



## Truax Dam Removal Monitoring on the Saugeen River - 2022 Update Report -

In a partnership between Bruce Power, the Lake Huron Fishing Club and the Municipality of Brockton, and with expert direction from GSS Engineering Consultants Ltd., the century-old Truax Dam in the town of Walkerton, ON was successfully removed in August 2019, thereby reducing safety concerns with the ageing structure and eliminating a major barrier to fish passage in the Saugeen River (Figure 1). Scientists from Bruce Power and Biotactic Inc. teamed up with support from Golder Associates to design a Before-After-Control-Impact (BACI) study to monitor the effects of the Truax Dam removal and to quantify the environmental benefits to the Saugeen River fishery. The monitoring performed to-date has included electrofishing surveys to measure changes in fish biomass and production, habitat assessments, redd surveys to monitor changes in fish spawning, and underwater video and radiotelemetry studies to track fish passage and movement.

Twenty-two sampling locations were established throughout the Saugeen River watershed (Figure 2). Two years of baseline data were collected in 2018 & 2019 before the dam was removed and post-dam removal monitoring began fall 2019. Currently on-going, several more years of monitoring are planned so that the long-term benefits of the dam removal can be quantified. Almost immediately after removal, sites within the former dam headpond re-established natural river flow and temperature regimes, providing additional spawning habitat and increasing fish diversity and biomass in the area. More easily able to pass the dam footprint, fish now have greater access to high-quality habitat upstream and spawning has increased within monitored tributaries. The following is a high-level summary of these data.



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 involves implanted transmitters and receivers that detect unique signals to individually track fish so that their migration patterns and behaviours can be analyzed. Biotactic Inc. specializes in performing these types of fish tracking studies and partnered with Bruce Power to better understand Rainbow Trout movement in the Saugeen River watershed as they migrate inland from Lake Huron each spring and fall, as well as the impacts of the removal of the Truax Dam on this movement. With help from Ontario Steelheaders and Lake Huron Fishing Club volunteers, 368 fish have been radio-tagged (additional fish will be tagged in spring 2023; Figure 3). Fish are tagged and released at Denny's Dam and their movement is tracked using stationary receivers installed near Denny's, Truax, Carrick and Maple Hill dams as well as by mobile methods including airplane, truck and by foot (Figure 4).





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

Figure 4 – A combination of fixed receiver stations and mobile methods are used to track fish movement each spring (March to June) and fall/winter (October to March).

The data collected have revealed unprecedented information on the timing, seasonality and degree of movement of fish throughout the watershed. Two runs enter the Saugeen River from Lake Huron each year, including spring fish that spawn in the same season and fall fish that over-winter in the river and are the first to reach spawning grounds in the spring. Once in the system, fish are now able to more easily pass the former dam footprint as well as dams further upstream (Table 1). For example, downstream delay at the footprint decreased by nearly 1 day in the spring, 35 days in the fall and 10 days for fall fish in the spring. Able to retain more of their energy reserves due to the reduced delay, passage at the footprint has increased by 1.4-fold, 4.7-fold and 1.3-fold, respectively for the three seasonal groups of fish. For fall fish, passage at Carrick Dam has also increased by 1.2-fold in the spring, with no fish able to pass pre-dam removal and 43% able to pass this dam and 80% able to pass Maple Hill Dam post-dam removal in the fall. In the spring, the time required by spring fish to travel from the Truax footprint to Maple Hill Dam has reduced by 42 hours and for fall fish by 233 hours. To-date 33 fish have been harvested with 20 captured downstream of Denny's Dam and tags reported from as far away as Wisconsin (one) and Michigan (four). Only 34 of the 368 (9%) tagged fish have returned to the Saugeen River in later years/seasons after having migrated back to Lake Huron. A separate detailed summary of all radiotelemetry data is available online at biotactic.com/migratory-patterns-of-rainbow-trout.

Table 1 – Radiotelemetry results collected in the spring and fall 2018-2022. Fifty adult Rainbow Trout were radio-tagged each season however no fish were tagged spring 2020 due to COVID-19 restrictions and 18 fish were tagged fall 2021 using tags returned from angler harvests. Abbreviations: S-spring, F-fall, T-Teeswater River, NS-North Saugeen River, DC-Deer Creek, OC-Otter Creek, H-Hanover Dam, MC-Meux Creek, BS-Beatty Saugeen River

Monitoring period		Spring		Fall		Spring		Fall
Fish tracking group		S'18 & S'19	F'18	F'18		S'21 & S'22	F'19, F'20, F'21	F'19, F'20, F'21
Sample size (n)	(# fish tagged or remaining)	100	47	50	TRUAX DAM REMOVED	100	111	118
Sample size (n)	(# relocated)	87	40	43		96	89	101
Denny's Dam	(# not migrating upstream)	22	6	4		31	15	39
Truax Dam	(# arrived at Truax)	55	29	17		45	42	33
	(# passed upstream)	34	21	3		39	38	28
	(% passage)	62	72	18		87	91	85
	(average delay, hrs)	26.7	232.5	894		4.9	1.1	63.2
Carrick Dam	(# arrived at Carrick)	34	21	2		39	55	28
	(# passed upstream)	31	16	0		26	51	12
	(% passage)	91	76	0		67	93	43
Maple Hill Dam	(# arrived at Maple Hill)	25	13	-		15	45	10
	(# passed upstream)	13	11	-		9	34	8
	(% passage)	52	85	-		60	76	80
Tributaries	(# relocated)	T-2, OC-6, H-1, BS-3	OC-2, MC-1, BS-3	-		DC-1, NH-1, OC-5, H-1	DC-1, OC-8, BS-11	T-1, OC-4, BS-1

## Fish Biomass - measuring changes in fish production

Using established multi-pass electrofishing methods, Bruce Power and Biotactic Inc. are collecting key information about all fish species inhabiting the study area (Figure 5). Fish are sampled each summer at each of the 22 sampling locations and identified. Each one has its length and weight recorded and is then returned safely to the river. This information is used to calculate the total fish biomass present in the fish community. Changes in fish production will be used to assess the impact of the Truax Dam removal on the Saugeen River watershed. The net gain in fish biomass is being credited to Bruce Power as an Offset within its *Fisheries Act* Authorization.



Figure 5 – Electrofishing and fish processing crews conducting biomass sampling (left) and examples of the 47 species that have been identified across the sampling locations (right).

A total of 51792 fish have been collected - 12323 fish in 2018, 8146 in 2019, 8713 in 2020 after the Truax Dam was removed, 9289 in 2021 and 13321 in 2022 (Figure 5). While the relative abundance of species within sites changes slightly from year to year, the number of Salmonids captured and their distribution across sites has increased dramatically since the dam was removed, likely due to the increased ability of migrating Rainbow Trout and Chinook Salmon to access high quality spawning habitat upstream of the footprint (Figure 6). Only 583 Salmonids across 10 sites were captured in 2018 (pre-dam removal), increasing to 806 fish across 15 sites in 2020 (year 1 post-removal) and most recently increasing to 1727 fish across 18 sites in 2022. The amount of fish biomass and fish production found throughout the Saugeen River system has also increased as a result of the Truax Dam removal. A significant increase had already occurred in sites immediately upstream of the dam footprint, which were those previously within the impounded dam headpond, immediately after dam removal. These significant increases extended to two additional upstream main-stem sites by year 2 in 2021. Most recently, after year 3 post-removal sampling in the summer of 2022, significant increases in biomass were found across the main-stem of the Saugeen River, both downstream and upstream of the Truax footprint, as well as within Otter Creek (Table 2). Sites located further upstream within the Beatty Saugeen River and Meux Creek are expected to produce significant increases in the coming years. An additional 2801kg of fish biomass and 2436kg/year of fish production has resulted within the watershed due to the removal of the Truax Dam.



Table 2 & Figure 6 – Community composition and fish biomass  $(g/m^2)$  within Saugeen River main-stem and Otter Creek sites in baseline 2018 and postremoval 2022 (pie chart row 1 & 2 respectively). Increase is the fold increase in biomass and numbers in pie charts are the number of Salmonids captured.

## **Underwater Video & Spawning Surveys**

Underwater solar-powered motion-activated infrared cameras were installed to monitor fish movement, activity and health at key times in the spring and fall at Otter Creek and the Maple Hill Dam Denil fishway. To-date the catch-per-unit-effort in the number of unique fish (fish/hour) identified at these locations has increased by 1.5 to 6.4-fold in the fall, and 1.1 to 2-fold in the spring at Otter Creek and by 5.6 to 9.8-fold in the fall, and 1.1 to 2.5-fold in the spring at the Maple Hill Dam fishway, from 2019 to 2022 after removal of the Truax Dam (Figure 7). Adult Chinook Salmon as well as adult and smolt Rainbow Trout have been observed passing upstream and downstream through the fishway (Figure 9). Adult Chinook Salmon and adult and juvenile Rainbow Trout are also regularly observed in Otter Creek with additional Salmonidae, Catostomidae, Cyprinidae and Percidae species also recorded using the tributary in the spring. In addition to videographic surveys, redd count surveys are also conducted to quantify the number of spawning Rainbow Trout in the spring and Chinook Salmon in the fall. Surveys are performed by both Bruce Power and Biotactic Inc. scientists at locations in Otter Creek, Meux Creek and the Beatty Saugeen River by foot, and post-Truax Dam removal within newly created spawning habitat in the Saugeen River within the former dam headpond by drone. To-date within just the Saugeen River and Otter Creek, the number of Rainbow Trout redds has increased by 2.3 to 2.9-fold and Chinook Salmon redds by 1.6 to 12.6-fold from 2019 to 2022 after the removal of the Truax Dam (Figure 8). The increased number of redds found in fall 2021 and spring 2022 translated into additional juveniles captured in these areas during summer 2022 biomass sampling, with 1191 Rainbow Trout and 43 Chinook Salmon captured, compared to 641 and 2, respectively, in 2021. 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 8 – Results from spawning surveys conducted in the Saugeen River and Otter Creek during baseline and post-dam removal monitoring (left and right of dotted line). Number of redds is the combined total.



Figure 9 – One of five adult Chinook Salmon observed passing upstream through the exit of the Maple Hill Dam fishway on October 14 to 16, 2022 (left); Chinook Salmon redds and fish observed October 5, 2021 during a drone redd count survey conducted upstream of the removed Truax Dam (right).