BELLEISLE WATERSHED COALITION

Restoring Access to Fish Habitat and Assessing Salmon Populations in the Belleisle Watershed

This report is submitted in fulfilment of the 2024 Foundation for Conservation of Atlantic Salmon project # NB-2024-03 entitled, "*Restoring Access to Fish Habitat and Assessing Salomon Populations in the Belleisle Watershed*"

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Belleisle Watershed Coalition
Preserving Our Good Nature

Acknowledgements

This project was made possible thanks to the generous support from the *Foundation for Conservation of Atlantic Salmon,* The New Brunswick *Wildlife Trust Fund,* The New Brunswick *Student Employment Experience Development*, and The Government of Canada's *Summer Jobs* program. We would also like to thank the Hammond River Angling Association for their assistance with electrofishing and redd surveys.

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Executive Summary

Throughout 2024, the BWC worked to continue to remove barriers and restore access through six culverts in the lower watershed that had been assessed as barriers during our 2023 fish passage assessments. This saw approximately 0.33 tons of mostly woody, rock and plastic debris cleared from the inlet or outlet of the culverts. Via debris removal, we opened a calculated total of 18 km of watercourse in the lower watershed.

Additionally, Staff from the BWC, with assistance from HRAA, conducted electrofishing surveys to collect baseline data on salmonid populations and distribution in the Watershed. Surveys were conducted in September, and 13 sites were electrofished across the Watershed. The results of the electrofishing efforts caught a total of 919 fish from 14 species. Of the fish caught, 278 were salmonids, accounting for 30% of the catch. Of the 278 salmonids caught, 58 were Atlantic salmon, 18 were brown trout, and 202 were brook trout. Atlantic salmon accounted for 21% of the salmonids caught. The 90% of salmon caught were 20 cm or less in length and were smolts or parr, with few adults caught during efforts.

We also conducted two sets of eDNA sampling in three watercourses: Belleisle Creek, Grant/Spragg Brook and Peter's Brook. results from each of the three sites sampled and analysed in summer and autumn showed diverse fish communities inhabiting the sampled watercourses. A total of 14 species were detected across the watercourse, and all three watercourses detected DNA fragments for Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*) and brook trout (*Salvelinus fontinalis*). This indicates that all three watercourses support Atlantic salmon populations.

Lastly, in November 2024, BWC and HRAA staff completed Redd surveys at six reaches on Belleisle Creek, Jolifs Brook, Henderson Brook, Grant/Spragg Brook and Ketchum Brook. The majority of the redds observed were at the Marven Covered Bridge site on Belleisle Creek, where 35 Brook trout and three salmon redds were observed. At the Grant/Spragg Brook site, two salmon redds were observed and one trout redd was observed at Henderson Brook. Only 12% were identified as salmon (*Salmo salar or Salmo trutta)* redds during field efforts.

All in all, this project has been a success, and we are excited by what we have learned over the past year and how we can use the information generated to continue our work to improve fish habitat and salmon populations in the watershed in the future.

Introduction

Overview of the Belleisle Watershed Coalition

The Belleisle Watershed Coalition (BWC) is a non-profit multi-stakeholder environmental organization that was established in 2013 to support scientific research, aquatic restoration, and environmental education within the Belleisle watershed. Our projects focus on water quality, environmental monitoring, fish and aquatic habitats, riparian assessment, enhancement, management, and community outreach. The BWC's strategic mandate is to engage the multi-sectoral communities of Belleisle in the collaborative management and restoration of our watershed.

Overview of Restoring Access to Fish Passage and Assessing Salmonid Populations in the Belleisle Watershed

Habitat alteration is a significant factor in the decline of aquatic species and is detrimental to their recovery. As anthropogenic expansion increases, instances of river crossings and alterations also increase. These changes in land use and road development are often the cause of aquatic habitat fragmentation. Frequently, the importance of maintaining the connectivity of the watercourse and its detrimental impacts on aquatic species should be considered during these projects. Culverts are the most commonly installed structure for watercourse crossings as they are pre-fabricated, cheap to build, and provide a quick installation as they are simply dropped into place and covered. If culverts are properly designed, installed properly, and/or maintained these structures can create physical barriers to fish passage.

Culverts can impede fish migration via the creation of a vertical barrier at the inflow or outflow of the culvert, the creation of turbulence in baffled culverts, increased velocity in undersized or high slope culverts, and accumulation of debris blocking fish passage in poorly maintained culverts. These barriers in a watercourse can cause fragmentation and negatively affect ecologically significant processes by altering natural channel morphology and creating physical barriers that directly affect aquatic connectivity to both upstream and downstream habitats. The interruption of unrestricted travel to aquatic species, specifically anadromous fish species, can limit their access to suitable habitat required for spawning and rearing, as well as limit their connectivity with neighbouring populations, and ultimately cause declines and inhibit recovery of at-risk fish populations.

The fragmentation of aquatic habitats is considered a significant concern and priority for the Belleisle Watershed Coalition. While some of the barriers to fish passage are known due to their visibility along major travel routes, there has been no concerted effort to date in accurately identifying, assessing, and delineating these barriers. The purpose of '*Restoring Access to Fish Habitat and Assessing Salmon Populations in the Belleisle Watershed*.' is to restore access through culverts identified and assessed as barriers to fish passage in the Belleisle watershed and assess salmon populations to establish a baseline of abundance and distribution to measure the effectiveness of restoration efforts and gauge population numbers. Specifically, the nature of this project is to remove blockages in culverts assessed as barriers and restore open access to fish habitat for salmonids in the watershed and collect baseline population information to aid future fisheries projects.

The specific objectives of this project:

- Remove blockages in culverts assessed as barriers and restore open access to fish habitat in the Belleisle watershed.
- Conduct baseline salmonid population assessments to measure the effectiveness of restoration efforts, gauge population numbers, and provide information for future fisheries projects.
- Identify and engage the stakeholder(s) interested in mitigating barriers to fish passage and assisting in the recovery of Atlantic salmon, an aquatic species at risk.
- Conduct educational outreach to raise awareness of barriers to fish passage and Atlantic salmon conservation and stewardship in the watershed.

The goals of the project are as follows:

- Restore open access to fish habitat in the Belleisle Watershed by removing blockages.
- Increase stakeholder awareness of the importance of fish passage and barrier mitigation.
- Increase stakeholder awareness of Atlantic salmon as an aquatic species at risk within the watershed.
- Provide baseline information and data on salmonid population distribution, abundance, and genetics within the Belleisle watershed.
- Increase community awareness of fish passage issues in the watershed through community outreach and youth education.

Debris Removal Methodology

Prioritizing Remediation Area

The Belleisle Watershed covers approximately 370 Km^2 (37,000 ha) and is a freshwater offshoot of the St. John (Wolastoq) River, slightly affected by tidal influences from the Bay of Fundy. Given its size, this restoration efforts were focused on the lower watershed as this area has a moderate concentration of roads and tributaries in the watershed, and the Upper Watershed was covered in 2023 (Figure 1). The area was further divided into sub-assessment areas based on tributaries that were prioritised based on water quality and the presence of fish populations, most notably salmonids. Specifically, in 2024, the fish passage restoration was conducted on Second Run Brook, Roger's (Sophie) Brook, Durian Brook, and various unnamed watercourses on Route 124 and Route 850; tributaries that flow into the lower portion of Belleisle Bay (Appendix 1).

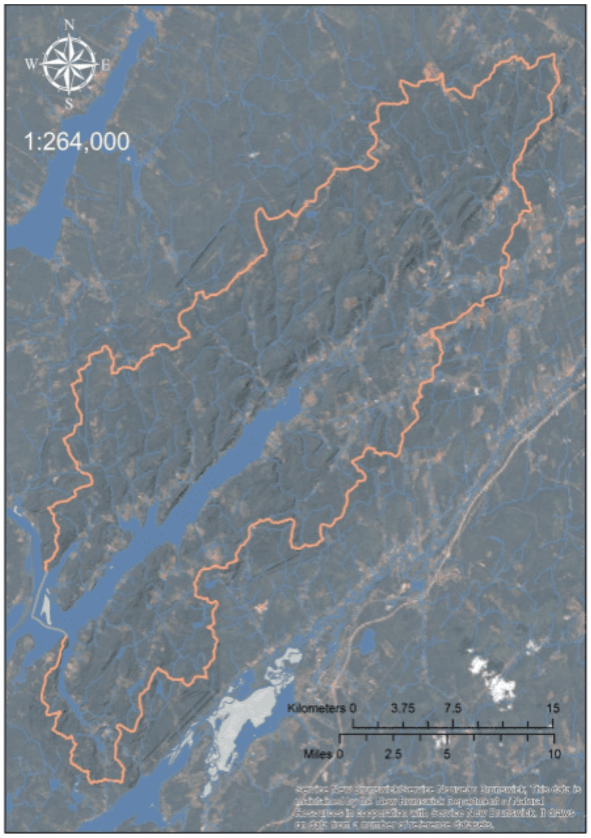

Figure 1: Map of the Belleisle Watershed.

Prioritising Culverts for Debris Removal

First, the Belleisle Watersheds Fish Passage Barriers Database was consulted to generate a prioritized list and map of culverts in the lower watershed requiring debris removal (Figure 2). These culverts were prioritized based on the culvert assessment data collected, upstream habitat gain, water quality and physical parameters of the stream, and the presence of salmonid populations.

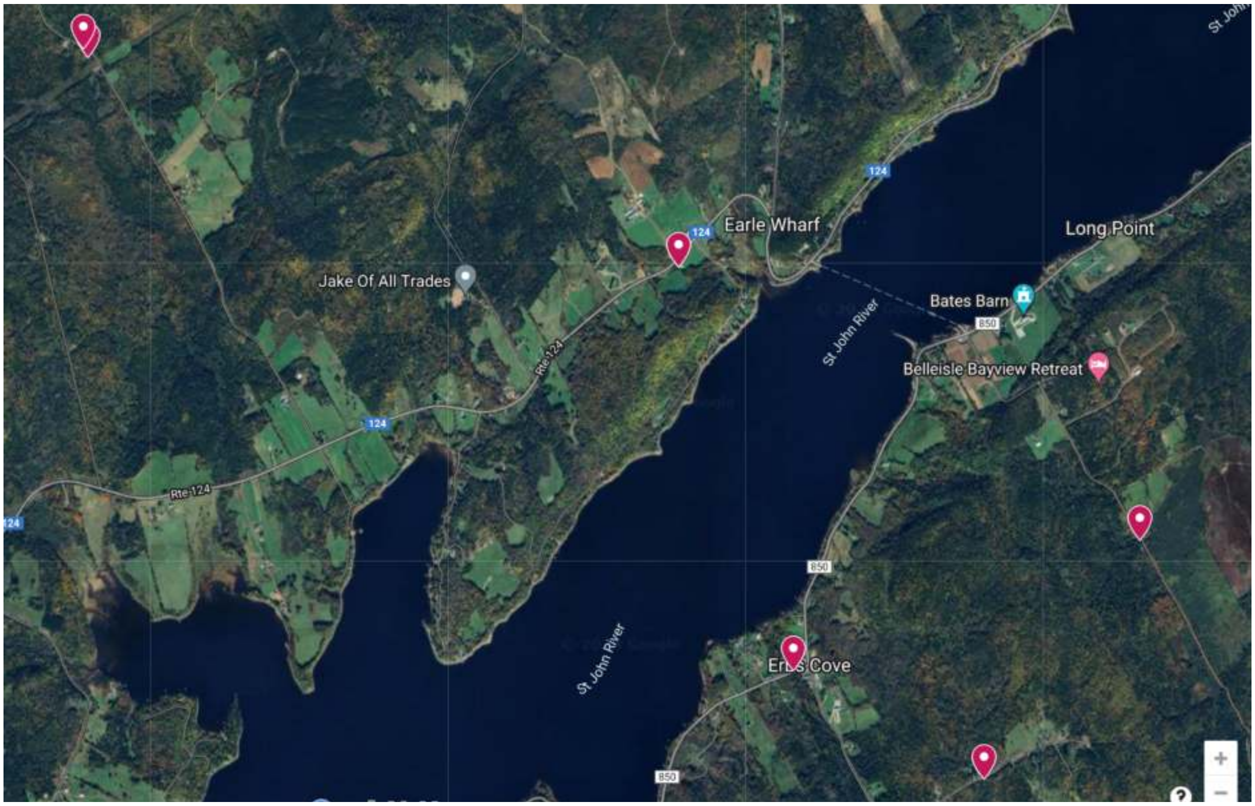

Figure 2: Map of debris blockages removed in 2024 in the lower Belleisle Watershed.

Planning and Implementation of Culvert Debris Removal

Once the prioritized list was generated a site visit to each of the six culverts was conducted to provide current information and photos of the barrier and assess how best to proceed with removal to mitigate impacts on the watercourse. Information from the site visit was used to generate a debris removal plan that followed an established method for efficient debris removal with minimal impact on aquatic and riparian habitats. Additionally, a Watercourse and Wetland Alteration Permit was obtained from the NB Department of Environment and Local Government, as well as permission from the NB Department of Transportation and Infrastructure to proceed with debris removal.

Once the debris removal plan was complete and permits and permissions were obtained, debris removal at the six culverts started (Appendix 1). Debris Removal followed our developed methodology. Staff collected by hand any human-generated debris and transported it to a landfill to be properly disposed of. The natural debris removal process proceeded from the upstream side of the culvert (Figure 3). Removal of large branches was completed before removing entire logs. Large log debris was cut into smaller pieces to ensure safety and ease of transport. All woody debris blocking each culvert was removed from both the inlet and outlet as needed to mitigate the barrier and restore fish passage. The removed organic debris was transported to a waste management facility to be composted. At each debris removal site, data was collected on the type and quantity of debris comprising the blockage and added to the fish passage database for future reference. Once the fish passage is restored, the BWC will conduct an annual site visit to monitor the amount and frequency of debris accumulation at each culvert. If at any site, debris accumulation continues as a reoccurring issue, the BWC will investigate options to mitigate debris accumulation at each culvert as needed.

Figure 3: Before and After debris removal from the fish ladder on Durian Brook.

Salmonid Population Assessment Methods

Salmonids are essential to the health of aquatic ecosystems and, as such, are a key indicator of aquatic ecosystem health. Therefore, by assessing salmonid populations, we can gain insight into the health of a watercourse, collect population data to help measure the effectiveness of our restoration efforts, track population changes over time and inform our future projects. Therefore, protecting salmonid populations is essential for preserving biodiversity, cultural heritage, and economic sustainability in regions that rely on these species. To aid in this, the BWC employed three main methodologies to assess the population in the watershed. These methods include electrofishing, eDNA sampling for genetic analysis and redd surveys described below.

Electrofishing Methods

To determine salmonid distribution and abundance, the Belleisle Watershed employed non-lethal methods of capturing fish via electrofishing surveys (Figure 4). Specifically, each watercourse surveyed reaching approximately 150 m in length above and below barriers was chosen to undertake the electrofishing survey. These sites were selected based on areas with acceptable salmonid habitats and based on our fish passage assessment of the barriers that are present within each of these watercourses. In 2024, a total of 13 sites were assessed via electrofishing (Appendix 1). Various sites across the watershed were selected, including Pascobac Brook, Belleisle Creek, Midland Brook, Stewarton Brook, Grant Brook, Sprag Brook, Reddin Brook, Durian Brook, Second Run Brook, and Peters Brook. All these watercourses were previously established to have salmonids present in 2017. All data collected was added to the project database.

Figure 4: BWC and HRAA Staff conducting electrofishing surveys.

eDNA Sampling and Analysis Methods

During the 2024 field season, eDNA sampling was conducted at three sites in the watershed, Belleisle Creek, Peters Brook, and Grant/Spragg Brook, in August and October (Appendix 1). At each of these sites, water was collected and filtered for eDNA with sampling kits from Jonah Ventures. These single-use kits use a 50ml syringe and filter to collect DNA fragments from surface waters. Water is passed through the filter until it slows to one drop per second. Once filtration is complete, a preservative is injected into the sample, and it is refrigerated for transport to the lab. Field data is also collected at each site to record in-situ parameters and added to the project database.

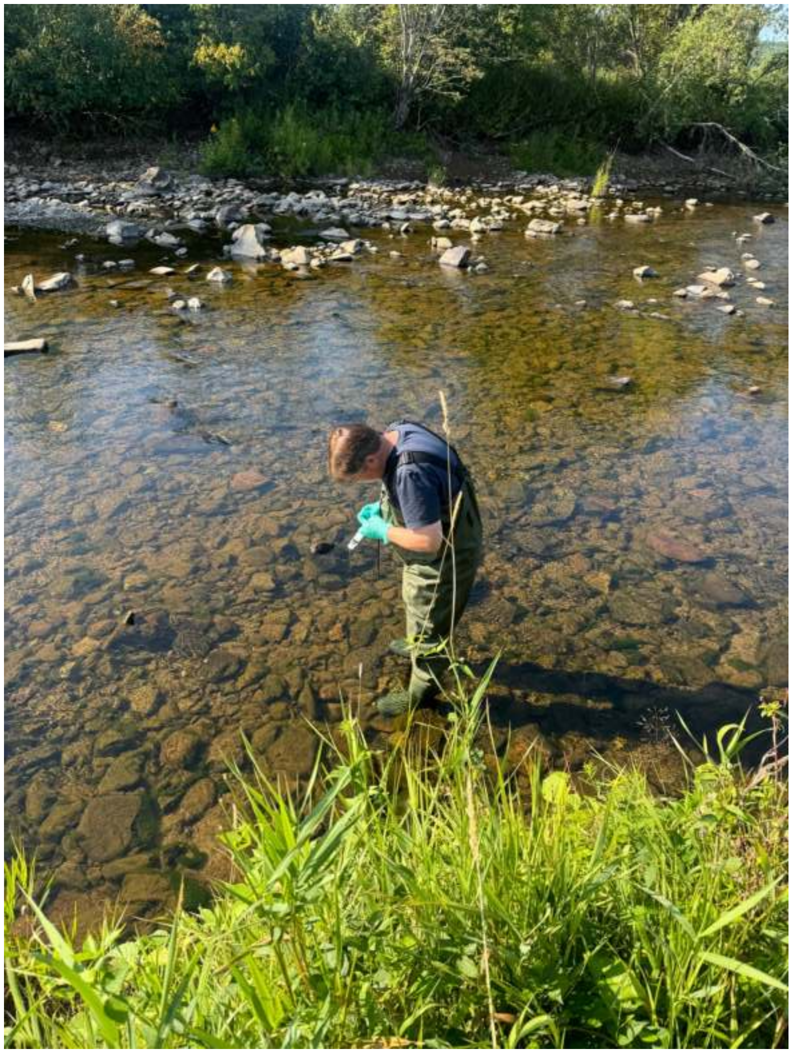

Figure 5: BWC's Executive Director conducting eDNA Sampling at Belleisle Creek.

Samples were analysed at the Jonah Ventures lab following the methods described. Sample barcodes were recorded and assigned a corresponding lysate tube. Sample filters, lysis buffer,and proteinase K were heated to 56 C for one hour. Under a laminar flow hood, warm lysis buffers were pushed through the filter housing, and all supernatant was collected in the corresponding lysate tube. Tubes were placed in an incubator overnight at 56 C. After incubation the lysate tubes were immediately processed.

Genomic DNA from samples was extracted using the Omega Biotek Mag-Bind Blood & Tissue DNA HDQ 96 Kit (4x96 Preps) (Cat. No. / ID: M6399-01) according to the manufacturer's protocol. Whole (25mm or 47mm) filters were used for genomic DNA extraction. The extraction protocol was automated and completed using a Hamilton Microlab Starlet. Genomic DNA was eluted into 100 µl and frozen at -20 C.

Portions of hyper-variable regions of the mitochondrial 12S ribosomal RNA (rRNA) gene were PCR amplified from each genomic DNA sample using the MiFishUF and MiFishUR primers with spacer regions. Both forward and reverse primers also contained a 5' adaptor sequence to allow for subsequent indexing and Illumina sequencing. PCR amplification was performed in replicates of six and all six replicates were not pooled and kept separate. Each 25 µL PCR reaction was mixed according to the Promega PCR Master Mix specifications (Promega catalogue # M5133, Madison, WI) which included 12.5ul Master Mix, 0.5 µM of each primer, 1.0 µl of gDNA, and 10.5 µl DNase/RNase-free H2O. DNA was PCR amplified using the following conditions: initial denaturation at 95C for 3 minutes, followed by 45 cycles of 20 seconds at 98C, 30 seconds at 60C, and 30 seconds at 72C, and a final elongation at 72C for 10 minutes. Added 11/2019.

To determine amplicon size and PCR efficiency, each reaction was visually inspected using a 2% agarose gel with 5µl of each sample as input. Amplicons were then cleaned by incubating amplicons with Exo1/SAP for 30 minutes at 37C followed by inactivation at 95C for 5 minutes and stored at -20C. A second round of PCR was performed to complete the sequencing library construct, appending the final Illumina sequencing adapters and integrating sample-specific, dual index sequences (2 x 10bp). The indexing PCR included Promega Master mix, 0.5 µM of each primer and 2 µl of template DNA (cleaned amplicon from the first PCR reaction) and consisted of an initial denaturation of 95 °C for 3 minutes followed by 8 cycles of 95 °C for 30 sec, 55 °C for 30 seconds and 72 °C for 30 seconds.

Final indexed amplicons from each sample were cleaned and normalized using mag-bind normalization. A 15µl aliquot of PCR amplicon was purified and normalized using Cytiva SpeedBead magnetic carboxylate-modified particles (#45152105050250). Samples were then pooled together by adding 5µl of each normalized sample to the pool. Sample library pools were sent for sequencing on an Illumina MiSeq (San Diego, CA) at the Texas A&M Agrilife Genomics and Bioinformatics Sequencing Core facility using the v2 500-cycle kit (cat# MS-102-2003). Necessary quality control measures were performed at the sequencing center prior to sequencing.

Lastly, Raw sequence data were demultiplexed using pheniqs v2.1.0 [1], enforcing strict matching of sample barcode indices (i.e, no errors). Cutadapt v3.4 [2] was then used remove gene primers from the forward and reverse reads, discarding any read pairs where one or both primers (including a 6 bp, fully degenerate prefix) were not found at the expected location (5') with an error rate < 0.15. Read pairs were then merged using vsearch v2.15.2 [3], discarding resulting sequences with a length of < 130 bp, > 210 bp, or with a maximum expected error rate [4] > 0.5 bp. For each sample, reads were then clustered using the unoise3 denoising algorithm [5] as implemented in v-search, using an alpha value of 5 and discarding unique raw sequences observed less than 8 times. Counts of the resulting exact sequence variants (ESVs) were then compiled and putative chimeras were removed using the uchime3 algorithm, as implemented in v-search. For each final ESV, a consensus taxonomy was assigned using a custom best-hits algorithm and a reference database consisting of publicly available sequences (GenBank [6]) as well as Jonah Ventures voucher sequences records. Reference database searching used an exhaustive semi-global pairwise alignment with v-search, and match quality was quantified using a custom, query-centric approach, where the % match ignores terminal gaps in the target sequence, but not the query sequence. The consensus taxonomy was then generated using either all 100% matching reference sequences or all reference sequences within 1% of the top match, accepting the reference taxonomy for any taxonomic level with > 90% agreement across the top hits.

Redd Count Survey Methods

Redd's are gravel nests built by salmon in streams, brooks, and rivers. A redd count is the survey of salmon nests, or redds, to estimate the size of the salmonid population. Based on electrofishing, eDNA and habitat assessment data, the autumn redd survey sites were selected. Redd surveys were conducted in October/November following the procedure established by our watershed partner, HRAA (Figure 6). The surveys consisted of observational or aerial drone surveys of watercourses that provide appropriate temperature, water quality, and substrate conditions for spawning salmonids. Identified Redds were recorded, and the coordinates were marked. Data on redds and their locations were mapped and added to our fish population database.

Figure 6: HRAA Staff assisting in conducting Redd Surveys at Belleisle Creek.

At each site, the following data was recorded on the datasheet: names of participants, Date of the survey, GPS coordinates of start location, stream flow condition, visibility condition, and time of day at the beginning of the survey (Appendix 1). Once the data was recorded, surveyors proceeded to walk upstream from the starting point, scanning the substrate for evidence of redds (Figure 7). When the stream substrate was visible from the bank, surveyors walked along the banks so as not to disturb fish and/or spawning sites. When possible, a surveyor walked on each bank, as redds may be more visible from a different angle. In locations where the substrate was not visible from the bank, surveyors cautiously walked in the stream channel while looking for redds. When a redd was observed, the team verified the redd and the following data was recorded: redd ID number, GPS coordinates of the redd location, macrohabitat type of redd, species observed on the redd (if any) and any observational notes. This process was repeated for each redd that was encountered for the length of the survey. Once the surveyors reached the end of their designated reach, the time of day was recorded on the data sheet along with the GPS coordinates of the ending point. Following the end of the survey, surveyors returned to the office to enter the data into the project database.

Figure 7: Redds observed at Grant Brook and Belleisle Creek.

Communication and Outreach Methods

As with all the BWC's projects, this project and its partners were promoted online through our social media accounts and our website. Additionally, this project was promoted through our outreach to landowners to gain permission to assess watercourse crossing on private land and to increase awareness of the importance of fish passage as an integral part of healthy aquatic ecosystems. Through incorporation into the numerous presentations made to schools, business development entities, and corporate interests, the BWC worked to engage the public (Figure 8). Lessons and activities on fish habitat, passage issues, and aquatic species at risk focused on Atlantic salmon were taught to youth through our watershed summer camp and afterschool program in partnership with the Boys and

Girls Club.

Figure 8: Belleisle Watershed Staff providing project information to the public at a Local Community Event.

Results

Debris Removal at Fish Passage Barriers

As part of this project, the BWC worked to continue to remove barriers and restore access through six culverts in the lower watershed that had been assessed as barriers during our 2023 fish passage assessments (Figure 9).

Figure 9: Before and After photos of debris removal at culvert barrier UNK124002.

Results of this part of the project saw approximately 0.33 tons of mostly woody and rock debris cleared from the inlet or outlet for culverts (Table 1, Figure 10, Appendix 2). Staff also removed any anthropogenic rubbish from the barriers inlet and outlet and surrounding watercourse area. The majority of this debris was plastic and comprised of bags, food warpers/containers and bottles. They also removed several cans and glass bottles (Table 1, Figure 10). The largest amount of debris was observed at Rogers Brook, where .0975 tons of sediment, wood and anthropogenic debris was removed from the culvert. A close second was the Durian Brook fish ladder, where .0900 tons of rock blocking the fish ladder was also removed. These results are similar to the results for our 2023 debris removal in the upper watershed.

Table 1: Total amount of debris removed, and upstream habitat gained from remediated barriers.

Crossing ID	Watercourse Name	Debris Blockage Present	Description of Debris	Debris Removed (Tons)	Upstream Habitat Gain (km)
DBK001	Durian Brook	Yes	Rock Blocking Fish Ladder	0.0900	12.98
DBK003	Durian Brook	Yes	Trees, Branches, plastic, cans	0.0150	0.21
ROB003	Rogers Brook	Yes	Mud, Branches, plastic and metal	0.0975	2.24
SRB002	Second Run Brook	Yes	Trees, Branches	0.0350	0.26
SRB003	Second Run Brook	Yes	Rocks, Sand	0.0200	2.216
UNK124002	Unnamed Brook	Yes	Branches, Mud Leaves, plastic, cans	0.0700	0.23
				0.3265	18.14

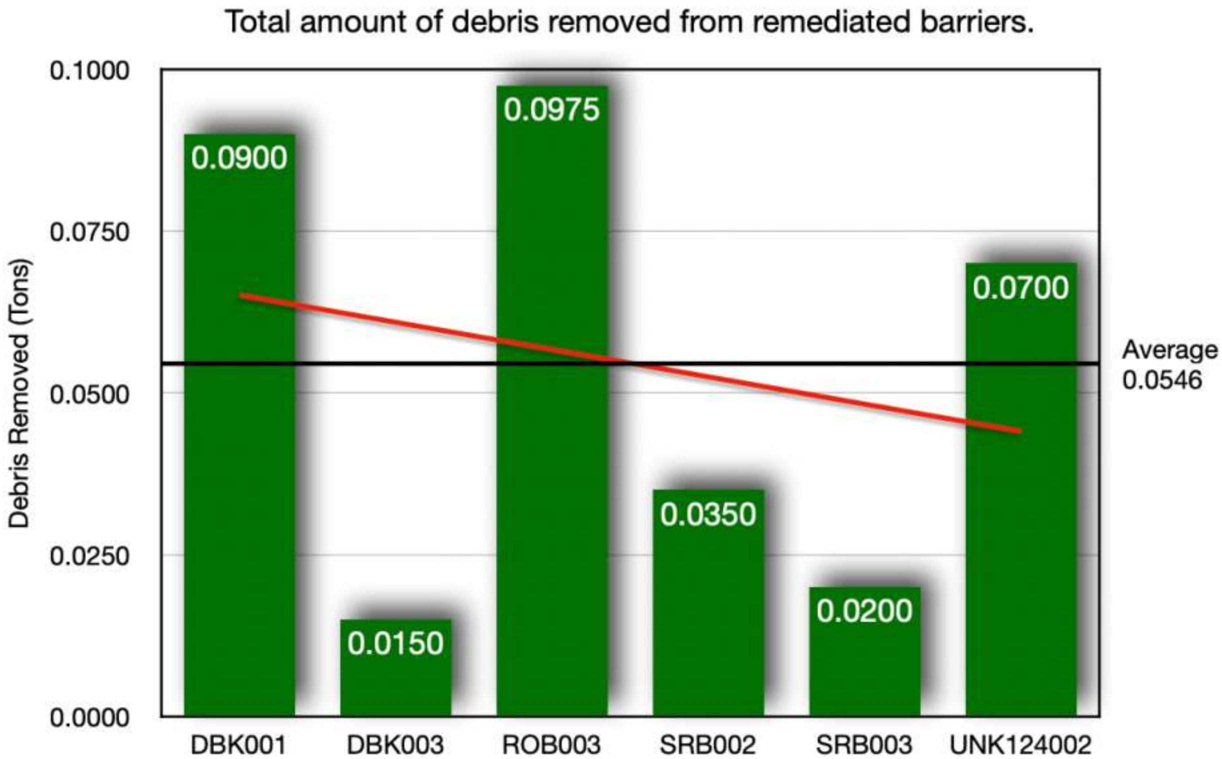

Figure 10: Column chart detailing the total amount of debris removed from remediated barriers.

The results for the upstream habitat gain from remediate barriers were also positive and provided connectivity to large sections of the watercourses focused on. During the 2024 field season, staff in total, removed the debris from barrier culverts and structures and opened a calculated total of 18 km of watercourse (Table 1 above, Figure 11, Appendix 2). The largest upstream habitat gain was observed at Durian Brook, where 12.98 Km of the watercourse was opened up after remediation of the fish ladder and culvert barriers (Table 1 above, Figure 11). Assessments of these sections of the watercourse identified them with valuable salmonid habitat on all four watercourses where fish passage was restricted in the lower watershed (Table 1 above, Figure 11).

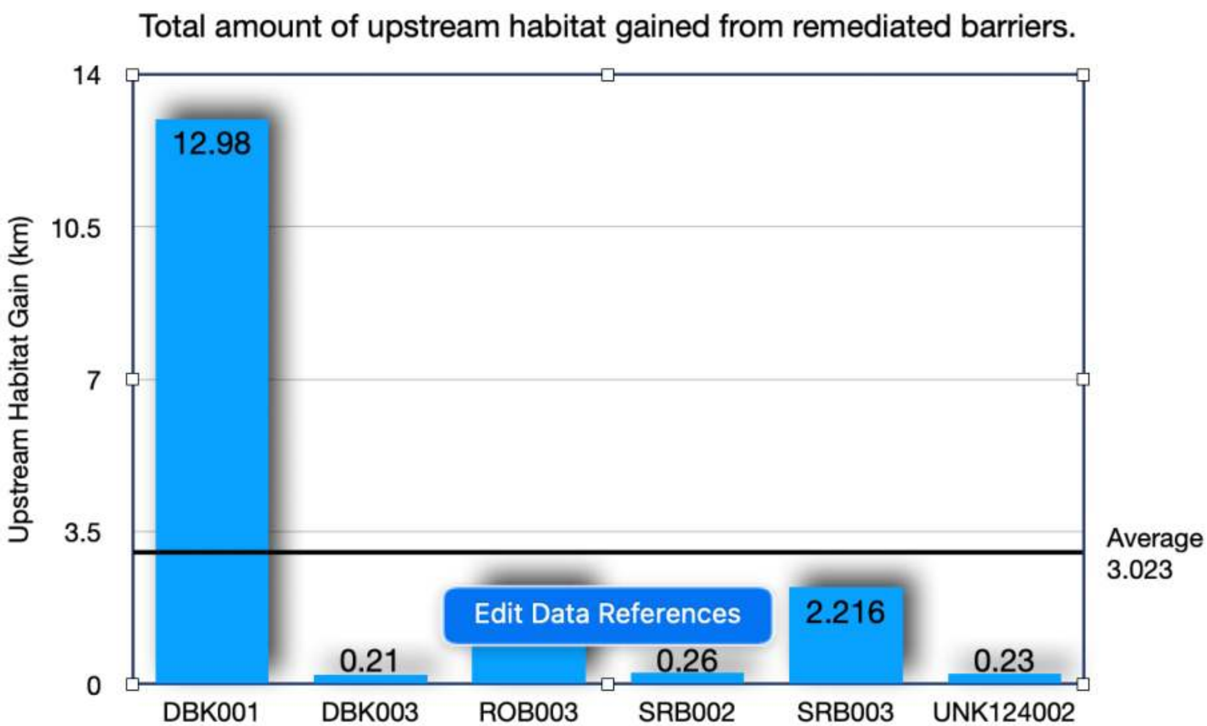

Figure 11: Colum chart detailing the amount of upstream habitat gain from remediated debris barriers.

Assessment of Upstream Habitat Gain Results

A total upstream habitat gains of 18.14 km became accessible to fish due to the six culverts with remediated barriers (Table 2, Figure 11, Appendix 2). Durian Brook had the most significant habitat gain, totaling 12.35 km. Second Run, Brook has the least significant gain, calculated at only 0.14 km of accessible habitat increase (Table 2, Figure 11). By remediating barriers, Rogers Brook, an additional 2.24 km of habitat was created. lastly, the Unnamed Brook on Route 124 opened an additional 0.23 km of habitat.

Table 2: Total amount of upstream habitat gain (percent) from remediated barriers.

Stream Name	Total Upstream Habitat Gain (km)	%
Rogers Brook	2.24	12.35
Durian Brook	13.19	72.71
Second Run Brook	2.476	0.14
Unnamed Brook	0.23	13.65
Total	18.14	100.00

Results of Electrofishing Surveys

During the field season of 2024, Staff from the BWC, with assistance from HRAA, conducted electrofishing surveys to collect baseline data on salmonid populations and distribution in the Watershed. Surveys were conducted in September, and 13 sites were electrofished across the Watershed (Figure 12, Appendix 1).

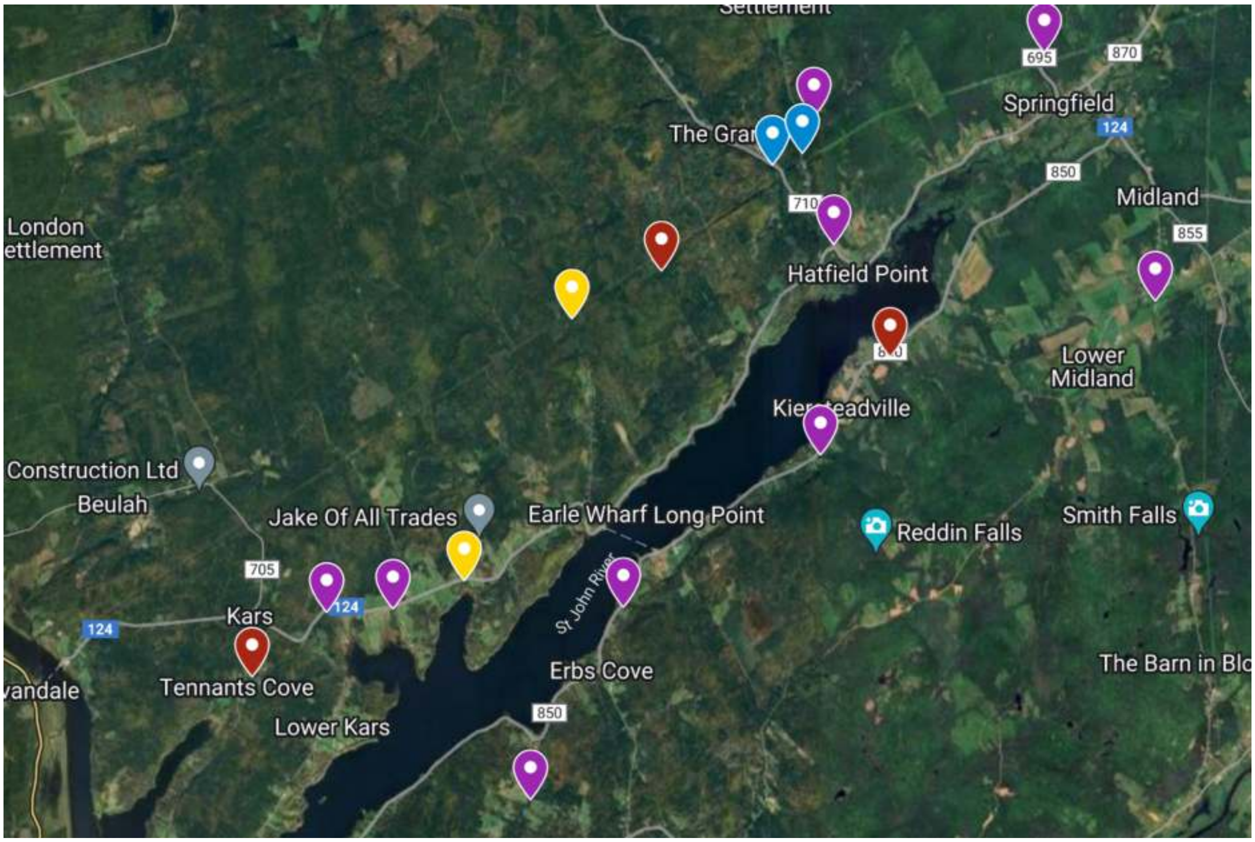

Figure 12: Watercourse sites electrofished in September 2024.

The results of the electrofishing efforts caught a total of 919 fish across the 13 sites (Figure 13, Appendix 3). Throughout the 13 sites, 13 different species of fish were observed (Figure 13). Black Nosed Dace was the most common, with 411 specimens observed (Figure 13). Brook trout were the second most common, with 202 specimens observed (Figure 13). Other species caught during electrofishing surveys included 87 American eels, 62 slimy sculpins, and 58 white sucker specimens were observed (Figure 13). Creek Chub was observed 15 times. Smallmouth bass, gaspereau, fall fish and sea lampreys were observed 1, 1, 4 and 2 times during this survey (Figure 13).

Of the 919 fish caught, 278 were salmonids, accounting for 30% of the fish caught (Figures 13 and 14). Of the 278 salmonids caught, 58 were Atlantic salmon, 18 were brown trout, and 202 were brook trout (Figure 13).

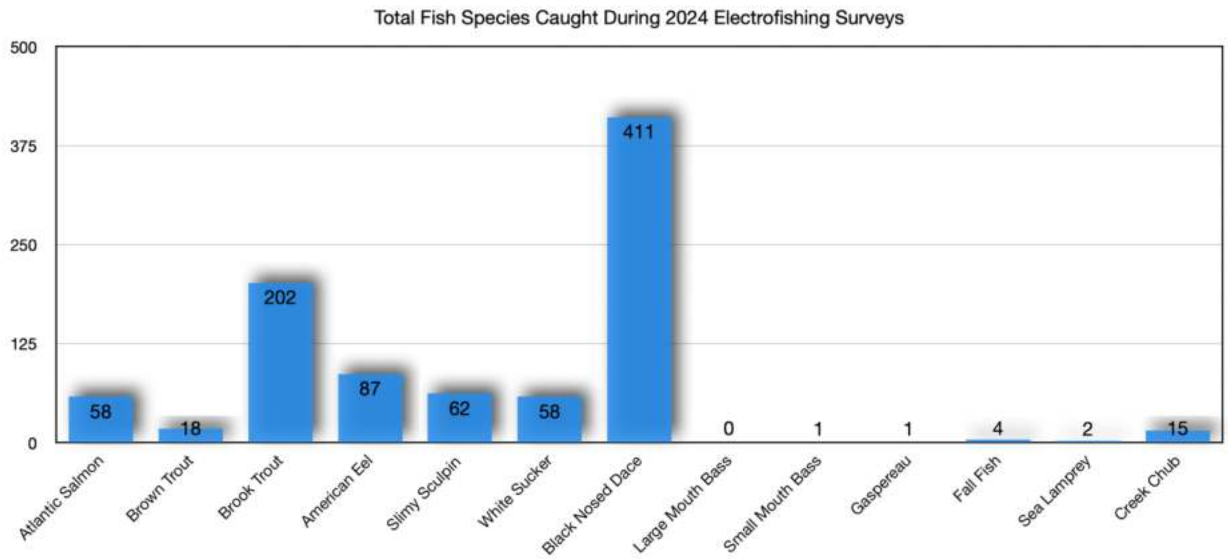

Figure 13: Total fish species caught during electrofishing surveys in Sept 2024.

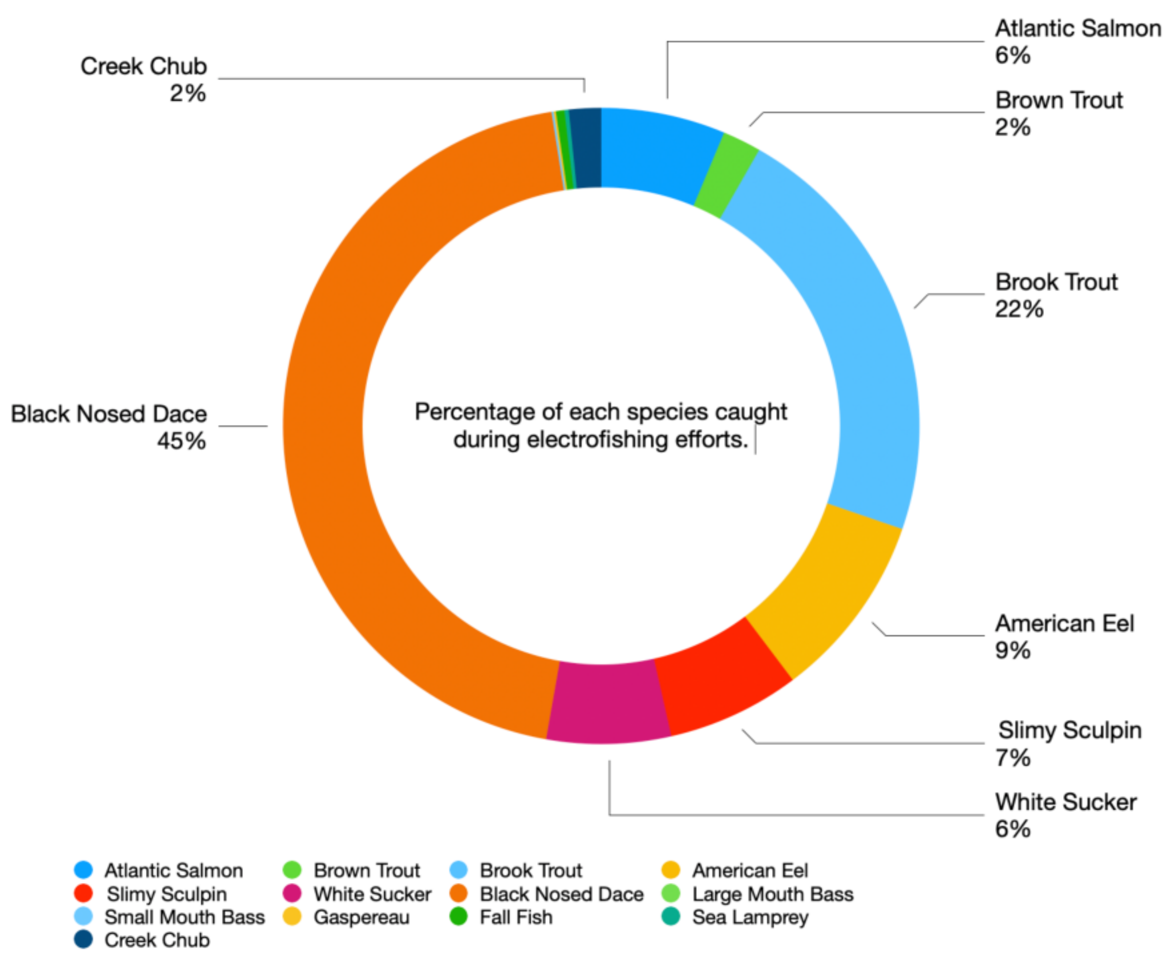

Figure 14: Percentage of fish species caught during electrofishing surveys in Sept 2024.

Atlantic salmon accounted for 21% of the salmonids caught (Figure 15). Most of the Atlantic was caught in Grant/Spragg Brook and its tributary Taylors Brook, with 16 and 27 caught at these sites, respectively, for a total of 43 in these watercourses (Figure 16). At Reddin Brook on the south side of the bay, we caught 13 salmon, including a 40 cm adult, the largest fish caught during the surveys (Figure 16). We caught one salmon at each of the Durian and Peter's Brook sites (Figure 16). Interestingly, no salmon were caught at Belleisle Creek sites despite the eDNA analysis and redd surveys that both indicate the presence of salmon in this watercourse. The 90% of salmon caught were 20 cm or less in length and were smolts or parr, with few adults caught during efforts.

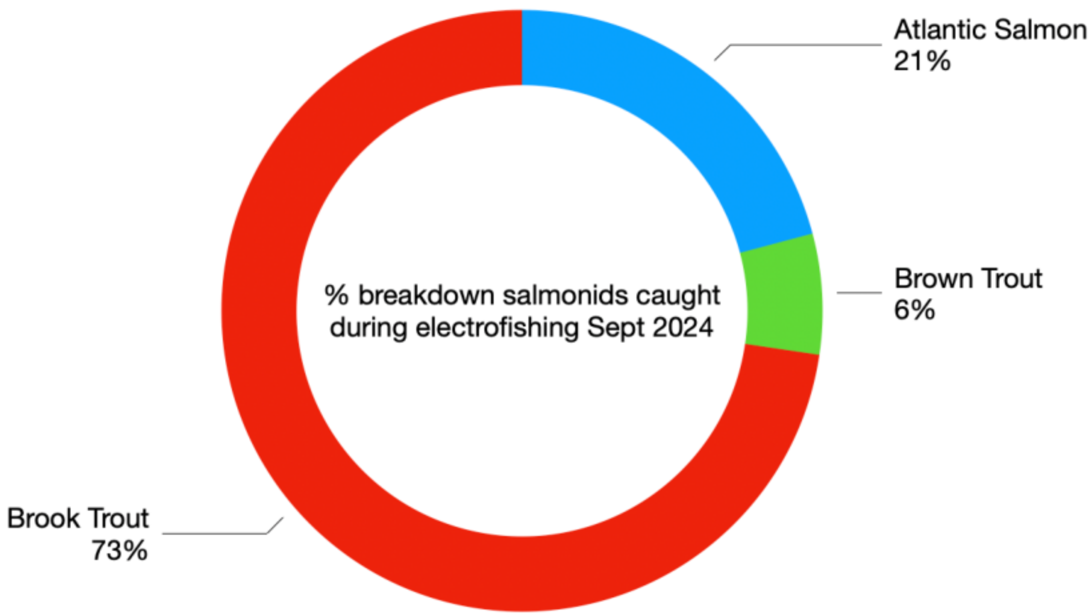

Figure 15: Percentage of salmonids caught during electrofishing surveys in Sept 2024.

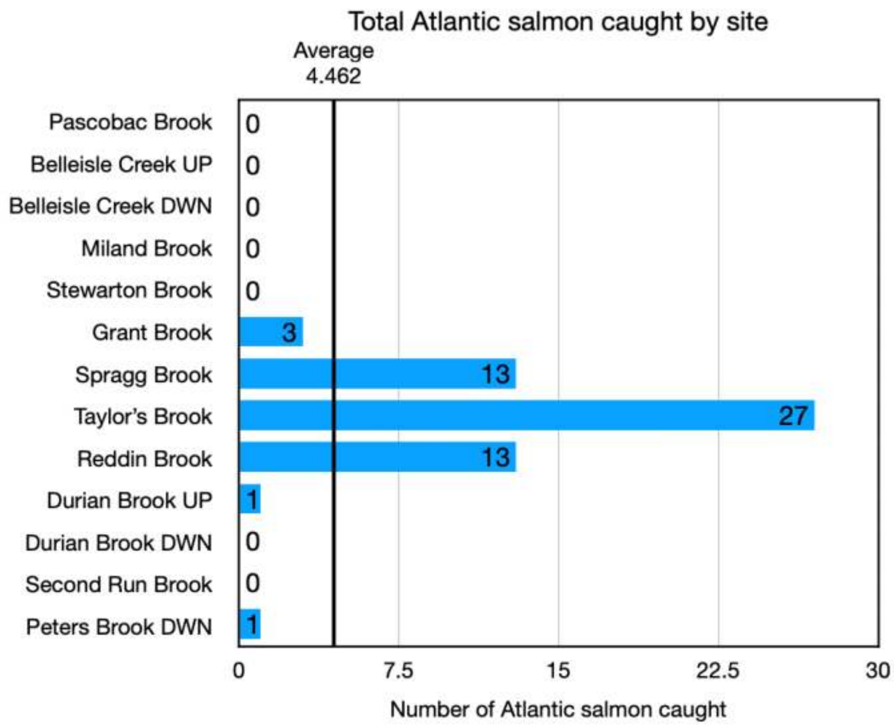

Figure 16: Total Atlantic salmon caught by site during electrofishing surveys in Sept 2024.

Results of eDNA and Tissue Sampling

During the field season, the BWC conducted two sets of eDNA sampling in three watercourses: Belleisle Creek, Grant/Spragg Brook and Peter's Brook (Figure 17, Appendix 1). These sites were selected as they have high-quality habitat and salmonids (Brook Trout) have previously been observed at each. This sampling was conducted to assist in determining the presence/absence of salmonids in target watercourses with identified barriers and high-quality salmonid habitat. The eDNA sampling also helped to supplement the data gathered during electrofishing surveys to provide a more accurate indication of the presence/absence of salmonids in the watershed not captured by electrofishing alone and in particular, Atlantic salmon.

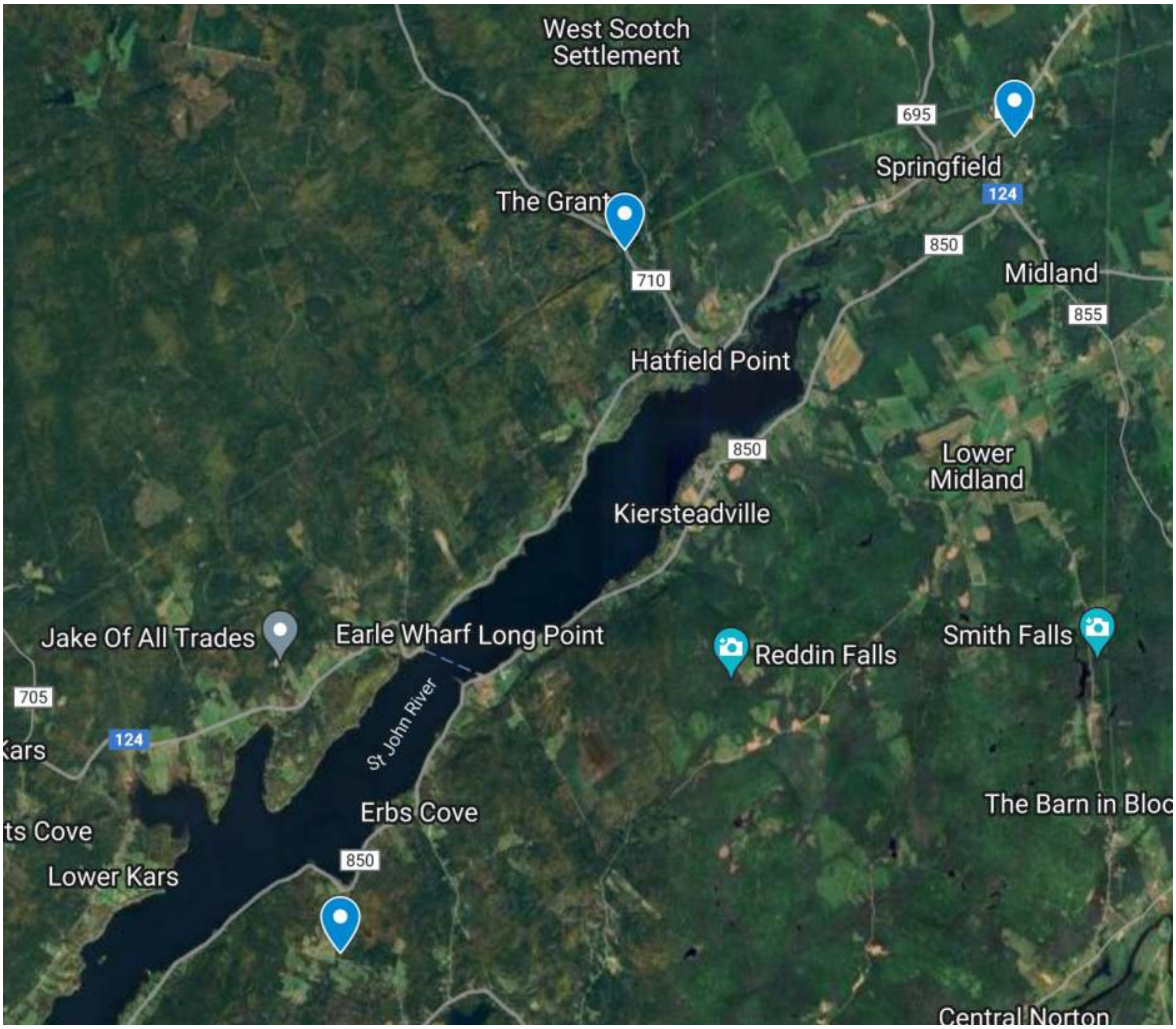

Figure 17: Watercourse sites sampled for eDNA analysis in summer and autumn 2024.

The results from each of the three sites sampled and analysed in summer and autumn showed diverse fish communities inhabiting the sampled watercourses (Figure 18, Appendix 4). A total of 14 species were detected across the watercourse, with all 14 detected in Belleisle Creek, six species detected in Grant/Spragg Brook and eight species in Peter's Brook (Figure 18). All three watercourses detected DNA fragments for Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*) and brook trout (*Salvelinus fontinalis*) with a 100%, 98.8% and 100% sequencing match, respectively (Figures 18 & 19). This indicates that all three watercourses support Atlantic salmon populations. To add to the genetic analysis of salmonids, staff collected fin clips from salmon (*Salmo salar & Salmo trutta)* during electrofishing surveys. These samples were sent to the lab for analysis. At the time of this report submission, the results from the tissue sampling have not yet been completed by the lab.

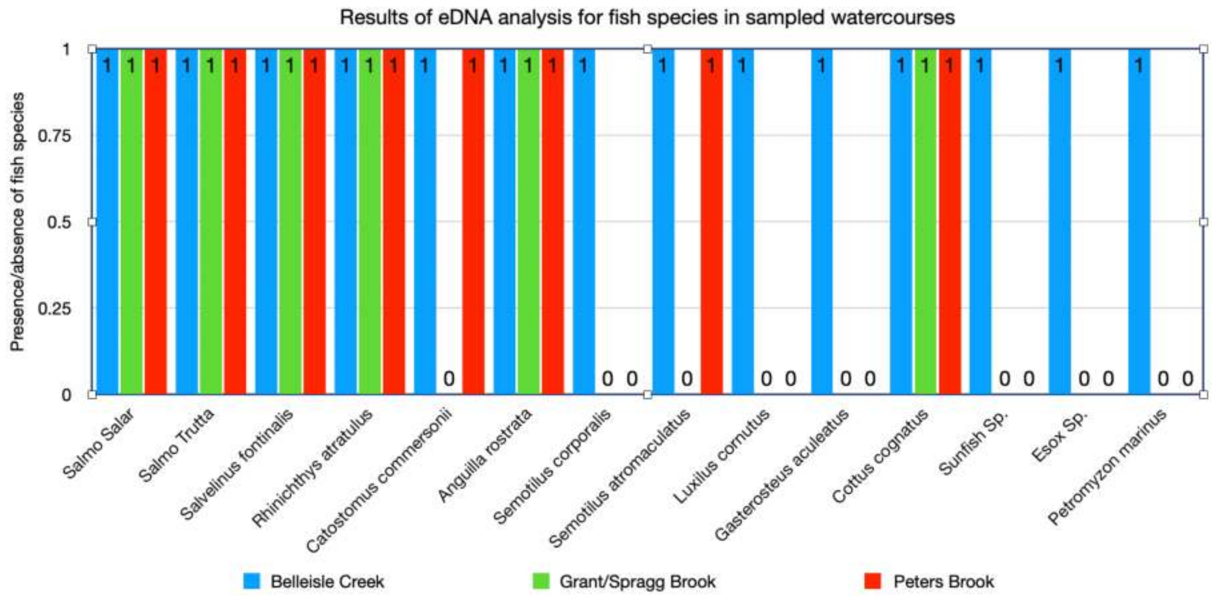

Figure 18: Watercourse sites sampled for eDNA analysis in summer and autumn 2024.

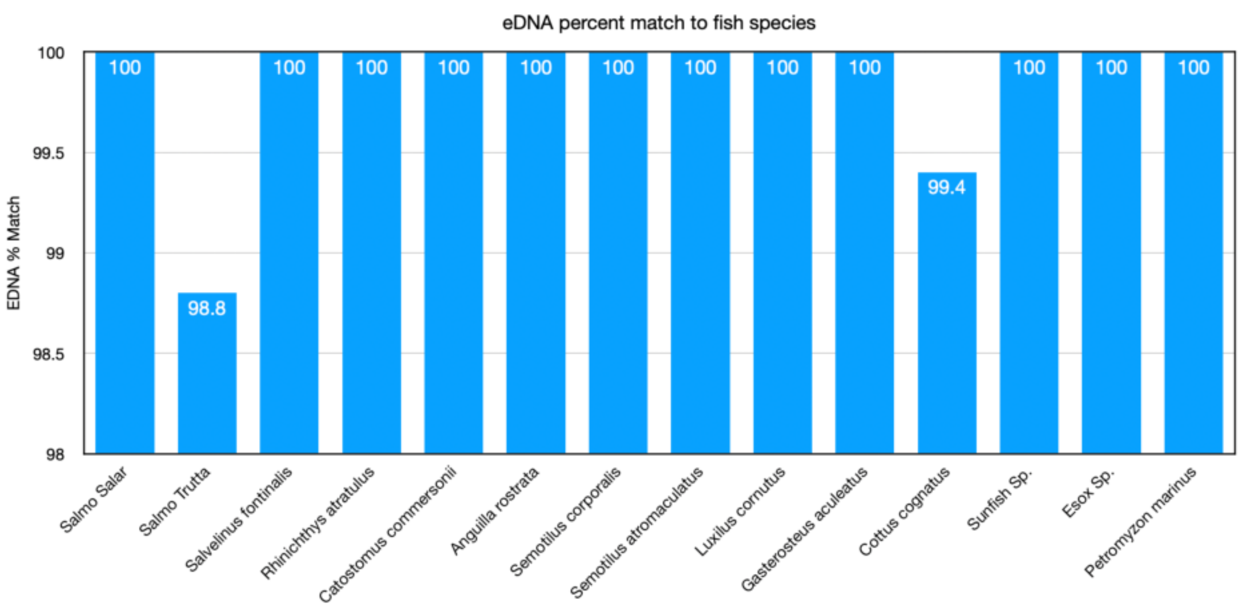

Figure 19: Watercourse sites sampled for eDNA analysis in summer and autumn 2024.

Results from Autumn Redd Surveys

In November 2024, BWC and HRAA staff completed Redd surveys at six reaches on Belleisle Creek, Jolifs Brook, Henderson Brook, Grant/Spragg Brook and Ketchum Brook (Figure 20, Appendix 1). This was conducted to detect evidence for spawning at electrofishing and eDNA sampling sites and those with identified spawning habitats.

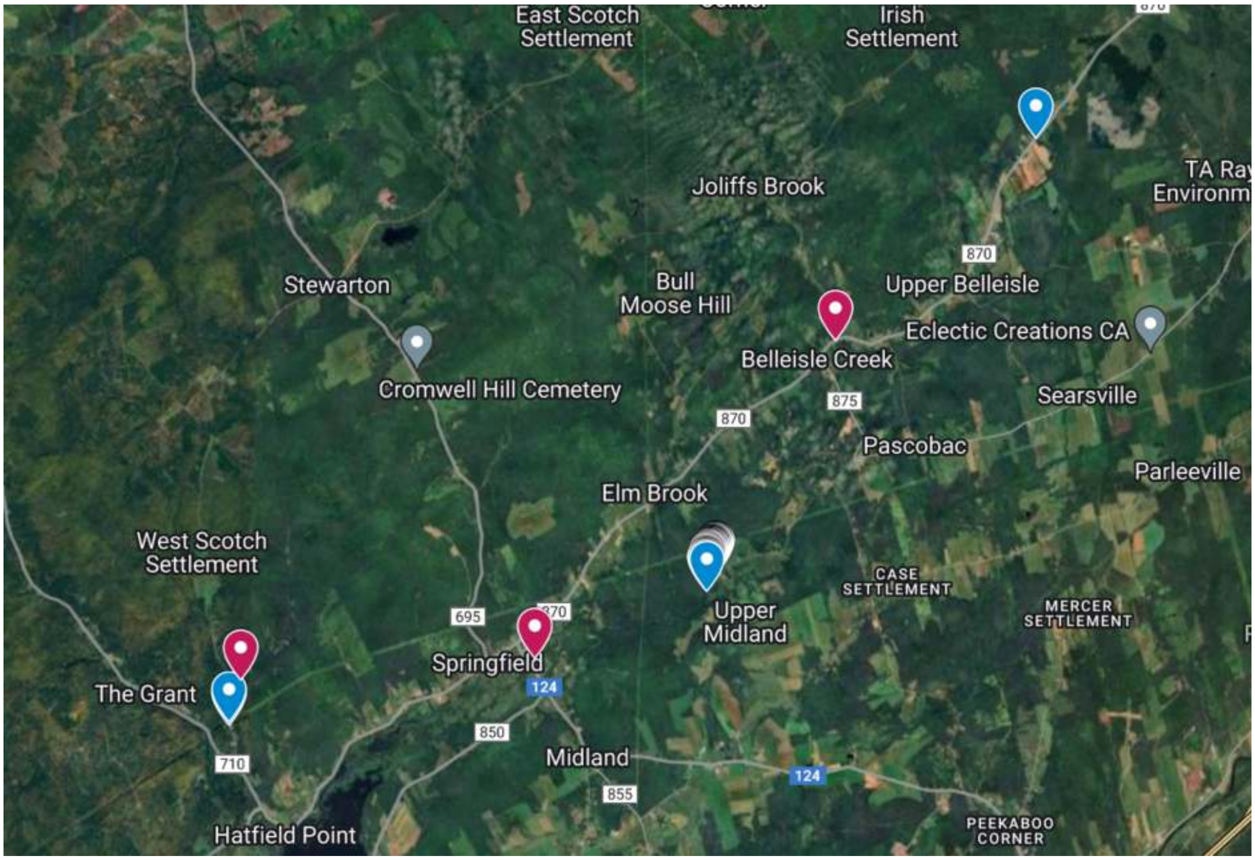

Figure 20: Watercourse sites surveyed for redds November 2024.

The results from the redd surveys observed redds at three of the six sites marked in blue in (Figure 20, Appendix 5). The majority of the redds observed were at the Marven Covered Bridge site on Belleisle Creek, where 35 Brook trout and three salmon redds were observed and recorded (Figure 21). At the Grant/Spragg Brook site, two salmon redds were observed and recorded (Figure 21). One trout redd was observed and recorded at Henderson Brook (Figure 21). No redds were observed at Jolifs Brook, Belleisle Creek at Route 124 bridge or Ketchum Brook (Figure 21). Trout redds accounted for 88% of the reds observed during field efforts and only 12% were identified as salmon (*Salmo salar or Salmo trutta)* redds during field efforts (Figure 22). No salmon or trout were observed on the redds at the time of the survey.

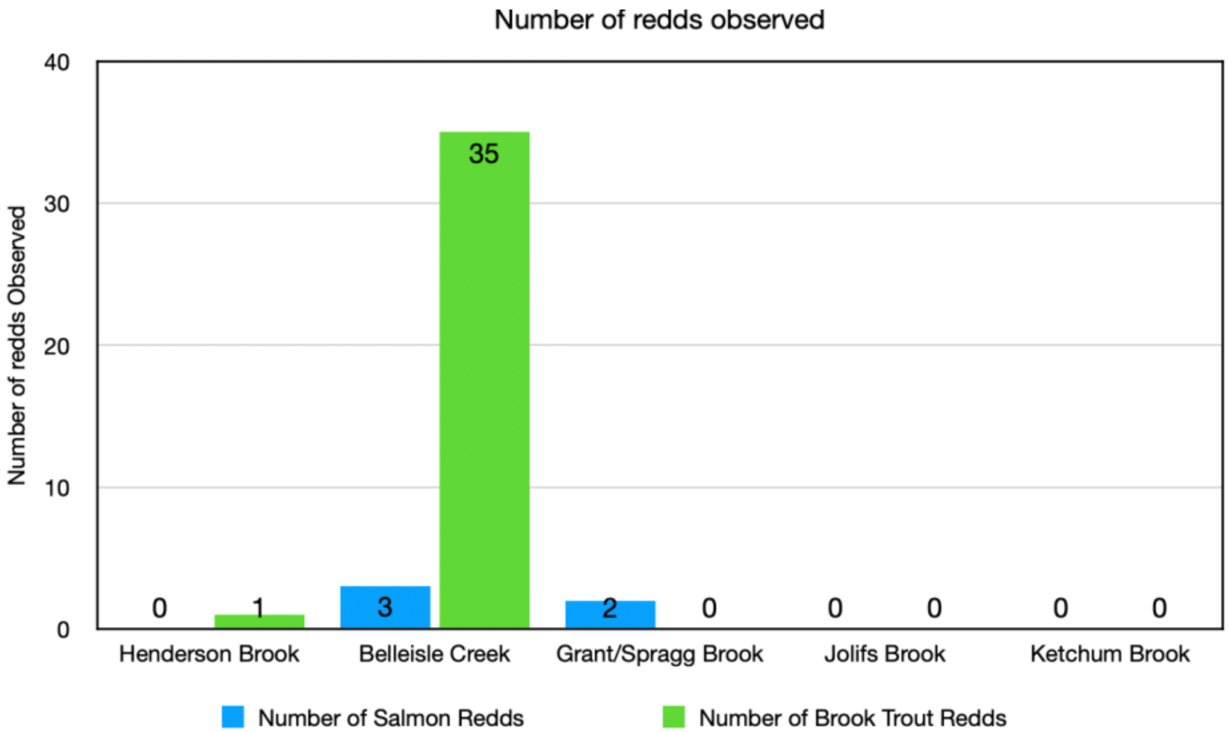

Figure 21: Number of redds observed by site during November 20024 surveys.

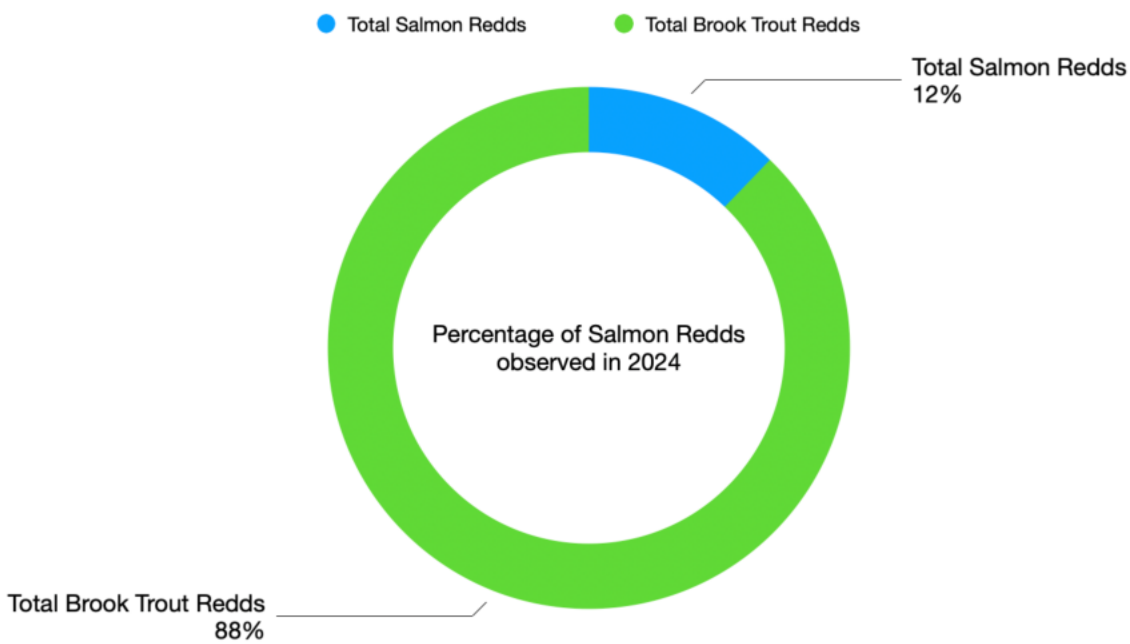

Figure 20: Percentage of trout and salmon redds observed during November 20024 surveys.

Conclusions

2024 was another successful year for the BWC as we continued to work to remove barriers and restore access to watercourses in the lower part of the watershed. This season, we added passage through six more culverts in the watershed that had been assessed as barriers during our 2023 fish passage survey. Results of this part of the project saw approximately 0.3265 tons of mostly woody and rock debris cleared from the inlet or outlet of these culverts, along with any anthropogenic rubbish. In total, removing the debris opened 18 km of watercourse with valuable salmonid habitat on four watercourses where fish passage was restricted in the lower watershed. This has helped to move forward our goal of removing barriers and creating connectivity throughout the watershed. Results show us that this can be achieved and that we still have lots of work to do to improve fish passage.

The results of our baseline salmon population work were also very interesting. The eDNA sampling and analysis gave us valuable information on where and what species of salmon are present in the watershed and raises questions about the potential hybridisation of Atlantic salmon and brown trout in the watershed. This was supported by the electrofishing surveys, which detected the presence of both species at the same sites, with some fish displaying characteristics of both species. This highlights the need for more investigation into the potential for salmon hybrids in the Belleisle watershed, and we are already reaching out to DFO and other salmon groups to gain more information on this discovery.

Electrofishing also provides us with much-needed information on the presence/absence of salmon in the watershed and provides important information on fish health, density, species composition, abundance and habitat use that we will continue to analyse. The results certainly indicate that salmon are present in more watercourses than previously known and in small numbers, which was speculated. The electrofishing surveys helped us identify that although there is a good diversity of fish species in the watershed, the abundance of salmon is low and possibly threatened by the encroachment of brown trout through competition for resources and the potential for hybridization with at-risk Atlantic salmon. This data has provided us with a new direction for investigation to help conserve salmon populations in the watershed.

Electrofishing also showed that barrier removal is working to restore and provide access. The removal of debris blocking the fish ladder at Durian Brook was followed by an increase in fish species above the ladder that was detected by electrofishing the site before and after that barrier removal. This result is also encouraging that restoration efforts are and can be effective at helping fish populations in the watershed.

The results of our redds surveys would seem to indicate that although salmon do spawn in the watershed and at locations we had previously identified with ideal habitat, it is occurring in low numbers and that other redd sites are likely out there that we have yet to find do to a lack of resources to invest in that search. We still have much to learn in this area and look forward to it so that we can better conserve salmon in the watershed.

All in all, this project has been a success, and we are excited by what we have learned over the past year and how we can use the information generated to continue our work to improve fish habitat and salmon populations in the watershed in the future.

Appendix 1 – Site Coordinates for Remediated Culverts, Electrofishing, eDNA, Redd Surveys

Table 3: Watercourses remediated by BWC field staff and their location.

Watercourse	Coordinates (Decimal Degrees)
Durian Brook	45.59303, -65.91451
Rogers Brook	45.60276, -65.90884
Second Run Brook	45.60193, -65.97066
Unnamed Brook Route 124	45.49941, -65.98465

Table 4: Locations of sites electrofished for salmonid presence/absence in Sept 2024.

Watercourse	Coordinates (Decimal Degrees)
Durian Brook	45.59303 -65.91451
Pascobac Brook	45.75054 -65.70597
Second Run Brook	45.60193 -65.97066
Belleisle Creek	45.68955 -65.77094
Midland Brook	45.64692 -65.79879
Stewarton Brook	45.68287 -65.82198
Grant Brook	45.65508 -65.86543
Spragg Brook	45.66835 -65.87195
Taylor’s Brook	45.67361 -65.86969
Reddin Brook	45.62466 -65.8682
Peters Brook	45.58377 -65.92702

Table 5: Locations of sites where eDNA sampling was conducted in 2024.

Watercourse	Coordinates (Decimal Degrees)
Belleisle Creek	45.6763, -65.80919
Grant/Spragg Brook	45.665, -65.87607
Peter's Brook	45.57465, -65.9282

Table 6: Locations of sites where redd surveys were conducted in 2024.

Watercourse	Coordinates (Decimal Degrees)	
Jolifs Brook	45.72183 -65.74737	
Henderson Brook	45.75081 -65.70623	
Belleisle Creek	45.68955 -65.77094	
Belleisle Creek Marven Bridge	45.68845 -65.7718	
Grant Brook	45.65508 -65.86543	
Spragg Brook	45.66835 -65.87195	
Taylor's Brook	45.67361 -65.86969	

Appendix 2: Raw Data for Culverts with Debris Blockages remediated in 2024.

Table 7: Raw data debris blocked culverts remediated in 2024.

Crossing ID	DTI #	PID	Date Assessed (DD/MM/YY)	Coordinates (Decimal Degrees)	Road Name	Road Type	Watercourse Name	Crossing Type	Debris Blockage Present	Description of Debris	Photos
UNK124002	N/A	#00000003	13/7/2023	45.61029, -65.93067	Route 124	Public	Unamed Brook	Culvert: Wood	Yes	Branches, Mud, Leaves	Yes
DBK001	N/A	#00000003	21/08/2023	45.59303, -65.91451	Route 850	Public	Durian Brook	Culvert: concrete With Fish ladder	Yes	Rock blocking fish ladder	Yes
DBK003	N/A	#00000003	29/08/2023	45.58746, -65.90043	Johnson Road	Public	Durian Brook	Culvert: concrete	Yes	Trees, Branches	Yes
ROB003	N/A	#00000003	18/08/2023	45.59975, -65.88894	Rogers Road	Public	Rogers Brook	Culvert: Corrugated Metal Pipe	Yes	Mud and Branches	Yes
SRB002	N/A	#00000003	18/7/2023	45.62469, -65.96664	Reicker Road	Public	Second Run Brook	Culvert: Corrugated Metal Pipe	Yes	Rocks and Sand	Yes
SRB003	N/A	#00000003	18/7/2023	45.62508, -65.96699	Reicker Road	Public	Second Run Brook	Culvert: Plastic	Yes	Trees, Branches	Yes

Appendix 3: Raw Electrofishing data.

Table 8: Raw data from electrofishing survey in September 2024.

Watercourse Site	Atlantic Salmon	Brown Trout	Brook Trout	American Eel	Slimy Sculpin	White Sucker	Black Nosed Dace	Large Mouth Bass	Small Mouth Bass	Gaspereau	Fall Fish	Sea Lamprey	Creek Chub	Total Fish / Site
Pascobac Brook	0	0	1	1	7	12	70	0	0	0	0	0	0	91
Belleisle Creek UP	0	0	2	17		9	8	0	0	1	4	1	0	42
Belleisle Creek DWN	0	0	0	6	0	2	57	0	0	0	0	1	0	66
Midland Brook	0	0	19	5	0	8	65	0	0	0	0	0	8	105
Stewarton Brook	0	0	18	1	0	0	41	0	0	0	0	0	0	60
Grant Brook	3	1	97	0	31	0	42	0	0	0	0	0	0	174
Spragg Brook	13	12	9	0	1	22	41	0	0	0	0	0	7	105
Taylor's Brook	27	1	0	0	1	1	11	0	0	0	0	0	0	41
Reddin Brook	13	4	3	20	0	1	6	0	0	0	0	0	0	47
Durian Brook UP	1	0	26	0	0	0	5	0	0	0	0	0	0	32
Durian Brook DWN	0	0	6	3	0	0	35	0	0	0	0	0	0	44
Second Run Brook	0	0	14	1	10	0	13	0	0	0	0	0	0	38
Peters Brook DWN	1	0	7	33	12	3	17	0	1	0	0	0	0	74
Species totals	58	18	202	87	62	58	411	0	1	1	4	2	15	919

Table 9: Shannon-Wiener Diversity Index Data for 2024 Electrofishing

Watercourse Site	Shannon diversity index	Evenness	Richness (number of species)	Total number of individuals	Average population size
Pascobac Brook	0.765	0.476	5	91	18.2
Belleisle Creek UP	1.56	0.801	7	42	6
Belleisle Creek DWN	0.514	0.371	4	66	16.5
Miland Brook	1.140	0.710	5	105	21
Stewarton Brook	0.690	0.628	3	60	20
Grant Brook	1.80	0.668	5	174	34.8
Spragg Brook	1.64	0.841	7	105	15
Taylor's Brook	0.900	0.559	5	41	8.2
Reddin Brook	1.45	0.809	6	47	7.83
Durian Brook UP	0.567	0.516	3	32	10.7
Durian Brook DWN	0.637	0.580	3	44	14.7
Second Run Brook	1.180	0.853	4	38	9.5
Peters Brook DWN	1.460	0.752	7	74	10.6

Appendix 4: Raw eDNA analysis data.

Table 10: Raw data from EDNA sampling in July and October 2024.

Tested	ESVId	Kingdom	Phylum	Class	Order	Family	Genus	Species	% match	# species	Peters Brook	Belleisle Creek	Grant Brook
MiFishU	ESV_003496	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Rhinichthys	Rhinichthys atratulus	100	1	4118	4554	919
MiFishU	ESV_011699	Eukaryota	Chordata	Actinopteri	Perciformes	Cottidae		Cottus cognatus	99.4	30	69	14	6032
MiFishU	ESV_009974	Eukaryota	Chordata	Actinopteri	Salmoniformes	Salmonidae	Salvelinus		100	3	1004	14	3217
MiFishU	ESV_000075	Eukaryota	Chordata	Mammalia	Artiodactyla	Bovidae			100	6	4234	0	0
MiFishU	ESV_000031	Eukaryota	Chordata	Actinopteri	Cypriniformes	Catostomidae	Catostomus	Catostomus commersonii	100	1	87	2028	0
MiFishU	ESV_009956	Eukaryota	Chordata	Actinopteri	Anguilliformes	Anguillidae	Anguilla	Anguilla rostrata	100	1	308	633	1123
MiFishU	ESV_011668	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus corporalis	100	1	0	1418	0
MiFishU	ESV_116276	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Rhinichthys	Rhinichthys atratulus	99.4	1	972	0	0
MiFishU	ESV_001136	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus atromaculatus	100	1	337	385	0
MiFishU	ESV_009990	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Luxilus	Luxilus cornutus	100	2	0	700	0
MiFishU	ESV_000043	Eukaryota	Chordata	Actinopteri	Salmoniformes	Salmonidae	Salmo		100	2	253	111	77
MiFishU	ESV_138925	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus corporalis	99.4	1	0	384	0

MiFish U	ESV_008617	Eukaryota	Chordata	Actinopteri	Perciformes	Gasterosteidae	Gasterosteus	Gasterosteus aculeatus	100	1	0	179	0
MiFish U	ESV_012418	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae			98.9	2	0	141	0
MiFish U	ESV_012443	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Luxilus		98.9	3	0	129	0
MiFish U	ESV_069004	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Rhinichthys	Rhinichthys atratulus	99.4	1	0	104	0
MiFish U	ESV_014839	Eukaryota	Chordata	Actinopteri	Perciformes	Cottidae			98.8	30	0	0	96
MiFish U	ESV_019546	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus corporalis	99.4	1	0	84	0
MiFish U	ESV_007995	Eukaryota	Chordata	Actinopteri	Cypriniformes	Catostomidae	Catostomus	Catostomus commersonii	99.4	1	0	78	0
MiFish U	ESV_065846	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Rhinichthys	Rhinichthys atratulus	100	1	0	72	0
MiFish U	ESV_133963	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Rhinichthys	Rhinichthys atratulus	99.4	1	0	67	0
MiFish U	ESV_011690	Eukaryota	Chordata	Actinopteri	Anguilliformes	Anguillidae	Anguilla	Anguilla rostrata	100	1	0	42	24
MiFish U	ESV_014459	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae			98.3	10	0	55	0
MiFish U	ESV_010112	Eukaryota	Chordata	Actinopteri	Salmoniformes	Salmonidae	Salvelinus		98.2	3	32	0	21
MiFish U	ESV_012398	Eukaryota	Chordata	Actinopteri	Salmoniformes	Salmonidae			97.6	16	30	0	20
MiFish U	ESV_010110	Eukaryota	Chordata	Actinopteri	Salmoniformes	Salmonidae	Salmo	Salmo Trutta	98.8	3	25	0	21

MiFish U	ESV_014588	Eukaryota	Chordata	Actinopteri	Salmoniformes	Salmonidae			97.6	14	32	0	13
MiFish U	ESV_019551	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus corporalis	96.6	1	0	37	0
MiFish U	ESV_019549	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus corporalis	98.9	1	0	36	0
MiFish U	ESV_065967	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus corporalis	99.4	1	0	35	0
MiFish U	ESV_015613	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus corporalis	95.4	1	0	28	0
MiFish U	ESV_014457	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus atromaculatus	96	1	26	0	0
MiFish U	ESV_138928	Eukaryota	Chordata	Actinopteri	Salmoniformes	Salmonidae	Salvelinus		99.4	3	20	0	0
MiFish U	ESV_011625	Eukaryota	Chordata	Actinopteri	Anguilliformes	Anguillidae	Anguilla	Anguilla rostrata	99.4	1	0	18	0
MiFish U	ESV_138926	Eukaryota	Chordata	Actinopteri	Anguilliformes	Anguillidae	Anguilla	Anguilla rostrata	99.4	1	0	14	0
MiFish U	ESV_066861	Eukaryota	Chordata	Actinopteri	Cypriniformes	Catostomidae	Catostomus	Catostomus commersonii	98.8	1	0	12	0
MiFish U	ESV_010790	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus atromaculatus	99.4	1	0	12	0
MiFish U	ESV_138927	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus corporalis	98.9	1	0	11	0
MiFish U	ESV_137290	Eukaryota	Chordata	Actinopteri	Anguilliformes	Anguillidae	Anguilla	Anguilla rostrata	99.4	1	0	11	0
MiFish	ESV_009950	Eukaryota	Chordata	Amphibia	Caudata	Plethodontidae	Eurycea	Eurycea bislineata	100	1	11	0	0

U													
MiFish U	ESV_116809	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus atromaculatus	99.4	1	0	10	0
MiFish U	ESV_022647	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus atromaculatus	99.4	1	0	10	0
MiFish U	ESV_014551	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae			98.3	5	0	10	0
MiFish U	ESV_018453	Eukaryota	Chordata	Actinopteri	Cypriniformes	Catostomidae	Catostomus	Catostomus commersonii	97.1	1	10	0	0

TestId	ESVId	Kingdom	Phylum	Class	Order	Family	Genus	Species		% match	# species	Grant/spragg brook OCT	Belleisle Creek OCT
MiFishU	ESV_003496	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Rhinichthys	Rhinichthys atratulus		100	1	40456	13964
MiFishU	ESV_000031	Eukaryota	Chordata	Actinopteri	Cypriniformes	Catostomidae	Catostomus	Catostomus commersonii		100	1	791	14191
MiFishU	ESV_009956	Eukaryota	Chordata	Actinopteri	Anguilliformes	Anguillidae	Anguilla	Anguilla rostrata		100	1	671	1376
MiFishU	ESV_011699	Eukaryota	Chordata	Actinopteri	Perciformes	Cottidae				99.4	30	10021	119
MiFishU	ESV_001136	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus atromaculatus		100	1	143	8796
MiFishU	ESV_009607	Eukaryota	Chordata	Actinopteri	Centrarchiformes	Centrarchidae	Micropterus			100	3	0	0
MiFis	ESV_009	Eukary	Chord	Actinopt	Cypriniformes	Leuciscidae	Luxilus			100	2	0	6447

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MiFis hU	ESV_009 942	Eukary ota	Chord ata	Actinopt eri	Centrarchiform es	Centrarchida e	Lepomis		Sunfi sh Sp.	100	3	0	30
MiFis hU	ESV_009 974	Eukary ota	Chord ata	Actinopt eri	Salmoniformes	Salmonidae	Salvelinus			100	3	3073	1620
MiFis hU	ESV_000 114	Eukary ota	Chord ata	Actinopt eri	Siluriformes	Ictaluridae	Ameiurus			100	2	0	0
MiFis hU	ESV_000 043	Eukary ota	Chord ata	Actinopt eri	Salmoniformes	Salmonidae	Salmo			100	2	3110	344
MiFis hU	ESV_009 627	Eukary ota	Chord ata	Actinopt eri	Perciformes	Percidae	Perca	Perca flavescens		100	1	0	0
MiFis hU	ESV_007 833	Eukary ota	Chord ata	Actinopt eri	Clupeiformes	Clupeidae	Brevoorti a			100	2	0	0
MiFis hU	ESV_010 000	Eukary ota	Chord ata	Actinopt eri	Esociformes	Esocidae	Esox		Picke rel sp.	100	2	0	10
MiFis hU	ESV_008 617	Eukary ota	Chord ata	Actinopt eri	Perciformes	Gasterosteid ae	Gasterost eus	Gasteroste us aculeatus		100	1	0	2226
MiFis hU	ESV_011 690	Eukary ota	Chord ata	Actinopt eri	Anguilliformes	Anguillidae	Anguilla	Anguilla rostrata		100	1	318	0
MiFis hU	ESV_009 957	Eukary ota	Chord ata	Actinopt eri	Cypriniformes	Leuciscidae	Notemigo nus	Notemigo nus crysoleuca s		100	1	0	0
MiFis hU	ESV_011 668	Eukary ota	Chord ata	Actinopt eri	Cypriniformes	Leuciscidae	Semotilus	Semotilus corporalis		100	1	0	770
MiFis hU	ESV_012 418	Eukary ota	Chord ata	Actinopt eri	Cypriniformes	Leuciscidae				98.9	2	0	1342
MiFis hU	ESV_012 443	Eukary ota	Chord ata	Actinopt eri	Cypriniformes	Leuciscidae	Luxilus			98.9	3	0	1293
MiFis hU	ESV_000 075	Eukary ota	Chord ata	Mammal ia	Artiodactyla	Bovidae				100	6	0	897

MiFishU	ESV_010767	Eukaryota	Chordata	Actinopteri	Cypriniformes	Catostomidae	Catostomus	Catostomus commersonii		95.4	1	0	548
MiFishU	ESV_014588	Eukaryota	Chordata	Actinopteri	Salmoniformes	Salmonidae				97.6	14	507	0
MiFishU	ESV_143285	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Rhinichthys	Rhinichthys atratulus		97.7	1	0	494
MiFishU	ESV_010112	Eukaryota	Chordata	Actinopteri	Salmoniformes	Salmonidae	Salvelinus			98.2	3	440	39
MiFishU	ESV_068165	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus atromaculatus		97.7	1	0	348
MiFishU	ESV_143282	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae				95.5	12	0	334
MiFishU	ESV_140562	Eukaryota	Chordata	Actinopteri	Cypriniformes	Catostomidae	Catostomus			94.3	7	0	331
MiFishU	ESV_140572	Eukaryota	Chordata	Actinopteri	Cypriniformes	Catostomidae	Catostomus	Catostomus commersonii		94.3	1	0	271
MiFishU	ESV_019551	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus corporalis		96.6	1	0	137
MiFishU	ESV_143287	Eukaryota	Chordata	Actinopteri	Siluriformes	Ictaluridae	Ameiurus			92.5	3	0	0
MiFishU	ESV_015613	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus corporalis		95.4	1	0	204
MiFishU	ESV_009176	Eukaryota	Chordata	Actinopteri	unk_order	Moronidae	Morone	Morone americana		100	1	0	0
MiFishU	ESV_001615	Eukaryota	Chordata	Actinopteri	Cyprinodontiformes	Fundulidae	Fundulus	Fundulus diaphanus		100	1	0	0
MiFishU	ESV_143286	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus corporalis		97.1	1	0	176
MiFis	ESV_011	Eukary	Chord	Actinopt	Anguilliformes	Anguillidae	Anguilla	Anguilla		99.4	1	154	0

hU	625	ota	ata	eri				rostrata					
MiFishU	ESV_003929	Eukaryota	Chordata	Actinopteri	Clupeiformes	Clupeidae	Alosa	Alosa aestivalis		100	1	0	0
MiFishU	ESV_067115	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus atromaculatus		98.3	1	0	137
MiFishU	ESV_138925	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus corporalis		99.4	1	0	127
MiFishU	ESV_018453	Eukaryota	Chordata	Actinopteri	Cypriniformes	Catostomidae	Catostomus	Catostomus commersonii		97.1	1	110	0
MiFishU	ESV_013307	Eukaryota	Chordata	Actinopteri	Cypriniformes	Catostomidae	Catostomus	Catostomus commersonii		97.1	1	104	0
MiFishU	ESV_137287	Eukaryota	Chordata	Actinopteri	Centrarchiformes	Centrarchidae	Lepomis			98.8	3	0	0
MiFishU	ESV_019458	Eukaryota	Chordata	Actinopteri	Perciformes	Gasterosteidae	Apeltes	Apeltes quadracus		100	1	0	0
MiFishU	ESV_038176	Eukaryota	Chordata	Actinopteri	Perciformes	Percidae	Perca	Perca flavescens		98.2	1	0	0
MiFishU	ESV_066934	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus atromaculatus		95.4	1	0	0
MiFishU	ESV_012686	Eukaryota	Chordata	Actinopteri	Perciformes	Gasterosteidae	Gasterosteus	Gasterosteus aculeatus		99.4	1	0	0
MiFishU	ESV_143284	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus corporalis		98.3	1	0	46
MiFishU	ESV_012398	Eukaryota	Chordata	Actinopteri	Salmoniformes	Salmonidae				97.6	16	0	35
MiFishU	ESV_143059	Eukaryota	Chordata	Actinopteri	Salmoniformes	Salmonidae				97.6	11	33	0
MiFis	ESV_019	Eukary	Chord	Actinopt	Cypriniformes	Leuciscidae	Semotilus	Semotilus		98.9	1	0	33

hU	549	ota	ata	eri				corporalis					
MiFishU	ESV_014457	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus atromaculatus		96	1	33	0
MiFishU	ESV_143289	Eukaryota	Chordata	Actinopteri	Cyprinodontiformes	Fundulidae	Fundulus			99.4	2	0	0
MiFishU	ESV_005120	Eukaryota	Chordata	Actinopteri	Cypriniformes	Catostomidae	Catostomus			94.2	2	0	27
MiFishU	ESV_042835	Eukaryota	Chordata	Actinopteri	Perciformes	Gasterosteidae	Gasterosteus	Gasterosteus aculeatus		97.6	1	0	23
MiFishU	ESV_143291	Eukaryota	Chordata	Actinopteri	Anabantiformes	Osphronemidae	Trichopsis	Trichopsis vittata		98.2	1	18	0
MiFishU	ESV_143290	Eukaryota	Chordata	Actinopteri	Perciformes	Percidae	Perca	Perca flavescens		97.6	1	0	0
MiFishU	ESV_009950	Eukaryota	Chordata	Amphibia	Caudata	Plethodontidae	Eurycea	Eurycea bislineata		100	1	14	0
MiFishU	ESV_143288	Eukaryota	Chordata	Actinopteri	Cyprinodontiformes	Fundulidae	Fundulus	Fundulus diaphanus		94.8	1	0	0
MiFishU	ESV_011631	Eukaryota	Chordata	Hyperoartia	Petromyzontiformes	Petromyzontidae	Petromyzon	Petromyzon marinus		100	1	0	14
MiFishU	ESV_013287											0	11
MiFishU	ESV_018058	Eukaryota	Chordata	Actinopteri	Cypriniformes	Leuciscidae	Semotilus	Semotilus atromaculatus		96.6	1	9	0
MiFishU	ESV_143283	Eukaryota	Chordata	Actinopteri	Anguilliformes	Anguillidae	Anguilla	Anguilla rostrata		91.2	1	0	8

Appendix 5: Raw Redd Survey data.

Table 11: Raw data from Redd Surveys in November 2024.

Site Name	Watercourse	Redd Id	Coordinates (Decimal Degrees)	Date MM/DD/YY	Type Complete or Test	Macro habitat (Run/ Riffle/ Pool)	Fish Observed on Redd	Flow Condition (Low/ Normal/ High)	Visibility (Clear, Moderate, Poor)	Observers	Notes
Henderson Brook	Henderson Brook	HB001	45.75081, -65.70623	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Possible Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB001	45.68845, -65.7718	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB002	45.68836, -65.77192	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB003	45.68833, -65.77202	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB004	45.68831, -65.77198	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB005	45.68833, -65.77202	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB006	45.68826, -65.77208	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB007	45.68822, -65.77213	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB008	45.68816, -65.77222	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek	Belleisle	BCB009	45.68804, -	11/14/2024	Complete	Run	No	Low	Clear	Colin,	Brook

Marven Bridge	Creek		65.77244							Sophie, Sarah	Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB010	45.68796, -65.77256	11/14/2024	In Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB011	45.68792, -65.77258	11/14/2024	In Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB012	45.6879, -65.77262	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB013	45.68786, -65.77267	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB014	45.68781, -65.77276	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB015	45.6878, -65.77278	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB016	45.68775, -65.77285	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB017	45.68769, -65.77285	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB018	45.68769, -65.7729	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB019	45.68766, -65.77291	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB020	45.68762, -65.77301	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek	Belleisle	BCB021	45.68757, -	11/14/2024	Complete	Run	No	Low	Clear	Colin,	Brook

Marven Bridge	Creek		65.77303							Sophie, Sarah	Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB022	45.68754, - 65.77308	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB023	45.68752, - 65.77305	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB024	45.68746, - 65.77315	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB025	45.68738, - 65.77327	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB026	45.68731, - 65.77337	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB027	45.68715, - 65.77353	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB028	45.68701, - 65.7737	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB029	45.6869, - 65.77374	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB030	45.68676, - 65.77383	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB031	45.68659, - 65.77387	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB032	45.68632, - 65.77391	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek	Belleisle	BCB033	45.68622, -	11/14/2024	Complete	Run	No	Low	Clear	Colin,	Brook

Marven Bridge	Creek		65.77393							Sophie, Sarah	Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB034	45.68616, -65.77395	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB035	45.68607, -65.77394	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Brook Trout Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB036	45.68595, -65.77394	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Salmon Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB037	45.68592, -65.77388	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Salmon Redd
Belleile Creek Marven Bridge	Belleisle Creek	BCB038	45.68589, -65.77392	11/14/2024	Complete	Run	No	Low	Clear	Colin, Sophie, Sarah	Salmon Redd
Grant/Spragg Brook	Spragg Brook	GSB001	45.66663, -65.87202	11/14/2024	Complete	Riffle	No	Low	Clear	Colin, Sophie, Sarah	Salmon Redd
Grant/Spragg Brook	Spragg Brook	GSB002	45.66714, -65.87197	11/14/2024	Complete	Riffle	No	Low	Clear	Colin, Sophie, Sarah	Salmon Redd
Jolifs Brook	**Jolifs Brook**	None Observed		11/14/2024						Colin, Sophie, Sarah	None Observed
Belleisle Creek 124 bridge	Belleisle Creek	None Observed		11/14/2024						Colin, Sophie, Sarah	None Observed
Ketchum Brook	Ketchum Brook	None Observed		11/14/2024						Colin, Sophie, Sarah	None Observed