**Minnesota Department of Natural Resources**
**Division of Fisheries and Wildlife**

**Completion Report**

# Large Lake Sampling Program Assessment Report
# for
# Leech Lake
# 2009

**by**

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# INTRODUCTION

Minnesota's ten largest walleye lakes account for nearly 40% of the annual statewide walleye *Sander vitreus* harvest and provide significant contributions to resource-based economies on both local and statewide scales (MNDNR 1997). Prior to 1983, fisheries assessments on these lakes were infrequent and highly variable in their methods. As a result, these surveys were unreliable for assessing fishery status as well as any fishery response to management actions. Recognizing the importance of these systems and the need for robust data to effectively identify and evaluate trends in fish stocks, the Minnesota Department of Natural Resources initiated the Large Lake Program (LLP) in 1983. Goals of the LLP include annual fishery surveys using standardized methods to facilitate comparisons among years and lakes, to detect management needs and evaluate management actions, and to enhance public outreach.

Sampling guidelines for the large lakes were outlined in the Large Lake Sampling Guide (Wingate and Schupp 1984). Since published in 1984, large lake sampling methods have been adapted on a lake-specific basis to ensure information collected is valid for both research and management applications; ineffective methods or those with poor reliability have been eliminated or de-emphasized. In some cases, additional targeted sampling has been added to augment methods delineated within the LLP. The primary focus of the LLP and its survey methods is to promote sound management of important sport fish populations. Leech Lake is the third largest lake within state boundaries and is one of eleven lakes monitored by the LLP (MNDNR 1997).

Leech Lake is renown among anglers as an exceptional multi-species fishery; however, most anglers target and harvest walleye. During the 1998-99 open water seasons, anglers averaged 1.2 million angler hours and 174,000 pounds of harvested walleye per year (Sledge, 1999, 2000). However, several consecutive years without a large walleye year class caused declines in overall walleye abundance and an unbalanced population size structure; this in turn produced historically low levels of angler effort and walleye harvest during the 2004-2005 open water seasons (Rivers 2005, 2006). These changes to the walleye fishery, as well as stress responses in the yellow perch population, coincided with expanding populations of double-crested cormorants and invasive aquatic species such as rusty crayfish and Eurasian watermilfoil. As a result, an aggressive management plan was developed and implemented to improve fishing quality and the long-term sustainability of Leech Lake. Management actions aimed at improving the walleye fishery included protecting the spawning stock of adult walleye, increasing overall abundance of walleye in Leech Lake, improving the walleye population size structure, and establishing two good walleye year classes from 2005-2010. Strategies adopted to achieve these goals included a protected slot limit to reduce exploitation of walleye brood stock, double-crested cormorant control, and stockings of marked walleye fry. The overall goal of this plan was to quickly improve the quality of walleye fishing on Leech Lake while expanding on the current knowledge of walleye recruitment dynamics and the potential effects other species might have on walleye populations.

This report primarily addresses the 2009 Leech Lake fishery assessment. The 2007-2008 assessments of the Leech Lake fishery determined that all management goals outlined in the 2005-2010 action plan had been met or exceeded (Schultz 2008a, 2008b). Fishing quality on Leech Lake, indexed by targeting angler catch rates, improved significantly from the historic lows observed during 2005 to record highs during the 2008 open water season (Schultz 2009). Recent surveys have indicated substantial improvements to the walleye population and its fishery over the course of a few years. Therefore, the 2009 population assessment is also compared to the action plan goals. The completion and thorough evaluation of these efforts will refine current management strategies on Leech Lake as well as identify the needs for new ones.

## LEECH LAKE ADVISORY COMMITTEE & WALLEYE REGULATIONS

Currently the MN DNR and a citizen input committee (Leech Lake Advisory Committee; LLAC) comprised of stakeholders representing local and statewide interests in Leech Lake management is working to update the existing management plan for the next five years (2010-2015). The committee will be building upon the success of the previous plan by recommending to the DNR specific goals and/or actions aimed at preserving a quality walleye fishery on Leech Lake. Specific topics include walleye population management goals, walleye fry stocking, harvest regulations, habitat protection, and double-crested cormorant management. Once drafted, committee recommendations will be available for public review and comment before being submitted to the DNR Commissioner for consideration and approval.

The current protected slot walleye regulation (PSL) on Leech Lake (18-26" walleye must be immediately released; possession limit of 4, one of which may be longer than 26") will be formally reviewed by the DNR following the 2010 summer angling season; any potential changes to the regulation will go into effect at the start of the 2011 walleye fishing season. Public comment on any proposed special regulation for Leech Lake walleye, including maintaining the current 18-26" PSL, will be sought during fall 2010.

## STUDY AREA

Leech Lake has approximately 112,000 surface acres. In its original state, Leech Lake covered about 106,000 acres. In 1884, a dam was built on the Leech River, raising the water level about two feet and increasing the surface area to its present size (Wilcox 1979). The maximum depth of the lake is near 150 feet; however, nearly 80 percent of the lake is less than 35 feet deep.

Leech Lake is located in three glacial zones and has an irregular shape with many large and small bays. Leech Lake varies considerably from a morphological perspective. Some large bays, such as Steamboat and Boy, display highly eutrophic water characteristics whereas other large bays, such as Walker and Kabekona, have properties more congruent with oligotrophic lakes. The main portion of the lake, like most large

Minnesota walleye lakes, is mesotrophic. Previous estimates of shoreline miles have varied, but using remote sensing technology, the estimate is 201 miles. Approximately 23 percent of the shoreline consists of a gravel-rubble-boulder mixture, nearly all of which is used by spawning walleye (Wilcox 1979).

The diversity of the Leech Lake shoreline and substrate, as well as its extensive littoral zone, provides excellent spawning and nursery habitats for a number of fish species, in particular for percids and esocids, which dominate the fish community. Walleye, northern pike *Esox lucius* and muskellunge *E. masquinongy* are the principal predators and are located throughout the lake. Although most fish species are found in every portion of the lake, the largest walleye and muskellunge concentrations exist in the mesotrophic areas. Northern pike are most common in eutrophic bays supporting large areas of dense vegetation. Yellow perch *Perca flavescens* are abundant throughout the lake and are the primary forage for walleye and northern pike. Cisco *Coregonus artedi* and lake whitefish *C. clupeaformis* are an important forage base for muskellunge and trophy northern pike (Engstrom-Heg et al. 1986) and are typically found in the mesotrophic and oligotrophic areas. Other species present in the lake include: white sucker *Catostomus commersoni*, burbot *Lota lota*, rock bass *Ambloplites ruspestris*, bowfin *Amia calva*, shorthead redhorse *Moxostoma macrolepidotum*, bullheads *Ameiurus spp.*, pumpkinseed *Lepomis gibbosus*, bluegill *L. macrochirus*, largemouth bass *Micropterus salmoides*, smallmouth bass *M. dolomieui*, and black crappie *Pomoxis nigromaculatus*.

## YOUNG-OF-YEAR ASSESSMENT

### Introduction

The objectives of this assessment are to index the relative abundance of young-of-year (YOY) walleye and yellow perch during this time period, to index growth rate, to collect structures necessary for stocking evaluations, and to estimate potential walleye year class strength. Standardized shoreline seining has been completed on Leech Lake since 1983. Shoreline seine catch rates can be strongly influenced by several factors, including fish behavior and size. Furthermore, seining occurs relatively early in the life-history process before first-year mortality processes, such as predation and growth, have fully acted on the cohort. Consequently, seining is reserved for collecting early information on YOY growth and is not used for estimating the potential strength of a year class.

Three long-term trawling stations were established in 1987. Other stations had been attempted in the past but were discontinued due to contours that were difficult to sample, abundant vegetation, or frequent snagging that would destroy the gear. Catch rates of YOY walleye in trawl hauls and gill net sets is, to date, the best tool for forecasting the potential strength of a walleye year class. Acknowledging that the relationships between YOY walleye catch rates in various gears and ensuing year class strength remain subject to the numerous mortality processes driving recruitment variability, year class strength is not determined until after the first winter. Fall electrofishing was added to the suite of

YOY walleye assessment tools in 2005 and standardized long-term stations were established in 2007 to improve on year class estimation. Electrofishing has proven to be a useful method for predicting walleye year class strength on some of Minnesota's other large walleye lakes and, in time, has the potential to improve on the trawl-only and trawl-gillnet methods currently employed. Electrofishing catch rates are highly dependent on water temperature, water clarity, and weather. Consequently, not all stations may be sampled during years of frequent inclement weather.

**Methods**

*Seining*

Five long-term seining stations (Figure 1) were sampled weekly from July 6 through July 29, 2009 using the parallel-to-shore method. Two hauls were made at each station using a bag seine (100-ft. long, 5-ft. deep, 0.25-in. untreated mesh). The area seined was determined by assuming the actual lakeward distance covered by the seine was 90 feet, which compensated for the bow in the seine created by water resistance during pulling. This figure was then multiplied by the distance of the pull (150 feet) and resulted in an area of 13,500 $ft.^2$ (0.310 acres) per seine haul.

All fish were identified to species when possible and measured to total length (TL, mm). With exception to minnows, fish judged as young-of-year (YOY) were measured separately. When necessary, seine hauls were sub-sampled due to an extremely large number of fish captured. In these instances a representative portion of fish in a volumetric sub-sample were measured, by species, and the total number obtained in the sub-sample was expanded to the total volume sampled. Age-0 walleye and age 1+ fish of other species were individually counted and measured before sub-sampling occurred. Up to 20 YOY walleye and yellow perch were collected from each haul when possible. These fish were kept for individual measurement (total length (TL), mm; weight (W), g) no later than the following day.

*Trawling*

Trawling was conducted at the three long-term stations (Figure 1) from August 17 through August 25, 2009 using a semi-balloon bottom trawl (25-ft. headrope, 0.25-in. mesh cod end liner). Hauls consisted of five-minute tow times at a speed of 3.5 mph for a total effort of 100 minutes of trawl time. Fish were identified, measured, and enumerated as per the methods described for shoreline seining. Up to 20 YOY walleye and yellow perch were collected per haul for individual measurement (TL, mm; W, g) no later than the following day.

Walleye year class strength is indexed by the respective relative abundance of age 1-4 walleye in gillnet catches and has traditionally been estimated using trawl catch rates of age-0 fish. However, numerous factors influence the survival of young walleye and eventually the size, or strength, of any given cohort. As a result, any measure of relative cohort strength based on the relative abundance of age-0 fish will inherently be highly variable. In spite of this, the incorporation of additional metrics, such as indices of growth or YOY walleye catch rate in experimental gillnet sets, can explain some of the additional year-to-year variability for a more precise estimate. For Leech Lake, more variability in walleye year class strength can be explained when it is predicted using both trawl and gillnet catch rates of YOY walleye (1987-2008; $F$ = 10.72; $R^2$ = 0.53; $P$ = 0.0008) than using trawl catch rates of YOY walleye independently (1987-2009; $F$ = 3.85; $R^2$ = 0.16; $P$ = 0.0637). Inclusion of YOY walleye growth, as indexed by mean TL (mm) during the 34$^{th}$ Julian week (mid-August), provides no substantial improvement over the trawl-gillnet based estimate at this time.

### *Fall Electrofishing*

Fall nighttime electrofishing targeting YOY walleye was conducted during the week of September 10, 2009 using a Coffelt pulsed-DC electrofishing boat (VVP 2E; array anode). Favorable weather allowed for successful sampling of all four stations this year. Sampling sites were approximately 3-5 feet deep on sand/gravel/cobble shorelines. Sampling runs consisted of 20 minutes of continuous on-time from the starting point (Figure 1). Up to 25 age-0 walleye per run were kept for individual measurement (TL, mm; W, g) and otolith removal no later than the following day; all age-1+ walleye captured were measured (TL, mm) and released.

## Results

### *Seine*

A total of 36 seine hauls captured 19 different species (Table 1). The Whipholt Beach station was not sampled the first two weeks of July because deposited cases from a large and prolonged mayfly (*Hexigina spp.*) hatch inundated the site. Seine catch rates of YOY walleye were highest at Ottertail Point, whereas catch rates of YOY yellow perch were highest at the Traders Bay station (Table 2). The overall catch rate of YOY walleye was 65 fish/acre and is near the 1983-2009 mean of 57.6 fish/acre (Figure 2). Conversely, the overall catch rate of YOY yellow perch was 313 fish/acre, well below the historical mean of 857 fish/acre (Figure 2). Seine catch rates are not used to index the relative abundance or the potential year class strength of YOY percids because it occurs too early in the life-history process.

### *Trawl*

A total of 95 minutes (19 hauls instead of 20) were trawled in Leech Lake in 2009, collecting 19 different species (Table 1). The missing haul was completed at Goose Island instead of Fivemile Point, and was excluded from summary to maintain consistency among years. By station, trawl catch rates of YOY walleye were highest at Goose Island and at the Whipholt Beach station for yellow perch (Table 3). The overall catch rate of YOY walleye was 153 fish/hour and is near the 1987-2008 mean of 143 fish/hour (Figure 2). Conversely, the overall catch rate of YOY yellow perch was 8,899 fish/hour and is also near the long-term average of 9,673 fish/hour (Figure 2).

This year's trawl catch rate predicts a walleye year class strength (± 95% CI) of 102 ± 30 (Table 4). However, inclusion of the YOY walleye gillnet catch rate suggests a potential year class strength of 72 ± 28. Both methods predict a year class with below-average strength.

### *Electrofishing*

All 12 electrofishing stations were successfully sampled during September 2009. The 2009 electrofishing catch rate of YOY walleye was 164 fish/hour (Table 4; Figure 2) and is considerably higher than all observations since standardized electrofishing began in 2005. Electrofishing catch rates should be viewed with caution as several consecutive years of consistent sampling are required before its utility for indexing walleye year class strength can be effectively evaluated. Furthermore, a change in anode type during 2009 (from spherical to array) could have increased catchability, which in turn would be reflected as a higher catch rate. More information is needed to draw sound conclusions on the utility of electrofishing catch rates of age-0 walleye for forecasting year class strength. In the near term, mean length of YOY walleye captured during electrofishing should be evaluated as a possible means to improve upon the existing trawl-gillnet model, as total length would be less influenced by capture efficiency than catch rates.

### *YOY Growth Indices*

Growth of YOY percids was indexed by mean weekly length and condition during July through September. Mean length-at-week was below respective long-term averages for both species (Figure 3), due largely to the cold summer. For walleye, the difference was about one inch; for yellow perch, this difference was about one-quarter inch. Condition of walleye, indexed using weekly K-factors, was approximately average and varied little on a week-to-week basis. Age-0 yellow perch were not weighed to save sample processing time during staffing shortage; thus, a condition index was not calculated.

## Discussion

Walleye recruitment in natural lakes is highly variable across years and is influenced by a number of physical and biological effects. High abundances of adult walleye can suppress ensuing year classes via predation (Chevalier 1973; K. Reeves, personal communication) and competition (Madenjian et al. 1996; Beard et al. 2003). Similarly, high adult abundances of other species, such as yellow perch, can exert enough predation on a walleye year class to significantly influence its outcome (Hansen et al. 1998). Spring warming rates have a strong influence on incubation times, egg survival, and food availability for newly-hatched fry (Madenjian et al. 1996; Hansen et al. 1998). Furthermore, first-winter survival of YOY walleye is size-specific and therefore strongly influenced by growth rate (Madenjian et al. 1996) and condition (Bandow and Anderson 1993) during the first summer. Therefore, the magnitude of a year class is not simply determined by the number of fry that are successfully produced, but more so through annual changes in the gauntlet of age-0 mortality sources and the severity each mortality source acts on a cohort during any given year.

Due to the high degree of variability in young walleye survival, forecasting recruitment (ie. year class strength) based on age-0 metrics is challenging. For example, diversity exists among Minnesota's ten largest walleye lakes as to which YOY walleye sampling methods are the best predictor of ensuing year class strength. Fall electrofishing catch rate is the best metric on Cass, Kabetogama, Rainy, and Vermillion lakes. Conversely, trawling is the preferred method on Lake of the Woods, Leech, Mille Lacs, and Winnibigoshish lakes. Upper Red Lake is the only lake where seining is the best tool for predicting walleye year class strength, and all three gears are used on Lake Pepin. Therefore, while nearly 20+ years of annual survey work has determined the best gear(s) for predicting walleye year class strength in each of these systems, no estimate is without error from year to year because of the dynamic mortality processes that determine recruitment.

Trawl catch rates of YOY walleye were near the long-term average, initially suggesting an average year class. However, growth of age-0 walleye was approximately 1-inch below average during 2009, likely caused by the late spring and cool summer, and led to only one age-0 walleye being sampled during the gillnet survey. An unusually warm September did extend the growing season beyond the completion of Large Lake survey work and thus average lengths for YOY fish at the end of the 2009 growing season are not available. Consequently, while initial predictions are for a below-average walleye year class produced in 2009, a cohort of average strength is possible and depends largely on how much additional growth occurred before the onset of colder temperatures in October.

## GILLNET SURVEY

### Introduction

Gillnet surveys on Leech Lake have been completed annually during the first two weeks of September. Gillnets are the most effective method for assessing walleye and yellow perch populations; however, information on other species is also collected. Experimental nets (50-ft. panels of 0.75, 1.00, 1.25, 1.5, and 2.0-inch bar mesh; 250-ft. total net length) are used to reduce size-selective biases encountered when using nets of a single mesh size. Standardized methods include net design, net location, net orientation, and time of year.

Since the LLP began in 1983, four nets have been fished at fixed locations within each major bay (Wingate and Schupp 1984); the Pelican Island sets were added in 1984 for a total of 36 net sets per year. Data collected with gillnets measure trends in population metrics, such as relative abundance, spawner stock biomass, age- and size-structure, growth rates, mortality, and year class strength. Gillnet catch rates are also used to establish population management goals that can be quantitatively evaluated over time.

## Methods

Standard experimental gillnet sets were lifted at 36 different locations throughout the lake from September 7 through September 18, 2009. Four sets were made in each of 9 different areas (Figure 4). For some analyses, gill net data were separated into western bays (17,927 acres) and main lake (93,914 acres) areas because differences in walleye abundance, growth, movement, and yield (Schupp 1978) between areas suggest the potential for contrasting population responses to fishing pressure and other environmental changes. Western bays sets included net stations 1-16 and main lake sets included net stations 17-36. Gill net locations in 2009 were nearly identical to locations sampled annually since 1984.

All fish captured were identified to species, measured (TL, mm), and weighed (g) with a 6.8-kg capacity digital scale. Sex and maturity data were recorded for all walleye, yellow perch, cisco, and northern pike when possible. Data were recorded separately for each of the five mesh sizes within each net. Weights and lengths were converted from metric units to English units for better comparison with historical data. Sex and maturity were assigned to fish destroyed by crayfish based on the frequency of occurrence in 25-mm length intervals within each basin using a modified version of an age-length key assignment program (Isermann and Knight 2005).

Ages were estimated using saggittal otoliths from all walleye and a single cleithrum from esocids. Otoliths were removed from a minimum random subset of five yellow perch and five cisco per sex per mesh panel of each net. In most cases, sub-sampling for yellow perch otolith collection only occurred within the 0.75- and 1.00-inch mesh sizes. To estimate age, a per-basin maximum subsample of 10 otoliths within 25-mm length intervals for both yellow perch and cisco were randomly selected and aged for each sex. Age was then assigned individually to fish not aged using observed length and sex frequencies (Isermann and Knight 2005) within 25-mm length intervals. Age assignment was basin-specific for each species because differences observed in walleye population metrics among basin types, particularly growth rate (Schupp 1978), also exist for other species (Schultz 2008a).

## Results

Catch rates and length-frequency distributions of all species caught during the 2009 gillnet survey are summarized in Tables 5 and 6; historical gillnet catch summaries are in Table A13 and Figure A1 in the Appendix.

*Walleye*

A total of 310 walleye were sampled in gillnets. The 2009 gillnet catch-per-effort (CPE) of 8.61 walleye/net is below the catch rate observed during 2008 (9.06 walleye/net) but still above the 1983-2009 average of 7.6 walleye/net (Figures 5 and 6). Historical gill net catch rates have ranged from 4.6 fish/set (1993) to 13.4 fish/set (1988). Of walleye captured during the 2009 gillnet survey, 77% were sampled in main lake sets. By sampling area, walleye gillnet CPE ranged from 2.75 (Walker Bay) to 19.50 fish/net (Pine Point) (Table 7). Standing stock biomass of mature female walleye was estimated to be 1.49 pounds/acre, which is within the current management goal of 1.25-1.75 pounds/acre (Figure 7).

Walleye from 5 to 27 inches (total length; TL) were present in the gillnet sample (Figure 8). The 2007 year class, now two years old, is above the third quartile and thus the third consecutive strong year class of walleye to establish in Leech Lake (2005-2007). The 2008 year class appears to be below-average, not surprising considering the cooler water temperatures experienced by the cohort during their first growing season and the magnitude of preceding year classes. Observed median lengths of the 2008, 2007, and 2006 year classes were approximately 9, 13, and 16 inches TL, respectively. While older year classes are still above the long-term length-at-age average, growth appears to have slowed to historical levels. The 2005-2007 year classes comprised 79% of the total walleye gillnet catch (Tables 8 and 9).

Walleye growth, indexed by mean length-at-age of fish caught in gillnets, was above the long-term average for all age groups (Figure 9; Tables A1-A4). Growth rates among sexes were similar until age-2 in both basins, after which females were consistently longer than males of the same age. Walleye length-at-catch was consistently longer for fish sampled in the main lake compared to the western bays. Calculated length and age of female walleye at 50% sexual maturity was 19.2 inches and 3.5 years, respectively (Table 8). Male walleye mature earlier than females and consequently grow slower because energy is allocated from physical growth (length) to gonad development (Table 9).

A suite of biological performance indicators (BPIs), or population response metrics, were developed to monitor exploitation of Minnesota's large lake walleye populations (Gangl and Pereira 2003). Exceedence of BPI threshold levels can indicate overharvest or, more precisely, increased mortality. One of the first physical signs of increased mortality is increased growth and earlier maturity rates. Over the past several years, mean length at age-3, omega, and female age at 50% maturity, all three of which are either direct measures of growth or are strongly influenced by growth, have shown cause for concern (Figures 10 and 11). While the same holds true for 2009 in that mean length at age-3 and omega still exceed their respective thresholds, the status of all three metrics are improving, and female age at 50% maturity has returned to its respective threshold. Furthermore, female length at 50% maturity continues to increase and female age diversity remains well-above its threshold, indicating that the 18-26" protected slot has had a positive effect on the population and that the population is beginning to revert to a more stable state. Therefore, while some BPIs that are most influenced by growth still exceed threshold values, nearly all BPIs indicate an overall improvement to the population.

### *Yellow Perch*

Similar to the walleye catch rate, the 2009 yellow perch gillnet catch-per-effort of 25.8 fish/net is down slightly from 2008 observations (26.6 fish/net) but above the 1983-2009 average of 22.0 fish/net (Figures 5 and 6). Historically, gill net catch rates have ranged from 12.9 fish/net (2005) to 37.7 fish/net (1995). Catch rates of yellow perch in the main lake were 14.5 fish/net, below its respective average, and 40.0 fish/net in the western bays, above its respective average (Table 5). By area, yellow perch gillnet catch rates ranged from 6.0 fish/net (Pelican Island) to 59.5 fish/net (Steamboat Bay) (Table 7).

Lengths of yellow perch sampled with gillnets ranged from 5 to 12 inches TL (Figure 12). Of yellow perch sampled, approximately 33% were 8 inches or longer and 11% were 10 inches or longer. This is the second consecutive year since 2001 that the proportion of perch 10 inches or longer has exceeded 10%, and suggests that yellow perch fishing should continue to improve.

In general, growth of yellow perch, measured by mean length-at-age of fish caught in gillnets, was generally above the long-term average for nearly all male and female age groups in both basins (Tables A5-A8). Similar to walleye, yellow perch grow slightly faster in the main lake than in the western bays. Growth rates between sexes are similar through about age-3, after which females tend to be larger than males of the same age. Length and age of female yellow perch at 50% sexual maturity were approximately 6.5 inches and 2.5 years, respectively (Table 10). Males tend to reach sexual maturity before they are effectively sampled by gillnets (Table 11).

### *Northern Pike*

The 2009 gillnet catch rate of northern pike of 4.94 fish/net is down slightly from 2008 but remains above the long-term average of 4.8 fish/net (Figures 5 and 6). Northern pike gillnet catch rates have been relatively stable, ranging from 3.6 fish/net (1993) to 6.2 fish/net (1995). Consistent with long-term trends, mean catch rate during 2009 was higher in the western bays (5.56 fish/net) then in the main lake (4.45 fish/net) (Table 5), likely due to the dense vegetation frequently found in the western bays that supports a higher density of northern pike. By area, gillnet catch rates of northern pike ranged from 1.25 fish/net (Pelican Island) to 8.25 fish/net (Kabekona Bay) (Table 7). Lengths of northern pike ranged from 11 to 32 inches (Figure 13).

Growth rates of northern pike, indexed by length-at-age of fish captured in gillnets, were near the long-term averages for most age classes of males and females in both basins (Tables A9-A12). The majority of both male and female northern pike sampled had reached sexual maturity by age 1 (Tables 12 and 13). Generally, males and females have similar lengths through age 2, after which females grow faster and achieve larger sizes. Similar to walleye and yellow perch, northern pike in Leech Lake tend to grow slightly faster in the main lake than in the western bays.

### *Cisco (Tullibee)*

The 2009 catch rate of 11.9 fish/net was well-above the 1983-2009 average of 5.65 fish/net (Figures 5 and 6) and is the highest observed since 1987. Gillnet catch rates of cisco have varied considerably, ranging from 0.6 fish/net (2006) to 18.5 fish/net (1987). Catch rates were lower in the western bays (5.50 fish/net) than in the main lake (17.05 fish/net). Cisco catch rates had been in a general state of decline since the mid-1990's, and this trend was most prominent in the main lake where coldwater refuge for this species is limited during summer months. Cisco, particularly in the main lake, likely benefited from the cooler summer weather patterns during 2008-2009. Strong year classes produced during 2007-2008 are apparent, and this trend is consistent with other nearby large lakes (eg. Winnibigoshish and Cass). Cisco catch rates during 2009 ranged from 0.00 fish/net (Kabekona and Steamboat bays) to 42.75 fish/net (Pine Point) (Table 7). Lengths of cisco sampled in gill nets ranged from 6 to 16 inches.

### *Bullheads*

The collective 2009 gillnet catch rate of bullhead species was 2.31 fish/net and ranged from 0.00 fish/net (Pelican, Pine, and Portage bay sets) to 9.25 fish/net (Steamboat Bay). The gill net catch rate for black bullhead (*Ictalurus melas*) was 0.31 fish/set, which is below the long-term mean catch rate of 5.92 fish/set. The catch rate of yellow bullhead (*I. natalis*) was 1.36 fish/set and is below the historical mean of 1.54 fish/net. The catch rate of brown bullhead (*I. nebulosus*) was 0.64 fish/net, which is also below the long-term average (1.68 fish/set). Of the 83 bullhead sampled, 28% were brown bullhead, 13% were black bullhead, and 59% were yellow bullhead.

### *Other Species*

Other species, which include bowfin, burbot, lake whitefish, muskellunge, rock bass, pumpkinseed, bluegill, largemouth and smallmouth bass, and black crappie are not effectively sampled by experimental gill nets or are present in low numbers. Gill net catch rates for these species were within observed ranges from 1983-2009.

## **Discussion**

Overall, gillnet catch rates of primary species decreased slightly from 2008 but remained above respective long-term averages. The consistency in the walleye and yellow perch populations since 2005 are positive responses to recent management actions. The protected slot limit on walleye has successfully protected mature females in Leech Lake, thereby maintaining the reproductive capacity of the population. The recruitment and fast growth of the 2005-2007 walleye year classes have been the primary cause for the increase in overall walleye abundance and numerous reports of improved fishing quality in Leech Lake. However, density is an important factor regulating growth, maturity, and recruitment (Spangler et al. 1977; Muth and Wolfert 1986; Schueller et al. 2005). As a result, walleye population metrics in Leech Lake, which are indexed by the BPIs, seem to be returning to levels more concordant with historical averages as density-dependent effects are expressing themselves with increasing abundance. Some of these, such as female age and length at 50% maturity, had already begun improving towards historical levels at the time of the 2007 assessment. Furthermore, the changes in the walleye population have led to considerable improvements to the recreational fishery, as indicated by summer creel surveys conducted during 2008-2009 (Schultz 2009; D. Schultz, MN DNR, unpublished data).

Double-crested cormorant control efforts have reduced predatory pressures on yellow perch. While reductions in cormorant numbers have occurred with increases in perch abundance and size structure with no other management actions directed specifically at the perch population, concrete conclusions should be based on a thorough evaluation of yellow perch population dynamics.

Significant improvements in the cisco population are encouraging, as cisco are a primary and important forage species for top predators. Cooler summers have reduced thermal stress that can lead to significant summer kills and potentially hamper natural reproduction. This trend is most prominent in the shallower, more windswept main lake basin of Leech Lake where oxygen-rich coldwater habitat is limited. When unusually warm air temperatures are combined with strong winds, the entire water column is mixed and water temperatures increase markedly over a short period. In the case of coldwater species (e.g. cisco), as environmental temperatures exceed the thermal optima for proper physiological functions and are sustained at unusually high levels for extended periods (days to weeks), basic cellular processes begin to operate less efficiently. As explained more specifically by Pörtner (2001) and Pörtner and Knust (2007), oxygen demand for metabolic processes at the cellular level in fish increases exponentially with increases in temperature. At the same time, the capacity for water to retain oxygen diminishes with increasing temperature. Thermal stress occurs when aerobic metabolic demands exceed the capacity of the oxygen delivery system (ventilation and circulation). Therefore, thermal stress in fish can primarily be defined as an oxygen-limiting process, much like human aerobic performance at high altitudes. As temperatures continue to increase beyond the onset of physiological stress, or as this stress is prolonged, an oxygen deficiency can occur and eventually lead to mortality. Consequently, as the cisco population in Leech Lake will be limited to the constraints of temperature-mediated mortality as dictated by summer climate trends, the potential exists for impacts on other species, specifically the growth rates of predatory species.

# FRY STOCKING

## Introduction

Recruitment variability, or the variability in the size, or strength, of a year class, is influenced by a host of factors, including spawner abundance (Ricker 1975), predation (Hansen et al. 1998; Beard et al. 2003; Quist et al. 2003), spawning conditions (Hansen et al. 1998), forage abundance (Chevalier 1973), and lake morphology (Nate et al. 2001). In Minnesota's ten largest walleye lakes, strong year classes, as indexed by gillnet catch rates of 1-4 year old walleye, are defined as cohorts having a relative abundance in the upper 75$^{th}$ percentile of historically observed values. Strong year classes typically occur every 3 to 5 years in the large lakes. However, variable spawning and summer growing conditions can intermittently alter this frequency. Unfavorable reproductive conditions, a limited forage base, or high abundances of adult walleye can extend the time between large year classes. Fishing quality, defined by angler catch rates, closely parallels the occurrence of a strong year class. The downturn in the Leech Lake walleye fishery during the mid-2000's was a product of an extended period between large year classes. Proposed causes of missing year classes included double-crested cormorant predation on juvenile walleye, lower reproductive success by Leech Lake walleye in recent years, and potentially higher walleye egg mortality via rusty crayfish predation. Jarnot (2009) investigated the potential effects of rusty crayfish predation on walleye eggs and Göktepe (2008) evaluated cormorant predation on Leech Lake walleye. Therefore, the objective of this portion of the 2009 large lake work was to directly estimate walleye hatch rates in Leech Lake and to compare hatch rates observed in Leech Lake to those in other systems where similar quantitative methods have been used.

## Methods

During May 2009, 22.7 million Woman Lake/Boy River walleye fry were stocked into Leech Lake. All stocked fry were marked with oxytetracycline, an antibiotic that leaves an indelible mark on fish bones that allows researchers to identify them as a stocked fish. By stocking a known number of fry, the total number of wild fry at the time of stocking was estimated using a Peterson mark-recapture equation (Logsdon 2006); this is based on the ratio of marked (stocked) to unmarked (wild) YOY walleye collected during the seining, trawling, fall electrofishing, and gillnet sampling events. The hatch rate of wild fry can then be estimated as a percentage of estimated eggs carried the previous fall by mature females that hatched into fry the following spring at the time stocking occurred.

## Results

A total of 366 YOY walleye were collected using shoreline seining (July), bottom trawling (August), and shoreline electrofishing (September) and examined for the presence of an OTC mark. Of the fish examined, 50% were identified as stocked fish. The 2009 wild fry hatch rate was estimated to be 0.60%, the highest observed since walleye hatch rate estimation began in 2005 (Table 14). The wild fry population estimate was 22.3 million and the estimated number of total fry (stocked plus wild) was 45 million. Fry densities per littoral acre were 385 wild fry/littoral acre (LA) and 775 total fry/LA. The 2005-2007 year classes of walleye were established with densities less than 600 total fry/LA.

### Discussion

Red Lake, with its windswept gravel substrate, has historically been considered ideal habitat for a self-sustaining walleye population. The collapse of the Red Lake walleye fishery during the 1990's provided a unique opportunity to characterize walleye recruitment dynamics during the recovery period. Walleye hatch rates in Red Lake were estimated from 1999-2003 using methods similarly described for Leech Lake and have served as a description, or benchmark, of good reproduction in self-sustaining walleye populations.

The range of walleye hatch rates in Leech Lake is very similar to those observed in Red Lake and the average hatch rate in Leech Lake has been slightly higher than that observed in Red Lake. Thus, these data strongly suggest there is no fundamental problem with walleye reproduction in Leech Lake and should alleviate concerns that rusty crayfish are negatively impacting walleye recruitment.

Walleye fry stocking has contributed to the establishment of recent year classes in Leech Lake. However, the hypothesis that these contributions have been entirely additive is not supported by the data. Total walleye fry stocked has ranged from approximately 7.5 million fry in 2005 and 2007 to 22.5 million fry in 2009, or roughly three times higher. While this difference has been expressed to some extent as a higher percentage of marked YOY within the 2006, 2008, and 2009 year classes, the overall gillnet catch rate of the 2006 and 2008 year class at ages 1-2 has not been of similar magnitudes higher (e.g. 3 times higher than the gillnet catch rates of the 2005 and 2007 year classes). Biological limitations (i.e. carrying capacity) are likely acting on these cohorts via replacement of wild fish and increased total mortality, which in turn limits the number of fish successfully surviving through their first winter.

## OTHER WORK

### Water Quality

Water samples were collected at stations 1 and 5 on 20 July 2009. The Minnesota Department of Agriculture Chemistry Laboratory in St. Paul, Minnesota analyzed these samples for total phosphorus concentration, conductivity, chlorophyll a, pH, total alkalinity and total dissolved solids. Oxygen and temperature profiles were not taken as during previous years due to staffing shortages.

There has been no apparent change in water quality since the inception of the Large Lake Program. In general, Walker Bay is less productive with better water clarity than the main lake (Table 15). Typically, deep water stations thermally stratify and experience dissolved oxygen depletion near the thermocline while main lake stations do not thermally stratify and maintain good dissolved oxygen concentration throughout the water column. Due to staffing shortages, temperature-oxygen profiles were not completed during 2009 (Figure 14 – no data collected).

**Aquatic Invasive Species**

A survey of Leech Lake boat harbors in 2004 found established beds of Eurasian watermilfoil (EWM) in several harbors between Stony and Rogers points and were immediately treated with aquatic herbicide. Every year since 2004 harbors have been checked for EWM by DNR personnel and treated when necessary. Extensive searches have not yet discovered rooted EWM outside of harbors to date and treatments have resulted in the eradication of EWM from some harbors. However, this invasive species continues to be discovered in new harbors throughout Leech Lake. Reports from lakeshore owners were investigated in conjunction with harbor searches by DNR crews in August 2009. EWM was found in 13 boat harbors, four of which were previously uninfested (Figure 15.). These four locations included one in Sucker Bay, one near Bear Island, one near Five Mile Point, and one near Diamond Point. Of the 13 infested harbors, 10 were chemically treated and three had the EWM removed by hand. EWM is now considered widespread across the main basin of Leech Lake.

While conducting EWM harbor searches on Leech Lake during 2009 curly-leaf pondweed (CLP) (*Potamogeton crispus*) was identified and removed from a harbor near Whipholt Beach. This is not the first occurrence of CLP in Leech Lake as it has been previously documented in the Leech River Bay near Federal Dam. Like EWM, CLP can be an aggressive invasive aquatic plant and DNR personnel and lakeshore owners will continue to monitor CLP presence in Leech Lake.

**Double-crested cormorant control**

A total of 3,084 adult cormorants were removed from Leech Lake during 2009, bringing the overall total to nearly 15,000 birds culled since work began in 2005 (Figure 16) and making Leech Lake the largest single control site in the U.S. (S. Mortensen, LLBO Division of Resource Management, personal communication). Small yellow perch have been the most common component of cormorant diets (LLBO 2007). The results of the diet study will be used to evaluate various cormorant control scenarios and to determine the appropriate cormorant population level that Leech Lake can support without impacting fishing quality. Additional diet work is scheduled by the LLBO DRM during 2010 (S. Mortensen, personal communication).

## SUMMARY

Recent management actions and favorable environmental conditions have allowed for quick and thus far sustained improvements in the Leech Lake yellow perch and walleye populations. Cormorant control efforts since 2005 have contributed to the dramatic increase of yellow perch, particularly in the main lake. Good recruitment and favorable growing conditions have led to the establishment of strong walleye year classes in 2005-2007. The strength of the 2009 year class will hinge largely on growth accrued during September, winter survival, and forage availability.

Growth of recent walleye year classes, indexed by length at age, is slowing. Fast growth greatly contributed to the rapid improvements in fishing quality that walleye anglers have been enjoying since 2007. The current walleye regulation (protected slot limit where all walleye from 18 inches to 26 inches must be immediately returned to the water, possession limit of four fish, one of which can be longer than 26.0 inches) has also benefited fishing quality by increasing the number of older, larger walleye in the population for anglers to catch. Furthermore, results of the creel surveys conducted during 2008-2009 indicated extremely good walleye fishing on Leech Lake throughout the summer. Another survey is scheduled for summer 2010.

Regarding walleye reproduction, rusty crayfish did not predate on walleye eggs at statistically higher rates than native crayfish (Jarnot 2009). Additionally, walleye hatch rates in Leech Lake have been very similar to those observed in Red Lake, a lake characterized by robust walleye production and no documented invasive species. These findings suggest that there is no systemic problem with walleye reproduction in Leech Lake.

Benchmarks used to evaluate the success of the 2005-2010 action plan designed to improve the walleye population include a standing stock biomass of mature females maintained at 1.25-1.75 pounds/acre, an increase in the walleye gillnet catch rate to at least 7.4 fish/net, at least 50% of walleye sampled in experimental gillnets being shorter than 15.0 inches, and the establishment of two strong year classes of walleye between 2005-2010. As in 2007-2008, nearly all goals for this action plan have been met or exceeded in 2009. The estimated spawner biomass in 2008 was 1.49 pounds of walleye per acre. The gillnet catch rate in 2009 remained above the 1983-2004 average of 7.4 walleye/net. Of the 310 walleye sampled in 2009 gillnet sets, 42% were shorter than 15.0 inches; the fast growth exhibited by 2006-2007 year classes in combination with a below-average year class produced during 2008 is why the goal of 50% was not sustained. Length-based metrics such as this one will inherently be subject to variability in recruitment and growth, especially when gill net selectivity is considered. Furthermore, strong year classes of walleye were produced during 2005, 2006, and 2007.

In addition to the dramatic improvements to the walleye and yellow perch populations, Leech Lake continues to support numerous sportfish populations that appear relatively healthy or unchanged, and remains a destination for many anglers pursuing quality multi-species angling opportunities. Northern pike abundance remains above average and the size structure of the yellow perch population has improved considerably. Anglers frequently report catching bluegills up to 10 inches, and the relative abundance of black crappie, as indexed by gillnet catches, is also above average. Leech Lake continues to be a destination for several bass, muskellunge, and walleye fishing tournaments each year.

Thus far, the aggressive monitoring and treatment of Eurasian watermilfoil (EWM) appears to have kept this invasive plant in check. Unfortunately, the plant continues to be found at new locations around the lake each year. Constant awareness by users and property owners alike is paramount to prevent the spread and establishment of EWM to new locations.

## RECOMMENDATIONS

Leech Lake supports a diverse fish population and maintains good water quality. However, human development continues to expand throughout the area and, as more people relocate to this area and recreate on and around Leech Lake, the opportunities for further detrimental effects from human activities will continue to increase. Habitat protection measures should continue to be a priority to ensure the ecological resilience of Leech Lake is not compromised. This can be done through scrutinizing development proposals within the watershed using the environmental review process. Projects that are approved should use techniques that minimize impacts to the resource. Landowners within the watershed should be encouraged to use Best Management Practices (BMPs), especially along the lakeshore. A comprehensive list of sensitive shoreline that is prone to development is in the process of being drafted to prioritize conservation action, particularly on new developments. In addition, these landowners should be contacted and made aware of options such as conservation easements. Efforts such as these provide the best opportunities to sustain the quality resources that Leech Lake provides.

Education and communication efforts are extremely valuable in changing attitudes and perceptions about what does or does not impact ecosystem health. News releases, articles in local papers, and newsletters such as the Leech Lake Update to resorts and interested clientele are some of the avenues that should be continued and expanded.

Continued monitoring and treatment of harbors with Eurasian watermilfoil is planned for 2010. Additional educational contacts should be made to those that use the harbors, with increased effort during high use periods. Cooperation of the harbor owners is critical to successful outreach. Similar efforts are needed to prevent the introduction of other exotic species, such as zebra mussels or spiny waterflea, which have already established in other Minnesota systems.

Annual monitoring of fish populations and water quality analyses should continue. The vegetation study that began in 2002 was completed in 2005, and the information obtained will further our understanding of fish habitats and identify areas of concern. Muskellunge, largemouth bass, bluegill and black crappie sampling should be conducted given adequate staff time. The effects of thermal stress on cisco, specifically recruitment and mortality, should also be explored. Double-crested cormorant control efforts on Leech Lake should continue as prescribed by the management plan for this species. Finally, to completely evaluate walleye reproduction capacity in Leech Lake, true stocking blanks, years where no stocking occurs, should be scheduled.

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**TABLES**

Table 1. Catch-per-effort of all species captured in seine (fish/haul) and trawl (fish/hour) hauls, Leech Lake, 2009. Age 1+ includes all non-YOY fish captured.

| Species | Age | Seine (fish/haul) | Trawl (fish/hour) |
|---|---|---|---|
| Banded killifish | All | 0.06 | |
| Bigmouth shiner | All | 0.92 | - |
| Black bullhead | All | - | - |
| Bluegill | 0 | - | 0.63 |
| Bluegill | 1+ | 0.39 | 0.63 |
| Bluntnose minnow | All | 3.11 | 19.58 |
| Brook stickleback | All | 0.03 | - |
| Burbot | 0 | - | 1.26 |
| Cisco | All | - | 8.21 |
| Common shiner | All | 0.33 | - |
| Emerald shiner | All | - | - |
| Fathead minnow | All | 0.03 | |
| Iowa darter | All | 0.67 | 0.63 |
| Johnny darter | All | 4.86 | 40.42 |
| Largemouth bass | 0 | 0.39 | 14.53 |
| Largemouth bass | 1+ | - | 0.63 |
| Logperch | All | 1.56 | 80.84 |
| Longnose dace | All | 0.89 | - |
| Mimic shiner | All | 143.72 | 210.95 |
| Mottled sculpin | All | - | 0.63 |
| Northern pike | 1+ | - | 3.16 |
| Pumpkinseed | All | 0.03 | - |
| Rock bass | 0 | - | 0.63 |
| Sand shiner | All | - | - |
| Smallmouth bass | All | 0.20 | 5.05 |
| Spotfin shiner | All | 3.08 | - |
| Spottail shiner | All | 11.81 | 445.26 |
| Tadpole madtom | All | - | 10.74 |
| Trout-perch | All | 0.06 | 795.16 |
| Walleye | 0 | 20.06 | 153.47 |
| Walleye | 1+ | - | 29.68 |
| White sucker | 0 | 30.14 | 20.21 |
| White sucker | 1+ | - | 4.42 |
| Yellow perch | 0 | 97.08 | 8,897.70 |
| Yellow perch | 1+ | 25.83 | 1,553.69 |

Table 2. Catch-per-effort (fish/haul) of young-of-year walleye and yellow perch at long-term seining stations, Leech Lake, 2009. A total of eight hauls were completed at each station.

| Station Name | Walleye/haul | Yellow Perch/haul |
|---|---|---|
| Whipholt Beach | 7.17 | 50.50 |
| Stoney Point | 35.88 | 104.50 |
| Traders Bay | 6.38 | 183.75 |
| Ottertail point | 40.00 | 67.38 |
| Fivemile Point | 2.63 | 43.38 |

Table 3. Catch-per-effort (fish/hour) of young-of-year walleye and yellow perch at long-term trawling stations, Leech Lake, 2009.

| Station Name | N Hauls | Walleye/hour | Yellow Perch/hour |
|---|---|---|---|
| Fivemile Point | 7 | 158 | 3,214 |
| Goose Island | 6 | 198 | 7,038 |
| Whipholt Beach | 6 | 104 | 17,388 |

Table 4. Catch-per-effort (CPE) of young-of-year walleye in selected gears and associated year class strength (YCS) indices. Incomplete estimates of observed and predicted walleye YCS (± 95% confidence intervals) are in bold.

| | | | | Year Class Strength (Schupp) | | |
|---|---|---|---|---|---|---|
| Year Class | Trawl CPE (fish/hour) | Gillnet CPE (fish/net) | Electrofishing CPE (fish/hour) | Observed | Eq. 1 Predicted | Eq. 2 Predicted |
| 1983 | | 0.22 | | 115 | | |
| 1984 | | 0.36 | | 61 | | |
| 1985 | | 0.03 | | 160 | | |
| 1986 | | 0.08 | | 162 | | |
| 1987 | 49 | 0.11 | | 63 | 82 | 56 |
| 1988 | 128 | 1.81 | | 239 | 97 | 232 |
| 1989 | 62 | 0.06 | | 49 | 84 | 55 |
| 1990 | 72 | 0.03 | | 69 | 86 | 55 |
| 1991 | 58 | 0.47 | | 97 | 84 | 91 |
| 1992 | 103 | 0.00 | | 25 | 92 | 62 |
| 1993 | 16 | 0.00 | | 10 | 76 | 36 |
| 1994 | 493 | 0.08 | | 230 | 166 | 182 |
| 1995 | 183 | 0.51 | | 126 | 107 | 131 |
| 1996 | 262 | 0.14 | | 91 | 122 | 120 |
| 1997 | 5 | 0.29 | | 188 | 73 | 59 |
| 1998 | 139 | 0.47 | | 64 | 99 | 114 |
| 1999 | 348 | 0.56 | | 97 | 139 | 183 |
| 2000 | 28 | 0.14 | | 37 | 78 | 53 |
| 2001 | 103 | 0.69 | | 83 | 92 | 124 |
| 2002 | 38 | 0.31 | | 80 | 80 | 71 |
| 2003 | 27 | 0.08 | | 29 | 78 | 47 |
| 2004 | 3 | 0.00 | | 20 | 73 | 33 |
| 2005 | 247 | 0.03 | 60 | 126 | 120 | 106 |
| **2006** | **240** | **0.69** | **35** | **248** | **118 ± 35** | **150 ± 32** |
| **2007** | **31** | **1.47** | **27** | **142** | **78 ± 37** | **176± 60** |
| **2008** | **508** | **0.00** | **42** | **79** | **169 ± 79** | **145 ± 62** |
| **2009** | **153** | **0.03** | **164** | | **102 ± 30** | **72 ± 28** |
| Mean | 143.3 | 0.32 | 66 | 103 | | |

Equation 1: YCS = (0.19069*trawl CPE) + 72.45884

Equation 2: YCS = (0.21488*trawl CPE) + (90.54184*gillnet CPE) + 36.3263

Table 5. Gillnet catch-per-effort (fish/net) summary by species and basin for Leech Lake, 2009.

| | | Western Bays | | | Main Lake | | | Overall (Whole Lake) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1983-2009 | | | 1983-2009 | | | 1983-2009 | |
| Code | Species | 2009 | Mean | s.e. | 2009 | Mean | s.e. | 2009 | Mean | s.e. |
| BLB | Black bullhead | 0.69 | 10.12 | 1.88 | 0.00 | 2.51 | 0.69 | 0.31 | 6.34 | 1.15 |
| BLC | Black crappie | 0.25 | 0.35 | 0.08 | 1.85 | 0.46 | 0.08 | 1.14 | 0.35 | 0.07 |
| BLG | Bluegill | 1.38 | 0.73 | 0.16 | 0.90 | 0.30 | 0.07 | 1.11 | 0.44 | 0.10 |
| BOF | Bowfin | 0.06 | 0.11 | 0.02 | 0.10 | 0.04 | 0.01 | 0.08 | 0.07 | 0.01 |
| BRB | Brown bullhead | 0.81 | 2.02 | 0.23 | 0.50 | 1.28 | 0.21 | 0.64 | 1.71 | 0.20 |
| BUB | Burbot | 0.00 | 0.03 | 0.01 | 0.00 | 0.07 | 0.01 | 0.00 | 0.06 | 0.01 |
| HBS | Hybrid sunfish | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| LKW | Lake whitefish | 0.06 | 0.09 | 0.04 | 0.00 | 0.03 | 0.01 | 0.03 | 0.06 | 0.02 |
| LMB | Largemouth bass | 0.19 | 0.13 | 0.03 | 0.05 | 0.09 | 0.03 | 0.11 | 0.10 | 0.02 |
| MUE | Muskellunge | 0.00 | 0.04 | 0.01 | 0.10 | 0.01 | 0.00 | 0.06 | 0.04 | 0.01 |
| NOP | Northern pike | 5.56 | 5.33 | 0.23 | 4.45 | 4.43 | 0.15 | 4.94 | 4.80 | 0.15 |
| PMK | Pumpkinseed | 0.63 | 1.13 | 0.15 | 0.70 | 0.57 | 0.11 | 0.67 | 0.78 | 0.10 |
| RKB | Rock bass | 3.81 | 3.22 | 0.31 | 0.85 | 0.27 | 0.03 | 2.17 | 1.56 | 0.14 |
| SHR | Shorthead redhorse | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SMB | Smallmouth bass | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| TME | Tiger muskellunge | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| TLC | Tulibee/cisco | 5.50 | 5.00 | 0.93 | 17.05 | 6.20 | 1.08 | 11.92 | 5.56 | 0.86 |
| WAE | Walleye | 4.44 | 5.77 | 0.34 | 11.95 | 9.06 | 0.72 | 8.61 | 7.50 | 0.49 |
| WTS | White sucker | 1.75 | 1.31 | 0.09 | 0.55 | 1.78 | 0.17 | 1.08 | 1.63 | 0.12 |
| YEB | Yellow bullhead | 1.88 | 2.26 | 0.29 | 0.95 | 0.92 | 0.17 | 1.36 | 1.51 | 0.19 |
| YEP | Yellow perch | 40.00 | 25.95 | 1.37 | 14.50 | 18.84 | 1.90 | 25.83 | 21.69 | 1.35 |

Table 6. Length-frequency distribution of all species sampled in experimental gillnet sets, Leech Lake, 2009.

| | Species | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | NOP | | | |
| TL (inches) | BLB | BLC | BLG | BOF | BRB | BUB | LKW | LMB | MUE | M | F | All | PMK |
| <4.00 | | | 5 | | | | | | | | | | 2 |
| 4.00-4.49 | | | 3 | | | | | | | | | | 5 |
| 4.50-4.99 | | | 6 | | | | | | | | | | 7 |
| 5.00-5.49 | | | 3 | | | | | | | | | | 1 |
| 5.50-5.99 | | | 2 | | | | | 1 | | | | | 2 |
| 6.00-6.49 | | | 3 | | | | | | | | | | 3 |
| 6.50-6.99 | | | 4 | | | | | | | | | | 3 |
| 7.00-7.49 | | | 3 | | | | | 2 | | | | | 1 |
| 7.50-7.99 | | 5 | 1 | | | | | | | | | | |
| 8.00-8.49 | | 5 | 8 | | | | | | | | | | |
| 8.50-8.99 | | 7 | 1 | | | | | | | | | | |
| 9.00-9.49 | | 3 | 1 | | | | | | | | | | |
| 9.50-9.99 | | 4 | | | | | | | | | | | |
| 10.00-10.49 | 2 | 4 | | | 1 | | | | | | | | |
| 10.50-10-99 | 2 | 7 | | | 3 | | | 1 | | | | | |
| 11.00-11.49 | 4 | 2 | | | 4 | | | | | 1 | | 1 | |
| 11.50-11.99 | 1 | 1 | | | 7 | | | | | | | | |
| 12.00-12.99 | 1 | 1 | | | 2 | | | | | | 1 | 1 | |
| 13.00-13.99 | 1 | 2 | | | 5 | | | | | | 3 | 3 | |
| 14.00-14.99 | | | | | 1 | | | | | 1 | 1 | 2 | |
| 15.00-15.99 | | | | | | | | | | 1 | 2 | 3 | |
| 16.00-16.99 | | | | | | | | | | 4 | 1 | 5 | |
| 17.00-17.99 | | | | | | | | | | 3 | 4 | 7 | |
| 18.00-18.99 | | | | 1 | | | | | | 10 | 4 | 14 | |
| 19.00-19.99 | | | | | | | | | | 11 | 7 | 18 | |
| 20.00-20.99 | | | | | | | | | | 10 | 7 | 17 | |
| 21.00-21.99 | | | | 1 | | | | | | 10 | 4 | 14 | |
| 22.00-22.99 | | | | | | | 1 | | | 10 | 9 | 19 | |
| 23.00-23.99 | | | | | | | | | | 6 | 8 | 14 | |
| 24.00-24.99 | | | | | | | | | | 4 | 8 | 12 | |
| 25.00-25.99 | | | | | | | | | | | 11 | 11 | |
| 26.00-26.99 | | | | 1 | | | | | 1 | | 6 | 6 | |
| 27.00-27.99 | | | | | | | | | | | 10 | 10 | |
| 28.00-28.99 | | | | | | | | | | | 6 | 6 | |
| 29.00-29.99 | | | | | | | | | | | 7 | 7 | |
| 30.00-30.99 | | | | | | | | | | 1 | 4 | 5 | |
| 31.00-31.99 | | | | | | | | | | | 1 | 1 | |
| 32.00-32.99 | | | | | | | | | | | 2 | 2 | |
| 33.00-33.99 | | | | | | | | | | | | | |
| 34.00-34.99 | | | | | | | | | | | | | |
| 35.00-35.99 | | | | | | | | | | | | | |
| ≥ 36.00 | | | | | | | | | 1 | | | | |
| Total | 11 | 41 | 40 | 3 | 23 | 0 | 1 | 4 | 2 | 72 | 106 | 178 | 24 |

Table 6 continued. Length-frequency distribution of all species sampled in experimental gillnet sets, Leech Lake, 2009.

| | Species | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | WAE | | | | | YEP | | |
| TL (inches) | RKB | SHR | SMB | TME | TLC | M | F | All | WTS | YEB | M | F | All |
| <4.00 | 2 | | | | | | | | | | | | |
| 4.00-4.49 | | | | | | | | | | | | | |
| 4.50-4.99 | 2 | | | | | | | | | | | | |
| 5.00-5.49 | 4 | | | | | 1 | | 1 | | | 33 | 4 | 37 |
| 5.50-5.99 | 2 | | | | | | | | | | 88 | 69 | 157 |
| 6.00-6.49 | 7 | | | | | | | | | | 72 | 94 | 166 |
| 6.50-6.99 | 9 | | | | 3 | | | | 3 | | 32 | 57 | 89 |
| 7.00-7.49 | 8 | | | | 20 | 1 | | 1 | | | 30 | 47 | 77 |
| 7.50-7.99 | 2 | | | | 29 | 1 | 1 | 2 | | 1 | 32 | 67 | 99 |
| 8.00-8.49 | 7 | | | | 15 | 3 | 5 | 8 | | | 12 | 51 | 63 |
| 8.50-8.99 | 4 | | | | 24 | 1 | 1 | 2 | 1 | 1 | 2 | 34 | 36 |
| 9.00-9.49 | 6 | | | | 113 | 3 | 5 | 8 | | 2 | 6 | 46 | 52 |
| 9.50-9.99 | 8 | | | | 110 | 4 | 1 | 5 | 1 | 4 | 6 | 44 | 50 |
| 10.00-10.49 | 12 | | | | 24 | | 1 | 1 | 1 | 9 | 3 | 30 | 33 |
| 10.50-10-99 | 4 | | | | 1 | | | | | 9 | 2 | 25 | 27 |
| 11.00-11.49 | | | | | | 3 | 1 | 4 | 5 | 6 | 4 | 28 | 32 |
| 11.50-11.99 | 1 | | | | 5 | 1 | 1 | 2 | 3 | 8 | | 10 | 10 |
| 12.00-12.99 | | | | | 56 | 7 | 18 | 25 | 5 | 7 | | 2 | 2 |
| 13.00-13.99 | | | | | 17 | 19 | 26 | 45 | 1 | 2 | | | |
| 14.00-14.99 | | | | | 3 | 5 | 21 | 26 | 2 | | | | |
| 15.00-15.99 | | | | | 7 | 14 | 21 | 35 | 3 | | | | |
| 16.00-16.99 | | | | | 2 | 13 | 24 | 37 | 5 | | | | |
| 17.00-17.99 | | | | | | 1 | 21 | 22 | 3 | | | | |
| 18.00-18.99 | | | | | | 7 | 8 | 15 | 4 | | | | |
| 19.00-19.99 | | | | | | 8 | 19 | 27 | 2 | | | | |
| 20.00-20.99 | | | | | | 5 | 10 | 15 | | | | | |
| 21.00-21.99 | | | | | | 5 | 5 | 10 | | | | | |
| 22.00-22.99 | | | | | | 3 | 2 | 5 | | | | | |
| 23.00-23.99 | | | | | | 2 | 7 | 9 | | | | | |
| 24.00-24.99 | | | | | | | 1 | 1 | | | | | |
| 25.00-25.99 | | | | | | | 3 | 3 | | | | | |
| 26.00-26.99 | | | | | | | | | | | | | |
| 27.00-27.99 | | | | | | | 1 | 1 | | | | | |
| 28.00-28.99 | | | | | | | | | | | | | |
| 29.00-29.99 | | | | | | | | | | | | | |
| 30.00-30.99 | | | | | | | | | | | | | |
| 31.00-31.99 | | | | | | | | | | | | | |
| 32.00-32.99 | | | | | | | | | | | | | |
| 33.00-33.99 | | | | | | | | | | | | | |
| 34.00-34.99 | | | | | | | | | | | | | |
| 35.00-35.99 | | | | | | | | | | | | | |
| ≥36.00 | | | | | | | | | | | | | |
| Total | 78 | 0 | 0 | 0 | 429 | 107 | 203 | 310 | 39 | 49 | 322 | 608 | 930 |

Table 7. Mean (± s.e.) gillnet catch-per-effort (fish/net) by sampling area for selected species, Leech Lake, 2009.

| | Walleye/net | | Yellow perch/net | |
|---|---|---|---|---|
| Station | Number | Pounds | Number | Pounds |
| Agency Bay | 6.50 (2.18) | 7.01 (2.06) | 24.75 (6.94) | 5.00 (1.39) |
| Bear Island | 10.00 (5.74) | 14.63 (6.68) | 12.50 (5.69) | 3.77 (1.76) |
| Kabekona Bay | 5.50 (2.53) | 8.73 (4.79) | 27.75 (15.53) | 6.10 (4.37) |
| Pelican Island | 9.00 (2.45) | 11.93 (1.89) | 6.00 (5.67) | 2.03 (1.34) |
| Pine Point | 19.50 (4.63) | 23.95 (7.07) | 13.00 (6.28) | 3.66 (1.89) |
| Portage Bay | 12.00 (1.58) | 18.71 (3.19) | 8.75 (5.42) | 2.04 (1.50) |
| Steamboat Bay | 3.00 (0.91) | 9.15 (2.62) | 59.50 (9.51) | 11.43 (2.55) |
| Sucker Bay | 9.25 (3.12) | 16.63 (6.64) | 32.25 (15.09) | 7.71 (4.58) |
| Walker Bay | 2.75 (1.25) | 6.05 (3.87) | 48.00 (20.92) | 11.75 (7.77) |
| Mean | 8.61 (1.22) | 13.35 (1.73) | 25.83 (4.45) | 6.17 (1.27) |

| | Northern pike/net | | Tullibee/net | |
|---|---|---|---|---|
| Station | Number | Pounds | Number | Pounds |
| Agency Bay | 3.00 (1.08) | 9.33 (2.45) | 19.25 (11.00) | 4.61 (2.99) |
| Bear Island | 7.75 (3.79) | 23.97 (7.60) | 15.75 (11.08) | 17.71 (8.64) |
| Kabekona Bay | 8.25 (2.87) | 17.05 (6.14) | 0.00 (0.00) | 0.11 (-) |
| Pelican Island | 1.25 (0.25) | 2.97 (0.37) | 14.25 (4.97) | 5.87 (2.32) |
| Pine Point | 2.50 (0.87) | 9.84 (3.25) | 42.75 (13.54) | 21.00 (7.47) |
| Portage Bay | 3.00 (0.71) | 7.48 (1.59) | 11.00 (5.05) | 4.91 (1.76) |
| Steamboat Bay | 4.00 (0.82) | 8.59 (1.31) | 0.00 (0.00) | 0.00 (0.00) |
| Sucker Bay | 7.75 (2.17) | 25.11 (6.77) | 1.50 (1.50) | 1.84 (-) |
| Walker Bay | 7.00 (2.42) | 22.16 (6.60) | 2.75 (1.11) | 1.59 (0.68) |
| Mean | 4.94 (0.73) | 13.77 (1.87) | 11.92 (3.06) | 7.95 (2.11) |

Table 8. Age-length frequency distribution of immature and mature (bold, right) female walleye captured in experimental gillnets, Leech Lake, 2009.

| | Age | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length Group | 0 | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8+ | | Total | |
| < 4.0 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 4.0-4.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 5.0-5.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 6.0-6.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 7.0-7.9 | | | 1 | | | | | | | | | | | | | | | | 1 | **0** |
| 8.0-8.9 | | | 6 | | | | | | | | | | | | | | | | 6 | **0** |
| 9.0-9.9 | | | 6 | | | | | | | | | | | | | | | | 6 | **0** |
| 10.0-10.9 | | | 1 | | | | | | | | | | | | | | | | 1 | **0** |
| 11.0-11.9 | | | | | 2 | | | | | | | | | | | | | | 2 | **0** |
| 12.0-12.9 | | | | | 16 | | 2 | | | | | | | | | | | | 18 | **0** |
| 13.0-13.9 | | | | | 25 | | 1 | | | | | | | | | | | | 26 | **0** |
| 14.0-14.9 | | | | | 12 | | 8 | **1** | | | | | | | | | | | 20 | **1** |
| 15.0-15.9 | | | | | 3 | | 18 | | | | | | | | | | | | 21 | **0** |
| 16.0-16.9 | | | | | | | 22 | **2** | | | | | | | | | | | 22 | **2** |
| 17.0-17.9 | | | | | | | 17 | **2** | 2 | | | | | | | | | | 19 | **2** |
| 18.0-18.9 | | | | | | | 1 | | 3 | **3** | | **1** | | | | | | | 4 | **4** |
| 19.0-19.9 | | | | | | | | | 7 | **12** | | | | | | | | | 7 | **12** |
| 20.0-20.9 | | | | | | | | | 5 | **4** | | **1** | | | | | | | 5 | **5** |
| 21.0-21.9 | | | | | | | | | | **1** | | | | **1** | | **2** | | **1** | 0 | **5** |
| 22.0-22.9 | | | | | | | | | | | | | | | | **2** | | | 0 | **2** |
| 23.0-23.9 | | | | | | | | | | | | | | | | **1** | | **6** | 0 | **7** |
| 24.0-24.9 | | | | | | | | | | | | | | | | | | **1** | 0 | **1** |
| 25.0-25.9 | | | | | | | | | | | | | | | | | | **3** | 0 | **3** |
| 26.0-26.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 27.0-27.9 | | | | | | | | | | | | | | | | | | **1** | 0 | **1** |
| 28.0-28.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 29.0-29.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| > 30.0 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| Total | 0 | **0** | 14 | **0** | 58 | **0** | 69 | **5** | 17 | **20** | 0 | **2** | 0 | **1** | 0 | **5** | 0 | **12** | 158 | **45** |

Table 9. Age-length frequency distribution of immature and mature (bold, right) male walleye captured in experimental gillnets, Leech Lake, 2009.

| | Age | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length Group | 0 | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8+ | | Total | |
| < 4.0 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 4.0-4.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 5.0-5.9 | 1 | | | | | | | | | | | | | | | | | | 1 | **0** |
| 6.0-6.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 7.0-7.9 | | | 2 | | | | | | | | | | | | | | | | 2 | **0** |
| 8.0-8.9 | | | 4 | | | | | | | | | | | | | | | | 4 | **0** |
| 9.0-9.9 | | | 7 | | | | | | | | | | | | | | | | 7 | **0** |
| 10.0-10.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 11.0-11.9 | | | | | 4 | | | | | | | | | | | | | | 4 | **0** |
| 12.0-12.9 | | | | | 5 | **1** | 1 | | | | | | | | | | | | 6 | **1** |
| 13.0-13.9 | | | | | 13 | **2** | 4 | | | | | | | | | | | | 17 | **2** |
| 14.0-14.9 | | | | | 2 | **3** | | | | | | | | | | | | | 2 | **3** |
| 15.0-15.9 | | | | | | | | **13** | | **1** | | | | | | | | | 0 | **14** |
| 16.0-16.9 | | | | | | | 1 | **11** | | **1** | | | | | | | | | 1 | **12** |
| 17.0-17.9 | | | | | | | | **1** | | | | | | | | | | | 0 | **1** |
| 18.0-18.9 | | | | | | | | **1** | | **2** | | **1** | | | | **2** | | **1** | 0 | **7** |
| 19.0-19.9 | | | | | | | | | | **1** | | | | | | **2** | | **5** | 0 | **8** |
| 20.0-20.9 | | | | | | | | | | | | | | | | **1** | | **4** | 0 | **5** |
| 21.0-21.9 | | | | | | | | | | | | | | | | | | **5** | 0 | **5** |
| 22.0-22.9 | | | | | | | | | | | | | | | | | | **3** | 0 | **3** |
| 23.0-23.9 | | | | | | | | | | | | | | | | | | **2** | 0 | **2** |
| 24.0-24.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 25.0-25.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 26.0-26.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 27.0-27.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 28.0-28.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 29.0-29.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| > 30.0 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| Total | 1 | **0** | 13 | **0** | 24 | **6** | 6 | **26** | 0 | **5** | 0 | **1** | 0 | **0** | 0 | **5** | 0 | **20** | 44 | **63** |

Table 10. Age-length frequency distribution of immature and mature (bold, right) female yellow perch captured in experimental gillnets, Leech Lake, 2009.

| | Age | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length Group | 0 | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8+ | | Total | |
| <4.00 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 4.00-4.49 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 4.50-4.99 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 5.00-5.49 | | | | | 2 | **1** | 1 | | | | | | | | | | | | 3 | **1** |
| 5.50-5.99 | | | | | 26 | **4** | 27 | **6** | 4 | **2** | | | | | | | | | 57 | **12** |
| 6.00-6.49 | | | | | 2 | **2** | 43 | **20** | 16 | **8** | 2 | **1** | | | | | | | 63 | **31** |
| 6.50-6.99 | | | | | 1 | **1** | 19 | **16** | 5 | **10** | 2 | **2** | | **1** | | | | | 27 | **30** |
| 7.00-7.49 | | | | | | | 6 | **17** | 2 | **12** | 1 | **4** | 1 | **4** | | | | | 10 | **37** |
| 7.50-7.99 | | | | | | | 4 | **18** | 2 | **20** | 2 | **9** | | **10** | | **2** | | | 8 | **59** |
| 8.00-8.49 | | | | | | | 1 | **13** | | **17** | 1 | **13** | | **6** | | | | | 2 | **49** |
| 8.50-8.99 | | | | | | | | **4** | | **15** | | **6** | | **8** | | **1** | | | 0 | **34** |
| 9.00-9.49 | | | | | | | | | | **13** | | **16** | | **8** | | **9** | | | 0 | **46** |
| 9.50-9.99 | | | | | | | | | | **9** | | **10** | | **14** | | **11** | | | 0 | **44** |
| 10.00-10.49 | | | | | | | | | | **1** | | **3** | | **12** | | **13** | | **1** | 0 | **30** |
| 10.50-10-99 | | | | | | | | | | | | **1** | | **6** | | **16** | | **2** | 0 | **25** |
| 11.00-11.49 | | | | | | | | | | | | **3** | | **5** | | **13** | | **7** | 0 | **28** |
| 11.50-11.99 | | | | | | | | | | | | | | **4** | | **2** | | **4** | 0 | **10** |
| 12.00-12.99 | | | | | | | | | | | | | | | | | | **2** | 0 | **2** |
| 13.00-13.99 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 14.00-14.99 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| > 14.99 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| Total | 0 | **0** | 0 | **0** | 31 | **8** | 101 | **94** | 29 | **107** | 8 | **68** | 1 | **78** | 0 | **67** | 0 | **16** | 170 | **438** |

Table 11. Age-length frequency distribution of immature and mature (bold, right) male yellow perch captured in experimental gillnets, Leech Lake, 2009.

| | Age | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length Group | 0 | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8+ | | Total | |
| <4.00 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 4.00-4.49 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 4.50-4.99 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 5.00-5.49 | | | | | | **10** | | **13** | | **9** | | **1** | | | | | | | 0 | **33** |
| 5.50-5.99 | | | | | | **15** | | **46** | | **23** | | **4** | | | | | | | 0 | **88** |
| 6.00-6.49 | | | | | | | | **41** | | **22** | | **9** | | | | | | | 0 | **72** |
| 6.50-6.99 | | | | | | | | **19** | | **5** | | **6** | | **1** | | | | **1** | 0 | **32** |
| 7.00-7.49 | | | | | | | | **5** | | **11** | | **5** | | **8** | | | | **1** | 0 | **30** |
| 7.50-7.99 | | | | | | | | **2** | | **15** | | **8** | | **3** | | **2** | | **2** | 0 | **32** |
| 8.00-8.49 | | | | | | | | | | **4** | | **6** | | **2** | | | | | 0 | **12** |
| 8.50-8.99 | | | | | | | | | | **1** | | | | **1** | | | | | 0 | **2** |
| 9.00-9.49 | | | | | | | | | | **1** | | | | **3** | | **2** | | | 0 | **6** |
| 9.50-9.99 | | | | | | | | | | | | | | **2** | | **3** | | **1** | 0 | **6** |
| 10.00-10.49 | | | | | | | | | | | | | | **3** | | | | | 0 | **3** |
| 10.50-10-99 | | | | | | | | | | | | | | | | **1** | | **1** | 0 | **2** |
| 11.00-11.49 | | | | | | | | | | | | | | **1** | | **2** | | **1** | 0 | **4** |
| 11.50-11.99 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 12.00-12.99 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 13.00-13.99 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 14.00-14.99 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| > 14.99 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| Total | 0 | **0** | 0 | **0** | 0 | **25** | 0 | **126** | 0 | **91** | 0 | **39** | 0 | **24** | 0 | **10** | 0 | **7** | 0 | **322** |

Table 12. Age-length frequency distribution of immature and mature (bold, right) female northern pike captured in experimental gillnets, Leech Lake, 2009.

| | Age | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length Group | 0 | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8+ | | Total | |
| < 4.0 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 4.0-4.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 5.0-5.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 6.0-6.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 7.0-7.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 8.0-8.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 9.0-9.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 10.0-10.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 11.0-11.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 12.0-12.9 | | | 1 | | | | | | | | | | | | | | | | 1 | **0** |
| 13.0-13.9 | 1 | | 2 | | | | | | | | | | | | | | | | 3 | **0** |
| 14.0-14.9 | | | | **1** | | | | | | | | | | | | | | | 0 | **1** |
| 15.0-15.9 | | | | **1** | | **1** | | | | | | | | | | | | | 0 | **2** |
| 16.0-16.9 | | | | **1** | | | | | | | | | | | | | | | 0 | **1** |
| 17.0-17.9 | | | | **2** | | **2** | | | | | | | | | | | | | 0 | **4** |
| 18.0-18.9 | | | | **1** | | **3** | | | | | | | | | | | | | 0 | **4** |
| 19.0-19.9 | | | | **1** | | **4** | | **2** | | | | | | | | | | | 0 | **7** |
| 20.0-20.9 | | | | | | **6** | | **1** | | | | | | | | | | | 0 | **7** |
| 21.0-21.9 | | | | | | **2** | | **2** | | | | | | | | | | | 0 | **4** |
| 22.0-22.9 | | | | | | **3** | | **5** | | **1** | | | | | | | | | 0 | **9** |
| 23.0-23.9 | | | | | | **2** | | **4** | | **1** | | **1** | | | | | | | 0 | **8** |
| 24.0-24.9 | | | | | | | | **3** | | **4** | | **1** | | | | | | | 0 | **8** |
| 25.0-25.9 | | | | | | | | **3** | | **4** | | **1** | | **1** | | **2** | | | 0 | **11** |
| 26.0-26.9 | | | | | | | | **2** | | **1** | | **1** | | **1** | | | | **1** | 0 | **6** |
| 27.0-27.9 | | | | | | | | | | **2** | | **5** | | **1** | | **1** | | **1** | 0 | **10** |
| 28.0-28.9 | | | | | | | | | | | | **2** | | **1** | | **1** | | **2** | 0 | **6** |
| 29.0-29.9 | | | | | | | | | | **1** | | **2** | | **3** | | **1** | | | 0 | **7** |
| 30.0-30.9 | | | | | | | | | | | | **2** | | | | | | **2** | 0 | **4** |
| 31.0-31.9 | | | | | | | | | | | | | | | | | | **1** | 0 | **1** |
| 32.0-32.9 | | | | | | | | | | | | **1** | | **1** | | | | | 0 | **2** |
| 33.0-33.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 34.0-34.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| 35.0-35.9 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| > 36.0 | | | | | | | | | | | | | | | | | | | 0 | **0** |
| Total | 1 | **0** | 3 | **7** | 0 | **23** | 0 | **22** | 0 | **14** | 0 | **16** | 0 | **8** | 0 | **5** | 0 | **7** | 4 | **102** |

Table 13. Age-length frequency distribution of immature and mature (bold, right) male northern pike captured in experimental gillnets, Leech Lake, 2009.

| | Age | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Length Group | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8+ | Total |
| < 4.0 | | | | | | | | | | 0 **0** |
| 4.0-4.9 | | | | | | | | | | 0 **0** |
| 5.0-5.9 | | | | | | | | | | 0 **0** |
| 6.0-6.9 | | | | | | | | | | 0 **0** |
| 7.0-7.9 | | | | | | | | | | 0 **0** |
| 8.0-8.9 | | | | | | | | | | 0 **0** |
| 9.0-9.9 | | | | | | | | | | 0 **0** |
| 10.0-10.9 | | | | | | | | | | 0 **0** |
| 11.0-11.9 | 1 | | | | | | | | | 1 **0** |
| 12.0-12.9 | | | | | | | | | | 0 **0** |
| 13.0-13.9 | | | | | | | | | | 0 **0** |
| 14.0-14.9 | | | **1** | | | | | | | 0 **1** |
| 15.0-15.9 | | | **1** | | | | | | | 0 **1** |
| 16.0-16.9 | | | **4** | | | | | | | 0 **4** |
| 17.0-17.9 | | **1** | **2** | | | | | | | 0 **3** |
| 18.0-18.9 | | | **4** | **3** | **3** | | | | | 0 **10** |
| 19.0-19.9 | | | **4** | | **2** | 1 **1** | **2** | **1** | | 1 **10** |
| 20.0-20.9 | | | **1** | **5** | | **2** | **1** | | **1** | 0 **10** |
| 21.0-21.9 | | | **1** | **3** | **2** | **3** | | **1** | | 0 **10** |
| 22.0-22.9 | | | **2** | **2** | **1** | **2** | **1** | **1** | **1** | 0 **10** |
| 23.0-23.9 | | | | **1** | | **2** | **1** | **2** | | 0 **6** |
| 24.0-24.9 | | | | | | **1** | **2** | **1** | | 0 **4** |
| 25.0-25.9 | | | | | | | | | | 0 **0** |
| 26.0-26.9 | | | | | | | | | | 0 **0** |
| 27.0-27.9 | | | | | | | | | | 0 **0** |
| 28.0-28.9 | | | | | | | | | | 0 **0** |
| 29.0-29.9 | | | | | | | | | | 0 **0** |
| 30.0-30.9 | | | | | | | | | **1** | 0 **1** |
| 31.0-31.9 | | | | | | | | | | 0 **0** |
| 32.0-32.9 | | | | | | | | | | 0 **0** |
| 33.0-33.9 | | | | | | | | | | 0 **0** |
| 34.0-34.9 | | | | | | | | | | 0 **0** |
| 35.0-35.9 | | | | | | | | | | 0 **0** |
| > 36.0 | | | | | | | | | | 0 **0** |
| Total | 1 **0** | 0 **1** | 0 **20** | 0 **14** | 0 **8** | 1 **11** | 0 **7** | 0 **6** | 0 **3** | 2 **70** |

Table 14. Summary of walleye fry stocking for Red Lake, 1999-2003 and Leech Lake, 2005-2009. SSB refers to spawner stock biomass estimated from gillnet catches of mature female walleye the previous fall.

| Lake | Year | SSB (lbs/A) | Amount Stocked/LA | YOY Marked (%) | Hatch Rate (%) | Fry per LA: Wild | Fry per LA: Total |
|---|---|---|---|---|---|---|---|
| Red | 1999 | 0.17 | 521 | 86 | 0.60 | 86 | 607 |
| | 2001 | 1.31 | 400 | 70 | 0.16 | 174 | 574 |
| | 2003 | 0.76 | 414 | 97 | 0.02 | 11 | 425 |
| | Mean | 0.74 | 445 | 84 | 0.26 | 90 | 535 |
| Leech | 2005 | 1.91 | 130 | 39 | 0.22 | 203 | 334 |
| | 2006 | 1.04 | 380 | 86 | 0.12 | 61 | 440 |
| | 2007 | 1.67 | 129 | 23 | 0.54 | 432 | 561 |
| | 2008 | 2.13 | 382 | 55 | 0.31 | 317 | 699 |
| | 2009 | 1.32 | 391 | 50 | 0.60 | 385 | 775 |
| | Mean | 1.61 | 282 | 51 | 0.36 | 280 | 562 |

Table 15. Mean chlorophyll-a (Chlor-a), total phosphorous (Total P), pH, alkalinity, total dissolved solids (TDS), Secchi depth, and mean calculated trophic state index (TSI) by basin, Leech Lake, 1984-2009.

| | Main Lake | | | | | | | | Western Bays | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Station | Chlor-a (ppb) | Total P (ppm) | pH | Alkalinity (ppm) | TDS (ppm) | Secchi (ft.) | Mean TSI | Station | Chlor-a (ppb) | Total P (ppm) | pH | Alkalinity (ppm) | TDS (ppm) | Secchi (ft.) | Mean TSI |
| 1984 | | 4.0 | 0.022 | - | 133 | 169 | - | - | | 4.0 | 0.011 | - | 132 | 147 | - | - |
| 1985 | | - | - | - | - | - | - | - | | - | - | - | - | - | - | - |
| 1986 | 7 | 3.0 | 0.011 | 8.51 | 134 | 158 | 4.7 | - | 1 | 3.0 | 0.006 | 8.61 | 135 | 160 | 9.3 | - |
| 1987 | 7 | 3.0 | 0.014 | 8.35 | 131 | 154 | 3.9 | - | 1 | 4.0 | 0.014 | 8.50 | 147 | 153 | 8.2 | - |
| 1988 | 5 | 3.0 | 0.031 | 7.85 | 133 | 169 | 7.7 | - | 1 | 3.0 | 0.017 | 8.00 | 46 | 377 | 7.9 | - |
| 1989 | 5 | 3.0 | 0.017 | 7.85 | 132 | 172 | 7.6 | - | 1 | 3.0 | 0.008 | 8.54 | 128 | 176 | 9.8 | - |
| 1990 | 3 | 3.0 | 0.015 | 8.61 | 130 | 168 | 7.3 | - | 1 | 3.0 | 0.015 | 8.40 | 130 | 164 | 12.2 | - |
| 1991 | 5 | 1.0 | 0.020 | 8.49 | 127 | 180 | 7.7 | - | 1 | 1.0 | <0.005 | 8.60 | 126 | 172 | 7.9 | - |
| 1992 | 5 | 2.0 | 0.016 | 8.44 | 139 | 178 | 11.4 | - | 1 | 3.0 | 0.010 | 8.54 | 139 | 168 | 13.2 | - |
| 1993 | 5 | 6.4 | 0.013 | 8.58 | 140 | 156 | 8.5 | - | 1 | 4.9 | 0.014 | 8.62 | 128 | 180 | 13.0 | - |
| 1994 | 5 | 5.5 | 0.023 | 8.58 | 138 | 170 | 6.0 | - | 1 | 2.9 | 0.016 | 8.66 | 140 | 168 | 8.0 | - |
| 1995 | 7 | 11.9 | 0.018 | 8.57 | 136 | 192 | 8.9 | - | 1 | 6.5 | 0.012 | 8.70 | 136 | 180 | 11.5 | - |
| 1996 | 7 | 3.1 | 0.055 | 8.50 | 133 | 176 | 8.9 | - | 1 | 2.4 | 0.020 | 8.73 | 136 | 224 | 10.6 | - |
| 1997 | 7 | 3.1 | 0.041 | 8.54 | 132 | 172 | 9.9 | - | 1 | 4.4 | 0.044 | 8.64 | 133 | 192 | 13.6 | - |
| 1998 | 3 | 6.5 | 0.028 | 8.64 | 131 | 152 | - | - | 1 | 4.2 | 0.029 | 8.66 | 133 | 172 | - | - |
| 1999 | 5 | 5.1 | 0.028 | 8.56 | 129 | 172 | 7.5 | 49 | 1 | 3.8 | 0.025 | 8.62 | 135 | 180 | 13.0 | 45 |
| 2000 | 3 | 4.2 | 0.028 | 8.46 | 139 | 180 | 6.0 | 49 | 6 | 2.4 | 0.019 | 8.62 | 138 | 176 | 17.2 | 41 |
| 2001 | 3 | 5.6 | 0.033 | 8.73 | 125 | 170 | 7.0 | 49 | 6 | 4.0 | 0.016 | 8.76 | 126 | 168 | 11.0 | 43 |
| 2002 | 3 | 5.4 | 0.020 | 8.66 | 133 | 164 | 6.5 | 49 | 6 | 4.1 | 0.020 | 8.75 | 136 | 176 | 11.0 | 44 |
| 2003 | 3 | 7.2 | 0.020 | 8.42 | 139 | 160 | 6.5 | 50 | 6 | 4.1 | 0.010 | 8.64 | 140 | 160 | 11.0 | 44 |
| 2004 | 3 | 3.4 | 0.013 | 8.50 | 143 | 176 | 9.0 | 44 | 6 | 2.4 | 0.010 | 8.69 | 146 | 176 | 13.1 | 40 |
| 2005 | 3 | 4.4 | 0.016 | 8.62 | 143 | 172 | 5.0 | 50 | 6 | 3.7 | 0.016 | 8.57 | 141 | 176 | 8.5 | 45 |
| 2006 | 3 | 8.4 | 0.016 | 8.51 | 140 | 148 | 6.0 | 51 | 6 | 4.2 | 0.010 | 8.51 | 135 | 144 | 10.0 | 44 |
| 2007 | 3 | 8.9 | 0.019 | 8.46 | 144 | 168 | 8.2 | 48 | 6 | 3.6 | 0.011 | 8.61 | 143 | 168 | 10.5 | 42 |
| 2008 | 5 | 3.4 | 0.013 | 0.85 | 146 | 172 | 6.5 | 39 | 1 | 5.2 | 0.012 | 8.50 | 148 | 168 | 10.5 | 38 |
| 2009 | 5 | 7.6 | 0.019 | 8.42 | 143 | 188 | - | 49 | 1 | 5.1 | 0.011 | 8.43 | 148 | 196 | - | 43 |
| Mean | | 4.9 | 0.022 | 8.2 | 135.7 | 169.4 | 7.3 | 47.8 | | 3.7 | 0.016 | 8.6 | 133.0 | 180.8 | 11.0 | 42.5 |

**FIGURES**

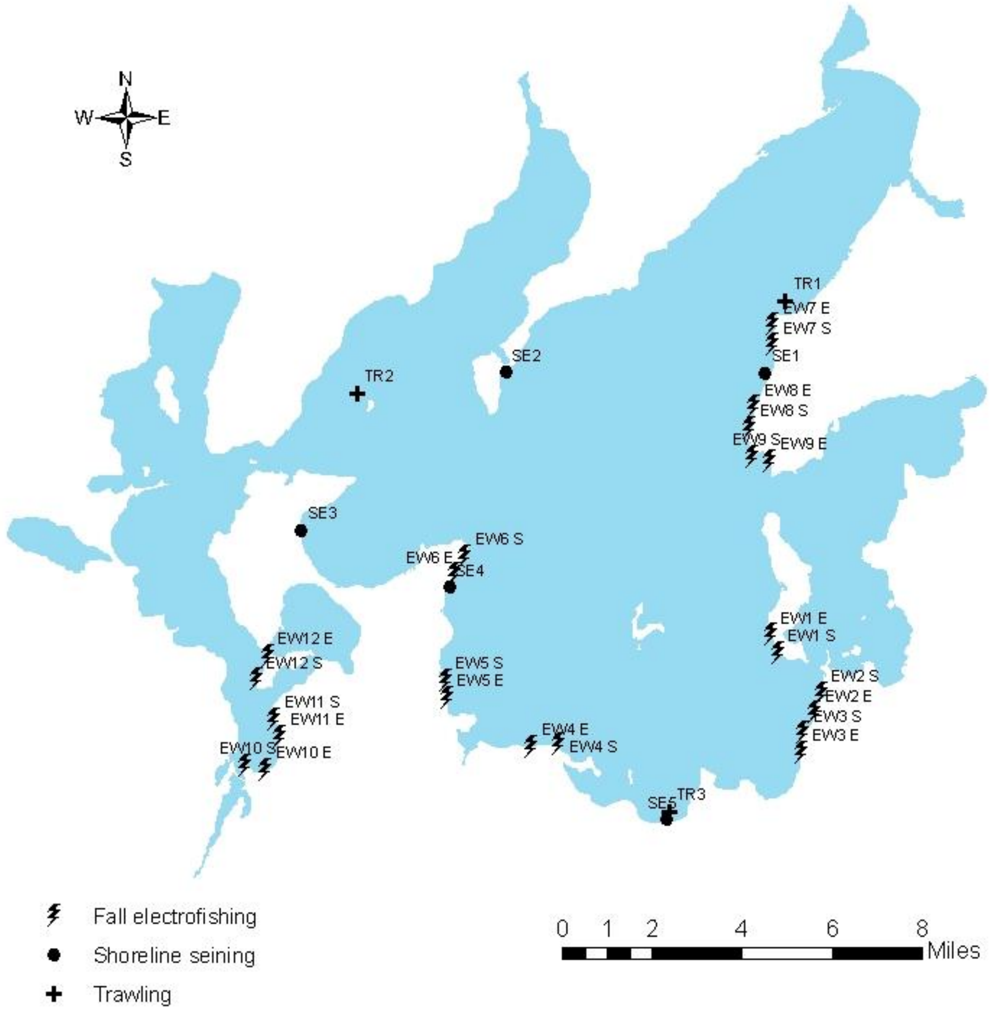


Figure 1. Long-term sampling stations targeting young-of-year percids in Leech Lake.

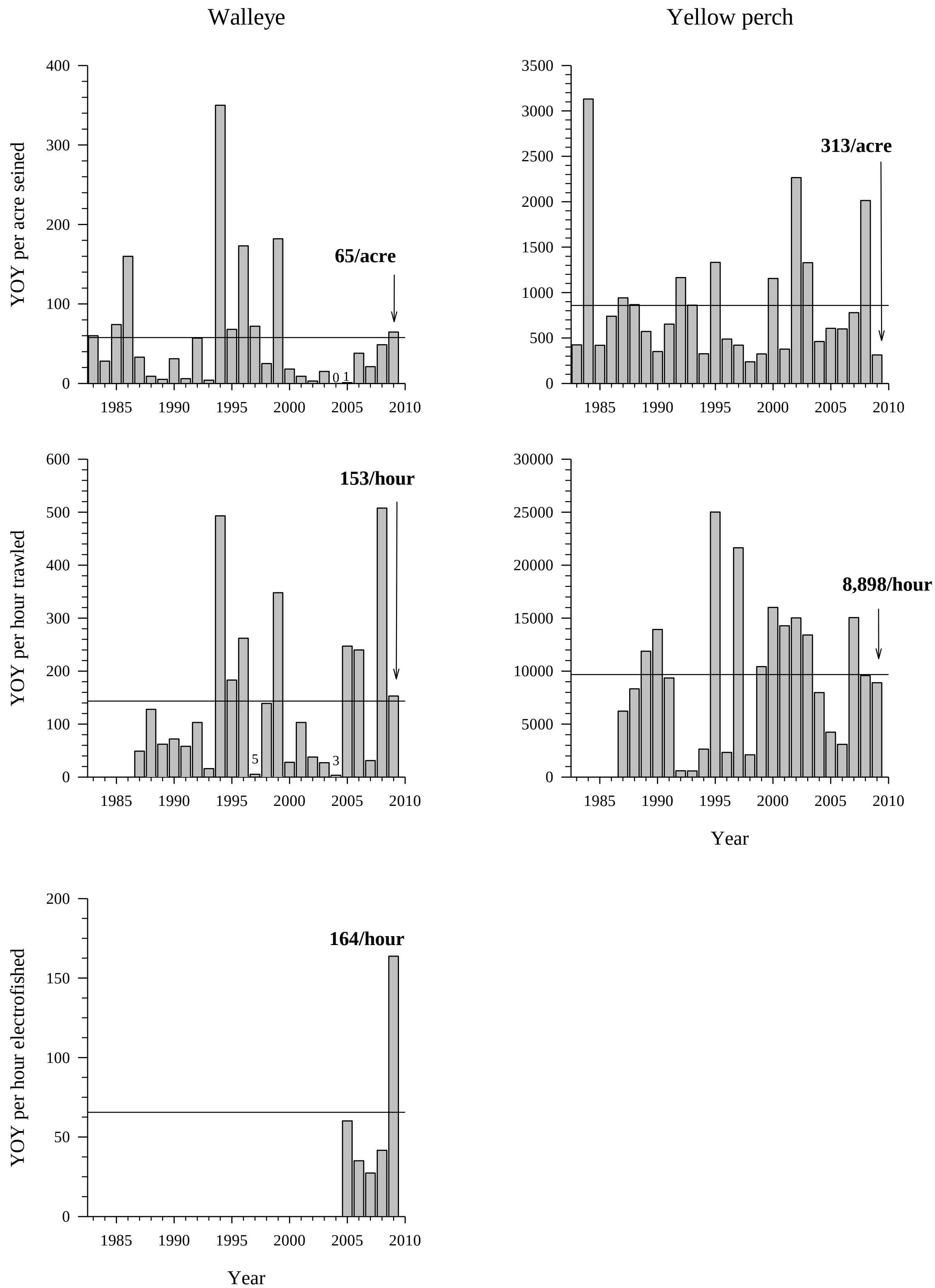


Figure 2. Catch-per-effort (bars) and historical averages (lines) of young-of-year (YOY) walleye (left column) and yellow perch (right column) at long-term sampling stations, Leech Lake, 1983-2009.

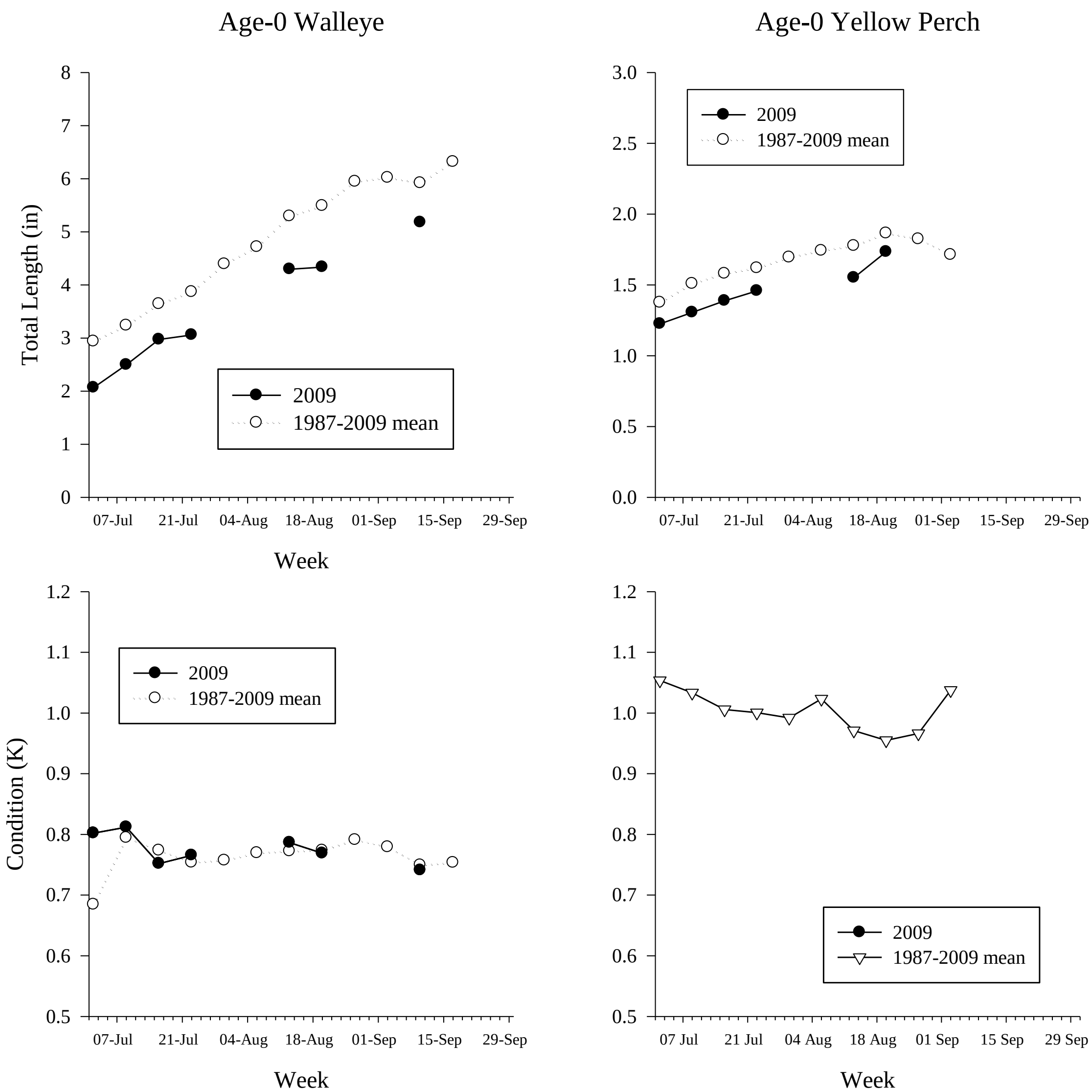


Figure 3. Mean weekly growth (top row) and condition (bottom row) of age-0 walleye (left column) and yellow perch (right column) captured in Leech Lake during the annual young-of-year assessment, 2009. Conditions factors for yellow perch were not calculated during 2009.


Figure 4. Gillnet (flags), temperature loggers (dots) and water quality (droplets) sampling locations on Leech Lake.

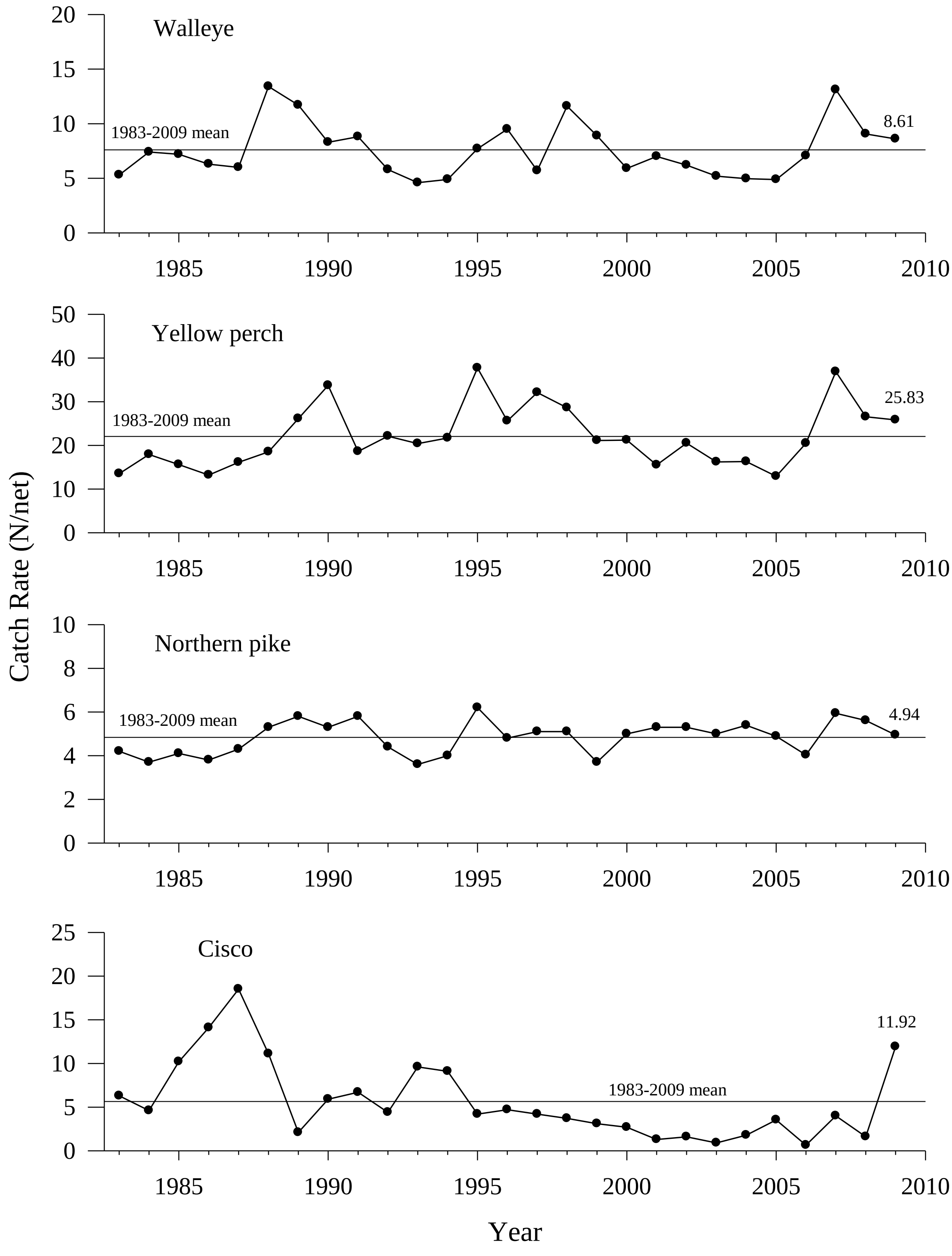


Figure 5. Gillnet catch rates (fish/net) of selected species in Leech Lake, 1983-2009. Horizontal lines represent respective upper (3rd) and lower (1st) quartiles.

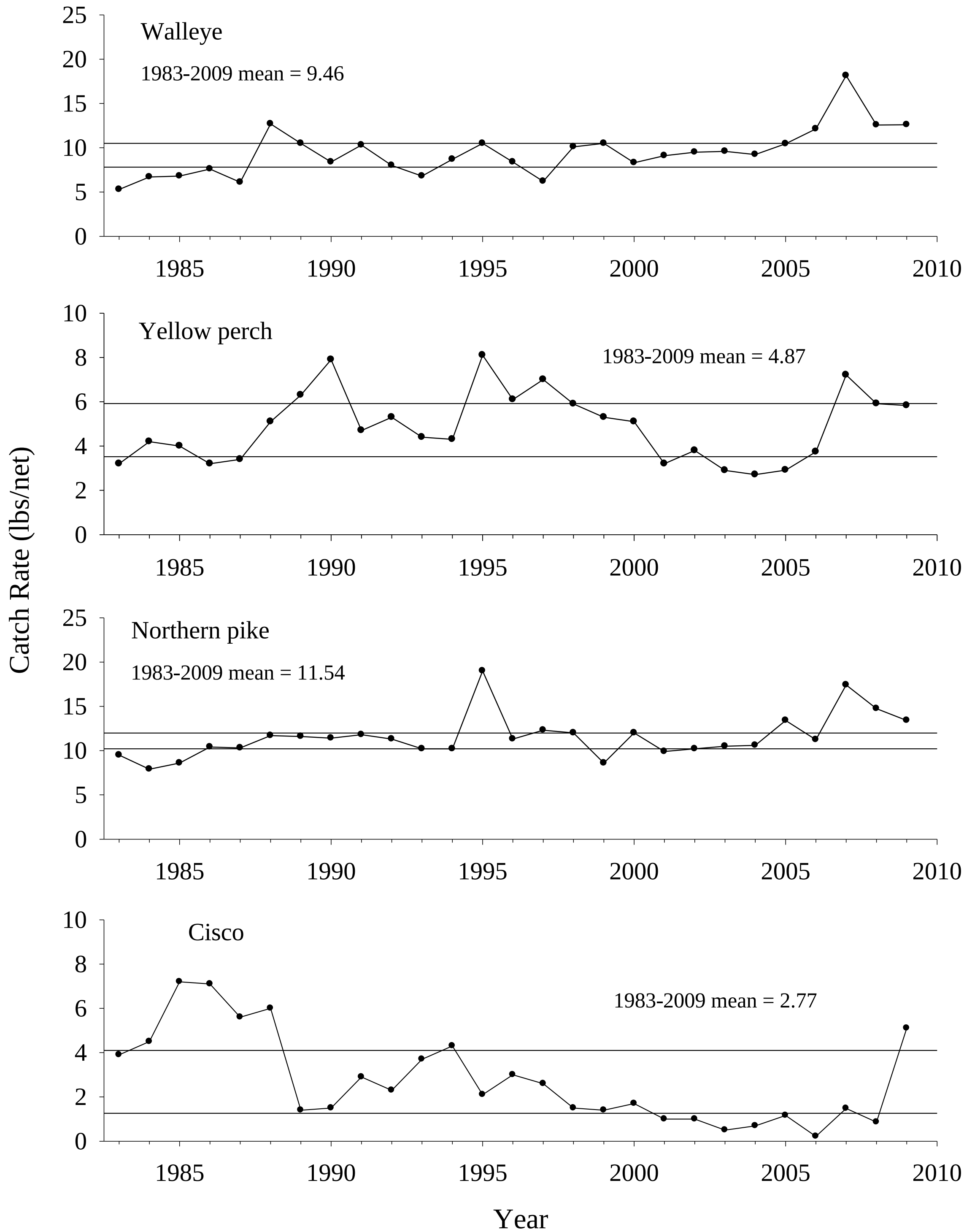


Figure 6. Gillnet catch rates (lbs/net) of selected species in Leech Lake, 1983-2009. Horizontal lines represent the respective upper (3rd) and lower (1st) quartiles.

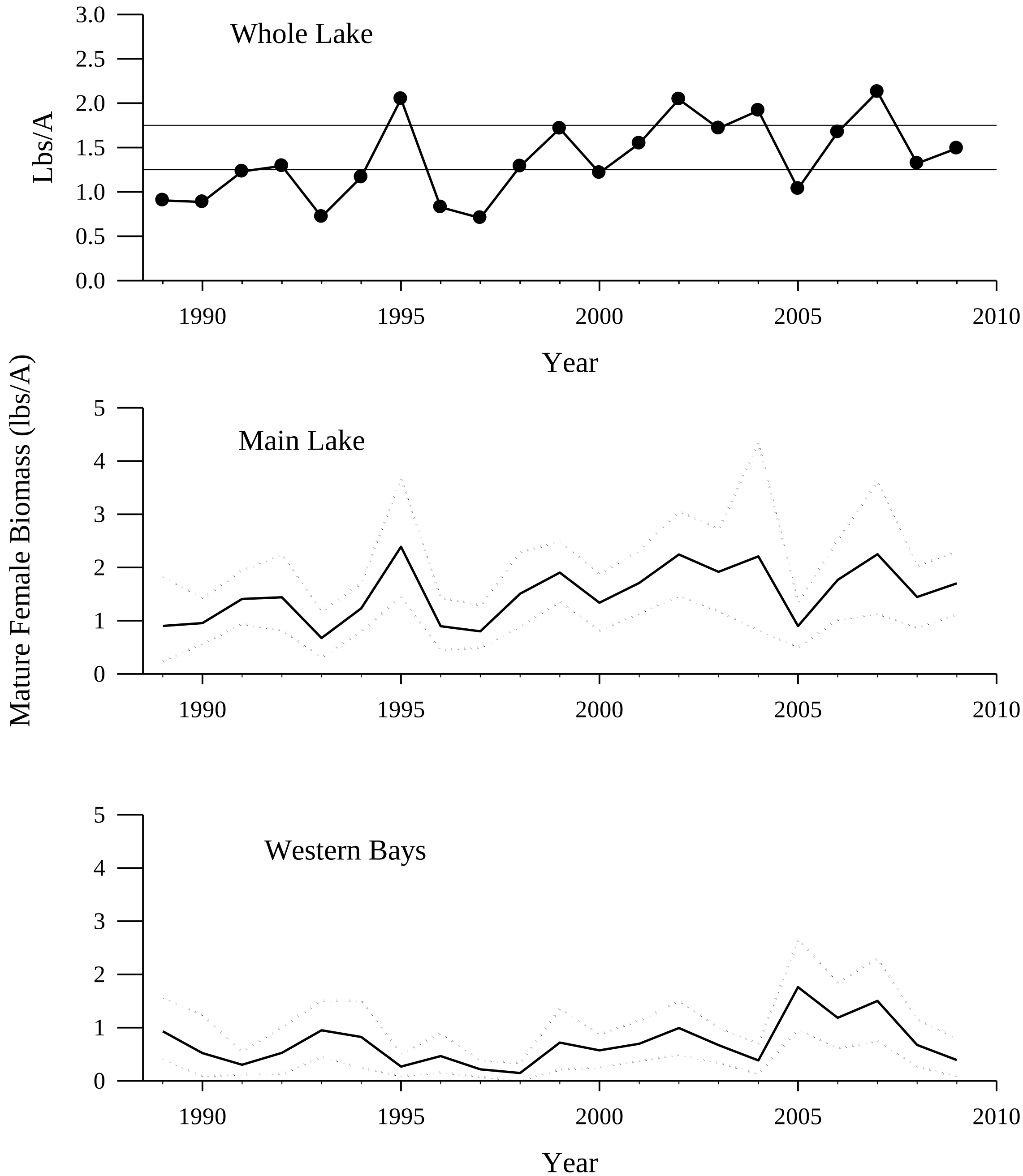


Figure 7. Estimated biomass (lbs/acre) of mature female walleye in Leech Lake, 1989-2009. Horizontal lines on the whole lake estimate (top) depict the current management goal of 1.25-1.75 lbs/acre. Dashed lines on the main lake (center) and western bays (bottom) estimates represent the 95% confidence intervals around basin-specific estimates.

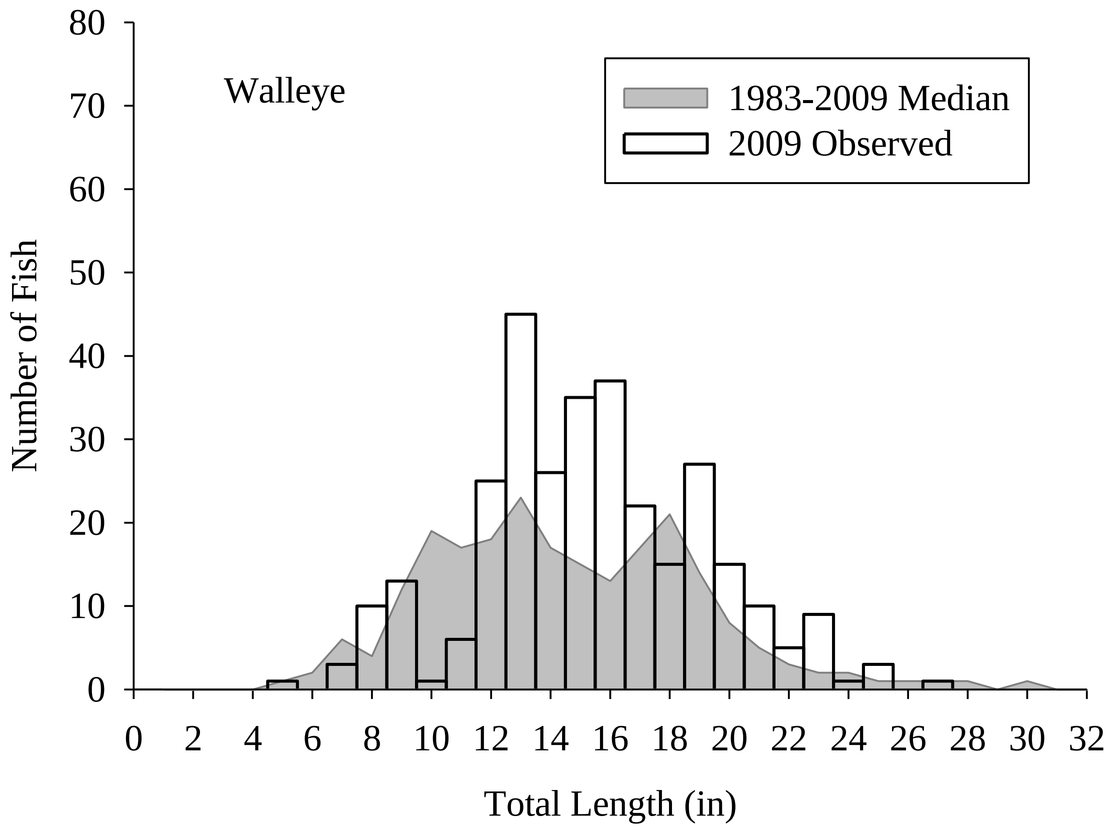


Figure 8. Length-frequency distribution of Leech Lake walleye sampled with experimental gillnets, 2009.

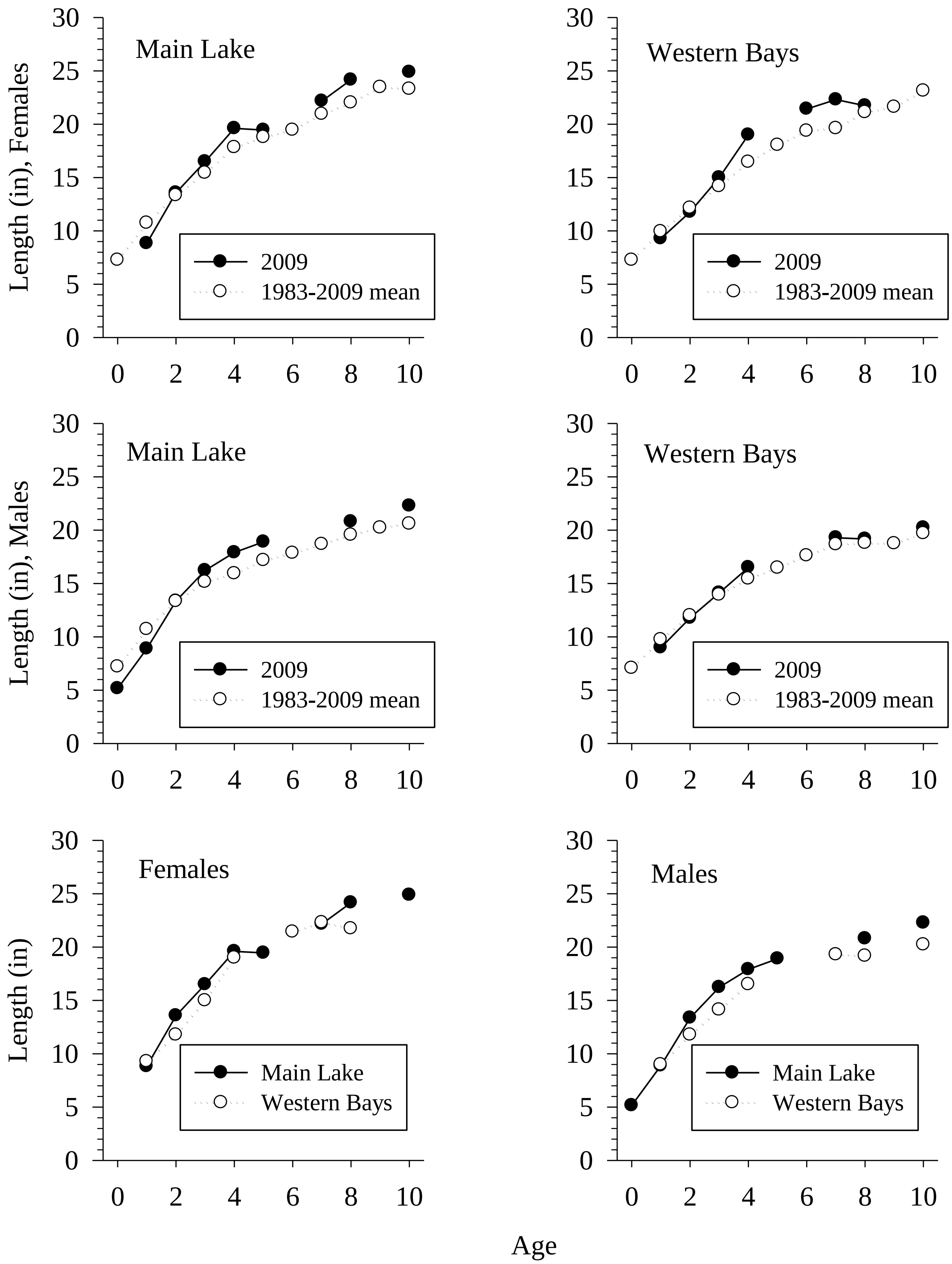


Figure 9.  Mean length-at-age of walleye captured in experimental gillnet sets, 2009.

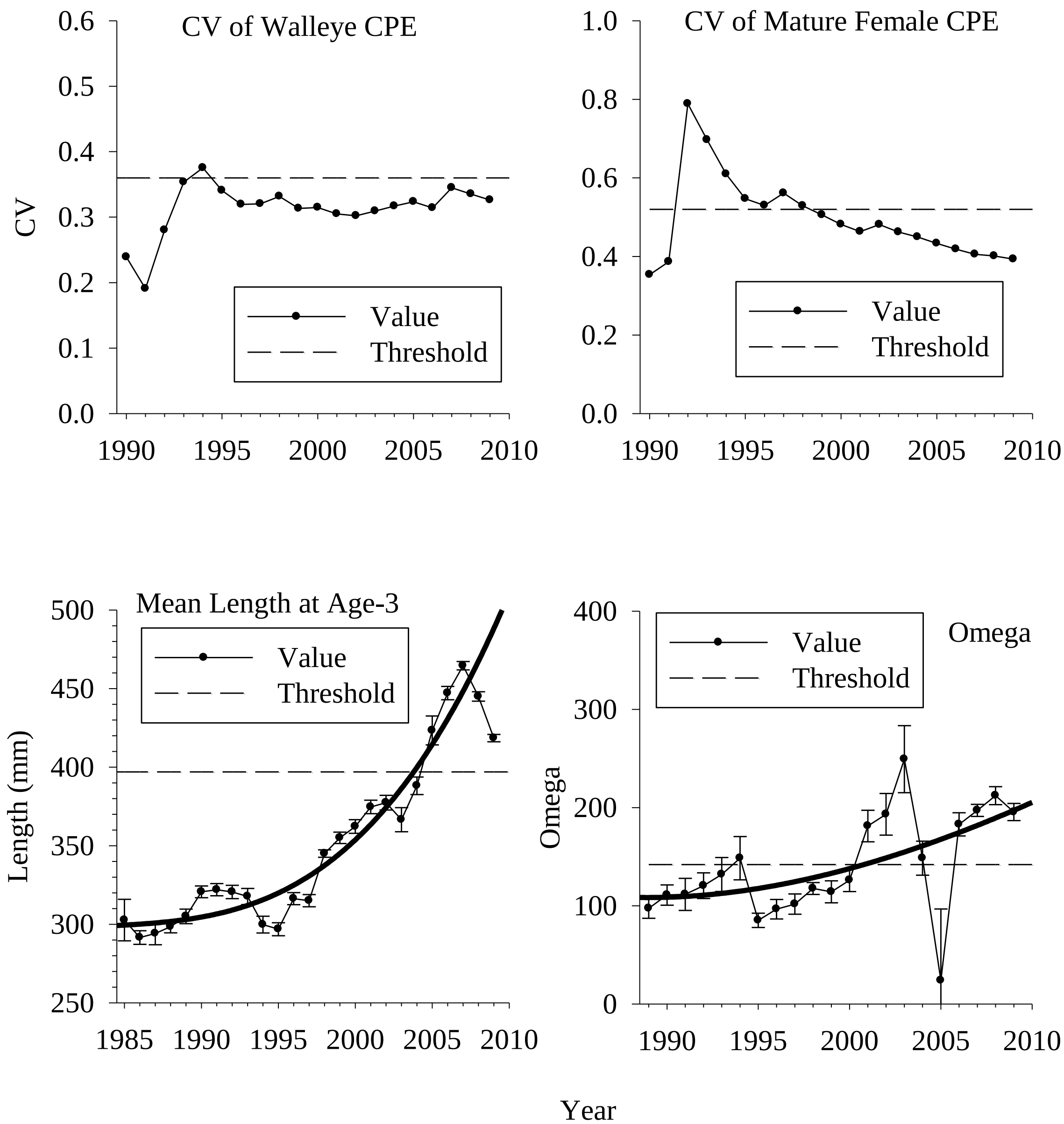


Figure 10. Coefficient of variation (CV) in gillnet catch-per-effort (CPE) of all walleye (top left panel) and mature female walleye (top right panel), mean length of all age-3 walleye sampled in experimental gillnets (bottom left panel), and omega values (bottom right panel) for the Leech Lake walleye population. Values above the respective thresholds (dashed lines) indicate population stress responses; error bars are standard error of the mean.

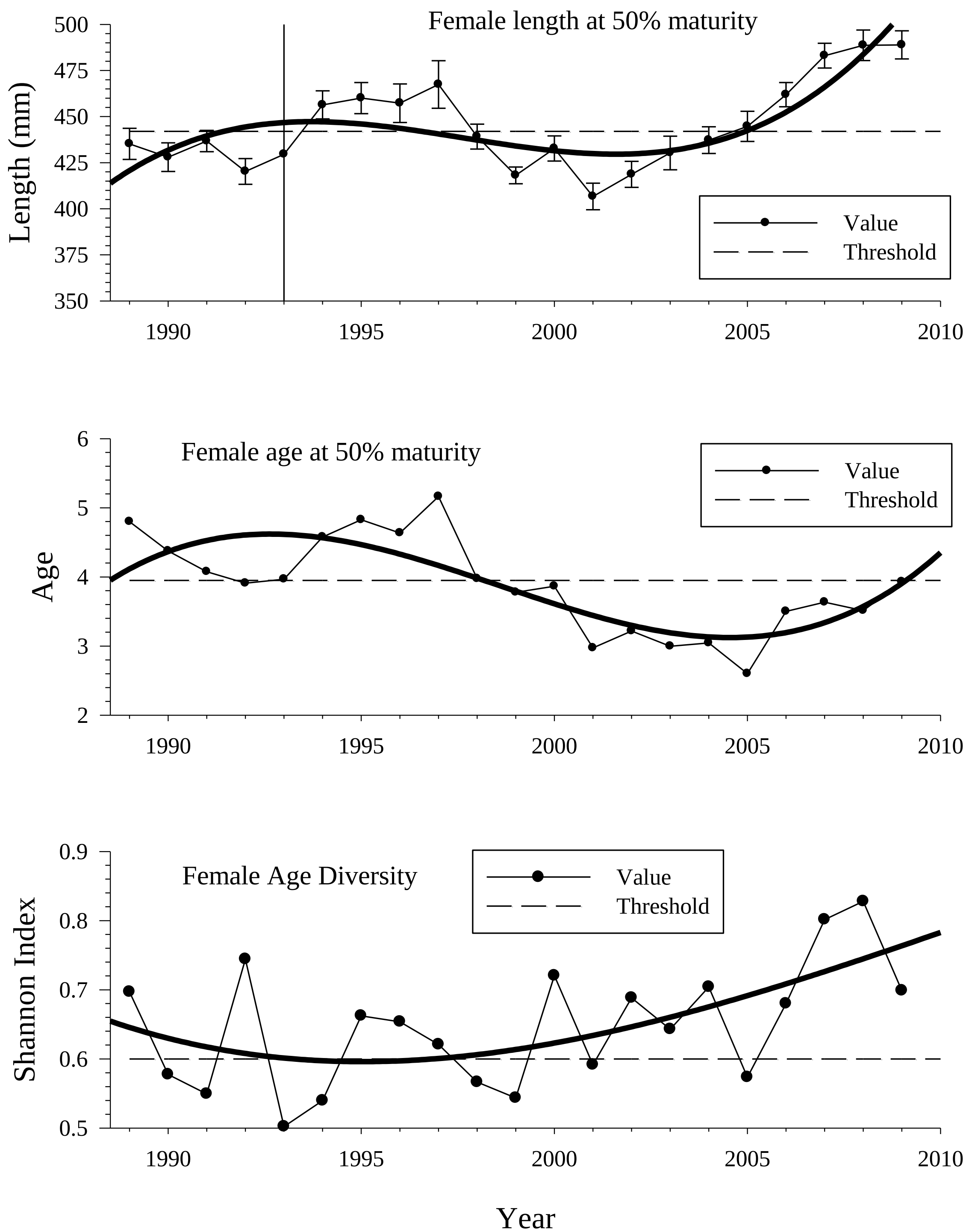


Figure 11. Mean length of female walleye at 50% maturity (top), estimated age of female walleye at 50% maturity (middle), and age diversity of female walleye sampled in experimental gillnets (bottom) from the Leech Lake walleye population. Values below the respective thresholds (dashed line) indicate a population stress response; error bars are standard error of the mean.

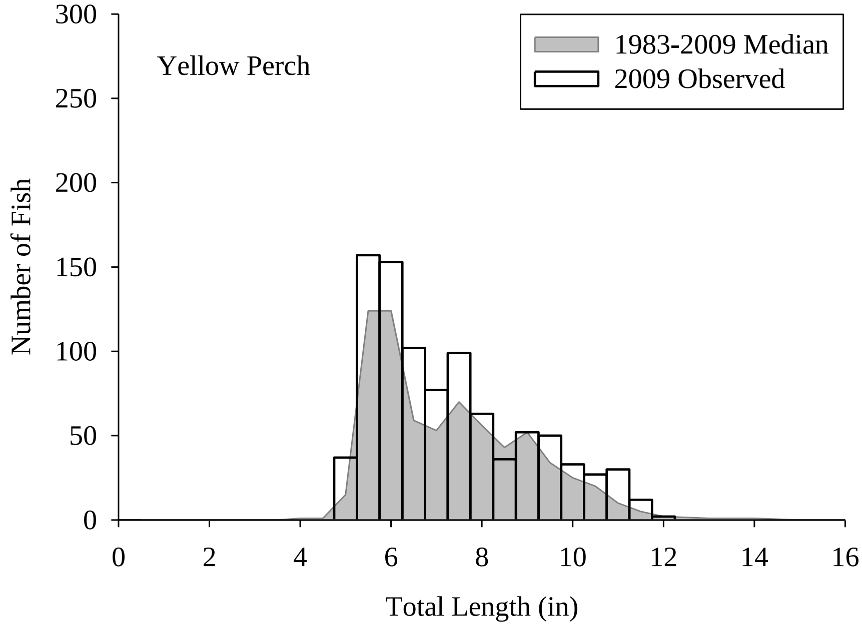


Figure 12. Length-frequency distribution of yellow perch sampled with experimental gillnets in Leech Lake, 2009.

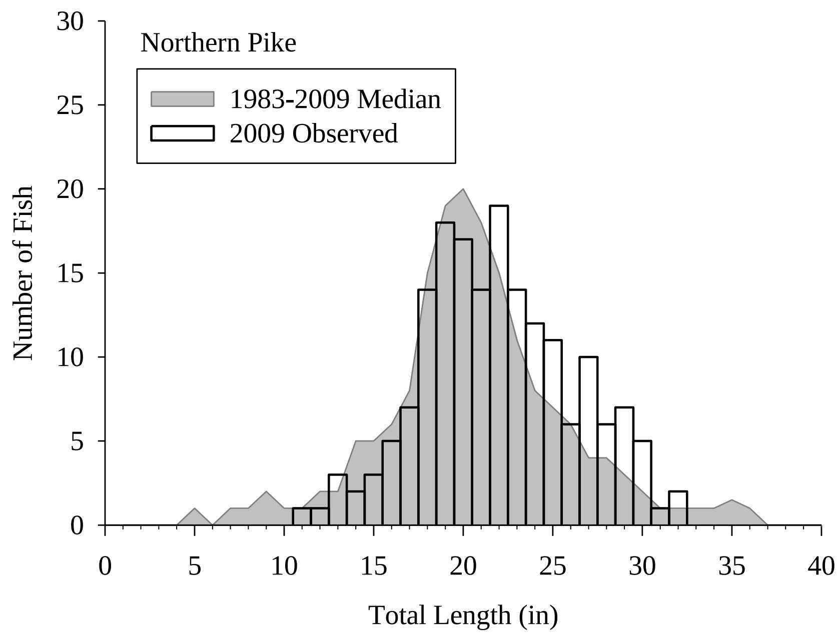


Figure 13. Length-frequency distribution of northern pike sampled with experimental gillnets in Leech Lake, 2009.

Figure 14.  Temperature and oxygen profiles were not collected during 2009.

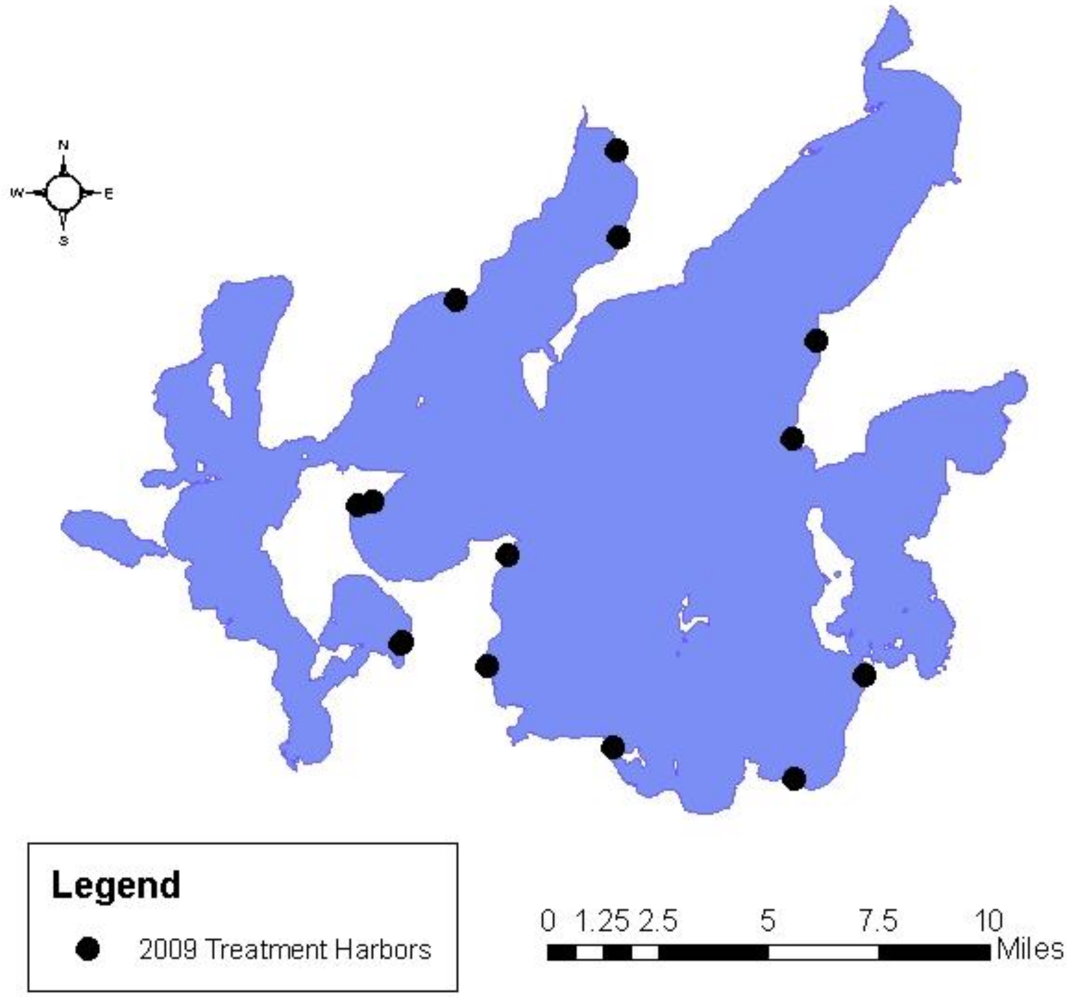


Figure 15. Leech Lake boat harbors where Eurasian watermilfoil was identified and chemically treated during 2009.

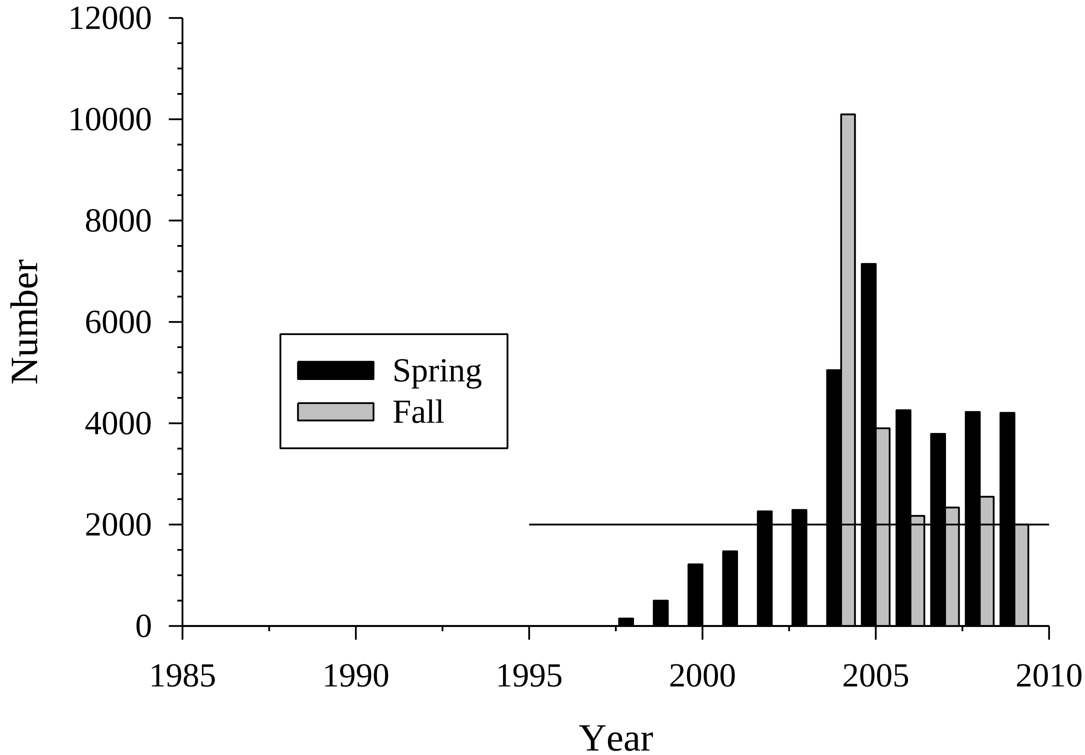


Figure 16.  Spring and fall double-crested cormorant numbers on Leech Lake, 1998-2009.  The line depicts the current fall population goal of 2,000 birds ([500 nesting pairs x 2 adults] + 2 offspring/nest).  (Division of Resource Management, Leech Lake Band of Ojibwe, 2009).

## APPENDIX

Table A1. Mean length-at-age data of female walleye captured with experimental gillnets in the main lake basin, Leech Lake.

| | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| YC | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1980 | | | | 12.99 | 16.17 | 16.04 | 18.53 | | 20.55 | | |
| 1981 | | | 10.85 | 13.26 | 14.20 | 16.15 | 18.73 | | 21.73 | 23.70 | 25.80 |
| 1982 | | 9.45 | 11.45 | 13.56 | 14.04 | 17.28 | 20.63 | 22.50 | 22.80 | | |
| 1983 | | 10.98 | 10.48 | 13.02 | 14.93 | 19.29 | 19.73 | 23.00 | | 22.40 | 22.80 |
| 1984 | 7.00 | 9.93 | 12.18 | 13.15 | 16.89 | 18.13 | 18.93 | 21.04 | | | |
| 1985 | | 9.65 | 11.07 | 13.31 | 15.84 | 18.31 | 19.67 | 20.00 | 20.80 | | 23.88 |
| 1986 | | 9.41 | 12.17 | 14.33 | 16.95 | 19.32 | 20.75 | 20.92 | 21.38 | 23.94 | 24.20 |
| 1987 | 7.10 | 10.60 | 13.20 | 13.39 | 16.97 | 20.01 | 20.20 | 21.75 | 21.95 | 25.60 | 21.25 |
| 1988 | 7.07 | 10.07 | 12.71 | 15.50 | 18.24 | 18.65 | 19.92 | 20.93 | 22.15 | 23.77 | 23.13 |
| 1989 | 6.50 | 10.39 | 14.01 | 14.50 | 18.80 | 19.34 | 19.31 | 22.40 | | | |
| 1990 | | 11.10 | 13.76 | 15.47 | 17.52 | 19.47 | 21.80 | 21.85 | 22.70 | 23.10 | 24.50 |
| 1991 | 7.46 | 11.02 | 13.11 | 15.96 | 17.86 | 19.65 | 20.85 | 20.05 | 23.90 | 24.90 | 20.28 |
| 1992 | | 9.85 | 12.52 | 15.00 | 18.27 | 19.70 | 19.30 | | | 24.88 | |
| 1993 | | 9.33 | 13.35 | 15.45 | 16.60 | 17.76 | 18.70 | | | | |
| 1994 | | 10.16 | 12.47 | 14.83 | 17.53 | 19.33 | 19.70 | 20.75 | 20.27 | 21.60 | 24.06 |
| 1995 | 7.30 | 9.69 | 12.78 | 15.54 | 17.48 | 19.24 | 19.45 | 20.47 | 22.03 | 23.82 | |
| 1996 | 9.55 | 10.40 | 13.13 | 15.51 | 18.25 | 19.31 | 19.51 | 23.13 | | | 24.25 |
| 1997 | 6.85 | 10.30 | 13.80 | 16.63 | 18.53 | 19.18 | 21.08 | 21.46 | 23.20 | 23.27 | 23.85 |
| 1998 | 6.97 | 10.88 | 14.63 | 16.71 | 18.36 | 19.36 | 22.11 | | 23.61 | | 23.62 |
| 1999 | 6.99 | 10.49 | 14.13 | 17.27 | 19.54 | 18.96 | 20.29 | 23.26 | 23.74 | 24.74 | 24.88 |
| 2000 | 7.15 | 11.29 | 13.87 | 18.26 | 19.51 | 20.21 | | 23.17 | | | |
| 2001 | 7.48 | 11.87 | 16.77 | 18.17 | 19.91 | 21.16 | 22.95 | | 24.16 | | |
| 2002 | 7.04 | 12.54 | 14.31 | 18.95 | 20.27 | 21.48 | | 22.17 | | | |
| 2003 | 7.24 | 10.91 | 14.17 | 19.57 | 21.50 | 21.02 | | | | | |
| 2004 | | 11.53 | 14.37 | 18.54 | 19.87 | 19.45 | | | | | |
| 2005 | | 12.33 | 16.16 | 18.33 | 19.60 | | | | | | |
| 2006 | 7.33 | 12.02 | 14.54 | 16.49 | | | | | | | |
| 2007 | 7.58 | 10.71 | 13.57 | | | | | | | | |
| 2008 | | 8.82 | | | | | | | | | |
| 2009 | | | | | | | | | | | |
| Mean | 7.29 | 10.58 | 13.32 | 15.69 | 17.83 | 19.11 | 20.10 | 21.70 | 22.33 | 23.81 | 23.58 |

Table A2. Mean length-at-age data of male walleye captured with experimental gillnets in the main lake basin, Leech Lake.

| | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| YC | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1980 | | | | 13.80 | 14.58 | 14.37 | 16.68 | 18.90 | 18.50 | | |
| 1981 | | | 10.87 | 12.43 | 14.48 | 16.24 | 17.43 | | 18.90 | 18.10 | |
| 1982 | | 10.05 | 11.81 | 13.89 | 14.67 | 16.09 | 17.72 | 18.70 | | | |
| 1983 | 7.17 | 11.03 | 10.96 | 13.55 | 14.73 | 17.75 | 18.53 | 18.96 | 19.30 | 20.60 | 19.55 |
| 1984 | 7.05 | 9.25 | 11.55 | 13.24 | 15.42 | 15.71 | 17.80 | | 18.60 | | |
| 1985 | | 9.48 | 11.95 | 13.36 | 14.93 | 17.05 | 18.43 | 18.13 | | 20.83 | |
| 1986 | 6.83 | 9.35 | 12.01 | 14.80 | 16.13 | 17.06 | 17.14 | 18.68 | 18.07 | 20.20 | 19.88 |
| 1987 | 6.80 | 10.50 | 13.00 | 14.04 | 16.58 | | 18.13 | 18.87 | 18.58 | 21.20 | |
| 1988 | 7.01 | 10.14 | 12.75 | 15.29 | 17.01 | 17.41 | 18.39 | 18.50 | 19.10 | 20.50 | 20.43 |
| 1989 | 7.10 | 9.85 | 13.04 | 14.75 | 16.15 | 18.07 | 19.50 | 19.95 | | 19.30 | |
| 1990 | | 10.78 | 14.03 | 14.73 | 16.40 | 17.13 | 18.75 | 18.50 | | 20.80 | |
| 1991 | 7.71 | 11.10 | 12.71 | 14.70 | 15.89 | 17.10 | 19.33 | | 21.40 | 20.90 | |
| 1992 | | 9.55 | 13.52 | 16.00 | 16.40 | 19.00 | 19.25 | | | | |
| 1993 | | 10.12 | | | 15.05 | | | | | 19.37 | 22.83 |
| 1994 | 6.35 | 9.99 | 12.23 | 14.64 | 15.94 | 17.82 | 17.87 | 18.71 | | 20.13 | 20.33 |
| 1995 | 7.55 | 9.48 | 12.58 | 15.12 | 16.28 | 17.84 | 18.24 | 19.61 | 19.59 | 20.37 | 20.75 |
| 1996 | 6.60 | 9.96 | 13.13 | 15.09 | 16.08 | 18.09 | 18.16 | 19.96 | | 20.04 | 20.35 |
| 1997 | 6.97 | 10.25 | 13.70 | 15.93 | 17.13 | 18.57 | 19.14 | 19.54 | 20.32 | 21.29 | 20.66 |
| 1998 | 7.27 | 10.98 | 14.58 | 16.03 | 18.12 | 17.38 | 19.75 | 19.29 | 20.28 | 20.59 | 21.22 |
| 1999 | 6.90 | 10.75 | 13.79 | 16.60 | 18.34 | 19.00 | 19.66 | 20.44 | 21.09 | | 22.28 |
| 2000 | 7.07 | 11.09 | 14.61 | 17.36 | 18.54 | 19.51 | 19.92 | | 19.69 | | |
| 2001 | 7.43 | 11.83 | 15.58 | 16.52 | 18.74 | 19.00 | 19.78 | 19.75 | 20.79 | | |
| 2002 | 7.04 | 12.49 | 15.07 | 17.24 | 18.84 | 19.88 | 20.19 | | | | |
| 2003 | | 12.03 | 14.65 | 17.24 | 18.15 | 20.71 | | | | | |
| 2004 | | 11.61 | 16.69 | 18.31 | | 18.90 | | | | | |
| 2005 | 6.57 | 12.32 | 15.74 | 17.45 | 17.90 | | | | | | |
| 2006 | 7.41 | 12.01 | 14.26 | 16.22 | | | | | | | |
| 2007 | 7.34 | 10.63 | 13.35 | | | | | | | | |
| 2008 | | 8.88 | | | | | | | | | |
| 2009 | 5.16 | | | | | | | | | | |
| Mean | 7.06 | 10.57 | 13.39 | 15.32 | 16.50 | 17.81 | 18.63 | 19.16 | 19.59 | 20.28 | 20.83 |

Table A3. Mean length-at-age data of female walleye captured with experimental gillnets in the western bays basin, Leech Lake.

| | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| YC | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1980 | | | | 13.72 | 14.08 | 17.40 | 16.28 | 18.02 | | 19.40 | |
| 1981 | | | 11.20 | 13.21 | 13.23 | 17.67 | 20.70 | 19.26 | 19.80 | | |
| 1982 | | 9.61 | 11.23 | 12.82 | 15.28 | 17.04 | 18.49 | 19.60 | 23.00 | | |
| 1983 | | 9.77 | 12.62 | 12.95 | 13.90 | 19.20 | 19.67 | | | | |
| 1984 | | 10.29 | 10.96 | 12.40 | 15.81 | 15.37 | 19.00 | 22.10 | 22.10 | | |
| 1985 | 7.60 | 7.80 | 12.30 | 13.24 | 14.12 | 18.00 | 20.00 | | | | 22.10 |
| 1986 | | 9.30 | 11.37 | 13.61 | 16.39 | 17.69 | 20.02 | 21.05 | 22.47 | 21.20 | 21.10 |
| 1987 | 7.60 | 9.73 | 11.93 | 13.57 | 15.37 | 18.45 | 19.10 | 20.04 | | | |
| 1988 | | 9.62 | 12.32 | 14.39 | 17.56 | 18.87 | 20.50 | 21.70 | 21.37 | 22.80 | |
| 1989 | | 10.16 | 12.67 | 14.16 | 18.50 | 18.35 | | 20.55 | | | 22.55 |
| 1990 | 6.30 | 9.89 | 12.11 | 13.78 | 15.65 | 16.50 | 19.40 | | 22.40 | | |
| 1991 | 7.25 | 9.89 | 10.57 | 13.20 | 14.82 | 18.44 | 19.30 | | 19.20 | 20.50 | |
| 1992 | | | 10.70 | 12.90 | 15.40 | 18.20 | 19.60 | 18.70 | | | |
| 1993 | | 8.82 | | 14.30 | 17.10 | 15.30 | 16.60 | | | 25.39 | |
| 1994 | | 8.97 | 11.28 | 13.18 | 15.90 | 17.90 | 18.87 | 18.94 | 18.94 | 18.98 | |
| 1995 | 6.50 | 8.50 | 11.12 | 14.18 | 14.90 | 18.16 | 17.52 | 19.24 | 23.66 | 24.49 | 21.38 |
| 1996 | 10.00 | 9.63 | 12.45 | 14.13 | 15.28 | 17.16 | 18.31 | | 25.12 | | 22.52 |
| 1997 | | 10.00 | 12.63 | 14.83 | 16.56 | 17.69 | 19.15 | | 19.55 | 21.34 | 24.20 |
| 1998 | 7.23 | 9.94 | 12.39 | 14.32 | 16.43 | 19.78 | 18.70 | | 22.28 | 24.76 | 23.77 |
| 1999 | 6.30 | 9.31 | 11.92 | 14.30 | 18.12 | 19.29 | 19.89 | 22.87 | 24.45 | 22.58 | |
| 2000 | | 9.79 | 13.22 | 14.37 | 17.70 | 19.07 | 20.59 | 21.67 | | | |
| 2001 | 7.09 | 10.42 | 14.37 | 15.65 | 18.73 | 20.10 | 21.27 | 21.99 | 21.73 | | |
| 2002 | | 10.37 | 12.83 | 16.17 | 18.55 | 20.26 | 20.60 | 22.30 | | | |
| 2003 | | 10.61 | 13.87 | 17.24 | 19.44 | 20.39 | 21.42 | | | | |
| 2004 | | 10.37 | 14.09 | 17.03 | | | | | | | |
| 2005 | | 11.47 | 14.67 | 16.34 | 18.99 | | | | | | |
| 2006 | | 10.71 | 13.55 | 14.98 | | | | | | | |
| 2007 | 7.01 | 9.57 | 11.77 | | | | | | | | |
| 2008 | | 9.27 | | | | | | | | | |
| 2009 | | | | | | | | | | | |
| Mean | 7.29 | 9.76 | 12.31 | 14.26 | 16.31 | 18.18 | 19.35 | 20.54 | 21.86 | 22.14 | 22.52 |

Table A4. Mean length-at-age data of male walleye captured with experimental gillnets in the western bays basin, Leech Lake.

| | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| YC | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1980 | | | | 13.99 | 14.70 | 15.55 | 16.38 | | 19.10 | | |
| 1981 | | | 11.46 | 12.91 | 14.80 | 15.92 | 15.75 | 17.60 | 18.30 | 19.83 | |
| 1982 | | 9.19 | 11.63 | 13.07 | 14.63 | 16.36 | 17.44 | 17.15 | 18.43 | 19.70 | 18.93 |
| 1983 | 6.80 | 9.83 | 11.46 | 13.20 | 14.35 | 16.92 | 17.03 | 18.57 | 19.05 | | 20.90 |
| 1984 | | 9.30 | 10.55 | 12.65 | 15.67 | 15.35 | 17.80 | 18.63 | 18.13 | | |
| 1985 | | 7.90 | 12.50 | 13.59 | 13.80 | 16.20 | 16.40 | 17.75 | | 18.38 | 20.10 |
| 1986 | | 8.74 | 11.18 | 13.10 | 15.45 | 16.68 | 18.46 | 18.22 | 18.82 | 16.80 | 19.60 |
| 1987 | | 10.08 | 12.13 | 13.54 | 14.75 | 16.30 | | 18.60 | | | |
| 1988 | | 10.06 | 12.32 | 14.24 | 16.84 | 17.98 | 18.43 | 18.77 | 17.98 | | 19.40 |
| 1989 | | 9.64 | 12.38 | 15.55 | 16.05 | 16.75 | | 19.30 | | 18.85 | |
| 1990 | | 10.00 | 12.70 | 12.84 | 14.50 | 18.80 | 16.30 | | | | |
| 1991 | 7.20 | 9.29 | 11.26 | 13.48 | 15.04 | 15.90 | 17.50 | | | | |
| 1992 | | 7.80 | 10.59 | 11.50 | 14.30 | | 18.40 | | | | |
| 1993 | | 10.08 | 11.25 | 12.80 | 14.90 | 18.90 | | | | | |
| 1994 | | 8.55 | 11.21 | 13.29 | 14.80 | 16.20 | 18.10 | 19.21 | | 19.45 | 19.50 |
| 1995 | 8.65 | 8.37 | 11.11 | 13.79 | 16.50 | 15.60 | 18.50 | | 18.31 | | 18.98 |
| 1996 | | 9.00 | 11.37 | 13.40 | 16.10 | 18.90 | | 19.09 | 18.80 | 18.50 | 19.69 |
| 1997 | | 9.46 | 11.96 | 14.95 | 16.85 | 18.31 | | 19.04 | 19.61 | 19.84 | 20.10 |
| 1998 | 6.90 | 9.87 | 12.60 | 15.07 | 17.64 | 17.32 | 18.76 | 19.85 | 18.54 | 20.59 | |
| 1999 | 5.50 | 9.95 | 12.02 | 15.19 | | 16.97 | 19.25 | | 19.51 | 18.19 | 20.22 |
| 2000 | | 9.92 | 12.76 | 14.70 | 16.38 | | 17.87 | | 19.80 | | |
| 2001 | 6.97 | 10.23 | 13.16 | 14.51 | 17.48 | 17.78 | 19.10 | 19.84 | 19.17 | | |
| 2002 | 6.46 | 10.51 | 12.74 | 15.81 | 16.82 | 18.43 | 19.46 | 19.29 | | | |
| 2003 | 6.61 | 10.05 | 14.33 | 16.18 | 18.50 | 18.48 | | | | | |
| 2004 | | 10.13 | 14.00 | | | | | | | | |
| 2005 | | 10.81 | 14.28 | 16.19 | 16.50 | | | | | | |
| 2006 | 6.75 | 11.15 | 12.62 | 14.12 | | | | | | | |
| 2007 | 7.52 | 10.17 | 11.77 | | | | | | | | |
| 2008 | | 8.98 | | | | | | | | | |
| 2009 | | | | | | | | | | | |
| Mean | 6.94 | 9.60 | 12.12 | 13.99 | 15.72 | 17.07 | 17.83 | 18.73 | 18.83 | 19.01 | 19.74 |

Table A5. Mean length-at-age data of female yellow perch captured with experimental gillnets in the main lake basin, Leech Lake.

| | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| YC | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1980 | | | | | | | 10.27 | 9.31 | 11.95 | 10.50 | |
| 1981 | | | | | | 8.89 | 9.27 | 10.97 | 9.80 | 11.07 | 11.30 |
| 1982 | | | | | 7.81 | 7.19 | 10.78 | 9.89 | 10.64 | 12.27 | 11.40 |
| 1983 | | | | 6.67 | 6.80 | 9.40 | 8.61 | 9.99 | 11.13 | 10.84 | 13.20 |
| 1984 | | | | 5.66 | 8.03 | 7.71 | 8.66 | 10.06 | 10.53 | 11.05 | 11.50 |
| 1985 | | | | 7.12 | 6.74 | 8.52 | 9.68 | 9.98 | 9.79 | 10.15 | 10.37 |
| 1986 | | | 5.93 | 6.03 | 7.51 | 8.82 | 9.67 | 9.65 | 8.97 | 10.45 | 10.62 |
| 1987 | | | | 6.42 | 7.42 | 8.04 | 9.03 | 8.68 | 9.85 | 10.14 | 9.90 |
| 1988 | | | | 5.91 | 7.26 | 7.75 | 8.30 | 9.18 | 10.26 | 10.30 | 12.50 |
| 1989 | | | | 5.45 | 6.51 | 7.19 | 8.07 | 8.94 | 9.61 | 10.80 | 11.93 |
| 1990 | | | | 6.00 | 6.62 | 7.51 | 7.90 | 9.18 | 10.28 | 10.90 | 11.18 |
| 1991 | | | 5.60 | 5.60 | 5.62 | 6.81 | 7.85 | 9.78 | 10.70 | 11.28 | 11.30 |
| 1992 | | | | 6.15 | | | 8.96 | 10.90 | 10.90 | | |
| 1993 | | | | 6.15 | 7.18 | 7.96 | 9.76 | 9.88 | 10.50 | | |
| 1994 | | | | 5.96 | 7.36 | 8.76 | 9.49 | 9.74 | 12.60 | | |
| 1995 | | | | 6.26 | 7.61 | 8.39 | 9.62 | 10.75 | | 11.93 | |
| 1996 | | | | 6.04 | 7.55 | 8.87 | | 11.90 | | | |
| 1997 | | | | 6.08 | 7.44 | | 9.05 | 11.30 | 10.39 | | |
| 1998 | | | 5.60 | 6.23 | | 8.74 | 10.33 | 11.34 | | | |
| 1999 | | | 5.60 | | 8.62 | 8.57 | 9.91 | | | | |
| 2000 | | | | 6.74 | 7.13 | 9.42 | 9.47 | 10.41 | | | |
| 2001 | | | 5.76 | 6.80 | 8.69 | 10.45 | 10.66 | 9.70 | 10.90 | | |
| 2002 | | | 5.54 | 7.00 | 9.33 | 10.43 | 10.20 | 10.56 | | | |
| 2003 | | | 5.95 | 8.22 | 8.62 | 9.33 | 10.59 | | | | |
| 2004 | | | 6.32 | 7.33 | 8.40 | 9.14 | | | | | |
| 2005 | | 5.39 | 6.39 | 7.56 | 8.63 | | | | | | |
| 2006 | | | 5.93 | 6.99 | | | | | | | |
| 2007 | | 5.76 | 5.84 | | | | | | | | |
| 2008 | | | | | | | | | | | |
| 2009 | | | | | | | | | | | |
| Mean | - | 5.58 | 5.86 | 6.45 | 7.59 | 8.54 | 9.40 | 10.09 | 10.52 | 10.90 | 11.38 |

Table A6. Mean length-at-age data of male yellow perch captured with experimental gillnets in the main lake basin, Leech Lake.

| | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| YC | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1980 | | | | | | | 8.90 | 7.70 | | | |
| 1981 | | | | | | 8.96 | 7.48 | 10.27 | 9.30 | 10.80 | 9.60 |
| 1982 | | | | | 7.02 | 7.03 | 9.42 | 8.97 | 10.05 | | 9.80 |
| 1983 | | | | 6.10 | 5.96 | 8.88 | 8.85 | 9.10 | 9.67 | 9.65 | 10.70 |
| 1984 | | | 6.70 | 5.64 | 8.43 | 7.53 | 8.76 | 9.14 | 8.03 | 9.80 | 9.70 |
| 1985 | | | 5.40 | 7.02 | 6.73 | 7.84 | 8.25 | 8.66 | 9.85 | 10.13 | |
| 1986 | | | 5.84 | 5.87 | 7.29 | 8.07 | 8.24 | 7.83 | 8.35 | 9.45 | 9.15 |
| 1987 | | 5.47 | | 6.19 | 6.73 | 8.00 | 8.13 | 8.36 | 8.80 | 8.20 | 8.80 |
| 1988 | | | 5.00 | 5.37 | 6.25 | 7.20 | 7.44 | 8.64 | 8.70 | 9.04 | 11.00 |
| 1989 | | | | 5.52 | 6.27 | 7.00 | 7.67 | 7.92 | 7.60 | 9.13 | |
| 1990 | | | | 6.07 | 6.33 | 7.17 | 7.43 | 8.65 | 8.60 | | |
| 1991 | | | | 5.60 | 7.20 | 7.27 | | 8.40 | 9.50 | | |
| 1992 | | | | 5.63 | 6.50 | | 8.00 | 8.85 | 10.10 | | |
| 1993 | | | 5.70 | 5.98 | 7.05 | 7.54 | 8.92 | 9.18 | 9.90 | | |
| 1994 | | | 5.65 | 5.74 | 6.60 | 7.98 | 8.21 | 9.70 | | | |
| 1995 | | | | 6.01 | 6.58 | 8.00 | 11.05 | | | | |
| 1996 | | | | 5.83 | 7.24 | 7.94 | | 10.90 | | | |
| 1997 | | | | 6.02 | 7.20 | | | | | | |
| 1998 | | | 5.47 | 6.05 | | 8.88 | | | | | |
| 1999 | | | 5.27 | | 8.30 | 7.83 | | | | | |
| 2000 | | | | 6.37 | 5.73 | 7.09 | | | | | |
| 2001 | | | 5.30 | 5.94 | 7.60 | | | | 10.79 | | |
| 2002 | | | 5.64 | 6.25 | 6.85 | 7.08 | 9.25 | 8.98 | | | |
| 2003 | | | 5.95 | 7.02 | 8.04 | 9.20 | 9.33 | | | | |
| 2004 | | | 6.02 | 6.44 | 6.79 | 6.98 | | | | | |
| 2005 | | 5.25 | 6.01 | 6.90 | 7.68 | | | | | | |
| 2006 | | | 6.06 | 6.31 | | | | | | | |
| 2007 | | 5.81 | 5.51 | | | | | | | | |
| 2008 | | | | | | | | | | | |
| 2009 | | | | | | | | | | | |
| Mean | - | 5.51 | 5.70 | 6.08 | 6.97 | 7.78 | 8.55 | 8.90 | 9.23 | 9.53 | 9.82 |

Table A7. Mean length-at-age data of female yellow perch captured with experimental gillnets in the western bays basin, Leech Lake.

| | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| YC | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1980 | | | | | | | 10.49 | 9.80 | 11.13 | 9.80 | 11.25 |
| 1981 | | | | | | 9.35 | 8.80 | 10.95 | 10.38 | 11.43 | 10.95 |
| 1982 | | | | | 6.97 | 8.12 | 10.18 | 9.21 | 11.70 | 9.80 | 10.70 |
| 1983 | | | | 6.41 | 6.61 | 9.19 | 8.25 | 10.93 | 10.90 | 10.53 | 10.00 |
| 1984 | | | | 5.70 | 7.95 | 7.63 | 8.85 | 10.50 | 9.98 | 10.50 | 10.12 |
| 1985 | | | | 7.21 | 6.67 | 8.65 | 9.34 | 9.49 | 9.86 | 9.50 | 9.35 |
| 1986 | | | 5.80 | 5.96 | 7.27 | 7.71 | 9.11 | 9.54 | 9.48 | 9.68 | 8.73 |
| 1987 | | | | 6.74 | 7.51 | 7.79 | 8.83 | 9.20 | 9.42 | 9.67 | 11.00 |
| 1988 | | | | 6.30 | 6.62 | 7.62 | 7.88 | 8.72 | 9.30 | 9.80 | 11.29 |
| 1989 | | | | 6.30 | 6.55 | 6.89 | 7.20 | 7.45 | 10.10 | 10.44 | |
| 1990 | | | | 5.62 | 6.05 | 7.28 | 7.45 | 9.70 | 10.13 | 10.80 | 10.87 |
| 1991 | | | | 5.70 | 6.18 | 7.06 | 7.25 | 9.41 | 11.11 | 11.14 | |
| 1992 | | | | 5.95 | 6.16 | 7.33 | 8.60 | 10.90 | 10.68 | 9.80 | 11.30 |
| 1993 | | | | 5.55 | 6.10 | 8.02 | 9.38 | 9.96 | 10.27 | 11.00 | 10.00 |
| 1994 | | | | 6.02 | 6.71 | 8.61 | 9.14 | 10.06 | 10.40 | 11.15 | |
| 1995 | | | | 6.02 | 7.27 | 8.37 | 10.14 | 9.98 | | 11.54 | |
| 1996 | | | | 5.90 | 7.21 | 8.05 | 8.13 | 10.58 | 10.16 | | |
| 1997 | | | | 6.11 | 7.01 | 8.27 | 9.98 | 9.78 | 11.56 | | |
| 1998 | | | 5.60 | 5.87 | 6.83 | 8.65 | 9.74 | 10.65 | | 11.61 | |
| 1999 | | | 5.30 | 5.86 | 7.43 | 8.37 | 9.97 | 10.14 | 11.77 | 11.89 | |
| 2000 | | | | 6.10 | 7.45 | 8..8 | 10.66 | | | 12.44 | |
| 2001 | | | 5.67 | 6.20 | 8.02 | 9.72 | 9.38 | 10.84 | 9.83 | | |
| 2002 | | | 5.14 | 7.25 | 8.34 | 8.40 | 9.64 | 10.28 | | | |
| 2003 | | | 6.28 | 7.01 | 7.61 | 5.23 | 9.10 | | | | |
| 2004 | | | 6.02 | 6.54 | 6.99 | 8.12 | | | | | |
| 2005 | | | 6.11 | 6.51 | 7.23 | | | | | | |
| 2006 | | | 5.81 | 6.62 | | | | | | | |
| 2007 | | 6.34 | 5.69 | | | | | | | | |
| 2008 | | | | | | | | | | | |
| 2009 | | | | | | | | | | | |
| Mean | - | 6.34 | 5.74 | 6.23 | 7.03 | 8.02 | 9.06 | 9.91 | 10.43 | 10.66 | 10.46 |

Table A8. Mean length-at-age data of male yellow perch captured with experimental gillnets in the western bays basin, Leech Lake.

| | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| YC | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1980 | | | | | | | 10.80 | 7.76 | | 10.28 | 10.60 |
| 1981 | | | | | | 8.73 | 7.77 | 10.40 | 9.97 | 9.60 | 10.60 |
| 1982 | | | | | 6.66 | 7.20 | 9.50 | 8.94 | 10.33 | | 10.75 |
| 1983 | | | | 6.40 | 6.19 | 8.97 | 7.79 | 9.59 | | 9.37 | |
| 1984 | | | | 5.83 | 7.67 | 7.21 | 8.34 | 9.10 | 8.83 | 10.10 | 9.73 |
| 1985 | | | | 7.08 | 6.26 | 8.37 | 8.10 | 8.60 | 8.60 | 9.00 | 10.10 |
| 1986 | | | 5.70 | 5.76 | 6.90 | 6.78 | 7.72 | 7.55 | | 9.10 | 9.13 |
| 1987 | | | | 6.00 | 6.40 | 6.96 | 8.00 | 8.10 | 9.50 | 8.10 | 9.83 |
| 1988 | | | | 5.83 | 6.17 | 7.02 | 7.39 | 8.87 | 8.10 | 8.73 | 10.00 |
| 1989 | | | | 5.67 | 6.08 | 6.87 | 7.74 | 7.60 | 8.23 | 9.48 | 10.25 |
| 1990 | | | | 5.42 | 6.34 | 7.28 | 7.67 | 7.55 | 8.78 | 10.65 | |
| 1991 | | | 5.20 | 5.65 | 6.50 | 7.80 | 8.05 | 8.18 | 9.13 | 11.00 | |
| 1992 | | | 5.40 | 5.90 | 6.15 | 6.66 | 7.75 | 9.56 | 10.10 | 10.30 | |
| 1993 | | | | 6.14 | | 7.10 | 8.50 | 9.25 | | | |
| 1994 | | | 5.70 | 5.67 | 6.74 | 7.30 | 8.19 | 9.95 | | 10.30 | 9.02 |
| 1995 | | | | 5.92 | 7.02 | 7.93 | 9.10 | | | 9.69 | |
| 1996 | | | | 6.02 | 6.70 | 7.70 | | 10.00 | 8.98 | 10.77 | |
| 1997 | | | 5.30 | 5.77 | 6.80 | | 9.12 | 9.77 | 10.47 | | |
| 1998 | | | 5.30 | 6.65 | | 7.92 | 9.40 | 8.88 | | | |
| 1999 | | | 5.50 | | 8.08 | 8.70 | 9.87 | | | 10.43 | |
| 2000 | | | | 6.36 | 7.11 | 9.35 | | 8.95 | | 9.17 | |
| 2001 | | | 5.73 | 5.84 | 6.90 | | 7.74 | 9.40 | 9.88 | | |
| 2002 | | | | 6.29 | 8.23 | 6.63 | 8.70 | 9.97 | | | |
| 2003 | | | 6.30 | 6.28 | 6.82 | 7.73 | 8.59 | | | | |
| 2004 | | | 5.89 | 6.51 | 6.41 | 7.06 | | | | | |
| 2005 | | | 5.55 | 6.15 | 6.36 | | | | | | |
| 2006 | | | 6.32 | 6.00 | | | | | | | |
| 2007 | | | 5.66 | | | | | | | | |
| 2008 | | | | | | | | | | | |
| 2009 | | | | | | | | | | | |
| Mean | - | - | 5.66 | 6.05 | 6.75 | 7.60 | 8.45 | 8.95 | 9.30 | 9.77 | 10.00 |

Table A9. Mean length-at-age data of female northern pike captured with experimental gillnets in the main lake basin, Leech Lake.

| | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| YC | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1980 | | | | | | | 22.02 | 26.55 | | 29.80 | |
| 1981 | | | | | | 24.15 | 27.58 | 30.70 | 28.00 | 32.50 | |
| 1982 | | | | | 23.04 | 26.61 | 29.48 | 27.20 | 29.40 | | |
| 1983 | | | | 19.08 | 23.93 | 28.20 | 29.40 | 31.50 | 28.70 | | |
| 1984 | | | 16.13 | 21.59 | 23.86 | 22.10 | 33.90 | | 33.80 | 33.40 | |
| 1985 | | 18.20 | 21.25 | 22.08 | 23.00 | 22.00 | 27.37 | 28.15 | 30.45 | | 28.60 |
| 1986 | | 15.50 | 20.74 | 22.44 | 21.23 | 27.13 | 29.70 | | 29.70 | 29.10 | |
| 1987 | | 18.20 | 19.71 | 21.06 | 26.46 | 24.46 | 27.45 | | 34.45 | 34.70 | 27.80 |
| 1988 | | 15.35 | 20.24 | 22.15 | 24.09 | 25.62 | 27.09 | 29.28 | 27.80 | 34.50 | |
| 1989 | | 17.80 | 21.13 | 22.61 | 23.87 | 25.32 | 29.63 | 32.50 | 32.40 | | |
| 1990 | | 13.10 | 20.85 | 22.40 | 25.08 | 25.03 | 26.95 | 26.70 | 33.65 | | |
| 1991 | | 16.77 | 21.87 | 22.99 | 24.91 | 27.48 | 29.00 | | | | |
| 1992 | | 16.79 | 22.42 | 21.78 | 23.36 | 26.93 | | 33.00 | | | |
| 1993 | | 17.27 | 20.38 | 21.79 | 26.73 | 27.72 | 31.10 | | | | |
| 1994 | | 17.43 | 20.91 | 22.54 | 24.64 | 30.15 | 32.05 | | | | |
| 1995 | 10.10 | 15.91 | 19.90 | 22.11 | 24.98 | 27.70 | | 29.20 | | | |
| 1996 | | 16.10 | 20.35 | 22.25 | 25.64 | | 25.50 | 24.60 | | | |
| 1997 | | 18.08 | 19.44 | 22.08 | 24.07 | 27.20 | 25.43 | | | 30.47 | |
| 1998 | | 15.73 | 19.98 | 21.59 | 23.48 | 23.78 | 29.57 | 36.16 | | | |
| 1999 | | 18.35 | 19.08 | 21.81 | 23.86 | 25.43 | 30.14 | 25.20 | | | |
| 2000 | | 15.30 | 21.18 | 22.47 | 23.37 | 25.26 | 25.94 | | | | |
| 2001 | | 16.43 | 20.54 | 22.12 | 22.62 | 26.57 | 26.70 | 32.17 | 28.36 | | |
| 2002 | | 16.90 | 22.52 | 23.98 | 25.94 | 28.07 | 28.99 | 27.41 | | | |
| 2003 | | 18.31 | 21.46 | 23.79 | 25.85 | 26.72 | 30.50 | | | | |
| 2004 | | 16.57 | 21.98 | 25.02 | 26.65 | 28.46 | | | | | |
| 2005 | | 17.31 | 20.49 | 24.53 | 25.06 | | | | | | |
| 2006 | | 17.17 | 20.39 | 24.16 | | | | | | | |
| 2007 | | 17.32 | 20.60 | | | | | | | | |
| 2008 | 8.50 | 15.80 | | | | | | | | | |
| 2009 | | | | | | | | | | | |
| Mean | 9.30 | 16.74 | 20.56 | 22.43 | 24.40 | 26.18 | 28.43 | 29.35 | 30.61 | 32.07 | 28.20 |

Table A10. Mean length-at-age data of male northern pike captured with experimental gillnets in the main lake basin, Leech Lake.

| | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| YC | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1980 | | | | | | | 21.55 | 21.85 | | | |
| 1981 | | | | | | 22.04 | 22.60 | 26.80 | 23.90 | 29.35 | 21.70 |
| 1982 | | | | | 21.83 | 20.18 | 25.00 | 25.10 | | 22.40 | 21.20 |
| 1983 | | | | 19.47 | 20.68 | 21.79 | 22.90 | 23.90 | 20.90 | 23.40 | |
| 1984 | | | 15.10 | 19.90 | 21.93 | 22.54 | 21.40 | 22.90 | | | |
| 1985 | | | 15.40 | 21.10 | 21.80 | 20.40 | 23.83 | | | 21.40 | |
| 1986 | | 15.00 | 18.55 | 20.33 | 20.50 | 20.00 | 21.60 | 23.06 | | 22.67 | |
| 1987 | | 15.03 | 18.25 | 18.44 | 21.47 | 21.74 | 22.80 | 20.00 | 21.60 | 17.07 | |
| 1988 | | 12.90 | 17.65 | 20.04 | 20.23 | 22.14 | 22.63 | 23.80 | 24.20 | 20.80 | |
| 1989 | | 15.70 | | 20.24 | 20.59 | 20.83 | 22.68 | 22.58 | | | |
| 1990 | | 17.80 | 18.90 | 21.60 | 21.10 | 22.37 | 20.80 | 26.20 | | 31.40 | |
| 1991 | | 16.20 | 19.68 | 19.68 | 21.05 | 18.65 | 21.35 | | | | |
| 1992 | | 17.00 | 18.55 | 20.48 | 21.50 | 20.86 | | | | | |
| 1993 | | 15.78 | 16.78 | 20.20 | 20.63 | 21.25 | | | | | |
| 1994 | 9.25 | 17.10 | 17.83 | 19.40 | 22.45 | 22.90 | | | | | |
| 1995 | 10.00 | 13.95 | 17.90 | 20.35 | 21.33 | 23.70 | | | | | |
| 1996 | | 15.83 | 18.68 | 20.11 | 22.38 | 21.10 | | 21.35 | | | |
| 1997 | 9.00 | 15.47 | 17.96 | 20.37 | 22.40 | 21.40 | 22.55 | | | | |
| 1998 | 9.60 | 15.20 | 18.09 | 20.54 | 21.12 | 21.51 | 22.64 | | | | |
| 1999 | | 14.90 | 18.19 | 20.28 | 21.49 | 21.77 | 24.09 | | | | |
| 2000 | 12.00 | 16.20 | 19.40 | 20.47 | 20.97 | 23.19 | | 22.36 | | | |
| 2001 | 9.63 | 14.05 | 17.58 | 20.39 | 21.65 | 24.02 | 23.46 | | 22.52 | | |
| 2002 | | | 19.45 | 20.42 | 22.62 | 23.98 | 23.11 | 22.94 | | | |
| 2003 | | 16.73 | 17.83 | 21.36 | 22.80 | 22.13 | 22.13 | | | | |
| 2004 | 9.41 | 14.84 | 19.66 | 21.59 | 21.50 | 22.36 | | | | | |
| 2005 | | 17.24 | 20.98 | 21.33 | 20.24 | | | | | | |
| 2006 | | | 18.84 | 20.69 | | | | | | | |
| 2007 | | 15.90 | 19.68 | | | | | | | | |
| 2008 | | | | | | | | | | | |
| 2009 | | | | | | | | | | | |
| Mean | 9.84 | 15.64 | 18.30 | 20.37 | 21.43 | 21.79 | 22.62 | 23.30 | 22.62 | 23.56 | 21.45 |

Table A11. Mean length-at-age data of female northern pike captured with experimental gillnets in the western bays basin, Leech Lake.

| | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| YC | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1980 | | | | | | | 28.00 | | | | |
| 1981 | | | | | | 22.73 | 26.68 | 29.07 | 27.00 | | |
| 1982 | | | | | 21.24 | 20.90 | 26.60 | 29.44 | | | |
| 1983 | | | | 19.33 | 24.93 | 27.78 | 23.40 | 30.00 | 35.60 | | |
| 1984 | | | 15.78 | 19.23 | 25.40 | 22.80 | 28.30 | 31.80 | | 33.90 | 28.05 |
| 1985 | | | 18.71 | 22.45 | 23.51 | 26.35 | 30.70 | 31.48 | 28.85 | | |
| 1986 | | 15.70 | 18.25 | 20.86 | 23.48 | 28.60 | 30.80 | 29.10 | 23.90 | 18.10 | 35.70 |
| 1987 | | 16.26 | 18.71 | 22.06 | 23.15 | 25.75 | 32.50 | 27.06 | 31.53 | 27.80 | |
| 1988 | | 15.43 | 18.76 | 21.37 | 26.58 | 25.18 | 25.45 | 30.05 | 28.70 | 33.40 | |
| 1989 | | 16.50 | 19.05 | 22.15 | 24.80 | 27.90 | 32.40 | 17.20 | 30.34 | | |
| 1990 | | 15.15 | 18.62 | 22.14 | 24.20 | 25.00 | 24.65 | 33.40 | | | |
| 1991 | | 15.95 | 17.05 | 21.77 | 25.21 | 25.48 | 27.08 | 32.40 | 29.00 | | |
| 1992 | | 14.93 | 20.10 | 20.74 | 23.38 | 24.63 | 29.93 | | 35.70 | | |
| 1993 | | 14.90 | 20.12 | 21.57 | 25.29 | 26.10 | 30.90 | 32.07 | 31.03 | | |
| 1994 | 9.40 | 16.65 | 19.17 | 21.56 | 23.92 | | 30.00 | 35.40 | | 34.60 | |
| 1995 | | 15.23 | 20.13 | 20.30 | 27.55 | 26.83 | 27.28 | | 30.20 | | |
| 1996 | | 14.19 | 18.08 | 21.93 | 26.98 | 23.90 | 29.20 | 30.64 | | | |
| 1997 | 10.55 | 14.71 | 17.68 | 21.31 | 23.20 | 24.59 | 24.47 | 27.95 | 32.80 | | |
| 1998 | 8.50 | 13.57 | 18.93 | 20.12 | 22.56 | 23.00 | 26.78 | 34.49 | 30.85 | 35.08 | |
| 1999 | | 14.72 | 17.75 | 21.09 | 22.91 | 26.27 | 26.62 | 27.24 | | 29.17 | |
| 2000 | | 15.14 | 17.50 | 20.17 | 22.13 | 26.88 | 29.46 | 30.38 | 31.72 | 27.95 | |
| 2001 | | 13.47 | 18.42 | 20.96 | 23.91 | 25.62 | 30.15 | 28.84 | 31.18 | | |
| 2002 | | 15.21 | 19.38 | 21.91 | 24.26 | 27.28 | 28.19 | | | | |
| 2003 | 9.70 | 14.33 | 18.73 | 21.94 | 24.24 | 25.93 | 26.28 | | | | |
| 2004 | | 17.76 | 19.30 | 22.78 | 23.34 | 26.72 | | | | | |
| 2005 | | 15.75 | 19.47 | 21.95 | 25.73 | | | | | | |
| 2006 | 10.45 | 14.89 | 19.54 | 22.49 | | | | | | | |
| 2007 | | 14.41 | 18.90 | | | | | | | | |
| 2008 | | 15.93 | | | | | | | | | |
| 2009 | 13.46 | | | | | | | | | | |
| Mean | 10.34 | 15.25 | 18.67 | 21.34 | 24.25 | 25.49 | 28.16 | 29.89 | 30.56 | 30.00 | 31.88 |

Table A12. Mean length-at-age data of male northern pike captured with experimental gillnets in the western bays basin, Leech Lake.

| | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| YC | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1980 | | | | | | | 21.37 | 23.60 | | | |
| 1981 | | | | | | 19.50 | 24.20 | | | | 23.10 |
| 1982 | | | | | 19.95 | 20.43 | 24.80 | | 21.20 | | 26.70 |
| 1983 | | | | 17.95 | 20.84 | 23.43 | | 21.00 | | | |
| 1984 | | | 16.96 | 17.25 | 21.39 | 24.55 | 22.70 | 23.70 | 28.20 | 25.17 | |
| 1985 | | | 16.82 | 19.65 | 20.89 | 21.50 | 22.47 | 18.00 | | | 24.30 |
| 1986 | | 13.95 | 17.24 | 19.71 | 19.20 | 18.70 | | 27.70 | 20.70 | 26.75 | 24.70 |
| 1987 | | 15.02 | 17.39 | 19.36 | 20.58 | 20.80 | 22.20 | | 21.65 | | |
| 1988 | | 14.26 | 17.32 | 18.29 | 20.10 | 21.07 | 19.95 | 23.77 | | 22.90 | |
| 1989 | | 15.44 | 17.62 | 21.09 | 20.18 | 22.30 | 22.58 | 21.10 | | | |
| 1990 | | 16.25 | 18.36 | 19.97 | 18.70 | 22.00 | 21.50 | | | | |
| 1991 | | 15.70 | 17.25 | 19.50 | 19.60 | 20.17 | 23.65 | 27.80 | | | |
| 1992 | | 13.80 | 18.30 | 18.50 | 20.98 | | | | | | |
| 1993 | | 14.36 | 17.49 | 21.03 | 21.08 | 23.88 | | | | | |
| 1994 | | 14.90 | 17.11 | 19.93 | 20.80 | 25.00 | | | | | |
| 1995 | 8.80 | 14.07 | 16.16 | 19.30 | 18.30 | 24.87 | | | 25.20 | | |
| 1996 | | 12.83 | 17.48 | 20.45 | 21.16 | 24.00 | | | | | |
| 1997 | 9.30 | 13.93 | 17.58 | 19.64 | 19.89 | 20.70 | 22.73 | 20.71 | | | |
| 1998 | | | 17.08 | 18.88 | 20.70 | 21.10 | 20.75 | | | | |
| 1999 | | 14.36 | 17.82 | 19.57 | 20.37 | 21.71 | 11.54 | | | 23.27 | |
| 2000 | 10.00 | 14.60 | 18.06 | 18.98 | 21.61 | 22.56 | | | | | |
| 2001 | | 12.96 | 16.75 | 18.76 | 20.38 | 24.71 | 22.64 | 26.57 | 20.51 | | |
| 2002 | | 14.17 | 17.11 | 18.53 | 21.26 | 21.94 | 19.41 | 21.69 | | | |
| 2003 | | 13.69 | 18.74 | 21.34 | 22.09 | 20.57 | 24.29 | | | | |
| 2004 | | 14.86 | 17.79 | 20.10 | 20.95 | 21.73 | | | | | |
| 2005 | | 15.10 | 17.10 | 19.19 | 20.00 | | | | | | |
| 2006 | 9.90 | 15.59 | 18.38 | 20.98 | | | | | | | |
| 2007 | | 13.33 | 17.52 | | | | | | | | |
| 2008 | | 17.17 | | | | | | | | | |
| 2009 | 11.26 | | | | | | | | | | |
| Mean | 9.85 | 14.56 | 17.48 | 19.50 | 20.46 | 22.05 | 21.67 | 23.24 | 22.91 | 24.52 | 24.70 |

Table A13. Gillnet catch-per-effort (fish/net) by species for Leech Lake, 1983-2009.

| | Year | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
| Black bullhead | 11.25 | 9.72 | 13.75 | 7.97 | 11.19 | 15.06 | 21.33 | 11.56 | 16.53 | 9.80 | 4.33 | 3.92 |
| Black crappie | 0.13 | 0.50 | 0.17 | 0.33 | 0.31 | 0.36 | 0.28 | 0.28 | 0.53 | 0.20 | 0.17 | 0.19 |
| Bluegill | 0.00 | 0.06 | 0.00 | 0.22 | 0.06 | 0.08 | 0.64 | 0.33 | 0.14 | 0.40 | 0.33 | 0.19 |
| Bowfin | 0.03 | 0.03 | 0.06 | 0.03 | 0.08 | 0.19 | 0.03 | 0.03 | 0.00 | 0.10 | 0.03 | 0.03 |
| Brown bullhead | 2.50 | 1.08 | 0.58 | 0.75 | 1.06 | 0.94 | 1.83 | 0.92 | 3.14 | 1.50 | 1.69 | 2.17 |
| Burbot | 0.09 | 0.08 | 0.11 | 0.17 | 0.03 | 0.08 | 0.08 | 0.00 | 0.08 | 0.10 | 0.08 | 0.08 |
| Hybrid sunfish | 0.03 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lake whitefish | 0.16 | 0.19 | 0.00 | 0.00 | 0.06 | 0.19 | 0.00 | 0.00 | 0.36 | 0.00 | 0.00 | 0.06 |
| Largemouth bass | 0.09 | 0.00 | 0.00 | 0.00 | 0.14 | 0.08 | 0.44 | 0.03 | 0.14 | 0.00 | 0.03 | 0.00 |
| Muskellunge | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.08 | 0.00 | 0.00 | 0.06 | 0.00 |
| Northern pike | 4.19 | 3.72 | 4.08 | 3.78 | 4.25 | 5.31 | 5.83 | 5.33 | 5.81 | 4.40 | 3.58 | 4.03 |
| Pumpkinseed | 0.09 | 0.25 | 0.28 | 0.22 | 0.33 | 0.69 | 1.11 | 1.61 | 1.00 | 1.10 | 0.47 | 0.44 |
| Rock bass | 0.50 | 1.31 | 2.11 | 1.06 | 0.39 | 0.86 | 2.25 | 2.67 | 2.11 | 1.10 | 2.06 | 1.17 |
| Shorthead redhorse | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 |
| Smallmouth bass | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tiger muskellunge | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tullibee/cisco | 6.31 | 4.56 | 10.19 | 14.06 | 18.47 | 11.08 | 2.11 | 5.94 | 6.67 | 4.40 | 9.64 | 9.14 |
| Walleye | 5.25 | 7.42 | 7.22 | 6.28 | 6.03 | 13.39 | 11.72 | 8.33 | 8.81 | 5.80 | 4.61 | 4.89 |
| White sucker | 1.31 | 1.78 | 1.78 | 1.06 | 2.36 | 2.56 | 2.06 | 2.14 | 1.75 | 2.00 | 1.64 | 1.86 |
| Yellow bullhead | 1.09 | 0.42 | 1.36 | 1.03 | 1.25 | 2.17 | 1.94 | 0.94 | 3.36 | 1.40 | 1.69 | 2.69 |
| Yellow perch | 13.50 | 17.94 | 15.61 | 13.19 | 16.06 | 18.47 | 26.08 | 33.67 | 18.64 | 22.10 | 20.39 | 21.67 |
| Total fish/set | 46.55 | 49.09 | 57.30 | 50.15 | 62.13 | 71.54 | 78.01 | 73.86 | 69.07 | 54.40 | 50.80 | 52.56 |
| Total sets | 32 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 |

Table A13 continued.  Gillnet catch-per-effort (fish/net) by species for Leech Lake, 1983-2009.

| | Year | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| Black bullhead | 0.88 | 0.67 | 1.49 | 2.50 | 1.75 | 0.54 | 0.69 | 1.22 | 1.25 | 4.25 | 3.50 | 1.44 |
| Black crappie | 0.12 | 0.14 | 0.11 | 0.17 | 0.31 | 0.20 | 0.36 | 0.31 | 0.56 | 0.25 | 0.39 | 0.64 |
| Bluegill | 0.09 | 0.08 | 0.14 | 0.17 | 0.11 | 0.57 | 0.64 | 1.00 | 0.50 | 0.78 | 2.08 | 1.14 |
| Bowfin | 0.00 | 0.03 | 0.03 | 0.06 | 0.33 | 0.17 | 0.06 | 0.11 | 0.03 | 0.11 | 0.00 | 0.00 |
| Brown bullhead | 0.91 | 0.58 | 0.66 | 1.28 | 3.25 | 2.09 | 2.08 | 0.86 | 0.94 | 1.61 | 4.11 | 2.00 |
| Burbot | 0.06 | 0.00 | 0.03 | 0.06 | 0.06 | 0.03 | 0.08 | 0.06 | 0.00 | 0.00 | 0.03 | 0.03 |
| Hybrid sunfish | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lake whitefish | 0.15 | 0.06 | 0.11 | 0.00 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Largemouth bass | 0.03 | 0.08 | 0.03 | 0.22 | 0.08 | 0.03 | 0.06 | 0.31 | 0.25 | 0.11 | 0.03 | 0.08 |
| Muskellunge | 0.06 | 0.03 | 0.11 | 0.06 | 0.03 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 |
| Northern pike | 6.17 | 4.83 | 5.14 | 5.08 | 3.69 | 4.97 | 5.28 | 5.28 | 4.97 | 5.39 | 4.89 | 4.03 |
| Pumpkinseed | 0.24 | 0.47 | 1.09 | 0.72 | 0.39 | 0.43 | 1.11 | 1.08 | 1.61 | 0.81 | 2.06 | 0.64 |
| Rock bass | 2.71 | 2.89 | 2.03 | 2.25 | 1.83 | 0.89 | 1.86 | 1.22 | 1.28 | 2.00 | 0.58 | 0.47 |
| Shorthead redhorse | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Smallmouth bass | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tiger muskellunge | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tullibee/cisco | 4.18 | 4.72 | 4.23 | 3.67 | 3.14 | 2.66 | 1.28 | 1.58 | 0.92 | 1.78 | 3.53 | 0.64 |
| Walleye | 7.74 | 9.50 | 5.69 | 11.64 | 8.92 | 5.91 | 7.03 | 6.19 | 5.17 | 4.97 | 4.89 | 7.06 |
| White sucker | 3.12 | 1.97 | 1.20 | 1.97 | 1.17 | 0.94 | 1.17 | 1.28 | 1.42 | 0.83 | 0.86 | 1.89 |
| Yellow bullhead | 0.41 | 0.33 | 0.91 | 0.83 | 0.86 | 0.37 | 0.53 | 1.61 | 1.28 | 2.72 | 2.56 | 1.69 |
| Yellow perch | 37.66 | 25.64 | 32.11 | 28.58 | 21.06 | 21.17 | 15.53 | 20.50 | 16.17 | 16.28 | 12.89 | 20.47 |
| Total fish/set | 64.56 | 52.02 | 55.11 | 59.26 | 47.01 | 41.06 | 37.73 | 42.64 | 36.33 | 41.91 | 42.43 | 42.25 |
| Total sets | 35 | 36 | 35 | 36 | 36 | 35 | 36 | 36 | 36 | 36 | 36 | 36 |

Table A13 continued. Gillnet catch-per-effort (fish/net) by species for Leech Lake, 1983-2009.

| | Year | | | | | | | Quartiles | |
|---|---|---|---|---|---|---|---|---|---|
| Species | 2007 | 2008 | 2009 | Min | Max | Median | Mean | First | Third |
| Black bullhead | 1.89 | 1.14 | 0.31 | 0.31 | 21.33 | 3.50 | 5.92 | 1.24 | 10.50 |
| Black crappie | 1.72 | 0.89 | 1.14 | 0.11 | 1.72 | 0.31 | 0.40 | 0.18 | 0.45 |
| Bluegill | 1.14 | 1.19 | 1.11 | 0.00 | 2.08 | 0.33 | 0.49 | 0.10 | 0.71 |
| Bowfin | 0.11 | 0.08 | 0.08 | 0.00 | 0.33 | 0.03 | 0.07 | 0.03 | 0.09 |
| Brown bullhead | 4.25 | 1.97 | 0.64 | 0.58 | 4.25 | 1.50 | 1.68 | 0.92 | 2.09 |
| Burbot | 0.06 | 0.00 | 0.00 | 0.00 | 0.17 | 0.06 | 0.05 | 0.03 | 0.08 |
| Hybrid sunfish | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lake whitefish | 0.00 | 0.06 | 0.03 | 0.00 | 0.36 | 0.00 | 0.06 | 0.00 | 0.06 |
| Largemouth bass | 0.22 | 0.08 | 0.11 | 0.00 | 0.44 | 0.08 | 0.10 | 0.03 | 0.13 |
| Muskellunge | 0.03 | 0.00 | 0.06 | 0.00 | 0.25 | 0.03 | 0.04 | 0.00 | 0.06 |
| Northern pike | 5.94 | 5.61 | 4.94 | 3.58 | 6.17 | 4.97 | 4.83 | 4.14 | 5.32 |
| Pumpkinseed | 1.33 | 1.47 | 0.67 | 0.09 | 2.06 | 0.69 | 0.80 | 0.41 | 1.11 |
| Rock bass | 1.33 | 2.39 | 2.17 | 0.39 | 2.89 | 1.83 | 1.61 | 1.08 | 2.14 |
| Shorthead redhorse | 0.03 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| Smallmouth bass | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tiger muskellunge | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tullibee/cisco | 4.00 | 1.61 | 11.92 | 0.64 | 18.47 | 4.23 | 5.65 | 2.39 | 7.91 |
| Walleye | 13.11 | 9.06 | 8.61 | 4.61 | 13.39 | 7.06 | 7.60 | 5.75 | 8.87 |
| White sucker | 0.72 | 0.61 | 1.08 | 0.61 | 3.12 | 1.64 | 1.58 | 1.13 | 1.97 |
| Yellow bullhead | 4.22 | 2.56 | 1.36 | 0.33 | 4.22 | 1.36 | 1.54 | 0.89 | 2.06 |
| Yellow perch | 36.86 | 26.56 | 25.83 | 12.89 | 37.66 | 20.50 | 22.02 | 16.23 | 25.96 |
| Total fish/set | 76.97 | 55.28 | 60.06 | 36.33 | 78.01 | 52.56 | 54.45 | 44.60 | 61.10 |
| Total sets | 36 | 36 | 36 | | | | | | |

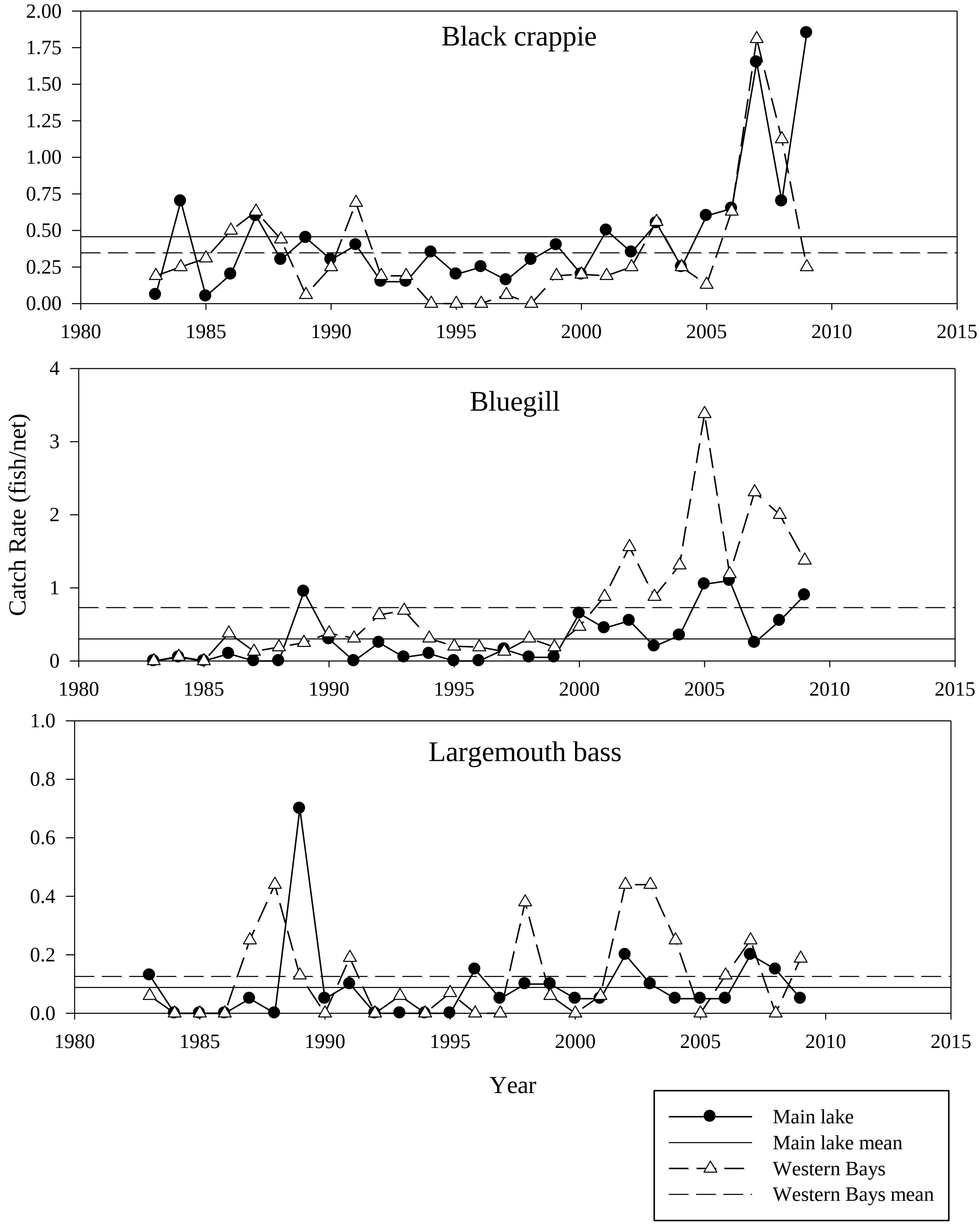


Figure A1. Basin-specific gillnet catch rates (fish/net) of selected species in Leech Lake, 1983-2009.

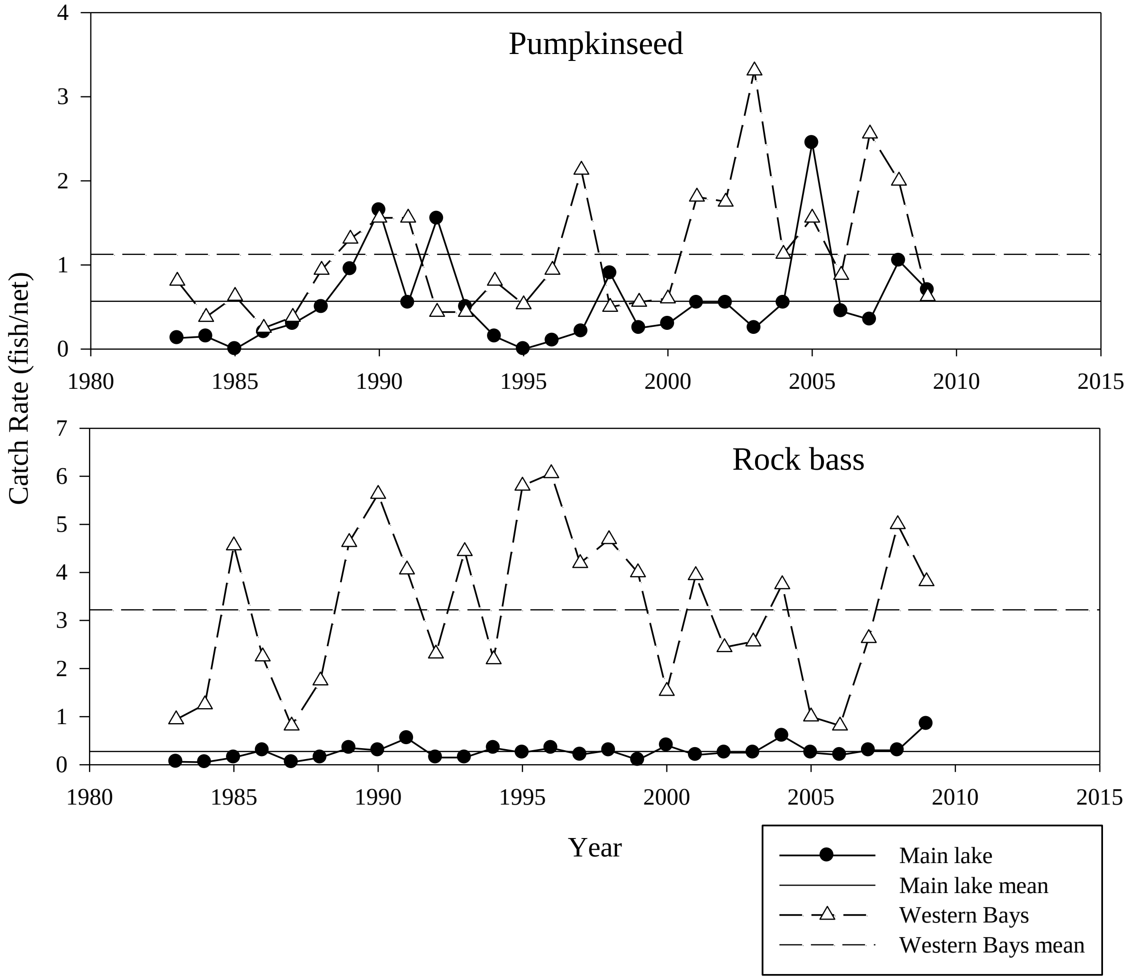


Figure A1, continued. Basin-specific gillnet catch rates (fish/net) of selected species in Leech Lake, 1983-2009

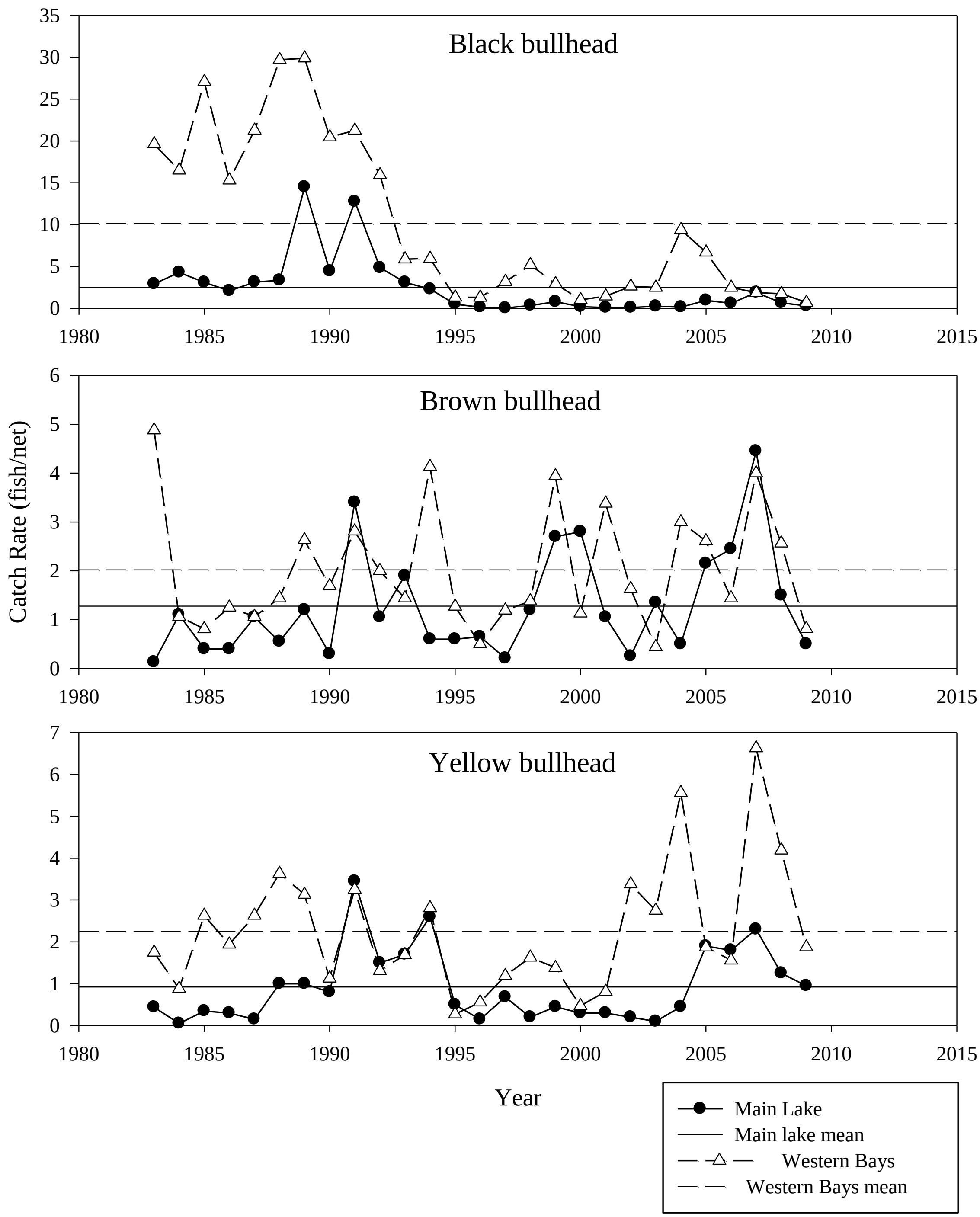


Figure A1, continued. Basin-specific gillnet catch rates (fish/net) of selected species in Leech Lake, 1983-2009

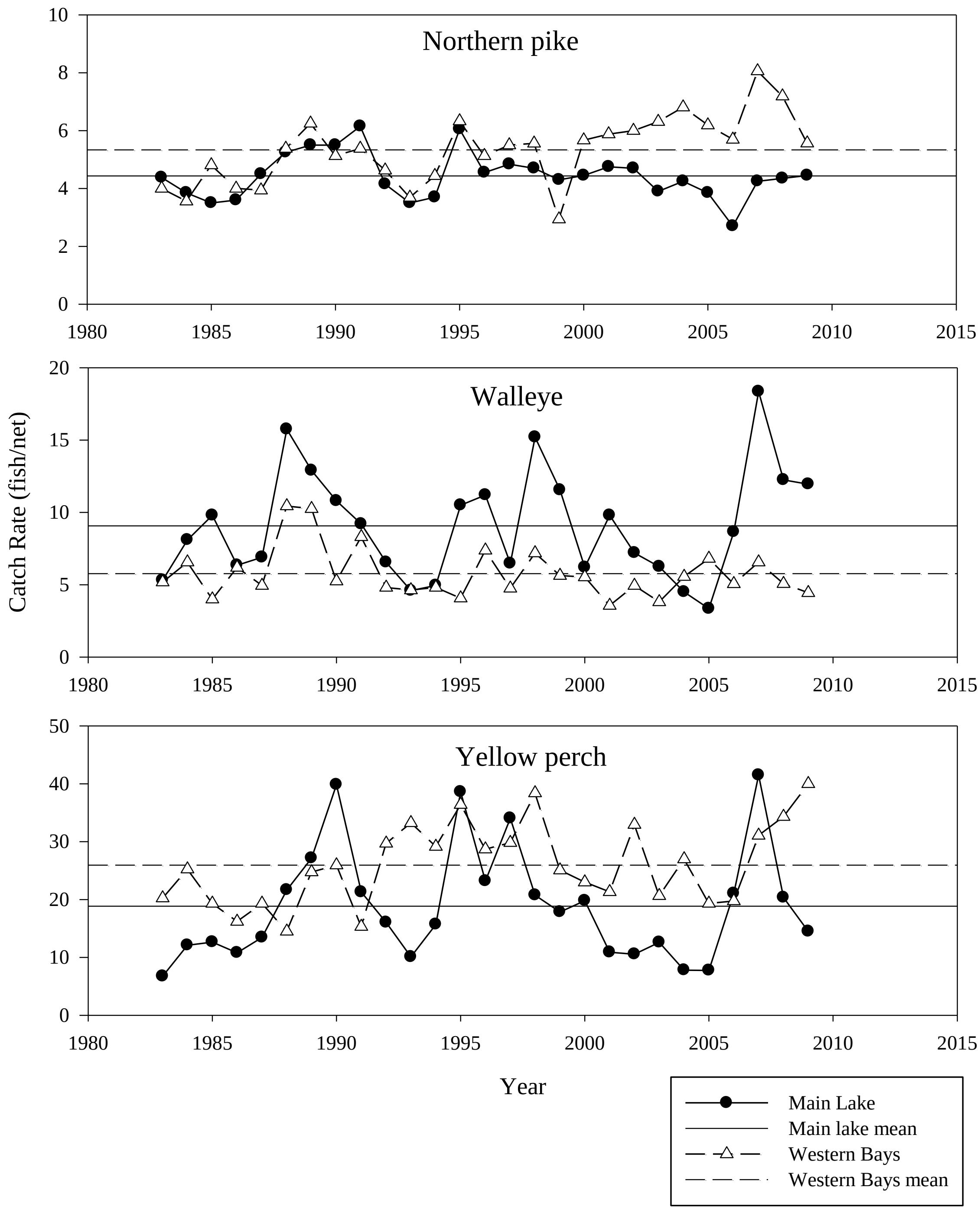


Figure A1, continued. Basin-specific gillnet catch rates (fish/net) of selected species in Leech Lake, 1983-2009

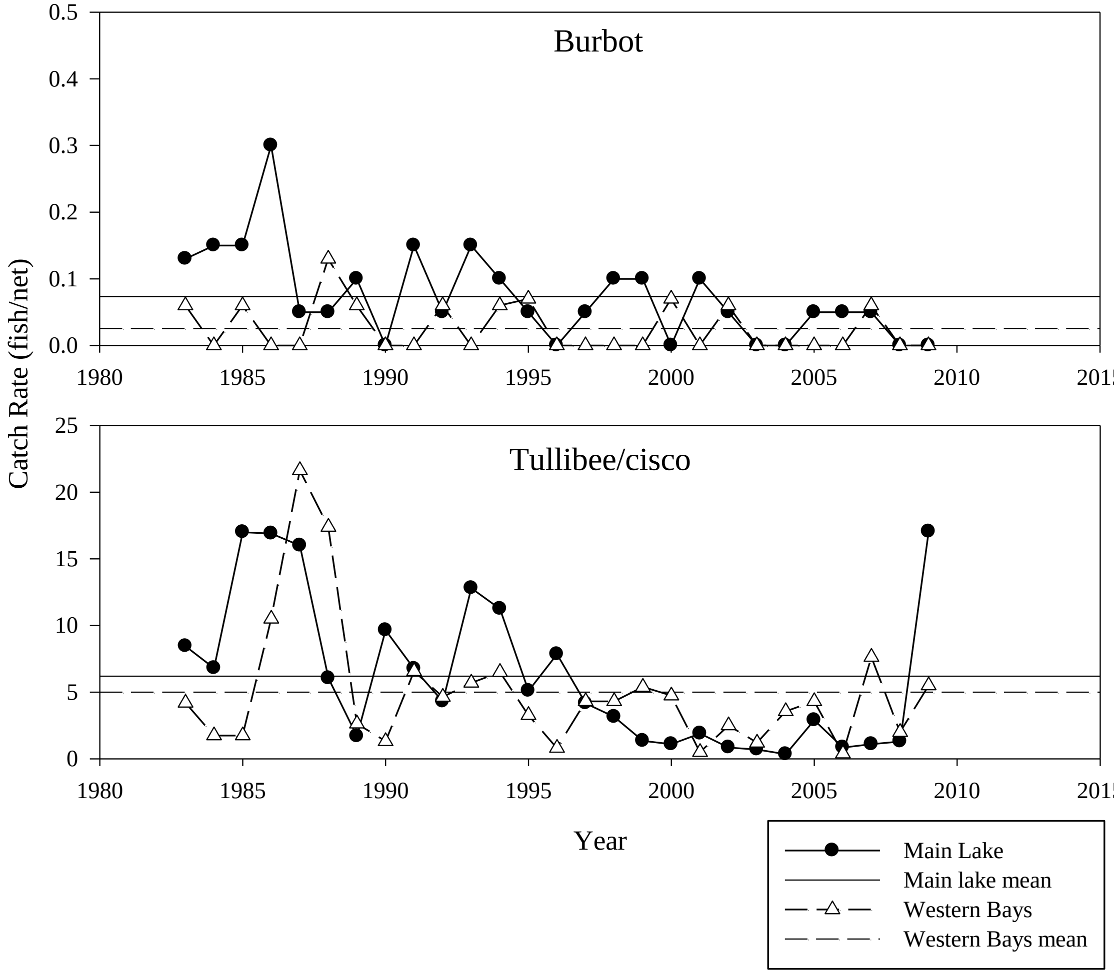


Figure A1, continued. Basin-specific gillnet catch rates (fish/net) of selected species in Leech Lake, 1983-2009

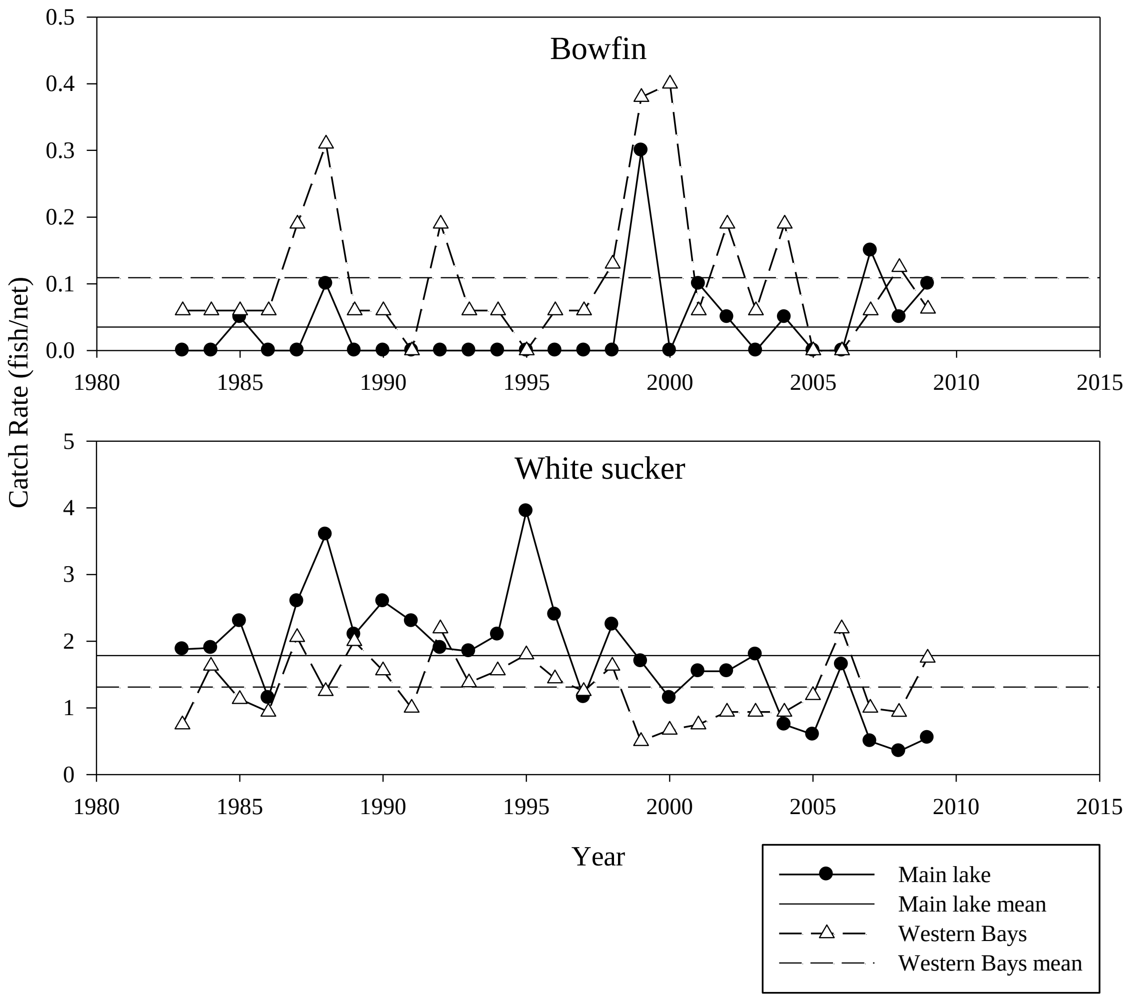


Figure A1, continued. Basin-specific gillnet catch rates (fish/net) of selected species in Leech Lake, 1983-2009