LETTING RIVERS RUN WILD: BROAD RANGE MONITORING OF IBOF ATLANTIC SALMON

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ACAP SAINT JOHN

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Introduction

The inner Bay of Fundy (iBoF) Salmon is a population of Atlantic Salmon (Salmo salar) that do not migrate outside of the Bay of Fundy. This population is listed as endangered by the Species at Risk Act and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). There are 50 iBoF rivers located from Mispec River in New Brunswick to Pereaux River in Nova Scotia (DFO, 2019). In 2019, ACAP Saint John set out to complete management plans for seven undermanaged iBoF rivers from Saint John to Saint Martins. These rivers are not classified as 'critical habitat' for the recovery of iBoF salmon and therefore have been mostly overlooked. To complete these plans, ACAP Saint John conducted stream assessments, monitoring, and restoration along these rivers and released the plans in 2021.

Black River, an identified iBoF Salmon River which has historically been known to support salmon, is located along the Fundy Coast, East of Mispec River. In 2019, the main stem of Black River was surveyed for salmon presence, habitat, and land use issues. Seven salmon parr were captured and released during electrofishing surveys, as well as five of eight eDNA sites sampled returned positive for Salmon presence. In 2022, ACAP Saint John expanded on activities and recommendations from the 2020 management plan for Black River by conducting stream assessments on tributaries, swim-through snorkel surveys, redd surveys, additional eDNA sampling, and restoration activities. Samples were taken throughout the salmon spawning season resulting in 12/12 positive samples confirming the presence of Atlantic salmon. In 2023, ACAP Saint John continued to explore these findings through additional eDNA sample collection, as well as capturing salmon to tag. Upon capture, genetic samples were acquired, and other physical characteristics were recorded; these salmon were released after monitored recovery. These efforts will increase our understanding of distribution and abundance of salmon within Black River.

Salmon Presence

Electrofishing Surveys

Electrofishing was conducted at five sites within the main stem of Black River (Figure 1). Three out of five sites resulted in the capture of Atlantic salmon. Survey and transect selection was based on site assessments conducted in 2019 and 2022 which determined favourable habitat conditions and spatial location within the watershed; determined through this ensured a broad range of sampling throughout.

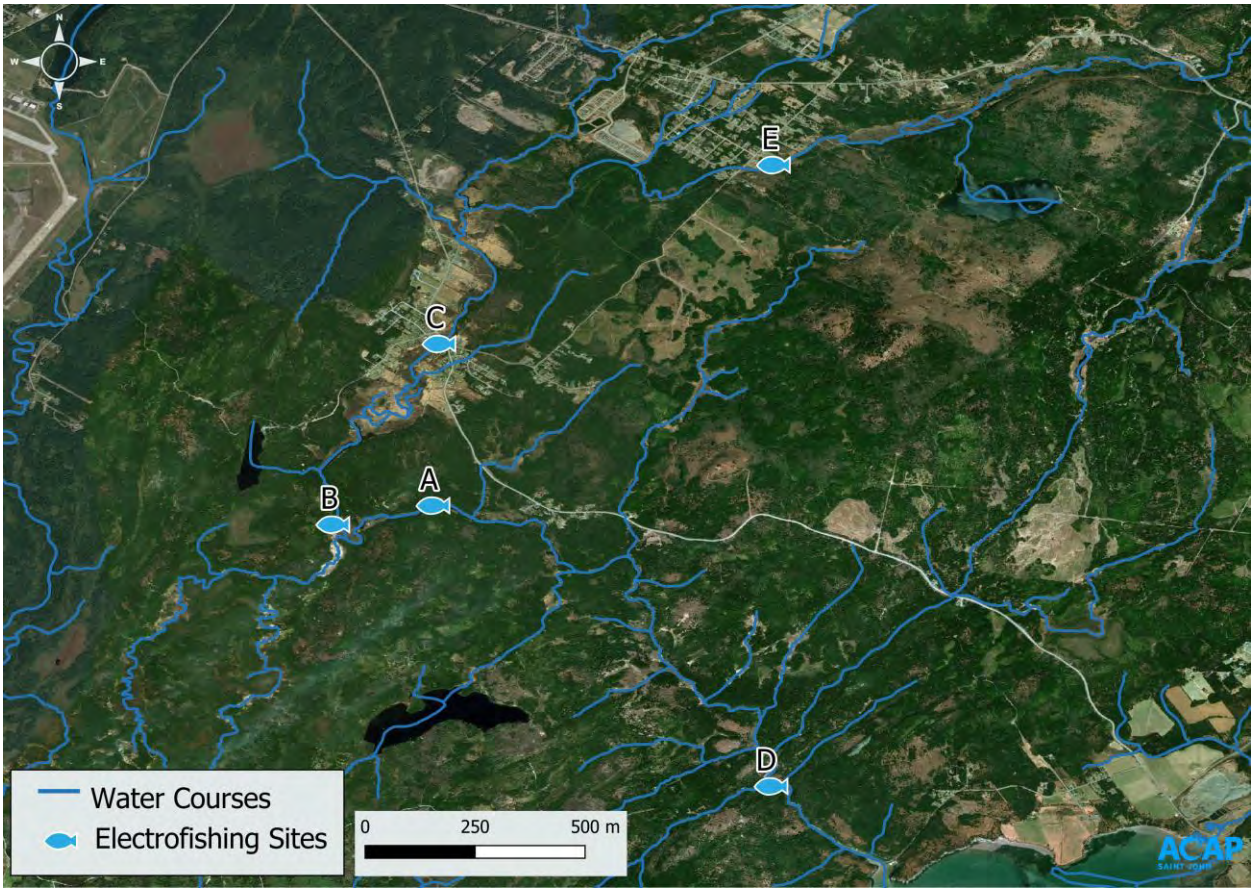

Figure 1. Electrofishing sites surveyed in 2023 located in Black River.

A GPS point was taken at the start of each site. Electrofishing transects were conducted by walking from one bank to the other targeting niches preferable for salmon (boulders, eddies, downed woody debris, pools, etc.). When salmon were captured, they were kept in a cool aerated bucket and walked to the field lab. At the field lab, salmon were sedated one at a time using clove oil. Once sedated, a series of measurements were taken. Measurements included, total length & fork length (mm), weight (g), life stage, and whether the individual was precocious. An 8 mm Passive Integrated Transponders (PIT) Tag was then inserted into the dorsal muscle, followed by a small fin clip on the caudal fin to acquire a genetic sample. The salmon was then placed in a separate aerated bucket to recover, then transferred into a flow-through tote in the stream and monitored for full recovery before being released downstream of the site.

Results

A total of 23 salmon were captured with genetic samples taken, of these, 17 were tagged, while the remaining 5 salmon were under the size restriction (>100 mm) and could not be tagged. This restriction is in place to lessen the tag burden keeping it at roughly < 8 percent. No salmon were captured near the mouth of the watershed (Site D); however, due to high, fast flowing water, it was difficult to sample this section of the river. A few fish exhibiting salmonid behaviour were observed, and a Brook trout *(Salvelinus fontinalis)* was captured at the lower-most tributary of Black River. No salmon were captured or observed at the upper-most sample location in the river (Site E). An eDNA sample was taken near this location to aid in

understanding the upper most limit of salmon presence in this watershed (waiting for lab results). Sites A, B, and C were positive locations resulting in the capture of salmon through electrofishing surveys (Figure 2). All salmon captured through this project were found within a 4 km length of the main stem, this is likely not the full extent of the salmons' range within the watershed but provides a good indication of where the majority of Salmon parr may be residing, serving as a key area for their survival.

Figure 2. Electrofishing transects where salmon were captured during 2023 Black River surveys.

Site B had the most captures with 12 salmon in a relatively small area of 1042 m^2 spanning 89 m. Total catches at both site B and C were limited by sampling duration, rather than a lack of fish or habitat; it is suspected that more sampling effort in these areas would result in more salmon captures. Salmonids were observed at all three of these sites, but individuals were unable to be captured. Site B had the highest density at 0.011 salmon parr/m^2. Salmon catches were spaced evenly across the transect in site A and B, however, a micro-site at the end of site C (labeled C2) had a higher density of 0.02 salmon parr/m^2 with 5 fish being caught within an approximate 196 m^2 area (Table 1).

*Table 1. Density of Atlantic salmon parr at each fishing site. *Site C2 is encompassed within site C, a separate calculation was created for this micro-site as the majority of the catch was in a small area and not evenly spaced throughout the entire site C transect.*

Site	Total Area (m^2)	Total Salmon Catch	Density (Salmon parr/m^2)
A	5433	3	0.000552
B	1042	12	0.011516
C	1070	8	0.007477
C2*	196	5	0.02551

During surveys at site B, an individual was found with a malformed mandible (Figure 3). No apparent surface damage was observed (i.e. cuts, scarring, blood, bruising, etc.). It is unknown whether this was an injury sustained during growth, or a genetic malformation; this was the only individual found with any sort of malformation or injury.

Figure 3. Atlatnic Salmon parr with malformed mandible (circled in red).

Measurements

Mean length was relatively consistent between all three sites; however, Site C had the broadest range in length and weight (Figure 4 and 5). This is likely the result of increased young-of-the-year parr having been captured. Site B also had some outlier individuals which are likely due to a similar result.

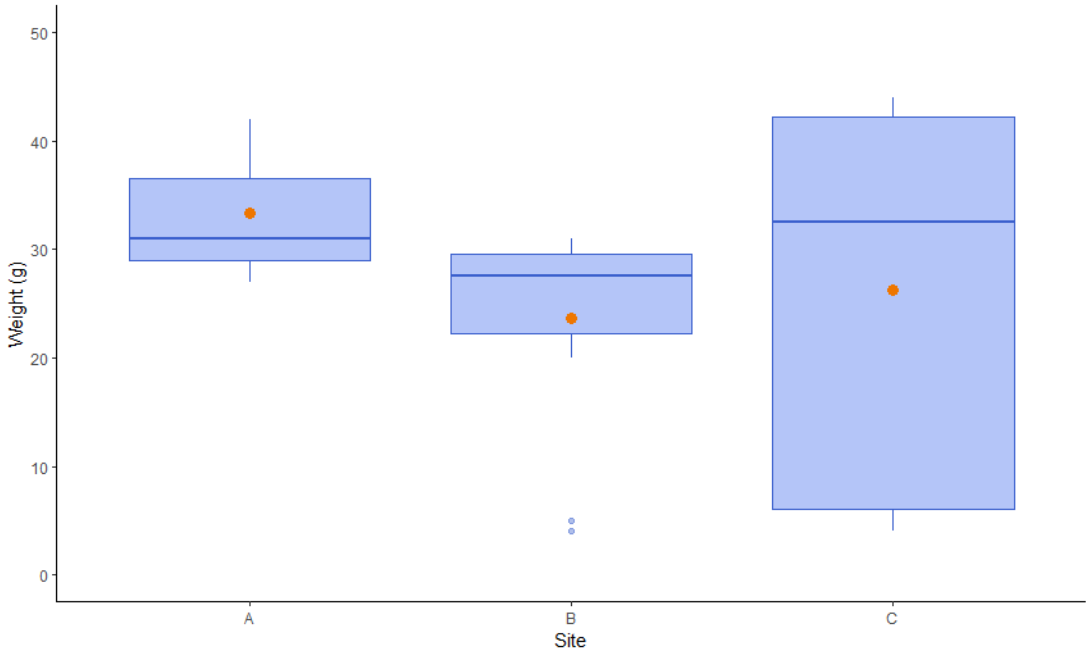

Figure 4. Weights (g) across all three sites. The mean weight at each site is indicated by orange circles. Outliers are represented by light blue circles.

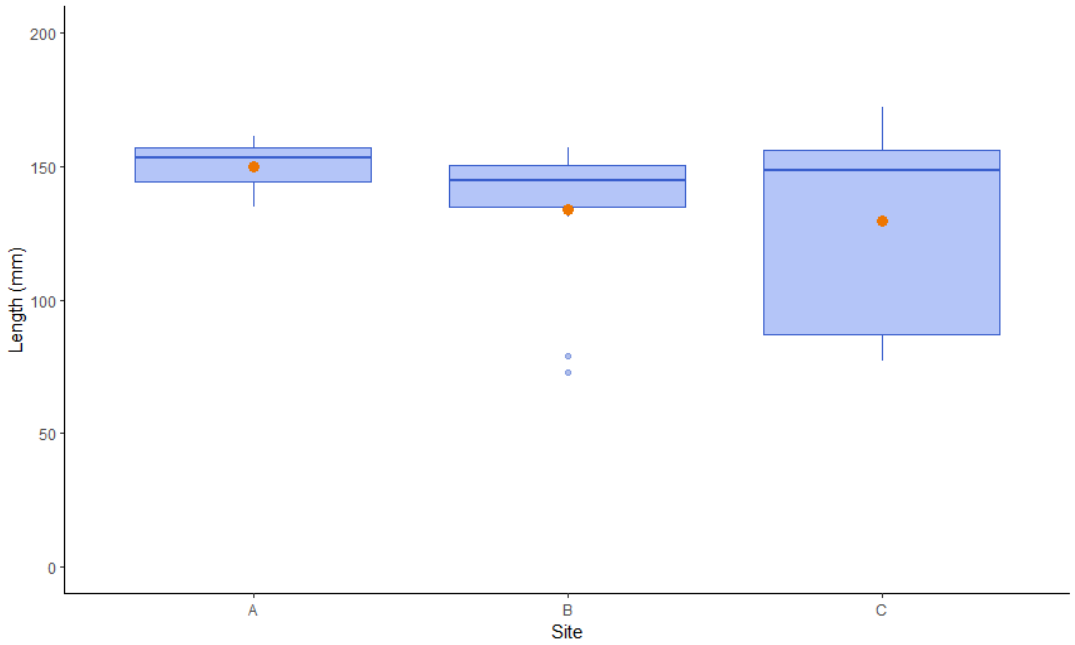

Figure 5. Total length (mm) across all three sites. The mean length at each site is indicated by orange circles. Outliers are represented by light blue circles

It was found that 33% of the overall catch were precocious. This percentage varied between sites, with site A (33%) and site C (38%) exhibiting relatively similar concentrations, while site B had an even split of 50% of the catch being precocious (Figure 6).

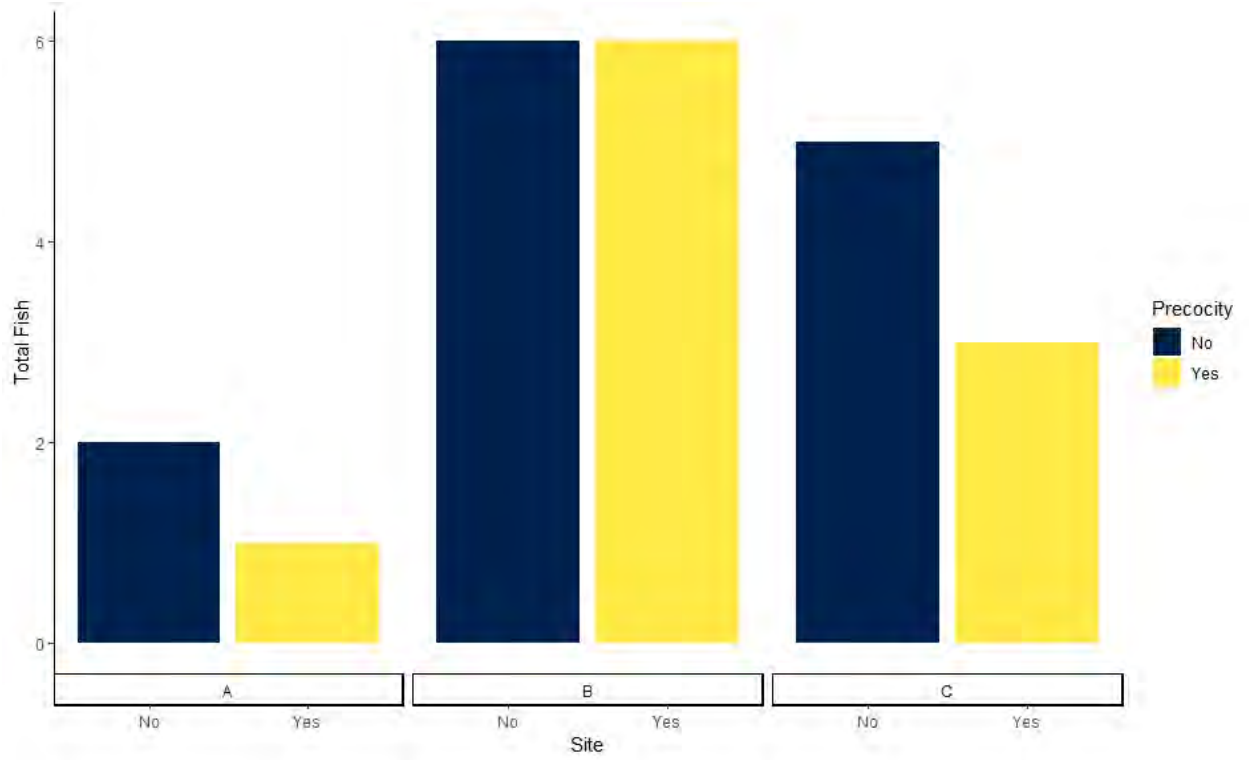

Figure 6. Total observed precocity of captured fish between sites in Black River.

Redd Survey

A redd survey was conducted near the end of the spawning season (November 10, 2023), to maximize the chance at successfully locating salmon. The survey began near site A, travelling upstream and ending above site B. This area was selected due to its preferred spawning habitat. In 2020, a half redd (scratch) was observed along this stretch, and the presence of salmon parr and young-of-the-year parr were found during electrofishing surveys, indicating that this stretch of river may host spawning salmon. In 2023, no salmon redds were observed over the 1.5 km stretch covered by the two-person observation team.

Genetics

A total of 23 genetic samples were collected. Fin clips were taken from the caudal fin as it has minimal effects on the swimming capability of salmonids and is one of the first fins to start regrowing post-manipulation. All genetic samples have been sent to the UNB Genomics lab for analysis where they will be compared to known Live Gene Bank genetics. We are still awaiting results at the time of this report.

Education and Engagement

Social Media Content

Two social media posts were created. This content was posted to ACAP Saint John's various social media platforms (i.e. Facebook, Instagram, X, and LinkedIn). Across all platforms, posts had a combined reach of over 2780, and combined reaction engagement (likes, retweets, etc.) of 210 (Figure 7).

Figure 7. Example of social media content created and posted to Instagram, highlighting the work that was accomplished.

Presentations

Two presentations were given to grade 9 environmental science students. The presentations covered endangered species with a focus on the inner Bay of Fundy Atlantic Salmon. Students learned about the various work going on at ACAP Saint John and other organizations to monitor and restore the iBoF and oBoF populations. Students received hands-on learning where they were able to PIT tag a banana using grains of rice. This interactive learning was a big success with the students and helps to engage different learning styles. A total of 31 youth and 2 teachers experienced these presentations. A presentation was also given to 15 people including 4 youth for the Nature NB's Festival of Nature. The group was brought to Mispec Beach where they learned about the iBoF river and iBoF salmon while observing some of our sampling techniques. An educational display board and accompanying presentation on the Atlantic

Salmon including the iBoF salmon was created. These educational pieces will contribute to future engagement efforts to further inform youth and the public in salmon conservation (Figure 8).

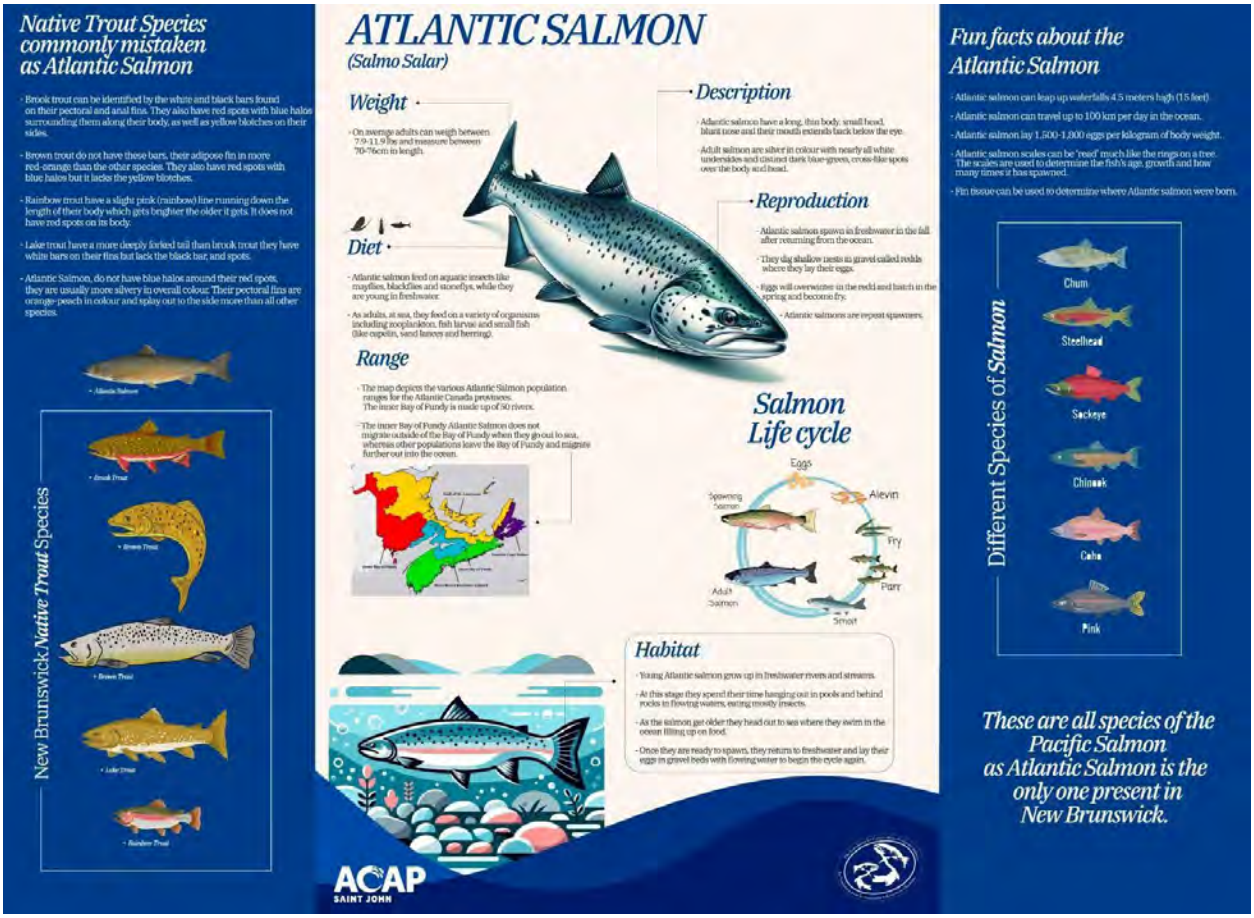

Figure 8. Atlantic salmon trifold board created as part of this project for educational purposes.

Landowner engagement

Two landowners were engaged with during electrofishing surveys. These landowners were educated on some of the fish habitat running through their property, and the potential of salmon presence. The landowners allowed access to the stream in support of our electrofishing surveys.

Conclusion

The success of this project acted as stepping stone into understanding the role Black River plays in iBoF salmon recovery and conservation. Further investigation on a larger multi-year scale is required to fully comprehend the distribution, populations, and abundances of iBoF Atlantic Salmon within Black River. Greater understanding the distribution and ecology of this river will lead to better management and recovery of the iBoF salmon throughout the entire watershed. Knowledge gained through this project can be applied to future work both within Black River and expanding into adjacent iBoF rivers. It is recommended that future sampling take place in the remaining iBoF rivers in addition to Black River as the knowledge and understanding of how these rivers behave in relation to iBoF salmon will play an important role

in the recovery of the wild self-sustaining populations. Identifying key areas where salmon reside in these watersheds, like those found in Black River, can have a lasting impact on future management and recovery.