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Information on Atlantic Salmon (*Salmo salar*) from Salmon Fishing Area 17 (Gulf Prince Edward Island) of relevance to the development of a 2nd COSEWIC status report

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Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

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ABSTRACT

To support preparation of a forthcoming Committee on the Status of Endangered Wildlife in Canada (COSEWIC) review, this report assembles data on Atlantic Salmon (*Salmo salar*) biology, demographics, habitat, and threats for Prince Edward Island (PEI) (Salmon Fishing Area 17). Historical accounts indicate that the original PEI Atlantic Salmon population was dominated by late-run and large (≥ 63 cm) fish. These characteristics are retained in small rivers. At least 38,826,353 Atlantic Salmon have been stocked in PEI in 1880 - 2020, mostly in larger rivers. The proportion of early-run and small Salmon has been increased in larger rivers by the stocking of fish intended to increase summer angling opportunities. Sea ages of returning adults are generally one year for small Salmon and two years for large Salmon. Return rates for fish of hatchery origin range from 0.5 to 5.9%. Data on return rates of naturally spawned fish are unavailable. In the Morell River, PEI's traditionally most important Salmon river, mean fecundity is 3,143 eggs for small Salmon and 4,963 eggs for large Salmon. The egg phase (1 year), juvenile phase (mean 2.32 years), and sea phase (mean 1.77 years) sum to 5.09 years, which is the mean generation time of the population. The typical early life history pattern of PEI Atlantic Salmon occurs in rivers, with eggs hatching as fry, fry developing into parr, and parr turning into smolts which leave on marine migrations. However, some juvenile males mature precociously, and some parr occupy ponds and estuaries. The ancestral trait of late-run and large returnees is shared by Atlantic Salmon in southeast New Brunswick and northern Nova Scotia. Genetic data on Salmon in stocked rivers suggest an affinity with Salmon in a broad geographic area centred in the southern Gulf of St. Lawrence. However, genetic samples from two small rivers in northeastern PEI clustered with each other but did not show affinities with samples from elsewhere in Canada. Redd counts for the period 1990 - 2019 showed rising trends in four rivers and falling trends in five rivers. Redd counts for the period 2004 - 2019 showed rising trends in 13 rivers and falling trends in six rivers. Seventy-one PEI rivers are large enough that they probably supported Atlantic Salmon populations in pristine times. For 2000 - 2019, juvenile electrofishing and redd surveys detected Atlantic Salmon at least once in 40 rivers, but detected Atlantic Salmon in every monitored year in only 12 rivers. The spawning population of Atlantic Salmon on PEI is estimated at 717, based on redd counts. Sediment deposition on spawning and rearing habitat is a major threat to Atlantic Salmon on PEI. Additional threats include pesticide-related fish kills, water extraction for municipal and irrigation purposes, climate change leading to more frequent droughts and higher water temperatures, fish passage impairment by dams (including beaver *Castor canadensis* dams), and competition with non-native Rainbow Trout (*Oncorhynchus mykiss*).

INTRODUCTION

Owing to glacial history, Prince Edward Island (PEI) (Salmon Fishing Area (SFA) 17) is depauperate in obligate freshwater fish species (Curry et al. 2007) but possesses a diverse array of diadromous species (Cairns et al. 1997). In common with many other parts of northeastern North America, Atlantic Salmon (*Salmo salar*) was an important part of PEI's original fish fauna (Dunfield 1985). Historic accounts emphasized Salmon's widespread and abundant distribution (Johnston 1978; Dupuis 2008). Stewart (1806) reported that Salmon were found in "all of our rivers." Based on early accounts, at the time of European contact Salmon probably inhabited all PEI rivers except creeks that were too small to provide adequate habitat for spawning or rearing. Cairns et al. (2010) listed 71 rivers which were probably large enough to support Salmon runs. Of these, 55 have specific records of containing Salmon at some time in the past or present, and 40 were mentioned by name to have had Salmon in annual government reports between 1880 and 1910 (Department of Marine and Fisheries).

European colonization, starting in the 1700s, affected PEI Salmon populations by direct exploitation and by habitat alteration, in particular by sediment deposition in streams and by the construction of dams for power generation (Dupuis 2008; Guignion 2009; Guignion et al. 2010; Samuelson 2013). In addition, the composition of PEI Salmon has been affected by stocking programs. Original PEI Salmon populations had late runs and multi-sea winter marine migrations. These patterns have been retained in small rivers, but in medium and larger rivers, stocking has increased the proportion of fish showing early runs and one-sea winter marine migrations.

PEI Salmon biology, status, and conservation have been reviewed by Ducharme (1977), Bielak et al. (1991), Davidson and Bielak (1992), Davidson and Angus (1994), Cairns et al. (1995, 1996, 2000, 2010, 2012), Cairns (1997), Marshall et al. (1999), Guignion et al. (2002, 2010, 2019), Chaput et al. (2006a), Guignion (2009), MacFarlane et al. (2009), COSEWIC (2010), Cairns and MacFarlane (2015), and DFO (2015, 2016a, 2017, 2018, 2019, 2020).

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) examines the status of wild flora and fauna in Canada. DFO supports the COSEWIC process by compiling and synthesizing relevant data for aquatic species. DFO reports prepared for the 2010 COSEWIC Atlantic Salmon assessment include Cairns (2006), Chaput et al. (2006a,b), O'Connell et al. (2006), Breau et al. (2009), Cameron et al. (2009), DFO and MRNF (2008, 2009) and Cairns et al. (2010). The 2010 Atlantic Salmon COSEWIC assessment placed PEI in the Gaspé-Southern Gulf of St. Lawrence Designatable Unit (DU). COSEWIC (2010) assessed Atlantic Salmon status in this DU as Special Concern.

A COSEWIC review for most Canadian populations of Atlantic Salmon, including those of the Gaspé and southern Gulf of St. Lawrence, is scheduled for November 2022. To support this review, the present report compiles information on PEI Atlantic Salmon life history characteristics, designatable unit affiliation, trends in population and distribution, population size, habitat characteristics and threats, other threats, and population manipulations.

In this paper, adult Salmon with fork lengths < 63 cm are termed small Salmon. Most of these fish have spent one winter at sea (1SW). Salmon with fork lengths ≥ 63 cm are termed large Salmon. Most of these fish have spent two or more winters at sea (MSW).

LIFE HISTORY CHARACTERISTICS

AGE AND/OR LENGTH AT MATURITY, MAXIMUM AGE/OR LENGTH, AND SEA AGE HISTORIES

The first written reference to life history characteristics of Atlantic Salmon in North America stems from Norse explorations of a land they called Vinland about the year 1021 (Fitzhugh and Ward 2000, Kuitems et al. 2022). Accounts of these explorations were carried in oral tradition until they were written down as sagas in Iceland in the 1200s. One saga, The Saga of the Greenlanders, refers to a site of attempted settlement: "There was no lack of Salmon both in the lake and in the river, and this Salmon was larger than they had ever seen before" (Smiley 2000). This reference to size implies MSW fish. On the basis of saga descriptions, Sigurdsson (1998, 2000) argued that Vinland was on the shores of Northumberland Strait, either on the mainland or the Prince Edward Island side. However, other interpretations of the Vinland location have also been proposed (Wallace 2012).

Reports from the 1800s provide information on the run timing of PEI Salmon. Stewart (1806) reported that "on the north side of the Island, in all the harbours they [Salmon] may be seen leaping out of the water frequently in the months of June and July, particularly at St. Peter's Bay, where, and in the River Morell, which runs into it a great many are taken: they do not come into the Hillsburgh River, and the other rivers on the south side of the Island, until the latter end of September, and the beginning of October, when they are on the point of spawning, and are not good" (Fig. 1). This report indicates that Salmon entered north side harbours (bays) in summer, but is silent on the timing of entries into rivers. For the south side, it unequivocally indicates river entry in fall.

Department of the Marine and Fisheries (1880) reported that "in the four reserved rivers, Dunk, Winter, Morelle and Midgel, they [Salmon] are in comparative abundance generally between the dates of 10th October and early in November, and in several other streams and inlets are frequently observed about the same date." Department of Marine and Fisheries (1881) quoted a warden in Winter River as writing that "Salmon are now in the bay [Tracadie Bay] waiting for a freshet; they mostly come up about the first week in November. A few clean fish were in the river in summer… " These accounts suggest that original PEI Salmon populations were dominated by late runs, with lesser early run components in at least some rivers.

Department of the Marine and Fisheries (1881) in reference to Salmon fisheries stated ”No correct record of the size of the individual fish taken could be obtained but the average weight may be safely set down at 10 pounds [4.5 kg]… " Bain (1890) reported that Salmon on PEI averaged 10 pounds (4.5 kg) each. In 1879, 75 female Salmon captured for broodstock from the Dunk River yielded 445,000 eggs (mean 5,933 per female) (Department of Marine and Fisheries 1880). However, Department of Marine and Fisheries (1885) noted that in addition to large Salmon, a "large number" of grilse also entered the Dunk River hatchery reception house in fall. These reports suggested that original PEI Salmon populations were dominated by MSW fish, but also included 1SW fish.

Current size at maturity of Atlantic Salmon on PEI must be understood in light of stocking history. Stocking records for the years 1880 - 2020 indicate release of 38,826,353 Atlantic Salmon (Tables 1-5; Fig. 2). Data are available for only 93 of the 141 years between 1880 and 2020, so the true number of released Salmon is likely higher. A detailed breakdown of the stocking numbers for 1880 - 1960 (Cairns et al. 2010, Appendix A) shows that most fish were released at the fry stage. Until 1887, broodstock origins were mostly from PEI and mostly from the Dunk River. Recorded broodstock origins for 1889 - 1907 were the Saint John and Miramichi Rivers, New Brunswick. Recorded broodstock origin for 1908 - 1916 was the

Miramichi River. Broodstock origin was not reported in most years after 1916. In the late 20th century, stocking programs emphasized release of early-run fish to increase summer angling opportunities. These programs increased small and early-run fish among returning spawners. In recent years (2009 - 2020), 512,000 Atlantic Salmon, from broodstock captured in the Morell River, have been stocked in the Morell and West Rivers (Table 5).

In two PEI rivers (Cardigan and Murray), Atlantic Salmon are considered to be escapees from local hatcheries or the direct descendants of these escapees (Table 6A). In other PEI rivers, most Salmon are from natural production, albeit from spawners whose ancestry may include stocked fish. The Morell River, traditionally PEI's most important Salmon angling river, was heavily stocked in the 1980s and 1990s. In 1981 - 2002, 95.2% of small Salmon (n = 6,665) and 90.1% of large Salmon (n = 564) captured at the Leards Dam trap on the Morell were of hatchery origin, as indicated by adipose fin clipping (Table 7).

Atlantic Salmon run timing in the Morell and Cardigan Rivers is mixed early and late (Table 8). Five rivers which are important for Salmon fisheries (Cains, Carruthers, Trout (Coleman), West, Dunk) have run timings that are some early but mostly late. The remaining rivers, all medium and small, for which information is available have late run timings.

Data on numbers of small and large Salmon from fish fences, traps, snorkel and other visual counts, and angling from the Cains, Carruthers, Morell, Valleyfield, Montague, West, and Dunk Rivers are compiled in Tables 9-10 and summarized in Table 11. Sex ratios vary with size, with males dominating the small category (proportions by river 0.721 - 0.960, overall 0.793) and females dominating the large category (proportions by river 0.588 - 0.925, overall 0.719 (Table 12). The proportion of large fish in the Mill River (Cains and Carruthers) is 0.508. In all other rivers, large fish are a small proportion of runs (0.000 - 0.174). However, these numbers are probably not representative of the overall Salmon population on PEI. There are no quantitative data for small rivers, where returning Salmon are all or nearly all large and late-run. Sampling has been most intense at times and in rivers which were heavily stocked with the aim of increasing the early-run component, which is mostly small. Most late-run fish are large. Most measurements of returnee size end before late-run fish enter rivers.

In 1989, small Salmon captured at the Leards trap on the Morell River had a mean fork length of 56.1 cm and a mean weight of 1.51 kg (Table 13). Large Salmon captured at the same site in 1989 and 1994 had mean fork lengths of 73.8 and 73.0 cm and mean weights of 4.08 and 3.90 kg, respectively.

Sea ages of four adults returning to Ellerslie Brook in 1953 - 1954 was two years (Table 14). Of 83 adults returning go the West River in 1989 - 1990, 50 (60.2%) were sea age one year and 33 (39.8%) were sea age two years.

NATURAL MORTALITY AND SMOLT PRODUCTION

Table 15 shows return rates of Atlantic Salmon from the stocking programs of the 1980s and 1990s, which emphasized rearing of hatchery-born juveniles in semi-natural ponds (Cairns et al. 1997). Juvenile Salmon were released as 0+ parr, 1+ parr, 1+ smolts, and as 2+ parr and smolts. Returning adults of hatchery origin were identified by adipose fin clipping. Return rate calculations assumed that smolts leave the river at age 2, that small Salmon have spent one winter at sea, and that large Salmon have spent two winters at sea. Calculated return rates to either adult size ranged from 0.1 to 5.9% (Table 15). Return rates to either adult size from fish reared in semi-natural ponds and released as 2+ smolts ranged from 0.5 to 5.9%. Return rates of hatchery fish may not reflect rates of naturally-spawned fish, because domestication may have reduced the fitness of hatchery fish released to the wild.

In 2016 - 2018, 106 smolts captured in North Lake Creek were fitted with acoustic tags (Guignion et al. 2019). Survival to the exit of North Lake was 71 - 95%. Some tagged fish skirted the west coast of Cape Breton Island before crossing Cabot Strait and proceeding to the Strait of Belle Isle. Survival to the Ocean Tracking Network receiver array in the Strait of Belle Isle in 2016 was 40 - 50%. Further results are anticipated.

Smolt production of PEI rivers in PEI rivers has not been measured. In North Lake Creek 1,876 smolts were captured on their downstream migration in 2016, but capture efficiency is not known (Guignion et al. 2019).

FECUNDITY

Mean fecundity for Morell River Salmon is 3,143 eggs per small Salmon and 4,963 eggs per large Salmon (Table 13).

GENERATION TIME

Scale aging data are available for smolts in Ellerslie Brook, the Morell River, and the West River (overall mean 2.32 years, n = 376) and for returning adults in Ellerslie Brook and the West River (n = 87) (Table 14). Small Salmon generally correspond to 1SW age and large Salmon generally correspond to 2SW age (Table 14). There are exceptions to this generalization, but these cannot be quantified by data presented in the source papers. There is more information on size of PEI Salmon than of age (Tables 11 and 14), which suggests that size data could be the basis for estimating overall sea age of PEI Salmon. However, available size data underrepresent times and locations where large Salmon are dominant. We calculate overall mean sea age of PEI Salmon using the river classification of Cairns et al. (2012) which assigns the proportion of large spawners to be 0.5 in rivers with an early run component and 0.9 in rivers without an early run component (Table 8). Mean durations of the egg, freshwater juvenile, and marine phases are 1, 2.32, and 1.77 years (Table 16). The sum of these values (5.09) is mean generation time. COSEWIC assesses abundance trends over three generations, which for PEI Salmon is 15.27 years, or 16 years after rounding up to the next whole number. Since trends are assessed according to changes between years, the number of data years used in trend analysis is 16 + 1 = 17.

EARLY LIFE HISTORY CHARACTERISTICS

The typical early life history pattern of PEI Atlantic Salmon occurs in rivers, with eggs hatching as fry, which develop into parr, which in turn become smolts which leave on marine migrations. However, variations in habitat use and maturity schedules also occur.

A counting fence near a spawning zone in the lower West River caught 196 Atlantic Salmon parr in 1989 of which 115 (57.8%) were precocious males, and 106 Atlantic Salmon parr in 1990 of which 90 (84.9%) were precocious males (Johnston and Dupuis 1990; Dupuis et al. 1991). Saunders (1960) reported that Atlantic Salmon parr occupied the estuary of Ellerslie Brook (salinity 0 – 27 ppt). Some parr were present in the estuary in all seasons of the year and some parr appeared to have smoltified in the estuary. Saunders (1960) also reported movement of Atlantic Salmon parr into the estuary of the Wilmot River.

SPECIALIZED NICHE OR HABITAT REQUIREMENTS

Atlantic Salmon occupying PEI waters do not appear have specialized niche or habitat requirements.

RELIABILITY OF DATA AND ESPECIALLY UNCERTAINTIES

Government fisheries agencies do not operate standardized or ongoing Atlantic Salmon monitoring programs on PEI. Hence, most of the data reported in this paper are from studies of limited duration, gathered by a mix of government agencies, universities, and local watershed groups. Much of the data was gathered in the 1980s and 1990s, and may not accurately reflect current conditions. Presence/absence status of Atlantic Salmon is uncertain for many small PEI rivers, due to the absence of recent sampling, and also because Salmon in these rivers may be rare or intermittent, and therefore difficult to detect. Knowledge of Atlantic Salmon characteristics in rivers is often based directly or indirectly on angling. This information source is not available for most small rivers, which are generally closed to angling because their Salmon return after the end of the fishing season. This means that quantitative data on size and age distribution of Salmon in small rivers are lacking. Age data for PEI Salmon are limited, especially for sea ages. The only reported sea age of large Salmon is 2. Some large Salmon are likely to have greater sea ages, but currently available sample sizes are insufficient to document this variation. Fecundity has been measured in only one study in one river. More measurements are required to properly characterize the fecundity of PEI Salmon. Natural mortality of PEI Atlantic Salmon at the juvenile phase is unknown. Mortality during the marine phase has been measured only for hatchery-born fish, and may not reflect wild fish. Life cycles of PEI Salmon are known to include precocious parr (Dupuis et al. 1991) and parr use of estuaries (Saunders 1960). Saunders (1960) reported that only one Atlantic Salmon successfully overwintered as a kelt in Ellerslie Brook in 1946 - 1951, but 20 did so in 1952 - 1957. Saunders (1960) attributed the greater overwintering success in the latter period to the construction of a pond in 1952, which provided deeper habitat.

OVERVIEW OF DESIGNATABLE UNITS

COSEWIC (2010) assigned PEI to Designatable Unit 12, Gaspé - Southern Gulf of St. Lawrence, which extended from Rivière Ouelle (a tributary of the St. Lawrence Estuary) to the northern tip of Cape Breton Island. This DU was drawn based on genetic affinities between the Gaspé and northeastern New Brunswick, and broad similarities in run timing and size distributions. At the time of this analysis, genetic data for PEI Salmon were unavailable.

Run timing and sea-age at return in Atlantic Salmon are genetically influenced. In most of Gulf New Brunswick, small Salmon are common and often the majority size category among returning adults (Chaput et al. 2006b). In southeastern New Brunswick, northern mainland Nova Scotia, and western and central Cape Breton Island, the proportion of returning Salmon which are small is the lowest of any region in Canada (Fig. 3; Chaput et al. 2006b). This proportion is < 40%, and < 20% in some areas. In much of eastern New Brunswick, returning Salmon show a strong early-run component. However, Salmon returns in southeast New Brunswick and northern mainland Nova Scotia are late-run. Early historical records compiled in a previous section, and data from Ellerslie Brook which is not known to have been stocked, suggest that the original Salmon population of Prince Edward Island was mostly late-run and large. This suggests an affinity with Salmon populations of southeast New Brunswick and northern Nova Scotia.

Moore et al. (2014) examined genotypes of Atlantic Salmon throughout its North American range. Bayesian Analysis of Population Structure (BAPS) showed that samples from the Mill, Morell, and West Rivers clustered with samples in the southern Gulf of St. Lawrence from the Bay of Chaleur to the northern tip of Cape Breton Island, and the Atlantic coast of Cape Breton Island and Chedabucto Bay (Fig. 4). Moore et al. (2014) attributed the affinity of Mill, Morell, and West samples to this broader group to widespread stocking of Miramichi Salmon. In contrast, samples from Cross River and North Lake Creek formed their own cluster, independent from all other samples in the study. Moore et al. (2014) suggested this finding may be due to the retention in these rivers of ancestral allele frequencies and that PEI may have constituted a different genetic group prior to stocking. A genetic study currently underway at the University of Prince Edward Island is expected to shed further light on genetic affinities of PEI Salmon.

PEI does not have a net-pen Salmon aquaculture industry because winter temperatures under the ice-covered Gulf of St. Lawrence can fall to levels that are lethal to Salmon. Juvenile Salmon are however reared in hatcheries adjacent to the Cardigan River and the Murray River. Juvenile Salmon, apparently escapees from these hatcheries, have been found in both these rivers. The number of escapees appears to be small, which reduces the risk that they will interbreed with wild fish and contaminate the genetic lineage of wild populations.

TRENDS IN POPULATION INDICATORS (COSEWIC CRITERION A)

The most widely applied Atlantic Salmon status measurement in PEI rivers is redd (spawning nest) counts, which are conducted in the fall spawning season, primarily by local watershed groups. Redd surveys generally aim to count all Atlantic Salmon redds in the river, but in some locations and years counts are incomplete due to insufficient field personnel or because high water conditions impair visibility. Redd counts have been conducted in 30 PEI rivers since 1990 (Table 17). In general, the number of rivers surveyed has increased over time, especially since 2010. However, the number of complete surveys fell sharply in 2018 due to poor counting conditions in that year. In this paper, trends are evaluated only in rivers in which complete redd counts are available for five or more years. Redd survey effort tends to concentrate in rivers with substantial Atlantic Salmon populations, and be sparse in rivers with low populations. There are no quantitative estimates of the proportion of the PEI Salmon population that returns to rivers where redds have been counted in five or more years.

Redd counts can be used as an indicator of population trends in returning adult Salmon. The major uncertainty in this endeavor arises from the possibility of confusing Atlantic Salmon redds with those of Brook Trout (*Salvelinus fontinalis*). Figs. 5A-C plot redd counts in 1990 - 2019 for the 19 rivers for which five or more counts are available. Exponential or linear trendlines are plotted for nine rivers which contain data both before and after 2003. Four (44.4%) of these trendlines are positive and five (55.6%) are negative (Table 18). Negative trends in Carruthers Brook and the Morell River may be due to high spawner numbers in the 1990s brought about by stocking programs.

Figs. 6A, B plots redd counts for 2003-2019, which covers 17 years, corresponding to the period of trend measurement for three Salmon generations (Table 16). However, redd counts were not conducted in 2013, so the actual periods of trend analysis are shorter than 17 years. Of the 19 rivers analysed, 13 showed positive trendlines and 6 showed negative trendlines (Table 18; Figs. 6A, B).

TRENDS IN DISTRIBUTION AND DECLINE OR FLUCTUATION (COSEWIC CRITERION B)

COSEWIC defines extent of occurrence as the area included in a polygon without concave angles that encompasses the geographic distribution of all known populations of a wildlife species. COSEWIC defines area of occupancy as the area within 'extent of occurrence' that is occupied by a taxon, excluding cases of vagrancy. In the PEI context, area of occupancy can be considered the fluvial habitat of rivers that are occupied by Salmon.

Table 9 summarizes Atlantic Salmon status in the 71 rivers considered to be large enough to have had Atlantic Salmon populations at the time of European settlement (the "pristine" period). Watershed and fluvial areas of these watersheds is 3,368.2 km^2 and 4,402,197 m^2, respectively (Table 19; Fig. 7). Forty PEI rivers were mentioned by name to have had Atlantic Salmon in annual reports of the Department of Marine and Fisheries (1880,1881, 1882, 1883, 1884, 1885, 1886, 1887ab, 1889, 1890, 1891, 1892, 1893ab, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906ab, 1907, 1908-9, 1909, 1910) (Fig. 8). These rivers constitute 71.4% of the watershed area and 71.8% of the fluvial area of the "pristine period". Marine and Fisheries reports do not comprehensively list Salmon rivers; instead Salmon rivers are mentioned in narrative accounts of fisheries and enforcement activities. It is likely that additional rivers, not mentioned in these reports, also contained Salmon. It is therefore unclear whether the number of rivers occupied by Salmon in 1880 - 1910 is lower than the 71 thought to be occupied in the "pristine" period. Environmental conditions on PEI at the turn of the 20th century were by no means pristine. PEI was intensely cultivated and only 31% of the land area remained forested in 1900 (Cairns 2002a). About 386 watermills were constructed on PEI between the mid 1700s and 1914 (Samuelson 2013). Many of these would have been complete barriers to upstream passage of anadromous fish.

Since about 2000, concerted attempts have been made to define the distribution of Atlantic Salmon in PEI rivers. The main tool of these efforts has been juvenile electrofishing, supplemented by redd surveys (Guignion 2009; Guignion et al. 2002, 2019; Table 6A; Table 17). In 2000 - 2019, Atlantic Salmon have been detected at least once in 40 rivers, although many of these rivers are different than those where Salmon were reported in 1880 - 1910 (Fig. 9). Detected rivers in 2000 - 2019 had watershed and fluvial areas 63.2% and 62.9%, respectively, of rivers in the "pristine" period (Table 19). In most of these rivers, Salmon detection has been spotty. In 28 rivers, Salmon has been detected in some but not all monitored years, and in only 12 rivers Salmon have been detected in all monitored years (Table 19; Figs. 10-11). In 21 rivers, Salmon have been detected during the most recent monitored year in the 2000 - 2019 period (Table 19; Fig. 12).

There are several problems in interpreting the areas summed in Table 19 as area of occupancy for Atlantic Salmon on PEI. Area summations include all the fluvial habitat in the rivers where Salmon were detected, but in systems where Salmon populations are low, most of the habitat would actually be unoccupied by Salmon. Table 19 presents four different way of tallying rivers with detected Salmon for 2000 - 2013. The method that gives the lowest count (12) includes only watersheds with detection in every monitoring year. Fluvial habitat in these rivers totals 1,034,371 m^2, which is 23.5% of "pristine" habitat. The method that gives the highest count (40) is inclusion of all watersheds where Salmon were ever detected. Fluvial habitat in these rivers totals 2,768,407 m^2, which is 62.9% of "pristine" habitat. In the 28 rivers where Salmon were detected only in some monitored years, failure to detect may be due to insufficient search effort in habitat where Salmon are rare. It may also be due to Salmon becoming extirpated from the system, being absent and then re-colonizing the system, or producing juveniles only in intermittent years.

Temporal trends in area of occupancy are also of interest. However, the high labour requirements of searching for Atlantic Salmon in a large number of rivers makes it difficult to implement regular schedules and consistent methods. In the absence of consistent protocols, results of 2000 - 2019 surveys do not provide a reliable indication of trends in Atlantic Salmon area of occupancy on PEI.

Atlantic Salmon freshwater habitat is commonly considered to be fluvial only. Impoundments and natural ponds constitute most PEI interior fresh waters (Cairns unpubl.). Saunders (1960) reported that Atlantic Salmon parr occupied an impoundment on the Ellerslie River and the marine estuary below it. It is not known how widely juvenile Salmon use estuary and pond habitat on PEI, and whether such habitat should be included in area of occupancy.

Fig. 9 shows a polygon drawn around PEI watersheds where Atlantic Salmon have been detected at least once in 2000 - 2019. The area of this polygon, 8,935.0 km^2 (Table 19), can be considered the extent of occurrence for Atlantic Salmon on PEI.

ESTIMATES OF TOTAL POPULATION (COSEWIC CRITERION C)

The number of mature Atlantic Salmon on PEI is estimated from redd counts (Table 17). In the West River in 1990, 14 female Salmon were counted through a fence in the lower part of the river (Dupuis et al. 1991). Forty-seven redds were counted in the West River in that year (Table 17). The ratio of redds to spawning females is thus 3.357. This ratio is used to convert redd counts to female spawners, and sex and size ratios (Table 20) are used to estimate spawner numbers by size and sex (Table 21). Based on the most recent complete redd counts, Atlantic Salmon spawners on PEI total 349 male, 367 female, 287 small, and 429 large, for an overall total of 717. The most important source of uncertainty in these estimates is the conversion of redds to number of female spawners, which is based on data from a single river in a single year. Fluvial habitat of the 71 PEI rivers considered to be large enough to support Atlantic Salmon is estimated to total 4,402,197 m^2 (Table 8). For this habitat, Cairns and MacFarlane (2015) estimated conservation requirements of 10,565,000 eggs and 3,557 spawners, of which 2,288 would be female.

CHARACTERISTICS AND ELEMENTS OF THE SPECIES HABITAT, AND THREATS TO THAT HABITAT

Cairns (2002a) provides an overview of PEI aquatic and land resources. PEI was originally part of the mainland Maritime Provinces, but was isolated as an island by rising sea levels between 7,000 and 5,000 years ago (Calder 2018). PEI's geomorphological history has produced a coastline deeply incised with bays and with estuaries formed from drowned river valleys (Fig. 1) (Owens and Bowen 1977). In many cases, estuaries are longer than the rivers that flow into them. Because of its size and shape, all of PEI is close to tidal water. Caledonia, southeast Queens County, is the most distant (11.1 km) location from tidal water, based on the coastline map in Cairns et al. (2012) (Fig. 1). Relief is generally moderate with a maximum elevation of 140 m at Hartsville, west Queens County (based on the provincial LIDAR map with 2 m contours) (Fig. 1). Total area of PEI is 5,660 km^2. PEI has few natural interior lentic waterbodies due to the erodability of its sedimentary bedrock (Cairns 2002a). However, there are numerous barachois ponds, formed by sediment transfer along coastlines, and numerous interior ponds formed by dams. Analysis of the WTB_1 layer of 1:50,000 National Topographic Series maps indicates 484 coastal barachois ponds (area 11.6 km^2), 464 headponds formed by dams (area 10.0 km^2), and 12 natural interior ponds (area 2.0 km^2) (Cairns unpubl.).

Guignion (2009) and Guignion et al. (2019) provide detailed reviews of Atlantic Salmon habitat characteristics and habitat issues in PEI rivers. Stream sedimentation is a particular risk, which is exacerbated by hedgerow removal for field consolidation, fields left exposed after potato harvest, inadequate crop rotation practices, and erosion from ditches and unsurfaced roads. Rocky substrates are a key need for Atlantic Salmon spawning and juvenile rearing, but deposited sediments can smother these substrates. Habitat contamination by pesticide release has caused 29 fish kills on PEI since 2000.

THREATS

RESIDENTIAL AND COMMERCIAL DEVELOPMENT

Housing and urban areas

While urban areas are geographically small on PEI, it is the most densely populated province in the country at 28.2 individuals/km^2 compared to the national average of 4 individuals/km^2 (PEI Department of Finance 2020). PEI also experienced the highest population growth in the country in 2018-2019 (PEI Department of Finance 2020). On PEI, most rivers containing Atlantic Salmon are some distance from urban areas. One exception, North River, was 12.7% urban area in 2010, and due to its proximity to Charlottetown, continued urban expansion is expected (PEI Department of Environment, Energy and Forestry (2010) Corporate Land Use Inventory 2010). In this watershed, urbanization is one of several potential threats. In 2014, North River suffered a pesticide-related fish kill, where dead Salmon were found in the stream (PEI Department of Forest Fish and Wildlife 2014). Additionally, Coles Creek, a tributary of the North River, has a recently established municipal wellfield to serve the increasing water needs of the greater Charlottetown area (van den Heuvel et al. 2020).

Commercial and industrial areas

There is no information to suggest that commercial or industrial areas are a threat to Atlantic Salmon on PEI.

Tourism and recreation

There is no information to suggest that tourism and recreation are a threat to Atlantic Salmon on PEI.

AGRICULTURE AND AQUACULTURE

Land conversion to agriculture

Due to the increasing cost of agricultural land there has been a recent move to convert forested areas to agricultural production and optimize area in agricultural production through field consolidation. Between 1990 and 2010 the total forested area of the province fell from 48% to 43.9% (Guignion et al. 2019). Completion of the 2020 Corporate Land Use Inventory is expected to reveal a further loss of forest cover. There are currently no regulations prohibiting the conversion of forested land to agriculture. Given that recent research has showed the importance of forest cover for healthy Salmon populations (Roloson et al. 2018), this conversion has the potential to negatively affect Atlantic Salmon habitat. Furthermore, Guignion et al. (2019) suggested that loss of riparian habitat along watercourses is one of the most significant factors impacting wild Salmon on PEI.

Livestock farming and ranching

On PEI, livestock are required by law to be fenced out of watercourses. While the situation is greatly improved compared to historic conditions, isolated issues of noncompliance may still threaten habitat integrity. Nutrient enrichment from manure, in the form of runoff or manure spread as fertilizer, may constitute a threat to Salmon habitat by contributing to eutrophication.

Marine and freshwater aquaculture

Marine and estuarine aquaculture on PEI is dominated by shellfish aquaculture as there is currently no finfish aquaculture in the marine or estuarine environment. Heavy ice conditions in many bays and lethal winter temperatures preclude sea-pen salmonid aquaculture.

Aquaculture with the potential to affect Atlantic Salmon populations is restricted to freshwater operations. Atlantic Salmon rearing facilities operate on the Cardigan River and Murray River. These operations supply Salmon smolts for sea-pen grow-out facilities in other Atlantic Canadian provinces.

Both the Cardigan River and the Murray River have had recent reports of juvenile Atlantic Salmon captured during electrofishing surveys. In the Cardigan River, Atlantic Salmon were thought to be on the verge of extinction, however electrofishing in 2019 revealed good numbers of Salmon juveniles in a small section of stream below the hatchery (Guignion et al. 2019). Additionally, a salmonid survey on 2001 in Murray River found no juvenile Atlantic Salmon, but a survey of the same site in 2016 found eleven Salmon parr. However Salmon were not observed in a follow-up survey in 2018. Guignion et al. (2019) concluded it was reasonable to assume that the Salmon observed in 2016 were escapees from the fish hatchery.

An aquaculture operation produces genetically modified (GM) Atlantic Salmon in Rollo Bay West and Bay Fortune in eastern PEI. These Salmon are considered advantageous for the aquaculture industry due to their rapid growth rate (Ignatz et al. 2020). The original Canadian Environmental Protection Act review, which was limited in scope to the production of GM eggs in Bay Fortune, which were to be shipped to Panama for rear-out, concluded that the receiving environment would not prevent survival and dispersal in the event of an escape of later life stages (parr to adult) (DFO 2013). The review further concluded that, given that the facility outflow is in the marine environment (20 – 30 PPT), the survival of eggs and fry would be precluded. In light of this, the risk of acute physical failure of containment measures was ranked as negligible with reasonable certainty. However, this review did not consider that Atlantic Salmon have been reported to spawn in the estuaries of two PEI streams, with at least some survival to April of the following spring (Saunders 1966).

More recently, the proponent was approved for commercial production in its facility in Rollo Bay West. This facility is located in the freshwater environment, meaning that all life cycle phases could survive in the event of unintentional release. While triploid induction sterilization of females is reported to be a minimum of 95% efficient (DFO 2013), sexually mature diploid AquaAdvantage Salmon (AAS) have been shown to compete for access to wild females and participate in natural spawning events (Moreau et al. 2011). In the original review (DFO 2013) it was stated that "…*potential exposure resulting from the survival, dispersal and persistence of AAS (AquaAdvantage Salmon) parr, smolts, post-smolts or adults that may be unintentionally released from the PEI facility is concluded to be high.*". While the physical and chemical containment measures mitigate the risk of escape, there is an inherent increased risk relative to the original review where eggs were to be exported (DFO 2013). DFO (2016b) further examines environmental risks of triploid Salmon aquaculture.

ENERGY PRODUCTION AND MINING IUCN-CMP THREAT CATEGORY

Oil and gas drilling and renewable energy

There is no current oil or gas drilling on PEI. According to provincial government records 20 exploratory wells were drilled across PEI from 1944 – 2007 (PEI Department of Transportation Infrastructure and Energy 2015). Oil and gas drilling is not a major industry on PEI and it is not thought to be a major threat to Atlantic Salmon on PEI.

Mining and quarrying

There is no mining on PEI but quarries exist for gravel, sand and peat. Due its sedimentary sandstone composition, there is a lack of quality rock for road construction and development and gravel is typically imported from Nova Scotia.

TRANSPORATION AND SERVICE CORRIDORS

Railway service on PEI ended in 1989 and railbeds were subsequently converted to a recreational trail network. Some unpaved roads are maintained with gravel. However many unpaved roads are unsurfaced and become rutted with erosion channels after heavy rains, contributing sediment to watercourses. There is over 1,800 km of unpaved roads on PEI (Statistics Canada 2013; Guignion et al. 2019). New highway construction is required to use straw bales and other forms of silt barriers to reduce erosion. However, it is to common see rivers near highway construction sites turn red with suspended sediment after a rain. The cumulative impacts of sediment derived from transportation infrastructure poses a significant threat to watercourses. However, the effects of sedimentation on biota are difficult to quantify as events are episodic and instrumentation is logistically challenging to operate (Alberto et al. 2016). In addition to contemporary sedimentation, Salmon habitat may already be compromised by historic sedimentation which has reduced integrity of Salmon habitat by infiltrating spawning gravels and cobble interstices.

Utility and service lines

Recent development of wind turbine farms in eastern and western PEI have resulted in expanded infrastructure needs for the industry, both in the form of increased space for construction of windmills and the construction of transmission lines to deliver power. Some of the watersheds that are proposed for windfarm operations have abundant Salmon populations and expanded transmission corridors could potentially cross many watersheds containing Salmon. The overall threat to wild Salmon is unknown.

Shipping lanes

The main shipping route from the Atlantic Ocean to interior Canadian provinces runs along the Laurentian Channel, approximately 200 km north of PEI. There is no container port on PEI. Most local shipping is cruise ships, oil tankers, and bulk cargo such as potatoes and agricultural fertilizer. There is no information to suggest that shipping lanes are a threat to Atlantic Salmon on PEI.

BIOLOGICAL RESOURCE USE

Logging and wood Harvest

On PEI, the overall effect of logging and wood harvest on Salmon populations is unknown. Deforestation is known to increase flood susceptibility at the watershed scale (Rogger et al. 2017). Moreover, there is a positive relationship between the occurrence of Atlantic Salmon and the percentage of a catchment in forest cover (Roloson et al. 2018). While wood harvest may result in increased flooding risk, the effects may be short term as forest regeneration may improve water retention at the catchment scale. The conversion of land from forest to agriculture likely has much stronger effects on Atlantic Salmon habitat than logging and wood harvest.

Fishing and harvesting aquatic resources

Current angling regulations do not permit retention of Atlantic Salmon and only two rivers (Mill (Carruthers and Cains) and Morell) have extended catch and release seasons for Atlantic Salmon angling. Atlantic Salmon angled during the regular Brook Trout fishing season are required to be released. Recent estimates of the risk of mortality from catch and release angling suggest mortality is about 5% in cool water (12 °C) and on average 16% in warm water (18 – 20 °C) (Van Leeuwen et al. 2020). There is no commercial harvest of Salmon on or near PEI. PEI First Nations are allocated food, social and ceremonial harvests of up to 450 Salmon (250 Native Council of PEI, 200 Abegweit First Nation). ,Between 2015 and 2017, fourteen Salmon were harvested and in recent years First Nations have chosen not to harvest Salmon citing species conservation concerns (C. Russell, DFO, pers. comm. 2020).

HUMAN INTRUSIONS AND DISTURBANCE

Recreational activities

Recreational activities are not believed to be a significant threat to Atlantic Salmon on PEI.

NATURAL SYSTEMS MODIFICATIONS

Fire and fire suppression

Fire and fire suppression are not believed to be a threat to Atlantic Salmon on PEI.

Dam and water management/use

Water use that affects water flow and discharge patterns may threaten wild Salmon on PEI. Potatoes are widely cultivated on PEI and the high water needs of this crop create demand for irrigation water in dry years. Since 2002, there has been a moratorium on the expansion of high capacity wells for agricultural irrigation. Current protocols require irrigation to stop when the river discharge falls 30% below the historic average for a given month. However, on the Dunk River between 19 – 26th August, 2020, the PEI government permitted extraction of surface water for irrigation purposes, despite the water level being below the 30% threshold. In the ensuing period there was a measurable reduction in the water level on the Dunk River, which is a river with a wild Salmon population (M. Durant pers. comm.). Current projections suggest that the incidence of dry and drought-like conditions will continue to be an issue for agricultural production, and any activities that reduce stream discharge will threaten Atlantic Salmon populations, particularly the reduction of the volume of surface water during drought conditions.

In addition to surface extractions there has been an increase in the construction of holding ponds which avoid the need for high capacity wells as they are supplied by multiple smaller wells. The construction of these ponds has heightened public concern over the ecological impact of water extraction for irrigation.

PEI has several hundred headponds created by dams. Many dams and ponds continue to threaten Atlantic Salmon populations by reducing habitat connectivity. However, the situation is much improved compared to historic head-of-tide mill dams which were constructed without regard for fish passage. These have likely directly caused Salmon extirpations in several rivers. While historic disregard for fish passage had profound effects for anadromous fish, installation of fish passage structures along the mainstems of most Salmon bearing rivers has improved habitat connectivity for Salmon and other fish.

INVASIVE AND OTHER PROBLEMATIC SPECIES AND GENES

Invasive non-native/alien species

On PEI, Rainbow Trout (*Oncorhynchus mykiss*) were stocked for nearly a century and records indicate at least one million Rainbow Trout have been introduced (Cairns et al. 2010; Roloson et al. 2018). Atlantic Salmon are reported to competitively displace Rainbow and Brook Trout from riffle habitat, but Trout are stronger competitors in slow water (Cairns 2006). Guignion (2010) and Cairns et al. (2012) reported that Salmon populations had declined in all PEI watersheds with Rainbow Trout incursion. However, a recent study that investigated the underlying drivers of salmonid abundance on PEI found that Rainbow Trout success was higher in watersheds with higher stream slope and higher agricultural land use. Alternately, Atlantic Salmon were found in more forested watersheds with abundant cobble substrate (Roloson et al. 2018). The association between Salmon with measures of ecological integrity (high forest, abundant cobble), suggests that direct competition is secondary to habitat suitability in shaping ecological interactions between the species on PEI. Additionally, this suggests that Rainbow Trout are better able to withstand perturbations associated with anthropogenic disturbance, while Salmon require undisturbed habitat to ensure population health. One manipulative field study that investigated Rainbow Trout and Atlantic Salmon overlap found that high quality Salmon habitat (abundant cobble) could support high numbers of both species (Stanfield and Jones 2003). On PEI, Rainbow Trout have been found in several highly productive Atlantic Salmon rivers, which could provide the opportunity to investigate outcomes of habitat overlap in high quality Salmon habitat.

Problematic native species

Historic stocking on PEI has been motivated largely by the desire to produce populations that are amenable to recreational angling. As a result, early-run strains from Miramichi River (Rocky Brook) were originally used as a stocking source. The focus on popular angling rivers has resulted in a homogenization of genetic composition in these major angling rivers (Mill, Morell, West River; Moore et al. 2014). Alternately, some other populations on PEI are known to possess a distinct genetic signature, thought to be related to the lack of stocking in these areas. The unique genetic signature found in two northeastern rivers has been speculated to reflect a distinct historic heritage (Moore et al. 2014). Alternate speculation suggests that this unique signature could be derived from a historic genetic bottleneck where conditions caused a population reduction to a few individuals and thus accounting for the unique signature. A current study underway at the University of Prince Edward Island (UPEI) is investigating the genetic composition of Atlantic Salmon in most of the remnant populations found in the province (about 25 rivers sampled) (C. Grove, UPEI pers. comm.). This study will result in an improved understanding of the genetic structure of contemporary PEI Salmon populations.

Beaver (*Castor canadensis*) is believed to be native to PEI, due to archeological finds and scattered records during early European settlement (Curley et al. 2019). Beavers disappeared and were re-introduced beginning in 1908, but once again became extirpated. Re-introductions in the 1940s gave rise to large populations that currently occupy suitable habitat across PEI (Dibblee 1994). Water diffuses through, rather than pours over, beaver dams. Consequently, water flow does not create the plunge pools that Salmon require to leap over barriers. This means that beaver dams may significantly restrict Salmon access to spawning habitat. Guignion et al. (2019) considered that beaver dams are one of the most important impediments to Atlantic Salmon in PEI streams. In the 2017 redd survey, the first major beaver dam often marked the upper limit of Salmon spawning. Beaver dams may also impede the downstream migration of smolts in spring (Guignion et al. 2019).

POLLUTION AND CONTAMINANTS

Several attributes of agricultural activity have the potential to negatively affect Atlantic Salmon populations on PEI.

Sediment

The deposition of sediment in watercourses compromises the integrity of Atlantic Salmon habitat by infilling interstitial spaces and reducing the structural diversity of the stream substrate (Cairns 2002b; Guignion et al. 2019). Across the province, Atlantic Salmon occurrence is associated with watersheds that have greater forest cover, and at the reach scale juvenile Salmon are associated with wider stream widths and substrates with a higher proportion of cobble (Roloson et al. 2018). Guignion et al. (2019) reported a 1996 - 97 experiment using artificial incubators in the Morell River where they noted that the emergence of young of year (YOY) Salmon varied dramatically with the amount of sediment that accumulated in each basket. Recent research (Sirabahenda et al. 2020) modelled the potential outcomes of increasing mandatory buffer zone width from 15 m. Findings suggested that increasing the buffer zone to 30 - 40 meters could optimize the reduction of sediment entering watercourses.

Pesticides

Since 1960 there have been at least 50 pesticide related fish kills on PEI, and many of these have been on rivers with wild Atlantic Salmon. Following a pesticide runoff event on the North River in 2014, deceased Salmon were recovered (Guignion et al. 2019). Research on the Wilmot River showed that non-native Rainbow Trout had higher survival than native Atlantic Salmon and Brook Trout following a pesticide runoff event attributed to the pesticide glyphosate (Gormley et al. 2005). The overall threat of pesticide runoff events to Atlantic Salmon on PEI is difficult to disentangle from other attributes of agriculture such as increased sedimentation and loss of riparian habitat integrity. However, the cumulative effect of these factors constitutes one of the most significant threats to Atlantic Salmon on PEI.

Nutrient induced anoxia

Anoxic and hypoxic events in PEI estuaries occur on an annual basis. Increased nutrient inputs from fertilizer applied to agricultural crops results in elevated concentrations of nitrate in groundwater which leads to anoxia in many estuaries across the province (Coffin et al. 2018). Anoxic events have been recorded at 44 sites in PEI estuaries since 2010 (PEI Department of Environment, Energy and Climate Action 2020). Mortality of fish and invertebrates in PEI estuaries has been attributed to anoxia, although effects on highly mobile fish species are not well understood. These events are most likely to occur throughout summer months and persist into the early fall, which could affect early-run Salmon that return during this period. Table 8 indicates five rivers that have an early run component and four of these had at least one anoxic event between 2010 and 2019, including Cardigan River, Dunk River, Mill River (Cains and Carruthers), Morell River, Trout River (Coleman), (PEI Department of Environment, Energy and Climate Action 2020). Aside from the early-run component, the timing of main anoxia events occurs after downstream egress of Salmon smolts, but before the arrival of late-run adults (approximately mid-late October). Overall, there is a lack of information on how anoxic conditions in PEI estuaries affect temporal and spatial aspects of the Atlantic Salmon life cycle.

Garbage and solid waste

PEI has a single province-wide system for source-sorting waste, recycling and compost where possible. Locations of waste processing facilities are given in Fig. 1, including a landfill in

Wellington, a compost facility in Brookfield, and a waste burning facility in Charlottetown (CBC News 2019a). There are at least 30 retired landfill sites on PEI that are currently the focus of a monitoring program to assess potential soil and water contamination (CBC News 2019b). At this time there is no information available to quantify the threat of garbage and solid waste for Atlantic Salmon populations on PEI.

Air-borne pollution

In some parts of the Atlantic provinces the effects of air-borne pollution, particularly acid precipitation, have been linked to regional declines or extirpation of Atlantic Salmon. On PEI, the inherent buffering capacity of soil and groundwater has mitigated the ecological effects of acid precipitation.

Excess energy

There is no information available to quantify the threat of excess energy for Atlantic Salmon populations on PEI.

GEOLOGICAL EVENTS

Volcanoes

There is no information to suggest that volcanic activity threatens Atlantic Salmon populations on PEI.

Earthquakes and tsunamis

In 1929 off the Newfoundland coast, an earthquake sent giant waves onto the Burin Peninsula, causing considerable loss of life and property. The effects of this event could be felt for great distances, including on PEI. However, the risk of earthquakes across PEI is considered low (Natural Resources Canada 2015). Thus, there is no information to suggest that earthquakes or tsunamis threaten Atlantic Salmon populations on PEI.

Avalanches and landslides

Due to the topography of PEI, and the lack of steep slopes or mountainous regions, there is no information to suggest that avalanches or landslides threaten Atlantic Salmon populations on PEI.

CLIMATE CHANGE

Habitat shifting and alteration

See below on changes to flood regime.

Droughts

Summer droughts commonly lead to high water temperatures, which may rise above the lethal limit for Atlantic Salmon. Droughts reduce water levels in rivers, forcing juvenile Salmon to concentrate in deeper pools or spring-fed areas, making them vulnerable to predation. Low water levels in drought years may be further lowered by water extraction for municipalities and agricultural irrigation. The occurrence of drought conditions will likely have a pronounced effect on juvenile Atlantic Salmon given that they tend to occupy shallow riffle habitat.

Temperature extremes

Several Salmon bearing watersheds on PEI may be at high risk of extreme temperature events. Annual monitoring of stream temperatures has identified several rivers that may fit this category, including the Morell River, Midgell River and the Naufrage River. In 2020, the Morell River was routinely observed over 24 °C (H. Murnaghan pers. comm.). Any projected increase in temperature will have the strongest effect on these rivers.

High temperatures and drought conditions, which occur simultaneously, are likely to have an additive threat for Atlantic Salmon as drought reduces the wetted area and high temperatures lead to congregation in thermal refugia. Both factors ultimately reduce the habitat available for juvenile Atlantic Salmon and represent a significant threat, particularly on rivers with current thermal challenges.

Storms and flooding

Compared to many of the larger rivers inhabited by Atlantic Salmon, the watersheds on PEI are small, largest being that of the Morell River at 171 km^2 . The small size of PEI watersheds reduces the risk of major flooding that is associated with larger watersheds such as the Saint John River (54,600 km^2).

Changes in hydrological regime over time are likely to be driven by seasonal changes in precipitation. Changes in hydrological regime may jeopardize key life cycle stages such as egg incubation or juvenile rearing. Increased flooding is likely to result in higher substrate turnover and elevated suspended sediment concentrations. On the Dunk River, Sirabahenda et al. (2019) found that elevated suspended sediment concentration during summer was driven by rainstorm events. For Salmon, any elevated risk of flooding during spawning or egg incubation has the potential to depress reproductive success. Given that Salmon eggs incubate throughout the winter, increased rainfall or snowmelt during this period has the potential to threaten entire year classes of Salmon. There is a current lack of understanding of future changes in hydrological regime associated with climate change on PEI.

MANIPULATED POPULATIONS

Historic stocking on PEI has been motivated largely by the desire to produce populations whose run timing is amenable to recreational angling. As a result, early run strains from Miramichi River (Rocky Brook) have been used as a stocking source. The stocking focus on popular angling rivers has resulted in a homogenization of genetic composition in these major angling rivers (Mill, Morell, West River; Moore et al. 2014). A research study is currently underway at the University of Prince Edward Island to elucidate the genetic signatures of Atlantic Salmon populations on PEI. This information will be a valuable tool in evaluating the extent of genetic modification that has occurred as a result of human introductions.

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TABLES

Table 1. Number of Atlantic Salmon reported stocked on Prince Edward Island, 1880 - 1960. Because records are incomplete, actual stocking numbers are likely higher than those shown. Data source: Cairns et al. (2010), Appendix A supplies a yearly breakdown of the data in this table.

River name	Located near	Totals		
		Fry, and stage not reported	Fingerlings	Total
Tignish River	Tignish	101,180	0	101,180
Mill River (Cains + Carruthers Brooks)	Cascumpec	20,300	0	20,300
Beatons (Trout) River	Coleman	325,000	0	325,000
Trout River Tyne Valley	Tyne Valley	117,000	0	117,000
Indian River	Indian River	340,000	0	340,000
Hy Brook, Morrisons Pond	Darnley	200	0	200
Trout River	Millvale	30,000	0	30,000
Hunter River	Hunter River	55,000	0	55,000
Wheatley River	Wheatley River	489,000	0	489,000
Black River	Brackley Point	204,000	0	204,000
Bells Creek (Gurneys River)	West Covehead	160,400	0	160,400
Winter River	Suffolk	2,492,160	24,909	2,517,069
Morell River	Morell	11,567,966	2,567	11,570,533
Marie River	Marie	124,000	0	124,000
Midgell River	Midgell	2,041,000	0	2,041,000
St. Peters River	St. Peters	1,077,040	0	1,077,040
Schooner Pond	St. Peters	333,600	0	333,600
McAskill Creek (Goose River)	Goose River	55,000	0	55,000
Naufrage River	Naufrage	1,112,440	0	1,112,440
Cross Creek	Hermanville	76,120	0	76,120
North Lake Creek	North Lake	113,120	0	113,120
Black Pond Creek	Black Pond, Red Pt.	68,000	0	68,000
Souris River	Souris	62,800	0	62,800
Rollo Bay	Rollo Bay	30,000	0	30,000
Fortune River	Dingwells Mills	378,100	0	378,100
Cardigan River	Cardigan	440,685	0	440,685
Brudenell River	Brudenell	70,000	0	70,000
Montague River	Montague	257,100	0	257,100
Sturgeon River	Sturgeon	158,800	0	158,800

River name	Located near	Totals		
		Fry, and stage not reported	Fingerlings	Total
Fox River	Murray River	25,000	0	25,000
Murray River	Murray River	382,000	0	382,000
Belle River	Belle River	425,000	0	425,000
Vernon River	Vernon Bridge	75,000	0	75,000
Forbes Creek (southeast branch of Fullertons Creek)	Mount Herbert	62,000	0	62,000
Johnstons River	Johnstons River	193,120	1,000	194,120
Glenfinnan River (Sherrys Creek)	Glenfinnan	148,500	0	148,500
Head of Hillsborough River	Mount Stewart	592,220	0	592,220
Hillsborough (East) River	Unspecified location	70,000	0	70,000
North River	Milton	983,500	0	983,500
Clyde River	Clyde River	144,000	0	144,000
West River	Bonshaw	310,100	0	310,100
Desable River	Desable	30,000	0	310,100
Westmoreland River	Crapaud	30,000	0	30,000
Tryon River	Tryon	10,000	0	10,000
Dunk River	Freetown	2,601,200	0	2,601,200
Wilmot River	Wilmot Valley	105,000	0	105,000
Miminigash River	Miminegash	196,000	0	196,000
Skinners Pond	Skinners Pond	40,800	0	40,800
Nail Pond	Nail Pond	60,800	0	60,800
Bakers River[a]	Location unknown	252,000	0	252,000
Curtisdale River[b]	Location unknown	0	355	355
Inspector River	Location unknown	10,000	0	10,000
Mores River[c]	Location unknown	0	1,000	1,000
Trout Newbarton	Location unknown	Unknown	0	Unknown
Total number released to wild		36,905,805	29,831	36,935,636

[a]Might be North Lake Creek. The Cummins (1928) atlas shows Bakers as landowners in the area
[b]Might be a branch of the North River. The Meacham (1880) atlas shows a Curtis Creek in this area and the Cummins (1928) atlas shows Curtis as landowners in the area
[c]Might be the branch of the Sturgeon River where Moores Pond is located

Table 2A. Number of Atlantic Salmon and Rainbow Trout from the Cardigan Fish Culture Station stocked in PEI waters, 1962 to 1963. The source is a letter from W.S. Freeman, Officer in Charge, Cardigan Fish Culture Station, Department of Fisheries and Forestry, to Arthur Smith, PEI Fish and Wildlife Division, dated 17 February 1972. The letter reports stocking numbers of Atlantic Salmon and Rainbow Trout beginning 1 January 1962. The letter further notes that Brook Trout is the chief species reared at the Fish Culture Station, but it does not report number of Brook Trout stocked[a].

		1962						1963				
		Atlantic salmon			**Rainbow trout**			**Atlantic salmon**			**Rainbow trout**	
River	**Located near**	**Code[a] 3**	**Code f**	**Total**	**Code 3**	**Code f**	**Total**	**Code 2**	**Code f**	**Total**	**Code 3**	**Total**
Tignish River	Tignish	24,000	-	24,000	-	-	0	24,000	0	24,000	24,000	24,000
Long Pond	Dalvay	-	-	0	-	-	0	-	-	0	5,000	5,000
Dalvay Lake	Dalvay	-	-	0	-	-	0	-	-	0	5,000	5,000
Lakeside Pond[b]	West St. Peters	-	-	0	-	-	0	-	-	0	5,000	5,000
Morell River	Morell	48,000	5,950	53,950	-	-	0	54,000	10,000	64,000	-	0
Midgell River	Midgell	50,400	-	50,400	-	-	0	54,000	4,000	58,000	-	0
Naufrage River	Naufrage	24,000	-	24,000	-	-	0	-	-	0	-	0
North Lake	North Lake	-	-	-	-	-	0	20,000		20,000	-	0
Fortune River	Dingwells Mills	16,000	-	16,000	-	-	0	20,000		20,000	-	0
Cardigan River	Cardigan	-	5,162	5,162	1,980	6,987	8,967	-	-	0	1,000	1,000
Glenfinnan Lake	Glenfinnan	-	-	0	-	2,625	2,625	-	-	0	13,200	13,200
O'Keefes Lake	Avondale	-	-	0	-	-	0	-	-	0	-	0
North River[c]	Charlottetown	-	-	0	-	-	0	-	-	0	-	0
Dunk River	Freetown	-	-	0	-	-	0	-	-	0	6,270	6,270
Scales Pond	Freetown	-	-	0	-	-	0	-	-	0	6,270	6,270
Totals		162,400	11,112	173,512	1,980	9,612	11,592	172,000	14,000	186,000	65,740	65,740

[a]**Codes used in W.S. Freeman's letter:**
Code 2: fish that had been feeding over 8 weeks and under 14 weeks.
Code 3: fish that had been feeding over 14 weeks and under 20 weeks.
Code f: fish over 1 year and under 2 years of age.

[b]Called Yorke River in W.S. Freeman's letter

Table 2B. Number of Atlantic Salmon and Rainbow Trout from the Cardigan Fish Culture Station stocked in PEI waters, 1964 to 1966. The source is a letter from W.S. Freeman, Officer in Charge, Cardigan Fish Culture Station, Department of Fisheries and Forestry, to Arthur Smith, PEI Fish and Wildlife Division, dated 17 February 1972. The letter reports stocking numbers of Atlantic Salmon and Rainbow Trout beginning 1 January 1962. The letter further notes that Brook Trout is the chief species reared at the Fish Culture Station, but it does not report number of Brook Trout stocked.

River	1964				1965				1966		
	Atlantic salmon		Rainbow trout		Atlantic salmon	Rainbow trout			Atlantic salmon		Rainbow trout
	Code 3	Total	Code 3	Total	Total	Code 3	Code f	Total	Code 3	Total	Total
Tignish River	-	0	-	0	0	-	-	0	-	0	0
Long Pond	-	0	5,000	5,000	0	-	-	0	-	0	0
Dalvay Lake	-	0	5,000	5,000	0	6,840		6,840	-	0	0
Lakeside Pond[a]	-	0	5,000	5,000	0	5,600		5,600	-	0	0
Morell River	12,000	12,000	-	0	0	-	-	0	1,575	1,575	0
Midgell River	7,200	7,200	-	0	0	-	-	0	-	0	0
Naufrage River	-	-	-	0	0	-	-	0	-	0	-
North Lake	6,500	6,500	-	0	0	-	-	0	-	0	0
Fortune River	6,500	6,500	-	0	0	-	-	0	-	0	0
Cardigan River	0	0	2,000	2,000	0	6,840	-	6,840	-	0	0
Glenfinnan Lake	0	0	10,000	10,000	0	13,680	1,818	15,498	-	0	0
O'Keefes Lake	0	0	-	0		11,400	-	11,400	-	0	0
North River[c]	10,000	10,000	-	0	0	-	-	0	-	0	0
Dunk River	0	0	5,000	5,000	0	-	-	0	-	0	0
Scales Pond	0	0	5,000	5,000	0	-	-	0	-	0	0
Totals	42,200	42,200	37,000	37,000	0	44,360	1,818	46,178	1,575	1,575	0

[a]For 1965, Lakeside Pond, rainbow trout column, W.S. Freeman's letter shows 6,840 fish, Code 3. However, there is a handwritten note saying 5,500 fish, Code 3. This table reports 5,500 fish stocked

Table 2C. Number of Atlantic Salmon and Rainbow Trout from the Cardigan Fish Culture Station stocked in PEI waters, 1967 to 1971. The source is a letter from W.S. Freeman, Officer in Charge, Cardigan Fish Culture Station, Department of Fisheries and Forestry, to Arthur Smith, PEI Fish and Wildlife Division, dated 17 February 1972. The letter reports stocking numbers of Atlantic Salmon and Rainbow Trout beginning 1 January 1962. The letter further notes that Brook Trout is the chief species reared at the Fish Culture Station, but it does not report number of Brook Trout stocked.

River	1967			1968		1969		1970		1971	
	Atlantic salmon		Rainbow trout	Atlantic salmon	Rainbow trout	Atlantic salmon	Rainbow trout	Atlantic salmon	Rainbow trout	Atlantic salmon	Rainbow trout
	Code f	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
Tignish River	-	0	0	-	-	-	-	-	-	-	-
Long Pond	-	0	0	-	-	-	-	-	-	-	-
Dalvay Lake	-	0	0	-	-	-	-	-	-	-	-
Lakeside Pond[b]	-	0	0	-	-	-	-	-	-	-	-
Morell River	19,370	19,370	0	-	-	-	-	-	-	-	-
Midgell River	-	0	0	-	-	-	-	-	-	-	-
Naufrage River	-	0	0	-	-	-	-	-	-	-	-
North Lake	-	0	0	-	-	-	-	-	-	-	-
Fortune River	-	0	0	-	-	-	-	-	-	-	-
Cardigan River	-	0	0	-	-	-	-	-	-	-	-
Glenfinnan Lake	-	0	0	-	-	-	-	-	-	-	-
O'Keefes Lake	-	0	0	-	-	-	-	-	-	-	-
North River[c]	-	0	0	-	-	-	-	-	-	-	-
Dunk River	-	0	0	-	-	-	-	-	-	-	-
Scales Pond	-	0	0	-	-	-	-	-	-	-	-
Totals	19,370	19,370	0	-	-	-	-	-	-	-	-

Table 2D. Summary number of Atlantic Salmon and Rainbow Trout from the Cardigan Fish Culture Station stocked in PEI waters, 1962 to 1971.

River	1962-1971						
	Atlantic salmon				Rainbow trout		
	Code 2	Code 3	Code f	Total	Code 3	Code f	Total
Tignish River	24,000	24,000	0	48,000	24,000	0	24,000
Long Pond	0	0	0	0	10,000	0	10,000
Dalvay Lake	0	0	0	0	16,840	0	16,840
Lakeside Pond[b]	0	0	0	0	15,600	0	15,600
Morell River	54,000	61,575	35,320	150,895	0	0	0
Midgell River	54,000	57,600	4,000	115,600	0	0	0
Naufrage River	-	24,000	0	24,000	0	0	0
North Lake	20,000	6,500	0	26,500	0	0	0
Fortune River	20,000	22,500	0	42,500	0	0	0
Cardigan River	0	0	5,162	5,162	11,820	6,987	18,807
Glenfinnan Lake	0	0	0	0	36,880	4,443	41,323
O'Keefes Lake	0	0	0	0	11,400	0	11,400
North River[c]	0	10,000	0	10,000	0	0	0
Dunk River	0	0	0	0	11,270	0	11,270
Scales Pond	0	0	0	0	11,270	0	11,270
Totals	172,000	206,175	44,482	422,657	149,080	11,430	160,510

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Table 3. Reported numbers of Atlantic Salmon stocked in the Morell River, 1978 - 1999, and their stages at release. Data from Bielak et al. 1991 (1978 - 1990), Cairns et al. 1996 (1991 - 1994), Cairns et al. 2000 (1995 - 1999) and M. Murray, Cardigan Hatchery, pers. comm., 15 Mar 2005, (2004).

Year	**Genetic stock**	**Parr**			**Smolt**		**Total**
		0+	**1+**	**2+**	**1+**	**2+**	
1978	NW Miramichi	14,943	-	-	-	-	14,943
1979	NW Miramichi, Restigouche	32,693	-	-	-	-	32,693
1981	NW Miramichi	-	-	-	-	692	692
1982	Miramichi, early migrating stock	34,764	-	-	-	3,645	38,409
1983	Miramichi, early migrating stock	9,000	-	-	-	-	9,000
1985	Miramichi, mixed early and late migrating stock	-	-	-	-	21,425	21,425
1986	NW Miramichi, early migrating stock	-	-	570	-	14,058	14,628
1987	NW Miramichi, early migrating stock	-	-	3,479	-	25,305	28,784
1988	Miramichi mixed	-	-	1,208	5,907	12,982	20,097
1989	Morell small salmon HR[a]	-	-	1,560	-	20,650	22,210
1990	Morell mixed HR	-	-	1,079	-	58,731	59,810
1991	Morell mixed HR	-	-	2,053	-	34,443	36,496
1992	Morell mixed HR	-	2,200	1,851	-	43,771	47,822
1993	Morell mixed HR	-	-	-	19,379	-	19,379
1994	Morell mixed HR	-	-	737	-	25,263	26,000
1995	Morell mixed HR	-	-	1,862	-	13,706	15,568
1996	Morell mixed	-	-	5,573	-	41,019	46,592
1997	Morell mixed	-	-	5,597	-	41,203	46,800
1998	Morell mixed	-	-	5,453	-	40,138	45,591
1999	Morell mixed	-	-	-	-	45,224	45,224
2004	Morell mixed	-	-	-	-	40,800	40,800

[A]PROGENY OF PREVIOUS HATCHERY RELEASES IN THE MORELL RIVER

Table 4. Reported numbers of Atlantic Salmon stocked in the Mill, Midgell, Valleyfield, West, and Dunk Rivers, 1985 - 1999, and their stages at release. Data from Cairns et al. 1996 (1985 - 1994), Cairns et al. 2000 (1995 - 1999) and D. Stewart, Cardigan Fish Hatchery, pers. comm., 8 Apr 2003 (2002).

River and Year	Parr				Smolt			Total
	0+	1+	2+	Total	1+	2+	Total	
Mill River								
1985	-	-	-	-	-	2,342	2,342	2,342
1986	-	-	580	580	-	2,417	2,417	2,997
1987	-	-	595	595	-	2,555	2,555	3,150
1988	-	-	349	349	-	3,079	3,079	3,428
1989	-	-	74	74	-	2,991	2,991	3,065
1990	-	-	25	25	-	3,082	3,082	3,107
1991	-	-	159	159	-	1,873	1,873	2,032
1992	-	-	169	169	-	3,657	3,657	3,826
1993	-	-	200	200	-	2,772	2,772	2,972
1994	-	-	127	127	-	2,584	2,584	2,711
1995	-	-	364	364	-	3,923	3,923	4,287
1996	-	-	-	-	-	1,065	1,065	1,065
1998	-	-	136	136	-	1,842	1,842	1,978
2002	-	-	-	-	-	2,904	2,904	2,904
Trout River (Coleman)								
1998	-	-	1,830	1,830	-	15,691	15,691	17,521
1999	-	-	-	-	-	-	-	21,000
2002	-	-	-	3,067	-	-	2,760	5,827
Midgell River								
1993	20,000	-	-	20,000	-	-	-	20,000
1994	20,000	-	-	20,000	-	-	-	20,000
1995	-	9,367	-	9,367	-	-	-	9,367
1996	-	8,564	-	8,564	-	-	-	8,564
1997	-	4,900	-	4,900	-	-	-	4,900
Valleyfield River								
1989	-	2,491	-	2,491	6,299	-	6,299	8,790
1990	89,003	-	-	89,003	738	-	738	89,741
1991	55,723	-	-	55,723	5,259	-	5,259	60,982
1992	32,494	10,014	-	42,508	-	12,000	12,000	54,508
1993	14,467	28,898	-	43,365	-	-	-	43,365
1994	20,000	-	-	20,000	5,896	1,980	7,876	27,876

River and Year	Parr 0+	Parr 1+	Parr 2+	Parr Total	Smolt 1+	Smolt 2+	Smolt Total	Total
1995	-	11,585	3,937	15,522	-	11,580	11,580	27,102
1996	-	-	140	140	1,733	13,432	15,165	15,305
1997	-	-	-	-	3,044	8,527	11,571	11,571
1998	-	4,200	-	4,200	-	5,400	5,400	9,600
1999	-	3,500	-	3,500	-	3,200	3,200	6,700
West River								
1988	-	-	-	-	1,390	-	1,390	1,390
1989	-	-	-	-	-	1,324	1,324	1,324
1991	50,750	-	-	50,750	-	-	-	50,750
1992	-	10,173	-	10,173	-	11,481	11,481	21,654
1994	-	-	209	209	3,965	3,355	7,320	7,529
1995	-	-	2,915	2,915	-	5,623	5,623	8,538
1996	-	-	212	212	-	6,759	6,759	6,971
1997	-	-	-	-	-	1,766	1,766	1,766
1998	-	-	-	-	-	10,206	10,206	10,206
Dunk River								
1991	-	-	-	-	-	2,017	2,017	2,017
1993	-	17,225	-	17,225	-	5,325	5,325	22,550
1994	-	-	341	341	-	7,259	7,259	7,600
1995	-	-	280	280	-	5,179	5,179	5,459
1996	-	-	-	-	-	11,350	11,350	11,350
1998	-	-	616	616	-	4,562	4,562	5,178
2002	-	-	-	18,617	-	-	12,282	30,899

Table 5. Reported numbers of Atlantic Salmon stocked on Prince Edward Island, 2009 - 2020. Data from PEI Fish and Wildlife Division files.

Year	Morell River Age	Morell River Stage	Morell River Number	West River Age	West River Stage	West River Number	Total Age	Total Stage	Total Number
2009	0+	Fall Fingerling	10,500	-	-	-	0+	Fall Fingerling	10,500
2010	-	-	-	-	-	-	-	-	0
2011	0+	Fall Fingerling	7,500	-	-	-	0+	Fall Fingerling	7,500
2012	0+	Fry	15,000	-	-	-	0+	Fry	15,000
2013	-	-	-	-	-	-	-	-	0
2014	-	-	-	-	-	-	-	-	55,000
2015	-	-	-	-	-	-	-	Fry	80,000

Year	Morell River			West River			Total		
	Age	Stage	Number	Age	Stage	Number	Age	Stage	Number
2016	-	Feeding fry (spring release)	60,000	-	Feeding fry (spring release)	60,000	-	Feeding fry (spring release)	120,000
2017	-	-	50,000	-	-	-	-	-	50,000
2018	-	-	12,000	-	-	3,000	-	-	15,000
2019	0+	-	50,000	0+	-	31,000	0+	-	81,000
2020	0+	-	63,000	0+	-	15,000	0+	-	78,000

Table 6A Summary of Atlantic Salmon status in Prince Edward Island rivers

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
Tignish River	2001	E	N	-	-	C	N	U	-	-	-	Guignion et al. 2002
Kildare River	2001	E	N	-	-	U	N	U	-	-	-	Guignion et al. 2002
Huntley River	2001	E	N	-	-	U	N	U	-	-	-	Guignion et al. 2002
Long Creek (Mill River East)	2001	E	Y	-	-	U	I	U	-	-	-	Guignion et al. 2002
	2008	R	N	-	-	-	-	-	-	-	-	Guignion unpubl.
Cains Brook-	1961	E	Y	-	-	U	C	D	C	D	-	Smith and Saunders 1961
	2001	E	Y	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2007	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	R	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2011	R	Y	-	-	-	-	-	-	-	-	Present report
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2016	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	R	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
Carruthers Brook-	1993	R	Y	-	-	C	C	D	C	D	-	Present report
	2001	E	Y	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2005	E	Y	-	-	-	-	-	-	-	-	MacFarlane et al. 2009
	2006	E	Y	-	-	-	-	-	-	-	-	MacFarlane et al. 2009
	2007	E	Y	-	-	-	-	-	-	-	-	Guignion 2009

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	2008	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion 2009
	2011	R	Y	-	-	-	-	-	-	-	-	Present report
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2016	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E,R	Y,Y	2	2	-	-	-	-	-	-	Guignion et al. 2019
	2019	R	Y	-	-	-	-	-	-	-	-	Present report
Trout River (Coleman)	1992	R	Y	-	-	C	C	D	C	D	-	Present report
	1993	E,R	Y,Y	1	1	-	-	-	-	-	-	Cairns 2002b, present report
	1994	R	Y	-	-	-	-	-	-	-	-	Premdas 1995, present report
	2008	R	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2014	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2016	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	R	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion et al. 2019, present report
	2019	R	Y	-	-	-	-	-	-	-	-	Present report
Ellerslie River	1952	E	Y	-	-	U	I	U	-	-	-	Saunders and Smith 1954
	1953	E	Y	-	-	-	-	-	-	-	-	Saunders and Smith 1954
	1946-1950	S	Y	-	-	-	-	-	-	-	-	Saunders 1960
	1946-1957	FF	Y	-	-	-	-	-	-	-	-	Saunders 1960

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	1958	FF	N	-	-	-	-	-	-	-	-	Saunders 1960
	1993	E	N	0	4	-	-	-	-	-	-	Cairns 2002b
	1994	E	N	0	12	-	-	-	-	-	-	Cairns 2002b
	1995	E	Y	1	12	-	-	-	-	-	-	Cairns 2002b
	2001	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2002	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
Trout River (Tyne Valley)	2001	E	Y	-	-	C	I	U	I	U	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2007	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion 2009
	2013	R	N	-	-	-	-	-	-	-	-	Present report
	2014	R	N	-	-	-	-	-	-	-	-	Present report
	2017	AA,R	Y,Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E	N	0	2	-	-	-	-	-	-	Guignion et al. 2019
Little Trout River	2001	E	Y	-	-	C	I	D	I	D	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2004	E,R	Y,Y	-	-	-	-	-	-	-	-	MacFarlane et al. 2009, present report
	2005	E,R	Y,Y	-	-	-	-	-	-	-	-	MacFarlane et al. 2009, present report
	2006	E	Y	-	-	-	-	-	-	-	-	MacFarlane et al. 2009
	2007	E	N	-	-	-	-	-	-	-	-	Guignion 2009
	2008	E,R	N,Y	-	-	-	-	-	-	-	-	Guignion 2009, present report
	2009	R	Y	-	-	-	-	-	-	-	-	Present report
	2010	R	Y	-	-	-	-	-	-	-	-	Present report
	2011	R	Y	-	-	-	-	-	-	-	-	Present report

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	2013	R	N	-	-	-	-	-	-	-	-	Present report
	2014	R	N	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E	Y	2	2	-	-	-	-	-	-	Guignion et al. 2019
Indian River	2000	E	N	-	-	U	N	U	-	-	-	Guignion et al. 2002
Granville Creek	2001	E	N	-	-	U	N	U	-	-	-	Guignion et al. 2002
Trout River (Millvale)	2001	E	N	-	-	C	N	U	-	-	-	Guignion et al. 2002
Hunter River	2001	E	N	-	-	C	N	U	-	-	-	Guignion et al. 2002
	2008	E	N	0	1	-	-	-	-	-	-	D. Guignion & P. Leblanc unpubl.
Wheatley River	2001	E	N	-	-	C	I	U	-	-	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	K. Gormley unpubl.
	2008	E	N	0	2	-	-	-	-	-	-	Guignion 2009
Black River	2001	E	Y	-	-	C	I	U	-	-	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2007	E	N	-	-	-	-	-	-	-	-	Guignion 2009
	2008	E	N	0	1	-	-	-	-	-	-	D. Guignion & P. Leblanc unpubl.
Bells Creek	2001	E	Y	-	-	C	I	U	-	-	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2007	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
	2008	E	N	0	1	-	-	-	-	-	-	Guignion 2009
Auld Creek	2001	E	N	-	-	U	N	U	-	-	-	Guignion et al. 2002
	~2002	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
Winter River	2000	E	N	0	3	C	N	U	-	-	-	Environment Canada files

River	Survey: Year	Survey: Method[a]	Survey: Salmon detected[b]	Number of electro-fishing surveys: Surveys detecting salmon	Number of electro-fishing surveys: Total surveys	Salmon status: Historic[c]	Salmon status: 2000-2019[d]	Salmon status: Most recent, 2000-2019[e]	Salmon status: 2010-2019[f]	Salmon status: Most recent, 2010-2019[g]	Salmon status: Hatchery[h]	Source
	2000	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002
Bristol Creek	1993	R	Y	-	-	C	I	U	I	U	-	Present report
	1994	R	Y	-	-	-	-	-	-	-	-	Premdas 1995
	1995	AA	Y	-	-	-	-	-	-	-	-	Guignion et al. 2002
	1996	AA,R	Y,Y	-	-	-	-	-	-	-	-	Guignion et al. 2002, present report
	2001	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2002	E	N	-	-	-	-	-	-	-	-	Guignion 2009
	2003	E	Y	-	-	-	-	-	-	-	-	Guignion unpubl.
	2004	E,R	N,Y	-	-	-	-	-	-	-	-	Guignion unpubl.
	2005	R	Y	-	-	-	-	-	-	-	-	Present report
	2007	E,R	N,Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion 2009
	2010	R	Y	-	-	-	-	-	-	-	-	Present report
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2014	R	N	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	R	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E	N	0	1	-	-	-	-	-	-	Guignion et al. 2019
Morell River	1975	E	Y	5	5	C	C	D	C	D	-	Cairns 2002b
	1984	E	Y	4	4	-	-	-	-	-	-	Cairns 2002b
	1985	E	Y	6	6	-	-	-	-	-	-	Cairns 2002b
	1990	R	Y	-	-	-	-	-	-	-	-	Present report
	1991	R	Y	-	-	-	-	-	-	-	-	Present report

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	1992	R	Y	-	-	-	-	-	-	-	-	Present report
	1993	R	Y	-	-	-	-	-	-	-	-	Present report
	1994	E,R	Y,Y	12	12	-	-	-	-	-	-	Premdas 1995, Cairns 2002b
	1995	E,R	Y	29	30	-	-	-	-	-	-	Cairns 2002b, present report
	1996	E,R	Y	12	14	-	-	-	-	-	-	Cairns 2002b, present report
	1997	E	Y	14	14	-	-	-	-	-	-	Cairns 2002b
	1998	E	Y	5	6	-	-	-	-	-	-	Cairns 2002b
	1999	E	Y	6	6	-	-	-	-	-	-	Cairns 2002b
	2000	E	Y	6	6	-	-	-	-	-	-	Cairns 2002b
	2001	E	Y	6	6	-	-	-	-	-	-	Cairns 2002b
	2001	E	Y	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2004	E,R	Y,Y	-	-	-	-	-	-	-	-	MacFarlane et al. 2009, present report
	2005	E	Y	-	-	-	-	-	-	-	-	MacFarlane et al. 2009
	2006	E	Y	-	-	-	-	-	-	-	-	MacFarlane et al. 2009
	2007	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion 2009
	2011	R	Y	-	-	-	-	-	-	-	-	Present report
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2014	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2016	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion et al. 2019

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	2018	E,R	Y,Y	3	3	-	-	-	-	-	-	Guignion et al. 2019
	2019	R	Y	-	-	-	-	-	-	-	-	Present report
Marie River	2001	E	N	-	-	C	I	U	-	-	-	Guignion et al. 2002
	2002	E	N	-	-	-	-	-	-	-	-	Guignion 2009
	2003	E	Y	-	-	-	-	-	-	-	-	Guignion unpubl.
	2007	E	N	-	-	-	-	-	-	-	-	Guignion 2009
Midgell River	1993	R	Y	-	-	C	C	D	C	D	-	Present report
	1996	R	Y	-	-	-	-	-	-	-	-	Present report
	2001	E	Y	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2004	R	Y	-	-	-	-	-	-	-	-	Present report
	2007	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	R	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2009	R	Y	-	-	-	-	-	-	-	-	Present report
	2011	R	Y	-	-	-	-	-	-	-	-	Present report
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2014	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E	Y	2	2	-	-	-	-	-	-	Guignion et al. 2019
St. Peters River	1993	R	Y	-	-	C	C	D	C	D	-	Present report
	1996	R	Y	-	-	-	-	-	-	-	-	Present report
	2001	E	Y	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	2007	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	R	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2011	R	Y	-	-	-	-	-	-	-	-	Present report
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2014	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2016	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	R	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E	Y	1	1	-	-	-	-	-	-	Guignion et al. 2019
McAskill Creek (Goose River)	2001	E	N	-	-	U	N	U	-	-	-	Guignion et al. 2002
Cow River	2000	E	Y	-	-	C	I	D	C	D	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2007	E	N	-	-	-	-	-	-	-	-	Guignion 2009
	2008	E	N	-	-	-	-	-	-	-	-	Guignion 2009
	2011	R	Y	-	-	-	-	-	-	-	-	Present report
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2014	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2016	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	R	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E,R	N,Y	0	0	-	-	-	-	-	-	Guignion et al. 2019, present report
	2019	R	Y	-	-	-	-	-	-	-	-	Present report

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
Naufrage River	1993	R	Y	-	-	C	C	D	C	D	-	Present report
	1996	R	Y	-	-	-	-	-	-	-	-	Present report
	2000	E	Y	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2004	R	Y	-	-	-	-	-	-	-	-	Guignion unpubl.
	2007	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	R	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2010	R	Y	-	-	-	-	-	-	-	-	Present report
	2011	R	Y	-	-	-	-	-	-	-	-	Present report
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2014	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2016	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	R	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E,R	Y,Y	1	1	-	-	-	-	-	-	Guignion et al. 2019
	2019	R	Y	-	-	-	-	-	-	-	-	Present report
Bear River	late 1960s	AN	Y	-	-	U	I	U	I	U	-	Guignion et al. 2002, 2019
	2000	E	N	0	6	-	-	-	-	-	-	Environment Canada files
	2000	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2011	R	N	-	-	-	-	-	-	-	-	Present report
	2012	R	N	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2014	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	2016	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	R	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E,R	N,Y	0	0	-	-	-	-	-	-	Guignion et al. 2019
	2019	R	N	-	-	-	-	-	-	-	-	Present report
Hay River	2000	E	Y	-	-	C	I	D	C	D	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2007	E	N	-	-	-	-	-	-	-	-	Guignion 2009
	2008	E,R	N,N	-	-	-	-	-	-	-	-	Guignion 2009
	2011	R	Y	-	-	-	-	-	-	-	-	Present report
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2014	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2016	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	R	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E,R	Y,Y	1	1	-	-	-	-	-	-	Guignion et al. 2019
	2019	R	Y	-	-	-	-	-	-	-	-	Present report
Cross River	2000	E	Y	-	-	C	C	D	C	D	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2004	R	Y	-	-	-	-	-	-	-	-	MacFarlane unpubl.
	2007	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	R	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2009	R	Y	-	-	-	-	-	-	-	-	Present report
	2010	R	Y	-	-	-	-	-	-	-	-	Present report
	2011	R	Y	-	-	-	-	-	-	-	-	Present report

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2014	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2016	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E,R	Y,Y	1	1	-	-	-	-	-	-	Guignion et al. 2019
	2019	R	Y	-	-	-	-	-	-	-	-	Present report
Priest Pond Creek	2000	E	Y	-	-	C	C	D	C	D	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2007	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	R	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2009	R	Y	-	-	-	-	-	-	-	-	Present report
	2010	R	Y	-	-	-	-	-	-	-	-	Present report
	2011	R	Y	-	-	-	-	-	-	-	-	Present report
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2014	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2016	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	R	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E,R	Y,Y	3	3	-	-	-	-	-	-	Guignion et al. 2019
	2019	R	Y	-	-	-	-	-	-	-	-	Present report
North Lake Creek[i]	1991	R	Y	-	-	C	C	D	C	D	-	Present report
	1992	R	Y	-	-	-	-	-	-	-	-	Present report

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	1993	R	Y	-	-	-	-	-	-	-	-	Present report
	2000	E	Y	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2003	R	Y	-	-	-	-	-	-	-	-	Guignion unpubl.
	2004	R	Y	-	-	-	-	-	-	-	-	Guignion unpubl.
	2005	R	Y	-	-	-	-	-	-	-	-	Guignion unpubl.
	2006	R	Y	-	-	-	-	-	-	-	-	Guignion unpubl.
	2007	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	R	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2009	R	Y	-	-	-	-	-	-	-	-	Present report
	2010	R	Y	-	-	-	-	-	-	-	-	Present report
	2011	R	Y	-	-	-	-	-	-	-	-	Present report
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2014	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2016	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	R	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E	Y	1	1	-	-	-	-	-	-	Guignion et al. 2019
	2019	R	Y	-	-	-	-	-	-	-	-	Present report
Black Pond Creek	2001	E	N	-	-	U	N	U	-	-	-	Guignion et al. 2002
Souris River	2000	E,FK	N,Y	-	-	U	I	U	I	U	-	Guignion et al. 2002
	2001	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
	2002	E,FK	N,Y	-	-	-	-	-	-	-	-	Guignion 2009, Guignion unpubl.

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	2005	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
	2006	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
	2008	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
	2011	R	N	-	-	-	-	-	-	-	-	Present report
	2012	R	N	-	-	-	-	-	-	-	-	Present report
	2013	R	N	-	-	-	-	-	-	-	-	Present report
	2014	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	N	-	-	-	-	-	-	-	-	Present report
Fortune River	2001	E	N	-	-	C	I	D	I	D	-	Guignion et al. 2002
	2008	E	N	0	3	-	-	-	-	-	-	Guignion & P., Leblanc unpubl.
	2014	R	N	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
Boughton River	2001	E	N	-	-	U	N	U	-	-	-	Guignion et al. 2002
Cardigan River	2001	E	Y	-	-	C	I	D	C	D	H	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2007	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	E,R	N,N	-	-	-	-	-	-	-	-	Guignion 2009
	2019	E	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
Brudenell River	2001	E	Y	-	-	C	I	U	-	-	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2005	E	Y	-	-	-	-	-	-	-	-	MacFarlane unpubl.
	2007	E	N	-	-	-	-	-	-	-	-	Guignion 2009
	2008	E	N	-	-	-	-	-	-	-	-	Guignion 2009
Montague River	2001	E	N	-	-	C	N	U	-	-	-	Guignion et al. 2002
	2007	E	N	-	-	-	-	-	-	-	-	MacFarlane unpubl.

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	2008	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
Valleyfield River	2000	E	N	0	3	C	N	U	-	-	-	Environment Canada files
	2001	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2002	E	N	-	-	-	-	-	-	-	-	Guignion 2009
	2007	E	N	-	-	-	-	-	-	-	-	Guignion 2009
	2008	E	N	0	2	-	-	-	-	-	-	Guignion 2009
Sturgeon River	2001	E	N	-	-	U	N	U	-	-	-	Guignion et al. 2002
Murray River	2001	E	N	-	-	C	I	U	I	U	H	Guignion et al. 2002
	2003	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
	2016	E	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2019
Belle River	2001	E	N	-	-	U	N	U	-	-	-	Guignion et al. 2002
Flat River	2001	E	N	-	-	U	N	U	-	-	-	Guignion et al. 2002
	2008	E	N	0	1	-	-	-	-	-	-	Guignion & P. Leblanc unpubl.
South Pinette River	2001	E	N	-	-	U	N	U	-	-	-	Guignion et al. 2002
Middle Pinette River	2001	E	N	-	-	U	N	U	-	-	-	Guignion et al. 2002
North Pinette River	2001	E	N	-	-	U	N	U	-	-	-	Guignion et al. 2002
Orwell River	2001	E	N	-	-	U	N	U	-	-	-	Guignion et al. 2002
Vernon River	1993	E	Y	2	4	C	I	D	I	D	-	Cairns 2002b
	1994	E	Y	2	12	-	-	-	-	-	-	Cairns 2002b
	1995	E	Y	2	8	-	-	-	-	-	-	Cairns 2002b
	1999	E	Y	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2001	E	Y	-	-	-	-	-	-	-	-	Guignion et al. 2002

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2007	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	R	N	-	-	-	-	-	-	-	-	Guignion 2009
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2014	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	N	-	-	-	-	-	-	-	-	Present report
	2017	R	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E,R	Y,Y	2	2	-	-	-	-	-	-	Guignion et al. 2019
	2019	R	Y	-	-	-	-	-	-	-	-	Present report
Seal River (Vernon)	1993	E	N	0	4	U	I	U	I	U	-	Cairns 2002b
	1994	E	N	0	12	-	-	-	-	-	-	Cairns 2002b
	1995	E	N	0	8	-	-	-	-	-	-	Cairns 2002b
	2001	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2018	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2019
Johnstons River	-	-	-	-	-	C	-	-	-	-	-	Cairns et al. 2010
Glenfinnan River	1970s	AA	Y	-	-	U	N	U	-	-	-	Guignion et al. 2002
	2001	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002
Clarks Creek	~1982	AN	Y	-	-	U	I	D	I	D	-	Guignion et al. 2002
	2001	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2002	E	N	-	-	-	-	-	-	-	-	Guignion 2009
	2007	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	R	N	-	-	-	-	-	-	-	-	Guignion 2009
	2012	R	N	-	-	-	-	-	-	-	-	Present report

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	N	-	-	-	-	-	-	-	-	Present report
	2017	R	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E	Y	2	2	-	-	-	-	-	-	Guignion et al. 2019
	2019	R	Y	-	-	-	-	-	-	-	-	Present report
Pisquid River	2001	E	Y	-	-	C	C	D	C	D	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2004	R	Y	-	-	-	-	-	-	-	-	Guignion unpubl.
	2005	R	Y	-	-	-	-	-	-	-	-	Guignion unpubl.
	2007	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	R	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2009	R	Y	-	-	-	-	-	-	-	-	Present report
	2010	R	Y	-	-	-	-	-	-	-	-	Present report
	2011	R	Y	-	-	-	-	-	-	-	-	Present report
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2014	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2016	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	R	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E	Y	2	2	-	-	-	-	-	-	Guignion et al. 2019, Present report
	2019	R	Y	-	-	-	-	-	-	-	-	Present report
	~1982	AN	Y	-	-	U	I	U	I	U	-	Guignion et al. 2002
	2001	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
Head of Hillsborough River	2002	E	N	-	-	-	-	-	-	-	-	Guignion 2009
	2007	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	R	N	-	-	-	-	-	-	-	-	Guignion 2009
	2011	R	N	-	-	-	-	-	-	-	-	Present report
	2012	R	N	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	N	-	-	-	-	-	-	-	-	Present report
	2017	R	N	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2019
North River	2001	AA,E	Y,N	-	-	C	I	U	I	U	-	Guignion et al. 2002
	2002	E	N	-	-	-	-	-	-	-	-	Guignion 2009
	2004	R	N	-	-	-	-	-	-	-	-	Guignion unpubl.
	2007	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion 2009
	2011	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2016	E	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2017	E,R	N,Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E	N	0	2	-	-	-	-	-	-	Guignion et al. 2019
Clyde River	~1970	AA	Y	-	-	U	I	U	I	U	-	Guignion et al. 2002, Guignion unpubl.
	2001	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2011	R	N	-	-	-	-	-	-	-	-	Present report
	2012	E	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2017	E,R	N,N	-	-	-	-	-	-	-	-	Guignion et al. 2019

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	2018	E	N	0	1	-	-	-	-	-	-	Guignion et al. 2019
West River	1990	R	Y	-	-	C	C	D	C	D	-	Present report
	1991	R	Y	-	-	-	-	-	-	-	-	Present report
	1992	R	Y	-	-	-	-	-	-	-	-	Present report
	1993	R	Y	-	-	-	-	-	-	-	-	Present report
	1994	R	Y	-	-	-	-	-	-	-	-	Premdas 1995
	1995	R	Y	-	-	-	-	-	-	-	-	Present report
	2001	E	Y	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2004	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion unpubl.
	2005	E	Y	-	-	-	-	-	-	-	-	Guignion unpubl.
	2006	E	Y	-	-	-	-	-	-	-	-	MacFarlane et al. 2009
	2007	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion 2009
	2009	R	Y	-	-	-	-	-	-	-	-	Present report
	2010	R	Y	-	-	-	-	-	-	-	-	Present report
	2011	R	Y	-	-	-	-	-	-	-	-	Present report
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2013	R	Y	-	-	-	-	-	-	-	-	Present report
	2014	R	Y	-	-	-	-	-	-	-	-	Present report
	2015	R	Y	-	-	-	-	-	-	-	-	Present report
	2016	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E,R	Y,Y	6	10	-	-	-	-	-	-	Guignion et al. 2019, present report

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	2019	R	Y	-	-	-	-	-	-	-	-	Present report
Desable River	~1990	AA	Y	-	-	C	N	U	-	-	-	Guignion et al. 2002
	2000	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2001	E	N	-	-	-	-	-	-	-	-	K. Gormley unpubl.
Westmoreland River	2000	E	N	-	-	C	N	U	-	-	-	Guignion et al. 2002
Tryon River	2000	E	N	-	-	C	N	U	-	-	-	Guignion et al. 2002
	2007	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
	2008	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
Bradshaw River	2001	E	Y	-	-	C	I	U	N	U	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2003	E	N	0	6	-	-	-	-	-	-	Guignion unpubl.
	2008	E	N	0	2	-	-	-	-	-	-	Guignion 2009
	2017	R	N	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2019
Dunk River	1993	R	Y	-	-	C	I	U	I	U	-	Present report
	2001	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2001	A	Y	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2002	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2003	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
	2004	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
	2005	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
	2006	E	Y	-	-	-	-	-	-	-	-	Guignion unpubl.
	2007	E,FK	N,Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	E,R	Y,Y	-	-	-	-	-	-	-	-	Guignion 2009

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	2012	R	Y	-	-	-	-	-	-	-	-	Present report
	2017	R	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E	N	0	2	-	-	-	-	-	-	Guignion et al. 2019
Wilmot River	2000	E	Y	-	15	C	I	D	C	D	-	Environment Canada files
	2001	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2002	E	N	-	-	-	-	-	-	-	-	Guignion 2009
	2003	E	Y	2	6	-	-	-	-	-	-	Guignion unpubl.
	2004	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
	2005	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
	2006	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
	2007	E	Y	-	-	-	-	-	-	-	-	Guignion 2009
	2008	E,R	N,N	-	-	-	-	-	-	-	-	Guignion 2009
	2017	E,R	N,Y	-	-	-	-	-	-	-	-	Guignion et al. 2019
	2018	E	Y	1	2	-	-	-	-	-	-	Guignion et al. 2019
Sheep River	Mid-20th century	AA	Y	-	-	U	N	-	-	-	-	Guignion unpubl.
Enmore River	1993	E	Y	2	4	U	N	U	-	-	-	Cairns 2002b
	1994	E	Y	9	16	-	-	-	-	-	-	Cairns 2002b
	1995	E	N	0	12	-	-	-	-	-	-	Cairns 2002b
Brae River	Unknown	AA	Y	-	-	U	N	U	-	-	-	Guignion et al. 2002
	2001	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002
Little Pierre Jacques River	1993	E	Y	3	4	U	I	U	-	-	-	Cairns 2002b
	1994	E	Y	3	12	-	-	-	-	-	-	Cairns 2002b
	1995	E	Y	3	12	-	-	-	-	-	-	Cairns 2002b
	2001	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002

River	Survey			Number of electro-fishing surveys		Salmon status						Source
	Year	Method[a]	Salmon detected[b]	Surveys detecting salmon	Total surveys	Historic[c]	2000-2019[d]	Most recent, 2000-2019[e]	2010-2019[f]	Most recent, 2010-2019[g]	Hatchery[h]	
	2002	E	N	-	-	-	-	-	-	-	-	Guignion 2009
	2003	E	Y	-	-	-	-	-	-	-	-	Guignion unpubl.
	2007	E	N	-	-	-	-	-	-	-	-	Guignion 2009
Big Pierre Jacques River	2001	E	N	-	-	C	N	U	-	-	-	Guignion et al. 2002
	2006	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
	2007	E	N	-	-	-	-	-	-	-	-	Guignion unpubl.
Little Mininigash River	1970s	AN	Y	-	-	U	N	U	-	-	-	Guignion unpubl.
	2001	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002
Miminigash River	Late 1960s	A	Y	-	-	U	I	D	C	D	-	Guignion et al. 2019
	1970s	AN	Y	-	-	-	-	-	-	-	-	Guignion unpubl.
	2001	E	N	-	-	-	-	-	-	-	-	Guignion et al. 2002
	2018	A,E	Y	-	-	-	-	-	-	-	-	Guignion et al. 2019

[a]E - electrofishing, AA - anecdotal account, AN - angling, FK - fish kill, FF - fish fence, R - redd count, S - seine.
[b]Where more than 1 method was used, presence indicated by each method is given in the same respective order. E.g. where Method is given as E,R and Salmon detected is given N,Y, electrofishing indicated non-detection and redd surveys indicated detection.
[c]C - confirmed; the river was mentioned by name by Department of the Marine and Fisheries (1880-1910) as having salmon present. U: unconfirmed; the river was not mentioned by the Department of Marine and Fisheries (1880-1910) as having salmon present.
[d]C - Consistently detected: Salmon were found in all years between 2000 and 2019 in which monitoring was conducted. I - Inconsistently detected: Salmon were found in only some monitored years in 2000-2019. N - No evidence of salmon presence in 2000-2019.
[e]D - salmon were detected in the most recent monitoring year in 2000-2019. U - Salmon were not detected in the most recent monitoring year in 2000-2019.
[f]Same codes as Footnote d, but for 2010-2019. / [g]Same codes as Footnote e, but for 2010-2019.
[h]H - Detected salmon are likely hatchery escapees or direct descendants of hatchery escapees./ [i]Both North Lake Creek and Mill Creek flow into North Lake. Mill Creek has traditionally not been covered by surveys. For 2017 and 2018, the entry for North Lake Creek includes data for Mill Creek. In 2017, about 10 of the redds reported under North Lake Creek were in Mill Creek (Guignion et al. 2019). In 2018, an electrofishing survey found 1 Atlantic salmon parr in Mill Creek.

Table 6B. Summary of Atlantic salmon occupancy based on historic data and recent surveys

Description	Totals
Number of rivers which probably supported salmon runs prior to European colonization	71
Number of rivers with Atlantic salmon presence confirmed by Dept. of Marine and Fisheries reports for 1880-1910	40
Number of rivers with monitoring in 2000-2019 that detected:	
Atlantic salmon presence in every monitoring year in this period	12
Atlantic salmon presence in some but not all monitoring years in this period	28
Atlantic salmon presence in any monitoring year in this period	40
Atlantic salmon presence in the most recent monitoring year in this period	21
Number of rivers with monitoring in 2010-2019 that detected:	
Atlantic salmon presence in every monitoring year in this period	17
Atlantic salmon presence in some but not all monitoring years in this period	12
Atlantic salmon presence in any monitoring year in this period	29
Atlantic salmon presence in the most recent monitoring year in this period	21
Number of rivers in which detected Atlantic salmon are likely hatchery escapees	2

Table 7. Size and origin (wild/hatchery) of adult Atlantic Salmon captured at the Leards Dam trap in the Morell River. Salmon without adipose fins are considered to be of hatchery origin.

Year	Small salmon						Large salmon						All salmon				
	Wild		Hatchery		Total		Wild		Hatchery		Total		Wild		Hatchery		Total
	No.	Prop.	No.	Prop.	No.	Prop.	No.	Prop.	No.	Prop.	No.	Prop.	No.	Prop.	No.	Prop.	
1981	0	0.000	39	1.000	39	0.867	6	1.000	0	0.000	6	0.133	6	0.133	39	0.867	45
1982	6	0.182	27	0.818	33	0.917	1	0.333	2	0.667	3	0.083	7	0.194	29	0.806	36
1983	1	0.500	1	0.500	2	0.500	0	0.000	2	1.000	2	0.500	1	0.250	3	0.750	4
1984	3	0.600	2	0.400	5	0.556	2	0.500	2	0.500	4	0.444	5	0.556	4	0.444	9
1985	2	0.143	12	0.857	14	0.933	1	1.000	0	0.000	1	0.067	3	0.200	12	0.800	15
1986	1	0.002	619	0.998	620	0.990	2	0.333	4	0.667	6	0.010	3	0.005	623	0.995	626
1987	2	0.002	1,166	0.998	1,168	0.945	2	0.029	66	0.971	68	0.055	4	0.003	1,232	0.997	1,236
1988	8	0.006	1,386	0.994	1,394	0.941	2	0.022	87	0.978	89	0.060	10	0.007	1,473	0.995	1,481
1989	12	0.036	323	0.964	335	0.728	0	0.000	125	1.000	125	0.272	12	0.026	448	0.974	460
1990	44	0.108	365	0.892	409	0.867	4	0.063	59	0.937	63	0.133	48	0.102	424	0.898	472
1991	33	0.101	294	0.899	327	0.893	11	0.282	28	0.718	39	0.107	44	0.120	322	0.880	366
1992	64	0.071	843	0.929	907	0.952	8	0.174	38	0.826	46	0.048	72	0.076	881	0.924	953
1993	44	0.070	584	0.930	628	0.983	0	0.000	11	1.000	11	0.017	44	0.069	595	0.931	639
1994	8	0.222	28	0.778	36	0.554	2	0.069	27	0.931	29	0.446	10	0.154	55	0.846	65
1995	14	0.075	172	0.925	186	0.925	5	0.333	10	0.667	15	0.075	19	0.095	182	0.905	201
1996	31	0.142	188	0.858	219	0.880	4	0.133	26	0.867	30	0.120	35	0.141	214	0.859	249
1997	32	0.147	185	0.853	217	0.943	4	0.308	9	0.692	13	0.057	36	0.157	194	0.843	230
1999[a]	15	0.185	66	0.815	81	0.942	0	0.000	5	1.000	5	0.058	15	0.174	71	0.826	86
2002	3	0.067	42	0.933	45	0.833	2	0.222	7	0.778	9	0.167	5	0.093	49	0.907	54
Total	323	0.048	6,342	0.952	6,665	0.922	56	0.099	508	0.901	564	0.078	379	0.052	6,850	0.948	7,227

[a]*Includes salmon which were seined from the pool below Leards Dam.*

Table 8. Watershed areas, stream habitat areas, Rainbow Trout presence, Atlantic Salmon stocking history and run timing, and Salmon status in Prince Edward Island rivers.

River	Located near	Watershed area (km²)	Fluvial area (m²)[a]	Rainbow trout present[b]	Stocked with Atlantic salmon			Atlantic salmon run timing	Run timing and size distribution influenced by stocking[c]	Atlantic salmon present in 2000-2019[d]
					1880-1899	1900-1949	1950-2011			
Tignish River	Tignish	44.5	58,241	-	-	X	-	-	-	-
Kildare (Montrose) River	Alma	29.0	37,911	-	-	-	-	-	-	-
Huntley River	Huntley	28.9	37,767	-	-	-	-	-	-	-
Long Creek	Mill River East	19.2	25,069	-	-	-	-	-	-	Y
Cains Brook	Mill River	30.9	22,845	N	-	-	-	Some early, but mostly late	Y	Y
Carruthers Brook	Mill River	47.9	35,455	N	-	X	X	Some early, but mostly late	Y	Y
Trout (Beatons) River	Coleman	107.1	140,202	N	X	X	X	Some early, but mostly late	Y	Y
Ellerslie (Bideford) River	Ellerslie	34.1	44,653	-	-	-	-	-	-	Y
Trout River	Tyne Valley	48.3	63,281	N	X	X	-	Late	-	Y
Little Trout River	Richmond	21.3	27,883	N	-	-	-	Late	-	Y
Indian River	Indian River	23.9	31,326	-	-	X	-	-	-	-
Granville Creek	Granville	26.0	34,036	-	-	-	-	-	-	-
Trout River	Millvale	53.3	69,787	N	X	-	-	-	-	-
Hunter River	Hunter River	88.8	116,259	Y	X	X	-	-	-	-
Wheatley River	Wheatley River	58.0	75,914	Y	X	X	-	-	-	Y
Black River	Brackley Point	20.9	27,307	-	-	X	-	-	-	Y

River	Located near	Watershed area (km^2)	Fluvial area (m^2)[a]	Rainbow trout present[b]	Stocked with Atlantic salmon			Atlantic salmon run timing	Run timing and size distribution influenced by stocking[c]	Atlantic salmon present in 2000-2019[d]
					1880-1899	1900-1949	1950-2011			
Bells Creek	West Covehead	28.9	37,819	N	-	X	-	-	-	Y
Auld Creek	West Covehead	14.4	18,785	-	-	-	-	-	-	-
Winter River	Suffolk	69.6	91,112	N	-	X	-	-	-	-
Bristol (Berrigans) Creek	Bristol	41.4	54,183	N	-	-	-	Late	-	Y
Morell River	Morell	170.6	237,176	N	X	X	X	Mixed early and late	Y	Y
Marie River	Marie	29.3	38,408	-	-	X	-	-	-	Y
Midgell River	Midgell	63.8	83,532	N	-	X	X	Late	-	Y
St. Peters River	St. Peters	44.6	58,333	N	-	X	X	Late	-	Y
McAskill Crk. (Goose R.)	Goose River	10.6	13,876	-	-	X	-	-	-	-
Cow River	Monticello	22.8	29,886	N	-	-	-	Late	-	Y
Naufrage River	Naufrage	43.6	57,037	N	-	X	X	Late	-	Y
Bear River	St. Margarets	17.2	22,477	N	-	-	-	Late	-	Y
Hay River	St. Margarets	25.7	33,696	N	-	-	-	Late	-	Y
Cross River	Hermanville	44.3	57,992	N	-	X	-	Late	-	Y
Priest Pond Creek	Hermanville	24.9	32,557	N	-	-	-	Late	-	Y
North Lake Creek[e]	North Lake	47.7	62,495	N	X	X	-	Late	-	Y
Black Pond Creek	Black Pond, Red Pt.	14.3	18,759	-	-	X	-	-	-	-
Souris River	Souris	53.2	69,578	Y	-	X	-	-	-	Y
Fortune River	Dingwells Mills	75.4	98,652	Y	-	X	-	-	-	Y
Boughton River	Bridgetown	51.2	67,025	N	-	-	-	-	-	-

River	Located near	Watershed area (km²)	Fluvial area (m²)[a]	Rainbow trout present[b]	Stocked with Atlantic salmon			Atlantic salmon run timing	Run timing and size distribution influenced by stocking[c]	Atlantic salmon present in 2000-2019[d]
					1880-1899	1900-1949	1950-2011			
Cardigan River	Cardigan	44.6	58,411	Y	-	X	X[f]	Mixed early and late	Y	Y
Brudenell River	Brudenell	55.3	72,379	Y	X	X	-	-	-	Y
Montague River	Montague	76.3	99,883	Y	X	X	-	-	-	-
Valleyfield River	Montague	87.7	127,500	Y	-	-	X	-	-	-
Sturgeon River	Sturgeon	60.4	79,068	Y	-	X	-	-	-	-
Murray River	Murray River	71.0	92,905	Y	X	X	X[f]	-	-	Y
Belle River	Belle River	35.9	47,022	Y	-	X	-	-	-	-
Flat River	Flat River	30.1	39,390	Y	-	-	-	-	-	-
South Pinette River	Pinette	18.3	23,891	-	-	-	-	-	-	-
Middle Pinette River	Pinette	8.8	11,530	-	-	-	-	-	-	-
North Pinette River	Pinette	27.5	35,987	-	-	-	-	-	-	-
Orwell River	Orwell	29.5	38,657	Y	-	-	-	-	-	-
Vernon River	Vernon Bridge	69.2	90,536	Y	X	-	-	Late	-	Y
Seal River	Vernon	23.4	30,646	Y	-	-	-	Late	-	Y
Johnstons River	Johnstons River	39.3	51,421	Y	X	X	-	-	-	-
Glenfinnan River	Glenfinnan	33.3	43,553	Y	-	X	-	-	-	-
Clarks Creek	Pisquid	46.3	60,610	Y	-	-	-	Late	-	Y
Pisquid River	Pisquid	47.6	62,247	Y	-	-	-	Late	-	Y
Head of Hillsborough R.	Mount Stewart	53.1	69,512	Y	-	X	-	Late	-	Y
North River	Milton	99.0	129,651	Y	-	X	-	Late	-	Y
Clyde River	Clyde River	41.7	54,549	Y	-	X	-	Late	-	Y

River	Located near	Watershed area (km²)	Fluvial area (m²)[a]	Rainbow trout present[b]	Stocked with Atlantic salmon			Atlantic salmon run timing	Run timing and size distribution influenced by stocking[c]	Atlantic salmon present in 2000-2019[d]
					1880-1899	1900-1949	1950-2011			
West River	Bonshaw	114.1	184,500	Y	X	X	X	Some early, but mostly late	Y	Y
Desable River	Desable	43.7	57,246	Y	X	-	-	-	-	-
Westmoreland River	Crapaud	43.2	56,500	Y	X	-	-	-	-	-
Tryon River	Tryon	56.4	73,767	Y	X	-	-	-	-	-
Bradshaw River	Bedeque	46.1	60,362	Y	-	-	-	-	-	Y
Dunk River	Ross Corner	165.7	193,078	Y	X	X	X	Some early, but mostly late	Y	Y
Wilmot River	Wilmot Valley	83.4	109,177	Y	X	X	-	Late	-	Y
Sheep River	Victoria West	30.7	40,202	-	-	-	-	-	-	-
Enmore River	North Enmore	42.6	55,767	-	-	-	-	-	-	-
Brae River	Brae	19.5	25,553	N	-	-	-	-	-	-
Little Pierre Jacques	Milburn	21.8	28,472	-	-	-	-	-	-	Y
Big Pierre Jacques	Glenwood	40.6	53,122	-	-	-	-	-	-	-
Little Mininigash River	Miminegash	60.2	78,846	-	-	-	-	-	-	-
Miminigash River	Miminegash	26.7	34,939	-	-	X	-	-	-	Y
Sums of areas with Atlantic salmon recently present:										
Rivers with run timing and size distribution influenced by stocking	-	680.9	871,668	-	-	-	-	-	-	-
Rivers with run timing and size distribution not influenced by stocking	-	1,448.9	1,896,739	-	-	-	-	-	-	-
Both of above river types	-	2,129.8	2,768,407	-	-	-	-	-	-	-

River	Located near	Watershed area (km^2)	Fluvial area (m^2)[a]	Rainbow trout present[b]	Stocked with Atlantic salmon			Atlantic salmon run timing	Run timing and size distribution influenced by stocking[c]	Atlantic salmon present in 2000-2019[d]
					1880-1899	1900-1949	1950-2011			
All	-	3,368.2	4,402,197	-	-	-	-	-	-	-

[a]For the Cains, Carruthers, Morell, Valleyfield, West, and Dunk Rivers, from field measurements of stream area. For other rivers, estimated from a linear regression based on stream area measurements and watershed areas for the Mill, Morell, Valleyfield, West and Dunk Rivers. For the Mill River, the breakdown between Cains and Carruthers Brooks is assumed to follow the relative proportions of the watershed areas of the two brooks. Data from Cairns et al. 2010.
[b]Data from Roloson et al. 2018 and Guignion et al. 2019.
[c]Classification by Cairns and MacFarlane 2015. Presence of an early run component is attributed to heavy stocking of small early-run fish. Spawners in these rivers are assumed to be 50% large. Spawners in other rivers are assumed to be 90% large.
[d]Rivers where Atlantic salmon have been either consistently or inconsistently detected in 2000-2019 (Table 6A).
[e]North Lake Creek and Mill Creek both flow into North Lake. Watershed area is given for the entire watershed of North Lake.
[f]Stocking is accidental, from hatchery escapees.

Table 9. Counts of small and large Salmon on PEI from monitoring studies. Fish fence counts include only Salmon moving upstream.

River and Year	Method	Small		Large		Total
		No.	Prop.	No.	Prop.	
Mill River (Cains and Carruthers)						
1993	Fish fence	17	0.773	5	0.227	22
1994	Fish fence	11	1.000	0	0.000	11
1995	Fish fence	3	0.100	27	0.900	30
	Total	31	0.492	32	0.508	63
Morell River						
1981	Fish trap, Leards Pond	39	0.867	6	0.133	45
1982	Fish trap, Leards Pond	33	0.917	3	0.083	36
1983	Fish trap, Leards Pond	2	0.500	2	0.500	4
1984	Fish trap, Leards Pond	5	0.556	4	0.444	9
1985	Fish trap, Leards Pond	14	0.933	1	0.067	15
1986	Fish trap, Leards Pond	620	0.990	6	0.010	626
1987	Fish trap, Leards Pond	1,168	0.945	68	0.055	1,236
1988	Fish trap, Leards Pond	1,394	0.940	89	0.060	1,483
1989	Fish trap, Leards Pond	335	0.728	125	0.272	460
1990	Fish trap, Leards Pond	409	0.867	63	0.133	472
1991	Fish trap, Leards Pond	327	0.893	39	0.107	366
1992	Fish trap, Leards Pond	907	0.952	46	0.048	953
1993	Fish trap, Leards Pond	628	0.983	11	0.017	639
1994	Fish trap, Leards Pond	36	0.554	29	0.446	65
1995	Fish trap, Leards Pond	186	0.925	15	0.075	201
1996	Fish trap, Leards Pond	548	0.880	75	0.120	623
1997	Fish trap, Leards Pond	217	0.943	13	0.057	230
1999	Fish trap, Leards Pond	81	0.942	5	0.058	86
2002	Fish trap, Leards Pond	61	0.871	9	0.129	70
	Total	7,010	0.920	609	0.080	7,619
1998	Visual counts (mostly by snorkel)	214	0.884	28	0.116	242
1999	Visual counts (mostly by snorkel)	48	0.814	11	0.186	59
	Total	262	0.870	39	0.130	301
Valleyfield River						
1990	Fish fence	36	1.000	0	0.000	36
1991	Fish fence	30	1.000	0	0.000	30
1993	Fish fence	84	1.000	0	0.000	84

River and Year	Method		Small		Large		Total
			No.	Prop.	No.	Prop.	
1994	Fish fence		15	0.682	7	0.318	22
1995	Fish fence		58	0.935	4	0.065	62
1996	Fish fence		75	0.904	8	0.096	83
		Total	298	0.940	19	0.060	317
Montague River							
1996	Fish fence		11	0.846	2	0.154	13
West River							
1989	Fish fence		31	0.620	19	0.380	50
1990	Fish fence		25	0.521	23	0.479	48
1993	Fish fence		250	0.954	12	0.046	262
1994	Fish fence		8	0.571	6	0.429	14
		Total	314	0.840	60	0.160	374
Dunk River							
1995	Fish fence		40	1.000	0	0.000	40

Table 10. Atlantic Salmon recreational catches on the Morell River, 1955 - 2011, by retention status and size. Numbers for 1955 - 1990 are estimates by DFO fisheries officers (Smith 1981; O'Neil and Swetnam 1984, 1991; Swetnam and O'Neil 1984, 1985; Bielak et al. 1991). Numbers for 1991, 1992, and 1994 are from angler mail-out surveys (MacFarlane and Guignion 1992, 1993; Cairns 1996). Numbers for 1995 - 2011 are angler harvest from licence stub or mail-in surveys. Salmon caught and retained include estimated mortality from catch-and-release fisheries. Blank cells with a dash mean that data are unavailable.

Year	Salmon caught and retained			Salmon caught and released			All salmon			Fishing effort (rod-days)	Salmon caught per rod-day
	Small	Large	Total	Small	Large	Total	Small	Large	Total		
1955	-	-	21	-	-	-	-	-	21	18	1.167
1956	-	-	29	-	-	-	-	-	29	87	0.333
1957	-	-	3	-	-	-	-	-	3	52	0.058
1958	-	-	9	-	-	-	-	-	9	52	0.173
1959	-	-	4	-	-	-	-	-	4	34	0.118
1960	-	-	4	-	-	-	-	-	4	44	0.091
1961	-	-	15	-	-	-	-	-	15	45	0.333
1962	-	-	13	-	-	-	-	-	13	50	0.260
1963	-	-	51	-	-	-	-	-	51	280	0.182
1964	-	-	12	-	-	-	-	-	12	46	0.261
1965	-	-	12	-	-	-	-	-	12	115	0.104
1966	-	-	10	-	-	-	-	-	10	-	-
1967	-	-	26	-	-	-	-	-	26	206	0.126

Year	Salmon caught and retained			Salmon caught and released			All salmon			Fishing effort (rod-days)	Salmon caught per rod-day
	Small	Large	Total	Small	Large	Total	Small	Large	Total		
1968	-	-	10	-	-	-	-	-	10	192	0.052
1969	-	-	12	-	-	-	-	-	12	214	0.056
1970	0	13	13	-	-	-	0	13	13	204	0.064
1971	0	0	0	-	-	-	0	0	0	83	0.000
1972	0	7	7	-	-	-	0	7	7	138	0.051
1973	2	0	2	-	-	-	2	0	2	168	0.012
1974	0	2	2	-	-	-	0	2	2	78	0.026
1975	0	0	0	-	-	-	0	0	0	0	-
1976	6	1	7	-	-	-	6	1	7	250	0.028
1977	0	0	0	-	-	-	0	0	0	105	0.000
1978	0	0	0	-	-	-	0	0	0	60	0.000
1979	1	2	3	-	-	-	1	2	3	54	0.056
1980	5	1	6	-	-	-	5	1	6	119	0.050
1981	108	4	112	-	-	-	108	4	112	914	0.123
1982	73	8	81	-	-	-	73	8	81	2,088	0.039
1983	7	2	9	-	-	-	7	2	9	686	0.013
1984	7	0	7	-	-	-	7	0	7	675	0.010
1985	47	-	47	-	-	-	47	0	47	1,007	0.047
1986	236	-	236	-	-	-	236	0	236	2,725	0.087
1987	476	-	476	-	-	-	476	0	476	-	-
1988	643	-	643	-	-	-	643	0	643	4,994	0.129
1989	167	-	167	-	-	-	167	0	167	4,506	0.037
1990	768	-	768	-	-	-	768	0	768	9,000	0.085
1991	657	-	657	1,033	164	1,197	1,690	164	1,854	11,552	0.057
1992	781	-	781	-	-	1,044	781	0	781	11,700	0.067
1993	-	-	-	-	-	-	-	-	-	-	-
1994	92	3	95	111	99	210	203	102	305	4,911	0.019
1995	454	3	457	146	95	241	599	98	697	5,073	0.136
1996	405	4	410	270	150	420	676	154	830	4,156	0.197
1997	201	1	202	92	36	127	293	37	330	2,796	0.117
1998	237	2	239	133	68	200	370	70	439	2,809	0.154
1999	158	4	162	147	122	269	305	126	431	2,556	0.165
2000	99	1	100	64	36	100	162	37	200	1,745	0.113
2001	151	3	153	156	84	239	306	86	393	1,791	0.215
2002	122	1	122	129	31	161	251	32	283	1,521	0.183
2003	274	4	278	266	133	400	541	137	678	2,708	0.246

Year	Salmon caught and retained			Salmon caught and released			All salmon			Fishing effort (rod-days)	Salmon caught per rod-day
	Small	Large	Total	Small	Large	Total	Small	Large	Total		
2004	89	1	90	129	33	162	218	34	252	2,093	0.118
2005	115	2	117	87	75	162	202	77	279	1,795	0.153
2006	100	1	101	177	41	218	277	42	319	2,190	0.143
2007	30	3	32	129	84	213	159	86	245	2,328	0.102
2008	26	0	26	0	0	0	26	0	26	1,132	0.023
2009	0	1	1	0	25	25	0	25	25	670	0.037
2010	1	0	1	48	0	48	49	0	49	501	0.095
2011	0	1	1	0	41	41	0	42	42	1,523	0.027
Total	6,537	75	6,843	3,117	1,316	5,477	9,654	1,391	11,276	94,839	-
Prop.	0.989	0.011	-	0.703	0.297	-	0.874	0.126	-	-	-

Table 11. A summary of size distribution data for adult Atlantic Salmon on Prince Edward Island.

Location	Method	Years	Small		Large		Total
			No.	Prop.	No.	Prop.	
Mill River (Cains and Carruthers)	Fish fence	1993-1995	31	0.492	32	0.508	63
Morell River	Angling	1955-2011	9,654	0.874	1,391	0.126	11,045
Morell River, Leards Dam	Trap	1981-2002	7,010	0.920	609	0.080	7,619
Morell River	Snorkel/canoe counts	1998-1999	262	0.870	39	0.130	301
Morell River, below Mooneys Dam	Seine	2000-2005	190	0.826	40	0.174	230
Valleyfield River	Fish fence	1990-1996	298	0.940	19	0.060	317
Montague River	Fish Fence	1996	11	0.846	2	0.154	13
West River	Fish fence	1989-1994	314	0.840	60	0.160	374
Dunk River	Fish fence	1995	40	1.000	0	0.000	40
Total		1955-2011	17,810	0.890	2,192	0.110	20,002

Table 12. *Sex ratios and proportion by size of adult Atlantic Salmon on Prince Edward Island. Data from Johnston and Dupuis 1990, Dupuis et al. 1991, and Cairns et al. 2010.*

				Small salmon						**Large salmon**						**All salmon**				
System	**Year**	**Location**	**Gear**	**Male**		**Female**		**Total**		**Male**		**Female**		**Total**		**Male**		**Female**		**Total**
				No.	**Prop.**	**No.**	**Prop.**	**No.**	**Prop.**	**No.**	**Prop.**	**No.**	**Prop.**	**No.**	**Prop.**	**No.**	**Prop.**	**No.**	**Prop.**	**No.**
Ellerslie Brook[a]	1950-1957	-	Fish fence	-	-	-	-	-	-	-	-	-	-	-	-	12	0.255	35	0.745	47
Morell	1986	Leards	Trap	520	0.848	93	0.152	613	-	-	-	-	-	-	-	-	-	-	-	-
Morell	1987	Leards	Trap	471	0.823	101	0.177	572	0.936	5	0.128	34	0.872	39	0.064	476	0.779	135	0.221	611
Morell	1988	Leards	Trap	547	0.760	173	0.240	720	0.961	11	0.379	18	0.621	29	0.039	558	0.745	191	0.255	749
Morell	1989	Leards	Trap	196	0.875	28	0.125	224	0.848	15	0.375	25	0.625	40	0.152	211	0.799	53	0.201	264
Morell	1990	Leards	Trap	131	0.728	49	0.272	180	0.700	29	0.377	48	0.623	77	0.300	160	0.623	97	0.377	257
Morell	1994	Leards	Trap	33	0.917	3	0.083	36	0.554	4	0.138	25	0.862	29	0.446	37	0.569	28	0.431	65
Morell Total				1,378	0.796	354	0.204	1,732	0.890	64	0.299	150	0.701	214	0.110	1,442	0.741	504	0.259	1,946
Morell	2000	Below Mooneys	Seine	47	0.723	18	0.277	65	0.844	0	0.000	12	1.000	12	0.156	47	0.610	30	0.390	77
Morell	2001	Below Mooneys	Seine	49	0.817	11	0.183	60	0.882	0	0.000	8	1.000	8	0.118	49	0.721	19	0.279	68
Morell	2004	Below Mooneys	Seine	30	0.588	21	0.412	51	0.836	2	0.200	8	0.800	10	0.164	32	0.525	29	0.475	61
Morell	2005	Below Mooneys	Seine	11	0.786	3	0.214	14	0.583	1	0.100	9	0.900	10	0.417	12	0.500	12	0.500	24
Morell total				137	0.721	53	0.279	190	0.826	3	0.075	37	0.925	40	0.174	140	0.609	90	0.391	230
West	1989	-	Fish fence	28	1.000	0	0.000	28	0.609	7	0.389	11	0.611	18	0.391	35	0.761	11	0.239	46
West	1990	-	Fish fence	20	0.909	2	0.091	22	0.579	7	0.438	9	0.563	16	0.421	27	0.711	11	0.289	38
West	Total	-	Fish fence	48	0.960	2	0.040	50	0.595	14	0.412	20	0.588	34	0.405	62	0.738	22	0.262	84
Grand total				1,563	0.793	409	0.207	1,972	0.873	81	0.281	207	0.719	288	0.127	1,644	0.727	616	0.273	2,260

[a]Most, probably all, fish were large.

Table 13. *Mean lengths, weights, and fecundities of female Atlantic Salmon sampled in the Morell River.*

Year	Fork length	Fork length (cm)		Weight (kg)		Fecundity	
		Mean	N	Mean	N	No. eggs	N
1989	<63 cm	56.1	68	1.51	17	3,143	68
1989	≥63 cm	73.8	24	4.08	24	4,963	24
1994	≥63 cm	70.3	17	3.91	17	-	-
Both years	≥63 cm	72.3	41	4.01	41	-	-

Table 14. Smolt and sea ages of Atlantic Salmon on Prince Edward Island.

System	Year	Smolt age									Sea age of returning adults							Source
		Sampling stage	2		3		4		Mean age	N	Sampling stage	1		2		Mean age	N	
			No.	Prop.	No.	Prop.	No.	Prop.				No.	Prop.	No.	Prop.			
Ellerslie Brook	1948	Smolt	30	0.58	22	0.42	-	-	2.4	52	-	-	-	-	-	-	-	Saunders 1960
	1953	Smolt	79	0.76	25	0.24	-	-	2.2	104	-	-	-	-	-	-	-	Saunders 1960
	1953	Adult	2	1.00	-	-	-	-	2.0	2	Adult[a]	-	-	2	1.00	2	2	Saunders 1960
	1954	Adult	6	1.00	-	-	-	-	2.0	6	Adult[a]	-	-	2	1.00	2	2	Saunders 1960
	1957	Smolt	66	0.92	6	0.08	-	-	2.1	72	-	-	-	-	-	-	-	Saunders 1960
	1958	Smolt	-	-	45	1.00	-	-	3.0	45	-	-	-	-	-	-	-	Saunders 1960
		All	183	0.65	98	0.35	-	-	2.3	281	Adult[a]	-	-	4	1.00	2	4	Saunders 1960
Morell River	1995	Smolt[b]	8	0.67	2	0.17	2	0.17	2.5	12	-	-	-	-	-	-	-	Cairns et al. 1997
West River	1989	Adult	33	0.73	12	0.27	-	0.00	2.3	45	Adult[c]	28	0.62	17	0.38	1.4	45	Johnston and Dupuis 1990
	1990	Adult	33	0.87	5	0.13	-	0.00	2.1	38	Adult[d]	22	0.58	16	0.42	1.4	38	Dupuis et al. 1991
		All	66	0.80	17	0.20	-	0.00	2.2	83	Adult	50	0.60	33	0.40	1.4	83	-
All rivers			257	0.68	117	0.31	2	0.01	2.3	376	-	50	0.57	37	0.43	1.4	87	-

[a]Fish had fork lengths between 69.5 and 78.0 cm
[b]Fish possessed adipose fins, indicating wild origin
[c]Fork length ranges - sea age 1: 48.5-59.0 cm; sea age 2: 67.5-77.0 cm. An additional fish, a male with fork length 97.0 cm, was not aged and is not included in this tabulation.
[d]Fork length ranges - sea age 1: 48.8-60.5 cm; sea age 2: 55.5-81.0 cm.

Table 15. Return rates of Atlantic Salmon stocked in PEI rivers. From Cairns et al. 1997.

Hatching year (Yr)	Number of fish stocked				Salmon returning[a]						
	0+ parr in Yr	1+ parr in Yr+1	1+ smolts in Yr+2	2+ parr & smolts in Yr+2	Small salmon in Yr+3		Large salmon in Yr+4		Both sizes,Yr+3 and Yr+4		Both sizes, from semi-natural 2+ smolts only
					Number	Percent re-turning	Number	Percent re-turning	Number	Percent re-turning	Percent returning
Morell River											
1990	-	-	-	45,622	-	-	208	0.5	-	-	-
1991	-	2,200	19,379	-	216	1.0	77	0.4	293	1.4	-
1992	-	-	-	26,000	1,326	5.1	200	0.8	1,526	5.9	5.9
1993	-	-	-	15,568	1,450	9.3	N/A	N/A	-	-	-
Mill River (Cains and Carruthers)											
1987	-	-		3,065	176	5.7	-	-	176	5.7	5.7
1990	-	-		3,826	17	0.4	-	-	17	0.4	0.4
1991	-	-		2,972	11	0.4	27	0.9	38	1.3	1.3
1992	-	-		2,711	3	0.1	N/A	N/A	-	-	-
West River											
1986	-	-	1,390	-	31	2.2	23	1.7	54	3.9	-
1987	-	-	-	1,324	25	1.9	-	-	-	-	-
1990	-	-	-	11,481	248	2.2	6	0.1	254	2.2	2.2
1991	50,750	10,173	-	-	4	-	-	-	-	-	-
Valleyfield River											
1987	0	0	6,299	0	36	0.57	0	0.00	36	0.57	-
1988	0	2,491	738	0	5	0.15	0	0.00	5	0.15	-
1989	0	0	5,259	0	25	0.48	0	0.00	25	0.48	-
1990	89,003	0	0	12,000	84	0.08	7	0.01	91	0.09	-
1991	55,723	10,014	0	0	15	0.02	4	0.01	19	0.03	-

Hatching year (Yr)	Number of fish stocked				Salmon returning[a]						
	0+ parr in Yr	1+ parr in Yr+1	1+ smolts in Yr+2	2+ parr & smolts in Yr+2	Small salmon in Yr+3		Large salmon in Yr+4		Both sizes,Yr+3 and Yr+4		Both sizes, from semi-natural 2+ smolts only
					Number	Percent re-turning	Number	Percent re-turning	Number	Percent re-turning	Percent returning
1992	32,494	28,898	5,896	1,980	58	0.08	8	0.01	66	0.10	3.3
1993	14,467	-	-	15,517	75	0.25	-	-	-	-	0.5

[a]Counts include hatchery fish only, where origin of fish was recorded. Return rates for the Mill, West, and the Valleyfield are minimal values as some angling takes place below the traps.

Table 16. Generation time of Atlantic Salmon on Prince Edward Island.

Phase	Duration (years)	Comments
Egg	1	Eggs are deposited in fall, incubate in winter, and hatch in spring.
Freshwater juvenile	2.32	Mean age at smolt migration in Ellerslie Brook, Morell River, and West River (Table 14).
Marine phase, small salmon	1	Salmon with fork lengths <63 cm are considered small salmon. 50 1SW salmon from the West River had fork lengths <63 cm (Table 10). However, an unknown number (but at least 1) 2SW salmon from the West River in 1990 were <63 cm fork length.
Marine phase, large salmon	2	Salmon with fork lengths ≥63 cm are considered large salmon. Most of 33 2SW salmon from the West River had fork lengths ≥63 cm (Table 10). However, an unknown number (but at least 1) 2SW salmon from the West River in 1990 were <63 cm fork length. One very large salmon in the West River (fork length 97 cm) was likely >2 years old, but this salmon was not aged.
Marine phase, overall mean	1.77	Calculations are based on the assumptions that i) small salmon are 1SW and large salmon are 2SW, ii) following Cairns et al. (2012), spawners returning to five rivers with a stocking-induced early-run component (Cains, Carruthers, Morell, West, Dunk) are assumed to be 50% large and spawners returning to other rivers are 90% large (Table 8), and iii) there are no repeat spawners. This gives mean sea ages of 1.5 for rivers influenced by stocking and 1.9 for other rivers. Calculation of overall mean sea age for all rivers is from the above means, weighted by fluvial areas of stocking-influenced and other rivers as proportions of the total fluvial area of rivers with salmon presence in 2000-2019 (0.315 and 0.685, respectively; Table 8).
Sum of mean durations of phases	5.09	This is the mean duration of one generation
Duration of 3 generations	15.27	COSEWIC assesses trends over 3 generations.
Duration of 3 generations, rounded up	16	Duration of 3 generations, rounded up to the next whole number.
Number of years to assess trends	17	Trends are assessed by changes between years, hence assessment of a trend over 3 generations requires 17 years of data.

Table 17. Counts of Atlantic Salmon redds in Prince Edward Island rivers. Data are unavailable for 1997 - 2003 and 2006 - 2007. Brackets indicate incomplete counts. Counts for 2020 have not yet been completely tabulated.

River	Year																					
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**2004**	**2005**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Cains Brook	-	-	-	-	-	-	-	-	-	58	-	-	56	41	38	-	(38)	(44)	75	23	-	-
Carruthers Brook	-	-	-	311	-	-	-	-	-	152	-	-	294	131	98	-	(103)	(94)	119	109	(38)	-
Trout River (Coleman)	-	-	33	58	(30)	-	42	-	-	2	-	-	-	-	59	38	(38)	(44)	41	32	(25)	-
Trout River (Tyne Valley)	-	-	-	-	-	-	-	-	-	14	-	-	-	-	0	0	-	-	4	-	-	-
Little Trout River	-	-	-	-	-	-	-	5	12	11	19	9	28	-	0	0	(2)	-	20	-	-	-
Bristol Creek	-	-	-	41	(17)	-	49	15	11	7	-	23	-	6	10	0	(1)	-	8	-	-	-
Morell River	656	637	917	377	(162)	(309)	438	(71)	-	328	-	-	450	(243)	(326)	388	(143)	204	191	(125)	(475)	-
Midgell River	-	-	-	77	-	-	73	64	-	69	116	-	110	81	(36)	76	140	-	104	-	(35)	-
St. Peters River	-	-	-	93	-	-	30	-	-	53	-	-	53	70	44	43	67	(20)	19	-	-	-
Cow River	-	-	-	-	-	-	-	-	-	-	-	-	4	1	50	12	67	56	38	(13)	8	3
Naufrage River	-	-	-	32	-	-	88	53	-	100	32	33	429	43	453	217	154	108	89	(43)	74	38
Bear River	-	-	-	-	-	-	-	-	-	-	-	-	0	0	16	3	13	35	7	(1)	0	11
Hay River	-	-	-	-	-	-	-	-	-	-	-	-	1	3	43	15	36	41	15	(4)	13	0
Cross River	-	-	-	-	-	-	-	-	-	120	70	100	190	83	268	193	238	170	192	(59)	33	115
Priest Pond Creek	-	-	-	-	-	-	-	-	-	(11)	8	13	20	21	151	129	138	70	150	(4)	22	5
North Lake Creek	-	29	200	36	-	-	-	84	68	200	213	205	355	106	333	183	262	251	213	(40)	56	78
Souris River	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	2	(0)	-	-	-	-	-
Fortune River	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	(2)	-	-	-	-	-

River	Year																					
	1990	1991	1992	1993	1994	1995	1996	2004	2005	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Cardigan River	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	N	-	-	-	-	-	-
Vernon River	-	-	-	-	-	-	-	-	-	0	-	-	-	7	11	(8)	0	-	17	(6)	9	-
Seal River (Vernon)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-
Clarks Creek	-	-	-	-	-	-	-	-	-	0	-	-	-	0	3	-	(0)	-	4	-	(2)	-
Pisquid River	-	-	-	-	-	-	-	14	17	38	-	(37)	68	35	39	(15)	47	29	28	(16)	10	-
Head of Hillsborough R.	-	-	-	-	-	-	-	-	-	0	-	-	0	0	2	-	0	-	0	-	-	-
North River	-	-	-	-	-	-	-	-	-	18	-	-	11	-	21	-	-	-	8	-	-	-
Clyde River	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-
West River	47	(33)	(274)	(165)	(59)	(57)	-	(18)	-	141	76	88	87	89	168	113	113	146	149	(124)	114	-
Bradshaw River	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Dunk River	-	-	-	6	-	-	-	-	-	(17)	-	-	-	(12)	-	-	-	-	78	-	-	-
Wilmot River	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	6	-	-	-

Table 18. Number of positive and negative trendlines in redd counts in Prince Edward Island rivers.

Period	Trends				Total
	Positive		Negative		
	Number	Percent	Number	Percent	
1990-2019	4	44.4	5	55.6	9
2003-2019	13	68.4	6	31.6	19
Total	17	-	11	-	-

Table 19. Watershed and fluvial areas of Prince Edward Island according to historic and current Atlantic Salmon status. Data from Tables 6B and 8.

Item	Number of watersheds	Land area[a]		Fluvial area	
		km^2	Percent	m^2	Percent
All PEI	-	5,660.0	-	-	-
Watersheds that probably contained salmon at the time of European settlement	71	3,368.2	100.0	4,402,197	100.0
Watersheds whose rivers were mentioned by name by Department of Marine and Fisheries (1880-1910) has having salmon	40	2,405.8	71.4	3,159,894	71.8
Watersheds in which salmon were detected at least once in 2000-2019	40	2,129.8	63.2	2,768,407	62.9
Watersheds in which salmon were detected in some but not all monitored years between 2000 and 2019.	28	1,342.8	39.9	1,734,035	39.4
Watersheds in which salmon were detected in all years between 2000 and 2019 in which monitoring was conducted.	12	787.0	23.4	1,034,371	23.5
Watersheds in which salmon were detected in the most recent monitored year in 2000-2019.	21	1,202.4	35.7	1,578,163	35.8
Atlantic salmon extent of occurrence in PEI freshwaters[b]	-	8,935.0	-	-	-

[a]*Includes enclosed waters.*
[b]*As per the COSEWIC definition, extent of occurence is the area included in a polygon without concave angles that encompasses the geographic distribution of a population (Fig. 11).*

Table 20. Proportion of spawning Salmon by size and by sex in rivers where the proportion large is 0.9 and 0.5, based on size-specific sex ratios measured on the Morell River in 1986 - 2001 (Cairns et al. 2012).

Sex	Proportion large is 0.9			Proportion large is 0.5		
	Small	Large	Total	Small	Large	Total
Male	0.0807	0.2462	0.3269	0.4036	0.1368	0.5404
Female	0.0193	0.6538	0.6731	0.0964	0.3632	0.4596
Total	0.1000	0.9000	1.0000	0.5000	0.5000	1.0000

Table 21. Estimated number of Atlantic Salmon spawners on PEI, based on the most recent complete redd count in rivers (up to 2019).

River	Most recent redd count		Assumed proportion large	Estimated spawners[a]								
				Male			Female					
	Year	No. redds		Small	Large	Total	Small	Large	Total	Small	Large	Grand total
Cains Brook	2018	23	0.5	6	2	8	1	5	7	7	7	15
Carruthers Brook	2018	109	0.5	29	10	38	7	26	32	35	35	71
Trout River (Coleman)	2018	32	0.5	8	3	11	2	8	10	10	10	21
Trout River (Tyne Valley)	2017	4	0.9	0	0	1	0	1	1	0	2	2
Little Trout River	2017	20	0.9	1	2	3	0	6	6	1	8	9
Bristol Creek	2017	8	0.9	0	1	1	0	2	2	0	3	4
Morell River	2019	475	0.5	124	42	166	30	112	141	154	154	308
Midgell River	2017	104	0.9	4	11	15	1	30	31	5	41	46
St. Peters River	2017	19	0.9	1	2	3	0	5	6	1	8	8
Cow River	2019	8	0.9	0	1	1	0	2	2	0	3	4
Naufrage River	2019	74	0.9	3	8	11	1	21	22	3	29	33
Bear River	2019	0	0.9	0	0	0	0	0	0	0	0	0
Hay River	2019	13	0.9	0	1	2	0	4	4	1	5	6
Cross River	2019	33	0.9	1	4	5	0	10	10	1	13	15
Priest Pond Creek	2019	22	0.9	1	2	3	0	6	7	1	9	10
North Lake Creek	2019	56	0.9	2	6	8	0	16	17	2	22	25
Souris River	2014	2	0.9	0	0	0	0	1	1	0	1	1
Fortune River	2015	2	0.9	0	0	0	0	1	1	0	1	1
Cardigan River	2008	0	0.5	0	0	0	0	0	0	0	0	0
Vernon River	2019	9	0.9	0	1	1	0	3	3	0	4	4
Seal River (Vernon)	-	-	-	-	-	-	-	-	-	-	-	-
Clarks Creek	2017	4	0.9	0	0	1	0	1	1	0	2	2

River	Most recent redd count		Assumed proportion large	Estimated spawners[a]								
				Male			Female					
	Year	No. redds		Small	Large	Total	Small	Large	Total	Small	Large	Grand total
Pisquid River	2019	10	0.9	0	1	1	0	3	3	0	4	4
Head of Hillsborough R.	2017	0	0.9	0	0	0	0	0	0	0	0	0
North River	2017	8	0.9	0	1	1	0	2	2	0	3	4
Clyde River	2017	0	0.9	0	0	0	0	0	0	0	0	0
West River	2019	114	0.5	30	10	40	7	27	34	37	37	74
Bradshaw River	2017	0	0.9	0	0	0	0	0	0	0	0	0
Dunk River	2017	78	0.5	20	7	27	5	18	23	25	25	51
Wilmot River	2017	6	0.9	0	1	1	0	2	2	0	2	3
Total	-	1,233	23	232	117	349	55	312	367	287	429	717

[a]The number of female spawners is estimated from the most recent redd count, assuming 3.357 redds per female spawner. Numbers of small male, large male, small female, and large female spawners are calculated from the size-specific proportions given in Table 20.

FIGURES

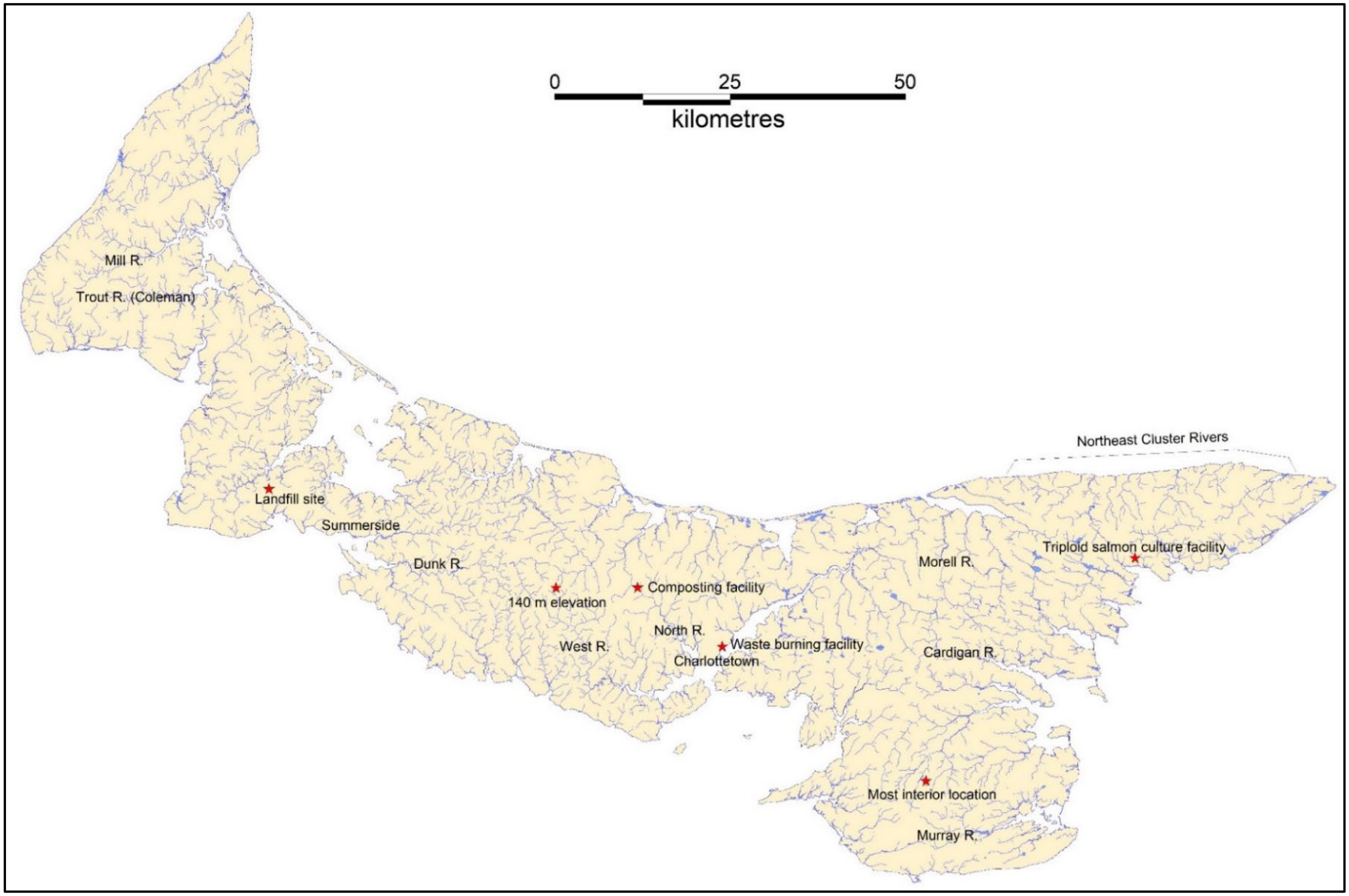

Figure 1. Prince Edward Island, showing locations mentioned in the text.

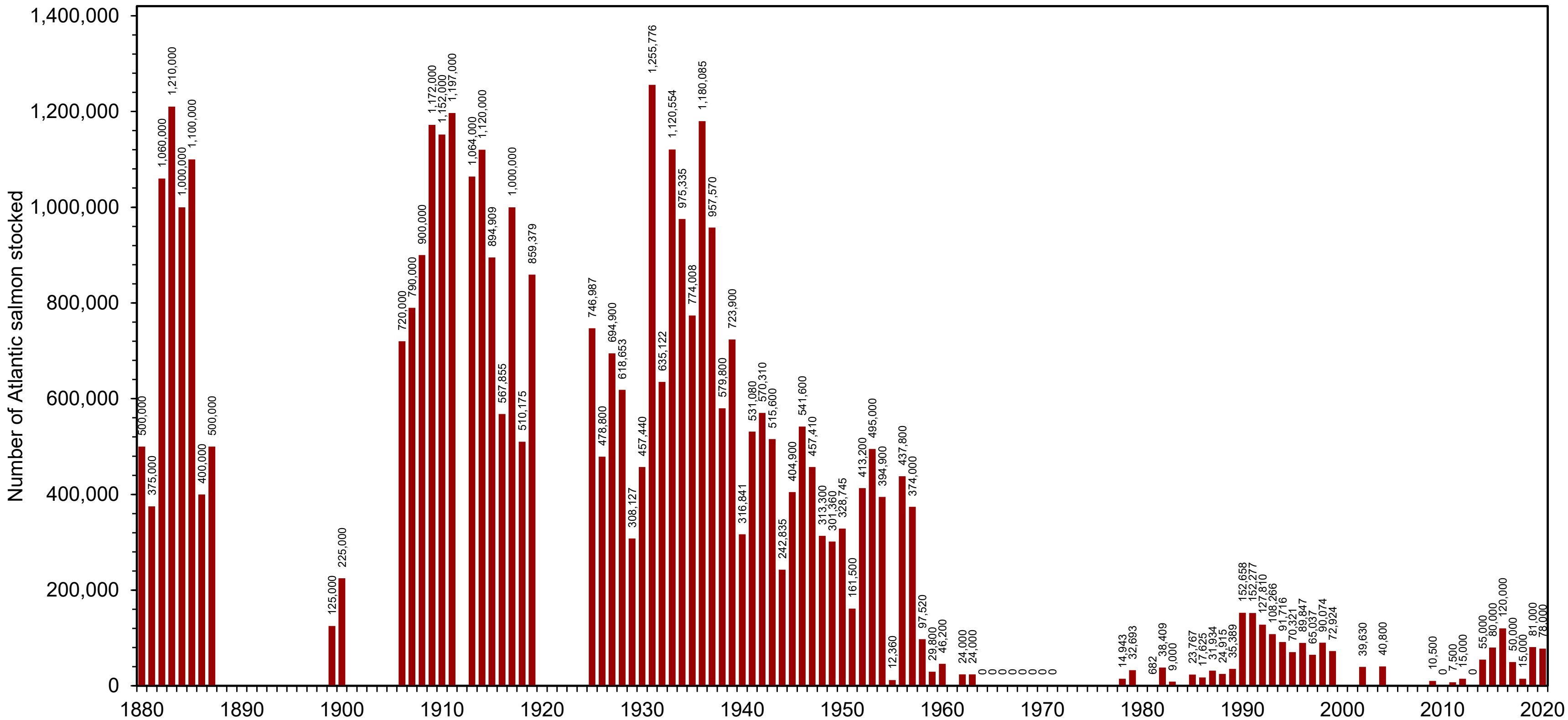

Figure 2. Numbers of Atlantic Salmon reported to have been stocked on Prince Edward Island, 1880 - 2020. The absence of a number on the graph indicates that the number of Salmon stocked is unavailable for that year.

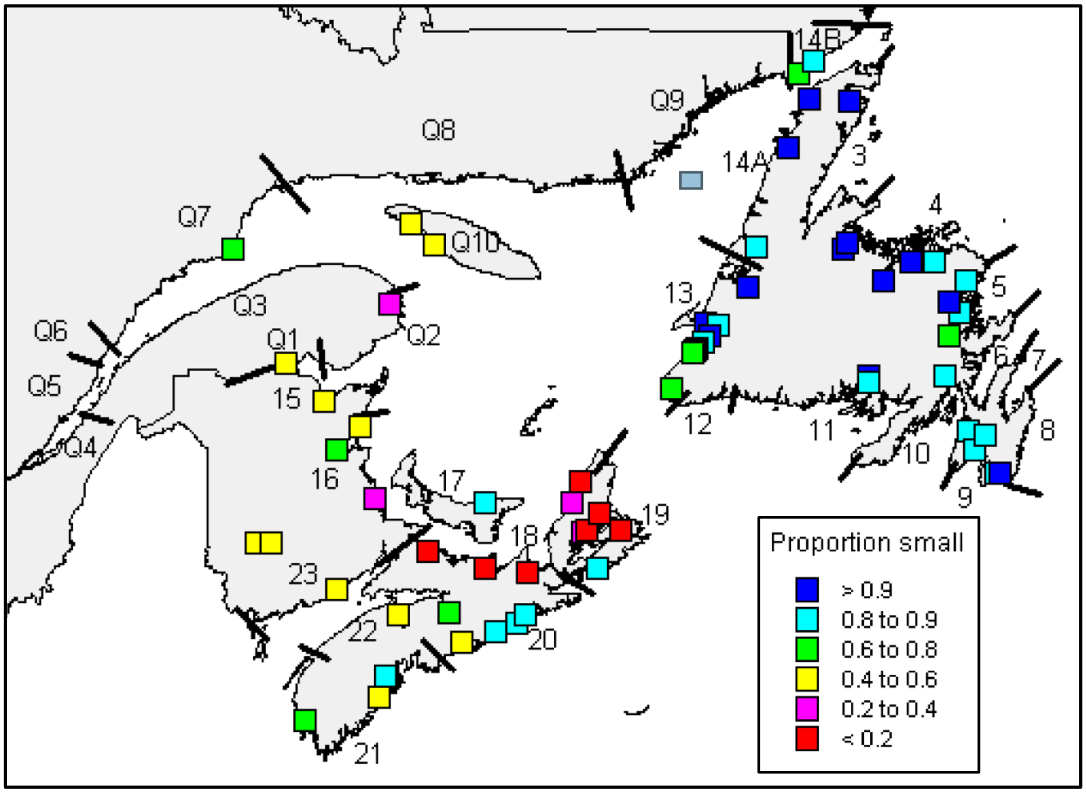

Figure 3. The proportion of small Salmon in the total returns to sampled rivers in eastern Canada. From Chaput et al. 2006b.

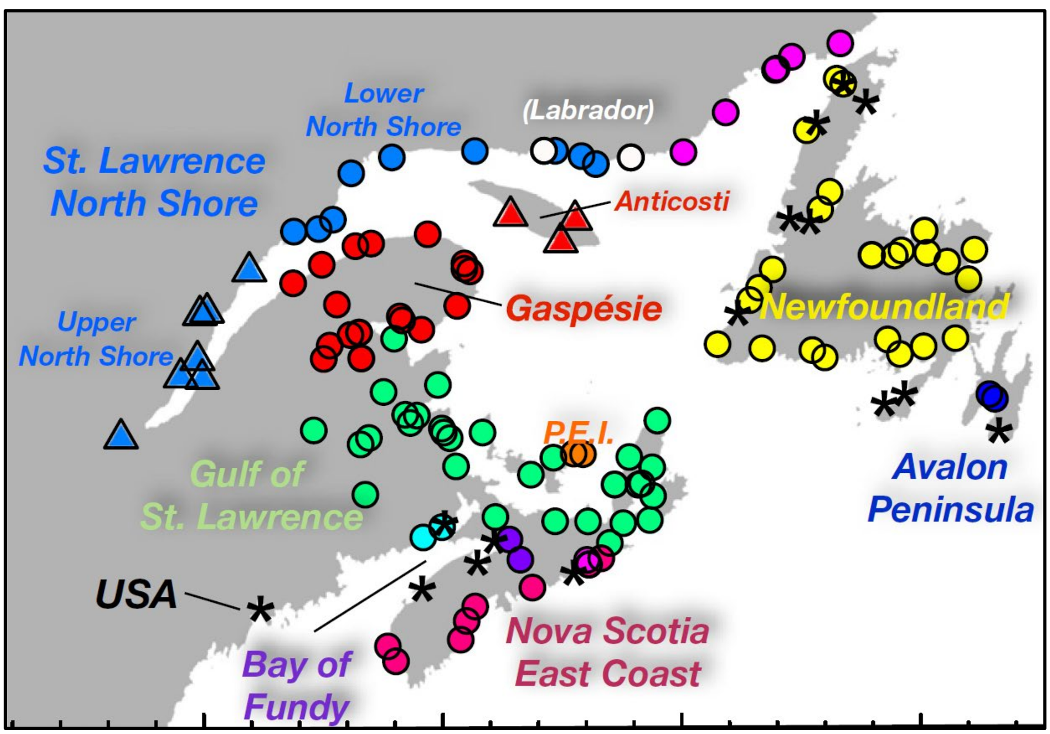

Figure 4. Results of BAPS clustering analysis of Atlantic Salmon microsatellites. From Moore et al. 2014.

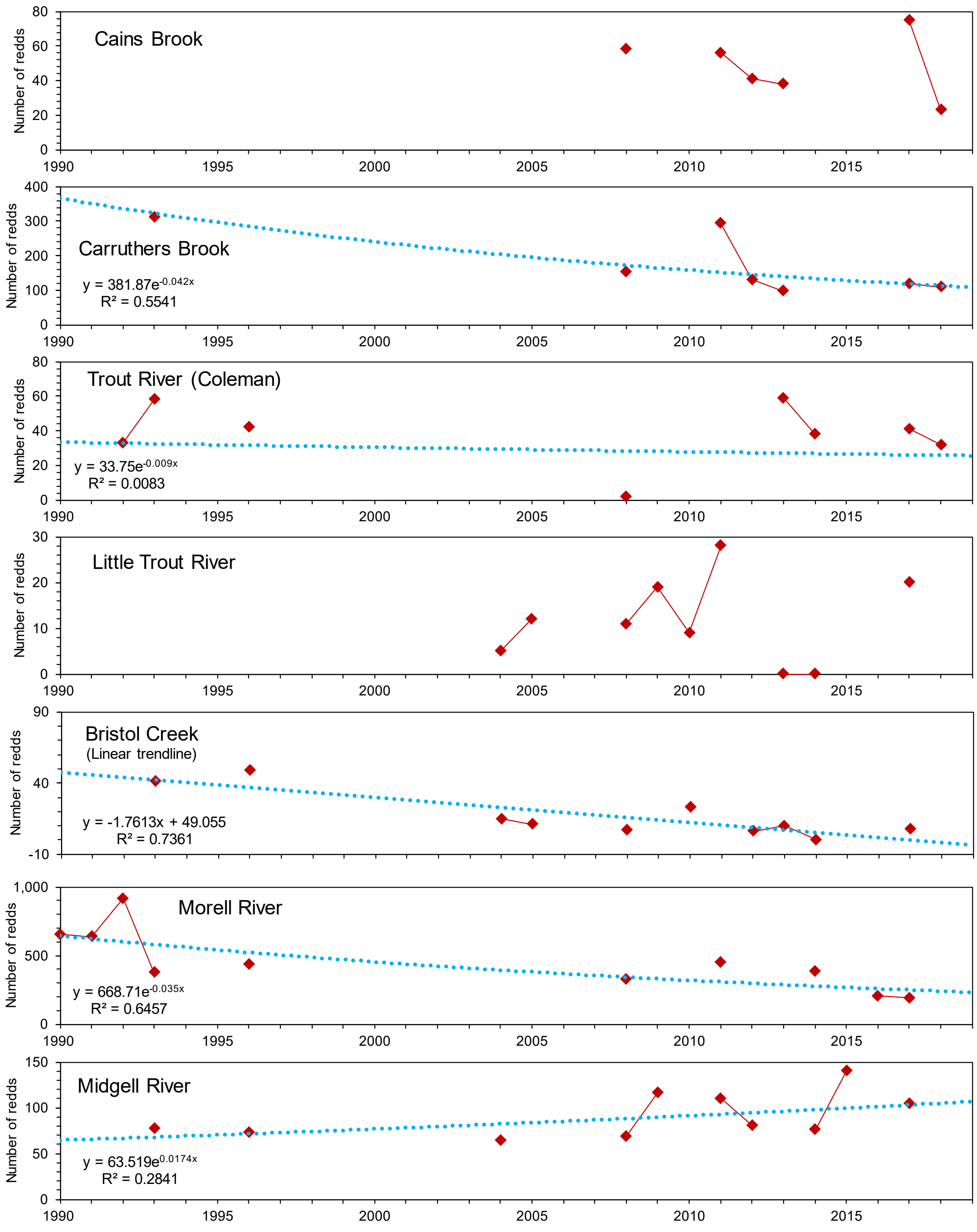

Figure 5A. Results of complete counts of Atlantic Salmon redd in PEI rivers for which > 5 counts are available, 1990 - 2019. Trendlines are shown for rivers in which counts are available both before and after 2003. Trendlines are exponential unless otherwise indicated.

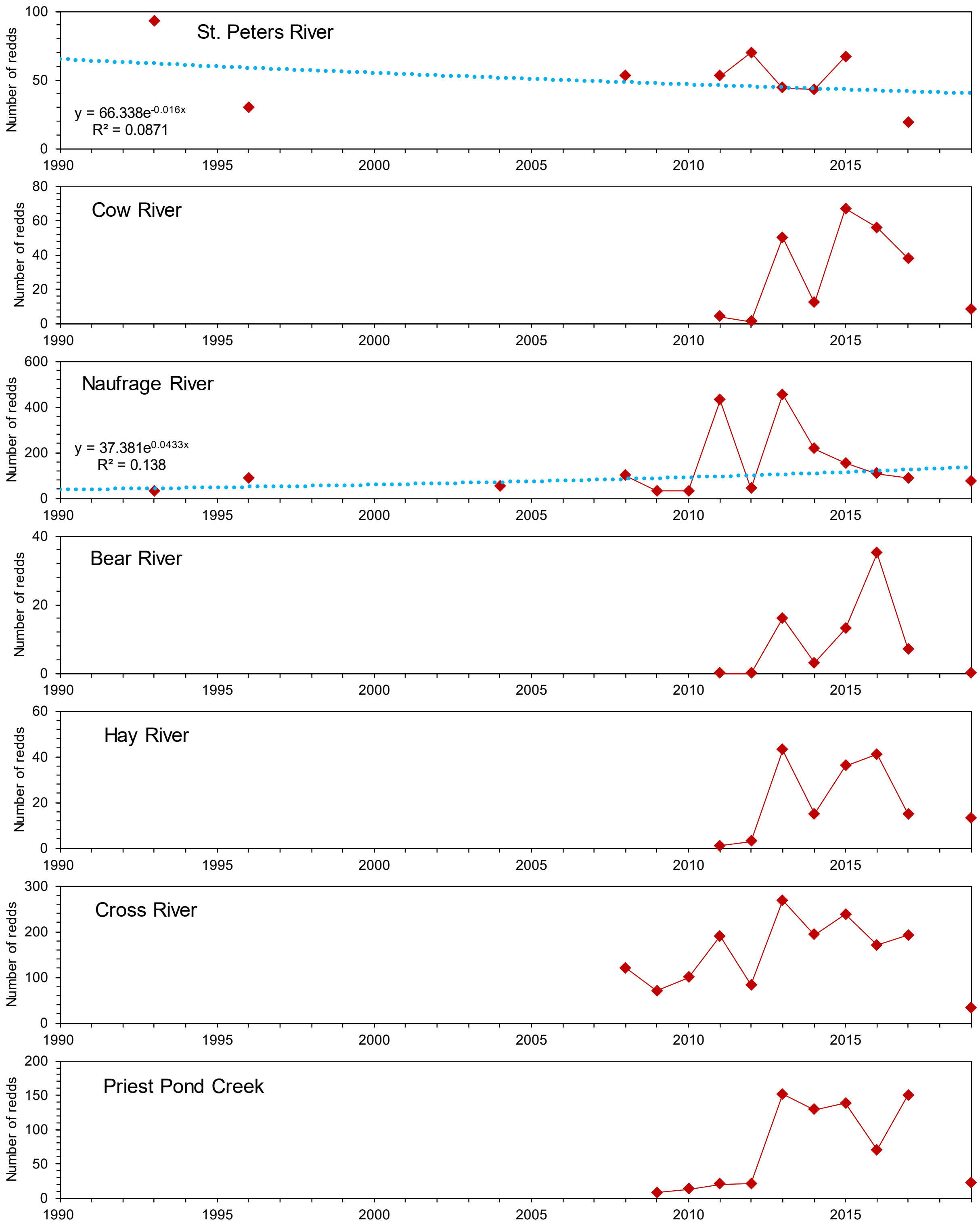

Figure 5B. Results of complete counts of Atlantic Salmon redd in PEI rivers for which > 5 counts are available, 1990 - 2019. Trendlines are shown for rivers in which counts are available both before and after 2003. Trendlines are exponential unless otherwise indicated.

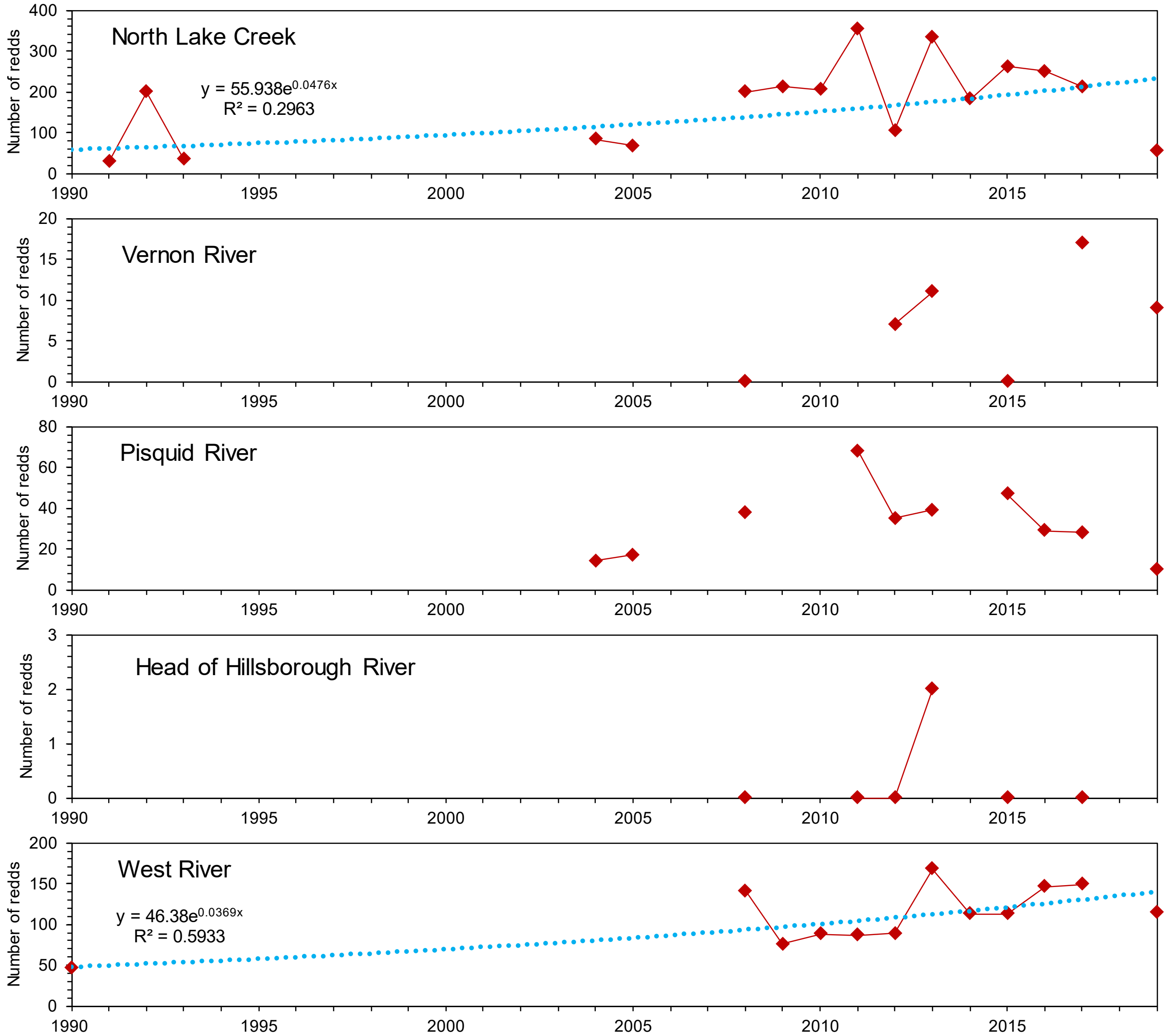

Figure 5C. Results of complete counts of Atlantic Salmon redd in PEI rivers for which > 5 counts are available, 1990 - 2019. Trendlines are shown for rivers in which counts are available both before and after 2003. Trendlines are exponential unless otherwise indicated.

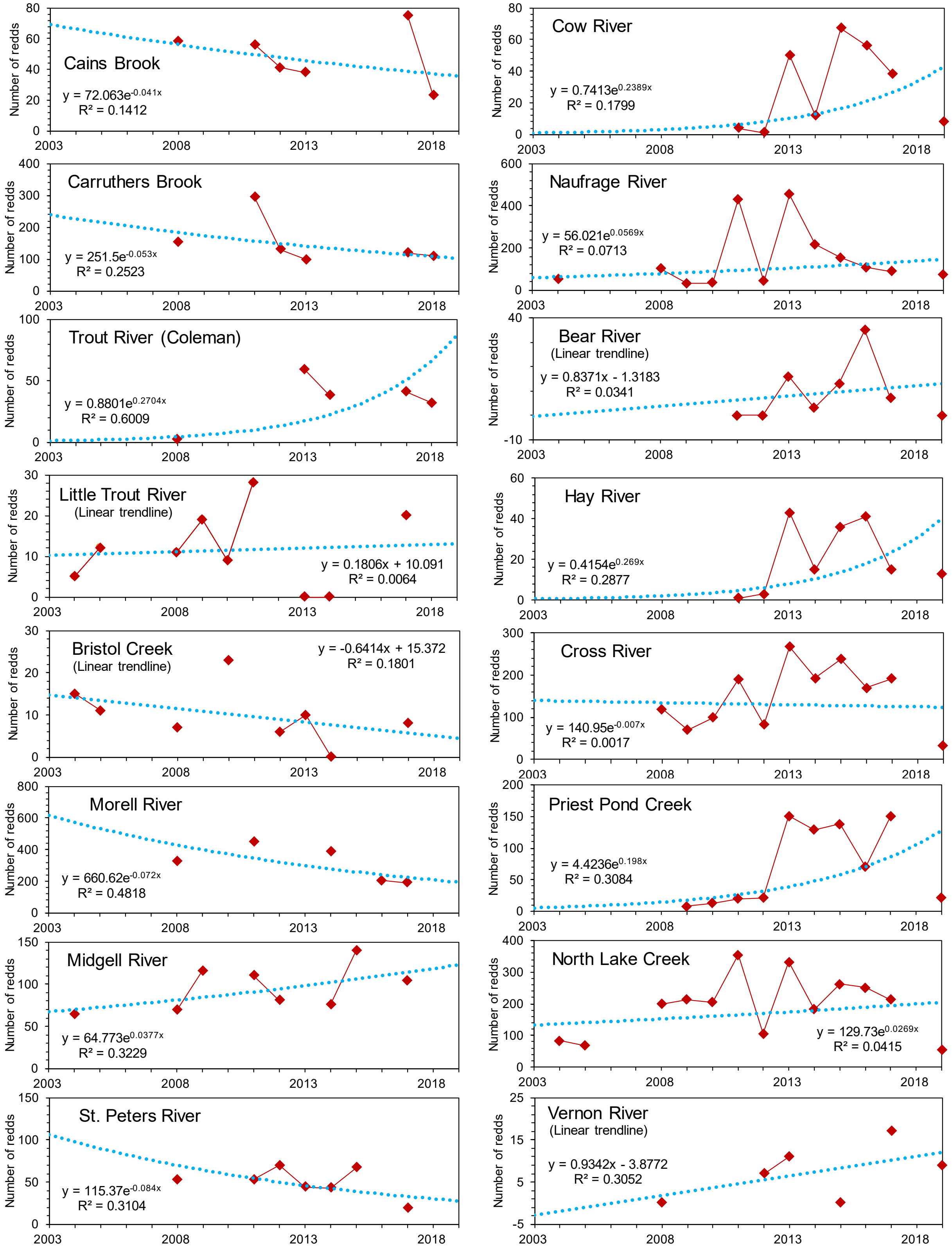

Figure 6A. Results of complete counts of Atlantic Salmon redd in PEI rivers for which > 5 counts are available, 2003 - 2019. Trendlines are exponential unless otherwise indicated.

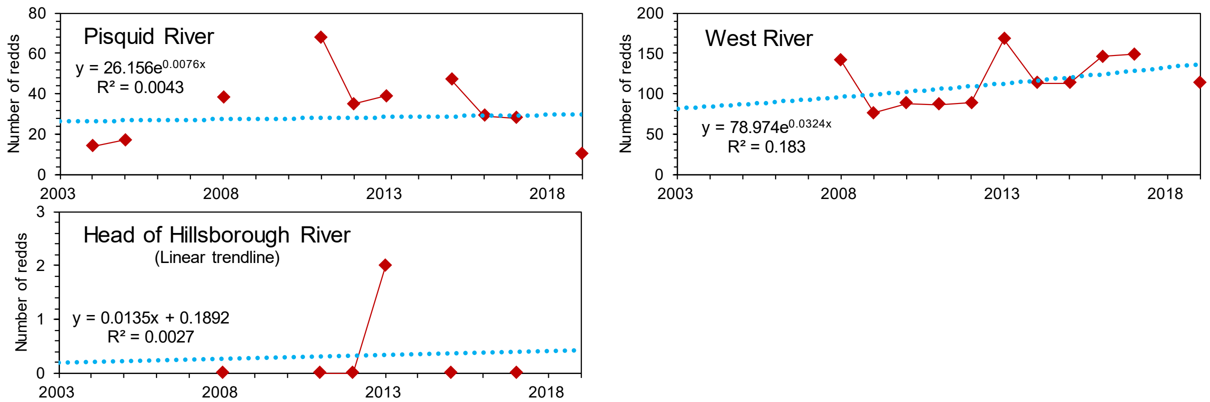

Figure 6B. Results of complete counts of Atlantic Salmon redd in PEI rivers for which > 5 counts are available, 2003 - 2019. Trendlines are exponential unless otherwise indicated

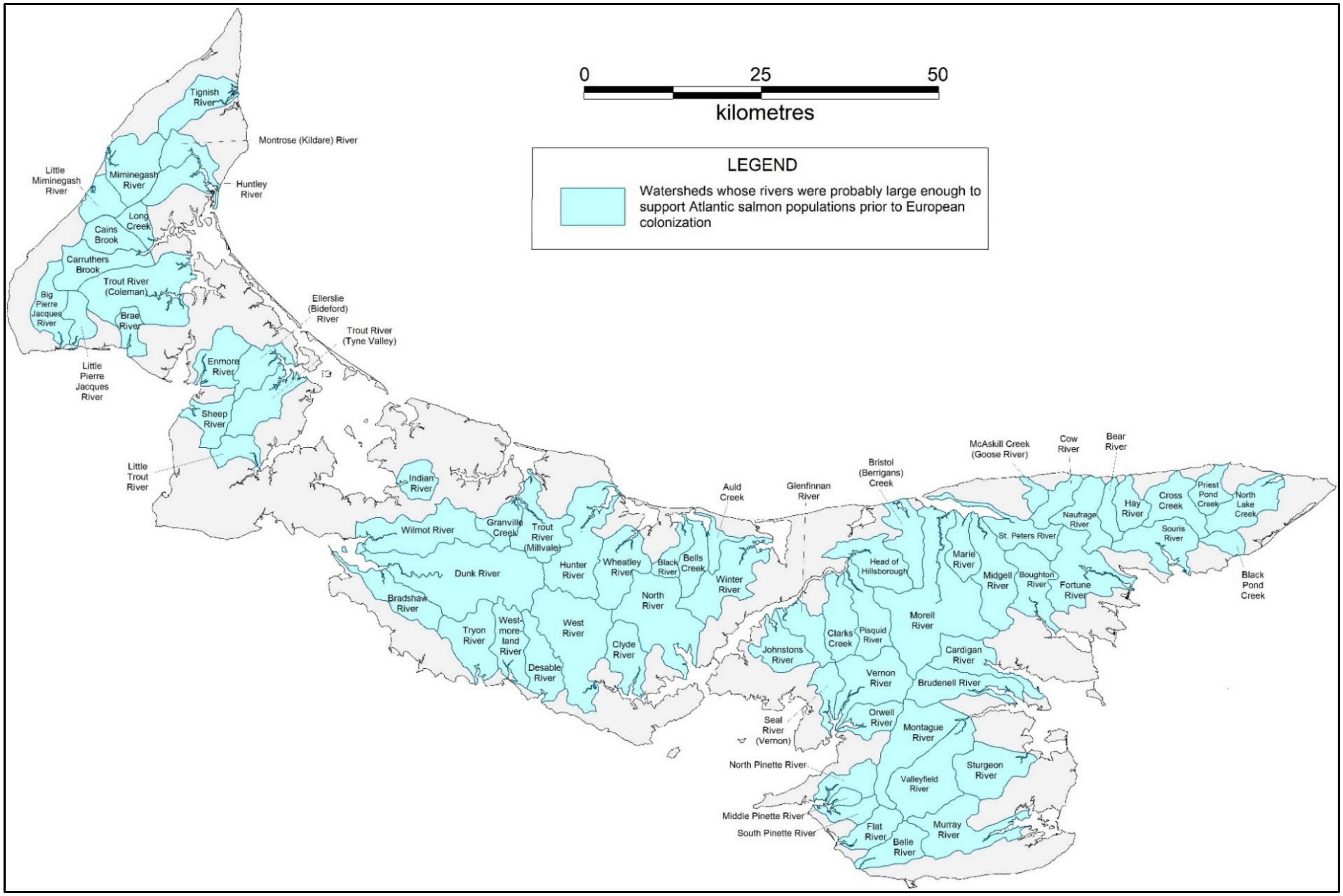

Figure 7. Seventy-one watersheds on Prince Edward Island whose rivers were probably large enough to support Atlantic Salmon populations prior to European settlement.

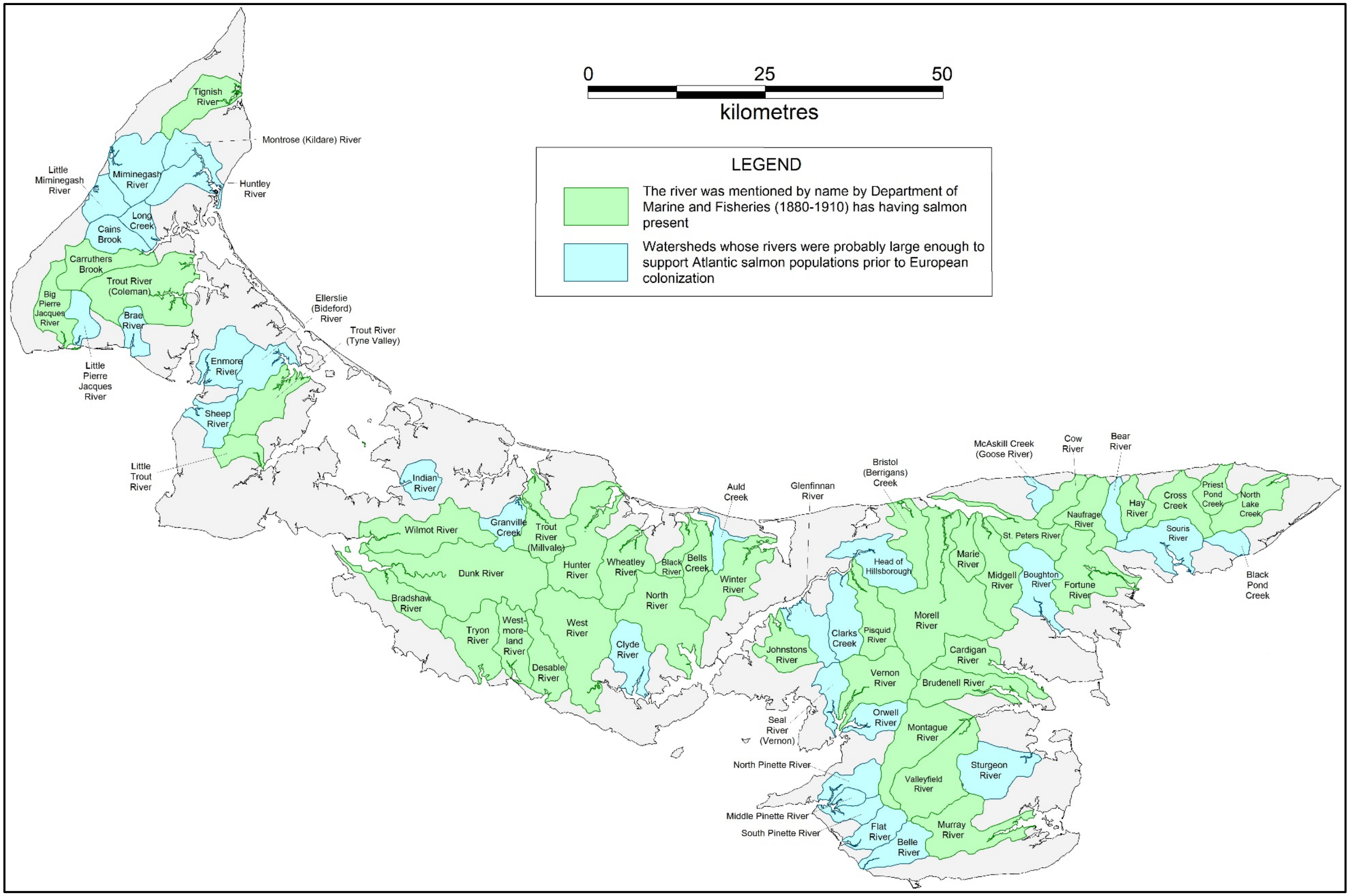

Figure 8. Forty watersheds containing rivers mentioned by name by Department of Marine and Fisheries (1880 - 1910) as having Atlantic Salmon populations.

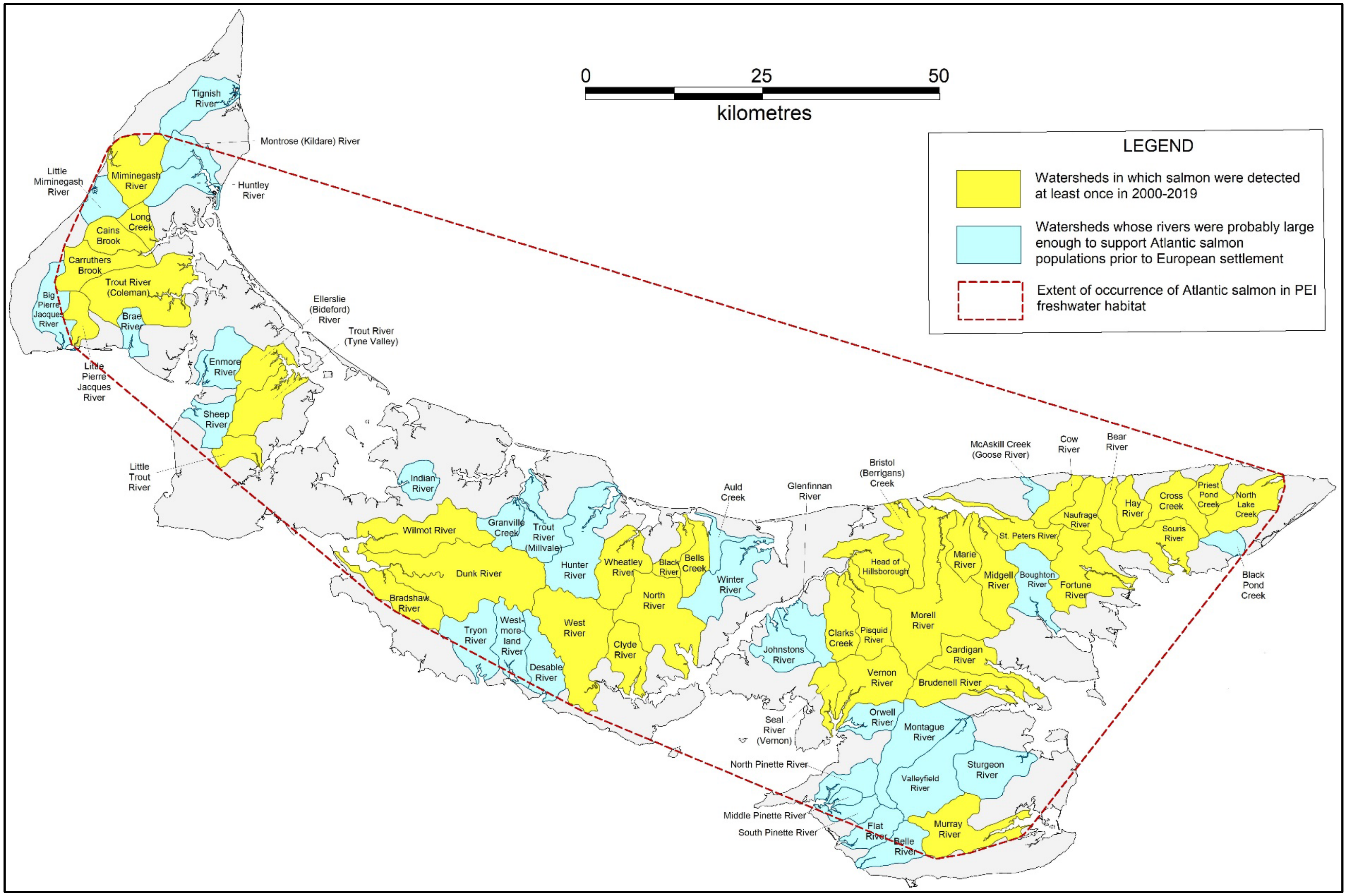

Figure 9. Forty watersheds in which Atlantic Salmon were detected at least once in 2000 - 2019. The COSEWIC definition of extent of occurrence is a polygon, without concave angles, that encompasses the geographic distribution of all known populations of a wildlife species.

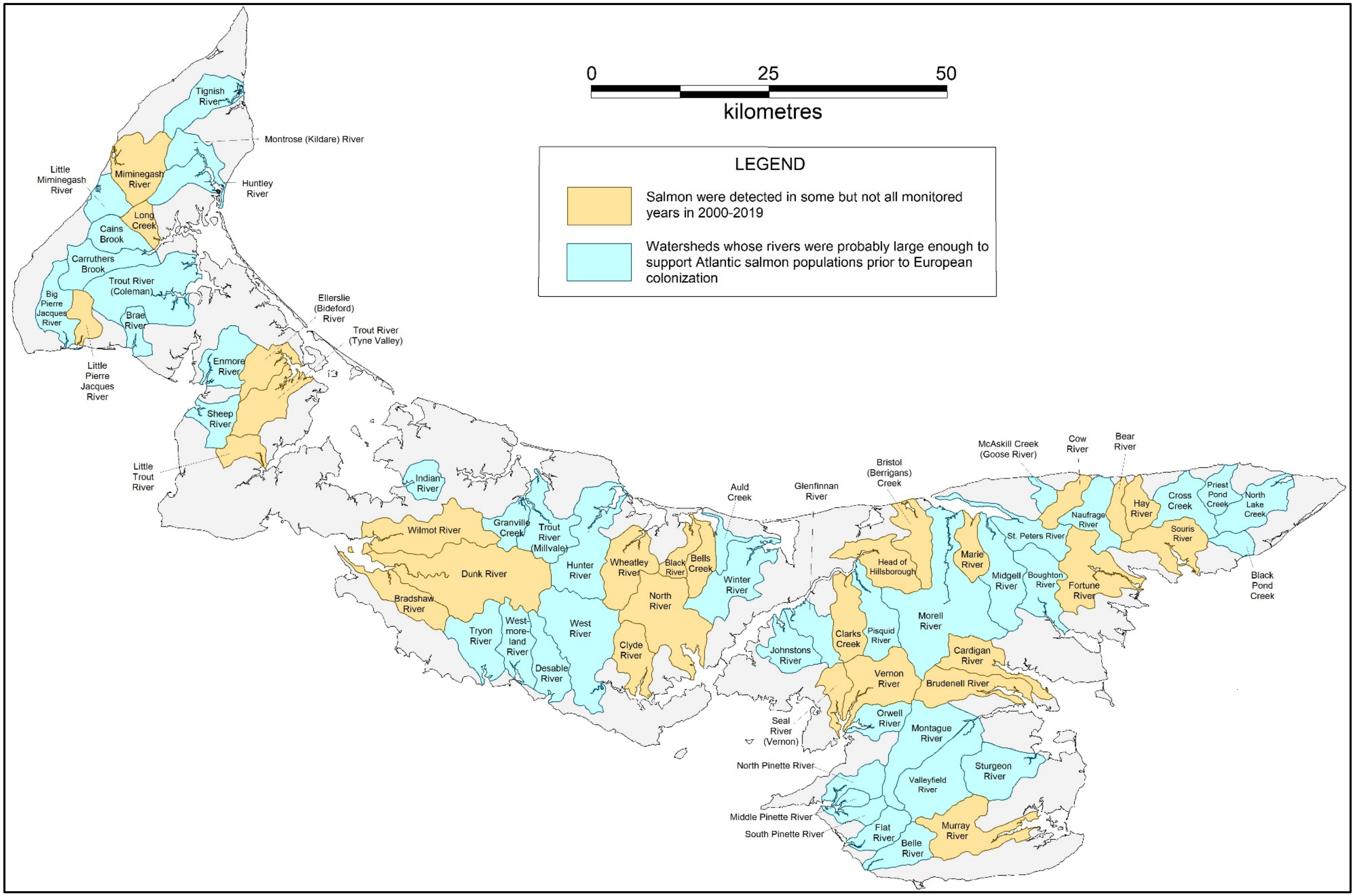

Figure 10. Twenty-eight watersheds in which Atlantic Salmon were detected in some but not all monitored years in 2000 - 2019.

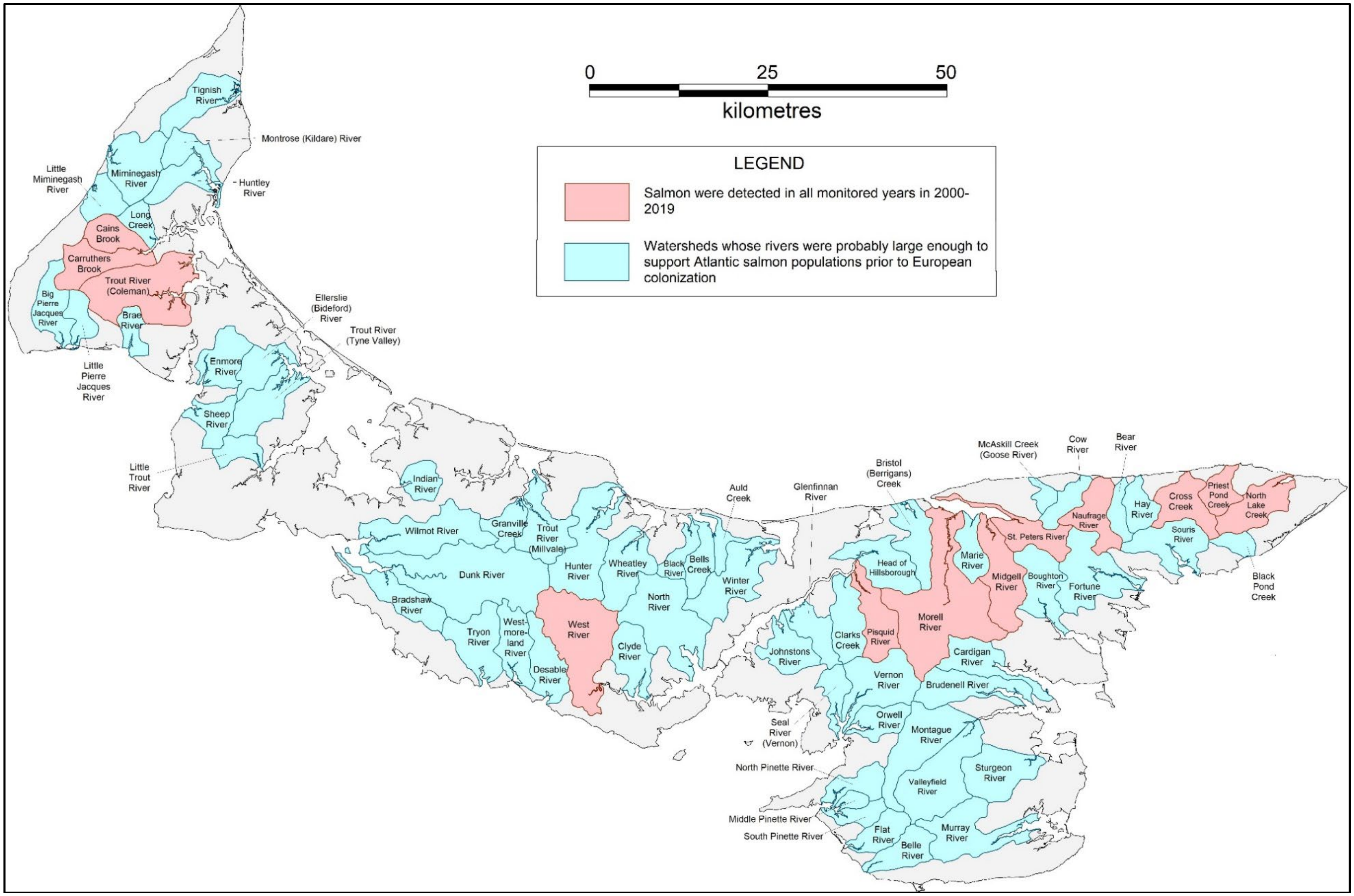

Figure 11. Twelve watersheds in which Atlantic Salmon were detected in all monitored years in 2000 - 2019.

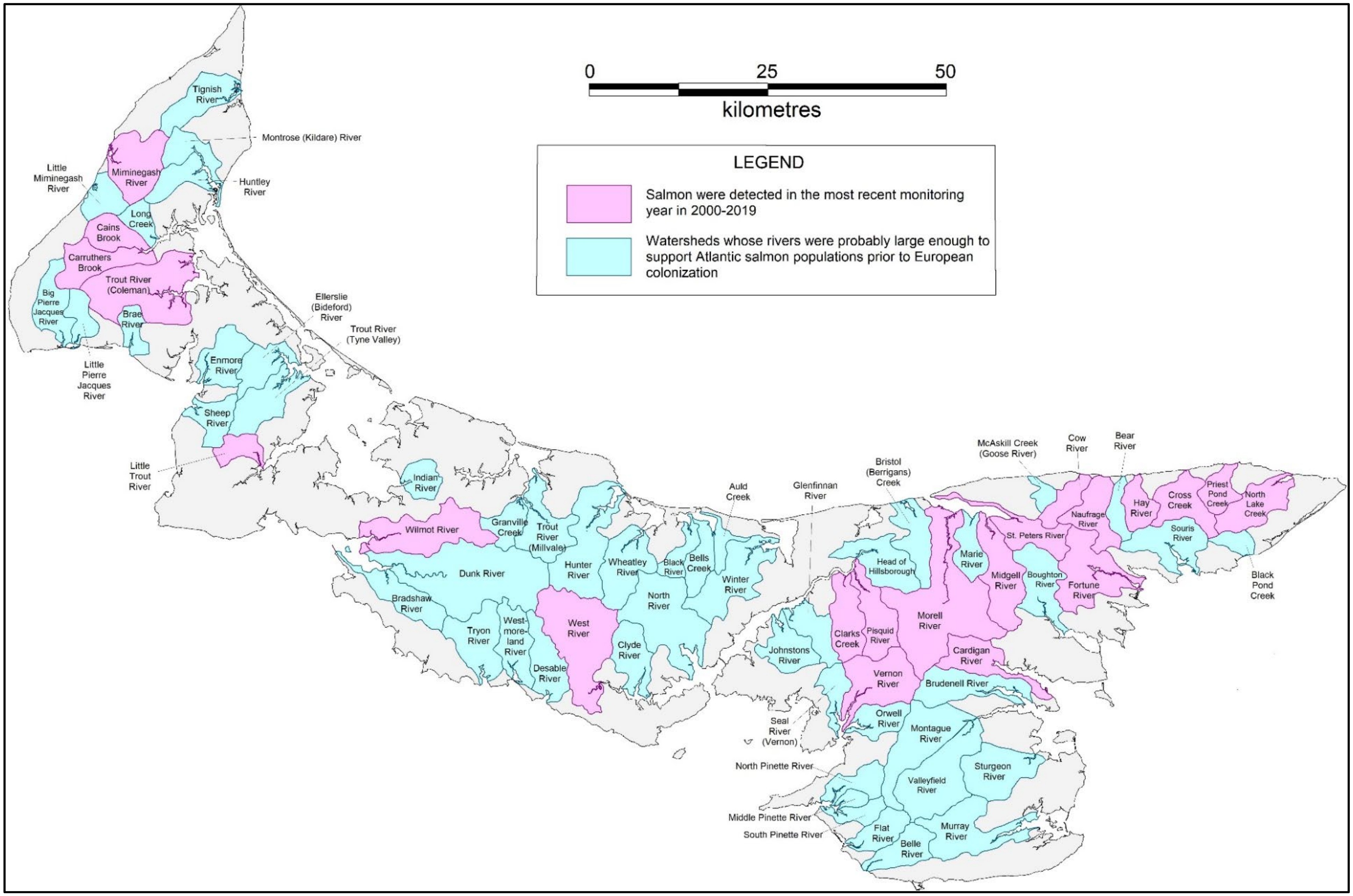

Figure 12. Twenty-one watersheds in which Atlantic Salmon were detected in the most recent monitored year in 2000 - 2019.