LAKE MANAGEMENT PLAN

Region	Area	D.O.W. Number	County	D.O.W. Lake Name	Lake Class	Acreage
1	Park Rapids	29-0161	Hubbard	Long	22	1,926 GIS 486 littoral

LONG RANGE GOALS:

- Maintain or improve the quality of fishing for walleye by attempting to provide a population with a mean catch per effort (CPE) index of at least 6 per gill net lift and a proportional stock density (PSD) index of 30 to 60. Attempt to maintain a relative stock density (RSD) of preferred length (20") walleye of at least 29 and an RSD of memorable length (25") walleye of at least 6.
- Walleye abundance should be balanced with abundance of preferred forage, yellow perch, by attempting to maintain a perch population with an average CPE index of at least 1 per gill net lift.
- Maintain related fish communities
- Protect or enhance desirable aquatic and riparian habitats (water quality, aquatic and riparian vegetation, and shoreline substrate).

OPERATIONAL PLANS:

- Conduct lake surveys or targeted sampling about every five years (2024, 2029...), or as needed to evaluate management efforts. Spring electrofishing effort may be included with evaluations to better assess largemouth bass, if feasible within time and staffing constraints. Targeted fall electrofishing may be conducted if desirable to evaluate natural reproduction or stocking success of walleye, and if feasible. Targeted sampling should include vertical gill net (VGN) sampling to better evaluate cisco, nearshore sampling to calculate an Index of Biotic Integrity (IBI), and additional targeted sampling to provide information about physical and chemical characteristics of the lake and its watershed about every ten years, within a 5 year window of MPCA Watershed Assessments.
- Stock walleye fingerlings at a density of 1 pound per littoral acre (485 pounds total) during even numbered years. If stocked walleye are less than 15 per pound average size, additional walleye should be stocked to compensate for the lower numbers, if available. Adjust stocking density, frequency, or rate (size of fish) if necessary to maintain desirable levels of abundance and size structures of walleye and forage fishes at minimum costs.
- Continue the fall tullibee netting season, with an opening date of the first Friday in November. Attempt to monitor and estimate participation in tullibee netting or harvest, at least subjectively.
- Monitor winter fishing pressure by conducting aerial fish house counts.
- Provide free and adequate public water access to Long Lake. Work with MDNR, Div. of Parks & Trails to investigate the feasibility of developing handicapped accessible shore or pier fishing opportunities near the north access site.
- Work with educators, groups, agencies, individuals or news media to provide aquatic education opportunities. Efforts may include presentations, news releases, personal contacts or special projects.
- Provide recommendations on permit applications that will minimize impacts to aquatic resources associated with projects in Long Lake, its tributaries, or its watershed.
- Encourage, support and assist efforts of local, state or federal groups or agencies to improve water quality, and maintain or improve fisheries habitat in Long Lake.

MID RANGE OBJECTIVES:

- Evaluate population characteristics (abundance, size and age structure, and growth) of walleye, yellow perch, northern pike, largemouth bass, black crappie, bluegill, and tullibee. Continue to refine definitions of desirable levels of abundance and size structure for managed fish species.
- Continue to evaluate the extent of natural reproduction of walleye, and the contribution of stocked walleye using the Walleye Stocking Evaluation Workbook.

POTENTIAL PLAN:

- Use fee title purchase or easements to protect additional lands in the watershed of Fifth Crow Wing Lake to maintain or improve lake water quality. Priority should be given to riparian lands adjacent to known spawning areas, sensitive shorelands, or other critical aquatic habitat.

  SUBTOTAL $ Costs would depend on extent and value of projects
- Conduct an angler creel and recreational use survey of Long Lake, possibly in conjunction with other area lakes.

  SUBTOTAL $ Costs would be shared with other lakes
- Work with MDNR, Div. of Trails & Waterways to look for other suitable sites that could be acquired for a new access site near the north end of Long Lake.

  SUBTOTAL $ Feasibility and costs would have to be determined
- Attempt to estimate stocked walleye fry or fingerling survival and contribution to year class strength by marking stocked walleye with fin clips, tags, or tetracycline, recapturing marked fish during assessments or surveys, and estimating relative proportion of stocked and non-stocked fish.

  SUBTOTAL $ 5,000

<table>
<tr><td colspan="2">NARRATIVE: (Historical perspectives - various surveys; past management; social considerations; present limiting factors; survey needs; land acquisition; habitat development and protection; commercial fishery; stocking plans; other management tools; and evaluation plans)

(see following)</td><td>FOR CENTRAL OFFICE USE ONLY

Entry Date: | Year Resurvey:
Stock Species-Size-Number per Acre
Schedule: | Year Beginning
Population Manipulation
YES NO Year</td></tr>
<tr><td>Primary Species Management:

Walleye</td><td>Secondary Species Management:
Yellow perch, Northern pike, Largemouth bass, Black crappie, Bluegill, Tullibee</td><td>Development
YES NO Year</td></tr>
<tr><td>Area Supervisor’s Signature:
Calub Shavlik Digitally signed by Calub Shavlik Date: 2021.07.21 13:10:52 -05'00'</td><td>Date</td><td>Creel or Use Survey
YES NO Year</td></tr>
<tr><td>Regional Manager’s Signature:</td><td>Date</td><td>Other:
Year</td></tr>
</table>

Long Lake is located two miles east of Park Rapids, in southwestern Hubbard County. Long Lake has a GIS measured surface area of 1,926 acres, a maximum depth of 135 feet, is 24% littoral (468 acres), and has been assigned to lake class 22. The only inlet to Long Lake comes from Mud Lake at the north end. The outlet flows from the south end of the lake, eventually joining the Fish Hook River and then Shell River. There is a dam at the outlet of Long Lake, and the small size of the inlet and outlet prevent boat access up or downstream.

PAST MANAGEMENT:

Minnesota fishing lakes can be grouped based on similar physical and chemical characteristics. These groups of lakes have similar fish communities. Long Lake has been grouped in lake class 22. Populations of walleye, yellow perch, pumpkinseed sunfish or rock bass generally characterize these lakes. Largemouth bass, northern pike, black crappie, bluegill, brown bullhead, yellow bullhead, black bullhead, tullibee (cisco), or bowfin may also be found in some of these lakes.

The fishery of Long Lake has been managed primarily for walleye with secondary emphasis on northern pike, largemouth bass, or black crappie. Management activities have consisted of: statewide fishing regulations; whitefish and tullibee netting since 1944; closures to dark house spearing in 1949-51; posting of bluegill spawning beds in 1949-54; fish stockings; improvement of angler access; efforts to protect aquatic habitat; and surveys and assessments of the lake and its fishery.

Records indicate walleye, northern pike, bass, crappies, sunfish, whitefish, and rainbow trout were stocked in Long Lake between 1911 and 1945. From 1946 through 1974 walleye and northern pike were stocked frequently, generally as fry or fingerlings, at various rates and densities. From 1975 through 1989 only walleye fry and fingerlings were stocked, but frequently and at various densities. From 1990 through 2002, walleye fingerlings, yearlings or adults were stocked, usually at a density of about ¾ pound per littoral acre, and only in alternate, even numbered years to better evaluate the extent of natural reproduction and to improve stocking success.

Lake management plan amendments recommended increasing the stocking density to 1 pound of walleye fingerlings per littoral acre (470 pounds) in 2004 to compensate for a decrease in the reported littoral acreage when the lake was remapped, and to stock up to an additional ½ pound per littoral acre (235 pounds) if surplus walleye fingerlings were available. A total of 598 pounds of fingerlings were stocked in 2004, including 128 pounds that were purchased from a private supplier by the Long Lake Association. Research has since suggested that there may be a benefit to stocking walleyes at densities as high as 1 pound per littoral acre per year average (2 pounds per littoral acre every other year) in some lakes. The Long Lake walleye stocking quota was increased to 2 pounds per littoral acre (935 pounds total) in even numbered years starting in 2006, in order to evaluate whether higher stocking densities could provide better results than those normally recommended. The lake association wanted to stock additional fish in 2005. They were permitted to stock an additional 193 pounds of walleye with the stipulation that yearlings (2004 year class) be stocked so as not to confound stocking evaluations. Walleye stockings continued with a total of 935 pounds in 2006, including 424 pounds purchased under contract, and a total of 937 pounds in 2008, which included 510 pounds of adult fish.

VARIOUS SURVEYS:

Long Lake was mapped by the CCC in 1941, and the fishery was initially surveyed in 1959. The lake was resurveyed in 1972, 1978 and 2014. Population assessments were conducted in 1983, 1988, 1993, 1998, 2004 and 2009. The Minnesota Pollution Control Agency (MPCA) collected water quality information in 1990 and conducted a Lake Assessment Program (LAP) study in 1995 to establish baseline water quality data. The Long Lake Association has participated in the Hubbard County Coalition of Lake Associations (COLA) lake water quality monitoring program annually since 1997, and lake water transparency was recorded through the MPCA Citizen Lake Monitoring Program annually since 1984. The Long Lake Association has also contracted to monitored dissolved oxygen and temperature profiles monthly from May through Sept. since 2012. Bluegill, largemouth bass, northern pike, walleye and white sucker were tested for contaminants in 1993. Largemouth bass and white sucker were analyzed again in 2000, and northern pike were analyzed again in 2009. Those analyses resulted in consumption advisories, particularly for larger walleye and northern pike because of elevated levels of mercury. Aerial fish house counts have been conducted annually since 1983 to monitor trends in ice fishing pressure. Counts have ranged from 20 to 72 houses (Figure 1).

Mean gill net catch rates provide the best index of walleye abundance. Average gill net catch rates of walleye

were very stable, and below the interquartile or "normal" range (4.0 to 9.6/gill net) for lakes with similar physical and chemical characteristics, from the initial survey in 1959 to 1978 (Figure 2). From 1978 through 2004 walleye gill net catch rates generally increased with little fluctuation. The average walleye catch rate was near the high end of the normal range and the highest ever observed in Long Lake in 2004. The average gill net catch rate of walleye declined in 2009 and 2014, and was near the middle of the normal range. The average of catch rates from all Long Lake samples was 4.7 per gill net following the 1998 sample. The Management Plan goal of 6 per gill net was set at that time between that long term average and the third quartile of historic walleye catch rates. Walleye catch rates were above the goal in 1998 and 2004, near the goal in 2009 and slightly below the goal in 2014 and 2019.

Proportional Stock Density (PSD) is an index of population size structure that measures the proportion of stock sized (10" or larger) walleye that are also a quality size of 15" or larger and Relative Stock Density- Preferred (RSD-P) is an index of population size structure that measures the proportion of stock sized (10" or larger) walleye that are also a quality size of 20". Walleye PSD in Long Lake was well above a desirable range of 30 to 60 in 1959 and 1972 samples, but has fluctuated at the high end or just above the desirable range since then (Figure 3). The RSD-P in Long Lake was quite high in 1959 and 1972 samples. RSD-P decreased but has still been quite good and remarkably stable, ranging from 26 to 33 since 1978.

It has been difficult to evaluate natural reproduction of walleye and the contribution of stocking, because there have been relatively few samples of the lake's fishery, there were relatively few years that walleye were not stocked in the lake prior to 1990, walleye were often stocked in consecutive years, and different sizes of walleye have been stocked, sometimes in the same year. In general, walleye stockings appear to be contributing substantially to the walleye population in Long Lake (Figure 4). However, sample sizes are small so conclusions about the effectiveness of stocking must be viewed cautiously. Walleye stocking densities were doubled, to two pounds per littoral acre in alternate years, beginning in 2006. Despite that, walleye abundance declined since 2004, there were no significant positive relationships between either numbers or pounds of walleye stocked and subsequent catch rates, and stocked year classes since 2006 did not appear to be any stronger than prior to 2006 (Figure 4).

Yellow perch abundance in Long Lake has historically been quite low. Average gill net catch rates of yellow perch in Long Lake have ranged from 0.5 to 4.0 per gill net (Figure 5). Average catch rates of perch since 1998 have been the highest ever observed, but were still considerably lower than the interquartile range for similar lakes (7.1 to 33.9/gill net). The long range goal of at least 1 perch per gill net was set near the 25th percentile of historic perch catch rates for Long Lake. Catch rates of perch were below the goal in 1988, at the goal in 1972, and above the goal in all other samples. Considering the low abundance of perch in Long Lake, predators like walleye and northern pike are probably also seeking other prey like tullibee. However, yellow perch are still an important source of food, and it is still important to maintain a good perch population to provide adequate forage for the lake's predators.

The abundance of northern pike in Long Lake has fluctuated, usually within the range typically found in similar lakes (3.0 to 7.9/gill net; Figure 6). Only in 1983 and 1998 were average catch rates of northern pike higher than the normal range. The PSD value for northern pike was very stable from 1959 through 1983, and near the low end of the desirable range of 30 to 60. Pike PSD generally increased from 1988 to well above the desirable range in 2014 and 2019.

Largemouth bass have been collected with both gill nets and trap nets during the course of population assessments and lake surveys, but those gears do not do a very good job of sampling bass. Catch rates with both gears have been relatively high. Catch rates fluctuated, but appear to have decreased from 1955 through the late 1970s, then increased since then. The 2009 average gill net catch rate of bass was the highest ever observed at Long Lake, and the second highest occurred in 2019. Population size structure indices of bass have been low, but remarkably

stable, and increasing slightly in 2019 to the highest levels observed at Long Lake. PSDs of largemouth bass were consistently around the low end of the desirable range of 30 to 60 until 2014 when they increased to the middle of the desirable range. Future population surveys should include spring electrofishing sampling to better evaluate bass populations, if possible within time and staffing constraints.

Average trap net catch rates probably provide the best index of black crappie abundance. Trap net catch rates of crappie in Long Lake have fluctuated within or below the interquartile range for similar lakes (0.3-1.7/net). The average trap net catch rates haven't shown any apparent long term trend of either increasing or decreasing over time. However, trap net catch rates increased in 2019 to the highest level ever observed at Long Lake and at the top of the normal range for similar lakes. Proportions of quality size (8" or larger) crappie (PSD) have fluctuated widely, but usually around the desirable range of 30 to 60 and with no apparent trends of either increasing or declining.

Mean trap net catch rates also provide the best index of bluegill abundance. Bluegill trap net catch rates in Long Lake have fluctuated within or above the interquartile range for similar lakes (3.7 to 42.9/net) with no apparent trend of increasing or decreasing over time. Size structure (PSD) of bluegills has generally been low, either below or near the low end of the desirable range of 20 to 60.

Tullibee (cisco) are very high in protein, and can provide another valuable source of forage. The average gill net catch rate of tullibee was near the high end of the interquartile range for similar lakes in the 1959 sample, declined and was below the normal range in 1976 through 1998 samples, then increased to within the normal range again in 2004 through 2014. Tullibee netting has been allowed in Long Lake since 1944, but it doesn't appear that many people participate or that it has much effect on the tullibee population.

SOCIAL CONSIDERATIONS:

Long Lake and its fishery are an important feature and recreational attraction for the Park Rapids area and surrounding communities. The lake and its fishery have the potential to contribute substantially to local and state economies. There were 466 homes/cabins reported on Long Lake during a 1993 population assessment and slowly increased since then (Figure 7).

PRESENT LIMITING FACTORS:

Heavy development on Long Lake and within its immediate watershed has resulted in removal of aquatic and riparian vegetation and probably increased erosion and contribution of nutrients to the lake. Loss of vegetation and the resulting loss of habitat and degraded water quality could negatively affect fish populations, reduce recreational opportunities, and reduce the aesthetic quality of the lake. The small proportion of shallow, littoral area in Long Lake probably limits production, abundance, growth, condition and sizes of warmwater fish species like bluegill, largemouth bass or black crappie. Emergent aquatic vegetation like bulrush is particularly sparse on Long Lake, and can provide spawning habitat for these nesting fish species. Removal of emergent aquatic vegetation will have the greatest negative impacts on these species.

A lack of clean, wave washed gravel or rubble habitat probably limits natural reproduction or recruitment of walleye. Other fish populations may affect survival or recruitment of stocked walleye. Yellow perch are an important source of food for predators like walleye and can often affect survival, growth or condition of either naturally produced or stocked walleye.

Northern pike reproduction and recruitment may be limited by the amount of seasonally flooded vegetation and marsh areas that provide suitable spawning habitat, and by water levels in inlets to allow pike to reach suitable spawning areas. However, higher recruitment and abundance of pike could lead to more competition for food, poorer growth and smaller fish. The amount of habitat in Long Lake for pike production appears to be adequate. Numbers of pike are generally within the normal range for lakes like Long, and growth and condition are good.

Dissolved oxygen and temperature monitoring contracted by the Long Lake Association has documented very limited habitat conditions for cisco in two of the four years that have been monitored since 2012. Following lake turnover in the spring, surface water temperature warms and dissolved oxygen declines in the lower depths of the lake until there was only about nine feet of water, between 30 and 40 feet deep, that has cool enough temperatures and high enough dissolved oxygen levels to sustain cisco. If air and surface water temperatures continue to increase with climate change, or if land use practices increase nutrients, increase oxygen consumption and lower dissolved oxygen levels, that narrow band of suitable cisco habitat could decrease further or result in unsuitable conditions to sustain cisco.

SURVEY NEEDS:

Fisheries surveys or targeted sampling should be conducted about every five years to monitor population trends of managed fish species. If possible with fiscal and staffing constraints, survey sampling should include spring electrofishing to better evaluate largemouth bass. Special fall electrofishing may be conducted if desirable to evaluate natural reproduction or stocking success of walleye, and if feasible. More frequent sampling may be necessary to determine management needs or better evaluate management efforts. Targeted nearshore sampling should be conducted about every ten years to calculate an Index of Biotic Integrity (IBI), vertical net sampling should be included to better evaluate cisco, and additional targeted sampling should be conducted to provide information about physical and chemical characteristics of the lake and its watershed that can be used to monitor long term habitat trends.

Citizen volunteers should be encouraged to continue collecting water quality information on a regular basis. At a minimum, lake water transparency (secchi disk) should continue to be monitored through the MPCA Citizen Lake Monitoring Program (Figure 8). Periodically, water samples should be tested for chlorophyll-*a* and total phosphorus to look for long term trends. If possible, dissolved oxygen and temperatures should continue to be monitored to evaluate any trends in oxygen depletion or changes in habitat suitability for species like tullibee. Dissolved oxygen and temperature profiles should be monitored more frequently during August to better evaluate the period when conditions are at their worst.

An angler creel and recreational use survey could be considered for Long Lake. A creel survey could provide needed information on fishing pressure, catch, harvest, angler characteristics, and recreational use. A creel survey could be used to evaluate the potential to improve managed fish populations with regulation changes (seasons, bag limits, size limits).

A mark and recapture tagging study could be undertaken to estimate stocked walleye fingerling survival and contribution to year class strength. Such a study could be conducted by marking stocked walleye with fin clips, tags or oxytetracycline, recapturing marked fish during targeted sampling or surveys, and estimating relative proportion of stocked and nonstocked fish.

HABITAT DEVELOPMENT AND PROTECTION:

Decreasing secchi depth measurements and resulting Trophic State Index at sites near the north and south ends of Long Lake from 1988 or 1990 through 2003, 2006 or 2007 suggested declining water quality. However, water sampling at the primary site since 1997 showed decreasing concentrations of Total Phosphorus, increasing secchi depth measurements and decreasing Trophic State Index which indicate improving water quality. The lake is considered mesotrophic based on those measurements. The Watershed Restoration and Protection Strategy (WRAPS) Report prepared for the Crow Wing River Watershed identified erosion control and nutrient management, increasing forest acreage in the watershed with conservation easements or acquisition, and protecting groundwater levels, quality and contribution to surface water features as strategies to reduce phosphorus loading and maintain or improve existing water quality of Long Lake.

The MN DNR Fisheries Habitat Plan used watershed disturbance as a surrogate of lake water quality. Modeling by DNR Fisheries Research staff suggests that total phosphorus concentrations increase significantly over natural concentrations in lakes with watershed land use disturbances greater than roughly 25%. Disturbed land includes urban development, agriculture, and mining. Those types of land use may contribute up to 15 times more phosphorus to surface waters than undisturbed lands. Between 25% and 60% of Long Lake's watershed is disturbed. The plan suggested that lakes with these conditions may be fully restorable and would benefit from watershed-level restoration efforts.

MN DNR Ecological and Water Resources staff identified sensitive shorelands around several lakes in Hubbard County, including Long Lake, based on surveys of aquatic plants and target animal species. Those surveys were incorporated into a model that also included lakeshore areas used by focal species, areas of high biodiversity, and critical and vulnerable habitats. Efforts should be made to protect those sensitive shorelands, to identify important spawning areas or other critical aquatic habitat on Long Lake and to protect those areas from further development or habitat degradation.

Fisheries personnel will continue efforts to inform and educate the public about the value of riparian and aquatic habitats (water quality, vegetation and substrates), and the need to protect or restore them. Efforts of local, state or federal groups, agencies or individuals to maintain or improve water quality or fisheries habitat in Long Lake will continue to be encouraged, supported and assisted. Aquatic plant management and work in protected waters permit applications will be reviewed, and recommendations will be provided to minimize loss or degradation of riparian and aquatic habitats. In particular, existing or prospective lakeshore property owners should be advised of the benefits of riparian and aquatic vegetation as habitat, shoreline protection and water quality improvement. They should be encouraged to maintain existing or restore destroyed vegetation. They should be given options to obtain access to open water or to reasonably use lakeshore property, but still maintain as much vegetation as possible. Fisheries personnel will also work with developers of private land or planning and zoning authorities whenever possible, to provide recommendations and define guidelines for aquatic plant management or protection of sensitive habitat.

LAND ACQUISITION:

Long Lake has two public access sites with concrete ramps and adequate parking. A state owned site is located on the north end of the lake, and a county owned site is located at the south end. There are two other county owned sites with earthen ramps and limited parking. One is located on the north shore of a southwest point (Norway Bay), and the other (Nakomis) is located on the west central shore. There are several other publicly owned easements to the lake, but they do not provide suitable access or parking. MN DNR, Div. of Parks and Trails has indicated that there is limited room for improvements at the north end public access site and they may be looking for an alternate site to develop a public access near the north end of the lake. Since the north end of Long Lake can provide some very good shore fishing in the early spring, that site could be retained and developed for handicapped and/or shore fishing opportunities. Except for the improvements to the north end access site, public access appears to be adequate for the present. However, additional land acquisition may be considered in the future to satisfy increased recreational demand or to ensure accessibility for shore fishermen, elderly or disabled. Any improvements in access should be weighed with anticipated negative effects of increased use.

Consideration should be given to acquiring property, acquiring conservation easements or using cost-share programs to protect additional lands in Long Lake's watershed in order to maintain or improve lake water quality. Priority should be given to protecting riparian areas that will also maintain or improve physical habitat in the lake. High priorities will be identified spawning areas, sensitive shorelands, and other critical habitat, to protect them from development or further degradation, or to improve habitat in those areas. The highest priority will be to protect large tracts of privately owned undeveloped shoreline that meet those criteria. Consideration might also be given to acquiring property or easements, or using cost-share programs to protect marginal land and critically eroding areas, or to provide vegetative buffer strips along the lakeshore or tributaries if necessary.

STOCKING PLANS:

Prior to 2006, walleye fingerlings were stocked in Long Lake at a density of 1 pound per littoral acre (470 pounds total). Stockings were increased to 2 pounds per littoral acre (935 pounds total) every other year beginning in 2006 to see if there would be any benefit to stocking walleye fingerlings at higher densities (up to 1 pound per littoral acre per year average or 2 pounds per littoral acre every other year). There was no increase in walleye abundance following the higher density stockings, sampling catch rates did not appear to be positively related to stocking densities, and year classes when walleye were stocked at higher densities were not noticeably stronger than years when walleye were stocked at lower densities. Consequently, walleye fingerlings was returned to the density of 1 pound per littoral acre (485 pounds total). Fingerlings should be stocked in alternate years to better evaluate natural reproduction, and to improve chances of stocking success. Stockings at Long Lake have sometimes included older, larger fish and consequently, lower numbers. Larger fish typically have better survival, so fewer can be stocked and achieve similar results. However, there is a point when stocking too few will not produce desirable results. If stocked walleye are less than 15 per pound average size, additional walleye should be stocked to compensate for the lower numbers, if they are available. Recommendations for future changes in walleye stocking schedules, densities, or rates (sizes of fish) should be based on results of evaluations. Walleye stocking frequency or density may be decreased if walleye stockings do not appear to be contributing significantly to the walleye population or if other fish populations (particularly yellow perch) are being negatively affected.

EVALUATION PLANS:

Fisheries sampling information will be used to evaluate population characteristics (abundance, relative abundance, size structure, age structure, growth or condition) of walleye, yellow perch, northern pike, black crappie, bluegill, largemouth bass, tullibee, and forage fishes. Fisheries sampling information will also be used to build a more complete database, allow better comparisons of species' population characteristics over time, and might aid with evaluation of community interactions. Results will be used to evaluate and adjust management efforts, including stocking, if necessary to achieve desirable levels of abundance and size structure for managed fish species and forage fishes at minimum costs. Periodic collection of information about physical and chemical characteristics of the lake and its watershed can be used to monitor and evaluate long term habitat trends.

If an angler creel survey can be conducted, particular attention should be placed on determining harvest of walleye, northern pike, black crappie, bluegill and bass, and resulting impacts to those populations. Consideration may be given to marking northern pike, walleye, crappie, bluegill and/or bass in conjunction with an angler creel survey to attempt to estimate exploitation. Results of an angler creel survey should be used to evaluate the potential to improve abundance and size structure of managed fish species (walleye, northern pike, crappie, bluegill or bass) with regulation changes (seasons, bag limits, size limits).

Figure 1. Fishhouse count on Long Lake.

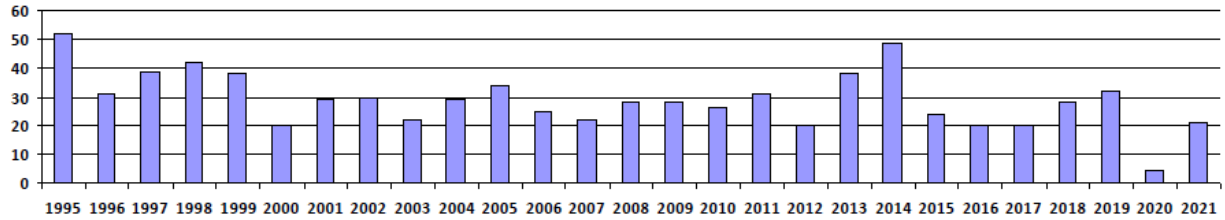

Figure 2. Walleye gill net catch rate for Long Lake.

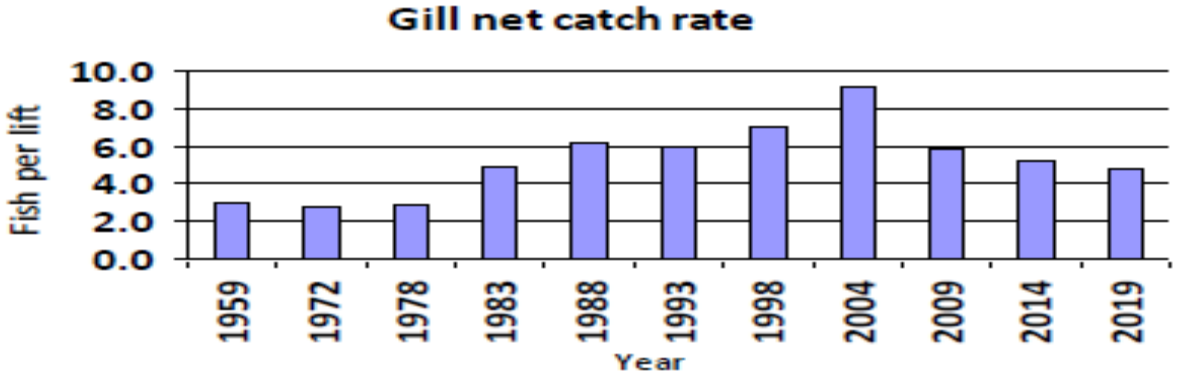

Figure 3. Length distribution for Walleye using Proportional Stock Density (PSD) and Relative Stock Density - Preferred (RSD-P) on Long Lake.

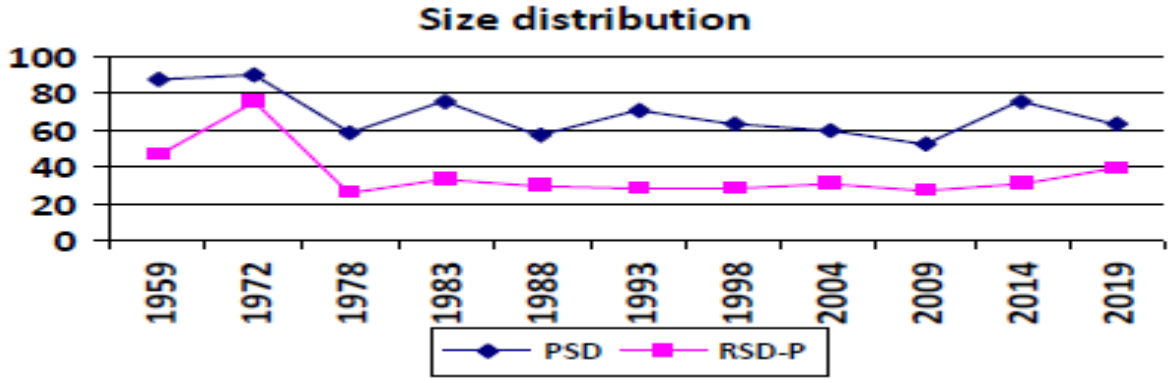

Figure 4. Year class catch rate (Age 1 - 6) for walleye from Long Lake using lake survey data in the walleye stocking evaluation program

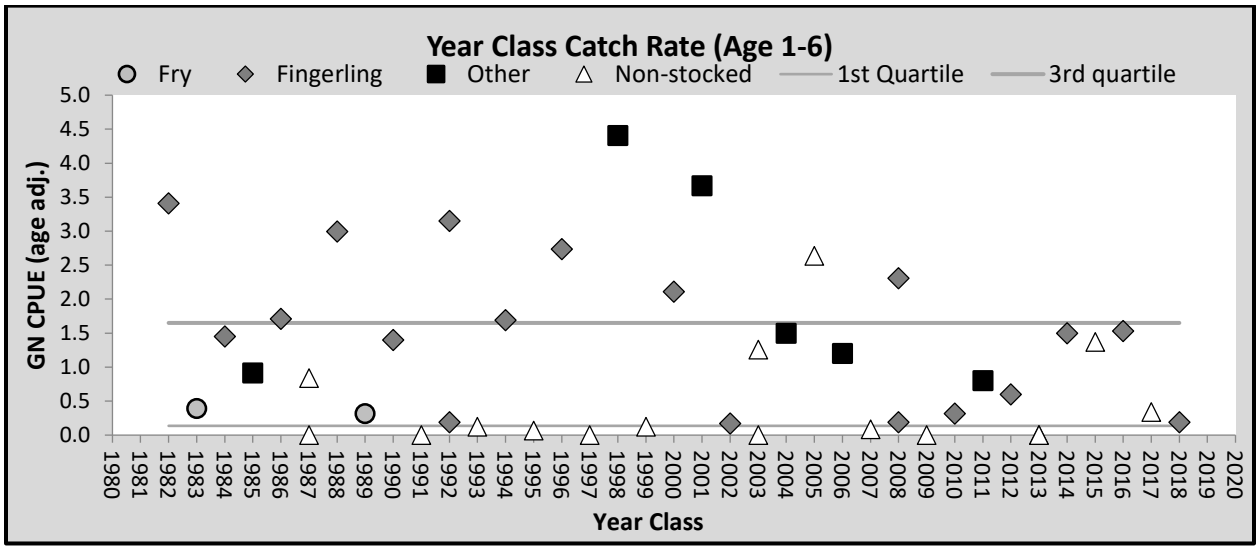

Figure 5. Yellow perch gill net catch rate for Long Lake.

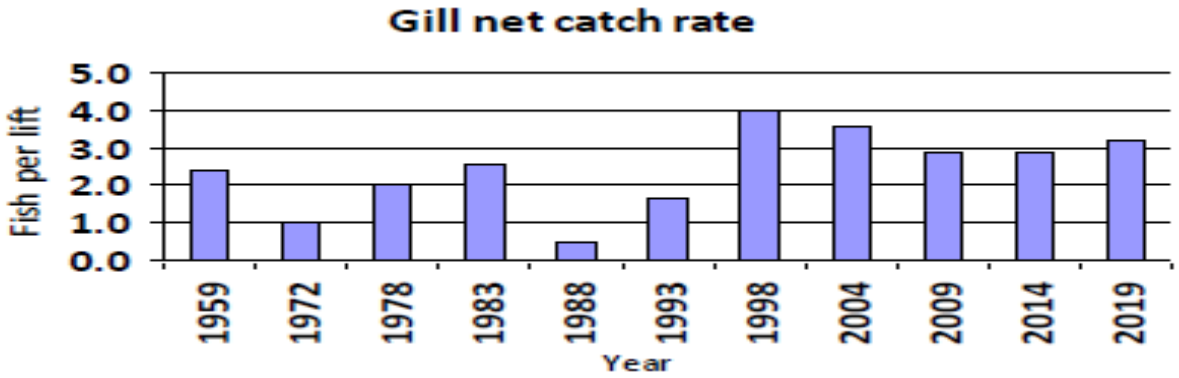

Figure 6. Northern pike gill net catch rate for Long Lake

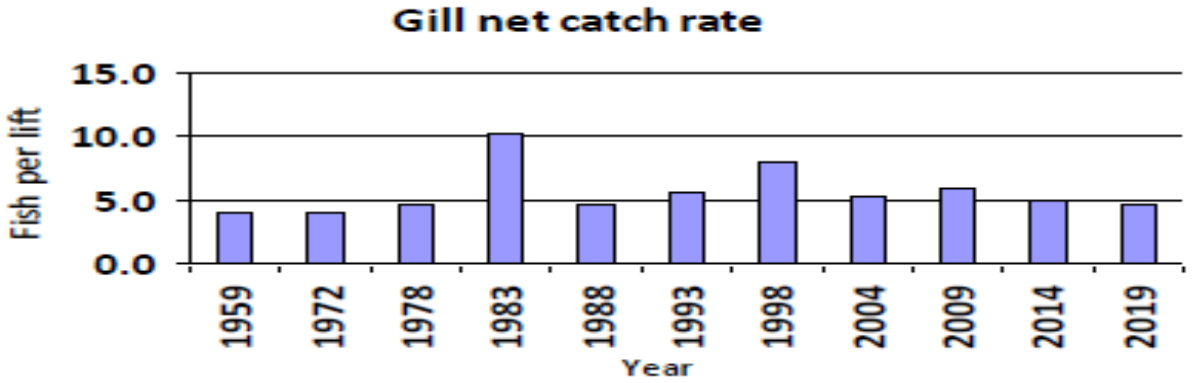

Figure 7. Cabin/home count for Long lake

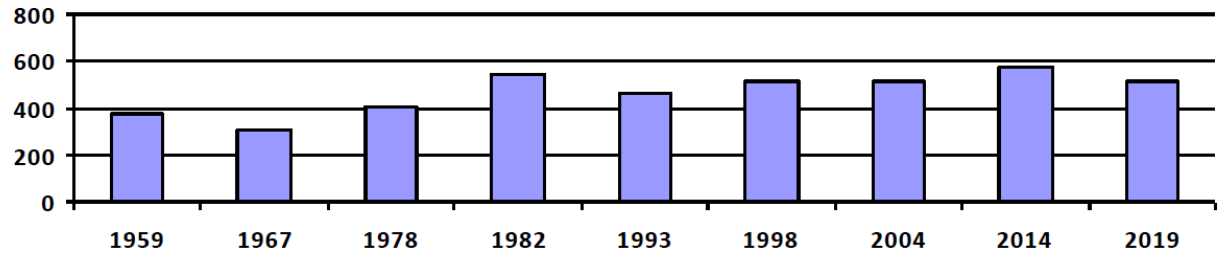

Figure 8. Average Seechi disk reading (ft) by year for Long Lake.