

### **Bass Lake (East)**

Marquette County, T45N, R24 and 25W, Sections 25, 30, 31, 36  
Escanaba River Watershed, last surveyed: 2007

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### **Environment**

Bass Lake (East) is located in south south-eastern Marquette County, about 2.5 miles southeast of the village of Gwinn. It is 271 acres in size with a maximum depth of about 24 feet (Figure 1).

The area surrounding Bass Lake (East) lies within the Dickinson subsection of the Northern Lacustrine-Influenced Upper Michigan and Wisconsin regional landscape ecosystem classified by Albert (1995), and it is characterized by features identified in the Gwinn sub-section. This area is a poorly drained outwash plain, but also includes areas of droughty outwash. Exposed bedrock can be found at the margins of the outwash plain on the western edge of the sub-section. Soils found in the southern section of the Gwinn sub-section have thick, acidic, organic soils over sand or sandy loam, while soils found in the northern part surrounding Bass Lake (East) are characterized by excessively-drained soils. Principle soil association found in the vicinity of Bass Lake (East) are the Rubicon and Kalkaska sands, Amasa very fine sandy loam, and Karlin sandy loam (USDA-NRCS 2009).

Pre-settlement vegetation in the vicinity of Bass Lake (East) consisted of white and red pine with some northern hardwoods located along the steeply sloped channels of outwash plain. The immediate shoreline surrounding Bass Lake (East) today consists of wooded uplands that support a vegetative community of northern hardwoods, cedar, and black spruce.

The majority of the perimeter (approximately 80%) of Bass Lake (East) has been extensively developed with seasonal and permanent dwellings. Natural riparian zone habitat such as downed trees and brush (deadwood) has been removed for several decades to improve swimming, boat dockage, and riparian aesthetics. However, sunken tree tops, logs, brush, and overhanging trees can be found in sections where there is no development. An improved public-access boat launch is located on the eastern shoreline and is maintained by the Michigan Department of Natural Resources and Environment (MDNRE) (Figure 1). Parking is available for approximately 8 vehicles with trailers.

Limnological characteristics were last measured on August 21, 2007. The water was clear with a Secchi disk reading of 7.5 feet. The water temperature varied very little from the surface of the lake (68.2° F) to the bottom (67.6° F at 17 feet). Dissolved oxygen ranged from 8.4 to 6.1 parts per million, which is sufficient to support aquatic life throughout the entire water column during the summer. The pH was 8.2 indicating that the water is slightly basic. Values for alkalinity, ammonia-N, chlorophyll-a, nitrate/nitrite, and total phosphorus were below the limits of detection. Water chemistry values indicate good water quality and a trophic status of meso-oligotrophic (moderate to low productivity).

The littoral zone is extensive with limited areas of deeper water. The lake substrate consists of mostly sand in the shoal areas with organic material found in deeper areas. Areas of aquatic vegetation are not extensive, but some pondweed (*Potamogeton* spp.), lily pads (*Nymphaea* spp.), and bulrush (*Scirpus* spp.) have been observed. No invasive aquatic plant species have been recorded to date.

## **History**

Bass Lake (East) has a long history of fisheries management. Investigations into the fisheries community were conducted in 1924, 1925, 1928, 1929 and 1935 to determine the fish community composition and collect specimens for identification. Species captured were yellow perch, largemouth bass, bluntnose minnow, fathead minnow, blacknose shiner, Iowa darter, brook stickleback, least darter, central mudminnow, and Johnny darter. Other than fish stocking, no fisheries investigations were conducted for nearly 40 years following 1935.

File records indicate that the lake was stocked with northern pike, largemouth bass, smallmouth bass, and bluegill from 1940 to 1945. More recent records indicate that tiger muskellunge were first stocked in 1978 and into the 1980's, while largemouth bass were also stocked from 1989 to 1992, and walleye were stocked between 1996 and 2005 (Table 1).

In 1973, a cursory habitat survey and discussion with riparian owners regarding possible sport fishing improvement and management goals for Bass Lake (East) were conducted. Land development in the riparian zone surrounding the lake was observed at that time to be substantial, although changes in the littoral habitat were deemed to be minimal. Habitat critical to fish communities such as sunken tree tops, logs, brush, and over-hanging trees were largely intact. Large numbers of adult largemouth bass and juvenile yellow perch were visually observed.

Subsequent fisheries surveys have been completed on Bass Lake (East) in 1976, 1981, 1987, 1989, 1996, and 2000. These assessments have documented 15 fish species (Table 2).

Tiger muskellunge were introduced into Bass Lake (East) in 1978 after MDNRE survey results from 1976 indicated a noteworthy forage base consisting of yellow perch and common white suckers. Tiger muskellunge were also stocked several times throughout the 1980's and in 1991 (Table 1) to provide a trophy fishery for anglers. Angler reports indicated that the introduced muskellunge achieved maximum total length up to 45 inches. The tiger muskellunge stocking program was met with mixed acceptance by the public.

A major fish kill attributed to natural environmental conditions was reported during early April 1986 on Bass Lake (East). Black bullhead, tiger muskellunge, largemouth bass, pumpkinseed sunfish, white sucker, and yellow perch were reported as species that were affected. The fish kill was caused by severe winter weather (early and heavy snow with extremely cold air temperatures in December and heavy snow throughout winter) which helped to create conditions of low dissolved oxygen. In the next years after the fish kill several populations (bullheads, pumpkinseed, perch) of fish dramatically increased in abundance which spurred further management efforts.

Manual removals of black bullhead, pumpkinseed sunfish, and yellow perch occurred in 1990, 1991, and 1992. Common white suckers were also removed during the 1990 effort. The goal of the manual removals was to reduce competition and predation on game fish species. After the manual removals, largemouth bass were stocked in the early 1990's to re-establish a predator population that was severely diminished after the 1986 winterkill. Walleye were then stocked in 1996 and several years

thereafter (Table 1) to serve as another predator on the expanding panfish populations and provide species diversity for anglers.

Sunny and calm weather with air temperatures in excess of 100° F created conditions for another fish kill during late June of 1995. MDNRE fisheries personnel reported that the main species affected was yellow perch. Reports of several other fish kills on area lakes were also received during the same time period.

### **Current Status**

In 2007, MDNRE Fisheries Division conducted a survey on Bass Lake (East). An assessment using fyke nets, gill nets, and a seine was conducted during June, while an electrofishing boat was used in July to complete the assessment.

During June 4-7, 2007, six fyke nets were fished at 12 locations over three nights. Two experimental gill nets were fished at five locations over three nights. Two mini-fyke nets were fished for two nights, and four 25-foot seine hauls were also made at four locations near the shoreline. On July 31, three 10-minute night electrofishing runs were conducted at three separate locations around the shoreline. All fish captured were measured for length and a sample of scales was collected from black crappie, bluegill, largemouth bass, northern pike, pumpkinseed, walleye, and yellow perch for age and growth analysis.

A low overall catch 433 fish representing 12 species were collected from the combined June and July efforts. Pumpkinseed sunfish and bluntnose minnow were the most abundant species comprising 45% of the total catch by number. Other fish species collected included bluegill, golden shiner, Johnny darter, largemouth bass, Western banded killifish, northern pike, walleye, white sucker, and yellow perch.

Black crappie (N=10) averaged 12.4 inches in total length and comprised 2% of the total survey catch by number (Table 3). Black crappies ranged from 10 to 14 inches with 100% of the fish meeting or exceeding an acceptable harvest length of 6 inches (Table 4). The age distribution indicated variable recruitment with representation of black crappie ages 5 through 11 (Table 5).

Bluegill (N=35) averaged 7.3 inches in total length and comprised 8% of the total survey catch by number (Table 3). Bluegills ranged from 3 to 10 inches with 55% of the fish meeting or exceeding an acceptable harvest length of 6 inches (Table 4). Age and growth data indicated that bluegills were growing at state average having a mean growth index of +0.5 inches (Table 5). The age distribution indicated fair recruitment with fair representation of bluegill ages 1 through 9 (Table 5).

Largemouth bass (N=23) averaged 11.0 inches in total length and comprised 5% of the total survey catch by number (Table 3). Largemouth bass ranged from 2 to 17 inches with 50% of the fish meeting or exceeding a minimum harvest length of 14 inches (Table 4). Age and growth data indicated that largemouth bass were growing at approximately state average having a mean growth index of +0.1 inches (Table 5). The age distribution indicated variable recruitment with representation of largemouth bass ages 0 through 7 (Table 5). The 2004 year class of largemouth bass was missing.

Northern pike (N=46) averaged 18.1 inches in total length and comprised 11% of the total survey catch by number (Table 3). Northern pike ranged from 9 to 28 inches with 24% of the fish meeting or exceeding minimum harvest length of 24 inches (Table 4). Age and growth data indicated that northern pike are growing at approximately state average having a mean growth index of +0.1 inches (Table 5). The age distribution indicated representation of northern pike ages 1 through 4 (Table 5). Age 3 and 4 fish were growing several inches faster than the state average reflecting a population with few large fish and good forage availability. Age 1 and 2 northern pike were growing at or several inches below state average, potentially indicating that segment of the population was high in number and young fish were intensely competing for forage. It should be noted that northern pike are a recent addition (probably an illegal public transfer) to Bass Lake (East) as surveys including year 2000 and prior never recorded northern pike. Additionally, the young (age 1-4) age structure of the northern pike population also indicates that pike are a recently introduced member to the fish community.

Pumpkinseed sunfish (N=101) averaged 7.1 inches in total length and comprised 23% of the total survey catch by number (Table 3). Pumpkinseed sunfish ranged from 3 to 10 inches with 65% of the fish meeting or exceeding the acceptable harvest length of 6 inches (Table 4). Age and growth data indicated that pumpkinseed sunfish are growing slightly above state average having a mean growth index of +0.9 inches (Table 5). The age distribution indicated good representation of pumpkinseed sunfish ages 1 through 11 (Table 5).

Walleye (N=48) averaged 15.5 inches in total length and comprised 11% of the total survey catch by number (Table 3). Walleye ranged from 8 to 21 inches with 58% of the fish meeting or exceeding the minimum harvest length of 15 inches (Table 4). Age and growth data indicated that walleye were growing at approximately state average having a mean growth index of +0.5 inches (Table 5). The age distribution indicated good representation of walleye ages 1 through 7 (Table 5). Analyses of the ageing data indicates that stocked spring fingerling walleye constitute a large percentage of the population, thereby indicating low levels of natural recruitment.

Yellow perch (N=49) averaged 5.9 inches in total length and comprised 11% of the total survey catch by number (Table 3). Yellow perch ranged from 2 to 12 inches with 29% of the fish meeting or exceeding the acceptable harvest length of 7 inches (Table 4). Age and growth data indicated that yellow perch are growing below state average having a mean growth index of -1.0 inches (Table 5). The age distribution indicated variable representation of yellow perch ages 2 through 7 (Table 5). Both the 2002 and 2006 year classes were missing from the survey.

Of the remaining species collected during the survey, a total of 96 bluntnose minnow were captured with fish ranging from 1 to 2 inches in total length. Only 3 golden shiners, 3 Western banded killifish, 15 Johnny darters, and 4 white suckers were captured during the survey.

### **Analysis and Discussion**

Black crappie have established a small population in Bass Lake (East) since first being documented by fishery surveys in the mid-1990's. Although growth trends have typically been average, catch per unit effort (CPUE) or number captured per net night is lower, and the 2007 survey failed to capture any black crappie less than age 5. Successful annual recruitment for this species is not occurring.

The bluegill population has also traditionally been small in Bass Lake (East). Growth rates are currently average and bluegills up to 10 inches are available to panfish anglers. Pumpkinseed sunfish currently provide an attractive fishery for anglers. Individuals up to 10 inches are present, and the population exhibits good size structure and relatively consistent natural reproduction. Adequate spawning habitat is available and forage resources are abundant enough to support average or positive growth characteristics.

Largemouth bass are providing at best a fair fishery for anglers. Largemouth bass have rebounded from poor growth documented during the 1990's to currently being at state average growth rates. The presence of multiple year classes and the tendency for bass anglers to practice catch-and-release fishing methodologies preserves legal size fish for multiple recaptures by anglers and preserves a desirable sport fishery.

Walleye are an important component of the predator community and a highly desirable sport fish. Ageing analysis from the current and previous surveys has indicated average growth rates and fair numbers of legal-size fish available to anglers. Ageing analyses indicates that the majority of walleye present are the result of stocking efforts, although limited natural reproduction is occurring as indicated by walleye present from non-stocking years.

Northern pike are a recent and unwelcome addition to the fish community of Bass Lake (East) and have become well established. Suitable spawning habitat is available and the population exhibits relatively consistent natural reproduction. Growth rates of older pike (age 3 and 4) are several inches above state average while young pike (age 1 and 2) are at or several inches below state average, indicating a lack of forage resources to sustain growth of young fish.

Comparison of CPUE for predators such as largemouth bass and northern pike for Bass Lake (East) are average compared to other Upper Peninsula lakes sampled using the MDNRE Fisheries Division Status and Trends survey protocol. Walleye CPUE, however, is approximately 2.5x higher than average for other Upper Peninsula lakes sampled. Additionally, CPUE for panfishes, such as bluegills and yellow perch, and common white suckers are currently much lower than the average for other Upper Peninsula lakes sampled using the Status and Trends protocols.

The fisheries community of Bass Lake (East) is in the process of shifting to a system where there may be a larger predator population than the forage base can support. The low chemical productivity of the water sets the bar as to how much biological biomass the lake can sustain. Additional predators such as black crappie and northern pike have established populations through natural reproduction and are now part of the food web of Bass Lake (East). The predation effect from these two species has added to the existing predation of the established largemouth bass and walleye populations. As an example of how the predator population is responding to increased numbers, the few older northern pike are exhibiting high growth rates while naturally reproduced younger pike are more numerous and displaying growth rates that are lower than the state average. In addition, forage fish populations such as yellow perch and common white suckers appear to be in low abundance as compared to other past surveys. Tiger muskellunge do not exist any more in this lake.

## **Management Direction**

Presently, Bass Lake (East) is in fair condition in terms of its overall fishery. Northern pike and largemouth bass populations are providing attractive fisheries for anglers. Black crappie and bluegills offer anglers an opportunity to harvest large fish, although their overall population abundances are not large. Pumpkinseed sunfish are numerous and offer very good opportunities for anglers. Continued management for walleye is also desirable as the population helps to control the expansion of yellow perch and white suckers and provides additional angling variety.

However, given the current condition of the fish community, there exists a concern regarding its long-term health. With the now established black crappie and northern pike populations, there is a concern regarding the predation pressure exerted upon the forage base. Walleye spring fingerlings have been stocked at a rate of approximately 52/acre since the late 1990's (Table 1). To compensate for the effects of the building predator population (mainly northern pike), spring fingerling walleye should be stocked at a reduced rate of 35/acre every other year. The intent is to reduce the predation effect on forage fishes and allow their abundance to increase to support and maintain adequate growth rates of predator fishes. Failure to recognize the changing community structure and not adjust walleye stocking rates could potentially cause a collapse of the forage base, a subsequent decline in growth rates for some predator fish populations, and cause a decline in the number of legal size fishes available to anglers. Stocked walleye should be marked with OTC and fall Serns index surveys should be then scheduled to further evaluate the contribution of stocked walleye.

Future management should focus on improving physical habitat deficiencies that are potentially having a negative effect upon the fish community. Natural lakes can have deadwood (2-inches and larger) abundances of 470 to 1,545 pieces per mile, but aggressive logging practices and development of lake shorelines have reduced inputs of deadwood to Michigan lakes for over 100 years (O'Neal and Soulliere 2006). Deadwood is a vital component of a healthy and diverse habitat in the littoral zone. Deadwood provides habitat for a multitude of animals including invertebrates, reptiles, birds, mammals, and fish, and rehabilitation programs designed to compensate for loss of deadwood should be considered. Rehabilitation programs designed to compensate for loss of deadwood in Bass Lake (East) should be considered as Bass Lake (East) has below average abundance of deadwood as compared to other Upper Peninsula lakes surveyed with the Status and Trends survey protocol. Staff from the MDNR and riparian landowners should work cooperatively to implement a habitat rehabilitation program for the littoral zone surrounding Bass Lake (East).

### References

Albert, D.A. 1995. Regional landscape ecosystems of Michigan, Minnesota, and Wisconsin: a working map and classification. General Technical Report NC-178. U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station, St. Paul. Available: [www.nprwc.usgs.gov/resource/habitat/rlandscape/index.htm](http://www.nprwc.usgs.gov/resource/habitat/rlandscape/index.htm) (May 2008).

O'Neal, R. P., and G. J. Soulliere. 2006. Conservation guidelines for Michigan lakes and associated natural resources. Michigan Department of Natural Resources, Fisheries Special Report 38, Ann Arbor.

USDA-NRCS. 2009. Web Soil Survey. Available: <http://soils.usda.gov/technical/classification/osd/index.html> . (March 2009).

Figure 1. Hydrographic contour map of Bass Lake (East), Marquette County.

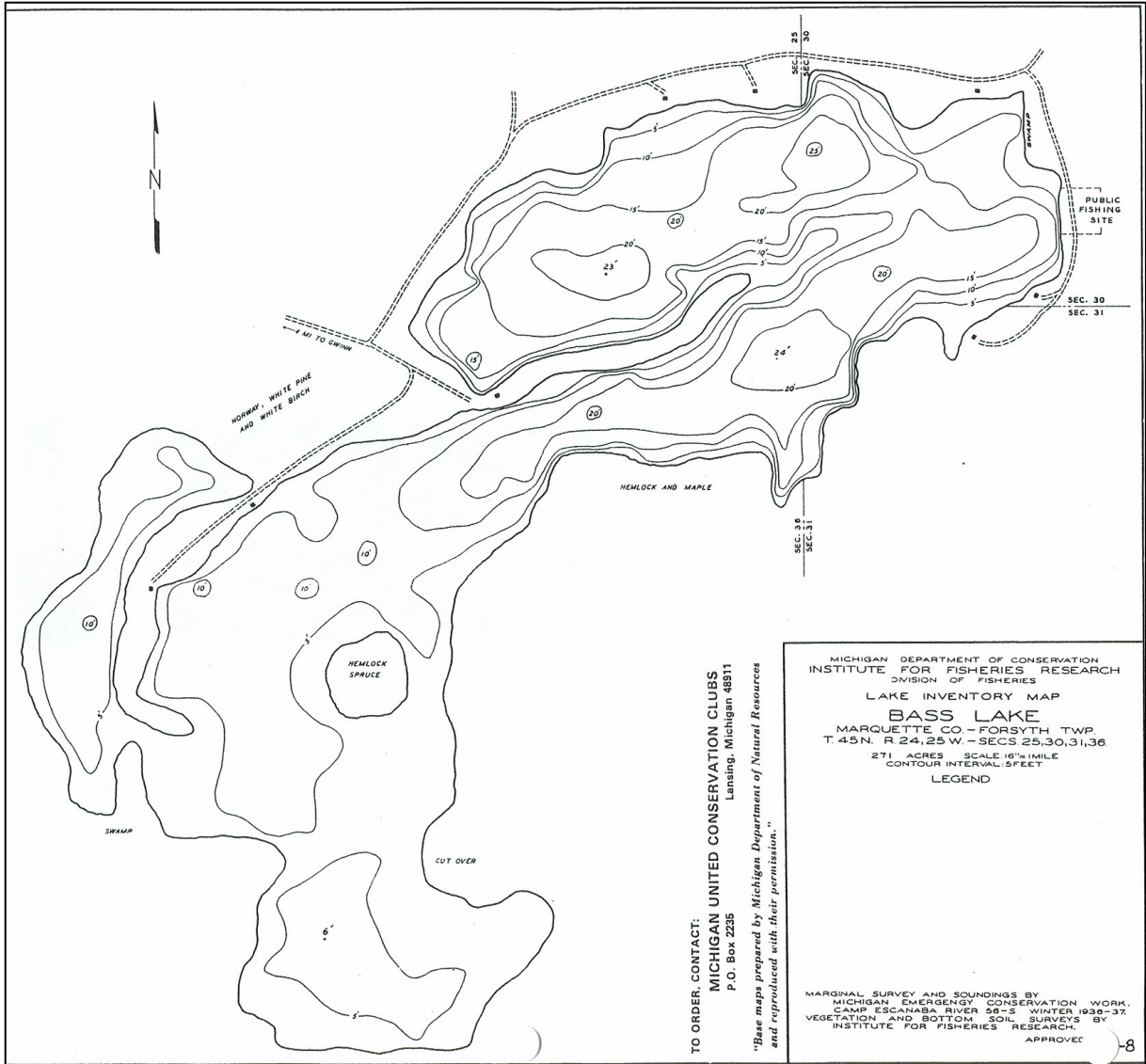


Table1.-Fish stocked into Bass Lake (East), Marquette County (1981 to 2005). Data from MDNRE, Fisheries Division records.

Year	Species	Number	Rate (#/acre)	Size (in.)
1981	Tiger muskellunge	550	2	7.0
1983	Tiger muskellunge	300	1	7.7
1985	Tiger muskellunge	210	1	10.4
1986	Tiger muskellunge	200	1	7.2
1987	Tiger muskellunge	350	1	10.4
1989	Tiger muskellunge	1,000	4	8.7
	Largemouth bass	3,264	12	3.9
1990	Largemouth bass	7,605	28	2.0
1991	Tiger muskellunge	1,000	4	9.4
	Largemouth bass	15,985	59	1.5
	Largemouth bass	4		15.2
1992	Largemouth bass	9,584	35	3.1
1996	Walleye	30,569	112	3.0
1997	Walleye	10,740	39	3.2
1999	Walleye	13,425	49	2.0
2001	Walleye	15,950	58	1.7
2003	Walleye	13,000	48	1.5
2005	Walleye	14,380	53	1.9



Table 2.-List of fishes (1981 to present) in Bass Lake (East), Marquette County. Origin: Native=N, I=Introduced. Status: P=recent observations. Data from MDNRE, Fisheries Division records.

Common Name	Scientific Name	Origin	Status
Black bullhead	<i>Ameiurus meelas</i>	N	P
Black crappie	<i>Pomoxis nigromaculatus</i>	N	P
Bluegill	<i>Lepomis macrochirus</i>	I	P
Bluntnose minnow	<i>Pimphales notatus</i>	N	P
Golden shiner	<i>Notemigonus crysoleucas</i>	N	P
Johnny darter	<i>Etheostoma nigrum</i>	N	P
Western banded killifish	<i>Fundulus diaphanous menona</i>	N	P
Largemouth bass	<i>Micropterus salmoides</i>	I	P
Northern pike	<i>Esox lucius</i>	I	P
Pearl dace	<i>Margariscus nachtriebi</i>	N	P
Pumpkinseed	<i>Lepomis gibbosus</i>	N	P
Tiger muskellunge (hybrid)	<i>Esox lucius x E. Masquinongy</i>	I	
Walleye	<i>Sander vitreus</i>	I	P
White sucker	<i>Catostomus commersonii</i>	N	P
Yellow perch	<i>Perca flavescens</i>	N	P

Table 3.-Number, weight, length, and affiliated percentages of fishes collected with fyke net, gill net, seine, and electrofishing gear from Bass Lake (East), Marquette County in June and July, 2007. Data from MDNRE, Fisheries Division records.

Common name	Number	Total weight (lbs.)	Average length (in.)	Length range (in.)	Percent by Number	Percent by weight	Percent legal size
Black crappie	10	11.6	12.4	10-14	2	5	100 (≥7")
Bluegill	35	11.9	7.3	3-10	8	5	55 (≥6")
Bluntnose minnow	96	<1		1-2	22	<1	100
Golden shiner	3	<1	4.5	3-4	<1	<1	100
Johnny darter	15	<1		1-3	3	<1	100
Western banded killifish	3	<1		1-3	<1	<1	100
Largemouth bass	23	25.6	11.0	2-17	5	10	50 (≥14")
Northern pike	46	70.6	18.1	9-28	11	28	24 (≥24")
Pumpkinseed	101	37.4	7.1	3-10	23	15	65 (≥6")
Walleye	48	66.1	15.5	8-21	11	27	58 (≥15")
White sucker	4	16.8	22.0	20-23	<1	7	100
Yellow perch	49	8.0	5.9	2-12	11	3	29 (≥7")

Table 4.-Length range of select fishes collected with fyke net, gill net, seine, and electrofishing gear from Bass Lake (East), Marquette County in June and July, 2007. Data from MDNRE, Fisheries Division records.

Inch group	Species							
	Black crappie	Bluegill	Largemouth bass	Northern pike	Pumpkinseed	Walleye	White sucker	Yellow perch
0								
1								
2			2					4
3		1			9			9
4		8			10			13
5		5	4		14			4
6			2		12			5
7		2	1		8			6
8		2	1		15	2		1
9		8		3	22	2		
10	3	5		4	4	1		2
11	1		1	3		2		1
12	2			2		7		4
13	2			2		5		
14	2		1			1		
15			5			3		
16			4	1		6		
17			1	5		5		
18				2		7		
19				5		3		
20				2		3	1	

Table 4.-Continued

Inch group	Species							
	Black crappie	Bluegill	Largemouth bass	Northern pike	Pumpkinseed	Walleye	White sucker	Yellow Perch
21				2		1	1	
22							1	
23							1	
24				2				
25				2				
26				2				
27				3				
28				1				

Table 5.-Weighted mean length (inches) at age, and growth relative to the state average for select fish sampled from Bass Lake (East) with fyke nets, gill nets, and electrofishing gear, June and July, 2007. Number of fish aged is in parentheses. Data from MDNRE, Fisheries Division records.

Species	Age/Length												Mean growth index <sup>1</sup>
	0	1	2	3	4	5	6	7	8	9	10	11	
Black crappie						10.2 (2)	10.6 (3)	12.6 (1)		13.1 (4)		14.0 (1)	**
Bluegill		1.6 (3)	4.7 (15)	7.7 (2)	9.3 (3)		9.0 (3)	9.1 (3)	10.3 (3)	10.3 (3)			+0.5
Largemouth bass	2.8 (2)	5.4 (7)	11.5 (1)		14.4 (2)	15.5 (1)	15.5 (4)	16.5 (5)					+0.1
Northern pike		11.2 (16)	19.0 (16)	25.8 (7)	27.2 (3)								+0.1
Pumpkinseed		3.4 (10)	4.6 (3)	5.8 (16)	7.5 (1)	7.7 (1)	8.0 (2)	8.5 (5)	9.4 (14)	9.4 (4)	9.1 (1)	9.4 (1)	+0.9
Walleye		9.4 (3)	12.5 (6)	13.1 (3)	16.7 (12)	17.9 (2)	19.2 (10)	19.5 (2)					+0.5
Yellow perch	2.7 (8)		4.1 (16)	5.6 (3)	7.2 (10)		12.3 (2)	11.7 (3)	11.4 (1)				-1.0

<sup>1</sup>Mean growth index is the average deviation from the state average length at age.

\*\*Mean growth index could not be calculated due to insufficient numbers of fish captured.