North Branch Au Sable River
Otsego and Crawford counties
Au Sable River Watershed, last surveyed 2019

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Environment

The North Branch Au Sable River (NBASR) originates as the outflow of Otsego Lake, south of Gaylord in Otsego County (Figure 1). The river flows in a south/southeasterly direction until its confluence with the mainstem Au Sable River south of the village of Lovells in Crawford County. Big Creek is the major tributary to this river and joins the North Branch just upstream of where it meets the mainstem. The North Branch Au Sable River has a catchment area of 167,457 acres or about 262 square miles. The dominant (96%) surficial geology type in this watershed is coarse textured ice contact/outwash material which helps supply groundwater to this stream. The watershed is primarily forested, with grass/shrubs, wetland, urban, water, and agriculture making up the remainder of the land cover types. Mean July temperature at Dam 4 was 66.4°F in 2018.

There are two different regulations on the North Branch: upstream of Sheep Ranch, it is a Type 1 Trout Stream, while it is a Gear-Restricted Trout Stream from Sheep Ranch downstream to the confluence with the mainstem Au Sable River. Sheep Ranch is an access site located approximately 0.5 mile north of the Twin Bridge Road crossing of the NBASR. The regulations for this gear-restricted stretch are as follows: the fishing season is open all year, but the possession season is from the last Saturday in April to September 30 for Brook Trout and Brown Trout; tackle is artificial flies only; the daily possession limit is 2 trout with no more than 1 trout 18" or greater; and the minimum size limit is 10" for Brook Trout and 18" for Brown Trout.

The NBASR is a wide river that is fairly shallow and easy to wade in most areas. At the Dam 4 status and trends site, the average width in September 2018 was approximately 167 feet and average depth was just over one foot. There are abundant public access opportunities on the North Branch Au Sable; thirteen public access locations for this waterbody are described in the Trout Trails application at www.michigan.gov/trouttrails. Recent surveys that are the focus of this report were conducted at Twin Bridges, which is just upstream of Lovells; Eamans Landing, which is just downstream of Lovells; and at Dam 4, which is approximately 4 miles downstream of Lovells (Figure 1).

History

The Au Sable River is a sand-dominated river and watershed as evidenced by its name, which means "river of sand." The river was called Riviere aux Sable, Sandy, Sand, and others, but the French name Au Sable was chosen by map makers by the early 1800s (Linsenman 1988).

The North Branch Au Sable River watershed was logged starting in 1870. Several dams were constructed on the NBASR to float logs downstream, and remnants of Dam 2 in Otsego County and Dam 4 downstream of Lovells in Crawford County are still evident today. This series of dams on the North Branch created 30 miles of slack/ponded water for log drives (Vincent 1962). The last log drive on the North Branch Au Sable River occurred around 1906 (Miller 1963). This logging activity not

only cleared trees from the watershed, but also negatively affected instream fish habitat. Woody material which provided cover for fish was removed to make it easier to move logs downstream, and major log drives eroded banks, and scoured the river bottom.

The fish community of the Au Sable River watershed, including the NBASR, was historically dominated by Arctic Grayling (Vincent 1962). The Au Sable River and NBASR were popular destinations to fish for Grayling, with anglers traveling from Chicago, Indianapolis, Buffalo, and other cities to target this species (Zorn and Sendek 2001). Grayling were easy to catch, with most anglers harvesting high numbers. Recreational harvest coupled with a commercial fishery that shipped to major markets led to over-exploitation which likely played a role in the elimination of Grayling from the watershed by the early 1900s. Other factors contributing to the extirpation of Grayling from the NBASR include decreased water quality as a result of logging, sedimentation, and forest fires; and competition from Brook Trout and Brown Trout (Vincent 1962, Zorn and Sendek 2001). The North Branch Au Sable is now widely recognized as a Brook Trout stream (Gates 2007).

The North Branch Au Sable River has a long history of quality fishing regulations and had the first flies-only gear restricted regulation in the state, enacted in 1907 (Clark et al. 1981). It has traditionally been managed as a Brook Trout stream.

We are fortunate to have long-term fisheries data sets for the NBASR. The river has been regularly surveyed by Fisheries Division at several sites since 1957. Data for three of these sites are presented in this report: Twin Bridge (Figures 2-5), Eamans Landing (Figures 6-9), and Dam 4 (Tables 1-3, Figures 10-13). The data presented here go back to 1985, representing the modern fishery over the last three and a half decades. Prior to 1985 the river generally supported higher trout abundance. Data prior to 1985 are available for the Dam 4 site online at www.mcgi.state.mi.us/fishpop/.

A number of trout research studies have also been carried out on the Au Sable River. These surveys include examining the effects of gear restriction regulations (Cooper 1952) and the effects of predators on trout populations (Alexander 1979, Alexander and Shetter 1962, and Shetter and Alexander 1969).

In May 2018, a number of anglers including professional fishing guides contacted the DNR to report an alarmingly low number of fish in the North Branch Au Sable River. Of particular note were reports of the virtual absence of Brook Trout and only a few larger Brown Trout observed by these anglers, even in stretches of the river that typically produce large catches or high catch rates. In response to these reports, NLHMU personnel, with the assistance of some guides and volunteers, did some brief "spot check" surveys of the trout populations at six locations on the river: Dam 4, Twin Bridge, Morley Road, Kellogg Bridge, Sheep Pasture, and the Black Hole. Much lower densities of trout were encountered than would normally be expected.

Additionally, Department of Environmental Quality (DEQ, now Department of Energy, Great Lakes, and Environment - EGLE) staff conducted three Procedure 51 habitat and macroinvertebrate surveys in mid-June, and all three sites scored excellent for both habitat and macroinvertebrates (Turek 2019). DEQ did water chemistry testing as well and found nothing at levels of concern. Fisheries Division collected Brook Trout for disease testing, and results showed nothing that would have caused the decline in trout abundance. United States Geological Survey and Mason Griffith Founders Chapter of Trout Unlimited deployed sampling devices in the river to look for organic contaminants. Analysis of

the samples found detectable levels of a number of organic compounds, including eight legacy pesticides, and three current-use pesticides, among others. Although these chemicals were detected, they were all at very low concentrations, and a comparison to levels of concern or concentrations in other rivers was not provided.

NLHMU did trout population estimate surveys at three locations (Twin Bridges, Eamans, Dam 4) on the river in August/September of 2018 (Figure 1). Population data are presented in Figures 2-7. The results from 2018 are summarized as follows:

- At Twin Bridge Brook Trout density and biomass were at the lowest recorded level in the past 30 years. Brown Trout density and biomass levels were similar to the past two years.
- At Eaman's Landing Brook Trout density was around the long-term average and biomass was similar to the past two years (but low compared with the long-term average).
- At Dam 4 Brook Trout density was well below average and biomass was at its lowest recorded level in the last 30 years. Brown Trout density was about average, but the biomass was well below average.

Current Status

The North Branch Au Sable River at Dam 4 was surveyed in 2019. This station is a 1,280-foot fixed site in the Status and Trends sampling design. It was historically surveyed on an annual basis from 1957-1967, and 1972-2001. With the Status and Trends protocols, the reach is surveyed on a 3-year rotational basis (3 years on, 3 years off). Trout population data here are presented for the period from 1985-2019. The most recent survey at this location was in 2019 which was year three of the three-year Status and Trends fixed site rotation. Brook Trout and Brown Trout population estimate data for Dam 4 are presented in Tables 1 and 2, and Figures 10-13. Brook Trout density (number per acre) was slightly lower than in 2018, and again was one of the lowest since 1985. Brook Trout biomass was up slightly from 2018 but remains well below long-term average. Brown Trout density was slightly above long-term average, but Brown Trout biomass was well below the long-term average. Although these numbers are low and of concern, low Brook Trout abundance in the North Branch Au Sable has occurred previously. In 2019, Brook Trout density was 715 per acre, but was lower in 1989 (617/acre), 1986 (706/acre), and 1977 (566/acre).

Analysis and Discussion

Anglers have reported declining trout populations in the North Branch for decades, but the dramatic decline in trout abundance observed in 2018 remains a mystery. Burroughs (2019) posited the decline could be attributed to either a long-term trend or a short-term, acute incident. Numerous hypotheses have been proposed to explain the decline, ranging from the realm of conspiracy theories to more reasonable speculations.

Predators. Predators, including fish, birds, or mammals, can consume large amounts of trout. Over the winter of 1961-62, Alexander and Shetter (1962) estimated that 14 mergansers consumed approximately 1500 pounds of trout in less than 20 miles of the North Branch Au Sable. Dolloff (1993) found that two river otters and their two young consumed at least 3300 juvenile salmonids during a 6-week period in an Alaskan stream. Shetter and Alexander (1969) found, however, that removal of large Brown Trout and mergansers from a section of the North Branch did not result in a significant change to catch rates or abundance of Brown Trout. These studies show that predation by

Brown Trout, mergansers, and river otters can be substantial. It is unlikely, however, to have been the sole cause of the dramatic decline in trout abundance experienced in 2018, since Brown Trout numbers were down and there were no reports of unusually abundant mergansers or otters.

Chemical dumping. There was some speculation that perhaps someone had illegally dumped chemicals in the river which killed all the fish. This suggestion can be discarded for a number of reasons: there were no reports of a large die-off of fish; all sites surveyed by EGLE scored Excellent for macroinvertebrates, and had a high number of intolerant taxa indicating excellent water quality (Turek 2019); and non-game fish did not seem to be affected..

Disease. To determine if disease may have caused the population decline, a number of Brook Trout were collected from the NBASR in September 2018 and transported live to the Michigan State University Aquatic Animal Health Laboratory for disease testing. Overall, the test results indicate that pathogens did not appear to be a key factor in the changes to the trout population in North Branch Au Sable River in 2018 (G. Whelan, DNR Fisheries Division, personal communication).

Organic contaminants/pesticides. Another hypothesis for the decline in trout populations was the use of pesticides on lawns and golf courses in the watershed, especially those used to reduce tick populations. Since the decline in the trout population happened after September 2017 but before May 2018, the event would have occurred during that time period. We contacted some golf courses in the watershed, and none had applied chemicals during that time frame nor did they use any pesticides targeting ticks.

The United State Geological Survey, Lovells Township, and Mason Griffith Founders Chapter of Trout Unlimited teamed up to monitor the river for organic contaminants, including legacy and current use pesticides, among other parameters. They deployed passive sampling devices at four locations throughout the North Branch Au Sable River for 28 days, starting in June 2018. Results show that a number of organic contaminants were detected above the laboratory method quantification limit (MQL), including: 8 legacy pesticides/herbicides, 1 PBDE analyte, 9 PAHs, and 3 current-use pesticides (Brennan and Alvarez 2020). Although these were found to be above laboratory MQL, they were all at very low levels. Since this type of sampling is relatively new, the measured levels can be used for future comparisons as more waters are tested.

Winter severity. Cold water temperatures and anchor ice can cause trout mortality, particularly for eggs and juvenile salmonids. Although the winter of 2017-18 was cold, it did not appear to be any more severe than other winters in recent history. Year-round temperature monitoring will help evaluate this concern in the future.

Long-term decline. Lower survival rates of juvenile trout indicate there may be a bottleneck for younger age groups. Although decent numbers of age-0 trout are being produced, they are not surviving to older ages. Nuhfer (personal communication) showed that percent survival of age-0 Brown Trout to age-1 went from 33% in 2005-2006, to 13% in 2017-2018. Similar declines in survival are apparent for other age groups as well, including from age-1 to age-2, age-2 to age-3, and age-3 to age-4. Nuhfer postulated that the North Branch Au Sable trout population slumps seem to be largely driven by generally lower survival rates for younger Brown Trout in recent decades.

Lack of food.
River users have reported that insect hatches have not been as prolific in recent years as they were historically, which led to the suggestion that perhaps there wasn't enough food anymore to support robust trout populations in the river. EGLE Procedure 51 macroinvertebrate surveys indicate a healthy, diverse insect population as discussed above. Since the P51 surveys are only semi-quantitative, the local groups (MGFTU, Anglers of the Au Sable), contracted with Mark Luttenton of Grand Valley State University to quantify the insect population. This study will estimate invertebrate population numbers and biomass. Since the P51 surveys found good numbers of sensitive taxa, and the trout that were captured during surveys looked healthy, it is unlikely that lack of food drove the population decline.

Flows.
The North Branch Au Sable River is a groundwater driven trout stream, and as such, maintains a notably stable flow regime. The Fall 2017 to Spring 2018 time period, however, saw heavy precipitation in the form of spring and fall rain events, as well as heavy snow over winter. Flows were higher over this time period than many could remember; in fact, several riparian property owners indicated that the river had flooded (gone over its banks) several times during that period, which is very unusual for the typically stable river. High flows were likely the most important contributor to the trout population decline.

Although we lacked data to conclusively determine the cause of the 2018 decline in trout populations, additional monitoring procedures are being implemented to improve data collection to ensure we have ample data for future analyses.

Management Direction

1. Gage relative desire of anglers for Brook Trout or Brown Trout in the North Branch Au Sable River and manage accordingly.
2. Install one or more stream flow gages on the North Branch Au Sable River.
3. Continue to investigate factors influencing population fluctuations in the NBASR.
4. Continue monitoring the NBASR at Dam 4 as a fixed site in the Status and Trends survey program.

References

Alexander, G.R. 1979. Predators of fish in coldwater streams. In Predator-prey systems in fisheries management.

Alexander, G. R., and D.S. Shetter. 1962. Trout populations and predator studies, North Branch Au Sable River, 1960-1962. Michigan Department of Natural Resources IFR Report No. 1652. Ann Arbor, Michigan.

Brennan, A.K., and D.A. Alvarez. 2020. Evaluation of legacy and emerging organice chemicals using passive sampling devices on the North Branch Au Sable River near Lovells, Michigan, June 208: U.S. Geological Survey Scientific Investigations Report 2020-5002, 21 p., https://doi.org/ 10.3133/ sir20205002.

Burroughs, B. 2019. Understanding the North Branch Au Sable trout loss. Michigan Trout, Summer 2019, pp 10-11, 25.

Challenge Chapter Trout Unlimited. Trout angler's guide to the Au Sable River. Challenge Chapter Trout Unlimited, Bloomfield Hills, Michigan.

Clark, R.D. Jr., G. R. Alexander, and H. Gowing. 1981. A history and evaluation of regulations for brook and brown trout in Michigan streams. North American Journal of Fisheries Management 1(1).

Cooper, E. L. 1952. North Branch Story. Michigan Conservation, March-April 1952, p. 8-11.

Dolloff, C.A. 1993. Predation by river otters (Lutra canadensis) on juvenile coho salmon (Oncorhynchus kisutch) and Dolly Varden (Salvelinus malma) in Southeast Alaska. Can. J. Fish. Aquat. Sci. 50: 312-315.

Gates, R. 2007. Seasons on the Au Sable. Sports Media Group. Ann Arbor.

Greenberg, J. 2014. Rivers of sand: fly fishing Michigan and the Great Lakes region. Lyons Press. Guilford, Connecticut.

Linsenman, B. Au Sable River. 1998. River Journal, Volume 5, Number 3. Frank Amato Publications, Portland, Oregon.

Miller, H.L. 1963. The Old Au Sable. William B. Eerdmans Publishing Co., Grand Rapids, Michigan.

Shetter, D.S., and G.R. Alexander. 1969. Results of predator reduction on brook trout and brown trout in 4.2 miles of the North Branch of the Au Sable River. Michigan Department of Natural Resources Research and Development Report No. 165.

Turek, K. 2019. Biological survey of selected stations in the Au Sable River and Black River watersheds in Otsego, Alpena, Crawford, Oscoda, and Alcona Counties, Michigan, June-August 2017 and June-December 2018. Michigan Department of Environment, Great Lakes, and energy, Water Resources Division, Staff Report MI/ELGE/WRD-19/007.

Vincent, R.E. 1962. Biogeographical and ecological factors contributing to the decline of Arctic grayling, Thymallus arcticus Pallus, in Michigan and Montana. Doctoral dissertation. University of Michigan, Ann Arbor, Michigan.

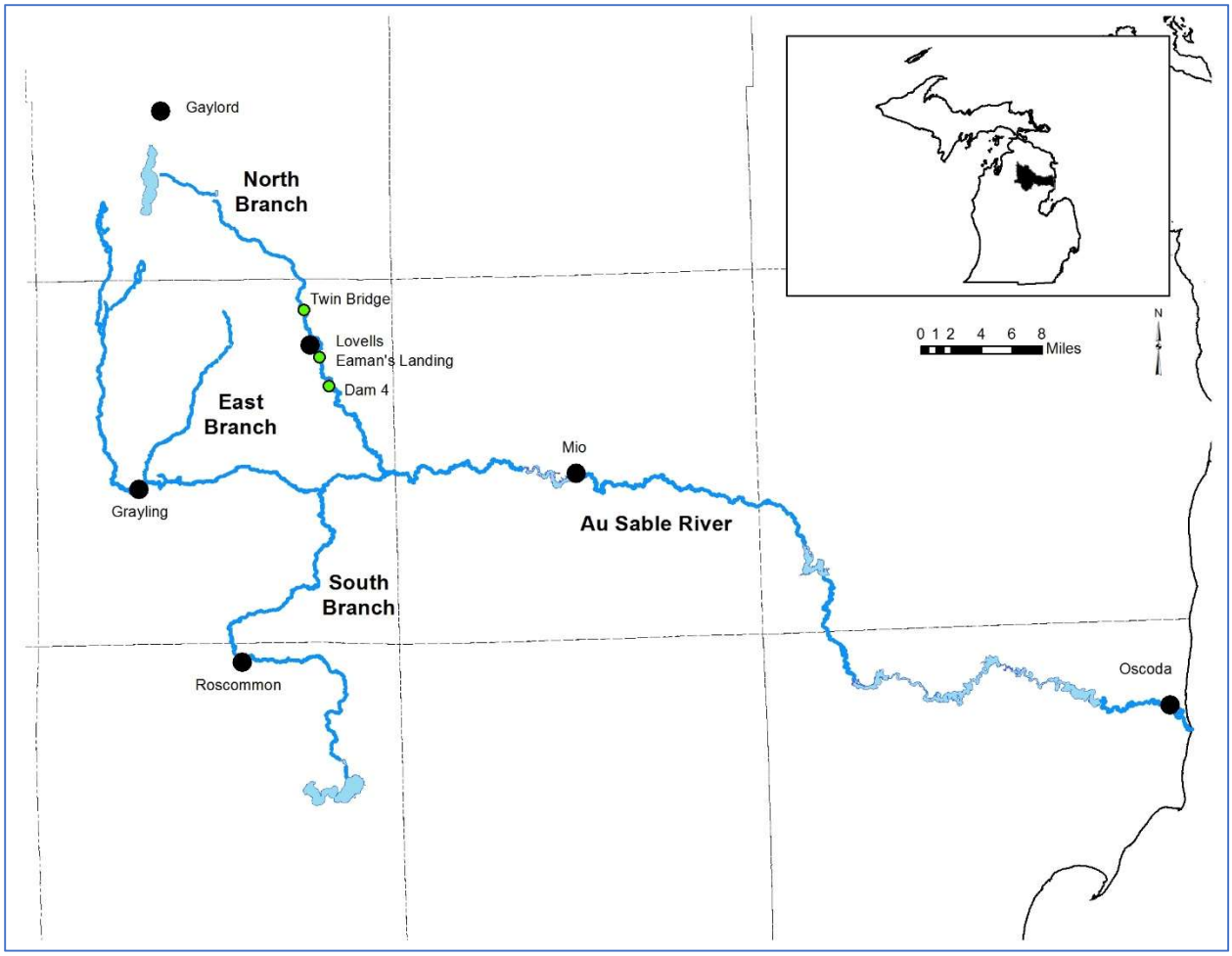


Figure 1. Map of the Au Sable River and major tributaries, with sampling locations on the North Branch Au Sable identified.

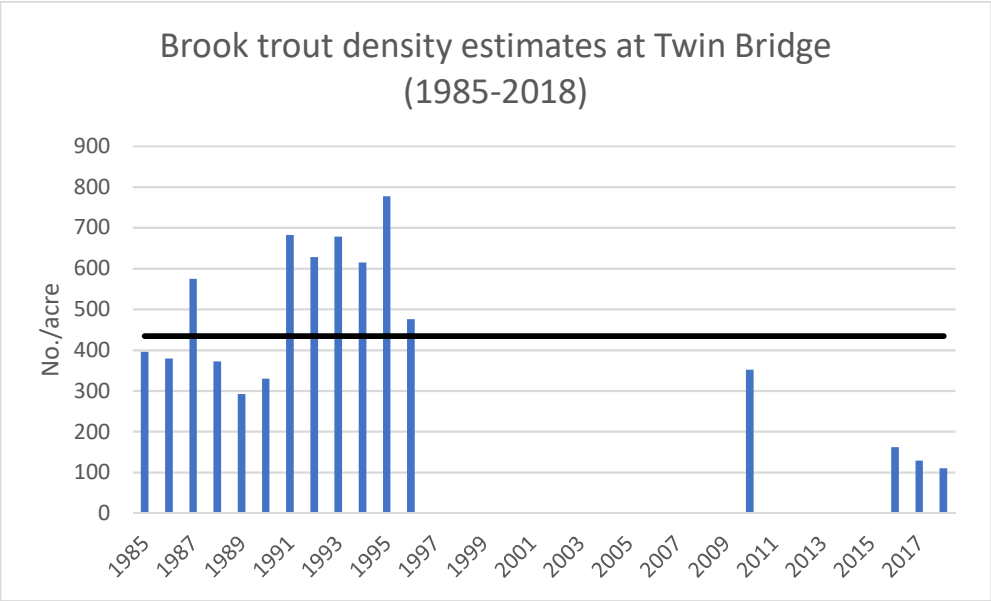
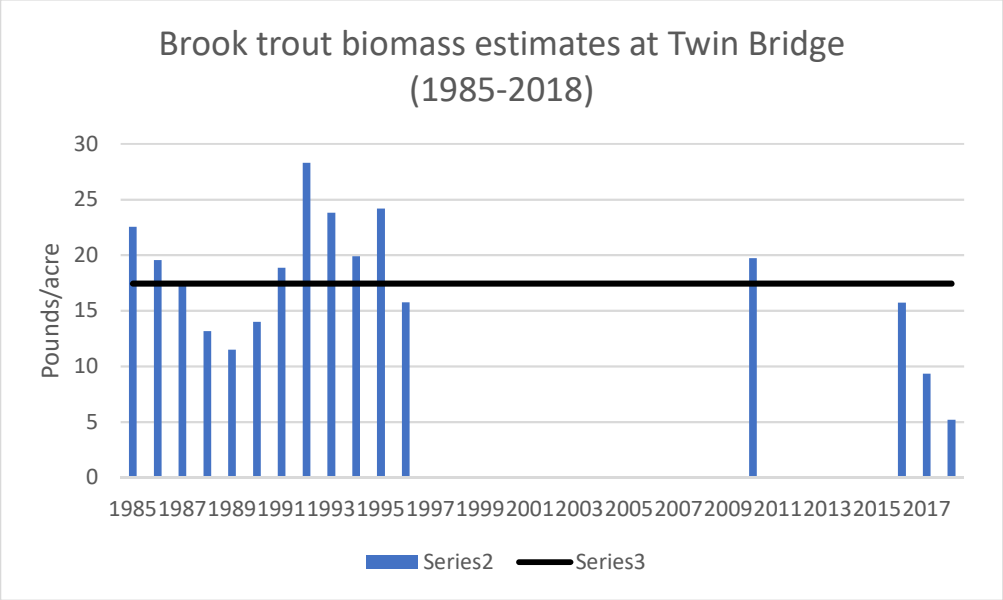


Figure 2. Brook trout density estimates (number per acre) at Twin Bridge compared to long-term average (1985-2018).



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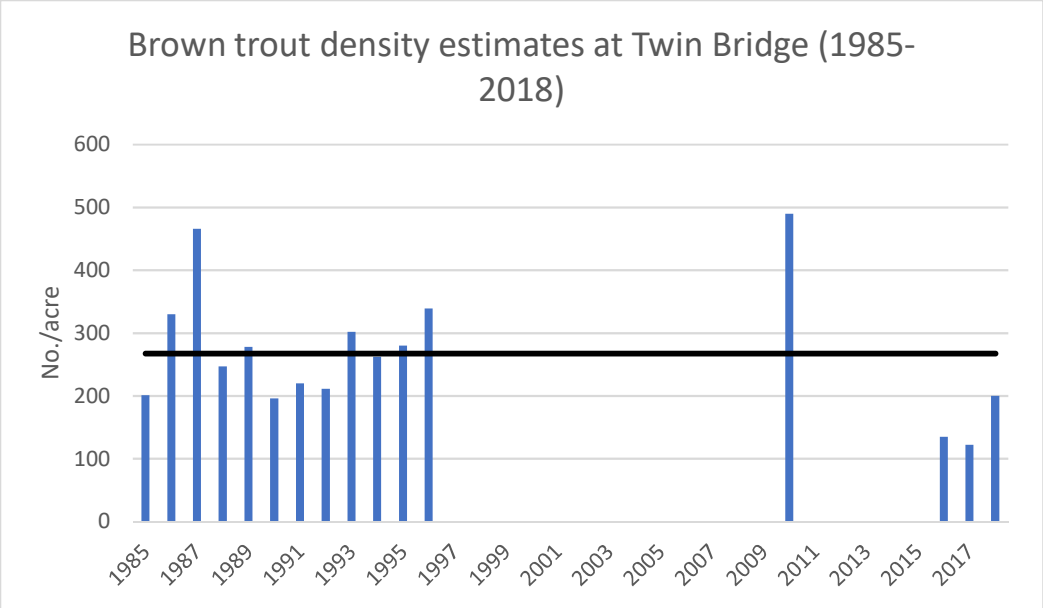

Figure 4. Brown trout density estimates (number per acre) at Twin Bridge compared to the long-term average (1985-2018).

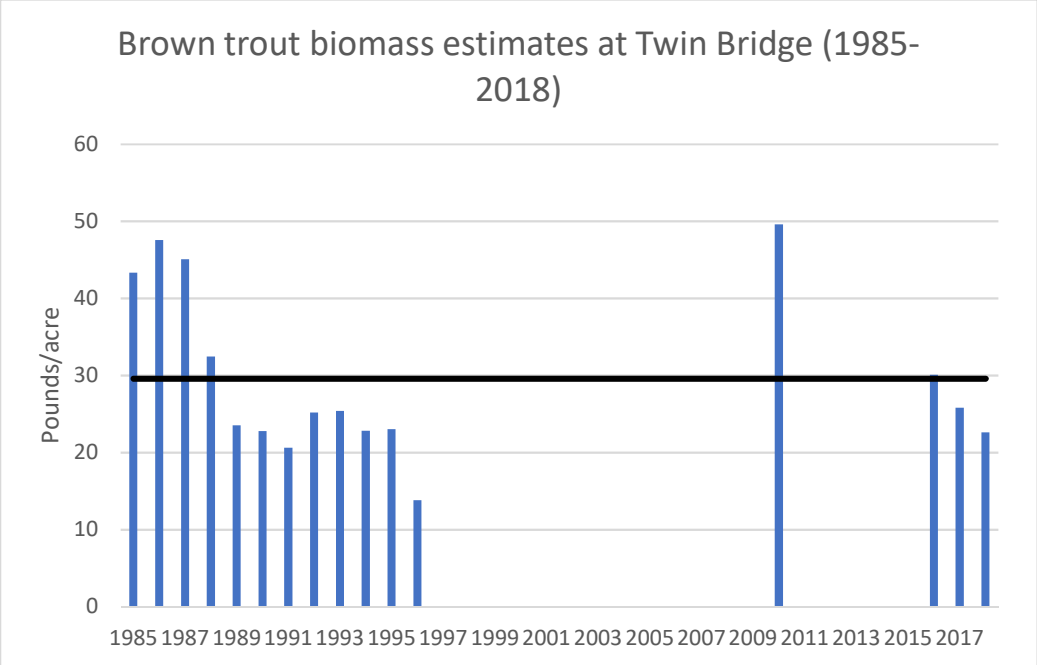

Figure 5. Brown trout biomass estimates (pounds per acre) at Twin Bridge compared to the long-term average (1985-2018).

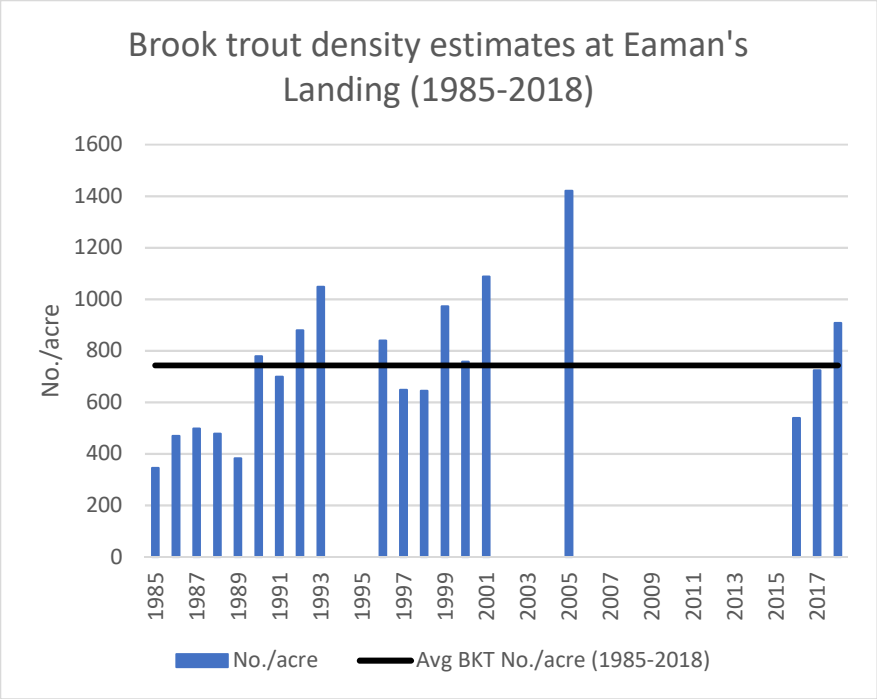

Figure 6. Brook trout density estimates (number per acre) at Eaman's Landing compared to long-term average (1985-2018).

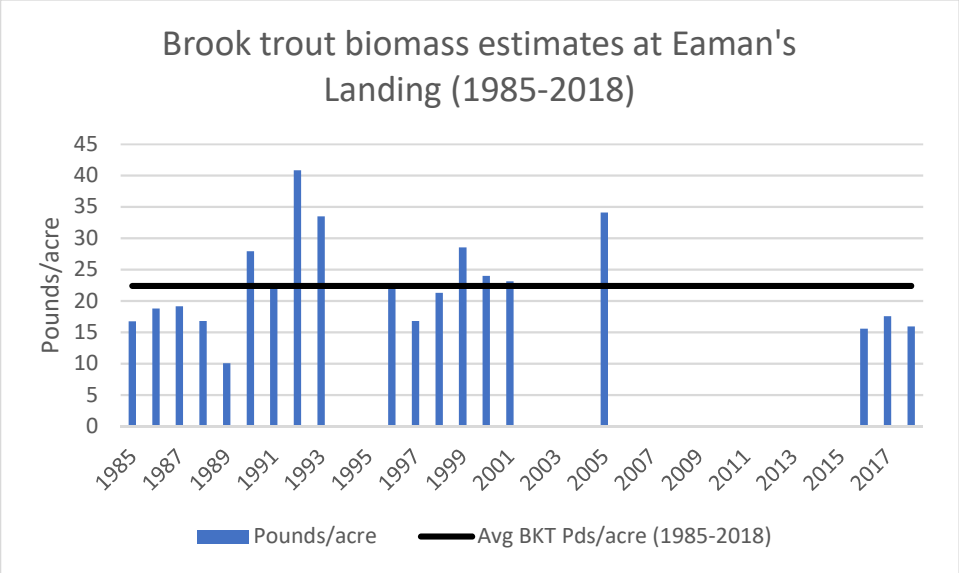

Figure 7. Brook trout biomass estimates (pounds per acre) at Eaman's Landing compared to long-term average (1985-2018).

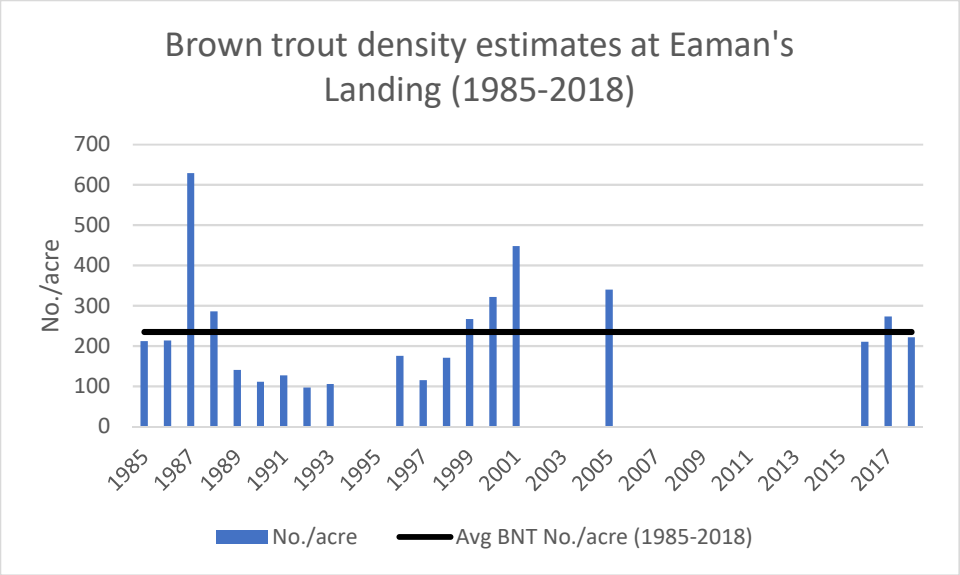

Figure 8. Brown trout density estimates (number per acre) at Eaman's Landing compared to long-term average (1985-2018).

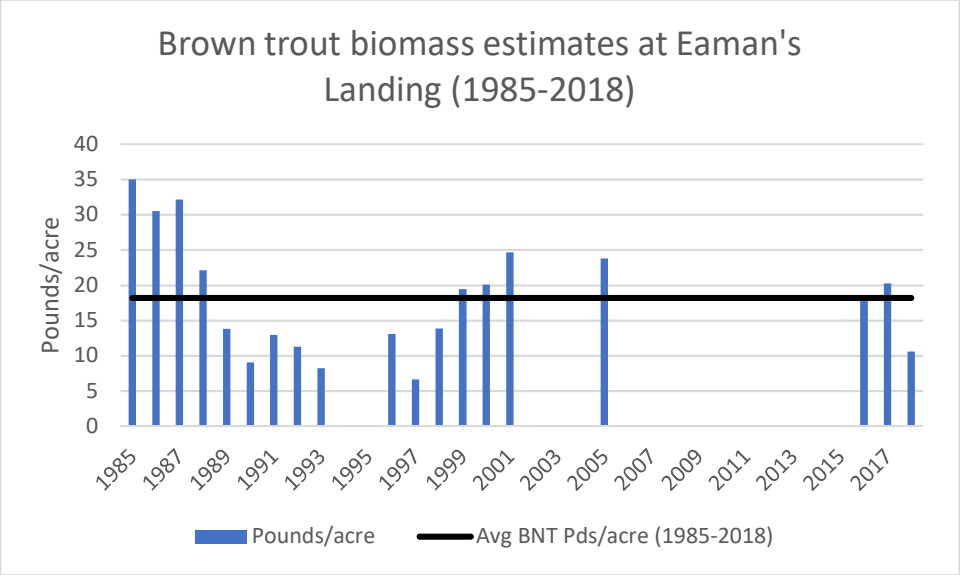

Figure 9. Brown trout biomass estimates (pounds per acre) at Eaman's Landing compared to long-term average (1985-2018).

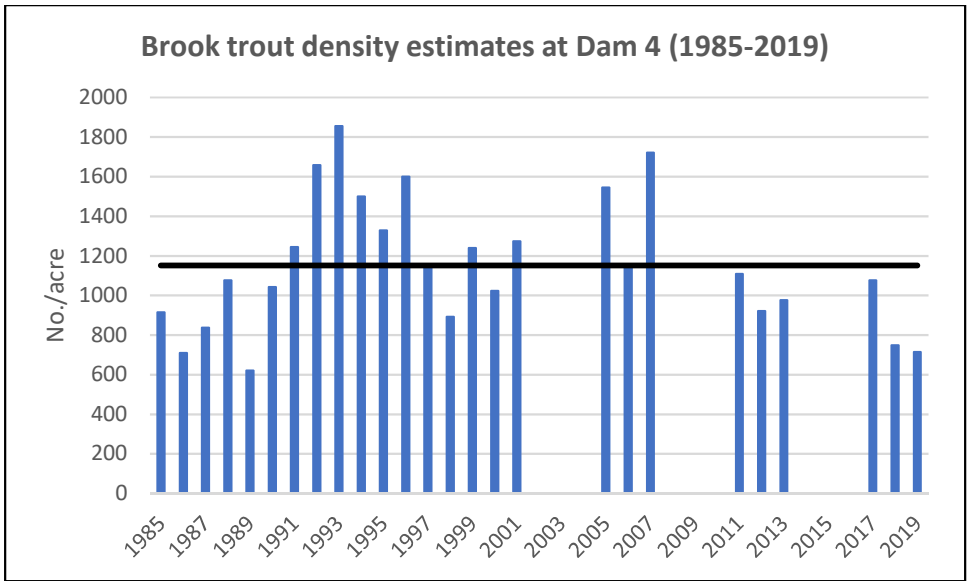

Figure 10. Brook trout density estimates (number per acre) at Dam 4 compared to long-term average (1985-2019).

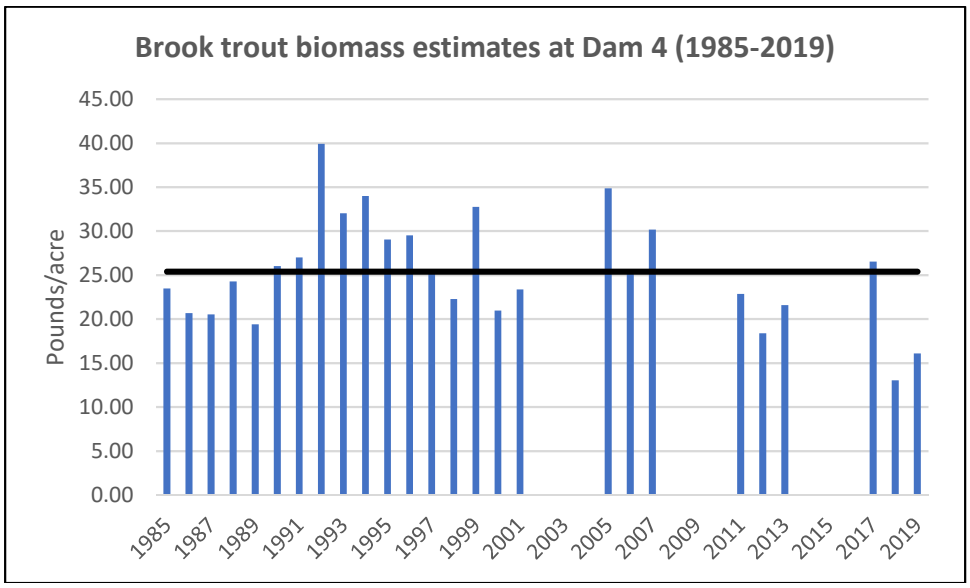

Figure 11. Brook trout biomass estimates (pounds per acre) at Dam 4 compared to long-term average (1985-2019).

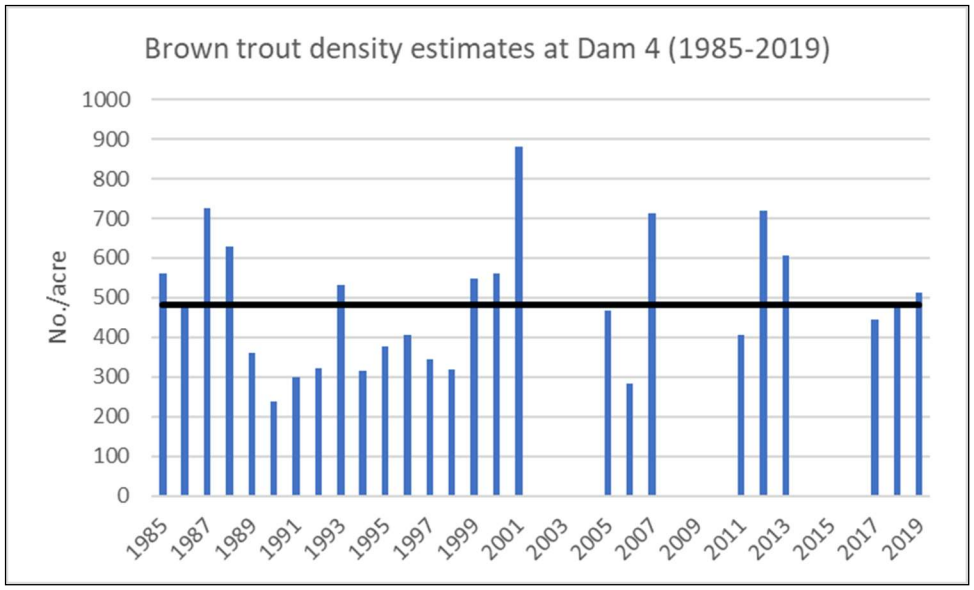

Figure 12. Brown trout density estimates (number per acre) at Dam 4 compared to long-term average (1985-2019).

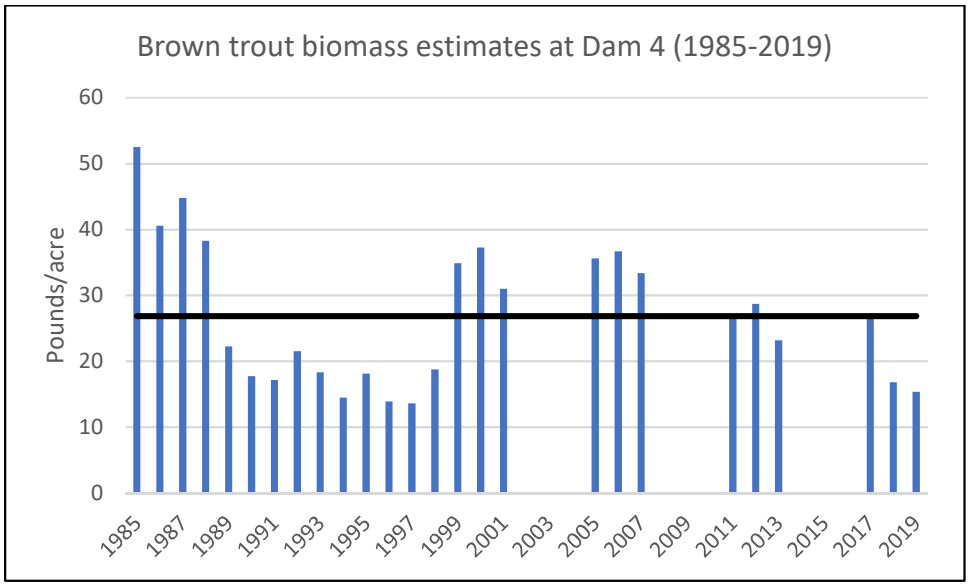

Figure 13. Brown trout biomass estimates (pounds per acre) at Dam 4 compared to long-term average (1985-2019).

Table 1. Brook trout population estimates by year for the North Branch Au Sable River at Dam 4, 1985-2019.

Year	No./acre	Pounds/acre	No./Mile	Length range (inches)	Age Range
1985	915	23.46	11,546.9	2-10	0-2
1986	709	20.68	8,948.0	2-11	0-3
1987	838	20.51	10,580.2	2-10	0-3
1988	1077	24.26	13,600.4	2-9	0-2
1989	620	19.38	7,827.3	2-11	0-2
1990	1042	26.00	13,151.7	2-9	0-2
1991	1244	26.99	15,701.9	2-13	0-3
1992	1658	39.92	20,931.3	2-10	0-2
1993	1856	32.02	23,433.0	2-11	0-2
1994	1500	33.99	18,938.3	2-11	0-2
1995	1328	29.05	16,765.4	2-12	0-2
1996	1601	29.51	20,212.3	2-9	0-2
1997	1158	25.54	14,616.2	2-9	0-3
1998	893	22.27	11,273.2	2-10	0-2
1999	1240	32.74	15,657.0	2-11	0-3
2000	1023	20.97	12,865.7	1-9	0-2
2001	1274	23.36	16,083.3	1-9	0-2
2002					
2003					
2004					
2005	1546	34.85	20,273.5	1-10	0-2
2006	1158	25.10	15,195.9	1-10	0-2
2007	1722	30.15	22,592.1	1-10	0-3
2008					
2009					
2010					
2011	1109	22.87	14,546.1	1-10	0-2
2012	921	18.39	12,080.6	1-10	0-2
2013	977	21.59	12,809.8	1-9	0-2
2014					
2015					
2016					
2017	1,077	26.54	14,130.5	2-9	0-2
2018	748	13.03	9,812.2	1-9	
2019	715	16.09	9,379.2	2-8	

Table 2. Brown trout population estimates by year for the North Branch Au Sable River at Dam 4, 1985-2019.

Year	No./acre	Pounds/acre	No./Mile	Length range (inches)	Age Range
1985	560	52.51	7,066.0	2-16	0-4
1986	478	40.57	6,027.9	2-16	0-5
1987	727	44.8	9,174.4	2-16	0-4
1988	628	38.26	7,930.5	2-16	0-5
1989	362	22.26	4,569.7	2-14	0-4
1990	237	17.71	2,994.1	2-16	0-4
1991	298	17.14	3,756.5	2-16	0-4
1992	323	21.51	4,071.8	2-16	0-4
1993	533	18.3	6,724.6	2-15	0-4
1994	316	14.49	3,983.6	2-16	0-4
1995	376	18.14	4,750.5	2-16	0-4
1996	406	13.89	5,120.2	2-14	0-3
1997	344	13.62	4,346.9	2-16	0-4
1998	318	18.73	4,020.1	2-16	0-4
1999	547	34.9	6,906.1	2-16	0-4
2000	562	37.25	7,066.6	1-22	0-6
2001	881	30.99	11,122.5	1-17	0-4
2002					
2003					
2004					
2005	467	35.6	6,121.8	2-19	0-5
2006	283	36.66	3,716.0	2-18	0-4
2007	714	33.36	9,360.7	1-16	0-4
2008					
2009					
2010					
2011	407	26.91	5,345.2	2-20	0-5
2012	718	28.72	9,412.5	2-17	0-4
2013	606	23.19	7,945.9	1-18	0-4
2014					
2015					
2016					
2017	443	26.94	5,808.5	2-19	0-4
2018	489	16.83	6,420.5	2-17	
2019	511	15.37	6,699.8	1-21	

Table 3. Estimated number per inch group of brook trout and brown trout in the North Branch Au Sable River at Dam 4, September 2019.

Inch Group	Brook Trout	Brown Trout
1		2
2	564	414
3	1,298	916
4	213	182
5	61	9
6	79	25
7	48	38
8	11	21
9		12
10		
11		2
12		1
13		
14		
15		
16		2
17		1
18		
19		
20		
21		1