

Truax Dam Removal Monitoring on the Saugeen River - Summer 2024 Update Report -

In August 2019, the century-old Truax Dam in Walkerton, ON was successfully removed through a collaboration between Bruce Power, the Lake Huron Fishing Club and the Municipality of Brockton, with direction from GSS Engineering Consultants Ltd. The removal addressed safety concerns related to the ageing structure and eliminated a significant barrier to fish migration in the Saugeen River (Figure 1). To assess the impact of the dam removal, scientists from Bruce Power and Biotactic Inc., supported by Golder Associates, designed a Before-After-Control-Impact (BACI) study. Monitoring for this study is conducted year-round and includes electrofishing surveys to measure fish biomass and production, habitat assessments, redd surveys to track fish spawning, and underwater video and radiotelemetry studies to monitor fish movement and passage.

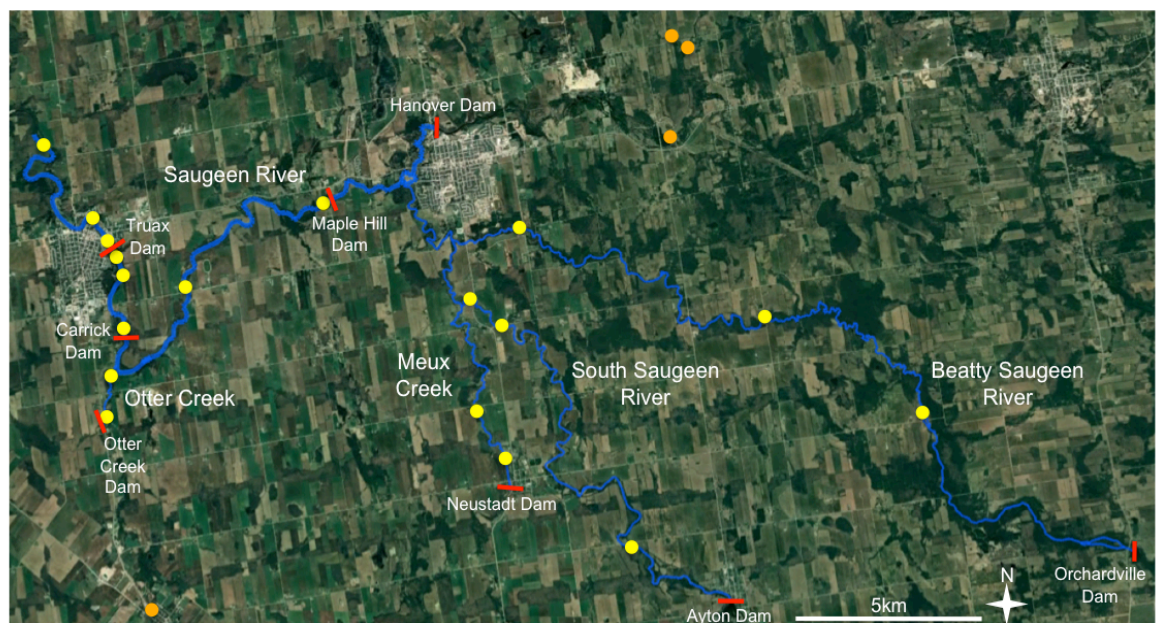
Twenty-two sampling locations were established throughout the Saugeen River watershed (Figure 2). Baseline data were collected in 2018 and 2019 before the dam was removed, and post-removal monitoring began in the fall of 2019. This on-going post-dam removal monitoring will continue for several more years to quantify the long-term benefits of the dam removal.

Almost immediately after the dam was removed, natural river flow and temperature patterns were restored in the former headpond area, creating new spawning habitat and increasing fish diversity and biomass. With the barrier gone, fish now have easier access to high-quality habitat upstream, leading to increased spawning in monitored tributaries. The following is a summary of data collected through spring 2024.



Figure 1 – Aerial images of the Truax Dam footprint, Walkerton, ON, before and after removal. The original wooden dam was built in 1852 and later replaced by the concrete structure shown above in 1919. While the dam had a fishway that allowed the passage of some migrating salmonids under specific flow conditions, it posed a significant barrier to fish passage before it was removed to restore river connectivity.

Figure 2 – Twenty-two long-term monitoring sites are located upstream and downstream of the former Truax Dam in the Saugeen River and within the South Saugeen and Beatty Saugeen Rivers and Otter and Meux Creeks. Red bars are locations of dams in the study area. Yellow circles are sites with fish communities that are monitored for potential changes related to the dam removal. Orange circles are control sites with independent fish communities located upstream of Hanover and Otter Creek Dams, which are barriers to upstream movement.



Radiotelemetry – Tracking the Movement of Rainbow Trout Throughout the Saugeen River Watershed

Radiotelemetry uses implanted transmitters and receivers that detect unique signals to track individual fish, allowing researchers to analyze their migration patterns and behaviours. Biotactic Inc., experts in fish tracking studies, partnered with Bruce Power to study Rainbow Trout movement in the Saugeen River watershed as they migrate inland from Lake Huron each spring and fall. With support from volunteers from the Ontario Steelheaders and Lake Huron Fishing Club, 443 fish have been radio-tagged so far, with more tagging planned in fall 2024 (Figure 3). The fish are tagged at Denny's Dam, and their movement is tracked using seven stationary receiver stations, as well as mobile methods such as by airplane, truck and on foot.

Studies conducted from spring 2018 to 2022, and again in fall 2023, involved releasing fish upstream of Denny's Dam to investigate how the removal of the Truax Dam affected fish passage and movement throughout the Saugeen River watershed (Table 1). The research revealed that removing the dam not only reduced downstream delays and improved passage at the former dam site, but also increased fish travel speeds and passage success at remaining upstream dams. Additionally, fall-run fish were able to overwinter closer to known spawning grounds. This research has been published and is publicly available at biotactic.com/peer-reviewed-scientific-papers



Figure 3 – Surgical implantation of a radio-tag in an electro-sedated Rainbow Trout.

Table 1 – Radiotelemetry results collected from studies where fish were released upstream of Denny's Dam (spring and fall 2018 - 2022 and fall 2023). Fifty adult Rainbow Trout were radio-tagged each season, however no fish were tagged spring 2020 or fall 2022 and only 18 and 27 fish were tagged fall 2021 and fall 2023, respectively. Abbreviations: S-spring, F-fall

Monitoring period		Spring		Fall	TRUAX DAM REMOVED	Spring		Fall
Fish tracking group		S'18 & S'19	F'18	F'18		S'21 & S'22	F'19, F'20, F'21,F'23	F'19, F'20, F'21,F'23
Sample size (n)	(# fish tagged/remaining)	100	47	50		100	137	145
Sample size (n)	(# relocated)	87	40	43		96	105	124
Denny's Dam	(# not migrating upstream)	22	6	4		31	19	51
Truax Dam	(# arrived at Truax)	55	29	17		45	46	41
	(# passed upstream)	34	21	3		39	40	35
	(% passage)	62	72	18		87	87	85
Carrick Dam	(# arrived at Carrick)	34	21	2		39	57	35
	(# passed upstream)	31	16	0		26	53	17
	(% passage)	91	76	0		67	93	49
Maple Hill Dam	(# arrived at Maple Hill)	25	13	-		15	47	14
	(# passed upstream)	13	11	-		9	35	8
	(% passage)	52	85	-		60	74	57

Recent studies conducted in spring 2023 and 2024, released fish downstream of Denny's Dam and focused on investigating the passage success of fish at the dam's fishway. This research aims to address an important gap in the understanding of how many fish from the migration run entering the Saugeen River can pass this partial downstream barrier and reach upstream tributaries to spawn. The studies were prompted by the observation that a significant number of newly tagged fish (e.g., 7 out of 13 fish detected fall 2021, 22 out of 49 fish detected spring 2022), and previously tagged fish returning from Lake Huron, remained downstream of Denny's Dam during the study period.

In spring 2023, 12 out of 18 tracked fish approached the fishway, but only 5 of these fish (42%) successfully passed upstream. In spring 2024, 11 of 12 tracked fish approached the fishway, with just 4 (36%) successfully passing upstream. Fish tagged in fall 2024 will also be released downstream of Denny's Dam to test the fishway's functionality for a different subset of the migration run – those entering the Saugeen River in the fall but not spawning until the spring. These fish may exhibit different motivations to pass the dam. Future studies will explore the differences in movement patterns and behaviours of river-resident Rainbow Trout and adfluvial Steelhead, as well as investigate whether fish that are spawned in upstream tributaries return to their original spawning beds as adults.

Fish Biomass – Measuring Changes in Fish Production

Bruce Power and Biotactic Inc. are collecting important data on all fish species in the study area. Each summer, fish are sampled using established electrofishing methods at the 22 designated sampling locations (Figures 2 and 5). For each fish, the species is identified, and its length and weight are recorded before being safely released back into the river. This data, along with information from four annual capture efficiency studies, is used to calculate the total fish biomass in the community. Changes in fish production will help assess the impact of the Truax Dam removal on the Saugeen River watershed and are credited to Bruce Power as an Offset under its *Fisheries Act* Authorization.



Figure 5 – Multi-pass zig-zag electrofishing within a blocked off section of a tributary (left) and set-up of a shoreline capture efficiency study within a section of the main-stem of the Saugeen River (centre). After sampling, each fish is identified, sorted, weighed and measured (right) before being released back into the monitoring site into the section from which they were captured.

A total of 64,358 fish have been collected so far: 12,323 in 2018, 8,146 in 2019, 8,713 in 2020 (after the Truax Dam was removed), 9,289 in 2021, 13,321 in 2022, and 12,566 in 2023. Additional sampling was conducted in 2024 and will continue until 2026. In 2018, before the dam was removed, only 583 salmonids were captured across 10 sites. This number increased to 806 fish across 15 sites in 2020 (the first year after the dam's removal) and reached 1,367 fish across 18 sites in 2023 (the fourth year post-removal). The amount of fish biomass and production have also increased throughout the Saugeen River system (Figure 6). Immediately after the dam removal, there was a significant increase in biomass within sites upstream of the dam footprint, specifically those previously within the impounded dam headpond. This growth has continued in the following years, with significant biomass increases now observed throughout the main-stem of the Saugeen River, from downstream of the former Truax Dam site upstream to Maple Hill Dam, as well as in Otter Creek. While the biomass increase further upstream in the South Saugeen River, Beatty Saugeen River, and Meux Creek sites is not yet significant overall, it is showing a positive trend across years.

In addition to electrofishing, full or partial habitat assessments are conducted at each site to evaluate the environmental conditions present during sampling and the type and quality of fish habitat available. This data is then correlated with the presence and abundance of fish to account for variations between years. Given the expected changes in river conditions upstream of the Truax Dam after its removal, complete assessments have been performed annually at sites immediately upstream and downstream of the dam footprint (Figure 1). Upstream, wetted width and water depth have decreased, while water velocity has increased, leading to the formation of riffle-pool sequences in the former dam headpond (Figure 7).

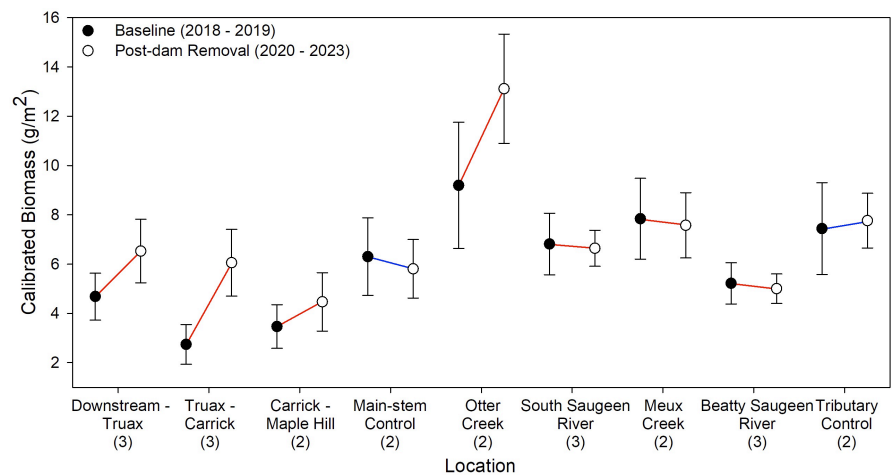


Figure 6 – Average calibrated fish biomass across sampled sites within the main-stem of the Saugeen River and upstream tributaries. Truax, Carrick and Maple Hill refer to the dams and numbers in brackets denote the number of sampled sites within each river segment (see Figure 2). Calibrated biomass is the amount of biomass captured from electrofishing surveys scaled by the percentage catch found within capture efficiency studies. Error bars are standard error.

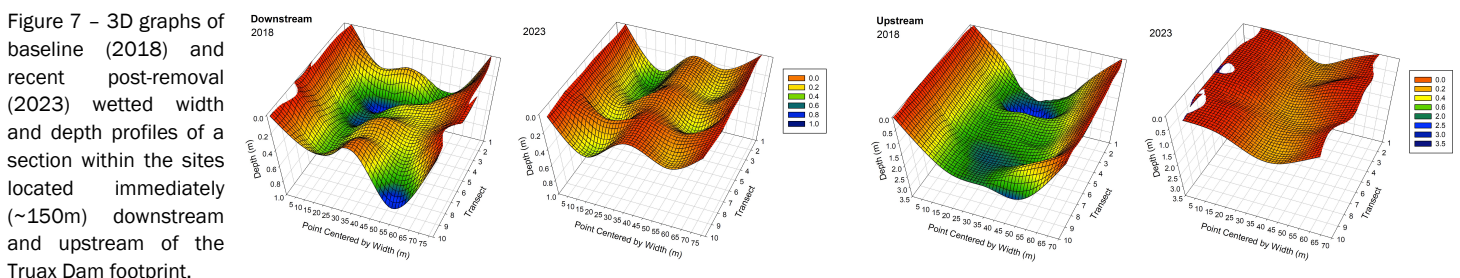


Figure 7 – 3D graphs of baseline (2018) and recent post-removal (2023) wetted width and depth profiles of a section within the sites located immediately (~150m) downstream and upstream of the Truax Dam footprint.

Underwater Video and Spawning Survey

Underwater solar-powered, motion-activated infrared cameras have been installed to monitor fish movement, activity, and condition during key periods in the spring and fall at Otter Creek and the Maple Hill Dam Denil fishway. Otter Creek was monitored from fall 2018 to spring 2022, with catch-per-unit-effort (CPUE) — the number of unique fish observed per hour — increasing by 1.5 to 6.4 times in the fall, and 1.1 to 2 times in the spring over this period. Monitoring at the Maple Hill Dam Denil fishway is on-going, with CPUE increasing by 5.6 to 12.8 times in the fall, and 1.1 to 2.5 times in the spring so far (Figure 8). The only decrease in CPUE post-removal compared to baseline occurred in spring 2023, where CPUE was 0.9 of the baseline. Additionally, limited monitoring at the Maple Hill Dam pool-and-weir fishway began in spring 2023, using a camera to track fish exiting upstream. Several adult Rainbow Trout were observed successfully passing upstream (full video of fish passage available on youtube: youtu.be/zgYfuCVzvIA).

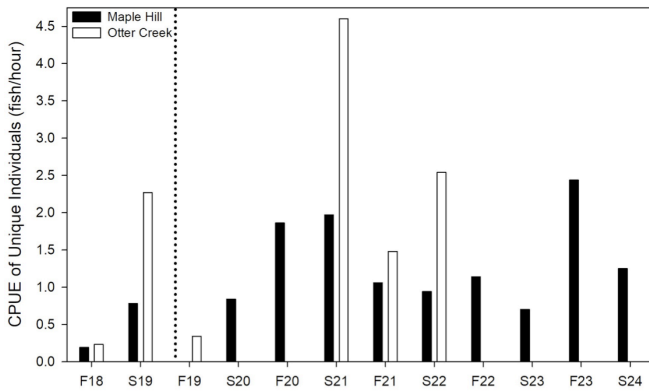


Figure 8 – Results from videographic surveys conducted in Otter Creek and at the Maple Hill Dam Denil fishway during baseline and post-dam removal monitoring (left and right of dotted line) and examples of adult Rainbow Trout observed passing upstream through the Maple Hill Dam pool-and-weir fishway.



Redd count surveys are conducted to measure the number of spawning Rainbow Trout in the spring and Chinook Salmon in the fall. These surveys are performed by scientists from Bruce Power and Biotactic Inc. on foot along Otter Creek, Meux Creek, and the Beatty Saugeen River. After the removal of the Truax Dam, newly created spawning habitats in the former dam headpond area of the Saugeen River are surveyed by drone. Since the dam removal, the number of Rainbow Trout redds in the Saugeen River and Otter Creek has increased by 2.1 to 7.2 times, while the number of Chinook Salmon redds has risen by 1.6 to 12.6 times between spring 2018 and 2024 (Figure 9). Although not perfectly correlated, the number of redds counted generally aligns with the number of juveniles captured in these areas during summer biomass sampling. Additionally, the timing of spawning has shifted earlier; the first count was conducted on May 1 in spring 2018 and April 24 in spring 2019 (baseline), but by spring 2023 it was conducted on April 12, and most recently, on March 13 in spring 2024. This shift could result in larger juveniles, and therefore increased biomass during summer electrofishing. Combined long-term monitoring data from radiotelemetry, electrofishing biomass surveys as well as videographic and redd count surveys are providing a comprehensive understanding of the impacts of the Truax Dam removal and the overall benefits to the Saugeen River fishery.

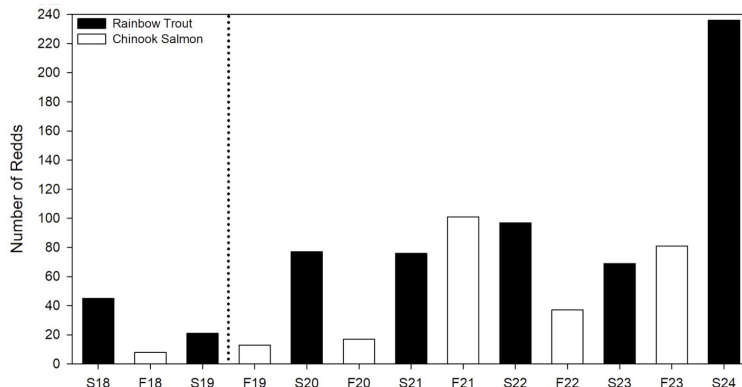


Figure 9 – Results from redd count surveys conducted in the Saugeen River and Otter Creek during baseline and post-dam removal monitoring (left and right of dotted line) and adult Rainbow Trout observed already on redds during a survey conducted March 13 2024 in Otter Creek.