MORELL RIVER ATLANTIC SALMON MANAGEMENT PLAN

Prepared by
Morell River Management Cooperative

Funded by
Atlantic Salmon Conservation Foundation

2023

March 2023

Morell River Atlantic Salmon (*Salmo salar*) Management Plan

By

H. Murnaghan

Morell River Management Cooperative Ltd.

2720 Mount Stewart Road, Route 22

Peakes, PE, C0A 1T0

902-583-3144

Acknowledgements

In recent years, Morell River Management Cooperative's Atlantic salmon habitat enhancement work, surveys, and monitoring projects have been guided by recommendations in *A Renewed Conservation Strategy for Atlantic Salmon (2019)* written by Daryl Guignion, Connie Gaudet and Rosanne MacFarlane. After following the recommendations outlined in the strategy, MRMC felt that a detailed plan specific to the Morell River was needed to ensure that the future work of the group incorporates best management practices and focuses on priority enhancement and monitoring efforts.

MRMC is grateful to the Atlantic Salmon Conservation Foundation for providing funding for this project. Thank you to the PEI Watershed Alliance for providing a Salmon Management Plan template for watershed groups on PEI. Thank you to the many conservationists, salmon experts, members of Abegweit First Nation, MRMC board members, anglers, and local community members that provided valuable input and perspective.

Most of the photos featured in this document were taken by MRMC's Watershed Coordinator, Hannah Murnaghan. Permission has been obtained for the use of other featured photos. MRMC would like to thank everyone that shared photos for this document. Additional photos and maps accessed through Morell River Management Cooperative's Google Drive.

Watershed enhancement work is always evolving and survey and monitoring techniques are always advancing. This management plan is intended to be a living document that can be updated with new data and new management recommendations as we continue to learn what is best for the river and the species that call it home.

Cover Photo: Aerial shot of the Morell River. Photo Credit: Century 21, used with permission.

Table of Contents

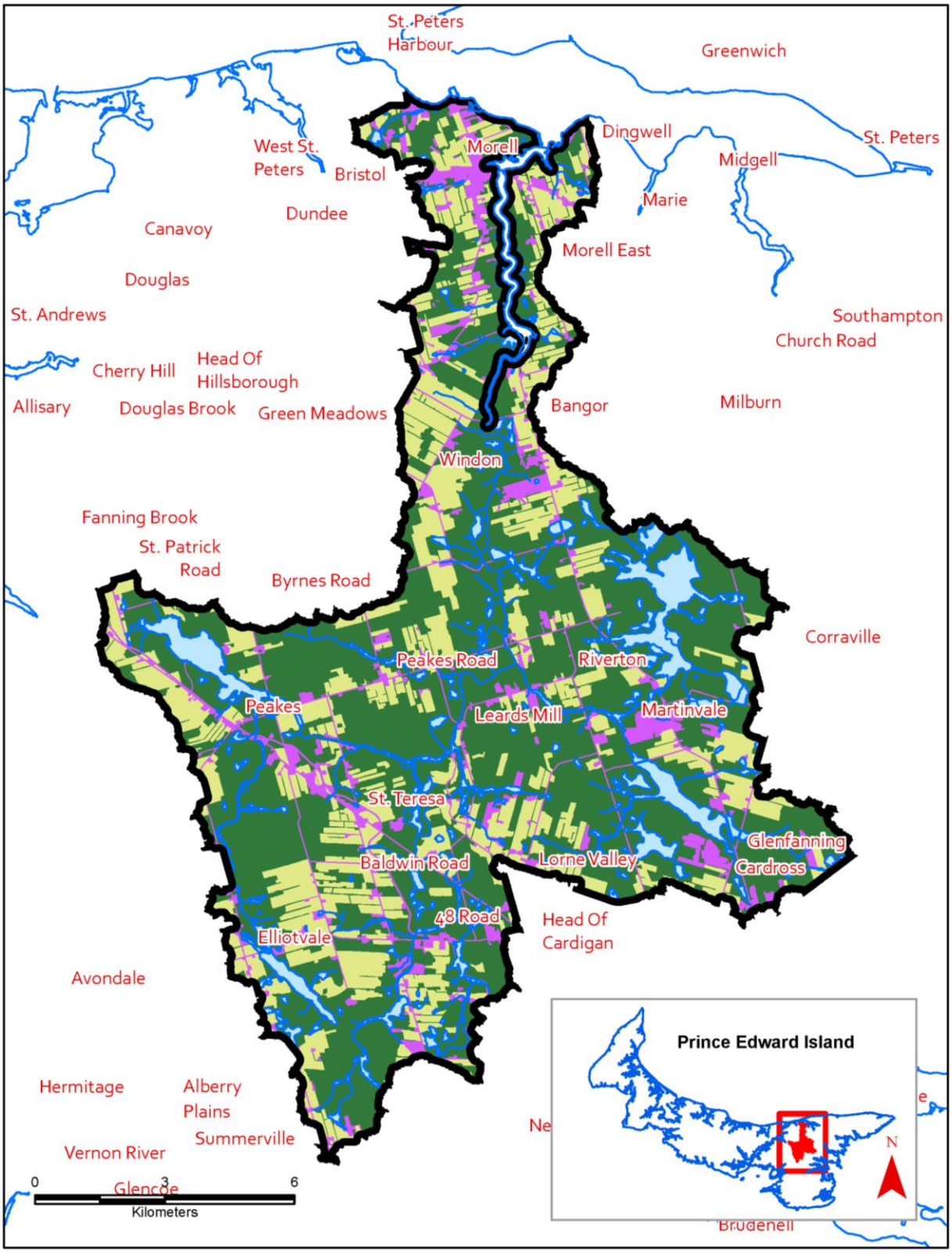
Main branch of the Morell River.

The Morell River Watershed

The Morell River is located in eastern Prince Edward Island and is one of four rivers that comprise the St. Peter's Bay drainage basin. Flowing due north into St. Peter's Bay, the Morell is one of the largest river systems on PEI with an area of 175.49 km^2. Travelling upstream from St. Peter's Bay, the first 8km of the Morell is a long narrow estuary with erratic tidal fluctuations. This brackish section of the Morell is very popular for early season brook trout anglers.

The tidal influence of St. Peter's Bay ends at Indian Bridge which marks the start of the main branch. The first 6.8km of the main branch provides popular fishing pools and an excellent canoe route. Just above Grant's Bridge on the Peakes Road, the river splits into the east and west branches. This split is known as 'the forks' and has been a very popular angling location for centuries. The spring-fed headwaters of the Morell River begin as far as Cardross to the east and extend past the 48 Road on the south branch. The west branch is fed by Pisquid Pond and springs above the Elliotvale Marsh. The best Atlantic salmon habitat is found along the main river and first few kilometers of each branch.

Morell River downstream of Indian Bridge Road. Photo Credit: Century 21

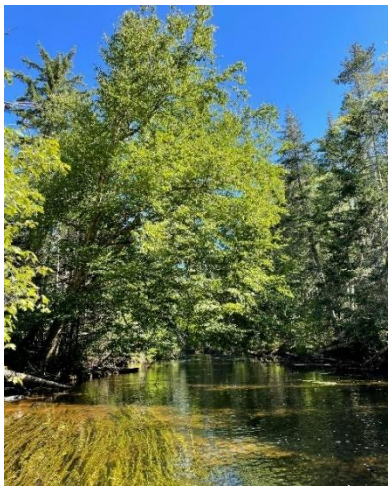


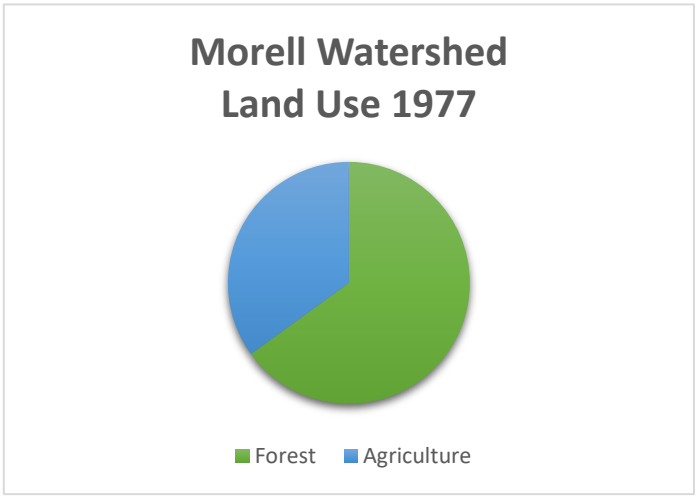
Map of the Morell River Watershed. Map provided by PEI Dept. of Environment, Energy and Climate Action.

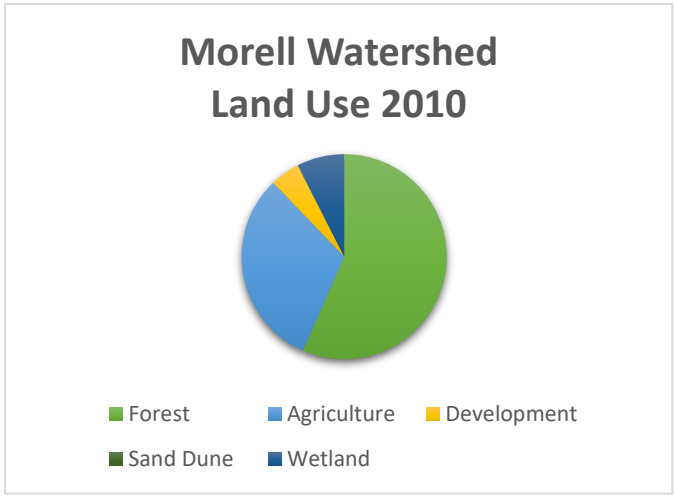
The Morell River watershed provides quality habitat for numerous species of native fish and wildlife. Large runs of migrating rainbow smelt and gaspereau provide cover and food for brook trout and juvenile salmon. The abundant marshes and wetlands provide ideal breeding habitat for waterfowl and are home to furbearers such as mink, common muskrat and American beaver. In the woodlands you can find other species including snowshoe hare, red fox and eastern coyote. In the spring, the melodies of warblers and other migrating songbirds can be heard along the riverbanks. The river's unfragmented forested riparian zone connects the various habitats found throughout. Thanks to the foresight of Morell area residents, the wilderness of the Morell River remains so today as a legacy of the Morell River Conservation Zone.

"A Hundred years ago much more of the Island was cleared and small farms existed even in areas where soils were marginal for crop production. The Morell area was no exception and today one can see the remnants of old homestead reverting back to woodland. Many of the fields that once extended to the edge of the river are now abandoned and so once again the River has acquired a "wild" appearance. Several species of wildlife became extinct on Prince Edward Island before the turn of the present century but for those that remain, the Morell River provides some of the best habitat found on the Island."

– Jubilee Seniors Club (1980)







Land use 1977 (Ducharme, 1977). *Land use 2010* (2020 PEI Water Quality Report Cards, 2022).
Updated land use data from the PEI 2020 land inventory will be available in the spring of 2023.

Morell River Conservation Zone

A Legacy to Take Pride In

The residents of the Morell area have always held great pride for their river. It is a place that holds fond memories for many. The Morell River provides recreation for anglers, paddlers, hunters, and trappers. It is a destination for school field trips for elementary to post-secondary students. Its freshwater habitats produce impressive runs of many fish species and the freshwater marshes are home to many mammals and waterfowl. Being one of the largest watersheds on PEI and holding so much ecological value, Morell area residents felt the need to protect it.

In 1972, a group of concerned citizens formed the Morell and Area Land Use Steering Committee to lobby the provincial government to protect the Morell River from a proposed cottage development. The committee met with all the landowners along the river and obtained signatures in support of the conservation zone from almost everyone. With the support of the provincial Environment Minister, the late Gilbert Clements, and majority support from landowners, in June of 1975 the Morell River Conservation Zone was legislated. The Morell River Conservation Zone, also known as the 'green belt,' remains in place today protecting 60 meters of riparian area on both sides of the river for a total of 44 km.

Morell River below Indian Bridge Road. Photo credit: Century 21.

The designation of the Morell River Conservation Zone is to obtain the following objectives:

(a) to maintain the recreational value of the Morell River

(b) to retain its unspoiled state for the use and enjoyment of present and future generations

(c) to protect the Morell River from encroachment of undesirable and incompatible land uses

Legislation for the Morell River Conservation Zone can be found in the Prince Edward Island Planning Act: Subdivision and Development Regulations

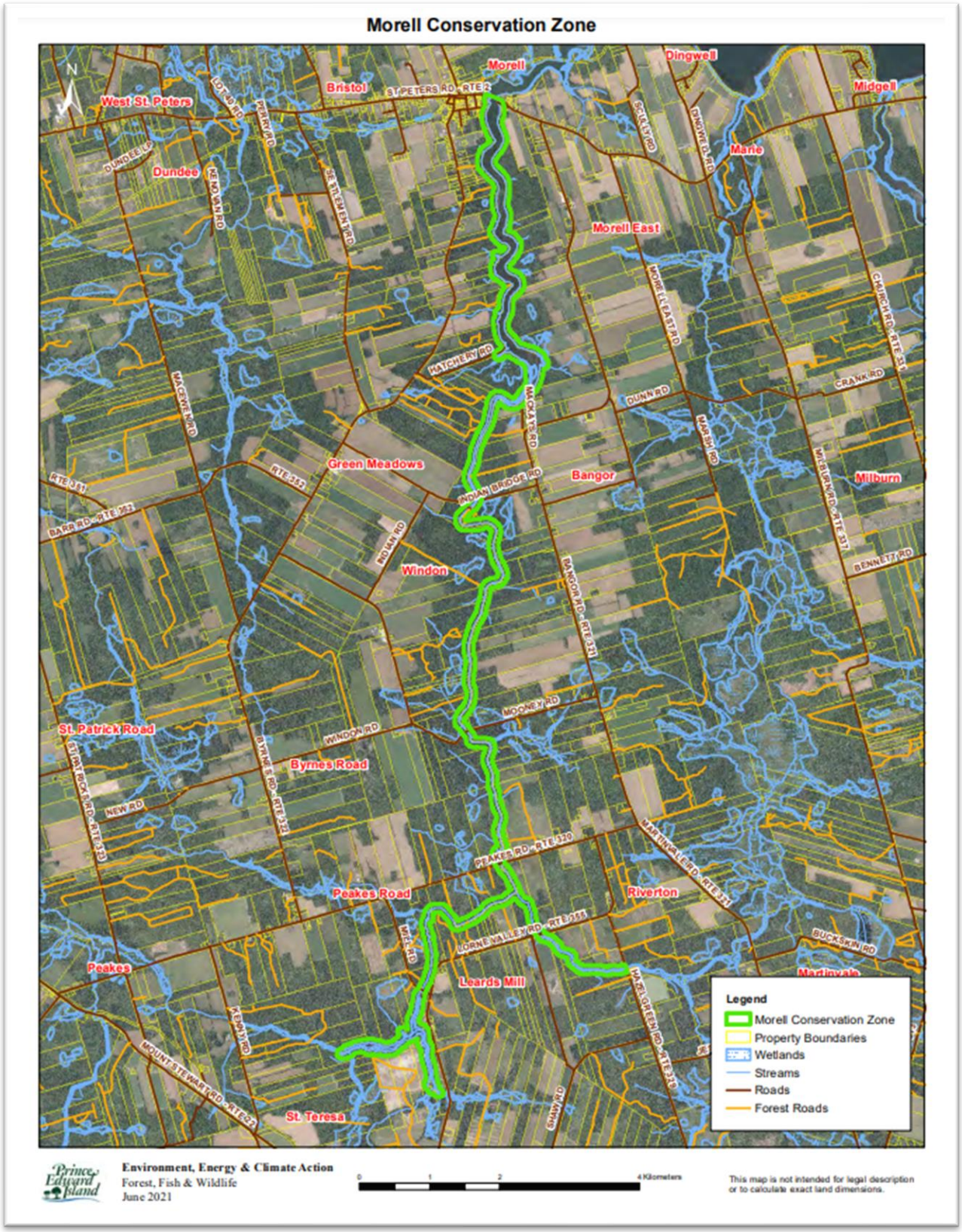
Morell River Conservation Zone Legislation

Main branch of the Morell River in October. Photo Credit: Santina Beaton-MacEachern

"In a densely populated province like PEI, finding wilderness can be difficult. But when you drift down the Morell River in a canoe, you feel like you are truly in a wilderness. I have watched a bald eagle fail in its attempt to pick up a large salmon on its fall spawning run in the Morell River. I have been fishing by myself in an isolated section of river and been serenaded by a pack of coyotes who seemed to be uncomfortably close. On another fishing excursion, I have been followed by a barred owl moving from tree to tree, curious about what I was doing. Every day is different on the Morell"

-Daryl Guignion, founding member of the Morell and Area Land Use Steering Committee (Island Tourism, 2017)

Main branch of the Morell River at the bottom of Mooney Road.



Map provided by the PEI Department of Forest, Fish and Wildlife.

Mi’kmaq First Nations

Indigenous people living on the land now known as Prince Edward Island are the Mi'kmaq. They have lived on the traditional Mi’kmaq territory, known as Mi’kmaki for at least 12,000 years. The Mi’kmaq are the only people native to PEI. The Mi'kmaq originally named PEI as 'Epekwitk', meaning "lying in the water". They lived in an annual cycle of seasonal movement between living in dispersed interior winter camps and larger coastal communities during the summer (Indigenous Tourism, 2022). The traditional Mi’kmaq name for the Morell River is Puku’samkek Sipu which means “at the place, in the river, where there are plenty of clams in the sand” (Inglis, 2019).

PEI has four indigenous reserves, one of which is located along the Morell River just above Indian Bridge. The Morell Reserve is held by the Abegweit First Nation and includes 189 acres with river frontage along the west bank of the Morell River. The Morell is a traditional location for fishing Plamu (Atlantic salmon). The Abegweit First Nation is involved in stock enhancement and conservation of salmonids on PEI through the Abegweit Biodiversity Enhancement Hatchery and the Abegweit Conservation Society. The hatchery produces Atlantic salmon and brook trout for the PEI Fish Stock Enhancement Program and the Plamu’k na Kitapina’q (Salmon are our Friends) Program. The Abegweit Conservation Society has an ecosystem approach to conservation and has been building their capacity to pursue conservation and restoration projects throughout PEI.

As part of the Plamu’k na Kitapina’q Program, Mi’kmaq elder Judy Clark performed a traditional ceremony to bless the Plamu before they were released into the Morell River (2018).

Morell River Management Cooperative works closely with Abegweit Biodiversity Enhancement Hatchery by assisting with fish releases and broodstock collection for the fish stocking program. Many of the Salmon are our Friends Program fish releases take place on the Morell River. The MRMC crew always looks forward to helping with the fish friends release events. MRMC has built a positive relationship with the Abegweit Conservation Society, working together to complete watershed enhancement projects on the Morell and Midgell Rivers. We look forward to this continuous relationship as their values continue to align with ours.

Abegweit Biodiversity Enhancement Hatchery

"Launched in 2012, the Abegweit Biodiversity Enhancement Hatchery raises indigenous fish species to restock Island rivers. This important work stems from a critical element of Mi'kmaq culture – the obligation to give back to the environment. The hatchery also plays an educational role to ensure that the younger generations are aware of the importance of the Island fishery and the role each of us can play in preserving it.
The Abegweit Biodiversity Enhancement Hatchery, the Island's only hatchery that has a restocking program operates under the Abegweit First Nation Fisheries and Natural Resources program. Currently, brook trout and Atlantic salmon are raised at the facility, which is located in Scotchfort, Prince Edward Island. Atlantic salmon is culturally significant to the Mi'kmaq community and is often used in ceremonial rites.
The Abegweit Biodiversity Enhancement Hatchery was created to fill a gap when a previous hatchery stopped producing fish for stocking rivers. Its primary goal is to enhance the Island's recreational fishery, which draws in tourists and contributes more than $7 million to the Island economy." (Abegweit Biodiversity Enhancement Hatchery, 2022)

Abegweit Conservation Society

"The Abegweit Conservation Society is a collective of passionate individuals dedicated to the beauty and health of Prince Edward Island. We boast a strong conservation ethic and work tirelessly to integrate this ethic into Island consciousness. The Society values and nurtures the natural interconnections between land, sea and air. We develop, implement and support preservation, protection and enhancement programs to benefit our cherished land." (Abegweit Conservation Society, 2023)

Recreational Use

Angling

The Morell River is arguably the most popular river for angling on PEI and has been for centuries. Angling on PEI has changed over the years. Historically, islanders fished ponds near their homes or within their local communities. As the means of transportation improved, people could travel farther for angling oppertunities (MacFarlane, pers. Comm). Today many people now take part in salt water angling and people from all across the province travel to the Morell River for angling oppertunities.

On opening day of the angling season, the trans-Canada highway in Morell is lined with vehicles, boat trailers and campers as anglers flock to the estuary of the Morell River. The brackish portion of the Morell is known for its early season catches of large sea-run brook trout and Atlantic salmon kelts. In 1991 an estimated 500 anglers were on the river for opening day.

Angling pressure lessens throughout the season but popular areas including Grant's Bridge and Indian Bridge are still busy with fly fishers pursing brook trout and early run Atlantic salmon. Striped bass fishing has taken some pressure off the Morell River during the warm summer months. The main branch of the Morell River is restricted to fly fishing only after June 15th. More information can be found in the PEI Angling summary.

Fishing at The Forks on the Morell River in 1895. Photo obtained from the PEI Archives.

Information on salmon harvest on the Morell River has been collected since 1955. Information was first collected via DFO Fisheries Officer estimates (Cairns et al, 2010). Between 1985 and 2006 data was collected though tear off stubs attached to the salmon license or thorough mail out surveys (MacFarlane & Guignion, 1992, Cairns & MacFarlane, 2015). Data from the 1992 survey showed the greatest anger success at Grant's Bridge, Indian Bridge and Leard's Pond on the Morell River (MacFarlane & Guignion, 1992). The sale of a separate salmon angling license on PEI ended in 2011, therefore salmon harvest numbers have not been collected since.

Since 2009 all salmon angling on PEI has been catch and release only. Today, most sections of the Morell River with salmon are restricted to fly fishing only after June 15th with a catch and release limit of two salmon. An extended Atlantic salmon angling season from September 16th to October 31st applies to Leard's Pond and the main branch from the forks to MacKay's. More information can be found in the PEI Angling Summary.

Retention Limit for Atlantic Salmon Angling in PEI	
Year	Retention limit for small salmon (grilse)
1997-2004	7
2005-2006	4
2007-2008	2
2009-Present	0 – Catch and Release Only

Opening day of the 2019 angling season. Photo taken near the Morell River boat slip along the Trans-Canada highway.

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

Figure. Atlantic salmon recreational catches on the Morell River, 1955-2009, table from *Stocking history, biological characteristics, and status of Atlantic salmon (Salmo salar) on Prince Edward Island* (Cairns et al, 2010)

MRMC has built a positive relationship with anglers on the Morell River as they provide valuable information and are extra 'eyes and ears' for the river. MRMC maintains a fishermen parking area at Grant's Bridge with the Department of Transportation and helps to maintain some access points to the Morell River which MRMC crews use for access to project sites and anglers use for access to fishing spots. MRMC has also built accessible angling infrastructure on the Morell River at Anderson's Pool and Mooney's Pond.

Mooney's Pond accessible floating dock.

Anderson's Pool accessible angling platform. Photo by Brian L. Simpson.

.

Anglers fishing below Indian Bridge on the Morell River.

Hunting & Trapping

The Morell Rivers excellent waterfowl and furbearer habitat provide excellent hunting and trapping opportunities. These activities were historically very popular but with poor pelts prices, few trappers take the time to harvest furbearers anymore. Hunting remains a popular activity at impoundments that produce excellent breeding areas for waterfowl.

A family of Canada geese at Mooney's' Pond. A young American beaver hiding in the tall grass along the riverbank. Photo credit: Tyler Power.

Paddling

Canoeing and kayaking are very popular on the Morell River. Two outfitters offer excursions downstream from Indian Bridge to the Village of Morell. When there is enough water in early spring or fall, you will not find a more beautiful paddle then the main branch of the Morell. The impoundments on the Morell also provide ideal sites for exploring by kayak or canoe.

Paddling downstream from Indian Bridge. Paddling along the main branch of the Morell River.

Aquatic Species

In addition to Atlantic salmon, there are many other important aquatic species found throughout the Morell River. Everything in the aquatic ecosystem is connected and many species play important roles in in the life stages of one another.

Brook Trout (*Salvelinus fontinalis*)

Also known as “brookies” or speckled trout, brook trout are abundant across PEI and are found in most rivers and streams. Some brook trout migrate to salt water estuaries and bays to feed and return upstream to freshwater to spawn in the fall. Anglers often pursue these sea-run trout. Like Atlantic salmon, brook trout thrive in clean, cool, and well oxygenated water. When the water temperature exceeds 20°C trout seek cold water refuge areas (Harris et al, 2012). Rivers that exceed 25°C for an extended period can be lethal for brook trout if no cold water refugia is accessible (Brook Trout, N.D.). MRMC’s stream enhancement efforts include removing blockages to keep water flowing and to ensure there is access to cold water refugia. Projects to enhance habitat for Atlantic salmon also improve habitat for brook trout.

Male and female brook trout broodstock caught on the Morell River for the PEI Fish Stock Enhancement Program.

American Eel (*Anguilla rostrata*) – Kat (Mi'kmaq)

American eels are a catadromous species that spend most of their life in freshwater and travel a long distance to spawn in marine water. Eels are quite abundant on the Morell River. They are observed frequently at electrofishing index sites and have been caught in fyke nets set up to catch migrating smolts. There is a commercial fishery for eels on the Morell River in late summer/early fall that also uses fyke nets. A small amount of spear fishing occurs in the winter. American eels can be found in all sections of the river from the estuary to headwater ponds but the fishery only occurs in tidal waters (PEI Flavors, 2018). The American eel is considered threatened in Canada so it is important to consider their presence when completing stream restoration work. As they are a migratory fish species, MRMC's work to remove barriers to fish passage helps to provide access to freshwater habitat for American eels.

American eel caught in the Morell River Smolt Tagging Project fyke net May 2022.

Rainbow Smelt (*Osmerus mordax*)

Rainbow smelt are an anadromous fish species that school in inshore coastal waters and travel upstream to freshwater spawning grounds in spring. On PEI, rainbow smelt return to freshwater between March and May depending on temperature (Harris et al, 2012). There is a recreational dip net fishery for rainbow smelt on PEI that runs from April 1st to June 15th. In the winter months smelts can be found in estuaries and bays where they are fished recreationally by spear fishing through the ice or commercially using box nets (PEI Flavors, 2018). The large runs of rainbow smelt likely provide important cover for Atlantic salmon smolts that are beginning their migration to sea in the spring.

Rainbow smelt caught in the Morell River fyke net May 2022.

Gaspereau

Alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*) are two very similar looking fish collectively referred to as gaspereau or river herring. They are anadromous, schooling fish that spend most of their life at sea and return to freshwater to spawn. In the Morell River, alewife arrive in May and can be found far up into the headwaters of the Morell's east branch. Blueback herring migrate later in the season and can be found in the lower sections of the Morell between June and July. Gaspereau play an important role in bringing nutrients from the ocean to inland freshwater habitats. The sticky eggs that the gaspereau lay and the newly hatched young provide a food source for larger fish like brook trout while the migrating adult gaspereau provide important cover during the spring smolt migration of Atlantic salmon (DFO, 2022).

Alewife caught in the Morell River fyke net May 2021.

Freshwater Mussels

To date there have been three types of freshwater mussels documented on PEI, the eastern pearlshell, eastern floater and alewife floater. Freshwater mussels are an important part of the freshwater ecosystem as they filter water and provide food for other critters. Freshwater mussels need clean water and a stream bed of cobble, sand or gravel. The larval part of the freshwater mussel life cycle is dependent on fish. Mussel larva develop on the fins, gills or body of their host fish species. Each species of freshwater mussel has certain host fish, for example the eastern pearlshell uses Atlantic salmon as its host (UPEI, 2022). Without the host species, freshwater mussels cannot reproduce. The stream enhancement work completed by MRMC creates unrestricted access for fish to migrate, this helps ensure that freshwater mussels can complete their lifecycle.

Freshwater mussel.

Aquatic Vegetation

In a habitat survey of the Morell River conducted in the early 1970's it was found that one of the most important habitat features for Atlantic salmon rearing potential was the abundance of submerged aquatic vegetation. It was found that four plant families had a key role in providing cover for Atlantic salmon; Riverweed (Cruciferae family), water milfoil (Haloragidaceae family), pondweed (Najadaceae family) and duckweed (Lamanaceae family). When conducting electrofishing surveys, salmon parr and brook trout were found using the submerged plants for cover. The disadvantage of the plants are their roots that bind the bottom substrate making it more difficult to use for spawning (Ducharme, 1977). The abundance of aquatic vegetation on the Morell River is likely due to the large amount of sunlight that reaches the stream in the wide, slower moving sections of the river.

Releasing Atlantic salmon fry from the PEI Fish Stocking program into aquatic vegetative cover along the Morell River 2022. A wide section along the main branch of the Morell River demonstrates how much sunlight can reach wide parts of the river.

Impoundments

"Prince Edward Island has an extensive history of dam construction, and there are currently over 800 ponds, or constructed impoundments, on the Island. Some are more than a century old, created when streams were impounded in order to operate saw, grist, woolen, and starch mills, some associated with the establishment of entire communities. Mills continued to be established on Prince Edward Island rivers and streams into the mid-1900s. Later ponds developed through agricultural practices and for creating recreational opportunities, such as hunting or fishing, or for enhancing aesthetics in local communities. The 1970s and 1980s were also a period of wetlands creation and enhancement, and initiatives during this period encouraged the development of numerous impoundments to provide habitat for waterfowl and other wildlife species. Many impoundments today require upkeep, management, maintenance, and decision-making. Like all environmental resources, these ponds and their wetland environments have a variety of different uses and meanings. Each impoundment has a unique history and a parallel, distinctive, and complex range of purposes, and each is valued for its historical significance, recreational, economic, or aesthetic value." (McCabe, 2000).

Leard's Mill on the west branch of the Morell River (1934). Photo provided by Linda Campbell.

Impoundment Management on the Morell River

Over the years, many large impoundments have been constructed on the Morell River, including mill ponds, private dams, rice ponds, and Provincial Government impoundments. For years the historic grist, starch, and lumber mills blocked migrating fish and filled the river with sawdust and other waste. By the mid 1900's, many water mills had stopped operating and the dam structures were deteriorating. In the 70s and 80s many of the historic dam structures were rebuilt with more modern structures that included fish passage (MacFarlane, 1999).

New bypass construction to create fish passage at Leard's Pond. Photo provided by Linda Campbell.

Ducks Unlimited Canada (DUC) was invited by the PEI Government to help with the design and re-construction of many PEI impoundments including Leard's Pond and Mooney's Pond on the Morell River. These ponds now provide an opportunity for recreational angling and habitat for wildlife. In the '70s and '80s additional impoundments were constructed by DUC to create breeding areas for waterfowl and habitat for wildlife. Constructed impoundments can provide overwintering habitat for fish and act as large silt traps (MacFarlane, 1999), which can help to protect important Atlantic salmon spawning areas downstream of the impoundment sites. Most impoundments on the Morell River are owned by the Provincial Government and fall under the management of the PEI Forest, Fish and Wildlife Division. DUC has partnered with the Province of PEI and has agreements to help with the management and maintenance of several Government impoundments on the Morell River.

"Prince Edward Island's wetlands and coastal areas support waterfowl from as far south as the Caribbean to as far north as the sub-Arctic. They give birds a place to nest and raise their young. They filter water, protect our coastlines, and give people a place to connect with nature. Don't let its size fool you. Prince Edward Island is delivering big conservation wins. With the help of research and funding partners, we're showcasing the latest in fishway design in PEI. Together, we're building more naturalized and hybrid fish ladders and monitoring them to find out how well they're passing a wider variety of fish." – Ducks Unlimited Canada (2023)

A guideline for the management of impoundments on PEI was developed by the Department of Fisheries and Oceans Canada and the Provincial Government of PEI. The guideline outlines best management practices for impoundments and their associated wetlands. An impoundment committee also helps bring DUC, private landowners, watershed groups, and Government departments together for specific impoundment projects. In recent years, DUC has worked with MRMC to get input on projects at the Elliotvale and Martinvale impoundments and has assisted MRMC with maintenance of the Mooney's Pond impoundment.

While man-made impoundments create valuable habitat for wildlife and can have positive effects, they can also impact the various life stages of Atlantic salmon. Man-made impoundments eliminate riffle areas needed for eggs and juvenile rearing habitat. They can also raise water temperatures to a harmful level for salmonids (Cairns et al, 2010). Impoundments on low gradient streams with long water residency times are especially susceptible to solar radiation and warming (MacMillan, 1988). Impoundments on the Morell River have been known to reach temperatures above the thermal threshold for salmonids.

Recommendations

1. MRMC has a positive relationship with local landowners, the PEI Department of Forest, Fish and Wildlife and Ducks Unlimited Canada. It would be beneficial to collaborate with landowners, DUC and the Provincial Government via the impoundment committee to discuss possible solutions to warm water outflow of the impoundments that could impact Atlantic salmon habitat on the Morell River.
2. Temperature data loggers should be installed at the upper end and outflow of all impoundments on the Morell River.

Morell River Impoundments

McKenna's Pond – Privately Owned

The McKenna's Pond impoundment was built by DUC in 1973. It is located on the south branch of the Morell River just above the 48 Road. The 25-acre impoundment was originally built with a drop-inlet as it did not meet the DFO requirements for fish passage at the time. In 2021 DUC built a nature like fishway at McKenna's Pond giving migrating fish access to the headwaters of the south branch. This is beneficial to salmonids as there are large springs at the upper end of the pond.

Nature like fish way constructed by Ducks Unlimited Canada at McKenna's Pond (2021).

Everglades – PEI Government Impoundment – Decommissioned in 2013

The Everglades (also known as Shaw's Marsh) impoundment was located on the east branch of the Morell River just below Jessie Maybelle Road. The structure was built in 1973 by DUC and consisted of a concrete impoundment with a fish ladder. The impoundment flooded 280 acres in an area that was historically a stream with several large springs. There were many concerns with the water temperature of this impoundment. In the summer of 1990, water temperatures at the road crossing of the Everglades impoundment were recorded as high as 30.5 °C. Because of the concern with high-water temperatures, the Everglades impoundment was decommissioned in 2013.

Old Everglades DU impoundment and fish ladder (2012). Photo Credit: MRMC

Looking upstream from the historic Everglades impoundment site (2022).

Elliotvale – PEI Government Impoundment

In 1976 DUC built the Elliotvale impoundment located just above 48 Road on the south-west branch of the Morell River. This 60-acre impoundment had a pool and weir fishway added in 1977 and a new culvert was installed in 2019. The summer water temperatures have historically been high with no capability for bottom draw-off at the impoundment. There have been issues with beavers blocking the structure creating higher water levels and restricting fish passage. DUC has been managing the impoundment to ensure fish passage remains intact.

Looking upstream at the Elliotvale DUC impoundment.

Martinvale – PEI Government Impoundment

The Martinvale impoundment, known as “The Sticks” was built by DUC in 1984 on the east branch of the Morell River. This impoundment is located upstream of Martinvale Road and can be accessed from Buckskin Road. This impoundment was not built with fish passage as it did not meet the DFO requirements for one. This is due to the small size and flow of the watershed above the impoundment. During warm summer periods, the outflow of the sticks is noticeably warmer than inflowing water.

The sticks impoundment in Martinvale. Photo credit: Ducks Unlimited Canada

MacAulay's Pond – PEI Government Impoundment– Historic Mill Pond

MacAulay's Pond is a small impoundment found on the south branch of the Morell River upstream of Old Mount Stewart Road. It is a government-owned pond that was formerly a mill pond. The pond is heavily infilled with sediments, especially at the top end. It is acting as a silt trap which protects downstream habitat from siltation. There is a heavy sediment load in the stream above MacAulay's Pond which is likely from a road washout that occurred in the early 2000's. The land use above MacAulay's Pond is now completely forested therefore sedimentation or "red water" events are infrequent. Although the pond is small, it provides some opportunity for angling, hunting, and trapping. Beavers frequently dam the outflow of the pond therefore MRMC continuously monitors the area to ensure fish passage is provided to the headwaters of the south branch.

Looking upstream at MacAulay's Pond.

Leard's Pond – PEI Government Impoundment - Historic Mill Pond

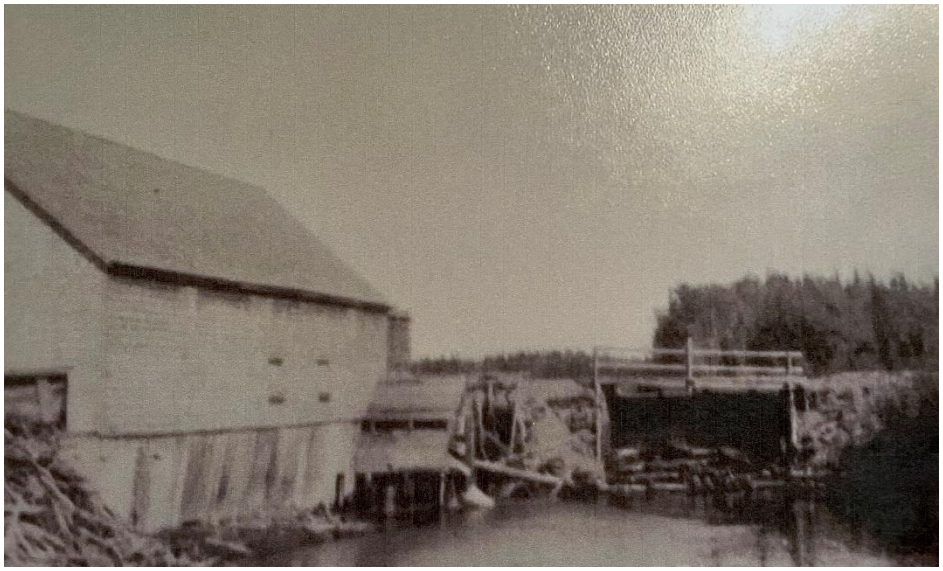
Leard's Pond is the largest historic mill pond on the Morell River. The pond is located on the west branch in Lorne Valley. The original mill burnt in 1946 and was rebuilt. For decades the mill was a major obstruction to fish passage and Atlantic salmon migration. In the early 1970's a spring flood washed out the mill and a new mill was rebuilt across the road (run by diesel). In the late 70's a bypass and fish ladder were constructed at Leard's Pond to re-establish fish passage.

The pond is long, narrow, and deep until the top end which splits into the south and west branches of the Morell River. The top end of the pond is becoming heavily infilled with sediment causing the water to become very shallow. The silt collected in the pond protects important Atlantic salmon spawning habitat which is found just downstream. The top end of the pond also marks the end of the Morell River Conservation Zone. Today fish passage is still provided through the bypass and covered fish ladder which also functions as a fish trap that is managed by MRMC. The pond offers some angling opportunities by boat, provides overwintering habitat for fish, and habitat for waterfowl.

Bert Leard's working at Leard's Mill in Lorne Valley (1934). Photo provided by Linda Campbell.

Former Crane's Mill Dam Site - Government Property

The former Crane's Mill dam site is found on the east branch of the Morell River just upstream from the Lorne Valley Road. The impoundment was taken out in the 1970's which re-established fish passage to the east branch. Due to years of flooding from the former impoundment, this section of the river is very open with grassy banks and provides excellent brook trout habitat. This section of the Morell is now designated as Crane's Conservation Zone. More information on Crane's Conservation Zone can be found in the PEI Angling Summary.



Crane's Mill on the east branch of the Morell River. Photo provided by Brian Crane.

Crane's Conservation Zone.

Mooney's Pond – PEI Government Impoundment - Historic Mill Pond

Mooney's Pond is located on the south-west branch of the Morell River. It has evolved over the years from a historic mill pond to a semi-natural rearing pond for salmonids. Between 1988 and 89 a substantial amount of work was done to the pond to create a suitable site for rearing Atlantic salmon. The pond was excavated to have steep banks and a depth ranging from 12 feet at the bottom end to 6ft near the top end. The pond was designed with a fish enumeration facility at the lower dam and a bypass for high water. The semi-natural rearing program successfully raised and released thousands of fish from Mooney's Pond (more info in 'Fish Stocking' section).

In the early 2000's the semi-natural rearing program ended due to lack of funding. Mooney's Pond evolved and became a recreational fishing location with an accessible nature trail (Peggy's Trail) and interpretive centre. The run around at the pond had excavation work done in 2014 to create better step pools for fish and an addition of a wooden fish ladder box created fish passage. Today, the Interpretive Centre, floating dock and accessible trails attract many tourists and islanders, especially during the month of October when the leaves change and reflect over the pond. Thanks to social media, the number of visitors at Mooney's Pond has been growing each year. In 2021 a trail counter installed around Peggy's Trail recorded 15,000 visitors.

Mooney's Pond floating dock and Interpretive Centre.

Pisquid Pond – Privately Owned - Wild Rice Pond

Pisquid Pond is a natural pond found on the headwaters of the west branch of the Morell River. The pond has been damned further to create deeper water for wild rice production. The pond is just over 100 acres and is an especially important area for waterfowl. It is comprised of open water with emergent vegetation surrounded by wooded swampland with many springs in and around the pond.

Daryl Guignion on Pisquid Pond

"Early in my research days on PEI, I accepted the challenge of assessing waterfowl populations on a variety of wetlands. It didn't take me long to see how special Pisquid Pond is. This 100-acre wetland located near the headwaters on the Morell River has an excellent mixture of woodland, marsh vegetation and water. Lady slippers and mayflowers can be found in the woodland areas each spring. The pond itself is covered with wild rice which is harvested by the owners of the pond. This makes the pond an extremely attractive site for a variety of wildlife, both resident and migratory species. Parking my canoe in the cattails well before dawn, I got to hear the sound of the pond come alive. The sound of so many birds calling from the woodland and marsh was truly amazing. Perched in a tree blind about one meter from a chickadee nest, I got a true appreciation of the diversity of wildlife around me. This was the first place I had seen floating pied-billed grebe nests. Another outstanding feature of Pisquid Pond is its large, extraordinarily deep springs. In our helicopter survey of the pond, I saw huge brook trout disappearing into the depth of large springs as we flew over. When the canoe leaves the shallow, rice covered water and drifts over these dark, seeming bottomless spring holes, you instinctively hold your paddle a little tighter." (Eco-Itineraries, 2017)

Dockerty's Dam – Was located on a tributary to the east branch of the Morell River above the Everglades. This was a small manmade impoundment that was taken out in the 90's in an effort to reduce water temperature on the east branch of the Morell River.

map of impoundments

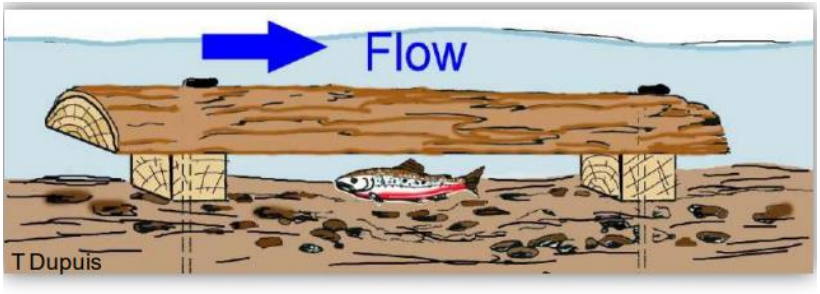
Early Stream Enhancement Efforts

"The earliest watershed management effort began in 1972 when the Morell and Area Land Use Steering Committee (MALUSC) became aware of a proposed cottage development along the Morell River. Subsequently, members of the MALUSC spent considerable time speaking to landowners about the importance of "protecting" the river from development. With the backing from the majority of landowners, the MALUSC convinced the provincial government to protect the greenbelt or "conservation zone" for 60 meters on both sides of the river for a total of 44 kilometers. Eventually, the Morell River Conservation Zone was formally designated and protected under the Planning Act and remains so today. Over time, the Morell and Area Land Use Steering Committee was dissolved and became the genesis for the Morell River Management Cooperative."- A Guide to Watershed Planning on PEI (PEI Department of Environment, n.d.)

Morell River Management Cooperative was officially incorporated on February 11th, 1988 but had undertaken several years of stream enhancement prior. The south branch of the Morell River was historically known as the best branch for forking Atlantic salmon, this is where stream enhancement began on the Morell. It was noted that fish were adversely affected when streams were choked with alders and logjams as it caused silt to build up and cover spawning substrate. Many white spruce stands that had established on abandoned farmland fell into Island rivers, including the Morell. Members of MRMC felt the Morell River would benefit if the woody stream bank vegetation and blockages were removed. In the early 80's, money made available through a Canada Community Development Project allowed MRMC to hire two work crews to clean up the stream banks with chainsaws and manual labor. As part of the stream bank enhancement project, a 10ft swath was cleared on the banks of the Morell River and any in-stream blockages were removed. This enhancement work increased the flow of the river and it was noted that results were seen in a short amount of time. In a matter of weeks, MRMC staff noticed silt being carried away and gravel bottom was showing (Murnaghan, 1983).

It didn't take long for members of MRMC to realize that natural cover was very important for fish. Trees that lean over a stream provide natural cover and create habitat for fish to rest and feed while being sheltered from predators. After the stream bank enhancement project, sufficient cover became a concern for MRMC. Since the natural woody debris would take time to re-establish, an alternative type of fish cover was introduced known as half log structures. Later in the 1980's half log structures were placed throughout the Morell River. They were very simple in design consisting of a half piece of tree trunk approximately 8ft long anchored to the stream bed with steel rods and wooden spacer blocks to keep the log sitting up off the stream bottom (Murnaghan, 1983).

Half log structure on the south branch of the Morell River.



Half log structure diagram from the Technical Manual for Watershed Management on PEI (Harris et al, 2012).

As techniques for watershed management and restoration were developed, Morell River Management Cooperative published *A Technical Manual for Stream Improvement on Prince Edward Island* in 1994. Some of the stream enhancement techniques written in the manual were implemented on the Morell in the 90's, including the construction of wooden crib deflectors on the main branch of the river. Other stream enhancement techniques that have been completed on the Morell River over the years include the excavation of silt traps, installation of wire gabion baskets, digger logs, brush mats, cover logs, alder management and blockage removal.

Stream enhancement efforts have evolved over the years and we know today that woody debris in rivers is extremely important and provides many benefits to fish and macroinvertebrates. MRMC's current enhancement work ensures every effort is made to preserve natural woody debris.

Since the 1980's, MRMC has worked with landowners, environmental groups, federal and provincial governments to pursue the following goals:

1. Maintain the Morell, Midgell, Marie, and St Peters River, as well as Schooner and Bristol Creek as close to a "wilderness" watercourse as possible

2. Conserve, restore, develop, and enhance in-stream and riparian habitat for fish and wildlife

3. Promote good land stewardship within watershed boundaries

4. Conserve, restore, develop, and enhance populations of fish and wildlife

5. Provide opportunities for compatible uses of the river, such as angling, bird watching, canoeing, hunting, and trapping

Kevin MacAdam and Todd Dupuis standing beside a wing deflector on the Morell River (1990s). Photo Credit: MRMC.

Stocking History

Stocking of Atlantic salmon on PEI dates back to 1879 when the first salmon hatchery opened on the Dunk River. The first 500,000 salmon fry were released in 1880, including 100,000 fry released into the Morell (Cairns et al, 2010). The Dunk River hatchery had many challenges with freshet washouts, poaching and a fire which destroyed the facility. Stocking continued during the late 1800's from mainland hatcheries with fry of mainland origin. In 1905 a new hatchery opened on PEI at Kelly's Pond in Stratford. The Salmon broodstock for PEI's hatcheries came from mix of PEI, Nova Scotia and New Brunswick Rivers. The first recorded broodstock collected on the Morell River was in 1931 (Cairns et al. 2010). Millions of Atlantic salmon eggs from Morell River broodstock were sent to the Kelly's Pond hatchery until the 1950's (Jubilee Seniors Club, 1980).

A new hatchery opened in Cardigan in 1938 which was operated by the federal government until 1997 after which it was transferred to the University of PEI. UPEI continued to provide Atlantic salmon for stocking PEI Rivers until 2005 when the hatchery was purchased by a private aquaculture company (Cairns et al, 2010). The Cardigan Hatchery continued to provide fish for stocking until 2012 after which the Abegweit Biodiversity Enhancement Hatchery facility began raising native fish for stocking on PEI.

In addition to fry from the hatcheries, nearly 9,000 Atlantic salmon smolts from the Restigouche River were released into the Morell in 1975. The goal of releasing smolts from the Restigouche was to establish an early-run salmon population on the Morell to provide angling opportunity (Cairns et al, 2010). Historical records indicate that PEI had late runs of salmon, primarily of MSW size fish (Cairns et al, 2010). With the different origins of broodstock and the millions of fish that were released, the Morell River now has a mix of early and late run Atlantic salmon.

Abegweit Biodiversity Enhancement Hatchery and MRMC crews at the 2022 Atlantic salmon release.

One of the most successful methods of fish stocking on the Morell River was the smolt production from the semi-natural rearing site at Mooney's Pond on PEI. Broodstock for the program were collected at Leard's fish trap on the west branch of the Morell River. The adult salmon were caught in early spring and held at the Cardigan Fish Culture Station until the fall when they were ready to spawn. The adults were stripped of their eggs which were incubated at the hatchery overwinter. The salmon fry remained at the hatchery for about one year. By the next May the salmon had grown to parr, had their adipose fins clipped for ID, and were transported to Mooney's Pond. After growing in the pond and being hand fed for anther year, most of the parr became smolts and were ready to migrate to sea. In May of 1990 the first Atlantic salmon smolts were released from Mooney's Pond. Over the years, some smolts were released directly downstream of Mooney's Pond, others were transported to other locations within the Morell River and a few thousand were released in the Dunk and Valleyfield Rivers (Guignion & MacFarlane, 1991). When the rearing program was at it's peak in the mid 1990's, there was an estimated 4000 salmon in the river. (Guignion et al, 2019). The semi-natural rearing facility at Mooney's Pond operated into the early 2000's until funding for the program was no longer available.

Stocking salmon into the semi natural rearing pond at Mooney's.

Photo credit: Daryl Guignion

Counting the smolts exiting the semi-natural rearing pond at Mooney's in May.

Photo credit: Rosie MacFarlane

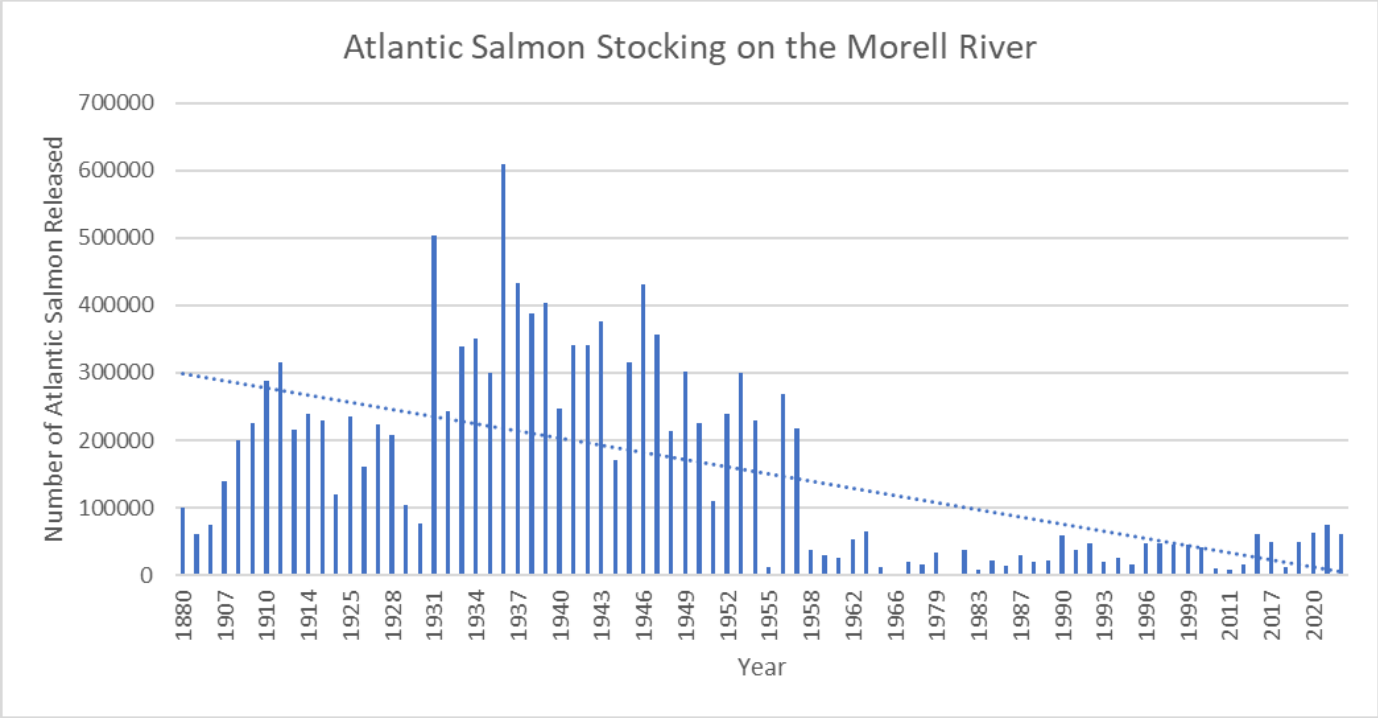


Figure. A total of 12,757,219 Atlantic salmon have been stocked into the Morell River since 1880. Historical stocking numbers compiled by Carissa Grove (DFO, pers. Comm). 2021 and 2022 numbers provided by Rosie MacFarlane (MacFarlane, pers. Comm). Full stocking table in appendix.

Recommendation: Investigate the possibility and feasibility of re-starting the semi-natural rearing program at Mooney's Pond.

Threats to Atlantic Salmon on the Morell River

Climate Change

Climate change will have implications on all features of the Morell River and poses a range of challenges for Atlantic salmon. Changes in rainfall timing and intensity, temperature shifts, and changes to riparian vegetation will all impact Atlantic salmon (Guignion et al, 2019).

In 2020 a warm dry summer created very low water conditions on the Morell. In 2022 a heatwave in August had devastating impacts on water quality on the east branch. In the fall of 2022 hurricane Fiona left some riparian areas along the Morell with hardly a tree left standing. In January of 2023 heavy rainfall events and an early winter thaw created extreme flooding on the main branch of the Morell River which put bridge infrastructure at risk. These are just some of the impacts of climate change.

There are steps we can take to ensure the Morell River watershed is healthy and resilient to face the impacts of climate change. A healthy riparian zone can reduce sedimentation, moderate water temperature, enhance biodiversity and stabilize stream banks. And a river that is free of blockages with well-connected floodplains will help remove sediment from the watercourse and be more resistant to bank erosion from floods (Guignion et al, 2019).

A riparian area along the west branch of the Morell River before and after Hurricane Fiona.

Sedimentation

Sediment is a significant threat to Atlantic salmon on PEI as it reduces habitat quality in multiple aspects. Sediment can cover redds which decreases oxygen supply to eggs. Embedded stream substrate also reduces fry and juvenile habitat and makes it more difficult for salmon to dig redds (Guignion, 2019). A coarse streambed can support a higher number of individuals compared to a streambed with no interstitial spaces. Another factor that can affect the growth of juveniles is the available dietary items present. Ideal dietary items are benthic macroinvertebrates, such as mayflies and stoneflies, and are usually found in high quality habitat with rocky streambed bottom opposed to a silt dominated stream, which would contain lower quality food items (midges, worms, etc.). Sediment runoff on the Morell River is a result of secondary roads, agricultural fields and the occasional new development which usually a short-lived issue. MRMC has been actively working with local landowners and the Department of Transportation to resolve problematic areas. Sediment issues on Indian Bridge Road, Kenny Road and the Old Mount Stewart Road have been addressed by the department of transportation.

A brush mat built along the south branch of the Morell River to collect access sediment.

Fish Kills

Fish kill events can devastate local populations as the young age classes are typically completely whipped out having detrimental long-term effects. Across PEI, agricultural fish kill event impacts are likely to intensify as a result of climate change, however, the Morell River has not had a fish kill due to agricultural impacts since August 15th, 1968 (Government of PEI, 2020). The absence of fish kills events on the Morell River is likely due to the strict regulations of the Conservation Zone. Over 50% of the Morell River watershed is forested and it is noted that watersheds with higher percentages of forest have better water quality (PEI Government, 2022).

In August 2022 the East Branch of the Morell River suffered a fish kill event. The initial results of water quality testing showed anoxic conditions caused by extremely high-water temperatures and slow flowing water. A monitoring plan is in place on the east branch of the Morell River to record dissolved oxygen levels and temperature. The MRMC plans to explore options to keep the east branch cooler and prevent blockages on this branch.

Collecting brook trout that died as a result of a fish kill on the east branch of the Morell River in August 2022.

Migration Barriers

The Morell River has no hanging culverts that impede salmon migration and other than the Martinvale impoundment, access is available at all former mill ponds and man-made impoundments. Beaver dams can however cause issues for Atlantic salmon migration. MRMC has a Beaver Management Plan with identified areas that are critical to Atlantic salmon. MRMC works with local trappers to ensure migration routs remain barrier free for salmon. MRMC also works with the Department of Transportation to deal with issues that arise at road crossings. MRMC has built a positive relationship with local trappers and the Department of Transportation which allows issues to be dealt with quickly.

An inactive beaver dam removed to re-establish fish passage.

Non-Native Species

Rainbow Trout

Between 1880 and 1960, 175,542 rainbow trout were released into Pisquid Pond on the West branch of the Morell River (Cairns et al, 2010). Although historical stocking occurred, today rainbow trout are not typically found on the Morell River. They are still abundant in other watersheds across PEI. While brook trout and salmon both spawn in late autumn, rainbow trout spawn in April. The impact of rainbow trout on PEI streams is not fully understood. Although they may not be the most significant threat to native salmonid populations on the Morell, until further impacts are known it would be a good idea to refrain from stocking the Morell River with rainbow trout.

Koi Fish

Koi fish are often kept in small backyard ponds or aquariums as pets, but sometimes people release them into streams and rivers on PEI. This can be dangerous for native species as the pet fish could carry parasites or viruses that could be spread. The kois could also reproduce and outcompete native fish for food and habitat. There has been at least one koi released into the Morell River, the CBC article explaining the situation can be found here: https://www.cbc.ca/news/canada/prince-edward-island/pei-koi-fish-found-1.4393365

MRMC encourages pet owners to never release a non-native species into the wild.

Koi fish caught on the main branch of the Morell River during fall broodstock collection 2017. Photo credit: MRMC

Atlantic Salmon Habitat & Future Enhancement Recommendations

"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" (Cairns et al, 2010).

A biological survey of the Morell River conducted by L.J.A. Ducharme in 1975 revealed a shortage of good quality spawning areas for Atlantic salmon. This was due to silt, aquatic vegetation, and the angular shape of the substrate. It was determined in the survey that the Morell River contained approximately 100 square meters of Atlantic salmon rearing area. This rearing area included 7km of the main branch, and the lower portions of the east and west branches (Ducharme, 1977).

An immense amount of Atlantic salmon habitat enhancement work has been completed on the Morell River since the 1970's. Today, the most productive Atlantic salmon habitat within the watershed that supports all life stages of salmon is found on the main branch, a large portion of the west and south branches and the first few kilometers of the east branch.

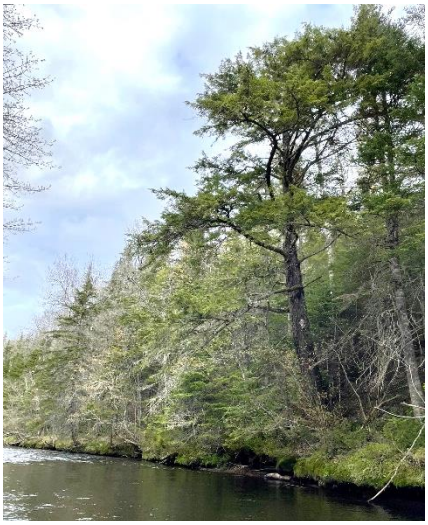
Recommendation: An updated survey of availability and quality of Atlantic salmon habitat on the Morell River should be completed. The MRMC has significantly enhanced habitats since 1975 to create better quality spawning areas and establish access to more reaches of the Morell.

Main branch of the Morell River.

Main Branch

The main branch of the Morell River is 7.2km in length and runs from the forks above Grant's Bridge to the head of tide at Indian Bridge. The riparian area is well forested and is completely protected by the Morell River Conservation Zone. The main branch is a popular canoe route therefore MRMC maintains a path through this section of the river on an annual basis. The main branch is wide, varying from 15 to 20m and is about 15-60cm deep apart from deeper pools created by deflector structures. There are large riffle sections with gravel suitable for Atlantic salmon spawning and other sections comprised of bedrock bottom. Some of the recent habitat restoration achievements MRMC has completed on the main branch include:

- Blockage removal/maintenance of the canoe route and salmon migration route (annually)
- Reconstruction of nine river deflector structures built in the early 1990's (2021-2022)
- Addition of boulder clusters between Grant's Bridge and the forks to create juvenile habitat and holding areas for adults (2021)
- Riparian zone diversification - tree planting (annually)
- Large brush mats built near the "spring hole" above Indian Bridge (2021)



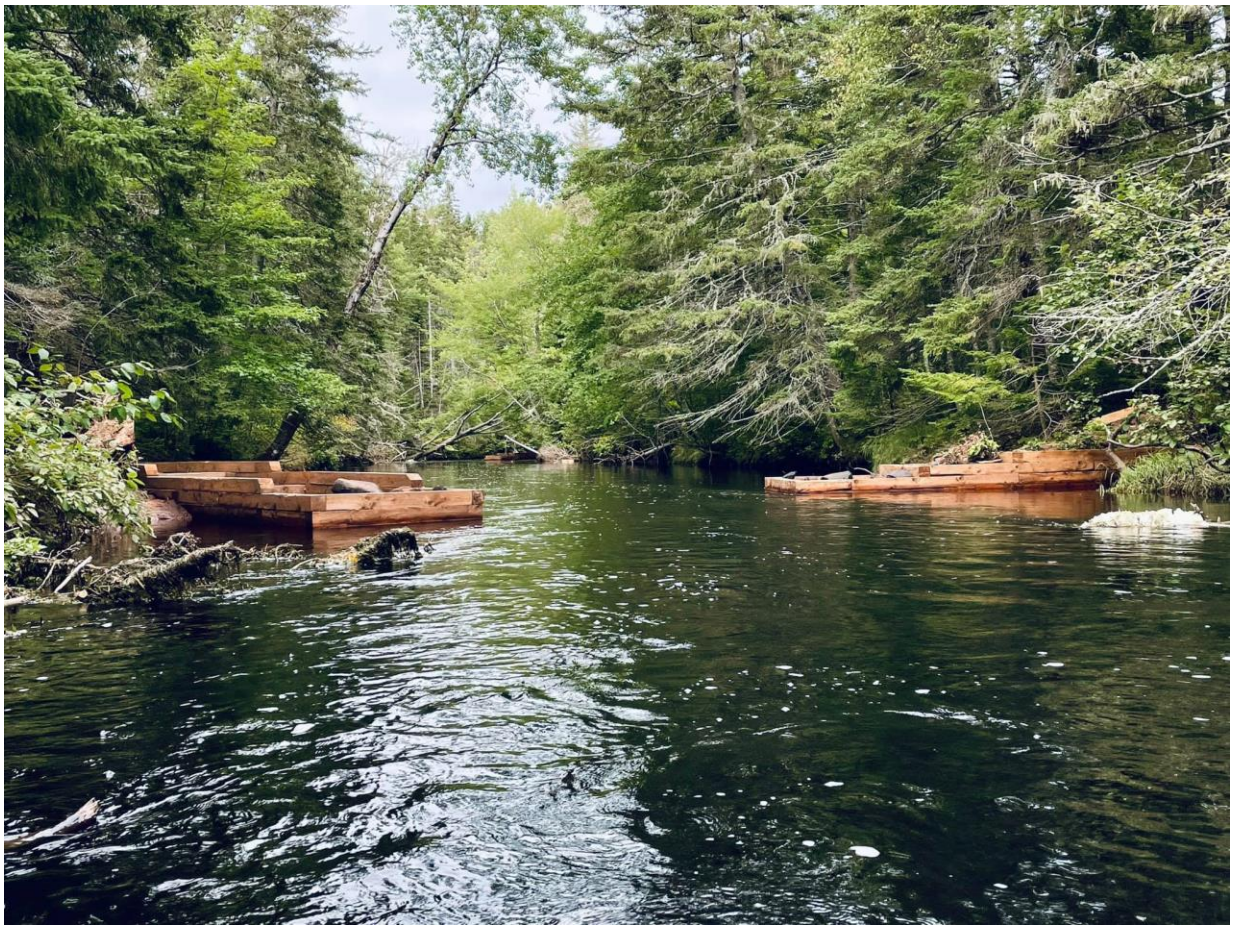
A mature eastern hemlock along the main branch of the river.

Atlantic salmon spawning habitat, juvenile habitat and holding pools for adults can be found throughout the main branch. The riparian zone often extends farther than the protected 60 meters with many properties owned by the PEI Government and Island Nature Trust to create an unfragmented forest. Because of the forested landscape and the lack of any road crossings, this section of the Morell has very few sedimentation issues. However, even with the 60m Conservation Zone, there have been instances where potato fields near Indian Bridge left exposed during the spring melt have allowed sediment to reach the main branch. The ditches along Indian Bridge Road also create a path for runoff to reach the river. The Department of Transportation has been working to limit this by re-grading the road and adding check dams to the ditch.

Recommendations:

The following are objectives to help further improve local populations of Atlantic salmon along the Main Branch section:

- Maintain stream connectivity by ensuring the migratory corridor from sea to spawning areas remains clear of blockages. When clearing windfalls, ensure plenty of cover is left for fish cover and habitat. Windfalls and woody debris can be anchored to create stable cover that does not interfere with paddlers or migrating fish.
- Monitor agriculture fields near Indian Bridge for sediment input. Continue working with the Department of Transportation and landowners to mitigate sediment input.
- Continue to build more resilient and diverse riparian zones by planting a variety of native trees and shrubs.



Deflector structures re-built in 2021 to maintain pools for Atlantic salmon on the main branch of the Morell River below the Mooney Road.

map to be provided by DFO

East Branch

The east branch of the Morell River begins where the main branch forks above Grants Bridge. The first 750 meters of stream up to Crane's Bridge on the Lorne Valley Road is heavily forested. This section is where the most productive Atlantic salmon habitat is found on the east branch.

Just upstream from Crane's Bridge is the former Crane's Mill dam site. This changes the east branch to a deep, slow-moving section which is open with grassy banks. It is an important area for brook trout and is now designated as Crane's Conservation Zone which is closed to all angling after July 1st. The stream bottom in this section contains a lot of hardpan or bedrock with less suitable sites for Atlantic salmon to spawn.

East branch of the Morell River between the forks and Crane's Bridge.This section is heavily forested and shaded and contains suitable spawning substrate for Atlantic salmon.

The grassy banks along the east branch provide cover and habitat for juvenile brook trout.

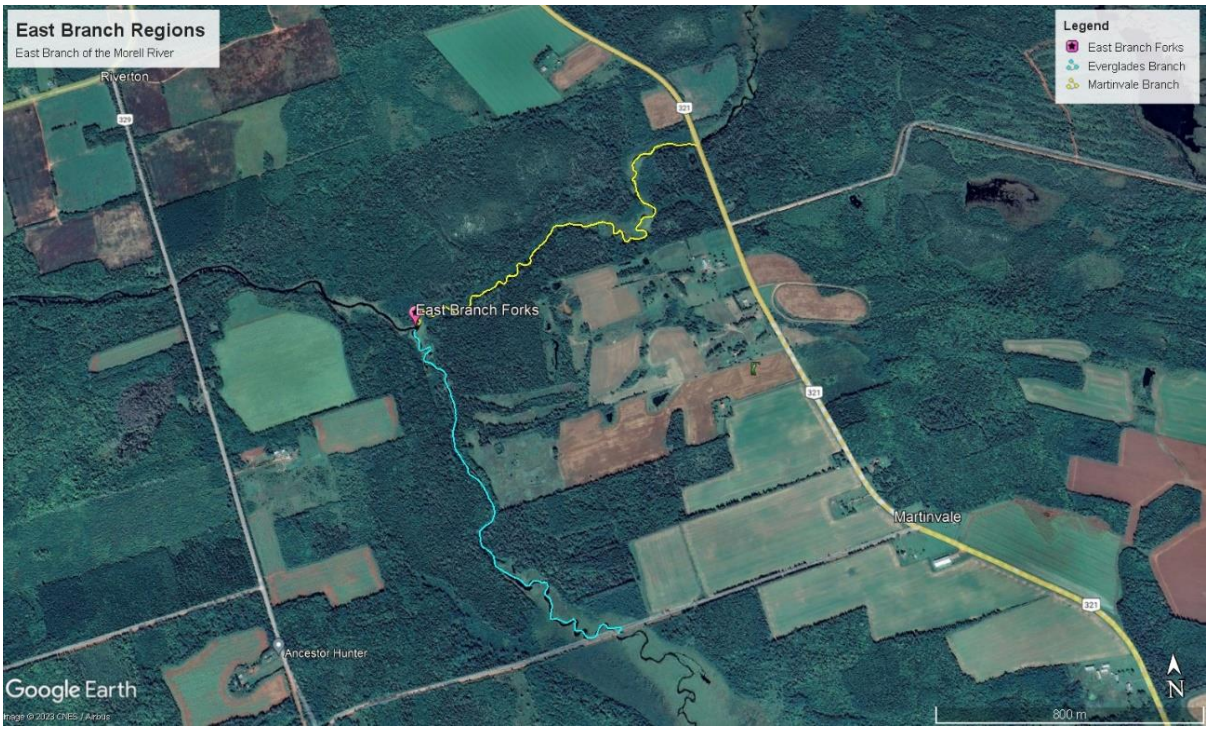
Photo location: above the Hazelgreen Road.

Cranes Mill Pond created an open grassy riparian area along the east branch.

Photo location: below the Hazelgreen Road – top end of the former Crane's Mill Pond.

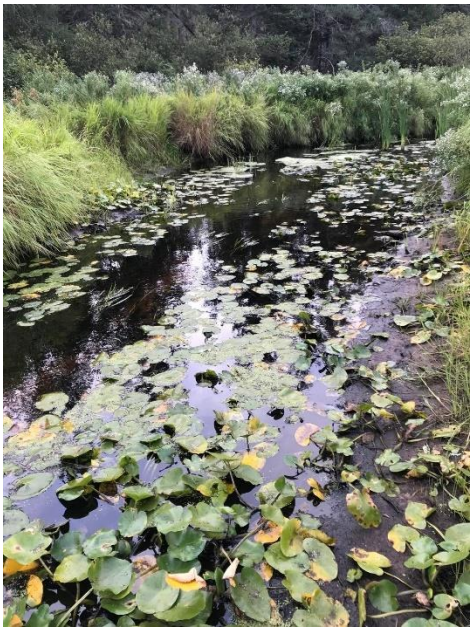
*The first 750m of stream from 'the forks' to the Lorne Valley Road is heavily forested and contains good Atlantic salmon spawning and juvenile habitat. ** better quality maps to be provided by DFO***

Continuing upstream from the former Crane's dam site, the river flows under the Hazelgreen Road (Route 329) up to a second fork in the river. At this fork the southern branch drains the Everglades and the eastern branch drains the Martinvale Region.



Martinvale Region

The Martinvale branch is generally very shallow in the summer with warm water temperatures. The bottom of this branch is silty and many lily pads grow where lots of sunlight reaches the stream. This branch was historically impounded with numerous beaver dams and has a mix of open grassy and think alder covered banks. MRMC has maintained the Martinvale branch from the east branch forks to the Martinvale Road as a beaver free zone since the 1990's. Above the Martinvale road is the location of the sticks DUC impoundment. The section above the Martinvale Road has not had any recent stream work completed for Atlantic salmon.



Shallow summer water levels and lily pads growing along the Martinvale region of the east branch (September 2020). Most of the Martinvale region has heavily grassed banks.

Upstream of the Martinvale Road.

Everglades Region

The everglades branch is the warmest branch of the Morell River and frequently exceeds temperatures of 20° Celsius in the summer months. Efforts have been made to cool this branch by decommissioning the Everglades DUC impoundment in 2013 and by implementing a beaver free zone on the entire branch up to the Jessie Maybelle Road.

Upstream of the old impoundment site, the stream is very open and deep with a slow meander. This section is very open with grassy and cattail filled stream banks. There is no shade along this section of the east branch.

Downstream of the former Everglades DU impoundment the riparian zone is comprised of alder and conifer stands before transitioning into grassy banks again where the Martinvale and Everglades regions meet.

Downstream and upstream of the old Everglades impoundment site on the east branch of the Morell River.

Recent restoration work completed on the east branch includes:

- Removal of all blockages and maintenance of beaver free zones on the east branch (1990-present)
- Temperature loggers deployed at the Martinvale Road, former Everglades impoundment and Hazelgreen Road (2014-present)
- Brush mats built on the Martinvale branch (2018)
- Brush mats built between Lorne Valley Road and the forks (2018)
- Brush mats built between Lorne Valley Road and Hazelgreen Road (2018)
- Tree planting around the old Everglades impoundment site (2014)
- Tree planting along upland riparian areas between the Hazelgreen road and Lorne Valley Road (2020 + 2022)
- Raking of Atlantic salmon spawning sites between the forks and cranes bridge (2020)

Recommendations:

The following are objectives to help further improve habitat and water quality for Atlantic salmon along the east branch:

- Ensure the entire east branch remains clear of blockages and beaver dams (Expand the beaver management zone on the Everglades branch: extend up to the Cardigan and Martinvale roads)
- Monitor for sediment input from secondary roads and fields
- Bi-weekly monitoring for new beaver blockages during stretches of high temperature from July to September
- Additional temperature and dissolved oxygen monitoring should be completed on the Everglades branch (planned for 2023)
- Blockages on tributaries with springs above the Jessie Maybelle Road should be identified and opened (planned for 2023)
- An effort should be made to provide more shade and cover for fish on the east branch especially near the Everglades and at Crane's Conservation Zone. Ex: floating cover structures

West Branch

The west branch of the Morell River contains a greater amount of Atlantic salmon habitat compared to the east branch. Two main tributaries feed the west branch. One tributary originates at Pisquid Pond, the other tributary (known as the south-west branch) feeds from Elliotvale. The west branch has four large impoundments and mix of riparian areas with much greater canopy cover than the east branch. The forested riparian zone is protected by the Morell River Conservation Zone up to the head of Leard's Pond. The river is slightly narrower than the main branch ranging from 9-15 meters wide. The first 1.5km from the forks up to Leard's Pond has the best habitat for juvenile salmon. In this section you can find the typically pool, riffle, run sequence with a 50-50 mix of excellent spawning substrate and hard bedrock bottom (Ducharme, 1977). About halfway between the forks and Leard's Pond, a smaller tributary known as the 'spring stream' provides cooler water to the bottom portion of the west branch.

A long riffle section along the first 1.5km section of west branch between the forks and Leard's pond.

Above Leard's Pond the west branch becomes narrower with a smaller amount of Atlantic salmon habitat. In recent years, MRMC has not identified salmon redds beyond the first crossing of the Peakes Road. It should be noted that the west branch above Leard's Pond is very important habitat for brook trout, especially between the Kenny Road and Peakes Road; Hundreds of brook trout redds can be found in this section. Above Leard's Pond the riparian area is a combination of dense alders and mixed forest.

A beaver lodge on the west branch of the Morell River between the Peakes Road and Kenny Road. This section of the west branch contains excellent brook trout habitat and has dense alder growth along the river banks.

West branch map to be provided by DFO

Below Leard's Pond the Mill Road historically crossed the river connecting the Peakes Road to Lorne Valley Road. The road is now decommissioned and the stream banks have been stabilized with wire gabion baskets. Parts of the concrete bridge abutments are found in the river below Leard's at the old road crossing

Old Mill Road Bridge. Photo credit: Rosie MacFarlane.

Below Leard's Pond 2022.

Looking upstream from the Leard's Pond from the boat slip (October 2019).

Recent Atlantic salmon habitat restoration efforts on the west branch include:

- Maintaining blockage and beaver management zones (annually)
- Stabilization of the Leard's Pond spillway/bypass (2021)
- Alder management above Leard's Pond (2014-present)
- Wing deflector structure built to create holding pool between the forks and Leard's Pond (2022)
- Brush mats built between Peakes road and St. Patrick's Road (2015+2020)
- Brush mats built above Peakes Road 1st Crossing (2021)
- Brush mats built above Mooney's Pond to 48 Road (2017+2019)
- Tree planting to diversity riparian areas between Leard's Pond and the forks (2021+2022), above Mooney's Pond (2019), between Peaks and Kenny Road (2020)

Recommendations:

The following are objectives to help further improve habitat for Atlantic salmon along the west branch of the Morell River:

- Maintain stream connectivity by ensuring the migratory corridor from the forks to spawning areas remains clear of blockages. When clearing windfalls, ensure plenty of cover is left for fish cover and habitat. Windfalls and woody debris can be anchored to create stable cover that does not interfere with paddlers or migrating fish.
- Continue to build more resilient and diverse riparian zones by planting a variety of native trees and shrubs.
- Monitor agriculture fields and land clearing for sediment input
- Encourage land acquisition by the Province of PEI, Island Nature Trust or the Nature Conservancy of Canada along the west branch beyond the green belt to protect the river from undesirable land use change.
- Continue alder management in sections with dense growth.
- Remove concrete pieces of the former bridge below Leard's Pond to revert the river to its natural state.

South Branch

The south branch of the Morell River begins at the top of Leard's Pond has two main tributaries that feed it. The tributaries merge above MacAulay's Pond with one extending above the 48 Road and the other being fed from the top of McKenna's Pond. The majority of Atlantic salmon habitat on the south branch is found between the top of Leard's Pond and MacAulay's Pond. The stream bottom along this section is suitable for spawning. This branch of the Morell River is very shaded up to the last crossing of the Old Mount Stewart Road and has relatively small impoundments compared to the west branch. This branch is important for Atlantic salmon as during the summer it is the coolest branch of the Morell River. In 2021 access to the headwaters of the south branch was established when Ducks Unlimited Canada built a nature like fishway at McKenna's Pond.

South branch of the Morell River along the 3rd crossing of the Old Mount Stewart Road.

Above MacAulay's Pond the in-stream habitat becomes better suited for brook trout, with more open sections and grassy banks. Thick aquatic vegetation grows where lots of sunlight reaches the stream. In some areas, watercress completely covers the surface of the stream. Beyond the open section, the stream narrows and becomes shaded by dense alder growth and a more mature forest closer to the 48 road. This stream bed along this section of the south branch is covered with a thick layer of sediment unsuitable for salmon spawning.

Open areas with sandy bottom above MacAulay's Pond on the south branch allow dense clusters of watercress to grow.

A brush mat built along a section of the south branch with heavy sediment load.

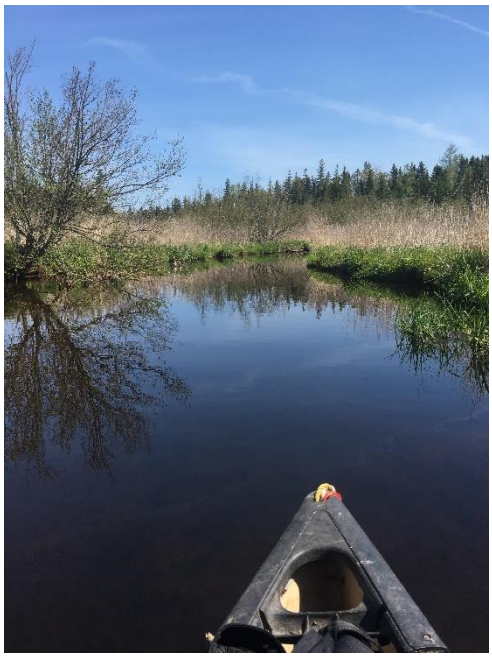
Recent Atlantic salmon habitat restoration efforts on the south branch include:

- Managing blockages and beaver management zones (annually)
- Alder management (2014-present)
- Brush mats built between above MacAulay's Pond on the McKenna and 48 road tributaries (2019,2021,2022)
- Tree planting to diversity riparian areas along crossing of Old Mount Stewart Road (2019)
- Nature like fish way built at McKenna's Pond by Ducks Unlimited Canada (2021)

Recommendations:

The following are objectives to help further improve local populations of salmon along the south branch:

- Maintain stream connectivity by ensuring the migratory corridor from the top of Leard's Pond to spawning areas remains clear of blockages. When clearing windfalls, ensure plenty of cover is left for fish cover and habitat. Windfalls and woody debris can be anchored to create stable cover that does not interfere with migrating fish.
- Continue to build more resilient and diverse riparian zones by planting a variety of native trees and shrub and encourage land acquisition by the Province of PEI, Island Nature Trust or the Conservancy of Canada along the south branch beyond the green belt to protect the river from undesirable land use change.
- Continue alder management in sections with dense growth.
- Monitor the success of brush mats built along the south branch and continue to add more where needed to collect the heavy sediment load.



Paddling the south branch of the Morell River entering the top of Leard's Pond.

Surveys and Monitoring

Redd Surveys

Redd surveys (also known as spawning surveys) are the standard for assessing salmon runs across PEI. A redd (or nest) is the term for where Atlantic salmon lay their eggs in the stream bed. MRMC has been completing redd surveys since 1990. The surveys are completed by a combination of walking and paddling sections of the river. Surveyors walk upstream with polarized glasses to see the redds. Compared to other population monitoring efforts like fish counting fences, redd surveys are relatively easy to complete if the conditions are right. High water and poor weather conditions can lead to an incomplete count which means that all sections of the river were not able to be surveyed.

Recommendation: Continue to complete annual redd surveys on the Morell River.

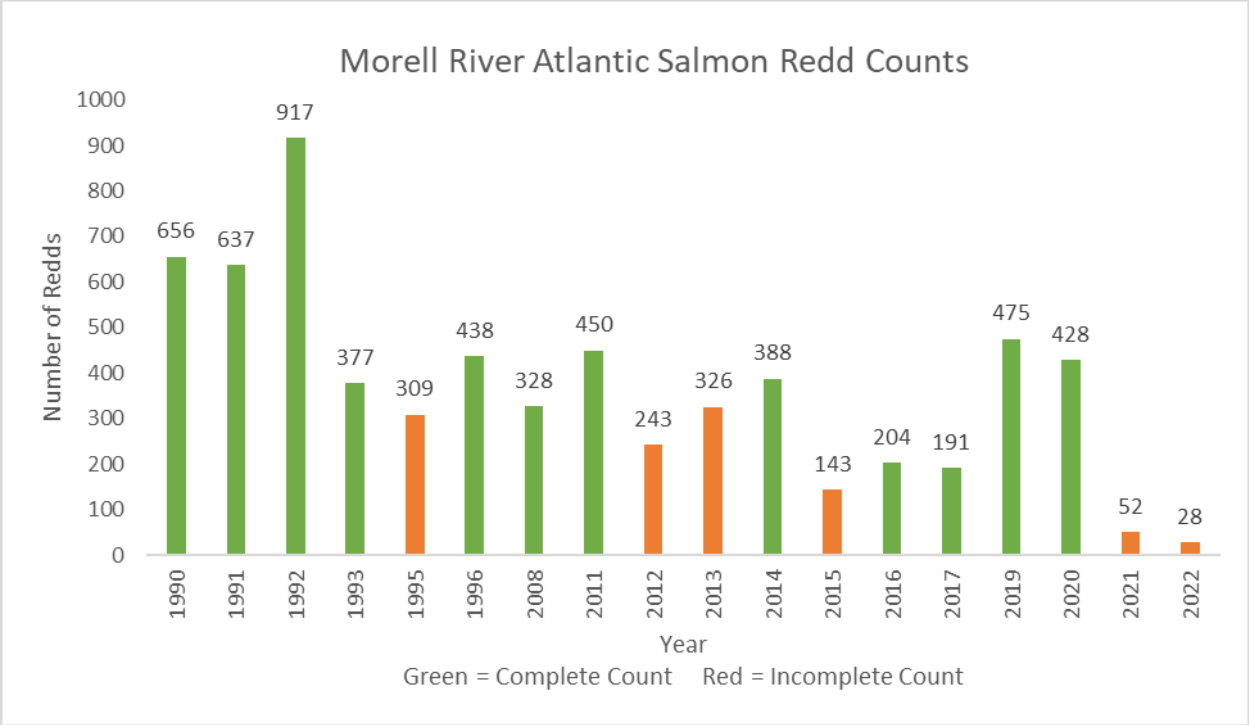
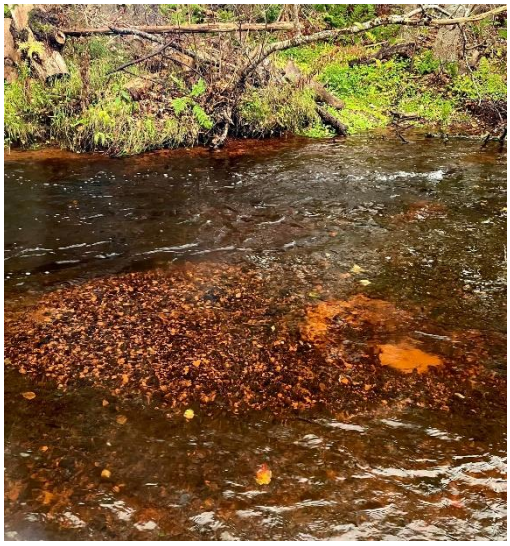


Figure. Graph of historical Atlantic salmon redd counts on the Morell River. Red indicates an incomplete count, meaning the entire river was not able to be surveyed that year.



In these photos of Atlantic salmon redds on the Morell River you can easily see the pronounced depression on the upstream end of the redd and the gravel pile covering the eggs.

2020 Redd Survey Map for Morell River

Starting Points- South Branch: MacAulay's Pond, East Branch: Jessie Maybell Road, West Branch: Mooney's Pond. End point – Indian Bridge.

As seen in the map from the 2020 redd survey, the highest density of Atlantic salmon redds (marked with blue stars) are found on the west branch below Leard's Pond and along the main branch of the Morell River.

Population Counts

Electrofishing Index Sites

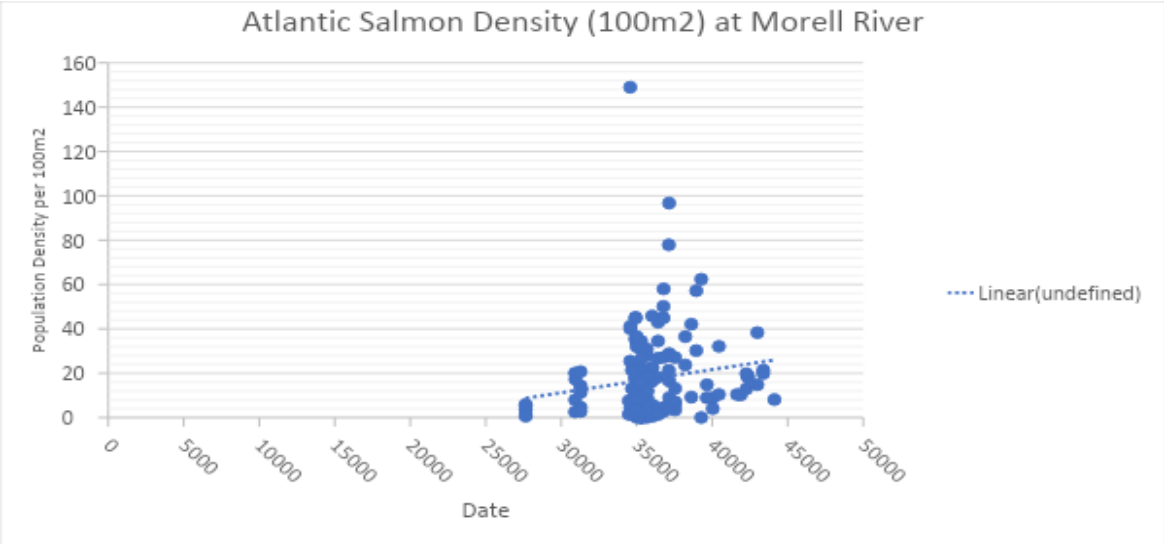
In 2022 the PEI Watershed Alliance completed a project to gather and analyze historical electrofishing data in four rivers on PEI including the Morell River. By gathering data from MRMC, the PEI Watershed Alliance and the PEI Department of Forest, Fish and Wildlife, a comprehensive electrofishing data set was created from decades worth of data. MRMC also collected electrofishing data from the Department of Fisheries and Oceans Canada.

It was found that electrofishing surveys have been completed 157 times at 28 different sites on the Morell River since 1975. The analysis of the data indicates a gradual increase in fish population density on the Morell. However, a low R^2 value and the presence of outliers in the data resulted in the data lacking statistical significance (PEI Watershed Alliance, 2022). Out of the 28 sites completed on the Morell River, two sites have been completed consistently; Crane's Bridge site on the east branch and Kenny's Bridge site on the west branch.

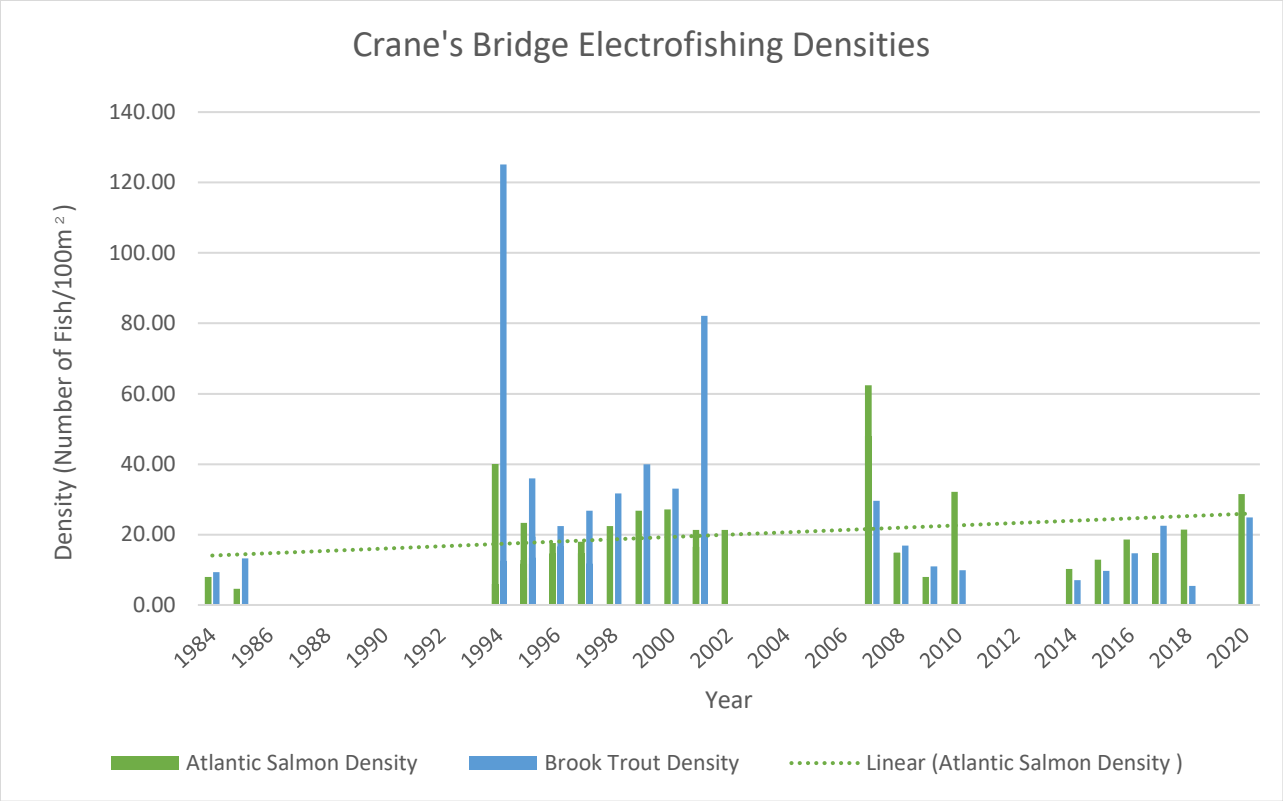
Recommendation: Continue to complete annual electrofishing surveys at the Cranes and Kenny electrofishing sites as they have the largest historical data sets. A consistent site on the south branch and main branch should be added for annual surveys.

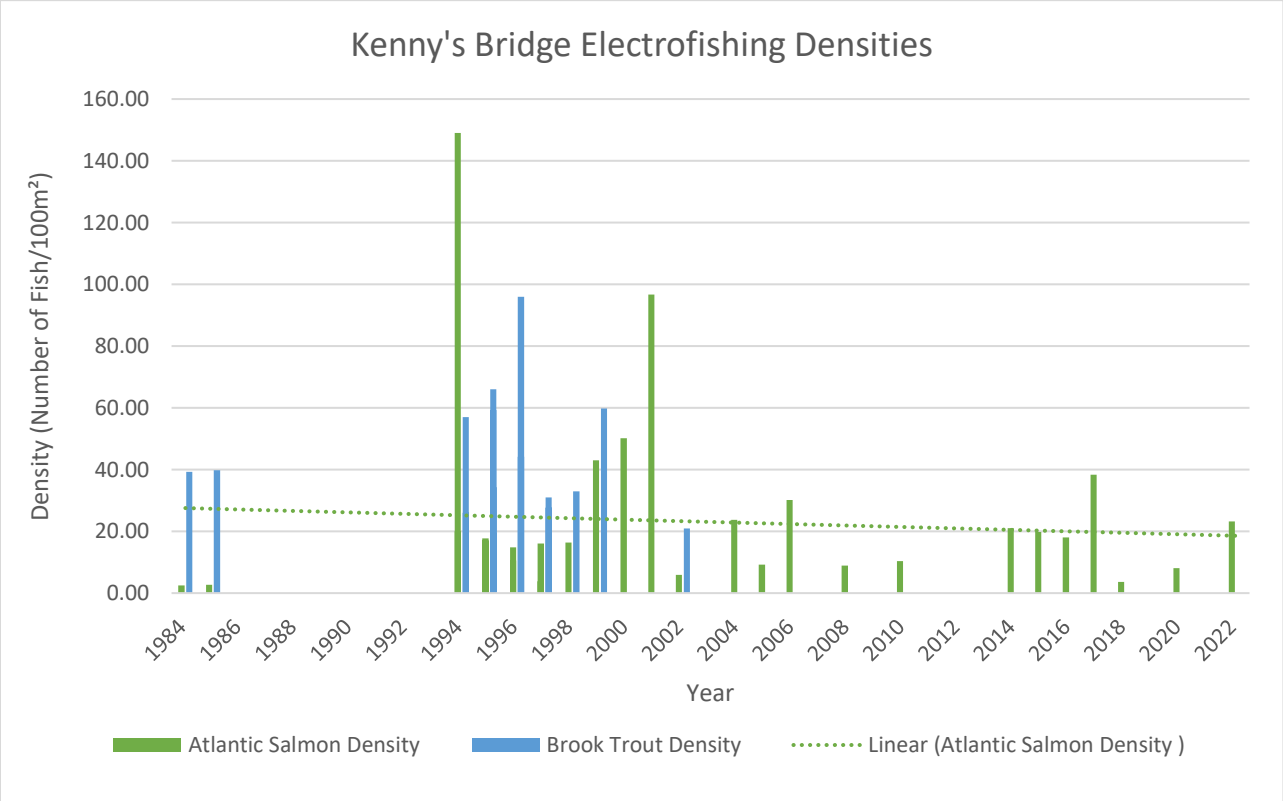
Many of the historical electrofishing records were missing key pieces of information like GPS points, dates, measurements etc. Electrofishing data can be used to indicate patterns in fish populations, but more consistent data collection and record keeping is needed to make the data for Morell River stronger statistically.

Recommendation: a standardized electrofishing protocol for the Morell River should be developed to provide consistent and detailed data sets. This will inure data sets can be compared and that a sufficient level of detail is recorded for each site.



Atlantic salmon population density over time in the Morell River (PEI Watershed Alliance, 2022).


Crane's Bridge Electrofishing Densities
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Density (Number of Fish/100m ²)
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year
Atlantic Salmon Density
Brook Trout Density
Linear (Atlantic Salmon Density)


Kenny's Bridge Electrofishing Densities
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Density (Number of Fish/100m²)
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
Year
Atlantic Salmon Density
Brook Trout Density
Linear (Atlantic Salmon Density)

Adult Counts

The longest running adult salmon population assessment on the Morell River is the counting of adults at the Leard's Pond fish trap on the west branch. Historically the trap was set in early spring and ran for the entire salmon run to count adults and catch broodstock for the PEI Fish Stocking Program. In recent years the trap at Leard's Pond only operates in the fall to catch broodstock. The trap does not provide a good indication of the total adult salmon returning to the Morell as it only captures fish that migrate far up the west branch. The trap is also not 100% effective as fish can bypass the trap in the spillway/runaround at Leard's Pond. Numbers of Atlantic salmon that were caught in the Leard's Pond fish trap in the 80s and 90s and information on trap efficiency can be found in *An update on the status of Atlantic salmon on Prince Edward Island in 1999* by Cairns, Murray, MacLean and Angus.

Smolt Counts

In the '90s fish traps were set up on the Morell River to catch smolts to get an indication of how many smolts from the semi-natural rearing site were exiting the river. After the semi-natural rearing program ended, there were no further smolt counts completed on the Morell River.

Recently, a tagging project through the Environmental Sciences Research Fund has provided funding to set up a fyke net on the Morell River to capture and tag smolts. MRMC has partnered with the Mi'kmaq Confederacy of PEI and the Abegweit Conservation Society to complete this project. The fyke net only captures a small percentage of smolts exiting the river as it does not completely block the entire width and water often flows overtop of the net.

Recommendation: Running fish traps and fences is very labor intensive and requires a huge commitment from staff and volunteers to run efficiently and properly. If getting population information will help with enhancement work or increasing the population of salmon on the Morell, then options for adult and smolt counting on the Morell River should be discussed with the PEI Department of Forest, Fish and Wildlife and the Department of Fisheries and Oceans Canada.

Temperature Monitoring

Like all Island rivers, the Morell is fed by springs and ground water seepage. Groundwater springs flow at a constant temperature of around 8ºC and typically keep rivers cool in the summer and warmer in the winter. However, temperatures on the Morell often exceed 20ºC between June and September. When summer temperatures reach 20°C and above, salmonids often seek refuge in cold water springs. The warm temperatures on the Morell are a result of a combination of factors. Compared to river systems like the Dunk or West Rivers which occur in areas with rolling hills, the Morell River drains a relatively flat area. The eight ponds and DUC impoundments on the Morell have large surface areas exposed to solar radiation and evaporation (Guignion et al, 1990). In a study done by Guignion, Dupuis and MacFarlane (1990), the key factors that influenced water temperature on the branches of the Morell River Included:

- Amount of direct sunlight reaching the stream or pond based on orientation
- Amount of shade provided by vegetation
- Number and size of impoundments (manmade and beaver dams)
- Width and depth of the stream
- Stream gradient
- Rainfall patterns and total discharge
- Amount of discharge from springs and seepage

MRMC has been monitoring water temperatures on the Morell River for decades. The most common pieces of equipment used to monitor temperature include Hobo™ Data Loggers and a YSI™ handheld unit. Additionally, in recent years a remote satellite temperature station has been transmitting real-time temperature data from the forks. Weekly temperature updates from the station are provided on the MRMC Facebook page.

The PEI Department of Environment, Energy and Climate action also collects temperature data on Island rives which is available through the PEI Surface Water Quality data set.

Temperature on the East Branch

The east branch is the warmest branch of the Morell River and although today it only has one remaining impoundment, the impacts of historical impoundments have left the river exposed to solar radiation. The east branch has a low gradient causing the river to meander slowly through the old impoundment sites. The man-made impoundments and historical beaver dams created large marshy areas with little to no overhead canopy. Water temperature on the east branch often reach 25°C at the Martinvale Road crossing and the former Everglades impoundment. Slightly more cover is provided by alders between the Hazelgreen Road and Crane's Bridge, but temperatures still reach 20+°C.

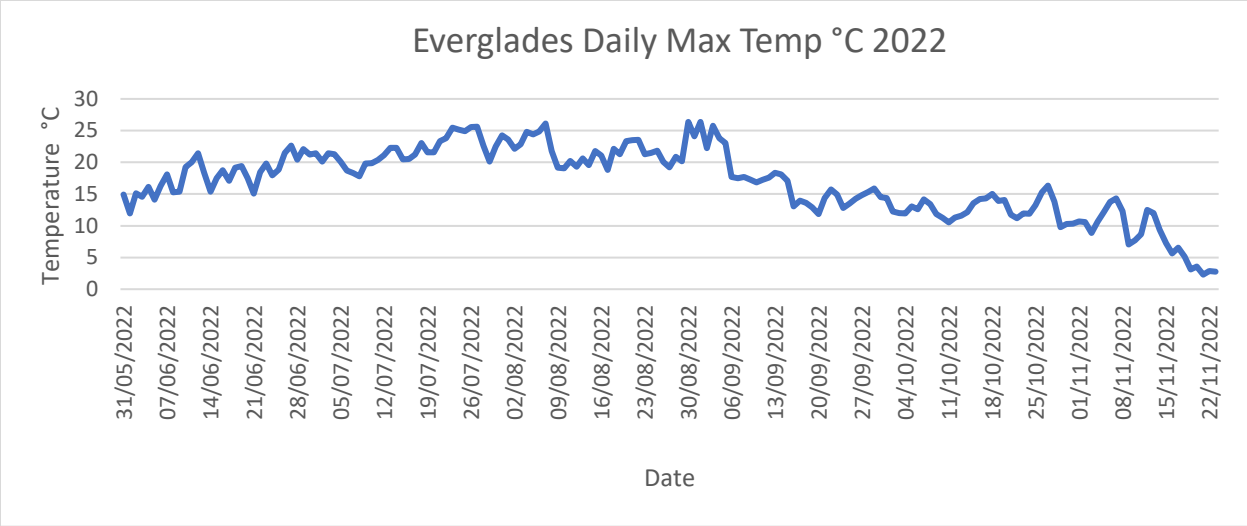
Since the 1990's extensive efforts have been made to try and keep the east branch from reaching lethal temperatures for salmonids. All windfalls and beaver blockages from the forks up to the Martinvale and Jessie Maybelle Roads have been removed. The MRMC crew maintains this section of the east branch on an annual basis. In 2013 the Everglades impoundment was removed in an attempt to further cool the east branch. In 2023 MRMC plans to expand management of the east branch beyond the Jessie Maybelle Road up to the Cardross and Martinvale Roads in attempt to improve water quality for Atlantic salmon and brook trout.

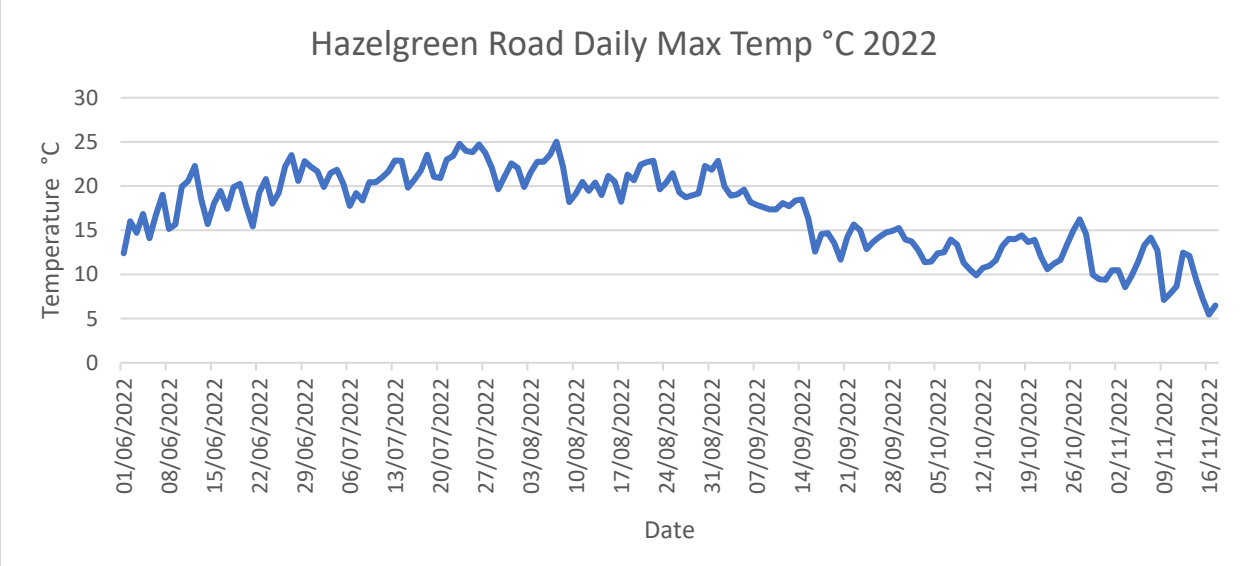
Current temperature monitoring locations on the east branch include Hobo temperature loggers deployed at:

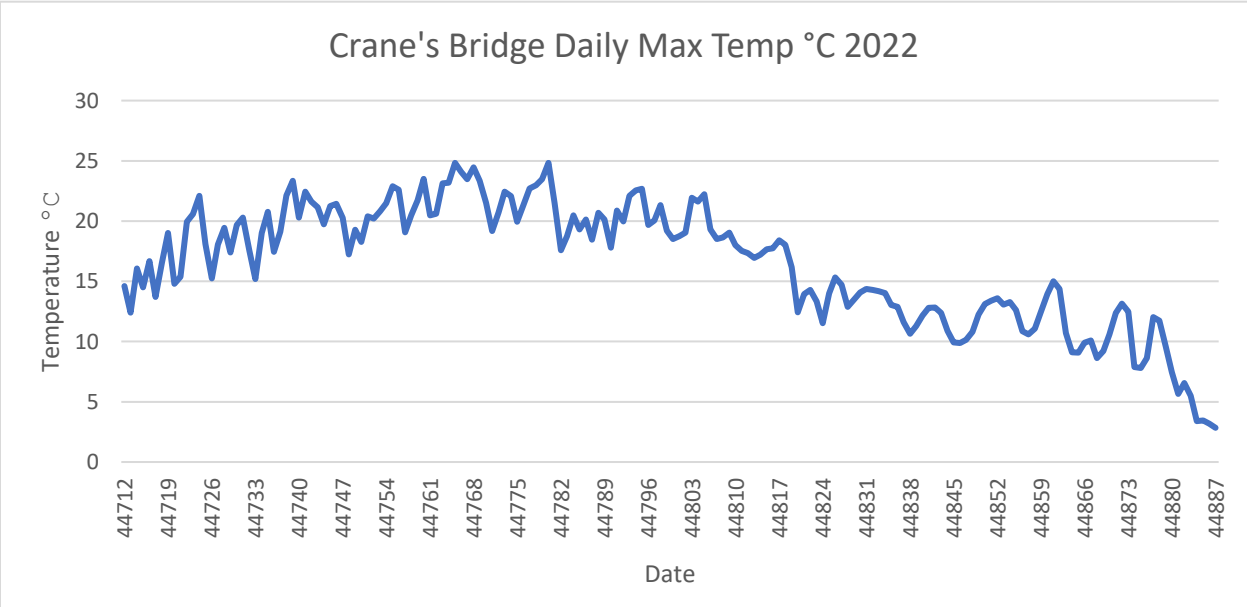
- Former Everglades impoundment site
- Martinvale Road
- Hazelgreen Road
- Cranes Bridge

Recommendation: In 2023, 10 additional Hobo temperature loggers and six dissolved oxygen loggers will be placed throughout the east branch to further understand and create a plan to improve water quality. An additional logger should be placed at the sticks impoundment.

Large open and flat areas comprise a large portion of the east branch.


Everglades Daily Max Temp °C 2022
Temperature °C
30
25
20
15
10
5
0
31/05/2022
07/06/2022
14/06/2022
21/06/2022
28/06/2022
05/07/2022
12/07/2022
19/07/2022
26/07/2022
02/08/2022
09/08/2022
16/08/2022
23/08/2022
30/08/2022
06/09/2022
13/09/2022
20/09/2022
27/09/2022
04/10/2022
11/10/2022
18/10/2022
25/10/2022
01/11/2022
08/11/2022
15/11/2022
22/11/2022
Date


Hazelgreen Road Daily Max Temp °C 2022
Temperature °C
30
25
20
15
10
5
0
01/06/2022
08/06/2022
15/06/2022
22/06/2022
29/06/2022
06/07/2022
13/07/2022
20/07/2022
27/07/2022
03/08/2022
10/08/2022
17/08/2022
24/08/2022
31/08/2022
07/09/2022
14/09/2022
21/09/2022
28/09/2022
05/10/2022
12/10/2022
19/10/2022
26/10/2022
02/11/2022
09/11/2022
16/11/2022
Date


Crane's Bridge Daily Max Temp °C 2022
Temperature °C
30
25
20
15
10
5
0
44712
44719
44726
44733
44740
44747
44754
44761
44768
44775
44782
44789
44796
44803
44810
44817
44824
44831
44838
44845
44852
44859
44866
44873
44880
44887
Date

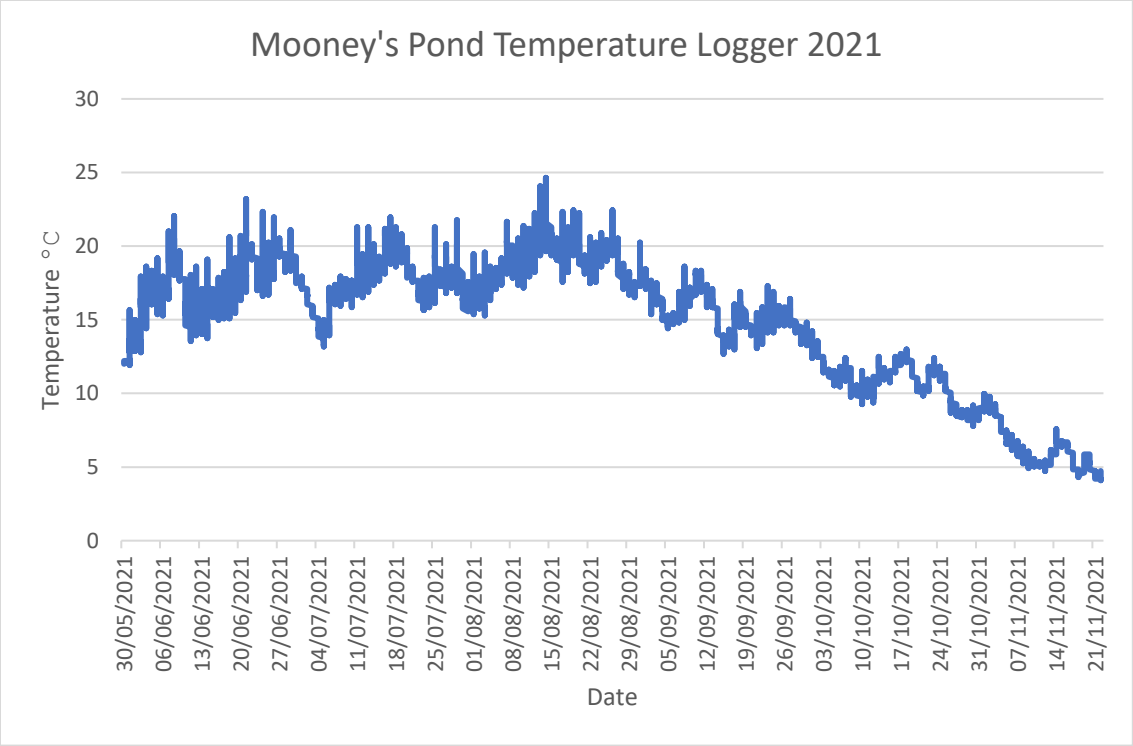
Temperature on the West Branch

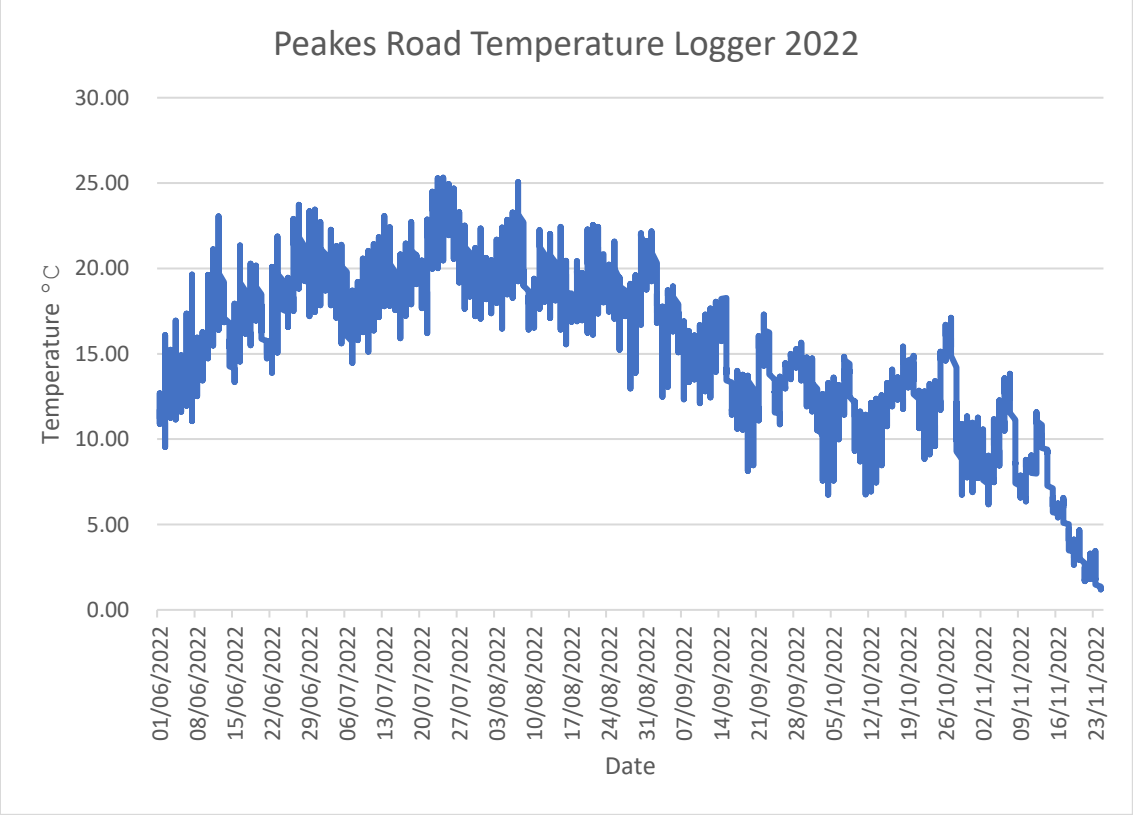
The west branch is only slightly cooler than the east branch with more shade and large springs providing some cooling effects. The impoundments that significantly impact temperature on the west branch are the Elliotvale DUC impoundment, Pisquid Pond and Leard's Pond. When the Elliotvale tributary joins the Pisquid Pond tributary, it flows through a low gradient section with little overhead cover to the Peakes Road (Peakes Road data logger). Between the Peakes road and Kenny Road the stream is provided with more shade from alders and some conifer stands and a large spring has a slight cooling influence (Kenny Road data logger). Continuing from Kenny Road to Leard's Pond the stream has good mix of forest and alder cover until the top of Leard's Pond. The top of Leard's Pond is heavily infilled with sediments and water is very shallow (only a few inches deep) and is exposed to substantial solar radiation creating warm temperature downstream from Leard's Pond (Leard's Pond data logger). About halfway between Leard's and the Forks, a smaller tributary known as the 'spring stream' flows into the west branch. There is a noticeable temperature change when walking this section in the summer as the spring stream provides cold water to the west branch. This 'spring stream' is likely an important cold water refuge area for salmonids in the warm summer months.

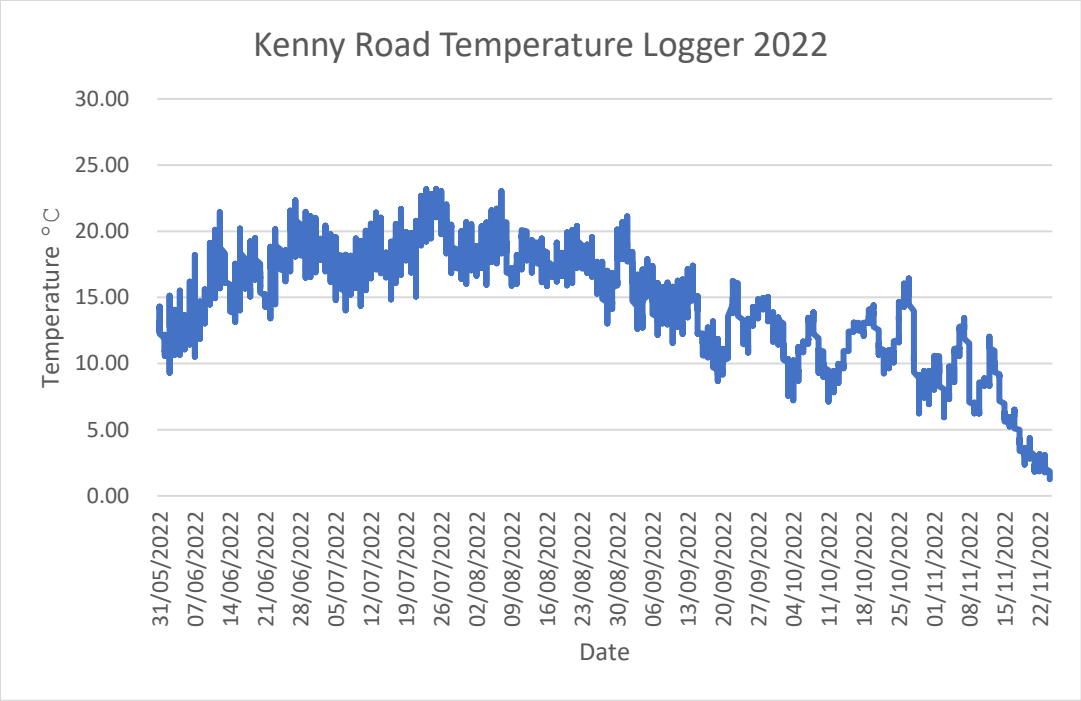
Current temperature monitoring locations on the west branch include Hobo™ temperature loggers deployed at:

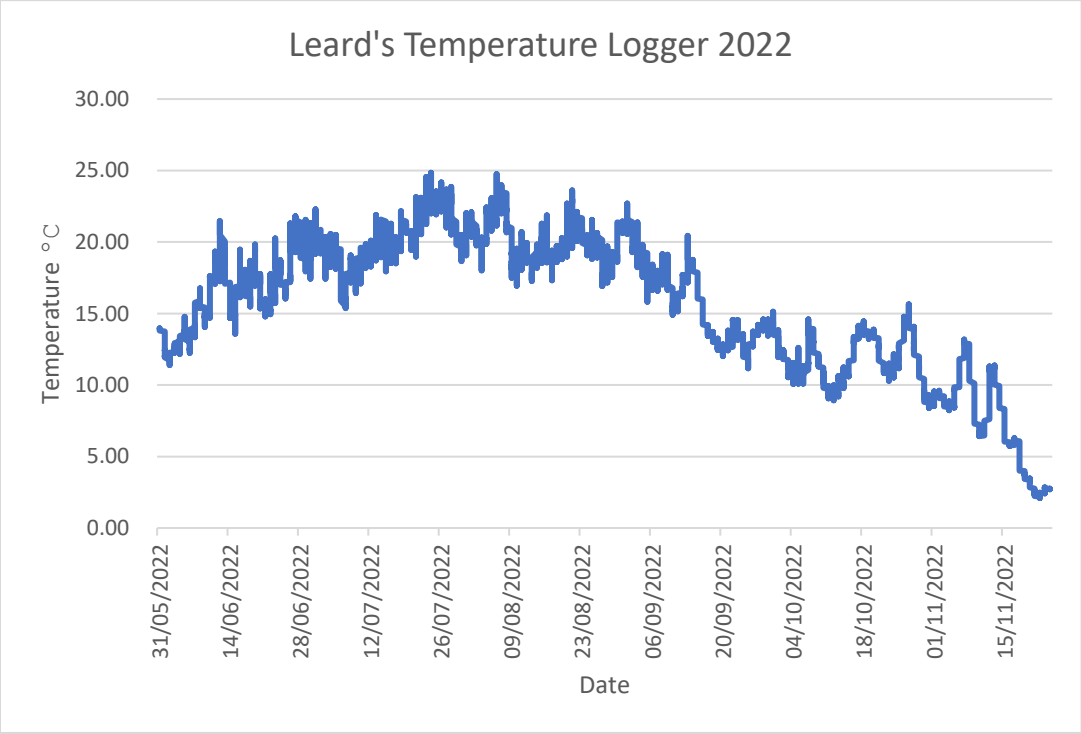
- Outflow of Mooney's Pond
- Outflow of Leard's Pond
- Last crossing of Peakes Road
- Below Kenny Road

Recommendation: additional temperature loggers should be deployed at the 'spring stream' and at the outflows of Elliotvale and Pisquid Ponds.


Mooney's Pond Temperature Logger 2021
Temperature °C
30
25
20
15
10
5
0
30/05/2021
06/06/2021
13/06/2021
20/06/2021
27/06/2021
04/07/2021
11/07/2021
18/07/2021
25/07/2021
01/08/2021
08/08/2021
15/08/2021
22/08/2021
29/08/2021
05/09/2021
12/09/2021
19/09/2021
26/09/2021
03/10/2021
10/10/2021
17/10/2021
24/10/2021
31/10/2021
07/11/2021
14/11/2021
21/11/2021
Date

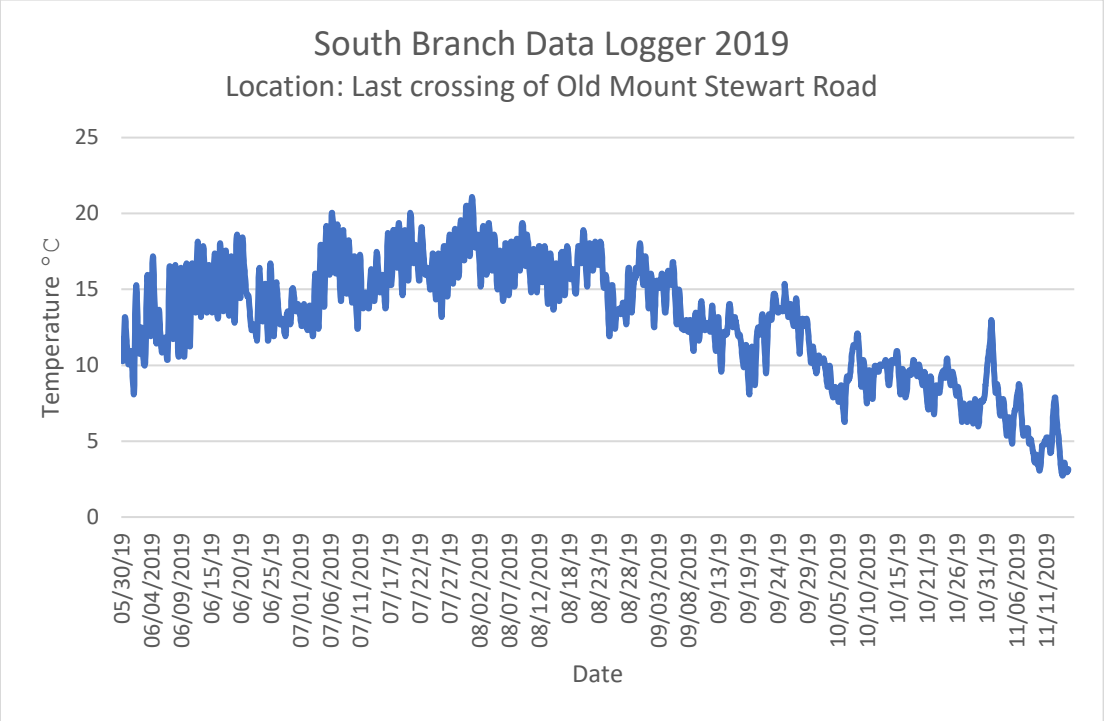

Peakes Road Temperature Logger 2022
Temperature °C
30.00
25.00
20.00
15.00
10.00
5.00
0.00
01/06/2022
08/06/2022
15/06/2022
22/06/2022
29/06/2022
06/07/2022
13/07/2022
20/07/2022
27/07/2022
03/08/2022
10/08/2022
17/08/2022
24/08/2022
31/08/2022
07/09/2022
14/09/2022
21/09/2022
28/09/2022
05/10/2022
12/10/2022
19/10/2022
26/10/2022
02/11/2022
09/11/2022
16/11/2022
23/11/2022
Date


Kenny Road Temperature Logger 2022
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Temperature °C
31/05/2022
07/06/2022
14/06/2022
21/06/2022
28/06/2022
05/07/2022
12/07/2022
19/07/2022
26/07/2022
02/08/2022
09/08/2022
16/08/2022
23/08/2022
30/08/2022
06/09/2022
13/09/2022
20/09/2022
27/09/2022
04/10/2022
11/10/2022
18/10/2022
25/10/2022
01/11/2022
08/11/2022
15/11/2022
22/11/2022
Date


Leard's Temperature Logger 2022
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Temperature °C
31/05/2022
14/06/2022
28/06/2022
12/07/2022
26/07/2022
09/08/2022
23/08/2022
06/09/2022
20/09/2022
04/10/2022
18/10/2022
01/11/2022
15/11/2022
Date

Temperature on the South Branch

The south branch is almost completely shaded by thick riparian forest up to the first crossing of the Old Mount Stewart Road. The south branch has much smaller impoundments than the west branch, is much more shaded than the east branch and has several large springs making it the coolest branch of the Morell with temperatures usually staying near or below 20°C during July and August.



Current temperature monitoring locations on the south branch include Hobo™ data loggers deployed at:

Old Mount Stewart Road

Recommendation: additional temperature data loggers should be deployed at the outflow of McKenna's Pond and MacAulay's Pond.

Temperature on the Main Branch

The temperature of the main branch is dependent on temperatures of the east and west branches mixing when they reach the forks. The short stretch between the forks and Grant's Bridge is very open and shallow, temperatures recorded here can reach 26°C in the summer. Downstream of Grant's bridge the main branch is heavily forested and is mostly shaded apart from some very wide and shallow sections. In a 1990 survey of the river there was not much temperature change on the main branch until it reached the large springs located above Indian Bridge (known as the 'spring hole') (Guignion et al, 1990).

Current temperature monitoring on the main branch includes:

- Remote satellite temperature station set up just below 'the forks'

Hobo™ temperature data loggers deployed at:

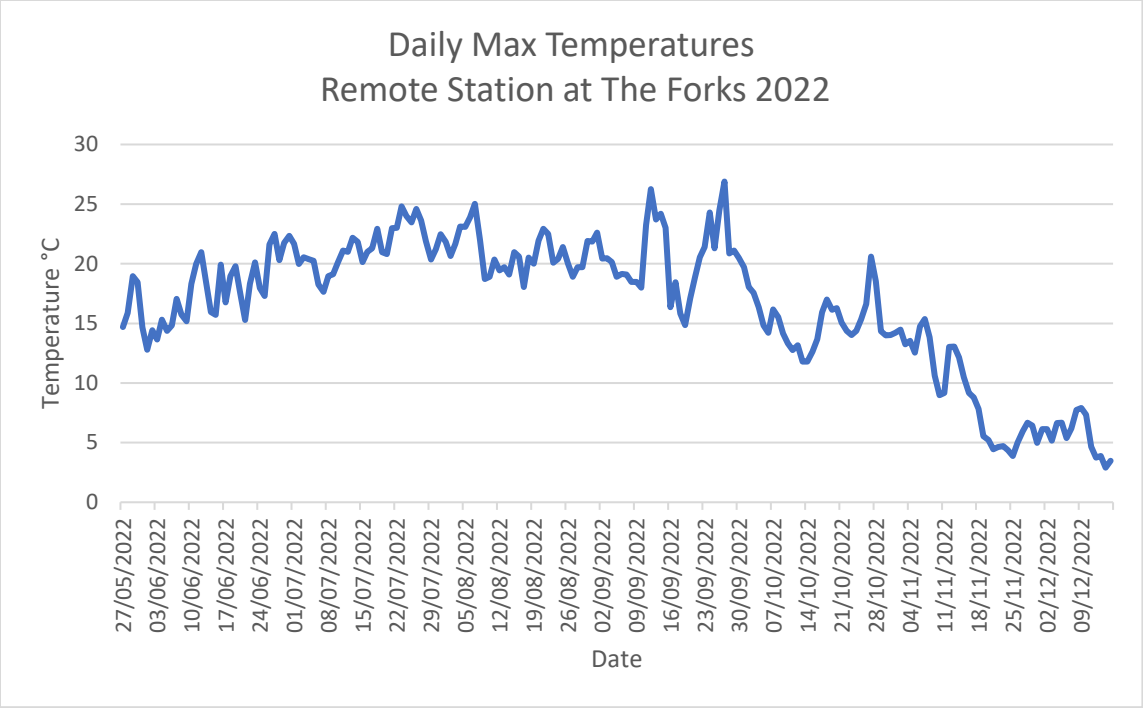
- Grant's Bridge
- Indian Bridge

Real time data from the remote temperature station is shared weekly throughout the summer months on the MRMC Facebook page so that anglers may make informed decisions about angling based on the river temperature.

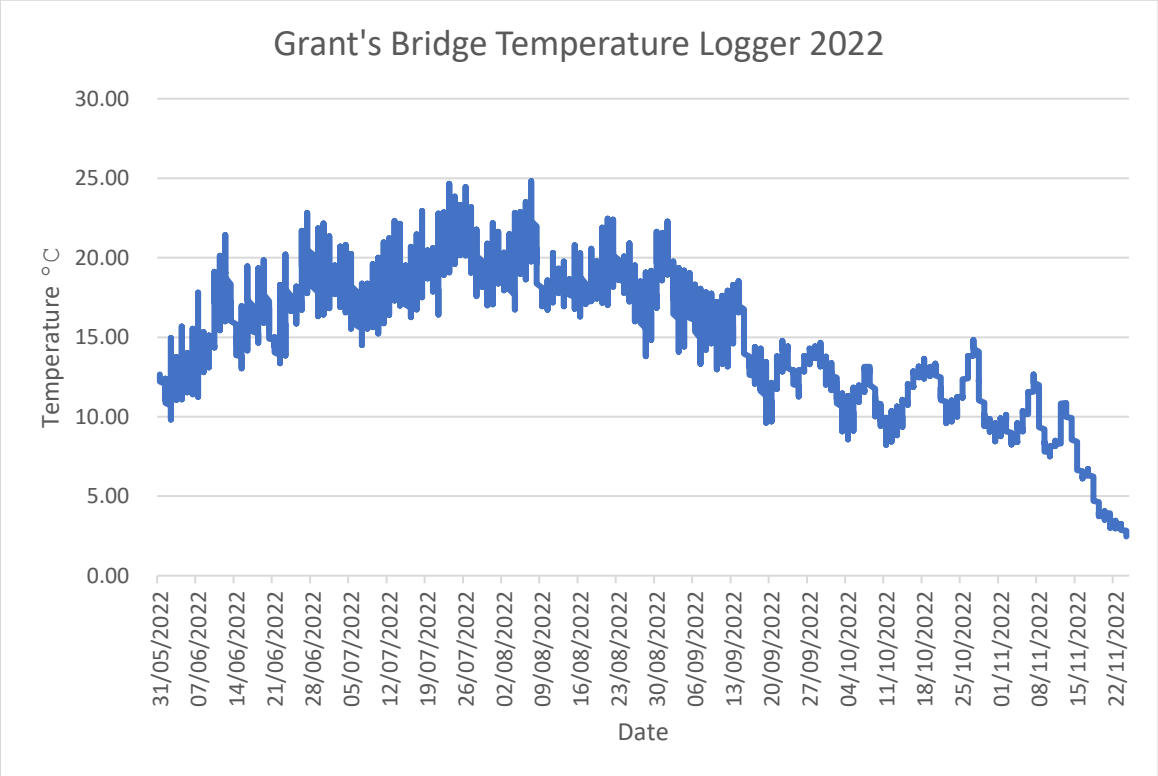
Recommendation: There is years' worth of historical temperature data from the Morell River which needs to be formatted in a useful way. PEI Department of Environment, Energy and Climate Action may be able to assist with this.

Recommendation: A thermal map of the Morell River should be developed to identify cold water refugia. The PEI Division of Forest, Fish and Wildlife may be able to assist with the use of a thermal drone.

Recommendation: The location of the remote satellite temperature station should be discussed with the Department of Fisheries and Oceans and the PEI Department of Forest, Fish and Wildlife so as to provide the best quality temperature data.



Note: Sudden spike in temperature around September could be due to temperature wire coming out of the water as no sudden spike was seen in the Grant's Bridge Temperature Logger



Riparian Surveys

A healthy riparian zone can reduce sedimentation, moderate water temperature, enhance biodiversity and stabilize stream banks (Guignion et al, 2019). There have not been any recent riparian surveys done on the Morell River. The PEI Department of Environment, Energy and Climate Action will be releasing a new aerial survey in spring of 2023 which was completed in 2020. This will allow us to compare the change in forest cover from the previous survey which was completed in 2010.

The PEI Watershed Alliance is working to develop a Riparian Assessment Protocol for PEI Watershed groups. This will be a useful tool for future riparian surveys.

Biomonitoring

"The Canadian Aquatic Biomonitoring Network (CABIN) is an aquatic biomonitoring program for assessing the health of fresh water ecosystems in Canada. Benthic macroinvertebrates are collected at a site location and their counts are used as an indicator of the health of that water body." (Environment and Climate Change Canada, 2018)

The Department of Fisheries and Oceans Canada has been completing CABIN sites on the Morell River with assistance from MRMC. Data from sampling sites if available on the Environment and Climate Change Canada website.

Recommendation: Continue CABIN monitoring every 5 years unless a drastic event takes place which could change water quality. E-DNA samples can be taken during years that CABIN is not completed.

Summary of Recommendations

Action Items

- An updated survey of availability and quality of Atlantic salmon habitat on the Morell River should be completed. The MRMC has significantly enhanced habitats since the last survey in 1975. MRMC has worked to create better quality spawning areas and establish access to more reaches of the Morell. This could be done in collaboration with DFO.

- It would be beneficial to collaborate with landowners, DUC and the Provincial Government via the impoundment committee to discuss possible solutions to warm water outflow of the impoundments that could impact Atlantic salmon habitat on the Morell River.

- Investigate the possibility and feasibility of re-starting the semi-natural rearing program at Mooney's Pond.

- Encourage land acquisition by the Province of PEI, Island Nature Trust, or the Nature Conservancy of Canada beyond the green belt to protect the river from undesirable land use change.

Habitat Enhancement

- Maintain stream connectivity on all sections of the Morell River by ensuring the migratory corridor from sea to spawning areas remains clear of blockages.
- When clearing windfalls, ensure plenty of cover is left for fish cover and habitat.
- Windfalls and woody debris from hurricane Fiona can be anchored to create stable cover that does not interfere with paddlers or migrating fish.
- Monitor agriculture fields for sediment input. Especially at Indian Bridge and the Compton Property on Peakes Road.
- Continue working with the Department of Transportation and landowners to mitigate sediment input.
- Continue to build more resilient and diverse riparian zones by planting a variety of native trees and shrubs.
- Expand the beaver management zone on the Everglades branch: extend up to the Cardigan and Martinvale roads
- Bi-weekly monitoring for new beaver blockages on the east branch during stretches of high summer temperatures
- Blockages on tributaries with springs above the Jessie Maybelle Road should be identified and opened (planned for 2023)
- Provide more shade and cover for fish on the east branch especially near the Everglades and at Crane's Conservation Zone. Ex: floating cover structures
- Continue alder management in sections with dense growth.
- Monitor the success of brush mats built along the south branch and continue to add more where needed.
- Remove concrete pieces of the former bridge below Leard's Pond to revert the river to its natural state.

Monitoring & Surveys

- Temperature data loggers should be installed at the upper end and outflow of all impoundments on the Morell River including: the sticks, McKenna's Pond, Pisquid Pond, Mooney's Pond, Elliotvale, Leard's Pond and MacAulay's Pond.
- Temperature data logger should be installed on the spring stream.
- Dissolved oxygen loggers should be installed on the east branch of the Morell River.
- Investigate the possibility and feasibility of re-starting the semi-natural rearing program at Mooney's Pond.
- Continue to complete annual redd surveys on the Morell River.
- Continue to complete annual electrofishing surveys at the Cranes and Kenny electrofishing sites sets.
- Identify a consistent site on the south branch for annual electrofishing surveys
- Develop a standardized electrofishing protocol to provide consistent and detailed data sets.
- Discuss location of the remote temperature station with the Department of Fisheries and Oceans and the PEI Department of Forest, Fish and Wildlife to provide the most accurate temperature data.
- Continue CABIN monitoring every 5 years unless a drastic event takes place which could change water quality. E-DNA samples can be taken during years that CABIN is not completed.

References

Abegweit Biodiversity Enhancement Hatchery. (2022). Retrieved from https://abegweithatchery.ca/story/#:~:text=Atlantic%20salmon%20is%20culturally%20significant,producing%20fish%20for%20stocking%20rivers.

Abegweit Conservation Society. (2023). Retrieved from https://abegweitconservation.com/

Cairns, D. K., Guignion, D. L., Dupuis, T., and MacFarlane, R. E. (2010). *Stocking history, biological characteristics, and status of Atlantic salmon (Salmo salar) on Prince Edward Island*. DFO Can. Sci. Advis. Sec. Res. Doc. 2010/104. iv + 50 p.

Cairns, D.K., and MacFarlane, R.E.(2015). *The status of Atlantic salmon (Salmo salar) on Prince Edward Island* (SFA 17) in 2013. DFO Can. Sci. Advis. Sec. Res. Doc. 2015/019. iv + 25 p.

DFO. (2022). *Stock status of Alewife and Blueback Herring (Gaspereau) in the DFO Gulf Region.* DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2022/014.

Ducharme, L. (1977). *Atlantic Salmon Habitat Enhancement in the Morell River*, Prince Edward Island. Retrieved from https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/18186.pdf

Environment and Climate Change Canada. (2018). *CABIN Canadian Aquatic Biomonitoring Network*. Retrieved from https://open.canada.ca/data/en/dataset/13564ca4-e330-40a5-9521-bfb1be767147

Government of PEI. (2022). *2020 PEI Water Quality Report Cards*. PEI Department of Environment, Energy and Climate Action.

Government of PEI. (2020). *Fish Kill Information and Statistics*. Retrieved from https://www.princeedwardisland.ca/en/information/environment-water-and-climate-change/fish-kill-information-and-statistics#:~:text=Since%201962%2C%20there%20have%20been,the%20chemical%20into%20nearby%20streams.

Guignion D.L., Dupuis T.D., MacFarlane R.E. 1990. *Factors Influencing Water Temperature and the Possible Impacts of High Water Temperatures on Salmonids in the Morell River Prince Edward Island*. University of Prince Edward Island.

Guignion D.L., MacFarlane R.E. (1991). *1991 Atlantic Salmon Smolt Release from Mooney's Pond*. Morell River Management Cooperative ltd.

Harris M, Dupuis T, Guignion D, MacFarlane R, 2012. *Technical Manual for Watershed Management on Prince Edward Island*. Prepared for the PEI Watershed Alliance, PE

Indigenous Tourism. (2022).*Prince Edward Island.* Retrieved from Indigenous Tourism: https://indigenoustourism.ca/regions/prince-edward-island/

Inglis, D. S. (2019, March). *MC PEI*. Retrieved from MC PEI: https://mcpei.ca/wp-content/uploads/2020/05/Mikmaq-Place-Names-Updated-5-March-2019-1.pdf

Island Tourism.(2017).*Eco-Itinineraries* Retrieved from Points East Coastal Drive: https://pointseastcoastaldrive.com/itineraries/entry/daryl-guignion

Jubilee Senior Citizens Club. (1980). *Morell its history*. Clark Printing Service.

McCabe, S. (2000, March). *Pondering Ponds: A Process for Assessing Community Attitudes Towards Stream Impoundments on Prince Edward Island*. Retrieved from Island Studies : https://islandstudies.com/files/2014/04/PONDERING-PONDS.pdf

Murnaghan, D. (1983). Morell River Improvement Project.

PEI Department of Environment. (n.d.). *A Guide to Watershed Planning on Prince Edward Island*.

PEI Flavors. (2018). *PEI Seafood*. Retrieved From https://peiflavours.ca/export/seafood

PEI Watershed Alliance. (2022). *Four River Historic Salmon Population Summary*.

Maryland Department of Natural Resources (n.d.). *Brook Trout* . Retrieved from https://dnr.maryland.gov/education/Documents/BrookTrout.pdf

Appendix

A total of 12,757,219 Atlantic salmon have been stocked into the Morell River since 1880. Historical stocking numbers compiled by Carissa Grove (DFO, pers. Comm). 2021 and 2022 numbers provided by Rosie MacFarlane (MacFarlane, pers. Comm).

Year	Number of salmon stocked in Morell River
1880	100000
1881	60000
1900	75000
1907	140000
1908	200000
1909	226000
1910	288000
1911	315000
1913	216000
1914	240000
1915	230000
1916	120000
1925	234897
1926	160000
1927	222900
1928	207653
1929	103607
1930	76720
1931	503436
1932	242622
1933	338054
1934	349835
1935	299608
1936	609000
1937	431970
1938	388680
1939	403900
1940	246841
1941	341080
1942	341310
1943	375600
1944	170835
1945	314900
1946	431600
1947	357410

1948	213300
1949	301360
1950	226245
1951	109500
1952	238200
1953	300000
1954	229900
1955	12360
1956	267800
1957	218000
1958	36520
1959	29800
1960	25000
1962	53950
1963	64000
1964	12000
1966	1575
1967	19370
1978	14943
1979	32693
1981	682
1982	38409
1983	9000
1985	21425
1986	14628
1987	28784
1988	20097
1989	22210
1990	59810
1991	36496
1992	47822
1993	19379
1994	26000
1995	15568
1996	46592
1997	46800
1998	45591
1999	45224
2004	40800
2009	10500
2011	7500
2012	15000
2016	60000

2017	50000
2018	12000
2019	50000
2020	63000
2021	75000
2022	60000
Total	12,757,291