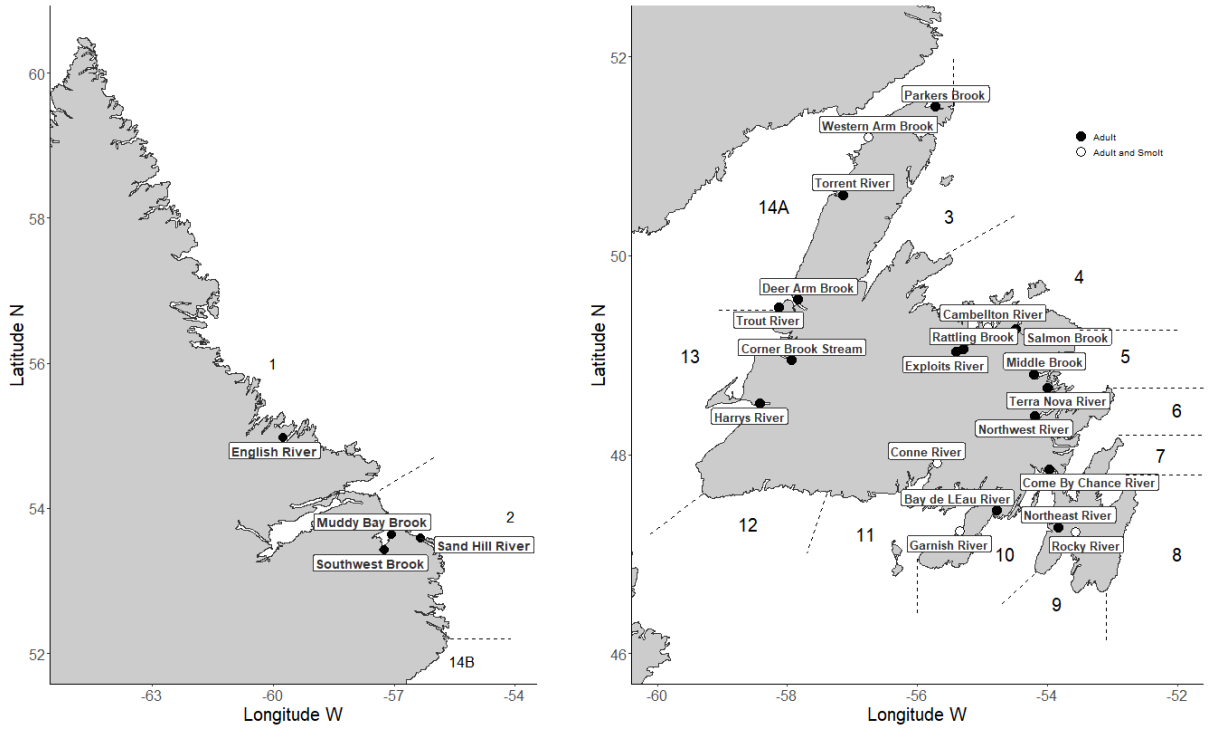

Figure 2. Map of the NL Region showing SFAs 1–14B and rivers where the number of out-migrating Atlantic Salmon smolts and/or returning adults were counted in 2023. Dashed lines indicate approximate SFA boundaries.

RESULTS AND DISCUSSION

Indigenous and Subsistence Fishery Data

Labrador FSC and subsistence fisheries harvests were inferred from logbook returns (59% return rate), and were estimated at 15,403 salmon in 2023 (7,677 small, 7,726 large), which was 16% more than the previous generation average (2016–22) of 13,312 salmon and 17% higher than the previous three generation average (2003–22) (Table 1, Fig. 3). Large salmon represented 50% of the catch by number.

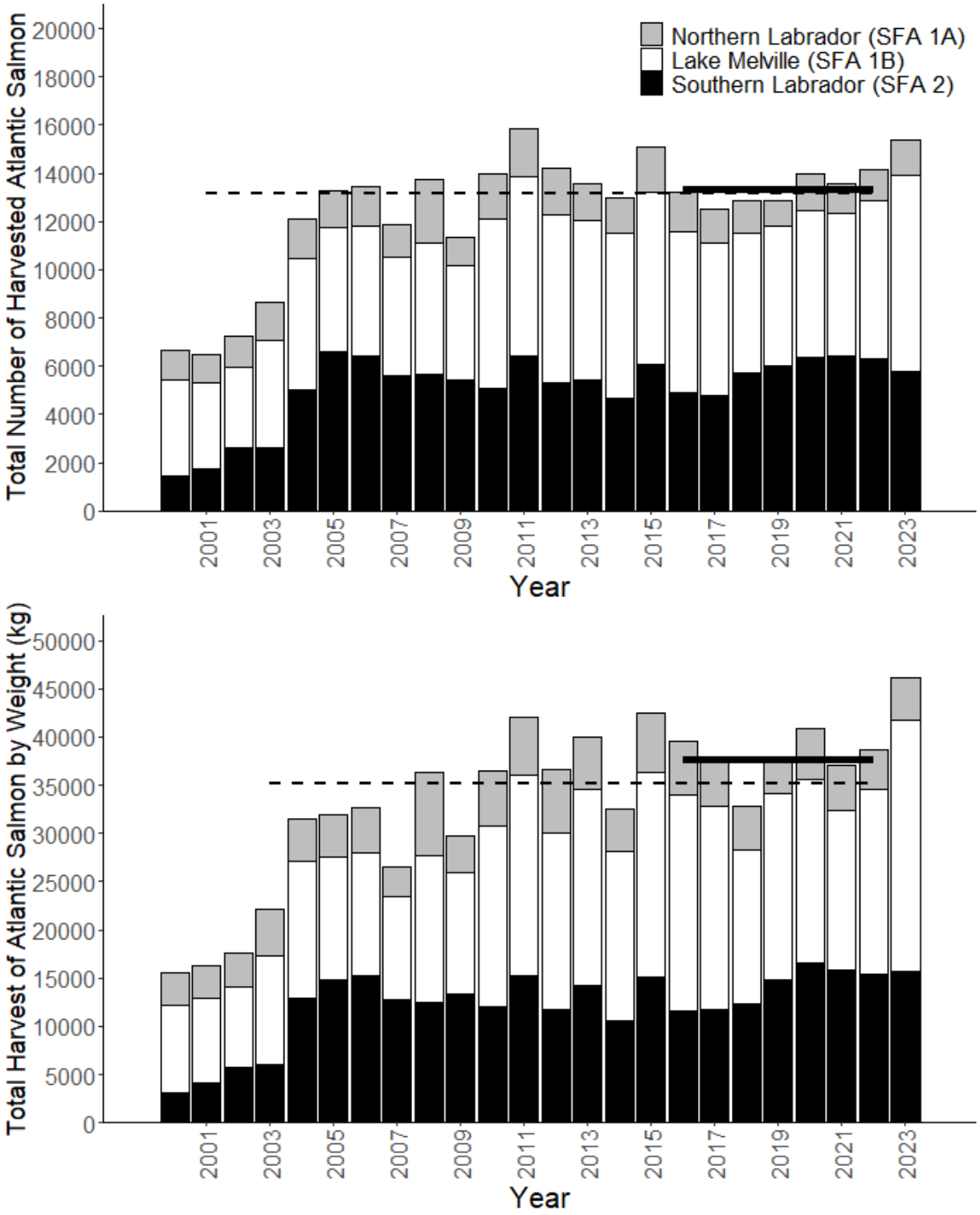

Figure 3. Estimated number (top panel) and weight (bottom panel) of Atlantic Salmon harvested in Labrador Indigenous and subsistence fisheries in SFAs 1A, 1B and 2 from 2000–23. Horizontal solid line represents the previous generation average (2016–22). Horizontal dashed line represents the previous three generation average (2003–22). Harvest estimates for 2023 are preliminary and will be updated upon the receipt and analysis of additional logbooks.

Recreational Fishery Data

Labrador (SFAs 1, 2, and 14B)

The estimate of total small salmon retained in 2023 in Labrador is 448 salmon (Table 2, Fig. 4), 54% below the previous generation average (2016–22). The estimated number of small salmon retained has declined by 72% since 1994 (negative binomial GLM, p<0.001, 95% Confidence Intervals [CIs]: 63%, 79%). The estimated number of released small salmon in 2023 in Labrador was 3,766 salmon, 6% below the previous generation average. Retention of large Atlantic Salmon in the recreational fishery has been prohibited since 2011. In 2023, there was an estimated 1,759 large salmon released in the Labrador recreational fishery, a 17% decrease compared to the previous generation average (Fig. 3). Since 1994, the estimated number of released large salmon in Labrador has increased by 257% (negative binomial GLM, p<0.001, 95% CIs: 124%, 469%). Effort in the 2023 Labrador fishery was estimated at 3,358 rod days, a 37% decrease compared to the previous generation average (Table 2, Fig. 4).

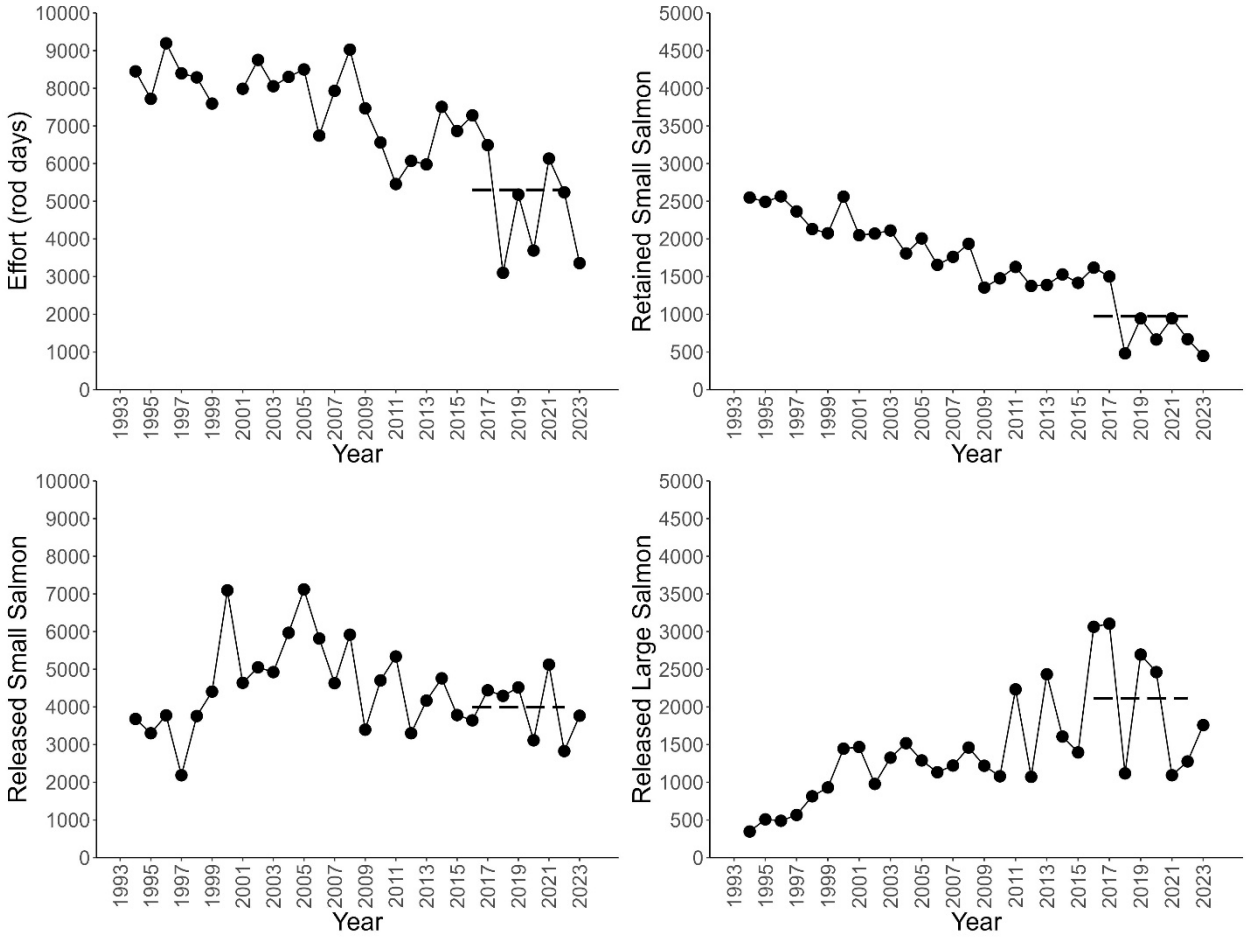

Figure 4. Recreational catch of small and large Atlantic Salmon and angling effort (rod days) in Labrador from 1994–2023. Horizontal dashed lines represent the previous generation average (2016–22).

Newfoundland (SFAs 3–14A)

The estimate of total small salmon retained in the 2023 recreational fishery is 9,006 fish (Table 3, Fig. 5), 38% below the previous generation average (2017–22). The preliminary estimate of total small salmon released in 2023 was 13,722 fish, which is 44% below the

previous generation average. Retention of large salmon has not been permitted in Newfoundland over the entire time series. In 2023, 2,838 large salmon were released across Newfoundland (SFAs 3–14A), which is 42% below the previous generation average (Fig. 5). Estimated angler effort in 2023 (27,232 rod days) was 54% lower than the previous generation average.

Recreational exploitation rates are relatively stable on most monitored rivers where estimates are available (Fig. 5), typically varying between 5–15% in most years on most rivers. In the 2023 recreational fishery, the average exploitation rate on monitored rivers in Newfoundland was 8.9% (range: 0.0%–22.5%) (Fig. 5).

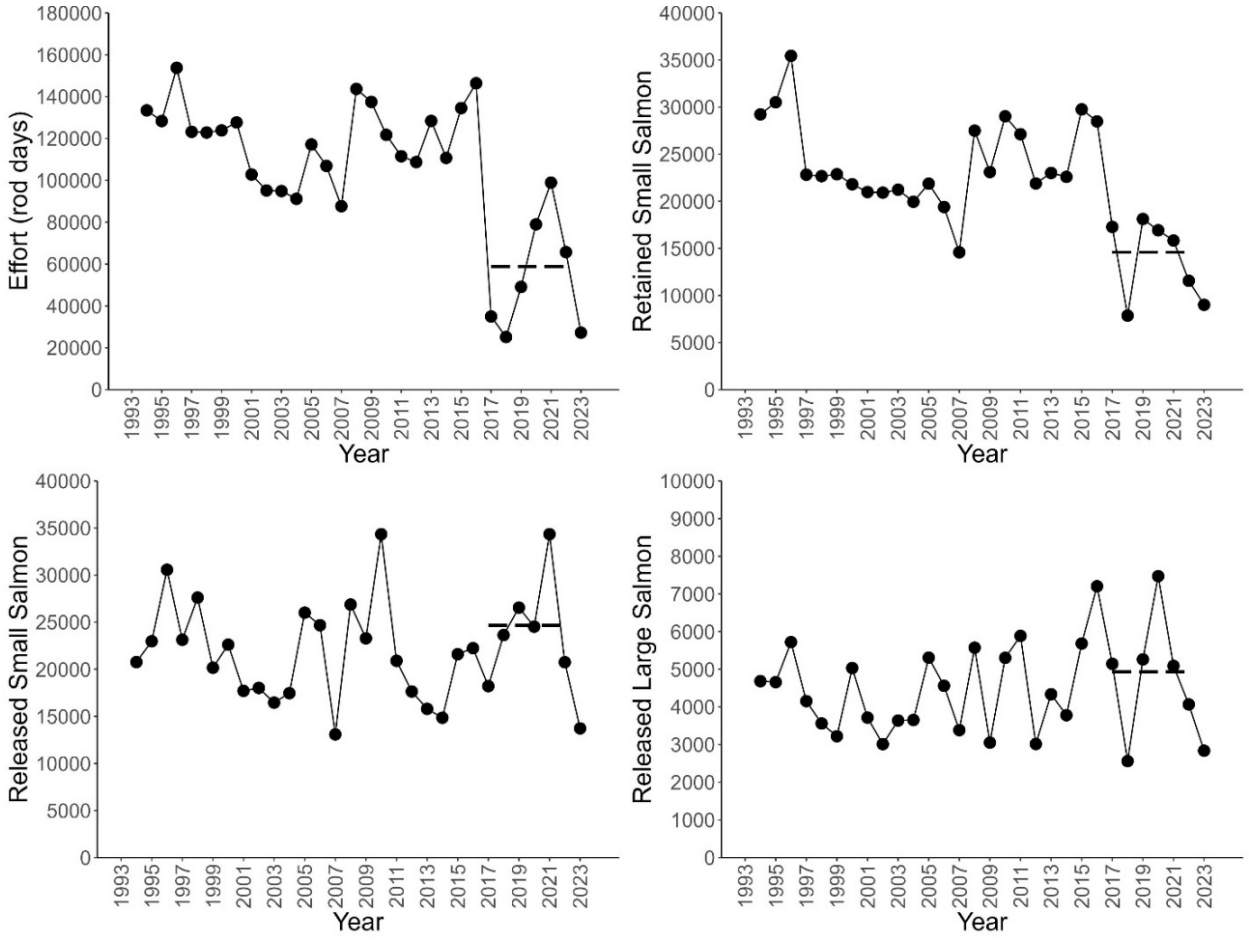

Figure 5. Recreational catch of small and large Atlantic Salmon and angling effort (rod days) in Newfoundland from 1994–2023. Horizontal dashed lines represent the previous generation average (2017–22).

Resource Status – Adult Salmon

Labrador

Four Atlantic Salmon rivers in Labrador were monitored in 2023 (Fig. 2). Total returns to English River (SFA 1) were higher than the previous generation average (2016–22) and previous three generation average (2003–22) and set a record high (Table 4, Fig. 6 and 7). In contrast, total returns to monitored rivers in SFA 2 were average (Sand Hill River) or far below average (Muddy Bay Brook and Southwest Brook).

In 2023, estimated egg depositions exceeded the USR (Healthy Zone) on English River (431%) in SFA 1 (Table 5, Fig. 8). Egg depositions on Sand Hill River (93%), Muddy Bay Brook (21%), and Southwest Brook (39%) were below their river-specific LRPs and in the Critical Zone in 2023 (Table 5, Fig. 8).

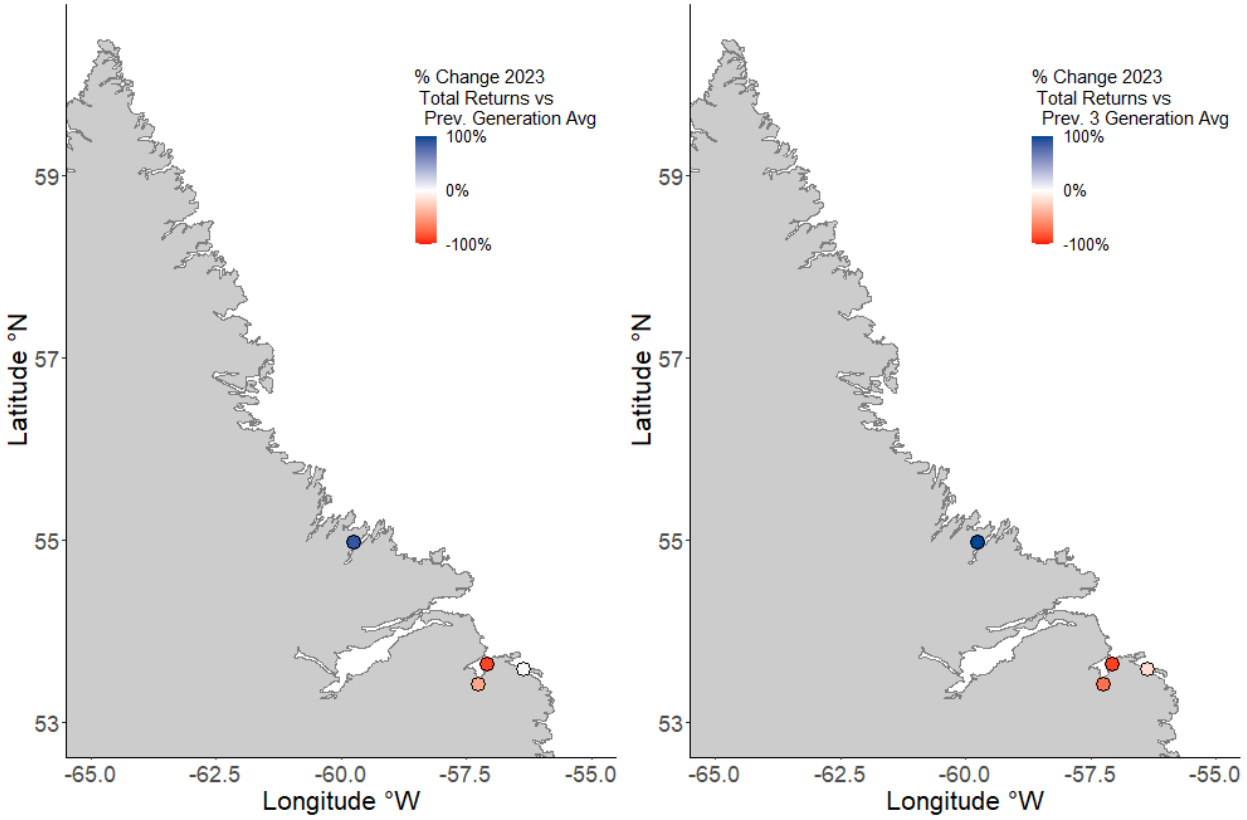

Figure 6. The percent change in 2023 total returns compared to the average returns over the previous generation (left panel) and previous three generations (right panel) for four monitored Atlantic Salmon populations in Labrador. The previous generation time period is seven years for Labrador rivers. The previous three generation time period is specific to each river (19–22 years for Labrador rivers). In cases where the magnitude of change is larger than 100%, values are scaled down to 100% for the figure. See Table 4 for actual percentages for each river.

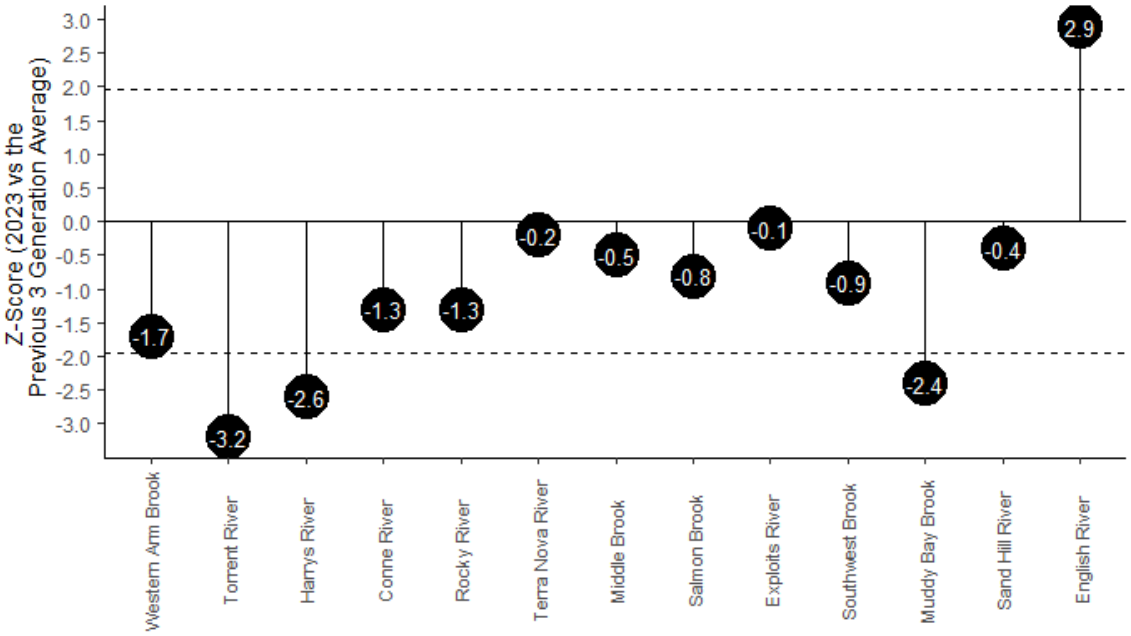

Figure 7. Z-scores of total Atlantic Salmon returns on monitored rivers in 2023 compared to their river-specific previous three generation average. The value shown for each river represents the number of standard deviations 2023 returns are from the mean over the previous three generation time period. Campbellton River was not included due to an incomplete count in 2023. Horizontal dashed lines represent approximate 95% confidence intervals (±1.96).

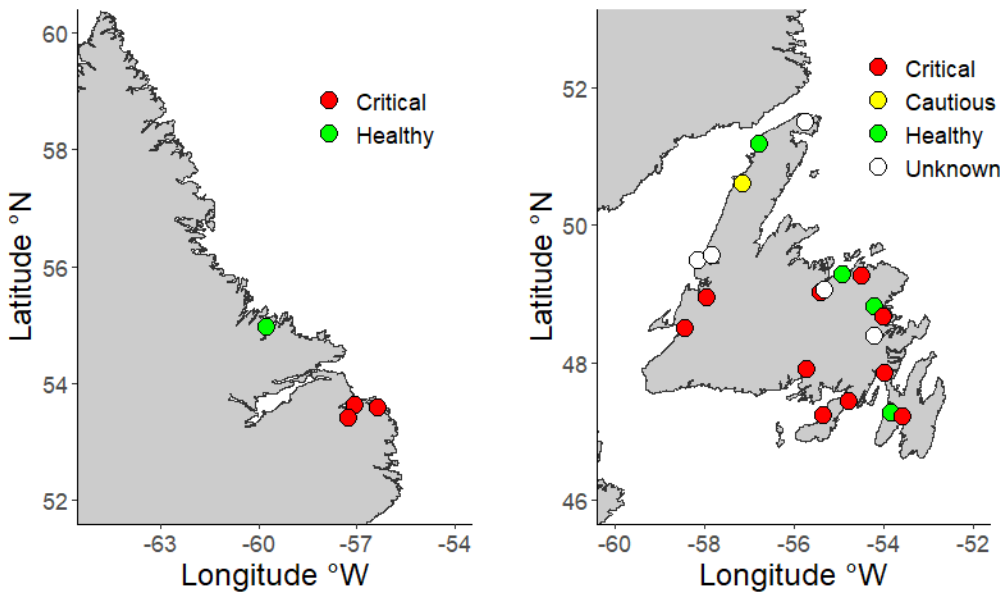

Figure 8. Map of monitored Atlantic Salmon rivers in Labrador (left) and Newfoundland (right) during 2023 coloured by their estimated stock status zone as per the Precautionary Approach (DFO 2015). Designation of a population within a stock status zone is based on comparing the estimated egg depositions in 2023 to the river-specific LRP: Critical Zone (0–99% of LRP), Cautious Zone (100–149% of LRP), and Healthy Zone (≥150% of LRP). The LRP is equivalent to a river's conservation egg requirement.

Newfoundland

Twenty Atlantic Salmon rivers in Newfoundland were monitored in 2023 (Fig. 2). Significant counting fence washouts impacted counts of returning adult salmon to seven rivers. Total returns to nine of 12 monitored rivers in Newfoundland with sufficient time series data were below the previous generation average (2017–22) in 2023 (Table 4, Fig. 9). In Newfoundland, only Exploits River exhibited above average returns in 2023 compared to the previous generation average and no monitored river had returns greater than the previous three generation average (16–18 years; Table 4, Fig. 9).

Estimates of stock status zone were unavailable for five monitored rivers in Newfoundland in 2023. Of the remaining 15 monitored rivers in Newfoundland, estimated egg depositions exceeded the USR (Healthy Zone) on four rivers (Table 5, Fig. 8); egg depositions on Torrent River exceeded the LRP (149%) but were below the USR (Cautious Zone); and ten monitored rivers in Newfoundland were in the Critical Zone with estimated egg depositions below their river-specific LRPs (Table 5, Fig. 8).

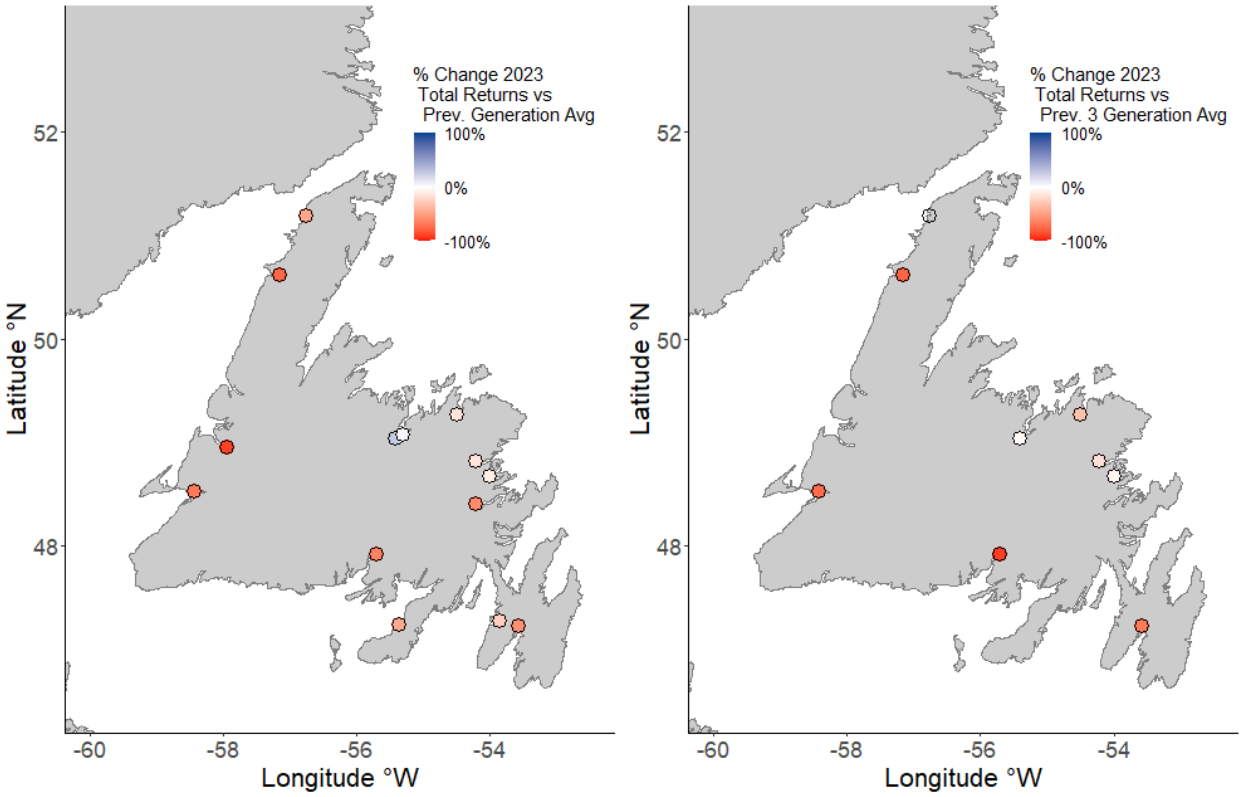

Figure 9. The percent change in 2023 total returns compared to the average returns over the previous generation (left panel) and previous three generations (right panel) for four monitored Atlantic Salmon populations in Newfoundland. The previous generation time period is six years for Newfoundland rivers. The previous three generation time period is specific to each river (16–18 years for most Newfoundland rivers). In cases where the magnitude of change is larger than 100%, values are scaled down to 100% for the figure. See Table 4 for actual percentages for each river.

Salmon Abundance Index

In Newfoundland, estimated marginal mean log salmon abundance declined after 2015, reflective of relatively poor returns observed on several monitored Atlantic Salmon rivers in

recent years, particularly 2017–19 (DFO 2020a, 2020b) and 2022 (DFO 2023a). Estimated abundance improved in 2021 after strong returns were observed on several monitored rivers (DFO 2023a). However, below average Atlantic Salmon returns were observed in 2022 and 2023, resulting in the third lowest and lowest estimated marginal mean log salmon abundance, respectively, in the time series (Fig. 10).

In Labrador, the estimated marginal mean log salmon abundance in 2023 was slightly lower than 2020–22 (Fig. 10). The estimate for 2023 is near the average over the time series. The slight decline in 2023 is likely due to the balance between average and above average returns on Sand Hill River and English River, respectively, and large declines (>60%) in abundance on Muddy Bay Brook and Southwest Brook (Table 4, Fig. 10).

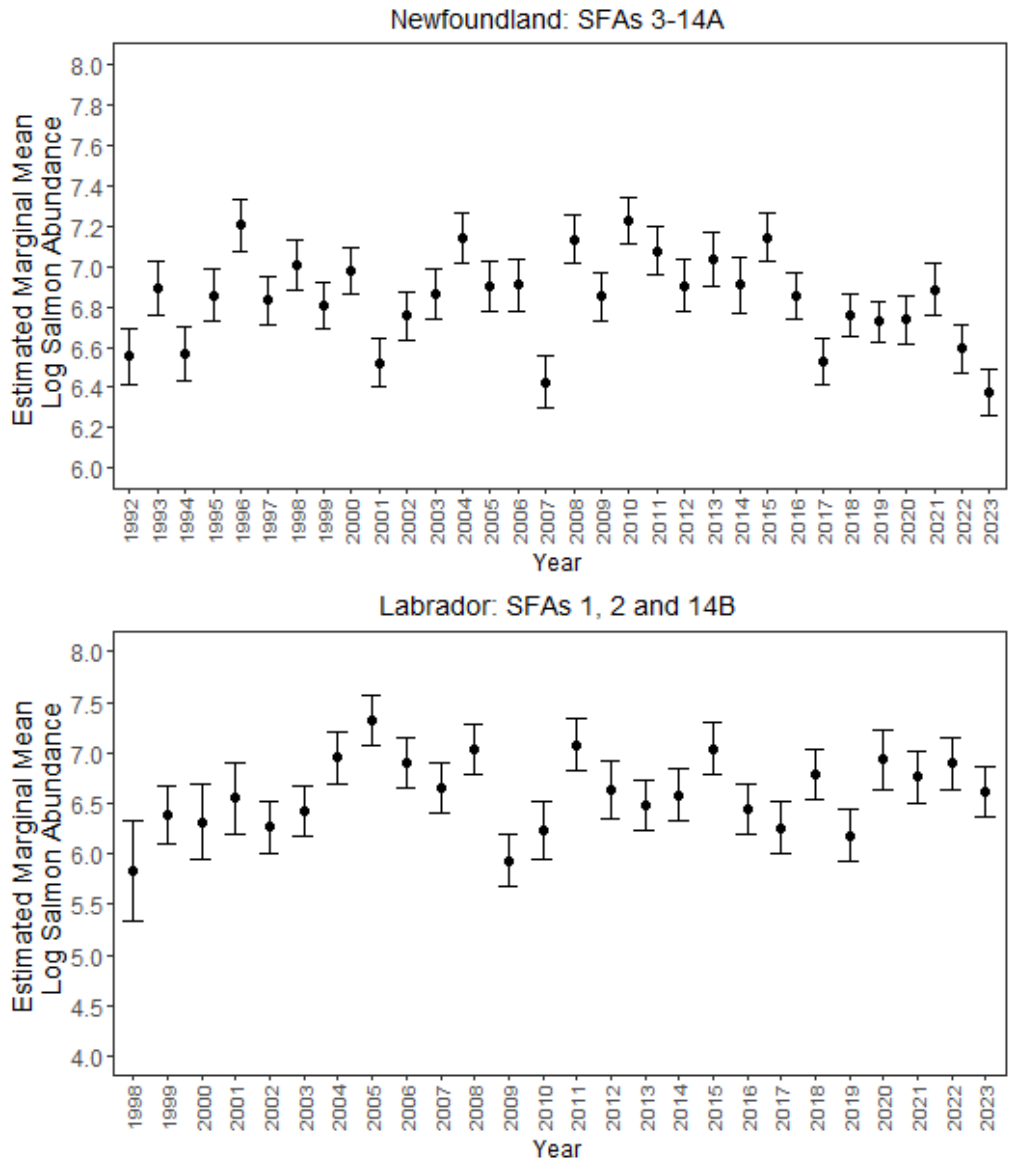

Figure 10. Estimated marginal mean log Atlantic Salmon abundance from negative binomial GLMs (log link function and year as a factor) applied to data from monitored rivers in Newfoundland (above) and in Labrador (below). Vertical lines represent ± one standard error. Each model only includes data since the commercial moratorium (1992 for Newfoundland and 1998 for Labrador).

Smolt Production and Marine Survival

Atlantic Salmon smolt abundance is monitored each year during the downstream migration on five rivers in Newfoundland (Table 6, Fig. 1 and 11). Extreme water levels resulted in washouts to the Campbellton River and Rocky River counting fences in 2023. Values presented for these two rivers are minimum estimates as there is a high probability based on historical smolt run timing that a large portion of the smolt run were not counted. Smolt abundance on Conne River was 30% below the previous generation average (2017–22) and 53% below the previous three generation average (Fig. 11). Smolt abundance was similar to the previous generation average for Garnish River (-1%) and Western Arm Brook (-8%). Modeling trends in smolt abundance over the previous three generations on monitored rivers suggests that, of the four rivers with sufficient time series data, smolt production is declining (GLM; $p < 0.05$) on Western Arm Brook, Rocky River, and Conne River (Fig. 11).

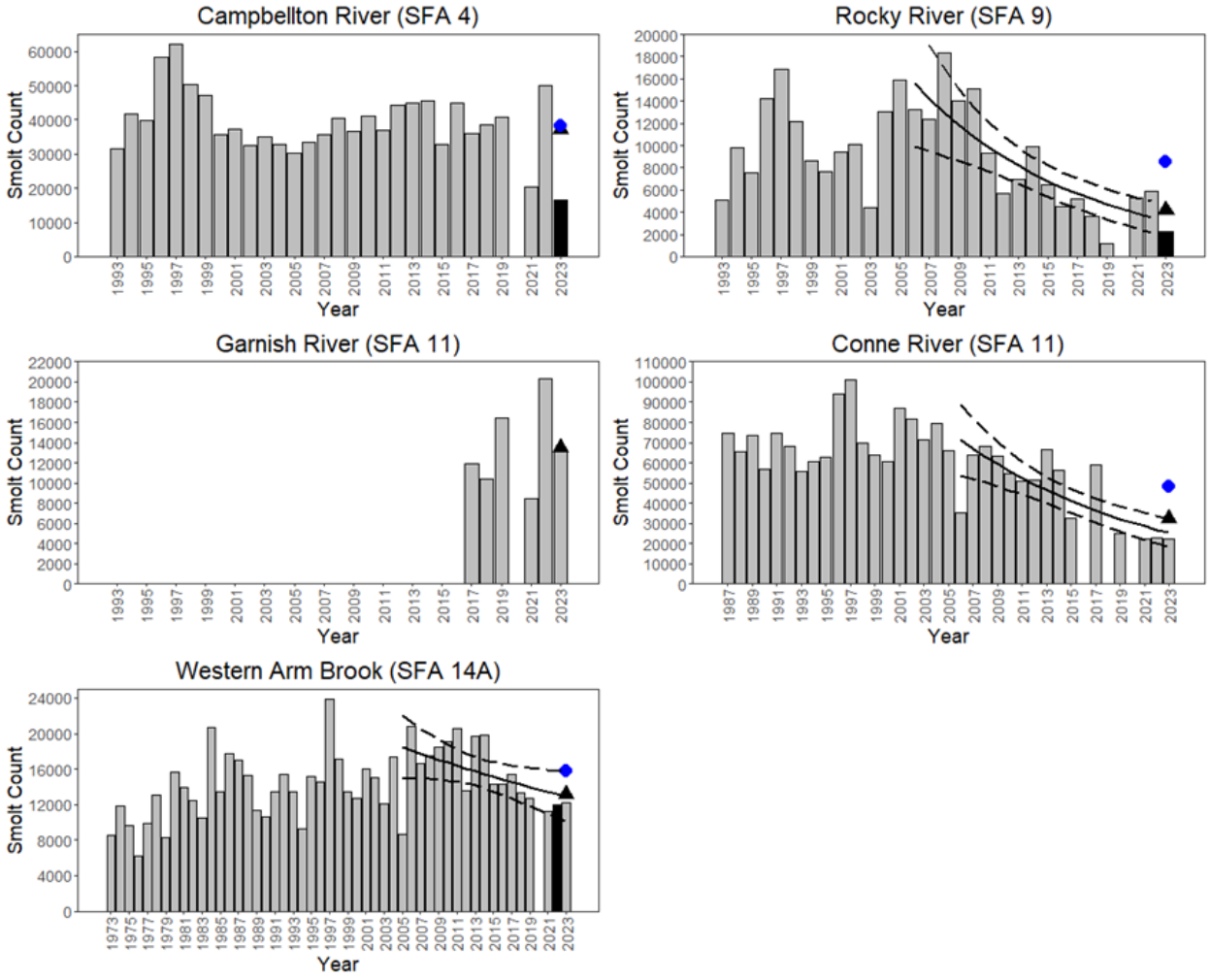

Figure 11. Smolt production on monitored Newfoundland Atlantic Salmon rivers in 2023. The black triangles and blue circles represent the previous generation average (2017–22) and previous three generation average (16–18 years), respectively. Smolt counts are not available for 2020 due to COVID-19 impacts on field operations. Percent change values reflect comparisons of 2023 smolt abundance to the previous generation average. For comparisons to previous three generation averages, see Table 6. Solid and dashed lines represent model estimates and 95% confidence intervals derived from a negative binomial generalized linear model (GLM) of smolt abundance over the previous three generations.

Marine survival estimates for 2023 (Table 7) are based on 2022 smolt migrations and corresponding 2023 small salmon returns. Significant washout events have impacted counting facilities in recent years with consequences for marine survival estimates in 2023. In 2022, the Western Arm Brook smolt fence was installed late due to extreme water levels, resulting in a partial smolt count for that year and an overestimate of marine survival to this river in the 2023 adult return year. In contrast, washout events significantly impacted the count of returning small salmon on Conne River and Campbellton River in 2023, thus 2023 marine survival estimates presented in this report for these two rivers are underestimates. It is important to note that although the marine survival estimate based on the partial adult count at Conne River in 2023 was 0.6%, actual marine survival was likely somewhere between 0.9–1.5%. Marine survival estimates for Rocky River and Garnish River in 2023 were far below (-56 to -75%) the previous generation and previous three generation averages (Table 7, Fig. 12).

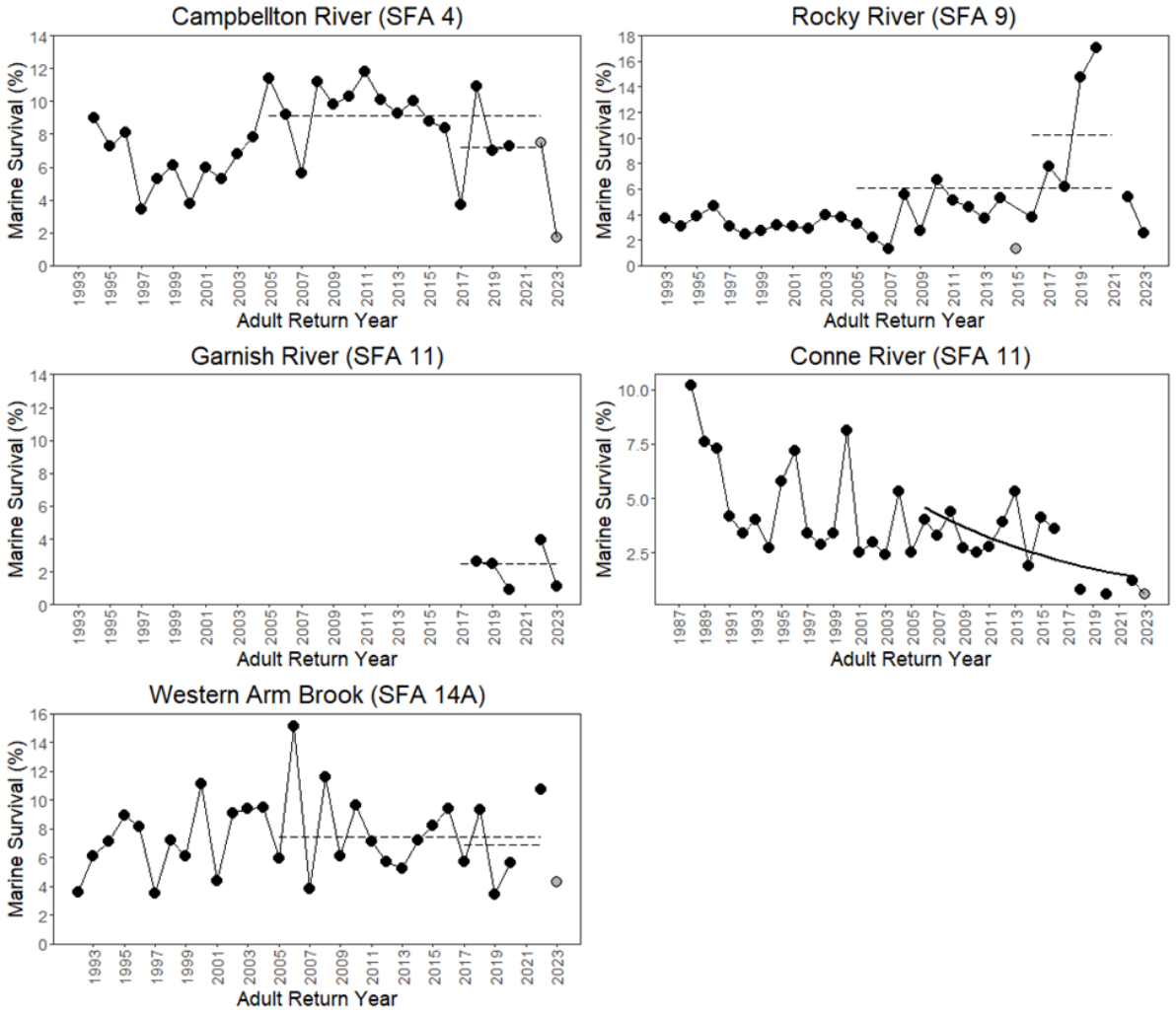

Figure 12. Marine survival rates of smolt to adult small salmon for monitored Newfoundland rivers. Horizontal dashed lines illustrate the previous generation average (2017–22) and previous three generation average where sufficient data are available. The estimate for Campbellton River in 2023 is considered a minimum estimate because the count of returning small salmon is considered incomplete. The estimate for Western Arm Brook in 2023 is an overestimate due to a partial smolt count in 2022. Solid line for Conne River represents model estimates derived from a beta generalized linear model (GLM) of marine survival over the previous three generations.

In recent years, marine survival rates on SFA 11 rivers have been poor relative to other monitored rivers in Newfoundland. The marine survival estimate on Garnish River (3.9%) in 2022 exceeded 3% for the first time since smolt monitoring began on this river in 2017 (Fig. 12). Available data suggest that marine survival from 2022 smolt to 2023 return barely exceeded 1% on Garnish River. On Conne River, estimated marine survival fell below 1% in 2018 and 2020, and increased slightly to 1.2% in 2022. It is highly likely that marine survival on this river in 2023 was ~1.5% or less. Of the four rivers with sufficient data, only Conne River shows a declining trend in marine survival (GLM; $p < 0.01$; Fig. 12). As returns of small salmon include a portion of repeat spawners, marine survival of smolt to maiden 1SW salmon will be slightly less than the numbers reported here.

Ecosystem Considerations

Freshwater Temperature

Water temperature was recorded and analyzed across 7 rivers in Labrador (Hunt River, English River, Muddy Bay Brook, Sand Hill River, Eagle River, and Paradise River) and 20 rivers in Newfoundland in 2023 (Table 8). In Labrador, 64 ± 14% of recorded hours had temperatures above 20°C in July 2023, compared to 5.6 ± 5.2% in July 2022. 6.8 ± 3.8 % of hours were above 20°C in August 2023 compared to 11.2 ± 5.0% in August 2022. In 2022, approximately 1% of recorded hours were above 25°C. However, in 2023, 9.1 ± 5.7% of recorded hours in July 2023 were above 25°C. Average maximum daily temperature was 26.4 ± 1.8°C in July. Across Newfoundland rivers there were 6.2 ± 3.0% recorded hours with temperatures above 20°C in June, 71.8 ± 10.3% recorded hours with temperatures above 20°C and 14.0 ± 7.8% recorded hours with temperatures above 25°C in July, and 30.1 ± 13.1 % recorded hours with temperatures above 20°C and 1.9 ± 0.5% recorded hours with temperatures above 25°C in August. In contrast, percent time above 20°C in 2022 ranged from 23% in June to 61% in August, and percent time above 25°C ranged from 6.1% in June to 9.8% in August. Average maximum daily temperature was 23.8 ± 1.3 in July. Water temperatures in the Central region were higher than the Avalon peninsula and the Western region in Newfoundland. Prolonged exposure to temperatures above 20–22°C can negatively impact Atlantic Salmon metabolism (Breau et al. 2011; Breau 2013) and growth (Jonsson and Jonsson 2009) and can become lethal at temperatures exceeding 27°C (Elliot 1991; Corey et al. 2017; Debes et al. 2021).

Marine Environment

Sea ice extent is positively related to adult run timing (date) for Atlantic Salmon (Dempson et al. 2017). In 2023, the sea ice season started late on most of the NL shelf. While sea ice volume remained relatively below normal on the Newfoundland shelf, it was close to normal on the Labrador shelf as a consequence of cold winter temperatures, especially in February in northern Labrador and in the Arctic. Because of sea ice advection from the north, the season finished later than usual in Newfoundland and southern Labrador, while being normal in northern Labrador (Cyr et al. In prep[1].).

Maiden 1SW salmon from the 2023 spawner cohort migrated to sea as smolts in spring 2022, a year in which above normal sea surface temperatures on the NL shelf established numerous new records (DFO 2023b). In 2023, sea surface temperatures were colder than normal in June, after which numerous warm records were established during the rest of the year, making this the second warmest year on record for sea surface temperatures (Cyr et al. In prep[1]). The

[1] Cyr et al. In prep. Physical Oceanographic Conditions on the Newfoundland and Labrador Shelf During 2023. DFO Can. Sci. Advis. Sec. Res. Doc.

impacts of marine temperature on Atlantic Salmon growth and survival are poorly understood, largely due to a complex combination of direct (i.e., physiological) and indirect processes (i.e., altering the temporal and spatial distribution of prey). Comparisons of sea surface temperature with growth and survival of North American Atlantic Salmon stocks have reported positive (Friedland 1998; Friedland et al. 2000) and negative (Friedland et al. 2003; Mills et al. 2012) relationships. Ocean climate variability during the first few months at sea (Friedland et al. 2003; Friedland et al. 2014) and in the overwintering habitat (Reddin and Friedland 1993) appears to be important to the survival of North American populations. Research on NL salmon populations suggests that the behaviour of smolts and kelts is influenced by thermal conditions in the early phase of their marine migration through coastal habitats (Bøe et al. 2019). While at sea, Atlantic Salmon generally occupy temperatures ranging from 4–10°C and depths less than 10 m (Reddin 2006; Strøm et al. 2017; Strøm et al. 2018; Rikardsen et al. 2021), and occasionally make deeper dives that are potentially associated with foraging behaviour (Reddin et al. 2011; Hedger et al. 2017). The effects of temperature on the marine ecosystem (plankton and forage fish abundance and distribution) of the Labrador Sea and coastal Newfoundland are likely more influential to the survival of migrating salmon than the direct effects that temperature has on bioenergetics and availability and extent of preferred thermal habitat (Mills et al. 2012; Strøm et al. 2023).

Overall, biological oceanography indices of the past 3–5 years along the NL bioregion indicate higher nutrient inventories and improved conditions at the lower trophic levels. These include earlier phytoplankton blooms, improved chlorophyll-a concentrations and increased zooplankton biomass driven by above normal abundances of both small and larger, more energy-rich, *Calanus* spp. copepods. Zooplankton abundance likely benefits Atlantic Salmon survival through bottom-up processes (Mills et al. 2012; Utne et al. 2022). In the marine environment, Atlantic Salmon post-smolts are opportunistic predators, feeding on a variety of species depending on what is spatiotemporally available (Renkawitz et al. 2015; Dixon et al. 2019; Hellenbrecht et al. 2023). During the early phase of their marine migration, post-smolts generally feed on krill (*Euphausiidae*), fish larvae, planktonic amphipods, and insects (Andreassen et al. 2001; Hellenbrecht et al. 2023). Some evidence suggests that as post-smolts grow larger, their diet transitions to largely preying on fish species like Capelin (*Mallotus villosus*) and sand lance (*Ammodytes* spp.) (Lear 1972; Dutil and Coutu 1988; Power et al. 2023). The size and abundance of Atlantic Salmon harvested in the West Greenland mixed-stock fishery has been positively linked with foraging on Capelin (Mills et al. 2013; Dixon et al. 2019). The complex migration and foraging behaviour of Atlantic Salmon combined with limited information available regarding the abundance of relevant predator and prey species makes it difficult to discern how changes to marine temperatures or ecosystem productivity directly influence the abundance of Atlantic Salmon returning to NL rivers each year.

Marine ecosystem conditions in the NL bioregion remained indicative of overall limited productivity of the fish community and is likely driven by bottom-up processes (e.g., food availability). Total biomass of the entire fish community across the bioregion remained much lower than prior to the collapse in the early-1990s. It showed some recovery up to the early to mid-2010s, followed by some declines. Some ecosystem indicators since 2019 suggest that conditions could be improving from the lows in the mid-late 2010s but have not generally reached the conditions observed in the mid-2010s.

Aquaculture Impacts

There were no reported containment issues or detections of escaped farmed salmon at Atlantic Salmon monitoring facilities in Placentia Bay, Fortune Bay, and Bay d’Espoir in 2023. However,

ongoing work in southern Newfoundland (SFA 11) has documented extensive hybridization with aquaculture escapees (Keyser et al. 2018, Sylvester et al. 2018, Wringe et al. 2018), reduced survival of the hybrid offspring (Sylvester et al. 2019; Crowley et al. 2022; San Roman et al. 2023), and predicted negative impacts on wild population size at existing levels of aquaculture production (Bradbury et al. 2020a). Eight years of escapee and genetic monitoring (2014–21) suggests escapees were present preceding each year of the time series with some smaller populations displaying evidence of significant genetic change (40–60% domestic ancestry) due to introgression with escapees (Holborn et al. 2022). This work suggests that the precocial maturation of male wild-farm hybrid parr likely fast tracks introgression (i.e., transfer of genetic material from farmed escapees to wild populations) and subsequent genetic impacts (Holborn et al. 2022). This is against the backdrop of a declining wild population which is designated as threatened under COSEWIC (2010). This population is currently being reevaluated after further declines (DFO 2023a) and now meets the criteria of endangered under COSEWIC.

The recent detection of European ancestry in aquaculture salmon and escapees likely elevates this risk to wild populations in the region (Bradbury et al. 2022; Nugent et al. 2023). This work demonstrated that both contained and escaped farmed salmon sampled in Atlantic Canada had a portion of their DNA attributable to recent interbreeding with European origin domestic salmon. In addition, two escaped farmed salmon were detected in the marine environment with 100% European ancestry (Bradbury et al. 2022). European genes were also detected in wild salmon sampled in areas around aquaculture sites (e.g., Conne River; Bradbury et al. 2022). In addition, analysis of samples of salmon which escaped from a Long Pond (net pen nursery) site in southern Newfoundland (2021) indicated continued presence of significant European ancestry in farmed salmon. In the 2021 escape, 21% of the 189 fish analyzed displayed more than 10% European ancestry (naturally occurring background levels are <10% in the Region). These results demonstrated that even though diploid European salmon have never been approved for use in Canada, individuals of full and partial European ancestry have been in use over the last decade, continue to be in use, and that some of these individuals have escaped and hybridized in the wild (Bradbury et al. 2022). European salmon have been shown to differ significantly from North American salmon across a variety of important genes and traits (Lehnert et al. 2020) and this observation significantly elevates the risk to wild salmon populations if individuals escape and interbreed, as has been documented previously on the south coast of Newfoundland (Bradbury et al. 2022).

In addition to genetic interactions, aquaculture associated factors such as disease and/or parasite transfer and ecological interactions (i.e., competition or predation) have been implicated as contributing to declines of wild salmon populations in Norway, Scotland, and Ireland (Bradbury et al. 2020b). Marine survival of monitored Atlantic Salmon populations in SFA 11 has been particularly poor in recent years (Fig. 12). Updated information on the presence of escapees and genetic interactions, disease and parasite transfer to wild populations from aquaculture salmon, predation of wild salmon in the region, and the residency of Atlantic Salmon post-smolts near aquaculture operations and/or sea lice infestations rates would improve our understanding of poor marine survival and declining abundance of returning Atlantic Salmon to rivers in that region in recent years.

Sources of Uncertainty

Calculations of 2023 total returns, spawners, and egg depositions on monitored rivers where angling was permitted included final estimates of recreational harvest and catch and release

mortality using recreational angling logs returned by anglers. In previous years, DFO Science sent 1–3 reminders in the fall (October-December) for anglers to submit their data. In addition, a phone survey was conducted in March each year to obtain data from a sample of the nonrespondent anglers (those who did not submit their logs). Due to increased costs related to postage for the mailed reminders and the few returns obtained in response, the phone survey for 2023 angling data was moved to November 2023 and the mailed reminders were not sent. This is expected to have a negligible impact on river-specific angling estimates; however, the actual impact is difficult to ascertain. In theory, moving the angler phone survey approximately four months closer to the end of the angling season is likely to improve the accuracy with which anglers remember their fishing effort and harvest that year, decreasing effects of angler recall bias on river-specific angling estimates (Connelly et al. 2000).

Returns of angling logs by recreational anglers have been low in recent years, averaging just over 15% from 2016–22. The relatively low return rate of angler logs in recent years will add uncertainty in estimates of retained and released salmon for monitored rivers where angling is permitted.

Estimates of recreational catch and effort data were dependent on the quantity and accuracy of angler licence stubs that were completed and returned. Similarly, the Indigenous FSC and resident trout/char harvest bycatch estimates in Labrador were dependent on the quantity and accuracy of logbooks completed and returned. For all salmon fisheries, uncertainty existed where inaccurate and/or incomplete information was provided.

Historical or estimated biological characteristic data (e.g., fecundity, sex ratio, female size) and estimated catch data used in the assessment added uncertainty to the estimates of egg depositions and % LRP attained. Contemporary estimates of adult salmon sex ratio obtained from DNA samples are used for rivers where available (Robertson et al. 2024).

No current assessments were available for salmon populations in SFAs 3, 6, 7, 8, 12, and 14B, or in the Lake Melville area of SFA 1.

Salmon populations in assessed rivers may have not been representative of all rivers in a given SFA.

CONCLUSIONS

Twenty-four populations of Atlantic Salmon were monitored in 2023. Adult salmon were enumerated at monitoring facilities (counting fences and fishways) on four rivers in Labrador and 20 rivers in Newfoundland. Atlantic Salmon abundance was estimated on Harrys River (SFA 13) with a counting fence near Gallants, NL and a snorkel survey covering most of the main watershed below the fence. Atlantic Salmon smolt abundance was monitored on five monitored rivers in Newfoundland during their migration to sea.

In 2023, significant washout events impacted salmon counts on seven rivers in Newfoundland. After data review and analyses, a stock status zone was designated for only three of these rivers in 2023 (Northwest River, Garnish River, and Conne River).

Of 16 monitored rivers with sufficient time series data, 12 showed declines in total returns compared to the previous generation average (Table 4, Fig. 6, 7, and 9), eight (67%) of which by >30%. Nine of 12 (75%) rivers with sufficient time series data exhibited declines in 2023 total returns compared to the previous three generation average, seven (58%) of which by >30% (Table 4, Fig. 6, 7, and 9). These declines met or exceeded the threshold outlined by DFO Science in 2014 to trigger a stock assessment meeting for Atlantic Salmon in March 2024, a year earlier than scheduled. Above average returns were observed on English River (SFA 1)

and Exploits River (SFA 4), and returns on Sand Hill River (SFA 2), Rattling Brook (SFA 4), and Terra Nova River (SFA 5) were near average over the previous generation (within 10%). All other monitored salmon rivers in NL with sufficient time series data had below average salmon returns in 2023, many of which by >50% (Table 4). Record low or near record low returns were recorded in 2023 on Southwest Brook and Muddy Bay Brook in SFA 2, Rocky River in SFA 9, Harrys River and Corner Brook Stream in SFA 13, and Torrent River and Western Arm Brook in SFA 14A.

A stock status zone was designated for 19 of 24 monitored populations in 2023. Estimated egg depositions were below the river-specific LRP (Critical Zone) on three of four assessed rivers in Labrador (Table 5, Fig. 8) and ten of the 15 (67%) assessed rivers in Newfoundland (Table 5, Fig. 8). Torrent River was the only monitored river in the Cautious Zone in 2023 (Table 5, Fig. 8 after falling below the Healthy Zone for the first time in several decades. Only four rivers were in the Healthy Zone in 2023. One in Labrador (English River) and four in Newfoundland (Campbellton River, Middle Brook, Northeast River, and Western Arm Brook).

Marine survival is considered to be a major factor limiting the abundance of returning adult Atlantic Salmon within the NL Region. Smolt to adult survival of the 2022 smolt class was below average compared to previous generation averages where estimates were available.

LIST OF MEETING PARTICIPANTS

Name	Affiliation
Hannah Murphy	DFO-NL – Science
Harry Murray	DFO-NL – Science
Hilary Rockwood	DFO-NL – Centre for Science Advice
Victoria Neville	DFO-NL – Centre for Science Advice
Brian Dempson	DFO-NL – Science Emeritus
Caity Brawn	DFO-NL – Science
Chantelle Burke	DFO-NL – Science
Chelsea Bloom	DFO-NL – Science
Curtis Pennell	DFO-NL – Science
David Bélanger	DFO-NL – Science
Emilie Geissinger	DFO-NL – Science
Frédéric Cyr	DFO-NL – Science
Hannah Munro	DFO-NL – Science
Ian Bradbury	DFO-NL – Science
Jessie Lilly	DFO-NL – Science
Jonathan Coyne	DFO-NL – Science
Kate Dalley	DFO-NL – Science
Keith Lewis	DFO-NL – Science
Kristin Loughlin	DFO-NL – Science
Michelle Fitzsimmons	DFO-NL – Science
Nick Kelly	DFO-NL – Science
Rebecca Poole	DFO-NL – Science
Rex Porter	DFO-NL – Science (Retired)

Name	Affiliation
Travis Van Leeuwen	DFO-NL – Science
Lottie Bennett	DFO-NCR – Science
Yamin Janjua	DFO-NCR – Science
Connie Dobbin-Vincent	DFO-NL – Resource Management
Terry Bungay	DFO-NL – Aquatic Ecosystems
Don Keefe	NL Department of Fisheries, Forestry and Agriculture
Aaron Dale	Torngat Wildlife, Plants & Fisheries Secretariat
Donna Carroll	NunatuKavut Community Council
George Russell	NunatuKavut Community Council
Elizabeth Barlow	Mi'kmaq Alsumk Mowimsikik Koqoey Association / Miawpukek First Nation
Ross Hinks	Miawpukek First Nation
Jon Carr	Atlantic Salmon Federation
Craig Purchase	Memorial University
Ian Fleming	Memorial University

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APPENDIX I – TABLES

Table 1. Harvests of Atlantic Salmon in the subsistence and FSC Fisheries in Labrador (SFA 1 and 2 combined), 2000–23. Estimates for 2023 are compared to the previous generation average (2016–22) and previous three generation average (2003–22). Estimates for 2023 are preliminary.

Year	Small salmon Number	Small salmon Weight (kg)	Large salmon Number	Large salmon Weight (kg)	Total Number	Total Weight (kg)
2000	5,324	10,353	1,352	5,261	6,676	15,614
2001	4,790	9,789	1,689	6,562	6,479	16,351
2002	5,807	11,582	1,437	5,990	7,244	17,572
2003	6,477	13,196	2,177	8,911	8,654	22,107
2004	8,385	17,380	3,695	14,168	12,080	31,548
2005	10,437	21,037	2,815	10,876	13,252	31,913
2006	10,377	21,197	3,092	11,525	13,469	32,722
2007	9,208	17,070	2,652	9,386	11,860	26,456
2008	9,838	19,395	3,906	16,943	13,744	36,338
2009	7,989	16,130	3,345	13,679	11,334	29,809
2010	10,157	20,946	3,840	15,512	13,997	36,458
2011	11,299	23,439	4,536	18,540	15,835	41,979
2012	9,977	18,739	4,227	17,823	14,204	36,562
2013	7,165	14,674	6,374	25,300	13,539	39,974
2014	8,960	17,662	3,999	14,877	12,959	32,539
2015	8,924	17,499	6,146	24,934	15,070	42,433
2016	7,646	14,581	5,595	25,023	13,241	39,604
2017	6,702	12,953	5,817	24,523	12,519	37,476
2018	8,780	16,537	4,077	16,271	12,857	32,808
2019	7,064	13,248	5,792	24,541	12,856	37,789
2020	7,608	14,367	6,346	26,529	13,954	40,896
2021	9,377	19,500	4,217	16,977	13,594	36,477
2022	8,383	16,147	5,779	22,566	14,162	38,713
2023	7,677	14,916	7,726	31,271	15,403	46,187
2016–22 mean	7,937	15,333	5,375	22,347	13,312	37,680
% Change	-3	-3	44	40	16	23
2003–22 mean	8,738	17,285	4,421	17,945	13,159	35,230
% Change	-12	-14	74	18	17	31

Table 2. Estimates of angling effort and the number of Atlantic Salmon retained and released in the 2023 recreational fishery in Labrador (SFAs 1, 2, and 14B), 1994–2023. Effort is measured in rod days; any day or part of a day fished by an angler.

Year	Effort (rod days)	Small salmon Retained	Small salmon Released	Large salmon Retained	Large salmon Released	Total Retained	Total Released
1994	8,449	2,549	3,681	377	347	2,926	4,028
1995	7,719	2,493	3,302	326	508	2,819	3,810
1996	9,193	2,565	3,776	260	489	2,825	4,265
1997	8,394	2,365	2,187	158	566	2,523	2,753
1998	8,288	2,131	3,758	231	814	2,362	4,572
1999	7,592	2,076	4,407	320	931	2,396	5,338
2000	10,645	2,561	7,095	262	1,446	2,823	8,541
2001	7,986	2,049	4,640	338	1,468	2,387	6,108
2002	8,751	2,071	5,052	207	978	2,278	6,030
2003	8,053	2,112	4,924	222	1,326	2,334	6,250
2004	8,302	1,808	5,968	259	1,519	2,067	7,487
2005	8,499	2,007	7,120	285	1,290	2,292	8,410
2006	6,743	1,656	5,815	227	1,133	1,883	6,948
2007	7,930	1,762	4,631	235	1,222	1,997	5,853
2008	9,025	1,936	5,917	200	1,461	2,136	7,378
2009	7,466	1,355	3,396	216	1,219	1,571	4,615
2010	6,560	1,477	4,704	197	1,080	1,674	5,784
2011	5,457	1,628	5,340	NA	2,233	1,628	7,573
2012	6,071	1,376	3,302	NA	1,072	1,376	4,374
2013	5,978	1,389	4,167	NA	2,433	1,389	6,600
2014	7,504	1,529	4,760	NA	1,607	1,529	6,367
2015	6,865	1,417	3,785	NA	1,396	1,417	5,181
2016	7,280	1,619	3,644	NA	3,063	1,619	6,707
2017	6,491	1,501	4,441	NA	3,104	1,501	7,545
2018	3,100	481	4,293	NA	1,118	481	5,411
2019	5,178	945	4,518	NA	2,695	945	7,213
2020	3,692	665	3,114	NA	2,462	665	5,576
2021	6,133	946	5,124	NA	1,094	946	6,218
2022	5,238	670	2,829	NA	1,277	670	4,106
2023	3,358	448	3,766	NA	1,759	448	5,525
Previous Generation Average (2016–22)	5,302	975	3,995	NA	2,116	975	6,111
% Change	-37	-54	-6	NA	-17	-54	-10

Table 3. Estimates of angling effort and the number of Atlantic Salmon retained and released in the 2023 recreational fishery in Newfoundland (SFAs 3–14A), 1994–2023. Effort is measured in rod days; any day or part of a day fished by an angler.

Year	Effort (rod days)	Small salmon Retained	Small salmon Released	Large salmon Retained	Large salmon Released	Total Retained	Total Released
1994	132,935	29,225	20,761	NA	4,685	29,225	25,446
1995	128,309	30,512	22,971	NA	4,658	30,512	27,629
1996	153,759	35,440	30,566	NA	5,720	35,440	36,286
1997	123,165	22,819	23,129	NA	4,154	22,819	27,283
1998	122,848	22,668	27,610	NA	3,561	22,668	31,171
1999	123,840	22,870	20,160	NA	3,222	22,870	23,382
2000	127,639	21,808	22,610	NA	5,033	21,808	27,643
2001	102,768	20,977	17,708	NA	3,716	20,977	21,424
2002	95,143	20,913	18,019	NA	3,014	20,913	21,033
2003	94,862	21,226	16,455	NA	3,639	21,226	20,094
2004	91,151	19,946	17,462	NA	3,653	19,946	21,115
2005	117,114	21,869	26,009	NA	5,308	21,869	31,317
2006	106,900	19,394	24,676	NA	4,561	19,394	29,237
2007	87,655	14,577	13,088	NA	3,385	14,577	16,473
2008	143,674	27,497	26,870	NA	5,573	27,497	32,443
2009	137,465	23,103	23,285	NA	3,053	23,103	26,338
2010	121,705	29,018	34,342	NA	5,303	29,018	39,645
2011	111,494	27,116	20,900	NA	5,886	27,116	26,786
2012	108,701	21,893	17,638	NA	3,017	21,893	20,655
2013	128,370	23,004	15,795	NA	4,337	23,004	20,132
2014	110,718	22,591	14,853	NA	3,781	22,591	18,634
2015	134,515	29,756	21,597	NA	5,683	29,756	27,280
2016	146,383	28,478	22,240	NA	7,203	28,478	29,443
2017	34,944	17,275	18,207	NA	5,143	17,275	23,350
2018	25,132	7,858	23,629	NA	2,562	7,858	26,191
2019	49,070	18,117	26,546	NA	5,262	18,117	31,808
2020	78,974	16,920	24,523	NA	7,470	16,920	31,993
2021	98,931	15,830	34,341	NA	5,089	15,830	39,430
2022	65,697	11,554	20,748	NA	4,067	11,554	24,815
2023	27,232	9,006	13,722	NA	2,838	9,006	16,560
Previous Generation Average (2017–22)	58,791	14,592	24,666	NA	4,932	14,592	29,598
% Change	-54	-38	-44	NA	-42	-38	-44

Table 4. Total returns (small (<63 cm) and large (≥63 cm) size groups combined) of Atlantic Salmon to monitored NL rivers in 2023 in comparison to the average returns (and percent change) during the previous generation and previous three generations. One generation corresponds to six years in Newfoundland and seven years in Labrador. Percent change of <10% is considered no change. Rivers where counts of returning salmon are considered incomplete in 2023 are bolded.

River Name	SFA	2023 Total Returns	Previous Generation Average	Percent Change Vs Previous Generation	Previous 3 Generation Average	Percent Change Vs Previous 3 Generations
English River	1	1,504	787	+91	605	+149
Southwest Brook	2	85	156	-46	287	-70
Muddy Bay Brook	2	42	364	-88	379	-89
Sand Hill River	2	3,437	3,332	+3	4,167	-18
Exploits River	4	28,857	22,880	+26	29,666	-3
Campbellton River	**4**	**1,172**	**3,468**	**NA**	**3,897**	**NA**
Salmon Brook	4	802	932	-14	1,188	-32
Rattling Brook	4	538	512	+5	NA	NA
Middle Brook	5	2,100	2,427	-13	2,505	-16
Terra Nova River	5	3,815	4,193	-9	4,055	-6
Northwest River	**5**	**630**	**1,542**	**NA**	**NA**	**NA**
Rocky River	9	151	351	-57	448	-66
Northeast River	10	449	599	-25	NA	NA
Come By Chance River	10	179	NA	NA	NA	NA
Bay de l"Eau River	10	302	NA	NA	NA	NA
Garnish River	**11**	**236** ***249 (244, 255)***	**419**	**-44** ***-41 (-39, 42)***	**NA**	**NA**
Conne River	**11**	**143**	**388**	**NA**	**1,443**	**NA**
Harry's River	13	855	2,661	-68	3,235	-74
Corner Brook Stream	13	13	119	-89	NA	NA
Torrent River	14A	1,182	4,784	-75	4,877	-76
Western Arm Brook	14A	584	1,075	-46	1,252	-53
Deer Arm Brook	**14A**	**18**	**NA**	**NA**	**NA**	**NA**
Trout River	**14A**	**3**	**NA**	**NA**	**NA**	**NA**
Parkers River	**14A**	**54**	**NA**	**NA**	**NA**	**NA**
Summary		Rivers Monitored: 24	-	Declines ≥30% 8/16 (50%)	-	Declines ≥30% 7/12 (58%)

Table 5. Summary of Atlantic Salmon stock status in Newfoundland and Labrador (SFAs 1–14B). The Limit Reference Point (LRP) and Upper Stock Reference point (USR) correspond to 100% and 150% of the previously defined conservation egg requirement, respectively. One generation corresponds to five to six years in Newfoundland and seven years in Labrador. Asterisks indicate rivers that have undergone enhancement activities. The 2023 values for bolded rivers are based on an incomplete counts and are considered to be a minimum estimate. See text for details regarding Healthy Zone designation for Campbellton River based on partial count in 2023 and historical counting fence data.

River Name	SFA	LRP Achieved (%) in 2023	2023 Stock Status Zone	Previous Generation Average	% Change Vs Previous Generation
English River	1	431	Healthy	225	+92
Southwest Brook	2	39	Critical	49	-20
Muddy Bay Brook	2	21	Critical	152	-86
Sand Hill River	2	93	Critical	78	+19
*Exploits River	4	52	Critical	37	+41
Campbellton River	**4**	**134**	**Healthy**	**324**	**NA**
Salmon Brook	4	85	Critical	104	-18
Middle Brook	5	244	Healthy	267	-9
*Terra Nova River	5	58	Critical	63	-40
Northwest River	**5**	**52**	**NA**	**101**	**NA**
*Rocky River	9	15	Critical	35	-57
Northeast River	10	212	Healthy	268	-21
Come By Chance River	10	98	Critical	NA	NA
Bay de l'Eau River	10	94	Critical	NA	NA
Garnish River	11	20	Critical	40	-50
***Conne River**	**11**	**7**	**Critical**	**18**	**NA**
Harry's River	13	40	Critical	83	-52
Corner Brook Stream	13	28	Critical	217	-87
Torrent River	14A	149	Cautious	702	-79
Western Arm Brook	14A	164	Healthy	287	-43
Summary		Rivers with estimated stock status: N = 19	5 Healthy 1 Cautious 13 Critical	-	Declines ≥30% 8/15 (53%)

Table 6. Summary of Atlantic Salmon smolt production in 2023 compared to the previous generation average (2017–22) and previous three generation average for each river. Smolt abundance values on Campbellton River and Rocky River (bolded) are underestimates due to counting fence washouts.

River Name	SFA	2023 Smolt Production	Previous Generation Average	% Change Previous Generation Average	Previous 3 Generation Average	% Change Previous 3 Generation Average
Campbellton River	**4**	**16,587**	**37,155**	**NA**	**38,378**	**NA**
Rocky River	**9**	**2,243**	**4,226**	**NA**	**8,564**	**NA**
Conne River	11	22,540	32,226	-30	47,921	-53
Garnish River	11	13,353	13,519	-1	NA	NA
Western Arm Brook	14A	12,167	13,193	-8	15,757	-23

Table 7. Summary of Atlantic Salmon marine survival in 2023 (adult return year) compared to the previous generation average (2017–22) and previous three generation average for each river. Marine survival estimates presented in 2023 for bolded rivers are inaccurate due to significant washouts to the smolt fence in 2022 (Western Arm Brook) or the adult fence in 2023 (Campbellton River and Conne River).

River Name	SFA	2023 Marine Survival	Previous Generation Average	% Change Previous Generation Average	Previous 3 Generation Average	% Change Previous 3 Generation Average
Campbellton River	**4**	**1.7**	**7.2**	**NA**	**9.1**	**NA**
Rocky River	9	2.6	10.2	-75	6.1	-57
Conne River	**11**	**0.6**	**0.9**	**NA**	**2.9**	**NA**
Garnish River	11	1.1	2.5	-56	NA	NA
Western Arm Brook	**14A**	**4.3**	**6.9**	**NA**	**7.6**	**NA**

Table 8. Monthly average river water temperature in Labrador (Char Brook, Hunt River, Shinney's River) and Newfoundland (20 stations and 12 rivers) in June, July, and August 2023. River temperature (°C) was recorded hourly and is expressed as a monthly average with standard deviation (SD).

Region	Month	Temperature (°C) ± SD
Labrador	June	11.6 ± 3.0
	July	21.1 ± 1.0
	August	17.0 ± 0.7
Newfoundland	June	13.0 ± 0.7
	July	21.6 ± 1.2
	August	18.9 ± 0.5

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