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Stocking history, biological characteristics, and status of Atlantic salmon (*Salmo salar*) on Prince Edward Island

Historique d'empoissonnement, caractéristiques biologiques et état du saumon atlantique (*Salmo salar*) sur l'Île-du-Prince-Édouard

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ABSTRACT

This paper compiles information on Atlantic salmon (*Salmo salar*) in Prince Edward Island (PEI), for use in a review by the Committee on the Status of Endangered Wildlife in Canada. Stocking of Atlantic salmon in PEI waters began in 1880, and has continued to the present time, with some interruptions. Prior to the 1970s, most reproductive material used to stock PEI waters was of PEI origin. In the 1970s, a management objective was set to create early salmon runs by using early-run broodstock of mainland origin, or local early-run broodstock which was likely descended at least in part from mainland fish. At least 37 million salmon were released to PEI waters during 1880 to 1960. Original PEI salmon populations were dominated by fall runs of large ($\geq$63 cm fork length) fish. These run-time and size characteristics persist in salmon populations in small PEI rivers. In larger PEI rivers where stocking has been intense, early-run small (<63 cm) salmon form a major, often dominant, component of returning adults. Accounts in the early historical period indicate that salmon were present throughout PEI. At least 71 PEI rivers probably offered sufficient habitat to support salmon populations. Of these, 55 rivers have historic or modern records of having been occupied by salmon. Surveys conducted in 2000 to 2002 and in 2007 to 2008 found salmon in 28 and 22 rivers, respectively. Populations in many rivers are very small and face the likelihood of extirpation if current trends continue. Threats to salmon populations in PEI include stream sedimentation, blockages by beaver dams, artificial impoundments, pesticide kills, competition with rainbow trout, and stream blockages by improperly installed culverts.

RÉSUMÉ

Ce document compile des renseignements sur le saumon atlantique (S*almo salar*) sur l'Île-du-Prince-Édouard (Î.-P.-É.) qui seront utilisés dans le cadre d'une étude du Comité sur la situation des espèces en péril au Canada. L'empoissonnement du saumon atlantique dans les eaux de l'Î.-P.-É. a commencé en 1880 et s'est poursuivi jusqu'à aujourd'hui, malgré quelques interruptions. Avant les années 1970, la majeure partie du matériel de reproduction utilisé pour peupler les eaux de l'Î.-P.-É. provenait de l'île. Dans les années 1970, un objectif de gestion a été établi pour créer des montaisons hâtives de saumons en utilisant des géniteurs de montaison hâtive provenant des provinces Maritimes ou des géniteurs locaux de montaison hâtive qui descendaient, au moins en partie, de poissons du continent. Presque 37 millions de saumons ont été relâchés dans les eaux de l'Î.-P.-É. entre 1880 et 1960. Les populations originales de saumons de l'Î.-P.-É. étaient dominées par des poissons de grande taille (longueur à la fourche $\geq$63 cm) de montaison d'automne. Ces caractéristiques de taille et de montaison sont toujours exprimées de nos jours pour les populations de saumons des petites rivières de l'Î.-P.-É. Dans les rivières plus grandes de l'Î.-P.-É. où l'empoissonnement a été intense, les petits saumons (<63 cm) de montaison hâtive forment une grande partie, souvent dominante, des adultes lors de la remontée. Les récits datant du début de la période des données historiques indiquent que les saumons étaient présents sur l'ensemble de l'île. Au moins 71 rivières de l'Î.-P.-É. offraient probablement un habitat suffisant pour héberger des populations de saumons. De ce nombre, 55 étaient occupées par des saumons, tel qu'il est indiqué par les données anciennes ou récentes. Des études menées entre 2000 et 2002 et en 2007 et 2008 ont confirmé, respectivement, que des saumons étaient présents dans 28 et 22 rivières. Les populations sont très basses dans de nombreuses rivières et sont menacées de disparition si les tendances actuelles se poursuivent. Les menaces encourues par les populations de saumons sur l'Î.-P.-É. comprennent la sédimentation du lit des cours d'eau, les blocages causés par les digues de castors, les retenues artificielles, les mortalités associées aux pesticides, la compétition avec les truites arc-en-ciel, et les ruisseaux bloqués par des ponceaux mal installés.

INTRODUCTION

Atlantic salmon populations in eastern Canada, exclusive of the genetically distinct population in the inner Bay of Fundy, are scheduled for review by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). This paper assembles information on Atlantic salmon in Prince Edward Island (Salmon Fishing Area 17) that is pertinent to the COSEWIC review. This information is largely derived from historical sources (notably from annual reports of the Departments of Marine and Fisheries and of the Naval Service), from DFO reports (Ducharme 1977; Bielak et al. 1991; Davidson and Bielak 1992; Davidson and Angus 1994; Cairns et al. 1995, 1996; Cairns 1997) and from work conducted by and for the University of Prince Edward Island, the Atlantic Salmon Federation, and the Prince Edward Island Department of Environment, Energy, and Forestry (Guignion et al. 2002, Guignion 2009; MacFarlane et al. 2009; D. Guignion, T. Dupuis, and R. MacFarlane, unpubl.).

In this paper salmon <63 cm fork length are classified as small, and those with $\geq$ 63 cm fork length are classified as large. These size categories approximately correspond to returning adults which have passed one winter at sea (1SW), and those which have passed two (2SW) or more winters (MSW) at sea, respectively.

CONSERVATION RANKS

The Atlantic Canada Conservation Data Centre ranks Atlantic salmon on Prince Edward Island as S2S3 (see http://accdc.com/webranks/htmvert/pevert.txt). Rank definitions are given in http://accdc.com/data/ranks.html. S2 means "Rare: May be vulnerable to extirpation due to rarity or other factors (6 to 20 occurrences or few remaining individuals)." S3 means "Uncommon, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences)."

STOCKING

Concerns about declining Atlantic salmon stocks in the late 19th century prompted the widespread development of hatchery programs in Canada (Dunfield 1985). The early development of salmon stocking programs on Prince Edward Island is described by Department of Marine and Fisheries (1874-1915), Department of the Naval Service (1916-1921), and Dupuis (2008). In addition, a diary maintained by operators of the Kellys Pond and Cardigan hatcheries between 1913 and 1960 was consulted in the preparation of the following history.

In 1874, construction of a fish hatchery on PEI was proposed, and in the following year federal officials scouted locations for such a facility. Winter River was suggested as a hatchery site, but a location on the Dunk River was chosen, and a salmon hatchery began operations there in fall 1879. Fry from this hatchery were first released in 1880. Broodstock came primarily from the Dunk, with some eggs of mainland origin. Hatchery operators evidently shared the widespread view of the time that hatchery reproduction was superior to natural reproduction, and in 1884 the reporting officer recommended that a spawning ground downstream from the hatchery be "ploughed up" to discourage natural spawning and increase broodstock captures. In 1886 a spring freshet destroyed most of the dam at the hatchery site and the system that supplied water to the egg troughs. In 1888, another freshet carried away the dam, forcing the operators to transfer the eggs to the federal hatchery at Bedford, Nova Scotia. In 1889 the hatchery was reported to be not in operation, but a re-opening was planned for the following year. In 1893 the hatchery was reported to have been destroyed by fire. In addition to flood and fire, Department of Marine and Fisheries operations on the Dunk River were beset by poachers who boldly took salmon from the river and also on occasion from the hatchery itself (Cairns 1971, Freetown Historical Society 1985).

In 1899-1902, the Department of Marine and Fisheries stocked PEI rivers with Atlantic salmon fry of mainland origin that had been hatched in mainland hatcheries. In 1905, a new hatchery began operations at Kellys Pond, in Southport, in what is now Stratford. The Dunk River hatchery had raised only Atlantic salmon, but the Kellys Pond hatchery raised brook trout, and in some years rainbow trout, in addition to salmon. The Kellys Pond/Cardigan hatchery diary does not explicitly indicate the source of the salmon broodstock used at the Kellys Pond hatchery. However references in the diary to field activities and construction expenses on the Morell River suggest that the Morell was the prime broodstock source. This is supported by Hornby's (1982) report of a "salmon camp" that operated on the Morell River for six weeks every fall, to capture broodstock. Guignion (2009) reported that salmon broodstock capture and holding operations on the Morell were located on the river's tidal estuary, at a point 3 km downstream from Indian Bridge. Jubilee Senior Citizens Club (1980) reported that salmon were captured by barrier net on the Morell at the "hatchery road," and held until the eggs were ready, whereupon the eggs were stripped and the fish returned to the river. Fertilized eggs were sent to Kellys Pond or other hatcheries in the Maritime Provinces. Jubilee Senior Citizens Club (1980) stated that 1,124 salmon were captured on the Morell in 1933. Some of these fish were released unstripped, but 2,720,600 eggs were taken from those that were stripped. According to Jubilee Senior Citizens Club (1980), it appears that 1950 was the last year that salmon were trapped for eggs on the Morell.

A federal fish hatchery was set up on the Cardigan River in 1937 (Brehaut 1987 gives 1938 as the year the hatchery was established). Beginning in 1943, the hatchery diary reports transfer of juvenile salmon to Cardigan rearing ponds. According to Hornby (1982), the Kellys Pond hatchery ceased operations in the late 1950s. Rearing of salmonids at the Cardigan Hatchery was suspended in 1976 and 1977 due to bacterial kidney disease at the site (Smith 1979). The Cardigan Hatchery was operated by the federal government until October 1997, when control was transferred to a subsidiary of the University of Prince Edward Island as part of a federal hatchery divestiture program. In June 2005, a private aquaculture company, the Dover Fish Hatchery Ltd., took ownership of the Cardigan Hatchery. Since the 1997 divestiture, the Cardigan Hatchery has continued to rear Atlantic salmon for stocking, supported by funding from public-sector sources.

Appendices 1 and 2 report numbers of Atlantic salmon and rainbow trout stocked in PEI in 1880-1960 according to Department of Marine and Fisheries (1874-1915), Department of the Naval Service (1916-1921), and the Kellys Pond/Cardigan hatchery diary. Five salmon stocking sites and one rainbow trout stocking site could not be located, despite reference to lists of geographic names (Douglas 1925, Rayburn 1973) and the national atlas online (www.atlas.nrcan.gc.ca). Records indicate release of 36,935,636 Atlantic salmon to PEI rivers in 1880-1960, and release of 519,086 rainbow trout in 1925-1954 (Appendices 1-2). These numbers are minima because the sources do not give data for some years.

In the 1970s there was renewed interest in rebuilding salmon stocks on PEI. A management objective was set to create early-run salmon populations that would provide angling opportunities over a longer time period (Ducharme 1977, Johnston 1978, Bielak et al. 1991). Ducharme (1977) released 8,873 age-2 smolts of Restigouche River origin into the Morell River in May 1975. In 1982 and subsequently, salmon eggs were transported from the Miramichi to the Cardigan Hatchery (Bielak et al. 1991). Further eggs and sperm were imported from the Miramichi in 1989 and 1990. The enhancement program also used early-returning fish from the Morell River as broodstock. In this program, salmon were raised in their first year in the hatchery, and subsequently raised to smolt age in semi-natural ponds, where they were fed, but were also exposed to natural predators. Salmon were released annually in the Morell, and were also released in other major PEI streams (Mill, Midgell, Valleyfield, West, Dunk; Davidson and Bielak 1992, Davidson and Angus 1994, Cairns et al. 1995, 1996, Cairns 1997; Table 1). This stocking program has continued into the 2000s, although with interruptions in some years. Overall, at least 42 of the 71 rivers listed in Table 1 have been stocked with Atlantic salmon.

BIOLOGICAL CHARACTERISTICS

The first written reports of Atlantic salmon in North America were made in the 1200s, as part of the Norse sagas which were derived from oral traditions of Viking voyages to North America that occurred some 200 years earlier. The account of Vinland in the Saga of the Greenlanders refers to a site where salmon was abundant, and "larger than they had ever seen before" (Smiley 2000). Sigurdsson (1998, 2000), on the basis of saga accounts, proposed that Vinland was on the shores of Northumberland Strait, either on the mainland side or on the Prince Edward Island side. If Vinland was indeed on PEI, the saga reference to large salmon would imply populations of MSW fish.

Stewart (1967), writing at the beginning of the 1800s, stated that salmon may be seen in the harbours of the north side of PEI in June and July, but they do not come into rivers on the south side of PEI until the end of September and the beginning of October. This report does not necessarily indicate early runs on the north side, because the reports are of salmon in harbours (i.e. bays), not rivers. Department of the Marine and Fisheries (1880) reported that salmon run up the Winter, Morell, and Midgell Rivers (north side) and the Dunk River (south side) between 10 October and early November. Department of the Marine and Fisheries (1880) indicated similar run timing in several other PEI streams, but did not name them. Department of the Marine and Fisheries (1882) reported that salmon mostly come up the Winter River in the first week of November, but "a few clean fish were in the river in summer." Saunders (1960), working in the 1940s and 1950s, found that salmon entered Ellerslie Brook on the north side of PEI only in autumn.

Saunders (1960) reported that smolts exiting Ellerslie Brook were a mix of age 2 and age 3 fish. Johnston and Dupuis (1990) reported that adult salmon returning to the West River included 33 (73.3%) of freshwater age 2 and 12 (26.7%) of freshwater age 3. Dupuis et al. (1991) found that 87% of outgoing smolts on the West River were age 2, with the remainder being age 3. Cairns et al. (1997) aged unclipped (i.e. not reared in hatchery) smolts captured at a fish fence on the Morell River. Numbers by age in this sample were one (2.1%) age 1, 42 (89.4%) age 2, two (4.3%) age 3, and two (4.3%) age 4. Mean age of the sample was 2.11 years.

Bain (1890) reported that salmon on PEI averaged 10 pounds (4.5 kg) each, which suggests MSW fish. In 1879, 75 female salmon captured for broodstock from the Dunk River yielded 445,000 eggs (mean 5,933 per female) (Department of the Marine and Fisheries 1880), which also suggests MSW fish. Department of the Marine and Fisheries (1885) reported that 160 of 220 (73%) salmon trapped for broodstock in the Dunk River in October-November were female. Mean number of eggs extracted per female was 7,800, and the estimated mean weight of female salmon was 13 lbs. (5.9 kg). A "large number" of grilse also entered the Dunk Hatchery reception house in fall.

Most (85.0%) salmon returning to the Morell River in recent years are small, based on captures at a trap at Leards Pond (Table 2). In other large PEI streams, the percent of salmon sampled in research gear that are small ranges from 49.1% to 100%, with an overall mean of 86.6% (Table 3). Twenty-eight of 45 (62.2%) of returning adult salmon on the West River were 1SW (Johnston and Dupuis 1990). Percent small in angler catches, estimated from stub and mail-out surveys, varied from 67.9% in the West River to 89.3% in the Mill (Table 4). These numbers may underestimate the contribution of large salmon to total runs, because fishing generally closes by early fall, and large salmon tend to be fall-run. In the Morell River, small salmon, and salmon of hatchery origin, have a stronger tendency to be early-run (before 1 Sep) than large salmon and wild-born salmon. Overall, 85.1% of salmon sampled at Leards Pond on the Morell River in 1996 were early-run (Cairns 1997). Among small salmon, 88.1% were early-run, and among large salmon, 60.0% were early-run. Among hatchery salmon, 87.9% were early run, and among wild salmon, 68.6% were early run. In the West River, fish fence counts between 17 September and 30 November indicate a peak run in the first half of November (Dupuis et al. 1991). Runs in small streams occur in fall, and are dominated by large salmon (D. Guignion, R. MacFarlane, T. Dupuis, pers. obs.).

Saunders (1960) reported that 46 of 63 (73.0%) salmon entering Ellerslie Brook to spawn were female. Mean fork lengths ranged from 67.6 to 84.0 cm, indicating dominance by the large size category. Minimum sizes were not given, so the possibility that some fish were small cannot be excluded. On the West River, 24 of 35 (68.6%) returning adults were male (Johnston and Dupuis 1990). Eighteen of 24 (75%) returning males were 1SW, while all 11 returning females were 2SW. Fork lengths of 1SW fish ranged from 48.5 to 59.0 cm, and fork lengths of 2SW fish ranged from 67.5 to 77.0 cm (Johnston and Dupuis 1990). On the Morell River, 21.4% of small salmon were female, while 81.1% of large salmon were female (Table 5). For the population overall, 32.8% was female. On the Morell, small salmon had a mean length of 56.1 cm and large salmon had a mean length of 74.3 cm (Table 5).

Saunders (1960) aged eight salmon from Ellerslie Brook, PEI, whose fork lengths ranged from 69.5 cm to 78.0 cm. All fish in the sample had spent two years in fresh water and two years at sea. If all small salmon are 1SW and all large salmon are 2SW, then mean sea age of returning adults is 1.15 years, based on Morell data.

Mean generation time of salmon on the Morell River can be calculated as age of fry at hatching (1) + mean river age of smolts (2.11) + mean sea age of returning adults (1.15) = 4.26 years. If we assume that the original salmon population had a mean sea age of 2 years, then mean generation time becomes 1+2.11+2=5.11.

Cairns (1997) reported return rates of salmon that had been reared in semi-natural ponds and released as age 2+ smolts in four PEI rivers in 1983-1993. Return rates are subject to error due to uncertainties in the number of released hatchery smolts and in numbers of returning adults. Percent of released fish returning as small or large adults ranged from 0.7% to 9.0% (mean 3.8%) in the Morell. Return rates ranged from 0.4% to 5.7% (mean 2.5%) in the Mill River, 2.2% in the West River, and 0.5% to 3.3% (mean 1.9%) in the Valleyfield River.

STOCK AFFINITIES

In Gulf New Brunswick with the exception of southeast NB, small salmon are common and often the majority size category among returning adults (Chaput et al. 2006). In southeastern NB, northern mainland Nova Scotia, and western and central Cape Breton Island, the proportion of returning salmon which are large is the highest of any region in Canada (Chaput et al. 2006). This proportion is >60%, and >80% in some areas. In much of eastern NB, returning salmon show a strong early-run component. However, salmon returns in southeast NB and northern mainland NS are late-run, from September onward.

Early historical records compiled in the previous section, and data from Ellerslie Brook which is not known to have been stocked (Appendix 1), suggest that the original salmon population of Prince Edward Island was mostly large and mostly late-run. This suggests an affinity with salmon populations of southeast New Brunswick and northern Nova Scotia. Biological characteristics of sea-age at return and run-timing are in part genetically based. Prior to the 1970s, salmon stocking operations on PEI generally used broodstock of local origin, and released fish in many streams, including small streams. Since the 1970s, stocking operations have used broodstock with a strong mainland heritage, and have concentrated on a few larger streams. In general, salmon returning to small PEI streams conform to the original pattern of large size and late run. In large streams, particularly the Morell, there is a stronger component of small size and early run. These characteristics show a stock affinity with the Miramichi River in eastern New Brunswick and are undoubtedly the consequence of sourcing genetic material from that region.

STATUS

Data on recreational catch of Atlantic salmon on the Morell River have been collected since 1955, first as estimates by fisheries officers (1955-1990) and subsequently by licence stub surveys and mail surveys (1991-2008). Catch per unit effort (CPUE, salmon caught per rod-day) was highest in the 1950s and 1960s, although total catch was low (Table 6, Figs. 1-2). CPUE showed a declining trend after 2004. Licence stub and mail survey data indicate that the Morell is the principal salmon angling river on PEI (Table 7). Nearly all salmon caught in the province are taken in the Morell, the Mill, the Trout (Coleman), the Valleyfield, the Montague, the West, and the Dunk Rivers. CPUEs estimated for these rivers show high inter-annual variability (Fig. 3).

Densities of juvenile Atlantic salmon in the Morell as estimated by electrofishing surveys show highest densities in the early 2000s (Table 8, Fig. 4). Estimated number of adult salmon returning to the Morell River at Leards Dam peaked in the late 1980s at over 1,300 fish, and has fluctuated on a descending trend until the end of the time series in 1999 (Table 9, Fig. 5).

Historical reports emphasized that Atlantic salmon were widespread and abundant in Prince Edward Island rivers (Johnston 1978, Dunfield 1985, Dupuis 2008). Stewart (1967, originally published in 1806) stated that salmon were found in "all of our rivers." Based on early reports, salmon probably inhabited all rivers on PEI at the time of European contact, except creeks that were too small to provide adequate habitat for spawning or rearing. Table 1 lists 71 rivers which were probably large enough to support salmon runs. Of these, 55 have records of containing salmon at some time in the past or present, and 41 were mentioned by name to have had salmon in annual government reports between approximately 1880 and 1910 (Table 10, Department of Marine and Fisheries 1880-1910).

Stream areas have been measured in five large rivers on PEI (Mill, Morell, Valleyfield, West, Dunk) for the purpose of estimating potential salmon rearing habitat (Table 1, Fig. 6). Watersheds of these rivers were taken from the Prince Edward Island government's GIS map. The relation between stream area and watershed area was examined by linear regression, with the regression line forced through the origin. The regression equation was stream area (in m^2) = 1,309.08 x watershed area (in km^2) (r^2 = 0.78, P=0.03).

Tables 1 and 10 show the number of rivers, their watershed areas, and their stream areas estimated from the regression equation, for rivers which have been known or inferred to contain Atlantic salmon. Stream areas estimated by the regression equation must be considered approximate. Figs. 7-11 map these areas. Survey series were conducted in 2000-2002 (Guignion et al. 2002) and again in 2007-2008 (Guignion 2009) and covered all PEI rivers which were deemed to have any chance of containing salmon. These surveys were based on electrofishing, supplemented in some cases with redd surveys. Twenty-eight rivers were found to contain salmon in 2000-2002, and 22 rivers were found to contain salmon in 2007-2008 (Table 10).

If we assume 71 rivers contained salmon at the beginning of European settlement at ca. 1730, and 22 rivers currently contain salmon, then loss rate is 69.0% by number of rivers, 56.7% by watershed area, and 57.1% by stream area. Assuming a generation time of 5.11 years, loss rate per generation is 1.3% by number of rivers, 1.0% by watershed area, and 1.0% by stream area. This analysis assumes that the proportion of stream habitat within watersheds that is occupied by salmon has not changed since 1730. However, it is virtually certain that the percent of habitat within watersheds that is occupied by salmon has declined greatly since 1730. This means that the true loss of stream area used by salmon is likely much greater than the figures given above.

Between 2000-2002 and 2007-2008, the number of PEI rivers with known salmon populations decreased from 28 to 22. Salmon populations were lost on Long Creek (Mill River East), Wheatley River, Black River,

Bells Creek, Cow River, Hay River, Souris River, Brudenell River, and Bradshaw River. Salmon populations re-appeared on Berrigans (Bristol) Creek, Clarks Creek, and Head of Hillsborough. For the interval 2000-2002 to 2007-2008, the loss rate of salmon populations was 21.4% by number of rivers, 11.5% by watershed area, and 11.6% by stream area. Percent loss per generation was 16.8% by number of rivers, 9.0% by watershed area, and 9.1% by stream area. We emphasize that these loss rates are approximate. When salmon are very rare they may be difficult to detect even with intensive surveys, and the apparent reappearance of salmon in some rivers may have been due to failure to detect populations in previous surveys.

In many of the rivers which currently contain salmon, populations are extremely low, sometimes containing only a single year class of juveniles, which testifies to discontinuous reproduction. Given the low populations and the ongoing threats (see next session), more PEI rivers can be expected to lose their salmon populations in the future.

HABITAT AND TREATS TO HABITAT

In the context of the identification and management for species at risk, a threat, is ‘an activity or process (both natural and anthropogenic) that has caused, is causing, or may cause harm, death, or behavioural changes to a species at risk or the destruction, degradation, and/or impairment of its habitat to the extent that population-level effects occur’ (Environment Canada 2006). In essence, a threat imposes a stress which contributes to or perpetuates the decline, or limits the recovery, of a population. In the case of Atlantic salmon, the elevated marine mortality and declining returns in recent years are stress caused by unknown (but hypothesized) threats.

Anadromous Atlantic salmon enter fresh water to spawn, and their progeny remain in fresh water until they leave as smolts. For this portion of the life cycle to be successful, a freshwater system must have a variety of habitats that supply the needs of each stage of the cycle. These include deep pools for returning fish to hold in prior to spawning, gravel bottoms suitable for redds, and suitable habitat for juvenile growth and rearing (Amiro 2006).

Guignion (2009) has extensively reviewed habitat issues and threats to Atlantic salmon on PEI. Table 11 presents a semi-quantitative assessment of the impact of habitat-related threats to PEI salmon. The principal threats are: habitat alteration including habitat fragmentation due to non compliant culverts, dam construction for purposes other than hydro-electric generation, agriculture/forestry/mining, and cumulative effect of ecosystem changes (DFO and MRNF 2009). These threats represent a loss of 5 to 30% of spawners. All other threats represent less than 5% of spawners lost. Many of these activities can be regulated under various sections of the Fisheries Act.

Table 12 gives additional details of the major threats to salmon on Prince Edward Island, including habitat-related threats. Prince Edward Island is the most densely populated province of Canada, and land use activity has substantial effects on aquatic habitat (Cairns 2002a, Guignion 2009). Large quantities of sediment enter streams, with major sources being farms, road construction, and urban and industrial development. Effects of sediment on salmon eggs and juveniles on PEI have been examined by Cairns (2002b), Caissie and Arseneau (2002), Cunjak et al. (2002), and Gormley (2005). Stream sedimentation is deemed to be a major limiting factor for salmon on PEI, in contrast to brook trout, which appear to be better adapted to heavy sediment loads.

There are over 600 artificial dams on PEI rivers, and many watersheds are dammed at multiple sites (MacFarlane 1999). Some dams have no fishways, and some fishways are non-functional. Dams without functional fishways may be a barrier to upstream migration of returning adults (Table 12). Effects of impoundments on downstream water quality vary widely, with some producing little or no impairment,

while others elevate water temperatures to levels that put salmon at risk (MacMillan 1998, MacFarlane 1999). Impoundments flood stream spawning and rearing habitat. Juvenile salmon are able to use ponds as growth habitat, but ponds may impede downstream smolt movements of both pond-reared and stream-reared fish (Saunders 1960). Impoundments may also benefit downstream waters by trapping sediment and preventing it from further progressing downstream (MacFarlane 1999).

Dams formed by beavers have substantial and often long-term effects on habitat availability and suitability for migratory salmonids (Naiman et al. 1994, Collen and Gibson 2000). Because water flow through beaver dams is diffuse, there is no plunge pool below the dam. This means that returning adult salmon cannot leap over the dam. Beaver activity constrains usable salmon habitat on many PEI streams (Guignion 2009). Some streams are blocked at or near the head of tide, rendering the entire system inaccessible to salmon. Some streams or stream reaches are dammed at multiple locations, leaving little or no habitat with flowing water. Beavers on PEI are often active in low-gradient streams, where a low dam will cause a long section of the stream to be flooded. In such systems, spring freshets have relatively low velocity due to the low gradient. Such dams tend not to wash out even after beavers have vacated the area (Guignion 2009). Beaver dams may also increase water temperature and decrease dissolved oxygen in downstream waters. Anoxic conditions have become increasingly common in PEI estuaries in recent years (Raymond et al. 2002). Under such conditions the water turns milky white, due to the presence of anaerobic bacteria. In or about 2005, a reach of the upper Midgell River which was blocked by beaver dams became anoxic and showed the milky white colour typical of this condition (Guignion pers. obs.).

On the basis of an extensive examination of historical documentation from the French and British colonial periods, Sobey (2007) concluded that beavers were not present on Prince Edward Island at the time of European colonization. Statements by Bain (1890) that remains of beaver dams could still be seen on streams, and by Cameron (1958) that early beaver tooth-marks had been seen on sticks found in peat bogs, lack supporting details and contrast with numerous historical records which indicate beaver absence. Current beaver populations are descendents of introduced animals, with introductions taking place in 1908 or 1909, and again in the 1940s (Cameron 1958, Dibblee 1994). Since beavers became established on PEI through human intervention, it is possible to view the impact of beaver activity on Atlantic salmon on PEI as an anthropogenic effect, rather than a natural effect.

PEI streams are subject to fish kills due to pesticides (Johnston and Cheverie 1980, Gormley et al. 2005). Mutch et al. (2002) documented 26 fish kills in 1966-1999, and an unpublished PEI government database contains 47 fish kill records from 1962 to ~2007. Fish kills typically occur when heavy rains fall on croplands that have just received pesticide applications.

The rainbow trout is an introduced species on Prince Edward Island and populations exist in at least 23 PEI rivers (Table 1). Juvenile Atlantic salmon specialize in riffle habitat, but may also occupy other types of stream habitat. Rainbow trout compete with Atlantic salmon for habitat and prevent 1+ parr from occupying habitat other than riffles (see review by Cairns 2006). Competition from exotic salmonids, including rainbow trout, may competitively suppress growth and survival of juvenile Atlantic salmon (Cairns 2006).

Prince Edward Island has a dense road network and some stream crossings have culverts which do not provide fish passage (Guignion 2009). Improperly installed culverts may prevent juvenile salmon from reaching rearing areas and adult salmon from reaching their spawning sites.

OTHER THREATS

In 1780, over-harvest of salmon prompted the PEI colonial legislature to enact seasonal restrictions on harvest. Salmon were extensively fished on PEI in the 19th century, both legally and by poaching, and both commercially and recreationally (Dupuis 2008). Aboriginal fisheries for small salmon on PEI are authorized, but removals have been small to nil in recent years other than in 2008 (Table 7). There is no retention fishery for large salmon. In 2008, recreational salmon fishing on PEI was subject to a daily possession limit of 1 small salmon and a seasonal retention limit of 2 small salmon. In 2009, the recreational salmon fishery became catch-and-release only. Salmon fishing is permitted from 1 June to 15 September. Extended seasons for catch-and-release only, using barbless hooks, apply to portions of Mill, Trout (Coleman), Dunk, and West Rivers to 31 October, and to portions of the Morell River to 30 November. Because of seasonal restrictions, fishing pressure is largely directed to early run and small salmon, most of which are of stocked origin. The small streams that support remnant populations of large late run fish are closed after 15 September, which means that these fish are not subject to fishing pressure.

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Table 1. Records of Atlantic salmon in Prince Edward Island.

River name	Located near	Water-shed area (km^2)	Stream area (m^2)[a]	Rain-bow trout pres-ent	Stock-ed[b]	His-toric stat-us[c]	Survey year	Survey method[d]	Salmon present (Yes or No)[e]	Number of electro-fishing surveys		Source
										Surveys reporting salmon	Total surveys	
Tignish River	Tignish	44.5	58,241		B	P	2001	E	N			Guignion et al. 2002
Montrose (Kildare) River	Alma	29.0	37,911				2001	E	N			Guignion et al. 2002
Huntley River	Huntley	28.9	37,767				2001	E	N			Guignion et al. 2002
Long Creek	Mill River East	19.2	25,069				2001	E	Y			Guignion et al. 2002
							2008	R	N			Guignion unpubl.
Cains Brook	Mill River	30.9	22,845				1961	E	Y			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
Carruthers Brook	Mill River	47.9	35,455		B,C	P	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
							2008	E,R	Y,Y			Guignion 2009
Beatons (Trout) River	Coleman	107.1	140,202		A,B,C	P	1993	E	Y	1	1	Cairns 2002b
							1994	R	Y			Premdas 1995
							2001	E	Y			Guignion et al. 2002
							2002	E	Y			Guignion 2009
							2007	E	Y			Guignion 2009
							2008	R	Y			Guignion 2009
Ellerslie (Bideford) River	Ellerslie	34.1	44,653				1952	E	Y			Smith and Saunders 1954
							1953	E	Y			Smith and Saunders 1954
							1946-1950	S	Y			Saunders 1960
							1946-1957	FF	Y			Saunders 1960
							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	48.3	63,281		A,B	P	2001	E	Y			Guignion et al. 2002
							2002	E	Y			Guignion 2009
							2007	E	Y			Guignion 2009
							2008	E,R	Y,Y			Guignion 2009
Little Trout River	Richmond	21.3	27,883			P	2001	E	Y			Guignion et al. 2002
							2002	E	Y			Guignion 2009
							2004	E	Y			MacFarlane et al. 2009
							2005	E	Y			MacFarlane et al. 2009
							2006	E	Y			MacFarlane et al. 2009
							2007	E	N			Guignion 2009
							2008	E,R	N,Y			Guignion 2009
Indian River	Indian River	23.9	31,326		B		2000	E	N			Guignion et al. 2002
Granville Creek	Granville	26.0	34,036				2001	E	N			Guignion et al. 2002
Trout River	Millvale	53.3	69,787		A	P	2001	E	N			Guignion et al. 2002
Hunter River	Hunter River	88.8	116,259		A,B	P	2001	E	N			Guignion et al. 2002
							2008	E	N	0	1	Guignion & P. Leblanc unpubl.
Wheatley River	Wheatley River	58.0	75,914		A,B	P	2001	E	N			Guignion et al. 2002
							2002	E	Y			K. Gormley unpubl.

Table 1 (continued).

River name	Located near	Water-shed area (km^2)	Stream area (m^2)[a]	Rain-bow trout pres-ent	Stock-ed[b]	His-toric stat-us[c]	Survey year	Survey method[d]	Salmon present (Yes or No)[e]	Number of electro-fishing surveys		Source
										Surveys reporting salmon	Total surveys	
Bells Creek	West Covehead	28.9	37,819		B	P	2001	E	Y			Guignion et al. 2002
							2002	E	Y			Guignion 2009
							2007	E	N			Guignion unpubl.
							2008	E	N	0	1	Guignion 2009
Auld Creek	West Covehead	14.4	18,785				2001	E	N			Guignion et al. 2002
							~2002	E	N			Guignion unpubl.
Winter River	Suffolk	69.6	91,112		B	P	2000	E	N	0	3	Environment Canada files
							2000	E	N			Guignion et al. 2002
Berrigans (Bristol) Creek	Bristol	41.4	54,183			P	1994	R	Y			Premdas 1995
							1995	AA	Y			Guignion et al. 2002
							1996	AA	Y			Guignion et al. 2002
							2001	E	N			Guignion et al. 2002
							2002	E	N			Guignion 2009
							2003	E	Y			Guignion unpubl.
							2004	E,R	N,Y			Guignion unpubl.
							2007	E,R	N,Y			Guignion 2009
							2008	E,R	Y,Y			Guignion 2009
Morell River	Morell	170.6	237,176		A,B,C	P	1975	E	Y	5	5	Cairns 2002b
							1984	E	Y	4	4	Cairns 2002b
							1985	E	Y	6	6	Cairns 2002b
							1994	R	Y			Premdas 1995
							1994	E	Y	12	12	Cairns 2002b
							1995	E	Y	29	30	Cairns 2002b
							1996	E	Y	12	14	Cairns 2002b
							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	Y			MacFarlane et al. 2009
							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
Marie River	Marie	29.3	38,408		B	P	2001	E	N			Guignion et al. 2002
							2002	E	N			Guignion 2009
							2003	E	Y			Guignion unpubl.
							2007	E	N			Guignion 2009
Midgell River	Midgell	63.8	83,532		B,C	P	2001	E	Y			Guignion et al. 2002
							2002	E	Y			Guignion 2009
							2007	E,R	Y,Y			Guignion 2009
							2008	R	Y			Guignion 2009
St. Peters River	St. Peters	44.6	58,333		B,C	P	2001	E	Y			Guignion et al. 2002
							2002	E	Y			Guignion 2009
							2007	E,R	Y,Y			Guignion 2009
							2008	R	Y			Guignion 2009
McAskill Crk. (Goose R.)	Goose River	10.6	13,876		B		2001	E	N			Guignion et al. 2002
Cow River	Monticello	22.8	29,886			P	2000	E	Y			Guignion et al. 2002
							2002	E	Y			Guignion 2009
							2007	E	N			Guignion 2009
							2008	E	N			Guignion 2009

Table 1 (continued).

River name	Located near	Watershed area (km^2)	Stream area (m^2)[a]	Rainbow trout present	Stocked[b]	Historic status[c]	Survey year	Survey method[d]	Salmon present (Yes or No)[e]	Number of electrofishing surveys		Source
										Surveys reporting salmon	Total surveys	
Naufrage River	Naufrage	43.6	57,037		B,C	P	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
Bear River	St. Margarets	17.2	22,477				late 1960s	AN	Y			Guignion et al. 2002
							2000	E	N	0	6	Environment Canada files
							2000	E	N			Guignion et al. 2002
Hay River	St. Margarets	25.7	33,696			P	2000	E	Y			Guignion et al. 2002
							2002	E	Y			Guignion 2009
							2007	E	N			Guignion 2009
							2008	E,R	N,N			Guignion 2009
Cross Creek	Hermanville	44.3	57,992		B	P	2000	E	Y			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
Priest Pond Creek	Hermanville	24.9	32,557			P	2000	E	Y			Guignion et al. 2002
							2002	E	Y			Guignion 2009
							2007	E	Y			Guignion 2009
							2008	R	Y			Guignion 2009
North Lake Creek	North Lake	47.7	62,495		A,B	P	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
Black Pond Creek	Black Pond, Red Pt.	14.3	18,759		B		2001	E	N			Guignion et al. 2002
Souris River	Souris	53.2	69,578	Yes	B		2000	E,FK	N,Y			Guignion et al. 2002
							2001	E	N			Guignion unpubl.
							2002	E,FK	N,Y			Guignion 2009, Guignion unpubl.
							2005	E	N			Guignion unpubl.
							2006	E	N			Guignion unpubl.
							2008	E	N			Guignion unpubl.
Fortune River	Dingwells Mills	75.4	98,652		B	P	2001	E	N			Guignion et al. 2002
							2008	E	N	0	3	Guignion & P. Leblanc unpubl.
Boughton River	Bridgetown	51.2	67,025				2001	E	N			Guignion et al. 2002
Cardigan River	Cardigan	44.6	58,411	Yes	B	P	2001	E	Y			Guignion et al. 2002
							2002	E	Y			Guignion 2009
							2007	E	Y			Guignion 2009
							2008	E,R	N,N			Guignion 2009
Brudenell River	Brudenell	55.3	72,379	Yes	A,B	P	2001	E	Y			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	Montague	76.3	99,883	Yes	A,B	P	2001	E	N			Guignion et al. 2002
							2007	E	N			MacFarlane unpubl.

Table 1 (continued)

River name	Located near	Watershed area (km^2)	Stream area (m^2)[a]	Rainbow trout present	Stocked[b]	Historic status[c]	Survey year	Survey method[d]	Salmon present (Yes or No)[e]	Number of electrofishing surveys		Source
										Surveys reporting salmon	Total surveys	
Sturgeon River	Sturgeon	60.4	79,068		B		2001	E	N			Guignion et al. 2002
Murray River	Murray River	71.0	92,905	Yes	A,B	P	2001	E	N			Guignion et al. 2002
							2003	E	N			Guignion unpubl.
Belle River	Belle River	35.9	47,022		B		2001	E	N			Guignion et al. 2002
Flat River	Flat River	30.1	39,390				2001	E	N			Guignion et al. 2002
							2008	E	N	0	1	Guignion & P. Leblanc unpubl.
South Pinette River	Pinette	18.3	23,891				2001	E	N			Guignion et al. 2002
Middle Pinette River	Pinette	8.8	11,530				2001	E	N			Guignion et al. 2002
North Pinette River	Pinette	27.5	35,987				2001	E	N			Guignion et al. 2002
Orwell River	Orwell	29.5	38,657	Yes			2001	E	N			Guignion et al. 2002
Vernon River	Vernon Bridge	69.2	90,536	Yes	A	P	1993	E	Y	2	4	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
							2002	E	Y			Guignion 2009
							2007	E	Y			Guignion 2009
							2008	R	N			Guignion 2009
Seal River	Vernon	23.4	30,646				1993	E	N	0	4	Cairns 2002b
							1994	E	N	0	12	Cairns 2002b
							1995	E	N	0	8	Cairns 2002b
							2001	E	N			Guignion et al. 2002
Johnstons River	Johnstons River	39.3	51,421		A,B	P						
Glenfinnan River	Glenfinnan	33.3	43,553	Yes	B		1970s	AA	Y			Guignion et al. 2002
							2001	E	N			Guignion et al. 2002
Clarks Creek	Pisquid	46.3	60,610	Yes			~1982	AN	Y			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
Pisquid River	Pisquid	47.6	62,247	Yes		P	2001	E	Y			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
Head of Hillsborough R.	Mount Stewart	53.1	69,512	Yes	B		~1982	AN	Y			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
North River	Milton	99.0	129,651	Yes	B	P	2001	AA	Y			Guignion et al. 2002
							2001	E	N			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
Clyde River	Clyde River	41.7	54,549	Yes	B		ca. 1970	AA	Y			Guignion et al. 2002, Guignion unpubl.
							2001	E	N			Guignion et al. 2002

Table 1 (continued).

River name	Located near	Watershed area (km^2)	Stream area (m^2)[a]	Rainbow trout present	Stocked[b]	Historic status[c]	Survey year	Survey method[d]	Salmon present (Yes or No)[e]	Number of electrofishing surveys		Source
										Surveys reporting salmon	Total surveys	
West River	Bonshaw	114.1	184,500	Yes	A,B,C	P	1994	R	Y			Premdas 1995
							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
Desable River	Desable	43.7	57,246	Yes	A	P	~1990	AA	Y			Guignion et al. 2002
							2000	E	N			Guignion et al. 2002
							2001	E	N			K. Gormley unpubl.
Westmoreland River	Crapaud	43.2	56,500	Yes	A	P	2000	E	N			Guignion et al. 2002
Tryon River	Tryon	56.4	73,767	Yes	A	P	2000	E	N			Guignion et al. 2002
							2007	E	N			Guignion unpubl.
							2008	E	N			Guignion unpubl.
Bradshaw River	Bedeque	46.1	60,362	Yes		P	2001	E	Y			Guignion et al. 2002
							2002	E	Y			Guignion 2009
							2003	E	N	0	6	Guignion unpubl.
							2008	E	N	0	2	Guignion 2009
Dunk River	Ross Corner	165.7	193,078	Yes	A,B,C	P	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
Wilmot River	Wilmot Valley	83.4	109,177	Yes	A,B	P	2000	E	Y		15	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
Sheep River	Victoria West	30.7	40,202				mid-20th century	AA	Y			Guignion unpubl.
Enmore River	North Enmore	42.6	55,767				1993	E	Y	2	4	Cairns 2002b
							1994	E	Y	9	16	Cairns 2002b
							1995	E	N	0	12	Cairns 2002b
Brae River	Brae	19.5	25,553				?	AA	Y			Guignion et al. 2002
							2001	E	N			Guignion et al. 2002
Little Pierre Jacques	Milburn	21.8	28,472				1993	E	Y	3	4	Cairns 2002b
							1994	E	Y	3	12	Cairns 2002b
							1995	E	Y	3	12	Cairns 2002b
							2001	E	N			Guignion et al. 2002
							2002	E	N			Guignion 2009
							2003	E	Y			Guignion unpubl.
							2007	E	N			Guignion 2009

Table 1 (continued).

River name	Located near	Water-shed area (km^2)	Stream area (m^2)[a]	Rain-bow trout pres-ent	Stock-ed[b]	His-toric stat-us[c]	Survey year	Survey method[d]	Salmon present (Yes or No)[e]	Number of electro-fishing surveys		Source
										Surveys reporting salmon	Total surveys	
Big Pierre Jacques	Glenwood	40.6	53,122			P	2001	E	N			Guignion et al. 2002
							2006	E	N			Guignion unpubl.
							2007	E	N			Guignion unpubl.
Little Mininigash River	Miminegash	60.2	78,846				1970s	AN	Y			Guignion unpubl.
							2001	E	N			Guignion et al. 2002
Miminigash River	Miminegash	26.7	34,939		B		1970s	AN	Y			Guignion unpubl.
							2001	E	N			Guignion et al. 2002

[a]For the Mill, 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 streams.

[b]A - salmon stocked in 1880-1899, B-salmon stocked 1900-1949, C- salmon stocked in 1950-2008. Data from Cairns 1997 and from Appendix 1.

[c]P - river mentioned by name as having salmon present, in Department of the Marine and Fisheries 1880-1910. Data as compiled in a map in the Atlantic Salmon Federation website http://asf.ca/docs/uploads/rivers/pei.html

[d]E - electrofishing, AA - anecdotal account, AN - angling, FK - fish kill, FF - fish fence, R - redd count, S - seine.

[e]Where more than 1 method was used, presence is indicated by each method is indicated in the same respective order. E.g. where Method is given as E,R and Salmon present is given N,Y, electrofishing indicated non-presence and redd surveys indicated presence.

Table 2. Size and origin of adult Atlantic salmon trapped in the Morell River. Small salmon have fork lengths < 63 cm. Hatchery salmon are those whose adipose fins have been clipped.

Year	Method	Small salmon					Large salmon					All salmon				
		Wild	Hatch-ery	Total	% wild	% small	Wild	Hatch-ery	Total	% wild	% large	Wild	Hatch-ery	Total	% wild	% small
1981	Leards Pond trap	0	39	39	0.0	86.7	6	0	6	100.0	13.3	6	39	45	13.3	86.7
1982	Leards Pond trap	6	27	33	18.2	91.7	1	2	3	33.3	8.3	7	29	36	19.4	91.7
1983	Leards Pond trap	1	1	2	50.0	50.0	0	2	2	0.0	50.0	1	3	4	25.0	50.0
1984	Leards Pond trap	3	2	5	60.0	55.6	2	2	4	50.0	44.4	5	4	9	55.6	55.6
1985	Leards Pond trap	2	12	14	14.3	93.3	1	0	1	100.0	6.7	3	12	15	20.0	93.3
1986	Leards Pond trap	1	619	620	0.2	99.0	2	4	6	33.3	1.0	3	623	626	0.5	99.0
1987	Leards Pond trap	2	1,166	1,168	0.2	94.5	2	66	68	2.9	5.5	4	1,232	1,236	0.3	94.5
1988	Leards Pond trap	8	1,386	1,394	0.6	94.1	2	87	89	2.2	6.0	10	1,471	1,481	0.7	94.1
1989	Leards Pond trap	12	323	335	3.6	72.8	0	125	125	0.0	27.2	12	448	460	2.6	72.8
1990	Leards Pond trap	44	365	409	10.8	86.7	4	59	63	6.3	13.3	48	424	472	10.2	86.7
1991	Leards Pond trap	33	294	327	10.1	89.3	11	28	39	28.2	10.7	44	322	366	12.0	89.3
1992	Leards Pond trap	64	843	907	7.1	95.2	8	38	46	17.4	4.8	72	881	953	7.6	95.2
1993	Leards Pond trap	44	584	628	7.0	98.3	0	11	11	0.0	1.7	44	595	639	6.9	98.3
1994	Leards Pond trap	8	28	36	22.2	55.4	2	27	29	6.9	44.6	10	55	65	15.4	55.4
1995	Leards Pond trap	14	172	186	7.5	92.5	5	10	15	33.3	7.5	19	182	201	9.5	92.5
1996	Leards Pond trap	31	188	219	14.2	88.0	4	26	30	13.3	12.0	35	214	249	14.1	88.0
1997	Leards Pond trap	32	185	217	14.7	94.3	4	9	13	30.8	5.7	36	194	230	15.7	94.3
1999	Leards Pond trap[a]	15	66	81	18.5	94.2	0	5	5	0.0	5.8	15	71	86	17.4	94.2
1999	Snorkel/canoe survey[b]			48					11					59		81.4
2002	Leards Pond trap	3	42	45	6.7	83.3	2	7	9	22.2	16.7	5	49	54	9.3	83.3
Total/mean[c]		323	6,342	6,665	14.0	85.0	56	508	564	25.3	15.0	379	6,848	7,227	13.4	85.0

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

[b]conducted on 16 July 1999

[c]Excludes the snorkel/canoe survey

Table 3. Counts of adult Atlantic salmon, by size, recorded at counting facilities on the Mill, Dunk, West, Valleyfield and Montague Rivers, 1989 to 1996.

Year	Mill River			Dunk River			West River			Valleyfield River			Montague River			All rivers		
	Small	Large	Total	Small	Large	Total	Small	Large	Total	Small	Large	Total	Small	Large	Total	Small	Large	Total
1989							31	19	50							31	19	50
1990							25	23	48	36	0	36				61	23	84
1991										30	0	30				30	0	30
1993	17	5	22				250	12	262	84	0	84				351	17	368
1994	11	0	11							15	7	22				26	7	33
1995	3	27	30	42	0	42				61	4	65				106	31	137
1996										77	8	85	11	2	13	88	10	98
Total	31	32	63	42	0	42	306	54	360	303	19	322	11	2	13	693	107	800
Percent	49.2	50.8		100.0	0.0		85.0	15.0		94.1	5.9		84.6	15.4		86.6	13.4	

Table 4. Estimated number, by size, of Atlantic salmon harvested (including mortalities due to catch and release) in seven rivers of PEI in all years, 1994 to 2008.

River	Estimated salmon harvest (including those released)			
	Number small	Number large	Total	Percent small
Mill	147	18	165	89.3
Trout (Coleman)	183	34	217	84.4
Morell	4,436	1,047	5,483	80.9
Valleyfield	174	49	223	77.9
Montague	64	22	86	74.5
West	468	221	689	67.9
Dunk	422	60	482	87.5

Table 5. Biological characteristics (sex ratios, fork lengths, weights, and fecundities) of adult Atlantic salmon in the Morell River. Data for 1986-1994 are from the Leards Pond trap. Data for 2000-2005 are from broodstock collections at the pool below Mooneys Pond.

Year	Small salmon			Large salmon			All salmon			Mean length (cm)		Mean weight (kg)		Mean fecundity	
	Female	Male	% female	Female	Male	% female	Female	Male	% female	Small salmon	Large salmon	Small salmon	Large salmon	Small salmon	Large salmon
1986	93	520	15.2				93	520	15.2						
1987	101	471	17.7	34	5	87.2	135	476	22.1						
1988	173	547	24.0	18	11	62.1	191	558	25.5						
1989	28	196	12.5	25	15	62.5	53	211	20.1	56.1	73.8	1.51	4.08	3,143	4,963
1990	49	131	27.2	48	29	62.3	97	160	37.7						
1994	3	33	8.3	25	4	86.2	28	37	43.1		73.0		3.90		
2000	18	47	27.7	12	0	100.0	30	47	39.0						
2001	11	49	18.3	8	0	100.0	19	49	27.9						
2004	21	30	41.2	8	2	80.0	29	32	47.5						
2005	3	11	21.4	9	1	90.0	12	12	50.0						
Total/mean	500	2,035	21.4	187	67	81.1	687	2,102	32.8	56.1	73.4	1.51	3.99	3,143	4,963

Table 6. Atlantic salmon recreational catches on the Morell River, 1955-2009. Figures for 1955-1990 are estimates by DFO fisheries officers (Smith 1981; O'Neil and Swetnam 1984, 1991; Swetnam and O'Neil 1985; Bielak et al. 1991). Figures for 1991, 1992, and 1994 are from angler mail-out surveys (MacFarlane and Guignion 1992, 1993; Cairns 1996). Figures for 1995-2009 are angler harvest (including estimated catch-and-release mortality) from licence stub or mail-in surveys.

Year	Salmon caught and retained			Salmon caught and released			Fishing effort	Salmon caught
	Small	Large	Total	Small	Large	Total	(rod-days)	per rod-day
1955			21				18	1.17
1956			29				87	0.33
1957			3				52	0.06
1958			9				52	0.17
1959			4				34	0.12
1960			4				44	0.09
1961			15				45	0.33
1962			13				50	0.26
1963			51				280	0.18
1964			12				46	0.26
1965			12				115	0.10
1966			10				N/A	
1967			26				206	0.13
1968			10				192	0.05
1969			12				214	0.06
1970	0	13	13				204	0.06
1971	0	0	0				83	0.00
1972	0	7	7				138	0.05
1973	2	0	2				168	0.01
1974	0	2	2				78	0.03
1975	0	0	0				0	
1976	6	1	7				250	0.03
1977	0	0	0				105	0.00
1978	0	0	0				60	0.00
1979	1	2	3				54	0.06
1980	5	1	6				119	0.05
1981	108	4	112				914	0.12
1982	73	8	81				2,088	0.04
1983	7	2	9				686	0.01
1984	7	0	7				675	0.01
1985	47	N/A	47				1,007	0.05
1986	236	N/A	236				2,725	0.09
1987	476	N/A	476				N/A	
1988	643	N/A	643				4,994	0.13
1989	167	N/A	167				4,506	0.04
1990	768	N/A	768				9,000	0.09
1991	657	N/A	657	1,033	164	1,197	11,552	0.06
1992	781	N/A	781			1,044	11,700	0.07
1993	N/A	N/A	N/A				N/A	
1994	92	3	95	111	99	210	4,911	0.02
1995	454	3	457	146	95	241	5,073	0.09
1996	405	4	410	270	150	420	4,156	0.10
1997	201	1	202	92	36	127	2,796	0.07
1998	237	2	239	133	68	200	2,809	0.09
1999	158	4	162	147	122	269	2,556	0.06
2000	99	1	100	64	36	100	1,745	0.06
2001	151	3	153	156	84	239	1,791	0.09
2002	122	1	122	129	31	161	1,521	0.08
2003	274	4	278	266	133	400	2,708	0.10
2004	89	1	90	129	33	162	2,093	0.04
2005	115	2	117	87	75	162	1,795	0.07
2006	100	1	101	177	41	218	2,190	0.05
2007	30	3	32	129	84	213	2,328	0.01
2008	26	0	26	0	0	0	1,132	0.02
2009	0	1	1	0	25	25	670	0.00

Table 7. Salmon fishing effort and harvest in Prince Edward Island rivers, 1994-2009. Data for 1994 and for 2007-2009 are from mail-out surveys. See Cairns (1996) for 1994 data. Data for 1995-2006 are from licence stub surveys. Data for 2009 are preliminary.

Year	Percent of respond-ents who fished river	Estimated total number of anglers who fished river	Mean number of rod-days per angler who fished river	Estim-ated total rod-days	Mean catch per rod-day				Estimated recreational catch				Estimated total harvest, including hook and release mortality*						
					Small salmon kept	Small salmon released	Large salmon released	All salmon	Small salmon kept	Small salmon released	Large salmon released	All salmon	Small, recre-ational	Large, recre-ational	Abor-iginal small	Abor-iginal large	Total, small	Total, large	Total, small and large
Morell																			
1994									89	111	99	299	92	3			92	3	95
1995	72	453	11.2	5,073	0.089	0.029	0.019	0.136	449	146	95	690	454	3	19	1	473	4	477
1996	66	462	9.0	4,156	0.096	0.065	0.036	0.197	397	270	150	818	405	4	17	0	422	4	427
1997	59	361	7.7	2,796	0.071	0.033	0.013	0.117	198	92	36	326	201	1	1	0	202	1	203
1998	63	325	8.6	2,809	0.083	0.047	0.024	0.154	233	133	68	433	237	2	28	0	265	2	267
1999	65	307	8.3	2,556	0.060	0.058	0.048	0.165	153	147	122	423	158	4	0	0	158	4	162
2000	61	230	7.6	1,745	0.055	0.036	0.021	0.113	97	64	36	197	99	1	28	0	127	1	128
2001	61	208	8.6	1,791	0.082	0.087	0.047	0.215	146	156	84	386	151	3	28	0	179	3	181
2002	56	196	7.8	1,521	0.077	0.085	0.021	0.183	118	129	31	278	122	1	29	0	151	1	151
2003	66	333	8.1	2,708	0.098	0.098	0.049	0.246	266	266	133	666	274	4	16	0	290	4	294
2004	56	255	8.2	2,093	0.041	0.062	0.016	0.118	85	129	33	247	89	1	0	0	89	1	90
2005	66	284	6.3	1,795	0.063	0.049	0.042	0.153	112	87	75	274	115	2	0	0	115	2	117
2006	68	214	10.2	2,190	0.043	0.081	0.019	0.143	95	177	41	313	100	1	5	0	105	1	106
2007	73	187	12.4	2,328	0.011	0.055	0.036	0.102	26	129	84	239	30	3	4	0	34	3	36
2008	54	120	9.4	1,132	0.023	0.000	0.000	0.023	26	0	0	26	26	0	20	0	46	0	46
2009	62	80	8.4	670	0.000	0.000	0.037	0.037	0	0	25	25	0	1	0	0	0	1	1
Mill																			
1994									11	NA	0	NA	11	0			11	0	11
1995	2	9	9.0	85	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
1996	7	52	4.2	218	0.119	0.075	0.030	0.224	26	16	7	49	27	0			27	0	27
1997	6	36	5.1	181	0.049	0.000	0.016	0.066	9	0	3	12	9	0			9	0	9
1998	7	38	8.4	317	0.017	0.034	0.026	0.077	5	11	8	24	6	0			6	0	6
1999	5	25	3.9	97	0.194	0.097	0.000	0.290	19	9	0	28	19	0			19	0	19
2000	8	30	8.3	251	0.072	0.012	0.000	0.084	18	3	0	21	18	0			18	0	18
2001	7	25	6.3	156	0.020	0.040	0.000	0.060	3	6	0	9	3	0			3	0	3
2002	6	20	6.8	133	0.029	0.000	0.000	0.029	4	0	0	4	4	0			4	0	4
2003	4	20	3.0	60	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2004	2	11	2.7	30	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2005	1	6	1.0	6	0.500	0.000	0.000	0.500	3	0	0	3	3	0			3	0	3
2006	1	4	3.0	12	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2007	5	13	57.5	742	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2008	12	26	17.0	437	0.020	0.000	0.000	0.020	9	0	0	9	9	0			9	0	9
2009	14	18	9.0	166	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0

Table 7 (continued).

Year	Percent of respond-ents who fished river	Estimated total number of anglers who fished river	Mean number of rod-days per angler who fished river	Estim-ated total rod-days	Mean catch per rod-day				Estimated recreational catch				Estimated total harvest, including hook and release mortality						
					Small salmon kept	Small salmon released	Large salmon released	All salmon	Small salmon kept	Small salmon released	Large salmon released	All salmon	Small, recre-ational	Large, recre-ational	Abor-iginal small	Abor-iginal large	Total, small	Total, large	Total, small and large
Trout (Coleman)																			
1994									5	6	0	11	5	0			5	0	5
1995	3	19	13.5	256	0.025	0.012	0.012	0.049	6	3	3	13	6	0			6	0	7
1996	7	46	6.1	277	0.024	0.000	0.024	0.047	7	0	7	13	7	0			7	0	7
1997	11	65	7.6	498	0.048	0.042	0.006	0.095	24	21	3	47	24	0			24	0	24
1998	8	41	3.9	157	0.000	0.121	0.017	0.138	0	19	3	22	1	0			1	0	1
1999	7	31	4.1	128	0.073	0.049	0.049	0.171	9	6	6	22	10	0			10	0	10
2000	13	48	9.6	463	0.059	0.033	0.020	0.111	27	15	9	51	28	0			28	0	28
2001	14	47	8.8	411	0.038	0.008	0.008	0.053	16	3	3	22	16	0			16	0	16
2002	9	31	3.9	122	0.000	0.097	0.000	0.097	0	12	0	12	0	0			0	0	0
2003	8	40	5.5	220	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2004	8	37	5.4	199	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2005	4	19	3.2	59	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2006	5	16	7.8	128	0.000	0.032	0.000	0.032	0	4	0	4	0	0			0	0	0
2007	8	19	18.3	355	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2008	12	26	11.0	283	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2009	24	31	8.2	252	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
Dunk																			
1994									11	38	5	54	12	0			12	0	12
1995	4	25	12.9	326	0.000	0.010	0.000	0.010	0	3	0	3	0	0			0	0	0
1996	7	52	6.8	352	0.009	0.306	0.037	0.352	3	107	13	124	6	0			6	0	7
1997	9	56	6.4	358	0.017	0.041	0.041	0.099	6	15	15	36	6	0			6	0	7
1998	13	65	11.2	729	0.019	0.007	0.015	0.041	14	5	11	30	14	0			14	0	14
1999	14	66	10.8	711	0.009	0.018	0.004	0.031	6	13	3	22	7	0			7	0	7
2000	14	51	10.4	537	0.012	0.042	0.000	0.054	6	22	0	29	7	0			7	0	7
2001	16	53	6.1	323	0.019	0.048	0.000	0.067	6	16	0	22	7	0			7	0	7
2002	18	63	7.1	447	0.009	0.149	0.000	0.158	4	67	0	71	6	0			6	0	6
2003	17	87	6.3	543	0.067	0.025	0.018	0.110	37	13	10	60	37	0			37	0	37
2004	11	48	9.5	454	0.016	0.016	0.008	0.041	7	7	4	18	8	0			8	0	8
2005	10	44	7.4	324	0.010	0.010	0.000	0.019	3	3	0	6	3	0			3	0	3
2006	12	37	3.6	132	0.000	0.063	0.000	0.063	0	8	0	8	0	0			0	0	0
2007	5	13	1.5	19	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2008	0	0	NA	0	NA	NA	NA	NA	0	0	0	0	0	0			0	0	0
2009	10	12	6.5	80	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0

Table 7 (continued).

Year	Percent of respond-ents who fished river	Estimated total number of anglers who fished river	Mean number of rod-days per angler who fished river	Estim-ated total rod-days	Mean catch per rod-day				Estimated recreational catch				Estimated total harvest, including hook and release mortality						
					Small salmon kept	Small salmon released	Large salmon released	All salmon	Small salmon kept	Small salmon released	Large salmon released	All salmon	Small, recre-ational	Large, recre-ational	Abor-iginal small	Abor-iginal large	Total, small	Total, large	Total, small and large
West																			
1994									20	38	NA	NA	21				21	0	21
1995	16	101	12.7	1,282	0.010	0.030	0.017	0.057	13	38	22	73	14	1			14	1	14
1996	24	166	6.1	1,006	0.061	0.055	0.042	0.159	62	55	42	160	64	1			64	1	65
1997	21	130	6.0	779	0.068	0.030	0.015	0.114	53	24	12	89	54	0			54	0	54
1998	18	95	6.9	653	0.017	0.004	0.017	0.037	11	3	11	24	11	0			11	0	11
1999	16	75	7.4	558	0.000	0.022	0.006	0.028	0	13	3	16	0	0			0	0	0
2000	15	57	3.9	224	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2001	15	50	9.1	451	0.000	0.048	0.034	0.083	0	22	16	37	1	0			1	0	1
2002	15	51	7.2	369	0.000	0.064	0.011	0.074	0	24	4	27	1	0			1	0	1
2003	15	73	6.0	436	0.015	0.015	0.008	0.038	7	7	3	17	7	0			7	0	7
2004	11	48	7.9	380	0.010	0.107	0.136	0.252	4	41	52	96	5	2			5	2	6
2005	12	53	6.7	355	0.000	0.018	0.079	0.096	0	6	28	34	0	1			0	1	1
2006	17	54	9.8	523	0.000	0.031	0.024	0.055	0	16	12	29	0	0			0	0	1
2007	20	52	7.9	406	0.000	0.048	0.032	0.079	0	19	13	32	1	0			1	0	1
2008	19	43	11.6	497	0.000	0.017	0.052	0.069	0	9	26	34	0	1	2		2	1	3
2009	29	37	6.5	240	0.000	0.026	0.000	0.026	0	6	0	6	0	0			0	0	0
Valleyfield																			
1994									5	28	5	38	5	0			5	0	5
1995	4	22	28.1	624	0.025	0.015	0.025	0.066	16	9	16	41	16	0			16	0	17
1996	12	85	5.5	466	0.077	0.049	0.042	0.168	36	23	20	78	37	1			37	1	37
1997	7	41	11.2	465	0.032	0.038	0.019	0.089	15	18	9	41	15	0			15	0	16
1998	8	41	8.1	330	0.000	0.074	0.000	0.074	0	24	0	24	1	0			1	0	1
1999	7	31	4.0	125	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2000	8	30	2.1	64	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2001	6	19	3.7	68	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2002	3	12	4.0	47	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2003	5	23	2.4	57	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2004	5	22	2.3	52	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2005	4	16	6.4	100	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2006	3	8	16.0	132	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2007	5	13	7.5	97	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2008	0	0	NA	NA	NA	NA	NA	NA	0	0	0	0	0	0			0	0	0
2009	5	6	8.0	49	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0

Table 7 (continued).

Year	Percent of respond-ents who fished river	Estimated total number of anglers who fished river	Mean number of rod-days per angler who fished river	Estim-ated total rod-days	Mean catch per rod-day				Estimated recreational catch				Estimated total harvest, including hook and release mortality						
					Small salmon kept	Small salmon released	Large salmon released	All salmon	Small salmon kept	Small salmon released	Large salmon released	All salmon	Small, recre-ational	Large, recre-ational	Abor-iginal small	Abor-iginal large	Total, small	Total, large	Total, small and large
Montague[b]																			
1994																			
1995	1	6	1.5	9	0.000	0.333	0.000	0.333	0	3	0	3	0	0			0	0	0
1996	0	0	NA	0	NA	NA	NA	NA	0	0	0	0	0	0			0	0	0
1997	3	21	6.0	124	0.095	0.000	0.000	0.095	12	0	0	12	12	0			12	0	12
1998	6	30	7.6	228	0.071	0.071	0.000	0.143	16	16	0	33	17	0			17	0	17
1999	4	19	6.2	116	0.054	0.081	0.189	0.324	6	9	22	38	7	1			7	1	7
2000	2	6	2.5	15	0.000	0.200	0.000	0.200	0	3	0	3	0	0			0	0	0
2001	4	12	20.0	249	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2002	2	8	5.0	39	0.100	0.100	0.000	0.200	4	4	0	8	4	0			4	0	4
2003	3	13	7.3	97	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2004	3	15	2.5	37	0.100	0.000	0.000	0.100	4	0	0	4	4	0			4	0	4
2005	3	12	7.3	90	0.000	0.069	0.000	0.069	0	6	0	6	0	0			0	0	0
2006	5	16	1.3	21	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2007	3	6	1.0	6	0.000	0.000	0.000	0.000	0	0	0	0	0	0			0	0	0
2008	0	0	NA	NA	NA	NA	NA	NA	0	0	0	0	0	0			0	0	0
2009	0	0	NA	NA	NA	NA	NA	NA	0	0	0	0	0	0			0	0	0
Pisquid																			
2008													0	0	5	0	5	0	5
All rivers																			
1994									142				142						
1995	80	506	15.1	7,669	0.063	0.027	0.018	0.109	484	209	139	832	491	4	19	1	510	5	515
1996	81	563	11.5	6,478	0.082	0.073	0.037	0.192	534	472	238	1,244	548	7	17	0	565	7	572
1997	76	468	11.2	5,254	0.061	0.034	0.015	0.109	320	178	77	575	325	2	1	0	326	2	328
1998	78	404	13.5	5,457	0.052	0.043	0.021	0.115	282	233	114	628	289	3	28	0	317	3	320
1999	75	357	12.0	4,291	0.045	0.046	0.036	0.128	194	197	157	548	200	5	0	0	200	5	205
2000	78	296	11.0	3,257	0.045	0.032	0.014	0.092	148	106	45	299	151	1	28	0	179	1	181
2001	80	271	12.7	3,449	0.050	0.059	0.030	0.138	171	202	103	476	177	3	28	0	205	3	208
2002	78	271	10.7	2,888	0.048	0.088	0.013	0.149	140	254	38	431	147	1	29	0	176	1	177
2003	81	406	10.1	4,121	0.075	0.070	0.036	0.180	310	286	147	743	318	4	16	0	334	4	339
2004	68	310	10.5	3,244	0.031	0.055	0.027	0.113	100	177	89	365	105	3	0	0	105	3	108
2005	73	315	8.7	2,730	0.043	0.038	0.038	0.119	118	103	103	324	121	3	0	0	121	3	125
2006	77	243	12.9	3,137	0.030	0.066	0.017	0.113	95	206	54	354	101	2	5	0	106	2	107
2007	75	194	20.3	3,935	0.007	0.038	0.025	0.069	26	148	97	271	30	3	4	0	34	3	37
2008	73	163	14.4	2,350	0.015	0.004	0.011	0.029	34	9	26	69	35	1	27	0	62	1	62
2009	81	104	13.9	1,456	0.000	0.004	0.017	0.021	0	6	25	31	0	1	0	0	0	1	1

[a]Assumed to be 3%.

[b]1994 Montague data are included with those of the Valleyfield.

Table 8. Mean densities of Atlantic salmon juveniles in the Morell River, from electrofishing surveys. N refers to the number of sites sampled.

Year	Mean densities of Atlantic salmon (fish 100 m^{-2})			
	N	Age 0+	Age 1+	Total
1975	5	0.00	3.38	3.38
1984	4	8.46	3.49	11.95
1985	6	6.75	4.34	11.09
1994	12	20.43	5.71	26.14
1995	30	8.60	6.49	15.09
1996	15	11.72	0.29	12.02
1997	13	9.09	4.68	13.77
1998	6	12.07	6.84	18.92
1999	6	10.11	10.86	20.97
2000	6	18.50	12.76	31.26
2001	6	16.21	14.33	30.54
2002	5	8.10	3.22	11.32

Table 9. Estimated run size (number of fish) of Atlantic salmon in the Morell River above Leards Dam. Run is adjusted for broodstock removals that occurred at or below the dam, but not for fisheries harvests.

Year	Small salmon	Large salmon
1981	39	6
1982	33	3
1983	2	2
1984	5	4
1985	14	1
1986	278	3
1987	658	54
1988	1,290	20
1989	330	48
1990	368	44
1991	280	14
1992	824	14
1993	461	0
1994	2	3
1995	130	2
1996	498	65
1997	158	10
1998	(no data available)	
1999	30	0

Table 10. Number of rivers with salmon on Prince Edward Island, and their watershed and stream areas.

Item	Number of rivers	Watershed area (km^2)	Stream area (m^2)
All of Prince Edward Island		5,668	
Rivers which likely contained salmon at the beginning of European colonization	71	3,368	4,402,197
Rivers with records of salmon, in any period	55	2,876	3,757,674
Rivers which were mentioned by name to have had salmon in ~1880 - ~1910	41	2,406	3,159,894
Rivers which were reported to have had salmon in 2000, 2001, or 2002	28	1,649	2,138,399
Rivers which were reported to have had salmon in 2007 or 2008	22	1,459	1,890,695

Table 11. Summary of threats to, and rating of effects on recovery and/ or persistence of Atlantic salmon on Prince Edward Island.

Potential sources of mortality /harm, permitted and unpermitted activities	**Source (*with examples*)**	**Proportion of salmon on PEI affected LOW < 5%, MEDIUM 5% to 30%, HIGH > 30%, UNCERTAIN**	**Cause/ Time Frame Historic (H) Current (C) Potential (P)**	**Effect on Population (LOW < 5% spawner loss, MEDIUM 5% to 30% spawner loss, HIGH > 30% spawner loss, UNCERTAIN)**	**Management Alternatives/ Mitigation *(relative to existing actions)***
Directed Salmon Fishing	Aboriginal	**Low**	**H C**	**Low**	Control harvest through agreements between DFO and First Nation (in place)
	Recreational: retention & release	**Low –**1SW retention only until 2008	**H C**	**Low**	Encourage catch and release (catch-and-release made mandatory in 2009)
	Commercial (domestic)	**Not Applicable–** all commercial fisheries closed			
	High Seas (West Greenland / St. Pierre – Miquelon)	**Low**	**H C**	**Low**	Reductions in internal use fisheries in those areas
	Illegal (poaching)	**Low**	**H C**	**Low**	Continue use of compliance monitors on selected watersheds including Aboriginal guardians
	CUMULATIVE EFFECT	**LOW**		**LOW**	
Bycatch of Salmon in Fisheries for Other Species	Aboriginal	**Low**	**C**	**Low–** all bycatch mandatory release	.
	Recreational	**Low**	**C**	**Low–** all bycatch mandatory release	
	Commercial near shore	**Low**	**C**	**Low–** all bycatch mandatory release	
	Commercial distant	**Low**	**C**	**Low**	None apparent
	CUMULATIVE EFFECT	**LOW**		**LOW**	None apparent

Potential sources of mortality /harm, permitted and unpermitted activities	**Source (*with examples*)**	**Proportion of salmon on PEI affected LOW < 5%, MEDIUM 5% to 30%, HIGH > 30%, UNCERTAIN**	**Cause/ Time Frame Historic (H) Current (C) Potential (P)**	**Effect on Population (LOW < 5% spawner loss, MEDIUM 5% to 30% spawner loss, HIGH > 30% spawner loss, UNCERTAIN)**	**Management Alternatives/ Mitigation *(relative to existing actions)***
Salmon Fisheries Impacts on Salmon Habitat	Aboriginal	**Low**	**H C**	**Low**	None apparent
	Recreational	**Low**	**H C**	**Low**	None apparent
	Commercial	**Not Applicable**			
	Illegal	**Low**	**H C**	**Low**	None apparent
	CUMULATIVE EFFECT	**LOW**		**LOW**	None apparent
Mortality Associated with Water Use	Power generation at dams & tidal facilities (turbine mortality, entrainment, stranding)	**Not applicable** - there are no dams with turbines on PEI			
Habitat Alterations	Municipal waste water treatment facilities	**Low–** small communities, two urban centers	**H C P**	**Low** –	Ensure current projects and future developments meet standards
	Pulp & paper mills	**Not Applicable –** no pulp and paper mills on PEI			

Potential sources of mortality /harm, permitted and unpermitted activities	Source (*with examples*)	Proportion of salmon on PEI affected LOW < 5%, MEDIUM 5% to 30%, HIGH > 30%, UNCERTAIN	Cause/ Time Frame Historic (H) Current (C) Potential (P)	Effect on Population (LOW < 5% spawner loss, MEDIUM 5% to 30% spawner loss, HIGH > 30% spawner loss, UNCERTAIN)	Management Alternatives/ Mitigation *(relative to existing actions)*
	Hydroelectric power generation (dams & reservoirs, tidal power): altered behavior & ecosystems Dams constructed for purposes other than hydro-electric generation	**Not Applicable –** no water power generation on PEI **Medium – High**		**Medium – High:** habitat fragmentation (more than 600 dams constructed, some have no salmonid fishways, loss of stream habitat, excessive water heating in some systems.	
	Water extractions	**Low**	**H C P**	**Low** - Water extractions on PEI are from groundwater. In dry years some water is extracted for row crop irrigation	Must meet regulations in place; monitoring; develop regional guidelines
	Urbanization (altered hydrology)	**Low**	**H C P**	**Low** – mostly small communities, two urban center	Project redesign; existing regulation - monitoring
	Infrastructure (roads/culverts) (fish passage)	**Medium** – **High**	**H C P**	**Medium – High –**many non compliant culverts; sedimentation; fish passage barriers	Existing regulations; more monitoring/ enforcement

Potential sources of mortality /harm, permitted and unpermitted activities	Source (*with examples*)	Proportion of salmon on PEI affected LOW < 5%, MEDIUM 5% to 30%, HIGH > 30%, UNCERTAIN	Cause/ Time Frame Historic (H) Current (C) Potential (P)	Effect on Population (LOW < 5% spawner loss, MEDIUM 5% to 30% spawner loss, HIGH > 30% spawner loss, UNCERTAIN)	Management Alternatives/ Mitigation *(relative to existing actions)*
	Aquaculture siting	**Low**	**H C P**	**Low** – many mussels farms in estuaries and bays, especially in eastern PEI. There are also a few aquaculture operations on freshwater systems.	Choose locations carefully; monitoring; follow the PEI Shellfish Aquaculture Environmental Code of Practice
	Agriculture / Forestry / Mining, etc.	**Medium – High**	**H C P**	**Medium – High**– extensive agriculture; sedimentation, nutrient loading, occasional fish kills due to pesticides. Anoxic events occur in estuaries and bays in summer.	Enforcement/ monitoring of existing suite of regulations, compensations where required
	Municipal, provincial & federal dredging	**Low**	**H C P**	**Low**	Follow regulations in place; mitigations and compensations as required; minimize amount
	CUMULATIVE EFFECT	**MEDIUM– HIGH**		**MEDIUM – HIGH** - sedimentation from agricultural, industrial, roadway, and residential sources has major negative effects on habitat quality. Salmon occasionally killed by pesticide incidents.	
Shipping, Transport and Noise	Municipal, provincial, federal & private transport activities (inc. land and water based contaminants/ spills)	**Uncertain**	**H C P**	**Uncertain**	Follow federal, provincial and municipal regulations
Fisheries on Prey	Commercial, Recreational,	**Uncertain**	**H C P**	**Uncertain**	None apparent

Potential sources of mortality /harm, permitted and unpermitted activities	Source (*with examples*)	Proportion of salmon on PEI affected LOW < 5%, MEDIUM 5% to 30%, HIGH > 30%, UNCERTAIN	Cause/ Time Frame Historic (H) Current (C) Potential (P)	Effect on Population (LOW < 5% spawner loss, MEDIUM 5% to 30% spawner loss, HIGH > 30% spawner loss, UNCERTAIN)	Management Alternatives/ Mitigation *(relative to existing actions)*
of Salmon (for ex. capelin, smelt, shrimp)	Aboriginal fisheries for species a, b, c etc.				
Aquaculture (Salmon and other species)	Escapes from fresh water, marine facilities, disease, parasites, competition, effects on behaviour and migration, genetic introgression	**Low**	**H C P**	**Low** - there are small aquaculture operations on PEI freshwaters that raise juvenile salmonids. There is no sea-cage culture.	Fish Health regulation.; Introduction and Transfer regulation
Fish culture / stocking (non-commercial, including private, NGO, government)	Impacts on effective population size, over representation of families, domestication	**Medium**	**H C P**	**Low** - Stocking has produced major changes in the biological characteristics of salmon in the large streams of PEI. Continued stocking has increased populations.	It would be difficult to utilize true native stock for enhancement, because the only systems that are unlikely to have been influenced by stocking are very small and have very small numbers of returning adults.
Scientific Research	Government, university, community and Aboriginal groups	**Low**	**C**	**Low**	None apparent
Military Activities	Field operations, shooting ranges	**Not Applicable**			
Air Pollutants	Acid rain	**Not Applicable** - PEI soil is well buffered	**H C P**	**Low**	None apparent
UN-PERMITTED					
Introductions of non-native / invasive species	Rainbow trout, invertebrates, plants, algae	**Low –** presence of rainbow trout in certain rivers	**H C P**	**Low** - Invasive invertebrate species are having major effects in estuaries. Few invasive animal species in	Increase monitoring and enforcement activities; conduct education programs

Potential sources of mortality /harm, permitted and unpermitted activities	Source (*with examples*)	Proportion of salmon on PEI affected LOW < 5%, MEDIUM 5% to 30%, HIGH > 30%, UNCERTAIN	Cause/ Time Frame Historic (H) Current (C) Potential (P)	Effect on Population (LOW < 5% spawner loss, MEDIUM 5% to 30% spawner loss, HIGH > 30% spawner loss, UNCERTAIN)	Management Alternatives/ Mitigation *(relative to existing actions)*
				fresh water	
International High Seas Targeted	Flags of convenience?	**Uncertain**		**Uncertain**	None apparent
Ecotourism and Recreation	Private Co's & public at large (water crafts, swimming, etc) effects on salmon behaviour & survival	**Low**	**H C P**	**Low**	Increase enforcement activities Conduct education programs
Ecosystem change	Climate change, changes in relative predator / prey abundances, disease	**Low – Uncertain–** habitat may favor exotic species	**C P**	**Low – Uncertain**, some rivers in this area are moderately impacted by low water levels and warm water temperatures; affect on salmon populations is unknown	

Table 12. Principal threats to Atlantic salmon on Prince Edward Island.

Threat	Life stage	Effect
Sedimentation	Egg	Sediment infiltrates redds, preventing oxygen from reaching the developing eggs
	Juvenile	Sediment covers bottom, including riffle areas favored by juveniles as rearing habitat
	Returning adult	Sediment fills pools, reducing areas in which salmon can hold prior to spawning
Artificial impoundments	Egg	Impoundments flood riffle areas needed for redds
	Juvenile	Impoundments flood riffle areas favoured by juveniles as rearing habitat. They may also raise water temperatures to harmful levels.
	Smolt	Downstream migrating smolts may be unable to find the pond exit and thus be prevented from reaching the sea.
	Returning adult	If the dam lacks a functioning fishway, it may prevent upstream migration of returning adults
Beaver dams	Egg	Beaver impoundments flood riffle areas needed for redds
	Juvenile	Beaver impoundments flood riffle areas favoured by juveniles as rearing habitat. They may also heat the water, raising downstream temperatures to harmful levels.
	Smolt	Because water tends to flow through, rather than over, beaver dams, smolts may be unable to pass the dam on their downstream migration.
	Returning adult	Because water flow through a beaver dam is diffuse, there is no plunge pool at the foot of the dam, meaning that returning adults are unable to leap over it and reach upstream spawning habitat
Pesticides	Juvenile	Pesticides may cause direct mortality to juvenile salmon
Competition with rainbow trout		
	Juvenile	Rainbow trout may constrain habitat available to juvenile salmon. Juvenile salmon of hatchery origin may have lower growth and survival in the presence of rainbow trout.
Culverts	Juvenile	Improperly installed culverts may prevent juvenile salmon from accessing rearing habitat that would otherwise be available
	Returning adult	Improperly installed culverts may prevent returning adult salmon from reaching spawning sites
Fishing	Smolt	Smolts may be caught by anglers targeting trout. There may be some mortality to smolts even if they are released.
	Adult	On PEI only small salmon may be retained and fishing is subject to seasonal limits. However a small percent of released small and large salmon are likely to die because of stress or injury incurred during the hook-and-release process.

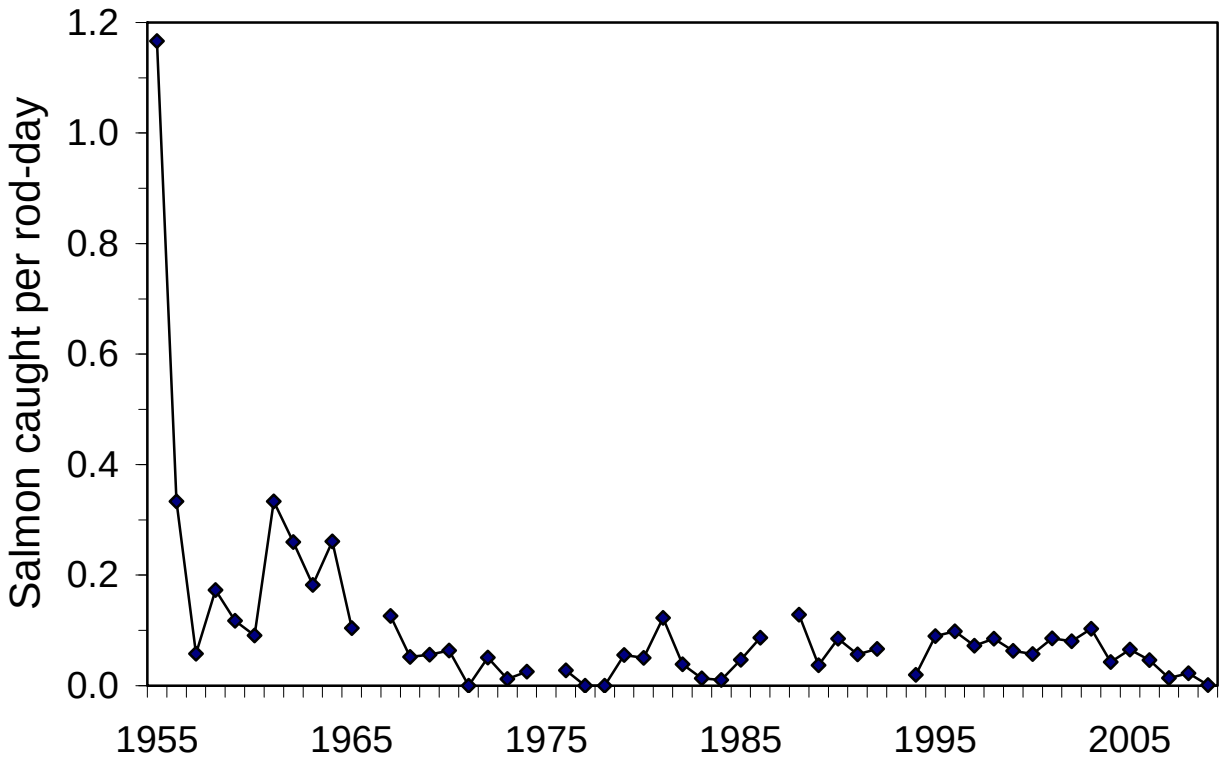

Figure 1. Salmon caught (including those released) per rod-day in the Morell River.

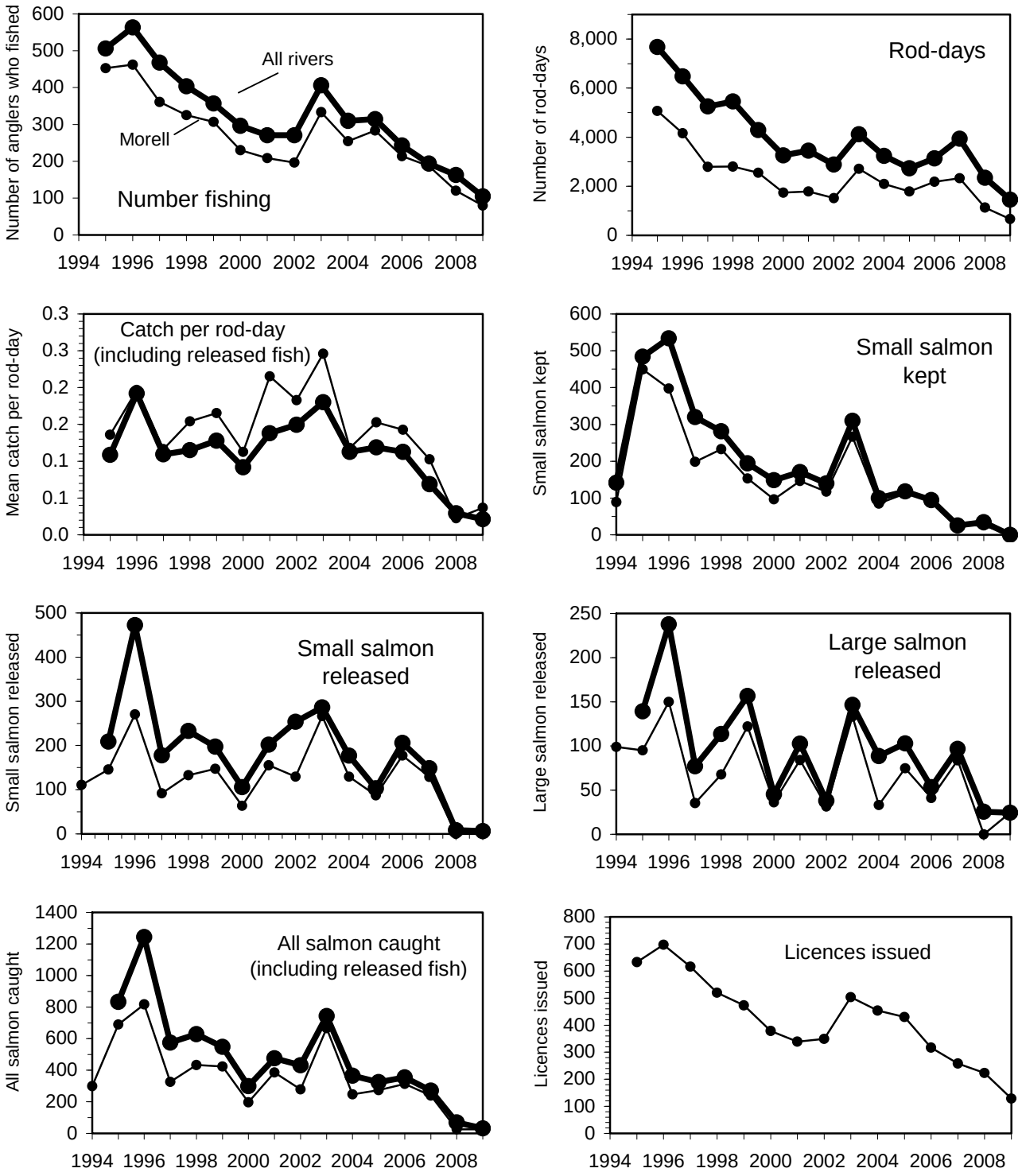

Figure 2. Salmon fishing effort and catch on the Morell River (light lines) and in all Prince Edward Island rivers (heavy lines), 1994 to 2009. Data for 2009 are preliminary. Number of salmon licences issued on PEI is also shown.

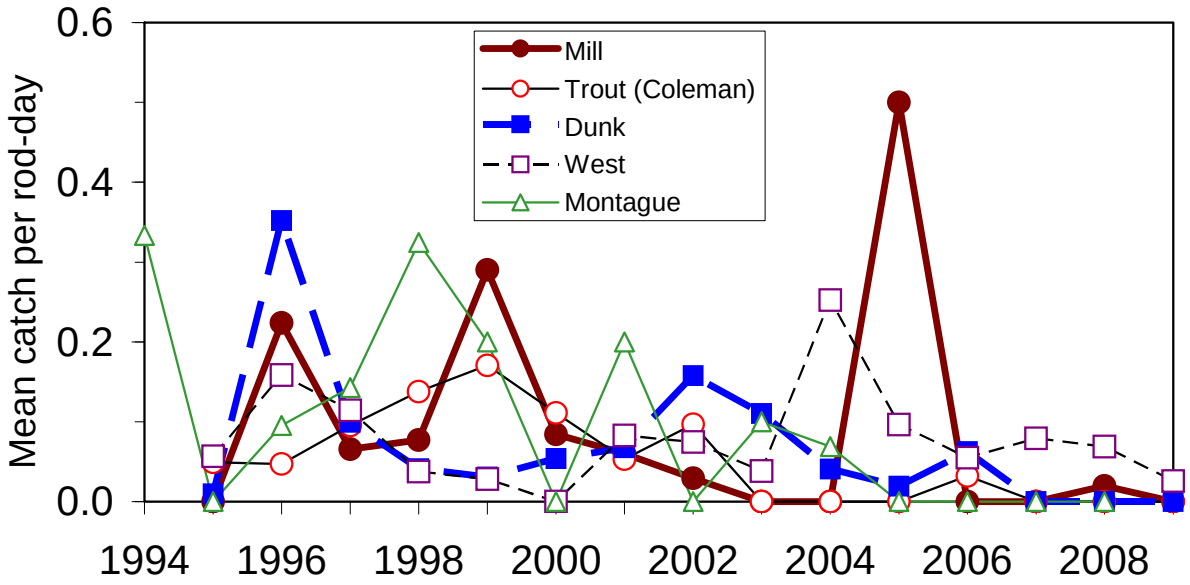

Figure 3. Mean catch of Atlantic salmon (including those released) per rod-day in 5 Prince Edward Island rivers.

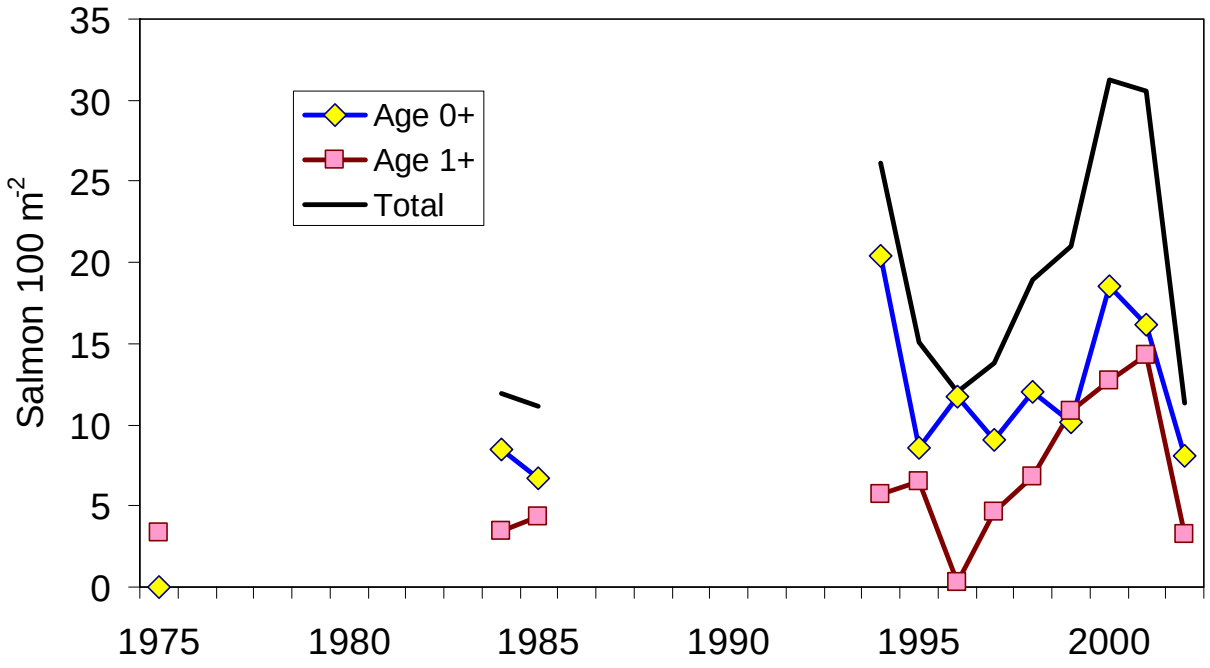

Figure 4. Mean densities of Atlantic salmon on the Morell River, from electrofishing surveys.

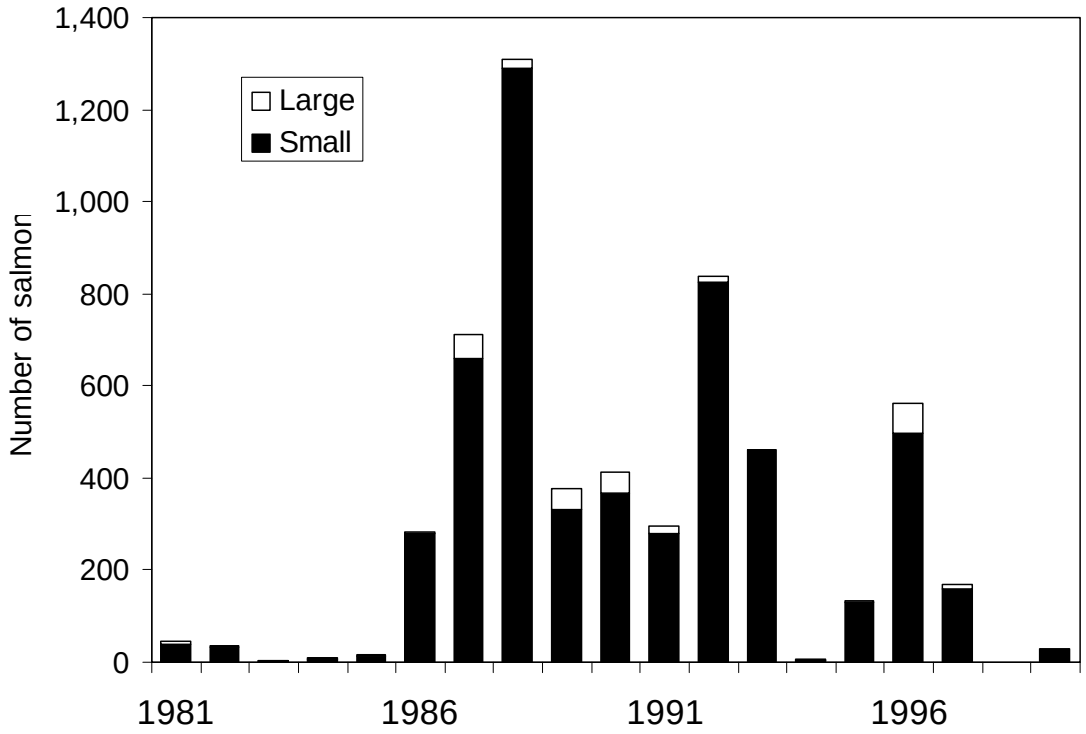

Figure 5. Estimated number of salmon returning to the Morell River above Leards Dam, 1981-1997 and 1999.

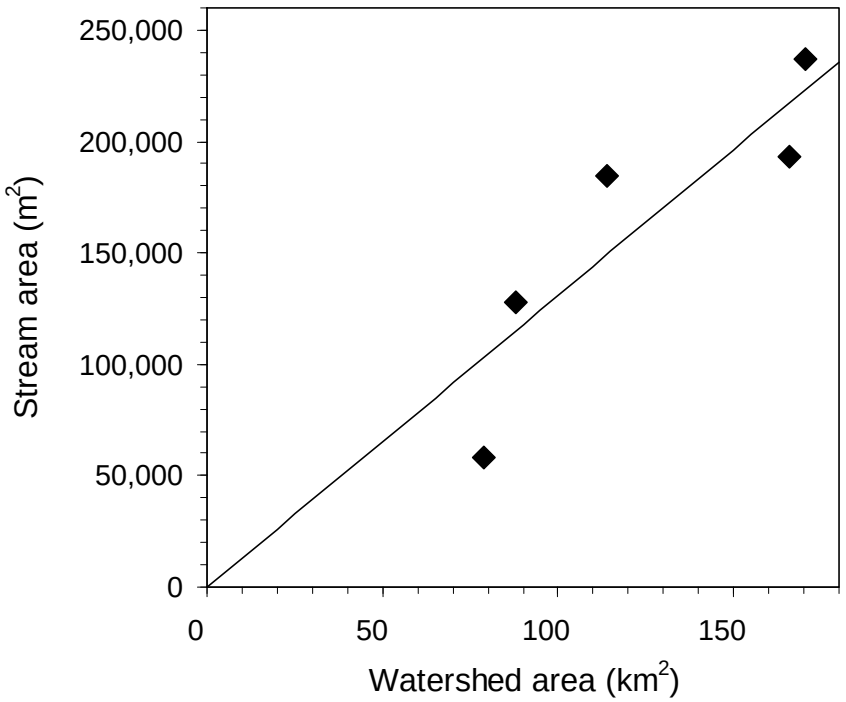

Figure 6. Relationship between watershed area and stream area in five PEI watersheds. The line shows the regression relation, with the line forced through the origin.

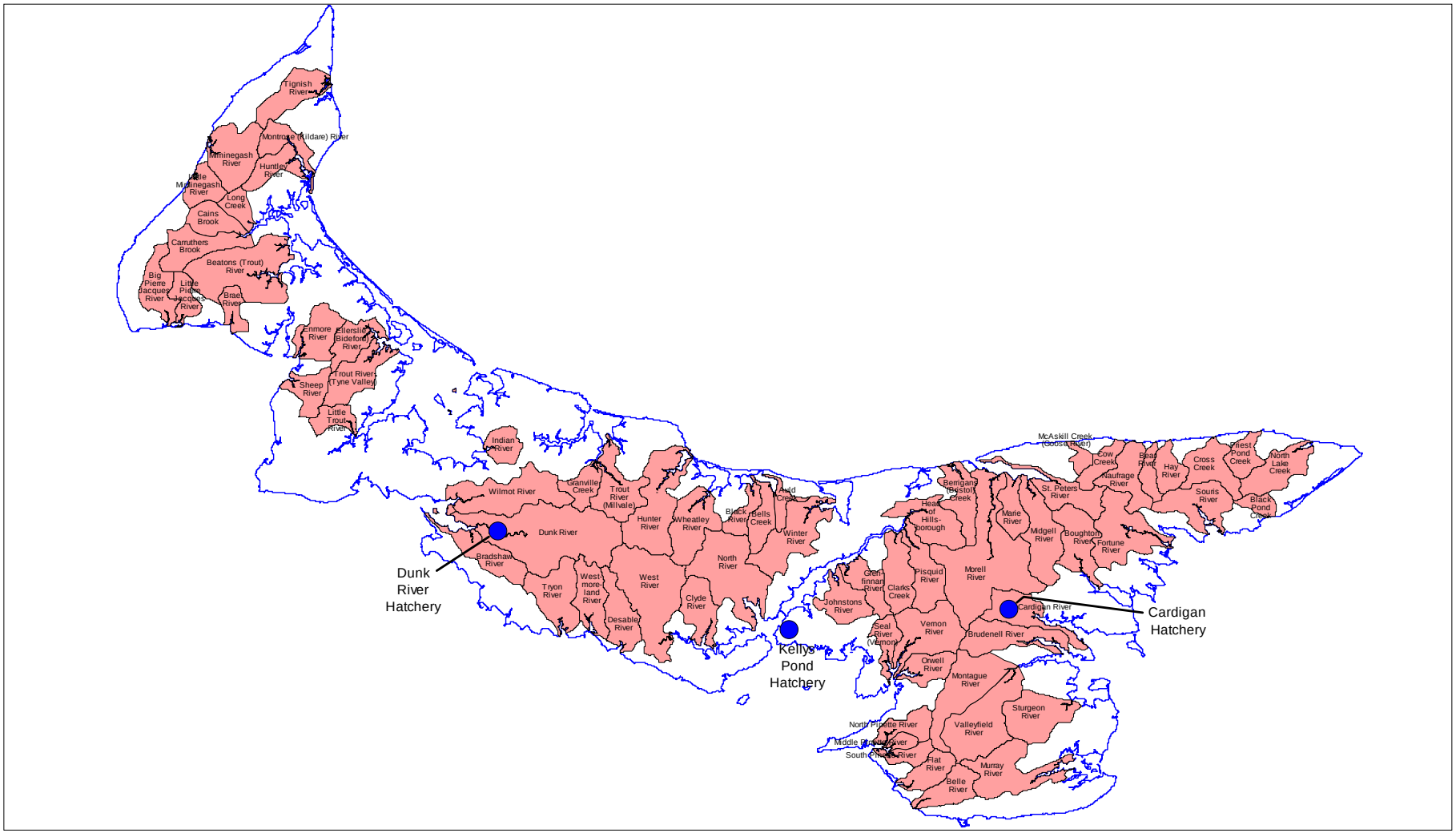

Figure 7. Watersheds of rivers in Prince Edward Island which likely contained salmon at the beginning of European settlement. Locations of the Dunk River, Kellys Pond, and Cardigan Hatcheries are also shown.

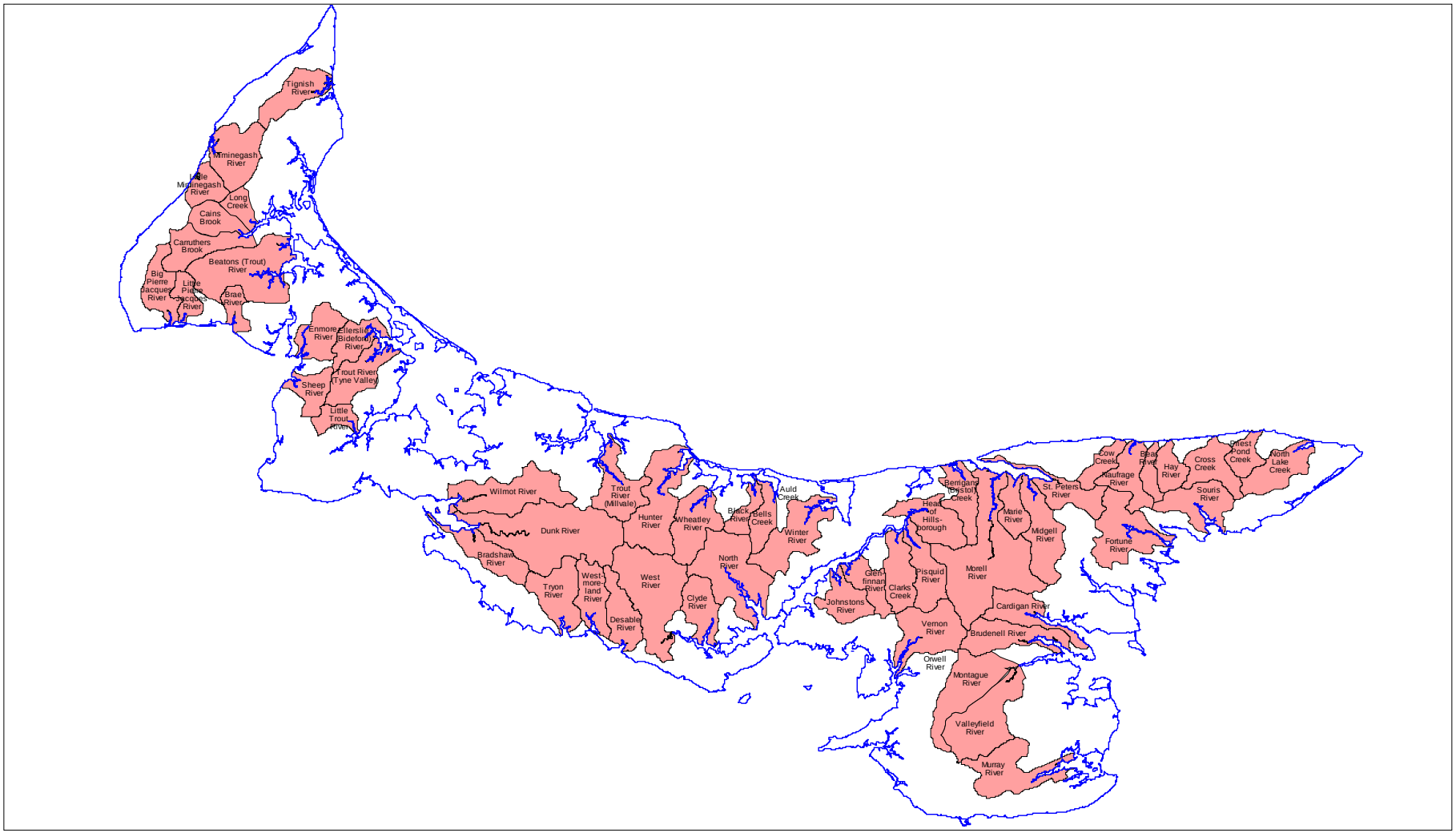

Figure 8.Watersheds of all rivers in Prince Edward Island which have been reported to contain salmon based on historic and current records.

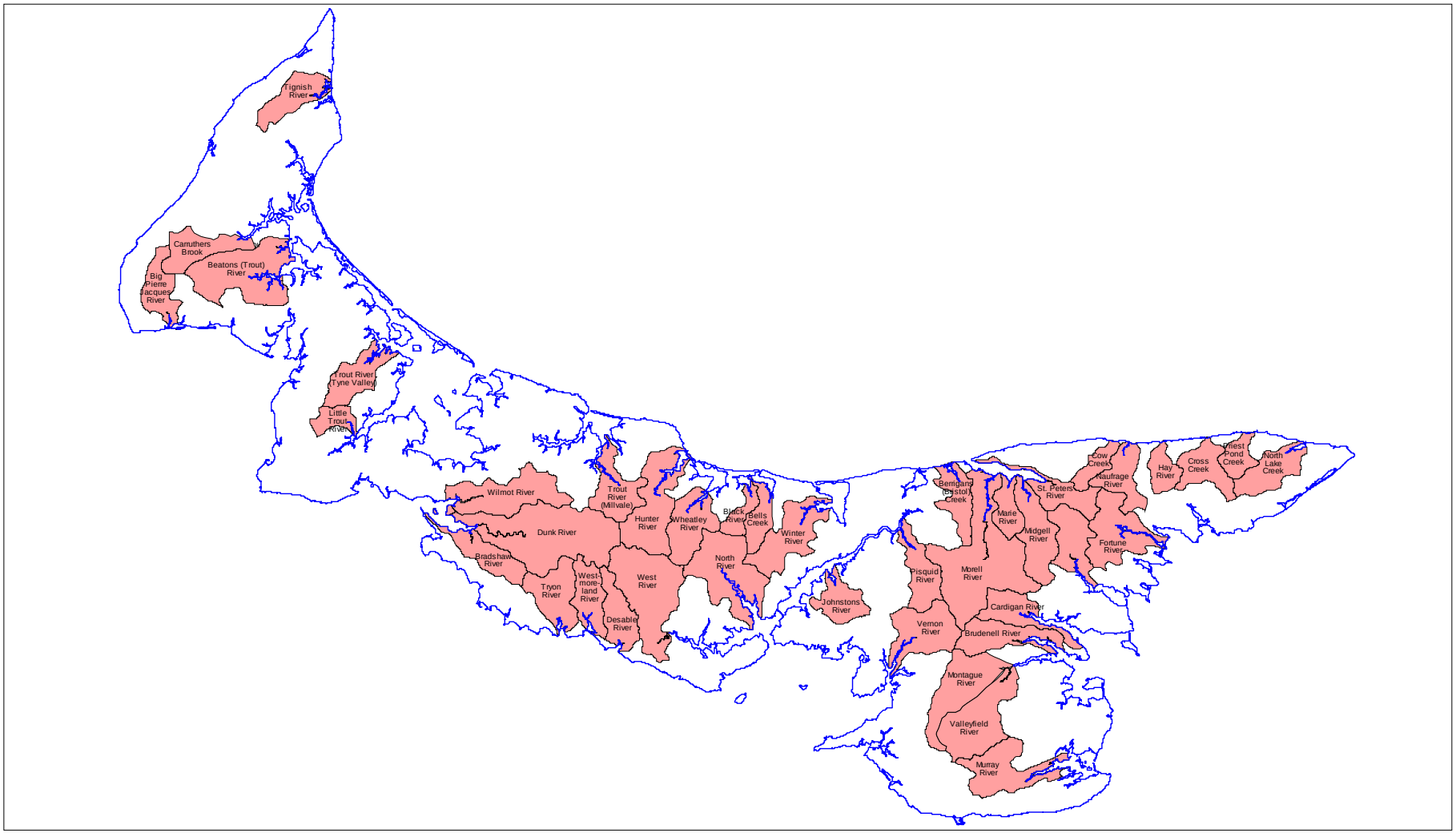

Figure 9. Watersheds of rivers in Prince Edward Island which were reported to contain salmon by Department of Marine and Fisheries from approximately 1880 to approximately 1910.

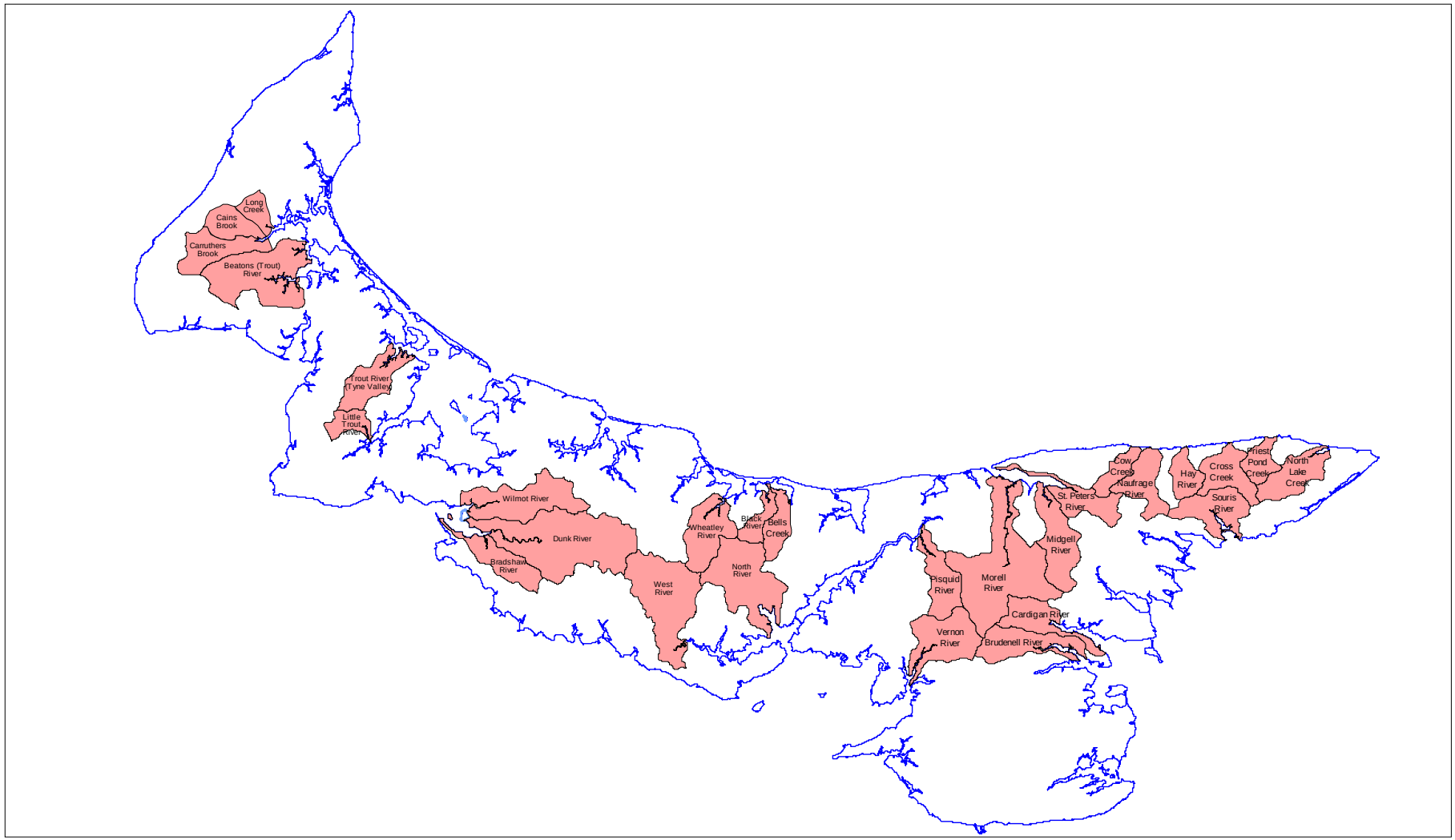

Figure 10. Watersheds of rivers in Prince Edward Island which were reported to contain salmon based on surveys conducted in 2000, 2001, or 2002.

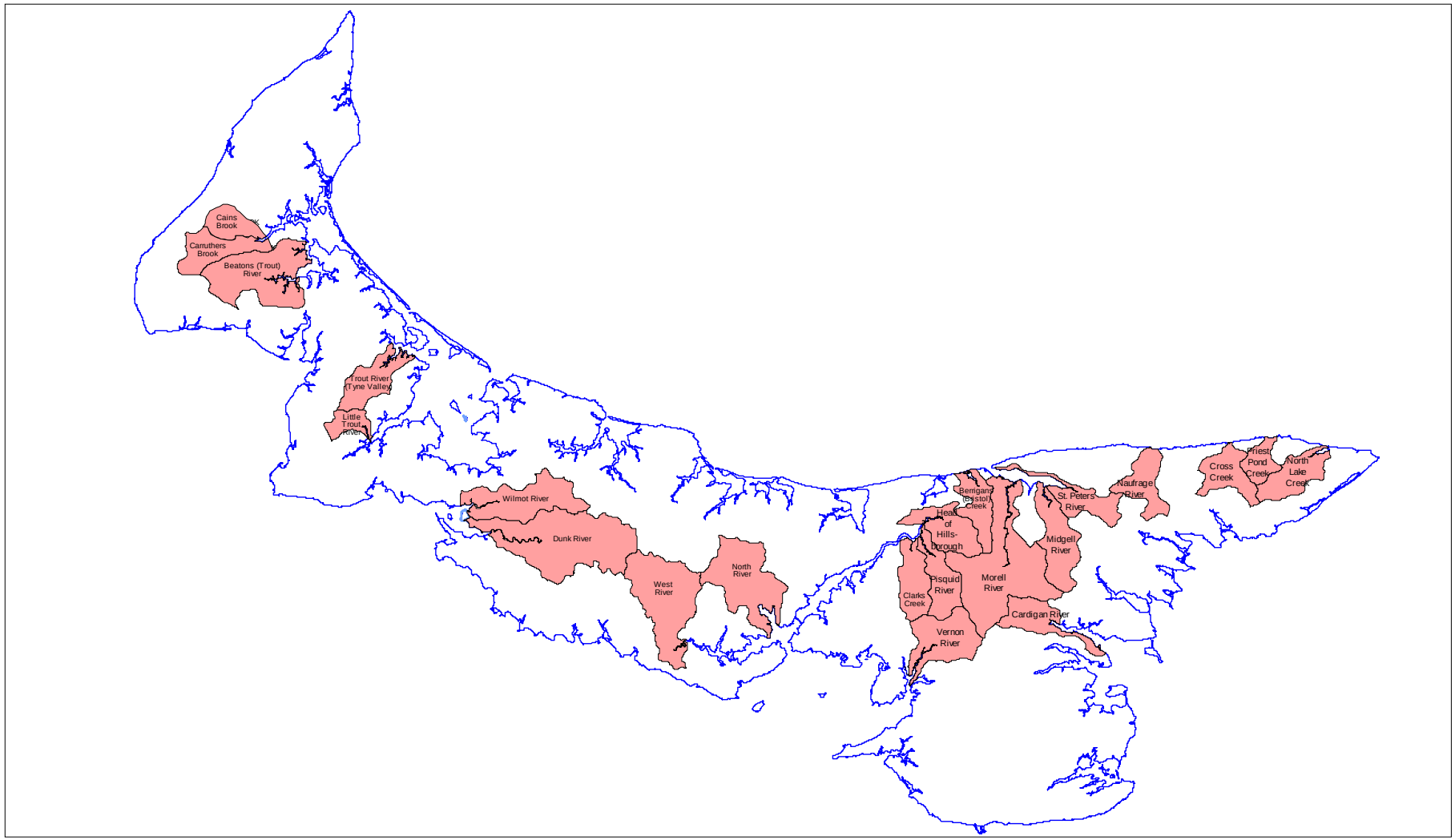

Figure 11. Watersheds of rivers in Prince Edward Island which were reported to contain salmon based on surveys conducted in 2007 or 2008.

Appendix 1. Numbers of Atlantic salmon stocked on Prince Edward Island, 1880 to 1960. Because records are incomplete, absence of data in a particular cell does not necessarily mean that stocking did not occur. Data sources: Department of Marine and Fisheries 1880-1915; Department of the Naval Service 1916-1921, Kellys Pond/Cardigan hatchery diary 1913 - 1960.

River name	Located near	1880 Fry	1881 Fry	1882 Fry	1883 Fry	1884 Fry	1885 Fry	1886 Fry
Broodstock origin		Mostly from the Dunk R, some from R. Phillip NS	Dunk R, Winter R, other PEI locations	Most, perhaps all, from Dunk R	Dunk R	Not reported	Dunk R	Possibly Dunk R, possibly NS
Tignish River	Tignish							
Mill River (Cains + Carruthers Brooks)	Cascumpique							
Beatons (Trout) River	Coleman	100,000	60,000			Yes		
Trout River Tyne Valley	Tyne Valley							
Indian River	Indian River							
Hy Brook, Morrisons Pond	Darnley							
Trout River	Millvale							
Hunter River	Hunter River					Yes		
Wheatley River	Wheatley River					Yes		
Black River	Brackley Point							
Bells Creek (Gurneys River)	West Covehead							
Winter River	Suffolk							
Morell River	Morell	100,000	60,000			Yes		
Marie River	Marie							
Midgell River	Midgell							
St. Peters River	St. Peters							
Schooner Pond	St. Peters							
McAskill Creek (Goose River)	Goose River							
Naufrage River	Naufrage							
Cross Creek	Hermanville							
North Lake Creek	North Lake							
Black Pond Creek	Black Pond, Red Pt.							
Souris River	Souris							
Rollo Bay	Rollo Bay							
Fortune River	Dingwells Mills							
Cardigan River	Cardigan							
Brudenell River	Brudenell		60,000			Yes		
Montague River	Montague					Yes		
Sturgeon River	Sturgeon							
Fox River	Murray River							
Murray River	Murray River							
Belle River	Belle River							
Vernon River	Vernon Bridge							
Forbes Creek (southeast branch of Fullertons Creek)	Mount Herbert							
Johnstons River	Johnstons River							
Glenfinnan River (Sherrys Creek)	Glenfinnan							
Head of Hillsborough River	Mount Stewart							
Hillsborough (East) River, unspecified location								
North River	Milton							
Clyde River	Clyde River							
West River	Bonshaw					Yes		
Desable River	Desable							
Westmoreland River	Crapaud							
Tryon River	Tryon							
Dunk River	Freetown	300,000	195,000			Yes		
Wilmot River	Wilmot Valley					Yes		
Miminigash River	Miminegash							
Skinners Pond	Skinners Pond							
Nail Pond	Nail Pond							
Bakers River[a]	Location unknown							
Curtisdale River[b]	Location unknown							
Inspector River	Location unknown							
Mores River[c]	Location unknown							
Trout Newbarton	Location unknown					Yes		
Total number released to wild		500,000	375,000	1,060,000	1,210,000	1,000,000	1,100,000	400,000
Number transferred to Cardigan rearing ponds								

Appendix 1 (continued).

River name	1887 Fry	1899 Fry	1900 Fry	1906 Fry	1907 Fry	1908 Fry	1909 Fry	1910 Fry	1911 Fry	1913 Fry	1914 Fry
Broodstock origin	Dunk R	Saint John R, Miramichi R, NB	Saint John R NB	Not reported	Saint John R, Miramichi R, NB	Miramichi NB	Miramichi NB	Miramichi NB	Miramichi NB	Miramichi NB	Miramichi NB
Tignish River											
Mill River											
Beatons (Trout) River	30,000						72,000		63,000		
Trout River Tyne Valley	30,000						72,000				
Indian River									63,000	72,000	80,000
Hy Brook											
Trout River Millvale	30,000										
Hunter River											
Wheatley River			75,000		60,000	60,000	72,000			72,000	80,000
Black River					60,000		72,000	72,000			
Bells Creek										72,000	
Winter River					160,000	200,000	370,000	432,000	189,000	72,000	80,000
Morell River			75,000		140,000	200,000	226,000	288,000	315,000	216,000	240,000
Marie River											
Midgell River					140,000		72,000	72,000		72,000	80,000
St. Peters River											
Schooner Pond											
McAskill Creek											
Naufrage River			75,000			100,000					
Cross Creek											
North Lake Creek	50,000					30,000					
Black Pond Creek											
Souris River											
Rollo Bay											
Fortune River					60,000	100,000					
Cardigan River											
Brudenell River											
Montague River											
Sturgeon River											
Fox River		25,000									
Murray River		25,000			60,000	80,000	72,000	72,000	63,000		
Belle River										200,000	80,000
Vernon River		75,000									
Forbes Creek											60,000
Johnstons River	50,000										
Glenfinnan River										72,000	
Head of Hillsborough R.											80,000
Hillsborough R, unspecified											
North River					30,000	50,000		72,000	189,000	144,000	160,000
Clyde River							72,000	72,000			
West River	50,000										80,000
Desable River	30,000										
Westmoreland River	30,000										
Tryon River	10,000										
Dunk River	100,000				80,000	80,000	72,000	72,000	63,000	72,000	100,000
Wilmot River	80,000										
Miminigash River											
Skinners Pond											
Nail Pond											
Bakers River[a]									252,000		
Curtisdale River[b]											
Inspector River	10,000										
Mores River[c]											
Trout Newbarton											
Total released to wild	500,000	125,000	225,000	720,000	790,000	900,000	1,172,000	1,152,000	1,197,000	1,064,000	1,120,000
To Cardigan rearing ponds											

Appendix 1 (continued).

River name	1915		1916		1917	1918	1919	1925	1926	1927	1928
	Fry	Finger-lings	Fry	Finger-lings	Fry	Fry	Fry	Stage not reported	Stage not reported	Fry	Fry
Broodstock origin	Miramichi NB		Miramichi NB		Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
Tignish River											
Mill River											
Beatons (Trout) River											
Trout River Tyne Valley										15,000	
Indian River	60,000							40,000			25,000
Hy Brook											
Trout River Millvale											
Hunter River			40,000								15,000
Wheatley River	70,000										
Black River											
Bells Creek											
Winter River	100,000	24,909	67,500					90,000	49,600	80,000	75,000
Morell River	230,000		120,000					234,987	160,000	222,900	207,653
Marie River											
Midgell River			67,500							15,000	15,000
St. Peters River								50,000	30,000	50,000	15,000
Schooner Pond										15,000	10,000
McAskill Creek											
Naufrage River								50,000	30,000	50,000	36,000
Cross Creek											
North Lake Creek											
Black Pond Creek											
Souris River											
Rollo Bay											
Fortune River								32,000		25,000	15,000
Cardigan River								50,000	30,000	25,000	25,000
Brudenell River											10,000
Montague River											
Sturgeon River											
Fox River											
Murray River											
Belle River	60,000		40,000					30,000			15,000
Vernon River											
Forbes Creek										2,000	
Johnstons River				1,000						25,000	15,000
Glenfinnan River			67,500						9,000		
Head of Hillsborough R.	60,000							50,000	30,000		25,000
Hillsborough R, unspecified											
North River	60,000		95,500						12,600	20,000	15,000
Clyde River											
West River	70,000		67,500					30,000	12,600		
Desable River											
Westmoreland River											
Tryon River											
Dunk River	160,000							90,000	90,000	150,000	100,000
Wilmot River									25,000		
Miminigash River											
Skinners Pond											
Nail Pond											
Bakers River[a]											
Curtisdale River[b]				355							
Inspector River											
Mores River[c]				1,000							
Trout Newbarton											
Total released to wild	870,000	24,909	565,500	2,355	1,000,000	510,175	859,379	746,987	478,800	694,900	618,653
To Cardigan rearing ponds											

Appendix 1 (continued).

River name	1929		1930	1931	1932	1933	1934	1935	1936	1937	1938	1939
	Fry	Finger-lings	Fry	Stage not reported	Stage not reported	Advanced fry	Stage not reported	Stage not reported	Stage not reported	Stage not reported	Stage not reported	Stage not reported
Broodstock origin	Not reported		Not reported	Some, perhaps all, from Morell R	Morell R	Not reported	Not reported	Not reported	Not reported	Morell R	Not reported	Not reported
Tignish River			31,680	49,500	20,000							
Mill River					20,300							
Beatons (Trout) River												
Trout River Tyne Valley												
Indian River												
Hy Brook					200							
Trout River Millvale												
Hunter River												
Wheatley River												
Black River												
Bells Creek						30,000	40,000	18,400				
Winter River	35,520		92,800	103,340	50,000	100,000	60,000	50,400	20,000	15,000		
Morell River	101,040	2,567	76,720	503,436	242,622	338,054	349,835	299,608	609,000	431,970	388,680	403,900
Marie River												
Midgell River			14,000	74,500	25,000	50,000	40,500	28,800	50,000	66,000		
St. Peters River			25,320	45,000	25,000	32,000	30,000	28,800	50,000	51,000	34,920	
Schooner Pond	15,000		14,000	25,000	24,000	25,000	36,000	38,400	48,000	30,000	53,200	
McAskill Creek									25,000	30,000		
Naufrage River	18,000		27,840	102,000	40,300	97,000	40,500	28,800	93,000	116,000	103,000	
Cross Creek			8,120	18,000						50,000		
North Lake Creek			8,120						25,000			
Black Pond Creek						25,000	23,000	20,000				
Souris River							40,000	22,800				
Rollo Bay						30,000						
Fortune River						47,300	30,000	28,800	40,000			
Cardigan River	18,000		25,200	50,000	23,400	24,000			60,085			
Brudenell River												
Montague River							40,500	50,000	85,000	81,600		
Sturgeon River						32,000	38,000	28,800	25,000	35,000		
Fox River												
Murray River				10,000								
Belle River												
Vernon River												
Forbes Creek												
Johnstons River			28,120	25,000	20,000	30,000						
Glenfinnan River												
Head of Hillsborough R.	33,000		25,320	50,000	24,000	35,000	40,500	38,400	50,000	51,000		
Hillsborough R, unspecified												
North River	25,000					32,000	40,000	38,400				
Clyde River												
West River												
Desable River												
Westmoreland River												
Tryon River												
Dunk River	60,000		80,200	200,000	100,000	96,000						320,000
Wilmot River												
Miminigash River					20,300	61,600	80,500	33,600				
Skinners Pond						17,800	23,000					
Nail Pond						17,800	23,000	20,000				
Bakers River[a]												
Curtisdale River[b]												
Inspector River												
Mores River[c]												
Trout Newbarton												
Total released to wild	305,560	2,567	457,440	1,255,776	635,122	1,120,554	975,335	774,008	1,180,085	957,570	579,800	723,900
To Cardigan rearing ponds												

Appendix 1 (continued).

River name	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950
	Stage not reported	Stage not reported	Stage not reported	Stage not reported	Stage not reported	Fry	Stage not reported	Stage not reported	Stage not reported	Stage not reported	Fry and advanced fry
Broodstock origin	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
Tignish River											
Mill River											
Beatons (Trout) River											
Trout River Tyne Valley											
Indian River											
Hy Brook											
Trout River Millvale											
Hunter River											
Wheatley River											
Black River											
Bells Creek											
Winter River											
Morell River	246,841	341,080	341,310	375,600	170,835	314,900	431,600	357,410	213,300	301,360	226,245
Marie River	20,000	40,000	24,000	30,000	10,000						
Midgell River	25,000	50,000	115,000	80,000	37,000	50,000	60,000	50,000	50,000		62,500
St. Peters River	25,000	50,000	30,000	30,000	25,000	40,000	50,000	50,000	50,000		40,000
Schooner Pond											
McAskill Creek											
Naufrage River											
Cross Creek											
North Lake Creek											
Black Pond Creek											
Souris River											
Rollo Bay											
Fortune River											
Cardigan River		50,000	60,000								
Brudenell River											
Montague River											
Sturgeon River											
Fox River											
Murray River											
Belle River											
Vernon River											
Forbes Creek											
Johnstons River											
Glenfinnan River											
Head of Hillsborough R.											
Hillsborough R, unspecified											
North River											
Clyde River											
West River											
Desable River											
Westmoreland River											
Tryon River											
Dunk River											
Wilmot River											
Miminigash River											
Skinners Pond											
Nail Pond											
Bakers River[a]											
Curtisdale River[b]											
Inspector River											
Mores River[c]											
Trout Newbarton											
Total released to wild	316,841	531,080	570,310	515,600	242,835	404,900	541,600	457,410	313,300	301,360	328,745
To Cardigan rearing ponds				60,000	100,000	162,000	150,000	50,000	50,000	125,000	300,000

Appendix 1 (continued).

River name	1951 Stage not reported	1952 Fry	1953 Fry	1954 Stage not reported	1955 Stage not reported	1956 Advanced fry	1957 Stage not reported	1958 Stage not reported	1959 Stage not reported	1960 Stage not reported
Broodstock origin	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
Tignish River										
Mill River										
Beatons (Trout) River										
Trout River Tyne Valley										
Indian River										
Hy Brook										
Trout River Millvale										
Hunter River										
Wheatley River										
Black River										
Bells Creek										
Winter River										
Morell River	109,500	238,200	300,000	229,900	12,360	267,800	218,000	36,520	29,800	25,000
Marie River										
Midgell River	22,000	95,000	110,000	105,000		100,000	86,000	40,000		21,200
St. Peters River	30,000	40,000	35,000	45,000		30,000	40,000			
Schooner Pond										
McAskill Creek										
Naufrage River		25,000	30,000			20,000	30,000			
Cross Creek										
North Lake Creek										
Black Pond Creek										
Souris River										
Rollo Bay										
Fortune River										
Cardigan River										
Brudenell River										
Montague River										
Sturgeon River										
Fox River										
Murray River										
Belle River										
Vernon River										
Forbes Creek										
Johnstons River										
Glenfinnan River										
Head of Hillsborough R.										
Hillsborough R, unspecified		15,000	20,000	15,000		20,000				
North River										
Clyde River										
West River										
Desable River										
Westmoreland River										
Tryon River										
Dunk River								21,000		
Wilmot River										
Miminigash River										
Skinners Pond										
Nail Pond										
Bakers River[a]										
Curtisdale River[b]										
Inspector River										
Mores River[c]										
Trout Newbarton										
Total released to wild	161,500	413,200	495,000	394,900	12,360	437,800	374,000	97,520	29,800	46,200
To Cardigan rearing ponds	400,000	306,000	50,000	300,000						

Appendix 1 (continued)

River name	Totals		
	Fry, and stage not reported	Finger-lings	Total
Broodstock origin			
Tignish River	101,180	0	101,180
Mill River	20,300	0	20,300
Beatons (Trout) River	325,000	0	325,000
Trout River Tyne Valley	117,000	0	117,000
Indian River	340,000	0	340,000
Hy Brook	200	0	200
Trout River Millvale	30,000	0	30,000
Hunter River	55,000	0	55,000
Wheatley River	489,000	0	489,000
Black River	204,000	0	204,000
Bells Creek	160,400	0	160,400
Winter River	2,492,160	24,909	2,517,069
Morell River	11,567,966	2,567	11,570,533
Marie River	124,000	0	124,000
Midgell River	2,041,000	0	2,041,000
St. Peters River	1,077,040	0	1,077,040
Schooner Pond	333,600	0	333,600
McAskill Creek	55,000	0	55,000
Naufrage River	1,112,440	0	1,112,440
Cross Creek	76,120	0	76,120
North Lake Creek	113,120	0	113,120
Black Pond Creek	68,000	0	68,000
Souris River	62,800	0	62,800
Rollo Bay	30,000	0	30,000
Fortune River	378,100	0	378,100
Cardigan River	440,685	0	440,685
Brudenell River	70,000	0	70,000
Montague River	257,100	0	257,100
Sturgeon River	158,800	0	158,800
Fox River	25,000	0	25,000
Murray River	382,000	0	382,000
Belle River	425,000	0	425,000
Vernon River	75,000	0	75,000
Forbes Creek	62,000	0	62,000
Johnstons River	193,120	1,000	194,120
Glenfinnan River	148,500	0	148,500
Head of Hillsborough R.	592,220	0	592,220
Hillsborough R, unspecified	70,000	0	70,000
North River	983,500	0	983,500
Clyde River	144,000	0	144,000
West River	310,100	0	310,100
Desable River	30,000	0	30,000
Westmoreland River	30,000	0	30,000
Tryon River	10,000	0	10,000
Dunk River	2,601,200	0	2,601,200
Wilmot River	105,000	0	105,000
Miminigash River	196,000	0	196,000
Skinners Pond	40,800	0	40,800
Nail Pond	60,800	0	60,800
Bakers River[a]	252,000	0	252,000
Curtisdale River[b]	0	355	355
Inspector River	10,000	0	10,000
Mores River[c]	0	1,000	1,000
Trout Newbarton	Yes	0	Yes
Total released to wild	36,905,805	29,831	36,935,636
To Cardigan rearing ponds			2,053,000

[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 Curtiss as landowners in the area.

[c]Might be the branch of the Sturgeon River where Moores Pond is located.

Appendix 2. Number of rainbow trout stocked on Prince Edward Island, 1880-1960. Because records are incomplete, absence of data in a particular cell does not necessarily mean that stocking did not occur. Data sources: Department of Marine and Fisheries, 1880-1915; Department of the Naval Service, 1916-1921; Kellys Pond / Cardigan hatchery diary, 1913-1960.

Broodstock origin		Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Saint John	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	
Dalvay Pond	Dalvay							5,000									5,000
Afton Lake	Tracadie Bay					10,372	11,000	23,620	14,459								59,451
Pisquid Pond, Morell River	Peakes	91,156	40,071	2,259	11,409	5,000	6,622	5,003	14,022								175,542
Cardigan River	Cardigan											25,000					25,000
Scales Pond, Dunk River	Freetown														10,000		10,000
O'Keefes Lake (landlocked)	Avondale											70,000			10,000		80,000
Glenfinnan Lake (landlocked)	Glenfinnan						9,762	24,220	17,659	11,657		77,485			13,310		154,093
Jimmy Jims (spelling is uncertain)	Location unknown					10,000											10,000
Total number released to wild		91,156	40,071	2,259	11,409	25,372	27,384	57,843	46,140	11,657	0	172,485	0	0	33,310	0	519,086
Number transferred to Cardigan rearing ponds											93,200	150,000	92,200	115,175	150,000	185,555	786,130