2.0 BACKGROUND

2.1 Prince Edward Island Physiography and Historical Information

Watercourses on Prince Edward Island may be called rivers, creeks or even brooks regardless of their size. All are small by mainland standards and the largest, the Dunk River and Morell River, are only about 25 m wide near the head of tide. Some streams as small as 3 metres in width as they approach salt water still have salmon runs. Springs are abundant on watercourses, and the numerous first and second order streams tend to make the total stream length within a watershed surprisingly long (Table 1). Only the uppermost reaches of streams run dry in summer because of the high proportion of spring water (about two-thirds of base flow) in most systems. Streams on Prince Edward Island generally have a high pH (normally from 6.5 – 8.5), and where wooded riparian zones are continuous, they possess cool summer water temperatures within the optimal range for salmonids. Nutrient levels in most streams are high (sometimes too high) and productivity is excellent.

Atlantic salmon populations probably became established on Prince Edward Island as ice disappeared after the last glaciation period. With ice melt and rising sea levels, the Island became isolated from the mainland some 5,000 years ago (DeGrace 1999). Limited numbers of other anadromous or freshwater fish were able to colonize Prince Edward Island, and Atlantic salmon and brook trout (*Salvelinus fontinalis*) had little competition within freshwater habitat and colonized most of the larger stream systems. Currently, some sticklebacks, American eels (*Anguilla rostrata*) and in a few rivers, white perch (*Roccus americanus*), red bellied dace (*Chrosomus eos*) and slimy sculpins (*Cottus cognatus*) are the only other common fishes. Other fish which use freshwater ecosystems for spawning and early growth include gaspereau or alewives (*Alosa pseudoharengus*), blue-backed herring (*Alosa aestivalis*), rainbow smelt (*Osmerus mordax*) and more recently, expanding populations of introduced rainbow trout (*Salmo gairdneri*).

Figure 1. The Midgell River estuary.

Prince Edward Island has a long coastline (1600 km) and is indented with numerous bays and estuaries, largely the result of drowned river valleys from glacial times. Many estuaries, especially on the northern coastline, have low tidal energy - the height difference between high and low tide is about twice as high on the south shore as compared to the north shore - and long water residence times. The water residence times, warm water temperatures, and high concentrations of nutrients from freshwater cause many estuaries to become over-enriched. The prolific growth of aquatic vegetation, such as sea lettuce (*Ulva lactuca*), is now common in summer. Later, as decay occurs, especially during calm weather, hypoxic events (low oxygen levels) may become widespread, having a negative impact upon shellfish and finfish. The expansive nutrient-rich estuaries provide essential habitat for growth of many anadromous and marine species which are of importance to the recreational and commercial fisheries and in these areas, nutrient problems need to be addressed.

Table 1. Total area, stream length, forest area and percent forest cover per drainage basin for Class I, Class II, Class III, Class IV and Class V Atlantic salmon rivers in Prince Edward Island.

River	Area (ha)[a]	Stream Length (km)[b]	Area Forested (ha)[c]	Percent Forested (%)
Class I				
Cains Brook	2983	34.77	1935	65
Carruthers Brook (Mill River)	4978	47.6	2856	57
Cross River	4508	48.6	3695	82
Naufrage River	4430	60.0	3242	73
North Lake Creek	5147	49.7	3582	70
Pisquid River	3864	38.6	2290	59
Priest Pond Creek	2397	25.5	2063	86
St. Peters River	3396	42.5	1874	55
Trout River (Coleman)	5271	46.8	2021	38
West River	10174	138.6	5153	51
Class II				
Clarkes Creek	4350	38.4	2161	50
Dunk River	14189	152.9	3671	26
Midgell River	6076	77.5	4057	67
Morell River	17166	177.9	9897	58
Vernon River	7179	70.6	3241	45
Class III				
Bristol Creek	4263	33.5	2508	59
Cardigan River	3004	34.5	1846	61
Head of Hillsborough	3693	33	2242	61
Little Trout River	2337	25.3	1365	58
North River	7421	43.4	1326	18
Wilmot River	6540	54.3	742	11
Trout River/Bank Brook (Tyne Valley)	3224	47.9	2004	62
Class IV				
Bells Creek	2336	19.2	699	30
Black River	1709	14.9	475	28
Bradshaw River	3944	34.2	643	16
Brudenell	3711	32	1461	39
Cow Creek	2252	28.4	1834	81
Hay River	2331	26.4	1959	84
Little Pierre Jacques	2613	24.9	1358	52
Marie River	2618	28.3	1245	48
Souris River	3067	30.8	1835	60
Valleyfield Rive	8646	78.2	5522	64
Wheatley River	3647	33.3	706	19

[a]PEI Watershed Layer, [b]PEI Watercourse Network, [c]PEI Corporate Landuse Inventory 2000

The first Atlantic salmon hatchery on Prince Edward Island was completed in 1879 and located on the Dunk River, a short distance from the head of tide (Dupuis 2008). In its first year of operation, salmon broodstock from the Dunk River and River Phillip in Nova Scotia were used as a source of eggs. The trend in the Maritimes over the next few decades was to regularly transfer salmon eggs from hatchery to hatchery for dispersal. Hence, many of the young salmon released on Prince Edward Island came from New Brunswick, especially the

Miramichi River and St. John River, or Nova Scotia (Margaree hatchery or Bedford hatchery). Movement of Atlantic salmon eggs was a “two way street” as indicated in this note from the 1934 Federal Government Hatchery Report: “2,419,800 eggs from Morell River. 500,000 each shipped to Grand Falls, Restigouche and Antigonish hatcheries”. One has to wonder how a river the size of the Morell could regularly provide the number of eggs collected. For instance, a 1935 note from the Federal Government Hatchery Report states: “1935 – 3,516,000 eggs taken from Morell River. 1,240,000 shipped to Bedford N.S. hatchery (eyed). Note: 1,032 salmon caught between Oct 11 and Nov 18, one night during the season holes were cut in the retaining net and 284 salmon escaped before repairs could be made.”

Salmon caught for broodstock in the Morell River were held in net cages located at the end of the Hatchery Road (clay road off Route 322). According to Miles Matheson who became a fisheries officer for the area in 1967, the salmon were “milked” on site and the spent salmon returned to the river. He also told me that the last year they operated the trap on the Morell River only seventeen fish were caught (Matheson, pers. comm.).

Until the mid 1900s, Atlantic salmon were stocked in numerous rivers on Prince Edward Island and occasionally ended up in small streams such as Hyde Creek in Cornwall or Fox River (Wilmot, near Murray Harbour). As might be expected, without continued stocking, with ongoing environmental problems and the arrival and spread of beavers (especially since 1960), Atlantic salmon runs have disappeared from many streams on Prince Edward Island. It is impossible to determine accurately how many Prince Edward Island streams once had annual runs of Atlantic salmon, either through stocking or original populations, since many of the streams lost their salmon populations many decades ago. I have documented salmon adults or juveniles in 55 drainage basins, in 1960 or later, using electrofishing surveys, angling observations, information from written reports, and oral reports from informed sport fishermen and mill operators. Obviously, many other streams on Prince Edward Island had Atlantic salmon runs that disappeared before 1960. A more detailed account of salmon presence in Prince Edward Island streams and an indication of when they may have disappeared can be found in Cairns et al. (2009).

In 2008, there were thirty active watershed groups on Prince Edward Island (Ledgerwood, pers. comm.). Members of these groups are obviously concerned about salmonid populations, especially brook trout. There is a strong desire to improve habitat and populations of salmonids but direction and expertise are sometimes lacking. Normally, habitat improvement for Atlantic salmon will also benefit populations of brook trout. However, if groups are not aware of critical habitat for Atlantic salmon, such as spawning and nursery areas, “enhancement work” may not favour salmon populations. The federal Department of Fisheries and Oceans has jurisdiction over anadromous fish on Prince Edward Island but various provincial agencies, such as the Department of Environment, Energy and Forestry, Department of Transportation and Public Works, and Department of Agriculture play leading roles in helping to improve water quality in watercourses.

2.2 Brief History of Land Use on Prince Edward Island

When Europeans first arrived on Prince Edward Island, they found a landscape densely covered with forests, later described as part of the Acadian Forest Region. On the uplands hardwoods prevailed, with yellow birch (*Betula alleghaniensis*), sugar maple (*Acer saccharum*) and American beech (*Fagus grandifolia*) being particularly common. Many of the shaded stream valleys had an abundance of eastern hemlock (*Tsuga canadensis*), white pine (*Pinus strobus*), and red spruce (*Picea rubens*). The western part of the province had pockets of dense northern white cedar (*Thuja occidentalis*) and American elm (*Elmus Americana*), white ash (*Fraxinus americana*), and tamarack (*Larix laricina*). Black spruce (*Picea mariana*) and red maple (*Acer rubrum*) were common in many regions, with white spruce (*Picea glauca*) dominating the windy, salt sprayed coastal landscape.

European settlement of Prince Edward Island was initially connected with transportation routes – the coastline and navigable waterways. After the Island was surveyed into lots by Samuel Holland in 1765, many more roads were built to supplement water routes and winter ice roads. With population growth and the prominence of the shipbuilding industry of the mid 1800s, much forest land was cleared for agriculture and the forests were high graded to build sailing ships and supply cargoes of lumber. By the late 19th century, Prince Edward Island had a population of about 100,000, widely distributed throughout the tiny province. Power to run the grist mills, starch mills, lumber mills, woolen mills and even electrical generation plants came from water. Mills were located where a good “head of water” could be obtained by damming off a stream. Lumber mills often dumped their sawdust directly into the river and most mills would act as a partial blockage to anadromous fish. Former mill operators describe how salmon would try to jump up the “paddle wheel” as the pond was refilling and before the bypass was again operable.

Some of the original mill ponds were later used primarily for recreational purposes and many new ponds were developed during the last half of the 20th century. The Agricultural Rural Development Act (ARDA) provided funds to help with dam construction. Private individuals built dams, as did non-government groups such as Ducks Unlimited, often in collaboration with the provincial Fish and Wildlife Division or private landowners. Fish passage at many of these ponds was compromised – some did not have fish ladders and those that did could not accommodate anadromous fish such as smelt. A pond-building technique that initially released large amounts of sediment to downstream habitat was the traditional “run around bypass” pond, where the connection between the pond and stream below was a bulldozed trench the width of a tractor blade. With time, much erosion occurred in these crude bypass structures. However, many of these bypass ponds still remain and provided the entry to the pond was constructed far enough upstream from the dam (thus lower gradient for stream flow), the bypass channels still allow passage of all species of fish, including smelt.

When several ponds are constructed close together on the same watercourse, water quality can become compromised in summer and winter. For instance, near the headwaters of the Glenfinnan River, the late Harold Jenkins owned nine ponds. Two additional ponds immediately downstream are owned by the provincial government. This creates an exceptional area for waterfowl and other wildlife species. While water quality within the impoundments can become inhospitable for salmonids in summer, water temperatures and dissolved oxygen downstream quickly recover because of the input of spring water. The recovery of summer stream water temperatures depends upon the system. For example, elevated water temperatures in outflowing water at Larkin's Pond on the Naufrage River do not recover to acceptable levels for brook trout until large springs join the main river some four kilometres downstream (MacFarlane 1999). Man-made and beaver blockages in the Grovepine branch of the Fortune River have caused summer water temperatures to exceed tolerable levels for salmonids and oxygen levels likewise fall well below minimum accepted concentrations. As a result, water quality is compromised in much of the main branch of the Fortune River, down to the head of tide.

Figure 2. MacMillans Pond on the Vernon River.

Agriculture has had a profound impact on the Prince Edward Island landscape over the past couple of centuries. Original settlement patterns led to mixed farms throughout the province, albeit some were on poor quality land. The late 1800s were a time of peak deforestation in favour of farming, but over the next half century, forests reclaimed much of the hilly or wet farmland. Oats was in demand for horses, both on and off Prince Edward Island but when oats would no longer grow, the land had to be abandoned. Until about 1960, long crop rotations, small fields and mixed farming were the norm. In the 1970s, the "development plan" pumped enormous quantities of "ten cent dollars" (the Province's portion of the cost was 10%) into the economy and thousands of farmers sold their land. Larger fields, fewer farmers, bigger machinery, shorter crop rotations and a reliance on monoculture became prevalent. Soil erosion has always been a problem because of the nature of the soil on Prince Edward Island. However, the new trends in agriculture exacerbated the extent of soil erosion and nutrient enrichment in surface water. New guidelines and regulations have been adopted after many studies and reports, but wind and water erosion, as well as nutrient inputs to both surface and ground water, remain major environmental challenges.