



Boardman River at Brown Bridge 2019 Fisheries Survey
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Introduction:

The Boardman River is a 26-mile-long river that flows through Kalkaska and Grand Traverse Counties in the northwestern lower peninsula of Michigan. The Boardman River and its tributaries encompass a drainage area of approximately 186,000 acres, or 287 square miles (Kalish et al., 2018). It originates from tributaries in the Mahan swamp near Kalkaska in central Kalkaska County. The Boardman River then flows generally west and then north until it empties into West Grand Traverse Bay of Lake Michigan in downtown Traverse City. Over the course of the last decade the Boardman River has seen several major dams removed. The Brown Bridge Dam was removed in 2012, the Boardman Dam was removed in 2017, and the Sabin Dam was removed in 2018, leaving the Union Street Dam as the only dam still in place on the Boardman River. Migratory fish from Lake Michigan have access to only approximately 1.5 miles of river in the lower watershed, up to Union Street Dam where fish passage has been blocked until the completion of the FishPass facility designed to replace Union Street Dam. The combined removal and modification of these dams will reconnect over 160 miles of free-flowing, cold-water stream and restore hundreds of acres of wetlands and upland habitat. It is one of the most comprehensive dam removal and restoration projects in Michigan's history.

The removal of the Brown Bridge Dam began in the summer of 2012. The water level in Brown Bridge Pond was drawn down through the former dam infrastructure until the water level was equal with that of the concrete sills. To further the dam removal process, a final drawdown of Brown Bridge Pond was needed to drop the water level down to a point which would allow for deconstruction of the dam itself. This drawdown was planned and approved at a maximum rate of 12-inches per day, through a device that is known as a temporary dewatering structure. On the day that the final drawdown was initiated, the Brown Bridge Pond water level was approximately 20 feet higher than the water level of the Boardman River just downstream of the dam. Final drawdown was planned to reduce the pond water level to approximately 2 feet higher than the Boardman River water level over the course of 18-20 days. On October 6 of 2012, the temporary dewatering structure was opened to allow water into the structure. Within an hour of the temporary dewatering structure being engaged, a large sinkhole had formed adjacent to the structure and water was draining from Brown Bridge Pond at an uncontrolled rate. Within 9 hours the breach was under control and the flow of water below the dam structure returned to a normal level. This abrupt release of water resulted in stream bank erosion, increased downstream movement of sediment, increased turbidity, and a loss of fish in the river downstream.

The removal of the Boardman Dam was completed in the fall of 2017. The deconstruction of this facility has proceeded as planned. Because the relic stream channel is on the opposing side of the powerhouse only the earthen embankment was to be breached. This allowed for the stream



channel to be reconstructed and sediment transport minimized while the earthen embankment was breached gradually. By dewatering the pond first, the powerhouse structure could be demolished and removed under dry conditions. The dam infrastructure was removed in the summer of 2017, while final site stabilization was started in the fall of 2017 and completed in the fall of 2018. In-stream habitat installation and floodplain vegetative plantings at the site are on-going.

The removal of Sabin Dam was completed in the fall of 2018. This dam removal involved three parts: breach and remove the dam and its earthen embankment after drawing down Sabin Pond; demolish and remove the powerhouse, intake works and existing spillway; and restore the river channel beginning 3,500 feet upstream to 500 feet downstream of the dam. The powerhouse was removed in August of 2018, and work continued through December of 2018 to remove infrastructure and begin instream habitat work. Large woody debris installations, native tree and grass plantings, and shoreline stabilization projects are on-going at all three dam removal locations.

From the site of the former Sabin Dam upstream, (including this sampling site at Brown Bridge Road) the Boardman River is a state-designated Natural River. The Boardman has historically been known as one of Michigan's better trout streams, and over half of the tributaries in the watershed flow through lands in public ownership (Boardman River Natural River Plan 1976).

The Boardman River at Brown Bridge Road is currently managed as a Type 1 Trout Stream. The daily possession limit for Type 1 streams is 5 fish, with no more than three fish 15 inches or larger. The minimum size limit for Brook Trout is seven inches, for Brown Trout it is eight inches, and for Rainbow Trout is ten inches. In Type 1 streams the fishing and possession season is from the last Saturday in April until September 30.

The Brown Bridge Road crossing on the Boardman River is located approximately 18 miles upstream of Lake Michigan (Figure 1). The station is located less than a mile downstream from the former location of the Brown Bridge Dam. Canoe access at this site can be found near the former dam site, within the Brown Bridge Quiet Area, which is managed by Grand Traverse County.

Methods & Materials:

In 1985, a number of index stations for fisheries surveys were established on the Boardman River. One of those stations was directly downstream of Brown Bridge Road. Fisheries surveys have been conducted at the Brown Bridge Road station in 1985-1987, 1994, 2005, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018, and now 2019. Historical survey information and proximity to the Brown Bridge Dam location make this survey station ideal. Results from surveys prior to 2012 can be compared to current results to measure change from both the dam removal process and changes in the fisheries as the stream recovers.



On July 17th and 18th, 2019 the Brown Bridge Road crossing was again sampled by MDNR Fisheries personnel. This survey was conducted using a three-probe barge electrofishing unit. The parameters of the station surveyed are from Brown Bridge Road, 1,000 feet downstream to a large private dock. This was a two-pass depletion survey where only trout species were collected in order to calculate population estimates measuring trout density.

Results:

Table 1 contains the data collected during the 2019 survey. Table 2 contains the population estimates for Brook Trout and Brown Trout from 1985 to 2019.

Table 3 contains Brown Trout age and growth information from this survey. Age and growth indices were determined by analyzing scale samples collected from 47 Brook Trout and 76 Brown Trout.

Discussion:

MDNR Fisheries Division has conducted population estimates in the Brown Bridge stretch of river in 1985, 1986, 1987, 1994, 2005, 2010, 2013, 2014, 2015, 2016, and now 2019. (Table 2). The surveys were conducted in accordance with Fisheries Division's Status and Trends sampling protocol (Wills et. al. 2011). Fisheries Division used a three-probe barge electroshocking unit to assess the fishery within a fixed 1,000-foot station in all sample years. The most significant changes detected in the surveys are when results from pre- and post-dam removal are compared (2010, 2013, 2014, 2015, 2016, and 2019). Based on the 2010 population estimate, 6 Brook Trout were estimated to inhabit the 1,000-foot reach of stream, while the 2019 survey estimated 184 Brook Trout. This results in a 2,967% increase in Brook Trout abundance from 2010 to 2019. The dramatic shift in the numbers of Brook Trout is most likely attributed to the change in water temperatures that occurred following the removal of Brown Bridge Dam. Water temperature downstream of the dam was typically 4-7°F warmer than water temperatures above the dam. After dam removal water temperature cooled significantly with temperatures, in what was once the stretch below the dam, now 1-3°F colder than temperature found above the dam historically (Rouse and Largent 2013). Conversely based on the 2010 population estimate 344 Brown Trout were estimated to inhabit the 1,000-foot stream reach, while the 2019 survey estimated 250 Brown Trout. This results in a 27.35% decrease in Brown Trout abundance from 2010 to 2019. Additionally, the pounds per acre of Brown Trout collected in the 2019 survey decreased from the 2010 survey by 73.4%, while the pounds per acre of Brook Trout collected in the 2019 survey went up 713% over what was collected in 2010. Some of this loss may be attributed to the increase in Brook Trout density, as studies have shown that juvenile Brook Trout of an equal size may out-compete juvenile Brown Trout (Fausch and White 1986). Given the changes in water temperature, this stretch of river may now be better suited to Brook Trout than Brown Trout.

In general, there continues to be a more balanced trout community in the Brown Bridge stretch of the Boardman River as of 2019. The community is comprised of nearly half Brook Trout and



half Brown Trout, though it now seems to go back and forth depending on the year. For instance, in 2016 it was an even split while in 2017 there were more Brook Trout present than Brown Trout. In the 2019 survey, results showed more Brown Trout than Brook Trout, however the total number of Brook Trout collected is still much higher than the number of Brook Trout collected before Brown Bridge Dam was removed. This would be considered natural variability and the overall numbers appear to be stabilizing and/or increasing as this section of river continues to respond to the dam removal.

Recommendations:

1. The Boardman River is a cold-water trout stream that supports self-sustaining Brook Trout and Brown Trout populations. Therefore, it should be protected from uncontrolled development and land-use practices by working with the Department of Environment, Great Lakes and Energy to evaluate and comment on permit applications.
2. The established Brown Bridge station should continue to be surveyed annually or every other year to monitor how the fish population responds to the removal of Brown Bridge Dam, Boardman Dam and Sabin Dam and the reestablished connectivity within the watershed.
3. Continue to work with the Grand Traverse Conservation District to protect and enhance the in-stream and riparian habitat found in this river stretch.
4. Passing migratory fish above the Union Street Dam should be considered when the FishPass project begin the optimization phase. Many Lake Michigan species have been denied access to the upper Boardman River for decades and should be allowed to fulfill their life cycle as well as provide for additional nutrient, diversity, and angling opportunities in the watershed.

References:

Boardman River Natural River Plan. 1976.
http://www.michigan.gov/documents/Boardman_River_Plan_23122_7.pdf. Michigan Department of Natural Resources.

Fausch, K. D. and R. J. White. 1986. Competition among Juveniles of Coho Salmon, Brook Trout, and Brown Trout in a Laboratory Stream, and Implications for Great Lakes Tributaries. Transactions of the American Fisheries Society. Volume 115, Issue 3.



Kalish, T. G., M. A. Tonello, and H.L. Hettinger. 2018. Boardman River Assessment. Michigan Department of Natural Resources Fisheries Report 31, Lansing.

Rouse, S. and S. Largent. 2013. Boardman River Temperature Study, Brown Bridge Dam Removal. Grand Traverse Conservation District Report.

Wills, T. C., T. G. Zorn, A. J. Nuhfer, and D. M. Infante. 2011 Draft. Stream Status and Trends Program sampling protocols. Chapter 26 in Manual of fisheries survey methods. Michigan Department of Natural Resources, Fisheries internal document, Ann Arbor.



Figure 1. Location of the Brown Bridge Road fisheries surveys on the Boardman River.

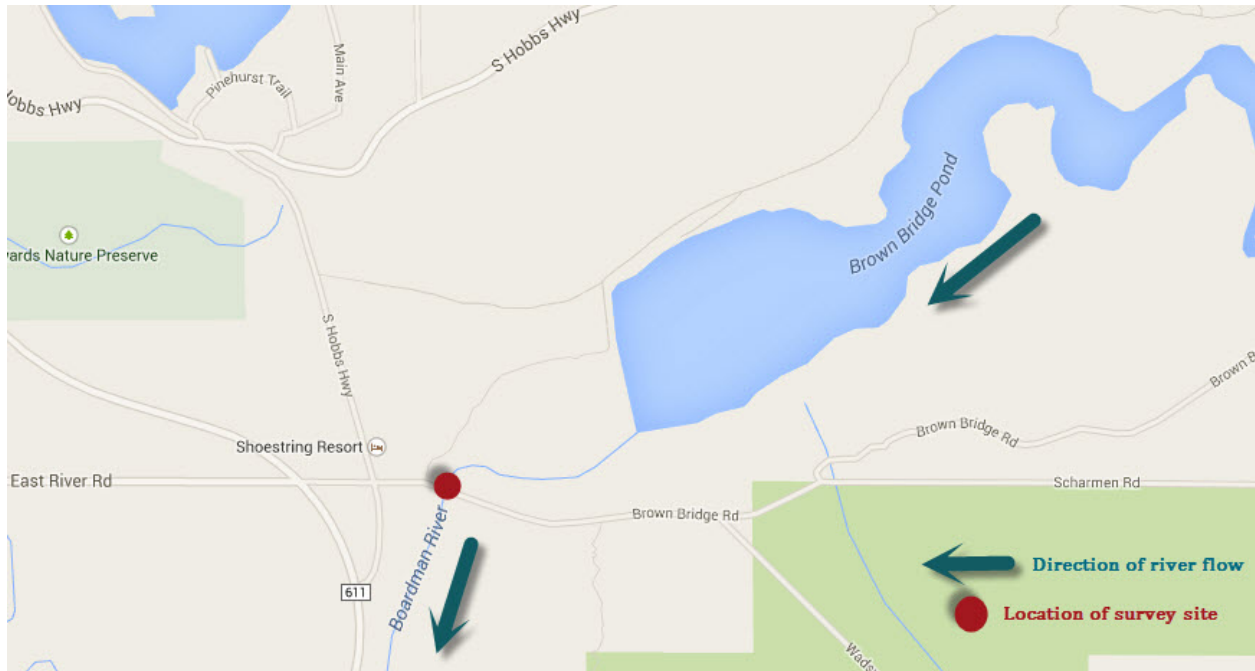


Table 1. Species observed during the July 17th and 18th, 2019 Boardman River electrofishing survey at Brown Bridge Road.

Species	Number Collected	Percent by Number	Weight (lb.)	Percent by Weight	Length Range	Percent Legal Size
Brook Trout	245	46.0	6.0	18.2	1-9	1.0
Brown Trout	288	54.0	27.2	81.8	1-17	11.0
Totals	533		33.2			



Table 2. Population estimates for Brown Trout and Brook Trout at the Brown Bridge station on the Boardman River.

Year	BNT		BKT	
	#/acre	lbs/acre	#/acre	lbs/acre
1985	171	59.76	10	1.07
1986	71	28.55	6	0.5
1987	259	37.94	13	1.2
1994	232	45.1	14	1.4
2005	246	30.31	12	0.15
2010	344	59.03	6	0.6
2012	**	**	**	**
2013	50	8.8	58	0.71
2014	70	8.7	28	2.82
2015	126	12.43	140	5.61
2016	174	25.27	173	7.68
2017	**	**	**	**
2018	**	**	**	**
2019	250	15.7	184	4.88

Station length: 1,000 feet

Station area: 1.45 acres

** Site was surveyed this year, but the survey was not a population estimate.



Table 3. Ages of Brook and Brown Trout sampled during the July 17th and 18th, 2019 Boardman River electrofishing survey at Brown Bridge Road.

Species		Number Aged	Length Range	State Ave. Length	Weighted Mean Length	Mean Growth Index*
Brook Trout						+ 0.5
	Age 0	22	1.7-3.5	2.30	2.79	
	Age 1	23	4.5-6.7	5.30	5.72	
	Age 2	2	8.0-9.2	8.10	8.60	
Brown Trout						+ 0.4
	Age 0	22	1.8-3.4	2.50	2.87	
	Age 1	29	4.6-8.0	5.80	6.10	
	Age 2	19	7.5-11.8	8.80	9.31	
	Age 3	3	12.2-12.7	11.80	12.47	
	Age 4	2	15.6-16.5	14.80	16.05	
	Age 5	1	17.00	17.80	17.00	

*Mean growth index is the average deviation from the state average length at age.