Michigan Department of Natural Resources
Status of the Fishery Resource Report
No. 2004-4, 2004

Manistee River
Below Tippy Dam

Manistee County (T22N, R13W Section 36
and T22N, R14W Sections 28, 29, 32, 33)
Surveyed July, 2003

Mark A. Tonello

Environment

The Manistee River watershed is one of the largest watersheds in Michigan. It drains a total of 1,780 square miles of land in 11 counties of Michigan's northwest lower peninsula before entering Lake Michigan at the town of Manistee (Rozich, 1998). This report refers to the 25-mile long section of the river between Tippy Dam and Manistee Lake, hereafter referred to as the Manistee River below Tippy Dam (Figure 1). Much of the land along the Manistee River below Tippy Dam is owned by the United States Forest Service (USFS) as part of the Manistee National Forest. This section of the Manistee River is federally designated as a Wild and Scenic River by the USFS and is largely undeveloped. The river cuts through a broad glacial-fluvial valley with a corridor that consists of high banks forested with conifers and northern hardwoods, as well as some swampy lowlands in the river bottoms. The Manistee River drains mostly deep, permeable, sandy soils and is one of the most stable groundwater-driven systems in the United States.

Tippy Dam, located about three miles north of the town of Wellston, is the upstream barrier to fish migrations from Manistee Lake and Lake Michigan. Consumers Power Company constructed Tippy Dam approximately 25 miles upstream of Manistee Lake in 1918. In 1993, the Federal Energy Regulatory Commission (FERC) relicensed Tippy Dam for 40 years. Tippy Pond, the impoundment created by Tippy Dam, is 1,540 acres in size. Tippy Dam has a head of 57.5 feet and is a top-draw structure by which water from the surface of Tippy Pond is released into the river below the dam. For many years after its construction, Tippy Dam was operated as a peaking facility. Water was held back in Tippy Pond, and then released twice daily in large pulses up to 5,000 cfs. In 1989, Consumers Power Company voluntarily switched to a run-of-the-river flow regime. As part of the 1993 FERC relicensing agreement, Consumers was required to maintain a run-of-the-river flow regime, and has done so since. Average annual discharge at Tippy Dam is 1,684 cfs. Although Tippy Dam was originally constructed with a fish ladder for passing fish, it was never successful (Lawler, Matusky, and Skeller Engineers, 1991).

The area currently impounded by Tippy Dam was fast-flowing riffle habitat prior to dam construction, with a gradient of about 6.0 ft/mile. The first several miles of the Manistee River immediately below Tippy Dam remain riffle, with an average gradient of about 4.7 ft/mile. The substrate consists primarily of gravel and cobble, which is heavily utilized for spawning by a number of fish species. After the first several miles below Tippy Dam, the river gradient decreases to less than 2.0 ft/mile. Due to the decrease in gradient, the primary substrate is sand, although the occasional gravel bar can still be found. The Manistee River averages 202.8 feet in width from Tippy Dam to just below High Bridge (Figure 2; Rozich 1998).

The Manistee River below Tippy Dam is fed by a number of coldwater tributaries, most notably Bear Creek and Pine Creek (Figure 1). Both of

these sub-watersheds support significant populations of naturally-reproducing chinook salmon, coho salmon, and steelhead (potamodromous rainbow trout), as well as resident populations of brown and brook trout. Other tributaries are much smaller and include Claybank Creek, Sickle Creek, Chief Creek, and a number of unnamed streams. Most of these streams are spring-fed systems that support small populations of resident trout, and in some cases, migratory trout and salmon.

Fishery Resource

The Manistee River below Tippy Dam is designated as a Type 3 trout stream by the Michigan Department of Natural Resources (MDNR) Fisheries Division, allowing anglers to fish the river year-round. Minimum size limits in this section are 15" on brook trout, brown trout, and rainbow trout (steelhead), 24" on lake trout, and 10" on coho, chinook, and pink salmon. The possession limit for trout is five fish, with no more than three fish 15 inches or larger. There are public boat launches located at Tippy Dam, High Bridge, Blacksmith Bayou, Bear Creek, and Rainbow Bend. The extreme lower portion of the river is often accessed by private boat launches located downstream of the M-55 crossing, just above Manistee Lake. Most of the fishing done on the Manistee River below Tippy Dam takes place in the first couple of miles below Tippy Dam, although this stretch of river is accessible for much if its length via Manistee National Forest land.

Prior to the late 1960s, the Manistee River below Tippy Dam was not intensively managed by the MDNR Fisheries Division. That changed in 1966, when almost 400,000 coho salmon were stocked into Bear Creek. Although the goal of the original Pacific salmon stocking program was to control the overabundant alewives in Lake Michigan, the return of those fish in 1967 and following years created a hugely popular sport fishery that still exists today. Since 1966, the Manistee River below Tippy Dam has been intensively managed by the MDNR for potomadromous salmonids. Although coho salmon were the first species stocked, chinook salmon were stocked in 1967, and they have since become the primary species in the Lake Michigan sport fishery. Large numbers of migratory salmonids are still stocked each year in the Manistee River below Tippy Dam (Table 1).

Since the late 1960s, potomadromous salmonids including chinook salmon, coho salmon, and steelhead have dominated the fishery of the Manistee River below Tippy Dam. The original gamefish community of the river consisted of species such as arctic grayling, northern pike, and Great Lakes muskellunge. Seasonal migrations brought in runs of lake trout, walleye, round whitefish, lake whitefish, burbot, and lake sturgeon, a state-listed threatened species (Rozich, 1998). Arctic grayling became extinct around 1900, and Great Lakes muskellunge and lake sturgeon populations are greatly reduced. Although runs of whitefish and burbot no longer occur, the occasional lake trout is still caught in the river.

The MDNR has conducted a creel survey on the Manistee River in each year since 1999. A creel survey was also conducted on the Manistee River in 1985 and 1987, but with different methods. Therefore, the data from the 1985 and 1987 surveys are difficult to compare to more recent surveys and are not discussed in this report. The results of the most recent surveys show that the Manistee River generates an incredible amount of fishing pressure (Table 2). Estimates range from 528,766 to 645,223 angler hours generated annually on the Manistee River below Tippy Dam for the period from 1999-2003, with an average of 570,500 annual angler hours. If the data are translated into angler days, the estimates range from 85,076 to 108,262, with an average of 101,738 for the same time period. According to the United States Department of the Interior (1996), an angler-day is worth an average of $25. Therefore, the Manistee River below Tippy Dam generates an estimated 2.5 million dollars each year from sportfishing expenditures. These numbers prove that the Manistee River below Tippy Dam is one of the most heavily utilized and economically valuable fisheries in the state of Michigan.

Chinook Salmon

Chinook salmon were first stocked in the Manistee River in 1971, when 200,000 parr were planted. They have been stocked in most years since, with numbers ranging from a high of 300,260 in 1980 to a low of 71,032 in 1992 (Table 1). Since 1993, the stocked chinook salmon parr have been held in net pens in either Manistee Lake or in the river channel between Manistee Lake and Lake Michigan for two to three weeks before smolting. This has resulted in better survival and imprinting (less straying). The current stocking regime calls for 100,000 chinook salmon parr to be stocked into the net pens annually. The Manistee County Sportfishing Association assists the MDNR by constructing and maintaining the net pens, and also by feeding and watching over the chinook parr while they are in the net pens.

The stocked chinook salmon are only one component of the entire Manistee River chinook salmon population. Research has shown that there is significant natural reproduction of chinook salmon in the Manistee River below Tippy Dam. In a 1995 MDNR study involving oxytetracycline-marked chinook salmon, 80% of the chinooks examined proved to be of wild origin, while only 20% were of hatchery origin. By converting the percentages to numbers, it can be estimated that at least 500,000 naturally-produced chinook salmon smolts leave the river each year. Undoubtedly, there is substantial natural reproduction of chinook salmon occurring in the Manistee River, perhaps even exceeding 1,000,000 smolts per year. This is most likely due to the conversion of the Tippy Dam flow regime from peaking to run of the river (T. Rozich, MDNR Fisheries Division, personal communication). Creel estimates for the number of chinook salmon harvested from the Manistee River below Tippy Dam ranged from 24,937 to 36,559 and averaged 30,688 for the period from 1999-2003 (Table 2).

Coho Salmon

Coho salmon are still stocked annually in the Manistee River below Tippy Dam (Table 1). The largest number ever stocked in the entire watershed was 749,983 into Bear Creek in 1968. In recent years, stocking rates have been maintained at about 100,000 yearlings annually. Coho salmon do not naturally reproduce to the same extent as chinook salmon in the Manistee River. The life cycle of the coho salmon requires that it remain in the river for over one full year after hatching, but temperatures in the majority of the Manistee River below Tippy Dam get too warm for significant survival of coho parr. Therefore, the fishery for coho in the Manistee River is made up mostly of hatchery fish. The only significant natural reproduction of coho salmon in the Manistee River system occurs in tributaries like Pine Creek and Bear Creek. Due to this lack of natural reproduction, coho runs in the Manistee River are much weaker than the chinook runs. Creel estimates for the number of coho salmon harvested from the Manistee River below Tippy Dam ranged from 247 to 3,183 and averaged 1,439 for the period from 1999-2003 (Table 2).

Steelhead

Steelhead have been present in the Manistee River for nearly a century. The first known stocking occurred in 1897, when 5,000 fry were stocked into Bear Creek. Another 6,000 fry were stocked the following year into the North Branch of the Pine River. Several years after the initial stockings, the first reports of adult steelhead being caught in the Manistee River began to filter in. By 1913, when Stronach Dam on the Pine River was constructed, excellent runs were occurring in both the Manistee and Pine Rivers. Beginning in 1914 and continuing until Junction (Tippy) Dam was constructed in 1918, eggs were collected each spring at a station below Stronach Dam. An egg taking station was built below Tippy Dam in 1918. A second station was established on Pine Creek, a tributary to the Manistee River, in 1924. By 1925, five million, two hundred thousand steelhead eggs were secured between the two egg-take stations. In 1926, a third station was operated at Fox Bridge on the Little Manistee River, Lake County, and approximately eleven million eggs were collected among the three stations. During the spring of 1927, the stations secured 7,376,000 eggs; in 1928, 7,514,000

eggs; and in 1929, 9,764,000 eggs. The trapping operation generally began around March 20 and extended over a 60-day period.

The number of eggs available at these locations was ample for the stocking of streams that were believed to be suitable for steelhead. Accordingly, it was no longer necessary to carry a stock of mature trout in the hatchery ponds. Progeny of these fish were widely distributed throughout Michigan and other states. By 1930, the steelhead distribution was mainly limited to suitable streams that were excluded from the spawning migration due to dams or other barriers. In 1930, the egg-take stations on the Pine Creek and Little Manistee River were discontinued, and all steelhead spawn taking operations were confined to the Junction Dam Field Station. The station produced 3,522,000 eggs that season. Eggs from the wild steelhead spawned at the Junction Dam, Pine Creek, and Little Manistee River stations supplied the entire steelhead program in Michigan from 1914 until 1931.

The collection of steelhead eggs from wild fish was discontinued after the 1931 season. At that time, the policy of trapping and transferring fish began. In most years from 1924 until 1966, the MDNR trapped and transferred steelhead over Tippy Dam. Numbers ranged from 2,718 in 1924 to just 17 in 1962. Correspondence in MDNR files states that the steelhead runs in the Manistee River began to fall off in the late 1950s due to predation from sea lampreys, which had become established in Lake Michigan. The correspondence indicates that in 1953, only 5% of the transferred steelhead showed lamprey scarring. By 1957, 50% of the transferred fish were scarred. In 1961, every single one of the 63 steelhead transferred had lamprey scars. Clearly, the sea lampreys had a profound affect on the steelhead population of the Manistee River.

The "modern" steelhead program on the Manistee River began in 1968, when 14,916 yearling Little Manistee strain steelhead were stocked. By that time, fisheries managers had developed strategies to combat sea lampreys, and had brought lamprey numbers down to moderate levels. Steelhead have been stocked in most years since, with numbers ranging from 6,000 to 120,950 yearlings (Table 1). In recent years, the target stocking numbers have been 50,000 Little Manistee strain (winter run) and 34,000 Skamania strain (summer run) steelhead annually. The hatchery fish are supplemented by the modest natural reproduction from tributaries like Pine Creek and Bear Creek, and also some natural reproduction from the mainstem of the Manistee itself. MDNR studies utilizing Ratio 23 analysis of scale samples (Seelbach and Whelan, 1988) collected from sport-caught steelhead show that naturally-reproduced fish typically comprise somewhere between 24% and 41.5% of the catch, with the rest being hatchery-produced fish (Table 3). Creel estimates for steelhead harvested from the Manistee River below Tippy Dam ranged from 12,204 to 22,091 and averaged 18,610 for the period from 1999-2003 (Table 2).

Although there is some natural reproduction of steelhead occurring in the Manistee River below Tippy Dam, it is limited due to high water temperatures caused by the surface draw of Tippy Dam (Woldt, 1998). If the temperature problems were alleviated, the potential exists for the production of substantial numbers of wild steelhead smolts. Woldt (1998) estimated that in early July of 1997, the abundance of young of the year (YOY) steelhead between Tippy Dam and High Bridge was over three million. However, that number had dropped to less than two thousand by the following March. He found that the largest losses occurred over the time period from July 15 to August 12, and attributed those losses to high water temperatures. Horne (2001) predicted that wild steelhead recruitment would increase to some degree if Tippy Dam were retrofitted with a bottom draw, cold water discharge. Such an apparatus would allow colder water from the hypolimnion of Tippy Pond to be released below Tippy Dam, creating a temperature regime that would allow for greater survival of YOY steelhead.

Brown Trout

The resident brown trout fishery in the Manistee River below Tippy Dam was created only recently. Stocking began in 1986, when 22,700

brown trout were planted at High Bridge. Brown trout stocking at High Bridge continued until 1991, when the stocking site was moved to Tippy Dam. Numbers stocked on an annual basis ranged between approximately 15,000 and 30,000 yearlings until 2001, when about 60,000 yearlings were stocked along with another 50,000 fall fingerlings (Table 1). An additional 40,000 yearlings were stocked in 2002. Most of the brown trout stocked in 2001 and all of those stocked in 2002 were Gilchrist Creek strain. In 2003, 60,000 yearling Wild Rose strain brown trout were stocked. Since the planting site was moved to Tippy Dam, this stocking regime has established a year-round brown trout fishery in the Manistee River below Tippy Dam. While not as popular as the salmon and steelhead fisheries, the brown trout are heavily targeted in the summer when the bigger potomadromous salmonids are scarce.

Lake Sturgeon

One native Manistee River species that has attracted a great deal of interest recently, after being ignored for many years, is the lake sturgeon. Currently listed as a state-threatened species, the lake sturgeon was most likely very abundant in the Manistee River prior to European settlement. However, dam construction, overharvest, and possibly stream habitat destruction from logging caused the sturgeon population of the Manistee River to nearly go extinct. Currently, there is a small, remnant population of lake sturgeon that runs the Manistee River annually. Little was known about the population before 1999, when several university studies (Gunderman 2001, Yeoman 2002, and Lallaman 2003) examined the lake sturgeon population in the Manistee River. Gunderman (2001) estimated the population of sturgeon in Manistee Lake to be 106 individuals in the spring of 1999, and 57 individuals in the spring of 2000. In both of those years, about half of the individual sturgeon sampled were juveniles. Lallaman (2003) estimated 23 and 36 spawning individuals in 2001 and 2002, respectively. Only a few of the spawners captured each year were females. Even so, it is evident that natural reproduction is still occurring to some extent in the Manistee River. Each year, anglers observe sturgeon spawning on the cobble that was placed as part of the Suicide Bend restoration project (located approximately 2/3 of a mile downstream from Tippy Dam). It also can be concluded that Manistee Lake is critical sturgeon habitat, used by juveniles for foraging, and by adults as they stage for the spawning run (Gunderman 2001, Yeoman 2002, and Lallaman 2003).

The Little River Band of Ottawa Indians (LRBOI) has also been conducting sturgeon research on the Manistee River below Tippy Dam. In 2002 and 2003, they were successful in capturing larval sturgeon in drift nets. In 2004, they plan to implement a streamside rearing program, in which they will capture larval lake sturgeon, raise them for several months, and then release them back into the Manistee River (M. Holtgren, LRBOI, personal communication).

Master Angler Data

A number of fish caught each year from the Manistee River qualify for the MDNR Fisheries Division Master Angler program (Table 4). The Master Angler records are organized by water body and county, which means that some of the fish entered could be from the Hodenpyl stretch of the Manistee River, which also flows through Manistee County. However, migratory fish do not have access to that stretch, and it gets only a fraction of the angling pressure that the Manistee River below Tippy Dam receives. Undoubtedly, the vast majority of the fish entered for the Manistee River, Manistee County come from the Manistee River below Tippy Dam. Since 1994, Manistee River entries for Manistee County have ranged from a minimum of 13 in 1998 to a maximum of 64 in 1996. Fish species which have been reported each year since 1994 include rainbow trout (steelhead), chinook salmon, and redhorse. In most years, steelhead approaching 20 lbs and chinook salmon exceeding 30 lbs are caught. Other species present in multiple years include brown trout, coho salmon, walleye, rock bass, channel catfish, white sucker, longnose sucker, and bowfin. Rare catches include two quillback carpsuckers entered in 2003, a lake

sturgeon entered in 2003, and a Great Lakes muskellunge entered in 1999.

Previous Fisheries Surveys

Other than the previously mentioned MDNR creel census and university research projects, the only other previous fisheries survey of the Manistee River below Tippy dam prior to 2003 was conducted by Consumers Power Company as part of the FERC relicensing process (Lawler, Matusky, and Skeller Engineers, 1991). In that survey, two river stretches were electroshocked in May of 1991. The most upstream site was near the Sawdust Hole (about two miles below Tippy Dam), which was sampled on May 17, 1991. The most downstream site was near High Bridge, and was sampled on May 15, 1991. Only one shocking run was completed at the Sawdust Hole site, while five runs were completed at the High Bridge site.

At the Sawdust Hole site, a total of 4,291 fish were caught, but the total number of species represented is unknown. Salmonid parr were not identified to species, and "tessellated darter" is listed, but is not known to live in the Manistee River watershed. Those fish which were identified as "tessellated darter" were most likely johnny darters, which are similar in appearance and known to be common in the watershed. Also, both rainbow trout and steelhead are listed, but are the same species. Almost half of the fish captured in the survey were alewives, presumably in the midst of a spawning run from Lake Michigan. Other species represented in strong numbers included golden redhorse, longnose sucker, "salmonid parr" (could have been a mix of brown trout, chinook salmon, coho salmon, and steelhead), shorthead redhorse, silver redhorse, and trout-perch. Gamefish recorded included brown trout (44 individuals from 4-8"), largemouth bass, rainbow trout, smallmouth bass, steelhead, and walleye.

At the High Bridge site, a total of 1,414 fish were caught, but again the exact number of species represented is unkown. As at the Sawdust Hole site, salmonid parr were not identified to species, and "tessellated darter" is listed again, but is not known to live in the Manistee River watershed. Species represented in significant numbers included golden redhorse, longnose sucker, salmonid parr (again, these could have been a mix of brown trout, chinook salmon, coho salmon, and steelhead), shorthead redhorse, silver redhorse, steelhead, "tessellated darter", and trout-perch. Gamefish recorded included brown trout (11 individuals from about 5-10"), northern pike, smallmouth bass, and steelhead. One adult lake sturgeon was also captured.

According to Rozich (1998), there are 80 species of fish which are known to currently live in the Manistee River watershed. Woldt (1998) captured a total of 40 fish species in the Manistee River below Tippy Dam.

2003 Fisheries Survey

The most recent fisheries survey of the Manistee River below Tippy Dam was done by MDNR Fisheries Division personnel on July 8th and 9th, 2003. Two stream stretches were surveyed using a Smith Root boomshocking boat equipped with a jet motor. The most upstream site included one shocking run on the northern half of the river, for one mile downstream from the Tippy Dam boat launch, and was sampled on July 8th. The most downstream site also included one shocking run on the northern half of the river, for one mile downstream from the High Bridge USFS boat launch, and was sampled on July 9th (Figure 2). The primary purpose of the survey was to determine the effectiveness of the brown trout stocking program by determining whether multiple year classes of fish were present, which would indicate "holdover", or survival, from one year to the next. A secondary survey purpose was to inventory the existing populations of other fish species.

When the survey below the Tippy Dam boat launch was initiated at 10:00 am on July 8th, the air temperature was 77.4°, and the water temperature was 69.8°. A grand total of 706 fish representing sixteen species were captured (Table 5). The most numerous species was brown trout, with 238 individuals ranging from

6-16" in length captured. Other salmonids present included steelhead, and YOY coho and chinook salmon. Other game and panfish species present included rock bass, smallmouth bass, walleye, and yellow perch. Other species present in modest numbers included logperch, shorthead redhorse, and silver redhorse. By weight, shorthead and silver redhorse comprised more than half of the total fish biomass captured in this survey reach.

When the survey was initiated below the High Bridge boat launch at 9:30 am on July 9th, the air temperature was 71.9°, and the water temperature was 68.5°. A grand total of 228 fish, representing eighteen species, were captured (Table 6). The only salmonid captured was one ten inch steelhead. Game and panfish present included black crappie, bluegill, largemouth bass, northern pike, rock bass, smallmouth bass, and walleye. Other species present in modest numbers included shorthead redhorse and silver redhorse. Again, shorthead and silver redhorse comprised about half of the total fish biomass captured in the survey. When combined with carp and white sucker, these so-called "rough" species made up 70% of the total fish biomass captured in this survey reach.

Age and Growth

Combined data for both survey stations on the Manistee River below Tippy Dam indicate that brown trout were substantially longer than the statewide average for the species (Table 7). This difference in length at age is primarily due to the good conditions for growth in the hatchery. A closer evaluation of the data shows that growth *rates* are much closer to average. The state average length at age table was developed from data collected in unstocked streams where annual growth increments are about three inches per year. Most growth in unaltered trout streams occurs during the months of May through October with little growth occurring during colder months. Thus, these fish are growing about a half-inch per month. The yearling brown trout stocked in 2003 averaged 6.9 inches when they were planted about three months before the survey. Accordingly, the 1.3 inch increase in length of yearling brown trout reflects "about average" growth rates. Nonetheless, the growth advantage conferred by the hatchery results in fish growing to catchable size at an earlier age than unstocked trout. Wild brown trout growing at about average rates would not usually grow to 10 inches until they are three years old, whereas the average size of two-year-old brown trout below Tippy Dam was 11.6 inches.

Steelhead were also substantially larger than the statewide average (Table 7). However, because of the presence of both naturally-reproduced and hatchery-raised steelhead, it is difficult to interpret the data. Age-0 steelhead (which are all naturally reproduced) were growing at the statewide average. However, age-1 steelhead, including both naturally-reproduced and hatchery-raised fish, were growing 3.5 inches faster than the statewide average. Not enough older steelhead were captured to make inferences regarding growth.

Growth for other species in the Manistee River below Tippy Dam was variable (Table 7). Bluegills from age groups 4-5 were smaller than the state of Michigan mean length at age by 0.3 inches, while rock bass from age groups 2-5 were larger than the state of Michigan mean length at age by 0.2 inches. Smallmouth bass from age groups 1-4 were smaller than the state of Michigan mean length at age by 1.1 inches, while largemouth bass from age group 5 were larger than the state of Michigan mean length at age by 0.9 inches.

Analysis

There were some major differences in the composition of the fish community between the upper (immediately below Tippy Dam) and lower (below High Bridge) stations. For example, a major portion of the catch below Tippy Dam consisted of salmonids, including brown trout, steelhead, juvenile coho salmon, and juvenile chinook salmon, while one juvenile steelhead was the only salmonid captured below High Bridge. Species captured below High Bridge but not below Tippy Dam included black crappie, blacksided darter, bluegill, bowfin, burbot, common carp, largemouth bass, and northern pike. The fish community immediately below Tippy Dam is more of a cold/coolwater community, while below High Bridge there is more of a cool/warmwater fish community,

despite the fact that the High Bridge station begins only about 4.8 miles below the bottom of the Tippy Dam station. The obvious change in the fish community is undoubtedly due to physical changes which occur as the river progresses downstream. In the first couple of miles below Tippy Dam, sufficient groundwater is entering the river to keep it cool enough for year-round survival of salmonids. At some point between Tippy Dam and High Bridge however, the river loses the groundwater influx, causing it to warm to the point where trout cannot survive year-round.

Even though trout can survive in the first couple of miles below Tippy Dam, natural reproduction is either very limited or nonexistent. The reason for the lack of natural trout reproduction in this stretch of the Manistee River below Tippy Dam is most likely the warmer than ideal summer water temperatures. According to Horne (2001), July and August temperatures in the Manistee River below Tippy Dam averaged near 70° in the period from 1997-2000. Therefore, the trout fishery in the Manistee River below Tippy Dam (at least in the first couple of miles immediately below the dam) is similar to other tailwater fisheries in the state, including the Manistee River below Hodenpyl Dam, Muskegon River below Croton Dam and the Au Sable River below Mio Dam. The warm water temperatures in these rivers are conducive to good growth for stocked trout, but inhibit natural reproduction. Therefore, as long as Tippy Dam is operated as a surface-draw facility, the steelhead, coho salmon, and resident brown trout fisheries will be dependent upon stocking.

Cool and warmwater game species including smallmouth bass, walleye, northern pike, and largemouth bass have self-sustaining populations in the Manistee River below Tippy Dam. Although some are caught each year by anglers, they are not heavily targeted. Creel census data shows that harvest for each of those species is minimal.

Management Direction

Summer warming of the Manistee River caused by the Tippy Dam is very likely the major factor limiting resident trout survival and steelhead natural reproduction. Therefore, lowering the temperature regime in this stretch is a very high priority. One way to improve the temperature regime would be to install a coldwater discharge at Tippy Dam. Theoretically, the discharge would draw from the cold water present at the bottom of Tippy Pond, which is known to thermally stratify in the summer. There should be sufficient cold water in the hypolimnion of Tippy Pond to lower the water temperature in the river below the dam, at least during critical periods. While there may not be enough cold water in Tippy Pond to run the coldwater discharge all of the time, there should be a way to strategically manage the cold water supply. Possible strategies could include discharging only on hot, sunny days, or during warm nights, to mimic “diurnal cooling” which takes place on free-flowing trout streams that are not influenced by dams. Such a device would likely allow increased survival of stocked trout, and increased natural reproduction. Currently, the MDNR Fisheries Division and its partners are negotiating with Consumers Power Company regarding the implementation of a plan to release cold water below the dam.

Until something is done to moderate the extreme water temperatures below the dam, the Manistee River below Tippy Dam will continue to be managed as a “put, grow, and take” resident trout fishery, and the steelhead fishery will continue to be dominated by hatchery fish. The limited natural reproduction that takes place in some years is insufficient to support the fishery. In January of 2004, a Fisheries Prescription was written to increase brown trout stocking numbers from 30,000 to 60,000 yearlings annually. This was done because Fisheries Division has previously had major successes with high stocking rates in other similar waters, including the Manistee River below Hodenpyl Dam, the Muskegon River below Croton Dam, and the Au Sable River below Mio Dam. Stocking 60,000 yearling brown trout annually below Tippy Dam should provide a good fishery for resident brown trout. Steelhead stocking rates will remain at 50,000 yearlings annually for Little Manistee (winter-run) strain steelhead, and 34,000 yearlings annually for Skamania (summer-run) strain steelhead. Coho salmon

will continue to be stocked at a rate of 100,000 yearlings annually, and 100,000 chinook salmon parr will continue to be stocked into the net pens and released in the Manistee River channel between Manistee Lake and Lake Michigan.

The amount of chinook salmon reproduction that is occurring in the Manistee River is currently unknown. Rough estimates made from informal MDNR studies indicate that there may be more than one million naturally reproduced chinook salmon parr leaving the Manistee River annually. While other Michigan rivers including the White, Pere Marquette, and Betsie also produce wild chinook salmon, the Manistee River is without a doubt one of the largest sources of wild chinook salmon in the Lake Michigan basin. Therefore, it is critical that MDNR determine the number of wild chinook salmon smolts outmigrating each year. These data will be extremely valuable in helping to manage the Lake Michigan ecosystem, and particularly in managing the Lake Michigan forage base. In the late 1980s and early 1990s, salmonid populations in Lake Michigan crashed due to a depleted forage base caused by overstocking. If we wish to avoid such crashes in the future, it is of extreme importance that we determine the number of wild chinook salmon entering Lake Michigan, starting with the Manistee River.

One management action that may benefit steelhead to some extent would be the addition of boulder habitat in the three or four miles of the Manistee River below Tippy Dam. Woldt (1998) found that the percentage of available boulder substrate was a significant factor affecting YOY steelhead in several of the models he ran for his thesis. During his study of the river, he noted that although boulder habitat was scarce, YOY steelhead selected it if it was available. While temperature is most likely the main limiting factor for steelhead production, the addition of boulder to the river might benefit wild juvenile steelhead to some degree.

It is well documented that sand is a poor substrate for aquatic organisms, and in particular, trout and juvenile salmon. While some of the sand in the Manistee River is of natural origin, large amounts of sand were deposited into the river from late 19th century and early 20th century logging practices. Today, sand is still entering the watershed via poor road crossings, poor riparian land use practices, and eroding streambanks. Therefore, rehabilitation efforts for the Manistee River below Tippy Dam, and the Bear Creek watershed, should concentrate on repairing poor road crossings, stabilizing eroding streambanks, and possibly removing sand from the streambed. We will continue to work with the Conservation Resource Alliance, the Lower Manistee River Partnership Agreement, and the Bear Creek Restoration Committee to improve the fisheries habitat in the Bear Creek watershed and in the Manistee River below Tippy Dam.

Other actions that should be taken include assessing fish populations in the small tributaries that enter the Manistee River between Tippy Dam and Lake Michigan, including Bear Creek, Pine Creek, and their associated tributaries. Many of these tributaries are trout streams which have not been surveyed by Fisheries Division since the 1960s, and likely have some fisheries potential.

References:

Gunderman, B. J. 2001. Population dynamics of lake sturgeon (*Acipenser fulvescens* Rafinesque) in the Manistee River. Master's Thesis, Central Michigan University, Mt. Pleasant.

Horne, B. D. 2001. Simulating effects of hydro-dam alteration on thermal regime and wild steelhead recruitment in the Manistee River, Michigan. Master's Thesis, University of Michigan, Ann Arbor.

Lallaman, J. J. 2003. Stock assessment and summer movement patterns of lake sturgeon (*Acipenser fulvescens*) in the Manistee River, MI. Master's Thesis, Central Michigan University, Mt. Pleasant.

Lawler, Matusky and Skeller Engineers. 1991. Application for license for major project-existing dam, Manistee River, Tippy project, FERC project #2580 and Hodenpyl project,

FERC project #2599, Binders 1-38. Prepared for Consumers Power Company, Jackson, Michigan.

Rozich, T. J. 1998. Manistee River Assessment. Michigan Department of Natural Resources, Fisheries Division, Special Report Number 21. Ann Arbor, Michigan.

Seelbach, P. W., and Whelan, G. E. 1988. Identification and Contribution of Wild and Hatchery Steelhead Stocks in Lake Michigan Tributaries. MDNR Fisheries Research Report 1950, Ann Arbor, MI.

U. S. Department of Interior, Fish and Wildlife Service and U. S. Department of Commerce, Bureau of the Census. 1996 Survey of Fishing , Hunting, and Wildlife-Associated Recreation.

Woldt, A. P. 1998. Production of juvenile steelhead in two northern Lake Michigan tributaries. Master's Thesis, University of Michigan, Ann Arbor.

Yeomans, L. H.-N. 2002. Seasonal movements of adult lake sturgeon (*Acipenser fulvescens)* and larval abundance in the Manistee River, Michigan. Master's Thesis, Central Michigan University, Mt. Pleasant.

Table 1.-Manistee River Fish Plantings, 1992-Present, Tippy Dam – Lake Michigan.

Year	Species	Number	Site	Strain	Mark
1992	Chinook salmon	71,032	Insta-Launch NP	Michigan	OX
	Brown trout	14,700	Manistee	Soda Lake	
	Steelhead	25,100	High Bridge	Little Manistee	
	Steelhead	20,000	High Bridge	Skamania	
	Brown trout	29,294	Tippy Dam	Soda Lake	
1993	Chinook salmon	112,176	Insta-Launch NP	Michigan	OX
	Brown trout	14,900	Manistee	Wild Rose	
	Coho salmon	110,000	High Bridge	Michigan	
	Steelhead	30,100	High Bridge	Little Manistee	
	Steelhead	19,900	High Bridge	Skamania	
	Brown trout	29,700	Tippy Dam	Plymouth Rock	
1994	Chinook salmon	120,514	Insta-Launch NP	Michigan	OX
	Brown trout	14,900	River St.	St. Croix	
	Steelhead	30,000	High Bridge	Little Manistee	
	Steelhead	25,000	Tippy Dam	Little Manistee	
	Brown trout	29,999	Tippy Dam	St. Croix	
1995	Chinook salmon	123,192	Insta-Launch NP	Michigan	OX
	Brown trout	13,300	River St.	Seeforellen	
	Brown trout	3,100	River St.	Soda Lake	
	Coho salmon	93,075	High Bridge	Michigan	
	Coho salmon	101,222	High Bridge	Michigan	
	Steelhead	25,000	High Bridge	Little Manistee	RP
	Steelhead	12,550	High Bridge	Skamania	RP
	Brown trout	3,000	Tippy Dam	Soda Lake	
	Brown trout	27,090	Tippy Dam	Wild Rose	
	Steelhead	25,000	Tippy Dam	Little Manistee	RP
	Steelhead	18,370	Tippy Dam	Skamania	RP
1996	Chinook salmon	124,958	Solberg net pen	Michigan	
	Steelhead	14,795	Manistee	Little Manistee	AD/CWT
	Brown trout	13,346	River St.	Wild Rose	
	Coho salmon	100,067	High Bridge	Michigan	
	Coho salmon	100,148	High Bridge	Michigan	
	Steelhead	20,487	High Bridge	Little Manistee	AD/CWT, RP
	Steelhead	15,357	High Bridge	Skamania	AD/CWT
	Steelhead	15,950	Tippy Dam	Little Manistee	AD/CWT
	Steelhead	21,430	Tippy Dam	Skamania	AD/CWT
	Brown trout	26,876	Tippy Dam	Wild Rose	
1997	Chinook salmon	125,080	Solberg net pen	Michigan	
	Steelhead	17,074	Manistee	Little Manistee	AD/CWT, RP
	Brown trout	13,490	River St.	Seeforellen	
	Coho salmon	100,502	High Bridge	Michigan	
	Steelhead	17,287	High Bridge	Little Manistee	AD/CWT, RP
	Steelhead	16,494	High Bridge	Skamania	AD/CWT
	Steelhead	16,980	Tippy Dam	Little Manistee	AD/CWT, RP
	Steelhead	15,965	Tippy Dam	Skamania	AD/CWT
	Brown trout	29,400	Tippy Dam	Wild Rose	

Table 1.-Continued

Year	Species	Number	Site	Strain	Mark
1998	Chinook salmon	112,498	Solberg net pen	Michigan	
	Steelhead	18,629	Manistee	Little Manistee	AD/CWT, RP
	Brown trout	14,550	River St.	Seeforellen	
	Steelhead	17,054	High Bridge	Little Manistee	AD/CWT
	Steelhead	16,971	High Bridge	Skamania	AD/CWT
	Steelhead	17,115	Tippy Dam	Little Manistee	AD/CWT
	Steelhead	17,105	Tippy Dam	Skamania	AD/CWT
	Brown trout	21,707	Tippy Dam	Seeforellen	
	Brown trout	6,133	Tippy Dam	Wild Rose	
1999	Chinook salmon	97,044	Solberg net pen	Michigan	
	Steelhead	17,080	Manistee	Little Manistee	AD/CWT, RP
	Brown trout	15,000	River St.	Seeforellen	
	Coho salmon	120,369	High Bridge	Michigan	
	Steelhead	17,562	High Bridge	Little Manistee	AD/CWT, RP
	Steelhead	12,555	High Bridge	Skamania	AD/CWT
	Steelhead	17,010	Tippy Dam	Little Manistee	AD/CWT, RP
	Steelhead	12,961	Tippy Dam	Skamania	AD/CWT
	Brown trout	3,900	Tippy Dam	Seeforellen	
	Brown trout	14,952	Tippy Dam	Wild Rose	
2000	Chinook salmon	97,344	Solberg net pen	Michigan	OX
	Brown trout	15,950	River St.	Seeforellen	
	Coho salmon	132,079	High Bridge	Michigan	
	Steelhead	51,009	Tippy Dam	Little Manistee	RP
	Steelhead	17,484	Tippy Dam	Skamania	LVRP
	Brown trout	11,215	Tippy Dam	Seeforellen	
	Brown trout	18,785	Tippy Dam	Wild Rose	
2001	Chinook salmon	96,197	Solberg net pen	Michigan	OX
	Brown trout	14,200	River St.	Seeforellen	
	Coho salmon	120,069	High Bridge	Michigan	
	Steelhead	51,000	Tippy Dam	Little Manistee	RP
	Steelhead	30,253	Tippy Dam	Skamania	DOLV
	Brown trout	8,935	Tippy Dam	Seeforellen	
	Brown trout	51,065	Tippy Dam	Gilchrist Creek	
	Brown trout	50,000	Tippy Dam	Gilchrist Creek	
2002	Chinook salmon	95,103	Solberg net pen	Michigan	OX
	Brown trout	15,350	River St.	Seeforellen	
	Coho salmon	98,434	High Bridge	Michigan	
	Steelhead	51,000	Tippy Dam	Little Manistee	RP
	Steelhead	36,478	Tippy Dam	Skamania	RP
	Brown trout	40,000	Tippy Dam	Gilchrist Creek	

Table 1.-Continued

Year	Species	Number	Site	Strain	Mark
2003	Chinook salmon	96,284	Channel net pen	Michigan	OX
	Brown trout	15,500	River St.	Wild Rose	
	Coho salmon	96,962	High Bridge	Michigan	
	Coho salmon	3,038	High Bridge	Hinchinbrooke	LV
	Steelhead	51,001	Tippy Dam	Little Manistee	RP
	Steelhead	33,260	Tippy Dam	Skamania	RP
	Brown trout	60,000	Tippy Dam	Wild Rose	

Fin Clip Legend:
RP = Right Pectoral
LV = Left Ventral
AD/CWT = Adipose with Coded Wire Tag implant
LVRP = Left Ventral / Right Pectoral
DOLV = Dorsal / Left Ventral
OX = Internal Oxytetracycline Mark, no fin clip

Table 2.-MDNR creel census data for the Manistee River from Tippy Dam to Manistee Lake, 1999-2003.

Year[1]	Estimated chinook salmon harvest	Estimated steelhead harvest	Estimated coho salmon harvest	Estimated angler trips	Estimated angler days	Estimated angler hours
1999	24,937	22,091	617	111,863	85,076	528,766
2000	25,159	21,437	2,048	128,158	100,280	600,247
2001	36,559	20,507	1,100	134,804	108,262	645,223
2002	30,735	12,204	3,183	110,993	108,046	546,750
2003	36,051	16,811	247	108,097	107,024	531,517

[1]The creel surveys in 1999-2003 took place from mid-February through mid-December.

Table 3.-Estimates of wild and hatchery steelhead in the Manistee River below Tippy Dam, based on Ratio 23 analysis of scale samples of sport-caught steelhead.

Year	Sample size	Percent Wild	Percent Hatchery
1992	94	41.5%	58.5%
1993	79	34.2%	65.8%
2000	463	24%	76.0%
2001	404	33%	67.0%
2002	321	28%	72.0%

Table 4.-Master Angler data for the Manistee River in Manistee County, 1994-2003.

Year	Total # of Entries	# Catch and Release Entries	# Catch and Keep Entries	# Chinook Salmon Entries[1]	# Steelhead Entries[1]
1994	28	1	27	15	5
1995	63	5	58	27	11
1996	64	11	53	20	26
1997	37	11	26	5	15
1998	13	5	8	3	3
1999	61	18	43	25	21
2000	28	14	14	3	7
2001	44	19	25	17	16
2002	21	16	5	3	4
2003	22	10	12	8	1

[1]Inclused both “catch and release” and “catch and keep” entries.

Table 5.-Number, weight, and length of fish collected from northern half of the one mile stretch of the Manistee River below the Tippy Dam boat launch by boomshocking, July 8, 2003.

Table 5. Number, weight, and length of fish collected from northern half of the one mile stretch of the Manistee River below the Tippy Dam boat launch by boomshocking, July 8, 2003.

Species	Number	Percent by number	Weight (pounds)	Percent by weight	Length range (inches)[1]	Average length	Percent legal size[2]
Brown trout	238	33.7	60.4	22.2	6-16	8.2	0.4 (16")
Chinook salmon	2	0.3	0.01	0.0	2-3	2.5	0 (10")
Coho salmon	18	2.5	0.11	0.0	2-4	2.7	0 (10")
Johnny darter	1	0.1	0.01	0.0	2-2	2.0	-
Logperch	91	12.9	1.79	0.7	3-5	3.3	-
Steelhead (unclipped)	97	13.7	3.26	1.2	1-14	2.3	0 (15")
Steelhead[a] (RP clip)	22	3.1	11.85	4.3	7-24	9.3	9 (15")
Rock bass	83	11.8	28.84	10.6	2-10	7.0	83 (6")
Sculpin	2	0.3	0.06	0.0	2-4	3.0	-
Sea lamprey	1	0.1	0.54	0.2	19-19	19.0	-
Shorthead redhorse	44	6.2	80.63	29.6	13-18	16.1	-
Silver redhorse	39	5.5	62.65	23.0	13-21	16.3	-
Smallmouth bass	55	7.8	10.19	3.7	3-14	5.7	0.02 (14")
Spotfin Shiner	1	0.1	0.03	0.0	4-4	4.0	-
Walleye	2	0.3	7.66	2.8	20-24	17.6	100 (15")
White sucker	3	0.4	3.43	1.3	12-15	13.7	-
Yellow perch	7	1.0	1.2	0.4	6-8	6.9	57 (7")
Total	706	100.0	272.66	100.0			

[1] Note some fish were measured to 0.1 inch, others to inch group: e.g., "5" = 5.0 to 5.9 inch, "12" = 12.0 to 12.9 inches; etc.

[2] Percent legal size or acceptable size for angling. Legal size or acceptable size for angling is given in parentheses.

[a] These steelhead were marked with a right pectoral fin clip, indicating that they were hatchery produced.

Table 6.-Number, weight, and length of fish collected from northern half of the one mile stretch of the Manistee River below the High Bridge boat launch by boomshocking, July 9, 2003.

Species	Number	Percent by number	Weight (pounds)	Percent by weight	Length range (inches)[1]	Average length	Percent legal size[2]
Black crappie	5	2.2	1.95	0.7	8-9	8.4	100 (7")
Blacksided darter	1	0.4	0	0.0	2-2	2.0	-
Bluegill	21	9.2	3.83	1.4	5-7	5.9	71 (6")
Bowfin	1	0.4	1.34	0.5	15-15	15.0	-
Burbot	1	0.4	0.68	0.2	13-13	13.0	-
Carp	4	1.8	36.81	13.5	25-28	26.8	-
Johnny darter	1	0.4	0.01	0.0	2-2	2.0	-
Largemouth bass	18	7.9	22.26	8.1	8-17	12.3	44 (14")
Logperch	3	1.3	0.08	0.0	3-4	3.7	-
Northern pike	2	0.9	11.66	4.3	21-34	27.5	50 (24")
Steelhead (unclipped)	1	0.4	0.40	0.1	10-10	10.0	0 (15")
Rock bass	34	14.9	7.85	2.9	3-10	5.6	26 (6")
Shorthead redhorse	33	14.5	50.27	18.4	11-19	15.0	-
Silver redhorse	52	22.8	85.44	31.2	13-22	16.3	-
Smallmouth bass	27	11.8	16.42	6.0	3-20	5.1	15 (14")
Spotfin shiner	11	4.8	0.11	0.0	2-4	2.5	-
Walleye	3	1.3	15.76	5.8	21-28	24.3	100 (15")
White sucker	10	4.4	18.57	6.8	12-19	16.0	-
Total	228	100.0	273.44	100.0			

[1] Note some fish were measured to 0.1 inch, others to inch group: e.g., "5" = 5.0 to 5.9 inch, "12" = 12.0 to 12.9 inches; etc.

[2] Percent legal size or acceptable size for angling. Legal size or acceptable size for angling is given in parentheses.

Table 7.-Average total length (inches) at age, and growth relative to the state average, for fish sampled from the Manistee River below Tippy Dam on July 8-9, 2003.

Species	Age group	Number of fish	Length range (inches)	Mean length (inches)	State average length	Growth index (by age group)[1]	Mean growth index for species
Black crappie	IV	3	8.8-9.6	9.1	8.9	-	-
	V	2	8.1-9.5	8.8	9.7	-	-
Bluegill	III	1	5.5-5.5	5.5	5.3	-	-0.3
	IV	9	5.1-6.8	6	6.2	-0.2	-
	V	8	5.4-7.7	6.5	6.5	-0.4	-
	VII	1	7.2-7.2	7.2	7.2	-	-
Brown trout	I	34	6-10.6	8.2	5.8	+2.4	+2.6
	II	22	8.3-13.9	11.6	8.8	+2.8	-
	III	1	16.3-16.3	16.3	11.8	-	-
Largemouth bass	II	3	8.2-9.3	8.7	8.7	-	+0.9
	III	1	8.8-8.8	8.8	10.6	-	-
	IV	4	11.4-14.4	13.1	12	-	-
	V	6	13.8-15	14.6	13.7	+0.9	-
	VI	2	13.1-13.7	13.4	15	-	-
	VIII	1	17.4-17.4	17.4	17.6	-	-
Northern pike	VI	1	34.2-34.2	34.2	27.8	-	-
	VII	1	21.5-21.5	21.5	30.0	-	-
Steelhead	0	20	1.6-2.4	2	2.0	-	+1.8
	I	30	6.1-10.6	8.7	5.2	3.5	-
	II	2	14.9-15.7	15.3	8.0	-	-
	III	1	17.1-17.1	17.1	11.0	-	-
	IV	1	24-24	24	14.0	-	-
Rock bass	I	1	2.8-2.8	2.8	3	-	+0.2
	II	13	3.3-5.3	4.1	4.3	-0.2	-
	III	10	4.9-6.2	5.7	5.4	0.3	-
	IV	8	5.3-7.2	6.5	6.4	0.1	-
	V	15	6.8-8.9	7.7	7.2	0.5	-
	VI	4	7.9-8.7	8.3	8.1	-	-
	VII	3	8.5-9.8	9.1	8.8	-	-
	VIII	4	9.7-10	9.9	9.4	-	-
	IX	3	9.2-10.2	9.8	-	-	-
	X	1	10.9-10.9	10.9	-	-	-

Table 7.-Continued

Smallmouth bass	I	14	3.4-5.5	4.4	5.5	-1.1	-1.1
	II	25	6.3-8.1	7.0	8.8	-1.8	-
	III	5	8.7-10.9	9.9	11.1	-1.2	-
	IV	8	9.9-14.3	12.6	13.0	-0.4	-
	V	1	16-16	16.0	14.7	-	-
	VI	1	15.8-15.8	15.8	15.5	-	-
	VIII	1	20.3-20.3	20.3	17.4	-	-
Walleye	IV	1	20.6-20.6	20.6	16.2	-	-
	VI	2	21.4-24	22.6	19.6	-	-
	VIII	1	24.6-24.6	24.6	21.7	-	-
	IX	1	28.8-28.8	28.8	22.6	-	-
Yellow perch	II	1	6.6-6.6	6.6	5.7	-	-
	III	3	6.1-7.6	6.7	6.8	-	-
	IV	1	7.5-7.5	7.5	7.8	-	-
	V	1	8.6-8.6	8.6	8.7	-	-
	VII	1	8-8	8	10.5	-	-

[1] Growth index is the deviation from the state average length; at least five individuals must be aged from any one age group to make the comparison.

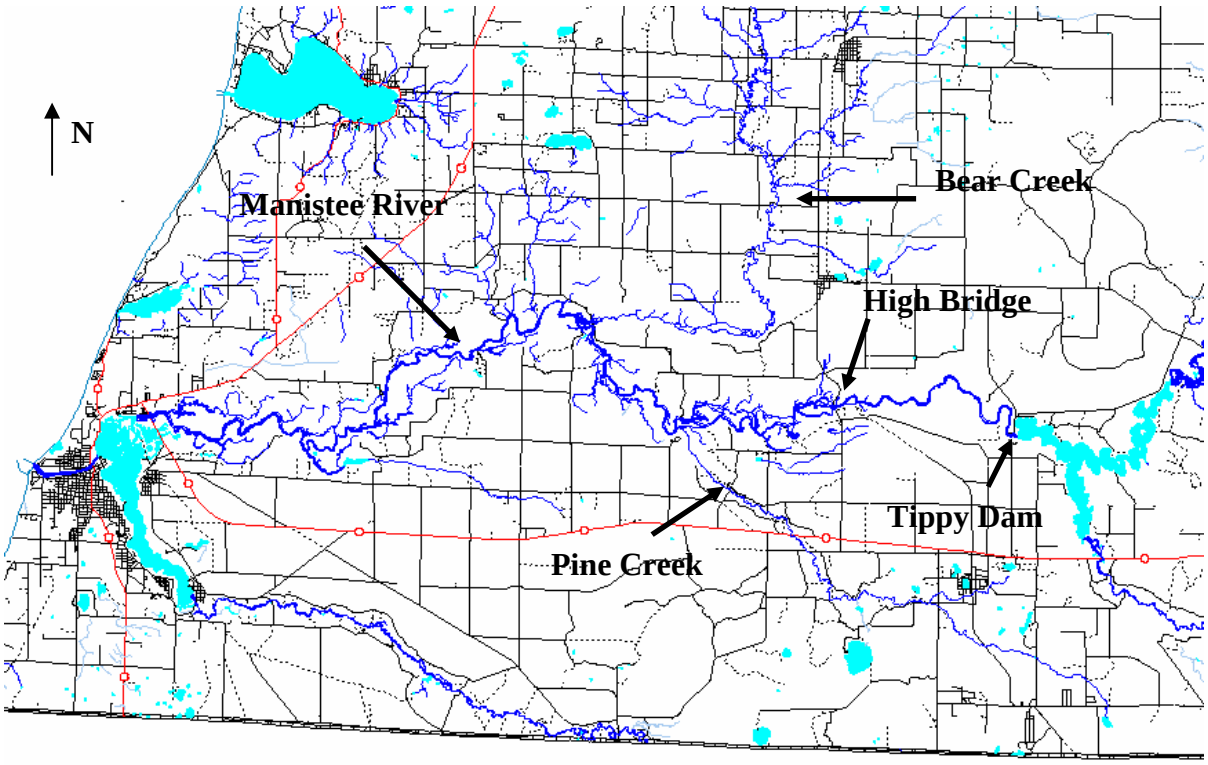

Figure 1.-The Manistee River between Tippy Dam and Lake Michigan.

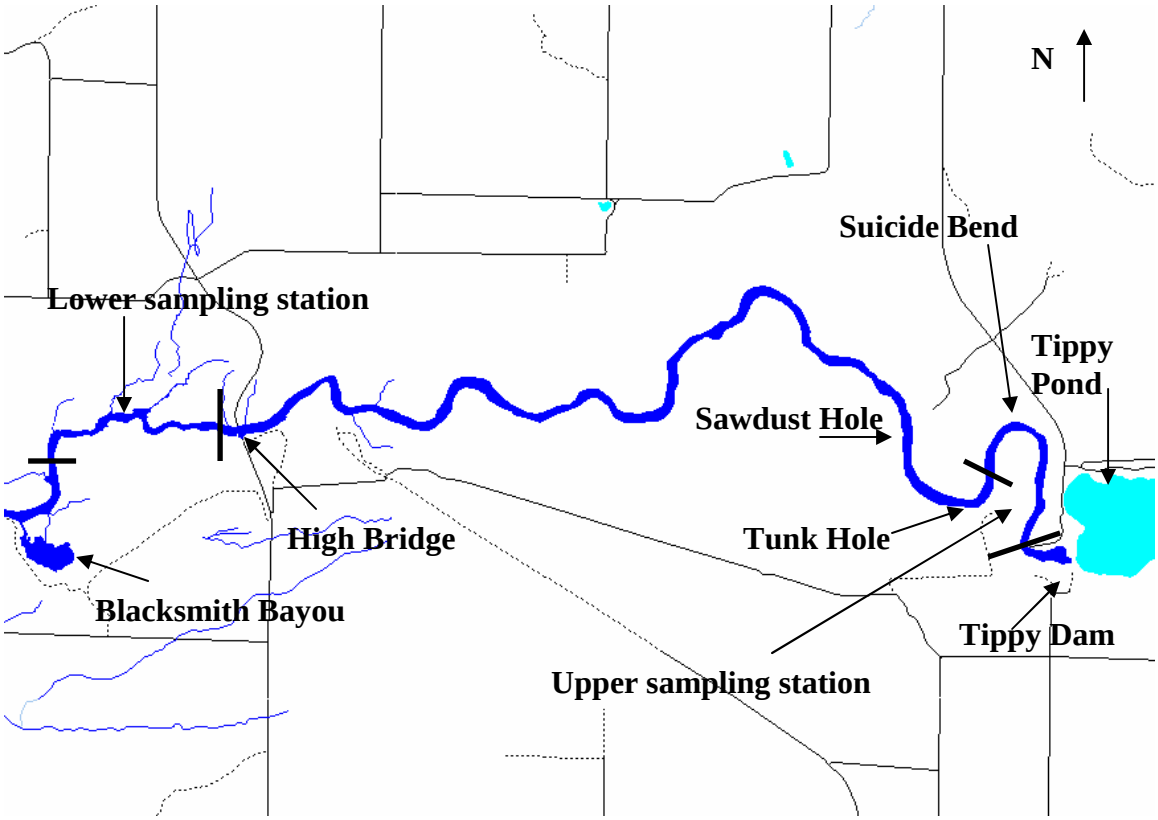

Figure 2.-The Manistee River between Tippy Dam and Blacksmith Bayou, including both sampling stations.