The Friends of the Kouchibouguacis

2023-2024 Activity Report

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****** All permits and licenses are kept on file digitally and physically and can be seen anytime if needed.***

1.0 Introduction

This report presents an overview of all activities performed by TFK during the 2023-24 season. Recommendations and needed adjustments for next year will be discussed also. This report has been created for the stakeholders and partners involved in this project, and for future reference of the organization.

A salmon restoration program has been in motion on the Kouchibouguacis River since the 1990's and has been evolving through the years. The Friends of the Kouchibouguacis (TFK) is proud to be a part of an Atlantic salmon population restoration project with Kouchibouguac National Park (KNP). This project focuses on assessing salmonid habitat; collecting and analyzing DNA samples of salmon specimen captured through electrofishing and box-net fishing activities; and determining lineage of salmon populating the Kouchibouguac and Kouchibouguacis River systems to help verify the effectiveness of the incubation project.

In 2012, an Atlantic salmon egg in-stream incubation initiative began in order to provide protection to the eggs from potential predators, improve egg hatching rates, and other environmental factors. This initiative would also contribute to the reestablishment of the Atlantic salmon population in the Kouchibouguacis River; the ultimate goal is to restore the Atlantic salmon populations to a healthy quality and quantity.

TFK takes a high-level approach to restoring the Atlantic salmon population, and the ecosystem as a whole within the Kouchibouguacis and Kouchibouguac watersheds. This includes the many initiatives described in this annual report, such as: Atlantic salmon and all fish species population monitoring; Atlantic salmon population enhancement via in-stream incubation; Habitat monitoring and restoration; Tree propagation within our nursery; Brook floater monitoring and conservation; Water quality monitoring; and many more.

2.0 Salmon Egg Incubation

The following section is a detailed description of the incubation project that outlines the multiple steps and procedures taken during each stage.

2.1 Salmon Egg Incubation Jordan-Scotty Salmonid Egg Incubators

Salmon broodstock collection for the purposes of in-stream incubation has been carried out annually on the Kouchibouguacis River since 2012 (except for 2014 due to rearing tank component resulting in entire project being cancelled – rearing tank yielded very poor results, and which later led to focusing on in-stream incubation instead). Two smelt box-nets are installed in the river and a select few of the mature Atlantic salmon caught are temporarily retained. These fish are transported to the Miramichi Salmon Conservation Centre (MSCC) where spawning/fertilization is performed (further details of the broodstocking process is provided in the following section).

The broodstock collection provides fertilized eggs for the incubation exercises. TFK completed our Atlantic salmon egg incubation efforts again this year; the number of eggs collected, and incubators installed within the Kouchibouguacis tributary - Ruisseau de la Truite, is described in detail within this section. Funding from the Atlantic Salmon Conservation Foundation and KNP allowed our incubation project to continue this year within the Ruisseau de la Truite (Latitude: 46,69119°, Longitude: -65.09666°)

a total of 10 incubators were used during the incubation process including two aerated low profiles, 3 aerated full sizes, 4 non-aerated full sizes and one full size with the outside plates being non-aerated, the inside plates aerated and the middle plate having 137 non aerated eggs and 63 aerated eggs. The Kouchibouguacis site (Latitude: 46,70321°, Longitude: -65.09520°) had a total of 11 incubators used, including one aerated low profile, one non-aerated low profile, 3 non-aerated full-size incubators, 5 aerated full size and one full size with only 238 non-aerated eggs and 42 aerated eggs on a separate plate. TFK decided to use two incubation sites for the 2023 season to try to disperse the number of spawning eggs and reduce any potential negative impacts regarding the carrying capacity in each stream. Kouchibouguac National Park (KNP) unfortunately could not complete their Atlantic salmon incubation stocking programme within the Kouchibouguac watershed (Black River and Rankin Brook) due to broodstock mortality at the hatchery. KNP released their remaining female after being treated for a prolonged health issue.

Jordan-Scotty Salmonid Egg Incubators

were used for the incubation of the salmon eggs. The incubators were ordered through the Scott Plastics Ltd. company located in Sidney, British Columbia. The recommended incubator plates varied in colours that determine the size of the escape holes; the recommended colour for Atlantic salmon eggs is red. Clear incubators are also available for educational purposes. One incubator "unit" is comprised of two matching plates made up of 200 individual chambers referred to as cells. One cell provides shelter for one egg. Therefore, a dead or infected egg will not affect neighbouring eggs; this was one of the main attractive features in acquiring this type of incubator.

Since 2015, TFK has been making modifications and alterations to the incubators in an attempt to better the survival rate of the eggs. Originally these efforts included tying 1-2-inch square steel tubing to the base of the incubator in order to lift the incubator off the substrate. This was implemented as a means to increase water flow through and under the incubators, and clear sediment build-up that can clog the cells and ultimately smother the eggs. Sedimentation was not the only factor hindering the success of the hatch rates. Organic debris such as branches, rocks, and ice flows were also damaging the incubators and at times, dislodging it from where it was originally installed. Last year, a new experimental method was used in an attempt to avoid both of the previously mentioned issues (sedimentation and destruction of incubators). Developed in partnership with KNP, a standard milk crate was equipped with two ropes at the bottom running parallel that were tied roughly three inches above the bottom of the crate. Acting similarly to the base plates used in past seasons, these ropes allow the incubator to be lifted off the substrate, while also allowing for a shaking action to occur – which can help wash away sediment during the incubation period. This will also provide increased circulation through the plates preventing sediment build-up, while also offering better cushioning during turbulent flows. The fully loaded incubator is then placed on the bottom ropes and a bungee cord is looped over the incubator and hooked on to the opposite side of the crate. The side where the bungee cord hooks are attached is pointed downstream to prevent it from lifting and/or coming loose. Should this take place, as a precaution a second rope was attached at the top on the opposite side of the crate and looped over the incubator, as well. This rope was then fastened with a zip tie (or carabiner depending on which was available at time of installation). This installation protocol using milk crates was performed again this year, after this method displayed great results in 2020 with a high hatch rate and well-preserved incubators. TFK also modified 4 incubators and milk crates for an experimental design by cutting them approximately in half to allow for these units to be installed in lower water depths; being placed in lower water depths can help improve the conditions for incubation to occur as there is faster moving water which can help reduce sedimentation and deliver more

consistent/higher levels of oxygen to the eggs during their development. TFK ensured that any cell left was fully enclosed to allow for proper function and protection of any eggs placed inside – any exposed cells were not loaded with eggs. The low-profile units installed during the seasons (2021-22 and 2022-23) were in great condition and displayed great hatch rate success comparable with the full-sized incubators, so TFK considers this experiment successful and will continue to monitor the results next year. Each "low-profile" incubator held 580 eggs, and 2 were installed at ruisseau de la truite and at the site in the Kouchibouguacis river (4 low-profile units total).

All empty milk crates were previously installed in the stream with rebar earlier in the season. This allowed for better scouting of prime locations within the waterway that ensured the incubators would remain submerged during low flow. This new setup allowed for installation time on incubation day to be decreased, which aided in the safety and efficiency of the technicians as less effort is spent attempting to tie incubators within the stream in near freezing temperatures.

Photo of empty milk crate design in stream

Photo of milk crate design with loaded incubator installed

Locating new incubation sites in other streams will help diversify the incubation project to more than just one stream and act as a fail-safe in the case of extreme flooding events like the one seen in the winter of 2018 which resulted in the damage and loss of multiple incubators. TFK selected a new incubation site on the main branch of the Kouchibouguacis River in 2022 to help spread out the spawning of Atlantic salmon. A new potential incubation site may be available on ruisseau baptiste. This year TFK successfully removed two beaver dams, replaced concrete man-made dam, and narrowed the water passage at last year's restoration site. These adjustments improved the watercourse and fish passage. In the coming years (depending on funding application results) TFK would like to lower a culvert to allow better water passage.

Fall incubation offers its advantages and disadvantages; the prime disadvantage lies within egg vulnerability. The very recently laid eggs are especially delicate 48 hours following fertilisation (2. Flanagan, Jason J., 2003.); at this stage the eggs are not yet eyed and are called "green eggs". The challenge here is to successfully accomplish the needed tasks within the 48-hour period post fertilisation. The 48-hour period is the only time allotted for handling the eggs without causing irreversible damage. It should also be noted that the hatchery used for the spawning of the adult salmon, the Miramichi Salmon

Conservation Center, is situated in South Esk New-Brunswick; a one-hour drive away from where the project takes place (Saint-Louis-de-Kent and Saint-Ignace area). Alternatively, the advantage of doing this project during the fall months is the comfort in knowing that the allowance of a backup plan could be possible in case the installation of the incubator was impossible due to unforgiving fall weather. Since eggs from Maritime Atlantic salmon eye up in March and only hatch in April (3. Flanagan, Jason J., 2003.), the incubators could be loaded up with eyed eggs and installed in the brook in early spring. Even though eggs are tougher when eyed, TFK still does not consider spring incubator installation as first preference for fear that ice and snow would add more challenges to incubation efforts as well as compromising safety. TFK also prefers to minimize the amount of time eggs/fish are kept in captivity, to educe any ill effects of human interference; and to also maximize time spent in their natural habitat.

2.2 Incubation Methodology

The following section outlines all steps taken prior to and the day of incubation. A transfer permit request for the transfer of Atlantic salmon eggs was submitted to the department of Fisheries and Oceans Canada. The request included a stocking plan for the stocking of the eggs. It should be noted that a fish health analysis was not mandatory prior to transfer because as indicated in the disease status section of the request, the eggs will be disinfected using an iodine solution (Ovadine) before incubation. Once the transfer permit was received, a signed copy was added to the pack of field equipment. As indicated in the permit, the signed copy accompanied the personnel responsible for transferring the eggs from the Miramichi hatchery to Saint-Louis-de-Kent, and again when the eggs were transported to the brook for incubation. A DFO field supervisor was notified of the intentions and activities prior to the transfer of eggs. To help prevent the transfer of diseases and pathogens to the sensitive eggs, an Ovadine solution was used as a disinfecting agent for both the eggs and any equipment used in the process.

TFK and Kopit Lodge staff transferring hardened eggs to Ovadine solution

Photo illustrating three stages of disinfection; Ovadine solution, rinse bin, fresh brook water

2.3 Once at the incubation site(s)

Several tasks are divided up and assigned to the team members present at each site on the day of incubation. Team members keep the same assignments throughout the entire day for the sake of instilling routine and in turn, encouraging faster processing time.

The field work includes two segments: the environmental parameter segment and the incubation segment. TFK decided that the environmental parameter segment would only need to be performed whenever a new site would be set-up or whenever significant changes were visible after arriving at the site. Information taken and recorded at each location is as follows: names of team members; date; site code; start and finish time; name of basin; name of water body; site photos; air temperature; longitude and latitude coordinates using a GPS unit; and water parameters using the YSI Professional Plus (Pro Plus) meter. Water parameters recorded at the sites included water temperature, dissolved oxygen, and pH levels.

To avoid temperature shock, after arriving at the site the Ovadine solution and the transportation jar containing the salmon eggs are placed in the stream. This allows the temperature of the disinfecting solution and the temperature of the water that the eggs were transported in to acclimate to the water temperature in the stream before incubation.

The Ovadine disinfecting solution and egg jar(s) are then retrieved from the brook and the temperatures verified and recorded. The temperatures are compared with the water temperature in the brook and once both are all within 3˚ Celsius of one another (and the eggs are left undisturbed in water long enough for hardening), the incubation preparations begin.

The Ovadine solution is poured in the disinfecting container. The lot of the eggs and water are then carefully poured from the jar into the 600 μm sieve that is in a container of fresh brook water (the brook water acts as a cushion so the eggs do not hit against the disinfecting container). The sieve containing the eggs is then transferred to the disinfecting container and left in the disinfection solution for 10 minutes. Once the allotted disinfecting time has passed, the 600 μm sieve of eggs is then transferred to a rinsing container. The sieve is moved around to assure that the eggs are well rinsed and then transferred again to a container of fresh brook water.

Once all are disinfected, the eggs are ready to be carefully transferred to the loading trays. A loading tray is set on top of the container of fresh water (in case eggs fall off the loading tray each can be safely caught and reused). One person gently collects a small handful of eggs from the sieve to place on the loading tray and then begins pushing the eggs around with a plastic (disposable) inoculating wand in order to fill up the compartments of the tray.

Once all of the individual compartments of the loading tray are occupied with an egg, all of the extra eggs sitting on the tray are wiped off into the fresh water and transferred back to the sieve. Any dead eggs are removed from the loading tray with the use of a plastic (disposable) inoculating wand. Once the loading tray is filled, it is passed along to the other two team members for transfer to a plate. The plate is placed on top of the loading tray and while holding the plate and tray tightly together, the designated member flips the pair upside down in order to have the loading tray on top of the plate. A squirt bottle is then sprayed over the now inverted loading tray to encourage the fertilized eggs to transfer into the cells of the incubation plate. As the plate is being filled, another loading tray is being prepared. The tray is lifted from the incubation plate and inspected for any remaining eggs. If eggs are still present in the tray, the tray is placed back on the plate and squirted with fresh water until the loading tray is completely empty. Once the loading tray is empty and the plate is full, another plate is placed on top of the now competed unit. Plastic nylon bolts are then run through the completed unit to help the plates stay together while the remaining plates are loaded. The unit is then placed in a container of fresh water from the stream with a

team member (or heavy object such as a rock) pushing down on top of the plates in order to prevent them from floating in the container and separating from one another.

This process is repeated for the remaining four units (5 pairs of plates creating a full incubator equalling 1000 incubated eggs per unit), or in the case of the modified low-profile incubators a full unit holds 580 eggs. Stacking each one on top of another assuring all cells are covered with fresh water and passing the bolts through all completed units. Once all the units are filled with eggs, stainless-steel nuts are screwed on to the bolts assuring that the plates are tightly clamped together. As previously mentioned, this season instead of securing the incubators with base plates and installing each in the stream fully exposed, the incubators were instead placed in milk crates specifically designed to lift the incubator off the substrate and protect it from potential debris (e.g., logs, ice flows, rocks, etc.).

The eggs will hatch in the following spring. Once the fry has used up all of the contents of its yolk sac, the fry will leave the incubator and merge into the water current and flow a few meters downstream to finally hide within the substrate. The fry will use the substrate as shelter and will begin feeding. The incubators will be recovered from the brook at the beginning of the following summer (June 2024 in this case). The eggs remaining in the incubators will give an approximate count of egg survival for each site. Doing this at the end of June will permit enough time for all eggs to be hatched and assure to not disturb the development of embryos from any possible late hatchers that may still present in the incubators.

Water temperature data loggers (brand name ONSET) were attached on one incubator at each site. The temperature data loggers were secured low enough to assure that each will always remain submerged. The devices were launched and programmed to register one reading per hour. The data logger will be recovered from the incubator during retrieval.

2.4 Spawning and Egg Collection

The spawning of the two first females tag #56946 (85cm total length - third female brought to hatchery) and tag #56945 (81.5cm total length - second female brought to hatchery) took place on November 2nd, 2023. The Miramichi Salmon Conservation Center (MSCC) gave TFK 24 hours notice before spawning so that TFK would be available to participate/assist in the spawning and collection process. Prior to spawning, the females were set in a mild anesthetic bath for a few minutes. The eggs from each female were divided into 3 separate bowls with each bowl being fertilized by one of the 6 male salmon parr that had been captured and brought to the hatchery. This method is to avoid bias and randomize spawning. Water was added to the egg and milt mixture, and it was left to sit for a few minutes in order to allow fertilisation to occur. After sufficient time had passed, the eggs were rinsed with freshwater, and all were placed in the same bowl. A displacement calculation and a weight calculation were used to determine the total amount of eggs collect. TFK initially estimated that the first Kouchibouguacis female had produced approximately 5,300 eggs (the second female's eggs were not measured)

The spawning of the two last females tag # 56950 (80cm total length - last female brought to hatchery) and tag# 56944 (80cm total length - first female brought to hatchery) took place on November 3rd, 2023. Hatchery spawning procedures were followed in an identical fashion to the spawning of the first female. with a known number of 2,987 eggs discarded following signs of mortality. In total 18,600 eggs were incubated in the Kouchibouguacis river in 2023

This year TFK decided to try a new method to estimate the number of eggs that would be collected. The usual displacement method has been used on 3 or the 4 females. as well as a weight ration method from (DFO). Both methods have been used to better compare the results. **the results are as follows in table 1 below.**

The discrepancy between these results could have been due to the method used to estimate egg counts during water displacement counting. Where the eggs are in the water hardening process, if not handled quickly, the water displacement number may vary as the eggs get larger with water absorption. The amount of dead discarded eggs could have been due to the fertility of either participant, how ripe the females were or whether the eggs were aerated or not.

	First day of incubation		Second day of incubation	
	Tag # 56946	Tag # 56945	Tag # 56950	Tag # 56944
Displacement method	5300	N/A	5000	4000
Weight method (1500/kg)	6180	7365	5205	5760
Weight method (1800/kg)	7416	8838	6246	6912
Fertilized egg count	9440		9160	
Dead egg count	2222		765	
Total number of eggs	11662		9925	

Table 1 : Salmon egg representation

MSCC staff collecting eggs from female salmon

Fertilized eggs being placed in container for transportation to incubation site

Following the displacement calculation, the eggs were placed in a wide-mouth sanitized plastic container for transportation to the incubation site. It should be noted that the jar (as per protocol) was half-filled with fresh water prior to adding the eggs. The water acted as a cushion for the eggs when they were transferred to the jar. It is best not to hit the eggs on hard surfaces at this point as the hardening process is not yet complete and the eggs are still very sensitive. With that being said, TFK was advised not to place the eggs in the incubators for transportation for this reason. It was determined that it would be best that

the eggs move around in the jar as a whole mass rather than being in solitude and hitting against the walls of the cell within the incubator. The jar was then topped off with fresh water and the lid was placed on tightly for the voyage back to the Kouchibouguacis River. TFK was also advised to leave the eggs in the water for at least 2 hours before handling. This allotted time would allow the eggs to fully water-harden.

2.5 Temperature, Oxygen and pH Level Guidelines

The recommendations for freshwater aquatic life set by the Canadian Environmental Quality Guidelines indicates that ambient oxygen levels should remain within 5.5 mg/L to 9.5 mg/L (5. CCME 1999), and pH levels should remain within 6.5 to 9.0 (6. CCME 1999). The Best Management Practices Bulletin offered by the Ontario Ministry of Natural Resources (OMNR) indicates that the water temperature used during the disinfection process should not change more than 3˚ Celsius and direct sunlight should be avoided (4. OMNR, 2009).

2.6 Temperature Levels

Temperature levels of the brook on the first incubation day, November 2nd, measured 1.8˚ Celsius. the water temperature level of the water within the jar of aerated eggs was recorded at 2.3˚ Celsius while the water of the non aerated eggs jar was recorded at 2.6˚ Celsius, and the disinfectant at 3.3˚ Celsius. The range in temperature between the brook water and the egg container as well as the Ovadine solution was a difference of 1.5˚ Celsius. This temperature difference was within the acceptable limit set for the disinfection process.

Temperature levels of the brook on the second incubation day, November 3rd, measured 2.5˚ Celsius. Following identical procedure to the first incubation day the water temperature level of the water within the jar of aerated eggs was recorded at 2.7˚ Celsius, while the water in the non aerated jar of eggs was recorded at 2.5˚ Celsius and the disinfectant at 4.5˚ Celsius. The range in temperature between the brook water and the egg container as well as the Ovadine solution was a difference of 2˚ Celsius. This temperature difference was within the acceptable limit set for the disinfection process.

2.7 Oxygen Levels

Oxygen levels in the brook measured on the first and second day of incubation were 15.84 mg/L and 17.35 mg/L respectively. These results, when compared with the recommendations set for freshwater aquatic life by the Canadian Environmental Quality Guidelines, were well above the approved levels.

2.8 pH Levels

The pH levels in the brook on the first and second day of incubation measured 6.65 and 7.21 respectively. These results, when compared with the recommendations set for freshwater aquatic life by the Canadian Environmental Quality Guidelines, were within approved levels.

2.9 2022 Incubation Results

TFK set out to retrieve their salmon egg incubators that were installed in the fall of 2022. The first retrieval date was June 19th of 2023 in the Kouchibouguacis main branch. The following incubator retrieval was on June 22nd of 2023 in Ruisseau de la truite. This was the third year using our protocol of installing incubators in the stream within a standard milk crate; that is, the entire incubator unit is placed within the crate and then firmly secured in place. This was done to further protect the incubator unit from detrimental stream conditions and improve hatch rates, this may be reflected in the 2022 hatch results. **The results are as follows in Table 2 and Table 3 on the following page:**

Incubator	Comments	Size
KS22-Inc1	Data logger installed/Good Condition/ Plates 2,3,4 Slightly open	Low Profile
KS22-Inc2	Good condition	Low Profile
KS22-Inc3	Not found	Full
KS22-Inc4	Good condition/ one loose rebar	Full
KS22-Inc5	Good condition	Full
KS22-Inc6	Good condition	Full
KS22-Inc7	Not found	Full
KS22-Inc8	Good condition	Full
KS22-Inc9	Not found	Full

Table 2 : Observation of Kouchibouguacis (KS) 2023 site

Incubator	Comments	Size
RT22-Inc1	Data logger installed/Good Condition	Low Profile
RT22-Inc2	Good condition	Low Profile
RT22-Inc3	Good condition	Full
RT22-Inc4	Good condition/ sediment build up	Full
RT22-Inc5	Good condition	Full
RT22-Inc6	Good condition/ sediment build up	Full
RT22-Inc7	Good condition	Full
RT22-Inc8	Good condition	Full

Table 3 : Observation of ruisseau de la Truite (RT) 2023 site

2.10 Egg Mortality

Counting the dead eggs left inside the incubators will give TFK an approximate value on the survival ratio for this type of stocking. The crew assigned for filling up the plates on incubation day the previous season, removed any visible dead eggs prior to assembling the units. These numbers are subject to a certain margin of error depending on many variables and TFK is always working to refine this method further. **Table 4 and Table 5 below** shows the total counts of dead eggs and the estimated hatch rate of the incubators that were installed during the incubation period between fall of 2022 through to summer of 2023. The average hatch rate across all recovered incubators in ruisseau de la truite was 84.7% and the incubators in Kouchibouguacis was 67.4%. This year's average survival rate of 76.05% is a significant improvement on the natural egg survival rate of 10%.

Ruisseau de la Truite Incubator Hatch Rate Evaluation 2022-2023												
Site #	# of dead eggs & approximate hatch %											
	(200 eggs per apartment (Apt.))											
	Apt. 1		Apt. 2		Apt. 3		Apt. 4		Apt. 5		Total/Avg	
	# dead eggs	%	#	%	#	%	#	%	#	%	#	%
RT-1	6	97.0%	7	96.5%	12	94.0%	12	94.0%	5	97.5%	**42**	**95.8%**
RT-2	23	88.5%	24	88.0%	19	90.5%	2	99.0%	2	99.0%	**80**	**92.0%**
RT-3	11	94.5%	23	88.5%	26	87.0%	32	84.0%	20	90.0%	**112**	**88.8%**
RT-4	44	78.0%	68	66.0%	133	33.5%	102	49.0%	27	86.5%	**374**	**62.6%**
RT-5	6	97.0%	28	86.0%	16	92.0%	13	93.5%	10	95.0%	**72**	**92.8%**
RT-6	39	80.5%	80	60.0%	60	70.0%	67	66.5%	49	75.5%	**295**	**70.5%**
RT-7	4	98.0%	60	70.0%	56	72.0%	63	68.5%	13	93.5%	**196**	**80.4%**
RT-8	9	95.5%	4	98.0%	0	100.0%	0	100.0%	42	79.0%	**55**	**94.5%**
Total	**142**	**91.1%**	**294**	**81.6%**	**322**	**79.9%**	**291**	**81.8%**	**168**	**89.5%**	**1226**	**84.7%**

Table 4 : Count of dead eggs found in each incubator installed during the fall of 2022 and retrieved in spring/summer 2023 (ruisseau de la truite)

Kouchibouguacis Incubator Hatch Rate Evaluation 2022-2023												
Site #	# of dead eggs & approximate hatch %											
	(200 eggs per apartment (Apt.))											
	Apt. 1		Apt. 2		Apt. 3		Apt. 4		Apt. 5		Total/Avg	
	# dead eggs	%	#	%	#	%	#	%	#	%	#	%
KS-1	48	76.0%	61	69.5%	52	74.0%	55	72.5%	47	76.5%	**263**	**73.7%**
KS-2	26	87.0%	60	70.0%	74	63.0%	69	65.5%	25	87.5%	**217**	**78.3%**
KS-3												
KS-4	59	70.5%	79	60.5%	68	66.0%	55	72.5%	38	81.0%	**299**	**70.1%**
KS-5	44	78.0%	111	44.5%	82	59.0%	90	55.0%	73	63.5%	**400**	**60.0%**
KS-6	54	73.0%	75	62.5%	89	55.5%	108	46.0%	91	54.5%	**417**	**58.3%**
KS-7												
KS-8	36	82.0%	112	44.0%	103	48.5%	63	68.5%	49	75.5%	**363**	**63.7%**
KS-9												
Total	**267**	**77.8%**	**498**	**58.5%**	**468**	**61.0%**	**440**	**63.3%**	**323**	**73.1%**	**1959**	**67.4%**

Table 5 : Counts of dead eggs found in each incubator installed during fall of 2022 and retrieved in spring/summer 2023 (Kouchibouguacis)

Further analysis was considered and documented following the assessment of the retrieved 2022/2023 incubators. TFK technicians counted all observable mortalities and ensured to document which plates on every individual incubator had remaining eggs. This analysis aids in potential future modifications and alterations to incubators that could aid in greater survival rates of all eggs regardless of plate placement. **Figure 1 below** illustrates the total egg mortality in each plate of all 14 recovered incubators from the 2022/2023 season collectively.

Though TFK considers the results of the 2022/2023 incubation season a success, increasing the survival rates each year is always a goal. TFK will continue to plan new changes in the methods used to further improve the results obtained from the installed incubators.

The counts and calculations for past and present seasons which include: the different parameters; notes taken; and survival ratios will be compared to determine future successes of this stocking method. All data has been entered in a new in-house data bank created for this purpose.

TFK installed the data logger on one of the incubators in each site to monitor the water temperature of the streams. The data logger from the ruisseau de la truite sites was installed on November 1st and stopped recording on June 20th. The data logger from the Kouchibouguacis site was installed on October 27th and stopped recording on December 8th. Atlantic Salmon egg typically hatch between April and may there for, the warm water temperatures recorded in June do not affect the incubated eggs**. Figure 2 and Figure 3 on the following page** illustrates the Data Logger water temperature readings.

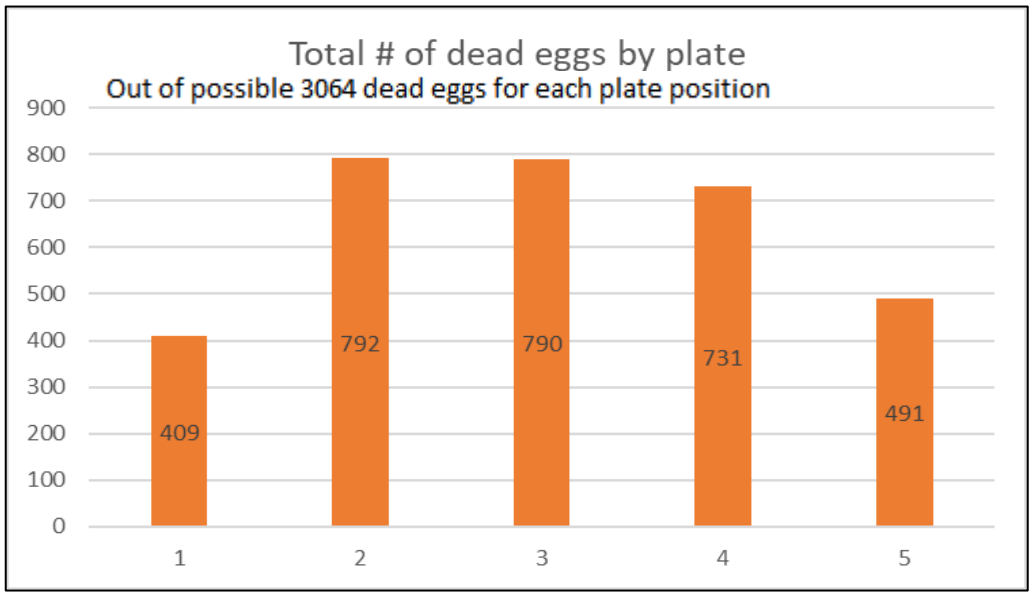

Figure 1 : Dead egg count by plate placement

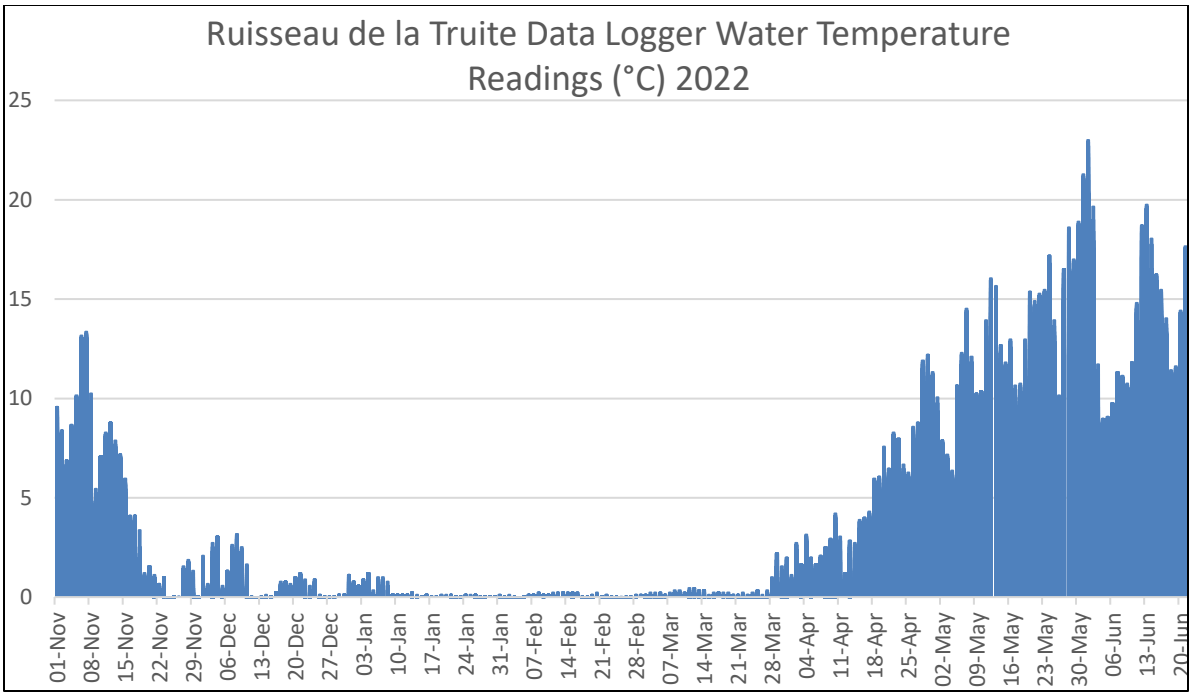

Figure 2 : ONSET water temperature data logger readout (1-hour intervals); channel shifting caused data logger to be closer to surface resulting in warmer temperatures, surface water temperature not representative of overall water column

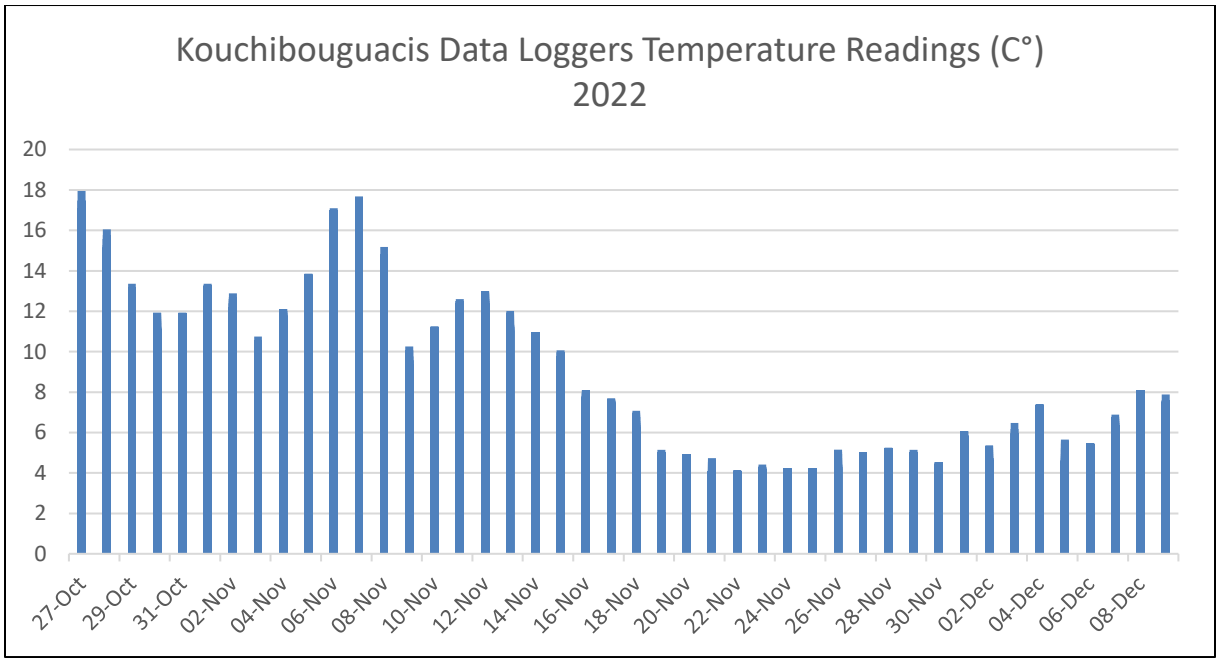

Figure 3 : ONSET water temperature data logger readout (1-hour intervals); channel shifting caused data logger to be closer to surface resulting in warmer temperatures, surface water temperature not representative of overall water column

3.0 Electrofishing

An annual electro-fishing exercise that is part of a broader monitoring program for the Northumberland Strait Rivers (South-eastern NB) has been active on the Kouchibouguacis River since 1996 (with a few exceptions). This exercise was held again in 2023 on several rivers in the Northumberland Strait.

Electrofishing sampling was conducted on 6 sites within the Kouchibouguacis watersheds; with 1 using a closed-site/diminishing return method and 3 using an open-site 500 second CPUE method, including the training site. The remaining 2 sites were performed by using an open-site method, no site data was collected and only salmon were collected/sampled any other species caught was released immediately. These sites were performed to collect 6 sexually mature juvenile salmon (male) to transport to MSCC, with the purpose of fertilizing the broodstock eggs.

TFK assisted KNP with 4 sites using the closed-site/diminishing return method. 2 sites were preformed (one upstream and one downstream from the incubation site) at each incubation site (Black River, Rankin Brook). KNP only completed 4 sites during the 2023 electrofishing season.

3.1 2023 TFK Electrofishing Results

A crew of at least 3 people using a Smith Root APEX backpack electrofisher (provided by Kouchibouguac National Park Canada) was appointed for the 2023 TFK sampling season on the Kouchibouguacis River. The frequency was set to a range of 30-45 Hz, the voltage at each site began between 400-450V although at many sites the voltage would go as high as 700V, TFK believes that the need for high voltage was caused by the high levels of precipitations received during the entire season. the duty cycle remained at 12% for each site. All adjustments to the settings were made based on the reaction and recovery of the specimens collected in each individual watercourse. Due to a change in protocol increasing time requirements of each sample session; weather conditions (e.g., unseasonably warm water temperatures, significant precipitation when water was finally cool enough, etc.)

A signed copy of the license to fish for scientific purposes was carried by the license holder while conducting the electrofishing activity and while in possession of fish caught during fishing activities as stated under the authorized license. A copy of our electrofishing certificate was also carried during this monitoring period. The regional field supervisors from the Conservation and Protection office were duly notified of the intended time and location of our fishing activities prior to commencing. The persons working under the authority of the licence carried a copy of the licence while conducting the fishing activities, and other related activities stated on the assigned permit. A summary report on the project activities was submitted to the Chief, Licensing at Fisheries and Oceans Canada once the work depicted on the permit was completed**.**

3.2 TFK Electrofishing Results

The information collected and recorded will be entered in the TFK in-house database and shared with relevant partners. Once the exercise was completed, the fish processed and fully recovered, all specimens were returned to the river. Only 6 fish were retained for broodstock purposes, however, all Atlantic salmon fry and parr captured were sampled for DNA (small clipping of adipose fin). All equipment used for collecting DNA was sanitized in between each sample collection. As part of the project with Kouchibouguac National Park (KNP), TFK and KNP performed electrofishing on Rankin Brook and Black River. Each site was fished a minimum of three sweeps with additional sweeps performed until ten

or less salmon were collected in accordance with the updated protocol. This method was also used on the Kouchibouguacis main branch. Each stream had two sites sampled; in the incubated streams, the selected sites were upstream and downstream of where incubators were located last year and arbitrary up and downstream sites were used in the control stream to maintain consistency. This year TFK completed electrofishing at 6 sites in total: KST-23, KS-23, RB-DS-EF-23, RB-US-EF-23, CF-EF-23, KST2-EF-23. The coordinates are as follows: KST-23 (N46.8996° W65.08415°), KS-23 (N46.69164° W65.09589°), RB-DS-EF-23 (N46.74372° W64.98574°), RB-US-EF-23 (N46.74372° W64.98573°), CF-EF-23 (N46.70302° W65.07995°), KST2-EF-23 (N46.8996° W65.08415°)

The following section details the results from each of the electrofishing sites this season. The tables provided also show the abundance of fish caught during each exercise and if DNA samples were collected (only Atlantic salmon were sampled, genetic information will be available at a later date).

TFK and Kopit Lodge staff electrofishing within a closed site on Tweedie Brook

KST-23 (Kouchibouguacis Main Branch – training site) open site set up coordinates: N46.8996° W65.08415°

Table 6 on the following page shows the results of the electrofishing sampling at KST-23 four Atlantic salmon were captured following the 500 second sweep of the area. Other fish captured during this sweep were 24 Blacknose dace and 1 Sea lamprey. Total fish abundance captured at KST-23 was 30 with a species richness of 3.

Species	Quantity	DNA Sample (Y/N)
Atlantic Salmon	4	Y
Blacknose Dace	24	N
Lamprey	1	N
Total	**30**	

Table 6 : Fish captured during electrofishing sampling at site KST-23

KS-23 (Kouchibouguacis Main Branch) closed site set up coordinates: (D/S net) N46.69164° W65.09589°/ (U/S net) N46.69155° W65.09608°

Table 7 below shows the results of the electrofishing sampling at KS-23, 4 Atlantic salmon were captured at this site following three sweeps. Other fish captured included 2 Creek chub, 29 blacknose dace, 2 lamprey, 1 American eel and 3 white sucker. Total fish abundance captured at TB (D/S) was 41 with a species richness of 6.

Species	Quantity	DNA Sample (Y/N)
Atlantic salmon	4	Y
Creek chub	2	N
American eel	1	N
White suck	3	N
Blacknose Dace	29	N
Lamprey	2	N
Total	**41**	

Table 7 : Fish captured during electrofishing sampling at site KS-23

RB-DS-E-23 (Kouchibouguacis Main Branch) open site set up coordinates: N46.74372° W64.98574°

Table 8 below shows the results of the electrofishing sampling at RB-DS-EF-23. A total of 9 Brook trout was captured at this location. Other fish captured following a 500 second sweep at this site were 1 Creek. Total fish abundance captured at RB-DS-EF-23 was 10 with a species richness of 2.

Species	Quantity	DNA Sample (Y/N)
Creek chub	1	N
Brook Trout	9	N
Total	**10**	

Table 8 : Fish captured during electrofishing sampling at site RB-DS-EF-23

RB-US-EF-23 (Kouchibouguacis Main Branch) open site set up coordinates: N46.74372° W64.98573°

Table 9 below shows the results of the electrofishing sampling at RB-US-EF-23. A total of 6 stickle back were captured at this location. Other fish captured following a 500 second sweeps at this site. Were 1 Brook trout, 3 Creek chub, 1 shiner and 1 Lamprey Total fish abundance captured at RB-US-EF-23 was 12 with a species richness of 5.

Species	Quantity	DNA Sample (Y/N)
Stickle back	6	N
Brook trout	1	N
Creek chub	3	N
Lamprey	1	N
Shiner	1	N
Total	**12**	

Table 9 : Fish captured during electrofishing sampling at RB-US-EF-23

The following sites were not official electrofishing sites. They were preformed by TFK to collect 6 juvenile salmon males for broodstock purposes. Only salmon was collected/sampled, any other species were released immediately. Due to the results bellow these sites will be strongly considered for the coming seasons.

CF-EF-23 (Kouchibouguacis Main Branch) open site set up coordinates: N46.70302° W65.07995°

Table 10 below shows the results of the electrofishing sampling at CF-EF-23. 22 Atlantic salmon were captured at this site.
Total fish abundance captured at CF-EF-23 was 22 with a species richness of 1.

Species	Quantity	DNA Sample (Y/N)
Atlantic Salmon	22	Y
Total	**22**	

Table 10 : Fish captured during electrofishing sampling at site CF-EF-23

KST2-EF-23 (Kouchibouguacis Main Branch) Open site set up coordinates: N46.8996° W65.08415°

Table 11 below shows the results of the electrofishing sampling at KST2-EF-23. 11 Atlantic salmon were captured at this site. Total fish abundance captured at KST2-EF-23 was 11 with a species richness of 1.

Species	Quantity	DNA Sample (Y/N)
Atlantic Salmon	12	Y
Total	**11**	

Table 11 : Fish captured during electrofishing sampling at site CF-EF-23

In total, the number of Atlantic salmon collected during the 2023 electrofishing season included 42 juvenile Atlantic salmon. All were measured and sampled for DNA. The complete count for the remaining specimens captured are as follows; 10 brook trout, 53 blacknose dace, 6 creek chub, 4 lamprey, 6 stickleback spp., 1 shiner and 3 white suckers.

3.3 DFO electrofishing 2022 results

Table 12 and Table 13 on the following page: Catch, predicted densities, size, PHS, biomass, and condition factor for fry and parr captured by site in the Kouchibouguac and Kouchibouguacis rivers in 2022.

Figure 4 on the following page and Figure 5 on page 19 illustrate the Densities of Atlantic salmon fry and parr expressed as number of fish per 100 m^2 in the Kouchibouguacis and Kouchibouguac River between 1974 and 2022. The horizontal dashed line represents the average fry density over the time series while the solid horizontal line represents the average parr density over the time series.

							Total catch			CPUE per 500 sec		Predicted density (per 100m^2)	
Year	Month	Day	Site	Basin	River	Area (m2)	fry	parr	Effort (sec)	fry	parr	Fry	Parr
2022	10	6	K1	Kouchibouguac	Kouchibouguac	182.1	29	32	529	27.4	30.2	45.6	39.9
2022	9	22	K2	Kouchibouguac	Kouchibouguac	119.3	30	14	495	30.3	14.1	50.5	18.6
2022	10	6	K3	Kouchibouguac	Kouchibouguac	200.2	22	18	523	21.0	17.2	35.0	22.7
2022	10	7	K4	Kouchibouguac	Kouchibouguac	106.8	38	12	528	36.0	11.4	59.9	15.0
2022	9	27	K5	Kouchibouguac	Kouchibouguac	96.1	10	13	545	9.2	11.9	15.3	15.7
2022	9	27	KS1	Kouchibouguacis	Kouchibouguacis	128.4	11	1	552	10.0	0.9	16.6	1.2
2022	9	22	KS2	Kouchibouguacis	Kouchibouguacis	155.6	9	3	562	8.0	2.7	13.3	3.5
2022	10	5	KS3	Kouchibouguacis	Kouchibouguacis	192.1	10	1	542	9.2	0.9	15.4	1.2
2022	10	5	KS4	Kouchibouguacis	Kouchibouguacis	165.5	14	5	512	13.7	4.9	22.8	6.4

Table 12 : Catch, predicted densities, size, PHS, biomass, and condition factor for fry and parr captured by site in the Kouchibouguac and Kouchibouguacis rivers.

						Length (mm) at age		PHS at age			Weight (g) at age		Biomass			Condition Factor	
Year	Month	Day	Site	Basin	River	Age 0+	Age 1+, 2+	Age 0+	Age 1+, 2+	Total	Age 0+	Age 1+, 2+	Age 0+	Age 1+, 2+	Total	Age 0	Age 1+, 2+
2022	10	6	K1	Kouchibouguac	Kouchibouguac	61.8	98.1	9.3	27.2	36.5	2.6	10.6	119.0	424.1	543.1	1.1	1.1
2022	9	22	K2	Kouchibouguac	Kouchibouguac	58.9	95.1	9.1	11.7	20.8	2.2	9.8	111.0	182.3	293.3	1.1	1.1
2022	10	6	K3	Kouchibouguac	Kouchibouguac	62.0	105.3	7.2	18.6	25.8	2.6	12.8	90.1	290.8	380.9	1.1	1.1
2022	10	7	K4	Kouchibouguac	Kouchibouguac	57.9	92.7	10.3	8.8	19.1	2.0	9.3	121.3	139.6	260.9	1.0	1.2
2022	9	27	K5	Kouchibouguac	Kouchibouguac	57.5	95.2	2.6	9.9	12.5	2.2	10.4	33.0	162.8	195.8	1.1	1.2
2022	9	27	KS1	Kouchibouguacis	Kouchibouguacis	58.3	86.0	2.9	0.6	3.5	2.1	7.1	34.3	8.5	42.8	1.0	1.1
2022	9	22	KS2	Kouchibouguacis	Kouchibouguacis	54.9	87.3	2.0	1.8	3.8	1.7	7.4	23.2	26.1	49.3	1.1	1.1
2022	10	5	KS3	Kouchibouguacis	Kouchibouguacis	54.0	113.0	2.2	1.2	3.4	1.6	16.1	25.1	19.5	44.6	1.0	1.1
2022	10	5	KS4	Kouchibouguacis	Kouchibouguacis	63.0	99.3	4.9	4.5	9.4	2.9	13.9	66.2	89.4	155.6	1.2	1.4

Table 13: Catch, predicted densities, size, PHS, biomass, and condition factor for fry and parr captured by site in the Kouchibouguac and Kouchibouguacis rivers. .

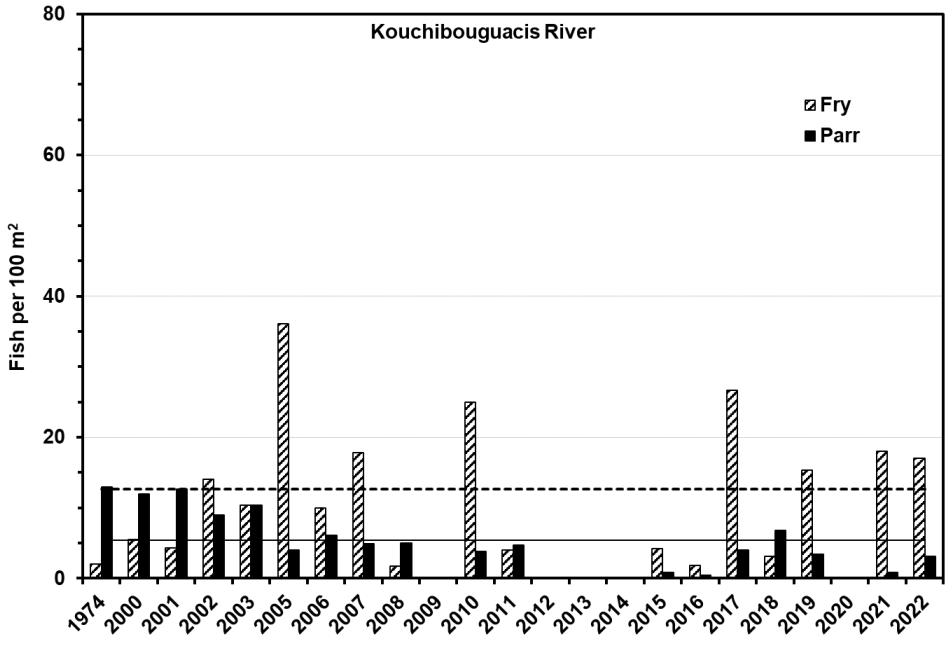

Figure 4 : Densities of Atlantic salmon fry and parr expressed as number of fish per 100 m^2 in the Kouchibouguacis River between 1974 and 2022. The horizontal dashed line represents the average fry

density over the time series while the solid horizontal line represents the average parr density over the time series.

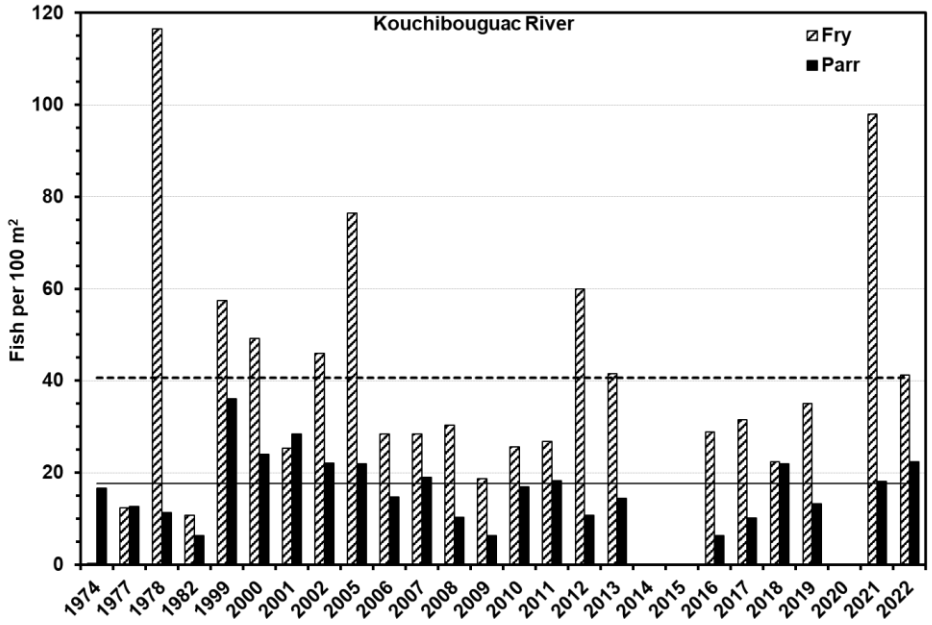

Figure 5 : Densities of Atlantic salmon fry and parr expressed as number of fish per 100 m^2 in the Kouchibouguac River between 1974 and 2022. The horizontal dashed line represents the average fry density over the time series while the solid horizontal line represents the average parr density over the time series

3.4 Electrofishing Certification

It should be noted that TFK's coordinator (Mike Rushton) received electrofishing certification in 2019 (re-certification is required every 5 years, therefore expires in 2024) and will require re-certification in 2024. The certification was acquired through the University of New Brunswick, through the Canadian River Institute branch and consisted of an online component and a field practicum. The learning objectives of the online portion of the course included the identification of the various parts of the backpack electrofisher unit by appearance and function; the identification of necessary personal safety gear; the identification of the safety standards that must be taken to competently and safely operate a backpack electrofisher; identify suitable and unsuitable electrofishing conditions; show how to modify settings of the electrofisher to make sure effective fishing under varying circumstances; and to show how to properly treat and handle fish in order to minimize stress and harm. In-the-field training allowed students to personally attach electrodes; install batteries; identify the safety features and equipment and demonstrate their uses; and properly operate the electrofisher unit; and collect samples as the unit operator and as the scoop net person. This exercise was done using the safety standards previously learned in the online portion of the course. Three technicians (Keiran Sharkey, Julie Jaillet, Nick Poirier) were certified under the UNB Backpack Electrofishing course this year and were in possession of valid first aid certifications.

4.0 Trap-net Population Monitoring and Broodstock Collection

Smelt fishing box-nets were installed at two sites at a newly designated location in the Kouchibouguacis River near Saint-Louis-de-Kent, New Brunswick (the first one was roughly 400 meters downstream of

the Highway 11 bridge and the other was approximately 900 meters down stream from the first one). These trap-nets enable TFK to passively collect species of all varieties that are present in the Kouchibouguacis River. Using this style of fishing allows for insight into not only Atlantic salmon migration populations, but the abundance of other species that all contribute to and represent the complexity of the river. The box-net fishing program within the Kouchibouguacis River has been on-going since 2005 with exception in 2014 when certain programs and budgets were cut due to various reasons resulting in retraction of the box-net fishing season of the same year.

The main objectives of this initiative are:

- Assess the upstream migration population of Atlantic Salmon
- Monitor all aquatic species and water quality within the waterway
- Collect adult salmon for broodstock and fish/egg stocking purposes

A stocking plan was presented to the Department of Fisheries and Oceans (DFO) and a fishing permit for scientific purposes along with the related tags were obtained from the said department prior of the beginning of the project.

TFK used Carlin tags provided by DFO staff that were installed with a hypodermic needle that was disinfected between every individual in an alcohol-filled sponge to reduce the risk of infection.

Salmon being released following sampling and tagging

The required permit was duly signed by DFO authorized staff and the licence holder. The regional field supervisors from the Conservation and Protection office were notified of the intended time and location of the fishing activities prior to commencing. The persons working under the authority of the licence carried a copy while conducting the fishing activities, and other related activities stated on the assigned permit. All fishing gear utilised during the fishing period were identified in a legible manner. The identification information was readily visible at all times; the name of the organization (licence holder), office telephone number, and the licence number. A summary report on the project activities was

submitted to Fisheries and Oceans Canada once the work outlined on the permit was completed**.** The two nets were fished and checked every 24-48 hours. If the fishing was unable to be performed for longer than 48 hours (e.g. due to bad weather), TFK staff would fish the nets the day(s) prior and then close to opening to prevent any species from entering and becoming stressed over the extended time period. Several water quality parameters, such as water temperature, dissolved oxygen, conductivity, salinity, and pH were monitored and recorded. A period of 2 to 4 hours/day/net was typically necessary to accomplish the task, though there were multiple days where work extended longer due to debris and storm damage. The Atlantic salmon captured were measured, sexed, sampled for scales, tagged and released back to the river (with a few exceptions due to either escape, or risk of irreversible harm to the fish). All salmon caught had DNA samples collected as well for parentage analysis.

The DNA and scale samples will be brought to the Kouchibouguac National Park for genetic analysis at a later date. The age approximations and total lengths from the 2022 season will be provided in the early months of 2024.

Age estimation for the Atlantic salmon sampled in 2023 have yet to be analysed and will be available at a later date. All other species caught during the population monitoring exercise were identified, counted, and released back in the river. Four salmon, (4 female) were collected from the trap-nets and an additional 6 salmon (6 male juveniles) collect while electrofishing. All 10 salmon were used for the purpose of broodstock collection and incubation within the Kouchibouguacis River

Only 4 broodstock were collected from the trap-nets this year due to poor catch numbers which could be due to various reasons (e.g., altered migration patterns, improper net function, fish evading nets, etc.); typically we collect 8 broodstock (6 males and 2 females) to maximize genetic diversity in our incubation efforts. A half-ton truck equipped with a disinfected fish tank and aeration system was used for the transfer to and from the MSCC hatchery. A transfer permit needed in order to make these transfers was obtained from the DFO. The persons working under the authority of the licence carried a copy of the licence while conducting the stated activities, and other related activities identified on the assigned permit. A schedule I report was returned to the NB introduction and Transfer Committee Chair once the transfers were completed.

5.0 Results from Fishing Efforts

This year's population monitoring program totalled 9 unique salmon captures which consisted of 7 females, and 2 males. There were 0 instances of recaptured salmon tagged by TFK this season or other years. as well as 0 fish captured with tags marking them as having also been sampled this year in other rivers (Richibucto and Kouchibouguac rivers).

The lengths of the measured fish ranged from 73-fork/77.5-total(cm) to 75-fork/81.5-total(cm). Salmon that were captured in the nets were measured, sex identified, sampled for scales and DNA, tagged and then released following recovery; excluding recaptures and those tagged in other rivers. The full Atlantic salmon results of the 2023 population monitoring program are available in **Table 14 on the following page.** A detailed excel spreadsheet with complete results is formatted with Department of Fisheries and Oceans standards and is available at the TFK office.

Salmon being released following sampling and tagging

Date	Box Net	Sex	Fork/Total Length (cm)
25-Sep	U/S	F	73/77.3
29-Sep	U/S	F	81/85
07-Oct	U/S	F	75/80
07-Oct	U/S	M	77/80.5
07-Oct	U/S	M	61/64
17-Oct	U/S	F	76.4/80
20-Oct	U/S	F	79/81.5
20-Oct	U/S	F	75/85
28-Oct	U/S	F	76/80

Table 14: 2023 Trap-net fishing results

The total number of salmon caught **(see Table 15 on page 24)** from 2002-2015 ranged from 4 to 14 (with the exception of 20 in 2011). Catch totals from 2016-2018 ranged from 29 to 65. Whether or not these increasing catch totals seen in 2016-2018, and 2020 respectively, are directly correlated to our incubation efforts cannot be verified without further genetic analyses.

Transporting female to river of origin to be released

TFK has observed an emerging pattern that has stood out from 2016-2020 (with 2019 being the exception due a lower than average salmon count, and improper net operation. This anomaly was also reported with various other organizations including partnering groups, Kouchibouguac National Park and Kopit Lodge). This pattern appears to be that a four-year cycle brings higher returns after each incubation year and has appeared to convey larger salmon populations in the Kouchibouguacis river system. The four-year cycle may consist of the salmon spending its first two years in freshwater, and then heading out to sea and returning after two years at sea for spawning. For example, TFK's incubation started in 2012, and an exponentially higher salmon return population was observed in 2016, and the same occurred four years after the 2013 incubation in the 2017 fishing season. It is worth noting that in 2014 TFK did not perform the incubation project, and following the logic of the pattern, the salmon return population appeared to drop in contrast to the last two years mentioned (2016 and 2017). Though, on a positive note, TFK's salmon count in 2018 was still higher than previous years on record, so it seems to show that momentum carried over from previous years.

Carlin tag style used during 2023 season

Research for the population monitoring program also includes age estimates for all salmon caught during the fishing season. These estimates are determined through scale samples which are processed at the Kouchibouguac National Park. Age estimations for the 2023 season have yet to be determined and will therefore be included in the 2023 report in the early months of 2024.

In 2018, TFK began collecting DNA tissue samples from the salmon genitors used in the incubation project and in 2019 TFK launched a new initiative, in collaboration with KNP, to collect DNA samples from salmon specimen during the electrofishing and box-net fishing exercises. A small tissue sample cut from the adipose fin is stored in ethanol vials and the genetic analyses will be used to determine the lineage of juvenile and adult salmon populating both Kouchibouguac and the Kouchibouguacis rivers to verify if the adults are a product of the incubation efforts. TFK continued the initiative this year and the 9 adult salmon captured in the box-nets had DNA samples taken. DNA sampling from this year also included the 42 juvenile salmon that were collected during electrofishing.

Population count was also collected for all other captured species. This count can be seen in **Table 15 on the following page.** Species identified as "Others" in **Table 16 on page 25** include killifish, shiner, and mummichog. The total count for other species for the entire 2023 fishing season is 11,241 of which the most dominant species counted in this category was white perch totaling 6,275.

Year	# ♀ Salmon	# ♂ Salmon	Sex Unknown Salmon	#♂ grilse	#♀ grilse	Sex Unknown Grilse	Total Salmon Caught	Total Mature Salmon	Catch Date First/Last
2002	3	5		0	5		13	13	Oct. 16th/Oct. 30th
2003	3	1		5	0		9	9	Oct. 25th/Nov. 7th
2004	1	2		3	0		6	6	Sept. 25th/Oct. 28th
2005	4	3		6	1		14	14	Sept. 26th/Oct. 9th
2006	2	0		2	0		4	4	Oct. 2nd/Oct. 5th
2007	5	1		8	0		14	14	Sept. 24th/Oct. 18th
2008	6	1		5	0		12	12	Sept. 24th/Oct. 27th
2009	7	1		3	0		12*	11	Sept. 26th/Oct.19th
2010	1	2		6	0		9	9	Sept. 30th/Oct. 28th
2011	11	0		8	1		20	20	Sept. 14th/Oct.24th
2012	6	2		5	0		13	13	Sept. 20th/Oct.13th
2013	6	2		1	0		9	9	Oct. 11th/Oct. 31st
2015	3	1		7	1		12	14	Sept. 26th/Oct. 28th
2016	38	4		18	2		62	62	Sept. 17th/Oct. 24th
2017	30	9		23	1	1	65*	64	Sept. 18th/Oct. 26th
2018	10	2		12	1		28*	25	Sept. 20th/Oct. 25th
2019	3	1		2	0		6	6	Sept. 20th/Oct. 29th
2020	57	53	3	TBD	TBD		113	113	Sept. 1st/Oct. 31st
2021	10	4		TBD	TBD		14	14	Sept. 2nd/Nov. 7th
2022	8	16		TBD	TBD		24	24	Sept. 8nd/Oct. 31th
2023	2	7		TBD	TBD		9	9	Sept. 25th/Oct. 28th

Table 15 : Yearly salmon catches in the Kouchibouguacis River since 2002 One parr was captured 2017 and three in 2018. Though not considered mature, parr were included in "Total Salmon Caught" total

Species	U\S		D\S	
	Total (56 Days)	Max (1 Haul) *if above 1	Total (56 Days)	Max (1 Haul) *if above 1
White Sucker	1447	362 (Oct, 23)	49	23 (Oct, 25)
Striped Bass	362	56 (Oct, 20)	156	39 (Sept, 6)
Atlantic Salmon	9	3 (Sept, 7)	N/A	N/A
Rainbow Smelt	5	2 (Oct, 15)	2	1(Sept, 9 & Oct, 17)
Atlantic Tomcod	280	41 (Sept, 27)	38	11 (Oct, 21)
Flounder	11	2 (Sept, 29 & Oct, 27)	16	6 (Sept, 22)
Gaspereau	179	65 (Oct,7)	1545	362 (Sept, 9)
American Eel	740	137 (Sept, 23)	N/A	N/A
White Perch	5653	765 (Oct, 27)	622	190 (Oct,25)
Mummichog	75	18 (Oct, 27)	17	4 (Sept, 6 & Oct, 2)
Banded killifish	8	4 (Sept, 27 & Oct, 2)	N/A	N/A
Chub	3	2 (Sept, 30)	N/A	N/A
Mackerel	N/A	N/A	11	4 (Sept, 9 & Sept 29)
Brook trout	11	4 (Sept, 29)	1	1 (Sept, 30)
Others	1	1 (Oct,27)	N/A	N/A

Table 16 : Fish species caught with 2 smelt fishing box-nets installed on the Kouchibouguacis River in 2023. Exercise held for salmon brood stock collection, fish migration and fish presence evaluation.

Water temperature readings were collected each day the nets were fished using a YSI Pro-Plus (with a few exceptions), these can be seen in **Figure 6 on the following page.** The highest recorded water temperature this year was 21.2˚ Celsius, recorded on September 6th. The lowest water temperature was 4.3˚ Celsius recorded on November 1st, 2023. The average water temperature for the 2023 fishing season was 13.10˚ Celsius. The data readout provided by the ONSET data logger installed can be seen in **Figure 7 on the following page.** The highest temperature recorded was on September 8th measuring at approximately 23.88˚ Celsius, and the lowest temperature recorded was on November 1th measuring at approximately 3.88˚ Celsius. * *The data Logger was installed on the box net on September 5th, 2023.*

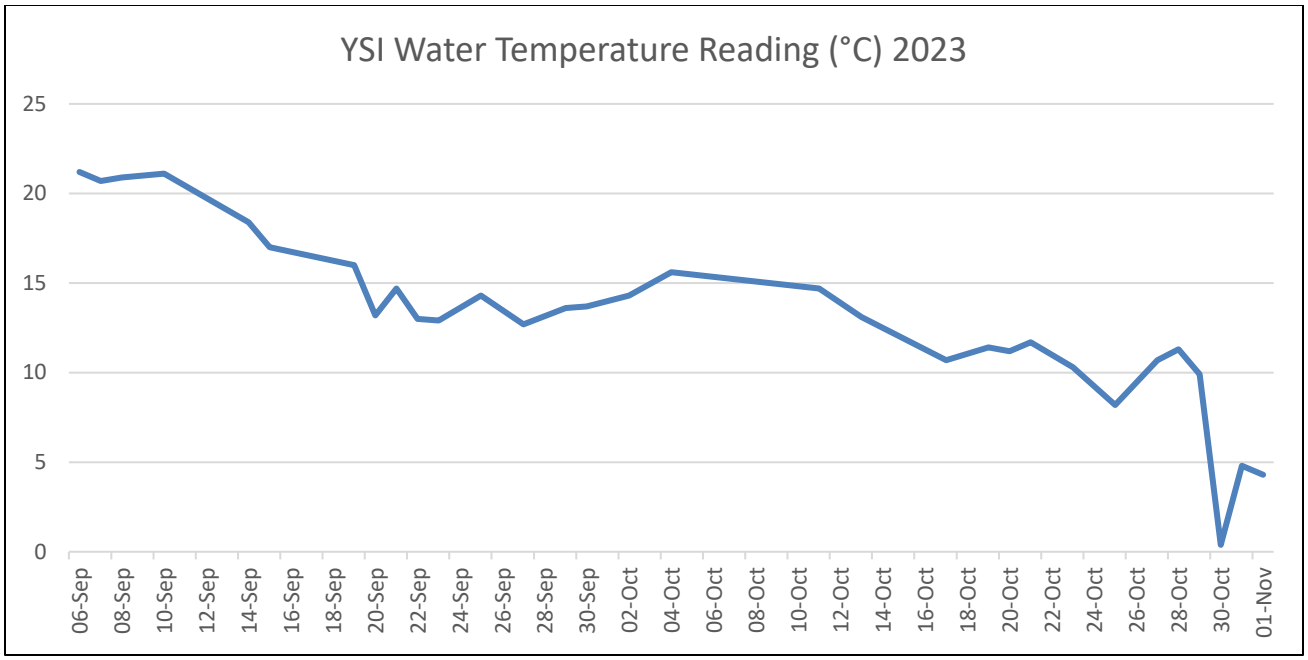

Figure 6: Daily water temperature readings during 2023 fishing season

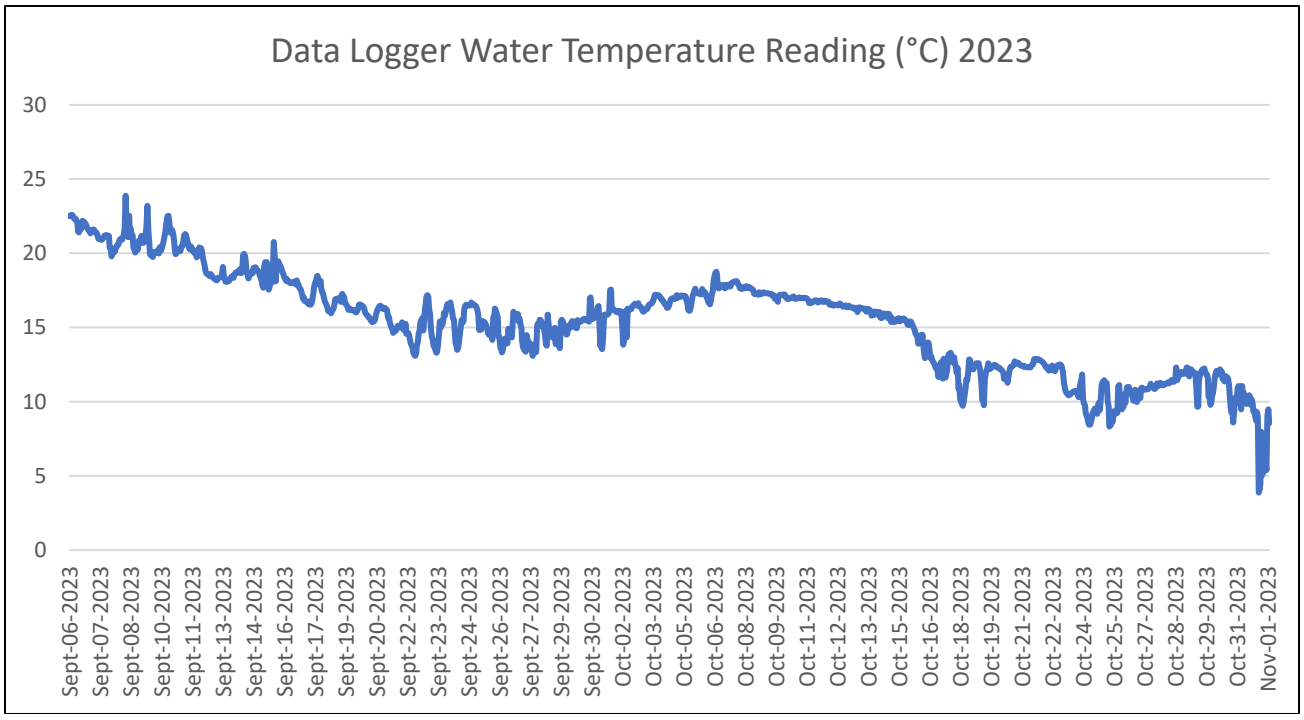

Figure 7 : Hourly water temperature readings during 2023 fishing season

6.0 Stream Survey

In 2023 TFK conducted stream surveys and aquatic habitat inventories on Ruisseau a baptiste, Kouchibouguacis River and Kouchibouguac in order to assess indicators of ecological health and habitat potential of the aquatic environment. Areas of assessment include substrate composition and embeddedness, water quality and related measurements, shoreline vegetation and environment composition, area surveyed by habitat composition, site parameters of each section were segmented down by habitat, stream canopy cover, bank stability, and cold-water/groundwater inputs, among many others. The method of survey consisted of identifying a given "section" by habitat type (riffle, run, or pool; distinguished by depth, velocity, and other features) and obtaining set measurements of said section. Details for both watercourses are in the following subsections.

6.1 Ruisseau a baptiste Stream Survey

In 2023 a total of approximately 245.09 meters of linear length was surveyed on ruisseau a baptiste, starting with the section identified as RB1-23, coordinate N 46.74360° W 64, 98506°, and ending with section RB6-23, coordinates N 46 ,74358° W64,98759. a map of the area surveyed with start and end points identified can be found in **Annex A**. Ruisseau a baptiste was evaluated via stream survey this year (2023) as part of a remediation assessment of the stream. This was determined to be appropriate to help track changes over time after the prior remediation efforts upstream.

Due to the fluctuation in habitats, we only included the habitats which were no less then 90% a riffle, run or pool to the data below. This method was deemed appropriate to give a representative outlook on each habitat.

Stream substrate was assessed due to its affects on fish life, such as reproduction or shelter, and because of its ability to indicate water quality impairments. Substrate was estimated by percentage within each section and then these estimates were averaged both by habitat type and as overall, in order to give an idea of the general composition. This breakdown of substrate composition can be found in **Table 17 below** along with the corresponding size specifications, this information is then visualized in **Figure 8 on the following page.**

Average Substrate Composition Percentage by Habitat Type (ruisseau baptiste)							
	Bedrock (Ledge)	Boulder (>460mm)	Rock (180-460mm)	Rubble (54-179mm)	Gravel (2.6-53mm)	Sand (0.06-2.5mm)	Fines (0.0005-0.05mm)
Riffle	0	15	20	30	20	10	5
Run	0	2.5	7.5	12.5	12.5	55	10
Pool	0	0	0	0	0	90	10
Overall	0.00	5.83	9.17	14.17	10.83	51.67	8.33

Table 17 : Average substrate composition percentage by habitat type (ruisseau baptiste)

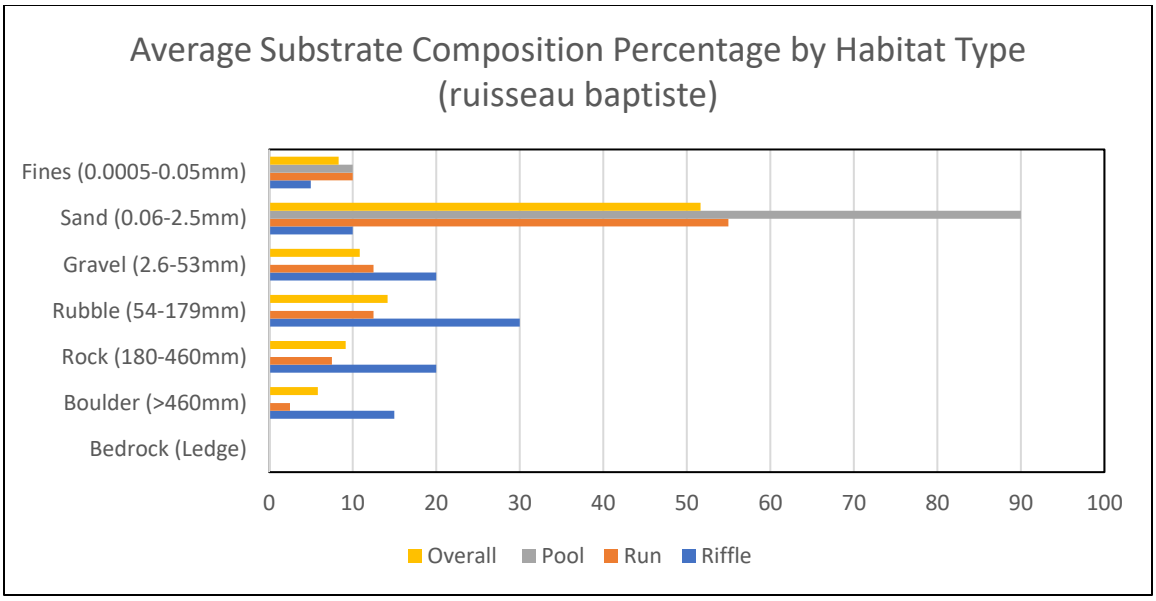

Figure 8 : Average substrate composition percentage by habitat type (ruisseau baptiste)

Percent embeddedness, that is the percentage of substrate buried by fine particles, was also estimated in each section, across all sections was an average embeddedness of 69%. Parameters of water quality and related ambient environmental factors were also measured in order to give an assessment of ecological health. Parameters assessed include ambient air temperature, water temperature, dissolved oxygen, pH, water velocity and conductivity. These results were averaged by habitat type and as an overall value across all sections. These results and their units of measurement can be found in **Table 18 below.**

Riparian vegetation and habitat were assessed for their possible implication of stream habitat health. The percentage of each shore within each section belonging to a corresponding habitat type was estimated by percentage. These percentages when then averaged by each bank side and then along both banks in order to achieve an accurate average estimated composition of total shore length by percentage. These composition percentages can be found in **Table 19** and are visualized in **Figure 9 on the following page.**

Average Water Measurements (ruisseau baptiste)					
	Air Temp (°C)	Water Temp (°C)	Dissolved Oxygen (ppm)	Velocity (m/s)	Conductivity (uS/cm)
Riffle	27	15.2	12.97	0.2703	109.80
Run	29	14.75	11.555	0.4028	108.85
Pool	27.75	14.9	12.465	0.3604	109.7
Overall	27.92	14.95	12.33	0.3445	109.45

Table 18 : Average Water Measurements (ruisseau baptiste)

Average Riparian Vegetation Composition	
Lawn	0%
Row crop	0%
Forage/Cover crop	0%
Shrubs	39%
Hardwood forest	11%
Softwood forest	29%
Mixed forest	0%
Meadow/ Tall grass	21%
Wetland	0%
Altered	0%

Table 19: Average riparian vegetation composition (%)

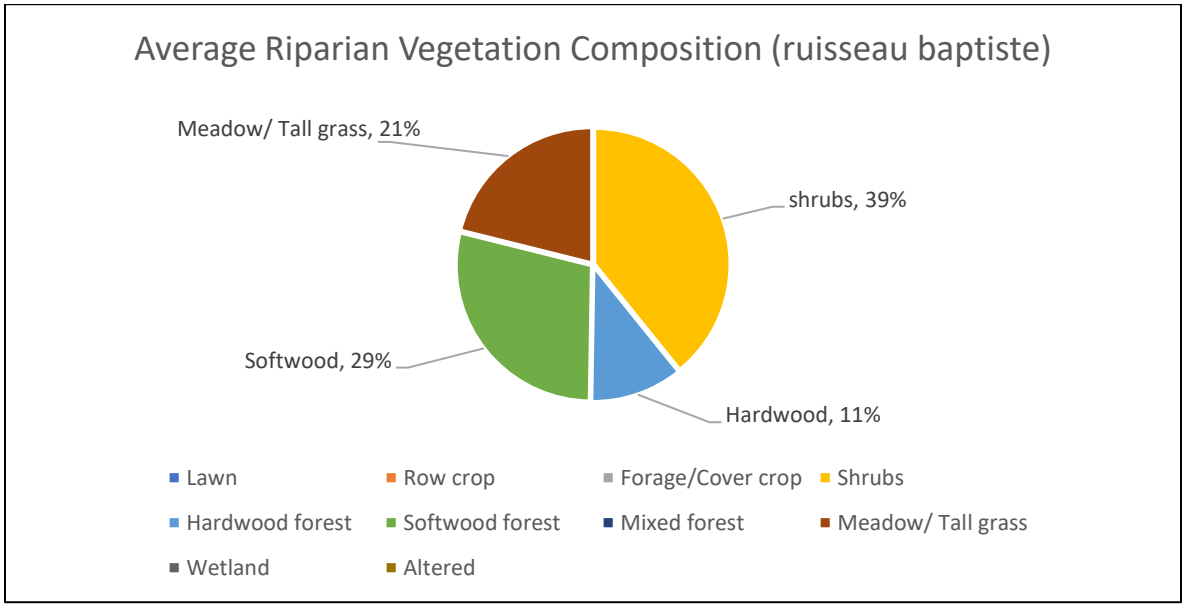

Figure 9: Average riparian vegetation composition (ruisseau baptiste)

The total flat area of stream survey was calculated in order give an idea of area of available habitat. The total was then further broken-down by habitat, accounting for both the area of the main section and the smaller “sub habitats” found within each section. Area was calculated using the measured length of each section and multiplying that by the averaged “wetted width” of each section. The total cumulative area of each habitat type and total area surveyed can be found in **Table 20**, the breakdown by habitat is visualized in **Figure 10 on the folloing.**

Area Surveyed (m^2)	
Riffle	276.55
Run	392.26
Pool	219.92
Total	888.73

Table 20 : Area surveyed (m^2) (ruisseau baptiste)

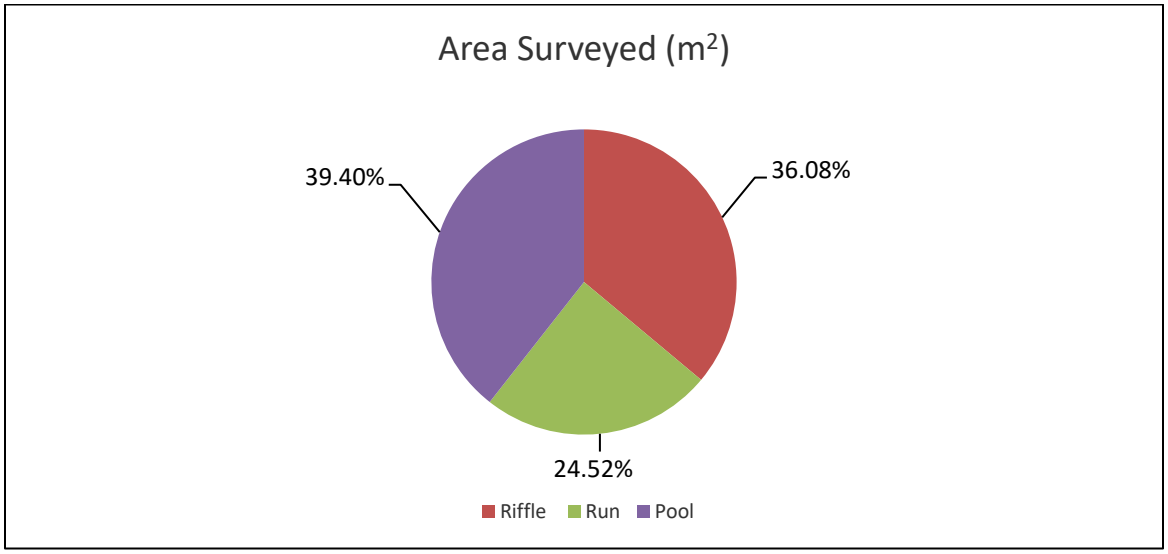

Figure 10 : Area stream surveyed by habitat type (ruisseau baptiste)

Site parameters of each stream section were measured in order to provided habitat and hydrological data. Measured parameters include average water depth, average wetted width, average bank full width, average bank full depth, and the average length of each section. These parameters were then averaged according to habitat type and as an overall value; these can be found in **Table 21 below** and visualized in **Figure 11 on the following page.**

Several other parameters relating to potential habitat and ecological health were also assessed. In terms of stream shelter an average of 47%% canopy cover, 102m woody debris, and 20m undercut was estimated across the entire section surveyed. The total bank stability, bank length free of erosion, was estimated as an average of 97% stable across the entire area surveyed.

Average Site Measurement Parameters (ruisseau baptiste)					
	Depth (cm)	Wet Width (m)	Bankfall Width (m)	Bankfall Depth (cm)	Average Length (m)
Riffle	28.5	4	5.9	54	70.8
Run	21.9	3.35	3.95	28	59.6
Pool	35.45	4.1	4.75	19.25	27.54
Overall	28.62	3.82	4.87	33.75	52.65

Table 21 : Average site measurement parameters (ruisseau baptiste)

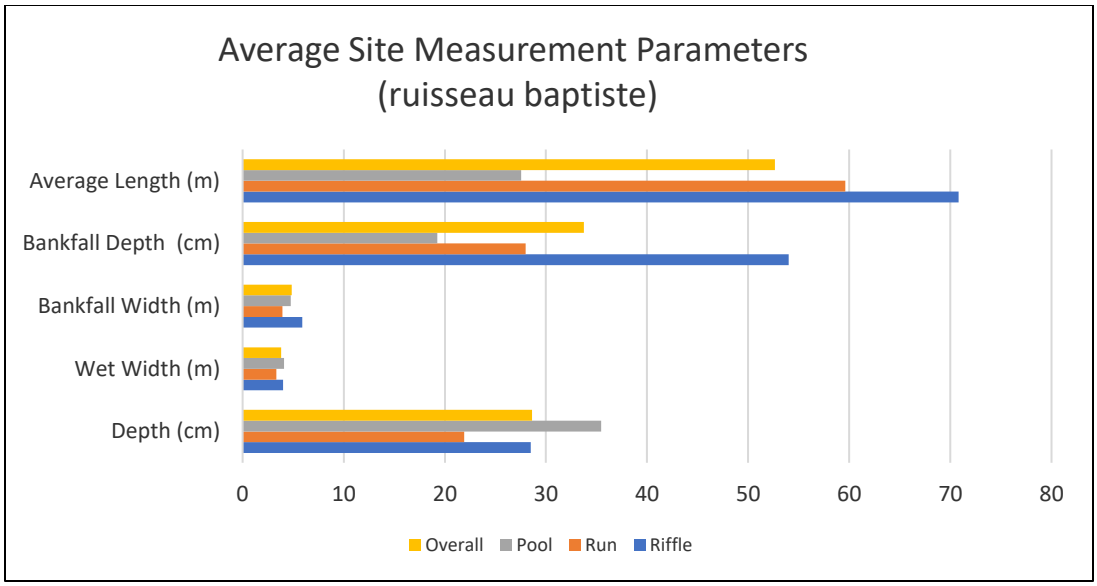

Figure 11 : Average site measurement parameters (ruisseau baptiste)

6.2 Kouchibouguacis River Stream Survey

The section on the Kouchibouguacis Main Branch ended upon the start of a new habitat type. In 2023 a total of approximately 2142 meters of linear length was surveyed starting with the section identified as KS1-23, coordinate N46.70135° W65.08177°, and ending with a braided section KS24-23L / KS24-23R, coordinates N46.69107° W65.09708°. a map of the area surveyed with start and end points identified can be found in **Annex A**.

Stream substrate was assessed due to its affects on fish life, such as reproduction or shelter, and because of its ability to indicate water quality impairments. Substrate was estimated by percentage within each section and then these estimates were averaged both by habitat type and as overall, in order to give an idea of the general composition. This breakdown of substrate composition can be found in **Table 22 below** along with the corresponding size specifications, this information is then visualized in **Figure 12 on the following page.**

Percent embeddedness, that is the percentage of substrate buried by fine particles, was also estimated in each section due to its implications of stream health, across all sections was an average embeddedness of 32.24%.

Average Substrate Composition Percentage by Habitat Type (Kouchibouguacis)							
	Bedrock (Ledge)	Boulder (>460mm)	Rock (180-460mm)	Rubble (54-179mm)	Gravel (2.6-53mm)	Sand (0.06-2.5mm)	Fines (0.0005-0.05mm)
Riffle	0	4	15	33	30	11	7
Run	15	10	11	21	28	9	5
Pool	0	10	20	10	15	25	20
Overall	5.10	8.10	15.42	21.31	24.17	15.02	10.77

Table 22 : Average substrate composition percentage by habitat type (Kouchibouguacis)

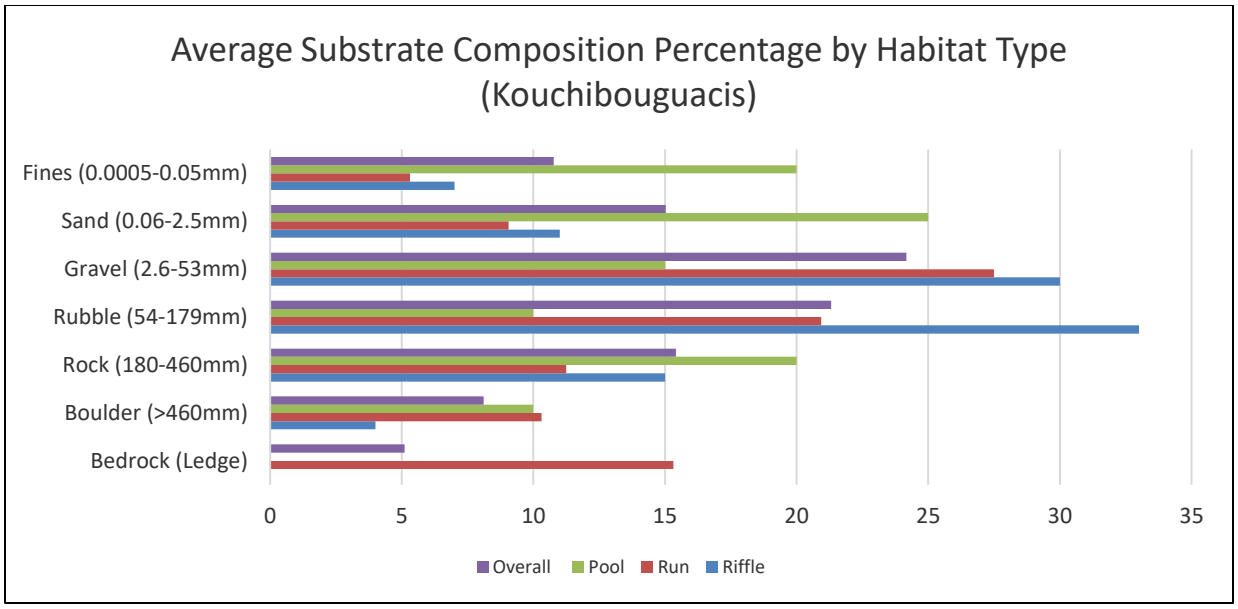

Figure 12 : Average substrate composition percentage by habitat type (Kouchibouguacis)

Parameters of water quality and related ambient environmental factors were also measured in order to give an assessment of ecological health. Parameters assessed include ambient air temperature, water temperature, dissolved oxygen, pH, water velocity and conductivity. These results were averaged by habitat type and as an overall value across all sections. These results and their units of measurement can be found in **Table 23 below.**

Average Water Measurements (Kouchibouguacis)					
	Air Temp (°C)	Water Temp (°C)	Disolved Oxygen (ppm)	Velocity (m/s)	Conductvity (uS/cm)
Riffle	29.4	22.9	162.32	0.565	56.34
Run	27.47	22.28	62.79	0.3691	46.32
Pool	25.4	21.5	11.36	0.1205	37
Overall	27.42	22.23	78.82	0.35	46.55

Table 23 : Average water measurements (Kouchibouguacis)

Riparian vegetation and habitat were assessed for their possible implication of stream habitat health. The percentage of each shore within each section belonging to a corresponding habitat type was estimated by percentage. These percentages when then averaged by each bank side and then along both banks in order to achieve an accurate average estimated composition of total shore length by percentage. These composition percentages can be found in **Table 24** and are visualized in **Figure 13 on the following page.**

Average Shoreline Vegetation Composition	
Lawn	3%
Row crop	0%
Forage/Cover crop	0%
Shrubs	20%
Hardwood forest	30%
Softwood forest	21%
Mixed forest	7%
Meadow/ Tall grass	19%
Wetland	0%
Altered	0%

Table 24 : Average riparian vegetation composition (%)

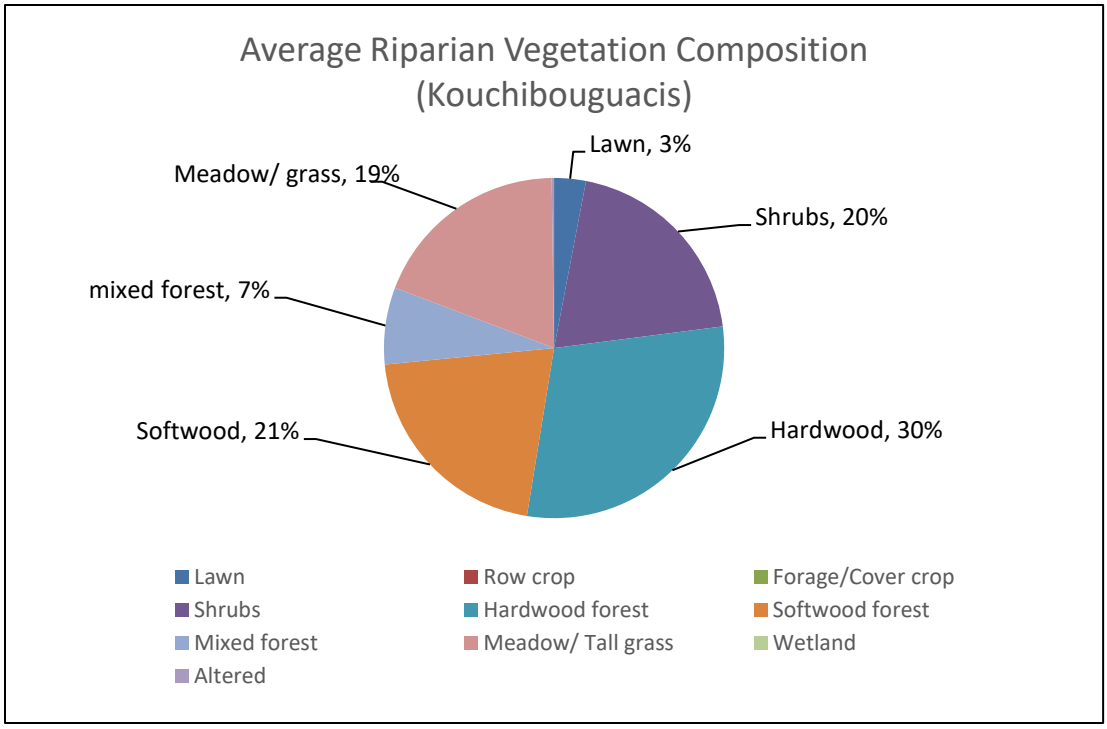

Figure 13 : Average riparian vegetation composition (Kouchibouguacis)

The total flat area of stream survey was calculated in order give an idea of area of available habitat. The total was then further broken-down by habitat, accounting for both the area of the main section and the smaller "sub habitats" found within each section. Area was calculated using the measured length of each section and multiplying that by the averaged "wetted width" of each section. The total cumulative area of each habitat type and total area surveyed can be found in **Table 25 below,** the breakdown by habitat is visualized in **Figure 14 below**.

Area Surveyed (m^2)	
Riffle	6558.65
Run	31870.03
Pool	3905.59
Total	42334.27

Table 25 : Area surveyed (m^2) (Kouchibouguacis)

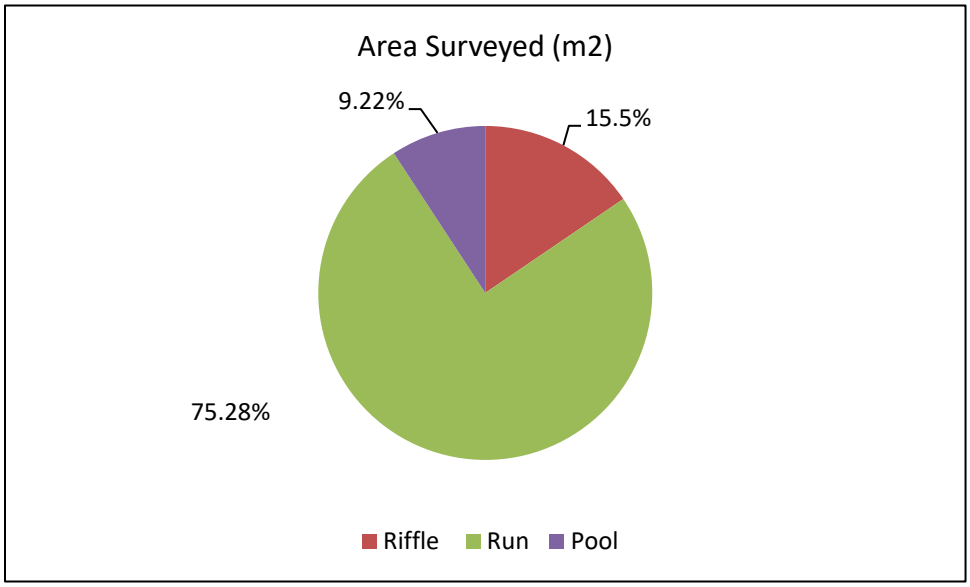

Figure 14 : Area surveyed (m^2) (Kouchibouguacis)

Site parameters of each stream section were measured in order to provided habitat and hydrological data. Measured parameters include average water depth, average wetted width, average bankfull width, average bankfull depth, and the average length of each section. These parameters were then averaged according to habitat type and as an overall value; these can be found in **Table 26** and visualized in **Figure 15 on the following page.**

Average Site Measurement Parameters (Kouchibouguacis)					
	Depth (cm)	Wet Width (m)	Bankfull Width (m)	Bankfull Depth (cm)	Average Length (m)
Riffle	31.39	25.10	26.7	49.6	43.17
Run	34.65	22.53	24.89	42.91	84.29
Pool	31.83	37.13	15.7	27	95.1
Overall	32.62	28.25	22.43	39.84	74.19

Table 26 : Average site measurement parameters (Kouchibouguacis)

Several other parameters relating to potential habitat and ecological health were also assessed. In terms of stream shelter an average of 13.62% canopy cover, 260.4m woody debris, and 131.6m undercut was estimated across the entire section surveyed. The total bank stability, bank length free of erosion, was estimated as an average of 91.29% stable across the entire area surveyed. A total of seven ground water inputs, which have the potential to create thermal refuges for fish, and were found to have an average temperature of 13°C.

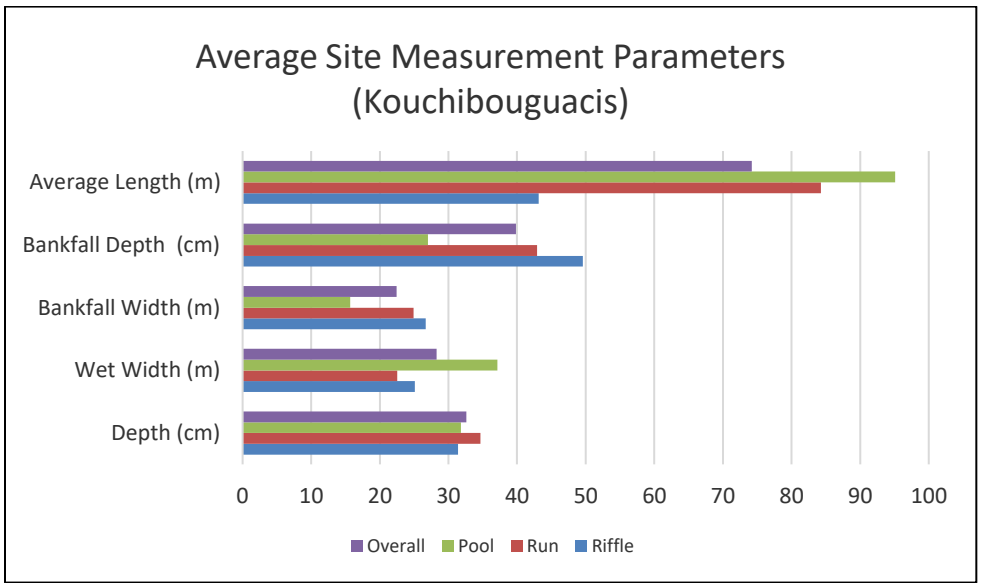

Figure 15 : Average site measurement parameters (Kouchibouguacis)

Kouchibouguac River Stream Survey

The section on the Kouchibouguac Main Branch ended upon the start of a new habitat type. In 2023 a total of approximately 1842 meters of linear length was surveyed starting with the section identified as KR1-23, coordinate N46.74313° W65.20407°, and ending with the section KR23-23, coordinates N46.73206° W65.21243°. a map of the area surveyed with start and end points identified can be found in **Annex A**. Stream substrate was assessed due to its affects on fish life, such as reproduction or shelter, and because of its ability to indicate water quality impairments. Substrate was estimated by percentage within

each section and then these estimates were averaged both by habitat type and as overall, in order to give an idea of the general composition. This breakdown of substrate composition can be found in **Table 27 below** along with the corresponding size specifications, this information is then visualized in **Figure 16 below.**

Average Substrate Composition Percentage by Habitat Type (Kouchibouguac)							
	Bedrock (Ledge)	Boulder (>460mm)	Rock (180-460mm)	Rubble (54-179mm)	Gravel (2.6-53mm)	Sand (0.06-2.5mm)	Fines (0.0005-0.05mm)
Riffle	3	7	16	34	24	11	5
Run	23	3	8	19	27	13	8
Pool	4	6	14	26	24	20	7
Overall	10	5	13	26	25	14	7

Table 27: Average substrate composition percentage by habitat type (Kouchibouguacis)

Percent embeddedness, that is the percentage of substrate buried by fine particles, was also estimated in each section due to its implications of stream health, across all sections was an average embeddedness of 28.91%.

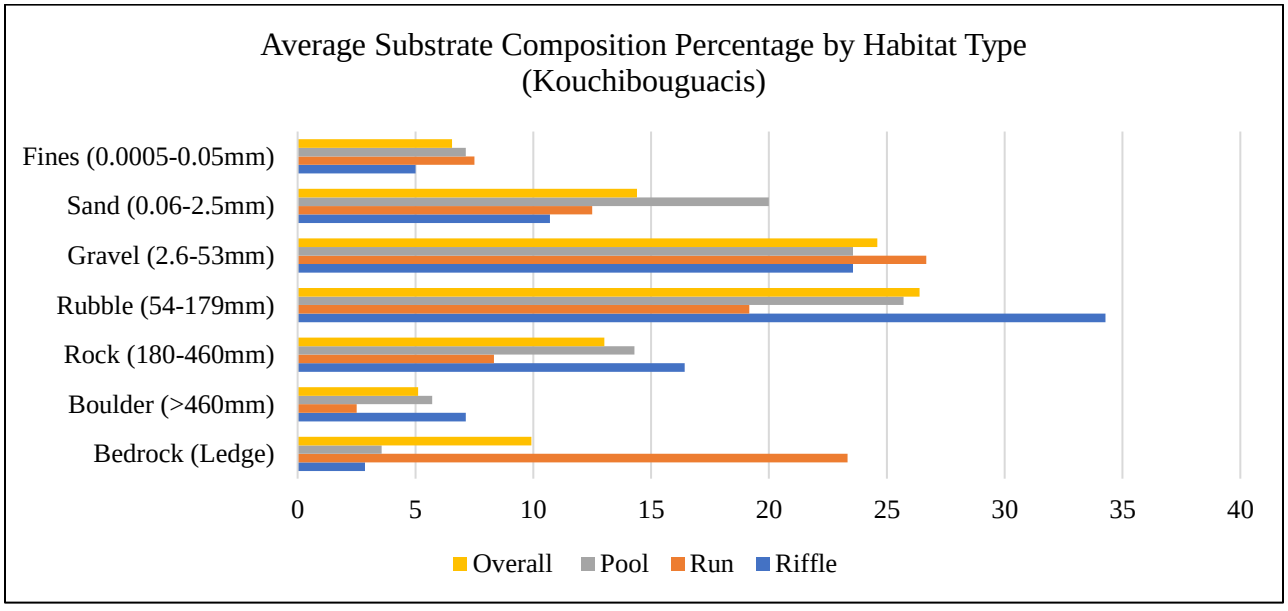

Figure 16 : Average substrate composition percentage by habitat type (Kouchibouguacis)

Parameters of water quality and related ambient environmental factors were also measured in order to give an assessment of ecological health. Parameters assessed include ambient air temperature, water

temperature, dissolved oxygen, pH, water velocity and conductivity. These results were averaged by habitat type and as an overall value across all sections. These results and their units of measurement can be found in **Table 28 below.**

Average Water Measurements (Kouchibouguac)					
	Air Temp (°C)	Water Temp (°C)	Disolved Oxygen (ppm)	Velocity (m/s)	Conductvity (uS/cm)
Riffle	23.20	16.77	11.61	0.4499	41.69
Run	23.18	16.63	11.59	0.4469	41.38
Pool	23.05	16.74	11.64	0.4211	42.55
Overall	23.14	16.71	11.61	0.4393	41.87

Table 28 : Average Water Measurements (Kouchibouguac)

Riparian vegetation and habitat were assessed for their possible implication of stream habitat health. The percentage of each shore within each section belonging to a corresponding habitat type was estimated by percentage. These percentages when then averaged by each bank side and then along both banks in order to achieve an accurate average estimated composition of total shore length by percentage. These composition percentages can be found in **Table 29 below** and are visualized in **Figure 17 on the following page.**

Average Shoreline Vegetation Composition (%)	
Lawn	6%
Row crop	0%
Forage/Cover crop	0%
Shrubs	39%
Hardwood forest	14%
Softwood forest	19%
Mixed forest	13%
Meadow/ Tall grass	10%
Wetland	0%
Altered	0%

Table 29 : Average riparian vegetation composition (Kouchibouguac)

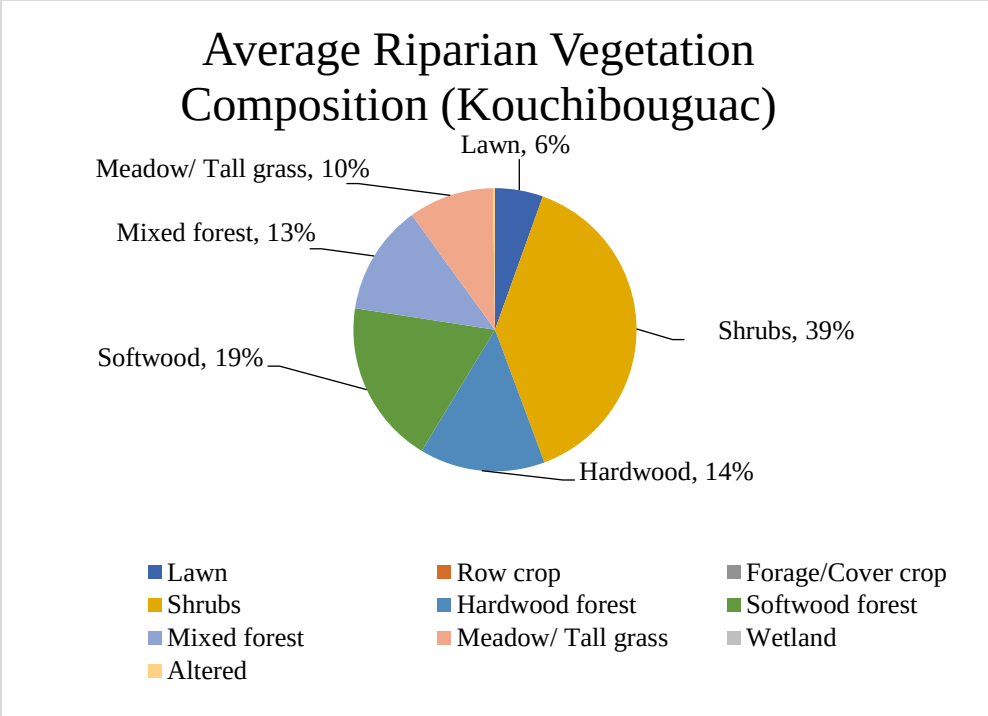

Figure 17 : Average riparian vegetation composition (Kouchibouguac)

The total flat area of stream survey was calculated in order give an idea of area of available habitat. The total was then further broken-down by habitat, accounting for both the area of the main section and the smaller "sub habitats" found within each section. Area was calculated using the measured length of each section and multiplying that by the averaged "wetted width" of each section. The total cumulative area of each habitat type and total area surveyed can be found in **Table 30 below** and the breakdown by habitat is visualized in **Figure 18 on the following page**.

Area Surveyed (m^2)	
Riffle	9157.15
Run	14396.52
Pool	4741.66
Total	28295.33

Table 30 : Area surveyed (m^2) (Kouchibouguac)

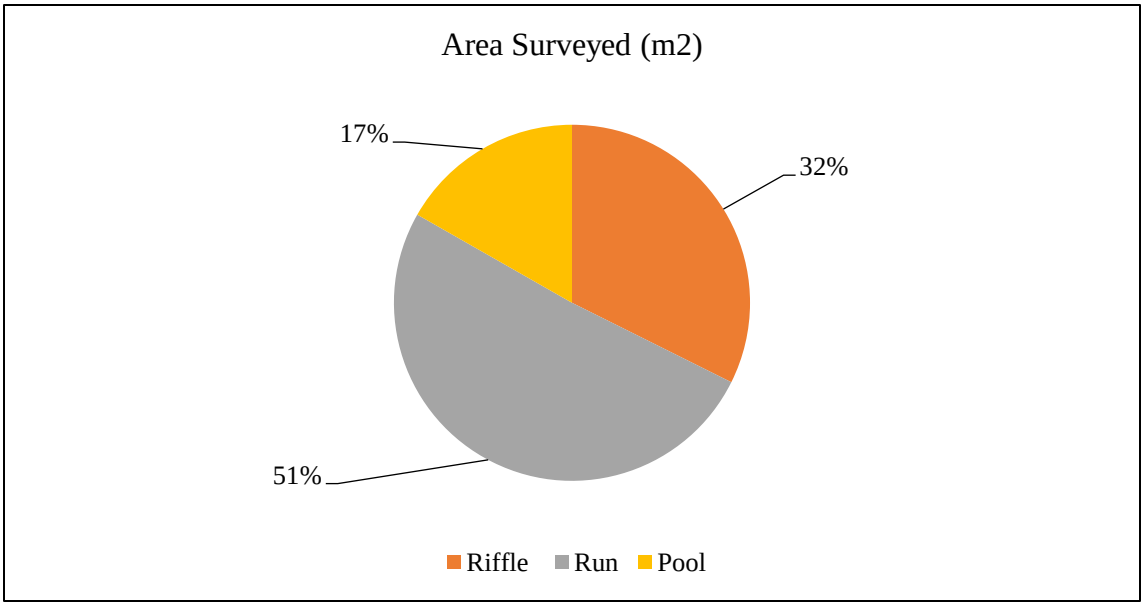

Figure 18 : Area surveyed (m^2) (Kouchibouguac)

Site parameters of each stream section were measured in order to provided habitat and hydrological data. Measured parameters include average water depth, average wetted width, average bankfull width, average bankfull depth, and the average length of each section. These parameters were then averaged according to habitat type and as an overall value; these can be found in **Table 31 below** and visualized **in Figure 19 on the following page.**

Average Site Measurement Parameters (Kouchibouguac)					
	Depth (cm)	Wet Width (m)	Bankfall Width (m)	Bankfall Depth (cm)	Average Length (m)
Riffle	28.21	17.59	18.94	35.86	71.67
Run	33.62	27.31	19.1	36.41	116.45
Pool	57.86	14.82	15.4	37.17	47.11
Overall	39.90	19.91	17.81	36.48	78.41

Table 31 : Average site measurement parameters (Kouchibouguac)

Several other parameters relating to potential habitat and ecological health were also assessed. In terms of stream shelter an average of 14% canopy cover, 456.8m woody debris, and 121m undercut was estimated across the entire section surveyed. The total bank stability, bank length free of erosion, was estimated as an average of 89.46% stable across the entire area surveyed. A total of eight ground water inputs, which have the potential to create thermal refuges for fish, and were found to have an average temperature of 11.45°C.

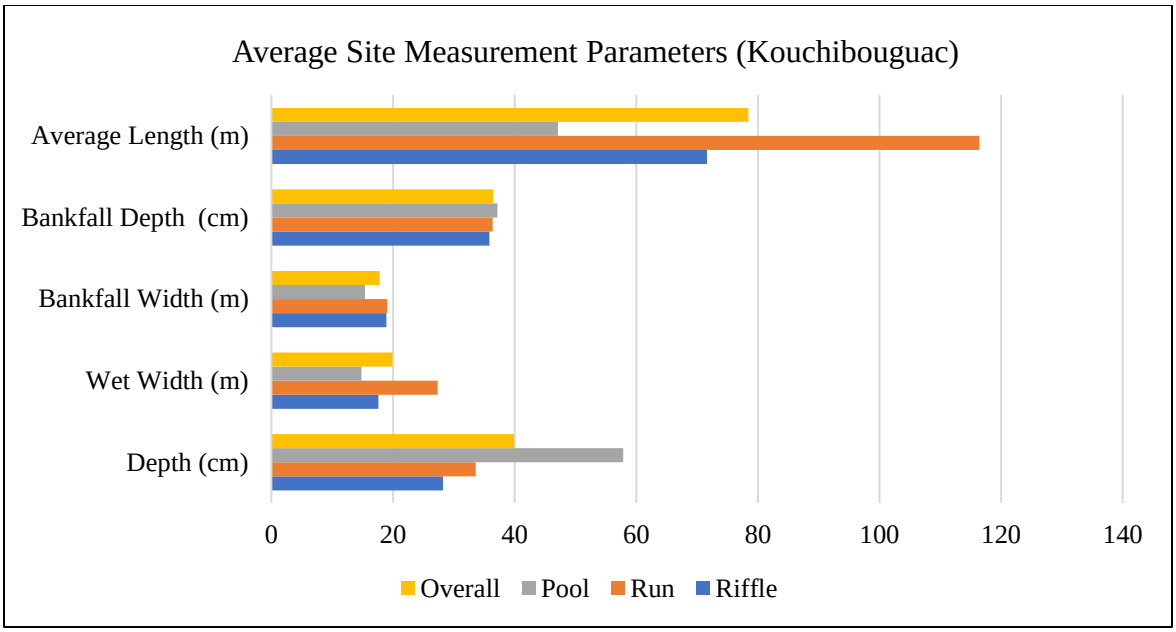

Figure 19 : Average site measurement parameters (Kouchibouguacis)

7.0 eDNA Sampling 2023

During the 2022-2023 season the Friends of the Kouchibouguacis collected environmental DNA (eDNA) samples from 12 sites each within the Kouchibouguacis watershed including the Ruisseau Baptiste, Beaver brook, Little beaver brook tributary, 10 sites were sampled from the Kouchibouguac watershed and its Tweedie brook, Fontaine river, Portage river, Black river, Rankin river tributary. (22 sites total). The samples were collected in accordance with the protocol provided by the UNB Saint John laboratory. The sites and sampling locations were selected with guidance from specialists with DFO. Each sample was shipped to the laboratory at UNB Saint John for analyses to detect the presence/absence of Atlantic salmon, Brook Floater and/or Brook trout specimen at each site.

Any sites that result in a positive detection of presence will be used to help plan new sampling and monitoring initiatives (e.g., electrofishing, visual Brook floater surveying, etc.) that can be used to collect valuable data on the populations of said species. These sites will also be assessed for any potential hazards or risks to the habitat of the said species, and restorative work can be carried out immediately if feasible or planned for the near future.

7.1 UNB SJ Laboratory Methodology

A positive means that there were Atlantic salmon, Brook trout or Brook floater present at the site or somewhere upstream. UNB SJ deemed the site positive if at least one of the two field replicates produced all positive qPCR replicates in the lab. Each field replicate had four qPCR replicates. A weak positive means the neither field replicate produced all positive replicates in the lab, but a signal was still detected in at least half of the total replicates (i.e., 4/8). This could be because the eDNA signal was very near to the detection threshold. UNB SJ was conservative in what was considered a positive detection.

The negatives associated with the remaining sites does not mean that there are no species of interest in this area, only that any signal was below the detection threshold. There many factors that affect DNA signal including: sunlight, temperature, abundance of individuals present, organic material, etc.

There were three types of negative controls (field, extraction and quantitative PCR) used throughout the process to detect if contamination occurred at any step. DNA from either species was not detected in any of these negative controls, which means there was no contamination during sampling, and positive detections are a result of Atlantic salmon, Brook floater or Brook trout DNA being present at these sites. An internal positive control was also used on all samples to test whether PCR inhibition was present and preventing Atlantic salmon, Brook floater and Brook trout DNA from amplifying. This control found no inhibition present.

A special eDNA sampling initiative is taking place on ruisseau a baptiste as part of a pre and post-remediation monitoring program. Ruisseau a baptiste is undergoing fish/water passage restoration and TFK replaced two culverts this field season, with plans for additional remediation next year. There were no solid positive eDNA detections of either Atlantic salmon or Brook floaters on any of the sampled sites within ruisseau a baptiste. If positive detections are observed moving forward, then this could be an indication of a successful restoration that allowed an established population of either species to inhabit ruisseau a baptiste.

The eDNA results of the 2023 season have yet to be received, all results will be provided in the early months of 2024.

7.2 2023 Brook Floater DNA Swabbing results

TFK performed DNA swabbing of Brook floater specimen as part of an initiative with DFO and US Fish and Wildlife Services (USFWS). Five sites total were surveyed during the 2023 season, in the Kouchibouguac River. Site KR1 was a new site TFK wanted to sample after possible siting in surrounding area. In the Kouchibouguacis River how ever TFK preformed eDNA sampling on the Kouchibouguac River to be certain. Sites BF1-23, BF2-23, BF3-23 and BF5-23 (see map in **Annex A**) were selected based on previously successful specimen location and quick access due to time constraints. Results of DNA analyses have yet to be received. Brook floater DNA Swabbing analyses are displayed in **Table 32 below.**

During Brook floater survey

Brook floater found during survey

Site	Coordinates	Number of live specimens	Number of shells	Number of DNA swabs	Swab #	Length	Width	Thickness
BF1-23	N46.71147 W65.06192 ST N46.71182 W65.06202 F	4	1	4	1	5	2.9	2.2
					2	6	3.8	3
					3	3.2	2	1.5
					4	5	3	2.1
BF2-23	N46.70501 W65.07910 ST N46.70443 W65.07922 F	None found						
BF3-23	N46.69947 W65.08511 ST N46.69917 W65.08588 F	None found						
BF5-23	N46.67189 W65.15867	None found						
KR1	N46.73266 W65.20759	None found						
KS*	N46.89960 W65.08415	0	1	1	Shell with fresh flesh observed during other activities			

Table 32: Brook Floater DNA Swabbing analyses

8.0 Water Quality Sampling

This year TFK performed various water quality sampling in the Kouchibouguac and Kouchibouguacis watersheds.

8.1 Cyanobacteria sampling

A total of six sites (3 in each watershed) were sampled 2 times this year for Cyanobacteria Anatoxin-A (commonly referred to as Blue-green algae) using test strip kits provided by Eurofins Abraxis (**see map in Figure 20 below**).

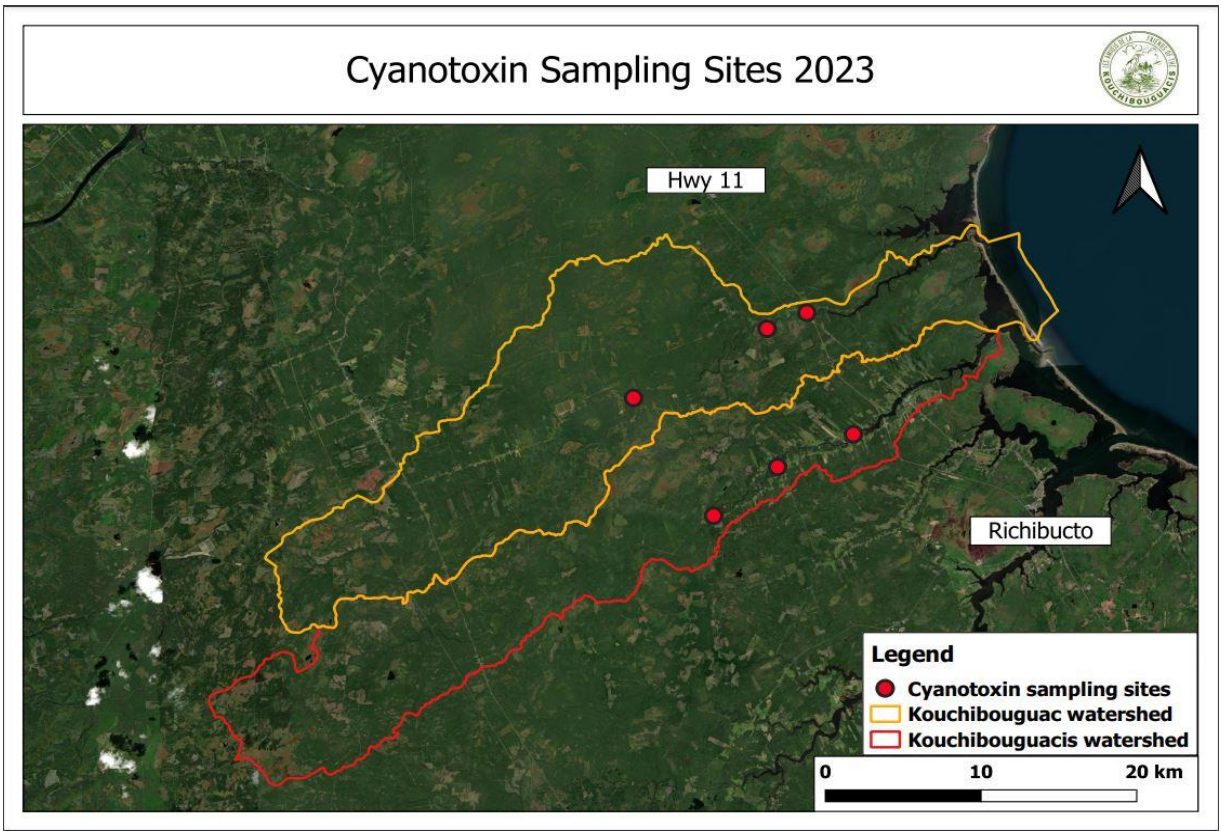

Figure 20 : 2023 Cyanobacteria sampling sites

Analyses was performed in-house using methods provided within the test strip kit. No sites yielded results that exceeded 4 parts per billion (ppb) which is the threshold of the most stringent drinking water regulations; TFK did not feel it necessary to notify the surrounding community of the trace amounts that were detected as there was no risk or concentration that justified creating any potential concern.

8.2 E. coli and Fertilizer sampling

A total of eight sites (4 in each watershed, **see map in Annex A**) were sampled once this year for E. coli and fertilizers (nitrates, nitrites and total phosphorus) using sampling bottle kits provided by RPC laboratories.

Analyses was performed by RPC laboratory and the results are as follows in **Table 33 on the following.**

	Date Analyzed:	10-Oct-2023	RL:	0.05	0.05	0.05	0.002
	Method ID:	FFA10	Method Reference	APHA 4500-NO3 H		APHA 4500-NO2-B	APHA 4500-P E
	Units:	MPN/100ml	Units:	mg/L	mg/L	mg/L	mg/L
Site	Analytes:	E. coli	Analytes:	Nitrate + Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Phosphorus-Total
KS1-WQ		161		< 0.05	< 0.05	< 0.05	0.030
KR1-WQ		169		< 0.05	< 0.05	< 0.05	0.023
KS2-WQ		132		< 0.05	< 0.05	< 0.05	0.031
KR2-WQ		63		< 0.05	< 0.05	< 0.05	0.023
KS3-WQ		199		< 0.05	< 0.05	< 0.05	0.030
KR3-WQ		1956		< 0.05	< 0.05	< 0.05	0.042
KS4-WQ		216		< 0.05	< 0.05	< 0.05	0.024
KR4-WQ		121		< 0.05	< 0.05	< 0.05	0.027

Table 33 : Sampling results.

After looking at the CCME Guidelines for the Protection of Aquatic Life, all the site samples were under the recommended limits except site KR3-WQ, the E. coli exceeded the provincial guideline by 1556/100ml. TFK plans to continue this monitoring in the future to keep an eye on existing environmental conditions in the area.

9.0 Stream Restoration

TFK has performed various restoration initiatives on multiple watercourses throughout our watersheds. In 2023, TFK initiated the restoration of ruisseau a baptiste – a tributary to the Kouchibouguacis River. Ruisseau a baptiste had a series of sites that imposed obstructions to fish and water passage which resulted in degraded habitat quality and access for many species. These sites included a series of three manmade dams that were constructed in the 1970's, one inactive beaver dam, as well as two faulty culverts that were clogged and creating large ponds. Last year, TFK successfully replaced the two faulty culverts (upstream of the other obstructions). This year, TFK successfully reconstructed stream banks at one of last year

restoration site, breached two beaver dams, removed a concrete man-made dam and installed a culvert. This initiative is described in more detail in the following subsection.

9.1 Ruisseau a baptiste

This year TFK successfully removed a faulty man-made concrete dam and installed a 1200mm concrete culvert, reconstructed stream banks to narrow the water passage and breached two beaver dams, with funding support from DFO-HSP, NB Wildlife Trust Fund, Atlantic Salmon Conservation Foundation, NB Environmental Trust Fund, Nature NB and Bass Pro Shops and Cabela's Outdoor Fund. This restoration work improved fish and water passage on ruisseau a baptiste as well as eliminated sedimentation inputs caused by erosion due to the previously altered water flow.

In the coming years (depending on funding application results) TFK would like to remove 2 more manmade concrete dams, lower a culvert and breach one active beaver dam that are currently obstructing water/fish passage and polluting the watercourse with high sediment loads. Pre-remediation assessments of the stream (e.g., drone imagery, eDNA sampling, substrate composition, electrofishing, etc.) have been done prior to the culvert replacements to be able to compare the changes in the years to come.

After the man-made concrete dam removal and culvert installment (D/S) and the reconstruction of the banks (U/S), TFK planted vegetation from our nursery along the embankments at both sites to encourage root systems to be established. The root systems will help to stabilize the area and reduce erosion and potential pollution coming from the surrounding areas. The vegetation planted at each site are displayed in **Tables 34 below** and **Table 35 on the following page.**

Upstream (U/S) culvert: N46.754959, W64.999599

Vegetation planted:

Species	Quantity
Bur oak	1
White spruce	1
White ash	2
Red oak	2

Table 34:U/S culvert vegetation

Note: This site had plenty of existing vegetation therefore less vegetation was necessary to plant. TFK will return in the spring of 2024 to determine if more vegetation planting is needed.

Downstream (D/S) culvert: N46.750475, W64.999443

Vegetation planted:

Species	Quantity
White pine	2
White ash	8
Elderberry	4
Sugar maple	2
Striped maple	1
White spruce	10
Elm	1
Cedar	2
Dogwood	6
Butternut	4
White birch	3
Deciduous Holly	2
Service berry	4
Bur oak	3
Red oak	2
Beech	2

Table 35 : D\S culvert vegetation

Note: In the spring of 2024 TFK will return and determine if more vegetation planting is needed.

A manmade concrete dam that got removed and replaced with a 1200mm culvert was clogged by debris likely accumulated by beavers and caused a lot of flooding. The altered stream blew out approximately 30 meters from the manmade dam (the original water channel) and resulting in a flanked channel. The flanked channel was then blocked by a beaver dam which caused further flooding of the site. After the removal of the manmade dam, the installation of the culvert and the breaching of the beaver dams the water levels receded to a much more natural state (see image on following page). Significant sediment has accumulated over the years at this site and the stream will slowly cleanse itself and reveal a natural channel and substrate via restored water passage. Fish spawning/rearing habitat has been impaired due to excessive sedimentation up to this point and will likely take a few years to be restored fully, though fish and other

species can now access these sites and other habitats within the stream. A more detailed stream restoration report will be generated as this initiative progresses over the years.

Before dam removal and culvert replacement – ruisseau a baptiste

After dam removal and culvert replacement – ruisseau a baptiste

10.0 Waterfront Stewardship Project

For over a decade, the Friends of the Kouchibouguacis (TFK) has participated in the *Waterfront Stewardship Project* which has provided numerous benefits to the local community and both the Kouchibouguac and Kouchibouguacis Rivers. By providing land owners with information on the advantages of improved land management practices, this project has been able to offer better protection of landowners' property, while also strengthening the health of the local rivers. Over the years, TFK has been able to educate numerous waterfront property owners on the benefits of this project while also offering recommendations and free trees/shrubs to aid in the management of the riparian zone. The following is a detailed summary of the 2023-2024 season.

In 2023, TFK evaluated two properties (both in the Kouchibouguacis watershed) through the Waterfront Stewardship Project. During the summer/fall months, TFK staff met with homeowners to review what vegetation was already present on the property while also observing any beneficial and/or problematic areas that could be better maintained/repaired through various techniques (e.g., planting vegetation, reducing land alteration activities, etc.). A land management plan was then compiled following the visitation. Each plan outlined all observations noted during the survey, as well as recommendations to improve the situation, catered specifically to each individual landowner. Additionally, TFK staff compiled a list of native trees and shrubs that could aid in the restoration of the properties. This year (2023-2024), the trees and shrubs were collected from Cornhill nursery as well as our own nursery and delivered to the landowners along with the completed land management plan. All trees and shrubs were uniquely assigned to each property, based on existing environmental conditions (e.g., soil types, land types, needs/desires of landowner, etc.), and to benefit specific issues noted during the site visit.

The following is an overview of the trees each of the properties received:
Property #1:
Site Location: Saint Ignace
PID Number: 25375833

A total of 12 trees and/or shrubs were delivered which included which are displayed in **Table 36 below.**

Type	Quantity
White Ash	3
Bur Oak	4
Elderberry	2
Butternut	2
White Spruce	2
Sugar Maple	1
Total	**12**

Table 36 : Trees provided to property owner #1

Property #2:
Site Location: Saint Ignace
PID Number: 25015991

A total of 9 trees and/or shrubs were delivered which are displayed in **Table 37 below.**

Type	Quantity
Bur Oak	2
Butternut	2
White Ash	2
Dogwood	2
Sugar Maple	1
Total	**9**

Table 37 : Trees provided to property owner #2

11.0 Tree Nursery and Propagation

This year, TFK planted one types of seeds and received a generous donation of approximately 200 red spruce that have been transplanted in our tree nursery **Table 38** and **Table 39 below** is a breakdown of the species, number of either seeds planted or vegetation planted:

Species	Number collected/planted
Red spruce	200
Total	**200**

Table 38 : Breakdown of the species, number of vegetation planted

Species	Number of seeds planted
Red Oak	52
Total	**52**

Table 39 : Breakdown of the species, number of seeds planted

Trees form the nursery such as 8 white ash, 2 white pine, 4 elderberry, 10 white spruce, 4 butternut, 1 striped maple, 2 cedar, 2 sugar maple, 1 elm, 3 white birch, 2 deciduous holly, 4 service berry, 3 bur oak,

2 red oak, 2 beech and 6 dogwoods were planted at the D/S ruisseau baptiste restoration site. TFK is waiting to see how vegetation planted this year (2023-24) fairs over the winter. More vegetation planting next year is planned as this site had less vegetation present due to decades of flooding/infilling of area. TFK also planted 1 bur oak, 1 white spruce, 2 white ash and 2 red oak at the U/S ruisseau baptiste restoration site. This site had plenty of existing vegetation therefore less trees were planted. More vegetation will be planted next year if deemed necessary.

12.0 Invasive Species

12.1 Purple Loosestrife

This year TFK staff performed the removal of an invasive species – Purple loosestrife from this site was a follow-up to a removal performed last year at the PL1 site adjacent to the Tim Hortons in Saint Louis de kent (Coordinates: N46.72480° W64.99029°). This is considered a mitigative measure to help slowly reduce the presence and propagation of this invasive species in wetland areas. Though this is very difficult to do successfully as it requires the removal/elimination of rhizomes in the root structure. Approximately 2 industrial sized garbage bags of purple loosestrife were removed from the sites and taken to KNP for proper disposal (i.e., burning). Similar measures may be necessary in the future to help manage and mitigate the spread of this species.

13.0 Bat Box Project

On June 15th the Friends of the Kouchibouguacis (TFK) installed data loggers in 3 bat boxes at N46.75058° W64.99829°, N46.75057° W64.99831° and, N46.75057° W64.99831° near Saint-Louis-de-Kent (**see map in Figure 21 on the following page**) to monitor the activity of bats in the area and evaluate the habitat provided by 3 different bat box designs.

Temperature and humidity data loggers were installed in select areas within the bat boxes (4 data loggers in the upper and lower part of front-most and rear-most chambers where possible, Box #3 could only fit two loggers – one on each side). These data loggers (**see image on page 53**) were installed on June 17th, 2023 and were retrieved on September 29th, 2023. (**see datalogger results in Annex B**)

On august 4th , 2023 an ultrasonic vocal monitor provided by Kouchibouguac National park (KNP) (see photos on the following page) was installed to try and capture activity from the bats to be able to identify the species based on their vocals. TFK assisted KNP with installing the monitors at 5 other sites within the Kouchibouguacis and Kouchibouguac watershed (**see map in Figure 22 on page 53**). The vocal monitors were secured on long PVC pipe and installed on rebar in a clear area at least 6m away from nearest clutter. The vocal monitors were typically removed from the sites a week or two after installment depending on the weather, the stored data was sent to KNP for analyses of which species (if any) were detected.

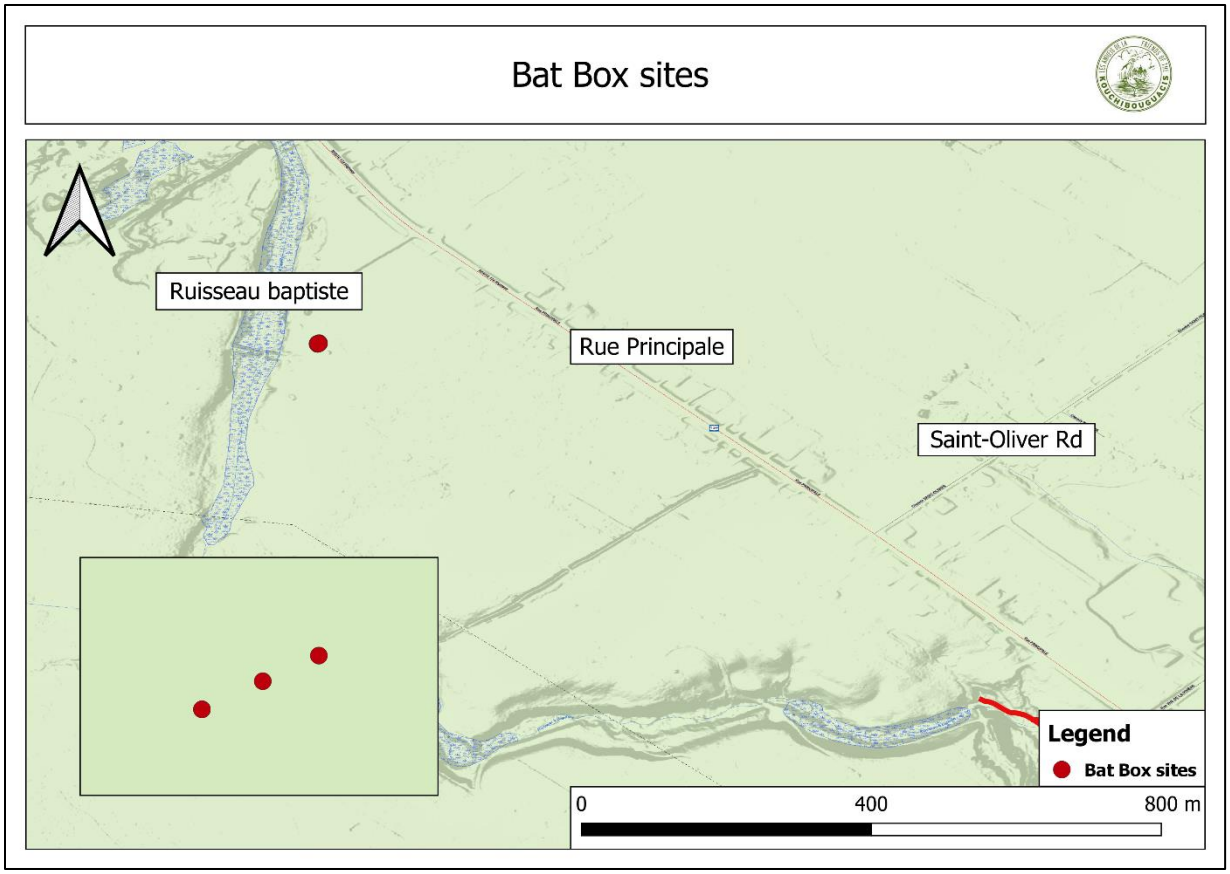

Figure 21 : 2023 Bat Boxes

Vocal monitor secured on PVC pipe after installation.

Vocal monitor installed near bat boxes.

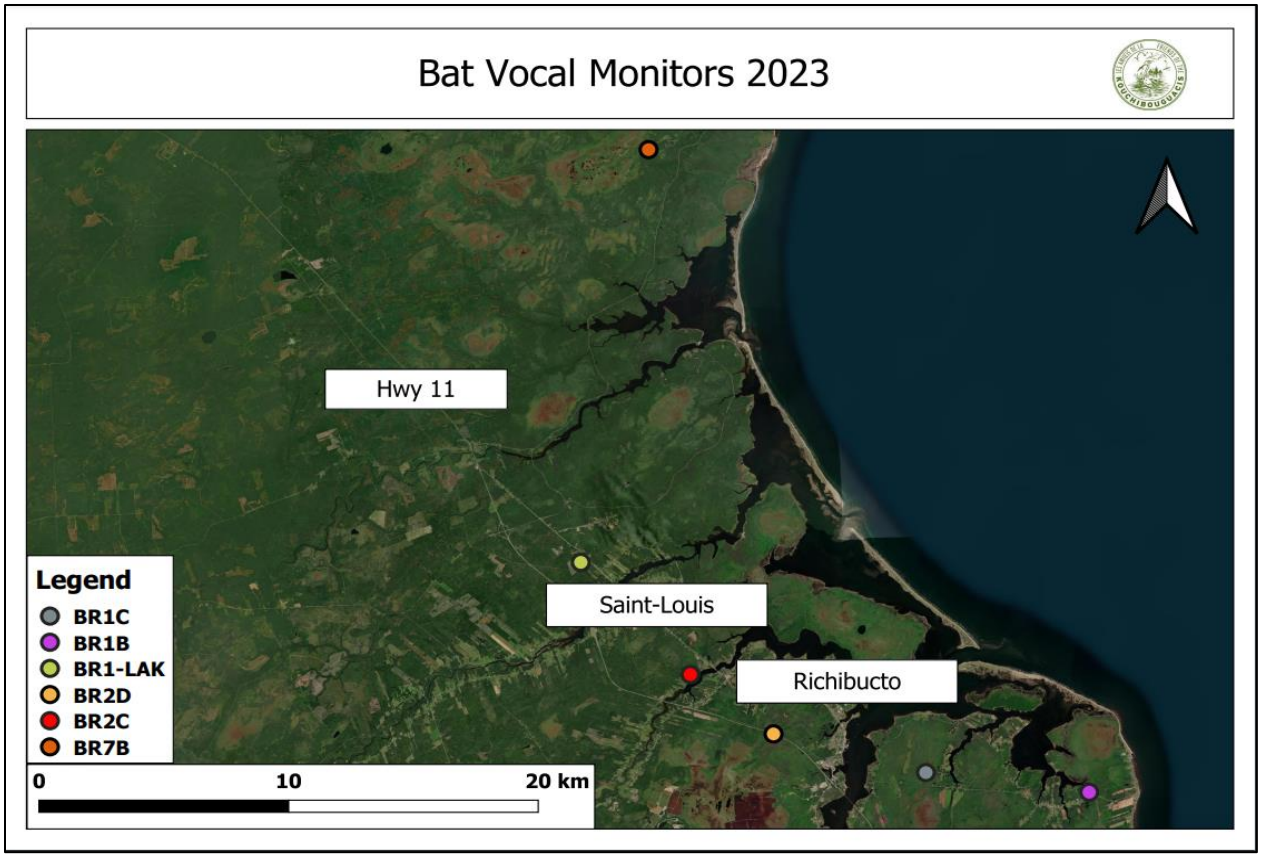

Figure 22 : Vocal monitor locations

Temperature and humidity datalogger installation within bat boxes

Box #1 Dataloggers: Upper bottom S/N 1010187129 Lower bottom S/N 1010193974 Upper front S/N 1010193966 Lower front S/N 1010187131	
Box 4 Comments: (Box #4 was installed on July 22nd and replaced box #2 which was student-made and lacked appropriate grip/mesh features for bats) Dataloggers: Upper back S/N 7106 Lower back S/N 7130 Upper front S/N 3970 Lower front S/N 3963	
Box #3 (Black Box) Comments: Could only fit 2 dataloggers in box #3, 1 on each side of box Dataloggers: Right S/N 3973 Left S/N 3972	

Project Summary: No visible evidence of bats was displayed this year (e.g., emergence, bats present in bat box, bats spotted on trail cameras, bat guano on the ground, etc.). Ultrasonic vocal monitors may reveal the presence of certain bat species upon data analyses from Kouchibouguac National Park staff. Temperature and humidity dataloggers The bat boxes were left at the site to remain over the winter, TFK has learned from relevant experts that bats may travel seeking shelter in the late spring (before the TFK field season begins); therefore, having the bat boxes out there earlier may yield a higher probability of bat inhabitation occurring.

14.0 Challenges and improvements

Due to the abnormal amount of precipitation and high-water levels this season TFK was unable to complete some of the planned monitoring sites. These included not being able to complete all of the planned electrofishing sites and Brook floater survey sites. The abnormal weather conditions also impacted TFK's counting fence efforts by causing substantial damage and multiple blow outs that led to the complete removal of the counting fence. TFK will aim to construct a more durable counting fence setup next year to address issues encountered this year and withstand the forces of the river better. Similar issues occurred with our 2023 trap-nets. Discussions with partners and experts suggest the fall migration of salmon may have occurred earlier in August due to higher-than-normal water levels. This altered migration may have resulted in TFK missing the run, resulting in extremely lower-than-usual numbers. Next year TFK plans to install monitoring equipment (e.g., trap-nets, counting fence) by mid-August to account for this next year and in the future. Our 2023 season total for Atlantic salmon captured in our trap-nets was 9 fish – compared to 113 unique individuals (140 including recaptures) in 2020. This was due in part to shifting substrates within the river that moves anchors – resulting in improper operation of the nets; but also due to lower numbers overall. Lower numbers were observed in multiple neighbouring river systems this year as well (Kouchibouguac and Miramichi rivers).

TFK has been collecting various types of data (age approximations, tagging, fish counts, etc.) on the different species that migrate in the Kouchibouguacis and Kouchibouguac watersheds for a number of years now through various programs such as trap-net fishing, counting fence fishing, electrofishing, and stream survey. TFK has completed an updated version of a management plan for these watersheds (available on our website or at our office anytime). This management plan serves as a summary of our years of work and data collection, as well as a document that can help guide future work. Experts will also be consulted to help interpret the findings within the management plan and provide guidance on the next steps to be taken. The management plan is intended to serve as a living document that will be updated every year to continue adding to a real-time view of the conditions of the watersheds – and allow TFK to perform various initiatives (e.g., habitat restoration, etc.) in a consistent and methodical manner both now and in the future.

15.0 Conclusion

Overall, despite many surprises (e.g., inclement weather) and the extra workload, TFK considers the outcomes of this year a success. The restoration of the Atlantic salmon populations in the Kouchibouguacis and Kouchibouguac watersheds is a project that the community takes to heart; various members of the community always look forward to the activities planned during the course of this project. The project not only contributes to the re-establishment of the salmon population, but also contributes to the education,

awareness, and the stewardship of the community. Many people look forward to the activities planned during the course of the projects related to the Atlantic salmon population.

Partners have been extremely involved again this year, which shows the support and interest for our projects. The long list of people contacted at the many establishments that helped and encouraged the progress of this project is one the main reasons for its success. Bass Pro Shops and Cabela's Outdoor Fund, DFO – Habitat Stewardship Program, New Brunswick Wildlife Trust Fund, The Foundation for Conservation of Atlantic Salmon, New Brunswick Environmental Trust Fund, Nature NB, Eco Canada, NB SEED program, Canada Summer Jobs, Parks Canada/Kouchibouguac National Park provided funding for many items including salaries, contract costs and travel expenses, and stream restoration expenses. The Town of Beaurivage offered support through staff and equipment. Miramichi Salmon Association once again was available with hatchery services and technical support. The Saint-Ignace Golf Club offered generosity by supplying quick and easy access to the brook via the golf course and supply of golf carts.

References

1. CCME 1999, Canadian Council of Ministers of the Environment 1999, Excerpt from Publication No. 1299; ISBN 1-896997-34-1(Canadian Water Quality Guidelines for the protection of Aquatic Life- Temperature (Marine) p. 3.)

2. Flanagan, J J., (2003) The Impacts of Fine Sediments and Variable Flow Regimes on the Habitat and Survival of Atlantic salmon (Salmo salar) Eggs, 24p.

3. Flanagan, J J., (2003) The Impacts of Fine Sediments and Variable Flow Regimes on the Habitat and Survival of Atlantic salmon (Salmo salar) Eggs, 3p.

4. OMNR, 2009, Ontario Ministry of Natural Resources, Fish Culture Technical Bulletin, The Best Management Practices, Bulletin 2009-01, 2p.

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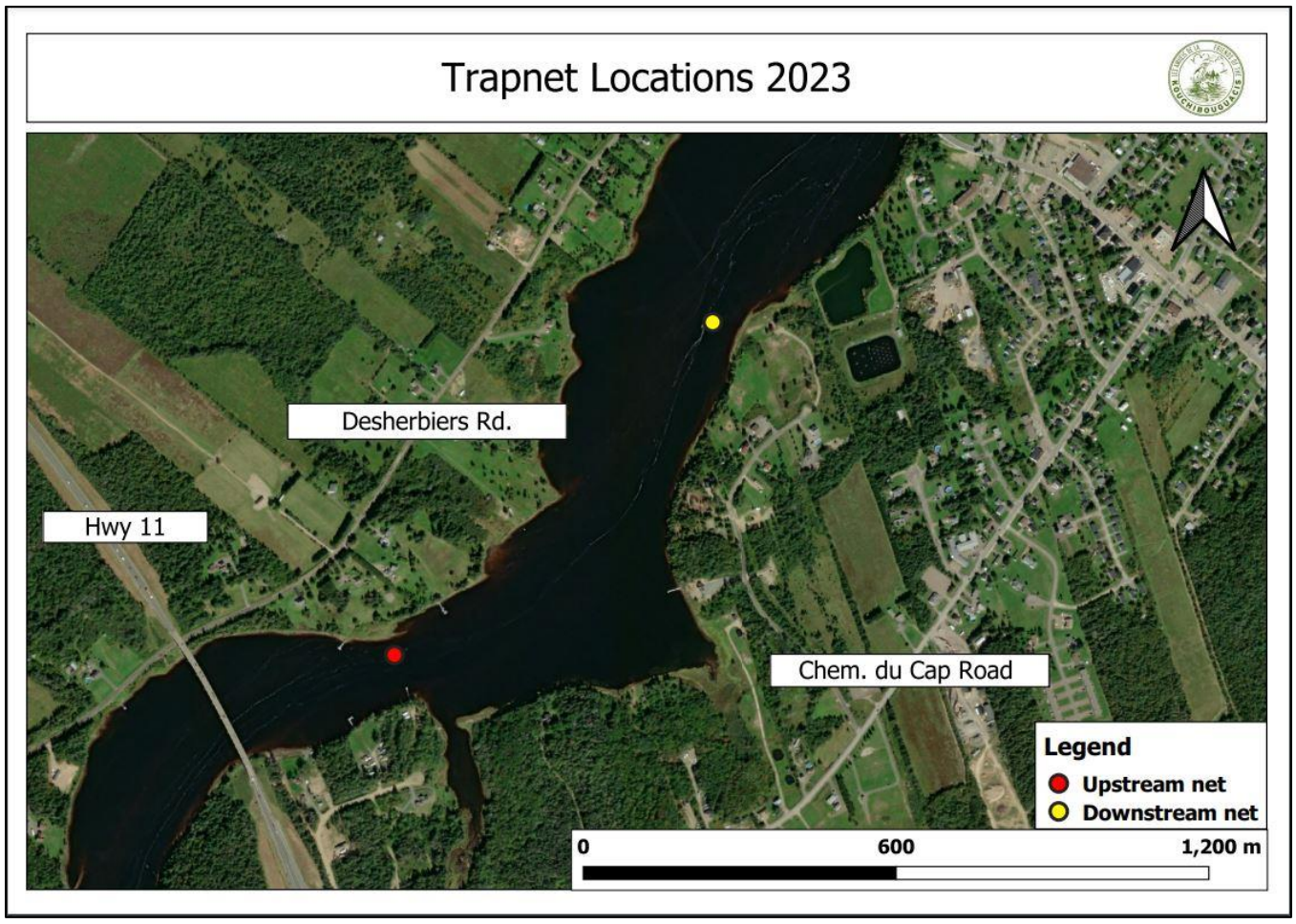
6. CCME 1999, Canadian Council of Ministers of the Environment 1999,Water Quality Guidelines Summary table-pH (Water Quality for the protection of Aquatic Life- 1p.

7. Paull, Tara, Environment Canada, Canadian Aquatic Biomonitoring Network Field Manual (CABIN) wadable streams protocol, March 2010, p. 20.

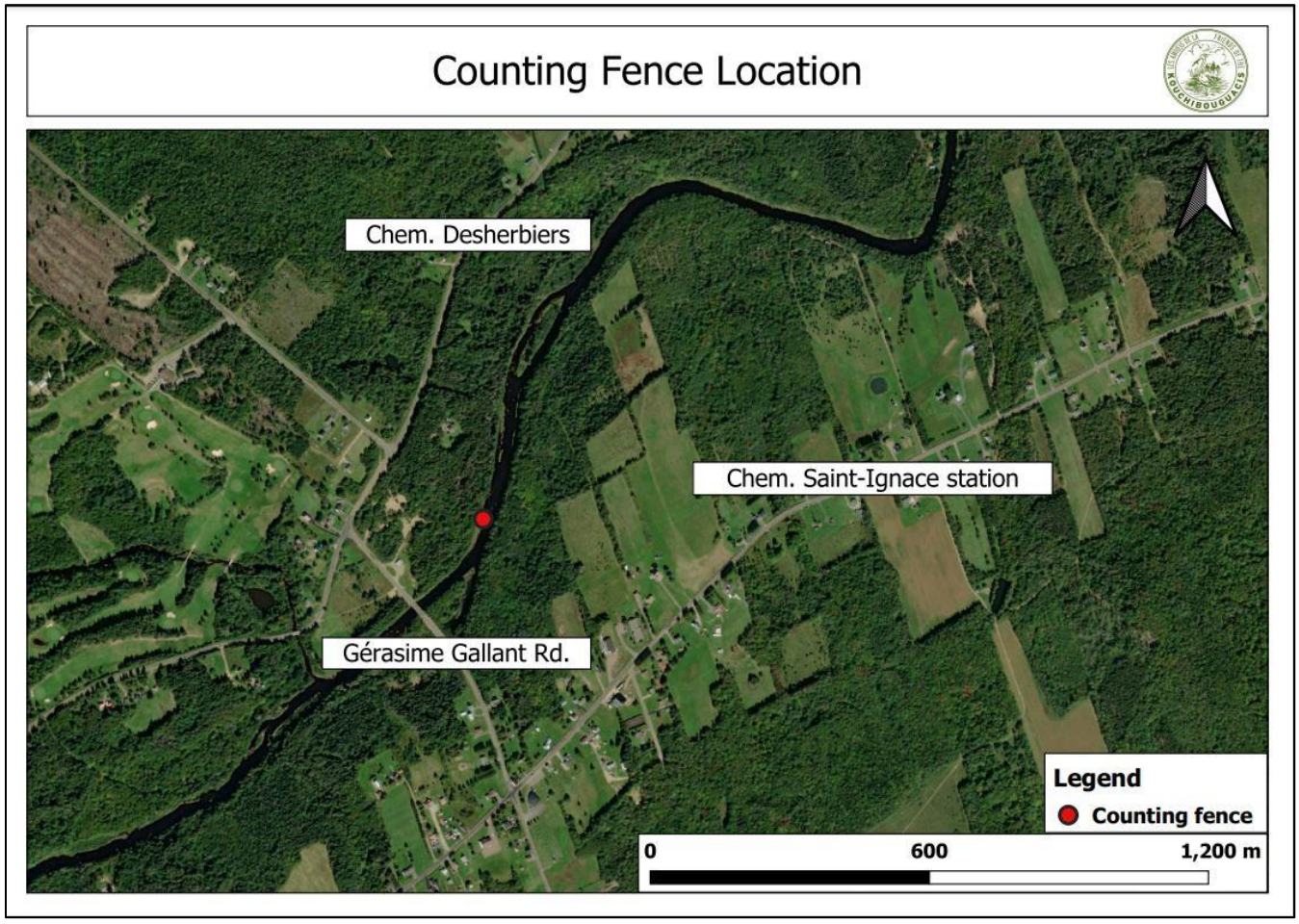
8. DFO, Fisheries and Oceans Canada, Atlantic salmon... a remarkable life cycle, October 2018, P. 2.

Annex A – Activity Maps (trap-nets, counting fence, electrofishing, incubation, stream survey, eDNA, Brook floater DNA swabbing, invasive species and water quality)

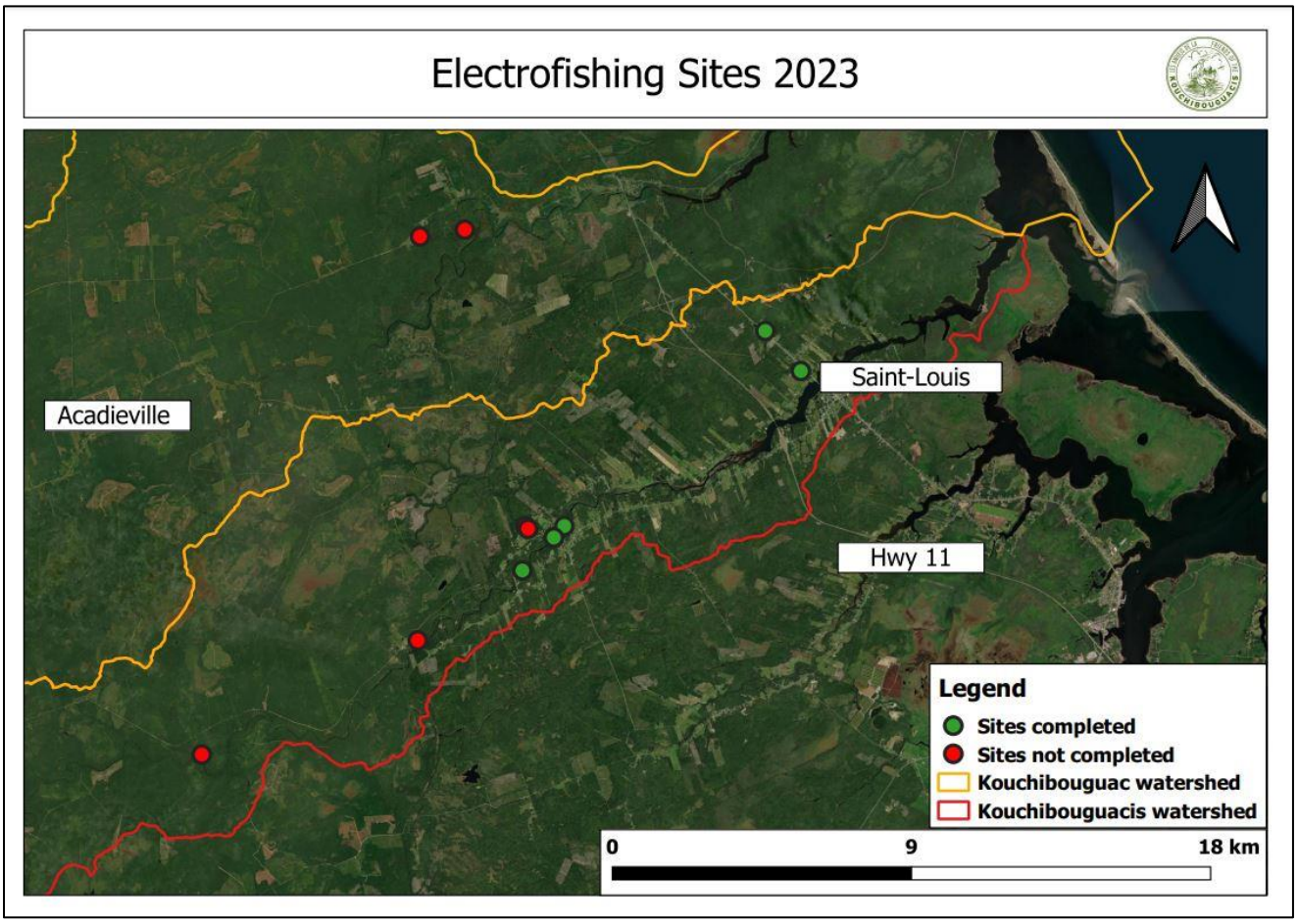
Map displaying box-net locations for 2023 season



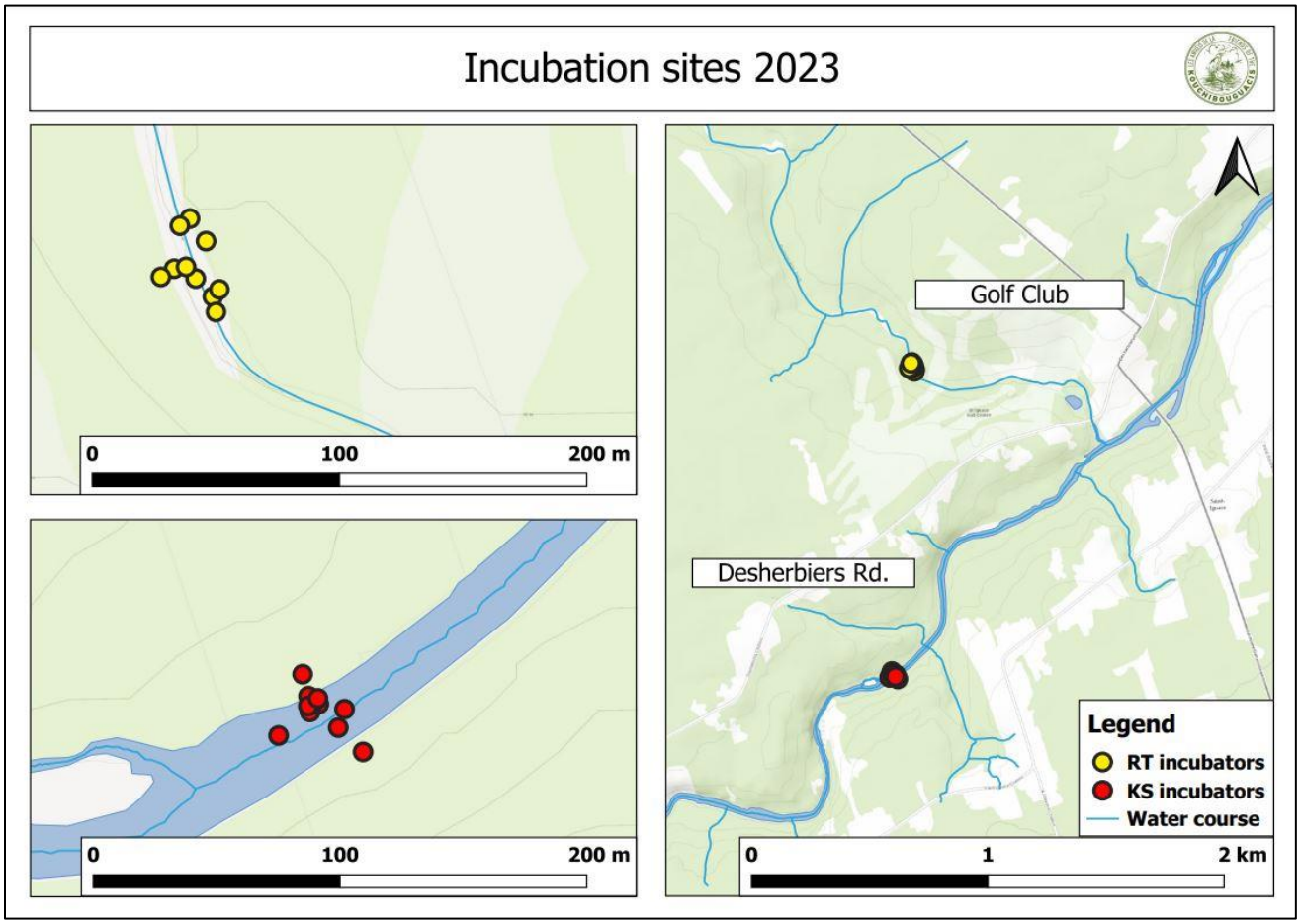
Map displaying counting fence location for 2023 season



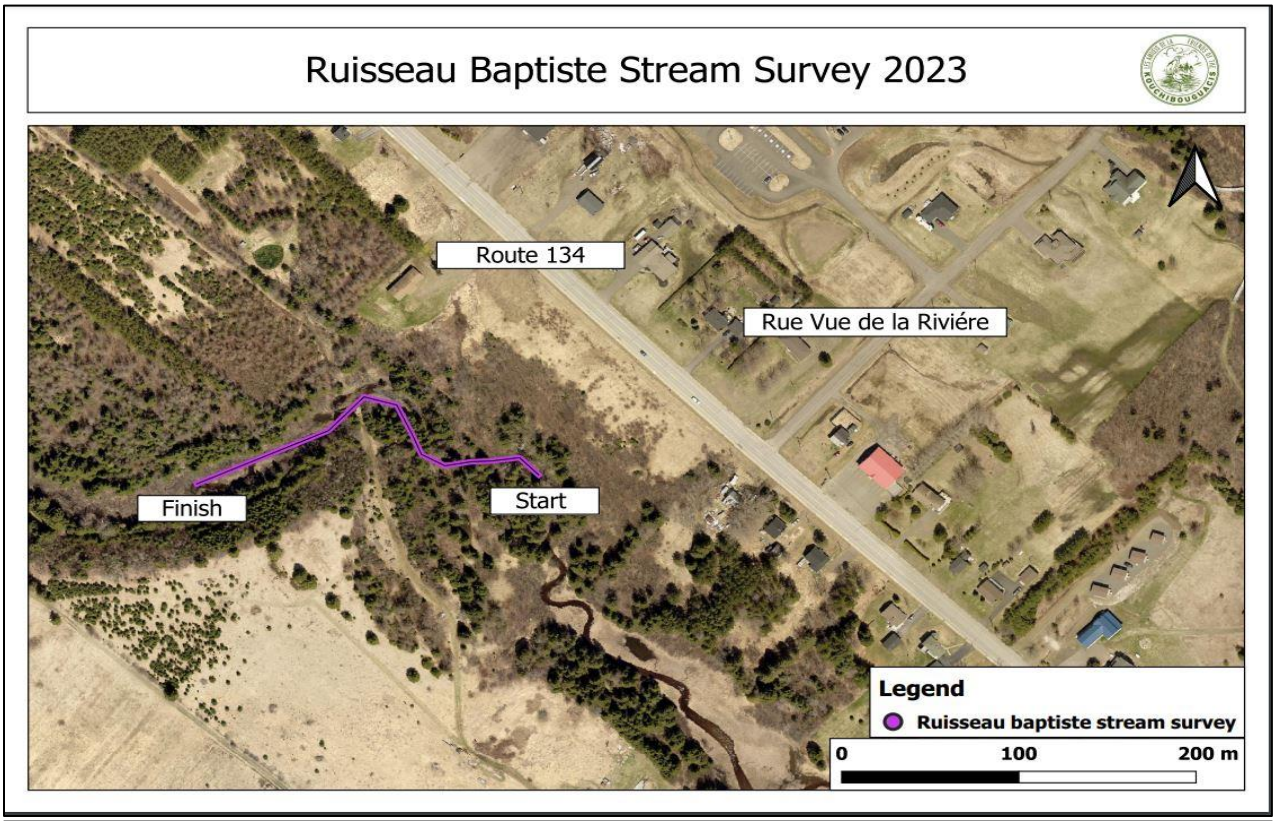
Map displaying 2023 electrofishing site locations

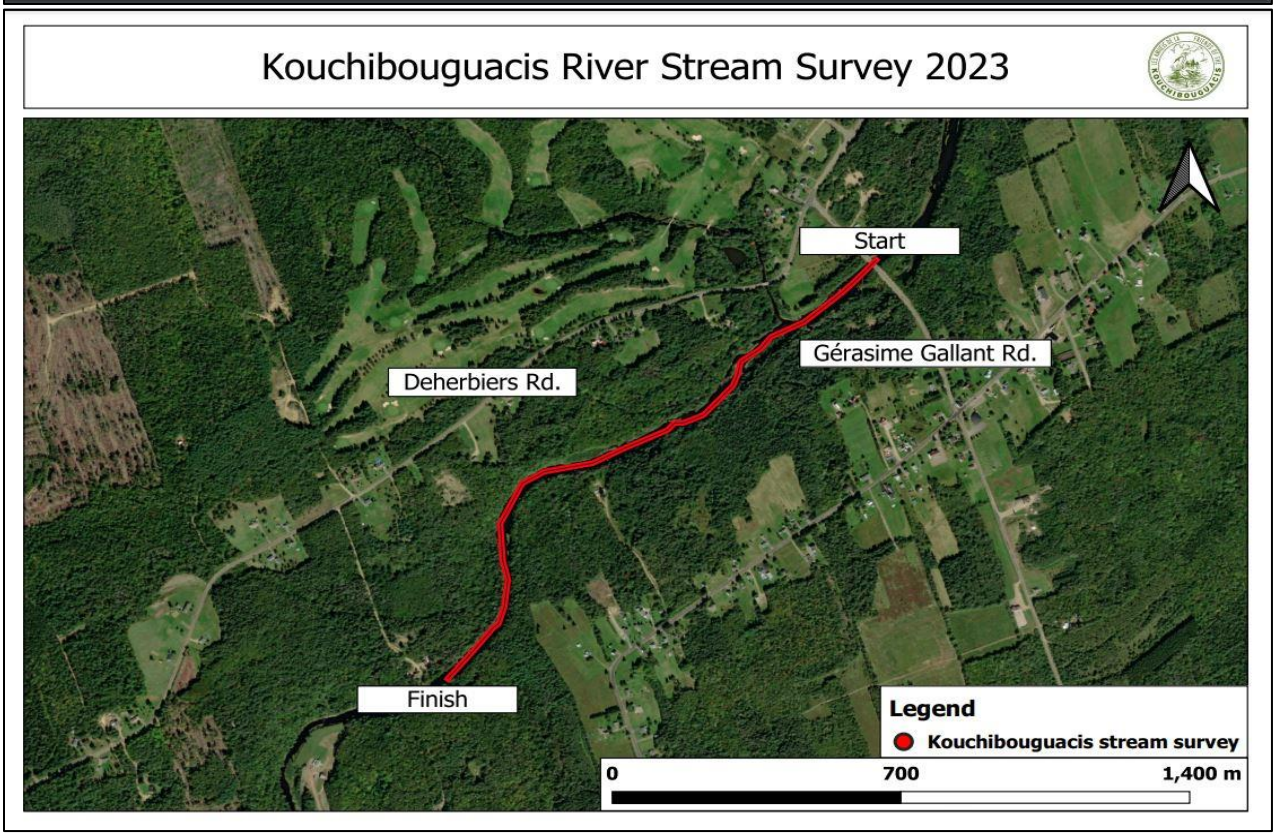


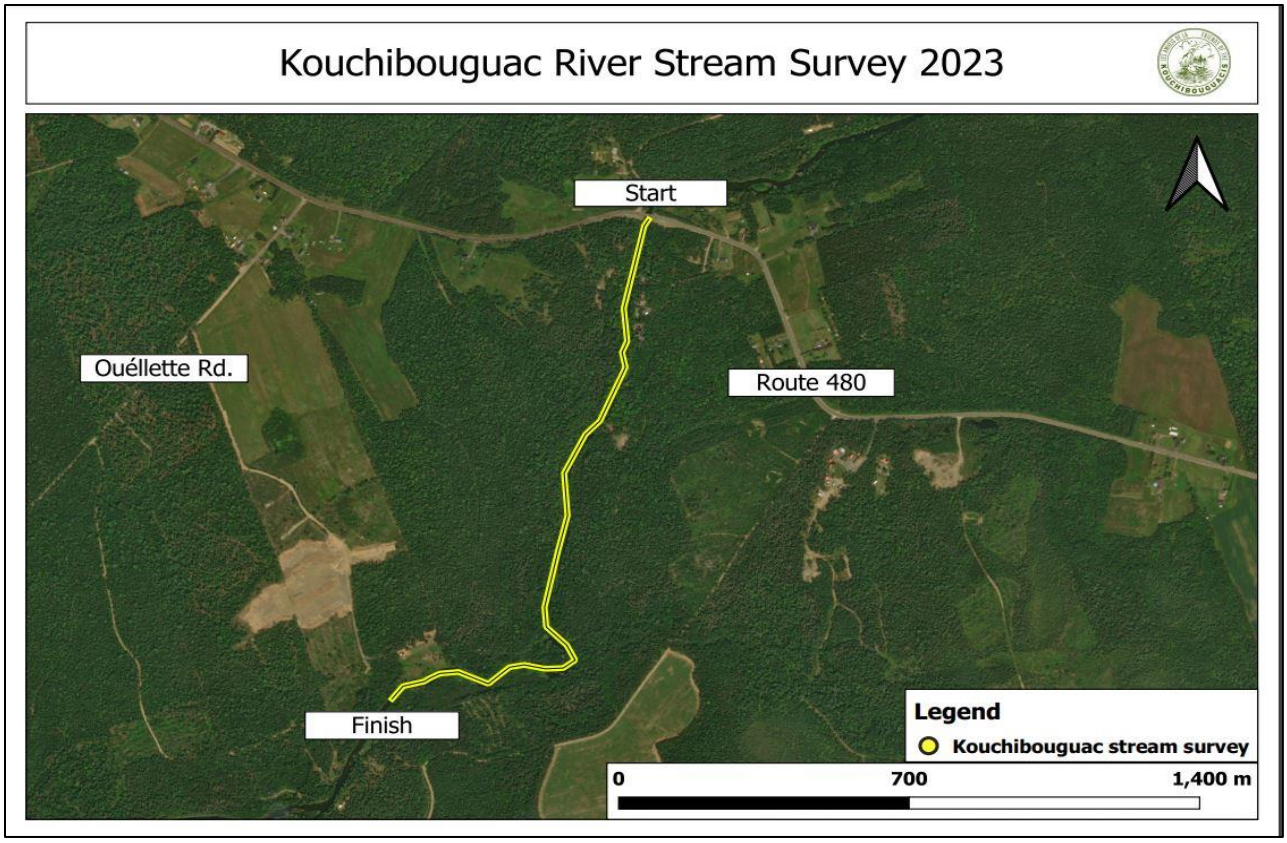
Map displaying 2023 incubation site locations



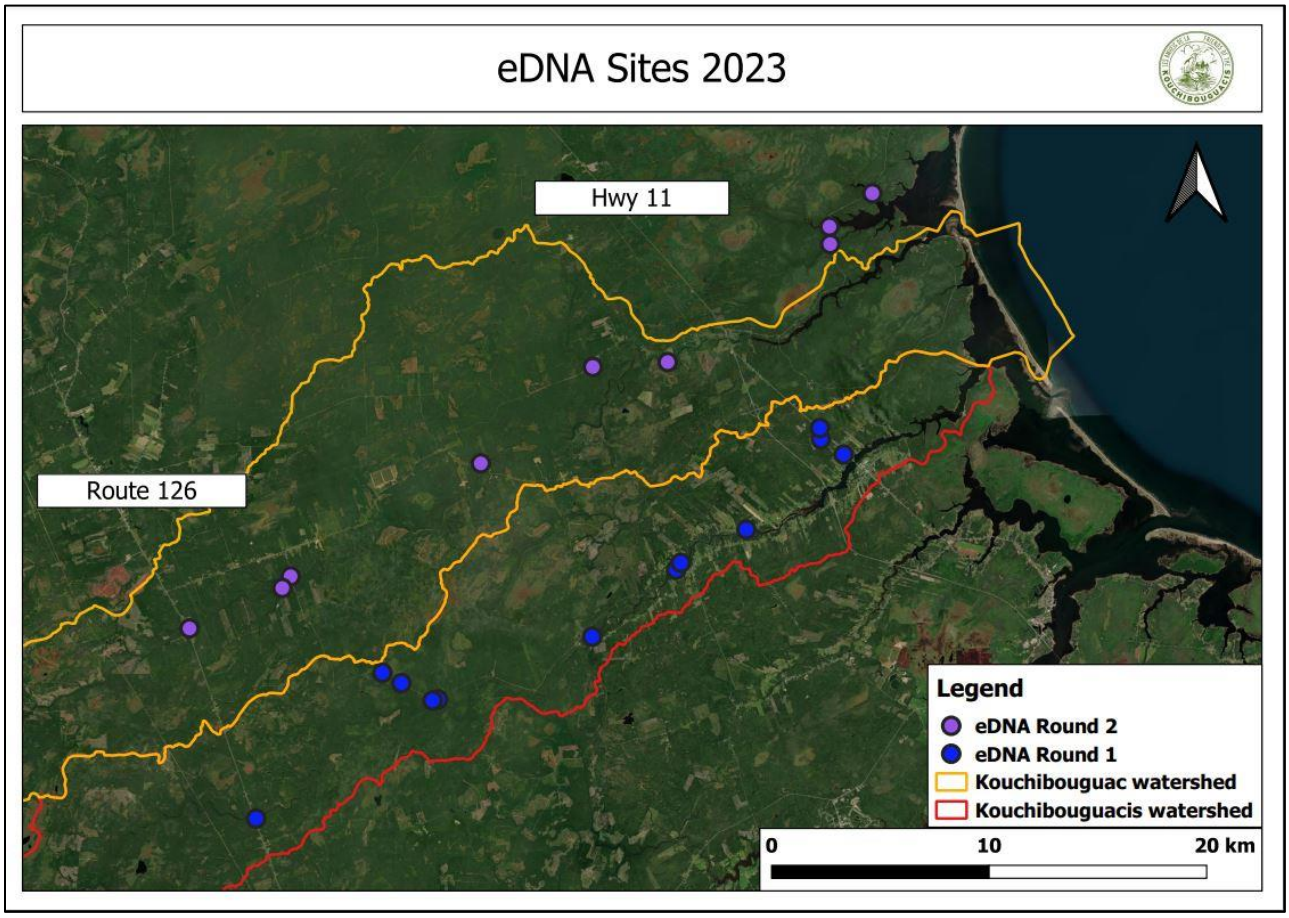
Map displaying 2023 Stream Survey



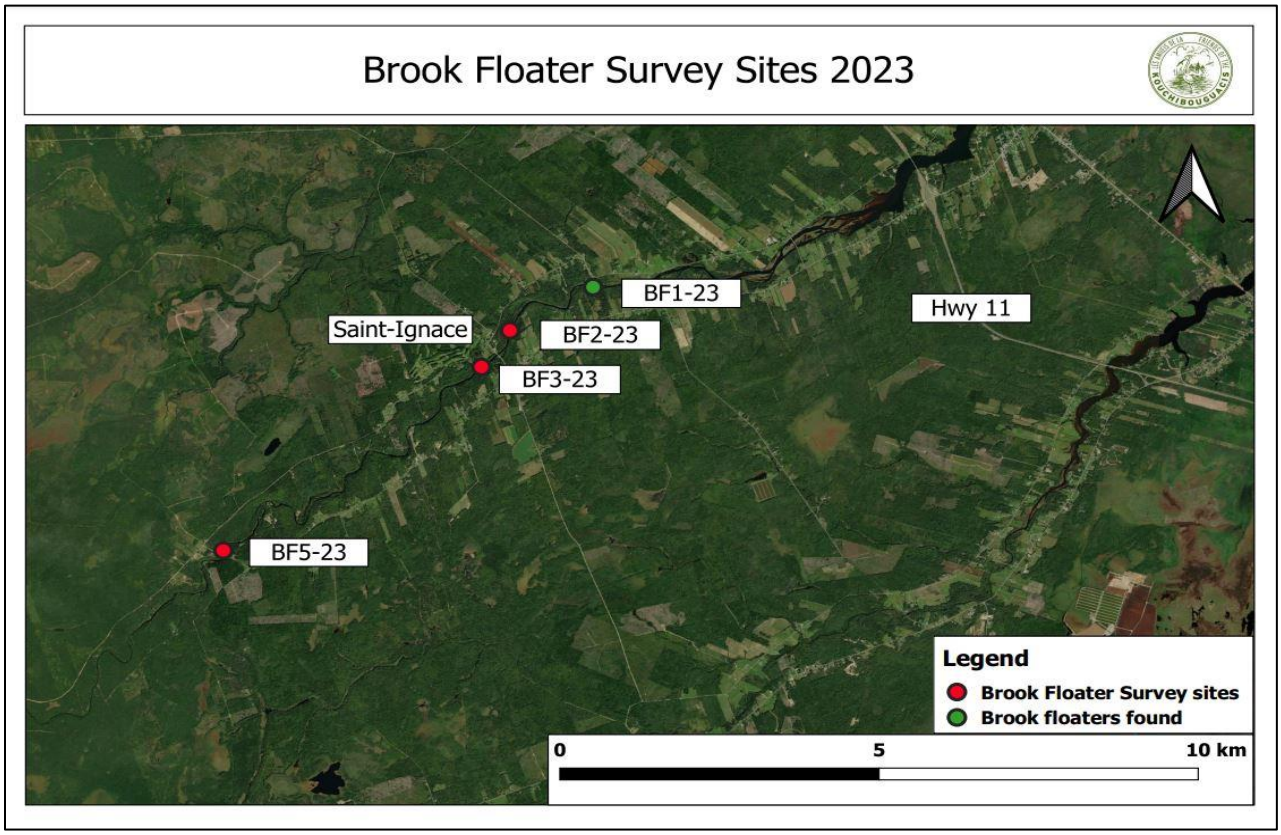



Kouchibouguac River Stream Survey 2023
Start
Ouéllette Rd.
Route 480
Finish
Legend
Kouchibouguac stream survey
0
700
1,400 m

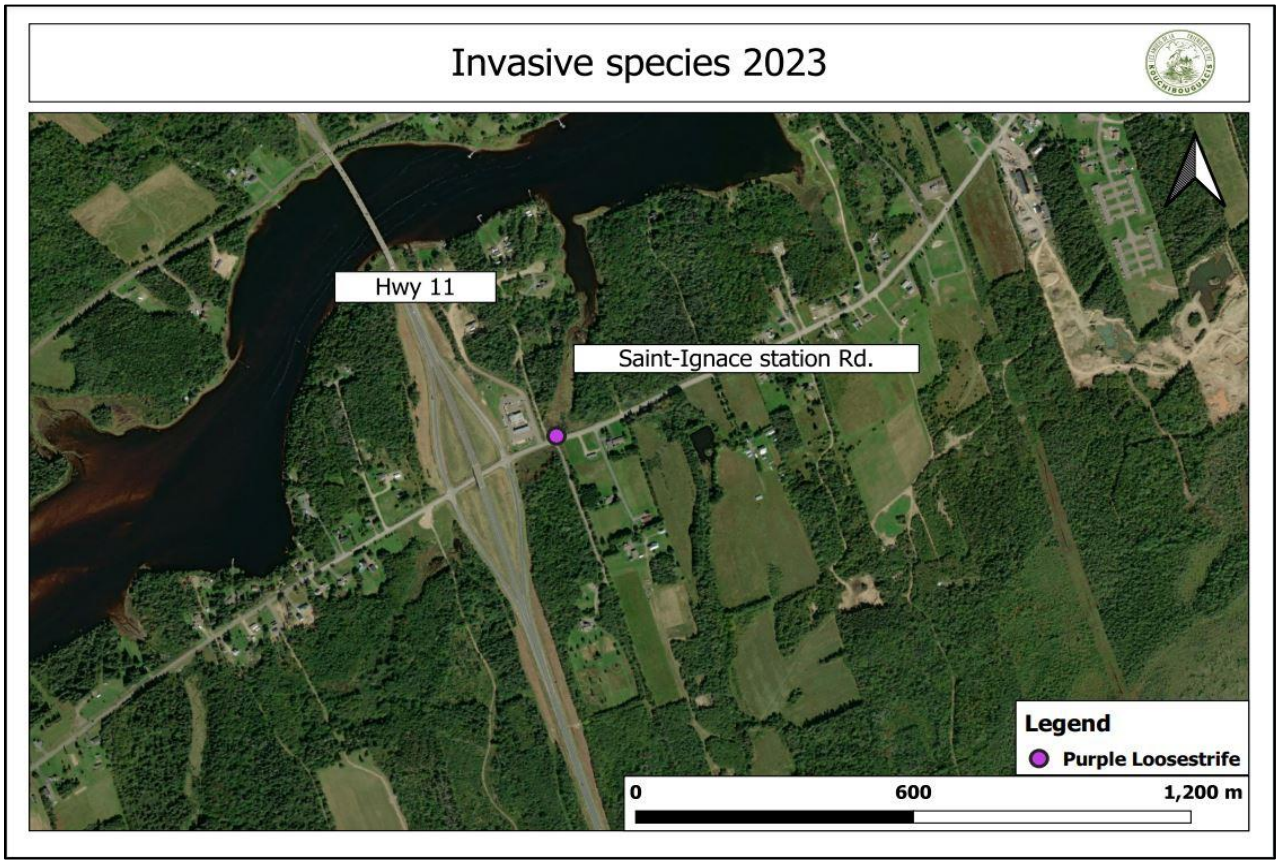
Map displaying 2023 eDNA Sites



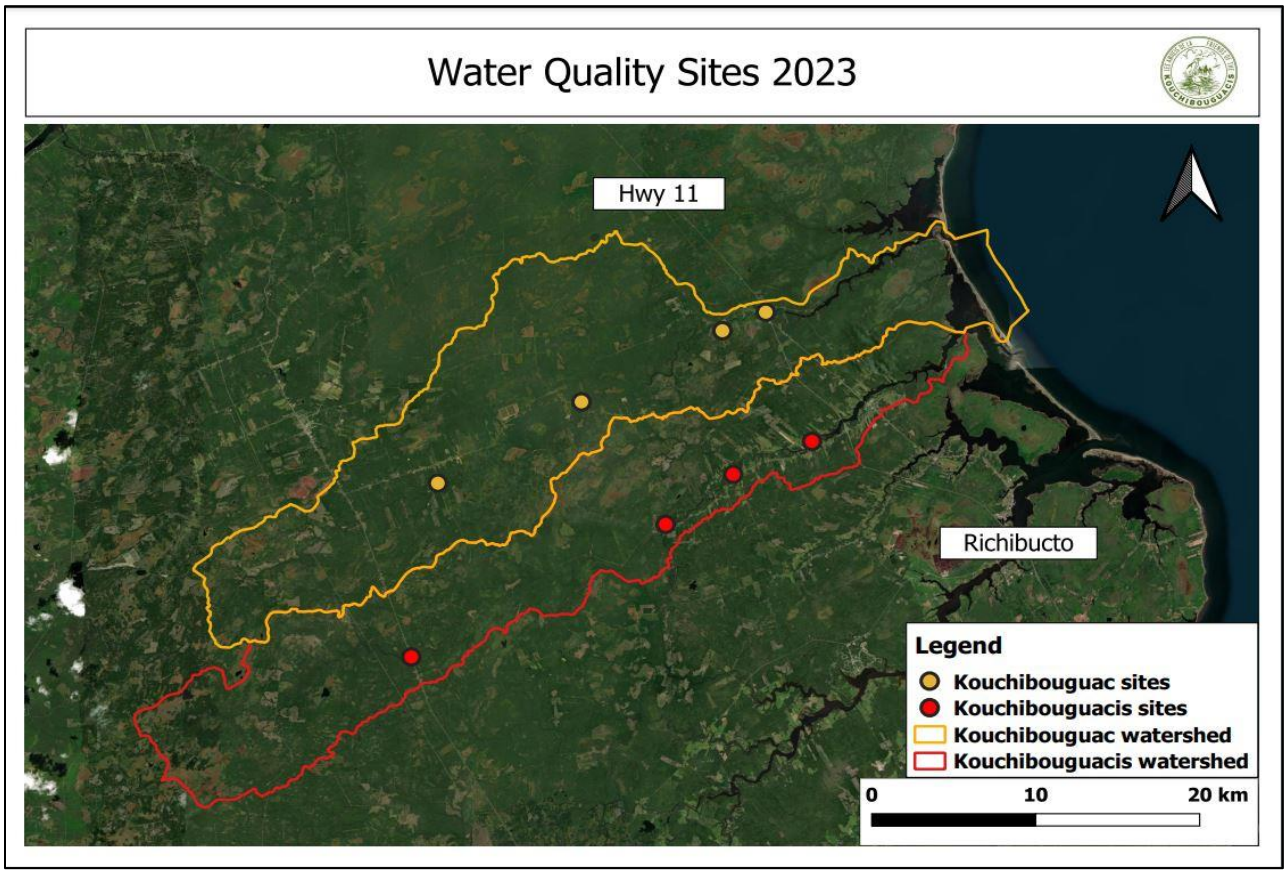
Map displaying 2023 Brook Floater DNA swab sample sites



Map displaying 2023 invasive species monitoring/mitigation sites



Map displaying 2023 water quality sites



Annex B – Bat box data logger results

Box 1 (lower back)

LogTag ID	1010193974	
Description	Batbox 1 LB	
Battery status	OK	
Time zone	UTC -04:00 DayLight	
Reading interval	4 Hours	
Number of starts	1	
Number of readings	699	
Number of started readings	699	
Non alert range	-20.0 to 70.0 °C	0.0 to 100.0 %RH
First reading	17-Jun-23 00:00:04	
Last reading	11-Oct-23 08:00:04	
Elapsed Time	116 Days 12 Hours	
Readings range	2.1 to 33.4 °C	35.4 to 94.2 %RH
Average reading	19.3 °C	72.7 %RH
Standard Deviation (S)	5.8 °C	14.5 %RH
Time below/equal lower alert	None	None
Time above/equal upper alert	None	None
Time not in alert	116 Days 12 Hours	116 Days 12 Hours
Degree Minutes below lower alert	0.0 °C-Minutes	0.0 %RH-Minutes
Degree Minutes above upper alert	0.0 °C-Minutes	0.0 %RH-Minutes
Mean Kinetic Temperature	21.0 °C	

Box 1 (lower front)

LogTag ID	1010187131	
Description	Batbox 1 LF	
Battery status	OK	
Time zone	UTC -04:00 DayLight	
Reading interval	4 Hours	
Number of starts	1	
Number of readings	699	
Number of started readings	699	
Non alert range	-20.0 to 70.0 °C	0.0 to 100.0 %RH
First reading	17-Jun-23 00:00:04	
Last reading	11-Oct-23 08:00:04	
Elapsed Time	116 Days 12 Hours	
Readings range	1.6 to 40.8 °C	25.0 to 94.4 %RH
Average reading	20.0 °C	69.2 %RH
Standard Deviation (S)	6.7 °C	14.8 %RH
Time below/equal lower alert	None	None
Time above/equal upper alert	None	None
Time not in alert	116 Days 12 Hours	116 Days 12 Hours
Degree Minutes below lower alert	0.0 °C-Minutes	0.0 %RH-Minutes
Degree Minutes above upper alert	0.0 °C-Minutes	0.0 %RH-Minutes
Mean Kinetic Temperature	22.5 °C	

Box 1 (upper back)

LogTag ID	1010187129	
Description	Batbox 1 UB	
Battery status	OK	
Time zone	UTC -04:00 DayLight	
Reading interval	4 Hours	
Number of starts	1	
Number of readings	699	
Number of started readings	699	
Non alert range	-20.0 to 70.0 °C	0.0 to 100.0 %RH
First reading	17-Jun-23 00:00:04	
Last reading	11-Oct-23 08:00:04	
Elapsed Time	116 Days 12 Hours	
Readings range	1.8 to 36.3 °C	31.9 to 94.6 %RH
Average reading	20.0 °C	72.7 %RH
Standard Deviation (S)	6.1 °C	15.6 %RH
Time below/equal lower alert	None	None
Time above/equal upper alert	None	None
Time not in alert	116 Days 12 Hours	116 Days 12 Hours
Degree Minutes below lower alert	0.0 °C-Minutes	0.0 %RH-Minutes
Degree Minutes above upper alert	0.0 °C-Minutes	0.0 %RH-Minutes
Mean Kinetic Temperature	21.9 °C	

Box 1 (upper front)

LogTag ID	1010193966	
Description	Batbox 1 UF	
Battery status	OK	
Time zone	UTC -04:00 DayLight	
Reading interval	4 Hours	
Number of starts	1	
Number of readings	699	
Number of started readings	699	
Non alert range	-20.0 to 70.0 °C	0.0 to 100.0 %RH
First reading	17-Jun-23 00:00:04	
Last reading	11-Oct-23 08:00:04	
Elapsed Time	116 Days 12 Hours	
Readings range	1.4 to 45.2 °C	24.7 to 100.0 %RH
Average reading	20.4 °C	72.3 %RH
Standard Deviation (S)	7.1 °C	17.0 %RH
Time below/equal lower alert	None	None
Time above/equal upper alert	None	8 Hours
Time not in alert	116 Days 12 Hours	116 Days 4 Hours
Degree Minutes below lower alert	0.0 °C-Minutes	0.0 %RH-Minutes
Degree Minutes above upper alert	0.0 °C-Minutes	0.0 %RH-Minutes
Mean Kinetic Temperature	23.3 °C	

Box 2 (lower front)

LogTag ID	1010187130	
Description	Batbox 2 LF	
Battery status	OK	
Time zone	UTC -04:00 DayLight	
Reading interval	4 Hours	
Number of starts	1	
Number of readings	699	
Number of started readings	699	
Non alert range	-20.0 to 70.0 °C	0.0 to 100.0 %RH
First reading	17-Jun-23 00:00:04	
Last reading	11-Oct-23 08:00:04	
Elapsed Time	116 Days 12 Hours	
Readings range	1.9 to 38.3 °C	26.8 to 99.2 %RH
Average reading	19.5 °C	75.6 %RH
Standard Deviation (S)	6.1 °C	17.0 %RH
Time below/equal lower alert	None	None
Time above/equal upper alert	None	None
Time not in alert	116 Days 12 Hours	116 Days 12 Hours
Degree Minutes below lower alert	0.0 °C-Minutes	0.0 %RH-Minutes
Degree Minutes above upper alert	0.0 °C-Minutes	0.0 %RH-Minutes
Mean Kinetic Temperature	21.5 °C	

Box 2 (upper back)

LogTag ID	1010187106	
Description	Batbox 2 UB	
Battery status	OK	
Time zone	UTC -04:00 DayLight	
Reading interval	4 Hours	
Number of starts	1	
Number of readings	654	
Number of started readings	654	
Non alert range	-20.0 to 70.0 °C	0.0 to 100.0 %RH
First reading	17-Jun-23 00:00:04	
Last reading	03-Oct-23 20:00:04	
Elapsed Time	109 Days	
Readings range	1.9 to 34.1 °C	29.5 to 98.8 %RH
Average reading	19.5 °C	76.4 %RH
Standard Deviation (S)	5.8 °C	15.3 %RH
Time below/equal lower alert	None	None
Time above/equal upper alert	None	None
Time not in alert	109 Days	109 Days
Degree Minutes below lower alert	0.0 °C-Minutes	0.0 %RH-Minutes
Degree Minutes above upper alert	0.0 °C-Minutes	0.0 %RH-Minutes
Mean Kinetic Temperature	21.2 °C	

Box 2 (upper front)

LogTag ID	1010193963	
Description	Batbox 2 UF	
Battery status	OK	
Time zone	UTC -04:00 DayLight	
Reading interval	4 Hours	
Number of starts	1	
Number of readings	699	
Number of started readings	699	
Non alert range	-20.0 to 70.0 °C	0.0 to 100.0 %RH
First reading	17-Jun-23 00:00:04	
Last reading	11-Oct-23 08:00:04	
Elapsed Time	116 Days 12 Hours	
Readings range	1.1 to 41.3 °C	35.5 to 98.7 %RH
Average reading	19.9 °C	70.7 %RH
Standard Deviation (S)	6.8 °C	13.7 %RH
Time below/equal lower alert	None	None
Time above/equal upper alert	None	None
Time not in alert	116 Days 12 Hours	116 Days 12 Hours
Degree Minutes below lower alert	0.0 °C-Minutes	0.0 %RH-Minutes
Degree Minutes above upper alert	0.0 °C-Minutes	0.0 %RH-Minutes
Mean Kinetic Temperature	22.4 °C	

Box 3 (left)

LogTag ID	1010193972	
Description	Batbox 3 left	
Battery status	OK	
Time zone	UTC -04:00 DayLight	
Reading interval	4 Hours	
Number of starts	1	
Number of readings	699	
Number of started readings	699	
Non alert range	-20.0 to 70.0 °C	0.0 to 100.0 %RH
First reading	17-Jun-23 00:00:04	
Last reading	11-Oct-23 08:00:04	
Elapsed Time	116 Days 12 Hours	
Readings range	0.4 to 44.8 °C	24.7 to 100.0 %RH
Average reading	20.3 °C	70.3 %RH
Standard Deviation (S)	7.5 °C	16.5 %RH
Time below/equal lower alert	None	None
Time above/equal upper alert	None	12 Hours
Time not in alert	116 Days 12 Hours	116 Days
Degree Minutes below lower alert	0.0 °C-Minutes	0.0 %RH-Minutes
Degree Minutes above upper alert	0.0 °C-Minutes	0.0 %RH-Minutes
Mean Kinetic Temperature	23.4 °C	

Box 3 (right)

LogTag ID	1010193973	
Description	Batbox 3 right	
Battery status	OK	
Time zone	UTC -04:00 DayLight	
Reading interval	4 Hours	
Number of starts	1	
Number of readings	699	
Number of started readings	699	
Non alert range	-20.0 to 70.0 °C	0.0 to 100.0 %RH
First reading	17-Jun-23 00:00:04	
Last reading	11-Oct-23 08:00:04	
Elapsed Time	116 Days 12 Hours	
Readings range	0.3 to 42.0 °C	26.4 to 100.0 %RH
Average reading	20.9 °C	69.2 %RH
Standard Deviation (S)	7.8 °C	18.8 %RH
Time below/equal lower alert	None	None
Time above/equal upper alert	None	3 Days 16 Hours
Time not in alert	116 Days 12 Hours	112 Days 20 Hours
Degree Minutes below lower alert	0.0 °C-Minutes	0.0 %RH-Minutes
Degree Minutes above upper alert	0.0 °C-Minutes	0.0 %RH-Minutes
Mean Kinetic Temperature	24.2 °C	