STOCK ASSESSMENT OF NEWFOUNDLAND AND LABRADOR ATLANTIC SALMON IN 2020

Image: Atlantic Salmon (Salmo salar).

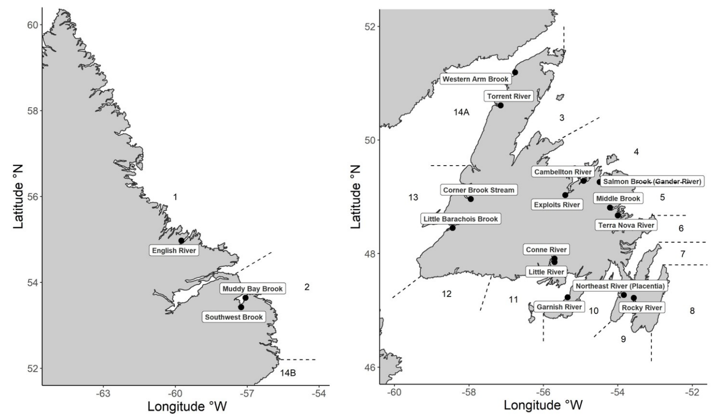

Figure 1. Map of the Newfoundland and Labrador Region showing Salmon Fishing Areas (SFAs) 1–14B.

Context:

*In Newfoundland and Labrador (NL), there are 15 Atlantic Salmon (*Salmo salar*) management areas, known as Salmon Fishing Areas (SFAs) 1–14B (Figure 1). Within these areas there are 394 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 (Fisheries and Oceans Canada [DFO] 2015) identifies two reference points for managing fisheries stocks, the Limit Reference Point (LRP) and Upper Stock Reference Point (USR). As per the Precautionary Approach (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 Labrador (SFAs 1–2) based on 1.9 eggs per m^2 of river rearing habitat, Northwest Newfoundland and 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). Conservation egg requirements were considered to be equivalent to a 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).*

Canada

Starting in 2019, DFO implemented a two-year management plan for Atlantic Salmon (Salmo salar) in the NL Region. This Science Advisory Report is from the March 2–5, 2021 Regional Peer Review Process on the Assessment of Atlantic Salmon in NL in 2020. This report provides information regarding the status of Atlantic Salmon stocks in 2020 for SFAs 1, 2, and 14B (Labrador), and SFAs 3 to 14A (Newfoundland) (Fig. 1; Fig. 2).

SUMMARY

- Seventeen populations of Atlantic Salmon (*Salmo salar*) were assessed in 2020. Returning adult salmon were counted on 16 rivers using monitoring fences or fishways, and returns were estimated on one river using a combination of a fish counting fence and snorkel survey (Little Barachois Brook, Salmon Fishing Area [SFA] 13).
  - COVID-19 public health measures in 2020 resulted in disruptions and delays to Atlantic Salmon monitoring activities. There were no smolt counts in 2020 and adult fences were not installed on Harrys River (SFA 13) and Sand Hill River (SFA 2). Counting fences were installed later than normal on six rivers. The proportion of the 2020 salmon run prior to counting facility operations was estimated using available run timing data on each of these rivers since 2005.
- In 2020, eight of 16 monitored rivers with information over the previous generation showed declines in total returns. This included one river in Labrador (English River, SFA 1) and seven rivers in Newfoundland, six of which declined by >30% relative to the previous generation. Five of six of the rivers were located on the south coast of Newfoundland.
- The status of the three monitored Atlantic Salmon populations in SFA 11 on the south coast of Newfoundland were deep in the critical zone (less than 20% of the Limit Reference Point [LRP]). Returns to Conne River in 2020 were the lowest on record over the available time-series, and returns to Little River were the second lowest, with both populations near local extinction. Estimated marine survival in 2020 (adult return year) on Conne River was <1%.
- Garnish River had historically large reported angling catches (approximately 1,000 to 2,000 fish landed in the late-1970s and 1980s) and, while monitoring data were limited (2015–20), the pattern of decline (>60%) was similar to neighbouring rivers. Estimated marine survival in 2020 (adult return year) on Garnish River was <1%.
- Marine survival was considered a major factor limiting the abundance of Atlantic Salmon in Newfoundland and Labrador, with adult returns in any given year determined primarily by marine survival rather than smolt production. Inter-annual estimates of marine survival were lower than the previous generation and three generation averages on most rivers where estimates were available.
- Of 13 rivers with information on adult returns over the previous three generations, total returns in 2020 were lower on six rivers (all in Newfoundland), five of which declined by more than 30%.
- In 2020, estimated spawning escapements (eggs) on Labrador rivers were in the critical zone (below the river-specific LRP) on Southwest Brook (SFA 2) and were in the healthy zone (above the Upper Stock Reference Point [USR]) on English River and Muddy Bay Brook.
- In 2020, estimated spawning escapements (eggs) on Newfoundland rivers were in the critical zone on seven of the 14 assessed rivers in 2020. Of the remaining rivers, five were in the healthy zone and two were in the cautious zone (between the LRP and USR).

- Preliminary estimates of harvest in the 2020 Labrador Indigenous and subsistence fisheries were inferred from logbooks (63% returned) to be 13,713 salmon in 2020 (7,558 small, 6,155 large), which was 3% lower than the previous seven-year average (2013–19).

Recreational Fisheries

- Estimates of catch and effort for the 2020 recreational fishery were unavailable at the time of the assessment. Mean catch values over the previous generation were used to calculate 2020 total returns and spawning escapements, and involved 20,574 retained and 25,704 released salmon for Newfoundland rivers and 1,288 retained and 6,302 released for Labrador rivers.

Genetics

- Juvenile surveys and genetic analysis indicated that the proportion of first-generation wild-escapee hybrids in southern Newfoundland in 2019 and 2020 were the lowest since monitoring began in 2014. Despite this, first-generation hybrids were detected in both years in Fortune Bay, and samples from smaller rivers continued to be dominated by hybrids. Both experimental evidence and increases in the detection of the offspring of first-generation hybrids and wild salmon supported a role for precocial male hybrid maturation in ongoing introgression.
- Genomic analysis of Atlantic Salmon throughout the Conne River watershed suggested that:
  1. despite genomic evidence of declines in abundance since the mid-1980s, there was still significant differentiation between the main stem and tributaries, and
  2. introgression with farmed escaped salmon occurred in lower parts of the watershed.
- Population genomic analysis exploring European introgression into North American farmed salmon indicated that some farmed Atlantic Salmon had been interbred with European-origin salmon, and that individuals escaped and hybridized in the wild in southern Newfoundland.

Environment

- Marine ecosystem conditions in the Newfoundland-Labrador Bioregion remained indicative of overall limited productivity of the fish community. Total biomass of the entire fish community remained much lower than prior to the collapse in the early-1990s. It showed some recovery up to the early to mid-2010s, when some declines where observed. Current total biomass of the fish community remained below the early-2010s level, but with some positive signals in 2020. Since the mid-2000s, this assemblage reverted to a finfish-dominated structure, though 2019–20 data suggested small increases in the proportion of shellfish.
- Mean annual air temperature in Newfoundland and southern Labrador was near the 1991-2020 long-term average in 2020, characterized by a cold winter/spring and a warm summer. Summer sea surface temperatures (SST) were above average and sea ice was below average for the first time since 2014 and 2013, respectively. The amplitude and duration of the warmest SST conditions in the shallower areas around Newfoundland has increased since the 1980s, in agreement with climate change projections.
- Chlorophyll concentrations and zooplankton biomass were below normal in the early and mid-2010s, but have increased to values above the long-term (1999–2020) average since 2016–17. Changes in zooplankton community structure over the past decade resulted in fewer large and more small copepods although the abundance of large, energy-rich calanoid copepods increased to above-normal levels in some areas since 2017. Additionally,

changes in zooplankton seasonality (weaker spring and stronger summer and fall zooplankton signals) may have changed the quality and timing of food availability for upper trophic levels.

BACKGROUND

Species Biology

Juvenile Atlantic Salmon predominantly remain in freshwater habitats for three to four years in Newfoundland (95.8% of samples taken since 2000) and four to five years in Labrador (83.5% of samples taken since 2000) prior to undergoing smoltification and migrating to sea as smolts (DFO 2020b). Spawning populations in NL consist of varying proportions of small (fork length <63 cm) and large (fork length ≥63 cm) adult salmon (Fig. 3). For the majority of rivers in Newfoundland (SFAs 3-12 and 14A), the small adult salmon population is predominantly grilse (one-sea-winter, 1SW salmon), that have spent one year at sea before returning to spawn for the first time. The large adult salmon population in Newfoundland rivers is 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. 2016). For most monitored rivers in NL, small salmon are predominantly female (range of 60–92% across rivers).

Stock Assessment

Since 2017, the status of Atlantic Salmon populations has been assessed relative to two reference points, defined on the basis of egg depositions, as per the Fishery Decision-Making Framework Incorporating the Precautionary Approach (DFO 2015). For each monitored river, the LRP is set at 100% of the previously defined conservation egg requirement (CER) (O'Connell and Dempson 1995, O'Connell et al. 1997, Reddin et al. 2006). Populations below the LRP fall in the critical zone, where management actions should both promote stock growth and minimize fisheries-related mortality. The interim USR is set at 150% of the previously defined conservation egg deposition rate. Populations above the USR are considered to be in the healthy zone and are therefore available for exploitation at some predetermined maximum exploitation rate. Populations with a status between the LRP and USR fall within the cautious zone, in which management actions should promote stock rebuilding to the healthy zone.

Atlantic Salmon stocks within the NL Region (SFAs 1–14B) were assessed using data collected from salmon monitoring facilities (fish counting fences and fishways; Fig. 2), in-river snorkel surveys, and the recreational fishery (catch and effort data). The Licence Stub Return System (O'Connell et al. 1998, Dempson et al. 2012, Veinott and Cochrane 2015) provided river-specific recreational catch and effort data for SFAs 2–14B, except for Eagle River and Sand Hill River in SFA 2 where data were provided by private fishing camps. DFO Science assumed a catch-and-release mortality rate of 10% when calculating estimates of total returns and total spawners on monitored rivers where angling was permitted. Preliminary estimates of river-specific harvest and catch-and-release angling were unavailable for the 2020 fishery. For each monitored river, preliminary estimates of total returns and egg depositions in 2020 were calculated using the average catch data over the previous generation (2014–19 for most Newfoundland rivers and 2013–19 for Labrador rivers). Accordingly, results presented in this report for assessed rivers in

2020 are considered preliminary and will be updated once 2020 river-specific recreational angling estimates are finalized.

DFO Science also examined trends over time in salmon abundance on each monitored river. In each year, the estimated number of returns on a given river were compared to the average returns over the previous generation and three generation time periods. For all comparisons, DFO Science used a minimum threshold of ten percent difference between an annual abundance and a multi-year average to determine whether the abundance of a monitored population increased or decreased. In stock assessment meetings prior to 2021, the previous generation referred to the previous five years for Newfoundland populations and six years for Labrador populations (DFO 2020a, 2020b). In preparation for the 2021 Committee on the Status of Endangered Wildlife in Canada (COSEWIC) review of Atlantic Salmon populations in Canada, DFO Science reviewed historical scale age data from rivers throughout the NL Region to estimate generation times and conduct trend analyses. As a result, DFO Science substituted these with river-specific generation times in Newfoundland and Labrador based on historical scale age data collected on each river. With some exceptions, generation times used in this report and going forward in future assessments correspond to six years for most Newfoundland rivers and seven years for most Labrador rivers. The previous three generation time period used was equal the river-specific generation time rounded to the nearest whole number and multiplied by three. For example, the estimated generation time for Campbellton River salmon using historical scale age data was 5.8 years; thus, the previous six years were used for comparisons to the previous generation and the previous 18 years were used for comparisons to the previous three generations. For a small number of rivers (e.g., Corner Brook Stream and Little Barachois Brook), no scale age data were available; therefore, the average generation time across other rivers within that SFA was used.

In addition to river-specific comparisons, regional trends in Atlantic Salmon abundance on monitored rivers were assessed using a Salmon Abundance Index. Time series of total return estimates for monitored Atlantic Salmon rivers were combined and modelled with a negative binomial generalized linear model (GLM) with a log link function and year as a factor. Returns were modelled separately for Newfoundland and for Labrador and only included years with data collected since the commercial moratorium in 1992. The estimated marginal mean log abundance (+/- standard errors) were presented for each year for Newfoundland and Labrador, respectively.

Eighteen populations of Atlantic Salmon were monitored in 2020 (Fig. 2). Adult salmon were counted on three rivers in Labrador and 15 rivers in Newfoundland. Atlantic Salmon abundance was estimated for Little Barachois Brook (SFA 13) using a combination of a counting fence operated throughout the adult migration and an in-river snorkel survey from the fence down to the river mouth in August (~9 km distance). Although time series of returning adult Atlantic Salmon were presented for Rattling Brook in SFA 4, this river was not included as an assessed river due to recent enhancement activities that had taken place. Therefore, DFO Science assessed seventeen Atlantic Salmon rivers in the NL Region in 2020.

The COVID-19 pandemic had a large impact on the 2020 Atlantic Salmon monitoring program in the region. There were no smolt counts conducted in the province (five Newfoundland rivers annually in recent years). Counting fences on Harry's River (SFA 13) and Sand Hill River (SFA 2) were not installed due to concerns about ensuring the health and safety of DFO Science staff and local contractors hired to install and run these counting facilities. Middle Barachois Brook (SFA 13) and Robinsons River (SFA 13), which were assessed in 2018 and 2019 via snorkel survey, were not surveyed in 2020. Fence installations on six monitored rivers were delayed due to the time it took to implement proper protocols and working procedures to ensure health and safety. This impacted four rivers in Newfoundland (Western Arm Brook, Campbellton River, Conne River, and Garnish River) and two rivers in Labrador (Southwest Brook and Muddy Bay Brook). The proportion of small and large salmon that migrated upriver prior to the late fence installation was calculated using a nonparametric bootstrap procedure to estimate mean proportion (and 95% confidence intervals) of the salmon run prior to the 2020 start date using run timing data from 2005–19. This was done for small and large salmon separately and counts of both size groups were adjusted using these estimated proportions. Three of these rivers also typically monitored smolt abundance (Western Arm Brook, Campbellton River, Conne River, and Garnish River). Marine survival estimates of 2019 smolt to 2020 returning small salmon were calculated using the adjusted small salmon counts.

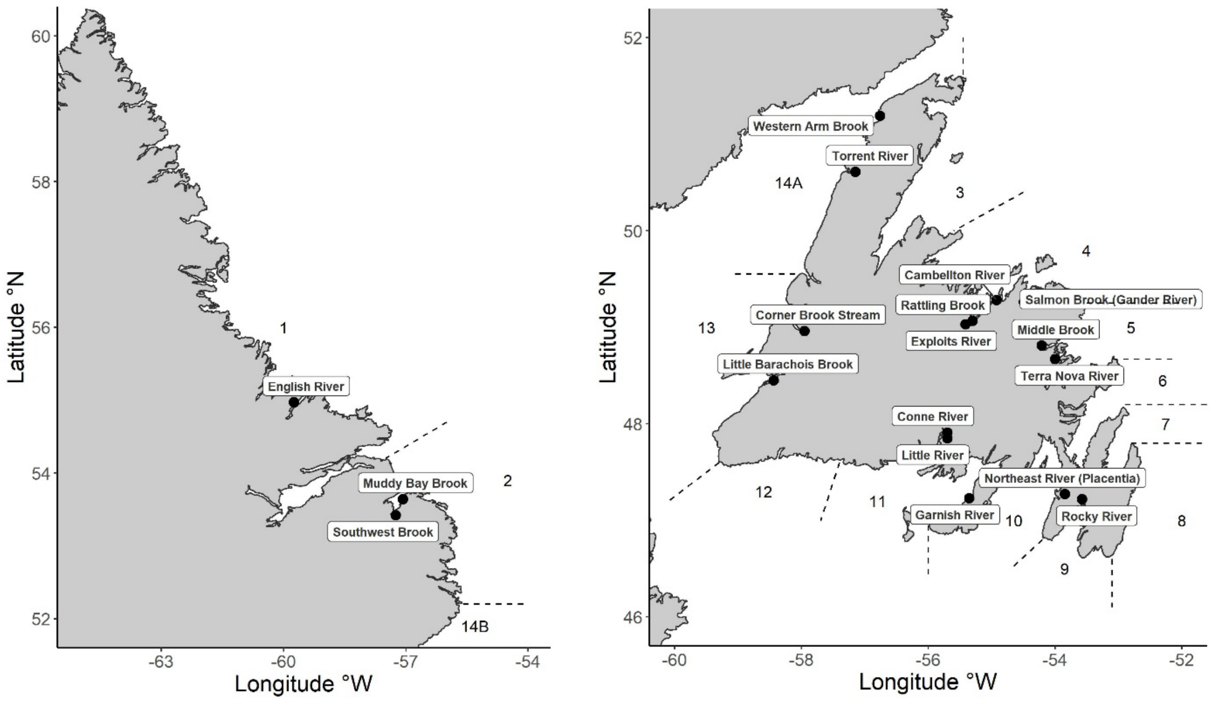

Figure 2. Maps of the rivers in Labrador (SFA 1, 2, and 14B) and Newfoundland (SFAs 3–14A) where Atlantic Salmon returns were monitored in 2020. Adult salmon were counted at eighteen monitoring facilities (three in Labrador and fifteen in Newfoundland). The approximate boundaries of each SFA are illustrated by dotted lines. Although Atlantic salmon were counted on Rattling Brook in SFA 4, this river was not included as an assessed river due to recent enhancement activities. Due to the COVID-19 pandemic, there were no smolt counts obtained on the five Newfoundland rivers where smolt abundance is typically assessed annually.

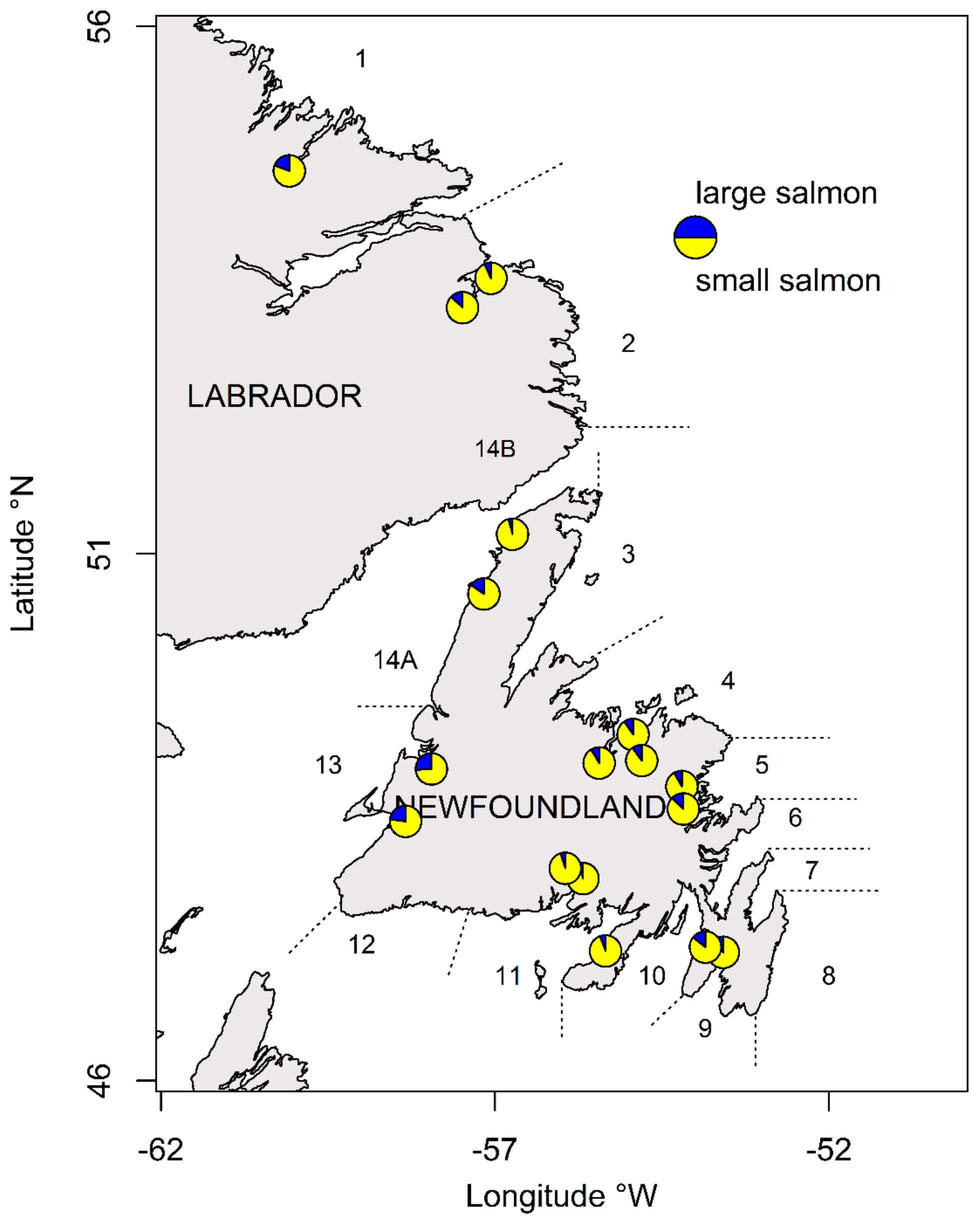

Figure 3. Proportion of small (fork length <63 cm) and large (fork length ≥63 cm) Atlantic Salmon across seventeen rivers assessed in 2020. Proportions represent the average over all monitoring data collected from 1992 to 2020 for each river, respectively. The approximate boundaries of each SFA are illustrated by dotted lines.

Recreational Fisheries

In 2020, the recreational salmon fishery for all Labrador rivers opened June 15 and closed September 15. Retention of large salmon has not been permitted in Labrador since 2011. The 2020 recreational salmon fishery for all Newfoundland rivers opened on June 1 and closed on September 7. However, there was a fall catch and release fishery on the Humber, Exploits, and Gander Rivers from September 8 to October 7, 2020. Retention of large salmon in Newfoundland has not been permitted since 1984. The management plan for Atlantic Salmon rivers in the NL Region in 2020 mirrored that of 2019 which included a seasonal retention limit of one fish on Class 2 rivers and two fish on Class 4, 6, and unclassified rivers, and daily catch-and-release limits of three fish on Class 2, 4, 6, and unclassified rivers. In addition, the protocol for closing rivers to angling during periods of extreme environmental conditions (i.e., high water temperatures and/or low water levels) restricted angling to morning hours (until 10 AM) rather than complete closures as done prior to 2019. In 2020, 12% of all potential angling days across all scheduled Atlantic Salmon rivers were restricted to morning hours only due to environmental conditions.

Indigenous Subsistence Fisheries

There has been no commercial salmon fishing in Newfoundland (SFAs 3–14A) since 1992, in the Straits area of Labrador (SFA 14B) since 1997, and in the rest of Labrador (SFAs 1–2) since 1998.

Indigenous Food, Social, and Ceremonial (FSC) fisheries for Atlantic Salmon, Arctic Charr (*Salvelinus alpinus*), and Brook Trout (*Salvelinus fontinalis*) occur in Labrador under communal licences. Labrador also has a Resident Subsistence Fishery for trout and charr with a permitted retention of salmon by-catch (three salmon since 2011). In Newfoundland, Miawpukek First Nation hold a FSC communal salmon fishing licence, but have chosen not to harvest salmon under this licence since 1997 due to conservation concerns. Labrador FSC and subsistence fisheries harvests were inferred from logbooks (63% returned) to be 13,713 salmon in 2020 (7,558 small, 6,155 large), which was 3% higher than the previous seven year average (2013–19) (Tables 1 and 2; Fig. 4). These estimates were preliminary and will be updated upon the receipt of additional logbooks.

In recent years, catch from the Labrador subsistence salmon fisheries was analyzed using the Single Nucleotide Polymorphism (SNP) panel with 31 range-wide regional reporting groups. In 2020, the estimated origin of >98% of the samples analyzed belonged to Labrador reporting groups (ICES 2021), which was consistent with previous analyses conducted from 2006–19 which estimated that >95% of the catch was attributable to Labrador stocks (ICES 2019, 2020).

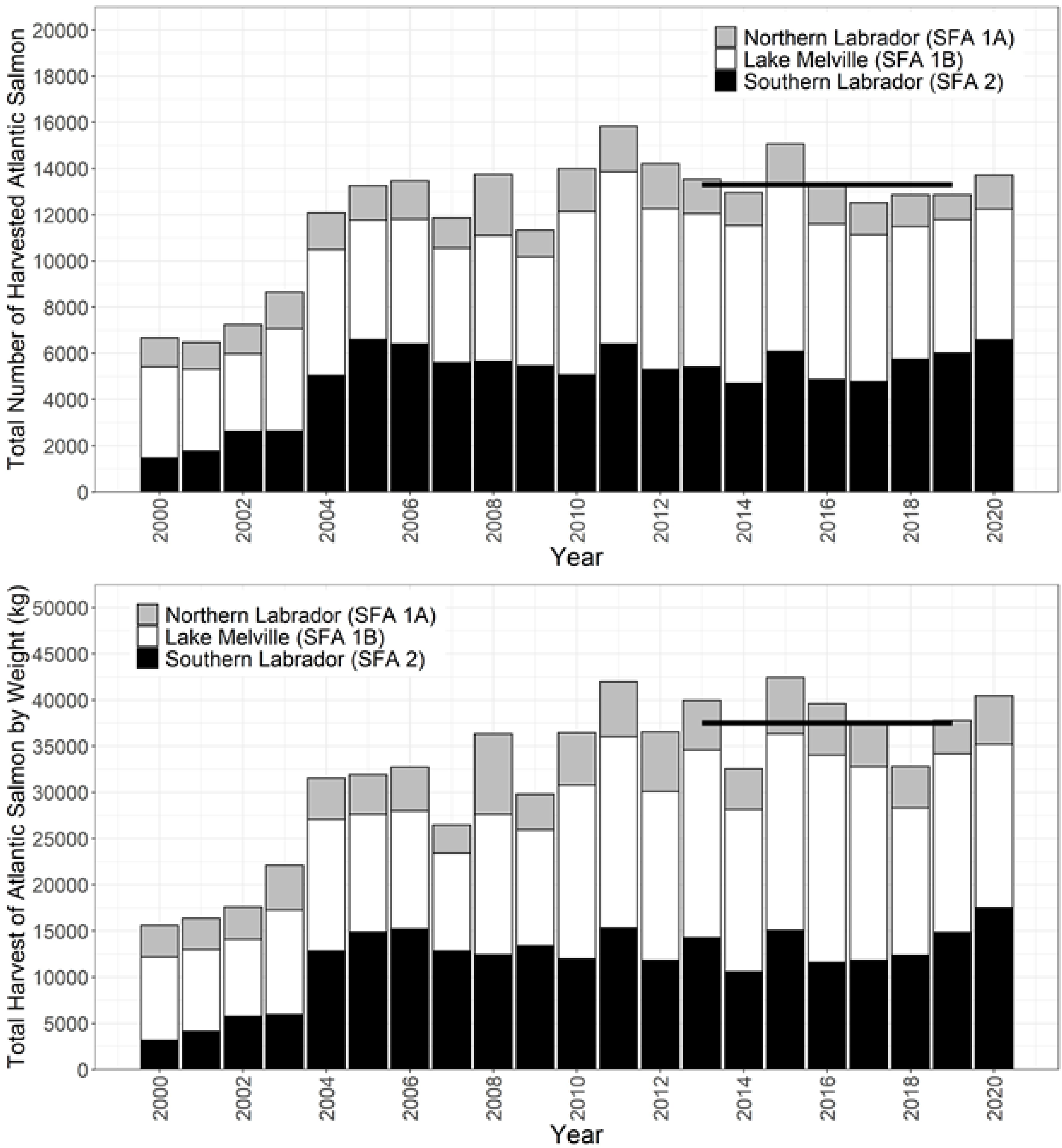

Figure 4. Estimated number (top panel) and weight (bottom panel) of Atlantic Salmon harvested in Labrador Indigenous and subsistence fisheries in SFAs 1A, 1B and 2. Horizontal solid line represents the previous generation average total harvest (2013–19). Harvest estimates for 2020 are preliminary.

ASSESSMENT

Resource Status – Adult Salmon

Northern Labrador and Lake Melville (SFA 1)

There are nine scheduled salmon rivers in SFA 1. One river (English River, near Postville) was assessed in 2020. Total returns of Atlantic Salmon on English River in 2020 were lower (13%) than the previous generation average (2013–19) and declines were observed in both small and large salmon size groups (-13% and -16%, respectively; Fig. 5). Total returns to English River in 2019 declined to the lowest point since 2012–13 (Fig. 5). As a result, estimated egg depositions in 2019 fell below the USR for the first time since 2012. However, improved returns observed in 2020 resulted in estimated egg depositions that exceeded the USR (Table 3).

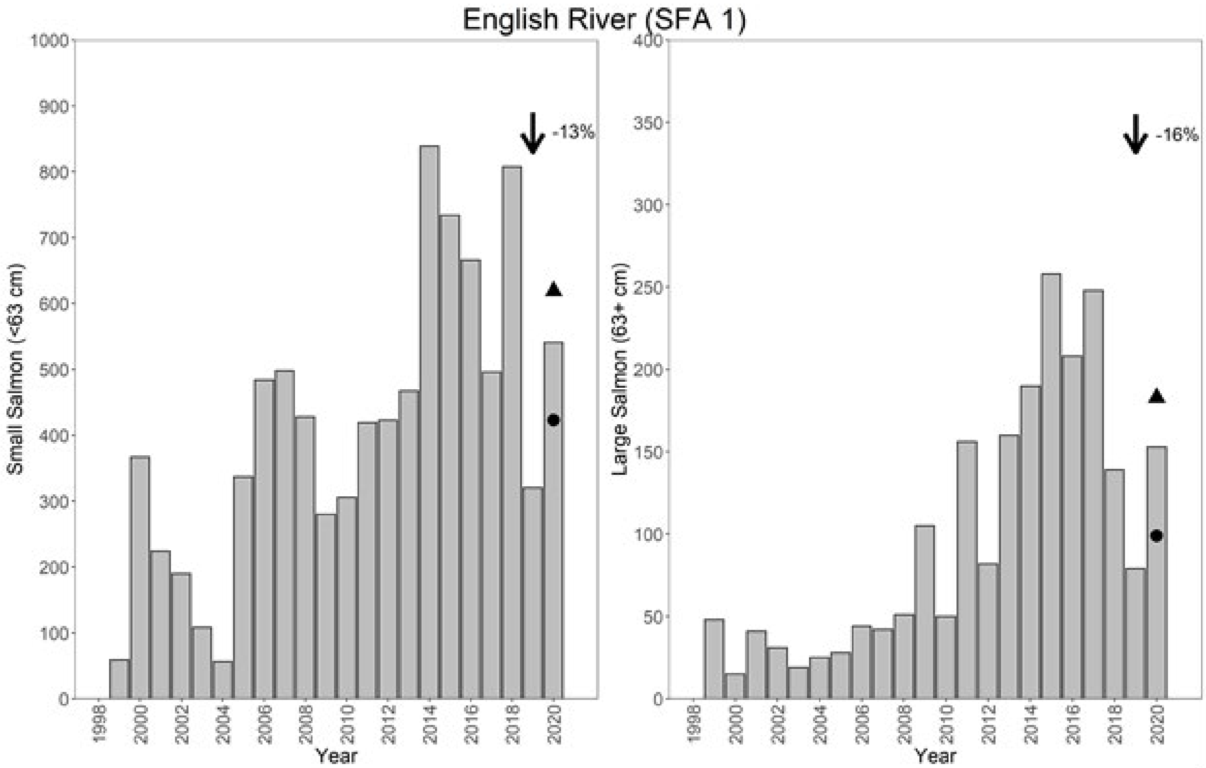

Figure 5. Total returns of small and large salmon on English River (SFA 1) from 1999 to 2020. Black triangles represent the previous generation average (2013–19). Black circles represent the previous three generation average (2000–19). Black arrows and percent changes shown represent 2020 small and large salmon returns compared to the previous generation average (2013–19).

Southern Labrador (SFA 2)

There are 16 scheduled salmon rivers in SFA 2. Two rivers were assessed in 2020: Muddy Bay Brook (Dykes River) and Southwest Brook. Total returns in 2020 were higher than the previous generation average (2013–19) on Southwest Brook (+66%) and Muddy Bay Brook (+73%) (Fig. 6; Table 3). Compared to the previous three generation average (2000–19), Atlantic Salmon returns in 2020 were 57% higher on Muddy Bay Brook and 4% lower on Southwest Brook (Table 3). Estimated egg depositions in 2020 were below the LRP (i.e., in the critical zone) on Southwest Brook (92%) and above the USR (i.e., in the healthy zone) on Muddy Bay Brook (222%). In comparison to the previous generation average, estimated egg depositions increased on both rivers in 2020 (Table 3). Atlantic Salmon returns to Sand Hill River were not monitored in 2020 due to COVID-19 impacts on field operations.

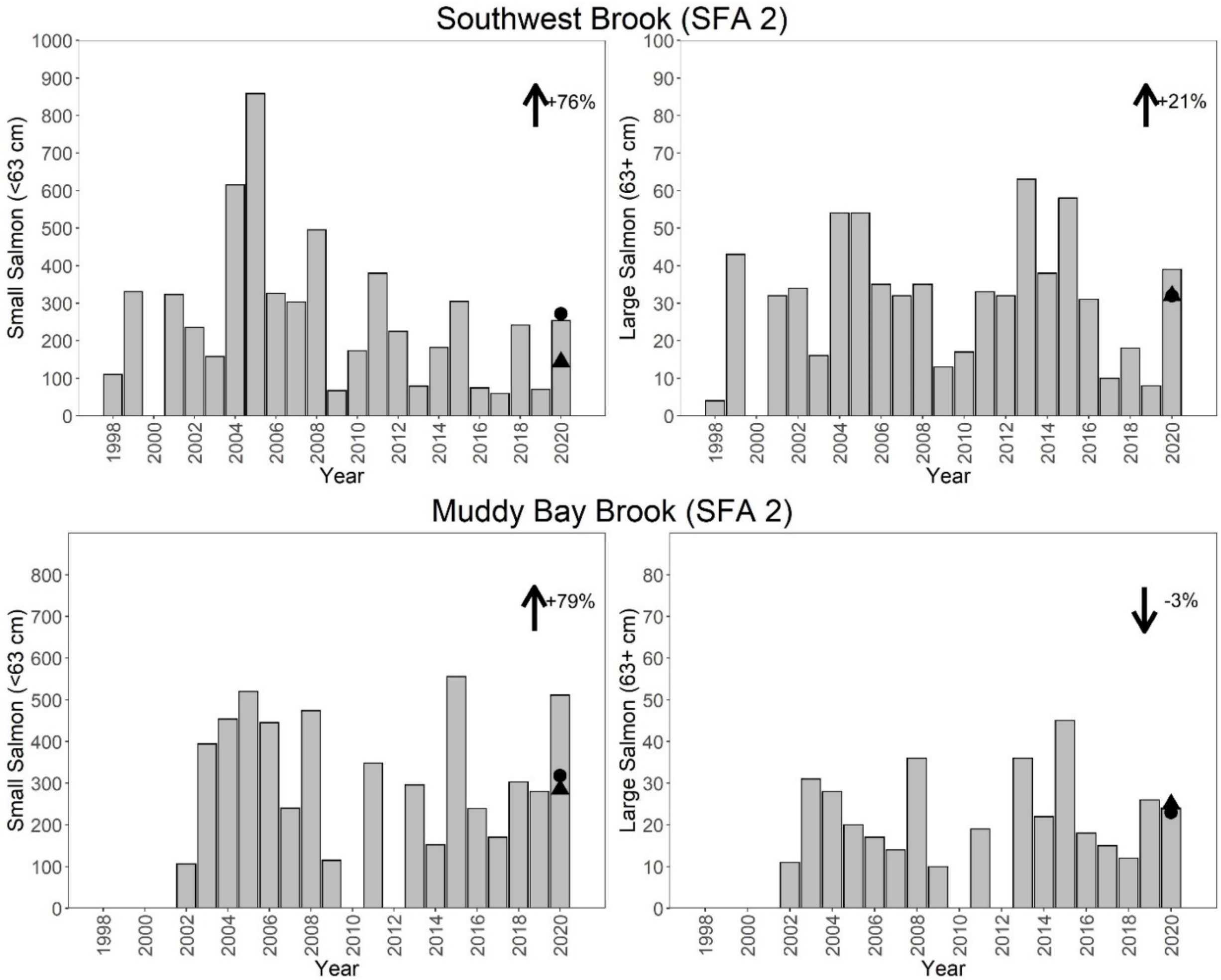

Figure 6. Total returns of small and large salmon at two monitored rivers in SFA 2 (Muddy Bay Brook and Southwest Brook), 1998 to 2020. Black triangles represent the previous generation average (2013–19). Black circles represent the previous three generation average (2000–19). Black arrows and percent changes shown represent 2020 small and large salmon returns compared to the previous generation average (2013–19).

Labrador Straits (SFA 14B)

There are three scheduled salmon rivers in SFA 14B. No rivers were assessed in 2020.

Northeast and Eastern Newfoundland (SFAs 3-8)

There are 60 scheduled salmon rivers in SFAs 3–8. Five rivers were assessed in 2020: Exploits River, Campbellton River, and Salmon Brook (tributary of Gander River) in SFA 4, and Middle Brook and Terra Nova River in SFA 5. No rivers were assessed in SFAs 3, 6, 7, and 8 in 2020.

Compared to the previous generation average (2014–19), total returns of salmon in 2020 were similar (<10% change) on Exploits River, Salmon Brook, Campbellton River, and Terra Nova River but were 30% lower on Middle Brook (Fig. 7, Fig. 8, Fig. 9; Table 3). When 2020 Atlantic Salmon returns to monitored rivers in this region were compared to average returns over the previous three generations, declines were observed on Exploits River (-31%), Campbellton

River (-12%), and Middle Brook (-10%) (Table 3). In contrast, total returns in 2020 were higher on Terra Nova River (+25%) and similar (+/-0%) on Salmon Brook (Table 3). In 2020, estimated total returns to Exploits River exceeded 20,000 Atlantic Salmon (Table 3) for the first time since 2016 (Fig. 7).

Estimated egg depositions exceeded the USR on Campbellton River and Middle Brook in 2020 (Table 3). These two rivers exceeded their LRP every year since 1992. Estimated egg depositions on Salmon Brook fell between the LRP and USR (i.e., in the cautious zone) in 2020 (Table 3). Estimated egg depositions on Exploits River and Terra Nova River have consistently been below their LRP over the entire monitoring time series available, including in 2020 (Table 3). Terra Nova River reached a record high in 2019 (98% of LRP).

It is important to note that large areas of rearing habitat were made accessible in the upper areas of Exploits River (above Red Indian Lake dam) in 1989 and Terra Nova River (above Mollyguajeck Falls) in 1985 which had not been fully colonized and therefore had consequences on the proportion of the total river egg deposition achieved. For Exploits River, adult salmon were counted at three locations: Bishop’s Falls (closest to the mouth of the river), Grand Falls, and Red Indian Lake dam. This allowed Exploits River to be assessed based on the entire watershed and on each of these individual sections. However, from 2018–20, adult salmon at the Grand Falls fishway were counted multiple times in each year due to fish falling back down over the falls after their initial passage. As a result, the count at the Grand Falls fishway was inaccurate in those three years and the allocation of estimated egg depositions between the three sections of Exploits River was not possible. DFO Science conducted a tagging study in 2020 and 2021 to quantify the fallback and better understand the issue. However, it was important to note that there were no issues with the fishway at Bishop’s Falls, and therefore, the total count at Bishop’s Falls was an accurate estimate of all the Atlantic Salmon that entered the Exploits River watershed in 2020.

Salmon passage on Rattling Brook (Norris Arm, SFA 4) was blocked for 52 years by a hydroelectric development project. From 2010–19, the upstream tributaries (2010–16) and the lower watershed (Amy’s Lake, 2017–19) were stocked with adult salmon from Exploits River. Since 2010, adult Atlantic Salmon have been transported upstream over a dam, and smolt and kelts returning to the sea did so through a smolt bypass. Monitoring of this river had been ongoing since 2013, but due to the recent stocking and unique fish passage situation on this river, it was not included as an assessed Atlantic Salmon river for the Northeast Coast. Atlantic Salmon returns to this river had been increasing since passage was restored in 2010, and peaked in 2020 at 1,238 salmon, 290% higher than the 2015–19 average (Fig. 7; Table 3).

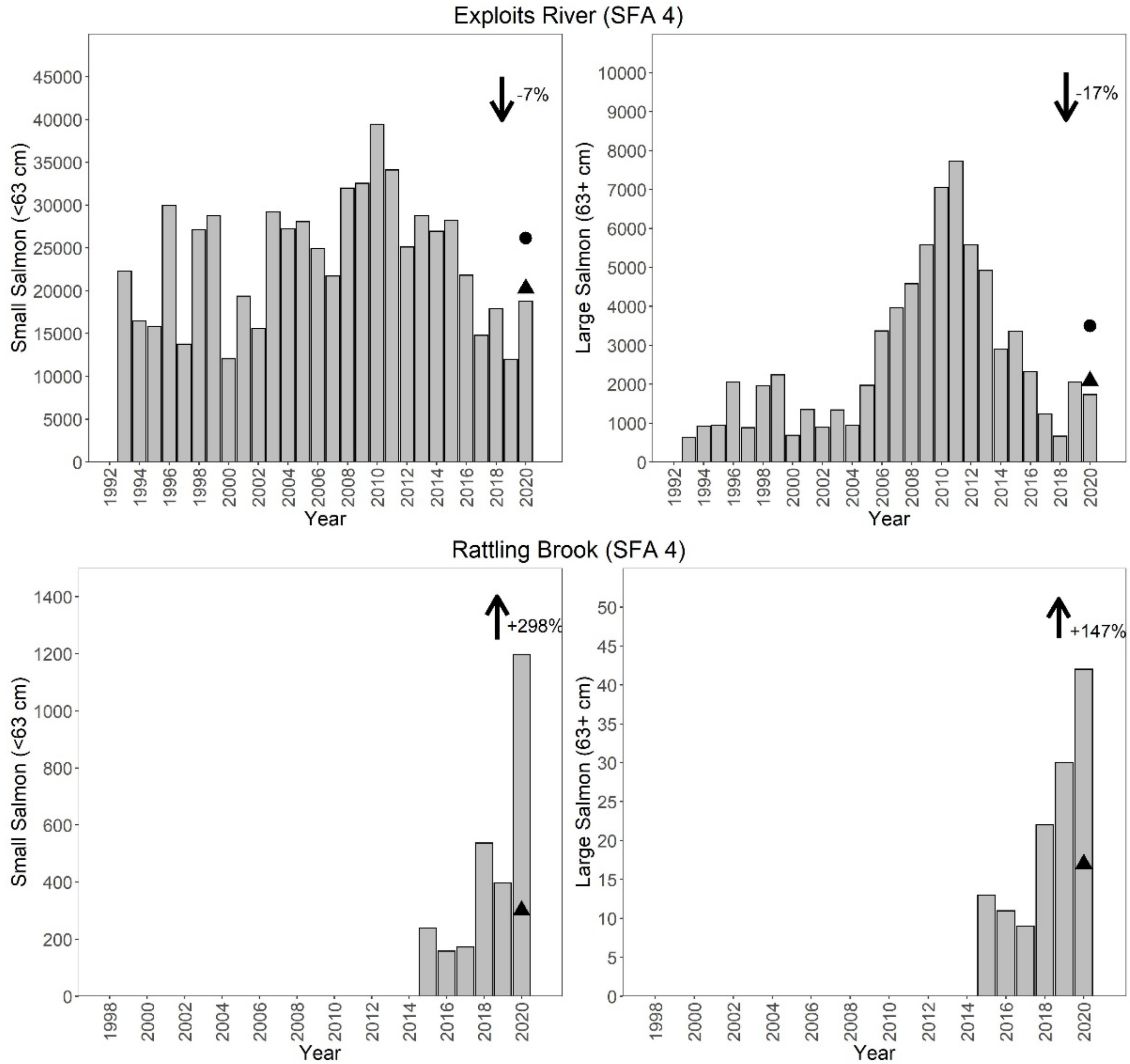

Figure 7. Total returns of small and large salmon to Exploits River and Rattling Brook in SFA 4, 1992 to 2020. Black triangles represent the previous generation average (2014–19). Black circles represent the previous three generation average. Black arrows and percent changes shown represent 2020 small and large salmon returns compared to the previous generation average (2014–19).

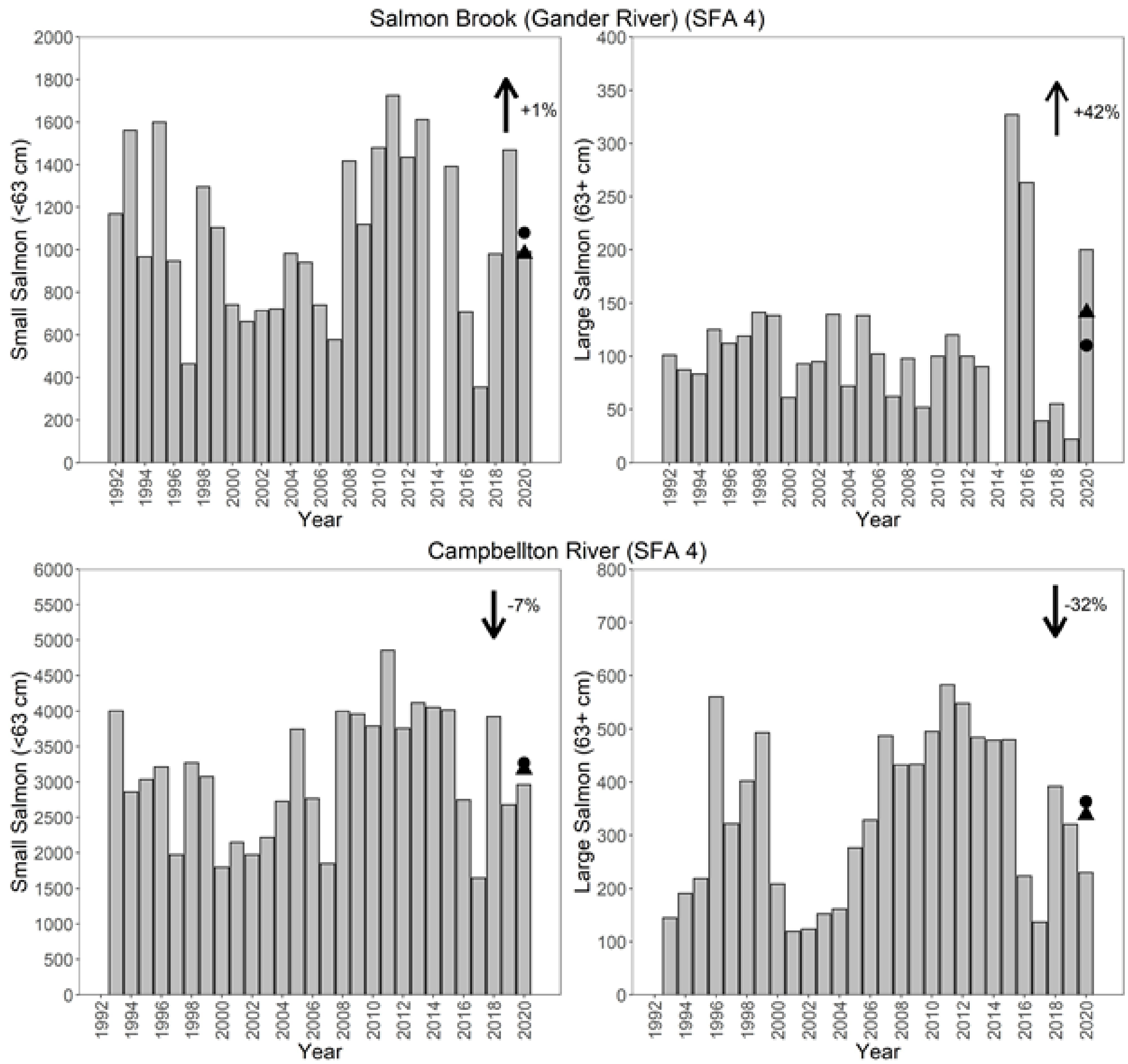

Figure 8. Total returns of small and large salmon to Campbellton River and Salmon Brook (Gander River tributary) in SFA 4, 1992 to 2020. Black triangles represent the previous generation average (2014–19). Black circles represent the previous three generation average. Black arrows and percent changes shown represent 2020 small and large salmon returns compared to the previous generation average (2014–19).

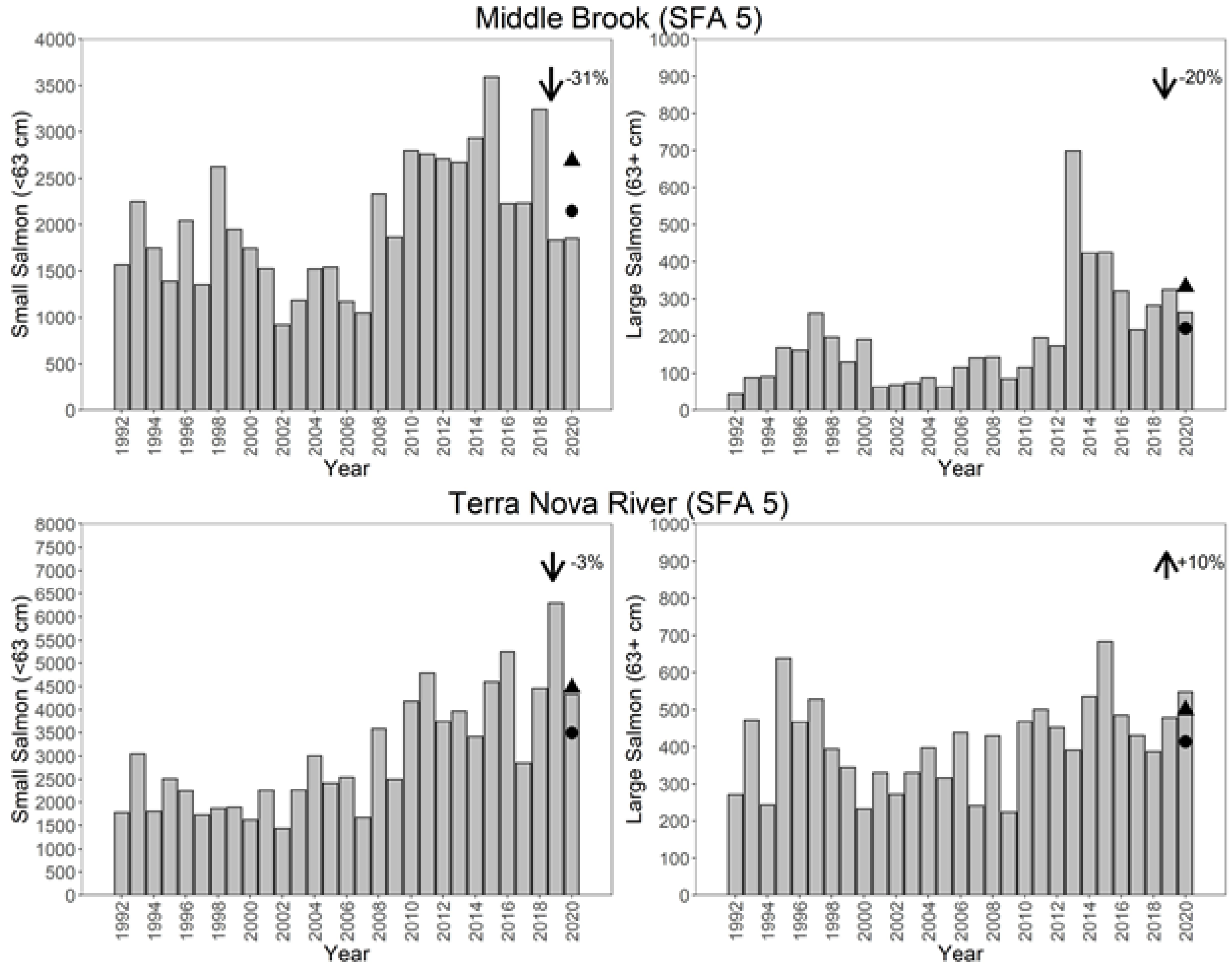

Figure 9. Total returns of small and large salmon at three monitored rivers in SFA 5 (Middle Brook and Terra Nova River), 1992 to 2020. Black triangles represent the previous generation average (2014–19). Black circles represent the previous three generation average. Black arrows and percent changes shown represent 2020 small and large salmon returns compared to the previous generation average (2014–19).

South Newfoundland (SFAs 9-11)

There are 48 scheduled salmon rivers in SFAs 9–11. Five rivers were assessed in 2020: Rocky River in SFA 9, Northeast River - Placentia in SFA 10, and Garnish River, Conne River, and Little River in SFA 11.

In 2020, total Atlantic Salmon returns on Rocky River were 48% below the previous generation average and 59% below the previous three generation average with large declines observed in both small and large salmon size groups (Fig. 11; Table 3). Estimated egg depositions for Rocky River had consistently been below the river-specific LRP every year it had been monitored. In 2020, Rocky River Atlantic Salmon egg depositions were estimated to be 20% of the LRP, 48% below the average over the previous generation (2014–19; Table 3). Total returns to this river in 2015 were poor due to fishway reconstruction during the return migration. Atlantic Salmon below the fishway were intercepted and transferred upstream; however, returns likely did not reflect the number of fish that would have returned to the river naturally had the fishway been operational. As a result, returns and egg deposition estimates from 2015 were not used in previous generation and three generation average calculations. Although fishway construction was completed in 2016 prior to the upstream salmon migration, there were still some operational issues that may have prevented a portion of returning fish from entering the river that year. Rocky River smolts spend three to four years in the river prior to migrating to sea (smolt sampled annually from 1992–2019 had mean proportions of 65% age 3 and 26% age 4 smolt across years) and typically only spend one year at sea. Therefore, any impacts from spawner abundance in 2015–16 would have been expected to primarily affect smolt abundance in 2019–20 and adult returns in 2020–21. There was no smolt count conducted in 2020 due to COVID-19, but the 2019 smolt count was the lowest on record (DFO 2020b). Total returns in 2020 (198) were the lowest since 1994 (177).

Northeast River was previously assessed from 1984–2002 and, after a period with no counts (2003–14), assessments began again in 2015. In 2020, estimated total returns of Atlantic Salmon decreased (-60%) relative to the previous generation average (Fig. 10; Table 3) and represented some of the lowest returns to this river since before the commercial Atlantic Salmon moratorium in 1992. Estimated egg depositions (98%) were below the LRP for the first time on record. It was important to note that egg deposition estimates may have changed slightly upon finalization of 2020 angling data which may or may not have resulted in an updated estimate that exceeded the LRP slightly.

Total returns of salmon to Conne River in 2020 were at a record low for the time series (1986–2020) and were 86% below the previous generation average and 92% below the previous three generation average (Fig. 11). Conne River achieved 7% of the LRP in 2020, which was 85% below the previous generation average. Since monitoring began in 1986, returns of small salmon to Conne River declined significantly with no indication that salmon returns would improve (Fig. 11). Little River showed a similar trend in 2020 with declines of 88% and 97% compared to the previous generation and three generation average, respectively (Table 3). The estimated egg depositions for Little River (2% in 2020) were below 5% of the LRP for the last four consecutive years (Table 3). Assessments of Atlantic Salmon on Garnish River began in 2015. In 2020, total Atlantic Salmon returns were 63% below the previous generation average (Fig. 11). Estimated egg deposition remained below the LRP (13%) for the fifth consecutive year and were the lowest on record since monitoring began in 2015. Overall, salmon returns to Garnish River were well below historical levels based on the reported angling catches from 1974–93, where reported harvest exceeded 2,000 salmon in some years (Moores et al. 1978).

The consequences for wild populations of Atlantic Salmon due to a single large aquaculture escape event in 2013 in a southern Newfoundland fjord were examined in recent years using targeted genomic tools. In 2014, the unambiguous, widespread detection of first- and second-generation wild-escapee hybrid salmon and pure feral offspring was reported (i.e., 27% hybrids in 17/18 rivers within 75 km of escape site) (Wringe et al. 2018). Repeated sampling of these rivers in recent years had shown that the number of hybrid (i.e., having one wild and one escapee parent) and feral (i.e., two escapee parents) salmon peaked in 2014 and consistently declined thereafter. Juvenile surveys and genetic analysis indicated that the proportion of first-generation wild-domestic hybrids in southern Newfoundland in 2019 and 2020 were the lowest since monitoring began in 2014. Despite this, first-generation hybrids were detected in Fortune Bay in both years, and samples from smaller rivers continued to be dominated by hybrids. Both experimental evidence and increases in the detection of the offspring of first-generation hybrids and wild salmon supported a role for precocial male hybrid maturation in ongoing introgression.

Genomic analysis of Atlantic Salmon throughout the Conne River watershed suggested that:

1. despite genomic evidence of declines in abundance since the mid-1980s, there was still significant differentiation between the main stem and tributaries, and
2. introgression with escaped farmed salmon occurred in lower parts of the watershed.

Population genomic analysis exploring European introgression into North American farmed salmon indicated that some farmed Atlantic Salmon had been interbred with European-origin salmon, and that individuals had escaped and hybridized in the wild in southern Newfoundland.

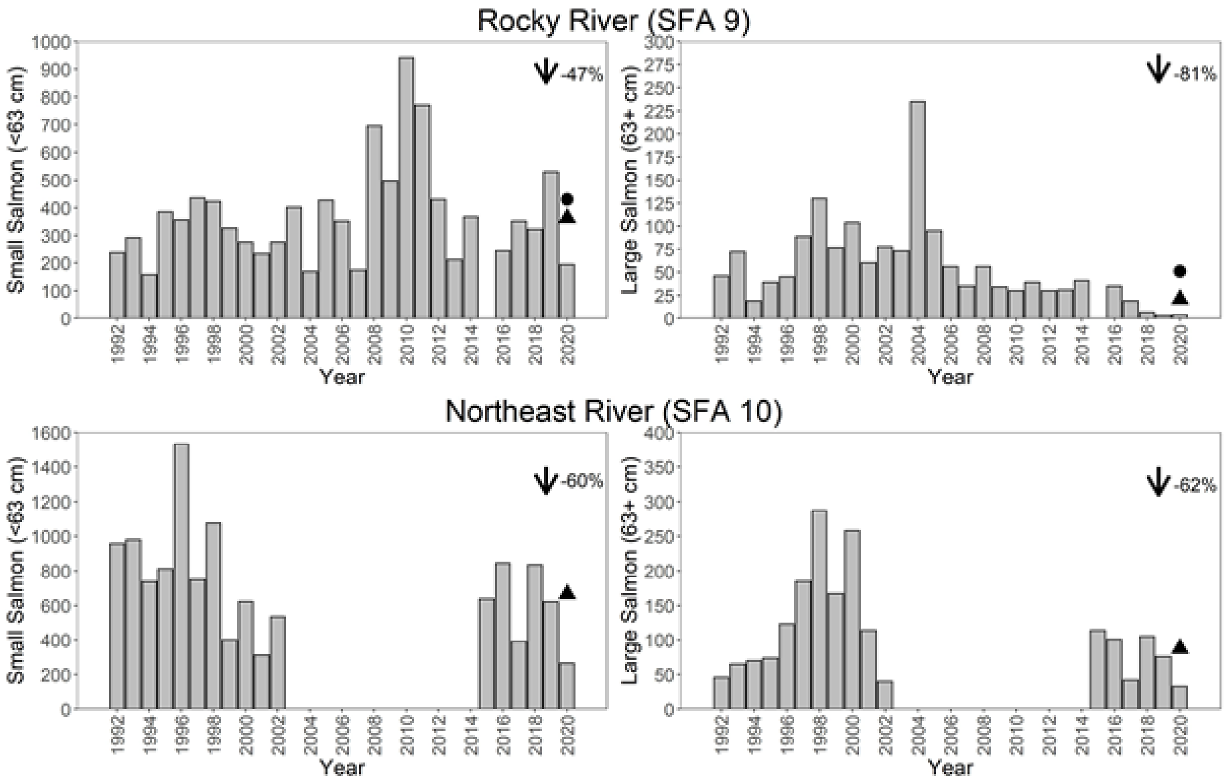

Figure 10. Total returns of small and large salmon at two monitored rivers in SFA 9 (Rocky River) and SFA 10 (Northeast River–Placentia Bay). Black triangles represent the previous generation average (2014–19). For Rocky River, black circles represent the previous three generation average. The Northeast River time series lacks sufficient data for comparisons to the previous three generations. Black arrows and percent changes shown represent 2020 small and large salmon returns compared to the previous generation average (2014–19).

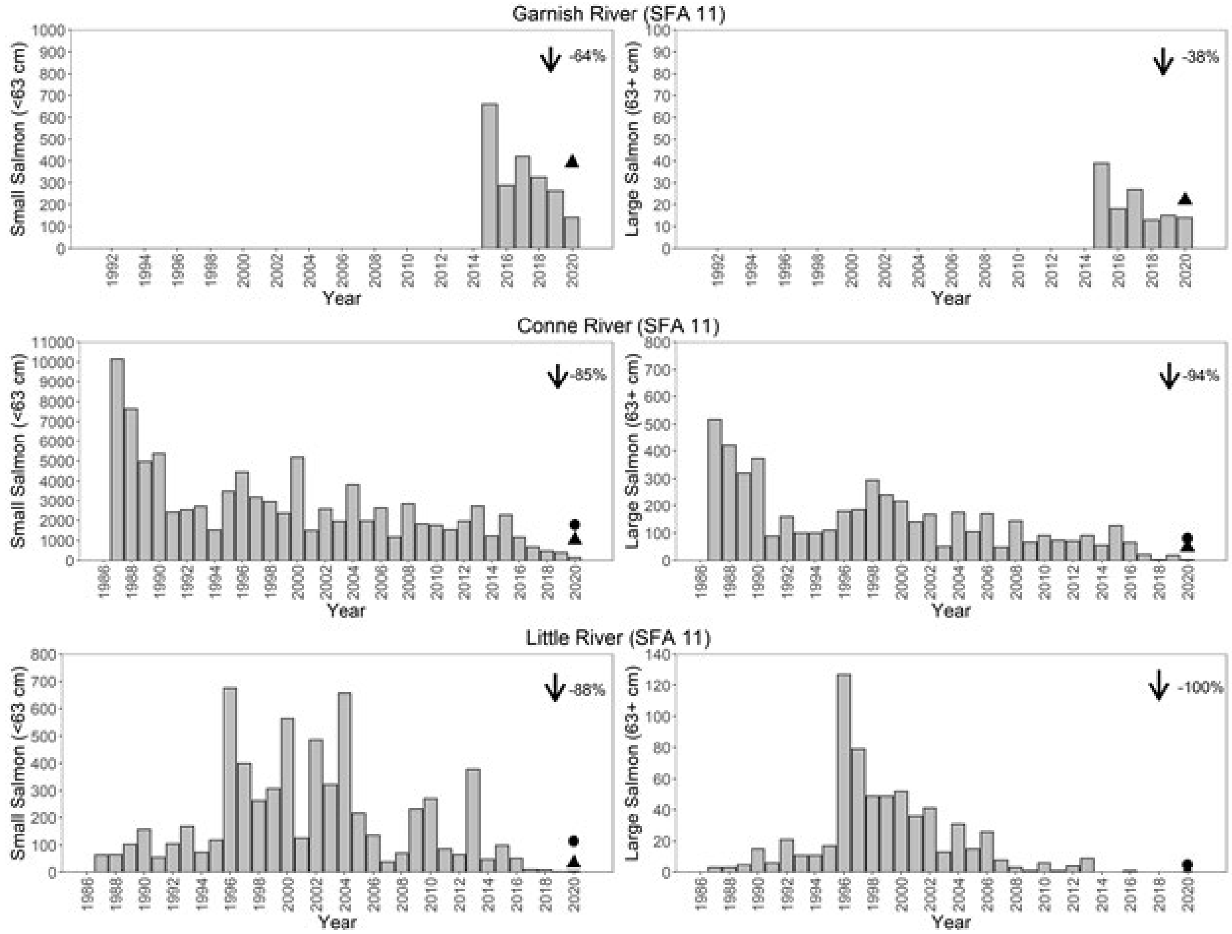

Figure 11. Total returns of small and large salmon at three monitored rivers in SFA 11 (Garnish River, Conne River, and Little River). Black triangles represent the previous generation average (2014–19 for Garnish River and Conne River; 2015–19 for Little River). Black circles represent the previous three generation average. Black arrows and percent changes shown represent 2020 small and large salmon returns compared to the previous generation average.

Southwest Newfoundland (SFAs 12-13)

There are 10 scheduled salmon rivers in SFA 12. No rivers were assessed in 2020.

There are 18 scheduled salmon rivers in SFA 13. Two rivers were assessed in 2020: Corner Brook Stream and Little Barachois Brook. Total returns to Little Barachois Brook were estimated using a combination of a counting fence installed 8–9 km upriver and a late-summer snorkel survey in the watershed below the fence to account for salmon lower in the watershed. Little Barachois Brook was first monitored in 2019 where returns were estimated to be 631 fish. In 2020, the fence count and snorkel survey resulted in an estimate of 899 Atlantic Salmon, a 42% increase over 2019 (Fig. 12). Estimated egg depositions for this river were below the LRP in 2019 (91%), and were between the LRP and USR (i.e., in the cautious zone) in 2020 at 106% (Table 3).

Total returns to Corner Brook Stream in 2020 (183 fish) were the highest on record, exceeding the previous generation average by 81% (Fig. 12; Table 3). Estimated egg depositions in 2020 were the highest on record (342%). From 2009–20, this population exceeded the USR every year except 2017.

Atlantic Salmon were typically monitored on Harrys River using a DIDSON (dual-frequency identification sonar). Unfortunately, this river was not monitored in 2020 due to COVID-19 impacts on field operations.

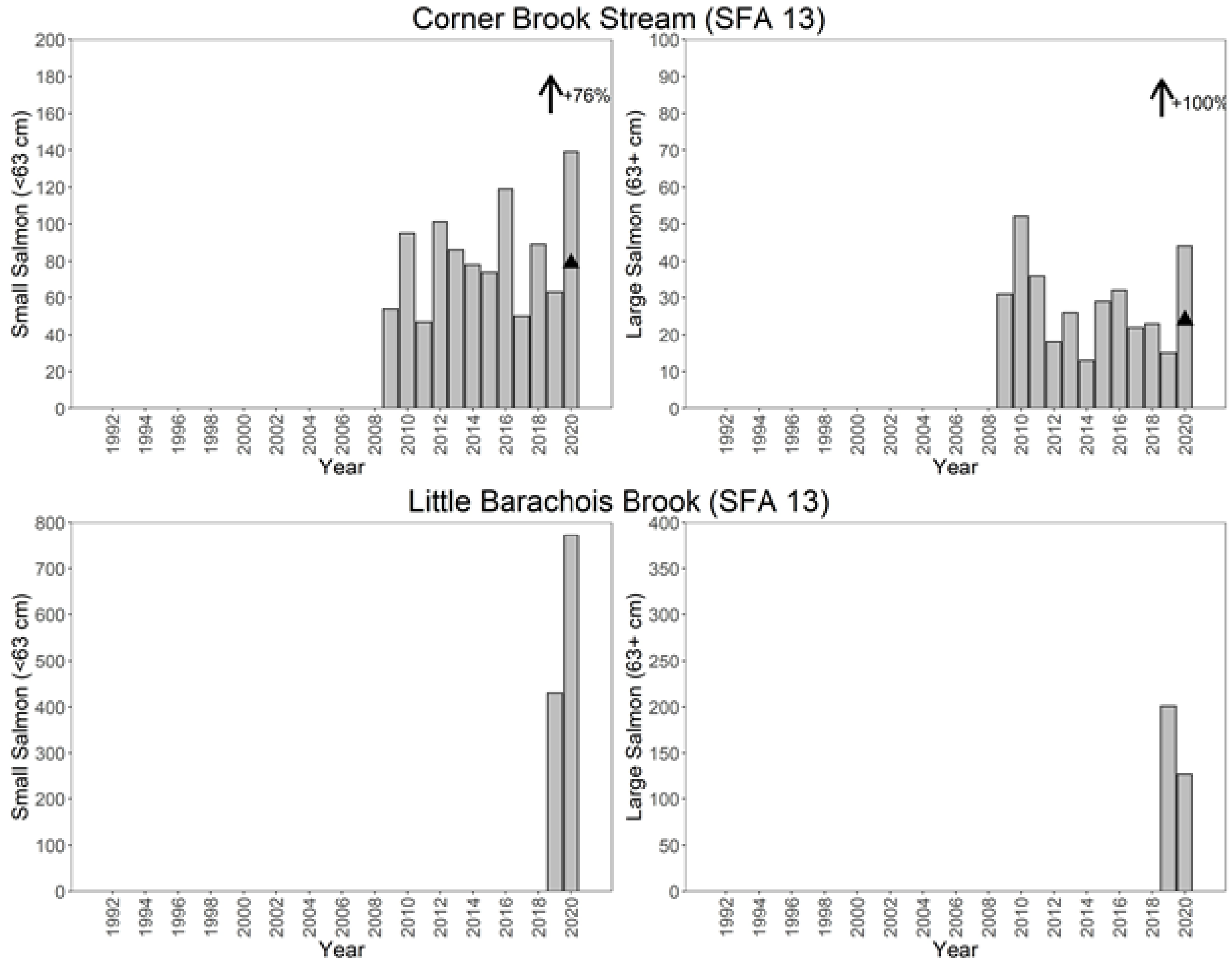

Figure 12. Total returns of small and large salmon at two monitored rivers in SFA 13 (Little Barachois Brook and Corner Brook Stream). Black triangles represent the previous generation average (2014–19). Black arrows and percent changes shown represent 2020 small and large salmon returns compared to the previous generation average.

Northwest Newfoundland (SFA 14A)

There are 22 scheduled salmon rivers in SFA 14A. Two rivers were assessed in 2020: Torrent River and Western Arm Brook. Total returns of Atlantic Salmon to Western Arm Brook in 2020 were 40% and 43% lower than the previous generation average and three generation average, respectively (Fig. 13; Table 3). In contrast, estimated total returns to Torrent River in 2020 were slightly higher (+10%) than the previous generation average and similar to the previous three generation average (Fig. 13; Table 3).

Estimated egg depositions on Torrent River and Western Arm Brook exceeded the USR for both rivers in 2020 (783% and 215% of the LRP, respectively) and had done so annually since 1984 and 1992, respectively.

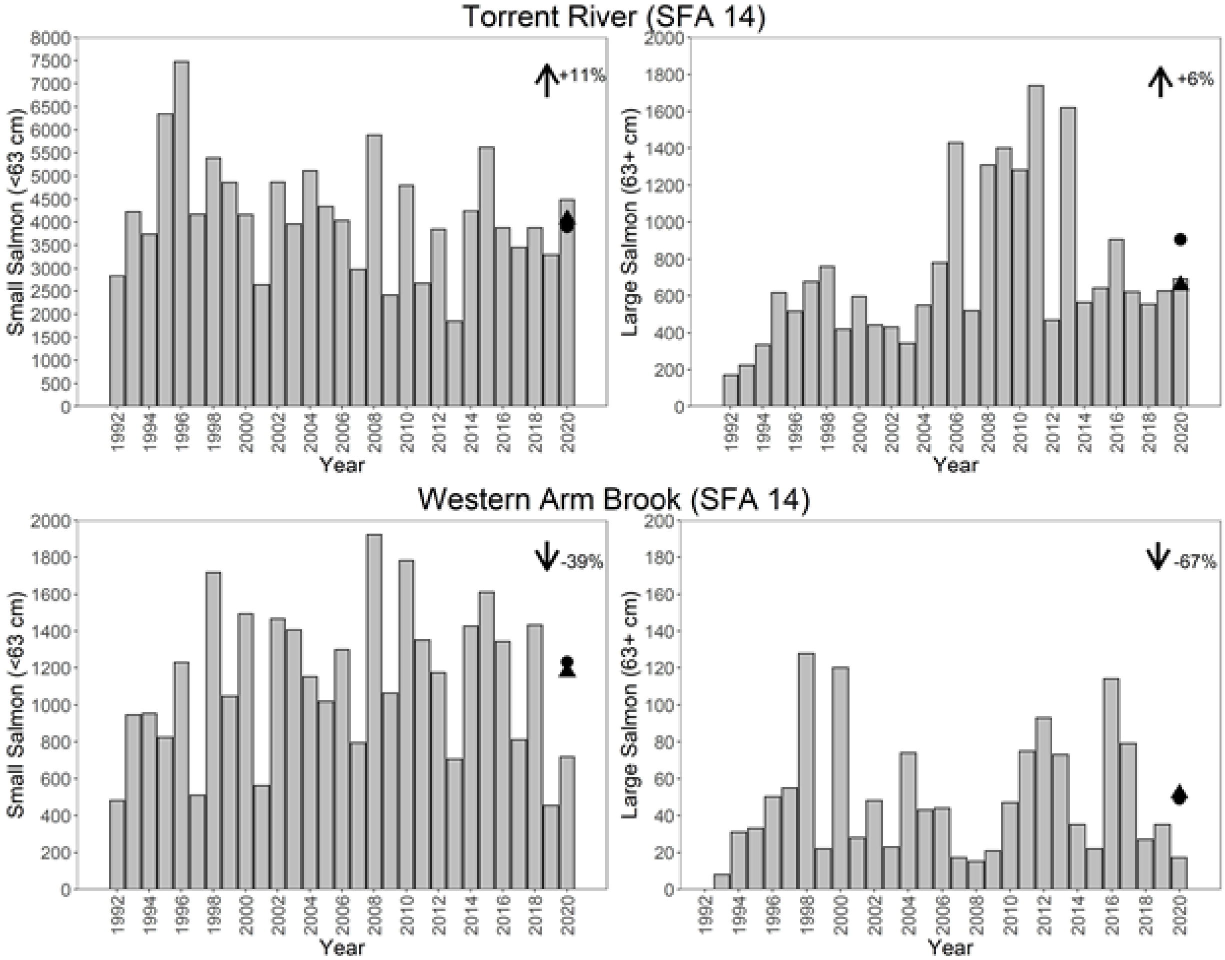

Figure 13. Total returns of small and large salmon at two monitored rivers in SFA 14A (Torrent River and Western Arm Brook). Black triangles represent the previous generation average (2014–19). Black circles represent the previous three generation average. Black arrows and percent changes shown represent 2020 small and large salmon returns compared to the previous generation average.

Salmon Abundance Index

The Atlantic Salmon abundance index was calculated by modeling total returns from monitored rivers combined using a negative binomial GLM with log link function and year as a factor (Fig. 14). This was compiled for Newfoundland and for Labrador separately, and included data since the commercial moratoriums (1992 for Newfoundland and 1998 for Labrador). It was important to note the relatively high amount of standard error around the abundance estimate for each year. This index was used to examine temporal patterns in Atlantic Salmon abundance on monitored rivers simultaneously within each of the two primary areas, as opposed to providing an actual estimate of total Atlantic Salmon abundance for Newfoundland and for Labrador.

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). In 2020, total returns to multiple monitored rivers in Newfoundland increased slightly above 2017–19 levels. As a result, the estimated marginal mean log abundance in 2020 was slightly higher as well, although there was considerable error around the estimates for each year (Fig. 14). Overall, the salmon abundance index suggested that Atlantic Salmon returns to monitored rivers in Newfoundland had not rebounded to pre-2016 levels.

In Labrador, the estimated marginal mean log salmon abundance in 2020 was the lowest since 2001 (Fig. 14). However, caution was warranted when interpreting the 2020 abundance estimate; total returns of Atlantic Salmon to Sand Hill River were typically an order of magnitude higher than that of the other three rivers monitored annually in Labrador (DFO 2020a, 2020b) and there was no estimate of returns to Sand Hill River in 2020 due to COVID-19 impacts on field operations. Without a count on Sand Hill River in 2020, it was not surprising that the estimated abundance from a negative binomial GLM for Labrador rivers declined slightly in 2020 compared to recent years. In addition, the standard error around the estimated marginal mean abundance for each year was relatively high.

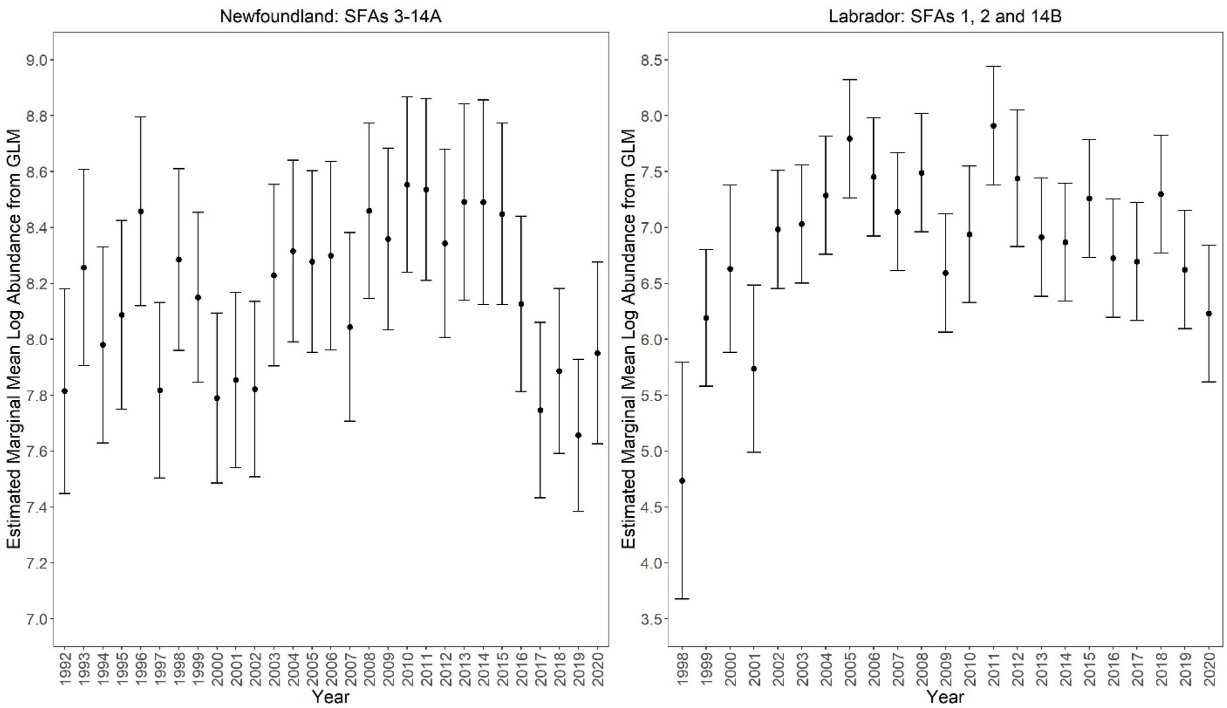

Figure 14. Estimated marginal mean log Atlantic Salmon abundance from negative binomial GLMs (log link function and year as a factor) applied to data from monitored rivers in Newfoundland (left) and in Labrador (right). Vertical bars represent standard errors. Each model only includes data since the commercial moratorium (1992 for Newfoundland and 1998 for Labrador).

Smolt Production and Marine Survival

Atlantic Salmon smolt abundance was typically monitored each year during the seaward migration on five rivers in Newfoundland: Campbellton River (SFA 4), Rocky River (SFA 9), Conne River (SFA 11), Garnish River (SFA 11), and Western Arm Brook (SFA 14A).

Due to the impacts of COVID-19 on DFO Science field operations, there were no smolt production data available for 2020. As a result, marine survival could not be estimated for the 2021 adult return year.

Marine survival estimates for 2020 were based on 2019 smolt migrations and corresponding small salmon returns in 2020. In 2020, marine survival of returning adult Atlantic Salmon was lower than the previous generation average and previous three generation average on Campbellton River (SFA 4), Garnish River (SFA 11), Conne River (SFA 11), and Western Arm

Brook (SFA 14A) (Fig. 15). Estimated marine survival was less than 1% for Conne River (0.6%) and Garnish River (0.9%), which represented record lows for both rivers (Fig. 15; Table 3). This was the third consecutive year where marine survival estimates for these south coast rivers did not exceed 3%. In contrast, marine survival on Rocky River in SFA 9 was 16.9% in 2020, a record high and an anomaly for the NL Region. In 2019, marine survival on this river was estimated at 14.7%, also higher than what was typically seen in SFAs 1–14B (Fig. 15). As returns of small salmon included a portion of repeat spawners, marine survival of smolt to maiden 1SW salmon would be slightly less than the numbers reported here.

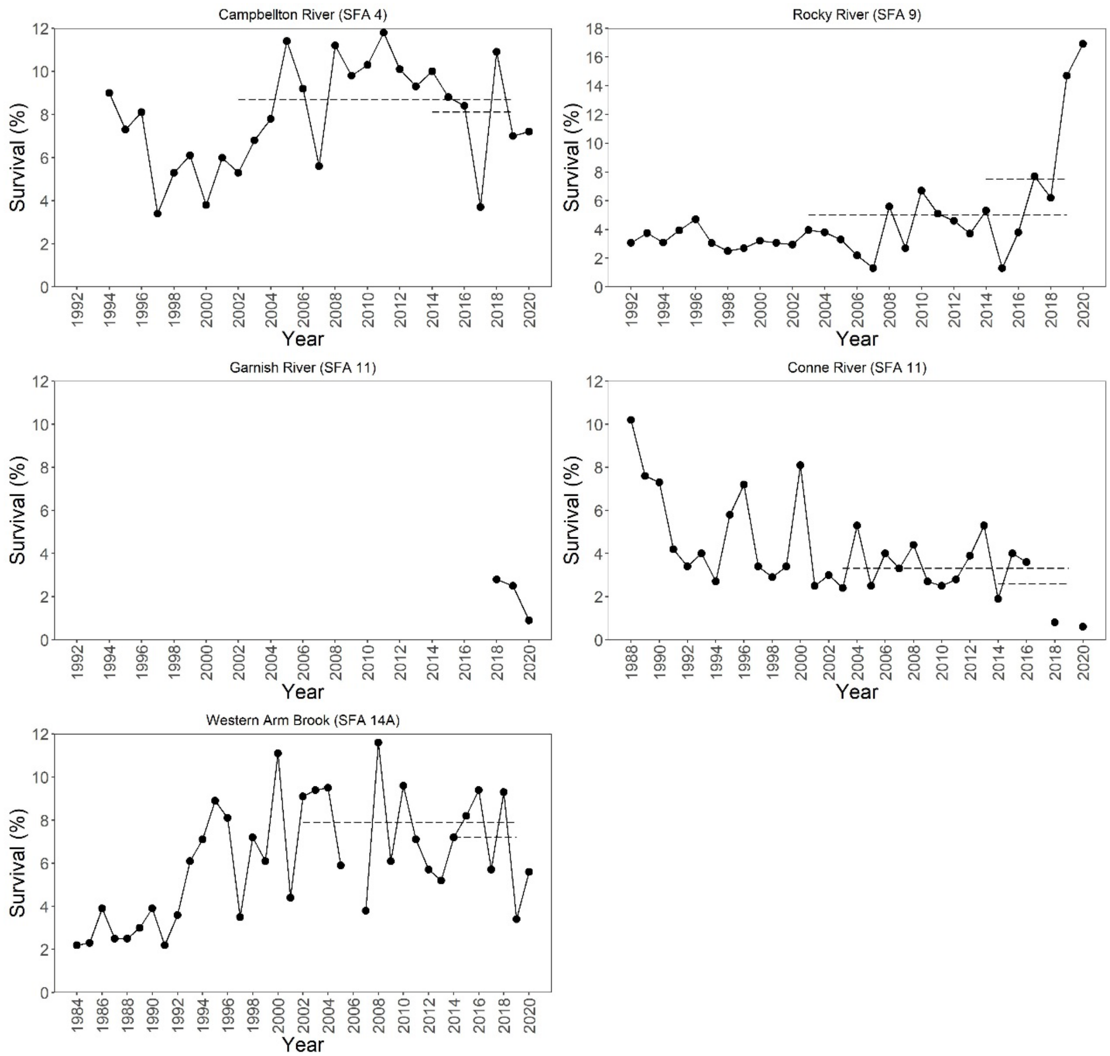

Figure 15. Marine survival rates of smolt to adult small salmon for monitored Newfoundland rivers. Survival rates have not been adjusted for marine exploitation during the commercial salmon fishery (prior to 1992) thus values represent survival of salmon back to the river. Horizontal dashed lines illustrate the previous generation average (2014–19) and previous three generation average where sufficient data are available. Values for 2020 for Campbellton River, Garnish River, Conne River, and Western Arm Brook are calculated using estimates of small salmon returns adjusted for late fence installations due to COVID-19 (see text for information on nonparametric bootstrap).

Ecosystem Considerations

Marine ecosystem conditions in the Newfoundland-Labrador Bioregion remained indicative of overall limited productivity of the fish community. Total biomass of the entire fish community remained much lower than prior to the collapse in the early-1990s. It showed some recovery up to the early to mid-2010s, when some declines where observed. Current total biomass of the fish community remained below the early-2010s level, but with some positive signals in 2020. Since the mid-2000s, this assemblage reverted to a finfish-dominated structure, though 2019–20 data suggested small increases in the proportion of shellfish.

Mean annual air temperature in Newfoundland and southern Labrador was near the 1991–2020 long-term average in 2020, characterized by a cold winter/spring and a warm summer. Summer SST were above average and sea ice was below average for the first time since 2014 and 2013, respectively (DFO 2021). The amplitude and duration of the warmest SST conditions in the shallower areas around Newfoundland has increased since the 1980s, in agreement with climate change projections.

Chlorophyll concentrations and zooplankton biomass were below normal in the early and mid-2010s, but increased to values above the long term (1999–2020) average since 2016–17 (DFO 2021). Changes in zooplankton community structure over the past decade resulted in fewer large and more small copepods, although the abundance of large, energy-rich calanoid copepods increased to above-normal levels in some areas since 2017 (DFO 2021). Additionally, changes in zooplankton seasonality (weaker spring and stronger summer and fall zooplankton signals) may have changed the quality and timing of food availability for upper trophic levels.

Sources of Uncertainty

Calculations of total returns and egg depositions on monitored rivers where angling was permitted included estimates of recreational harvest and catch-and-release mortality. Values presented in this report did not use 2020 angling estimates and will be updated once all angler log and phone survey data are processed. Therefore, some values presented here may change slightly once data are finalized; however, any changes are typically negligible.

Returns of angling logs by recreational anglers declined in recent years. Following the implementation of the license stub program in 1994, return rates ranged from 50–60% in 1994–97. Return rates were much lower in recent years averaging 20% from 2014–19 (range of 10–25%). The preliminary estimates of 2020 total returns and egg depositions presented in this report for assessed rivers where angling was permitted used river-specific angling estimates (harvested and released salmon) averaged over the previous generation. The relatively low return rate of angler logs in recent years added uncertainty for 2020 values for these rivers.

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 conservation egg requirement values.

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

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 AND ADVICE

Seventeen populations of Atlantic Salmon were assessed in 2020. Estimated Atlantic Salmon spawning escapements (eggs) exceeded the USR on two of three assessed rivers in Labrador (English River and Muddy Bay Brook) and on five of 14 assessed rivers in Newfoundland (Campbellton River, Middle Brook, Corner Brook Stream, Torrent River, and Western Arm Brook) (Fig. 16). Estimated egg deposition fell within the cautious zone (i.e., between the USR and LRP) on two Newfoundland rivers (Salmon Brook (Gander River) and Little Barachois Brook) (Fig. 16). During 2020, estimated egg depositions were below the LRP and assessed as being in the critical zone on one of three assessed rivers in Labrador (Southwest Brook) and seven of 14 assessed rivers in Newfoundland. Egg deposition estimates were particularly low in SFA 11 on the south coast of Newfoundland, where values ranged from 2–13% of river-specific LRPs.

Eight of the 14 rivers that were assessed during the generation prior to 2020 recorded relative declines in total returns in 2020 (Fig. 17). These declines were particularly high on all five monitored Atlantic Salmon rivers in SFAs 9, 10, and 11 on the south coast of Newfoundland (mean = -69%, range = -48% to -88%). Returns to Little River and Conne River in 2020 were >90% below their river-specific three generation averages (Fig. 17). Record low returns were observed on Conne River and Garnish River. In contrast, Atlantic Salmon returns to Corner Brook Stream had set a record high in 2020 (2009–20) and returns to five monitored rivers across the Northeast coast of Newfoundland (SFAs 4 and 5) and Northern Peninsula (SFA 14A) were within 10% of the previous generation average. In Labrador, returns to both monitored rivers were similar to, or above, previous generation and previous three generation averages (Fig. 16 and 17). In SFA 2, total returns to Southwest Brook and Muddy Bay Brook exceeded their previous generation averages (2013–19) by >65%. Estimated returns to Muddy Bay Brook were the third highest since monitoring began in 2002.

The South Newfoundland (SFAs 9–12) Atlantic Salmon populations remained a concern, especially those of Conne River and Little River. Total returns to Little River equaled four fish, the second lowest on record in the 34-year time series and the fourth consecutive year where fewer than ten fish had returned to this river. Total returns of salmon to Conne River in 2020 had set a fourth consecutive record low and were 92% below average returns over the previous three generations (2003–19). Marine survival estimates on monitored rivers in this region continued to be poor in 2020, setting record lows at <1% for both Garnish River (2018–20) and Conne River (1988–2020). South Newfoundland (i.e., COSEWIC Designatable Unit, [DU] 4) salmon populations were designated as threatened by COSEWIC (COSEWIC 2010). There was genetic evidence that farmed salmon escapees were breeding with wild Atlantic Salmon in southern Newfoundland rivers. Genomic analysis of Atlantic Salmon from Conne River suggested that introgression with farmed escaped salmon had occurred in lower parts of the watershed. The consequences of continued farmed salmon escapes and subsequent interbreeding with wild Atlantic Salmon would contribute to a loss of genetic diversity, although the long-term consequences on wild salmon populations were uncertain.

Management Advice

Caution is warranted in the management of Atlantic Salmon stocks in 2021. Total returns in 2020 rebounded slightly in several areas of the province after significant declines were observed in recent years. Returns to several monitored populations were similar to, or below, the previous generation average, which included values from some years when Atlantic Salmon returns to the NL Region were particularly poor (e.g., 2016 and 2017).

There should be no human-induced mortality on populations that were below the LRP except possibly for areas which have in-season reviews or special management plans.

Efforts should be made to increase returns to south coast rivers (i.e., DU 4), and options should be explored to mitigate known effects of finfish aquaculture escapees on wild salmon stocks.

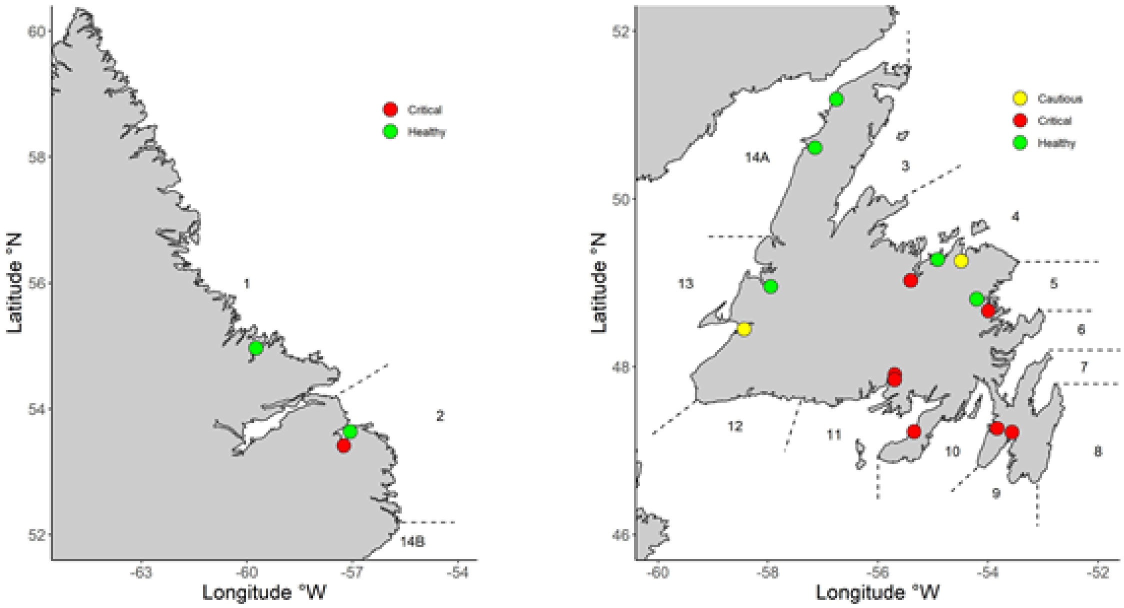

Figure 16. Map of Atlantic Salmon rivers monitored in 2020 in Newfoundland (right) and Labrador (left). Rivers are coloured by their estimated stock status zone as per the Precautionary Approach (DFO 2015). Designation of a population within a stock status zone is based on comparing the estimated egg depositions in to the river-specific LRP: critical zone (0–99% of LRP), cautious zone (100–149% of LRP), and healthy zone (≥150% of LRP). Numbers and dashed lines represent SFAs and their approximate boundaries.

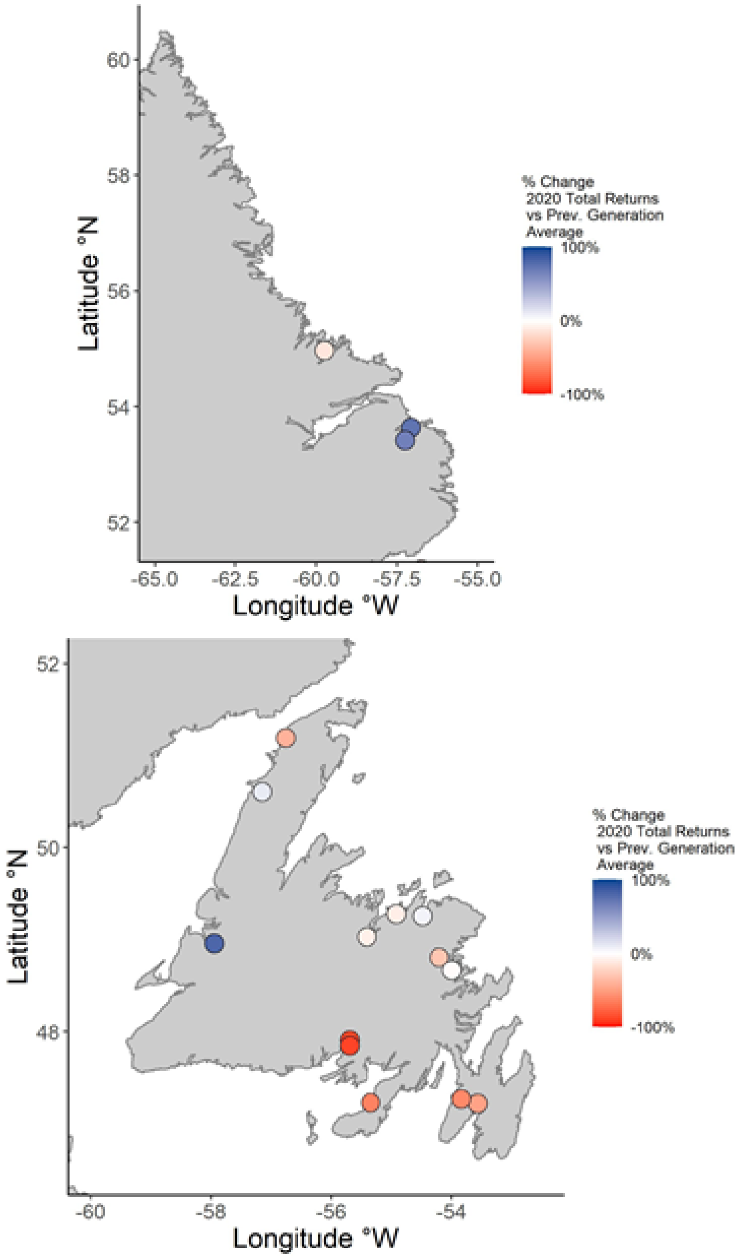

Figure 17. The percent change in 2020 total returns compared to the average returns over the previous generation for 17 monitored Atlantic Salmon populations in Newfoundland (bottom) and Labrador (top). Total returns in 2020 on each river are compared to average returns over the previous generation time period specific to each river (six years for most Newfoundland rivers and seven years for Labrador rivers). Percent change estimates are scaled between +100% (blue) and -100% (red).

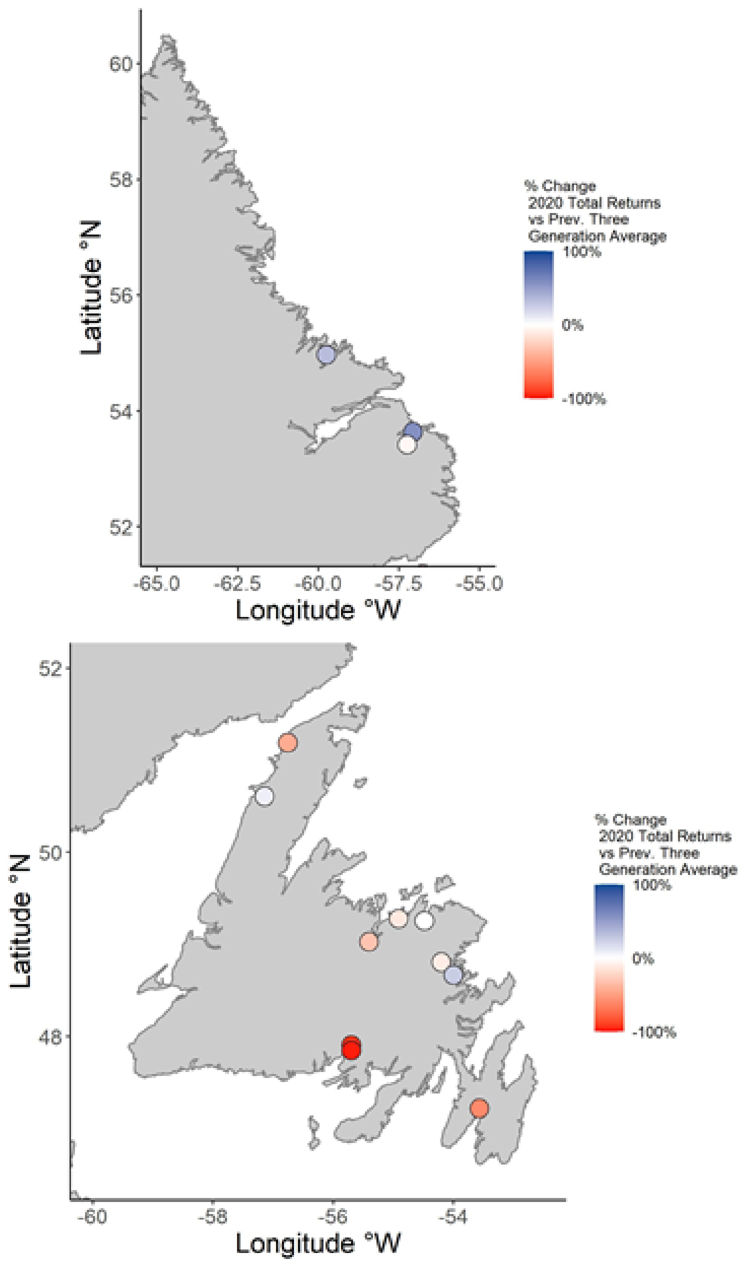

Figure 18. The percent change in 2020 total returns compared to the average returns over the previous three generations for 17 monitored Atlantic Salmon populations in Newfoundland (bottom) and Labrador (top). Total returns in 2020 on each river are compared to average returns over the previous three generation time period specific to each river. Percent change estimates are scaled between +100% (blue) and -100% (red).

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SOURCES OF INFORMATION

This Science Advisory Report is from the March 2–4, 2021 Regional Peer Review Process on the Assessment of Atlantic Salmon in Newfoundland and Labrador. Additional publications from this meeting will be posted on the DFO Science Advisory Schedule as they become available.

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APPENDIX – DETAILS ON CATCHES AND HARVESTS AND STATUS OF ATLANTIC SALMON IN NEWFOUNDLAND AND LABADOR

Table 1. Estimated harvest of Atlantic Salmon by number in Indigenous and Subsistence Fisheries in Labrador (SFAs 1 and 2), 2000–20. Estimates for 2020 are preliminary. The 2013–19 mean represents the previous generation mean.

Year	Number of Small Salmon (SFA 1A)	Number of Large Salmon (SFA 1A)	Total Number of Salmon (SFA 1A)	Number of Small Salmon (SFA 1B)	Number of Large Salmon (SFA 1B)	Total Number of Salmon (SFA 1B)	Number of Small Salmon (SFA 2)	Number of Large Salmon (SFA 2)	Total Number of Salmon (SFA 2)	Total Number of Salmon (all areas)
2000	770	481	1,251	3,341	610	3,952	1,212	260	1,472	6,675
2001	629	532	1,162	2,764	782	3,547	1,396	374	1,770	6,478
2002	838	438	1,276	2,771	577	3,348	2,197	422	2,619	7,243
2003	849	731	1,580	3,533	908	4,441	2,095	536	2,632	8,653
2004	980	614	1,593	3,842	1,596	5,438	3,564	1,486	5,050	12,081
2005	943	548	1,491	4,015	1,139	5,154	5,479	1,130	6,609	13,253
2006	930	734	1,664	4,493	904	5,397	4,955	1,451	6,406	13,467
2007	832	482	1,314	3,868	1,078	4,947	4,507	1,092	5,599	11,860
2008	1,260	1,395	2,655	3,885	1,549	5,433	4,694	961	5,656	13,743
2009	523	642	1,165	3,441	1,265	4,706	4,024	1,437	5,461	11,332
2010	1,147	719	1,866	5,079	1,970	7,050	3,929	1,151	5,080	13,996
2011	1,217	755	1,972	5,256	2,195	7,452	4,826	1,584	6,411	15,834
2012	938	1,007	1,945	4,802	2,155	6,956	4,237	1,066	5,303	14,204
2013	399	1,096	1,494	3,356	3,266	6,622	3,410	2,012	5,422	13,539
2014	665	768	1,433	4,632	2,206	6,838	3,662	1,026	4,688	12,959
2015	694	1,152	1,846	4,127	3,007	7,134	4,103	1,987	6,090	15,069
2016	681	962	1,643	2,524	2,795	5,320	3,531	1,352	4,883	13,240
2017	517	868	1,384	2,351	3,229	5,579	3,299	1,473	4,773	12,518
2018	572	790	1,362	3,626	2,132	5,757	4,582	1,156	5,738	12,858
2019	373	688	1,061	2,690	3,097	5,788	3,998	2,008	6,007	12,855
2020p	466	1,009	1,475	2,885	2,758	5,642	4,207	2,388	6,595	13,712
2013-2019 Mean	557	903	1,460	3,536	2,924	6,459	3,798	1,574	5,372	13,291
% Change	-16	+12	+1	-18	-6	-13	+11	+52	+23	+3

Table 2. Estimated harvest of Atlantic Salmon by weight (kg) in Aboriginal and Subsistence Fisheries in Labrador (SFAs 1 and 2), 2000–20. Estimates for 2020 are preliminary. The 2013–19 mean represents the previous generation mean.

Year	Weight (kg) of Small Salmon (SFA 1A)	Weight (kg) of Large Salmon (SFA 1A)	Total Weight (kg) of Salmon (SFA 1A)	Weight (kg) of Small Salmon (SFA 1B)	Weight (kg) of Large Salmon (SFA 1B)	Total Weight (kg) of Salmon (SFA 1B)	Weight (kg) of Small Salmon (SFA 2)	Weight (kg) of Large Salmon (SFA 2)	Total Weight (kg) of Salmon (SFA 2)	Total Weight (kg) of Salmon (all areas)
2000	1,537	1,914	3,451	6,574	2,451	9,024	2,242	897	3,139	15,614
2001	1,288	2,092	3,379	5,708	3,093	8,800	2,793	1,378	4,172	16,351
2002	1,676	1,793	3,469	5,710	2,648	8,358	4,196	1,549	5,745	17,572
2003	1,721	3,115	4,836	7,373	3,911	11,284	4,102	1,885	5,987	22,108
2004	2,000	2,493	4,493	8,038	6,164	14,202	7,341	5,512	12,852	31,547
2005	2,023	2,281	4,304	8,093	4,650	12,743	10,922	3,946	14,868	31,914
2006	1,913	2,819	4,732	9,276	3,512	12,788	10,008	5,193	15,201	32,721
2007	1,492	1,536	3,028	6,814	3,778	10,592	8,764	4,073	12,837	26,456
2008	2,560	6,152	8,712	7,765	7,420	15,185	9,071	3,373	12,444	36,340
2009	1,243	2,638	3,881	6,931	5,594	12,524	7,956	5,449	13,405	29,810
2010	2,497	3,168	5,665	10,619	8,183	18,802	7,828	4,160	11,988	36,456
2011	2,648	3,310	5,959	11,189	9,516	20,705	9,602	5,715	15,316	41,979
2012	1,673	4,803	6,476	8,956	9,319	18,275	8,110	3,699	11,809	36,560
2013	854	4,530	5,384	6,900	13,405	20,305	6,920	7,364	14,284	39,973
2014	1,322	3,063	4,385	9,450	8,122	17,572	6,891	3,692	10,583	32,539
2015	1,349	4,749	6,098	8,164	13,093	21,257	7,988	7,093	15,081	42,435
2016	2,932	6,941	9,873	4,959	13,152	18,111	6,688	4,929	11,618	39,601
2017	2,367	6,421	8,788	4,637	14,140	18,777	6,251	5,557	11,808	37,475
2018	1,128	3,377	4,505	7,114	8,810	15,923	8,295	4,084	12,379	32,807
2019	738	2,876	3,614	5,143	14,197	19,340	7,368	7,470	14,838	37,791
2020p	901	4,343	5,244	5,336	12,346	17,682	8,011	9,500	17,512	40,437
2013-2019 Mean	1,104	3,793	4,897	7,004	12,676	19,679	7,200	5,741	12,941	37,517
% Change	-18	+15	+7	-24	-3	-10	+11	+65	+35	+8

Table 3. Summary of Atlantic Salmon stock status in Newfoundland and Labrador (SFAs 1–14B). The LRP and USR correspond to 100% and 150% of the previously defined conservation egg requirement, respectively. One generation corresponds to five or six years in Newfoundland and seven years in Labrador (see text for more information on river-specific generation times). Marine survival estimates are calculated by dividing the small (<63 cm) salmon returns in 2020 to smolt counts in 2019. Rivers marked with an asterisk (*) have undergone various enhancement activities in the past. Atlantic Salmon returns to Rattling Brook (SFA 4) were monitored 2020, however, egg deposition is not estimated and this river is not assessed due to recent enhancement activities.

River (SFA)	Total Returns (2020)	Percent Change in Returns from Previous Generation Average (16 rivers)	Percent Change in Returns from Previous 3 Generations Average (13 rivers)	Percent of River-specific LRP Attained (2020)	% Change Conservation Egg Requirement from Previous Generation Average	No. Years LRP met or exceeded (2020 plus previous generation)	Marine Survival (%)
English River (SFA 1)	694	-13%	+33%	197%	-14%	8 of 8	NA
Southwest Brook (SFA 2)	293	+66%	-4%	92%	+58%	1 of 8	NA
Muddy Bay Brook (SFA 2)	535	+73%	+57%	222%	+81%	6 of 8	NA
*Exploits River (SFA 4)	20,539	-8%	-31%	31%	-10%	0 of 7	NA
*Rattling Brook (SFA 4)	1,238	+290	NA	NA	NA	NA	NA
Campbellton River (SFA 4)	3,195	-9%	-12	270%	-12%	7 of 7	7.2
Salmon Bk., Gander River (SFA 4)	1,193	+6%	+0%	138%	-9%	5 of 6	NA
Middle Brook (SFA 5)	2,117	-30%	-10%	225%	-29%	7 of 7	NA
*Terra Nova River (SFA 5)	4,875	-2%	+25%	75%	+0%	0 of 7	NA
*Rocky River (SFA 9)	198	-48%	-59%	20%	-48%	0 of 7	16.9
Northeast River-Placentia (SFA 10)	298	-60%	NA	99%	-72%	5 of 6	NA
*Little River (SFA 11)	4	-88%	-97%	2%	-96%	0 of 6	NA

River (SFA)	Total Returns (2020)	Percent Change in Returns from Previous Generation Average (16 rivers)	Percent Change in Returns from Previous 3 Generations Average (13 rivers)	Percent of River-specific LRP Attained (2020)	% Change Conservation Egg Requirement from Previous Generation Average	No. Years LRP met or exceeded (2020 plus previous generation)	Marine Survival (%)
*Conne River (SFA 11)	157	-86%	-92%	7%	-85%	1 of 7	0.6
Garnish River (SFA 11)	155	-63%	NA	13%	NA	0 of 6	0.9
Corner Brook Stream (SFA 13)	183	+81%	NA	342%	+85%	7 of 7	NA
Little Barachois Brook (SFA 13)	899	NA	NA	106%	NA	1 of 2	NA
Torrent River (SFA 14A)	5,179	+10%	+8%	783%	+11%	7 of 7	NA
Western Arm Brook (SFA 14A)	735	-40%	-43%	215%	-42%	7 of 7	5.6

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