Maple River
Emmet County
Cheboygan River Watershed, last surveyed in 2012

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Environment

The Maple River is located in the northern part of Michigan's Lower Peninsula, and is part of the Cheboygan River watershed (Figure 1a). The West Branch Maple River originates in the Pleasantview Swamp, while the East Branch Maple River starts as the outlet from Douglas Lake (Figure 1b). The Maple River main stem begins at the confluence of the West Branch Maple River and East Branch Maple River at the Maple River Dam (Lake Kathleen) in eastern Emmet County, near the village of Pellston. The main stem Maple River begins from cascading top water at the Maple River Dam (which forms Lake Kathleen) and flows for approximately seven miles south through a forested riparian corridor of private and public land to Burt Lake. This river is known to carry a heavy sand bedload which helps to form a natural delta near its mouth at Burt Lake. A large wetland area is located along the lower river reaches and Burt Lake shoreline (Fuller 2006).

The Maple River watershed is approximately 168 square miles in area and is heavily influenced by glacial deposits. Catchments for the East and West Branches of the Maple River have large amounts of coarse textured glacial till. The catchment for the main stem Maple River also has coarse textured material in the form of lacustrine sand and gravel. The prevalence of this larger (coarse) material in the underlying geology promotes groundwater movement and keeps the river cold and suitable for trout.

The Maple River Dam has a considerable influence over the main stem Maple River. In some years, the warming effect of the impoundment can result in a 5.4°F increase in mean July water temperatures, and can change the classification of the river from a "cold" stream to a "cold-transitional" (marginal) trout stream (Zorn et al. 2008, Table 1). Although originating as a tailwater below Maple River Dam, water temperatures are fairly cold because there is a considerable amount of groundwater inflow in the vicinity of the dam and immediately downstream. This cold-transitional reach is managed with Type 4 trout stream regulations.

History

Early fisheries management activities in the Maple River were in response to the failure of the Maple River Dam in 1952. In addition to the sediment (silt and sand) released from the washout, several dump truck loads of sand were reportedly placed in the river at that location in an attempt to stop the flow. The river was first surveyed in 1954, when electrofishing was used to target game fish. Few trout were collected, and it was noted that there was quite a bit of sand in the river from the dam failure.

The river was surveyed annually from 1956-1958, with the purpose of monitoring the trout population. Although the files don't provide any detail, fish habitat structures were placed in the Maple River sometime after the dam failure and prior to 1956, as the stated purpose of one survey in 1956 was to

specifically check the trout population in relation to those structures. Each of these surveys found numbers of brown, rainbow, and brook trout along with an assemblage of nongame fish species such as lamprey (American brook and sea), slimy and mottled sculpin, brook stickleback, and burbot. Fisheries Division files show brown trout and rainbow trout were stocked in the Maple River starting in 1956.

Additional efforts to improve instream fish habitat were completed in 1963 according to the files, but no details are given regarding what improvements were made. Later reports indicate the project involved bank stabilization with rock riprap and tree plantings, and the installation of numerous current deflectors.

The dam that was destroyed in 1952 was reconstructed in 1967. A 1967 survey downstream of Brutus Road following dam reconstruction found a fish community similar to previous surveys, but indicated that the stream bottom was covered with sand with depths of 6 inches to 4 feet. It was also noted that some of the fish appeared to be lake run. Surveys upstream from Brutus Road (at Maple River Road and Woodland Road) that year showed good trout abundance and an increase in gravel closer to the dam. Northern pike, yellow perch, and rock bass were found just downstream of the dam, likely coming from the warmer impoundment.

Fisheries management activities in the Maple River in the 1970s were aimed at improving instream fish habitat and controlling erosion and sand in the watershed. In 1974-75, approximately 91 instream structures were placed along 5,400 linear feet of eroding streambank in the Maple River. This was a $100,000 project funded by the Soil Conservation Service, with work done by the DNR. The Maple River Sediment Control Project was started in 1975 to address the erosion and sedimentation issues associated with the dam washout of 1952 and the subsequent temporary repairs and attempts to restore the dam. The project identified excessive sedimentation in the lower river (an area known as "the spreads" near Burt Lake) as being an impediment to fish migrating into the river from Burt Lake. Two sand traps were excavated near Brutus Road to help address this problem by removing the sand before it reached the spreads. Fisheries Division's current philosophy of sediment management, as well as the effect of the spreads, has changed substantially. This change in philosophy is discussed later in the Analysis and Discussion section of this report.

Survey frequency of the Maple River was reduced in the 1970s and 1980s, as more effort was focused on habitat improvement. Surveys were done in 1972 and 1976, with good survival and growth of brook, brown, and rainbow trout. All three species were growing above the statewide average growth rate. Habitat improvement efforts during this time period focused on sediment (sand) management and bank stabilization, including projects done by the DNR and Trout Unlimited. A 1989 report recommended the removal of the current deflectors installed during the 1950s.

The Maple River was next surveyed in 2002 as a random site under Fisheries Division's Status and Trends protocol. The 1100-foot electrofishing survey was done downstream of Woodland Road, below Maple River Dam. A fish community of both cold- and warmwater species (likely coming from the impoundment upstream) was again observed, similar to previous surveys.

A study was initiated in 2007 in cooperation with the owner of the Maple River Dam to examine the influence of the dam on the temperatures of the Maple River. Temperature loggers were placed at 3 to

10 sites throughout the watershed annually from 2007-2010. The study showed that the thermal influence of dam puts the river in a cold-transitional category, which is characterized not only by temperature but also by a fish community comprised mostly of coldwater fish, but also has some warmwater fish present. This classification is consistent with the fish community observed over time in the Maple River.

In early 2010, Fisheries Division solicited nominations from the public for waters to be put into a new "gear restricted" category of regulations, including "flies-only" or "artificials-only." The gear-restricted regulations also typically had more restrictive harvest limits, including a reduced daily possession limit or increased minimum-size limit. The Northern Lake Huron Management Unit received several nominations from the public to have the Maple River, from Maple River Dam downstream to Burt Lake, be placed into a gear-restricted category. We did not have sufficient biological data to make a decision at that time, so it was decided to collect those data over the next few years.

In 2011, Conservation Resource Alliance, in partnership with the Northern Lake Huron Management Unit, did some habitat work in the Maple River in the vicinity of the former sand traps near Brutus Road. Approximately 60 trees (primarily maple and spruce) were cut and winched to the river, where they were anchored to provide overhead fish cover for 25 structures. Additional fish habitat work, including large woody structure, was done in 2012 and 2013, by Conservation Resource Alliance on private property just downstream of Brutus Road.

Most recently (2013), the owner of the Maple River Dam working with Conservation Resource Alliance (CRA), commissioned an alternative analysis for Lake Kathleen/Maple River Dam to look at options for dam removal and providing cost estimates for the various options. An advisory group for this effort was organized by CRA and included the owner of the dam, Michigan Department of Natural Resources, United States Fish and Wildlife Service, Little Traverse Conservancy, as well as the study engineering firm (Spicer Group) and their subcontractor (Streamside Ecological Services). This advisory group met in June 2013 to discuss the various alternatives and agreed to pursue full removal of the dam. It should be noted that Sea Lamprey Control, part of the USFWS, does not support dam removal because of the potential for increased sea lamprey production upstream of the dam. This current lack of support virtually eliminates the possibility of federal funding for the project. The group, however, decided to proceed with removal and is currently seeking funding for that effort.

Current Status

The Maple River was surveyed annually from 2010-2012 at two locations: Woodland Road and just upstream of Brutus Road (Figure 1). The Woodland Road location is just downstream of Maple River Dam and the Brutus Road location is near the former sand traps upstream of the road-stream crossing. The surveys were mark-recapture population estimates, with each station consisting of a 1000-foot reach of river (Lockwood and Schneider 2000). These were targeted trout surveys, so non-trout species data were not collected.

Although brook, brown, and rainbow trout are all part of the fish community in the Maple River, it is dominated by brown trout; up to 94% numerically at the Brutus Road site and up to 96% of the standing crop. (Tables and Figures 2a, 2b, 3a, and 3b).

Total trout densities averaged 455 trout per acre at Woodland Road over the three years of the study, and 638 trout per acre at Brutus Road (Tables 2a and 2b). Trout biomass or standing crop at Woodland Road averaged 51.4 pounds per acre, while at Brutus Road it averaged 54.63 pounds per acre (Tables 3a and 3b).Overall, brown trout densities were fairly stable, with the lowest density occurring in 2010 at Brutus Road. Brown trout biomass surged in 2012, as the pounds per acre of brown trout that year were roughly double what they had been previously. Growth rates were good for brown trout and brook trout, as both species had positive mean growth indexes of at least +0.9 (Tables 4a and 4b).

Analysis and Discussion

The trout populations in the Maple River are doing well based on current population estimates at Woodland and Brutus roads. Brown trout dominate the fish community both in numerical abundance (Tables 2a and 2b) and in percentage of biomass (Tables 3a and 3b).

Substrate in this reach is primarily sand, especially in the Brutus Road area and likely always will be due to its geology. Recent fish habitat projects which incorporate the placement of large woody structures have improved hydraulic diversity or variety of pools, riffles, and runs by moving and trapping sediment. The spike in biomass of brown trout in 2012, the year after the habitat structures were installed, indicate that fish habitat was successfully created.

Fisheries Division's philosophies on habitat improvement and sediment management have changed with the advancement of science. Many of the early habitat improvements discussed in the History section consisted primarily of rock riprap or current deflectors. While riprap does reduce localized streambank erosion, "hard" engineering techniques like this tend to shift the erosive force of the river to another bank downstream. Instead, it is preferred to stabilize banks now using "soft" engineering techniques such as coir logs (made of coconut fibers), or whole tree revetments. Current deflectors also can shift damage elsewhere if not installed properly. While current deflectors are still a tool that can be used, the same result can be achieved using whole trees or other large woody structure. These techniques have the added benefit of not only deflecting current and scouring out pools or runs, but they can also trap sediment behind them.

The Maple River supports a good population of lake run fish, both brown and rainbow trout (steelhead). These fish live a portion of their lives in Burt Lake and will return to the Maple River at different times for feeding, thermal refuge, or spawning. The abundance of lake-run fish in the Maple River dispels the myth that the shallow water at the river's mouth (in the spreads) prevents access for migratory fish returning to the Maple River. In fact, maintenance of the sand traps that were installed just upstream at Brutus Road as a part of 1975's Maple River Sediment Control Project was discontinued in the late 1990s.

Recent habitat improvement efforts near the Brutus Road station appear to be having a positive effect on the trout populations. Not only was there an increase in the number of trout at that location over the study period, but it was accompanied by a substantial increase in the total standing crop (pounds per acre) of trout (Tables 3a and 3b, Figure 2b). These habitat improvements involved the strategic placement of whole trees and brush bundles to provide specific functions (e.g., overhead cover for fish, moving and containing sediment, or nursery habitat).

The purpose of the 2010-12 study was to evaluate the Maple River's suitability for gear restricted regulations in response to the nomination by the public. Fisheries Order 213, Criteria for Selection of Trout Streams with Gear Restriction Regulations, includes the following information for part of the decision making process: angler fishery, mean size-at-age for age-2 fish, natural mortality, and fishing mortality.

The first question in the Criteria for Selection of Trout Streams with Gear Restriction Regulations (Criteria) is, "Is angler fishery dominated by trout?" The fisheries surveys show a community dominated by trout and angler reports for this river are exclusively for trout.

The next step in the Criteria questions is whether the mean size-at-age for age-2 fish is at or above state average. Brown trout mean length at age-2 for both sites was above state average in all three years surveyed (Table 5). Therefore brown trout are growing well and were 1 inch or greater than the statewide average length-at-age for all ages of brown trout sampled (Tables 4a and 4b). Brook trout growth rates were also good. Since this is a brown trout dominated stream that is where the focus will remain.

The next steps in the Criteria relate to mortality, both natural and fishing. A creel survey is needed to separate these two types of mortality. Fishing mortality is assumed to be low based on professional knowledge of this river, surveys of anglers on other rivers, and general trends over time on larger rivers. The annual mortality rate at the Woodland Road site was approximately 46% for age-0 brown trout, but increased to 91% for age-1 and age-2 fish. Mortality rates were more difficult to calculate for the Brutus Road location, as there was immigration of brown trout to this section from other parts of the river during the study period. This is likely due to the addition of large woody structure in this stretch for fish habitat improvement. Overall, total mortality in Maple River is high and we suspect that most of this is due to natural mortality. Combined with fairly low abundance relative to other streams in the area with gear restrictions (Figures 4 and 5), this reach of the Maple River is not a good candidate for gear restrictions.

The Maple River is a good place to go trout fishing, with the opportunity to catch brown, brook, or rainbow trout. It also provides seasonally good fishing for rainbow trout (steelhead) migrating up from Burt Lake.

Management Direction

1. Continue efforts to remove the Maple River Dam. This would provide connectivity to the upper portion of the watershed, as well as return temperatures to pre-dam conditions which would be beneficial for the trout populations.

2. Inventory and evaluate function of existing fish habitat structures between Maple River Dam and the river mouth. Based on evaluation, structures should be removed, repaired, or replaced.

3. Replace road-stream crossings to appropriately-sized structures that allow fish passage. The Woodland Road crossing needs to be the first one replaced.

4. Continue managing naturally reproducing trout populations.

5. Maintain Type 4 trout stream regulations on this reach.

References

Fuller, D.R. 2006. Water resources of the Cheboygan River watershed. Unpublished class handout produced by SEE-North, Petoskey, MI. 46 pp.

Lockwood, R.N., and J.C. Schneider. 2000. Stream fish population estimates by mark-and-recapture and depletion methods. Chapter 7 in J.C. Schneider, editor, Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Division Special Report Number 25, Ann Arbor.

Zorn, T.G., P.W. Seelbach, E.S. Rutherford, T.C. Wills, S.-T. Cheng, and M.J. Wiley. 2008. Regional-scale habitat suitability model to assess the effects of flow reduction on fish assemblages in Michigan streams. Michigan Department of Natural Resources, Fisheries Division Research Report 2089.

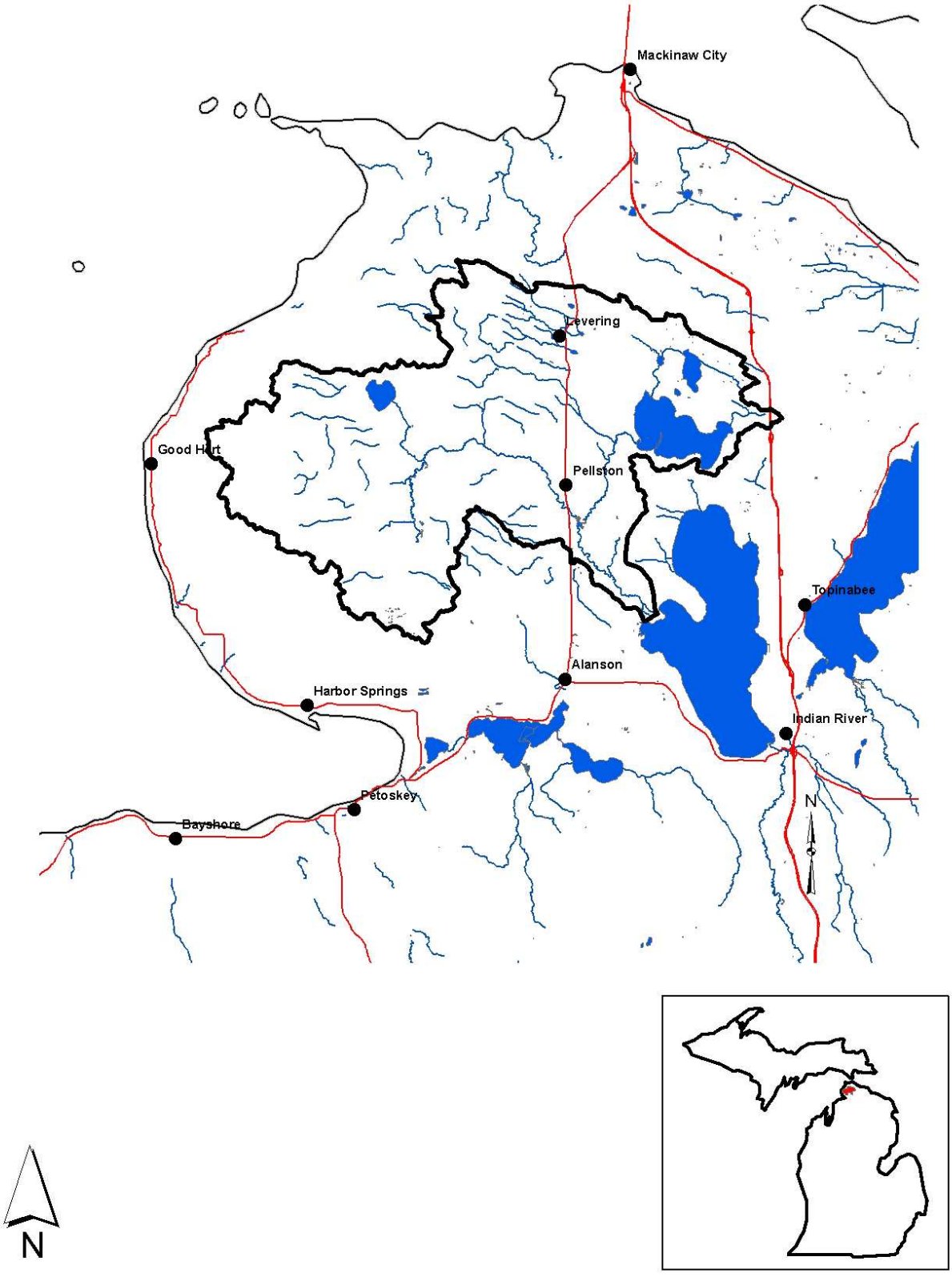

Figure 1a. Locator map of Maple River watershed (heavy black outline).

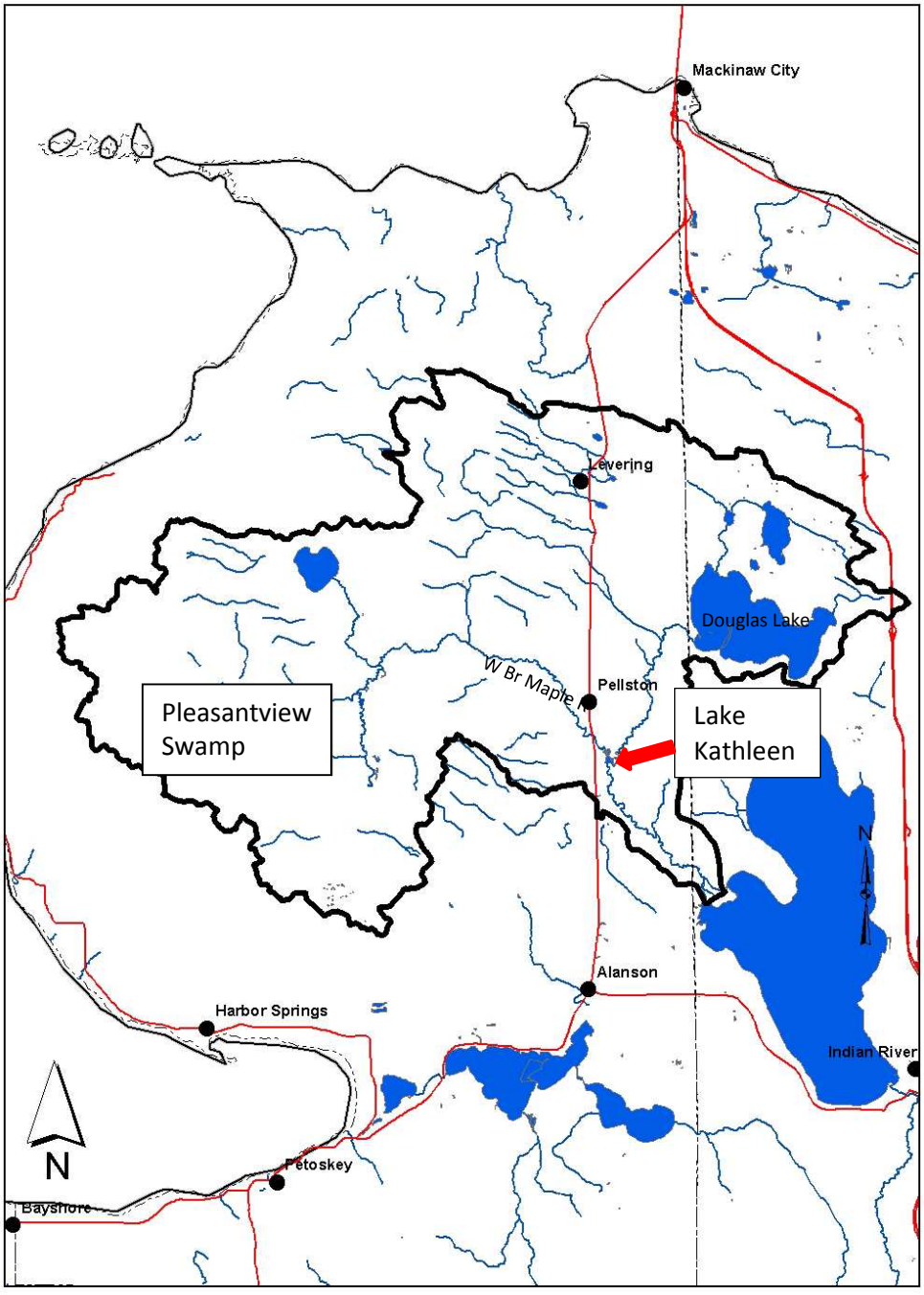

Figure 1b. Map of Maple River watershed

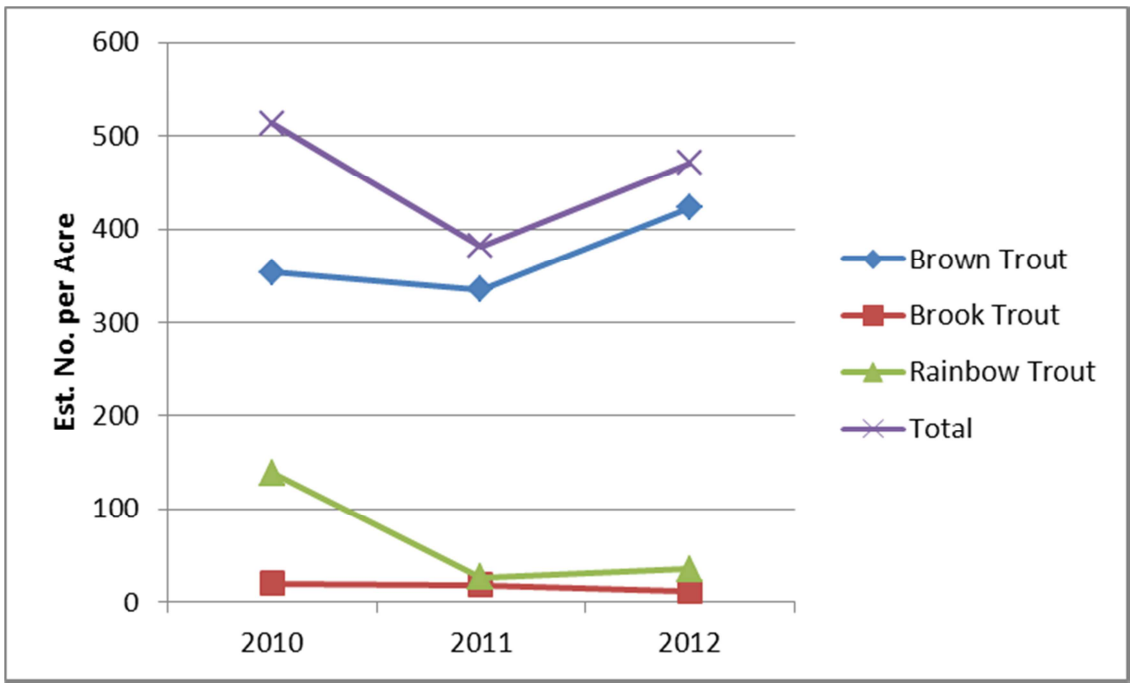

Figure 2a. Densities (number per acre) of brook trout, brown trout, rainbow trout, and all (total) trout in the Maple River at Woodland Road, 2010-12.

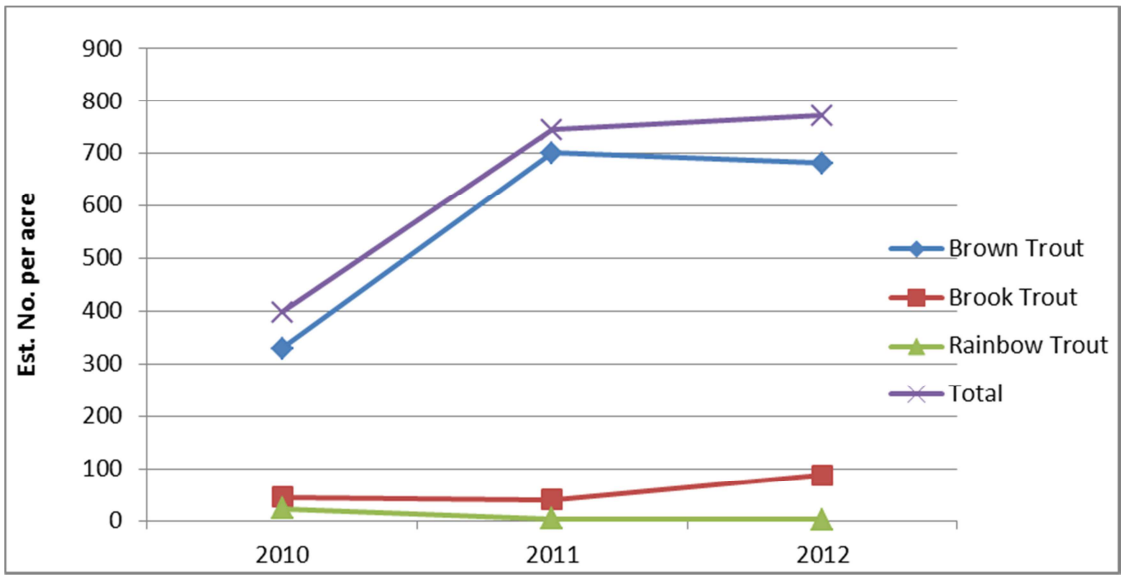

Figure 2b. Densities (number per acre) of brook trout, brown trout, rainbow trout, and all (total) trout in the Maple River at Brutus Road, 2010-12.

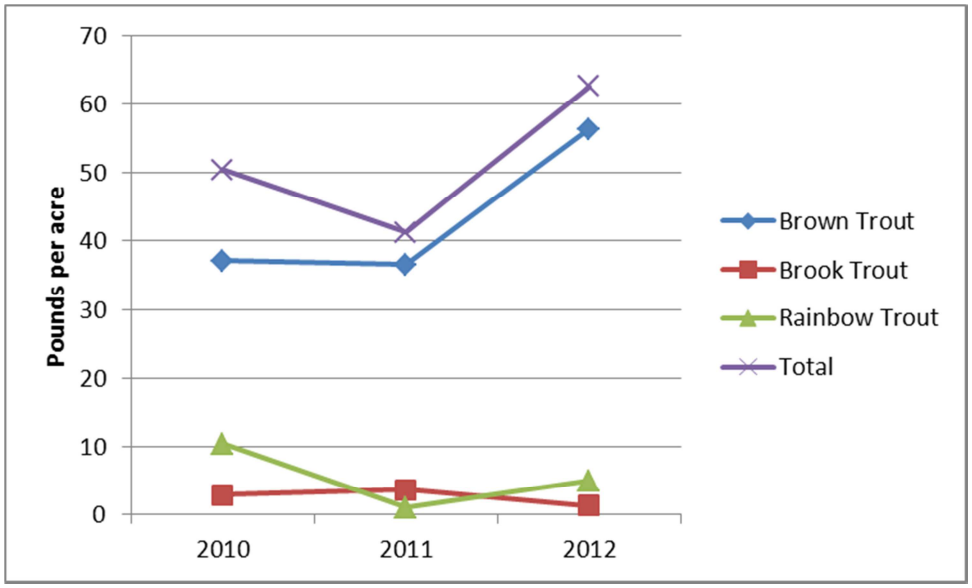

Figure 3a. Estimated pounds per acre of brook trout, brown trout, rainbow trout, and all (total) trout in the Maple River at Woodland Road, 2010-12.

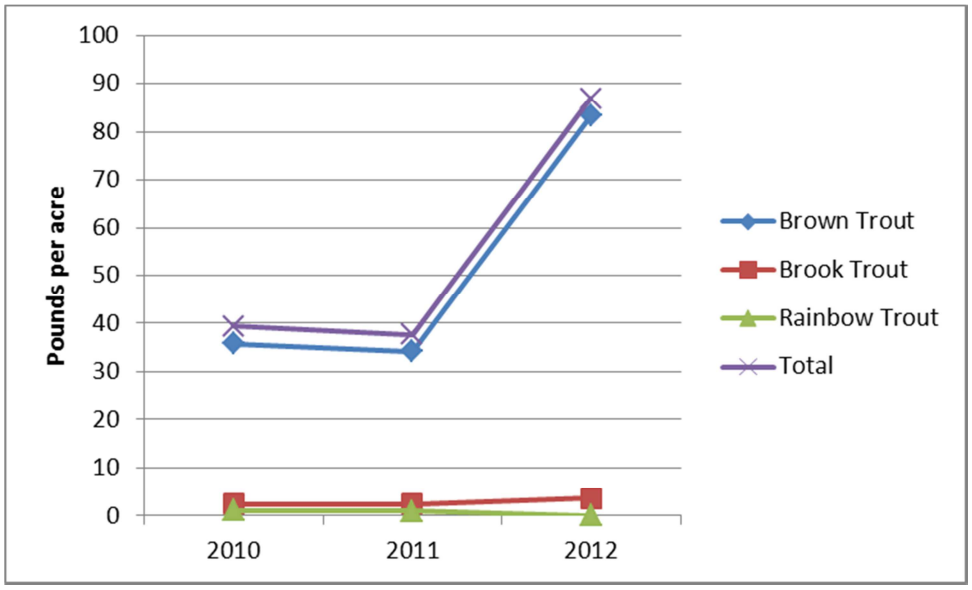

Figure 3b. Estimated pounds per acre of brook trout, brown trout, rainbow trout, and all (total) trotu in the Maple River at Brutus Road, 2010-12.

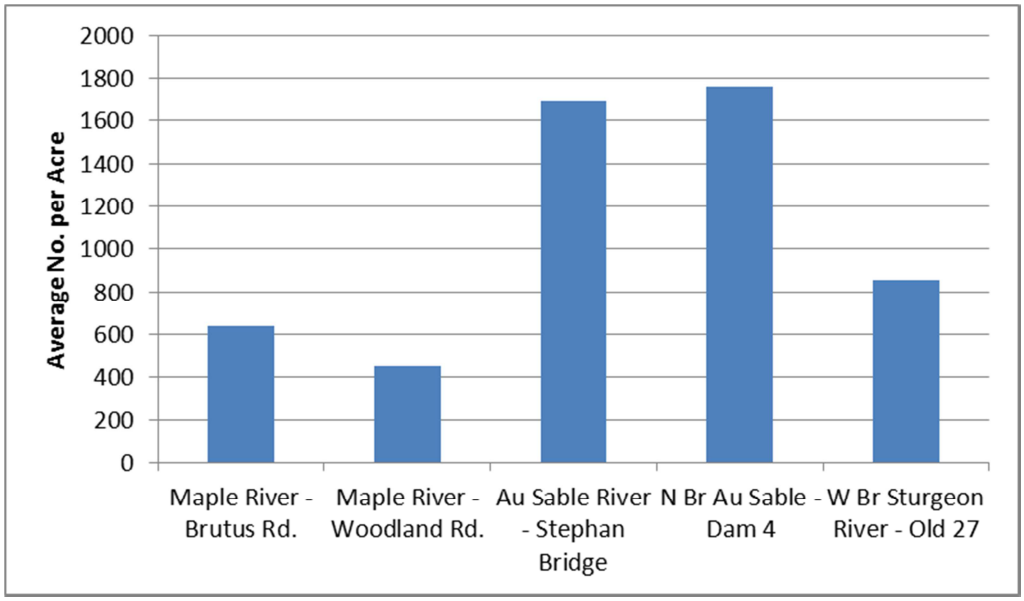

Figure 4. Densities (number per acre) of all trout at two locations in the Maple River compared to other locations in Northern Lake Huron Management Unit.

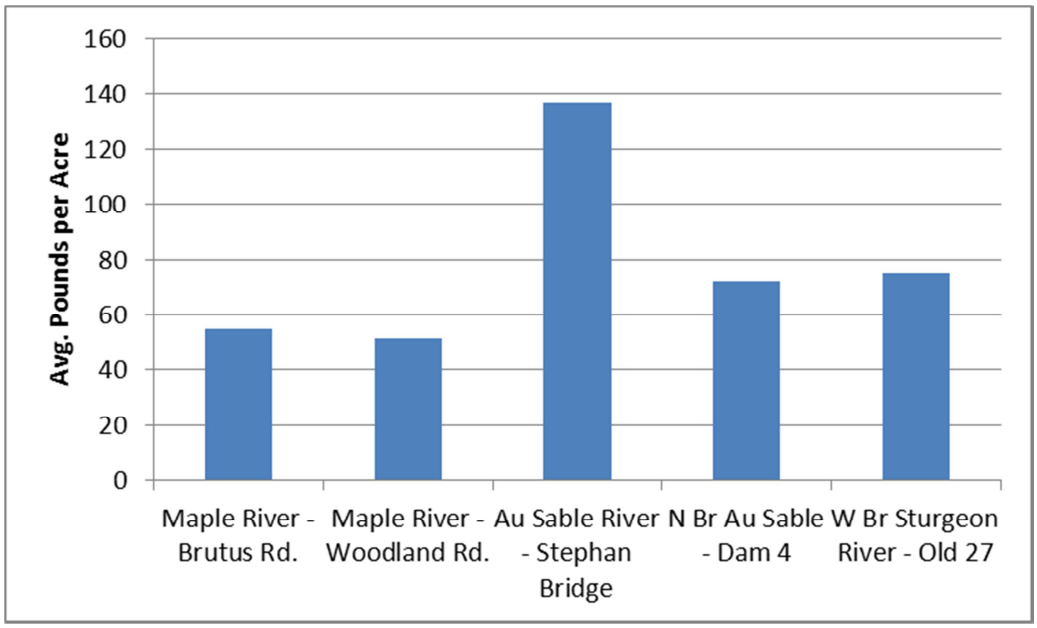

Figure 5. Estimated pounds per acre of all trout at two locations in the Maple river compared to other locations in Northern Lake Huron Management Unit.

Table 1. Summary of temperature data for Maple River watershed during the summer of 2010.

River	Location	Month	Mean (°F)	Min (°F)	Max (°F)
E Br Maple	Douglas Lake Rd	Jun 2010	66.7	57.5	77.8
E Br Maple	Douglas Lake Rd	Jul 2010	73.4	60.9	81.3
E Br Maple	Douglas Lake Rd	Aug 2010	71.6	62.9	81.0
E Br Maple	Robinson Road	Jun 2010	64.2	54.1	75.3
E Br Maple	Robinson Road	Jul 2010	71.1	59.4	78.4
E Br Maple	Robinson Road	Aug 2010	69.1	60.3	78.1
E Br Maple	u/s Lake Kathleen	Jun 2010	62.4	52.1	72.5
E Br Maple	u/s Lake Kathleen	Jul 2010	68.6	58.3	75.2
E Br Maple	u/s Lake Kathleen	Aug 2010	65.7	57.4	74.3
W Br Maple	Robinson Rd	Jun 2010	61.1	52.2	70.2
W Br Maple	Robinson Rd	Jul 2010	63.1	57.0	70.3
W Br Maple	Robinson Rd	Aug 2010	62.2	55.1	68.8
W Br Maple	u/s Lake Kathleen	Jun 2010	57.5	50.9	66.7
W Br Maple	u/s Lake Kathleen	Jul 2010	52.9	49.8	59.3
W Br Maple	u/s Lake Kathleen	Aug 2010	54.7	50.3	60.7
Maple River	Below dam	Jun 2010	62.1	56.3	69.4
Maple River	Below dam	Jul 2010	66.6	59.9	71.2
Maple River	Below dam	Aug 2010	63.9	57.7	70
Maple River	Maple River Road	Jun 2010	60.6	53.8	68.4
Maple River	Maple River Road	Jul 2010	64.4	58.9	69.2
Maple River	Maple River Road	Aug 2010	62.3	57.2	67.2
Maple River	Brutus Road	Jun 2010	60.2	52.7	68.9
Maple River	Brutus Road	Jul 2010	64.0	58	69.5
Maple River	Brutus Road	Aug 2010	62.3	57.4	67.8

Table 2a. Estimated number per acre of brook trout, brown trout, rainbow trout, and all (total) trout in the Maple River at Woodland Road, 2010-12.

	Brown Trout	Brook Trout	Rainbow Trout	Total
2010	353	21	139	513
2011	335	19	27	381
2012	423	12	36	471

Table 2b. Estimated number per acre of brook trout, brown trout, rainbow trout, and all (total) trout in the Maple River at Brutus Road, 2010-12.

	Brown Trout	Brook Trout	Rainbow Trout	Total
2010	330	45	23	398
2011	701	40	4	745
2012	682	88	2	772

Table 3a. Estimated pounds per acre of brook trout, brown trout, rainbow trout, and all (total) trout in the Maple River at Woodland Road, 2010-12.

	Brown Trout	Brook Trout	Rainbow Trout	Total
2010	37.08	2.90	10.36	50.34
2011	36.52	3.68	1.0	41.2
2012	56.3	1.28	5	62.58

Table 3b. Estimated pounds per acre of brook trout, brown trout, rainbow trout, and all (total) trout in the Maple River at Brutus Road, 2010-12.

	Brown Trout	Brook Trout	Rainbow Trout	Total
2010	35.83	2.47	1.09	39.39
2011	34.21	2.46	0.95	37.62
2012	83.3	3.56	0.02	86.88

Table 4a. Mean growth index for brook trout, brown trout, and rainbow trout in the Maple River at Woodland Road, 2010-12.

	Brown Trout	Brook Trout	Rainbow Trout
2010	+1.4	+1.6	+1.6
2011	+0.7	--	--
2012	+1.8	+1.8	+1.9

Table 4b. Mean growth index for brook trout, brown trout, and rainbow trout in the Maple River at Brutus Road, 2010-12.

	Brown Trout	Brook Trout	Rainbow Trout
2010	+1	+0.9	--
2011	+1.4	+1.3	--
2012	+1.5	+2.1	--

Table 5. Mean length at age-2 for brown trout in the Maple River at Woodland Road and Brutus Road, 2010-12.

	Woodland Rd. Mean Length at Age-2	Brutus Rd. Mean Length at Age-2	State Avg. Length at Age-2
2010	10.54	11.19	9.2
2011	10.85	11.62	9.2
2012	12.03	10.97	9.2