Foote Pond

Iosco County, T24N, R07/08E
Au Sable River watershed, last surveyed 2003

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Environment

Foote Pond is the sixth impoundment in a series of hydroelectric impoundments along the Au Sable River and located in Iosco County, approximately seven miles west of Oscoda Michigan, in the Lower Peninsula (Figure 1). Foote Pond is approximately 1,570 surface acres in size, just over 7 six miles long and typically under a half-mile wide. The pond has 37,000 acre-feet of storage.

The Consumer's Energy dam was built in 1918 and restricted fish access to river reaches further upstream. Early fish ladders at Foote Dam were considered failures. The dam has a head of 44 feet and has an average annual production of nearly 31,000 MwH. The dam completely prevents upstream fish passage and downstream entrainment of fish through the turbines does occur. Foote Dam is operated to discharge flows similar to the natural changes in flows found upstream of the project. This provides a natural flow regime below the Foote Project. This type of operation is referred to as "re-regulation". The flows are based on discharges from the upstream Alcona Project and adjusted for time and additional inflows to the river. This operation mode is required to mitigate for the operation of the peaking projects immediately upstream of the Foote Dam.

Most of the impoundment has upland woods and lowland swamps along its shore. The land surrounding the Foote Pond is a combination of private, state and federal land. The south shore has a large campground and boat launch located within Old Orchard Park. This public recreation facility is part of a Consumers Energy project licensed by FERC and directly managed by Oscoda Township. The township also oversees a paved boat launch near the dam which requires a permit for launching. The site offers ample parking for boat trailers and is known as Foote Site Park. There is also a small unimproved launch site at the upper reaches of Foote Pond. This site is located in the more riverine reaches of the pond below Cooke Pond Dam.

Maximum depths of Foote Pond reach over 40 feet and are found in the basin nearest the dam (Figure 2). The upper reaches of the impoundment are riverine and sinuous, offering many channels and bays. The wider, lake-like reaches of the impoundment have limited littoral zones or shoals, and drop-offs are prominent. Deeper water areas (15 feet or greater) make up over 60% of the pond area (Hanchin and Kinney 1997). Aquatic vegetation is prominent throughout the impoundment and most associated with the shallower reaches. Both submerged and emergent vegetation are prominent and include a variety of native and non-native plants. Woody debris amounts are variable throughout the impoundment, and more often found in shallow bays (Hanchin and Kinney 1997). Bottom substrate is primarily sand and gravel near shore, with silt, sand, and clay in the deeper depths.

History

Historical stocking records for Foote Pond are few when compared to stocking records at other regional lakes prior to 1960. Nearly two-million Walleye fry were stocked in the impoundment in the late 1950s,

and 1,500 Northern Pike fingerlings were stocked more recently in 1972. The Department of Conservation (DOC) interviewed anglers from 1933-1962 and found that fisherman primarily caught Rock Bass, Yellow Perch, Smallmouth Bass, and Northern Pike in the impoundment. In August 1950, DOC conducted a water temperature and dissolved oxygen profile of the deeper eastern basin. They found some thermal stratification but declining oxygen levels near the bottom.

A fish community survey was conducted by DOC in September 1956. Gill nets were used to collect fish throughout the impoundment, yet very few fish were collected. The few species collected included Rock Bass, Smallmouth Bass, Walleye, White Sucker, and Redhorse sucker species. A second more thorough survey was made in early-July 1969 by DOC utilizing two trap net nights and three fyke net nights. The catch was dominated by 6-8 inch Yellow Perch, 4-8 inch Rock Bass, and 4-8 inch Pumpkinseed. Also collected were bullhead species and lesser numbers of Northern Pike, Smallmouth Bass, Walleye, White Suckers, and redhorse suckers.

In the 1970s, fishing reports for the impoundment indicated that anglers had good success fishing for Northern Pike with good numbers of legal-size fish present. Angler complaints centered around the abundance of rough fish such as bullheads and Bowfin, as well as a desire to have Walleye stocked into Foote Pond. Department of Natural Resources (DNR) surveyed the fish community in mid-May 1972 with 150 minutes of electrofishing, 8 trap net lifts, shoreline seining, and 11 experimental gill-net lifts. The survey catches were again poor and surveyors found the placement of gear in this impoundment to be a challenge. Rock Bass dominated the catch, followed by Northern Pike and Brown Bullhead. Other fish species collected indicated a warm to cool water fish community and included Yellow Perch, Pumpkinseed, Black Bullhead, Bowfin, Smallmouth Bass, Walleye, White Sucker, Common Carp, and Golden Shiner.

Predator stocking became the focus of fisheries management for Foote Pond beginning in the 1980s (Table 1). Managers during this period indicated an "insufficient numbers of large game fish to provide a good fishery" and a fish population "dominated by rough species." DNR Walleye and Tiger Muskellunge rearing programs were underway statewide and both these species were stocked in Foote Pond for several years or even decades (Table 1).

Private consultants, hired by Consumers Energy, surveyed the fish community of Foote Pond in the fall of 1989 and spring of 1990. This was done in preparation for upcoming dam re-licensing. Hanchin and Kinney (1997) summarize the results,

"Their survey entailed the use of electrofishing gear, fyke, gill, trap, and seine nets. When data from all gears were combined, a total of 2,097 fish were captured representing 31 species. Fish from seining made up 55% of the total number of fish collected, electrofishing made up 27%, fyke netting made up 17%, and gill and trap netting made up the remaining 2%. Because the species composition is somewhat skewed from the large numbers of forage fish captured by electrofishing and seining, the summary is given for fyke and gill nets only. Game fish (Black Crappie, Largemouth Bass, Northern Pike, Pumpkinseed, Rock Bass, Smallmouth Bass, Walleye, and Yellow Perch) comprised 70%, while rough fish comprised 27%, and forage fish comprised 3% of the total catch. No Tiger Muskellunge were captured in the gill and fyke nets and only two were caught electrofishing. The only two Walleye captured in the survey were caught in gill nets.

The relative weight of game fish was generally low as compared to state standards. Black Crappie, Northern Pike, and Yellow Perch were all below the standard. Rock Bass were approximately equal to the standard, while relative weight indices were not calculated for Pumpkinseed, Largemouth Bass, Smallmouth Bass, and Walleye due to insufficient data."

DNR conducted numerous water temperature and dissolved oxygen profiles at Foote Pond in the summer of 1991 and 1992. These were done to assess the presence of oxygenated cold water in the pond and determine if adjustments could be made at Foote Dam to have a cold-water release (likely in preparation for the 1994 dam settlement agreement). Profiles were done at various locations and depths. Most shallow or riverine reaches where measurements were taken had little thermal stratification and dissolved oxygen levels were suitable throughout the water column. Dissolved oxygen was unsuitable to fish or even absent below 30 feet at the deeper basins, though cold water was available in deeper water.

During the 1990's, DNR continued a modified stocking program which began in the 1980's including subsequent follow-up fishery survey assessments. Walleye fingerlings were stocked in 1993 and nighttime electrofishing was used on one date in the fall of 1993 to assess stocking success. Sampling effort covered 2.4 miles of shoreline. No yearling or adult Walleye were captured in the shallows, and only four young-of-year (age-0) fish were caught (Table 2). While these results suggested poor fingerling survival, it was noted that sampling efforts were hindered by poor electrofishing conditions. Spring fingerling Walleye were also stocked in Foote Pond in 1996 (Table 1). DNR and USFS crews assessed this stocking event with nighttime electrofishing over two nights in the fall of the same year. The survey covered the nearshore environment for a combined four hours of sampling. Only one Walleye was collected, further suggesting poor survival of stocked Walleye fingerlings. Despite intermittent walleye stocking through the 1990s, Tiger Muskellunge stocking efforts were discontinued at Foote Pond and statewide after 1991 (Table 1) due to poor survival.

A joint fish community survey between DNR and the United States Forest Service (USFS) was conducted at Foote Pond from May 28 to June 5, 1996. Sampling gear included mainly small and large mesh fyke- nets, and two experimental gill nets for a total of 76 net nights. Catch composition and growth rates of fish from the survey can be found in Tables 3 and 4. A summary of the results were reported by Hanchin and Kinney (1997),

"The fish community observed in 1996 is characteristic of large impoundments. Game fish dominate the community in numbers, but rough fish make up a higher percentage of the biomass. The present game fish population is comprised of Black Crappie, Bluegill, Channel Catfish, Largemouth Bass, Northern Pike, Pumpkinseed, Rock Bass, Smallmouth Bass, Walleye and Yellow Perch. No Tiger Muskellunge were captured. The game fish observed in the 1996 survey comprised 1,009 of the 1,408 fish captured, or 72%, but they made up only 45% of the biomass. The rough fish community is composed of Bowfin, Brown Bullhead, Yellow Bullhead, White Sucker, and Common Carp. Forage fish observed were Golden Shiners, Northern Redbelly Dace, and Bluntnose Minnow. The 399 rough fish captured in the survey made up 28% of the total and accounted for 55% of the captured biomass. The rough fish population in the impoundment is high, and a smaller population in terms of biomass would be ideal for the more desirable game fish. An observable trend from present and historical survey data is that the percentage of the rough fish biomass has been increasing.

The current growth rates of game fish as compared to state averages vary depending on the species. The growth rates of game fish as compared to state averages vary depending on the species. The growth rates of Bluegill, Northern Pike, and Pumpkinseed all exceed the state average, while Rock Bass, Smallmouth Bass, and Yellow Perch have lower growth rates than the state averages. The growth rate of Black Crappie was equal to the state average. Growth indices were not calculated for Largemouth Bass or Walleye due to insufficient data.

The age composition of the fish populations was normal, with the exceptions of a few poor year classes in some species."

Hanchin and Kinney (1997) suggested that Foote Pond would continue to be managed for a warm water fish community. Management recommendations included continued fish population monitoring as well as periodic predator stocking. Secondary recommendations were to maintain peripheral wetlands of Foote Pond for Northern Pike spawning and rearing habitat, as well as potential installation of fish cribs or gravel reefs for other species.

Current Status

A general fish community survey of Foote Pond was conducted by DNR from May 20-24, 2002. The purpose of the survey was general in nature, but to also evaluate previous Walleye stocking efforts. Procedures followed the Status and Trends protocol design developed by the Fisheries Division to standardize data collection methods and to allow assessment of temporal and spatial fish population trends. Survey effort consisted of 15 large-mesh fyke-net lifts, 5 mini-fyke net lifts, 4 large-mesh trap-net lifts, and 6 inland gill-net lifts. The trap netting effort was supplemental to the required survey sets. Nighttime electrofishing, though a part of the survey protocol effort, was not conducted during this survey for unknown reasons. Fish were also not aged during the survey for reasons unknown.

Notes indicated that the rapid drop-offs near the littoral zone made standardized Status and Trend survey efforts non-optimal and resulted in a very low catch of fish. A total of 437 fish were captured during the survey effort (Table 5). This is a low number when compared to regional lakes that are surveyed with similar sampling efforts. Panfish catch was comprised of Rock Bass, Yellow Perch, Bluegill, Pumpkinseed, and Black Crappie. Most panfish were 6 inches or less in size (Table 6) except for Black Crappie which attained larger sizes.

The only predator game fish collected in good numbers was Northern Pike (Table 5). This species was dominated by sub-legal fish, but acceptable numbers of legal (24 inches and larger) pike were collected. Only two Walleye were collected in the survey, despite stocking efforts in the previous two-decades. A recommendation from managers following the survey was to continue Walleye stocking. Other predators such as Largemouth and Smallmouth bass were collected, but in very low numbers (Table 6).

Rough fish such as bullheads and Bowfin were caught in relatively high numbers in the survey, as well as a variety of minnows, shiners, and darters (Table 5).

A water temperature and dissolved oxygen profile was also collected in the deep eastern basin of Foote Pond on August 23, 2002 (Figure 3). The impoundment was thermally stratified at the time of sampling, with the thermocline starting at a depth of 30 feet. Dissolved oxygen levels suitable to fish (6ppm and

greater) were found above the thermocline, with oxygen levels decreasing significantly in the deep, colder water. The pH ranged throughout the column from 7-8. An alkalinity value of 127ppm was found to be normal. Water clarity was high, and chlorophyll-a was very low (1ppm).

DNR performed a nighttime electrofishing survey in the fall of 2003 to evaluate success of stocked Walleye fingerlings planted in the same year (Table 1). No age-0 Walleye were collected in the one-night survey and only two adult fish were collected. It was noted that a lack of suitable habitat for juvenile Walleye could explain low catches.

Analysis and Discussion

The Foote Pond fish community and limnology can be characterized as having the following: 1) an average growing panfish community consisting primarily of Yellow Perch, Black Crappie, Rock Bass, Bluegill, and Pumpkinseed. None of these species are considered abundant based on survey catches compared to other regional lakes. Black Crappie and Rock bass were the two species of panfish that can attain larger sizes that are attractive to anglers in Foote Pond. Yellow Perch, Bluegill, and Pumpkinseed are available to anglers but few reach sizes larger than 8-inches; 2) a predator population consisting of Walleye, Northern Pike, and Smallmouth and Largemouth bass. Northern Pike are the top predator in Foote Pond and have average growth rates when compared to the statewide average. Most pike are less than legal size (24-inches or larger), but acceptable numbers of legal-size fish are present. Smallmouth and Largemouth Bass are not common, based on survey catches. Despite this, anglers do target both species, particularly Smallmouth Bass which can reach large sizes. Walleye numbers are generally lower in Foote Pond compared to other regional waterbodies where fish are or were stocked. Survival of this species from stocking events is likely limited due to the lack of classic shoal habitat in the impoundment; 3) an abundant non-game fish community of bullhead species and Bowfin; 4) a lake chemistry profile which is typical for warm water species, thermally stratifies in the deep portions of the impoundment, and lacks suitable dissolved oxygen below the thermocline (typically 30 feet in summer).

Despite stocking efforts of Walleye from 1985 through 2010, very few catch reports for this species have been gathered from anglers. This is also true for past Tiger Muskellunge stocking efforts.

Access to the impoundment from the riverine reaches and lower impounded reaches is good for angling and boating. Foote Pond offers a unique experience to anglers because of its remote setting, and interesting morphometry consisting of the old river channel and numerous bays. This morphometry also poses a challenge for fisheries managers when trying to select appropriate gear to assess fish populations.

Management Direction

1. The standard State of Michigan fishing regulations (bag limits and size limits) for game fish are appropriate.

2. Walleye spring fingerling stocking efforts were discontinued at Foote Pond after 2013. This was a result of continued poor survey catches at the impoundment, both currently and historically. In addition, very few angler reports for this impoundment suggest that Walleye are routinely caught. Stocking efforts for this species continue periodically at upstream impoundments on the Au Sable River, particularly Cooke Pond. It is likely that downstream migration does occur into Foote Pond from these upstream

efforts. Entrainment studies at the dams have historically shown that fish move downstream and not all fish are killed by the turbines.

3. Stocking efforts for Great Lakes Muskellunge fall fingerlings were prescribed for Foote Pond over a decade ago. Due to limited statewide production of fall fingerlings, Fisheries Division made the decision to focus fall fingerling stocking efforts on one Au Sable impoundment (Cooke Pond). A stocking prescription currently does exist for Muskellunge for Foote Pond, but it involves surplus spring fingerlings. The prescription is for periodic stocking of 38,926 (20/acre) spring fingerlings. This stocking was first accomplished in spring 2019. If DNR production is increased, then Foote Pond would be a good candidate for receiving additional Muskellunge, either spring or fall fingerlings.

4. Anglers of Foote Pond should share their catch information with fisheries managers. This allows for better management of the lake, both today and in the future.

5. Utilize best available fish population assessment techniques for this impoundment. Traditional survey gear deployment has not resulted in efficient capture of a variety of fish species. Perhaps innovative approaches, or more narrow gear choices are appropriate for Foote Pond to assess future fish populations, particularly those that may be stocked.

References

Hanchin, P., and J. Kinney. 1997. Foote Pond Au Sable River System. U.S. Forest Service, Mio, MI.

Zorn, T.G., and S.P. Sendek. 2001. Au Sable River Assessment. Michigan Department of Natural Resources, Fisheries Division, Special Report 26, Ann Arbor, Michigan.

Figure 1.-Foote Pond (red arrow) in Michigan's northeastern Lower Peninsula, Iosco County.

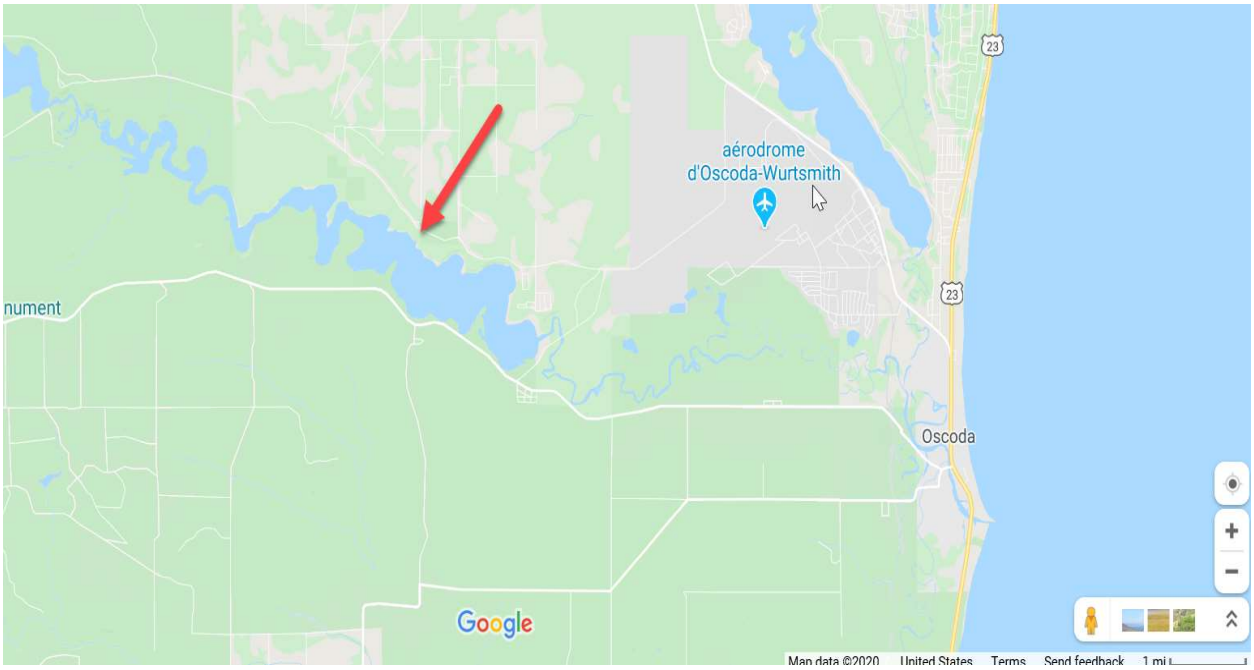

Figure 2.-Bathymetric map for Foote Pond, Iosco County.

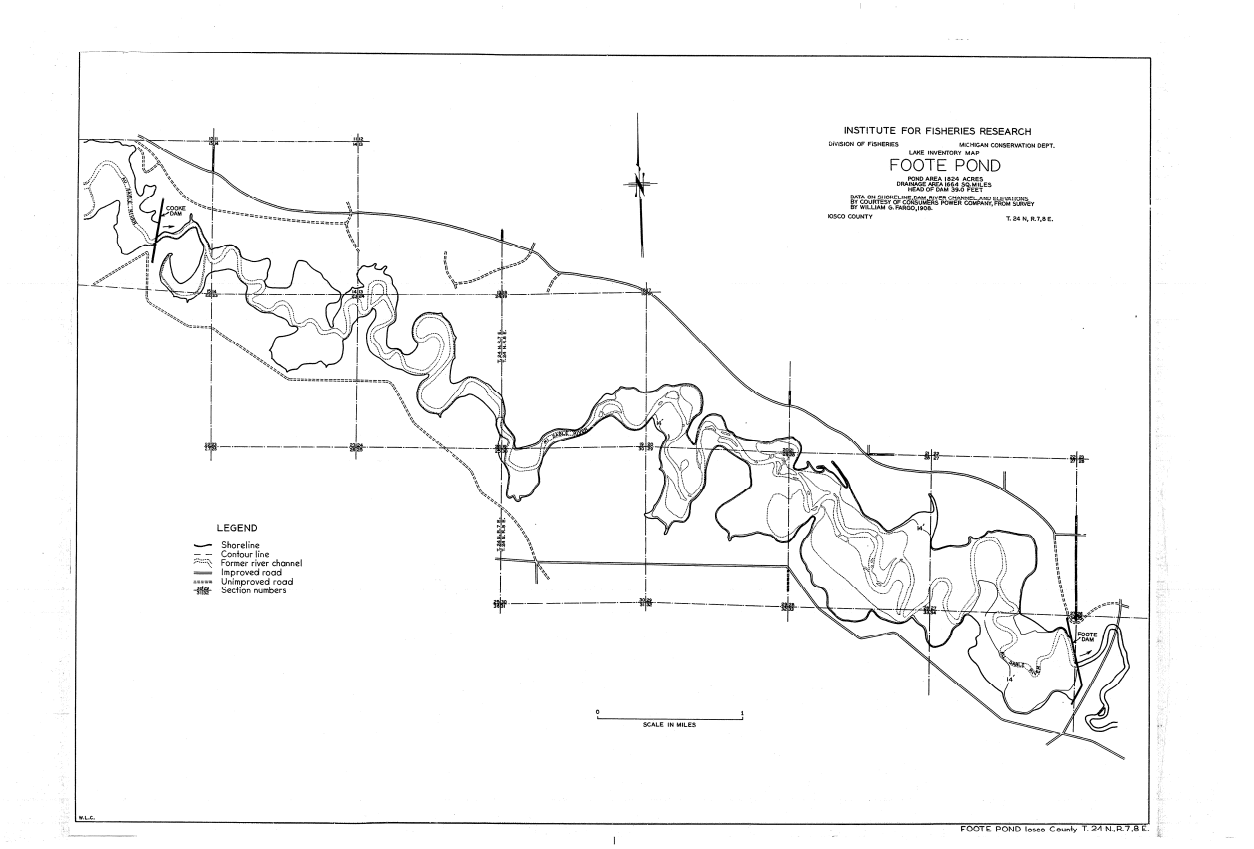

Figure 3.-Water temperature and dissolved oxygen profile for Foote Pond on August 23, 2002.

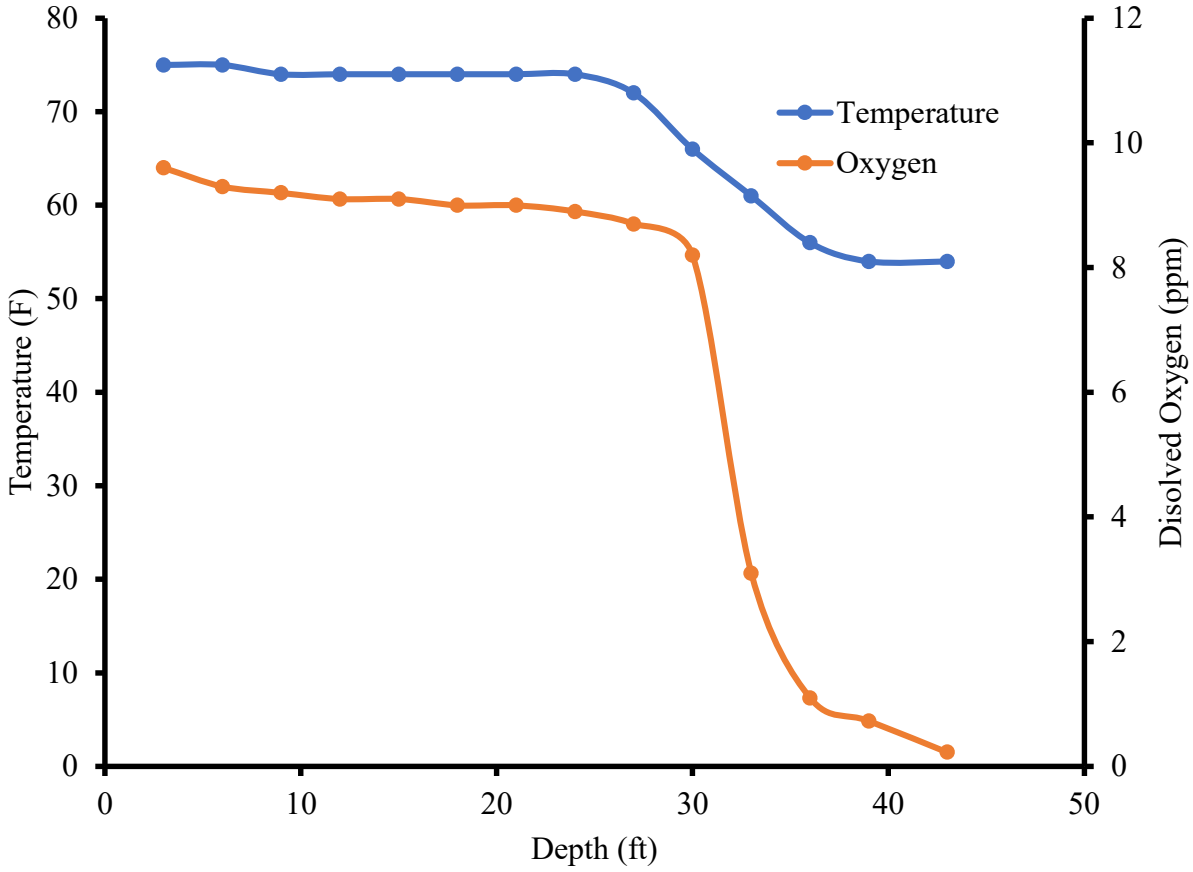

Table 1.-Recent stocking history of fish for Foote Pond by the Michigan Department of Natural Resources. OTC is oxytetracycline.

Year	Species	Strain	Length (in)	No. Stocked	Mark
1985	Walleye	Muskegon	1.5	67,050	--
1986	Walleye	Muskegon	2.4	67,280	--
1989	Walleye	Muskegon	1.3	49,329	--
1991	Walleye	Ohio	1.6	62,322	--
1993	Walleye	Muskegon	1.8	60,562	--
1996	Walleye	Muskegon	1.4	109,620	--
2001	Walleye	Tittabawassee	1.9	76,302	OTC
2003	Walleye	Tittabawassee	1.3	60,713	OTC
2004	Walleye	Tittabawassee	1.8	52,224	OTC
2006	Walleye	Tittabawassee	1.9	93,740	OTC
2009	Walleye	Muskegon	1.5	60,877	--
2010	Walleye	Muskegon	2.0	62,097	--
1984	Tiger Muskellunge	--	6.9	14,000	--
1985	Tiger Muskellunge	--	6.2	8,000	--
1986	Tiger Muskellunge	--	6.5	10,000	--
1987	Tiger Muskellunge	--	10.0	10,000	--
1988	Tiger Muskellunge	--	9.4	8,600	--
1989	Tiger Muskellunge	--	9.0	19,008	--
1990	Tiger Muskellunge	--	8.9	10,000	--
1991	Tiger Muskellunge	--	9.1	16,060	--
2019	Muskellunge	Great Lakes	3.6	38,926	--

Table 2.-Fall Walleye nighttime electrofishing assessments at Foote Pond. Percent stocked determined in years when fingerling Walleye were stocked marked with oxytetracycline. Sample size of age-0 fish tested is in parentheses.

Year	Date	Water Temp (F)	Hours shocked	Miles shocked	Age-0 Walleye	No. Age-0 per hour	Age-1+ Walleye	Percent stocked (n)
1993	9/23	61	2.50	2.4	4	0	0	--
1996	9/23; 10/3	58-65	4.02	-	1	0	0	--
2003	9/22	66	2.00	2.9	0	0	2	--

Table 3.-Fish collected from Foote Pond May 28-June 5, 1996 by DNR and USFS with large and small mesh fyke nets, and gill nets. Table reproduced from Hanchin and Kinney (1997).

Species	Total Catch	Percent by number	Weight (lbs)	Percent by weight	Length range (in)
Rock Bass	556	39.5	18.7	13.3	2-10
Brown Bullhead	276	19.6	227.8	16.5	2-15
Pumpkinseed	169	12.0	31.0	2.3	2-9
Northern Pike	100	7.1	198.5	14.1	10-29
Bowfin	77	5.5	372.6	27.1	20-27
Smallmouth Bass	65	4.6	103.2	7.5	7-19
Bluegill	49	3.5	2.8	0.2	1-7
Yellow Perch	38	2.7	4.3	0.3	2-12
Yellow Bullhead	34	2.4	34.3	2.5	9-15
Black Crappie	19	1.3	12.4	0.9	2-14
Walleye	10	0.7	29.3	2.1	14-25
Common Carp	7	0.4	131.4	9.3	27-34
White Sucker	5	0.4	23.9	1.7	19-23
Largemouth Bass	2	0.1	5.8	0.4	15-16
Channel Catfish	1	0.1	17.1	1.2	31
Total	**1,408**		**1,376.9**		

Table 4.-Comparison of mean length (inches) at age for various game fishes of Foote Pond from 1996 to 2002. Number in parentheses represents number aged. The growth index is the average growth for each species at Foote Pond in 1996 compared to the statewide average for that species across ages.

Species	**Age group**	**May/June 1996**	**Growth Index (in)**
Black Crappie	I	3.0 (2)	0.0
	II	6.0 (8)	
	III	--	
	IV	11.2 (3)	
	V	--	
	VI	--	
	VII	13.3 (1)	
	VIII	13.9 (4)	
Pumpkinseed	I	--	+0.9
	II	2.0 (4)	
	III	4.9 (38)	
	IV	6.8 (4)	
	V	8.0 (12)	
	VI	7.8 (4)	
	VII	8.0 (2)	
	VIII	9.5 (1)	

Table 4.-Continued.

Species	Age group	May/June 1996	Growth Index (in)
Northern Pike	I	11.9 (7)	+0.1
	II	17.7 (38)	
	III	20.8 (25)	
	IV	23.9 (11)	
	V	25.0 (11)	
	VI	25.8 (2)	
Smallmouth	I	--	-1.4
Bass	II	--	
	III	7.6 (1)	
	IV	10.2 (6)	
	V	12.8 (15)	
	VI	14.0 (16)	
	VII	15.0 (15)	
	VIII	17.0 (9)	
	IX	18.6 (2)	

Table 4.-Continued.

Species	Age group	May/June 1996	Growth Index (in)
Walleye	I	--	--
	II	13.6 (2)	
	III	18.0 (1)	
Yellow Perch	I	3.1 (11)	-0.1
	II	4.8 (13)	
	III	6.7 (14)	
	IV	7.4 (4)	
	V	8.2 (2)	
	VI	--	
	VII	--	
	VIII	12.6 (1)	

Table 5.-Fish collected from Foote Pond May 20-24, 2002 by DNR in a Status and Trends survey with large- and small-mesh fyke- nets, and gill nets.

Species	**Total Catch**	**Percent by number**	**Length range (in)**
Rock Bass	96	21.8	3-10
Fathead Minnow	70	15.9	--
Brown Bullhead	40	9.1	8-15
Bluegill	36	8.2	4-8
Yellow Perch	35	8.0	4-8
Northern Pike	31	7.0	15-31
Common Shiner	20	4.5	--
Iowa Darter	20	4.5	--
Bowfin	19	4.3	18-27
Smallmouth Bass	19	4.3	14-19
Black Crappie	15	3.4	6-15
Black Bullhead	10	2.3	10-19
Bluntnose Minnow	10	2.3	--
Golden Shiner	6	1.4	--
Blacknose Shiner	4	0.9	--
Pumpkinseed	3	0.7	6
Yellow Bullhead	3	0.7	8-10
Walleye	2	0.5	13-21
Largemouth Bass	1	0.2	6
Total	**437**		

Table 6.-Length-frequency of certain game fish collected at Foote Pond with sampling gear in May 2002.

Length group (in)	Black Crappie	Yellow Perch	Bluegill	Walleye	Northern Pike	Smallmouth Bass
<5		1	3			
5		7	9			
6	1	16	2			
7		5	2			
8	1	6	1			
9	3					
10	2					
11	1					
12						
13	1			1		
14	1					1
15	1				1	
16						1
17						
18						
19					3	1
20					3	
21				1	5	
22					7	
23					3	
24					3	
25					2	
26					1	
27					1	
28					1	