Union Lake
Oakland County, T2N/R9E/Sec. 6
Huron River Watershed, Last Surveyed Fall 2020 and Spring 2021

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Environment

Union Lake is a 465-acre natural lake located in central Oakland County in Commerce and West Bloomfield townships. An inlet flows in from Green Lake on the southeast side and Hayes Creek, a tributary to the Huron River, flows out from the southwest corner of the lake. The lake watershed area is 4.8 square miles and relatively level to the west and south, with hilly terrain to the north and east (Figs. 1 and 2). A few smaller lakes exist within the marsh environment on the eastern end of the surrounding land. The lake was mapped in 1940. Morphology includes wide shallow beaches, sharp drop-offs, irregular contour breaks, submerged islands, and deepwater plateaus (Fig. 3). About half of the lake is 20 feet deep or less, but there is a significant amount of deep water (25% is deeper than 50 feet). There is a maximum depth of 110 feet and an average depth of 29 feet. There are several shoals and roughly three main basins. The water is typically very clear with visibility usually 10 feet or more, cooler temperatures, and the presence of dissolved oxygen deeper than many other lakes in the area. The thermocline sets up relatively deep (at about 30-35 feet) in comparison to other area lakes where 12-18 feet is more typical. Littoral zone cover consists of sparse to moderately abundant submerged aquatic vegetation. Bottom substrates are composed of marl, sand, or other hard bottom types. The surface water level in Union Lake is legally established and controlled by a dam on the southwest corner of the lake. The structure was built in 1964 and is owned by the Oakland County Drain Commissioner. The winter water level is 0.41 feet lower than the summer level.

The surficial geology of the surrounding area is glacial outwash sand, gravel and end moraines of coarse-textured till. This type of geology is well drained and allows good movement of groundwater. The land cover for the surrounding area and portion of the watershed upstream of Union Lake is mostly urban (82%) with some wetland (6%), additional lakes and streams (7%), and forest (5%). The population of Oakland County is around 1.25 million people (US Census Bureau, 2019), contributing to the high level of urban land use in the watershed. The lake shoreline is seven miles in length. Almost all of the shoreline is developed into residential units with approximately 94% of the shoreline being armored with vertical walls or artificial riprap. There were no submerged trees recorded along the entire shoreline during the shoreline habitat survey in 2002, nor were any observed during recent

survey efforts. Union Lake has an average of 83 dwellings and 77 docks per mile of shoreline (Google Earth imagery) which is much greater than median values (27 dwellings and 39 docks per mile) for the southern part of the state. A new Michigan Department of Natural Resources (DNR) boating access site with 21 trailer parking spaces was developed in 2022 at the southwest corner of the lake at the intersection of Wise and Union Lake roads. Prior to 2022, the public boat launch existed off Union Lake Road in the northwest corner of the lake. This property was recently purchased by the Charter Township of Commerce and now serves as a kayak launch and shore access site. Boat traffic can be heavy on the lake and access sites, especially on summer weekends.

Lake profiles are collected in the deepest basin to identify stratification zones in the lake. Lake stratification occurs where the water density gradient, caused by warming of the upper waters, is large enough that it prevents wind currents from mixing waters throughout the water column. The epilimnion is the well-mixed, upper layer of warm water with uniform temperatures and DO levels, the metalimnion is the middle layer of cooler water where temperatures change rapidly with depth, and the hypolimnion is the bottom layer of cold water where mixing does not occur, and temperatures decrease slowly with depth. The most recent water temperature and DO profile was conducted on August 12, 2021 (Fig. 4) and indicated that the epilimnion extends from the surface to a depth of 18 feet. The metalimnion was observed at depths from 18-39 feet and the hypolimnion from 39-103 feet (bottom). The thermocline is the area in the lake with the greatest temperature change and was observed at a depth of 25 feet. Habitats with DO levels of 3.0 mg/L or higher are suitable for most fish species in Michigan require (Schneider 2002). By this definition, DO levels in Union Lake were only suitable from the surface to a depth of 64 feet.

No obvious water quality concerns have been reported or known to exist in Union Lake. A decline in dissolved oxygen (DO) concentrations was observed in the deeper waters in the 1970's and 1980's since the earliest limnology sampling in 1947. The earlier testing showed DO concentrations greater than 4 parts per million (ppm) extended to depths of 80 feet, whereas the surveys in the 1970's and 1980's, and 1997 all consistently showed hypoxic hypolimnion with DO values not surpassing 4 ppm below 45 feet deep. The 2002 survey showed DO concentrations greater than 4 ppm as deep as 93 feet, whereas the 2016 survey showed DO at comparable concentrations no deeper than 45 feet.

Water quality and chemistry results were also collected from select waters in the Lake Erie Management Unit in September of 2019. Union Lake values were as follows: Total alkalinity 140

mg/L; chlorophyll a 0.001 ug/L; total Kjeldahl nitrogen 0.050 mg/L; nitrogen, ammonia 0.003 mg/L; nitrogen, nitrate + nitrite 0.519 mg/L; total phosphorus 0.008 mg/L, and a Secchi disk reading depth of 14.1 ft. Using Secchi depth, total phosphorus, and chlorophyll a to calculate a Carlson's Trophic State Index (TSI) resulted in a value of -21.2, indicating that Union Lake is an oligotrophic, low-nutrient lake.

Fishery Resource

History

The Union Lake paper files contain surveys conducted periodically by Michigan DNR Fisheries Division since 1940. Stocking records indicate that during the 1930's and 40's, Walleye, Largemouth Bass, Smallmouth Bass, Bluegill, and Yellow Perch were planted. Rainbow Trout stocking began in 1947 with many angler reports of success on file from that era. Union Lake was stocked with Rainbow Trout every year from 1979-1990. This stocking program ceased after 1990 due to failure of the trout to survive and provide a fishery. Union Lake was also stocked with Splake roughly every other year from 1981-1990, Brown Trout in 1984, Lake Trout from 1988-1989, and Redear Sunfish from 1998-2000 (Table 1).

Walleye were first stocked in 1986, and spring fingerlings were planted every other year at about 50/acre through 1991. A fishable Walleye population did not develop, although habitat and forage conditions seemed good. From 1993-1995 stocking rates were increased to 280/acre to overcome the presumed high predation mortality. The 1993 fall survey of young-of-the-year (yoy) Walleye indicated a significant increase in fingerling survival over the 1991 survey (25 yoy/acre vs. 2.2 yoy/acre). Subsequent surveys in 1994 and 1995 showed only a modest increase over 1991 with densities of 4.8 fingerlings/acre. Angling reports from 1995 indicated fair numbers of sub-legal Walleye were beginning to show up in catches. Stocking rates were cut back to 75-150 fingerlings per acre, every other year from 1997 through 2003, and the DNR determined that a more thorough evaluation of the Walleye population was necessary when the fish planted in 1993-1995 would have reached sizes susceptible to capture by trap nets.

A mark re-capture survey was conducted in 1997 to estimate the population size of Walleye. A total of 131 Walleye were caught in the trap nets and averaged almost 17 inches in length. Approximately 60% exceeded the minimum legal-size limit of 15 inches and several were over 24 inches. Growth rates

were close to state averages overall, but smaller fish from the high-density stocking years exhibited significantly poorer growth than older fish from the earlier, lower density stockings. The population estimate resulted in a calculated population of 641 adult Walleye which equals about 1.4 Walleye/surface acre. This was considered satisfactory and similar to, or slightly more abundant than other clear water Walleye lakes in the region. Northern Pike, Largemouth Bass, and Smallmouth Bass were the other large predatory gamefish collected during this survey. They comprised 1.6%, 3.7%, and 1.4% respectively of the total catch by number. Northern Pike averaged 19 inches in length with only two of the 16 caught exceeding the minimum legal-size limit of 24 inches. The attempt to conduct a population estimate for Northern Pike was unsuccessful due to the low number collected. Largemouth Bass averaged almost 15 inches in length with over 78% (29 of 37) exceeding the minimum legal size limit of 14 inches, and one over 19 inches. Largemouth Bass growth rates were also good with lengths-at-age averaging 0.7 inches above state averages. Smallmouth Bass averaged just under 13 inches with three of the 14 caught exceeding the legal size limit of 14 inches. Lengths-at-age were similar to state averages, indicating acceptable growth rates.

A standardized Status and Trends survey was conducted in May of 2002. Eight State Threatened Cisco (Lake Herring) were caught in this survey, ranging from 14-15 inches in length. Adult Walleye numbers were very low (n=6) with a CPE of 0.4 fish per trap net lift. However, this is expected as netting surveys in May do not normally catch high numbers of Walleye in the shallow waters. Surveys specifically targeting Walleye are conducted after ice out. Survival of Walleye from the lower stocking density years (1997-2003) appeared to be poor. A Serns survey in the fall of 2003 (stocking density of 149 spring fingerlings per acre) found no yoy Walleye, therefore the stocking rate was increased to 200/acre in 2005 due to the apparent low survival rate of the 2003 fingerlings. After several years of no stocking due to disease issues, the lake was again stocked in 2011, 2012, 2014, and 2015 with an average stocking rate of 147 SF/acre.

Union Lake was included in a statewide zooplankton survey effort conducted in 2002. The average number of large Daphnia (> 1.34 mm) per sample in Union Lake was 288 individuals. Lakes that have more than 150 large Daphnia per sample should be a good trout or Cisco lake and exhibit higher survival rates. The results also showed the mean body length (mm) of zooplankton in Union Lake were well above statewide averages (0.97 vs. 0.73), which indicates a quality food base for fishes that rely on zooplankton for various life stages (e.g., young Walleye and adult Yellow Perch). 90^{th} percentile

body length (mm) values were right at the statewide average (1.4) also indicating good condition of the food base, which can relate to favorable Bluegill growth.

Union Lake receives relatively heavy fishing pressure with effort generally targeted towards bass, Walleye, and panfish. Due to the lack of detailed evaluation of fishing activity on the lake, a creel survey was conducted in 2016 to provide a quantifiable measure of angling effort and catch occurring on Union Lake. Two survey periods were sampled. The winter ice fishery was surveyed on Union Lake from January 30 to February 29, 2016, while the open water boat fishery was surveyed from March 19 to October 31, 2016. On Union Lake the total number of fish caught by boat anglers was estimated at just under 20,000 fish for an overall catch rate of 1.8 fish per hour of angling effort. Smallmouth Bass were the most frequently caught fish with an estimated 8,416 caught by anglers. Largemouth Bass were the second-most caught fish with an estimated 4,276 caught. All bass combined made up 64% of the total fish caught by boat anglers. The overall calculated catch rate for these two species combined was about 1.1 bass caught per hour of total fishing effort. The catch rates were likely much higher for those anglers targeting them. Over 98% of all bass caught were released according to this survey. Walleye were also caught in good numbers (1,248 fish) with about 28% of these being harvested. July was the most productive month for Walleye (650 caught), followed by August (159 fish) and October (126 fish). Northern Pike were also caught in good numbers (578 fish) by boat anglers. The total number of fish estimated caught by ice anglers during the survey period was 186 fish for an overall catch rate of 0.4 fish per hour of angling effort. Yellow Perch were the most-caught fish (104 fish) during ice fishing, but all of these were reported as being released. Other fish reported caught and released included Smallmouth Bass (31 fish), Northern Pike (29 fish), and Largemouth Bass (8 fish). Northern Pike was the only species harvested by ice anglers (14 fish harvested).

Since 2016, MDNR has collected data related to fishing tournaments (DNR Fishing Tournaments) on all public waters in the state, and these data indicate that Union Lake is a popular bass fishing lake. From 2016 through 2024, there were a total of 68 bass tournament reports (average of 8 tournaments per year) for Union Lake (Fig. 5). The lake averaged about 16 anglers, 10 boats, and 29 fish measured per tournament. Largemouth Bass comprised 53% of fish measured in tournaments, followed by Smallmouth Bass, which comprised the remaining 47%.

Current Status of the Fish Community

Methods

Union Lake was sampled in the fall of 2020 as part of a discretionary survey with an objective to quantify population dynamics of Largemouth and Smallmouth Bass. In addition, the lake was surveyed again in the spring of 2021 as part of a management evaluation, with the objective to quantify population dynamics of Walleye and Northern Pike. Largemouth and Smallmouth Bass were also opportunistically collected in the spring for additional supplemental data for the prior fall survey. Catches were then used to complete a mark re-capture population estimate calculated using the Chapman modification of the Petersen formula (Ricker 1975) in MDNR's Fish Collection System:
Where:

$$N = \frac{(M+1)(C+1)}{R+1}$$

N = population estimate of adult fish in each inch group;

M = number of adult fish caught, marked and released in initial marking phase;

C = total number of adult fish caught in recapture phase (unmarked + recaptures); and

R = number of adult fish recaptured in recapture phase.

If a reliable population estimate could be calculated, a catch-curve-based total annual mortality rate generated from fitting a linear regression to the descending limb of a catch curve analysis using the FSA package (Ogle et al. 2020) in R (R Core Team 2019) was also completed. A growth index was calculated by subtracting the state average mean length from the mean length-at-age from the Union Lake survey. Growth indices for each age class represented by a minimum of five fish were averaged to provide a mean index of fish growth (Schneider et al. 2000b). Growth index scores between +1 and -1 are considered similar to the state average while scores less than -1 and greater than +1 are considered below or above the state average, respectively.

Proportional size distribution (PSD) values for Smallmouth and Largemouth Bass, Walleye, and Northern Pike were also calculated (Anderson 1980; Gabelhouse 1984) using Michigan Fisheries Analysis program. PSD refers to the distribution of fish sizes compared to stock length within a population in proportion to their total abundance or biomass and help provide insight into recruitment patterns and the effects of fishing pressure on the population. Stock length (PSD_S) is defined as the approximate length at maturity, minimum length effectively sampled by fisheries gear, and the minimum length of fish that provide recreational value. Quality, preferred, memorable, and trophy size indices correspond to species specific relative percentages of world record lengths, with quality and

preferred sizes typically matching minimum size limits and lengths of fish that most anglers like to catch (Anderson and Neumann 1996). PSD length category measurements used for Smallmouth Bass, Largemouth Bass, Walleye, and Northern Pike are summarized in Table 2.

The fall survey was conducted after sunset over three nights during October 14–21, 2020. Although no formal MDNR sampling protocol for bass was developed prior to this survey, methods from McInerney and Cross (2000) were closely followed. Each night, MDNR boat electrofishing crews completed a single pass of the nearshore zone (depths less than six feet) along the entire perimeter of Union Lake. We electrofished one-mile sections at a time, which totaled approximately four sections.

The spring survey followed both the MDNR Walleye Sampling Protocol and the Northern Pike Sampling Protocols. This survey was conducted from March 15 through April 5, 2021, shortly after the ice cover was gone from the lake. Eight large-mesh trap nets were set around the lake in the nearshore zone (< 8 feet deep) targeting adult Walleye and Northern Pike. Each net was lifted after one to three nights of soaking. When the daily recapture rate reached or exceeded 20% Walleye for all of the nets combined, the netting effort ended, and boat electrofishing was initiated on April 7, 2021. Electrofishing crews completed a single pass of the nearshore zone (depths less than six feet) along the entire perimeter of Union Lake. All species were identified and measured to inventory the fish community as well.

Results

The 2020 fall survey captured 549 bass, with Smallmouth Bass (75%) dominating the catch, followed by Largemouth Bass (25%). Of the 412 Smallmouth Bass caught, sizes ranged from 4–19 inches and averaged 13.4 inches (Table 3). Natural reproduction appears strong with consecutive age classes represented, ranging from young-of-year (age-0) to age-13 (Table 4). Two- and three-year-old fish made up a combined total of 27% of the population of Smallmouth Bass. The Mean Growth Index (MGI) for Smallmouth Bass was -0.6, suggesting that growth rates were very similar to state-wide averages (Table 4). Average Catch Per Effort (CPE) of Smallmouth Bass was 0.7 fish/minute for electrofishing efforts, which is higher than the median for other lakes in the Lake Erie Management Unit (LEMU) (Table 5). The numbers of Smallmouth Bass originally marked (n=241) and recaptured (n=15) were high enough to reliably estimate the population size with statistical confidence. The estimated total annual mortality rate for Smallmouth Bass was 36.9%, and the population size was 2,558 (± 1,510) fish, which corresponded to a lake-wide density of about 5.5 fish/acre. PSD values

were PSD_Q = 73, PSD_P = 54, and PSD_M = 22, which suggests that 73% of the population are quality-sized fish, 54% exceeded the MSL (preferred size) and 22% memorable sized fish (Table 6).

Of the 137 Largemouth Bass caught in the 2020 survey, sizes ranged from 4–19 inches and averaged 11.4 inches (Table 3). Natural reproduction was also strong for Largemouth Bass, with consecutive age classes represented ranging from young-of-year (age-0) to age-11, only missing age-9 fish from the catch (Table 4). One- and two-year-old fish made up a combined total of 54% of the population of Largemouth Bass with age-5 fish comprising 14% of the population. The MGI for Largemouth Bass was +0.8, suggesting that growth rates were similar to state-wide averages (Table 4). Average CPE of Largemouth Bass was 0.2 fish/minute for electrofishing efforts, which is lower than the median of other LEMU lakes (Table 5). The numbers of Largemouth Bass originally marked (n=68) and recaptured (n=4) were too low to reliably estimate the population size with statistical confidence. However, using these numbers, the estimated population size output was 440 (± 209) fish, which corresponded to a lake-wide density of about 0.95 fish/acre. PSD values were PSD_Q = 54, PSD_P = 34, and PSD_M = 0, which suggests that 54% of the population are quality-sized fish, 34% exceeded the MSL (preferred size) and 0% memorable-sized fish (Table 6).

The 2021 spring survey captured 172 Walleye, 50 Northern Pike, 156 Largemouth Bass, and 109 Smallmouth Bass. Walleye sizes ranged from 12–26 inches and averaged 19.9 inches (Table 7). Six different stocked age classes were represented ranging from age-2 to age-10 (Table 8). Six- and seven-year-old fish made up a combined total of 60% of the population of Walleye. The MGI was +0.2, suggesting that growth rates were almost equal to state-wide averages (Table 8). Average CPE was 0.1 fish/minute for electrofishing efforts and 2.1 fish/net lift for the trap nets (Table 5). The number of Walleye originally marked (n=121) and recaptured (n=4) were barely high enough to reliably estimate the population size with statistical confidence. The estimated population size was 310 (± 139) fish, which corresponded to a lake-wide density of about 0.7 fish/acre. PSD values were PSD_Q = 96, PSD_P = 38, and PSD_M = 2, which suggests that 96% of the population were quality-sized fish exceeding the MSL, 38% preferred size, and 2% memorable-sized fish (Table 6). Mortality rates were not calculated for Walleye due to the year classes being limited to only stocked years.

Of the 50 Northern Pike caught in the 2021 survey, sizes ranged from 10–37 inches and averaged 22.3 inches (Table 7). Natural reproduction was good, with consecutive age classes represented, ranging from age-1 to age-8, (Table 8). Three-year-old fish made up 22% of the population of Northern Pike

with age-1 fish comprising 18% of the population. The MGI was +1.5, suggesting that growth rates were greater than state-wide averages (Table 8). Average CPE was 0.004 fish/minute for electrofishing efforts and 0.7 fish/net lift for the trap nets (Table 5). PSD values were $PSD_Q = 77$, $PSD_P = 21$, and $PSD_M = 5$, which suggests that 77% of the population were quality-sized fish, 21% preferred size, and 5% memorable-sized fish (Table 6). The number of Northern Pike originally marked (n=46) and recaptured (n=1) were too low to reliably estimate the population size with statistical confidence and subsequently estimate annual mortality.

Of the 156 Largemouth Bass caught in the 2021 survey, sizes ranged from 6–19 inches and averaged 15 inches (Table 7). The MGI for Largemouth Bass was +2.1, suggesting that growth rates were much higher than state-wide averages (Table 8). Average CPE was 0.1 fish/minute for electrofishing efforts and 1.8 fish/net lift for the trap nets (Table 5). The number of Largemouth Bass originally marked (n=120) and recaptured (n=1) were too low to reliably estimate the population size with statistical confidence. PSD values were $PSD_Q = 90$, $PSD_P = 68$, and $PSD_M = 0$, which suggests that 90% of the population are quality-sized fish, 68% exceeded the MSL (preferred size) and 0% memorable-sized fish (Table 6).

Of the 109 Smallmouth Bass caught in the 2021 survey, sizes ranged from 4–19 inches and averaged 14.7 inches (Table 7). The MGI for Smallmouth Bass could not be calculated because of low sample size. Average CPE was 0.3 fish/minute for electrofishing efforts and 0.5 fish/net lift for the trap nets (Table 5). PSD values were $PSD_Q = 93$, $PSD_P = 76$, and $PSD_M = 39$, which suggests that 93% of the population are quality-sized fish, 76% exceeded the MSL (preferred size) and 39% memorable sized fish, with no trophy-sized fish (Table 6). The number of Smallmouth Bass originally marked (n=31) and recaptured (n=10) in the spring were too low to reliably estimate the population size with statistical confidence and subsequently estimate annual mortality.

The spring 2021 survey captured a total of 3,222 fish representing 16 different species (Table 7). Bluegill were the most abundant species, making up 50% of the total catch by number. Bluegill sizes ranged from 2-10 inches in length with 36% of them being quality size by anglers (>6”). Rock Bass were the next most abundant species, making up 19% of the total catch by number, and ranging from 3-11 inches. Walleye (21%), Bowfin (20%), and Largemouth Bass (15%) were the top three species by weight, making up a combined total of 56% of the total biomass caught. Other popular sport fish collected were Black Crappie and Yellow Perch, with 57% and 84% respectively being at or above

legal size. No new species were detected in this survey, when compared to all previous surveys (Table 9). Although no Cisco were collected during spring 2021, one was captured in the fall 2020 electrofishing survey. It was 13 inches and estimated to be three years old. Since 1985, a total of 28 different species have been captured in Union Lake.

Analysis and Discussion

Union Lake has a diverse fishery, with the opportunity to catch a wide variety of quality-sized fish including Smallmouth Bass, Largemouth Bass, Walleye, Northern Pike, Bluegill, Black Crappie, Pumpkinseed, and Yellow Perch (Table 10). The 2016 creel survey and tournament data indicate the lake is a popular bass fishing destination in highly populated Oakland County. The Smallmouth and Largemouth Bass populations in Union Lake are in good condition. Catch rates from the recent surveys were fair with average growth rates observed. Legal- and memorable-sized fish were present in high numbers. Several year classes of smaller fish were present that will continue to contribute to the fishery. While both species of bass are growing at average rates, longer-lived individuals can attain large sizes as evidenced by both species reaching up to 19 inches in length. The Largemouth Bass population is less dense than Smallmouth Bass, but good numbers of both species were still present. Although Smallmouth Bass fishing opportunities are limited on inland lakes in southern Michigan, Union Lake is an exception.

In the 2020 fall bass survey, catch rates for Smallmouth Bass were greater than Lake Erie Management Unit (LEMU) median for electrofishing and even exceeded 75th percentile (Table 5), which suggests that the Smallmouth Bass population in Union Lake is relatively abundant for the region. The estimated population size of 2,558 and density of 5.5 fish/acre indicates a substantial number of Smallmouth Bass in Union Lake. However, there are few estimates available on other local lakes for comparison. Smallmouth Bass in Union Lake exhibited similar growth to statewide averages, with PSD values exceeding accepted objective ranges (Willis et al. 1993). These PSD values indicate there are high number of large-sized Smallmouth Bass for anglers to target with stable recruitment, growth, and mortality. Relatively low annual mortality rates of 36.9% for Smallmouth Bass estimated from the 2020 fall survey aligns with catch-and-release practices of anglers as documented by the creel study in 2016, which showed that 98% of all bass caught were released.

Catch rates for Largemouth Bass, which were lower than LEMU median for electrofishing and even below the 25th percentile (Table 5), and the estimated population size of 440 and density of 0.95

fish/acre suggests that the Largemouth Bass population in Union Lake is not relatively abundant for the region. However, there are few estimates available for other lakes for comparison. Largemouth Bass in Union Lake had similar growth as state averages, with PSD values within accepted objective ranges. These PSD values indicate there are a decent proportion of large-sized Largemouth Bass in the population for anglers to target with stable recruitment, growth, and mortality.

As a result of recent stocking efforts (years 2011-2019), 172 Walleye from these stocking year classes were caught during the 2021 spring survey. The trap net catch rates for Walleye in 2021 were similar to the LEMU averages for early spring surveys conducted from 1987 to 2018 (Table 11). The estimated population size of 310 and density of 0.7 fish/acre was also the highest compared to other local lake surveys conducted in the 2000's. This suggests that the Union Lake Walleye population is relatively abundant for the region. Walleye in Union Lake in 2021 exhibited similar growth when compared to statewide averages, with PSD values exceeding accepted objective ranges. These PSD values indicate there are high proportions of quality-sized Walleye for anglers to target. Annual mortality rates were not estimated for Walleye from the 2021 spring survey, because natural reproduction does not occur in Union Lake. However, some level of fishing mortality of Walleye occurs as found during the 2016 creel survey. Of the 1,248 Walleye caught from spring through fall of 2016, about 28% were harvested. Walleye prefer cool, oxygenated water at depth in Michigan inland lakes. In the Management Plan for Walleye in Michigan's Inland Waters, Union Lake is categorized as a Class-2 Lake (i.e., high degree-days, intermediate mean temperature (59.9 °F), large surface area, and deep), which are found primarily in the Lower Peninsula (Herbst et al. 2021). Lakes of this type often support strong Walleye populations, but struggle to sustain themselves with natural reproduction, as is the case on Union Lake.

Fifty Northern Pike were captured during the 2021 spring survey, which was conducted immediately after ice out during spawning when catch rates of Pike and Walleye are higher than later, warmer months. Northern Pike are abundant in the Huron River watershed in areas where wetland spawning habitat is present. Union Lake lacks this specific type of habitat, with approximately 94% of the shoreline being armored with vertical walls or artificial riprap, which is likely limiting spawning success and abundance. The low-density population of Northern Pike in Union Lake was growing well, with a high percentage of quality sized fish with PSD values exceeding accepted objective ranges. Annual mortality rates were not estimated for Northern Pike from the 2021 spring survey because of low catches. However, fishing mortality seems to be low or non-existent based on the 2016 creel

survey results. Of the 578 Northern Pike caught from spring through fall of 2016, none were harvested. However, 14 of the 43 Northern Pike caught (33%) were harvested during the winter ice season in 2016.

Over 100 each of Largemouth and Smallmouth Bass were also captured in the spring 2021 portion of the current survey. While these species are not usually targeted during the early spring season, we were interested in comparing the fall and spring catches to help refine future targeted bass survey protocols. Similar numbers of Largemouth Bass were caught fall 2020 (n=137) compared to spring 2021 (n=156). However, during spring, the majority of the Largemouth Bass (n=130) were caught in trap nets and boat electrofishing was not as efficient as during fall. Smallmouth Bass catches were much lower during spring (n=109) utilizing the two gear types combined when compared to fall catches (n=409). Only 72 Smallmouth Bass were caught using boat electrofishing gear during spring, with 37 fish caught in the trap nets. The fall survey for targeted bass population estimates was more efficient and effective for Union Lake and did not require the use of trap nets. Catch per effort for both Smallmouth and Largemouth Bass using boat electrofishing were at least two times greater in the fall survey compared to the spring survey (Table 5). Despite the lower spring catches overall for both bass species, Largemouth Bass were more susceptible to the trap nets with more than three times the CPE when compared to Smallmouth Bass. Additionally, proportional size distribution percentages were much higher for both Smallmouth and Largemouth Bass during the spring season compared to fall (Table 6). This is likely gear-related as the trap nets were biased towards large fish while electrofishing targets all sizes of bass observed.

Union Lake is a popular destination for bass tournament anglers, ranking 91st of 368 lakes throughout the state of Michigan in number of tournaments (Fig. 5). Bass tournament pressure is higher in southern Michigan due to proximity to population centers and the quality bass fisheries present. Union Lake receives higher than average tournament pressure because it meets several criteria. For example, it has a quality bass fishery and both Largemouth and Smallmouth Bass can be targeted. Union Lake also has a public boating access site and is large enough to allow anglers to spread out across the lake. The DNR supports bass tournament angling as part of our strategy to provide diverse fishing opportunities. Union Lake has supported a quality bass fishery and consistent tournament pressure. There are no indications that above-average bass tournament pressure has had any negative impact on the fishery.

Michigan DNR's Master Angler Program is a voluntary program that rewards anglers by providing patches if they catch and report fish meeting a species-specific minimum length criteria. This helps promote fishing as a popular sport in Michigan and provides other anglers with valuable information on where and how the big fish in our state can be found. From 1994 to 2022, a total of 55 Master Angler (MA) fish were submitted from Union Lake. Bluegill, Rock Bass, and Yellow Perch were the three most-caught species which accounted for 71% of the submissions. Two Smallmouth Bass were submitted and measured at 21.0 and 25.2 inches in length. Both fish were caught drifting with live leeches. One Cisco (State Threatened) was submitted to the MA program, and one was also captured in the fall 2020 electrofishing survey which was measured at 13 inches and estimated to be three years old. Union Lake appears to be providing ample opportunities to catch Master Angler class fish of several species.

Management Direction

Union Lake currently has a balanced fish community with desirable populations of sportfish with good growth and size structure. The targeted species data from the current survey and the 2016 creel study show the uniqueness of the fishery in Union Lake. While panfish are the most sought species on most lakes in the area, on Union Lake they are ranked third after Largemouth and Smallmouth Bass. With bass comprising almost two-thirds of the fish caught here, and with almost half of all anglers here targeting bass, this lake is undoubtedly a popular bass fishing destination for the Oakland County area. The DNR Lake Erie Management Unit will continue to conduct fall bass population estimates in the region to further refine sampling methodologies, build datasets on regional and statewide populations, and evaluate other assessment approaches. Due to the immense popularity of Union Lake for bass fishing, we will closely monitor the tournament data collected each year for this lake and revisit the lake to monitor the bass population in the next 10-15 years.

The DNR will discontinue Walleye stocking in Union Lake. While the stocking program has created opportunities to catch Walleye in the lake since 1986, management efforts will shift focus to naturally occurring, self-sustaining species that are the primary target species (e.g., Largemouth and Smallmouth Bass) of the fishery, in addition to protecting populations of Cisco, a State Threatened species. Although relatively suitable Walleye habitat (rating of 0.59, Wehrly, unpublished data) exists in Union Lake, there is an abundance of other predators competing for space and resources, which is inadvisable

for Walleye stocking efforts (Raabe et al. 2020). Lastly, there are several other local inland lakes with Walleye fisheries within a five-mile radius of Union Lake.

Inland Cisco lakes are unique among lakes in Michigan, with fewer than 200 in the state. These waters are typically characterized as cold and deep with narrow, shallow, nearshore zones, steep drop offs, and good water quality. Cisco are a State Threatened species that has been extirpated from numerous inland lakes over the years. Cisco rely heavily on shallow, nearshore, vegetated habitat for spawning, and growth/survival of larvae. However, much of the littoral zone habitat that benefits Cisco, and all other native species present in Union Lake, is currently threatened by habitat loss due to several factors including shoreline modification. Because eutrophication is one of the largest threats to Cisco (Latta 1995), emphasis should be placed on reducing or eliminating sources of nutrient loading in the watershed. Lands in the watershed, especially those adjacent to Union Lake and its tributaries, should incorporate best management practices such as wetland protection, no-mow or native vegetated buffer strips, limiting use of fertilizers and pesticides on lakefront properties, and bioengineered shorelines in place of vertical seawalls to address nutrient loading into the lake. The importance of using best management practices to protect the lake against eutrophication should be conveyed to residents in the watershed. These actions will help maintain the quality fisheries on Union Lake.

The Michigan Wildlife Action Plan (WAP) for 2015 – 2025 provides a strategic framework for conservation of wildlife and their habitat, identifying priorities and goals (Derosier et al. 2015). Vertical walls at the shoreline severely disrupt the connection between the aquatic and terrestrial ecosystems, having a direct negative impact on reptiles and amphibians by eliminating an exit point from the water to the terrestrial environment. Vertical walls also reduce habitat complexity in the dynamic nearshore area, which supports the life history of many aquatic organisms, including many fish species found in Union Lake. Much of the shallow nearshore habitat in Union Lake has been altered with vertical walls and development. Providing protection for the remaining natural shoreline and restoring natural shorelines where seawalls currently exist, would greatly benefit the water quality, habitat, and aquatic ecosystem of Union Lake.

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Tables and Figures

Table 1. Total number of fish stocked of each species in Union Lake from 1979 - 2025 by the Michigan DNR Fisheries Division.

Year	Rainbow Trout	Splake	Brown Trout	Walleye	Lake Trout	Redear Sunfish
1979	14,000					
1980	15,000					
1981	10,000	7,000				
1982	19,000	7,000				
1983	29,920					
1984	14,000		14,000			
1985	23,020	14,210				
1986	23,000	20,100		5,129		
1987	23,000					
1988	23,000	19,500		25,189	5,500	
1989	23,000			15,928	5,100	
1990	23,000	23,000				
1991				10,935		
1992						
1993				131,214		
1994				130,440		
1995				130,970		
1996						
1997				40,769		
1998						1,547
1999						1,392
2000				33,344		893
2001				70,603		
2002						
2003				69,420		
2004						
2005				94,214		
2006						
2007						
2008						
2009						
2010						
2011				98,597		
2012				49,097		
2013						
2014				70,567		
2015				68,079		
2016						
2017				73,258		
2018						
2019				86,469		
2020						
2021						
2022				40,567		
2023				52,652		

Table 2. Proportional size distribution (PSD) length categories for various fish species. Measurements are minimum total lengths (inches) for each category. The table is updated from Anderson and Neumann (1996).

Species	Stock	Quality	Preferred	Memorable	Trophy
Smallmouth Bass	7	11	14	17	20
Largemouth Bass	8	12	15	20	25
Walleye	10	15	20	25	30
Northern Pike	14	21	28	34	44

Table 3. Number per inch group, average length (inches), and percent of catch legal size (>14") of target species collected by boat electrofishing from the Union Lake fisheries survey, Fall 2020.

Inch Group	Smallmouth Bass	Largemouth Bass
4	4	2
5	3	7
6	8	3
7	26	21
8	16	15
9	27	9
10	36	8
11	50	16
12	13	8
13	17	4
14	26	9
15	54	15
16	46	9
17	59	7
18	24	3
19	3	1
TOTAL	412	137
Average Length (in.)	13.4	11.4
Percent Legal (>14")	51%	32%

Table 4. Weighted mean length and age composition of select target species collected by boat electrofishing during the fisheries survey of Union Lake, Fall 2020.

Species	Age	No. aged	Length range (in.)	State avg. length (in.)	Weighted mean len. (in.)	Weighted age freq.	Mean growth index*
Largemouth Bass	0	4	4.40-5.20	4.2	4.92	3.19%	+0.8
Largemouth Bass	I	36	5.40-9.60	7.1	7.59	27.14%	+0.8
Largemouth Bass	II	33	6.50-12.30	9.4	10.28	26.92%	+0.8
Largemouth Bass	III	12	8.50-14.70	11.6	11.64	9.82%	+0.8
Largemouth Bass	IV	7	12.00-15.70	13.2	14.28	6.64%	+0.8
Largemouth Bass	V	15	14.60-16.60	14.7	15.43	13.97%	+0.8
Largemouth Bass	VI	4	13.10-17.00	16.3	15.66	3.13%	+0.8
Largemouth Bass	VII	3	15.90-17.00	17.4	16.33	2.48%	+0.8
Largemouth Bass	VIII	4	16.80-17.30	18.3	17.02	3.03%	+0.8
Largemouth Bass	X	3	17.00-18.70	19.3	17.87	2.57%	+0.8
Largemouth Bass	XI	1	18.10-18.10		18.10	1.10%	+0.8
Smallmouth Bass	0	6	4.50-5.50	3.8	4.95	1.46%	-0.6
Smallmouth Bass	I	45	5.50-8.90	7.5	7.64	11.36%	-0.6
Smallmouth Bass	II	47	7.10-11.80	10.8	9.97	12.31%	-0.6
Smallmouth Bass	III	56	9.30-13.20	12.6	11.35	14.61%	-0.6
Smallmouth Bass	IV	43	10.20-15.80	14.4	13.02	11.39%	-0.6
Smallmouth Bass	V	45	11.00-16.60	15.3	15.07	11.98%	-0.6
Smallmouth Bass	VI	33	14.50-17.20	16.3	15.88	8.60%	-0.6
Smallmouth Bass	VII	34	15.70-18.00	17.3	16.85	8.44%	-0.6
Smallmouth Bass	VIII	22	15.80-18.10	18.1	17.14	5.58%	-0.6
Smallmouth Bass	IX	16	15.90-18.50	18.9	17.66	4.00%	-0.6
Smallmouth Bass	X	15	15.10-19.50	18.9	17.92	3.85%	-0.6
Smallmouth Bass	XI	18	17.30-19.70		17.95	4.66%	-0.6
Smallmouth Bass	XII	6	17.40-18.90		18.10	1.50%	-0.6
Smallmouth Bass	XIII	1	17.80-17.80		17.80	0.26%	-0.6

*Mean growth index is the average deviation from the state average length at age.

Table 5. Comparison of catch-per-effort (CPE) for select species in Union Lake along with statewide and Lake Erie Management Unit (LEMU) CPE generated from the Status and Trends Program (Wehrly et al. 2015). CPE for electrofishing is number of fish per minute. CPE for trap net is number of fish per lift.

Species	Gear	25th Percentile Statewide CPE	Median Statewide CPE	75th Percentile Statewide CPE	**Union Lake Fall 2020**	**Union Lake Spring 2021**	LEMU Median CPE
Largemouth Bass	Electrofishing	0.3	0.8	1.6	0.2	0.1	0.9
Largemouth Bass	Trap net	1.0	2.4	4.3	N/A	1.8	2.0
Smallmouth Bass	Electrofishing	0.1	0.2	0.4	0.7	0.3	0.2
Smallmouth Bass	Trap net	0.3	0.9	2.2	N/A	0.5	0.8
Walleye	Electrofishing	0.0	0.1	0.4	0.002	0.1	0.1
Walleye	Trap net	0.3	0.6	1.3	N/A	2.1	0.7
Northern Pike	Electrofishing	0.0	0.0	0.1	0.0	0.004	0.0
Northern Pike	Trap net	0.4	0.8	1.6	N/A	0.7	1.0

Table 6. Summary of percentages of proportional size distributions (PSD) for target species by survey year in Union Lake, Oakland County.

Year (Season)	Species	Quality (%)	Preferred (%)	Memorable (%)	Trophy (%)
2020 (Fall)	Largemouth Bass	54	34	0	0
2020 (Fall)	Smallmouth Bass	73	54	22	0
2021 (Spring)	Largemouth Bass	90	68	0	0
2021 (Spring)	Smallmouth Bass	93	76	39	0
2021 (Spring)	Northern Pike	77	21	5	0
2021 (Spring	Walleye	96	38	2	0

Table 7. Species catch summary of fish collected with both gear types (trap net and boat electrofishing) combined during the Union Lake fisheries survey, Spring 2021. Fish weight (lbs.) are estimates based on length.

Species	Number	Percent by number	Weight (lb.)	Percent by weight	Length range (in.)*	Average length (in.)	Percent legal size**
Black Crappie	236	7.3	73.4	3.5	3-13	7.8	57
Black Bullhead	3	0.1	4.5	0.2	13-15	14.8	100
Bluegill	1,615	50.1	251.3	12.1	2-10	5.8	36
Bowfin	77	2.4	422.8	20.4	18-29	25.1	100
Brown Bullhead	7	0.2	8.2	0.4	12-14	13.6	100
White Sucker	7	0.2	21.1	1.0	9-22	18.8	100
Golden Shiner	1	0.0	0.1	0.0	6-6	6.5	100
Green Sunfish	1	0.0	0.1	0.0	5-5	5.5	0
Largemouth Bass	156	4.8	308.1	14.8	6-19	15.0	78
Northern Pike	50	1.6	158.0	7.6	10-37	22.3	46
Pumpkinseed	84	2.6	26.5	1.3	4-9	7.1	82
Rock Bass	612	19.0	102.9	5.0	3-11	6.1	26
Smallmouth Bass	109	3.4	226.5	10.9	4-19	14.7	75
Walleye	172	5.3	443.3	21.4	12-26	19.9	95
Yellow Perch	89	2.8	25.7	1.2	4-13	8.3	84
Yellow Bullhead	3	0.1	3.7	0.2	12-15	13.8	100
All species totals	**3,222**		**2,076.0**				

*Some fish may be measured to 0.1 inch, others to inch group: '5' = 5.0 to 5.9 inches; '12' = 12.0 to 12.9 inches; etc.

** Percent legal or acceptable size for angling.

Table 8. Weighted mean length and age composition of select target species collected with both gear types (trap net and boat electrofishing) combined during the fisheries survey of Union Lake, Spring 2021.

Species	Age	No. aged	Length range (in.)	State avg. length (in.)	Weighted mean len. (in.)	Weighted age freq.	Mean growth index*
Largemouth Bass	II	1	6.50-6.50	7.1	6.50	0.67%	+2.1
Largemouth Bass	III	4	9.10-12.00	9.4	10.39	6.04%	+2.1
Largemouth Bass	IV	10	10.40-14.50	11.6	13.65	20.90%	+2.1
Largemouth Bass	V	4	13.50-16.60	13.2	15.89	51.58%	+2.1
Largemouth Bass	VI	4	17.30-18.20	14.7	17.61	8.95%	+2.1
Largemouth Bass	VII	1	18.00-18.00	16.3	18.00	0.78%	+2.1
Largemouth Bass	VIII	3	17.90-18.40	17.4	18.05	5.26%	+2.1
Largemouth Bass	IX	3	17.60-19.60	18.3	18.07	5.03%	+2.1
Largemouth Bass	X	1	18.40-18.40	19.3	18.40	0.78%	+2.1
Northern Pike	I	12	10.30-14.70	11.7	12.92	18.00%	+1.5
Northern Pike	II	6	19.30-22.80	17.7	21.03	8.00%	+1.5
Northern Pike	III	14	18.80-23.80	20.8	21.14	22.40%	+1.5
Northern Pike	IV	6	21.40-28.30	23.4	25.37	15.00%	+1.5
Northern Pike	V	5	23.40-29.20	25.5	27.19	12.10%	+1.5
Northern Pike	VI	5	24.90-32.50	27.3	27.89	10.50%	+1.5
Northern Pike	VII	4	24.60-37.00	29.3	27.63	9.50%	+1.5
Northern Pike	VIII	2	26.50-34.50	31.2	30.06	4.50%	+1.5
Smallmouth Bass	I	12	10.30-14.70	11.7	12.92	18.00%	-
Smallmouth Bass	III	1	7.40-7.40	10.8	7.40	26.67%	-
Smallmouth Bass	IX	2	18.40-18.80	18.1	18.60	53.33%	-
Smallmouth Bass	X	1	19.00-19.00	18.9	19.00	13.33%	-
Walleye	II	8	12.20-13.80	10.4	13.00	4.68%	+0.2
Walleye	IV	9	17.90-19.80	15.8	18.52	7.11%	+0.2
Walleye	VI	40	16.10-22.70	19.2	19.35	30.33%	+0.2
Walleye	VIII	41	16.70-24.50	20.6	19.90	30.12%	+0.2
Walleye	IX	26	17.90-26.50	22.4	20.54	18.69%	+0.2
Walleye	X	13	18.50-26.30	23.1	21.26	9.07%	+0.2

*Mean growth index is the average deviation from the state average length at age.

Table 9. Detection history of species in Union Lake for surveys where all species were recorded. 1985, 1993, 1997, and 2002 were general fish community surveys using trap nets only, with 2002 using additional sampling gears. The 1990 survey used gillnets only. The 2021 survey used trap nets and boat electrofishing.

Species	1985	1990	1993	1997	2002	2021
American Eel			x			
Black Bullhead			x			x
Black Crappie	x	x	x	x	x	x
Bluegill	x	x	x	x	x	x
Bluntnose Minnow					x	
Bowfin	x	x	x	x	x	x
Brook Silverside					x	
Brown Bullhead		x	x	x	x	x
Common Carp	x		x			
Golden Shiner	x			x		x
Green Sunfish	x		x			x
Hybrid Sunfish				x		
Iowa Darter					x	
Lake Chubsucker	x					
Lake Herring (Cisco)		x			x	
Largemouth Bass	x		x	x	x	x
Logperch					x	
Longnose Gar	x	x	x		x	
Northern Pike			x	x	x	x
Pumpkinseed	x	x	x	x	x	x
Rainbow Darter					x	
Redear Sunfish					x	
Rock Bass	x		x	x	x	x
Smallmouth Bass	x		x	x	x	x
Spottail Shiner					x	
Walleye		x	x	x	x	x
White Sucker			x	x		x
Yellow Bullhead				x	x	x
Yellow Perch	x	x	x	x	x	x
TOTALS	13	9	17	15	21	16

Table 10. Number per inch group of select species collected with both gear types (trap net and boat electrofishing) combined from the Union Lake fisheries survey, Spring 2021.

Inch Group	Bluegill	Rock Bass	Black Crappie	Walleye	Largemouth Bass	Smallmouth Bass	Pumpkinseed Sunfish	Northern Pike
2	4							
3	128	110	38					
4	349	202	0			1	4	
5	556	141	0				11	
6	265	52	63		1		27	
7	174	34	57		1	4	24	
8	129	28	10		1	2	16	
9	9	27	28		3		2	
10	1	10	12		6	2		1
11		8	21		5	9		
12			6	3	8	2		4
13			1	5	10	7		2
14					16	4		2
15				1	42	16		
16				5	32	20		
17				20	22	32		
18				36	7	8		3
19				36	2	2		2
20				15				3
21				30				3
22				10				3
23				4				4
24				3				5
25				1				2
26				3				5
27								2
28								4
29								2
32								1
34								1
37								1
TOTAL	1,615	612	236	172	156	109	84	50

Table 11. Catch rates (#/net night) and standardized population estimates (#/acre) from early spring fisheries surveys conducted in LEMU from 1987 through 2018.

Lake Name, County	Year	Walleye #/net night	Walleye #/acre	Northern Pike #/net night	Northern Pike #/acre
Cass Lake, Oakland	1987	3.3	-	1.0	-
Cass Lake, Oakland	1992	2.5	0.55	1.0	-
Cass Lake, Oakland	1996	1.2	1.1	4.4	0.6
Cass Lake, Oakland	2008	1.0	0.5	2.8	0.8
Belleville Lake, Wayne	1988	1.6	-	0	-
Belleville Lake, Wayne	1990	1.8	-	0	-
Belleville Lake, Wayne	1992	0.9	-	0	-
Kent Lake, Oakland	1994	6.1	3.3	3.2	0.5
Kent Lake, Oakland	1995	7.0	2.5	5.2	1.0
Kent Lake, Oakland	2006	1.5	-	2.9	-
Union Lake, Oakland	1997	4.2	1.4	0.5	-
Union Lake, Oakland	2021	2.1	0.7	0.7	-
White Lake, Oakland	1998	6.8	1.5	1.6	-
White Lake, Oakland	2013	0.56	0.5	3.58	3.3
Long Lake, Oakland	2007	1.2	1.6	0.6	-
Devils Lake, Oakland	2015	0.95	0.3	2.0	0.5
Lake Orion, Oakland	2018	0.8	0.5	4.8	3.6
LEMU Average	-	2.59	1.26	2.10	1.47
75th Percentile	-	3.98	1.60	3.49	3.30
25th Percentile	-	0.96	0.50	0.53	0.50

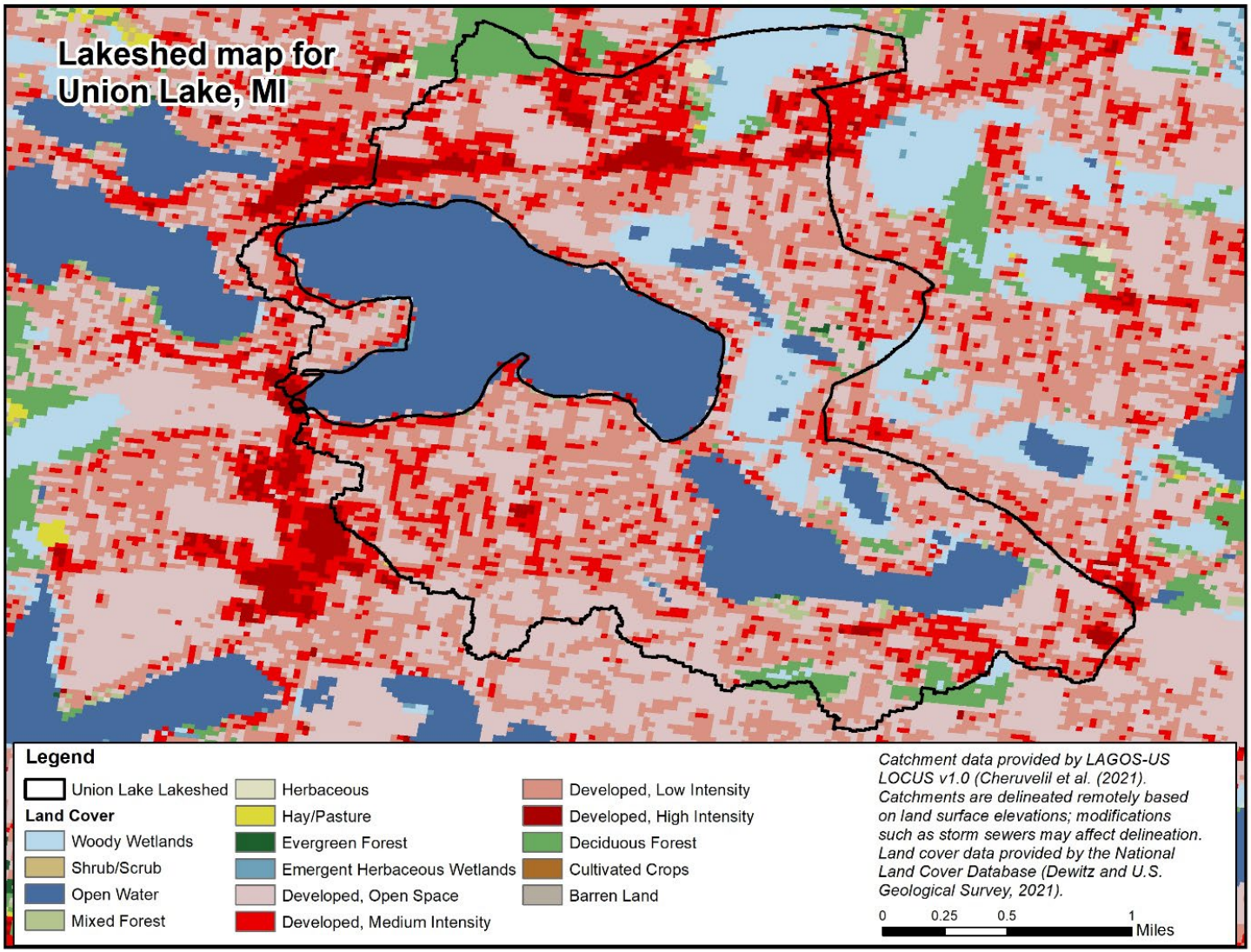


Figure 1. Lakeshed catchment (outer black line) and land cover map (colors) of Union Lake, Oakland County.

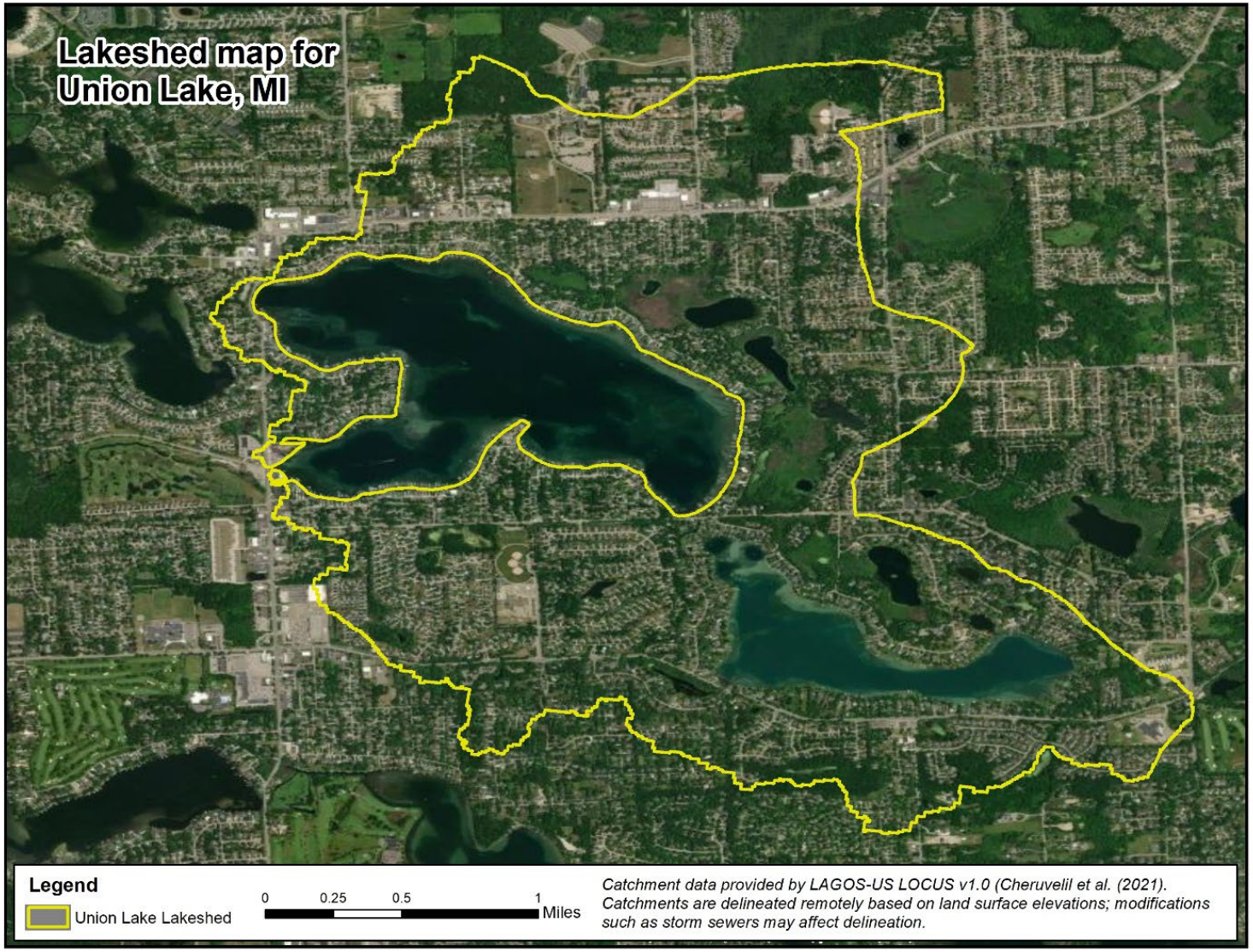


Figure 2. Lakeshed catchment (outer yellow line) and aerial satellite map of Union Lake, Oakland County.

Figure 3. Bathymetric map of Union Lake, Oakland County. The Michigan DNR Boating Access Site and depth contour lines (feet) are shown combined with aerial satellite imagery.

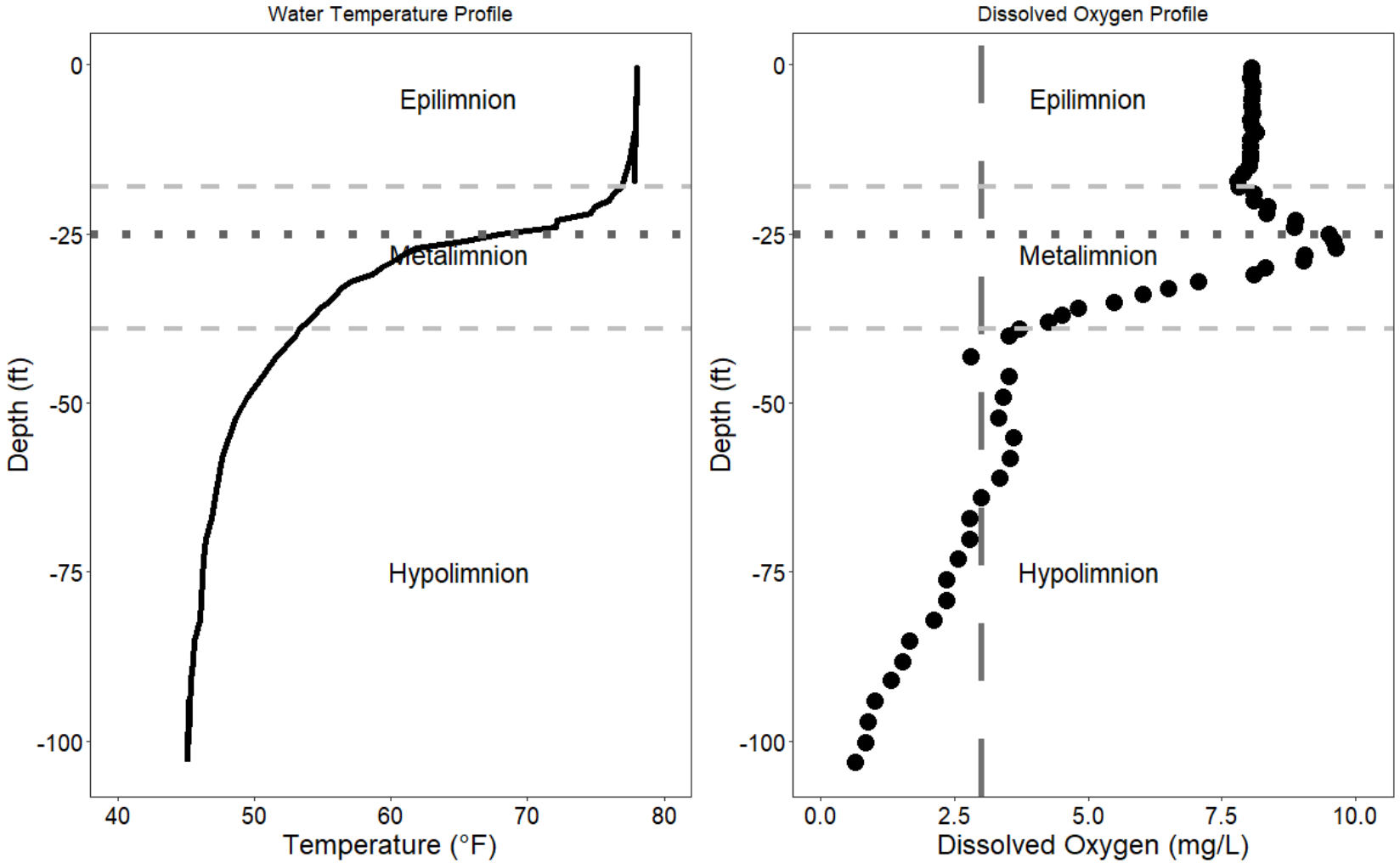


Figure 4. Water temperature (left panel) and dissolved oxygen (right panel) profiles for Union Lake collected August 12, 2021. In the left panel, the solid black line indicates water temperature. In the right panel, the black dots indicate dissolved oxygen concentration, whereas the vertical dashed line represents the lower limit of suitable dissolved oxygen (3.0 mg/L). The horizontal dashed lines represent the upper and lower bounds of the metalimnion, whereas the horizontal dotted line indicates the thermocline.

General Stats

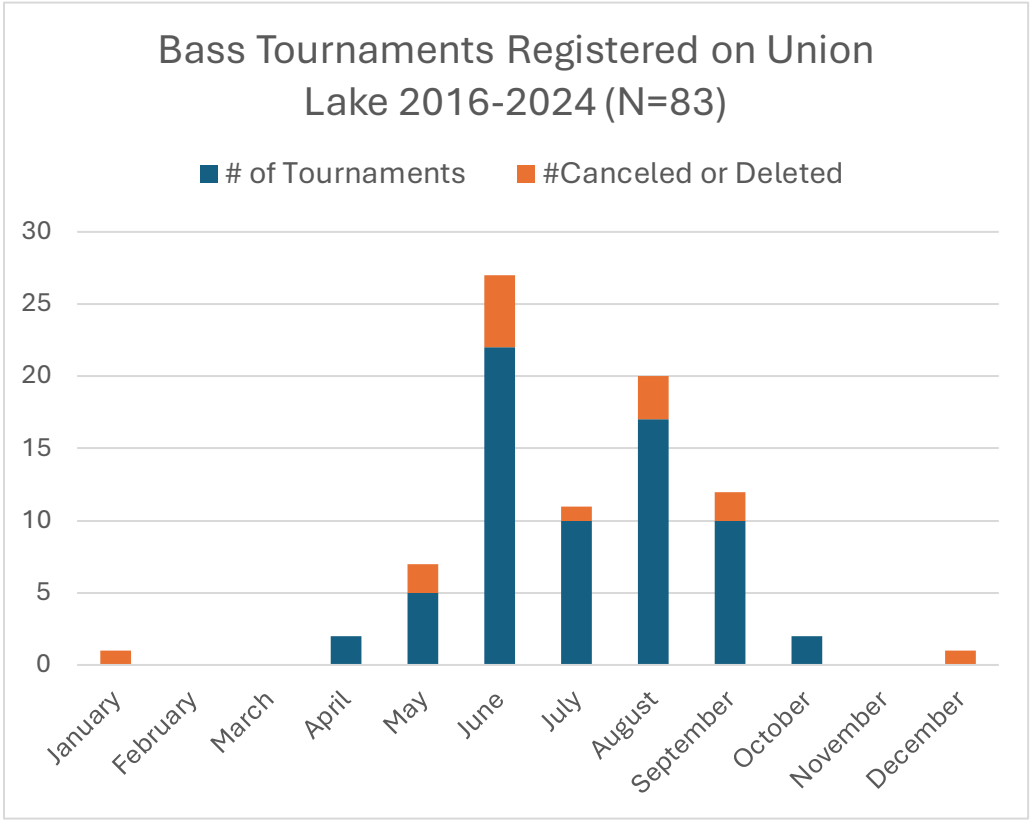
Total Number of Registrations	83
Total Number of Directors	36
Average Registrations / Director	2.31
Total Number of Deleted Tournaments	4
Total Number of Cancelled Tournaments	11
Number of Reports Received (N= 68)	66
Number of Missing Reports (N= 68)	2
Reporting Compliance w/ Cancelations (N= 79)	97.5%
Average Number of Tournaments per Year	7.6
Statewide Waterbody Ranking	91st

Tournament Summary Analytics

# of Weight Based Tournaments Reporting	65
# of Length Based Tournaments Reporting	1
Average # of Anglers	16.1
Average # of boats	10.0
Average # of Bass Weighed/Measured per Event	29.2
Average # of Bass Weighed/Measured per Angler	1.82
Total Bass Weighed/Measured (estimate for all 68)	1,986
Percentage LMB Weighed/Measured	52.5%
Percentage SMB Weighed/Measured	47.5%
Total LMB Weighed/Measured (estimate for all 68)	1,042
Total SMB Weighed/Measured (estimate for all 68)	943

Weight Based Tournament Stats Only (N=65)

AVG Weight of Bass Weighed-in (lb.)	2.13
Average Heaviest Fish (lb.)	3.48
Minimum # of Fish Reported Greater than 4 lb.	23



Length Based Tournament Stats Only (N=1)

Average Length of Measured Fish (in.)	14.55
Average Longest Fish (in.)	18.5
# of Fish Reported Greater than 20 inches	0

Fish Health Questions (2022-2024)

Black Melanomas were reported in 0 tournaments

Sores/Lesions were reported in 0 tournaments

Figure 5. Michigan DNR's Fishing Tournament Information System summary statistics for bass tournaments from (2016-2024) on Union Lake, Oakland County. LMB=Largemouth Bass, SMB=Smallmouth Bass.

Literature Path

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