SOUTHERN GULF OF ST. LAWRENCE (SFA 15–18) ATLANTIC SALMON (*SALMO SALAR*) UPDATE OF STOCK INDICATORS UP TO 2024

CONTEXT

The Fisheries and Harbour Management sector of Fisheries and Oceans Canada (DFO) has requested an update of stock status indicators of Atlantic Salmon in DFO Gulf region Salmon Fishing Areas (SFA) 15–18 to 2024. This Fisheries Science Response Report results from the regional peer review of February 27, 2025 on Fisheries and Oceans Canada Gulf Region (SFA 15–18) Atlantic Salmon (*Salmo salar*) Update of Stock Indicators up to 2024. Updates on Atlantic Salmon stock status for the Region have been published regularly since 2014 (DFO 2023).

SCIENCE ADVICE

Status

- Returns of large (≥ 63 cm fork length) and small (< 63 cm fork length) Atlantic Salmon observed or estimated from all counting facilities and assessment programs in monitored rivers of SFAs 15A, 16A, and 18B in 2024 were the lowest or among the lowest of the various time series.
- In SFA 15A, the estimate of egg deposition from adult Atlantic Salmon spawners was below the Limit Reference Point (LRP) for the Restigouche River and the stock was in the Critical Zone of the Precautionary Approach (PA) framework in 2023 and 2024.
- In SFA 16A, estimates of egg deposition from adult Atlantic Salmon spawners were below the LRP for the Southwest (SW) and Northwest (NW) branches of the Miramichi River and the stocks were in the Critical Zone of the PA framework in 2023 and 2024.
- Stock status could not be assessed in SFA 17, Prince Edward Island (PEI), in relation to the PA framework.
- Stock status could not be determined for the Margaree River (SFA 18B) in relation to the PA framework as the model is currently operating outside its calibration range. However, estimates from the model output are expected to provide an indication of population fluctuations.

Trends

- Over the recent 12-year period (2012-2024), two generations for Atlantic Salmon in Gulf Region rivers, the trend in large adult Atlantic Salmon returns has been declining in the Restigouche River (SFA 15A) (52%), the Miramichi River (SFA 16A) overall (64%), the SW Miramichi River (66%), and the NW Miramichi (not statistically significant). Similarly, small Salmon returns have been declining in the Restigouche River (74%) and in the Miramichi River as a whole and in each of its two main branches (range 79% to 86%).

- Since 2012, the estimated median egg deposition was below the LRP (Critical Zone of PA) for the Restigouche River (SFA 15A) 11 times, for the whole Miramichi River (SFA 16A) six times, the SW Miramichi River five times, and for the NW Miramichi River nine times.
- Due to data limitations, trends in adult Salmon returns are unavailable for PEI (SFA 17), but redd counts in 2024 were generally lower than in previous years.
- Trends for large and small Salmon returns to the Margaree River (SFA 18B) are not presented given that the estimated abundance of fish and the magnitude of change between years is suspected of being inaccurate. Based on the model output and catch information from the provincial license stubs, the returns of small Salmon to the Margaree River were among the lowest of the time series in 2023 and 2024, whereas large Salmon returns were among the lowest of the time series in 2024 only. In 2024, total egg deposition was likely among the lowest of the time series.
- Over the last 12 years in SFA 15A, the abundance of Atlantic Salmon fry and small parr have been relatively stable in nearly all of the four surveyed sub-catchments of the Restigouche system, while large parr have fluctuated without trend or declined in two sub-catchments.
- Over the last 12 years in SFA 16A, Atlantic Salmon juveniles of all age classes in the four main rivers of the Miramichi watershed have declined significantly. In the five surveyed rivers of SFA 16B, fry and parr densities remain generally low.
- Over the last 12 years in SFA 18, Atlantic Salmon fry and parr abundances have fluctuated without trend in each of the four surveyed rivers. Where earlier juvenile densities are available, abundances since the mid-2000s have been approximately half those of the 1990s to early 2000s for the Margaree (SFA 18B) and West River (Antigonish; SFA 18A).

Ecosystem and Climate Change Considerations

- Atlantic Salmon populations have been experiencing long-term, and widespread declines across the species' global range. The main contributor to the range-wide declines is a reduction in post-smolt survival associated with a decline in marine productivity.
- Climate change, changes to species composition and interspecific interactions, and ecosystem-level alterations influence estimates of spawner abundance, but these were not accounted for in the stock assessment models. These climate-related changes would also affect growth and survivorship of salmon across their life stages. Additionally, sources of adult Salmon mortality once fish return to home waters, such as mortalities associated to warm water and/or disease, were not accounted for but could have reduced the number of returning adult spawners that deposited eggs in the rivers.

Stock Advice

- Atlantic Salmon egg deposition rates were below the LRP for the Restigouche and Miramichi rivers again in 2024, placing these stocks in the Critical zone of the PA management framework for several consecutive years (range 5–11 times of the last 12 years).
- DFO's PA policy when stocks are in the Critical zone is to promote stock growth and keep preventable loss to a minimum.
- The returns of small Salmon observed or estimated from all counting facilities and assessment programs in monitored rivers of SFAs 15A, 16A, and 18B in 2024 were the

lowest on record. Given the precarious returns of small salmon in 2024, fish from the same cohort that will have spent two winters at sea (2SW) are not expected to have strong returns in 2025. Large Salmon, particularly 2SW Salmon, contribute most of the eggs deposited in Gulf region rivers annually which suggests that egg depositions may be low again in 2025.

BASIS FOR ASSESSMENT

Assessment Details

Year Assessment Approach was Approved

The background and evolution of the stock assessment programs for SFAs 15–18 can be found in the references listed in Table 1.

Assessment Type

The 2023 and 2024 stock assessments for each SFA in the Gulf region are Interim-Year Updates.

Most Recent Assessment Date

1. The last Atlantic Salmon stock assessment for SFAs 15–18 was for the 2019 return year (Cairns et al. 2023, Daigle 2023, Dauphin 2022, Douglas et al. 2023).
2. The last interim-year update for Atlantic Salmon in SFAs 15–18 was in March 2023 (DFO 2023).

Assessment Approach

1. Broad category:
   Restigouche (SFA 15A) – Single stock assessment model
   SW Miramichi (SFA 16A) – Single stock assessment model
   NW Miramichi (SFA 16A) – Single stock assessment model
   PEI (SFA 17) – Index-based (trends in empirical indices only)
   Margaree (SFA 18B) – Single stock assessment model
2. Specific category:
   Restigouche (SFA 15A) – Index-based (fishery-dependent indices only)
   SW Miramichi (SFA 16A) – Index-based (fishery-dependent and independent indices)
   NW Miramichi (SFA 16A) – Index-based (fishery-dependent and independent indices)
   PEI (SFA 17) – Index-based (fishery-independent index)
   Margaree (SFA 18B) – Index-based (fishery-dependent and independent indices)

Table 1. References to key Atlantic Salmon stock assessments and methodologies used in SFAs 15–18. SENB = southeastern New Brunswick.

SFA	River	Methodology	References
SFA 15A	Restigouche	Apply an exploitation rate of 40% to the large and small Salmon catches since 2001. Juvenile Salmon electrofishing surveys.	Cameron et al. (2009), DFO (2012), Dauphin et al. (2021), Dauphin (2022)

SFA	River	Methodology	References
SFA 16A	Miramichi	Annual mark and recapture data modelled in a Bayesian hierarchical framework to estimate large and small adult Salmon returns to the river and each of its two major branches since 1998. Juvenile Salmon electrofishing surveys.	Randall and Chadwick (1983), Courtenay et al. (1993), Claytor (1996), Chaput et al. (1999), Chaput et al. (2005), Moore and Chaput (2007), Chaput and Douglas (2012), Douglas et al. (2023)
SFA 16B	SENB rivers	Juvenile Salmon electrofishing surveys.	Atkinson (2004)
SFA 17	PEI	Redd counts.	Cairns and MacFarlane (2015), DFO (2018), Cairns et al. (2023)
SFA 18A	Mainland Nova Scotia rivers	Juvenile Salmon electrofishing surveys.	Breau et al. (2009), Daigle (2023)
SFA 18B	Margaree	Estimated exploitation rates in the recreational Salmon fishery are modelled from mark and recapture experiments conducted between 1988 and 1996. These are then applied to the annual recreational fishery catch and effort data recorded in volunteer angler logbooks and license stub returns. Juvenile Salmon electrofishing surveys.	Chaput and Claytor (1989), LeBlanc et al. (2005), Breau et al. (2009), Breau and Chaput (2012), Daigle (2023)

Stock Structure Assumption

Reference points have been developed for 98 Atlantic Salmon bearing rivers in SFAs 15–18 (DFO 2018, DFO 2022b). However, stock status in relation to the PA framework is only evaluated in SFAs 15, 16 and 18 by monitoring the river within each SFA that historically had the highest Atlantic Salmon returns (Table 2).

Reference Points

Limit Reference Points (LRP), Upper Stock Reference Points (USR), Target Reference Points (TRP), and Removal Rates (RR) have been defined for 98 rivers known to support Atlantic Salmon populations in the Gulf Region (DFO 2018, DFO 2022a, DFO 2022b, Chaput et al. 2023) and have been summarized previously (see Appendix 1 in DFO 2022b). Reference points for monitored rivers in the Gulf Region are summarized in Table 2.

- Limit Reference Point (LRP): The LRP for Atlantic Salmon in Gulf Region rivers was modelled with a Beverton-Holt stock and recruitment relationship and was defined as an egg deposition rate that results in a low probability (<= 25%) that the resulting recruitment will be less than 50% of maximum recruitment. The predicted LRP egg deposition rates for the rivers of the southern Gulf of St. Lawrence range between 1.52 and 1.76 eggs per m² of fluvial area (DFO 2018, DFO 2022a).

- Upper Stock Reference (USR): The candidate USR for Atlantic Salmon in Gulf region rivers was analyzed from adult-to-adult stock and recruitment data and defined as 80% of recruitment at maximum sustainable yield. A ratio 3.8 times higher than the LRP defined the USRs for Gulf Region rivers (DFO 2022b).
- Target (TRP): The candidate TRP for Atlantic Salmon in Gulf Region rivers was analyzed from adult-to-adult stock and recruitment data and defined as recruitment at maximum sustainable yield. A ratio 4.7 times higher than the LRP defined the TRPs for Gulf Region rivers (DFO 2022b).
- Removal Reference (RR): The candidate RR for Atlantic Salmon in Gulf Region rivers is equivalent to fishing at maximum sustained yield (MSY) when the recruitment is at MSY and was defined as 0.6 for all rivers (DFO 2022b).

Table 2. Atlantic Salmon fishing areas (SFA) in the southern Gulf of St. Lawrence showing monitored river, Limit Reference Point (LRP), Upper Stock Reference (USR), and Target Removal Point (TRP). Reference points are in eggs per 100 m^2.

SFA	Monitored River	LRP	USR	TRP
SFA 15A	Restigouche	152	578	717
SFA 16A	Miramichi	160	606	753
	SW Miramichi	152	578	717
	NW Miramichi	176	669	830
SFA 17	Small rivers with minor stocking	152	578	717
SFA 17	Large rivers with major stocking	158	600	743
SFA 18B	Margaree	152	578	717

Data

SFA 15A (Restigouche River)

- Annual private lodge catches and provincial Crown reserve catches adjusted for missing data (i.e., non-reporting lodges and anglers)
- Reported, assumed, and calculated losses from Food, Social and Ceremonial (FSC) and recreational fisheries
- Historical biological characteristics (Peppar 1983, Randall 1989)
- Annual juvenile Salmon abundances from electrofishing surveys at approximately 60 sites

SFA 16 (Miramichi River and five rivers in Southeastern NB)

- Annual mark and recapture data for the Miramichi and each of its' two major branches
- Reported, assumed, and calculated losses from FSC and recreational fisheries (Miramichi only)
- Annual biological characteristics of adult Salmon from DFO Index trapnets operated in the SW and NW Miramichi rivers

- Annual juvenile Salmon abundances from electrofishing surveys at approximately 50 sites in the Miramichi watershed and 25 sites distributed among five rivers of Southeastern NB (Bouctouche, Cocagne, Richibucto, Kouchibouguacis, and Kouchibouguac)

SFA 17 (various rivers of PEI)

- Annual Atlantic Salmon redd counts

SFA 18 (Margaree and three rivers in mainland NS)

- Catch and effort statistics from the provincial recreational angling license stubs (n = 633 in 2024 as of January 30, 2025) and volunteer Salmon angler logbooks (n = 16 in 2024)
- Reported, assumed, and calculated losses from FSC and recreational fisheries (Margaree only)
- Historical biological characteristics of adult Salmon from the Margaree River (LeBlanc et al. 2005)
- Annual juvenile Salmon abundances from electrofishing surveys at approximately 13 sites in the Margaree River and six sites in each of the West River (Antigonish), East River (Pictou), and River Philip

ASSESSMENT

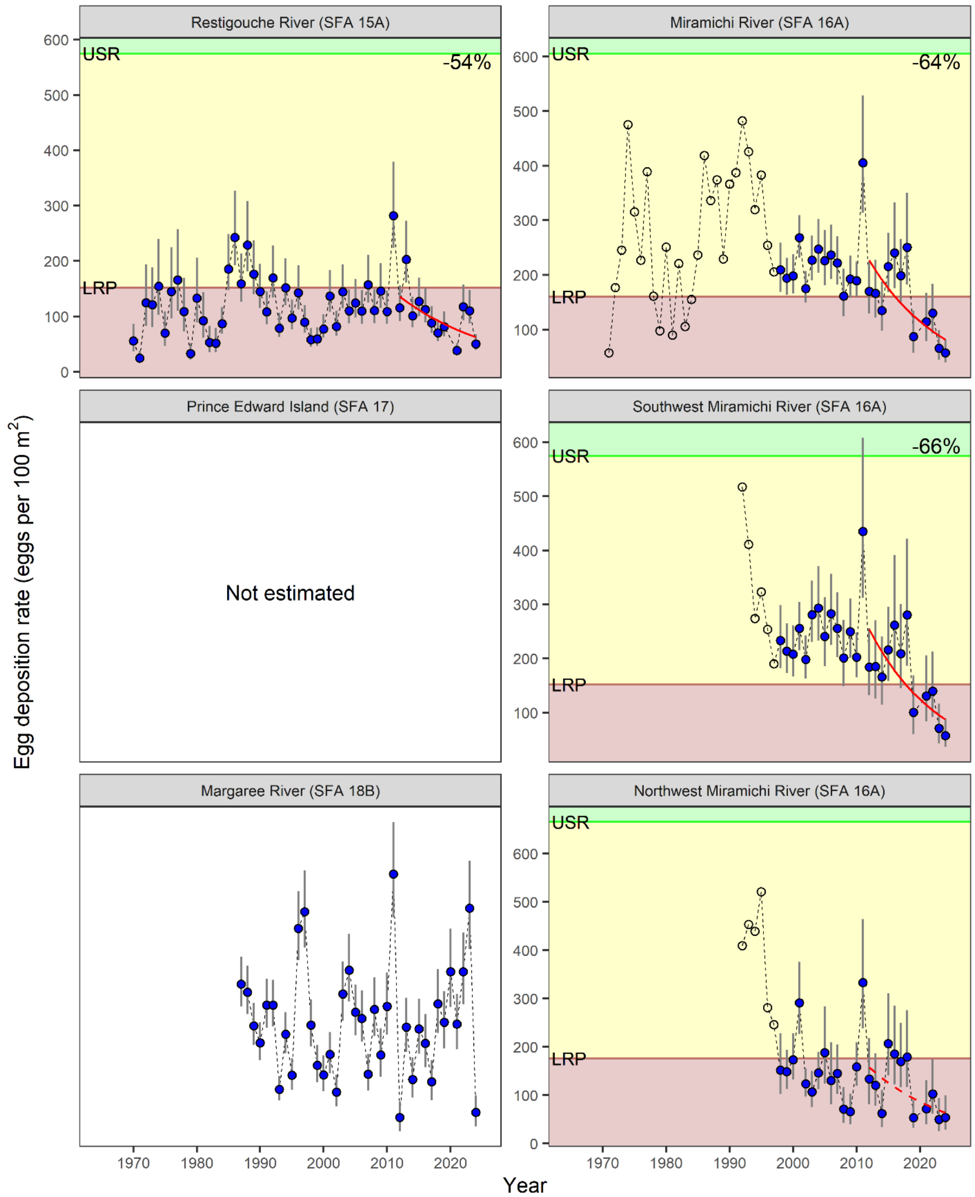

Figure 1. Estimates of egg deposition rates from small and large Atlantic Salmon spawners combined across SFAs 15–18 from 1970 to 2024. For the Restigouche River (SFA 15A), blue circles are estimates based on an assumed exploitation rate of 40% and the vertical lines encompass the range for exploitation rates between 30% and 50%. For the Miramichi (SFA 16A) and Margaree (SFA 18B) rivers, blue circles are the median estimates and the vertical lines encompass the 5th to 95th percentile range of the number of eggs. Open circles indicate years when a 5th to 95th percentile range could not be generated. The LRP and USR are indicated with horizontal red and green lines, respectively, and the Critical, Cautious, and Healthy zones of the PA are identified by the areas shaded in red, yellow, and green, respectively. The dark red trend line represents the exponential regression in the estimated egg deposition rates over the previous 12-year time period (2012 to 2024). If the trend is significant then the line is solid and the corresponding percent change over that period is shown in the upper right corner of each panel; dashed lines indicate a non-significant trend. Egg deposition rates could not be estimated for Prince Edward Island (SFA 17) and stock status relative to reference points could not be assessed for the Margaree River (SFA 18B) due to concerns about estimate accuracy.

Historical and Recent Stock Trajectory and Trends

Returns of large and small adult Atlantic Salmon observed or estimated from all counting facilities and assessment programs in monitored rivers of SFAs 15A, 16A and 18B in 2024 were the lowest or among the lowest of the various time series (Appendix, Figures A1-A3).

In the Restigouche River (SFA 15A), large Salmon returns in 2023 were similar to 2022 but declined substantially in 2024 and were the third lowest of the time series (Appendix, Figure A1). The estimate of small Salmon returns to the Restigouche River in 2024 was the lowest on record. Similarly, estimates of large and small Salmon spawners from completed end-of-season visual surveys in 2024 were the lowest of the time series (Appendix, Figure A2). In 2023 and 2024, the Restigouche River was in the Critical zone of the PA framework, with an estimated median egg deposition rate of 110 and 50 eggs per 100 m^2, respectively (Figure 1, Table 3). The percentage of LRP attainment was 72% and 33%, respectively, in both years. Since 2012, the significant 12-year trend estimated a 54% decline in estimated egg deposition and across that period, the egg deposition was below the LRP in all but one of the assessed years (Cautious zone in 2013). Over the last 12 years, the abundance of Atlantic Salmon fry and small parr have fluctuated without trend in nearly all of the four surveyed sub-catchments of the Restigouche system, while large parr have been relatively stable or declining in two sub-catchments (Figure 2). Abundances of all juveniles in each of the four main Restigouche sub-catchments are near the post-1984 average (Figure 2). The contrasting trends for adults and juveniles may reflect the deteriorating marine conditions experienced by post-smolts (see Ecosystem and Climate Change Considerations).

In SFA 16A, estimates of large Salmon returns in 2023 were the second lowest (third lowest for the NW Miramichi River) of the time series for the Miramichi and SW Miramichi rivers, followed in 2024 by the lowest large Salmon return estimates of the time series for each river (Appendix, Figure A1). Small Salmon return estimates in 2023 and 2024 were the second lowest and lowest of the time series for each river, respectively. In 2023 and 2024, the Miramichi River (SFA 16A) was in the Critical zone of the PA management framework (Figure 1, Table 3). For the Miramichi River as a whole, the median egg deposition rate was estimated to be 66 and 57 eggs per 100 m^2 in 2023 and 2024, respectively. Similarly for the SW and NW Miramichi rivers, the median egg deposition rate was estimated to range between 50 and 71 eggs per 100 m^2 in 2023 and between 54 and 57 eggs per 100 m^2 in 2024 (Figure 1, Table 3). Over the last 12 years, the trend in the median egg deposition rate was a significant decline between 64% (Miramichi) and 66% (SW Miramichi). The trend for the egg deposition rate in NW Miramichi spawners was not statistically significant and reflects the difficulty in detecting changes at very low abundances (Figure 1, Table 3). The percentage of LRP attainment in 2023 ranged between 28% (NW Miramichi River) and 47% (SW Miramichi River) and the probability of being above the LRP for each river was 1% or less. Similarly in 2024, the percentage of LRP attainment ranged between 31% (NW Miramichi River) and 37% (SW Miramichi River) and the probability of being above the LRP for each river was 0% or less than 1% (Table 3). Since 2012, the median egg deposition rate from spawners was below the LRP (Critical zone) for the Miramichi River (SFA 16) overall six times (50%), the SW Miramichi River five times (42%), and for the NW Miramichi River nine times (75%). Atlantic Salmon juveniles of all age classes in the four main rivers of the Miramichi watershed (SFA 16A) continue to show significant declines over the last 12 years and all are below the post-1984 average (Figure 3). In monitored rivers of SFA 16B, the trends in fry and parr densities have been stable or increasing, despite abundances remaining low (Figure 4).

For the Margaree River (SFA 18B), there are concerns about the model producing inaccurate estimates of Salmon abundance (see Sources of Uncertainty for details) and therefore, estimated egg deposition will not be presented relative to reference points until estimates are deemed reliable and the model is validated (Figure 1). Indeed, the average estimated returns to the river are similar throughout the time series (Appendix, Figure A1) but this population level does not align with field observations, the decline in juvenile abundances, and reporting from angler license stubs. While the estimated abundance of fish and the magnitude of change between years are suspected of being inaccurate, model outputs are expected to provide an indication of population fluctuations. The abundance of fry and parr in SFA 18 has fluctuated over the last 12 years but is generally stable. Where earlier juvenile densities are available, abundances since the mid-2000s have been approximately half those of the 1990s to early 2000s period for the Margaree (SFA 18B) and West River (Antigonish; SFA 18A).

Redd counts

For rivers in PEI (SFA 17), an assessment of stock status relative to the PA framework is not available due to data limitations. Previous Atlantic Salmon assessments for rivers in SFA 17 converted redd counts to number of female spawners as outlined in Cairns and MacFarlane (2015). However, see Sources of Uncertainty for reasons why this methodology was not applied in 2024. Nevertheless, monitoring the number of redds counted annually is still considered to be the best indicator of adult Atlantic Salmon abundance available for PEI rivers. Twenty rivers on Prince Edward Island were surveyed for Atlantic Salmon redds in 2023, followed by 18 in 2024 and the general trend has been a decline in the total number of redds. However, in the three rivers where most Salmon spawn (Mill River, Morell River, West River), the most recent complete counts have been near or slightly above the twelve-year average (Table 4).

Table 3. Summary of Atlantic Salmon stock status for 2023 and 2024 in the Restigouche (SFA 15A) and Miramichi (SFA 16A) rivers. The calculation of the probability that the egg deposition rate in the Restigouche River is above the LRP is not possible. The trend in the egg deposition rate over the last 12 years (2012-2024) is presented unless it was statistically non-significant (ns).

		2023			2024			12-year trend
SFA	**River**	**Egg deposition (eggs per 100 m^2)**	**% LRP attainment (prob. > LRP)**	**PA status**	**Egg deposition (eggs per 100 m^2)**	**% LRP attainment (prob. > LRP)**	**PA status**	**Egg deposition (eggs per 100 m^2)**
15A	Restigouche	110	72%	Critical	50	33%	Critical	-54%
16A	Miramichi	66	41% (<1%)	Critical	57	36% (0%)	Critical	-64%
16A	SW Miramichi	71	47% (1%)	Critical	57	37% (<1%)	Critical	-66%
16A	NW Miramichi	50	28% (<1%)	Critical	54	31% (<1%)	Critical	ns

Table 4. Count of Atlantic Salmon redds in monitored rivers of Prince Edward Island (SFA 17) from 2013 to 2024. Brackets indicate that the count was incomplete and a dash indicates no survey was performed.

River	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Cains Brook	38	-	(38)	(44)	75	23	-	(51)	-	51	(48)	-
Carruthers Brook	98	-	(103)	(94)	119	109	38	92	133	(119)	154	-
Trout River, Coleman	59	38	(38)	(44)	41	32	25	28	38	40	42	16
Trout River, Tyne Valley	0	0	-	-	4	-	-	-	-	-	-	-
Little Trout River	0	0	(2)	-	20	-	-	-	-	-	-	-
Bristol (Berrigans) Creek	10	0	(1)	-	8	-	-	25	(5)		(2)	14
Morell River	(326)	388	(143)	204	191	(125)	(475)	428	(52)	(28)	(58)	288
Midgell River	(36)	76	140	-	104	-	-	-	-	-	-	-
St. Peters River	44	43	67	(20)	19	-	-	101	-	-	(4)	34
Cow River	50	12	67	56	38	(13)	8	3	-	-	(5)	0
Naufrage River	453	217	154	108	89	(43)	74	38	(0)	-	(29)	33
Bear River	16	3	13	35	7	(1)	0	11	-	-	(0)	0
Hay River	43	15	36	41	15	(4)	13	0	(1)	-	(12)	4
Cross Creek	268	193	238	170	192	(59)	33	115	(27)	(20)	(10)	23
Priest Pond Creek	151	129	138	70	150	(4)	22	5	(0)	-	0	0
North Lake Creek	333	183	262	251	213	(40)	56	78	(11)	(49)	49	75

River	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Vernon River	11	(8)	0	-	17	(6)	9	12	18	(15)	(9)	9
Clarks Creek	3	-	(0)	-	4	-	(2)	-	12	(6)	(9)	9
Pisquid River	39	(15)	47	29	28	(16)	10	26	13	(5)	(19)	17
Head of Hillsborough R.	2	-	0	-	0	-	-	11	6	(2)	(1)	4
North River	21	-	-	-	8	-	-	0	14	(7)	0	6
Clyde River	-	-	-	-	0	-	-	-	-	-	-	-
West River	168	113	113	146	149	(124)	114	101	(38)	141	(84)	130
Dunk River	-	-	-	-	78	-	-	-	-	(7)	(35)	-
Wilmot River	-	-	-	-	6	-	-	-	-	-	-	-
Mimnegash River	-	-	-	-	-	-	-	-	-	-	-	4

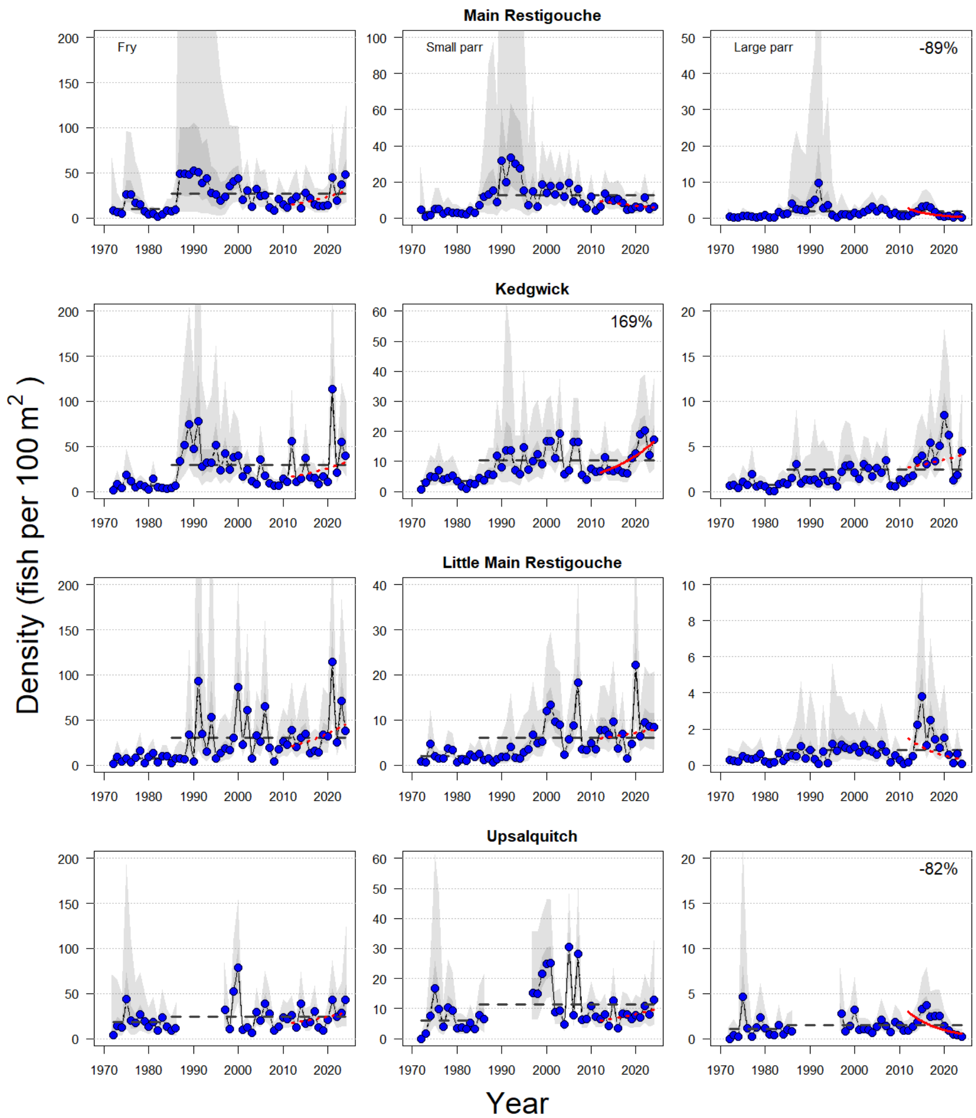

Figure 2. Annual median densities (blue circles) of Atlantic Salmon fry (left column), small parr (middle column), and large parr (right column) at sampled sites in four major sub-catchments of the Restigouche watershed (SFA 15A): main Restigouche (top row), Kedgwick (second row), Little Main Restigouche (third row), and Upsalquitch (bottom row) from 1972 to 2024. The light and dark shading represent the 2.5th-97.5th and 25th-75th percentile ranges, respectively. The horizontal dashed lines in each panel are the average densities corresponding to the periods before and after significant management changes were implemented to the commercial and recreational Salmon fisheries in 1984. The dark red trend line represents the exponential regression in the estimated juvenile densities over the previous 12-year time period (2012 to 2024). If the trend is significant then the line is solid and the corresponding percent change over that period is shown in the upper right corner of each panel; dashed lines indicate a non-significant trend.

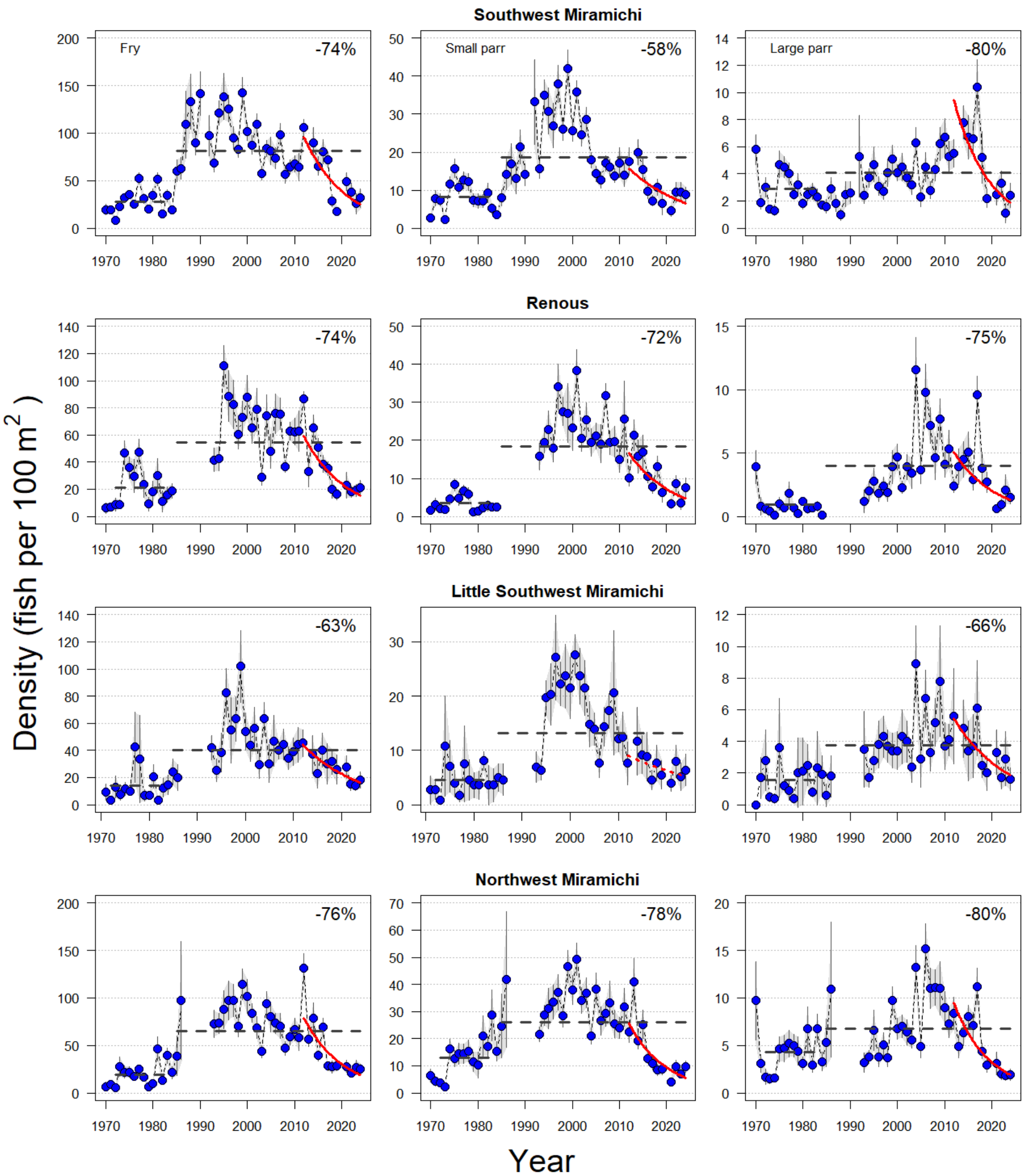

Figure 3. Annual average densities (blue circles) of fry (left column), small parr (middle column), and large parr (right column) at sampled sites in four major rivers of the Miramichi (SFA 16A): SW Miramichi (top row), Renous (second row), Little Southwest Miramichi (third row), and NW Miramichi (bottom row) from 1970 to 2024. The vertical lines and grey shading represent the standard error when shown. The horizontal dashed lines in each panel are the average densities corresponding to the periods before and after significant management changes were implemented to the commercial and recreational Salmon fisheries in 1984. The dark red trend line represents the exponential regression in the estimated juvenile densities over the previous 12-year time period (2012 to 2024). If the trend is significant then the line is solid and the corresponding percent change over that period is shown in the upper right corner of each panel; dashed lines indicate a non-significant trend.

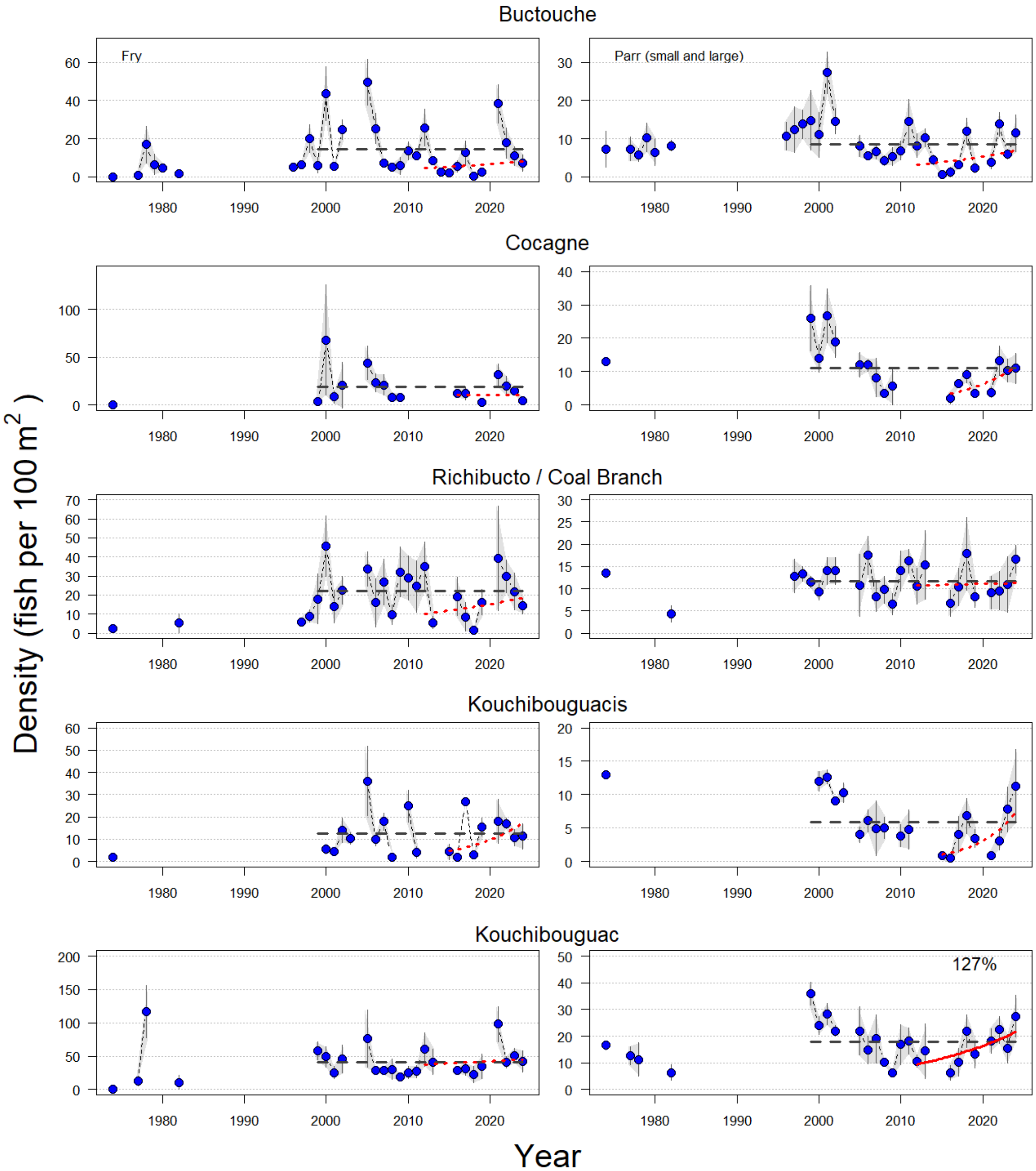

Figure 4. Annual average densities (blue circles) of fry (left column) and parr (small and large sizes combined, right column) at sampled sites in five major rivers of southeastern New Brunswick (SFA 16B): Buctouche River (top row), Cocagne River (second row), Richibucto/Coal Branch river (third row), Kouchibouguacis River (fourth row), and Kouchibouguac River (bottom row) from 1974 to 2024. The vertical lines and grey shading represent the standard error when shown. The horizontal dashed lines represent average fry and parr densities for the years after the closure of the Indigenous and recreational fisheries in 1998. The dark red trend line represents the exponential regression in the estimated juvenile densities over the previous 12-year time period (2012 to 2024). If the trend is significant then the line is solid and the corresponding percent change over that period is shown in the upper right corner of each panel; dashed lines indicate a non-significant trend.

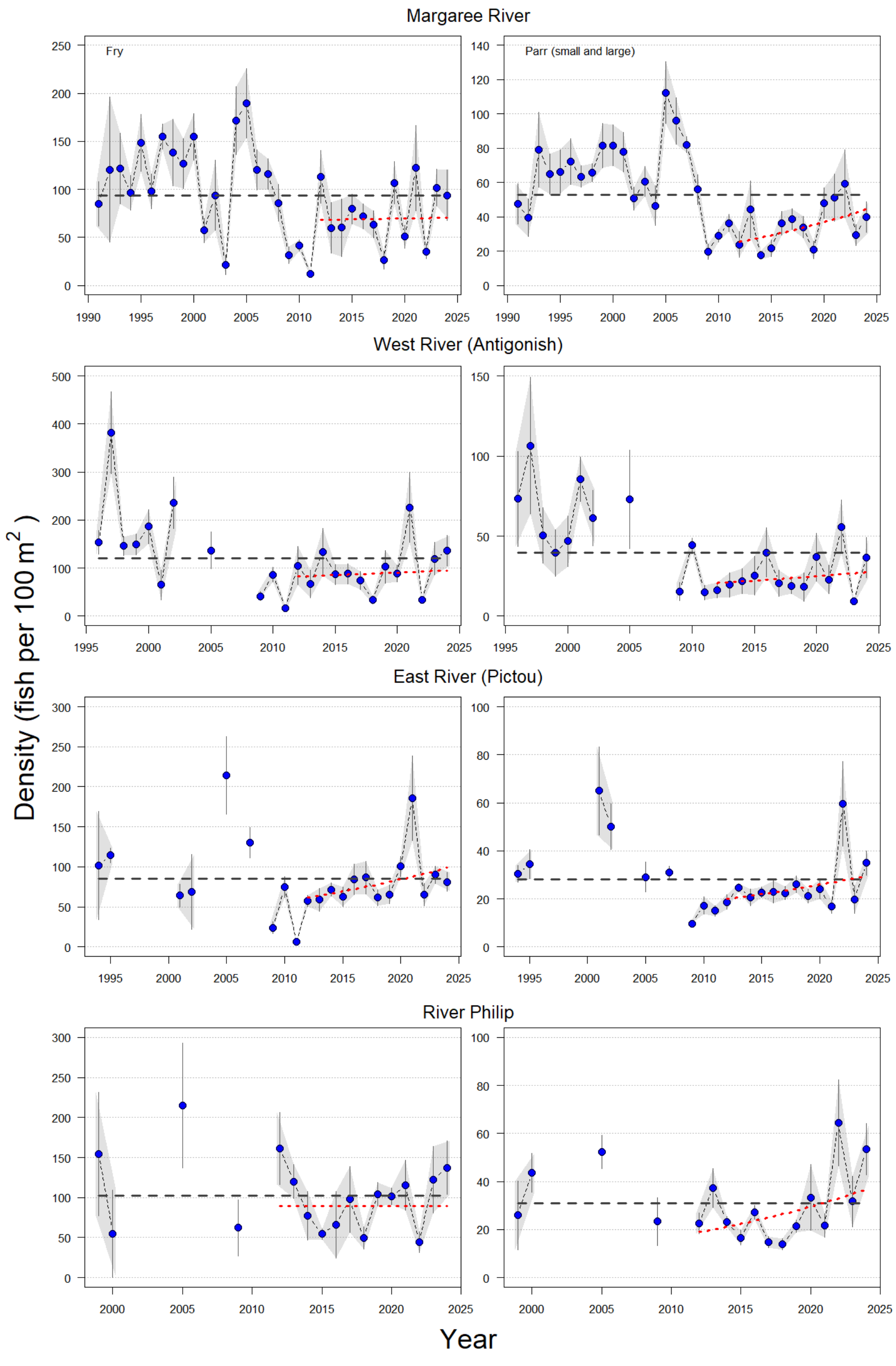

Figure 5. Annual average densities (blue circles) of fry (left column) and parr (small and large sizes combined, right column) at sampled sites in the four largest rivers of SFA 18: the Margaree River (top row; SFA 18B), West River Antigonish (second row; SFA 18A), East River Pictou (third row; SFA 18A), and River Philip (bottom row; SFA 18A) from 1991 to 2024. The vertical lines and grey shading represent the standard error when shown. The horizontal dashed line in each panel represents the average densities for the time series presented. The red dashed trend lines (not statistically significant) represent the exponential regression in the estimated densities over the previous 12-year time period (2012 to 2024).

History of Management

There has not been an Atlantic Salmon commercial fishery in the Gulf Region since 1984 due to concerns about the stocks' conservation. However, Food, Social and Ceremonial (FSC) fisheries for Atlantic Salmon occur in several rivers in Gulf Region and removals of Gulf Region origin fish in marine salmon fisheries still occurs (Douglas et al. 2023)

DFO manages a directed Atlantic Salmon recreational fishery in the Gulf Region. Mandatory catch and release measures for the recreational fishery started in 1984 for large Salmon and have been extended to small Salmon since 2015 in all SFAs where recreational fisheries were authorized. Prior to 2015, retention of small Salmon had been permitted in SFAs 15, 16A, and 18. Since 1998, rivers in SFA 16B have been closed to all directed Salmon fishing. In SFA 17, mandatory catch and release has been in effect since 2009 (DFO 2012) and a recreational fishery is allowed on only two rivers (Mill and Morell). Changes to the daily catch limit have also changed over the years but are river-specific and vary depending on season (DFO Atlantic Salmon Integrated Management Plan 2008-2021 Gulf Region (DFO 2008, Breau and Chaput 2023).

Ecosystem and Climate Change Considerations

Atlantic Salmon populations have been experiencing long-term, widespread declines across the species' global range (ICES 2024). The main contributor to the range-wide declines was a reduction in post-smolt survival associated with a decline in marine productivity (ICES 2024). Post-smolts from SFAs 15–18 travel through the Gulf of St. Lawrence during spring and early summer. Water temperatures in the Gulf of St. Lawrence have regularly reached new record highs in recent years (Galbraith et al. 2024) which may have contributed to observed changes in abundance and distribution of a variety of species (e.g., DFO 2025a). Higher water temperature increases energetic requirements of Salmon and may also decrease food availability and quality or create a mismatch between the timing of migration and food availability. Similar changes in temperature and food availability have occurred on Salmon feeding grounds in the North Atlantic, further negatively impacting post-smolts (ICES 2024).

In addition to the large-scale global factors impacting Salmon populations, regional or river-specific factors also have influence. Air temperatures in the Gulf Region have significantly increased in recent years (Goguen 2025). High air temperatures during low summer flows have resulted in elevated water temperatures within Gulf Region rivers (except SFA 17) (Goguen 2025), which negatively affect adult and juvenile Salmon survivorship, growth, and production (Breau 2013, Van Leeuwen et al. 2020). Climate change and ecosystem change influence all life stages of Atlantic Salmon but these are not well known nor accounted for in the stock assessment models. For example, Salmon mortality may occur after fish return to the river, (e.g., from warm water conditions and/or disease) possibly reducing the number of spawners.

Climate change also influences community species composition and interspecific interactions which can result in ecosystem-level alterations (e.g., DFO 2025b). Salmon populations are subject to predation across life stages and therefore changes in predator abundance or predator behaviour in response to climate change may influence survivorship. The invasive Smallmouth Bass is now established in the Southwest Miramichi River and was detected in the Northwest Miramichi River for the first time in 2024. Anthropogenic stressors such as land-use activities that modify water quality and quantity also create ecosystem-level changes that affect Salmon (COSEWIC 2010).

A summary of Threats to Atlantic Salmon which include ecosystem and climate change considerations can be found in the research document series "Information on Atlantic Salmon

(*Salmo salar*) from Salmon fishing areas 15–18 of relevance to the development of a 2nd COSEWIC status report" (Cairns et al. 2023, Daigle 2023, Dauphin 2022, Douglas et al. 2023).

Stock Advice

Atlantic Salmon smolts from Gulf Region rivers spend one to three years at sea before returning to home waters to spawn for the first time. The majority (~90%) of Salmon that return after one year at sea (1SW or grilse) are male while the majority (~85%) of Salmon from the same cohort that return after two or three years at sea (2SW, 3SW) are female. Collectively, the returning 2SW maiden females carry the highest number of total eggs and make the most important contribution to egg depositions in Gulf Region rivers annually. The returns of 1SW Salmon observed or estimated from all counting facilities and assessment programs in monitored rivers of SFAs 15A, 16A and 18B in 2024 were the lowest on record (Appendix, Figures A1-A2). Given the precarious returns of 1SW fish in 2024, there are no expectations for a strong return of 2SW fish in 2025, especially considering the incurrence of an additional year of mortality at sea.

Atlantic Salmon egg deposition rates (median) were below the LRP for the Restigouche and Miramichi rivers again in 2024, placing these stocks in the Critical zone of the PA management framework. Since 2012, the Restigouche salmon population has been in the Critical zone 11 times while the Miramichi, SW Miramichi, and Northwest Miramichi rivers have been in the Critical zone six, five, and nine times, respectively. Serious harm to a stock is occurring when it is in the Critical zone and therefore, stock growth must be promoted, and preventable loss minimized (DFO 2009).

Harvest Decision Rule

There are no Harvest Decision Rules (HDR) in place for Atlantic Salmon in the Gulf Region. However, a recent case study evaluated candidate HDRs for the recreational Atlantic Salmon fishery of the Miramichi River for compliance with the PA policy (Breau and Chaput 2023).

SOURCES OF UNCERTAINTY

Sources of uncertainty relating to data acquisition, such as delayed or incomplete reporting of fisheries data and environmental conditions impacting estimation of losses or sampling, are detailed in DFO (2023) and remain relevant for this update. In particular, these include partial reporting of fisheries-dependent data, uncertainty around end-of-season visual spawner surveys (snorkel counts), incomplete accounting of in-river losses, and periodic reduced sampling effort when counting facilities are inoperable. Below the focus is on uncertainties specific to this update of stock indicators and that may warrant evaluation of the current stock assessment framework in the future.

Restigouche assessment model (SFA 15A)

The assessment model for Restigouche relies on fisheries-dependent data from private lodge owners and provincial catch statistics and does not incorporate effort. This model assumes an exploitation rate of 40% (with variation from 30% to 50%), which was established during a period when fishing pressure was higher and retention was still authorized (Randall et al. 1990). This rate may now be too high and currently exceeds the assumed exploitation rate applied to Quebec rivers (Julien April, pers. comm.). An end-of-season visual spawner survey has been conducted regularly since 1999 (Appendix, Figure A2) but there are uncertainties associated with this methodology which are currently being examined. Ultimately, a review of the existing model and an incorporation of the visual spawner survey information may yield a more accurate assessment model for SFA 15A.

Redd counts (SFA 17)

Assessment of Salmon status on Prince Edward Island is entirely reliant on redd surveys which are affected by high water conditions during the spawning period and often lead to incomplete counts. Additional sources of uncertainty arise from watershed groups' ability to devote their resources to conducting rigorous redd surveys, the difficulty in distinguishing between brook trout redds and Atlantic Salmon redds, and the potential for interannual variation in the timing of spawning events. Further, there are uncertainties in the relationships between the number of redds and spawner abundance. The previous peer-reviewed work by Cairns and MacFarlane (2015), assumed an influence of stocking on salmon size estimates, where more heavily stocked rivers were presumed to have a higher proportion of small salmon relative to unstocked rivers. However, recent evidence from Grove et al. (2025) demonstrated that stocking history has had little impact on the current, and distinct, salmon populations throughout SFA 17. Thus, assumptions related to the size of returning salmon being a consequence of stocking history are invalid. Overall, methods to assess Atlantic Salmon abundance on PEI are not well developed.

Margaree assessment model (SFA 18B)

There are concerns about the accuracy of the adult return estimates generated from the Margaree assessment model. The model was developed from fisheries-independent data collected at a DFO-operated trapnet from 1988 to 1996 in parallel with catch and effort information collected from the recreational license stub data and volunteer angler logbooks. It is likely that the model has been operating outside of its calibration range for some time as there has been a reduction in angler effort on the Margaree River, perhaps because of more restrictive management measures over time. The reduction in juvenile abundance since the mid-2000s (Figure 5), field observations by DFO Science staff, angler license stubs, and anecdotal observations of fewer fish and repeated recapture of the same fish by anglers, all suggest that the model may be overestimating adult returns, and therefore, stock status relative to the reference points. Options to improve the assessment model, including a mark and recapture study conducted using a trapnet, are being explored to obtain fishery-independent data on adult Salmon to recalibrate the model, though results and subsequent validation are not expected for several years.

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APPENDIX

Supplementary figures and data relating to adult Atlantic Salmon monitoring in SFAs 15-18

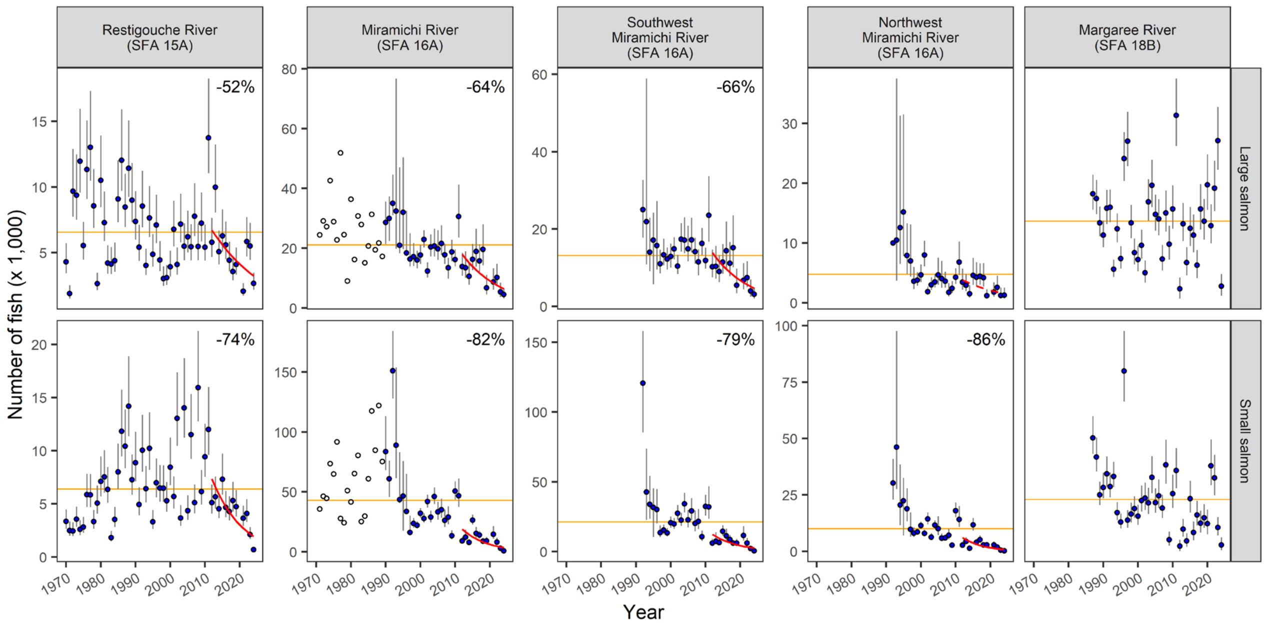

Figure A1. Return estimates for large (top row) and small (bottom row) Atlantic Salmon from SFAs 15A, 16A, and 18B from 1970 to 2024. For the Restigouche River (SFA 15), blue circles are estimates based on an assumed exploitation rate of 40% and the vertical lines encompass the range of exploitation rates between 30% and 50%. For the Miramichi (SFA 16A) and Margaree (SFA 18B) rivers, blue circles are the median estimates and the vertical lines encompass the 5th to 95th percentile range of the number of fish. Open circles indicate years when a 5th to 95th percentile range could not be generated for the Miramichi River overall. The dark red trend line represents the exponential regression in the estimated returns over the previous 12-year time period (2012 to 2024). If the trend is statistically significant, the line is solid and the corresponding percent change over that period is shown in the upper right corner of each panel; non-significant trends are indicated with dashed lines. Return estimates and trend lines were not provided for the Margaree River. The horizontal orange line indicates the mean number of returns across the time series for each river and Salmon size class.

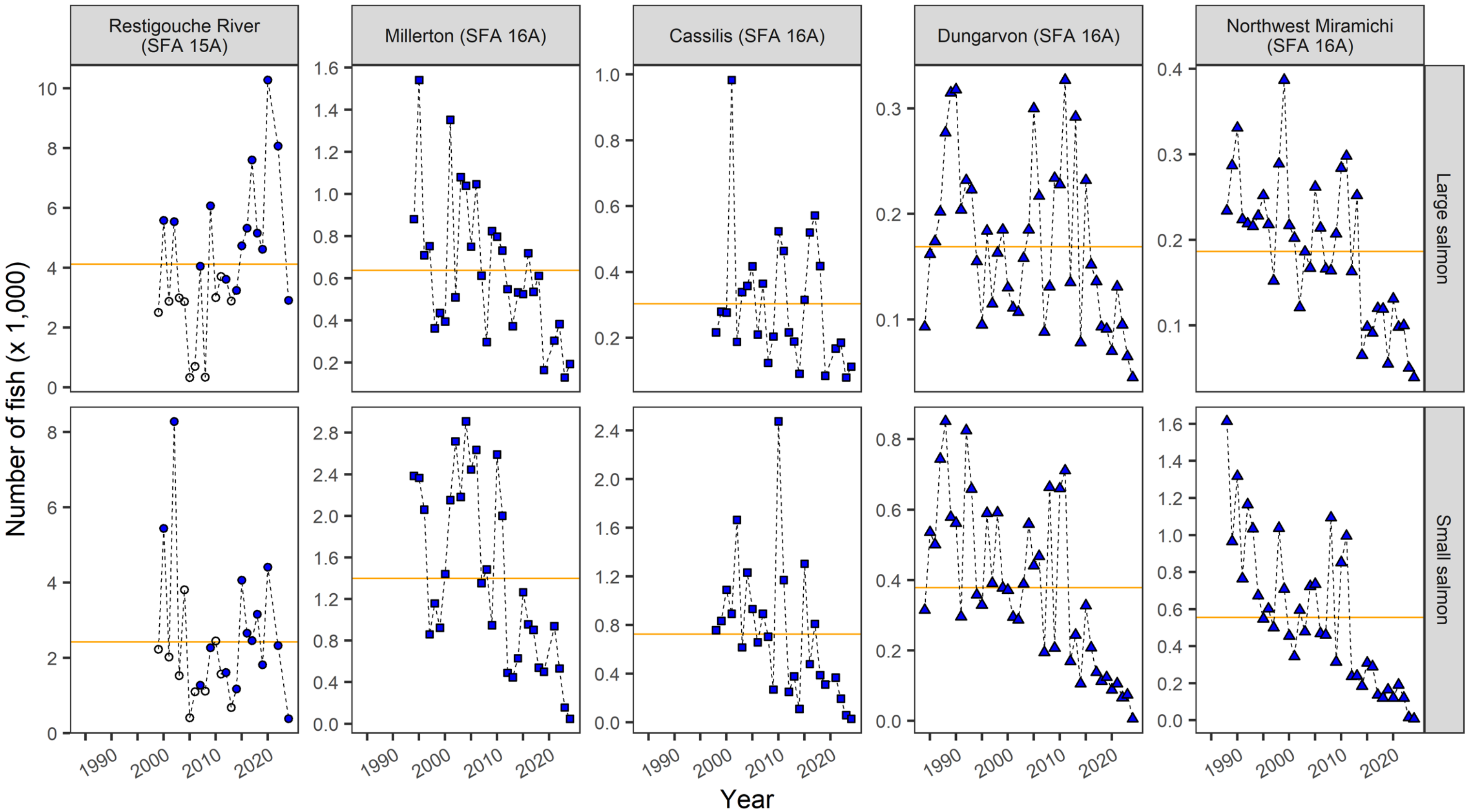

Figure A2. Fishery-independent counts or catches of Atlantic Salmon in the Restigouche River (SFA 15A) from end of season visual spawner counts (circles), DFO index trapnets (squares) located at Millerton (SW Miramichi) and Cassilis (NW Miramichi) (SFA 16A), and headwater protection barriers (triangles) located in the Dungarvon River (tributary of the Renous and SW Miramichi rivers) and the Northwest Miramichi River (SFA 16A). Open circles for the Restigouche River indicate years when the visual surveys were incomplete. The horizontal orange line indicates the mean number of fish across the time series for each river and Salmon size class.

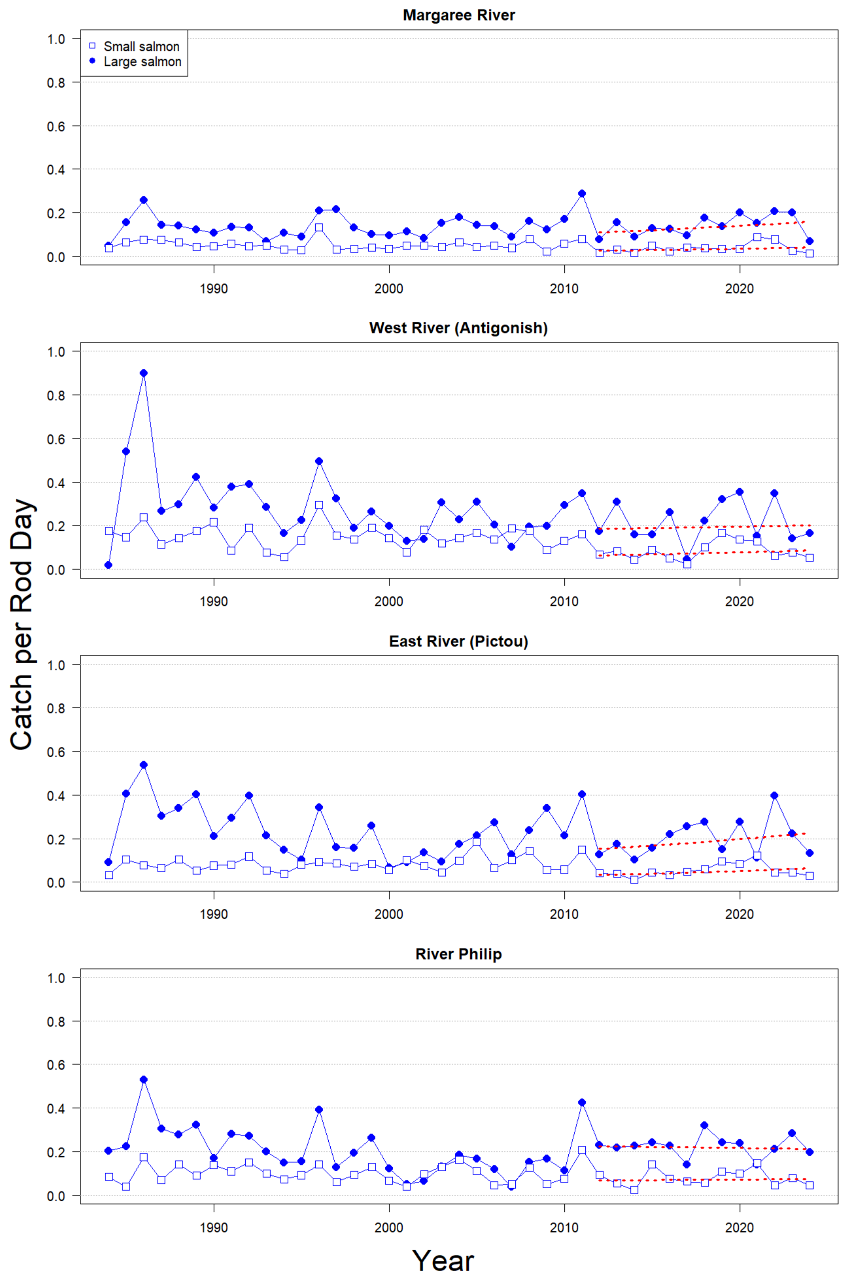

Figure A3. Estimated catch rates (catch per rod day) of large (circles) and small (squares) Atlantic Salmon from the recreational fishery in the four largest rivers of SFA 18 from 1984 to 2024. The red dashed trend lines (not statistically significant) represent the exponential regression in the estimated CPUE over the previous 12-year time period (2012 to 2024). The CPUE index has been calculated from catch and effort in the recreational Salmon fishery since 1984.

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