Kaks Lake (Keck's Lake)
Luce County, T45N, R10W, section 09
Tahquamenon River Watershed, last surveyed 2019

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Environment

Kaks Lake (Keck's Lake) is a 60-acre natural lake (small lake per Michigan Status and Trends Inland Lakes protocol) located approximately 7 miles southwest of the Village of Newberry, Michigan in Luce County (Figure 1). There are two inlets to the lake, McGraw Creek flows from the east (origin at Maki Lake) and Carlson Creek which flows from the west. Carlson Creek serves as the only outlet which drains north to Teaspoon Creek and ultimately into the Tahquamenon River. All inlets and outlets to Kaks Lake are unstocked designated trout streams (Brook Trout stocked in Carlson Creek in 1959). The surrounding land cover is primarily forested (50%) with a large proportion as wetland types (32%), while the remaining portion is comprised of agricultural (6%), grass shrub/scrub (6%), and urban (5%).

Kaks Lake is a bowl-shaped basin with 20% of the lake deeper than 15 feet (deep lake) and a maximum depth of 22 feet. Forty percent of the lake is 10 feet deep or less. The littoral zone substrate consists primarily of sand, marl, and organics. Aquatic vegetation identified when mapped and inventoried in the early-1950s included Elodea, Chara (algae), Spatterdock, Water Lily, Potomogeton sp., bulrush, and sedges. Surveys from earliest records for Kaks Lake, indicated vegetation growth was "excessive" and a possible hinderance to boat navigation. In the benthic region of the lake, the substrate is primarily fibrous peat with a marl and organics. The surrounding surface geology is comprised of coarse textured organic types (mostly Carbondale, Lupton, and Tawas with the remaining portions comprised of Kalkaska, Pickford, and Rudyard silt-loam) stemming from herbaceous and woody material covering glacial outwash. These soil types make the surrounding area very poorly drained. Except for the Boating Access Site (BAS) owned and maintained by Michigan Department of Natural Resources (MDNR) Parks and Recreation Division, the land surrounding Kaks Lake is entirely under private ownership. Shoreline development is minimal with two small docks and no shoreline armoring. The BAS (developed in 1951) is easily accessed from State Highway M-117 one half mile south of the intersection with State Highway M-28. The BAS offers 5 paved parking spaces, paved boat launch, assistance pier, and restroom (pit toilet).

The trophic status of a lake refers to overall productivity (biomass). Lakes can be described as oligotrophic, mesotrophic, and eutrophic which are defined as low, medium, or high productivity, respectively. Water samples collected in August 2019 were examined for chlorophyll-a, total phosphorus, total nitrogen, and alkalinity, which are parameters used to measure a lake's productivity. Chlorophyll-a concentrations were identified as high (17.3 µg/L). Total phosphorus was found to be medium (19 µg/L) and total nitrogen was found to be medium (0.726 mg/L). Total alkalinity is a measure of buffering capacity and plays an important role in determining pH and consequently, overall lake productivity. In 2019, alkalinity in Kaks Lake was measured at 120 mg/L (medium). Comparably, pH was measured at 8.4 at the water surface and ranged down to 6.4 near the bottom of the lake (21 ft) making Kaks Lake more alkaline (basic). In 1978, pH was measured at 8.5 at the surface and 6.8 near the bottom of the lake. For a complete description of ranges for chlorophyll-a, total phosphorus, and total nitrogen for Michigan inland lakes, see Wehrly et al. (2015).

Dissolved Oxygen (DO) is a critical component to suitable habitat in aquatic ecosystems. Dissolved oxygen in lakes derives from the atmosphere as well as from aquatic plants during photosynthesis. Concentration of DO in lakes can limit the distribution and growth of fish in lakes as well as the size composition and biomass of zooplankton, which is a primary food resource for juvenile and prey fishes. Concentrations of DO begin to limit fish populations at approximately 4.0 mg/L and are often lethal below 0.5 mg/L. Profiles of the water column have been conducted in the summers of 1978 and 2019 (Figure 2). When comparing these profiles, acceptable DO levels for fish were found down to 14 and 11 feet, respectively. Critical depth is defined as the depth at which DO concentrations are below 0.5 mg/L which may be lethal to fish populations. The recorded critical depth in Kaks Lake in 2019 was 12 feet and 18 feet in 1978. In addition, Secchi disk readings are an excellent indicator for primary production occurring in the water column by measuring lake transparency. Secchi disk readings may vary depending on the time of the open water season when measured and weather preceding the reading. Readings may also vary depending on the time of year when measured, such as during early thermal stratification and early lake turnover in the fall. In August 1978 and 2019, Secchi disk readings on Kaks Lake were recorded at 7.5 and 8 feet, respectively. According to Wehrly et al. (2015), a Secchi depth measurement between 7.5 feet and 13.4 feet is considered medium in Michigan lakes. Using the above attributes, Kaks Lake can be characterized as a mesotrophic lake, suggesting moderate production and the capability of supporting a relatively diverse fish community and a moderate biomass. Mesotrophic lakes comprise the greatest proportion of lakes surveyed under the Michigan Status and Trends sampling program, making Kaks Lake like many other small-deep lakes distributed across the state.

Lakes that are deep enough stratify during the summer months with the upper layer (epilimnion) containing the warmest water and suitable DO because of photosynthesis and gas exchange from the atmosphere (wind). The colder, lower layer or hypolimnion typically has the lowest available DO because of the lack of photosynthesis (lack of light penetration) and decomposition of organic material. The transition zone between these two zones is known as the metalimnion or thermocline and has the most rapid change in temperature and slight increase in DO. Stratification is an important determinant of thermal habitat, chemical characteristics, the distribution and composition of biota, and overall lake productivity. Using the water profile taken in August 2019, Kaks Lake was stratified and held a thermocline from 7 feet to 18 feet (Figure 1). According to Wehrly et al. (2015), the majority of lakes sampled across the state between 2002 and 2007, stratify during the summer.

In 2008, as part of a statewide study on Largemouth Bass populations, an Onset HOBOr Pro water temperature logger was deployed during the months of May through October. The temperature logger was deployed at the BAS site, affixed to the boating assistance pier, and was set to record water temperatures every hour. The average water temperature during deployment was 66.1°F and the maximum temperature was 80.1°F. The average water temperatures for the months of June, July, and August were 67.4°F, 71.6°F, and 71.8°F, respectively.

Large woody debris is an important habitat component offering cover for fishes and other aquatic organisms as well as offering stability for the lake bottom and shorelines. In 2019, an assessment of lake habitat and riparian conditions in Kaks Lake was conducted. Despite being surrounded almost entirely by private land, the shoreline was characterized as highly intact (except for the BAS). The amount of large woody debris along the shoreline in 2019 was recorded to be 36 trees per mile which is considered high for any inland lake in Michigan.

History

Kaks Lake has been stocked and surveyed by the State of Michigan several times since the 1920s. The earliest record from 1926 shows the presence of Bluegill, Common White Sucker, Largemouth Bass, and Northern Pike. In the 1930s Bluegill were stocked twice and Largemouth Bass were stocked once (Table 1). Not until the 1950s were surveys of the aquatic community undertaken on Kaks Lake. These surveys were conducted by the Institute of Fisheries Research under the Michigan Department of Conservation (MDOC, today MDNR) and show the presence of Bluegill, Brown Bullhead, Common White Sucker, Golden Shiner, Largemouth Bass, Northern Pike, Pumpkinseed Sunfish, Rock Bass, and Yellow Perch. Also captured in the 1950s were Blacknose Shiner, Central Mudminnow, Common Shiner, Johnny Darter, Logperch, and Mimic Shiner. All game species were growing slowly except for Northern Pike which were growing faster than the statewide average. Panfish and Yellow Perch were identified by anglers as having grubs, but still provided good catches during the winter and summer seasons. Weed growth was characterized as heavy on shoal areas of the lake.

In the 1960s two surveys were conducted using gill nets in the summer. These surveys conducted in 1968 and 1969 combined, captured Brook Trout, Brown Bullhead, Common White Sucker, Golden Shiner, Largemouth Bass, Northern Pike, Pumpkinseed Sunfish, Rock Bass, and Yellow Perch. Northern Pike growth continued to be good, while panfish growth continued to be poor. Densities for Brown Bullhead and Common White Sucker were high. Fish reports for panfish and Yellow Perch were fair, while spearing for Northern Pike in the winter was good. Then in 1969, as an attempt to improve panfish growth and provide a good game species, MDOC stocked Tiger Muskellunge fingerlings.

In November of 1968, a truck loaded with #2 grade fuel oil overturned near the Kaks Lake access site. It was reported that 1,500 gallons of fuel oil was lost and ran into the lake. A report was filed with the Water Resources Commission (now Department of Environment, Great Lakes, and Energy or EGLE). Anglers reported that through the winter, an "oil slick" appeared under the ice. The following spring, an incident assessment was completed by local Fisheries Biologists. There was an "oil slick" extending about 100 feet from shore and there were no dead fish or insects sighted.

Coinciding with the stocking of Tiger Muskellunge, winter spearing was closed on Kaks Lake in 1970. Gill net surveys in 1970 (spring) and 1971 (summer) captured abundant Tiger Muskellunge up to 20 inches, abundant Brown Bullhead, a reduced number of Common White Sucker, fewer Northern Pike, Largemouth Bass, and Yellow Perch. Growth data indicated most species were growing normally and had achieved statewide average growth. Aquatic vegetation was considered excessive with marl accumulations on submerged vegetation and dense vegetation made for tough boat navigation. Anglers reported enjoying catching Tiger Muskellunge despite issues identifying them. Multiple game violations were reported by local Conservation Officers citing anglers for misidentification of Tiger Muskellunge and Northern Pike. The ice fishery continued to be popular among locals targeting Yellow Perch. Tiger Muskellunge were stocked a total of four times between 1969 and 1976, with the last occurring in 1976. Tiger Muskellunge management stopped due to small lake size and the large population of Northern Pike present. Also, Tiger Muskellunge were moving downstream (Carlson Creek) into Dollarville Flooding putting pressure on the Northern Muskellunge population present there. Largemouth Bass in Kaks Lake were also believed to be thinned too heavily by the Tiger Muskellunge. Winter spearing was reinstated in 1977.

In the summer of 1980, a netting survey captured Bluegill, Brown Bullhead, Common White Sucker, Golden Shiner, Largemouth Bass, Northern Pike, Pumpkinseed Sunfish, Rock Bass, and Yellow Perch. No Tiger Muskellunge were captured or observed. Brown Bullhead and Common White Sucker comprised 23% of the total biomass captured in the survey. Growth for Yellow Perch was above statewide average, Largemouth Bass were growing below statewide average, and Northern Pike were growing at statewide average. Fisheries managers wished to manage Kaks Lake as a warm- and coolwater fishery with the existing species present in the lake.

Ten years later, in 1990 a summer survey was conducted using fyke nets. This survey captured Bluegill, Brown Bullhead, Common White Sucker, Golden Shiner, Largemouth Bass, Northern Pike, and Yellow Perch. Rough fishes (Brown Bullhead and Common White Sucker) comprised 48.4% of the total biomass captured in the survey. Growth for Bluegill was at statewide average, while Largemouth Bass and Yellow Perch continued to grow below statewide average. Density of Largemouth Bass, Northern Pike, and Yellow Perch was stated as low, but Bluegill, Golden Shiner, and rough fish were high. Anglers still reporting Muskellunge, however, they did not indicate whether they were Tiger or Northern Muskellunge.

In 1999, a more comprehensive fish community survey was conducted using fyke nets, trap nets, and an electrofishing boat. This survey captured Bluegill, Brown Bullhead, Common White Sucker, Golden Shiner, Largemouth Bass, Northern Pike, Pumpkinseed Sunfish, Rock Bass, and Yellow Perch. Growth was good for Bluegill, Northern Pike, and acceptable for Largemouth Bass and Yellow Perch. The fish community shows good balance with piscivores (predators) representing 48% of the total biomass, planktivores and insectivores (pelagic species, such as shiners and panfish) at 22%, and benthivores (rough fish) at 29%.

Current Status

The most recent fisheries survey of Kaks Lake was conducted in 2019 using Status and Trends (S&T) protocols (Wehrly et al. 2010). This was the first Status and Trends assessment conducted on Kaks Lake. The purpose of a S&T assessment is to provide a lake-wide inventory of various lake characteristics including fish community composition, water chemistry, and habitat status. Managers can then use results from this assessment and compare across similar waterbody types and species compositions to determine trends in the ecosystem. From May 21-24, the effort consisted of 2 experimental gill nets (4 net lifts), 3 large-mesh fyke nets (9 net lifts), 2 small-mesh fyke nets (4 net lifts), and 3 seine hauls (Table 2). On July 28, night electrofishing was conducted with a boat unit lasting 1,500 seconds, covering the entire shoreline (water depths less than four feet). Only one seine haul captured fish. Large- and small-mesh fyke nets were used for calculation of catch per unit effort (CPUE). Water temperatures ranged from 51°F to 54°F during the netting survey and was 78°F during the electrofishing effort.

A total of 853 fish were captured during the survey comprised of 17 different species (Table 3). Predators or gamefish species (i.e., Brook Trout, Largemouth Bass, Northern Pike, Rock Bass, and Yellow Perch) comprised 28% of the total catch by number and 37% of the total biomass. Pelagic species (i.e., shiners and panfish) comprised 23% of the total catch by number and 2% of the total biomass. Benthivore (i.e., Brown Bullhead and Common White Sucker) species represented 49% of the total catch by number; however, they comprised 61% of the biomass.

Northern Pike catch totaled 107 with an average total length of 20.6 inches and a length range of 8 to 26 inches (Figure 3). Only eight percent of the Northern Pike were greater than 24 inches (legal size). Northern Pike were growing 2.5 inches below statewide average (Schneider et al. 2000). Age classes captured for Northern Pike included all ages from 1 to 8. Catch per unit effort for Northern Pike was 6.2 fish/net lift.

Yellow Perch catch totaled 105 with an average total length of 4.6 inches and a length range of 2 to 9 inches (Figure 4). As indicated by length distribution, 16% of Yellow Perch were greater than preferred harvestable size at 7 inches. Age analysis indicated Yellow Perch were growing half an inch above statewide average and found six age classes (ages 1 to 6). Catch per unit effort for Yellow Perch was 5.7 fish/net lift.

Bluegill are currently the most abundant panfish in Kaks Lake. Total catch for Bluegill was 55 with an average length of 3.8 inches and a length range of 1 to 10 inches (Figure 5). About a quarter of the Bluegill captured were 6 inches or larger, which is considered the minimum desirable size for angler harvest. Bluegill growth was slightly higher than statewide average (0.5 inches above). Seven year classes of Bluegill were captured, which is an acceptable number of year classes. Bluegill CPUE was 4 fish/net lift.

Pumpkinseed Sunfish catch totaled 37 fish in the S&T effort. Average length for Pumpkinseed Sunfish was 5.7 inches (slightly higher than Bluegill), however fewer fish 4 inches and smaller were captured. Growth for Pumpkinseed Sunfish was average (0.2 inches above statewide average) and acceptable for lakes located in the Lake Superior drainage. Pumpkinseed Sunfish CPUE was 2.3 fish/net lift.

The Rock Bass catch was low at 23 fish. Rock Bass are common in many waters in the Lake Superior drainage and especially in the Tahquamenon River watershed. Length range for Rock Bass was 3 to 11 inches and roughly 65% were greater than 7 inches (preferred harvestable size). Rock Bass were included as a predator in the calculation of fish community structure (see above). If Rock Bass were included as a pelagic species in Kaks Lake it would change the proportions to the following: piscivores at 36% biomass and pelagic species at 3%. The designation of Rock Bass is irrelevant as their presence in the fish community is insignificant.

Largemouth Bass, an important component of the fish community for many years in Kaks Lake, represented less than 1% of the total catch by number (n=7). Using S&T protocols, Largemouth Bass catches are typically low due to their avoidance of netting gear or net shyness. During the electrofishing run only two Largemouth Bass were captured, however, staff conducting the survey commented about the dense vegetation and the inefficiencies of this gear-type. Of the Largemouth Bass that were captured, 71% were greater than legal size (14 inches) and had a length range of 2 to 19 inches. An estimate for growth could not be made due to the small sample size. Year classes collected for Largemouth Bass were ages 2, 3, 7, 8, 10, and 12.

Brown Bullhead and Common White Sucker catches were 390 and 24, respectively. These species combined to represent 61% of the total biomass, which is greater than preferred abundance (less than 50%) for rough fish species.

The remaining fish community captured in 2019 reflects a lake with cold stream inlets and outlets. Those species captured included Blackchin Shiner, Brook Stickleback, Brook Trout, Central Mudminnow, Common Shiner, Golden Shiner, Iowa Darter, Johnny Darter, and Northern Redbelly Dace. Many of these species have been captured during previous surveys conducted on Kaks Lake and Carlson Creek. Herpetofauna captures and observations during the survey included Eastern American Toad, Mudpuppy, and Snapping Turtle.

Analysis and Discussion

Kaks Lake is a small-deep natural lake in Michigan's Upper Peninsula with moderate productivity. It has a densely vegetated littoral zone and a relatively deep basin. The lake has an intact undeveloped shoreline, despite being mostly private land. The BAS provides adequate access to the public for fishing, trapping, and hunting opportunities.

The fish community of Kaks Lake can be generally characterized as having: 1) a panfish community of low diversity but acceptable sizes, 2) a naturally-reproducing predator population consisting of Largemouth Bass, Northern Pike, Rock Bass, and Yellow Perch which exhibit average to below average growth rates, 3) a highly diverse non-game fish community and abundance. Overall, the fish assemblage of Kaks Lake is more diverse than most small-deep lakes in Michigan. Using Wehrly et al. (2015), in 2019, species richness was on the high end of moderate (17 species), where species richness can be classified as low (<10 species), moderate (10-17 species), and high (>17 species). Because Kaks Lake has direct connection to two cold-water inlets and the Tahquamenon River, species richness is expected to be greater than an isolated inland lake. Species presence may also vary depending on timing of survey.

Within the Management Plan for Northern Pike in Michigan, fisheries managers can evaluate populations and review regulation options for the populations of which they wish to improve density or size structure (Smith et al. 2016). For example, a population of Northern Pike is determined to be slow growing when Age 3-, 4-, and 5-year-old fish are growing below the State's 25th percentile. Considering Northern Pike samples from the 2019 survey, growth was above the 25th percentile and still below the State's median. Additionally, age 3, 4, and 5 Northern Pike mean lengths were below the State's mean lengths.

Hanchin (2017) reported that adult Northern Pike density was correlated with both fyke net and trap net spring CPUE for large lakes in Michigan; thus there is evidence that CPUE may serve as an index of relative abundance. Fyke net catch for Northern Pike from 2019 was assessed. The 2019 sample exceeded the State's 75th percentile (3.3 fish/net lift) for fyke net catches suggesting the Northern Pike population to be moderate to high density.

Size distribution for Northern Pike populations can also be investigated for determining population density. From 1968 to 2019, Northern Pike size structure has remained consistent with a few atypical large individuals (Figure 6). Michigan lakes with low density of Northern Pike have average lengths in fyke net catches of 22 inches or greater. Moderate density lakes have average lengths of 18 to 20 inches with less than 40% proportional stock densities or "PSD" (Gabelhouse 1984; PSD is the ratio of the number of fish quality size (≥21 inches) and stock size (≥14 inches)). The average length for Northern Pike from fyke nets in 2019 was 20.3 inches. The PSD for Northern Pike in 2019 was 62. Therefore, because average length and PSD align with criteria set by Anderson and Weithman (1978), Northern Pike in Kaks Lake can be considered a moderate density population.

Recruitment is another important dynamic of Northern Pike populations that should be considered. Summer gill net catch rates can be used as an index for recruitment in Northern Pike populations, where low recruitment is often fewer than two fish/net. Gill net catch in 2019 was 6.8 and exceeded the State's 75th percentile indicating the Kaks Lake Northern Pike population has high recruitment.

The Northern Pike population should benefit from an intact shoreline for spawning success and a preferred forage base (suckers, shiners, panfish, and Yellow Perch). Growth for Northern Pike is likely low because of two reasons: 1) dense vegetation in the shallow water areas of the littoral zone resulting in poor feeding efficiency, 2) good recruitment resulting in high densities for a small inland lake.

The Northern Pike population in Kaks Lake is slow growing and has a moderate density with consistent recruitment. Using the recommended regulation suite identified in Michigan's Northern Pike Management Plan, Kaks Lake Northern Pike population could be managed using one of two regulations. Using a conservative regulation such as 24-inch minimum size limit, with a daily possession limit of two fish would promote harvest of older Northern Pike, while protecting slow growing females through maturity (age 4-5) and maintaining good recruitment. Alternatively, to improve growth rates and somewhat reduce abundance of Northern Pike in Kaks Lake, the no minimum size limit with a five fish daily possession limit, including only one Northern Pike greater than or equal to 24 inches, would be recommended.

Since 1994, four Master Angler (≥10 inches) Bluegill have been reported from Kaks Lake. Schneider (1990) developed a scoring system to interpret Michigan Bluegill populations and their size structure. Using length-frequency to determine average length and proportion of the population within size classes (% >6, 7, and 8 inches) along with mean growth index, Bluegill in Kaks Lake scored a 3.4. Using the Schneider Index, the Bluegill population in Kaks Lake would be considered "acceptable to satisfactory" (scale: 1= very poor and 7= superior). Additionally, the Bluegill population in Kaks Lake was evaluated using PSD where a value falling between 20-60 is considered acceptable (Anderson 1985). Bluegill PSD from the 2019 survey was 52. Overall, Bluegill in Kaks Lake would be considered a balanced population with the ability to achieve larger sizes up to 10 inches for table fare and a memorable catch (Master Angler). Bluegill along with Pumpkinseed Sunfish provide an excellent forage base for the large predators in Kaks Lake.

Other than Northern Pike, Largemouth Bass serve as a top predator in Kaks Lake. Largemouth Bass appear to have low mortality and longevity as indicated by individuals reaching ages 10 and 12. Historically, Largemouth Bass in Kaks Lake have shown poor growth despite the abundant and diverse forage community. This phenomenon may likely be due to the dense aquatic vegetation located in the littoral zone resulting in poor foraging efficiency for Largemouth Bass. The Largemouth Bass population in Kaks Lake should continue to provide anglers an opportunity for a catch and release fishery with the occasional 18 inch plus fish.

Brown Bullhead have represented some proportion of the Kaks Lake biomass since the first surveys conducted in the 1950s. In the 2019 survey, Brown Bullhead comprised 53% of the total biomass which is 43% more than found in the 1999 survey. Schneider (1981) indicates that warmwater fish communities become undesirable and fishing quality becomes poor when rough fish species (e.g., Common White Sucker, Bullhead sp., Common Carp) biomass exceeds 50% of the total biomass of the

fish community. Manual removal of undesirable species was historically a common practice used by fisheries managers. However, some recent research suggests removal efforts are unlikely to result in an improvement of intended species (Zorn et al. 2020). Conversely, Sikora et al. (2021) found in lakes where bullhead densities are relatively high, manual removals may be a viable strategy to increase recruitment and abundance of some fish species. Brown Bullhead are expected to remain a significant component of the fish community due to their resilience to winter-kill conditions (low DO). Common White Sucker continue to remain a low proportion of the fish community and should remain low considering the abundance of Northern Pike.

Management Direction

Fisheries management for Kaks Lake should focus on continuing the cool- and warmwater species present in the fish community. Regulation changes for Northern Pike should consider improving size structure and growth rates for a top predator. Maintaining large-bodied Northern Pike will continue to keep Common White Sucker abundance to a minimum and provide greater opportunity for Bluegill and Yellow Perch to achieve preferred sizes. The regulation for Northern Pike is currently a 24-inch minimum size limit, with a possession limit of 2 fish. Consideration should be given to changing the Northern Pike regulation on Kaks Lake to the no minimum size limit with a possession limit of five fish, with only 1 over 24 inches allowed. If necessary, following the public vetting process, a regulation change proposal should be prepared to go before the Natural Resources Commission.

Fisheries Division should work through EGLE to understand and consider aquatic vegetation management strategies where appropriate. Although native species, the dense aquatic vegetation in Kaks Lake has continued to hinder the ability of predators to forage efficiently, affecting predator growth rates. Working with the local Cooperative Invasive Species Management Area and Conservation District is recommended for monitoring and considering vegetation management in the future.

Lastly, Fisheries Division along with EGLE should work with landowners to continue protecting the intact shoreline and good riparian practices on Kaks Lake. Through education and the EGLE permit process, limiting shoreline disturbances should be paramount. Maintaining natural shorelines will be important in maintaining the natural aquatic community in Kaks Lake.

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Table 1.-Species, age at stocking, number, and average length by year stocked into Kaks Lake, Luce County from 1933 to 2019.

Year	Species (strain)	Age	Number	Average Length (inches)
1933	Bluegill	5 months	1,800	-
1933	Largemouth Bass	3 months	300	-
1936	Bluegill	5 months	600	-
1969	Tiger Muskellunge	Fingerlings	1,500	-
1973	Tiger Muskellunge	Fingerlings	152	9.5
1974	Tiger Muskellunge	Fingerlings	750	-
1976	Tiger Muskellunge	Fall Fingerlings	750	-
1994	Largemouth Bass	Fall Fingerlings	655	1.7

Table 2.-Sampling effort during the S&T survey on Kaks Lake, Luce County May 21 to 24, 2019.

Sampling Period	Gear type	Effort
May 21	Seine	3 hauls (25 ft each)
May 21 - May 23	Exp. Gill Net	4 net lifts (2 nets)
May 21 - May 23	Small-mesh fyke net	4 net lifts (2 nets)
May 21 - May 24	Large-mesh fyke net	9 net lifts (3 nets)
July 28	Electrofishing-night	1,500 secs (entire shoreline)

Table 3.-Numbers, weights, lengths, and mean growth indices for fish species collected during the S&T survey on Kaks Lake, Luce County in May 2019. Fish were captured using fyke nets, gill nets, trap nets, seines, and nighttime electrofishing gear.

Species	Number	Percent by number	Weight (lb)	Percent by weight	Length range (inches)	Average Length (inches)	Percent legal or harvestable[1]	Growth Index[2]
Brown Bullhead	390	45.7	354.4	52.9	4-14	12.4	-	-
Northern Pike	107	12.5	217.3	32.4	8-26	20.6	8	-2.5
Yellow Perch	105	12.3	6.7	1.0	2-9	4.6	16	0.5
Bluegill	55	6.4	6.1	0.9	1-10	3.8	24	0.5
Blackchin Shiner	52	6.1	0.1	0.0	1-2	1.8	-	-
Pumpkinseed Sunfish	37	4.3	6.6	1.0	2-8	5.7	46	0.2
Common White Sucker	24	2.8	55.0	8.2	12-21	17.8	-	-
Rock Bass	23	2.7	8.7	1.3	3-11	7.2	65	N/A
Golden Shiner	19	2.2	0.5	0.1	2-6	4	-	-
Johnny Darter	10	1.2	0.1	0.0	1-2	2.2	-	-
Iowa Darter	8	0.9	0.0	0.0	1-2	2.1	-	-
Largemouth Bass	7	0.8	14.1	2.1	2-19	13.9	71	N/A
Northern Redbelly Dace	5	0.6	0.0	0.0	2-2	2.5	-	-
Common Shiner	4	0.5	0.1	0.0	2-3	3.3	-	-
Central Mudminnow	4	0.5	0.0	0.0	2-3	2.8	-	-
Brook Stickleback	2	0.2	0.0	0.0	1-1	1.5	-	-
Brook Trout	1	0.1	0.1	0.0	6-6	6.5	0	-
Total	853	100	669.7	100				

[1] Harvestable size is 6 inches for Bluegill, Pumpkinseed Sunfish and Rock Bass and 7 inches for Yellow Perch. All other game species based on statewide regulations.

[2] Average deviation from the statewide average length at age. Mean growth indices <-1 indicate below average growth, indices between -1 and +1 indicate average growth, and indices >+1 indicate growth is faster than statewide average.

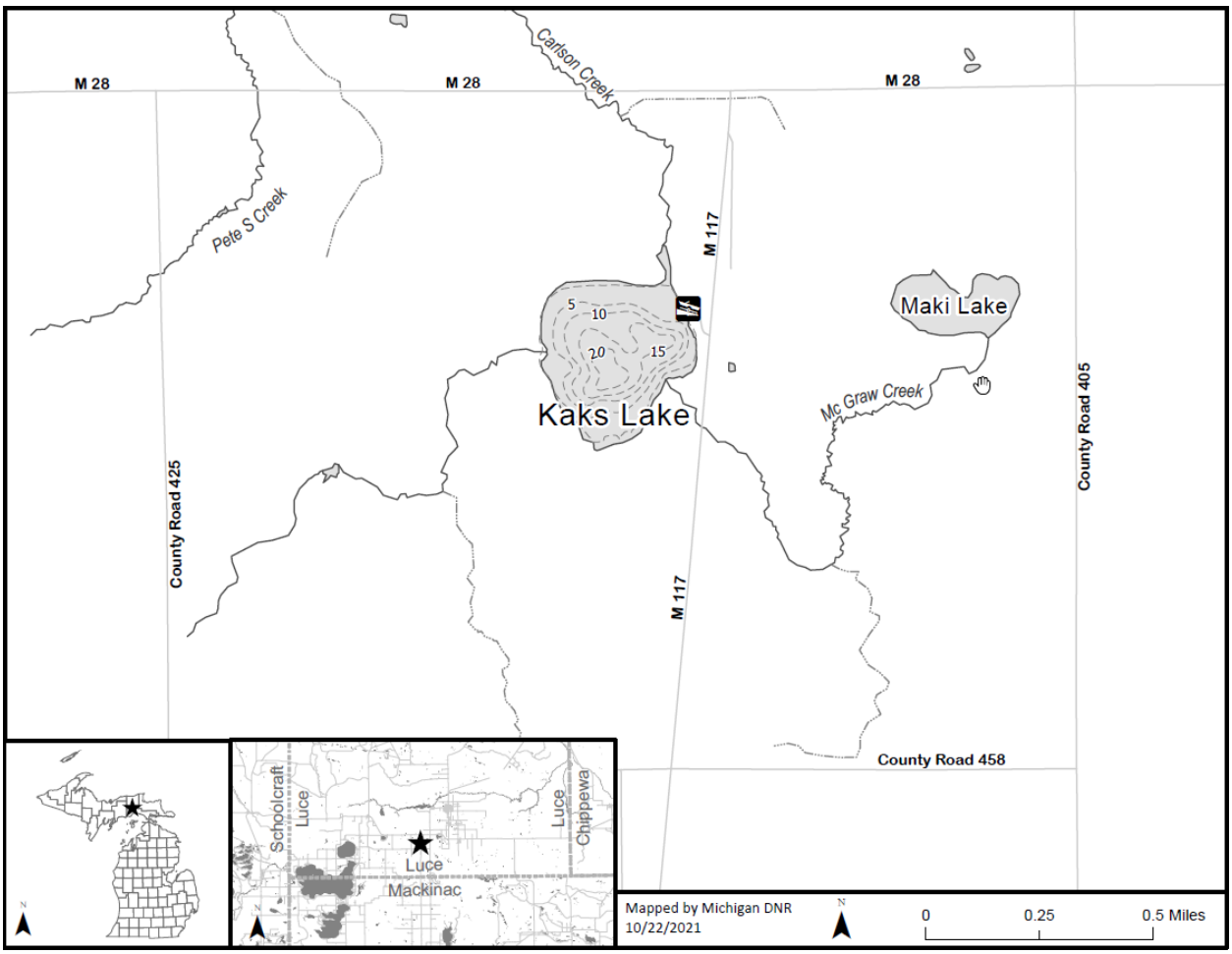

Figure 1.-Map of Kaks Lake, Luce County.

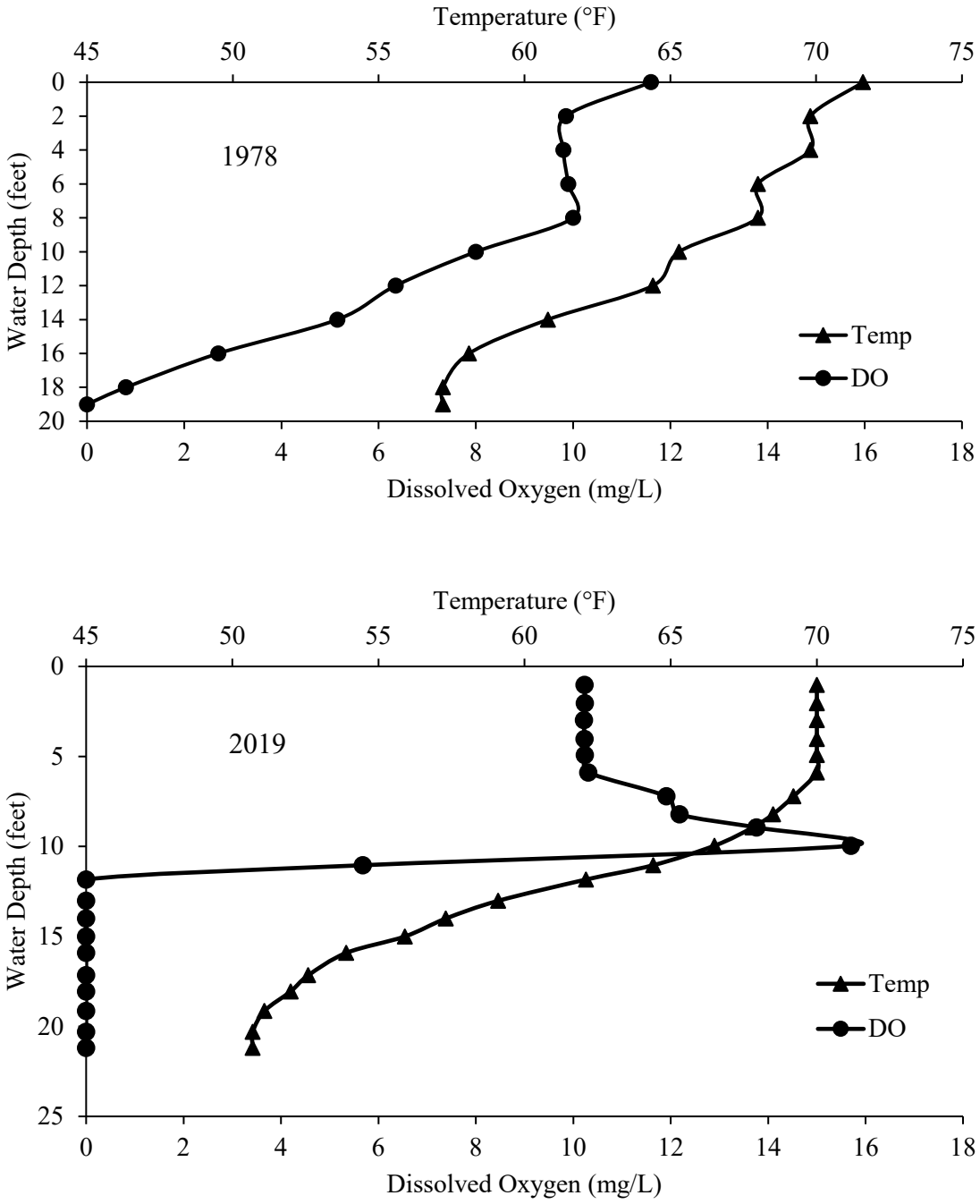

Figure 2.-Limnological profiles for Kaks Lake, Luce County conducted in August 1978 and 2019.

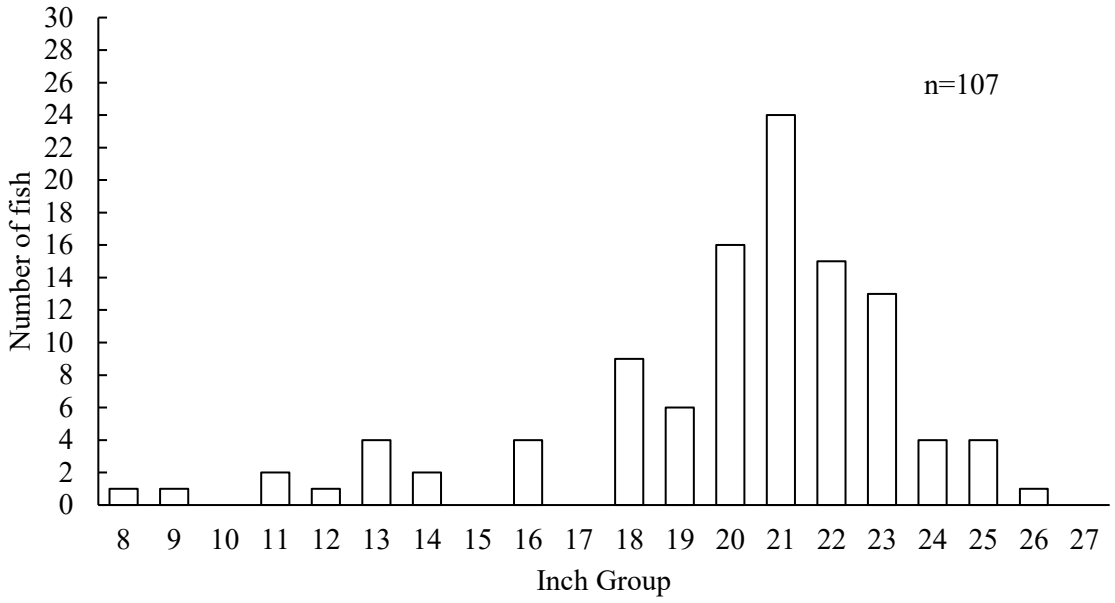

Figure 3.-Length distribution for Northern Pike captured during the S&T survey conducted on Kaks Lake, Luce County on May 21-24, 2019.

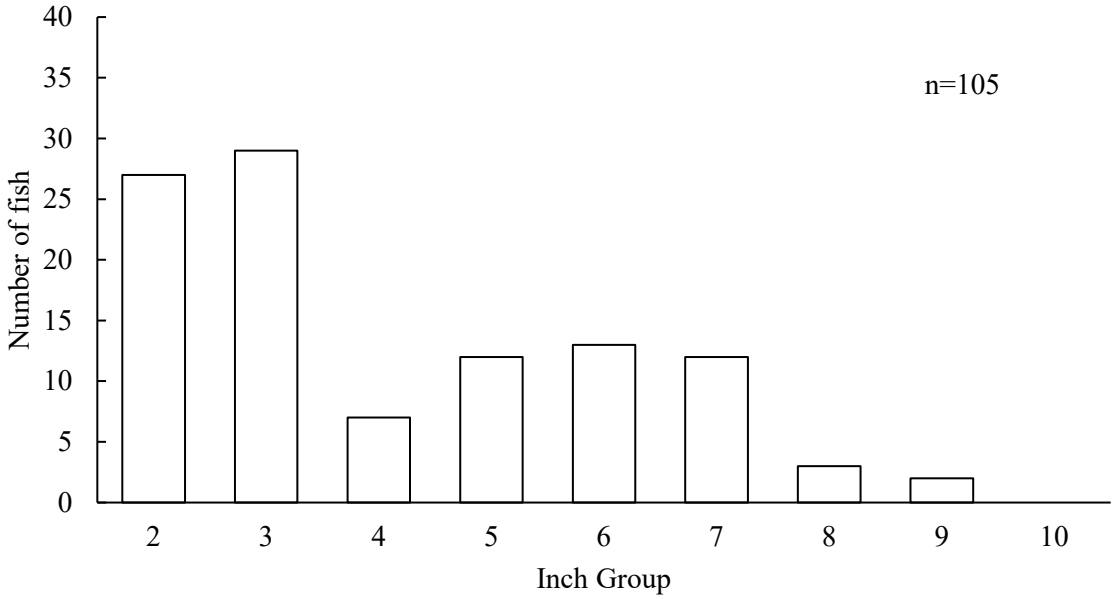

Figure 4.-Length distribution for Yellow Perch captured during the S&T survey conducted on Kaks Lake, Luce County on May 21-24, 2019.

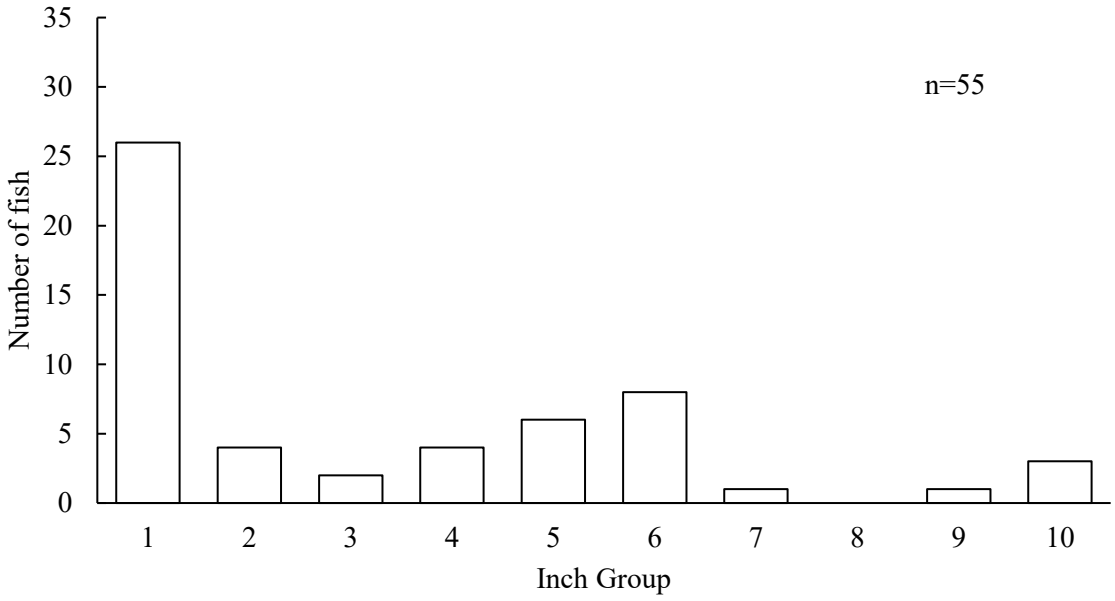

Figure 5.-Length distribution for Bluegill captured during the S&T survey conducted on Kaks Lake, Luce County on May 21-24, 2019.

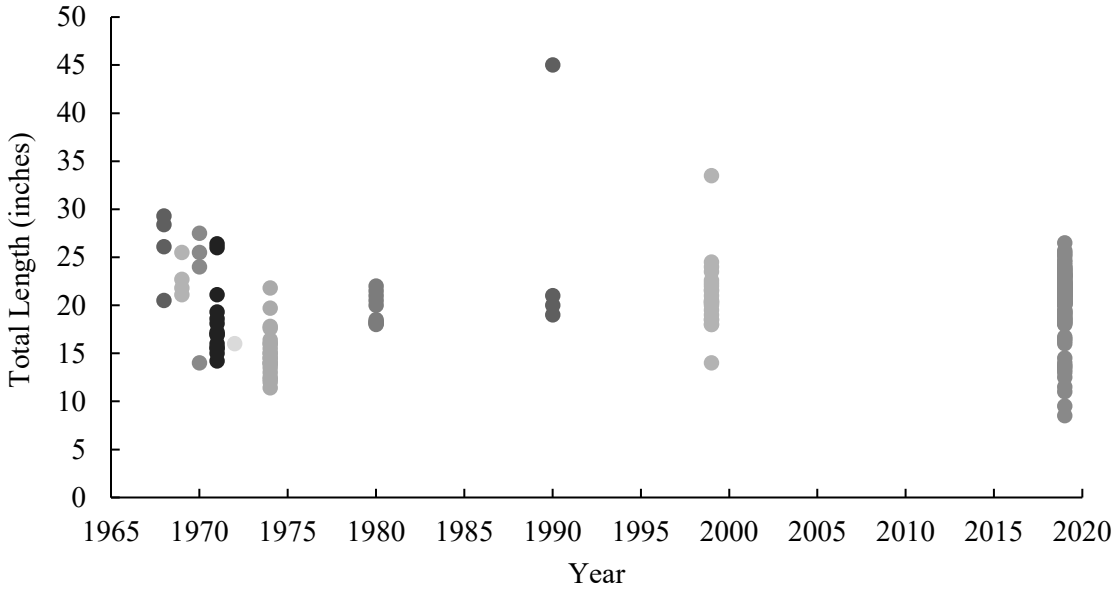

Figure 6.-Length distribution by year for Northern Pike captured during surveys conducted on Kaks Lake, Luce County from 1968 to 2019.

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