Wabasis Lake
Kent County (T9N, R9W, S27-29 & 33-34)
Grand River Watershed, 2010

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Environment

Wabasis Lake is a 418-acre inland waterbody located approximately seven miles west of Greenville and thirty miles northeast of Grand Rapids in Oakfield Township, Kent County, Michigan (lat. 43.138, long. -85.396). The basin is situated in an east-west orientation with an estimated length of 1.6 miles, a shoal area (less than 15 ft) of roughly 20%, and with approximately 40% greater than 30 ft deep. Wabasis Lake encompasses two main basins: east (maximum depth of 48 ft) and west (maximum depth of 58 ft). Both basins have similar bathymetry characterized by steep nearshore drop-offs and multiple deep depressions, and they are separated by a relatively narrow (approximately 0.3 miles) north-south stretch of water in which the maximum depth is 25 ft. Marl and organic matter predominate the shoal substrates throughout the basin, although dispersed sandy areas occur along the southern shorelines. Offshore, deeper water substrates are entirely pulpy peat, marl, and organic matter. Two tributaries flow into Wabasis Lake: Beaver Dam Creek (lat. 43.138, long. -85.365) enters at the southernmost end of the west basin and an unnamed stream connects Little Mud Lake to Wabasis Lake (lat. 43.133, long. -85.387) at the easternmost end of the east basin. Several nearshore natural springs persist around the lake. Wabasis Creek (lat. 43.145, long. -85.369) flows out at the north end of the east basin and downstream to Little Wabasis Lake.

The uplands surrounding Wabasis Lake are primarily rolling farmlands and mixed hardwood forests. Loamy-sand composites, sands, and loams cover 76% of the watershed. These substrates have a high infiltration rate (low runoff potential) when thoroughly wet and a high rate of water transmission. The immediate lake perimeter is wooded and largely undeveloped with surface substrates composed almost entirely of Houghton muck. The total dwelling density for Wabasis Lake is 5.3 dwellings/mile of shoreline, which is low relative to most other lakes in southwest Michigan. Residences are located along the southern and eastern shorelines. No dwellings occur along the northern shore. An estimated 91.3% of the shoreline is natural. The remaining 8.7% of the shoreline is armored with seawalls or riprap. Large overhanging and submerged woody debris are abundant throughout the shoreline and nearshore areas. Moderately dense stands of emergent, submergent, and floating vegetation are found along the entire perimeter of the lake, with predominant species including cattail, chara, arrowhead, bulrushes, lilies, pondweeds, and coontail. Invasive vegetation species documented include Eurasian Water Milfoil and Purple Loosestrife. The western shore of the lake is bordered by Wabasis Lake County Park which has a public boat launch and waterfront access for shore fishing.

A limnological assessment of the thermal and dissolved oxygen profiles was conducted on August 30, 2010 in the deepest portion of the western basin. The lake was thermally stratified (Figure 1) and the epilimnion (upper layer of warm water) extended to a depth of 11 ft. Epilimnetic temperatures ranged from 78.4 ºF (surface) to 74.8 ºF (11 ft) with a mean temperature of 76.8 ºF. The metalimnion (middle layer of cool water where temperature changes rapidly with depth) width was approximately 11 ft, spanning 12 to 23 ft below the surface. Water temperatures within the metalimnion declined rapidly from 72.9 ºF (12 ft) to 57.7 ºF (23 ft) at a rate of 1.38 ºF/ft. The thermocline (single point at which

temperature changes are greatest) depth was 17 ft where the temperature was 69.2 ºF. The bottom layer of cold water, the hypolimnion, extended immediately below the metalimnion (23 ft) to the bottom of the lake. Hypolimetic temperatures changed slowly with depth ranging from 55.8 ºF (23 ft) to 52.3 ºF (50 ft) with a mean temperature of 53.7 ºF.

The dissolved oxygen concentrations within Wabasis Lake were described by a clinograde curve (Figure 2), characterized with the highest oxygen concentrations near the surface and declining with depth. Epilimnetic oxygen concentrations were relatively stable ranging from 9.58 ppm to 8.59 ppm with a mean of 9.37 ppm. Oxygen concentrations declined rapidly with depth from the top of the metalimnion (8.59 ppm) to immediately below the thermocline (0.92 ppm) at a rate of 1.28 ppm/ft. Concentrations remained above 3 ppm to a depth of 16 ft. Hypolimnetic oxygen concentrations were less than 0.5 ppm.

Biological productivity of a lake is often limited by the concentrations of two important nutrients: phosphorous and nitrogen. The ratio of total nitrogen (726 µg/L) to total phosphorus (14.8 µg/L) in Wabasis Lake was > 49:1, suggesting phosphorus is the limiting nutrient (Shaw et al. 2004). The chlorophyll a concentration, an index of algal biomass, was estimated at 3.4 µg/L and the secchi disk depth (measure of water transparency) was 8 ft. Based on data collected in 2010, Wabasis Lake is a moderately productive or mesotrophic system (Carlson 1977; Vollenweider and Kerekes 1980; Carlson and Simpson 1996).

History

The first fisheries assessment on Wabasis Lake occurred during July 1891 as part of a broad survey effort of inland waterways entitled "Examination of Interior Lakes" conducted by the Michigan Fish Commission. A total of 178 fish, representing eight species, were captured via angling and bottom-set gill nets. Ciscoes, Largemouth Bass, Bluegills, Yellow Perch, Bullhead spp., Black Crappies, "Sunfish" (probably Pumpkinseeds), and a "Pickerel" (most likely a Northern Pike) were collected (Table 1). All fish were described to be in good condition and showed exemplary growth. At this time, the researchers recommended the introduction and future stocking of Walleye.

A comprehensive fish assemblage inventory of Wabasis Lake was conducted on June 23-July 2, 1952 by the Michigan Department of Conservation (predecessor to the Michigan Department of Natural Resources) and the University of Michigan-Institute for Fisheries Research. A total of 605 fish, representing 23 species, were captured with 22 bottom-set gill nets and 2 100-ft. bag seine collections (Table 2). Yellow Perch was the most abundant game species in the catch, followed by Northern Pike, Bluegill, Largemouth Bass, Black Crappie, and Pumpkinseed (Table 2). Yellow Perch, Northern Pike, Bluegill, and Largemouth Bass populations appeared healthy with average or above average growth rates.

The next Wabasis Lake surveys were completed in 1970 and 1971 by the Michigan Department of Natural Resources (MDNR). Nearshore boat electrofishing was conducted the nights of June 18-19, 1970 and three 125-ft. experimental gill nets, three trap nets, and three fyke nets were deployed and lifted July 15, 1971. A combined total of 450 fish, representing 16 species, were captured in the 1970 and 1971 surveys (Table 3). Yellow Perch populations remained in excellent condition, similar to that observed in 1952, with many year classes, large sizes, and above average growth rates (Table 4).

Bluegill, Pumpkinseed, and Black Crappie populations appeared healthy with average growth rates (Table 4).

Walleye stocking was initiated in 1987 and continued through 1992. The Michigan Department of Natural Resources stocked a total of 57,256 spring fingerling Walleyes (Muskegon River strain) in Wabasis Lake during 1987-1990, which equates to an average annual stocking density of 34 fish per acre (Table 5). Approximately 1,100 fall fingerling Walleyes were also stocked in 1989. In 1992, more than 55,000 spring fingerling Walleyes were stocked. This stocking equated to 132.5 individuals per acre and was nearly equal to all of the 1987-1990 efforts combined.

The Fisheries Division of the MDNR completed a general fisheries survey of the lake in 1993. Three trap nets and two 125-ft. experimental gill nets captured a total of 222 fish, representing 11 species (Table 6). Only two adult Walleyes were captured during the survey and these fish were from the 1987 and 1988 stocked cohorts. It should be noted that the 1992 stocked cohort would not have been vulnerable to the sampling gear. In addition, the survey was conducted in late June when most fish would have moved offshore (hence the poor trap net catch for all species). However, the low catch of Walleyes in the gill nets coupled with angler reports of poor fishing for Walleyes, strongly suggested poor survival of spring fingerling Walleyes and the stocking program was discontinued. Subsequently, larger (average length 4.6-6.8 in) fall fingerling Walleyes have been stocked during 2014-2016 (Table 5).

In 1993, survey catches were dominated by Bluegill (47.7%), followed by Largemouth Bass (8.1%) and Yellow Perch (5.9%; Table 6). Bluegill, Yellow Perch, and Black Crappie populations appeared healthy with average or above average growth and a high percentage of harvestable-sized individuals (Table 7). Harvestable size is 6 in or larger for Bluegills and 7 in or larger for Yellow Perch and Black Crappies. Longnose Gar, Bowfin, and Yellow Bullhead were also abundant in the survey catch, with large sizes recorded.

Current Status

The most recent survey on Wabasis Lake was conducted by the MDNR during June 2010. Fish were captured using a variety of gear types as part of the Status and Trends Program, which involved standardized sampling to provide information about spatial and temporal trends in Michigan's fish communities (Table 8). Dorsal spines and/or scale samples were collected for aging up to 10 fish per inch group for all sport fish species. Weights for all fish species were calculated using the length-weight regression coefficients compiled by Schneider et al. (2000b). Weighted age frequencies and weighted mean length at age were derived using the procedures described by Schneider (2000). Total annual mortality was estimated for Largemouth Bass using catch curve analysis (Ricker 1975; Robson and Chapman 1961). Proportional stock density was calculated for Bluegills and Largemouth Bass using the formula developed by Anderson (1976). Stock lengths were 3 in for Bluegills and 12 in for Largemouth Bass. Relative stock density also was calculated for Largemouth Bass 14 in or larger (Wege and Anderson 1978).

A total of 3,407 fish comprising 23 species were captured during the 2010 survey. Nine sportfish species were captured (Table 9) which composed 93% of the total catch by count. Bluegill (n = 2,405) was the most abundant sport fish species, at 70.6% of the catch by count and 34% of the catch by weight. Sizes ranged from 1 to 9 in with an average length of 5.1 in, and 23% were 6 in or larger.

Slightly below average growth was observed among Bluegills < 3 years of age (mean growth index for Ages 1-3: -0.49), while Bluegills ≥ 4 years of age had above average growth (mean growth index for Ages 4-5: +1.31; Figure 3). Seven age classes ranging from 1 to 7 were collected (Figure 4) and the most abundant cohorts by weight were ages 3 (37.2%) and 4 (27.0%). The proportional stock density for Bluegills was 36.17%.

Largemouth Bass (n = 251) were the second most abundant species captured, composing 7.4% of the catch by count and 10.9% by weight (Table 9). Sizes ranged from 0.8 to 17.1 in, with an average length of 8.3 in, and only 4% exceeded legal size (Figure 5). The majority of the Largemouth Bass catch by weight (91.3%) was below legal harvestable size and did not exceed 5 years of age (Figure 6). The mean growth index was -1.3, with below average growth rates observed among all age classes (Figure 7). The annual total mortality rate of Largemouth Bass ages 3 to 7 was estimated to be 48.9% (Figure 8). The proportional stock density for Largemouth Bass was 31.33% and the relative stock density for Largemouth Bass 14 inches or greater was 10.84%.

Northern Pike (n = 28, 0.8% of catch by count) were the most abundant piscivorous (i.e., fish eating) species by weight (14.4%; Table 9). Sizes ranged from 11 to 34 in, with an average length of 24.2 in, and 46% exceeded the minimum legal size limit of 24 in. Northern Pike attained 24 in at three years of age and mean length-at-ages were slightly above average for Northern Pike populations in Michigan (mean growth index = +0.83; Figure 9).

Yellow Perch (n = 152) composed 4.5% of catch by count and 1.5% of the catch by weight. Sizes ranged from 1 to 9 in, with an average length of 5.4 in, and only 9% were 7 in or larger. Mean length-at-ages were slightly below average across all age classes with a mean growth index of -0.73 (Figure 10). The 2006 and 2008 year classes (2- and 4-yr old fish) made up 49% of the Yellow Perch catch (Figure 11).

Growth rates of Rock Bass (n = 38), Pumpkinseed (n = 72), and Black Crappie (n =145) (Table 9) in Wabasis Lake were average and size and age structures for these species were similar to previous surveys. Over 50% of captured individuals from each population exceeded harvestable lengths (Figure 12; Table 9). Individuals of all three populations attained large sizes and likely contribute significantly to the seasonal panfish fishery.

A total of 104 turtles were captured representing five species. Common Map (46.2%) and Painted turtles (20.2%) were most common followed by Snapping (13.5%), Common Musk (11.5%), and Spiny Softshell turtles (8.7%). None of these species are listed as threatened or endangered in Michigan.

Analysis and Discussion

Catch-per-effort (CPE) among specific gear types provides an index of a species relative abundance, permitting spatial and temporal comparisons. The Bluegill trap net CPE was 113.1 fish/net night and the electrofishing CPE was 9.5 fish/minute. For comparative purposes, the statewide average CPE of lakes surveyed as part of the Status and Trends program during 2002-2007 was 48.1 fish/net night and 4.9 fish/minute. The average for lakes in southwest Michigan was 78.8 fish/net night and 5.9 fish/minute (K. Wehrly, MDNR - Fisheries Division, unpublished), for trap net and electrofishing gear respectively. Bluegill is the most prevalent sport fish species in Wabasis Lake and comparative CPE

estimates suggest above-average population densities. In an effort to minimize the subjectivity associated with analyses of Bluegill catch data, Schneider (1990) developed a standardized scoring system for interpreting length-frequency distributions and size structure of Bluegills collected with various types of sampling gear. Based on independent analyses of the trap/fyke net sample (n = 2,093) and the electrofishing sample (n = 286), size scores calculated for the Wabasis Lake Bluegill population were 3.25 (acceptable) for both trap/fyke net and electrofishing samples indicating an average Bluegill population size structure. The relative stock density for Bluegills lies within the generally accepted range for a balanced fish population (Anderson 1985; Willis et al. 1993).

Slower growth rates observed among Bluegills ≤ 3 years of age (as compared to older Bluegills; Figure 3) may be due to competitive interactions among the abundant age 0-4 cohorts. Alternatively, predation pressure by larger piscivores could restrict habitat use of small individuals to densely vegetated refugia with poor forage (Savino and Stein 1989; Warner et al. 1983). As predation vulnerability decreases with increasing prey body size and predator gape limitations, large individuals would be more likely to occupy open water habitats where greater foraging opportunities and resources are found (Warner et al. 1983).

The size structure and length and age frequencies of Largemouth Bass were skewed toward sub-legal individuals (Figures 5; 6). The electrofishing CPE for Largemouth Bass was 2.6 fish/minute, considerably above the southwest Michigan average catch rate of 1.6 fish/minute. This suggests an above-average population density of Largemouth Bass in Wabasis Lake. Recruitment, annual mortality, and growth are factors that often influence fish population size structures. A catch curve analysis (Robson and Chapman 1961) was performed to evaluate annual total mortality. Catch curve analyses reflect only fish that have recruited to a fishery, or in this case fish that have recruited to the survey gear, and assume consistent yearly recruitment. The annual total mortality of Largemouth Bass in Wabasis Lake was 48% (Figure 8). Allen (2008) compiled Largemouth Bass annual total mortality estimates for waters throughout North America and the median annual total mortality estimate was 58%. Based on the available data, the annual total mortality of Largemouth Bass in Wabasis Lake appears to be low to moderate relative to other populations in North America.

Only 4% of captured Largemouth Bass were above the legal size limit and the average total length was < 10 in. Growth was below state averages for all age classes (Figure 8). Minimum harvestable sizes were not attained until 6 years of age, compared to 5 years of age for Largemouth Bass populations with average growth. The relative density of harvestable (14 in) to stock (8 in) individuals lies near the bottom of the generally accepted range for a balanced fish population (Gabelhouse 1984; Willis et al. 1993). The proportional density of quality (12 in) individuals is well below the generally accepted range for a balanced fish population (Gabelhouse 1984; Willis et al. 1993). The low-proportional and relative stock density population is likely the result of a high abundances of small individuals (Figure 5) and low mortality rates. However, six individuals (22.0-24.5 in) caught between 2000 and 2015 were submitted to the MDNR Master Angler Program indicating that some bass are able to achieve trophy sizes.

Forage biomass and availability may be limiting growth in this system. Forage seine CPE for Largemouth Bass (< 4 in) was 31.8, 6.0 for Bluegill, and other forage species (n = 9) combined for a total CPE of 12.3. However, small mesh fyke net CPE was grossly dominated by small Bluegill (278.5). Although multiple shiner and minnow species are present it appears Bluegill are the primary

available forage. The relationship between predator-prey proportional stock densities indicates an overabundance of small Largemouth Bass and the cropping of young Bluegill. This may be resulting in forage limitations for small Largemouth Bass and helps to further explain the generally observed poor growth patterns.

Northern Pike abundance in Wabasis Lake was average for lakes in this region. The mean bottom-set gill net CPE for Northern Pike was 2.88 fish/net night in Wabasis Lake, compared to 2.5 fish/net night for southwestern Michigan lakes (K. Wehrly, MDNR - Fisheries Division, unpublished). Above average growth rates were observed with the potential to support a trophy fishery (Figure 9). Individuals typically attain 24 in at four years of age in Michigan, whereas Northern Pike in Wabasis Lake reach 24 in at three years of age. Exceptional mean-length-at-age was observed among the largest two age classes with above average mean growth rates (+3.90, +2.90 at ages 6, 7; Figure 9); however, the sample size of individuals greater than 5 years of age was relatively low (n = 5).

The relative abundance and age structure of Yellow Perch (Table 9, Figure 11) appear consistent with those observed during the 1993 fisheries survey (Table 6), although declines in both relative abundance and total asymptotic body sizes have occurred since the 1970s and earlier surveys. Wabasis Lake historically supported a trophy Yellow Perch fishery with multiple observations of individuals attaining sizes greater than 13 in. The largest individual recorded during the 2010 survey was 9 in. Increased competition with abundant panfish species and juvenile Largemouth Bass may be limiting foraging opportunities and growth potential for Yellow Perch. Alternatively, temporal changes in the thermal regime (i.e., increasing annual water temperatures) of Wabasis Lake could be impeding optimal growth and recruitment of Yellow Perch, while benefiting species that prefer warmer waters (e.g., Bluegill and Largemouth Bass).

During the last decade, fisheries surveys and angler reports indicate that stocking fall fingerling Walleyes has created popular Walleye fishing opportunities in many lakes in southwest Michigan, including lakes where past spring fingerling Walleye stocking had yielded poor returns. In addition, the Southern Lake Michigan Management Unit of MDNR has been able to increase production of fall fingerling Walleyes in local rearing ponds. In light of these developments, an updated evaluation of the potential for Walleye stocking in Wabasis Lake is warranted.

Walleye populations typically have greater establishment potential and are more successful in large lake or river ecosystems (Kitchell et al. 1977). Efforts to establish populations in small inland lakes are constrained by limited availability of heterogeneous habitats and optimal thermal and oxygen requirements. Observations of typical Walleye spawning habitat include nearshore reef-like structures composed primarily of wave-washed gravel and cobble substrates (Johnson 1961; Priegel 1970).

Mesotrophic lakes often provide optimal survival, growth, and reproduction of Walleye populations compared to eutrophic and oligotrophic systems (Schupp and Macins 1977). However, under warm, summer conditions the hypolimnion may become hypoxic or anoxic which can force populations to seek refugia in intermediate conditions or become extirpated. Optimal thermal habitat for Walleye (64-72 ºC; Christie and Regier 1988; Hasnain et al. 2010) is available in Wabasis Lake at depths between 16 and 20 feet. Upper incipient or lethal temperatures (≥ 84 ºC) were not observed. Optimal dissolved oxygen concentrations of > 5 ppm are available in depths of < 16 ft from the surface. Dissolved oxygen quickly declines to lethal concentrations (< 1 ppm; Scherer 1971) immediately below the

thermocline at 17 feet. Optimal thermal habitat with ideal dissolved oxygen concentrations is narrowly available near a depth of 16 ft. Habitat with suitable oxygen conditions but sub-optimal thermal environment is available throughout the upper metalimnion (above thermocline) and epilimnion. Lethal oxygen concentrations will prevent Walleye occupancy below the thermocline. The thermal and oxygen regime in Wabasis Lake likely concentrates Walleyes along a very narrow band of optimal habitat as Walleyes behaviorally tend to orientate towards optimal temperature over optimal oxygen conditions (Fitz and Holbrook 1978). An increased probability and intensity of both intra- and inter-specific competition and predation would likely result from occupying these waters. Water clarity and transparency measured by secchi disk readings was 8 ft, which falls within an estimated range of < 12 ft and > 4 ft (K. Wehrly, MDNR - Fisheries Division, unpublished) to best support efficient foraging and growth of Walleye.

Southwest Michigan inland lakes are typically small in total area with thermal and oxygen regimes that do not favor coolwater fishes. Wabasis Lake is slightly smaller in total area (418 acres) than the Michigan DNR Walleye stocking recommendations of ≥ 500 acres (K. Wehrly, MDNR - Fisheries Division, unpublished). Habitat characterized by optimal thermal and dissolved oxygen content is extremely limited in Wabasis Lake. Survival of stocked fish is almost certainly impacted by these habitat limitations either directly via thermal stress effects or indirectly by congregating abundances and therefore increasing susceptibility to competition and predation.

Management Direction

Two fisheries management objectives have been developed for Wabasis Lake to enhance or maintain the existing fishery. Our proposed objectives for Wabasis Lake are 1) protect existing natural shoreline, and 2) maintain recent stocking of fall fingerling Walleyes.

Natural shorelines provide vital habitat for both fish and wildlife species and help maintain water quality by filtering nutrients and reducing erosion. Natural shorelines play important roles in ecosystem functioning and are often characterized by abundant native submerged and emergent vegetation and woody debris. These characteristics are important for successful reproduction and early life stage survival of many gamefish species. Additionally, natural shorelines are important to maintaining diversity of many wildlife species including reptiles, amphibians, and waterfowl. Very few lakes in southwest Michigan have as much natural shoreline as Wabasis Lake, thus preserving the current natural shoreline area should be a primary management objective.

There continues to be strong demand for Walleye fishing opportunities in southwest Michigan. As one of the largest public lakes in Kent County, Wabasis Lake is a likely candidate for Walleye stocking. However, summer water temperatures and oxygen concentrations in the lake are outside of the optimal range for Walleyes, and survival from spring fingerling plants appeared to be poor. Recent surveys and angler reports on southwest Michigan lakes have revealed that stocking of fall fingerling Walleyes has created Walleye fisheries in other lakes with similar habitat limitations (Gunderman 2015). MDNR initiated fall fingerling Walleye stocking in Wabasis Lake in 2014 (Table 5). Given the habitat conditions and the existing predator-prey ratio in Wabasis Lake, it is not prudent to stock large numbers of Walleyes in this system. The recommended biennial stocking density is 4 fall fingerlings per acre.

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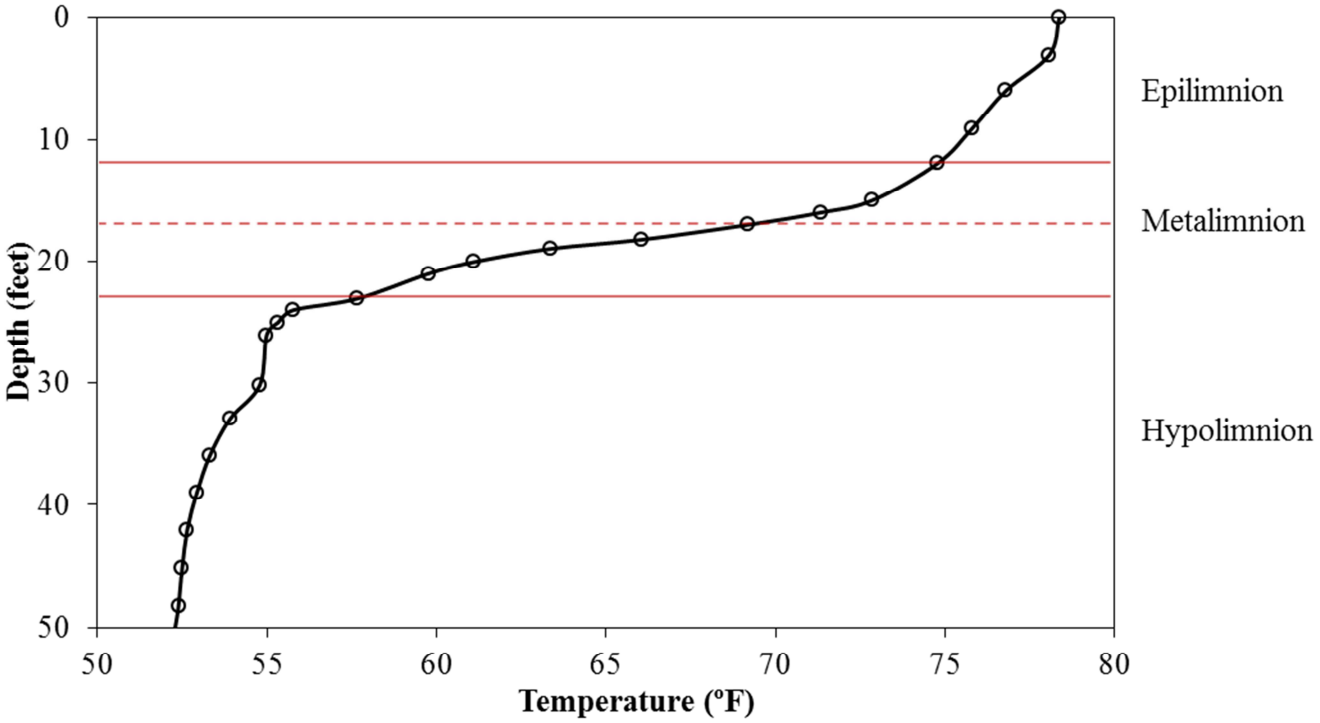

Figure 1. ─Thermal structure for Wabasis Lake (Kent County), August 30, 2010. Solid lines indicate boundaries of metalimnion. Dashed line represents thermocline.

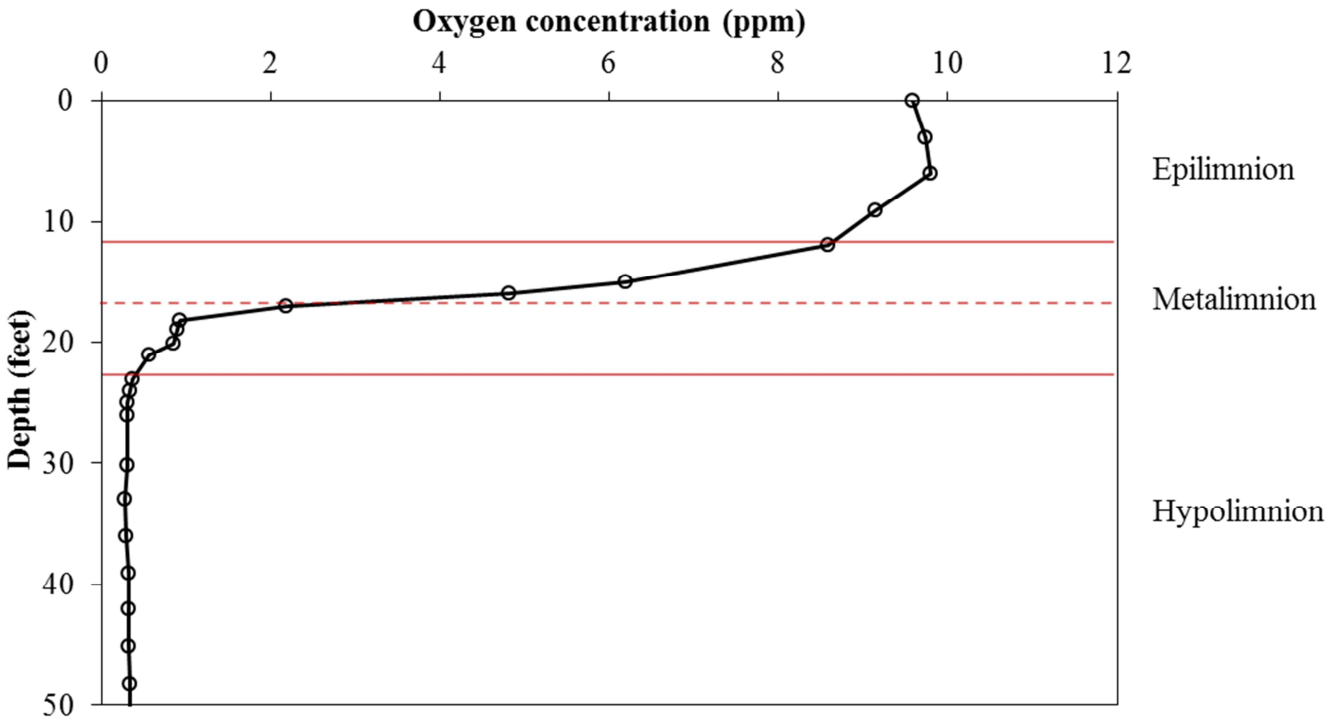

Figure 2. ─Dissolved oxygen profile for Wabasis Lake (Kent County), August 30, 2010. Solid lines indicate boundaries of metalimnion. Dashed line represents thermocline.

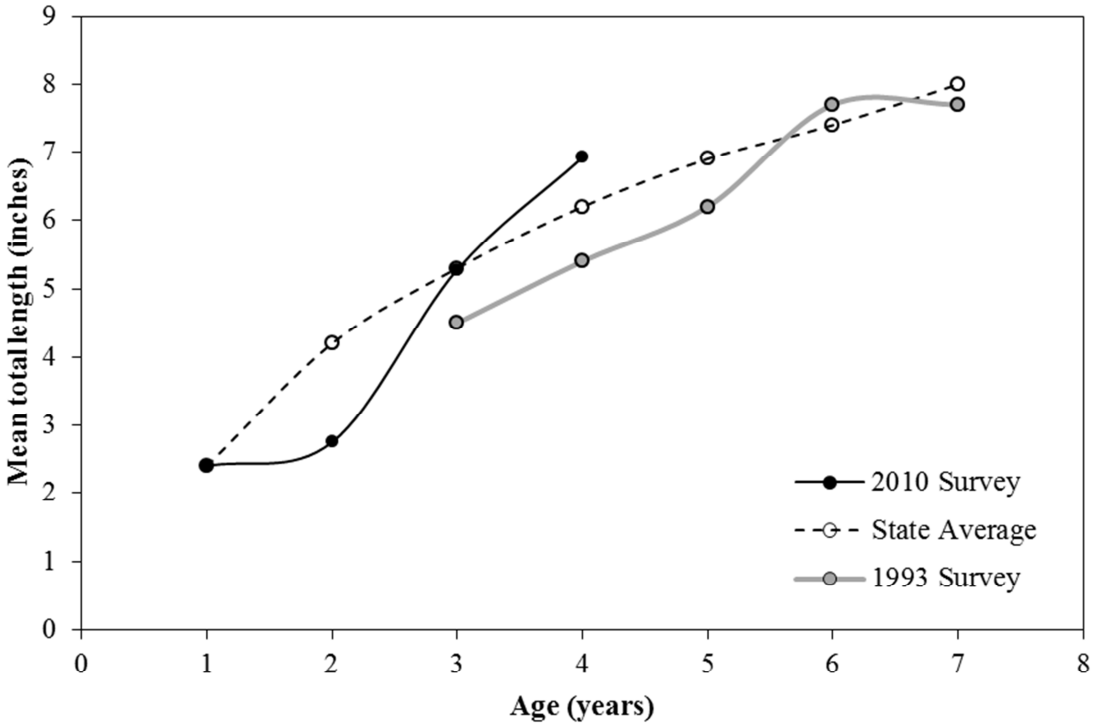

Figure 3.─Length-at-age of Bluegill in Wabasis Lake (Kent County) compared with state average growth from Schneider et al. (2000a). Age classes represented by ≥ 5 individuals.

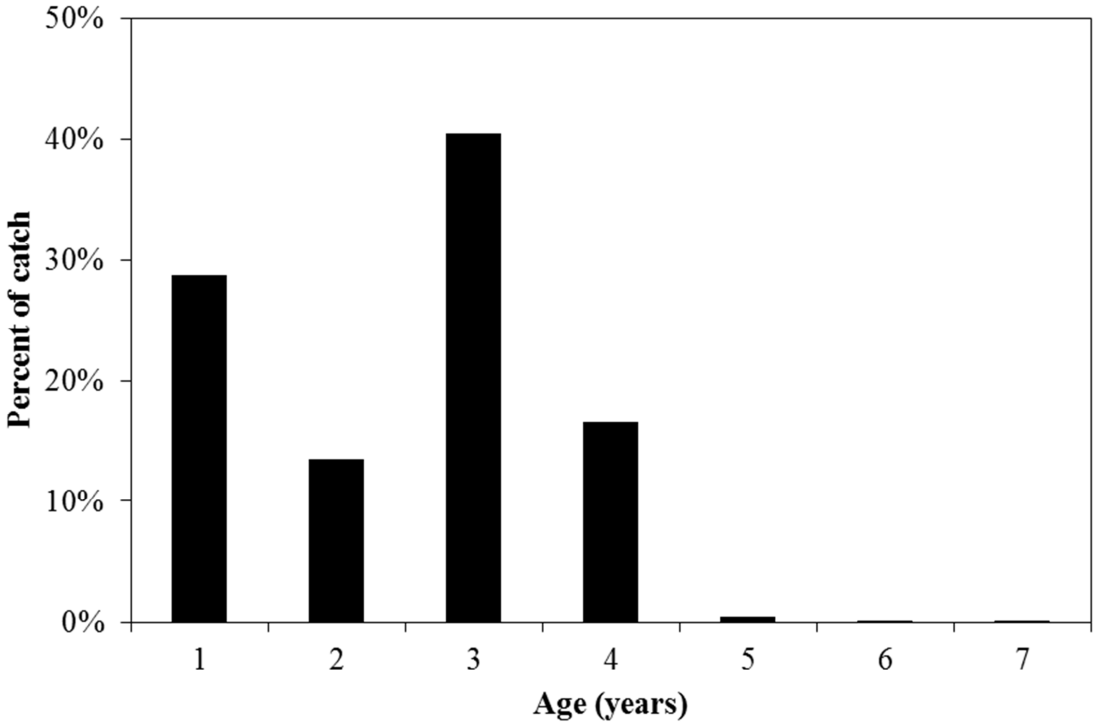

Figure 4. ─Age frequency distribution of Bluegill collected in Wabasis Lake (Kent County) during 2010 fisheries survey.

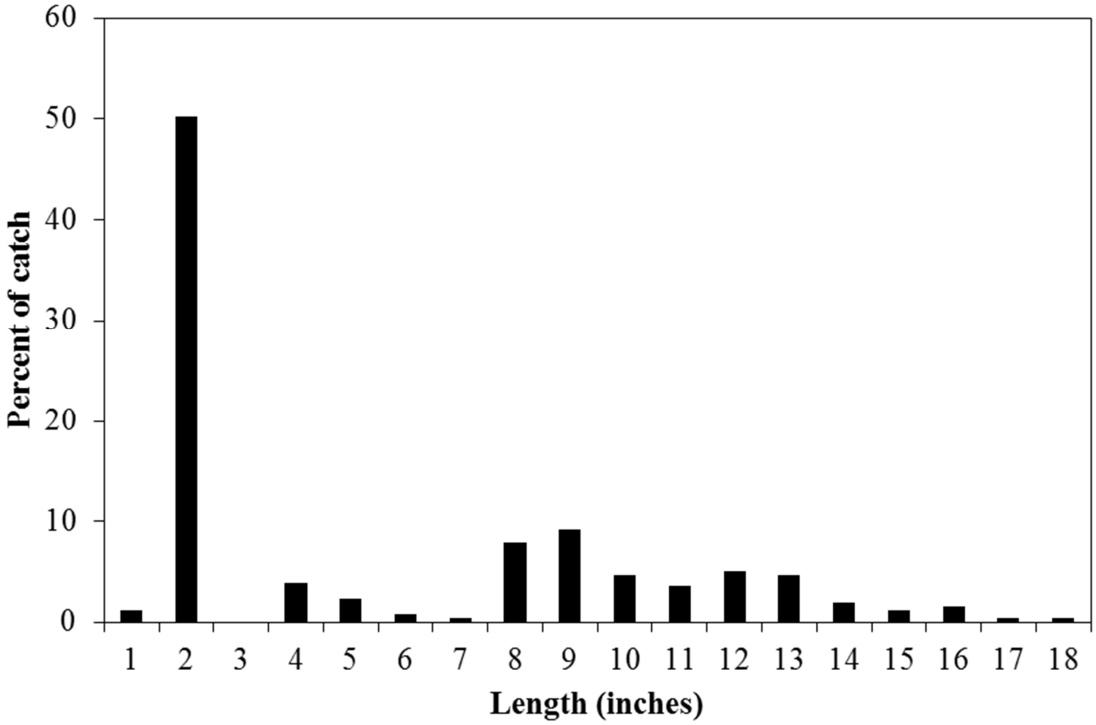

Figure 5.─Length frequency distribution of Largemouth Bass collected in Wabasis Lake (Kent County) during 2010 fisheries survey.

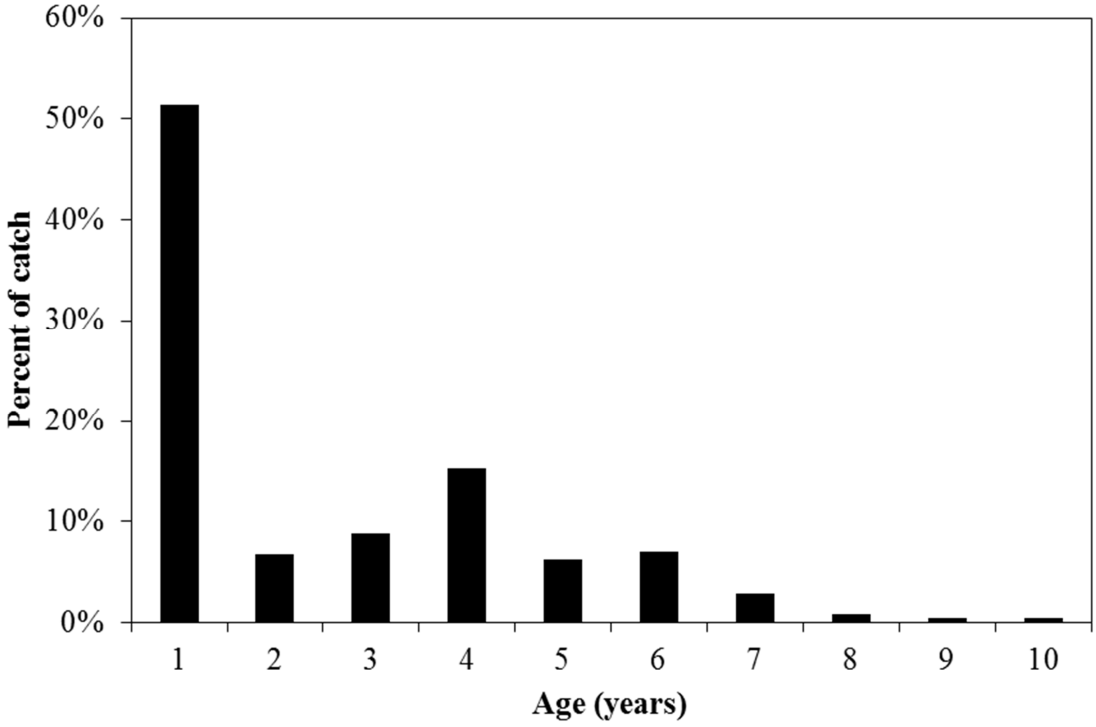

Figure 6. ─Age frequency distribution of Largemouth Bass collected in Wabasis Lake (Kent County) during 2010 fisheries survey.

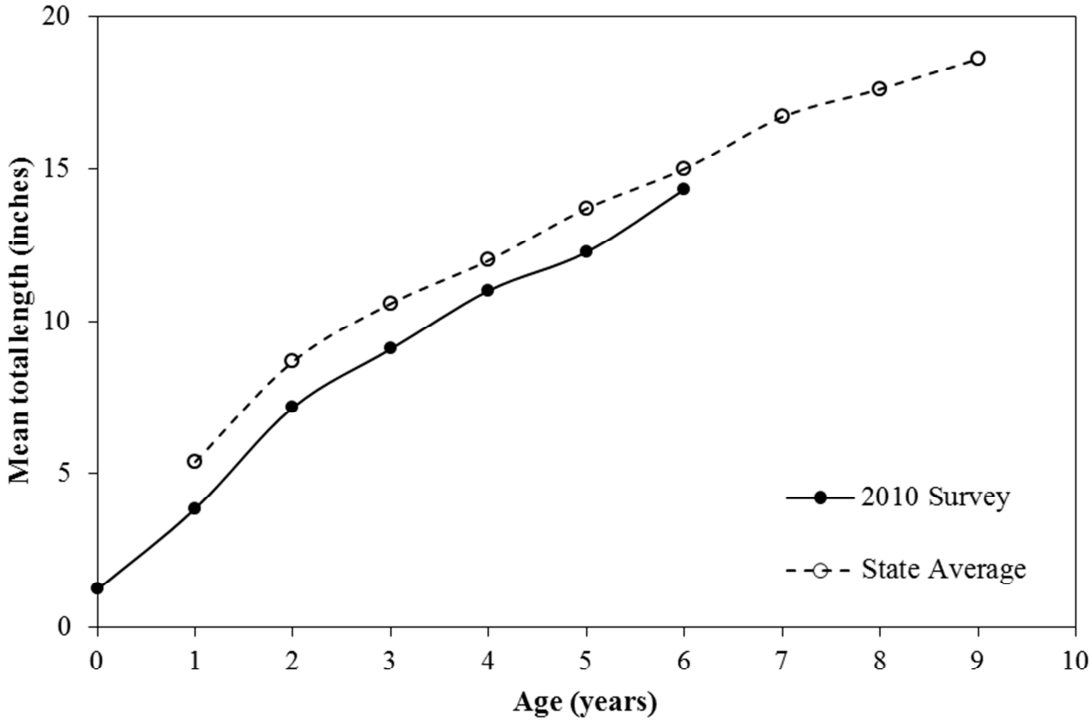

Figure 7.─Length-at-age of Largemouth Bass in Wabasis Lake (Kent County) compared with state average growth from Schneider et al. (2000a). Age classes represented by ≥ 5 individuals.

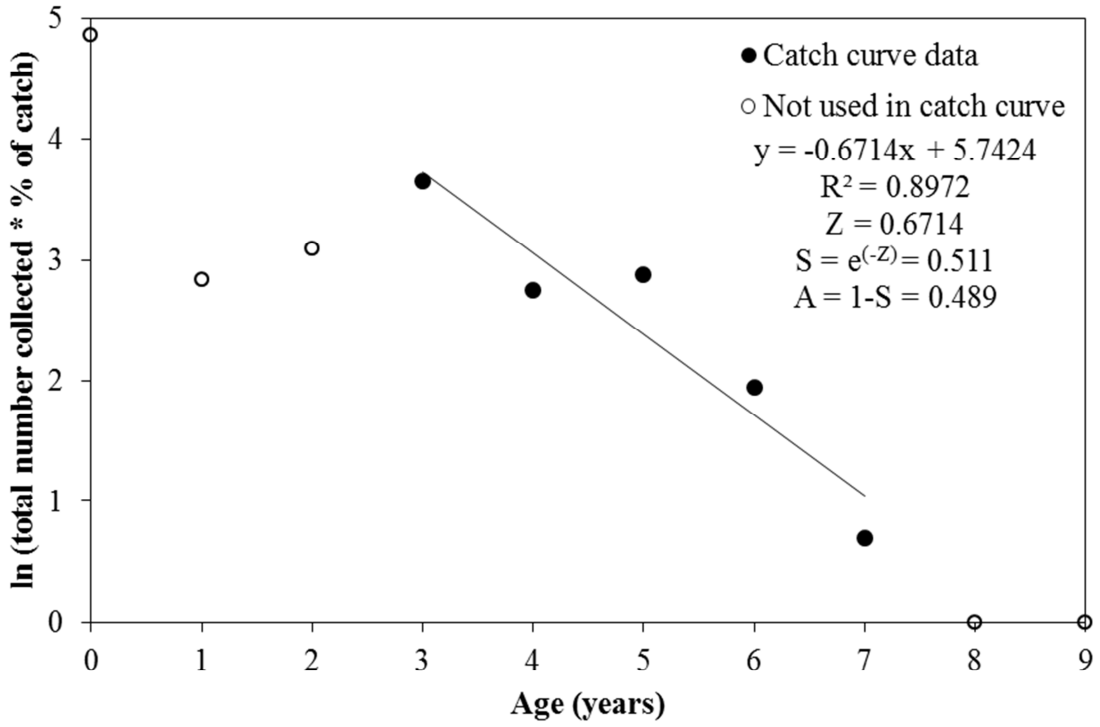

Figure 8. ─Catch curve of ages 3-7, natural log of the product for total number collected across all age classes by the age class specific percent of catch, for Largemouth Bass collected in Wabasis Lake (Kent County) during 2010 fisheries survey.

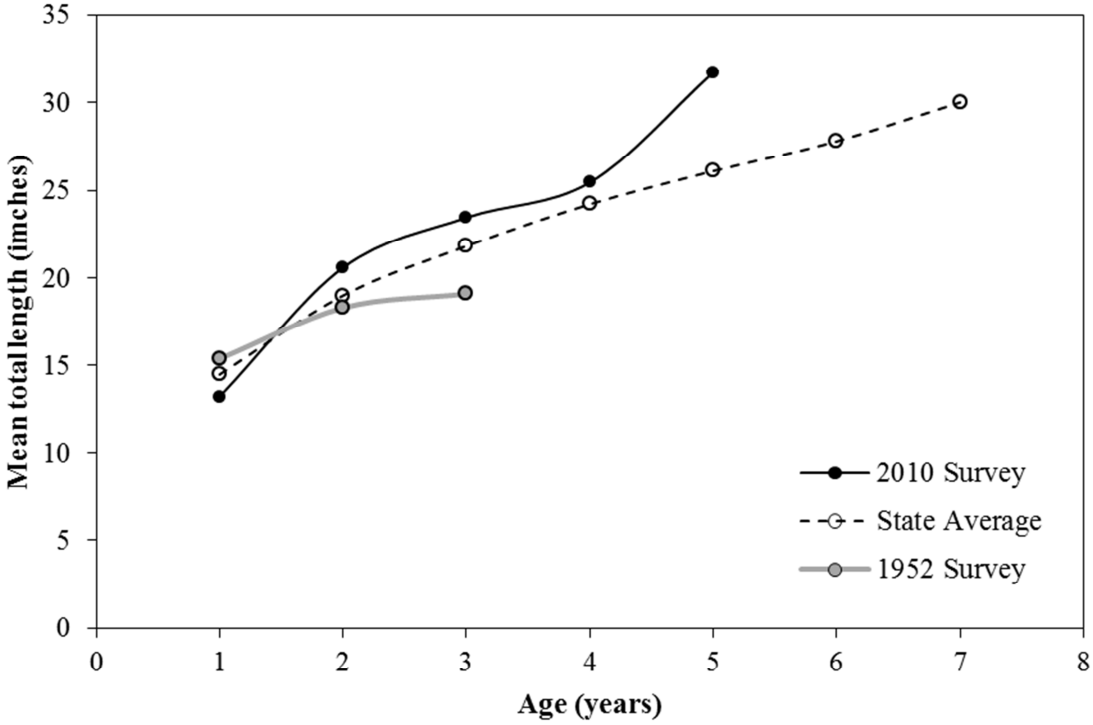

Figure 9.─Length-at-age of Northern Pike in Wabasis Lake (Kent County) compared with state average growth from Schneider et al. (2000a). Age classes represented by ≥ 4 individuals.

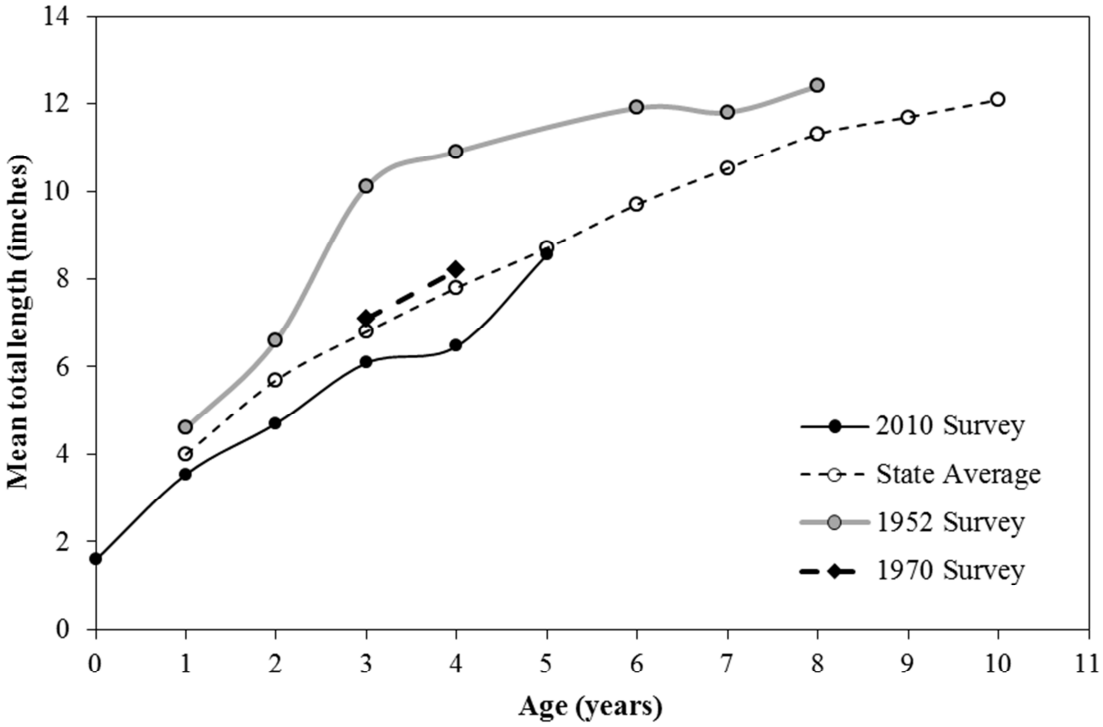

Figure 10.─Length-at-age of Yellow Perch in Wabasis Lake (Kent County) compared with state average growth from Schneider et al. (2000a). Age classes represented by ≥ 5 individuals.

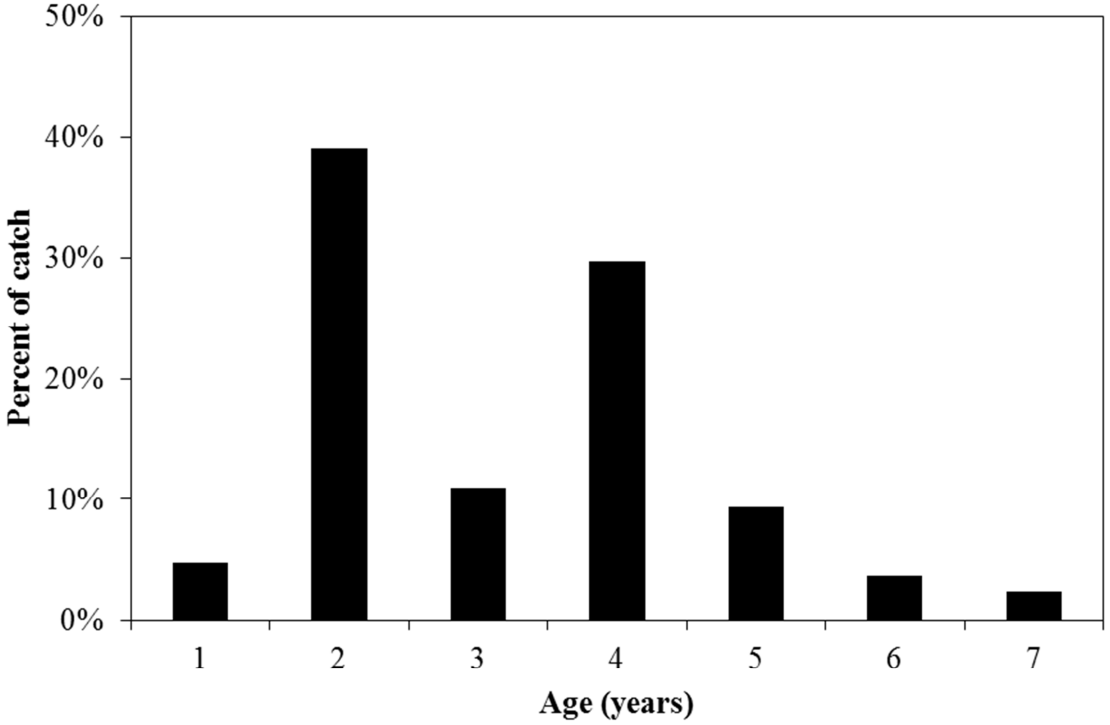

Figure 11.─Age frequency distribution of Yellow Perch collected in Wabasis Lake (Kent County) during 2010 fisheries survey.

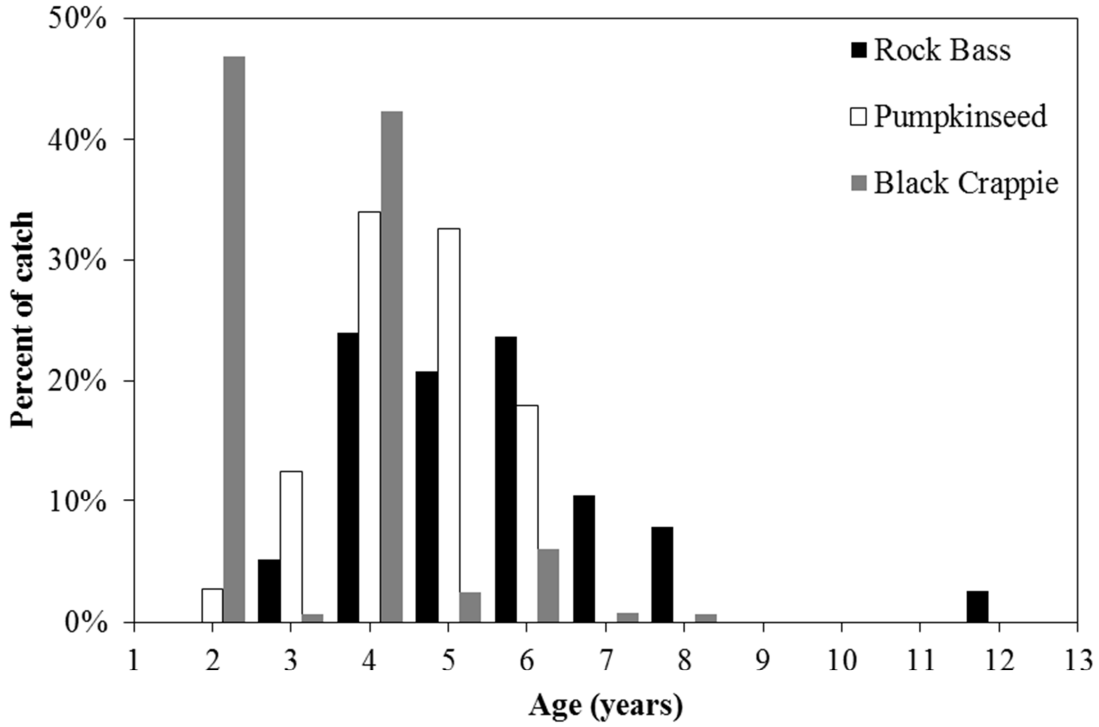

Figure 12. ─Age frequency distributions of Rock Bass, Pumpkinseed, and Black Crappie collected in Wabasis Lake (Kent County) during 2010 fisheries survey.

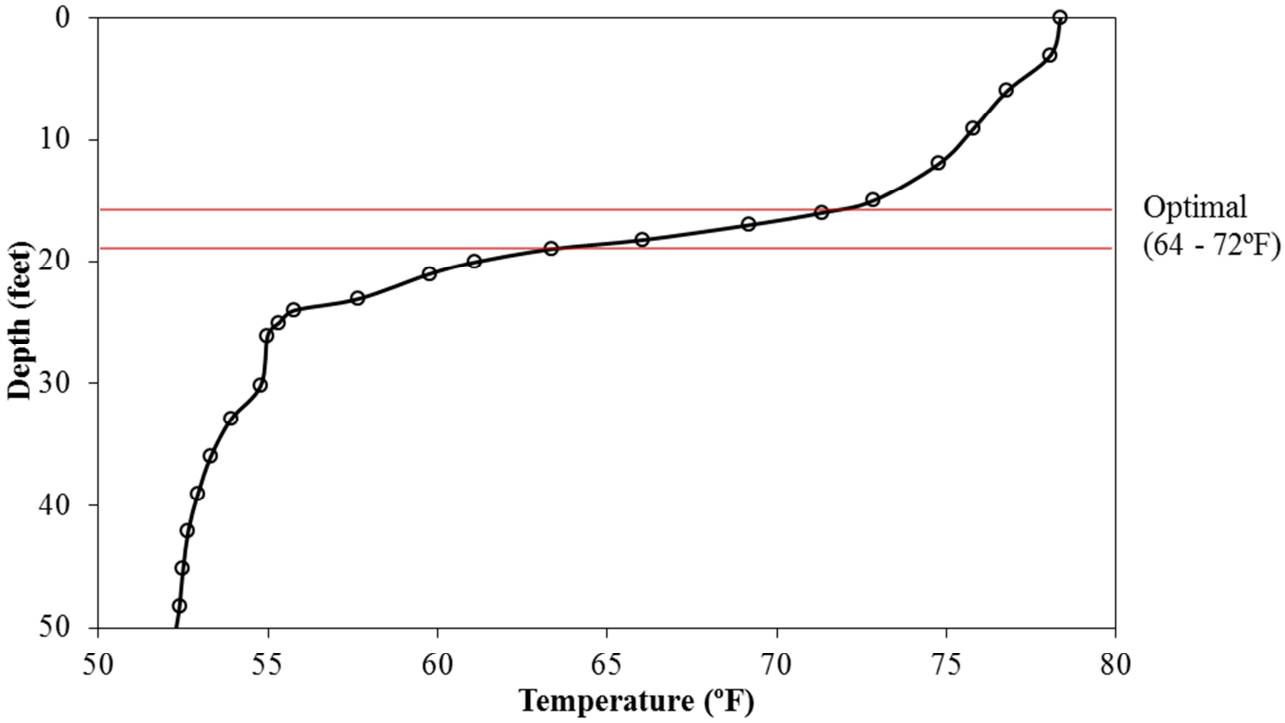

Figure 13.─ Optimal Walleye thermal area outlined by solid lines, overlaid on the temperature profile, taken August 30, 2010, of Wabasis Lake (Kent County).

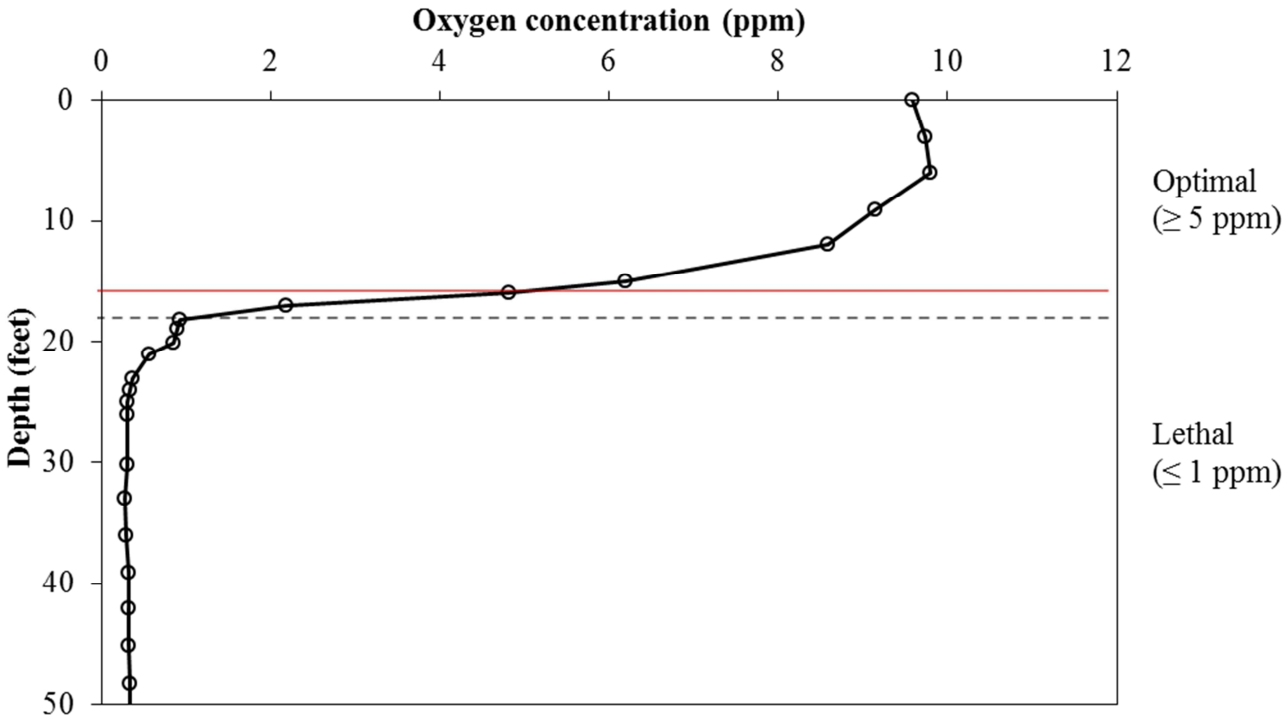

Figure 14.─ Optimal dissolved oxygen conditions lies in area above solid line. Lethal conditions area lies below dashed line and is characterized by low oxygen concentrations. Both indicators are overlaid on the oxygen profile, taken August 30, 2010, of Wabasis Lake (Kent County).

Table 1. ─Numbers and percent catch for fish species collected during the Michigan Fish Commission fisheries survey on Wabasis Lake (Kent County), July 1891. The “Sunfish” probably were Pumpkinseeds and the “Pickerel” likely was a Northern Pike.

Species	Number	Percent by number
Black Crappie	30	16.9
Bluegill	33	18.5
Bullhead spp.	17	9.6
Cisco	3	1.7
Largemouth Bass	15	8.4
Pickerel	1	0.6
Sunfish	12	6.7
Yellow Perch	67	37.6
Total	178	100

Table 2. ─Number, lengths, and percent catch for fish collected during a joint fisheries survey by the Michigan Department of Natural Resources and the University of Michigan of Wabasis Lake (Kent County), July 1952.

Species	Number	Length range (inches)	Percent by number
Banded Killifish	3	2.0-2.3	0.5
Black Bullhead	1	8.1	0.2
Black Crappie	14	6.9-8.2	2.3
Blackchin Shiner	16	1.8-2.5	2.6
Blacknose Shiner	1	2.3	0.2
Bluegill	32	2.1-8.6	5.3
Bluntnose Minnow	6	2.1-2.7	1.0
Bowfin	14	1.8-2.4	2.3
Brook Silverside	4	3.0-3.4	0.7
Brown Bullhead	2	7.8-12.6	0.3
Central Mudminnow	1	1	0.2
Golden Shiner	1	7.6	0.2
Honeyhead Chub	1	3.9	0.2
Iowa Darter	4	1.7-2.0	0.7
Largemouth Bass	20	1.0-21.7	3.3
Least Darter	6	1.1-1.4	1.0
Longnose Gar	12	25.4-44.0	2.0
Northern Pike	62	13.8-32.5	10.2
Pumpkinseed	5	2.9-5.3	0.8
Redhorse spp.	2	14.1-18.7	0.3
Rock Bass	9	2.1-8.4	1.5
Warmouth Bass	1	6.7	0.2
Yellow Perch	388	1.8-14.0	64.1
Total	605		100

Table 3. ─Number, total length range, and percent catch of fish collected during a fisheries survey conducted by the Michigan Department of Natural Resources of Wabasis Lake (Kent County), 1970 and 1971.

Species	Number	Length range (inches)	Percent by number
Black Crappie	8	5.2-8.4	1.8
Bluegill	170	2.5-8.6	37.8
Bowfin	5	19.4-26.0	1.1
Brown Bullhead	9	8.5-13.0	2.0
Golden Shiner	1	4.6	0.2
Green Sunfish	1	4.9	0.2
Lake Chubsucker	4	4.7-7.2	0.9
Largemouth Bass	25	4.5-15.4	5.6
Longnose Gar	20	24.0-43.8	4.4
Northern Pike	18	16.9-25.4	4.0
Pumpkinseed	37	2.7-11.7	8.2
Rock Bass	39	2.4-9.9	8.7
Warmouth Bass	10	4.4-8.2	2.2
White Sucker	7	11.1-19.3	1.6
Yellow Bullhead	5	6.1-13.4	1.1
Yellow Perch	91	4.1-13.2	20.2
Total	450		100

Table 4. —Age assignments, total length range, average total length, and mean growth index for fish collected during a fisheries survey conducted by the Michigan Department of Natural Resources of Wabasis Lake (Kent County), June 1971.

Species	Number aged	Age	Length range (inches)	Average length (inches)	Growth index
Black Crappie	1	I	-	4.5	-0.6
	7	III	7.2-8.6	7.9	-0.3
	1	IV	-	8.6	-0.4
	1	VI	-	11	+0.4
	2	VII	10.6-11.7	11.2	+0.3
Bluegill	2	II	-	4.2	-0.2
	30	III	4.7-7.3	5.7	+0.2
	11	IV	5.9-7.0	6.5	+0.1
	1	V	-	8.3	+1.3
Largemouth Bass	1	I	-	8.0	+1.9
	2	II	9.6-10.3	10.0	+1.4
	1	III	-	9.9	-0.7
	1	V	-	14.2	+0.6
	1	VI	-	15.4	+0.3
Northern Pike	7	II	16.9-21.2	19.5	+0.1
	1	III	-	21.8	-0.4
Pumpkinseed	2	II	-	4.7	+0.3
	11	III	4.8-5.6	5.2	0.0
	5	IV	5.4-7.3	6.0	+0.1
Rock Bass	1	III	-	5.4	-0.2
Warmouth Bass	1	IV	-	6.3	+0.8
Yellow Perch	8	III	6.4-7.8	7.1	+0.1
	8	IV	8.0-8.7	8.2	+0.2
	4	V	10.3-11.3	10.8	+1.8
	2	VI	10.2-11.6	10.9	+1.0
	2	VII	-	12	+1.3
	1	IX	-	13.2	+1.4

Table 5. ─Walleye stocking history in Wabasis Lake (Kent County), 1987-2015.

Year	Developmental stage	Number stocked	Weight (lbs)	Number/lb	Number/acre	Average length (in)
1987	SF	12,520	32.4	386.3	30.0	1.6
1988	SF	13,600	11.2	889.4	23.9	1.5
1989	SF	16,800	18.5	907.2	40.2	1.7
1989	FF	1,084	26.2	41.3	2.6	4.5
1990	SF	14,336	11.5	1250.5	34.3	1.3
1991	-	-	-	-	-	-
1992	SF	55,396	26.2	2115.1	132.5	1.2
1993-2013	-	-	-	-	-	-
2014	FF	2,132	57.6	37.0	5.1	4.6
2015	FF	2,000	192.5	10.4	4.8	6.8
2016	FF	1,624	84.0	19.3	3.9	5.7

* SF/FF denote spring/fall fingerlings, respectivley

Table 6. ─Number, total length range, and percent catch of fish collected during a MDNR fisheries survey on Wabasis Lake (Kent County), 1993.

Species	Number	Length range (inches)	Percent by number
Black Crappie	7	5.0-10.0	3.2
Bluegill	106	3.0-9.0	47.7
Bowfin	16	15.0-26.0	7.2
Largemouth Bass	18	9.0-17.0	8.1
Longnose Gar	23	19.0-36.0	10.4
Northern Pike	3	12.0-21.0	1.4
Pumpkinseed	6	4.0-5.0	2.7
Rock Bass	9	4.0-9.0	4.1
Walleye	2	19.0-21.5	0.9
Yellow Bullhead	19	9.0-14.0	8.6
Yellow Perch	13	5.0-11.0	5.9
Total	222		100

Table 7. —Age assignments, total length range, average total lengths, and growth index of fish collected during a MDNR fisheries survey of Wabasis Lake (Kent County), 1993.

Species	Number aged	Age	Length range (inches)	Average length (inches)	Growth index
Black Crappie	6	III	5.0-7.3	6.5	-1.4
	2	IV	8.2-10.5	-	-
	3	V	9.5-10.5	-	-
Bluegill	8	III	3.8-5.0	4.5	-0.8
	10	IV	4.7-8.3	5.4	-0.8
	15	V	6.0-7.1	6.2	-0.7
	9	VI	7.8-8.4	7.7	+0.3
	6	VII	6.8-8.4	7.7	-0.3
	1	VIII	9.2	-	-
Largemouth Bass	1	IV	9	-	-
	8	V	11.8-12.5	12.1	-1.6
	8	VI	11.5-12.7	12.1	-2.9
	1	IX	17.8	-	-
Northern Pike	1	I	12.1	-	-
	1	II	18.7	-	-
	1	III	21.7	-	-
Pumpkinseed	2	IV	4.5-5.2	-	-
Walleye	1	V	19.5	-	-
	1	VI	21.4	-	-
Yellow Perch	9	II	5.7-7.1	6.2	+0.5
	2	III	5.7-6.2	-	-
	1	IV	11.2	-	-
	1	V	10.0	-	-
	1	VI	11.0	-	-

Table 8. Fisheries assessment gear used during the 2010 MDNR Status and Trends survey of Wabasis Lake (Kent County).

Gear type	Effort	Specifications	Range of depths fished
Gill net	9 overnight sets	125 x 6 ft. monofilament, 1.5 - 4 in. graded mesh, 0.5 in. increments	13.5 - 45.3 ft.
Fyke net - small mesh	5 overnight sets	6 x 4 ft., 48 x 4ft lead, 0.1875 in. mesh	0 - 4.5 ft.
Fyke net - large mesh	8 overnight sets	6 x 4 ft., 95 x 6 ft. lead, 2 in. mesh	0 - 4.5 ft.
Trap nets	9 overnight sets	7 x 5 x 3 ft., 100 x 6 ft. lead, 1.5 in. mesh	0 - 6 ft.
Seine	4 hauls	45 x 6 ft., 0.12 in. mesh	0 - 3.5 ft.
Boat electrofishing	three 600 sec. transects	NA	2 - 15 ft.

Table 9. ─Numbers, weights, percent catch metrics, and total length ranges for fish collected during MDNR fisheries survey on Wabasis Lake (Kent County), 2010.

Species	Number	Percent by number	Weight (lbs)	Percent by weight	Length range (inches)	Percent legal or harvestable[1]
Banded Killifish	1	0.0	0	0	1-1	100
Black Crappie	145	4.3	26	4.1	2-13	52
Blackchin Shiner	36	1.1	0.1	0	1-2	100
Blacknose Shiner	3	0.1	0.0	0	2-2	100
Bluegill	2,405	70.6	213.8	34	1-9	23
Bluntnose Minnow	18	0.5	0.5	0.1	2-7	100
Bowfin	27	0.8	84.3	13.4	17-24	100
Brook Silverside	14	0.4	0	0	2-3	100
Brown Bullhead	4	0.1	4.1	0.6	12-13	100
Central Mudminnow	11	0.3	0	0	2-3	100
Golden Shiner	4	0.1	0.1	0	2-4	100
Hybrid Sunfish	39	1.1	9.2	1.5	4-8	62
Iowa Darter	12	0.3	0	0	1-1	100
Largemouth Bass	251	7.4	68.2	10.9	0-17	4
Longnose Gar	7	0.2	16.7	2.7	23-33	100
Northern Pike	28	0.8	90.2	14.4	11-34	46
Pumpkinseed	72	2.1	15.5	2.5	1-7	71
Rainbow Darter	1	0.0	0	0	2-2	100
Rock Bass	38	1.1	9.5	1.5	0-10	68
Sand Shiner	6	0.2	0	0	2-2	100
Warmouth Bass	37	1.1	8.9	1.4	1-9	73
Yellow Bullhead	96	2.8	71.7	11.4	7-15	100
Yellow Perch	152	4.5	9.5	1.5	1-9	9
Total	3,407	100		100		

[1] Legal or harvestable size for Bluegill, Warmouth Bass, Rock Bass, Hybrid Sunfish, and Pumpkinseed is 6 inches, Black Crappie and Yellow Perch is 7 inches.