Osterhout Lake

Lee Township, Allegan County
Surveyed May and August 2007

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Environment

Osterhout Lake is a 168 acre water body located 4 miles southeast of the village of Pullman, Allegan County. Osterhout Lake is a shallow lake with a maximum depth of 22 feet. Most of the bottom area of the lake is a large shallow flats extending to the five foot contour depth. Because of the lakes shape, proportionally more bottom area of the lake is within the littoral zone than the open water or pelagic zone. There is a township owned access site on the north side of the lake off of 103rd Ave. Limited parking is available at this unimproved road ending to the lake.

Important components of water quality include phosphorous, nitrogen (ammonia, nitrate, and nitrite), water temperature, oxygen, carbon dioxide, pH, and a number of metals and salts. Water temperature and dissolved oxygen are critical habitat components for aquatic organisms. Water temperature influences internal structure, chemistry, biological metabolism, and the types of aquatic organisms that live in lakes. Water temperatures in Michigan lakes vary from the southern portion of the state to the northern portion. Internal lake water temperatures also vary. The warmest water temperatures are found near the surface of the lake (epilimnion) during summer months and near the bottom of the lake (hypolimnion) during winter months. This condition is called stratification. Stratification is most pronounced during summer months when temperature changes are the greatest. A zone of rapid temperature change occurs in the metalimnion (also called thermocline) and this often forms a physical barrier that prevents interchange of water, gases, organic material, and nutrients between the epilimnion and the hypolimnion. Temperature profile was obtained from a single location in the deepest basin of Osterhout Lake during August 2007. This temperature profile illustrates that summer stratification occurred in the lake with the metalimnion demarcated by a depth below 13 feet.

Dissolved oxygen is important for sustaining aquatic life. The solubility of oxygen and other gases depend on water temperature. Colder water can contain more dissolved gases. Oxygen enters the water from the atmosphere and it is produced by aquatic plants during photosynthesis. Oxygen is used by all animals and microorganisms in lakes and it is removed by plants during respiration when sunlight is not available. Oxygen depletion can occur in lakes with high plant and animal oxygen demand, especially in areas of lakes where waters do not mix freely or come in contact with the atmosphere. Water quality standards (related to discharges) in Michigan require maintenance of 7 mg/l dissolved oxygen for all Great Lakes and connecting waters, designated trout streams, and coldwater inland lakes. The water quality standard for other water bodies is 5 mg/l. Minimum dissolved oxygen levels for suitable summer habitat are approximately 3.0 mg/l for coldwater and cool-water fish and 2.5 mg/l for warm-water fish. The influence of water temperature stratification, dissolved oxygen, and trophic status determine the types of aquatic organisms that live in a lake. Dissolved oxygen profiles in Osterhout Lake showed a clinograde curve where the oxygen content of the hypolimnion depleted rapidly by oxidative processes. The hypolimnion remains anaerobic in Osterhout Lake throughout the summer stratification period. Dissolved oxygen concentrations were above the warm-water fish levels of 2.5 mg/l at a depth of 13 feet with anaerobic conditions in the hypolimnion. Critical depth is defined as the point at which dissolved oxygen concentrations are less than 0.5 mg/l and refers to conditions below which microorganisms like zooplankton will not occur below this depth. The critical depth in Osterhout Lake occurred at 15 feet.

Osterhout Lake is eutrophic and is characterized by high phosphorus (20 ug/l), low Secchi disk transparency (5.5 ft.), and high chlorophyll a (8.6 ug/l). Secchi disk transparency is a function of the reflection of light from the water and is influenced by the absorption properties of water and the amount of dissolved particulate matter (Wetzel 2001). The watershed surrounding the lake is dominated by agriculture. The lake receives excess nutrients from agricultural runoff, contributing to the eutrophic condition. Eutrophic conditions result in excess algal growth, low visability, and poor bluegill growth.

History

The first survey of the fish community of Osterhout Lake was made during the fall of 1961. This early survey indicated poor bluegill growth rates and an abundant carp population. Osterhout Lake was treated with rotenone in October of 1962 to remove the existing fish community. The lake was restocked with rainbow trout, largemouth bass and muskellunge in 1963. Annual evaluations of the fish community were made in 1963 and 1964 by seining the shoreline. Additional surveys from 1966 to 1970 were made to evaluate the effectiveness of muskellunge stocking and the potential for the lake to support a population of muskellunge for brood stock. These early surveys indicated good survival of stocked muskellunge fingerlings and provided the evidence for continued stock enhancement of muskellunge in the lake.

Stock enhancement of the fishery in Osterhout Lake has primarily involved hybrid muskellunge and more recently pure strain muskellunge. The hybrid (Tiger) muskellunge stocking was initiated in 1972 and continued until 1991. The next muskellunge survival assessment was conducted in October 1985. Sampling effort consisted of two electro-shocking transects covering the entire shoreline during each transect. No hybrid muskellunge were collected from previous stocking year classes, yet 13 muskellunge were collected from the 1985 stocking. This electro- shocking survey in 1985 documented a fish community that consisted of mainly Centrarchids (bluegill, pumpkinseed, largemouth bass, warmouth, green sunfish, and black crappie). Pure strain muskellunge were first stocked in Osterhout Lake in 1998 and have received supplemental stockings in 2001, 2004, and 2006.

In 1990, a fish survey consisting of four trap nets, two fyke nets, and four experimental gill nets was conducted to evaluate fish growth and community composition because of angler complaints of poor bluegill fishing. Comparisons of Osterhout Lake largemouth bass to the Michigan average length at age suggested that Osterhout Lake bass reached a legal length at approximately the same age (5 years) as largemouth bass in other water bodies in Michigan. These results suggested that conditions for bass growth may be typical for a Michigan Lake. Comparisons of Osterhout Lake bluegill to the Michigan average length at age suggested bluegill growth was well below the state average. This 1990 survey documented a fish community in Osterhout Lake that consisted of 15 species again with a fish community that consisted primarily of Centrarchids.

Current Status

The most recent fish community survey of Osterhout Lake was made from May 21-23, and 30, 2007. Sampling effort consisted of six large mesh trap-net lifts, six large mesh fyke net lifts, six experimental gill net lifts, four seine hauls, and four 10-minute electro-shocking transects. This sampling effort followed the MDNR-Fisheries Division sampling design for status and trends surveys for a medium size lake. A total of 2,057 fish and 18 turtles were captured during the three day survey. The catch of turtles consisted of five species with common musk, common map, and snapping turtles the most abundant and low numbers of painted and spiny softshell turtles. The catch of fish consisted of 16 species (Table 1) and was dominated by Centrarchid species (bluegill, pumpkinseed, black crappie, largemouth bass, warmouth, and green sunfish) which comprised 90% of the survey catch by numbers. Benthic fish species such as carp, brown bullhead, and yellow bullhead were present but were not well represented in the catch. Spotted gar was abundant in the survey, but not well documented in historic surveys. Yellow Perch were captured in the survey, but their relative abundance appears to be low. Other common fish found in the lake were golden shiner, bluntnose minnow, and brook silverside. There were two Esocid fish species found in the lake, muskellunge and grass pickerel. Grass pickerel are the smallest member of the Esocid family and usually only grow to lengths of 11 inches and are rarely caught by anglers because of their smaller size.

Bluegill was the most abundant fish caught in the survey, consisting of 70 % of the Centrarchids caught by number. Bluegill catch per unit effort was above the median and 75th percentile for all lakes in the management unit (Figure 1). This indicates that bluegill abundance is higher in Osterhout Lake compared to other typical bluegill populations in the region. Bluegill growth continues to be well below acceptable growth rates observed in other bluegill populations in the region (Figure 2). Quality lengths of bluegills are usually larger than 7 inches; however, very few fish larger than this were collected. Pumpkinseed was the second most abundant Centrarchid species caught, consisting of 15 % of the Centrarchid catch by numbers. Pumpkinseed were also growing below the state average. Black crappie were not well represented in the catch,but the catch was comprised of fish from age 2 to 10. Quality length black crappies were captured from 11 to 13 inches, but their average length at age was lower than acceptable growth rates observed in other black crappie populations in the region (Figure 3).

Largemouth bass catch per unit effort was below the median and 25th percentile for all lakes in the management unit (Figure 4). This indicates that the relative abundance of largemouth bass is lower in Osterhout Lake compared to other typical populations in the region. Age composition of the largemouth bass catch was dominated by age 3 (44%) with a steady decrease in successive age groups. There was no largemouth bass caught from the age 2 group. Growth rates from younger age classes of largemouth bass were acceptable compared to other populations in the region and the catch consisted of a few quality length bass from 14 to 16 inches.

Muskellunge were stocked in Osterhout Lake during the fall of 1998, 2001, 2004, and 2006. There was two muskellunge recaptured from the fall stocking in 2006 that were between 11 and 12.5 inches in length. There were two muskellunge recaptured from the fall stocking in 2001 that were 35.5 and 36.5 inches. There was one fish recaptured from the 1998 stocking that was 40.5 inches. No muskellunge were recaptured from the 2004 stocking effort. Growth information could not be determined with only 5 fish captured.

Analysis and Discussion

The quality of bluegills inhabiting a lake depends on their relative abundance, population size structure, and growth. Bluegill relative abundance was high in Osterhout lake while their growth continues to be poor. Competition between bluegills under these conditions generally includes poor fishing success for larger bluegills. Attributes of bluegill predators, mainly largemouth bass, are generally associated strongly with bluegill population size structure. Largemouth bass populations comprised of larger population size structure and low relative abundance are associated with bluegills of lower quality in many southern Michigan lakes. High bluegill quality is usually associated strongly with high relative abundance of small largemouth bass less than 12 inches. Sustaining a population of bluegills through all size ranges requires constricting the population size structure of the bass that prey on them. Currently largemouth bass are at low relative abundance and growing at acceptable rates within younger age groups. Changes to one fish populations size structure to emphasize the high end of the size range may involve shrinking the size structure of the other fishes. This predator-prey relationship is clear for Osterhout Lake.

Aquatic vegetation and zooplankton size composition also have significant influences on bluegill quality. Bluegill populations having a high number exceeding six inches are often associated with waters where the percent cover of submerged vegetation is meager, the water is deep, and well oxygenated. These environmental conditions are quite different in Osterhout lake where the water column is shallow, low oxygen concentrations, and altered aquatic vegetation have been documented since the 1970's. Bluegill quality in southern Michigan lakes depends a great deal on the size of available zooplankton, not necessarily their concentration, and adult bluegills prefer abundant large cladocerans (Schneider 1999).

Survey records show that species composition has changed in Osterhout Lake over time. Northern pike, bowfin, and lake chubsuckers were present in previous surveys and were absent during this survey. Lake chubsuckers are an important forage for largemouth bass and muskellunge. Their absence during the current study and presence during past surveys may indicate that their status has declined to low levels. In many southern Michigan lakes, lake chubsuckers provide the soft-rayed forage because of the absence of white suckers that are commonly found in northern Michigan lakes. Reduction of lake chubsuckers in Osterhout Lake may influence changes in growth for largemouth bass and muskellunge. Lake characteristics and environmental factors, such as temperature and dissolved oxygen, have substantial effects on northern pike populations. Lakes with greater depths often have the thermal refuge and oxygen concentrations to support large populations of northern pike. Shallow, warmwater lakes such as Osterhout Lake typically do not have the habitat characteristics to support abundant coolwater species like the northern pike. In the absence of northern pike, muskellunge should survive because of their tolerance to slightly warmer temperatures.

A total of 1,620 fall fingerling muskellunge have been stocked in Osterhout Lake since 1998. Recapture of stocked fingerlings from the 1998, 2001, and 2006 year classes appear to have some survival with no apparent survival from the 2004 year class. Approximately 39% of the total muskellunge stocked occurred in 2004 indicating that a higher stocking number may not be necessary.

Management Direction

There are three ecologically sensitive areas in Osterhout Lake. In the northwest corner there is a diverse wetland community that provides spawning habitat and a buffer from nutrient enrichment and development pressure. In the southwest area of the lake is a large water lily habitat that provides spawning and juvenile habitat for bluegills and largemouth bass. The nearshore area along the south side of the lake is mostly marl bottom that provides good habitat for aquatic insects and freshwater mussels. Protection of these areas from aquatic weed treatment, aquatic weed harvesting and dredging is critical to the survival of aquatic organisms that use these habitats. Control measures for nitrogen and phosphorus should also be considered in this basin. Implementation of such control measures may be socially complex and politically controversial, but technologically attainable and economically prudent.

Many of Michigan's small centrarchid lakes have high densities of slow growing bluegill and low densities of small sized yellow perch. The management challenge for these lakes involves shifting these population size structures toward sizes more acceptable to anglers. The introduction of muskellunge to the lake does not appear to have an affect on improving the size structure of bluegill or yellow perch because poor growth rates have continued since the early 1960's and 1970's. Prey preference and composition are also important, and better muskellunge survival and growth occurs in systems with soft-rayed or fusiform prey rather than in centrarchid-dominated systems. However the introduction of muskellunge has provided a local fishery.

Stunted bluegill populations and their communities tend to be stable and resist management efforts to affect permanent change. Elimination of all fish with chemicals such as rotenone, followed by restocking, has been a remedial management technique used in Michigan since the 1930s (Ball 1948, Spitler 1970). Benefits of this tool have been short-lived. Future management actions should involve communication with local anglers on new fishery objectives. Introductions of walleye as a predator may have some influence on shifting population size structures of bluegill and black crappie. New length limit regulations on largemouth bass may provide more predators to prey on smaller sized bluegills.

References

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Schneider, J. C. 1999. Dynamics of quality bluegill populations in two Michigan lakes with dense vegetation. North American Journal of Fisheries Management 19:97-109.

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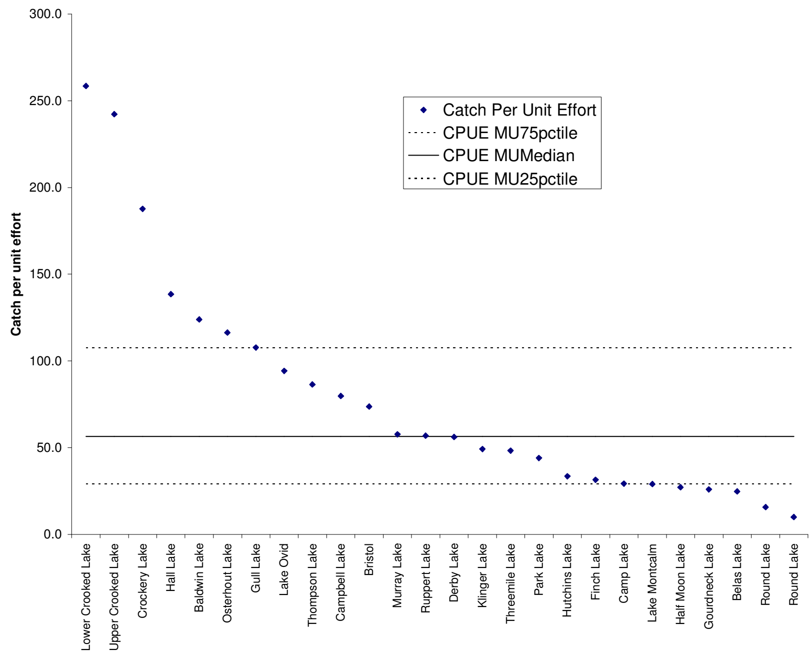

Figure 1. Trapnet catch per unit effort of bluegills in Osterhout Lake compared to other status and trends lakes in the region. The solid line represents the median catch per unit effort of bluegills for all lakes in the region (2002-2007). Dashed lines represent the 25th and 75th percentile.

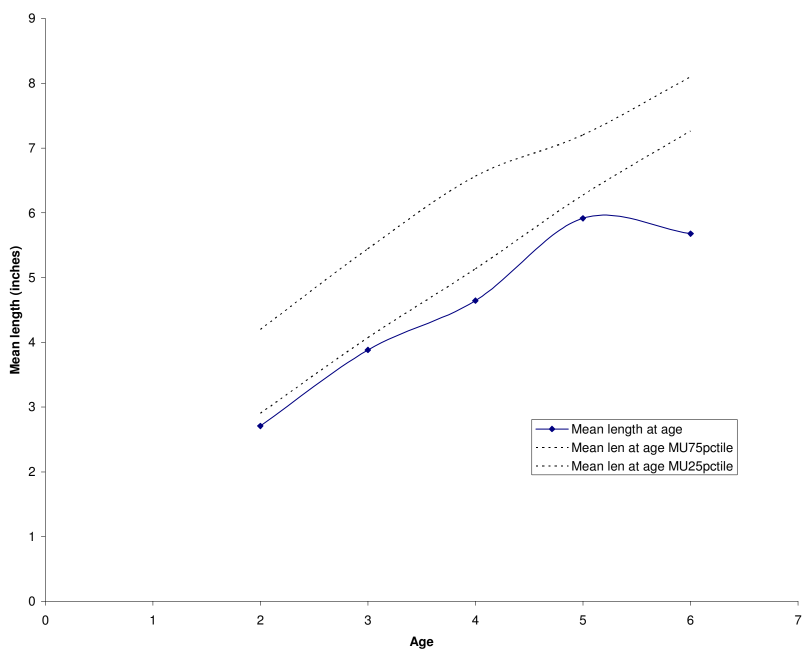

Figure 2. Average length at age for bluegills in Osterhout Lake compared to the 25th and 75th percentile lengths at age for bluegills in status and trends lakes in the region (2002-2007).

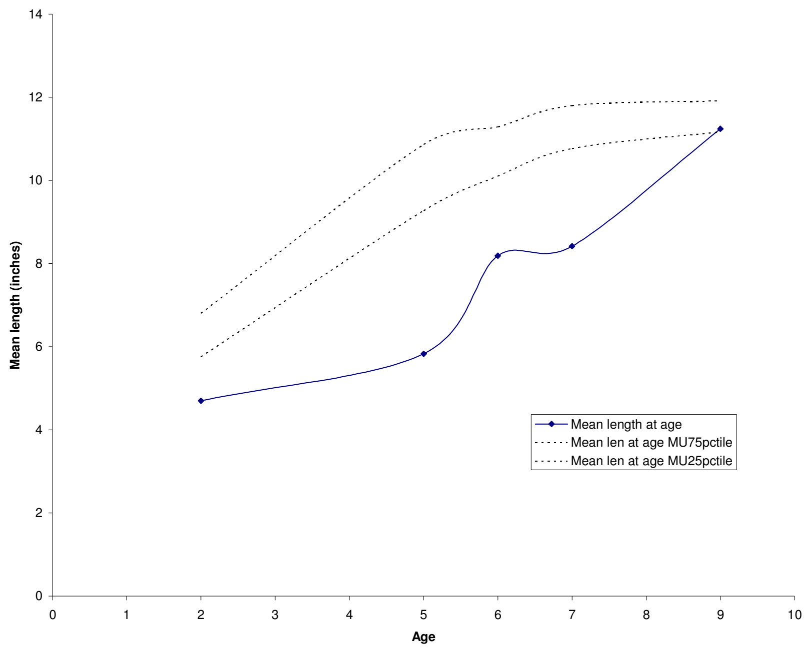

Figure 3. Average length at age for black crappies in Osterhout Lake compared to the 25th and 75th percentile lengths at age for black crappie populations in other status and trends lakes in the region (2002-2007).

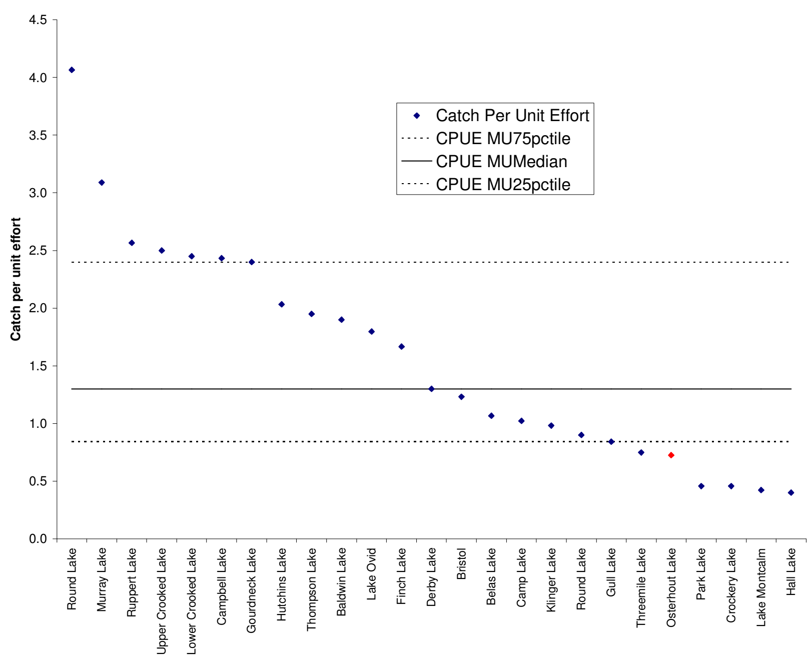

Figure 4. Electrofishing catch per unit effort of largemouth bass in Osterhout Lake compared to other status and trends lakes in the region (2002-2007).

Table 1. List of fishes in Osterhout Lake, Allegan County. Origin: N= native, I = introduced. Status: P = recent survey observation, H = past survey observation.

	Common Name	Scientific Name	Origin	Status
1	Black Crappie	*Pomoxis nigromaculatus*	N	P
2	Bluegill	*Lepomis macrochirus*	N	P
3	Bluntnose minnow	*Pimephales notatus*	N	P
4	Bowfin	*Amia calva*	N	H
5	Brook silverside	*Labidesthes sicculus*	N	P
6	Brown bullhead	*Ameiurus nebulosus*	N	P
7	Common Carp	*Cyprinus carpio*	I	P
8	Golden shiner	*Notemigonus crysoleucas*	N	P
9	Grass pickerel	*Esox americanus*	N	P
10	Green sunfish	*Lepomis cyanellus*	N	P
11	Lake chubsucker	*Erimyzon sucetta*	N	H
12	Largemouth bass	*Micropterus salmoides*	N	P
13	Muskellunge	*Esox masquinongy*	I	P
14	Northern pike	*Esox lucius*	N	H
15	Pumpkinseed	*Lepomis gibbosus*	N	P
16	Spotted Gar	*Lepisosteus oculatus*	N	P
17	Warmouth	*Lepomis gulosus*	N	P
18	Yellow bullhead	*Ameiurus natalis*	N	P
19	Yellow perch	*Perca flavescens*	N	P

Table 2. Weighted mean length at age of fish sampled in Osterhout Lake with trap nets, fyke nets, gill nets and electrofishing gear combined. Number of fish aged is in parentheses.

	Age/Length									
Species	1	2	3	4	5	6	7	8	9	10
Black crappie		4.7 (8)	5.35 (2)	5.6 (1)	5.85 (10)	7.9 (13)	7.97 (7)	8.09 (4)	11.24 (5)	11.10 (3)
Bluegill		2.71 (10)	3.88 (6)	4.27 (9)	5.02 (23)	5.31 (9)	7.0 (1)			
Largemouth bass	2.83 (6)		9.74 (22)	11.28 (10)	11.28 (3)	14.13 (4)	14.3 (2)	15.0 (2)	15.45 (2)	
Muskellunge						35.8 (2)			40.7 (1)	
Pumpkinseed	2.20 (1)	2.78 (11)	3.95 (8)	4.67 (12)	5.10 (7)	5.49 (4)				
Yellow Perch		5.15 (2)	5.70 (1)	6.72 (4)	6.30 (1)	8.8 (1)	9.3 (1)			