Fisheries and Oceans Canada
Pêches et Océans Canada

Ecosystems and Oceans Science
Sciences des écosystèmes et des océans

Gulf Region

Canadian Science Advisory Secretariat
Science Response 2020/028

UPDATE OF INDICATORS OF ATLANTIC SALMON (*SALMO SALAR*) IN DFO GULF REGION SALMON FISHING AREAS 15 – 18 FOR 2019

Context

The last assessment of stock status of Atlantic Salmon for Fisheries and Oceans Canada (DFO) Gulf Region was completed after the 2013 return year (DFO 2014) and updates on stock status in 2014 to 2018 for each of the four Salmon Fishing Areas (SFA 15-18) were prepared (DFO 2015a; 2015b, 2016, 2017, 2018a, 2019). DFO Fisheries and Aquaculture Management (FAM) requested an update of the status of the Atlantic Salmon stocks in DFO Gulf Region for 2019. Indicators for adult and juvenile Atlantic Salmon in SFAs 15 to 18 are provided in this report. This Science Response Report results from the Science Response Process of February 21, 2020 on the update of indicators of Atlantic salmon to 2019 for Salmon Fishing Areas 15 to 18, DFO Gulf Region.

Background

All rivers flowing into the southern Gulf of St. Lawrence are included in DFO Gulf Region. Atlantic Salmon (*Salmo salar*) management areas in DFO Gulf Region are defined by four salmon fishing areas (SFA 15 to 18) encompassing portions of the three Maritime provinces (New Brunswick, Nova Scotia, and Prince Edward Island) (Fig. 1).

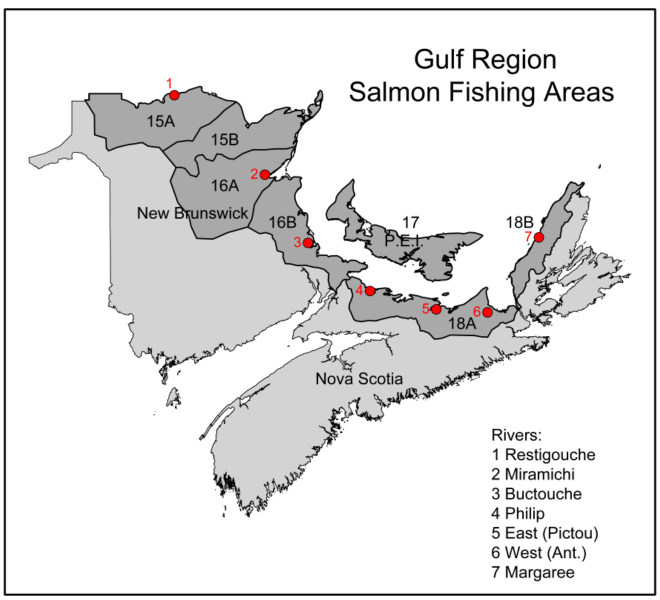

Figure 1: Salmon Fishing Areas in the DFO Gulf Region and locations of New Brunswick and Nova Scotia rivers mentioned in the report.

For management purposes, Atlantic Salmon are categorized as small salmon (grilse; fish with a fork length less than 63 cm) and large salmon (fish with a fork length equal to or greater than 63 cm).

This report presents indicators of abundance for adult salmon and juvenile life stages. To provide a perspective on recent trends, the changes (exponential regression of change) in the indicators over the recent 12 years, approximately two generations for Atlantic Salmon, are presented.

During 2015 to 2019, mandatory catch and release measures for the recreational fishery were in effect in all Salmon Fishing Areas where recreational fisheries were authorized. This was a change from 2014 and previous years when retention of small salmon had been allowed in SFA 15, SFA 16A, and SFA 18. Since 1998, rivers in southeast New Brunswick (SFA 16B) have been closed to all directed salmon fishing.

In this report, status is assessed relative to a Limit Reference Point (LRP) consistent with the precautionary approach (PA; DFO 2009), as recently defined for Atlantic Salmon rivers in DFO Gulf Region (DFO 2018b). In conformity with the PA, the management objective is to have a low probability (5% or less) of the stock being below the LRP (i.e. in the critical zone).

Environmental conditions in 2019

Air temperature data collected from the Environment and Climate Change Canada meteorological station (station number 8100989) in Miramichi (NB) was used to characterize summer conditions in 2019. The mean air temperature during the summer months (July and August) in 2019 was 19.8ºC, lower than the record high value of 21.3°C recorded in 2018 (Fig. 2). There is a statistically significant ($p < 0.001$) increasing trend over the time series with data, 1873 to 2019; the mean summer air temperature has increased by 2.15°C over the past 100 years (Fig. 2).

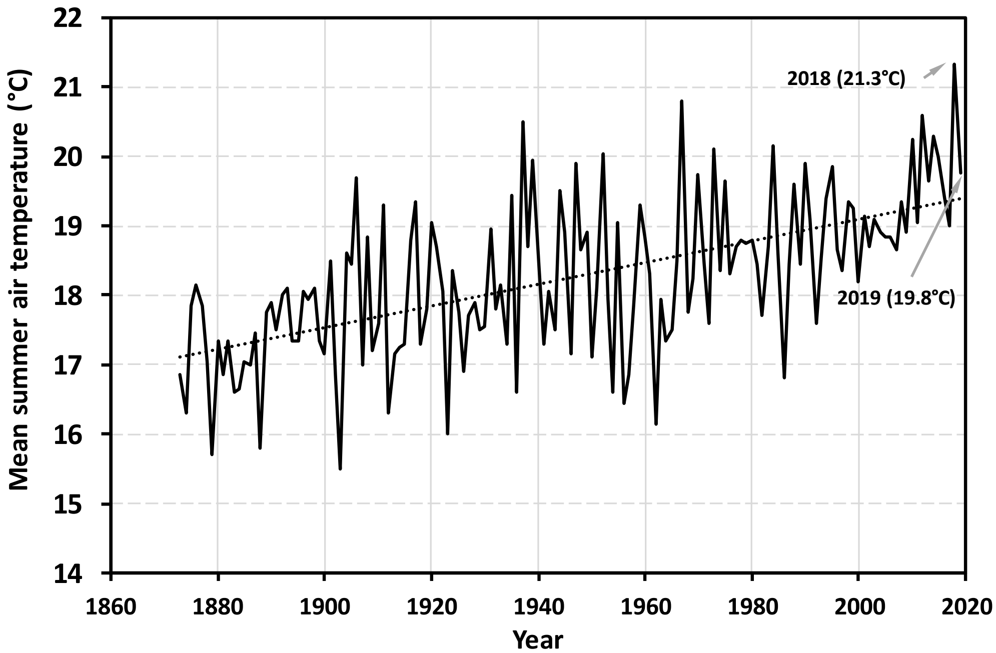

Figure 2: Mean annual summer (July and August) air temperatures and linear trend in mean temperature based on data from the Environment and Climate Change Canada meteorological station in Miramichi (station 8100989), 1873 to 2019.

High air temperatures in the Miramichi area during the summer of 2019 resulted in high water temperature (> 23ºC; temperature at which adult salmon become stressed) events in the Miramichi River. High river temperatures occurred between 4 July and 22 August at the monitoring station in the Little Southwest Miramichi River (Upper Oxbow site; Fig. 3). The maximum water temperature was recorded on July 31 at 29.4°C.

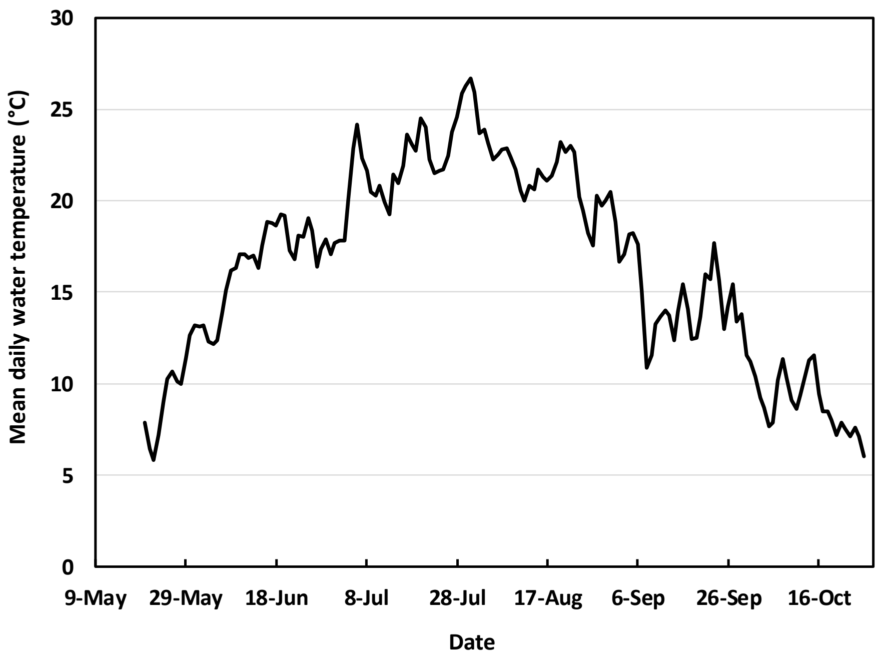

Figure 3: Mean daily water temperatures monitored at the Upper Oxbow site of the Little Southwest Miramichi River (SFA 16) in 2019. Data were obtained from the Miramichi River Environmental Assessment Committee monitoring station.

The daily maximum water temperature at the Little Southwest Miramichi River monitoring station exceeded 23°C for 35 days in 2019, fewer days than in 2018 and 1999 (Fig. 4). Water temperatures experienced at different locations in large rivers can be quite variable and generally water temperatures in the Miramichi River (SFA 16) are much warmer than those of the Restigouche (SFA 15) and Margaree (SFA 18) rivers.

The resulting high water temperatures in 2019 prompted angling restrictions in the Miramichi River system to mornings only (6 am to 11 am) for six days between 1 August and 7 August and the closure of cold water holding pools on two occasions; the first for five days between 19 July and 23 July, and the second for ten days between 30 July and 8 August (DFO 2020). Management interventions in the Miramichi River in 2018 were more severe, with morning only fishing for 18 days and the closure of cold water holding pools for 47 days (DFO 2019). For the Restigouche River (SFA 15) and the Margaree River (SFA 18), there were no closures in 2019 associated with high water temperature events while in 2018 some temporary closures were in place in those rivers.

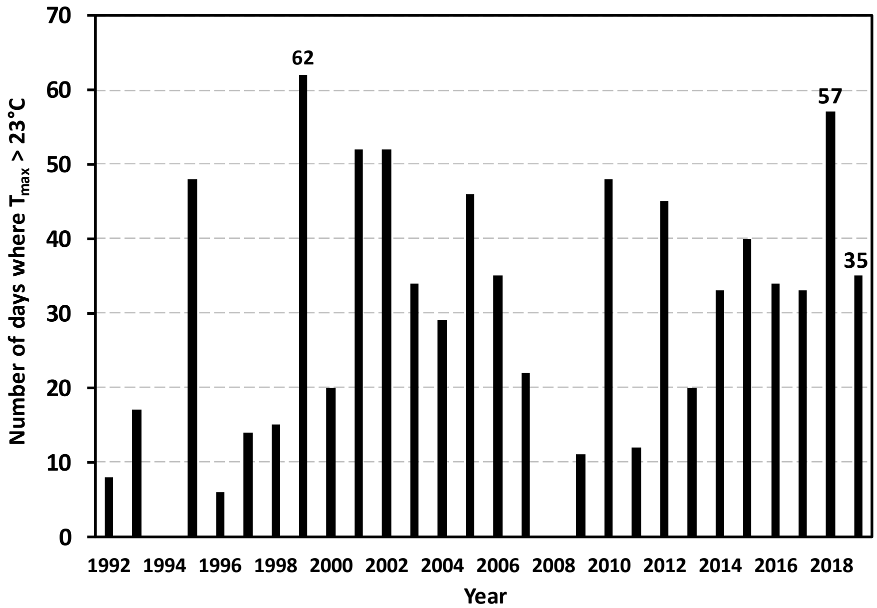

Figure 4: Number of days per year when the daily maximum water temperature exceeded 23°C at monitoring stations in the Little Southwest Miramichi River (SFA 16) during 1992 to 2019. Data for 1992 to 2013 are from the DFO station above Catamaran Brook whereas for 2014 to 2019, the data are from the downstream Upper Oxbow site (Miramichi River Environmental Assessment Committee station).

During the winter (Jan. and Feb.) of 2019, flows were excessive in many monitored rivers of DFO Gulf Region including the Southwest Miramichi, Northeast Margaree, and Wilmot rivers (Fig. 5). Similarly, a record high flow for the month of April was observed in 2019 for the Southwest Miramichi River, a flow of 682 m^3 per second compared to the long-term monthly flow for April of 329 m^3 per second (Fig. 5a). The Upsalquitch and Northeast Margaree rivers also experienced an excessive flow in April (Figs. 5b and 5c). The Wilmot River (SFA 17) experienced normal flows in the spring but excessive flows from July to December due to post – tropical storms, a record flow in November of 1.74 m^3 per second (Fig. 5d). Excessive flows, particularly during the winter, can have negative consequences on egg survival and juvenile abundances in subsequent years.

The low flow period was not severe in 2019 in NS and PEI (Figs. 5c and 5d), however, lower than average flows were observed in both the Southwest Miramichi and Upsalquitch rivers during the summer (Figs. 5a and 5b). Deficient flows were observed in June for the Upsalquitch River and a prolonged low flow period from June to October.

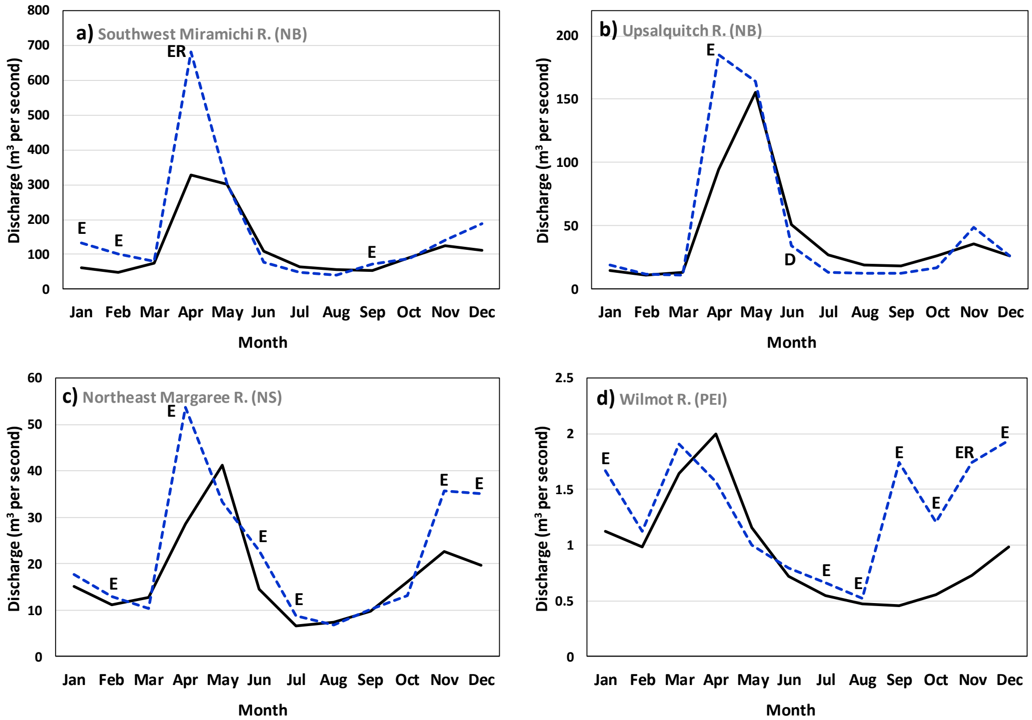

Figure 5: Monthly flow conditions in 2019 (blue dashed line) and long-term monthly flow conditions (black line; 1919-2015) for Environment and Climate Change Canada index rivers within the DFO Gulf Region. In the graphs, E = excessive flow (above 75th percentile), ER = excessive and record flow, and D = deficient flow (below the 25th percentile).

Analysis and Response

Abundance indices of adult salmon

SFA 15A Restigouche River

Information on adult salmon abundance from the Restigouche River (NB), which excludes the Matapedia River which is entirely within the province of Quebec, comes primarily from angling catches as well as end of season spawner counts. For recreational fisheries, catches in the Restigouche River (NB) are based on lodge catch reports compiled by DFO Science and Crown Reserve angling catches compiled by the province of New Brunswick. Catches exclude those from public waters. As of the date of this review, the catch data from lodges for 2019 were incomplete with information missing from 6 of 22 lodges. Catches from all lodges were estimated by assuming that the catch data from the missing lodges were of the same proportion of the total catch based on the time series (2001-2018).

Angling effort from lodges and leases in 2019 was estimated at 5,758 rod days, an 8% decrease in effort compared to the revised 2018 data (6,235 rod days). As in 2017 and 2018, lodges reduced the extent of their fishing activity to certain pools / stretches in August and September 2019 because of low water levels. Total parties registered in Crown Reserve waters in 2019 decreased by 2% from 2018 (922 anglers in 2019 compared to 943 in 2018). Of the registered parties, 72% had returned creel forms. Total Crown Reserve catches were estimated by raising the reported catches to all registered parties in 2019. Combined, the provisional recreational fishery catches for 2019 were 1,557 large salmon and 1,866 small salmon from the Restigouche River (NB).

Similar to previous assessments, returns of small salmon and large salmon to the Restigouche River (NB) were estimated from an assumed angling exploitation rate of 40% to which were added the assumed Indigenous food social and ceremonial (FSC) fishery harvests from the NB side of Chaleur Bay (DFO 2014).

Returns to the Restigouche River (NB) in 2019 were estimated at 4,145 large salmon and 4,700 small salmon (Fig. 6). As in 2017 and 2018, unfavourable angling conditions likely resulted in lower catches and a lower exploitation rate than the assumed value of 0.4. Over the recent 12 year period (approximately two generations), the median annual abundance of large and small salmon has decreased by 46% and 51%, respectively (Fig. 6).

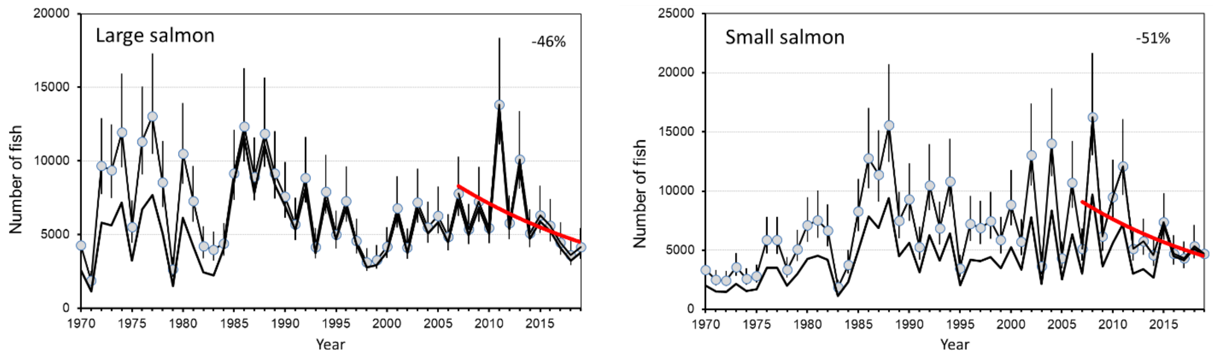

Figure 6: Estimated returns (grey circles and thin solid line are for 40% catch rate and the vertical error bars show range based on catch rates of 30% to 50%) and spawners (thick solid line and no symbols, for 40% catch rate assumption) based on angling catches of large salmon (left panel) and small salmon (right panel) to the Restigouche River (NB), 1970 to 2019. The data for 2019 are preliminary. The trend line (exponential regression, red line) for returns over the previous twelve year time period (2007 to 2019) and the corresponding percent change over that period are shown in each panel.

Assessments on the Restigouche River (NB) are also informed by visual spawner counts at the end of the season, after all fisheries and in-river losses are complete. In late September 2019, end of season visual spawner counts were conducted in the main stem of the Restigouche (NB) and four of its major tributaries (Kedgwick, Little Main Restigouche, Upsalquitch, and Patapedia) (Fig. 7). Water and weather conditions in 2019 were generally ideal for conducting visual spawner counts.

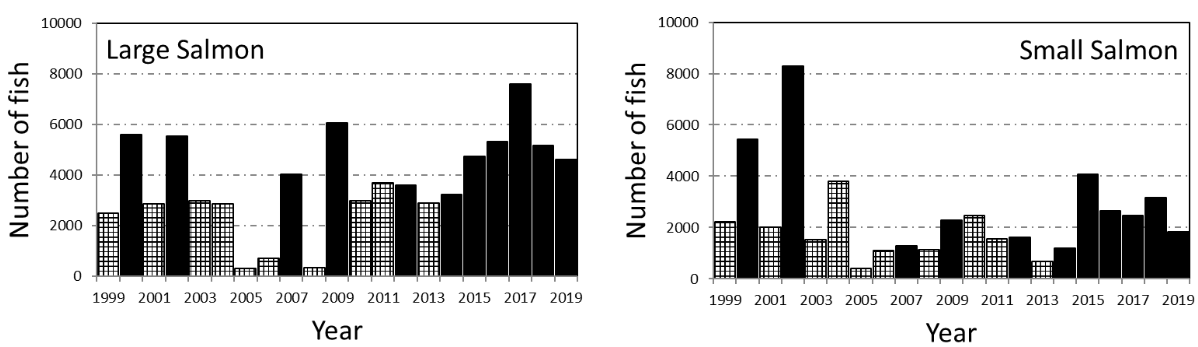

Figure 7: Total end of season visual spawner counts of Atlantic Salmon, by size group (large salmon left panel, small salmon right panel) from four tributaries and the main stem of the Restigouche River for 1999 to 2019. Years with incomplete visual spawner counts, mainly due to high water conditions, are shown as hatched bars.

Estimates of egg depositions relative to LRP

In 2019, the potential egg depositions from the combined returns of large and small salmon represented 59% of the LRP (Fig. 8). The potential egg depositions from large and small spawners combined, based on the recreational fisheries model and accounting for in-river fishery losses (assumed Indigenous FSC fishery harvests and 6% catch and release mortality in the recreational fishery) represented 54% of the LRP (Fig. 8). The potential egg depositions from large and small salmon spawners combined based on the end of season spawner count represented 66% of the LRP (Fig. 8).

Based on the recreational fisheries catches and an assumed angling exploitation rate of 40%, the egg depositions in the Restigouche River (NB) from returns and spawners have been below the LRP, i.e. in the critical zone, in 9 of the last 12 years. The eggs in the returns have declined by 46% over the same time period (Fig. 8).

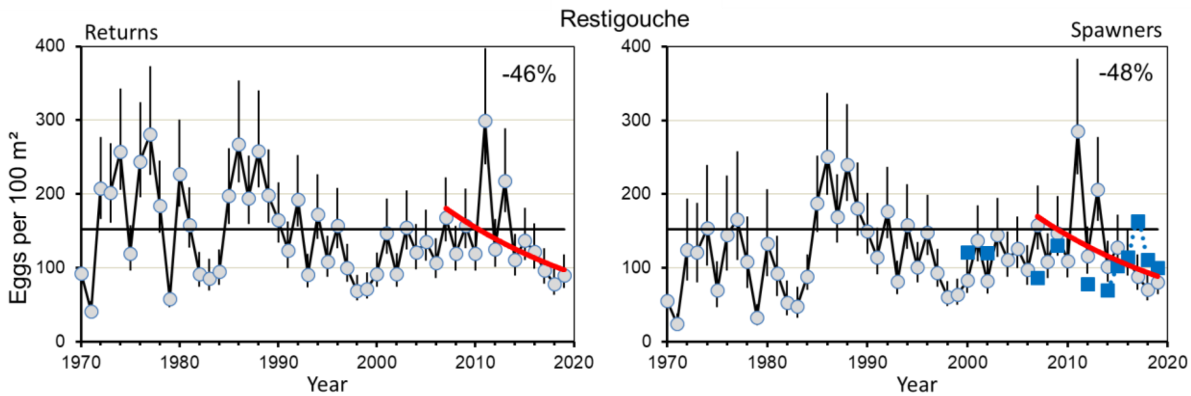

Figure 8: The potential eggs (expressed as eggs per 100 m² of wetted habitat area; total area of 26.39 million m²) by the combined small and large salmon returns (left panel) and spawners (right panel) in the Restigouche River (NB), 1970 to 2019. The estimates for 2019 are based on preliminary data. The solid horizontal line is the Limit Reference Point egg deposition rate of 152 eggs per 100 m² defined for the Restigouche River (NB; DFO 2018b). In the both panels, grey circles are estimates based on an assumed catch rate of 40% and the vertical bars show the range for catch rates of 30% to 50%. In the right panel, the eggs in spawners based on the end of season spawner counts are shown as blue square symbols for the years with complete coverage. The trend line (exponential regression, red line) for eggs in returns or eggs in spawners over the previous 12-year time period (2007 to 2019) and the corresponding percent change over that period are shown in each panel.

SFA 16A Miramichi River

The Miramichi River is the largest watershed in SFA 16 and DFO Gulf Region. Returns of small and large salmon are estimated using mark and recapture experiments based on catches at various monitoring facilities throughout the watershed (DFO 2014). The estimates of returns and spawners of Atlantic Salmon for the Miramichi River (Northwest and Southwest branches combined) and to each of the Northwest Miramichi and Southwest Miramichi branches are repeated here from DFO (2020).

The estimated return of large salmon to the Miramichi River in 2019 was 6,500 fish (median; 5th to 95th percentile range 4,300 to 10,600) and represented the lowest large salmon return estimate of the time series from 1971 to 2019 (Fig. 9). Small salmon returns to the Miramichi River in 2019 were estimated at 8,800 fish (median; percentile range 6,800 to 11,700), the same level as estimated in 2018, and well below the average of small salmon return estimates for the 1971 to 2018 time series (Fig. 9).

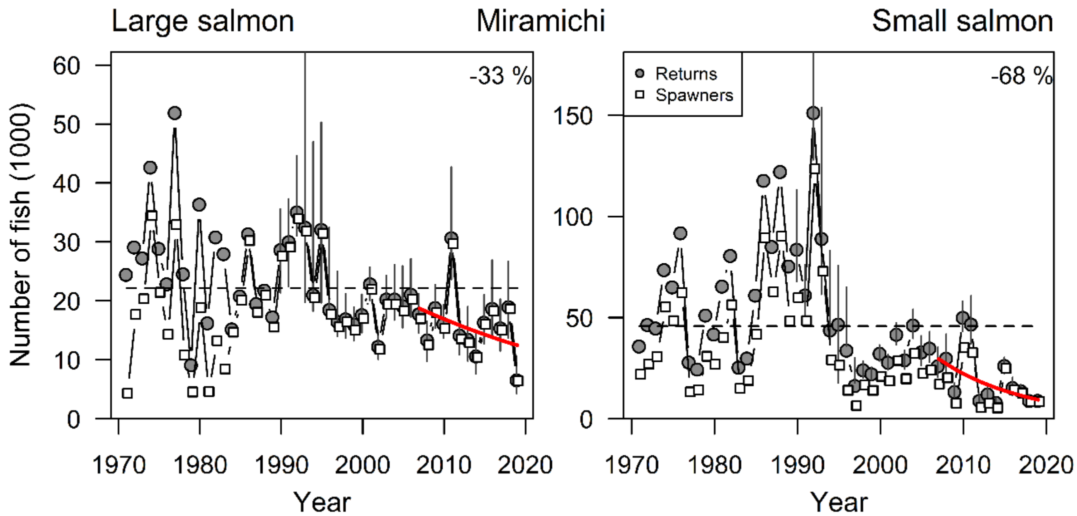

Figure 9: Estimated (median and 5th to 95th percentile range) returns and spawners of large salmon (left panel) and small salmon (right panel) for the Miramichi River for 1971 to 2019. The horizontal dashed line is the average of the median return estimates of large salmon or small salmon for the available time series. The trend line (exponential regression, red line) for returns over the previous 12-year time period (2007 to 2019) and the corresponding percent change over that period are shown in each panel.

Estimated returns for the two main branches of the Miramichi River are available since 1992 (Fig. 10). The return of large salmon to the Southwest Miramichi River in 2019 was estimated at 5,200 fish (median; percentile range 3,200 to 9,300) and represented the lowest large salmon return estimate of the 1992 to 2019 time series (Fig. 10). Small salmon returns to the Southwest Miramichi in 2019 were estimated at 5,900 fish (median; percentile range 4,200 to 8,600), the same abundance as estimated in 2018, and well below the average small salmon return estimate for the 1992 to 2018 time series (Fig. 10).

The return of large salmon to the Northwest Miramichi River in 2019 was estimated at 1,100 fish (median; percentile range 675 to 2,300) and represented the lowest large salmon return estimate of the 1992 to 2019 time series (Fig. 10). Small salmon returns to the Northwest Miramichi in 2019 were estimated at 2,800 fish (median; percentile range 2,000 to 4,100), the same abundance as estimated in 2018, and well below the average small salmon return estimate for the 1992 to 2018 time series (Fig. 10).

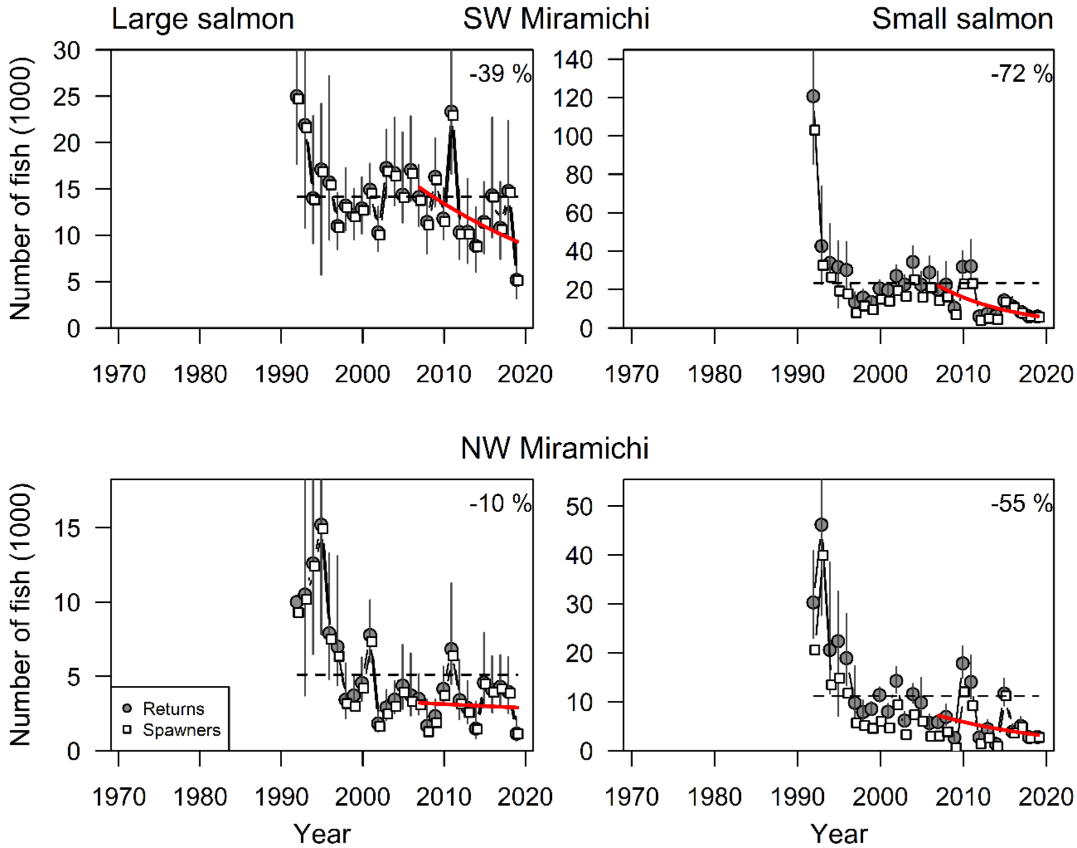

Figure 10: Estimated returns (median and 5th to 95th percentile range) and spawners (median) of large salmon (left panels) and small salmon (right panels) for the Southwest Miramichi River 1992 to 2019 (top row), and the Northwest Miramichi River 1992 to 2019 (bottom row). The horizontal dashed line is the average of the median return estimates of large salmon or small salmon for the available time series. The trend line (exponential regression, red line) for returns over the previous 12-year time period (2007 to 2019) and the corresponding percent change over that period are shown in each panel.

Over the recent 12-year period, approximately two generations for Atlantic Salmon, the estimated returns of large salmon have declined 33% in the Miramichi River, 39% in the Southwest Miramichi River, and 10% in the Northwest Miramichi River (Figs. 9 and 10). Similarly, the estimated returns of small salmon over the last 12 years have declined in the Miramichi River (68%) and in each of the main branches; declined 72% in the Southwest and 55% in the Northwest (Figs. 9 and 10).

Estimates of egg depositions relative to LRPs

The Southwest Miramichi system, that includes the Barnaby River, Southwest Miramichi River, and the Renous River, has a Limit Reference Point (LRP) egg deposition rate value of 152 eggs per 100 m^2 (DFO 2018b). The Northwest Miramichi system, that includes the Northwest Millstream, Little Southwest Miramichi River and the Northwest Miramichi River, has an LRP egg deposition rate value of 176 eggs per 100 m^2 (DFO 2018b). The LRP for the Miramichi River (Southwest Miramichi system and Northwest Miramichi system) is calculated as the habitat weighted average of the Southwest Miramichi system and Northwest Miramichi system LRP values, and is equivalent to 160 eggs per 100 m^2.

The eggs for small and large salmon returns and spawners for the Miramichi River and for the two main branches were determined using the 2019 biological characteristics (mean fork length, proportion female, eggs per fish). In 2019, the median egg deposition rates for returning small and large salmon combined were 84 eggs per 100 m^2 for the Miramichi River, 97 eggs per 100 m^2 for the Southwest Miramichi River, and 51 eggs per 100 m^2 for the Northwest Miramichi River (Table 1; Figs. 11 and 12).

These estimated egg deposition rates in 2019, translated into percentages of LRP attainment that ranged from 29% (median value) in the Northwest Miramichi River to 64% (median value) in the Southwest Miramichi River (Table 1).

Table 1: Summary of estimated eggs per 100 m² in the combined returns of small salmon and large salmon by river / tributary in 2019, relative to the Limit Reference Point (LRP), and the probability of the eggs in the returns being less than the LRP.

River / tributary	Eggs in returns expressed as eggs per 100 m²; median (5th to 95th perc. range)	LRP (eggs per 100 m²)	Percentage of LRP attained; median (5th to 95th perc. range)	Prob. (%) of egg deposition rate being less than the LRP
Miramichi River	84 (56 to 128)	160	53% (35% to 81%)	> 99%
Southwest Miramichi	97 (59 to 162)	152	64% (39% to 106%)	93%
Northwest Miramichi	51 (29 to 90)	176	29% (17% to 51%)	> 99%

Over the previous 12-year period, the estimated number of eggs in the returns of small and large salmon combined have declined 32% in the Miramichi River, 35% in the Southwest Miramichi River, and 23% in the Northwest Miramichi River (Figs. 11 and 12).

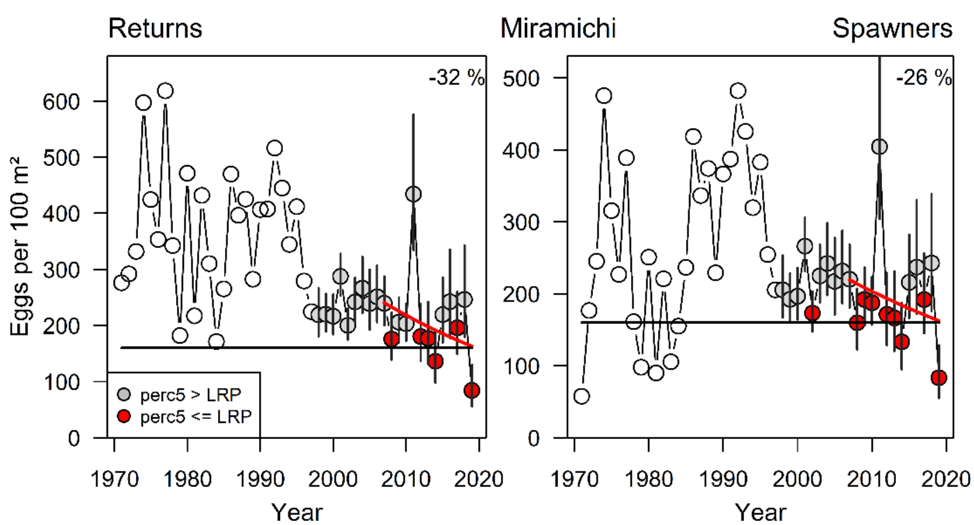

Figure 11: The estimated median (1971-2019) and 5th to 95th percentile range (1998-2019) of the number of eggs (expressed per 100 m² of habitat) from the returns (left panels) and spawners (right panels) of small and large salmon combined to the Miramichi River. The Limit Reference Point is shown as the solid horizontal line (Table 1; DFO 2018b). Grey symbols indicate when the 5th percentile of the number of eggs was above the LRP and red symbols indicate when the 5th percentile of the number of eggs was below the LRP. The white open circles are for years without estimates of uncertainties for egg depositions. The trend line (exponential regression, red line) in the number of eggs of large and small salmon combined over the previous 12-year time period (2007 to 2019) and the corresponding percent change over that period are shown in each panel.

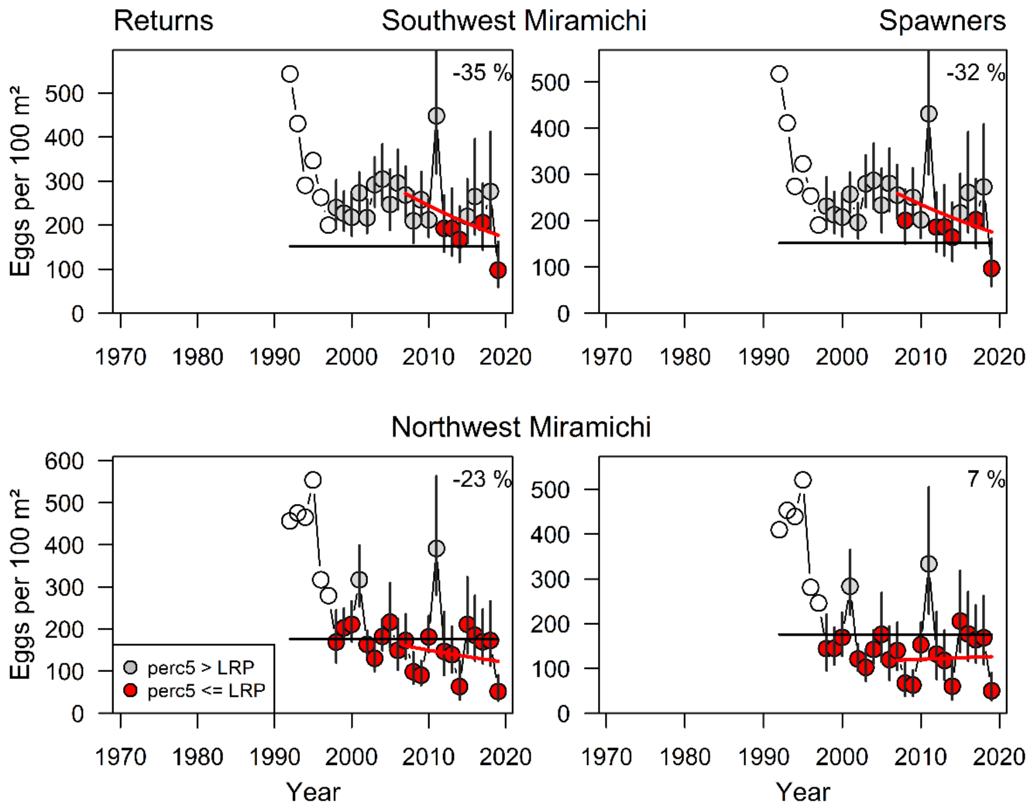

Figure 12: The estimated median (1992-2019) and 5th to 95th percentile range (1998-2019) of the number of eggs (expressed per 100 m² of habitat) from the returns (left panels) and spawners (right panels) of small and large salmon combined to the Southwest Miramichi River (top row) and the Northwest Miramichi River (bottom row). The Limit Reference Point is shown as the solid horizontal line (Table 1; DFO 2018b). Grey symbols indicate when the 5th percentile of the number of eggs was above the LRP and red symbols indicate when the 5th percentile of the number of eggs was below the LRP. The white open circles are for years without estimates of uncertainties for egg depositions. The trend line (exponential regression, red line) in the number of eggs of large and small salmon combined over the previous 12-year time period (2007 to 2019) and the corresponding percent change over that period are shown in each panel.

Spawners are calculated as returns minus losses from reported Indigenous FSC fisheries (based on data available to date) and from recreational fisheries. With the introduction of the mandatory release of small salmon in the recreational fishery, losses due to catch and release mortality were assumed to be 0.9% of the total returns (3% mortality of caught and released salmon, assuming 30% of the small salmon or large salmon return is caught and released), identical to the formula used for calculating large salmon losses in the recreational fishery since 1984.

After accounting for removals and losses from fisheries, the median egg deposition rate for large and small salmon combined in 2019, was 83 eggs per 100 m^2 for the Miramichi River, 96 eggs per 100 m^2 for the Southwest Miramichi River, and 50 eggs per 100 m^2 for the Northwest Miramichi River (Table 2; Figs. 11 and 12).

In 2019, the reported and estimated fisheries related losses were low. The percentages of the LRP attained by estimated eggs in the combined spawners of small salmon and large salmon ranged from 28% (median value) for the Northwest Miramichi to 63% (median value) for the

Southwest Miramichi, similar to the percentages of LRP attainment in the returns (Tables 1 and 2).

The probability of being below the LRP in 2019 was high for each river; >99% for the Miramichi River, 93% for the Southwest Miramichi River, and >99% for the Northwest Miramichi River. All rivers were considered to be in the critical zone of the PA in 2019 (Tables 1 and 2; Figs. 11 and 12).

The trends in the number of eggs from large and small salmon spawners combined show decreases over the last 12 years for spawners in the Miramichi River (-26%) and the Southwest Miramichi River (-32%), but an increase of 7% in the Northwest Miramichi River (Figs. 11 and 12).

Table 2: Summary of estimated eggs per 100 m² in the combined spawners (after removals and losses from fisheries) of small salmon and large salmon by river / tributary in 2019, relative to the Limit Reference Point (LRP), and the probability of the eggs in the returns being less than the LRP.

River / tributary	Eggs in spawners expressed as eggs per 100 m²; median (5th to 95th perc. range)	LRP (eggs per 100 m²)	Percentage of LRP attained; median (5th to 95th perc. range)	Prob. (%) of egg deposition rate being less than the LRP
Miramichi River	83 (55 to 128)	160	52% (34% to 80%)	> 99%
Southwest Miramichi	96 (58 to 160)	152	63% (38% to 106%)	93%
Northwest Miramichi	50 (29 to 90)	176	28% (16% to 51%)	> 99%

SFA 17

Salmon redds have been surveyed at least once since 1990 in all but two rivers in PEI that currently have salmon. The method for converting redd counts to female salmon spawners is described in Cairns and MacFarlane (2015). The derivation of river-specific spawners corresponding to the LRPs is described in DFO (2018b).

There are 25 rivers in SFA 17 with current or recent Atlantic Salmon occupancy based on confirmed observations of redds or juveniles (Table 3; Fig. 13). This excludes the Cardigan River where juvenile salmon are considered to be hatchery escapees. Juvenile salmon were observed in two rivers (Murray, Miminegash) in 2017 or 2018 but these rivers were not included in the list of rivers with defined LRPs and their status is unknown.

Environmental conditions for conducting redd counts in 2019 were difficult and of the 14 rivers surveyed, 10 had complete counts. Only one river (Naufrage) with complete counts in 2019 had spawner estimates above the LRP, however, two rivers with incomplete counts had estimates which were above the LRP (Table 3). Comparisons with 2018 are difficult because only three rivers had complete surveys in 2018. A notable finding in 2019 was the decline in status in the Northeast Cluster (seven rivers between Cow River and North Lake Creek). From 2013 to 2017, four to seven of these rivers exceeded their LRPs, but in 2019, only one (Naufrage) of these seven surveyed rivers exceeded the LRP.

Table 3: The percentage attainment of the Limit Reference Point (LRP) value for Atlantic Salmon monitored rivers in SFA 17, 2012 to 2019. A dash indicates no survey was performed. The spawner requirement is the estimated number of spawners, sexes and sea ages combined, corresponding to the LRP for the river (DFO 2018b). Status of rivers for previous years is available in Cairns and MacFarlane (2015).

River	Spawner Req.	2012	2013	2014	2015	2016	2017	2018	2019
Cains Brook	15	173	161	-	161 [a]	186	316	96	-
Carruthers Brook	24	352	263 [a]	-	277 [a]	253	320	293	102 [a]
Trout River, Coleman	94	-	41	25	25	31	29	22	17 [a]
Trout River, Tyne Valley	26	-	0	0	-	-	7 [a]	-	-
Little Trout River	11	-	0	0	7	-	77	-	-
Bristol (Berrigans) Creek	22	12	19	0	2 [a]	-	16	-	-
Morell River	160	98 [a]	132 [a]	157	58 [a]	83	78	51 [a]	193 [a]
Midgell River	34	105	46 [a]	97	181	-	135	-	-
St. Peters River	24	128	80	79	122	37	35	-	-
Cow River	12	4	182	43	245	204	139	48 [a]	29
Naufrage River	23	80	845	405	288	201	166	80 [a]	138
Bear River	9	-	74	14	60	164	33	5 [a]	0
Hay River	14	9	140	49	117	133	49	13 [a]	42
Cross Creek	24	153	496	357	440	315	355	109 [a]	61
Priest Pond Creek	13	70	506	433	462	234	503	13 [a]	74
North Lake Creek	26	180	568	311	447	428	364	68 [a]	95
Vernon River	37	9	12	9 [a]	0	-	19	7 [a]	11
Clarks Creek	25	0	5	-	0 [a]	-	7	-	4 [a]
Pisquid River	26	60	67	26 [a]	81	49	47	28 [a]	17
Head of Hillsborough R.	29	0	4	-	0	-	0	-	-
North River	53	-	18	-	-	-	7	-	-
Clyde River	22	- [b]	- [b]	- [b]	- [b]	-	0	-	-
West River	124	46	88	59	59	76	78	64 [a]	59
Dunk River	130	7 [a]	-	-	-	-	39	-	-
Wilmot River	45	-	-	- [c]	- [c]	-	5	-	-

[a] Considered to be a minimum value due to poor counting conditions or incomplete survey coverage.
[b] Juveniles were found by electrofishing in 2012 but not in 2013, 2014, and 2015.
[c] Juveniles were found by electrofishing in 2014 and 2015.

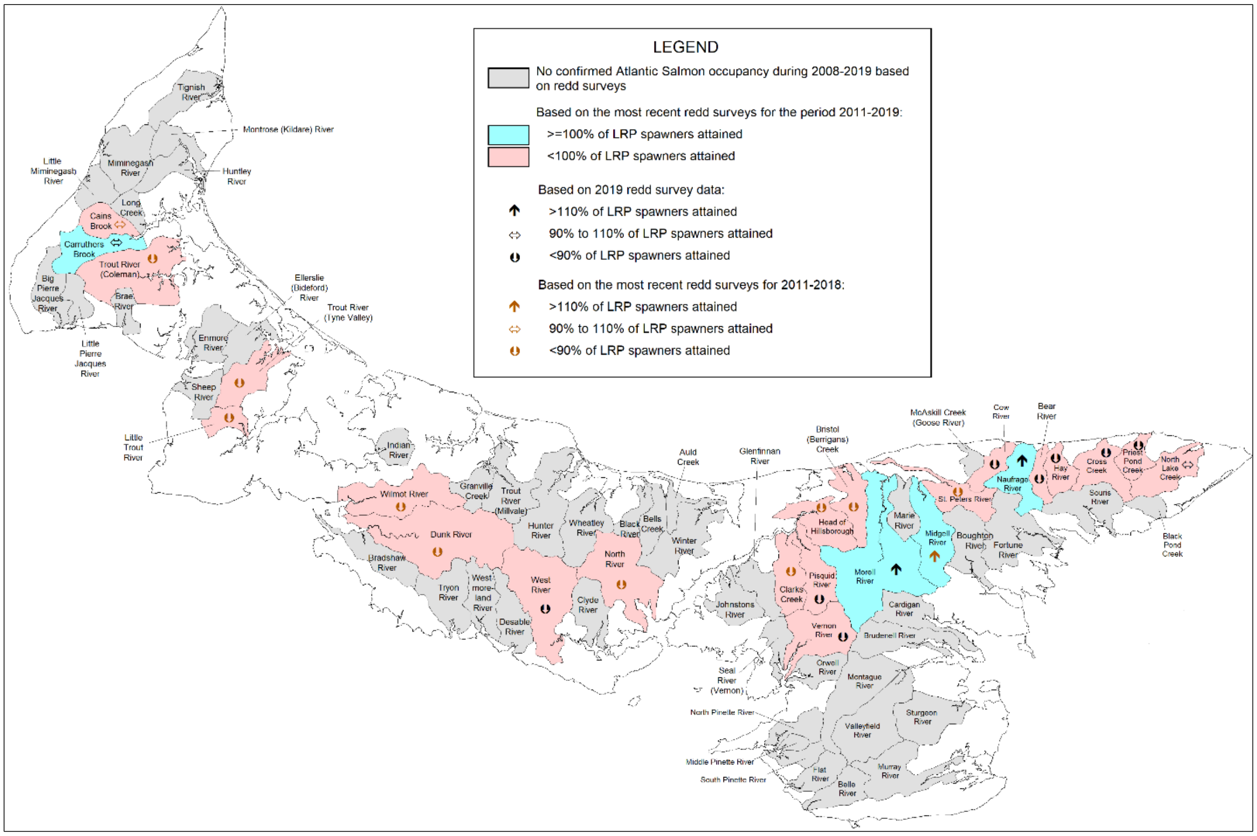

Figure 13: Location of SFA 17 watersheds with historic or current Atlantic Salmon occupancy and summary of their status relative to the percentage of the LRP attained in 2019 (Carruthers, Morell, Cow, Naufrage, Bear, Hay, Cross, Priest Pond, North Lake, Vernon, Pisquid, West) and in 2018 or earlier (all other watersheds). Blue shading indicates watersheds which met or exceeded the LRP whereas pink shading indicates watersheds that are below the LRP. Grey shading indicates watersheds with no evidence of salmon redds since 2008. The symbols are as follows: less than 90% of LRP attained, ⇔ between 90% and 110% of LRP, and ↑ greater than 110% of LRP.

SFA 18 Gulf Nova Scotia

Indices of abundance for the rivers in SFA 18 are derived from recreational fishery catch and effort data. The recreational fishery data for 2019 are preliminary and based on extracts from the licence stub return database to February 17, 2020 (475 licence stubs returned out of 2,449 licences sold in 2019; 19% return rate). Catch and effort from the returned licence stubs are raised by total licence sales to estimate total catch and effort.

SFA 18A Mainland Gulf Nova Scotia

In 2019, there was a decrease in the catch of large salmon for West River (Antigonish), East River (Pictou), and River Philip relative to 2018 (Fig. 14). Values for all three rivers were lower than their respective long term average (1984 to 2018; Fig. 14). Catch for small salmon decreased slightly in West River (Antigonish) in 2019 relative to 2018, while East River (Pictou) and River Philip experienced little change. All three rivers remained below their respective long term average (1984 to 2018; Fig. 14).

The catch rates (catch per rod day) of large salmon for West River (Antigonish), East River (Pictou), and River Philip all declined in 2019 relative to 2018 (Fig. 14). Over the recent 12-year period, the trend for catch rates of large salmon declined 34% in West River (Antigonish) and

3% in East River (Pictou). Catch rates of large salmon in River Philip increased 110% over the same time period (Fig. 14).

In 2019, catch rates of small salmon decreased in West River (Antigonish), increased in East River (Pictou), and showed little change in River Philip, relative to 2018 (Fig.14). Over the recent 12-year period, the trend for catch rates of small salmon declined 77% for West River (Antigonish), 43% for East River (Pictou), and 15% for River Philip (Fig. 14).

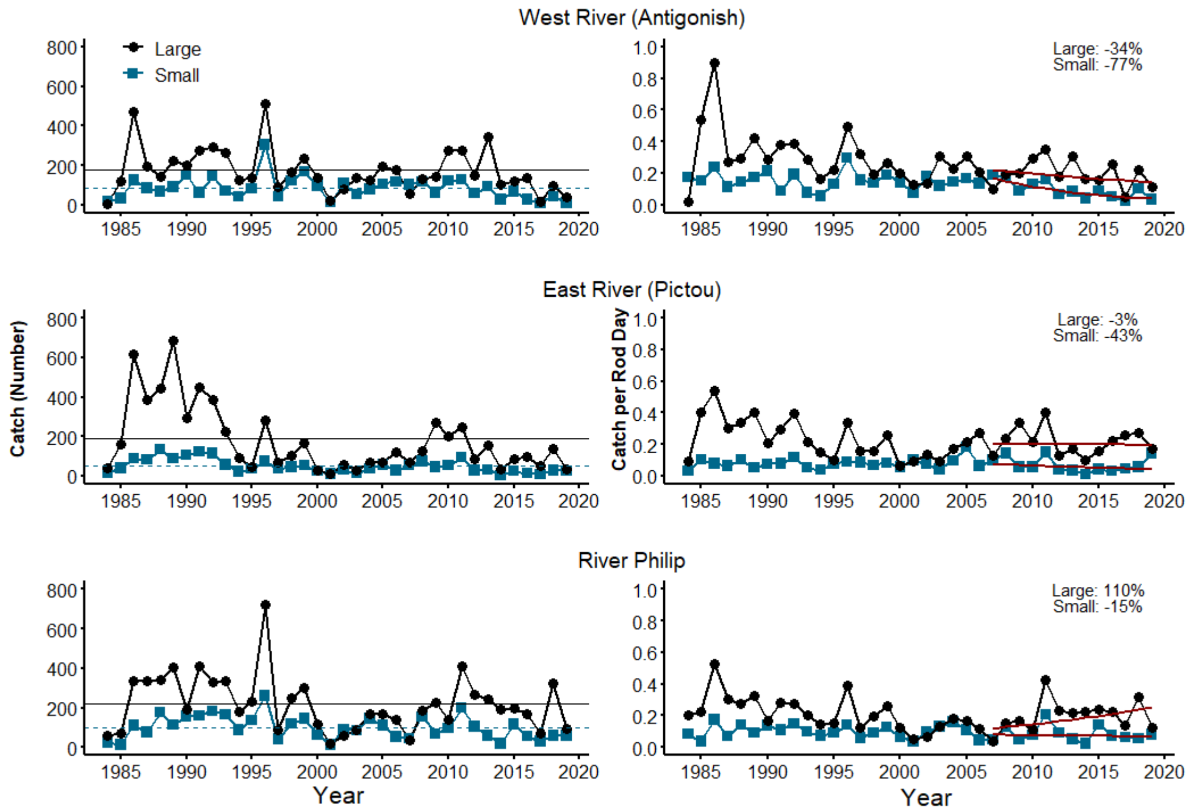

Figure 14: Estimated catches (left panels) and catch rates (catch per rod day; right panels) of large salmon and small salmon from the recreational fishery in the three largest rivers of SFA 18A, 1984 to 2019. The data for 2019 are preliminary. In the left panels, the horizontal lines are the average catch for large salmon (solid) and for small salmon (dashed line) for the time series (1984 to 2018). The trend line (exponential regression, red line) in the median of the estimated catch rates over the previous 12-year time period (2007 to 2019) and the corresponding percent change over that period are shown in each panel on the right.

SFA 18B Margaree River

The catches of large and small salmon for the Margaree River were similar in 2019 relative to 2018 (Fig. 15). Catches for both size groups were below their respective long term averages (1984 to 2018; Fig. 15). In 2019, the catches per rod day of large and small salmon for the Margaree River were lower than in 2018 (Fig. 15). Trends in catch rates over the recent 12 years show a decline of 8% for large salmon and 30% for small salmon (Fig. 15).

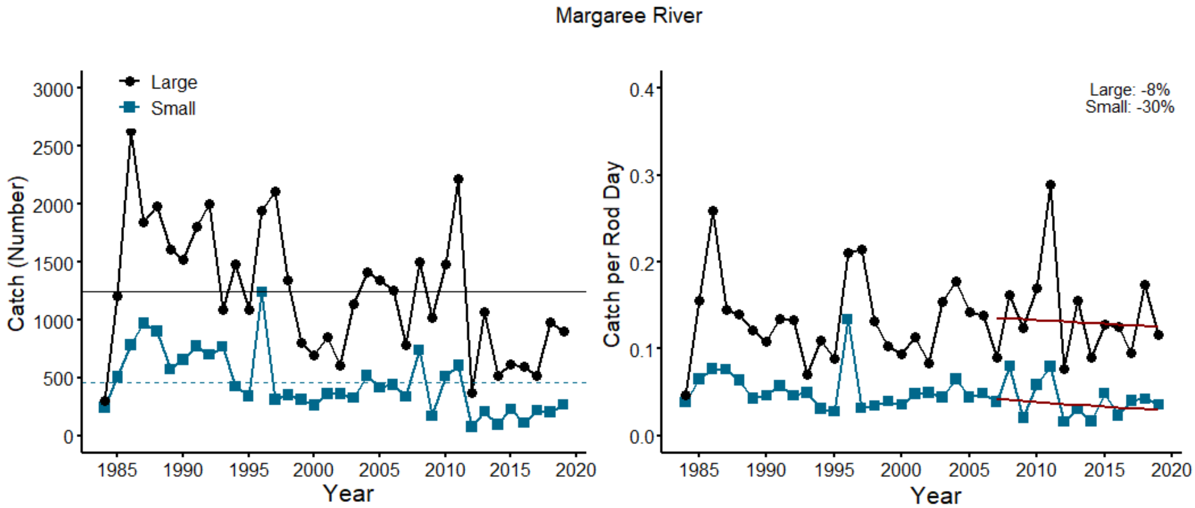

Figure 15: Estimated catches (left panel) and catch rates (catch per rod day; right panel) of large salmon and small salmon from the recreational fishery on the Margaree River (SFA 18B), 1984 to 2019. The data for 2019 are preliminary. In the left panels, the horizontal lines are the average catch for large salmon (solid) and for small salmon (dashed line) for the time series (1984 to 2018). The trend line (exponential regression, red line) in the median of the estimated catch rates over the previous 12-year time period (2007 to 2019) and the corresponding percent change over that period are shown in the panel on the right.

Adult salmon abundance for the Margaree River is derived with a model that estimates exploitation rates in the recreational fishery based on mark and recapture experiments conducted between 1988 and 1996 applied to the corresponding recreational fishery catch and effort data recorded in volunteer angler logbooks, and licence stub returns (Breau and Chaput 2012). Estimates for 2019 are based on catch and effort data from volunteer angler logbook returns (n = 50) and licence stubs processed as of February 17, 2020.

The estimated returns of large salmon to the Margaree River in 2019 were 2,515 fish (median; 5th to 95th percentile range of 1,979 to 2,902), which is below the long term average of 2,768 fish (1988 to 2018; Fig. 16). The estimated returns of small salmon to the Margaree River in 2019 were 584 fish (median; 5th to 95th percentile range of 410 to 827), which is below the long term average of 844 fish (Fig. 16). For the Margaree River, trends in estimated returns over the recent 12-year period show a decline of 7% and 31% for large and small salmon, respectively.

Estimates of egg depositions relative to LRP

The eggs in the returns and spawners of small salmon and large salmon combined are estimated using average biological characteristics of salmon in the Margaree River (DFO 2018b, 2019). In 2019 the estimated eggs in the returns of small salmon and large salmon combined were 593 eggs per 100 m² (median; 5th to 95th percentile range of 466 to 753 eggs per 100 m²), 3.9 times the LRP value of 152 eggs per 100 m². The eggs in the combined returns of small and large salmon have exceeded the LRP value every year since 1987 (Fig. 17).

The spawners are estimated after accounting for reported in-river fisheries losses (Indigenous FSC and recreational fisheries). For the recreational fishery, an assumed 5% catch and release mortality rate is applied to the salmon released in the fishery (DFO 2014). In 2019, the estimated eggs in the spawners of small salmon and large salmon combined were 582 eggs per 100 m² (median; 5th to 95th percentile range of 455 to 742 eggs per 100 m²), 3.8 times the LRP value. The eggs in the combined spawners of small and large salmon have exceeded the LRP value every year since 1987 (Fig. 17).

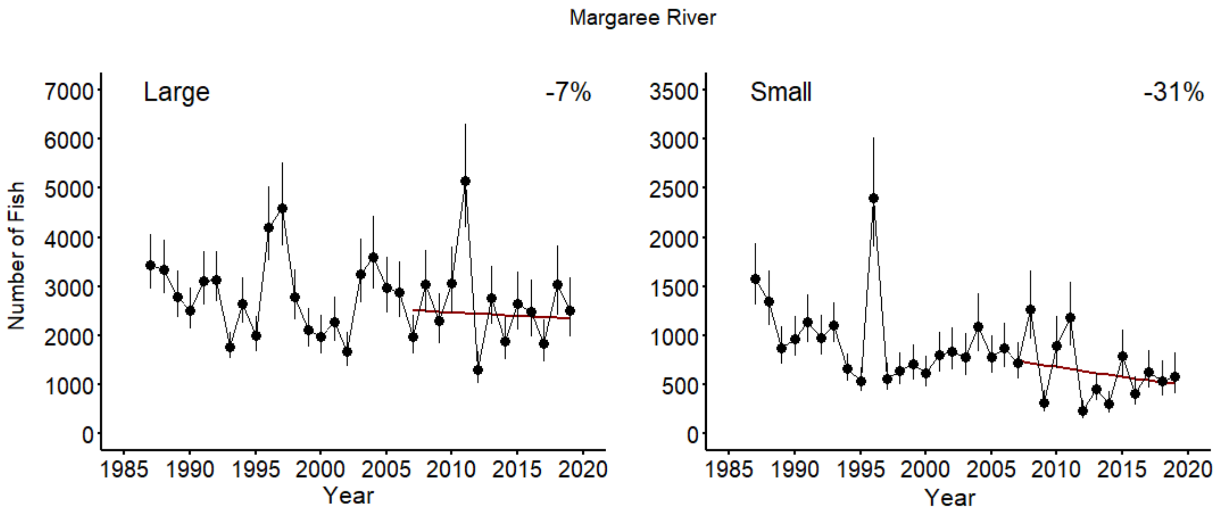

Figure 16: Posterior distributions (medians; 5th to 95th percentile range) of estimated returns of large salmon (left panel) and small salmon (right panel) to the Margaree River, 1987 to 2019. Values for 2019 are preliminary. The trend line (exponential regression, red line) in the median estimated returns over the previous 12-year time period (2007 to 2019) and the corresponding percent change over that period are shown for each size group in each panel.

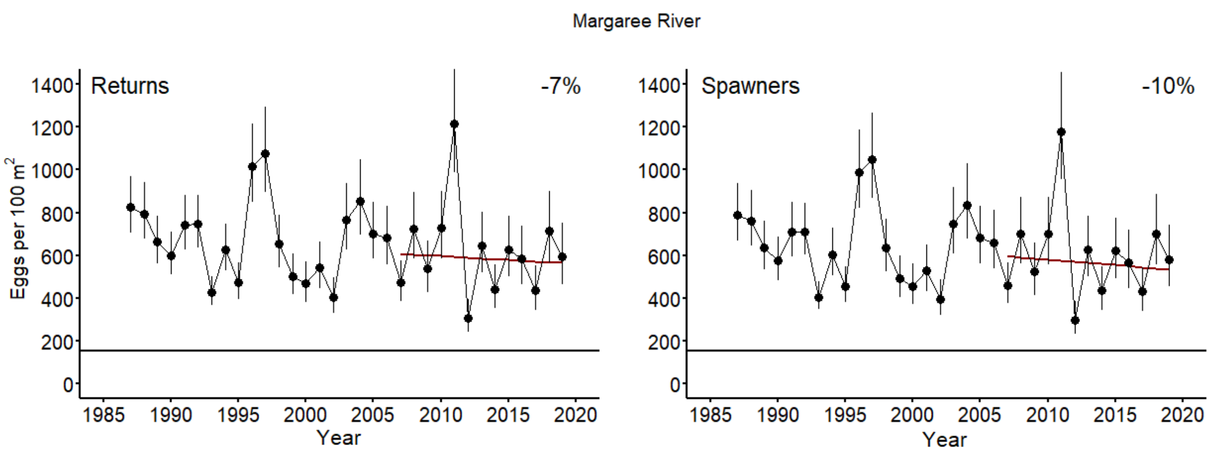

Figure 17: Median and 5th to 95th percentile range of the estimated number of eggs (expressed per 100 m² of habitat) in the returns(left panel) and spawners (right panel) of small and large salmon combined to the Margaree River, 1987 to 2019. The LRP value (152 eggs per 100 m²) is shown as the solid horizontal line. The trend line (exponential regression, red line) in the median of the estimated eggs for large salmon and small salmon combined over the previous 12-year time period (2007 to 2019) and the corresponding percent change over that period are shown in each panel.

Gulf Region

Estimates of total returns of small salmon and large salmon are developed for each SFA and overall for Gulf Region based on estimates from monitored rivers (DFO 2014).

Returns of large salmon to Gulf Region in 2019 were estimated at 19,700 fish (5th to 95th percentile range of 14,700 to 24,800 fish), 57% of the 2018 estimate, and 45% of the long-term average (43,600 fish) of the 1970 to 2019 time series (Fig. 18). Small salmon returns to Gulf Region in 2019 were estimated at 19,200 fish (5th to 95th percentile range of 15,400 to 23,000 fish), similar to 2018 (19,600 fish), and only 28% of the average abundance (69,000 fish) of the time series from 1970 to 2019 (Fig. 18).

Over the recent 12 years, approximately two generations, the estimated abundances of large salmon have decreased in all Salmon Fishing Areas, ranging from a 5% decrease in SFA 17 and SFA 18 to 46% decrease in SFA 15 (Fig. 18). Overall in Gulf Region rivers, large salmon abundance has declined by 27% over the period 2007 to 2019. For small salmon, abundances have declined by 30% to 69% in the four Gulf Region SFAs with a decline in estimated small salmon abundance of 63% to Gulf Region rivers overall (Fig. 18).

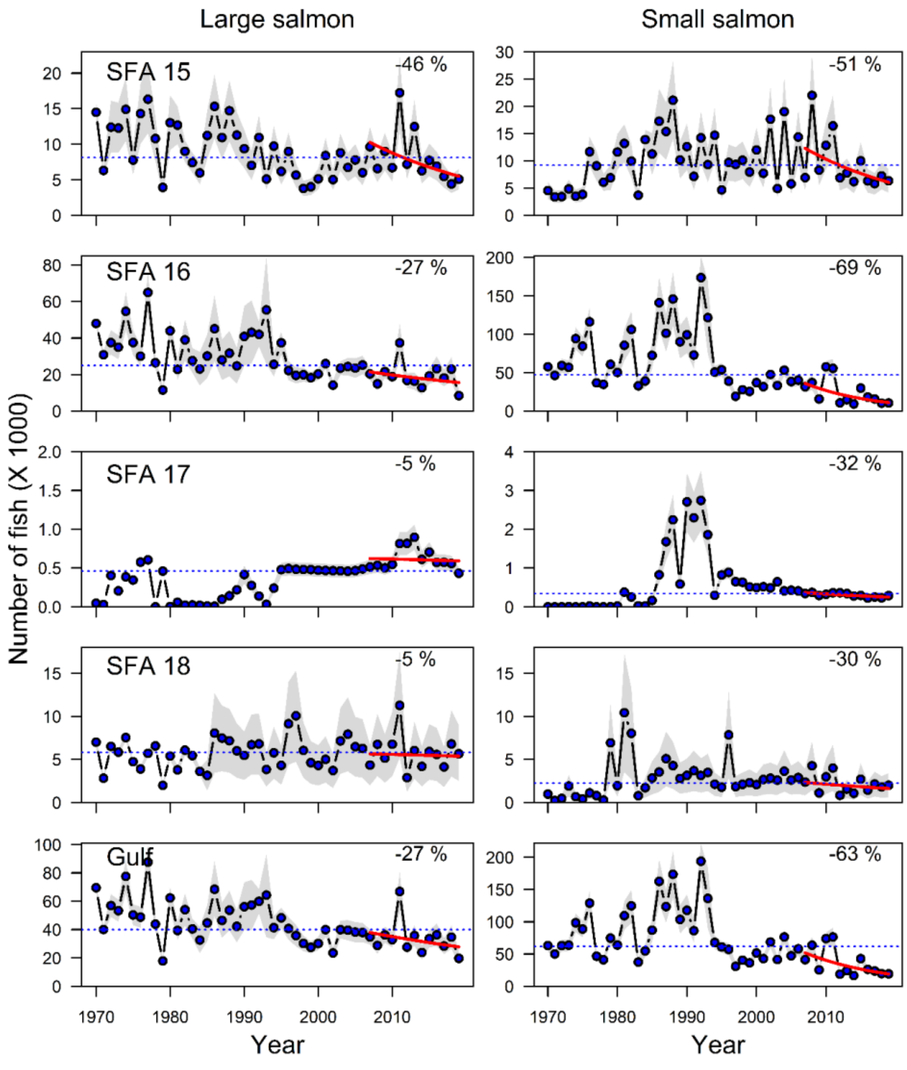

Figure 18: Estimates (medians are coloured symbols, shaded contours are the 5th to 95th percentile ranges) of total returns of large salmon (left panels) and small salmon (right panels) to each of SFA 15, 16, 17, and 18, and to Gulf Region rivers overall, 1970 to 2019. The trend line (exponential regression, red line) in the median of the estimated returns over the previous 12-year time period (2007 to 2019) and the corresponding percent change over that period are shown in each panel. The light horizontal dashed line in each panel is the median abundance for the time series 1970 to 2019.

Abundance indices of juvenile salmon

Indices of freshwater production are derived from electrofishing surveys. Fixed site sampling for juvenile salmon has been conducted most consistently since the early 1970s in the Restigouche (SFA 15) and Miramichi (SFA 16) rivers, and since the mid-1980s for SFA 18 rivers. Juvenile salmon abundances at sites, in terms of number of fish per habitat area sampled by age or size group (densities), are obtained using successive removal sampling or catch per unit effort sampling calibrated to densities. Sampling intensities vary among years and among rivers. When information is available, annual densities are referenced to averages for two time periods, prior to 1984 and post-1984 (or later depending upon the age group) corresponding to the year (1984) when commercial fisheries were closed and mandatory catch-and-release for large salmon in the recreational fishery was introduced. Size groups of juveniles (fry, small parr, large parr) are used as proxies for cohorts.

SFA 15A Restigouche River (NB)

In 2019, one to three cohorts (fry, small parr, large parr) were captured at most sampling sites in Restigouche River (NB; n = 63 sites excluding those of the Matapedia and Patapedia rivers) indicating that there had been multiple years of spawning success. Three sites had no salmon juveniles, 12 sites had no fry, 11 sites had no small parr, and 22 sites had no large parr. Salmon juveniles are broadly distributed in the river with the exception of some small streams which are prone to periodic blockages to spawners by beaver dams. Densities of Atlantic Salmon fry, small parr (mostly one-year old), and large parr (mostly two-year and older) all increased post-1984 and remain at moderate levels (Fig. 19). Over the past 12 years, the abundances of juvenile salmon have increased by 17% for fry and small parr, and by 28% for large parr (Fig. 19). Results from juvenile salmon surveys in 2008 and 2011, which showed decreased abundance of some age classes, could be biased due to difficult sampling conditions (extremely high water) rather than an indicator of actual lower abundance.

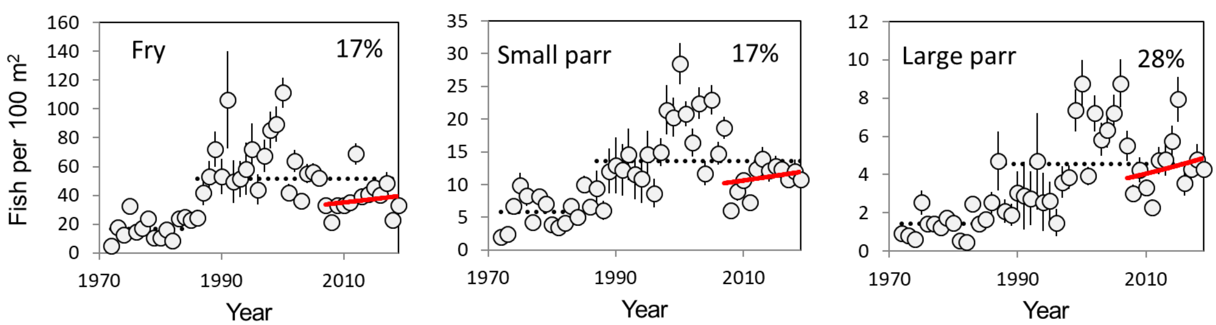

Figure 19: Mean juvenile densities (fish per 100 m²) for fry (upper panel), small parr (middle panel) and large parr (lower panel) for the sites sampled in the Restigouche River (NB waters only, excluding Matapedia and Patapedia rivers), 1972 to 2019. Vertical bars are one standard error. The horizontal dashed lines in each panel are the average densities corresponding to periods before and after, respectively, the significant management changes that were implemented to the commercial and recreational salmon fisheries in 1984. The trend line (exponential regression, red line) in the median of the estimated densities over the previous 12-year time period (2007 to 2019) and the corresponding percent change over that period are shown in each panel.

SFA 16A Miramichi River

Densities of Atlantic Salmon fry, small parr, and large parr in the Miramichi watershed are summarized according to the four major tributaries which drain into tidal waters (Southwest Miramichi [SW], Renous, Northwest Miramichi [NW], and Little Southwest Miramichi [LSW] rivers). Average juvenile densities were only calculated when four or more sites per major tributary were surveyed in a given year.

Electrofishing surveys were carried out at seven sites in the LSW, at 17 sites in the NW, at nine sites in the Renous and at 14 sites in the SW, for a total of 47 sites throughout the Miramichi watershed in 2019. High water conditions were encountered in September which resulted in delays to complete the survey and may have impacted sampling efficiencies by electrofishing.

In 2019, salmon fry were captured at all but five sites. Salmon parr (small and large combined) were captured at all but four sites.

Average fry densities in the four monitored rivers were low in 2019 and ranged from 16 (Renous) to 29 (NW) fish per 100 m^2. Fry densities in the SW and Renous rivers in 2019 were the lowest of the post-1984 average fry densities and also below the pre-1984 average fry densities in those rivers (Fig. 20). Average fry densities in the LSW and NW were also low in 2019 and among the lowest average fry densities since the post-1984 average fry densities in those rivers (Fig. 20).

Similar to 2018, the average small parr densities in 2019 remained low and ranged from 6 (LSW) to 9 (NW) fish per 100 m^2. Average small parr densities in 2019 represented the lowest or second lowest value of the long term (1986 to 2018) average for this life stage in each river (Fig. 20).

The average large parr densities in 2019 were similar among all four rivers (2 fish per 100 m^2 in the Renous and LSW, 3 fish per 100 m^2 in the SW and NW) and were lower in each river relative to densities estimated in 2018 (particularly for the SW) (Fig. 20). The average large parr densities in 2019 were below the long term (1987 to 2018) average for this life stage in all monitored rivers (Fig. 20).

With the exception of the average large parr density in the Southwest Miramichi River, the average density of all juvenile life stages has decreased in the four monitored rivers over the last 12 years (Fig. 20). The decrease in average densities over the last 12 years has ranged from 33% (LSW) to 67% (Renous) for fry, from 54% (SW) to 73% (NW) for small parr, and from 35% (Renous) to 59% (NW) for large parr (Fig. 20). While the previous 12-year trend is increasing for the large parr density in the SW, the average large parr density dropped in 2019 to levels below the pre and post-1984 average large parr densities in that river (Fig. 20).

SFA 16B Buctouche River

The Buctouche River in SFA 16B is used as an index river to inform on the status of Atlantic Salmon in southeastern New Brunswick. High and turbid water conditions in southeast NB during the fall of 2019 may have impacted sampling efficiencies by electrofishing. In 2019, the average salmon fry density in the Buctouche River was 3 fish per 100 m^2, a slight increase from the near zero levels estimated in 2018 but still well below the average fry density since the 1998 closure of the directed salmon fisheries in SFA 16B (Fig. 21). The average parr (age classes combined) density in 2019 was estimated at 4 fish per 100 m^2, lower than in 2018, and lower than the average parr density for the Buctouche River since 1998 (Fig. 21). During the recent 12-year period, the abundances of fry and parr in the Buctouche River have decreased by 87% and 59%, respectively (Fig. 21).

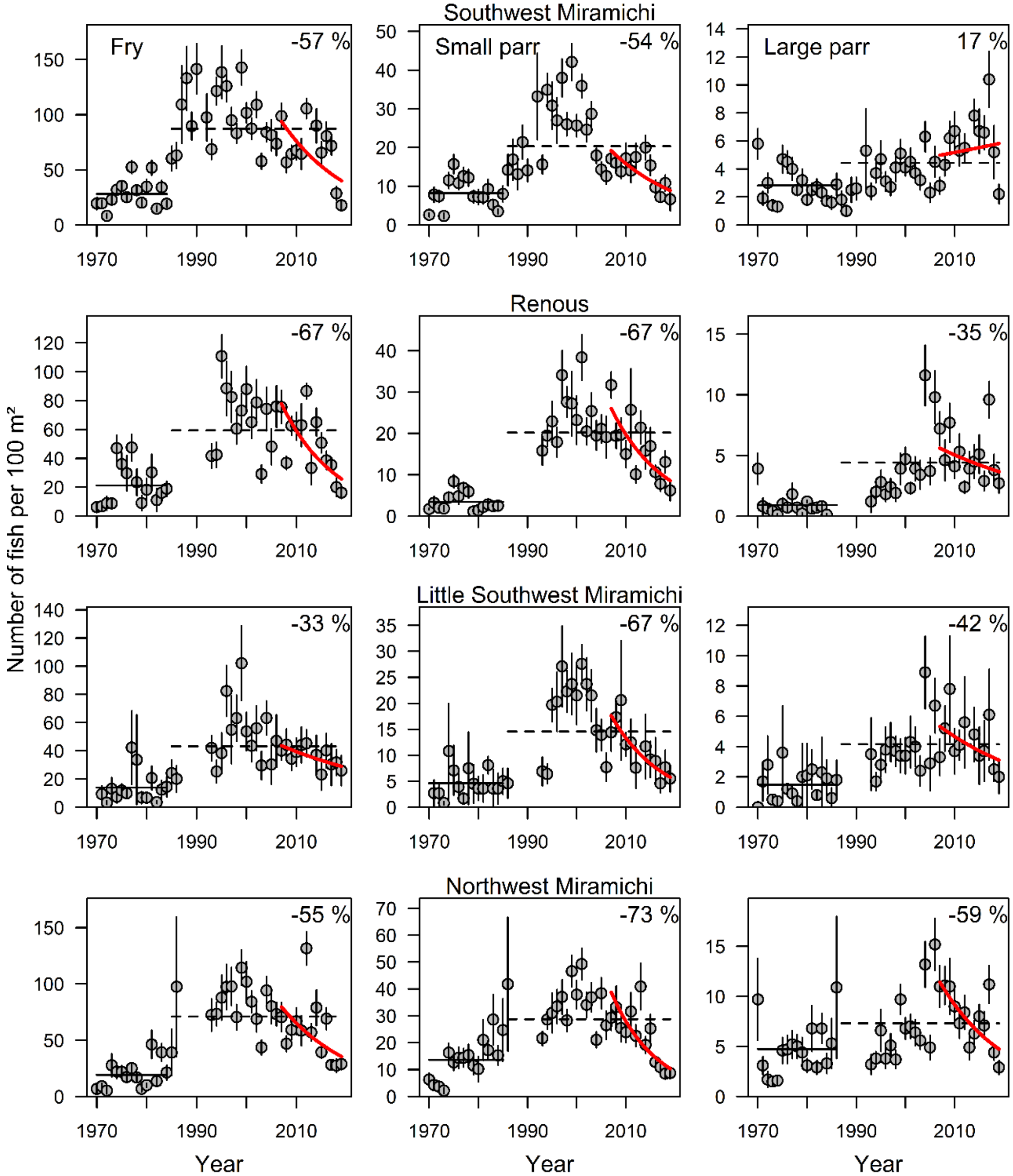

Figure 20: Annual average densities, expressed as fish per 100 m² of sampled area, for fry (left column), small parr (middle column), and large parr (right column) at sampled sites in the four major rivers of the Miramichi watershed: Southwest Miramichi (upper row), Renous River (second row), Little Southwest Miramichi (third row), and Northwest Miramichi (bottom row) for 1970 to 2019. Vertical bars are one standard error. The horizontal solid and dashed lines in each panel are the average densities corresponding to periods before and after, respectively, significant management changes were implemented to the commercial and recreational salmon fisheries in 1984. The trend line (exponential regression, red line) in the median of the estimated densities over the previous 12-year time period (2007 to 2019) and the corresponding percent change over that period are shown in each panel.

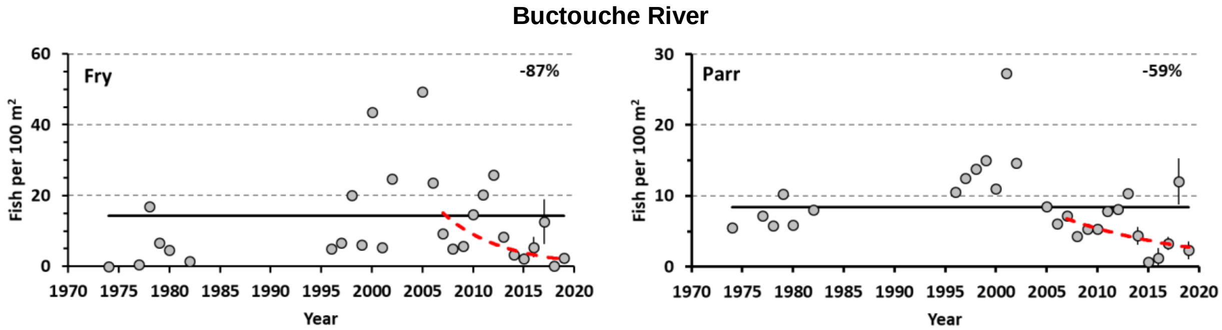

Figure 21: Average densities, expressed as fish per 100 m² of sampled area, for fry (left panel) and parr (size groups combined, right panel) from sampled sites in the Buctouche River 1974 to 2019 sampling years. Vertical bars when shown for the period 2014 to 2019 are one standard error. The horizontal lines represent average fry and parr abundance for the years after the closure of the aboriginal and recreational fisheries in 1998. The trend line (exponential regression, red line) in the median of the estimated densities over the previous 12-year time period (2007 to 2019) and the corresponding percent change over that period are shown in each panel.

SFA 18A Mainland Gulf Nova Scotia

Juvenile salmon surveys have been conducted in three index rivers in SFA 18A: West River (Antigonish), East River (Pictou), and River Philip. Results are presented for years with at least three sites sampled per river. Since 2012, six sites have been sampled per river. All sites sampled in 2019 were occupied by juvenile salmon.

Fry abundance increased in West River (Antigonish) and River Philip in 2019 compared to 2018, while East River (Pictou) showed little change (Fig. 22). Over the past 12 years, fry abundances increased 77% in West River (Antigonish), 72% in East River (Pictou) and decreased 20% in River Philip (Fig. 22).

In 2019, parr abundances were similar to 2018 in all three rivers with slight decreases in West River (Antigonish) and East River (Pictou) (Fig. 22). The recent 12-year parr abundance trends show an increase of 5% in West River (Antigonish), an increase of 37% in East River (Pictou), and a decrease of 43% in River Philip (Fig. 22).

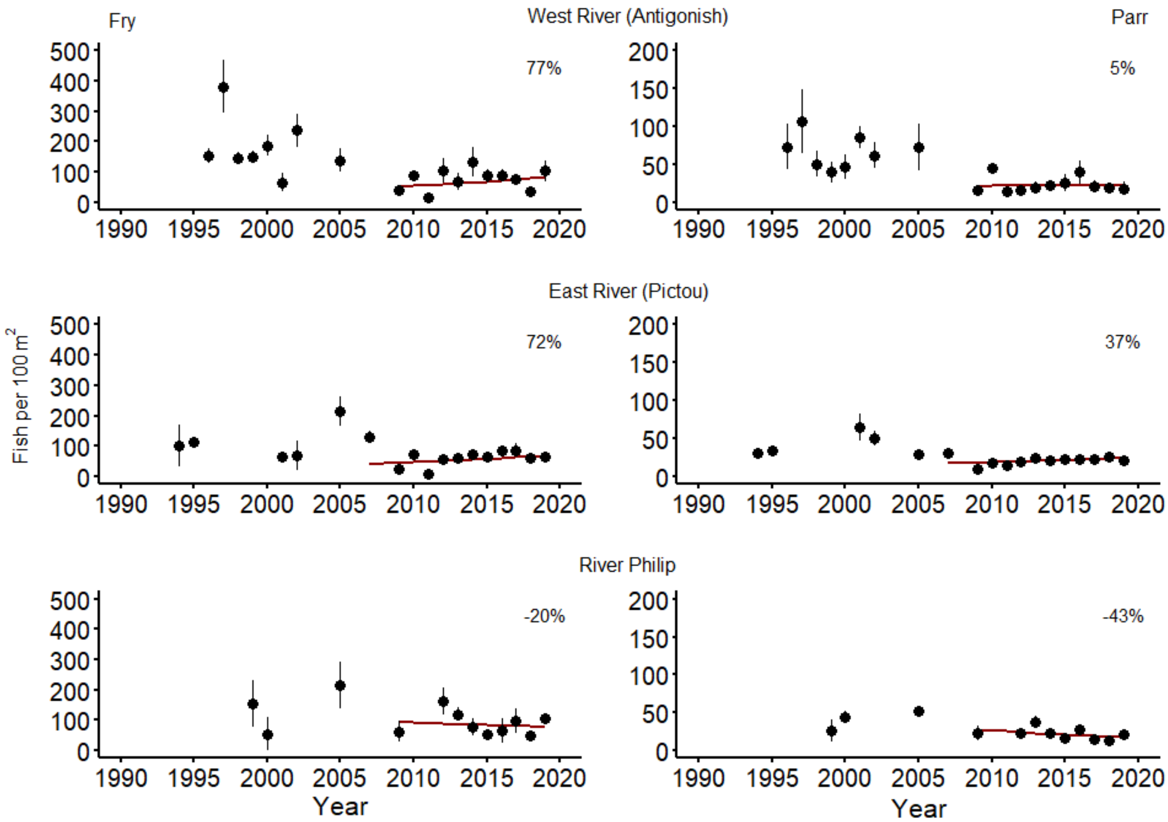

Figure 22: Mean juvenile Atlantic Salmon densities (fish per 100 m²) for fry (left panels) and parr (right panels; small and large size groups combined) for sites sampled in the West River (Antigonish; top row), East River (Pictou; middle row) and River Philip (bottom row), 1994 to 2019. Only years for which at least three sites per river were sampled are presented. Vertical bars are one standard error. The trend line (exponential regression, red line) in the median of the estimated densities over the previous 12-year time period (2007 to 2019) and the corresponding percent change over that period are shown in each panel. Note different range in y-axes for fry and parr.

SFA 18B Margaree River

Eleven sites were surveyed in the Margaree River during 2019. Salmon fry and parr were captured at all sampling sites, with the exception of three sites on the Southwest Margaree River that had only fry. Mean fry abundance in 2019 of 107 fish per 100 m^2 was four times greater than in 2018 (26 fish per 100 m^2; Fig. 23). The mean parr abundance in 2019 of 21 fish per 100 m^2 was lower than 2018 (34 fish per 100 m^2; Fig. 23). The recent 12-year fry abundance trend shows an increase of 8%, while the parr abundance trend shows a decrease of 44% (Fig. 23).

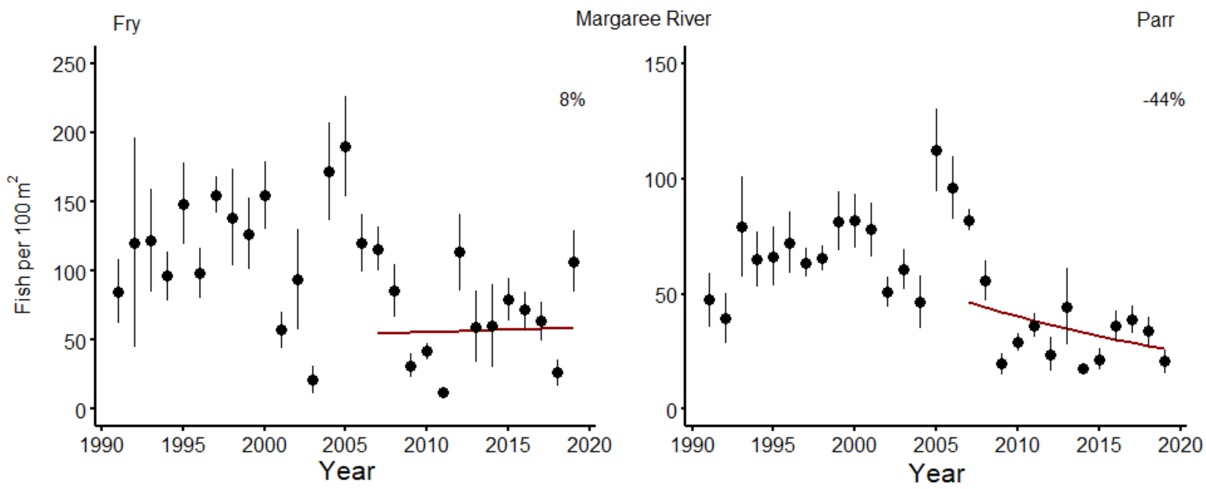

Figure 23: Juvenile densities (fish per 100 m²; mean ± one standard error) for fry (left panel) and parr (right panel) for all sites sampled each year in the Margaree River, 1991 to 2019. The trend line (exponential regression, red line) in the median of the estimated densities over the previous 12-year time period (2007 to 2019) and the corresponding percent change over that period are shown in each panel.

Sources of Uncertainty

A number of indicators of Atlantic Salmon adult abundance (Restigouche River (NB) and SFA 18 rivers of mainland Gulf Nova Scotia) are based on catches, and catch per unit effort data reported from the recreational fishery. Conditions for recreational fishing are variable and success can be dependent upon water level and temperature. In 2019, low water conditions in the summer that continued into the fall likely impacted both the August fishing effort in the Restigouche River (NB) and possibly the availability of salmon to the fishery.

For the Restigouche River (NB), the assessment model for estimating returns, the habitat areas, and the biological characteristics to be used for calculating the total egg depositions and the attainment of LRP are currently being refined. Depending on the refinements to the data inputs, the total egg requirement for the LRP and the status may change.

In the Margaree River assessment model, catch rates which are estimated using a derived catchability value (per rod day) from the early 1990s are used to estimate returns. The applicability of this value in the recent years is uncertain given the changes in fisheries management measures that have occurred over the past two decades, including the mandatory catch and release measures for all size groups since 2015.

In all areas, adult Atlantic Salmon losses not accounted for in the estimation of spawners include those from incomplete reporting of fisheries catches, poaching, experimental manipulation, and broodstock collections. Losses due to natural factors including disease, mortalities from warm water, predation on adult salmon, and others are also not accounted for in the estimation of spawners. Consequently, the egg depositions are considered to be over-estimates of the realized egg depositions in any year.

For SFA 17, conditions for redd counting in 2019 improved over 2018 and complete counts were obtained for 10 rivers. Redd counts are converted to spawner numbers based on historical data obtained from a single river in a single year. A larger number of data points would give a more reliable basis for estimating spawner numbers. There is ongoing uncertainty with respect to salmon occupancy status for a number of small rivers that are not consistently surveyed and in which spawning may be intermittent.

Electrofishing surveys across the region occur from mid-July to early October depending upon the area. Sampling in SFA 15 occurs between July and early September whereas sampling in SFA 16 and SFA 18 occurs between late August and October. Catchability of juvenile Atlantic salmon may vary as a function of size, water temperature, stream size, water levels, visibility, etc. Some of the annual variations in juvenile indices may be associated with variations in sampling conditions that affect catchability and which are not accounted for in the current models to estimate juvenile abundance indices.

The freshwater life history dynamics of Atlantic Salmon in the Gulf Region rivers show variable patterns within and among rivers over time. The juvenile population dynamics linked with environmental variables such as summer water temperatures, water levels, and hydrological conditions during the winter need to be examined for their potential consequences on future adult recruitment and abundance.

Conclusions

Estimated returns of large salmon to Gulf Region rivers in 2019 were 19,700 fish, 57% of the 2018 estimate, and 45% of the long-term average (43,600 fish) of the 1970 to 2019 time series. Small salmon returns to Gulf Region in 2019 were estimated at 19,600 fish, similar to 2018, and only 28% of the average abundance (69,000 fish) of the time series.

Over the recent 12 years, approximately two generations for Atlantic Salmon, the estimated abundance of large salmon in Gulf Region rivers has declined by 27% whereas the small salmon abundance has declined by 63%. Among the four SFAs, small salmon abundance has declined by 30% to 69% over the past 12 years, whereas large salmon abundance has declined by 5% to 46%,with the strongest decline occurring in SFA 15.

River specific stock status for Gulf Region rivers is summarized in Tables 4a and 4b. All monitored rivers show declines (17% to 77%) in estimated abundances of small salmon over the recent 12 years, with the strongest decline in the Southwest Miramichi (SFA 16A) and in the West River (Antigonish) (SFA 18A), the latter based on catch rates in the recreational fishery (Table 4a). Large salmon abundances show less severe declines than small salmon, the exception being for River Philip (abundance based on catch rates in the recreational fishery) which shows an increasing trend.

The assessed rivers in Gulf New Brunswick (SFA 15 and 16) were below their respective LRPs in 2019. The Restigouche River (NB; SFA 15) was estimated to have been above the LRP in only three of the past 12 years.

For the second time in five years, and following on 2014, the eggs in the returns of small salmon and large salmon combined in 2019 were a record low in the Miramichi River (1971 to 2019), the Southwest Miramichi River (1992 to 2019), and the Northwest Miramichi River (1992 to 2019) (Figs. 11 and 12). The Northwest Miramichi has met or exceeded the LRP (based on the median estimate), in only two of the past 12 years (Table 4b). For the first time on record (1992 to 2019), the median estimates of eggs in the returns and spawners to the Southwest Miramichi were below the LRP.

The assessed river in Gulf Nova Scotia (SFA 18), the Margaree River, has been above the LRP every year of its time series (1987 to 2019).

Table 4a: Summary of trends over the recent 12 years of DFO Gulf Region river-specific Atlantic Salmon adult return and juvenile indicators to 2019. The symbol na means no data.

	Trend in adult returns (12 years)		Trend in juvenile abundances (12 years)	
River (SFA)	Small salmon	Large salmon	Fry [1]	Parr [1,2]
Restigouche (NB; 15)	-51%	-46%	+17%	+17%
Northwest Miramichi (16A)	-55%	-10%	-33% -55%	-67% -73%
Southwest Miramichi (16A)	-72%	-39%	-57% -67%	-54% -67%
Buctouche (16B)	na	na	-87%	-59%
River Philip (18A) [3]	-15%	+110%	-20%	-43%
East River (18A) [3]	-43%	-3%	+72%	+37%
West River (18A) [3]	-77%	-34%	+77%	+5%
Margaree (18B)	-31%	-7%	+8%	-44%

[1] For the Northwest Miramichi, trends in juveniles are presented for Little Southwest and Northwest Miramichi, respectively. For the Southwest Miramichi, trends in juveniles are presented for the Southwest Miramichi and Renous, respectively.
[2] For the Restigouche, Northwest Miramichi, and Southwest Miramichi, parr refers to small parr. For all others rivers, parr refers to small and large parr combined.
[3] For the trends in returns for the three rivers in SFA 18A, the catch rates (catch per rod day) in the recreational fishery are used.

For SFA 17, the assessments of status confirm the precarious status of salmon in several small rivers, especially those in which spawning appears to occur only in intermittent years. During the mid-2010s, rivers of the Northeast Cluster were the salmon stronghold of SFA 17, with percentages of LRP attained commonly exceeding 300%. These rivers have fallen from this status, with only one of 7 assessed rivers in this area (Naufrage at 138%) exceeding the LRP in 2019.

Table 4b: Summary of status in 2019 (median relative to the LRP) and the trends over the recent 12 years for Atlantic Salmon in DFO Gulf Region monitored rivers.

	Returns relative to LRP		Spawners relative to LRP	
River (SFA)	In 2019 (prob. > LRP)	trend	In 2019 (prob. > LRP)	trend
Restigouche (NB; 15)	59% na [1]	-46%	54% 66% [1]	-48%
Northwest Miramichi (16A)	29% (< 1%)	-23%	28% (< 1%)	+7%
Southwest Miramichi (16A)	64% (7%)	-35%	63% (7%)	-32%
PEI (14 rivers; 17) [2]	na	na	3 of 14; 0% to 193%	na
Margaree (18B)	390% (100%)	-7%	383% (100%)	-10%

[1] For the Restigouche, the values represent the estimate relative to LRP based on the catches and a catch rate of 40% and based on the end of season spawner counts, respectively. The trend is based on catches and catch rate estimation model.
[2]Status is presented for fourteen rivers in 2019, including ten rivers with complete surveys and four with incomplete surveys. The number of rivers in which spawners exceeded the LRP in 2019 is shown along with the range of percent attainment for those fourteen rivers in 2019. In two of the four rivers with incomplete surveys, the estimated abundance from the incomplete survey exceeded the respective LRP for the river (Table 3). For the trend, the number of rivers with complete surveys varies by year and no decline estimate is provided.

Although the juvenile indices in the rivers of SFA 15 and SFA 18 since 2010 are generally lower than during the previous decade, the trends over the past 12 years are either stable or increasing in these areas (Table 4a). This contrasts with the trends for both fry and parr indices in the rivers of SFA 16 (Miramichi, southeast NB) which are strongly declining.

There were fewer warm water temperature and low flow events that affected fisheries access to Atlantic Salmon in DFO Gulf Region rivers in 2019 compared to 2018. Excessive flows in winter and in April 2019 were noted in DFO Gulf Region rivers with a record high flow in April recorded for the Southwest Miramichi (SFA 16). High winter and spring discharges may contribute to reduced survival of eggs and emergent fry and these conditions may further reduce future recruitment potential resultant of already low spawning escapements. The potential consequences of these flow and temperature events on future adult recruitment and abundance is unknown.

Based on the trends in abundance of small salmon and large salmon and the generally declining or stable juvenile abundance indices, there is no expectation of increased abundance of salmon in rivers of DFO Gulf Region in 2020.

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Sources of information

This Science Response Report results from the Science Response Process of February 21, 2020 on update of indicators of Atlantic Salmon to 2019 for Salmon Fishing Areas 15 to 18, DFO Gulf Region. No additional publications from this process are anticipated.

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