Yellow and Little Yellow Lakes Fishery Survey, Burnett County, Wisconsin

2008-2009

MWBIC (Yellow Lake – 2675200, Little Yellow Lake – 2674800)

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Executive Summary

Yellow and Little Yellow Lake (Burnett County) were surveyed during 2008 and 2009 following the protocol established by the Wisconsin Department of Natural Resources Treaty Fisheries Assessment Unit. The primary objective of this survey was to assess the status of walleye, muskellunge, and other game and panfish populations. Also, a creel survey assessed angler effort, catch, and harvest of all fish species on the two lakes.

The 2008 adult walleye population estimate on Yellow Lake (4.6 fish/acre) was very similar to previous surveys and higher than both Burnett County and northwest Wisconsin averages. Growth rates for both male and female walleyes continued to exceed regional averages. Catch curve analysis estimated adult walleye mortality at 22.4%. Muskellunge sampling was ineffective during this survey. However, results from the creel survey suggest a low density population. Northern pike continue to be an important component of the Yellow Lake fishery. Largemouth bass are low density but show above average growth rates and size structure.

Total angler effort on both Yellow Lake (29.6 hours/acre) and Little Yellow Lake (35.9 hours/acre) exceeded Burnett County and ceded territory averages. The majority of angler effort on Yellow Lake was directed towards walleye (55.6%). Bluegill (32.3%) and black crappie (23.2%) were the primary species targeted by anglers on Little Yellow Lake. Adult walleye exploitation including both sport angler and tribal harvest on Yellow Lake was relatively low at 14.3%.

Management recommendations include: 1) Maintain existing walleye regulations and continue to not stock walleye in the Yellow Lakes, 2) Further muskellunge evaluations are needed, changing stocking to spring yearlings should be considered, 3) assess the Yellow Lake cisco population 4) Continue managing Little Yellow Lake as a

self-sustaining fishery, 5) Continue efforts to maintain and enhance habitat diversity whenever possible, and 6) Continue exotic species monitoring and control programs.

Introduction

Yellow Lake and Little Yellow Lake are St. Croix River basin drainage lakes located in north central Burnett County. The Yellow River feeds both waterbodies while a water control structure on the Danbury Flowage maintains water levels of both lakes. The shoreline of both lakes is primarily privately owned and well developed. Yellow Lake is 2,287 acres with a maximum depth of 31 feet and mean depth of 19 feet. Little Yellow Lake is 348 acres and shallower than Yellow Lake with a maximum depth of 21 feet and mean depth of 10 feet. Fish movement between the two lakes is unimpeded.

Both Yellow and Little Yellow are eutrophic, polymictic lakes. TSI is an index for evaluating trophic state or nutrient condition of lakes (Carlson 1977; Lillie et. al. 1993). TSI values can be computed for water clarity (secchi disk measurements), chlorophyll-a, and total phosphorus values. TSI values represent a continuum ranging from very clear, nutrient poor water (low TSIs) to extremely productive, nutrient rich water (high TSIs). The data on both Yellow and Little Yellow Lake (WDNR (online) 2010) indicate the nutrient conditions were eutrophic (high productivity) when considering secchi disk, total phosphorus and chlorophyll-a TSI indices. Between 1992 and 2008, mean secchi TSI values were 56.2 (S.D. = 2.5) from samples taken near the center of Yellow Lake and 56.4 (S.D. = 3.5) near the deepest point on Little Yellow Lake (WDNR (online) 2010).

The morphological differences between the two lakes lead to much different fish communities. Walleye Sander vitreus, muskellunge Esox masquinongy, and lake sturgeon Acipenser fulvescens are more abundant on Yellow Lake while largemouth bass Micropterus salmoides, bluegill Lepomis macrochirus, and black crappie Pomoxis nigromaculatus are more common in the shallower waters of Little Yellow Lake. Other species common in the Yellow Lakes include northern pike E. lucius, smallmouth bass

M. dolomieui, yellow perch Perca flavescens, bowfin Amia calva, redhorse species Moxostoma spp.,cisco Coregonus artedii, bullhead species Ameiurus spp.,common carp Cyprinus carpio, and white sucker Catostomus commersoni.

Past fisheries surveys conducted by Wisconsin DNR on Yellow Lake occurred in 1986, 1992, and 2008. These surveys primarily targeted walleyes but other species were also surveyed. The Great Lakes Indian Fish and Wildlife Commission has also conducted numerous fall surveys targeting juvenile walleyes as well as conducting adult walleye population estimates in 1996 and 1997.

Since 1974, lake sturgeon, muskellunge and walleye have been the only fish species stocked into the Yellow Lakes (Appendix Table 1). Since 1991, large fingerling muskellunge have typically been stocked in alternate years in Yellow Lake, with a range of 580-6,900 fish. Muskellunge have not been stocked in Little Yellow Lake since 1998. Current stocking quotas continue to request alternate year fall stocking of muskellunge on Yellow Lake. Stocking of walleye in the Yellow Lakes has been discontinued since 2005 due to sufficient natural reproduction to support the fishery. During this survey, all of the standard statewide fishing regulations applied to the Yellow Lakes, except for a 40 in minimum size limit on muskellunge (Appendix Table 2).

The primary objective of this study was to assess the status of the walleye population, as well as sport and tribal exploitation of walleye on the Yellow Lakes. Secondary objectives were to assess muskellunge, largemouth bass, smallmouth bass, northern pike, and lake sturgeon populations. Lake sturgeon results were presented in a separate report (Wendel and Damman 2011).

Methods

Yellow Lake, Little Yellow Lake, and portions of the Yellow River upstream of Yellow Lake were surveyed during 2008-2009 following the Wisconsin Department of Natural Resources treaty assessment protocol (Cichosz 2010). The first phase of this

survey consisted of spring fyke netting and electrofishing to estimate walleye, muskellunge, northern pike, largemouth bass, and smallmouth bass abundance. Beginning with the gamefishing opener in May, 2008, a creel survey (both open water and ice) was conducted. Fall electrofishing targeting young-of-the-year (YOY) walleye was conducted in 2008.

The first phase of the spring survey targeted adult walleye in the Yellow River with a pulsed DC electrofishing boat. River sampling began on 17 April when water temperatures reached 44 F. Daily shocking runs to increase the number of adult walleye marked for a population estimate continued through 21 April. The locations of daily shocking runs varied but all runs were confined to the Conners Bridge Landing on the upstream end of the river to the confluence with Yellow Lake (Figure 1). River sampling concluded 22 April with a recapture shocker run for adult walleyes. The entire portion of the Yellow River from the Conners Bridge Landing to the confluence with Yellow Lake was sampled during this portion of the survey.

After the river portion of spring sampling concluded, efforts focused on sampling the Yellow Lakes. This portion of the survey started soon after ice out with fyke nets (4 x 5 ft frame) set on 25 April. Nets were checked daily and set at areas expected to contain high concentrations of spawning walleye. Nets were removed on 30 April, with a total effort of 23 net nights on Yellow Lake and 12 net nights on Little Yellow Lake. After removal of nets, the entire shoreline of Yellow and Little Yellow Lakes were sampled with an electrofishing boat on 30 April for the lake recapture run.

On 5 May, five fyke nets targeting adult muskellunge were set on Yellow Lake and removed on 8 May. Two nets did not fish on 7 May, so the total number of net nights was 13. Due to the very low number of muskellunge captured during the 2008 survey, the muskellunge recapture planned for 2009 was cancelled.

Sampling targeting largemouth bass, smallmouth bass, and panfish was conducted on 27 May. Both bass species were sampled over three, two-mile index stations. A 1/2 mile index station was embedded in each station where panfish were collected in addition to bass.

The final component of the on-the-water sampling consisted of a fall electrofishing run on 24 September. During this survey, only walleye <14.0 in and muskellunge <20.0 in were targeted and collected over the entire shoreline.

All walleyes, muskellunge, northern pike, largemouth bass, and smallmouth bass captured during the spring portion of the survey were measured to the nearest 0.5 in and given the appropriate fin clip (Appendix Table 3). To determine if recaptured fish had been initially captured during river or lake sampling, different fin clips were used (RP for river, LV for Yellow Lake, AN for Little Yellow Lake). Sex was determined for walleyes, muskellunge, and northern pike by the presence of gametes.

Spring survey data were used to estimate the adult walleye populations for Yellow Lake and Little Yellow Lake. The walleye populations on Yellow Lake and Little Yellow Lake are considered relatively discreet based on prior sampling. Therefore, separate population estimates were calculated for each population. For Little Yellow Lake, fish captured during netting were included in the marked sample and fish captured during the electrofishing run were included in the recapture sample. As a significant portion of the adult walleye in Yellow Lake migrate upstream into the Yellow River for spawning, the river and lake portions of that survey were combined to calculate a population estimate. The total number of marked fish included both the number of fish marked during netting on Yellow Lake and fish captured on Yellow River between 17-21 April. For the recapture sample, the number of marked and unmarked fish captured on 22 April in the river and 30 April on the lake were both included. During the lake sampling effort, any fish captured with the river clip (RP) were not included in the final

analysis. Adult walleye population estimates were calculated using the Chapman modification of the Petersen Estimator as outlined in Cichosz (2010).

For age analysis, scale samples were removed from walleyes and largemouth bass less than 12 in, while dorsal spines were removed from larger walleyes and largemouth bass. Age interpretations on northern pike were not conducted due to the unreliability and difficulty of determining annuli. Casselman (1990) found this to be due to irregular growth and resorption or erosion on the midlateral region.

Mean length-at-age comparisons for walleye and largemouth bass were made to regional (18 county Northern Region) and statewide data using the WDNR Fish and Habitat statewide database. Local comparisons for largemouth bass were made using Washburn and Burnett County data from 2000 to 2006. Mean length at age was used to assess growth for walleye and largemouth bass using the following von Bertalanffy equation:

$$l_t = L_\infty(1-e^{-K(t+t_o)})$$

Where l_t is length at time t, L_∞ is asymptotic length, K is a growth parameter, t is age in years, and t_0 is the age at which l_t is zero (Van den Avyle and Hayward 1999). L_∞ predicts the average ultimate length attained for fish in that population. Assuming dimorphic separation of length at age, growth equations were calculated separately for male and female walleye.

The descending limb of a catch curve regression was used to estimate total annual mortality for walleye (Ricker 1975). As aging materials were not taken for all fish, an age-length key was used to assign a sample age distribution.

Size structure quality of species sampled was determined using the indices proportional (PSD) and relative (RSD) stock densities (Anderson and Gutreuter 1983). The PSD and RSD value for a species is the number of fish of a specified length and

longer divided by the number of fish of stock length or longer, the result multiplied by 100 (Appendix Table 4).

Catch per Unit Effort (CPE) was calculated as the number of fish captured above stock, preferred, and quality sizes divided by the appropriate unit of sampling effort for that species. That value is then compared to surveys of similar waterbodies throughout Wisconsin using the Fisheries Assessment Classification Tool (FACT) to determine how that value compares to other fisheries.

Creel survey data were collected on the Yellow Lakes beginning the first Saturday in May and continuing through 1 March of the following year (the open season for gamefish angling in Wisconsin). No creel survey data were collected during November because thin ice created dangerous fishing conditions. Creel survey methods followed a stratified random design as described by Rasmussen et al. (1998) and Cichosz (2010). Walleye exploitation rates were calculated using the proportion of fin clipped walleye (from spring population estimates) observed and measured during the creel survey.

Results

Walleye. Adult walleye population density estimates for Yellow Lake showed very low variability among surveys since 1986, ranging from 4.0-4.7 fish/acre (Table 1). The 2008 estimate (4.6 adult walleyes/acre) was greater than both the Burnett county and Northwest Wisconsin averages of 1.4 and 2.7 fish/acre, respectively (WDNR unpublished data).

Similar to adult walleye density patterns on Yellow Lake, length distributions have shown little variability between surveys (Figure 2). For the spring 2008 survey, mean lengths of male and female walleyes were 16.7 (S.D. = 1.7) and 20.0 in (S.D. = 2.2), respectively. All female walleyes captured in the 2008 survey were longer than the 15 in minimum size limit. The proportional stock density (PSD) and relative stock density of

preferred size (RSDP) walleyes captured during spring surveys have shown low variation (Table 2). PSD ranged from 81 to 90, while RSDP ranged from 6 to 10 (Table 2).

Growth rates for both male and female walleyes on Yellow Lake have exceeded regional averages in every survey since 1986 (Figures 3 and 4). The von Bertalanffy growth curve for female walleyes in the 2008 and 1986 surveys were very similar (Figure 5). The male growth curve for 2008 was more similar to the growth curve from the 1992 survey (Figure 6).

The adult walleye population estimate for Little Yellow Lake (0.5 fish/acre) was well below regional averages (Table 1). However, the coefficient of variation was very high (0.57). Adult walleyes on Little Yellow Lake ranged from 13-26 in during the 2008 survey (Figure 2). Mean lengths of male and female walleyes were 16.3 (S.D. = 1.9) and 20.0 (S.D. = 3.2), respectively. PSD and RSDP ranked relatively low (13th and 23rd percentiles) compared to surveys of similar Wisconsin waterbodies (Table 2).

Catch curve analysis estimated annual mortality of Yellow Lake adult walleye at 22.4% (Figure 7). Mortality estimates from previous surveys on Yellow Lake adult walleye were much higher, ranging up to 43% in 1986 (Table 3).

The average catch rate of Young of Year (YOY) walleye in surveys conducted by both Great Lakes Indian Fish and Wildlife Commission and Wisconsin DNR crews between 1990 and 2010 was 7.1 fish/mile (S.D. = 10.5, N = 14; (Figure 8)). Recent catch rates (2002-2010) have been higher, averaging 12.8 fish/mile (S.D. = 12.2, N = 9). Catch rates of walleye less than 10 in averaged 15.1 fish/mile between 2002-2010, greater than 48% of similar surveys statewide (FACT).

Muskellunge. Only five muskellunge were captured during spring survey work, ranging from 27-35 in. The netting survey targeting muskellunge only captured two fish. The low catch may have been the result of a sudden increase in water temperatures in the

spring and crews were not able to run nets during the peak of muskellunge spawning activity.

Northern Pike. A total of 142 northern pike, ranging in length from 8-26 in were captured during spring surveys (Figure 9). PSD for northern pike was 60. No fish greater than 28 in were captured during spring surveys, resulting in a RSDP of zero.

Largemouth and Smallmouth bass. A total of 117 largemouth bass were captured during the all spring 2008 sampling on Yellow Lake. The mean length of largemouth bass collected during all phases of the spring 2008 survey on Yellow Lake was 13.0 in (S.D. = 2.0), with a range of 8.0-17.4 in (Figure 10). The mean length of the seven smallmouth bass captured during the spring survey was 11.3 in (S.D. = 1.3), with a range of 10-13 in.

To allow comparisons to statewide averages, only largemouth bass collected during 27 May sampling were included in CPE, PSD, and RSD analyses. A total of 100 largemouth bass (16.7/mile) were collected during that survey, which is greater than 45% of surveys in Wisconsin (FACT). PSD value was 90 (C.I. = 5.9), greater than 92% of surveys from similar Wisconsin lakes. The proportion of fish greater than the 14 in minimum size limit (RSD-14) was 35 (C.I. = 9.4), greater than 40% of statewide surveys.

Largemouth bass growth rates met or exceeded statewide averages for all ages up to eight years (Figure 11). Mean ultimate length from the von Bertalanffy growth equation was 17.6 in (Figure 12).

Panfish. Panfish catch from the 27 May sampling was low, with only 45 bluegill sampled (Table 4). Catch rates may have been impacted by poor water clarity during sampling along some portions of shoreline.

Angler Survey. Total projected angling effort on Yellow Lake and Little Yellow Lake during the 2008-2009 season was estimated at 67,775 hours and 12,482 hours,

respectively (Table 5). The majority of angling effort was directed at walleye on Yellow Lake and bluegill and black crappie on Little Yellow Lake.

Projected catch and harvest for walleye were higher in the 2008-2009 survey than in either of the previous surveys on Yellow Lake (Table 6). The estimated number of fish caught and harvested per acre also exceeded Burnett County and ceded territory averages. Adult walleye exploitation was estimated at 11% by sport anglers and 3.3% by tribal harvest (Krueger 2009) for a total exploitation rate of 14.3%. The mean length of walleyes harvested by tribal spearers in 2008 was 17.7 in, compared to 17.6 in for sport anglers.

Both the number of fish harvested/acre and the mean lengths of harvested northern pike on Yellow Lake exceeded Burnett County and ceded territory averages (Table 7). The harvest rate during the winter season (0.07 fish/hour) was lower than during the open water season (0.09 fish/hour). Specific catch rates of northern pike were higher on Little Yellow Lake than Yellow Lake in the 2008-2009 survey. However, the specific harvest rate and mean length of harvested northern pike on Little Yellow Lake was much lower.

The muskellunge catch rate for Yellow Lake anglers was lower in 2008 than in previous creel surveys (Table 8). No documented muskellunge harvest occurred on either Yellow or Little Yellow Lake in 2008-2009.

Catch and harvest rates for largemouth bass were much higher in the 2008-2009 creel survey on Yellow Lake (Table 9). While catch rates for largemouth bass were below Burnett county averages, harvest rates and mean lengths of harvested fish exceeded county averages. Catch and harvest rates for largemouth bass on Little Yellow Lake were very similar to county averages.

Bluegill and black crappie effort, catch, and harvest was much higher on Little Yellow Lake than Yellow Lake (Tables 10 and 11). Comparisons of yellow perch catch

and harvest rates on the two lakes were very similar while mean length of harvested fish was higher on Yellow Lake (Table 12).

Discussion

The Yellow Lakes have historically supported very diverse, balanced fisheries (Johannes 1988). Results from this survey indicate that has not changed. With their connection to the Yellow River, the Yellow Lakes have high productivity with diverse habitat availability. Between the two lakes, quality angling opportunities exist for most of the fish species of interest to Wisconsin anglers.

Fish communities of Yellow Lake have shown remarkably few changes from previous surveys. Walleye continues to be the primary sport fish and density estimates have shown little variation between 1986-2008. Muskellunge densities appear to have decreased compared to previous surveys. Northern pike have provided an important secondary gamefish for anglers and have remained at moderate densities. Largemouth bass have remained at low densities but offer above average size fish compared to area lakes.

Shifts in species abundance towards increasing centrarchid abundance and stable or decreasing percid abundance have been observed on many regional lakes (Toshner 2009). That shift does not appear to be occurring on Yellow Lake where walleye are still at high density levels and largemouth bass and panfish species have remained stable at low densities. Due to its eutrophic state, low water clarity, and river spawning walleye population, Yellow Lake may be more resistant to this shift than other area lakes.

Good to excellent natural reproduction supports all fish communities in the Yellow Lakes except muskellunge. Walleye reproduction has been adequate but not abundant. Surveys to monitor levels of natural reproduction of walleye should continue. If walleye recruitment appears to be inadequate, efforts should be made to enhance

natural reproduction. Maintaining the genetic integrity of the river spawning stock of walleyes (Jennings et al. 1996, Franckowiak et al. 2009) should be a high priority. Therefore, walleye stocking should only be considered after efforts to enhance natural reproduction have been exhausted.

Walleye exploitation was well below the 35% maximum level recommended for Wisconsin waters (Staggs et al. 1990). The total mortality rate of adult walleye was also relatively low. With adequate recruitment, the population should be able to maintain current densities under current exploitation levels.

Unfortunately, sampling for muskellunge during this survey was mostly unsuccessful. Given the very low specific catch rates of muskellunge by anglers, the population is likely low density. Also, muskellunge catch rates and targeted effort by anglers has declined from previous creel surveys, indicating the population may be at lower abundance. Targeted sampling towards muskellunge should be a high priority the next time Yellow Lake is intensively surveyed. Also, stocking of spring yearling muskellunge instead of fall fingerlings should be considered to possibly increase survival of stocked fish (Margenau 1992).

Northern pike also provide a popular sport fishery on Yellow Lake. Interestingly, harvest rates for anglers targeting northern pike on Yellow Lake were higher in the open water season than in winter. In 55 creel surveys from northern Wisconsin lakes, Margenau et al. (2003) found much higher harvest rates for northern pike during the ice fishing season. While the reason for this is unclear, it should be mentioned that the summary provided by Margenau et al. (2003) included creel surveys during the 1990s. It may be angler attitudes toward keeping or releasing a northern pike are changing. Mean length of angler harvested northern pike in Yellow Lake (24.0 in) was also greater than the average reported by Margenau et al. (2003) of 21.6 in. Better size structure in the Yellow Lake population may have an effect on an angler's decision to harvest a

northern pike, regardless of season. Nevertheless, seasonal behavior of anglers should be followed in future creel surveys.

The largemouth bass population of Yellow Lake is low density with above average growth rates. Although largemouth bass PSD was quite high, the proportion of fish greater than the 14 in minimum size limit was only average. A couple of factors may be causing this discrepancy. First, the largemouth bass length frequency shows an abundance of fish between 12 and 14 in. With a 14 in minimum size limit, some overharvesting of these larger fish may be occurring. Also, growth of largemouth bass is excellent until fish reach approximately five years of age, or about 14 in. Forage availability may be limiting growth of these larger fish.

Panfish effort was relatively light on Yellow Lake. Black crappie and bluegill were targeted almost equally while yellow perch effort was slightly lower. However, yellow perch had the highest estimated number of fish harvested of any species on Yellow Lake. While nearly all of the harvest of black crappie and bluegill occurred during the open water season, 74% of the yellow perch harvest was during the ice fishing season.

Compared to Yellow Lake, Little Yellow Lake offers a much different fishery for anglers. Black crappie and bluegill were the primary species of interest on Little Yellow Lake. Projected harvest/acre of both species was much higher on Little Yellow Lake while mean lengths of harvested fish were slightly lower for bluegill and identical for black crappie. Northern pike and largemouth bass were the primary gamefish species of interest on Little Yellow Lake.

Conclusions and Management Recommendations

1. Walleye abundance and growth rates exceed regional and local averages. Barring changes in recruitment or exploitation levels, the current regulation should remain in effect on the Yellow Lakes. Stocking of walleye into the Yellow Lakes should be discouraged.

2. Muskellunge abundance appears to be quite low. Switching muskellunge stocking from fall fingerlings to spring yearlings should be evaluated. Also, targeted muskellunge sampling should be a high priority in future surveys.
3. Cisco is an important, ecologically sensitive species in Yellow Lake. Future sampling should be conducted to assess the status of cisco in Yellow Lake.
4. Little Yellow Lake provides a self sustaining fishery dominated by largemouth bass, black crappie, and bluegill that is a nice complement to the Yellow Lake fishery. No changes in regulations or management strategies need to be made at this time on Little Yellow Lake.
5. Critical fish habitat, both in the Yellow River and the Yellow Lakes, needs to be protected and enhanced where possible. Efforts should be made to work with the Yellow Lakes and River Association and local angler groups stressing the importance of protecting critical habitat and water quality.
6. Efforts to increase habitat complexity in the Yellow Lakes should be strongly encouraged. Input of coarse woody debris, protection of aquatic vegetation, and maintenance or restoration of 35 foot vegetative buffers are some examples of work that can increase habitat complexity.
7. Exotic species monitoring and control programs should continue. Efforts to keep aquatic invasive species out of a waterbody are much more effective than controlling these species once they are established.

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Table 1. Summary of Yellow Lake and Little Yellow Lake, Burnett County, Wisconsin, adult walleye population estimates.

	Yellow Lake (2008)	Yellow Lake (1992)	Yellow Lake (1986)	Little Yellow Lake (2008)	Burnett County Average	NW WI Average
P.E.	10,464 (4.6/acre)	9,222 (4.0/acre)	10,650 (4.7/acre)	182 (0.5/acre)	1.4/acre	2.7/acre
C.V.	0.07	0.06	NA	0.57	NA	NA
Average Size	17.0 (S.D. 2.1)	NA	NA	17.0 (S.D. 2.7)	NA	NA
Male: Female Ratio	3.8	NA	NA	1.4	NA	NA

Table 2. Walleye PSD and RSDP values from fish collected during spring spawning population assessments in Yellow Lake and Little Yellow Lake, Burnett County, Wisconsin. The numbers in parentheses refers to the percentage of surveys of similar waterbodies in Wisconsin below the value for that survey as calculated from the FACT database.

Parameter	Yellow Lake (2008)	Yellow Lake (1992)	Yellow Lake (1986)	Little Yellow Lake (2008)
PSD (percentile)	85 (48)	81 (39)	90 (62)	64 (13)
RSDP (percentile)	7 (18)	6 (16)	10 (21)	11 (23)

Table 3. Adult walleye mortality rates estimated on Yellow Lake, Burnett County, Wisconsin.

Parameter	2008	1992	1986
A	0.22	0.35	0.43
R^2	0.34	0.70	0.91

Table 4. Panfish catch summary from three ½ mile electrofishing index stations on Yellow Lake, Burnett County, Wisconsin, in May 2008.

	Bluegill	Pumpkin-seed	Black Crappie	Yellow Perch	Rock Bass
N	45	3	7	9	27
Length Range	3.4-8.8	7.1-7.3	7.1-10.2	6.3-9.3	3.8-9.4
Mean Length (S.D.)	6.3 (1.4)	7.2 (0.1)	9.1 (1.3)	7.7 (1.0)	7.2 (1.1)

Table 5. Total and directed angling effort summary for Yellow Lake and Little Yellow Lake, Burnett County, Wisconsin. Effort is displayed in estimated hours and hours/acre in parentheses for the Yellow Lakes. Burnett county and ceded territory averages are displayed in hours/acre only.

Effort (Hours/Acre)	Yellow Lake (2008)	Yellow Lake (1992)	Yellow Lake (1986)	Little Yellow Lake (2008)	Burnett County Average	Ceded Territory Average
Total	67,775 (29.6)	41,713 (18.4)	70,211 (30.7)	12,482 (35.9)	24.0	32.9
Walleye	46,809 (20.5)	27,444 (12.0)	NA	668 (1.9)	7.5	11.4
Northern Pike	8,852 (3.9)	15,323 (6.7)	NA	2,169 (6.2)	6.4	4.8
Muskellunge	5,990 (2.6)	7,776 (3.4)	NA	889 (2.6)	2.1	9.4
Largemouth Bass	1,706 (0.8)	915 (0.4)	NA	1,253 (3.6)	5.3	3.9
Smallmouth Bass	262 (0.1)	457 (0.2)	NA	251 (0.7)	0.2	2.3
Bluegill	6,172 (2.7)	3,659 (1.6)	NA	4,925 (14.2)	NA	NA
Black Crappie	6,314 (2.8)	2,744 (1.2)	NA	3,536 (10.2)	NA	NA
Yellow Perch	4,919 (2.2)	1,830 (0.8)	NA	76 (0.2)	NA	NA

Table 6. Summary of walleye catch, harvest, and mean length statistics for Yellow and Little Yellow Lake, Burnett County, Wisconsin, compared to Burnett county and ceded territory averages.

	Yellow Lake (2008)	Yellow Lake (1992)	Yellow Lake (1986)	Little Yellow Lake (2008)	Burnett County Average	Ceded Territory Average
Projected Catch (# of fish)	8,629	2,116	4,629	124	NA	NA
Catch/Acre	3.77	0.93	2.02	0.36	0.74	3.0
Specific Catch Rate (Fish/Hour)	0.18	0.08	0.15	0.00	0.07	0.24
Projected Harvest (# of fish)	3,188	751	2,216	110	0.29	0.77
Harvest/Acre	1.39	0.33	0.97	0.32	0.29	0.77
Specific Harvest Rate (Fish/Hour)	0.07	0.03	0.07	0.00	0.03	0.06
Mean Length (in)	17.6	17.0	16.2	15.3	18.4	16.2

Table 7. Summary of northern pike catch, harvest, and mean length statistics for Yellow and Little Yellow Lake, Burnett County, Wisconsin, compared to Burnett county and ceded territory averages.

	Yellow Lake (2008)	Yellow Lake (1992)	Yellow Lake (1986)	Little Yellow Lake (2008)	Burnett County Average	Ceded Territory Average
Projected Catch (# of fish)	7,775	1,580	4,421	1,924	NA	NA
Catch/Acre	3.40	0.69	1.93	5.53	3.54	2.03
Specific Catch Rate (Fish/Hour)	0.21	0.05	0.15	0.39	0.29	0.18
Projected Harvest (# of fish)	1,562	629	2,216	116	NA	NA
Harvest/Acre	0.68	0.28	0.97	0.33	0.57	0.38
Specific Harvest Rate (Fish/Hour)	0.08	0.03	0.07	0.02	0.06	0.05
Mean Length (in)	24.0	23.2	23.3	21.4	21.4	22.7

Table 8. Summary of muskellunge catch, harvest, and mean length statistics for Yellow and Little Yellow Lake, Burnett County, Wisconsin, compared to Burnett county and ceded territory averages.

	Yellow Lake (2008)	Yellow Lake (1992)	Yellow Lake (1986)	Little Yellow Lake (2008)	Burnett County Average	Ceded Territory Average
Projected Catch (# of fish)	132	263	470	0	NA	NA
Catch/Acre	0.06	0.11	0.21	0	0.05	0.44
Specific Catch Rate (Fish/Hour)	0.01	0.03	0.03	0	0.01	0.03
Projected Harvest (# of fish)	0	24	27	0	NA	NA
Harvest/Acre	0	0.011	0.093	0	0.003	0.018
Specific Harvest Rate (Fish/Hour)	0	0.003	0.002	0	0.001	0.001
Mean Length (in)	NA	37.2	39.1	NA	38.7	38.1

Table 9. Summary of largemouth bass catch, harvest, and mean length statistics for Yellow and Little Yellow Lake, Burnett County, Wisconsin, compared to Burnett county and ceded territory averages.

	Yellow Lake (2008)	Yellow Lake (1992)	Yellow Lake (1986)	Little Yellow Lake (2008)	Burnett County Average	Ceded Territory Average
Projected Catch (# of fish)	1,719	182	425	1,320	NA	NA
Catch/Acre	0.75	0.08	0.19	3.79	6.67	2.81
Specific Catch Rate (Fish/Hour)	0.57	0.11	0.19	0.70	0.70	0.27
Projected Harvest (# of fish)	278	26	114	145	NA	NA
Harvest/Acre	0.12	0.01	0.05	0.42	0.52	0.16
Specific Harvest Rate (Fish/Hour)	0.08	0.01	0.09	0.02	0.06	0.02
Mean Length (in)	15.9	15.7	12.6	15.8	14.4	14.9

Table 10. Summary of bluegill catch, harvest, and mean length statistics for Yellow and Little Yellow Lake, Burnett County, Wisconsin.

	Yellow Lake (2008)	Yellow Lake (1992)	Yellow Lake (1986)	Little Yellow Lake (2008)
Projected Catch (# of fish)	4,179	3,797	3,197	12,816
Catch/Acre	1.83	1.66	1.40	36.83
Specific Catch Rate (Fish/Hour)	0.48	0.93	1.19	2.48
Projected Harvest (# of fish)	2,146	2,532	2,576	7,891
Harvest/Acre	0.94	1.11	1.13	22.68
Specific Harvest Rate (Fish/Hour)	0.25	0.61	0.96	1.57
Mean Length (in)	8.1	6.7	NA	7.8

Table 11. Summary of black crappie catch, harvest, and mean length statistics for Yellow and Little Yellow Lake, Burnett County, Wisconsin.

	Yellow Lake (2008)	Yellow Lake (1992)	Yellow Lake (1986)	Little Yellow Lake (2008)
Projected Catch (# of fish)	4,806	1,215	4,307	4,863
Catch/Acre	2.10	0.53	1.88	13.97
Specific Catch Rate (Fish/Hour)	0.52	0.45	1.27	1.21
Projected Harvest (# of fish)	3,787	1,089	4,173	4,284
Harvest/Acre	1.66	0.48	1.82	12.31
Specific Harvest Rate (Fish/Hour)	0.47	0.41	1.24	1.05
Mean Length (in)	10.4	NA	10.5	10.4

Table 12. Summary of yellow perch catch, harvest, and mean length statistics for Yellow and Little Yellow Lake, Burnett County, Wisconsin.

	Yellow Lake (2008)	Yellow Lake (1992)	Yellow Lake (1986)	Little Yellow Lake (2008)
Projected Catch (# of fish)	9,867	2,593	4,124	571
Catch/Acre	4.31	1.13	1.80	1.64
Specific Catch Rate (Fish/Hour)	0.96	0.55	1.86	0.95
Projected Harvest (# of fish)	4,146	1,127	2,906	116
Harvest/Acre	1.81	0.49	1.27	0.33
Specific Harvest Rate (Fish/Hour)	0.69	0.32	1.23	0.63
Mean Length (in)	9.2	8.3	NA	7.2

Figure 1. Map depicting areas of the Yellow River sampled during spring 2008, Burnett County, Wisconsin.

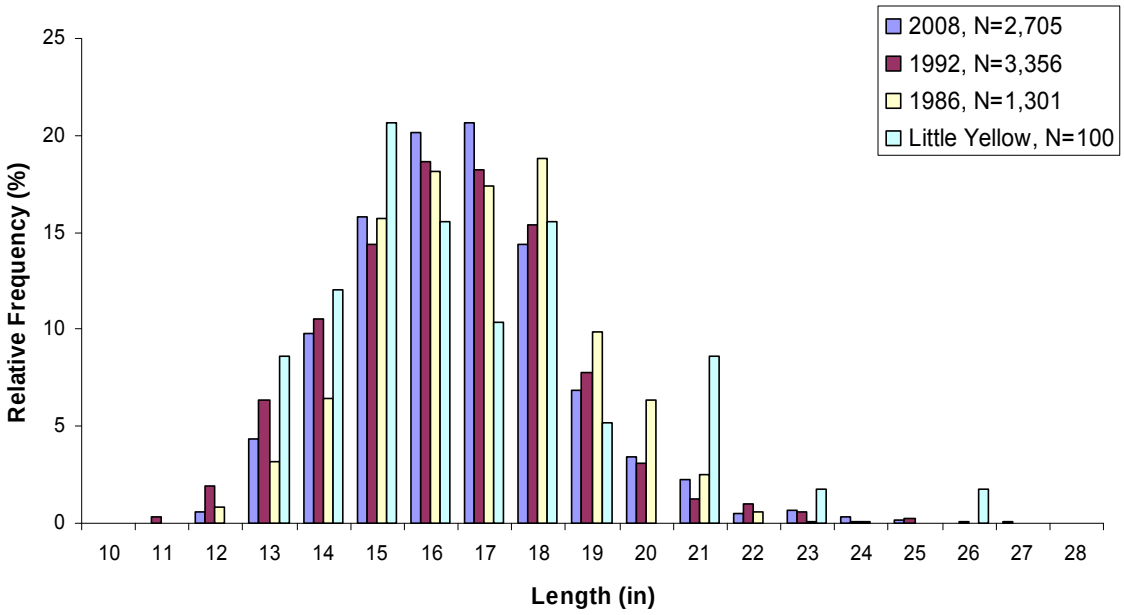

Figure 2. Relative length frequencies of spawning walleyes captured in Yellow Lake and Yellow River, spring 2008, 1992, and 1986, and Little Yellow Lake in 2008, Burnett County, Wisconsin.

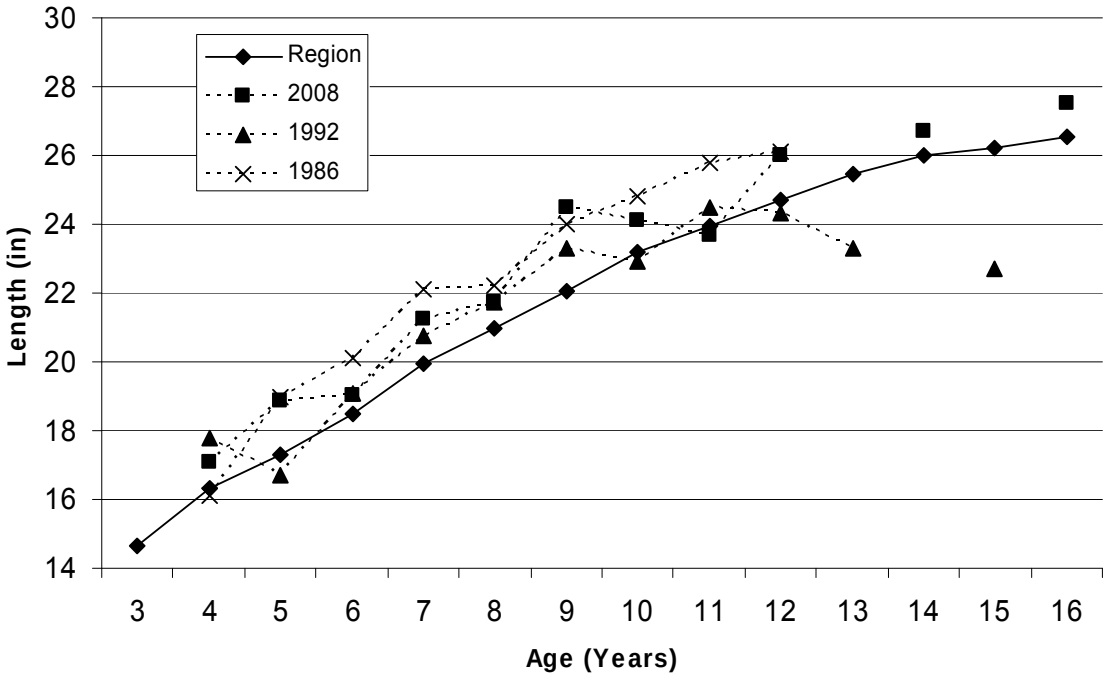

Figure 3. Mean lengths at age for female walleyes captured during spring surveys on Yellow Lake and Yellow River, Burnett County, Wisconsin. Regional averages are displayed for comparison.

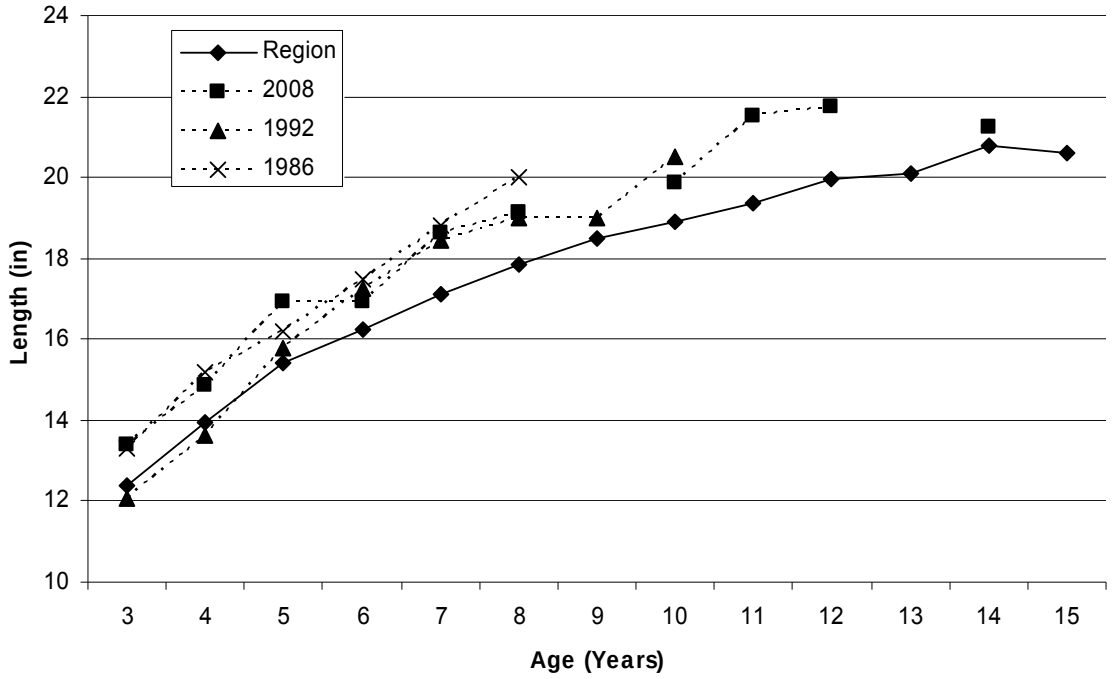

Figure 4. Mean lengths at age for male walleyes captured during spring surveys on Yellow Lake and Yellow River, Burnett County, Wisconsin. Regional averages are displayed for comparison.

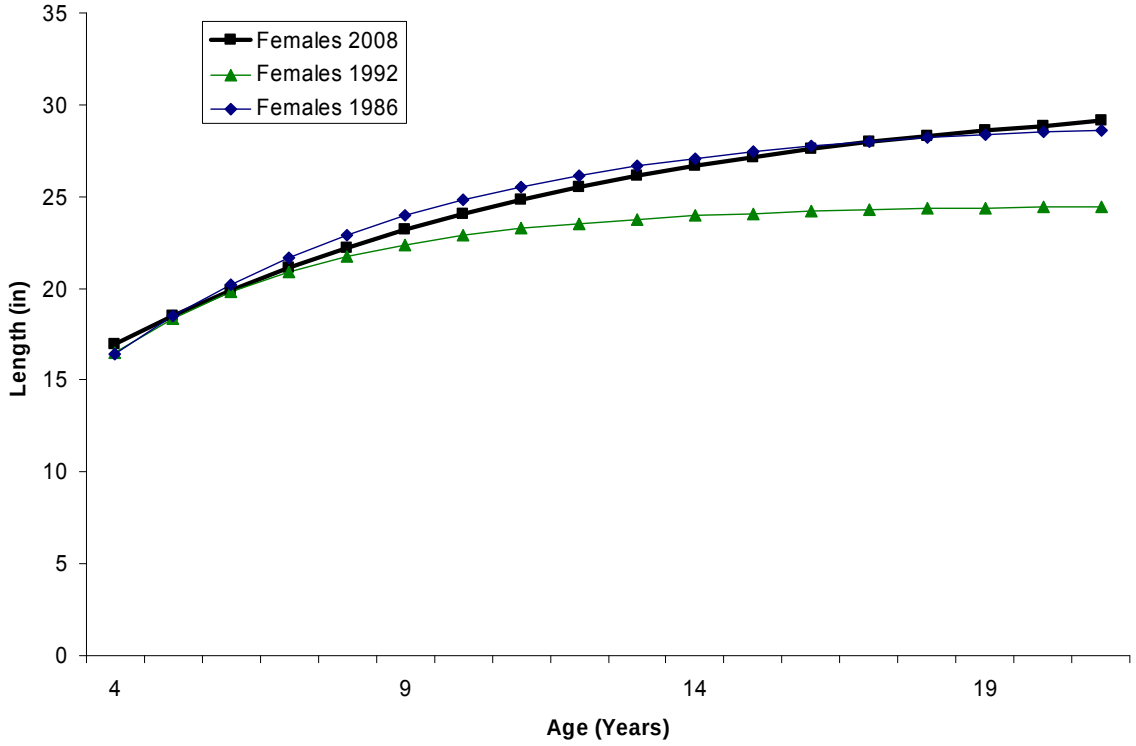

Figure 5. von Bertalanffy growth curves for female walleyes captured during spring surveys on Yellow Lake and Yellow River, Burnett County, Wisconsin.

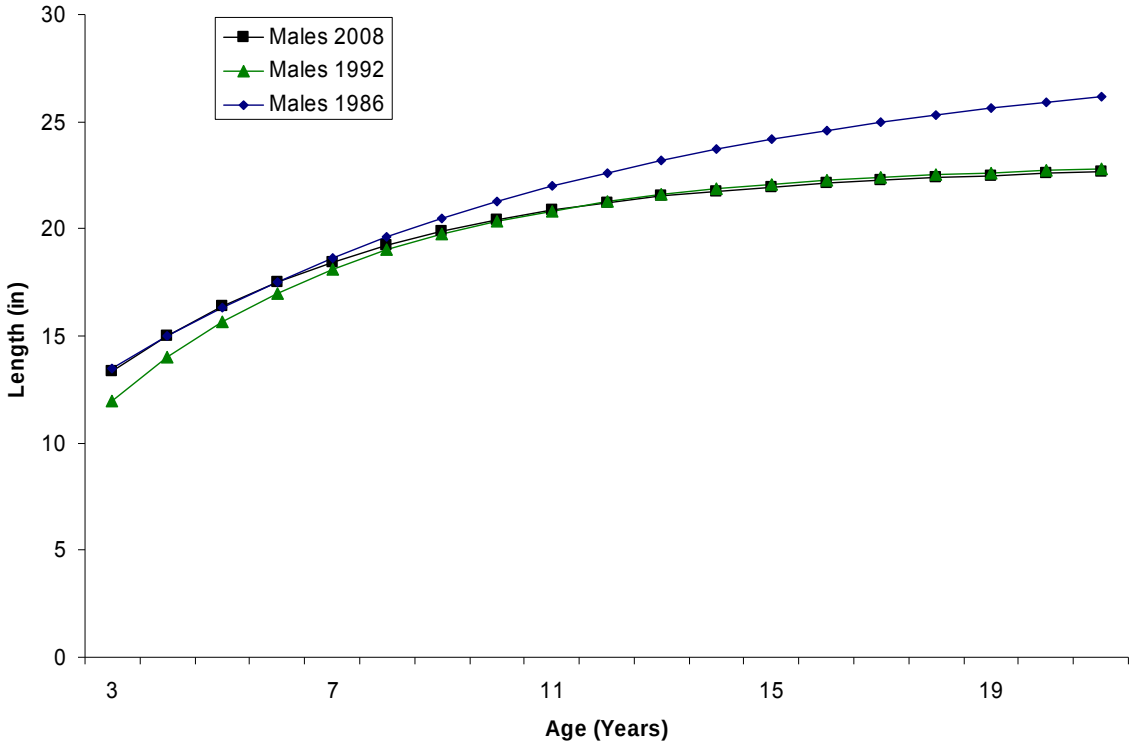

Figure 6. von Bertalanffy growth curves for male walleyes captured during spring surveys on Yellow Lake and Yellow River, Burnett County, Wisconsin.

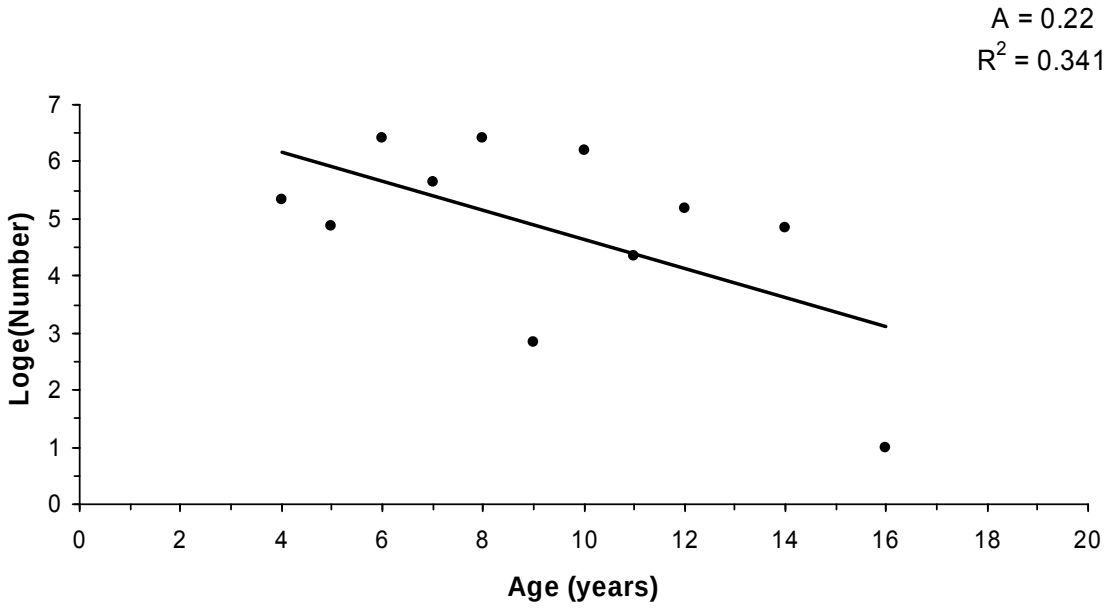

Figure 7. Catch curve for adult walleye sampled in Yellow Lake and Yellow River, Burnett County, Wisconsin, in spring 2008.

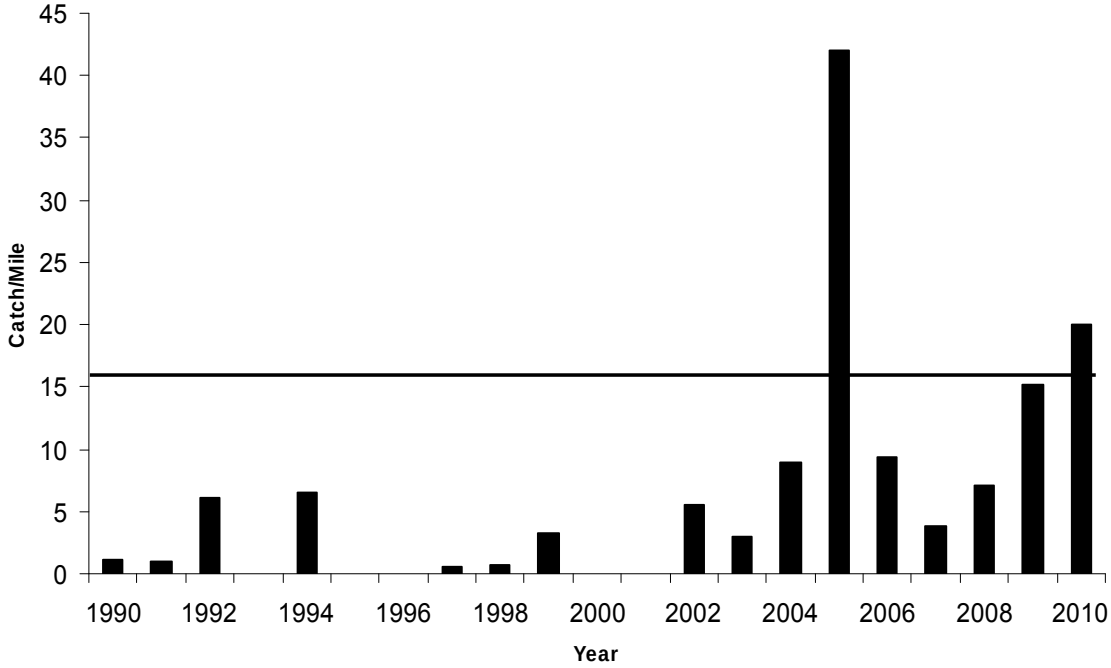

Figure 8. Young of year (YOY) walleye relative abundance determined by fall electrofishing surveys on Yellow Lake, Burnett County, Wisconsin. The solid horizontal line indicates the modal catch of 16 YOY walleye per mile in northern Wisconsin lakes supported by natural reproduction. Fall surveys were not conducted on Yellow Lake in 1993, 1995, 1996, 2000, and 2001.

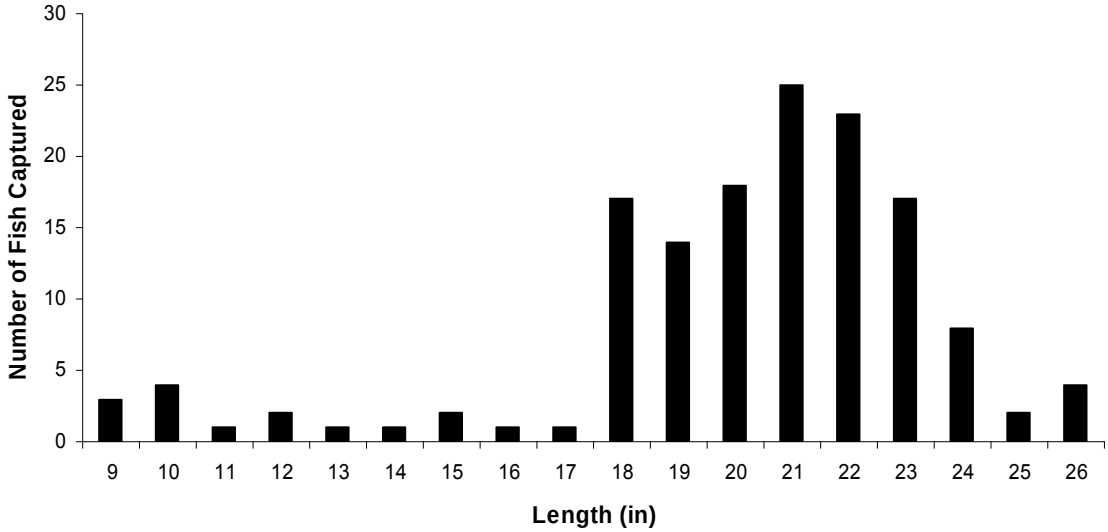

Figure 9. Length frequency of northern pike captured in Yellow Lake, Burnett County, Wisconsin, in spring 2008 surveys (N=144).

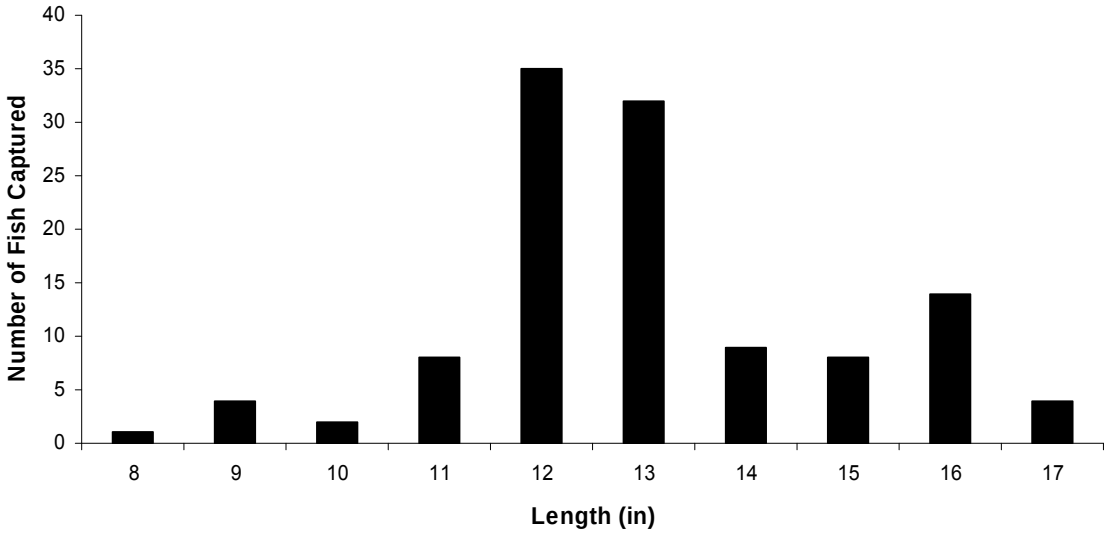

Figure 10. Length frequency of largemouth bass captured in Yellow Lake, Burnett County, Wisconsin, in spring 2008 surveys (N=117).

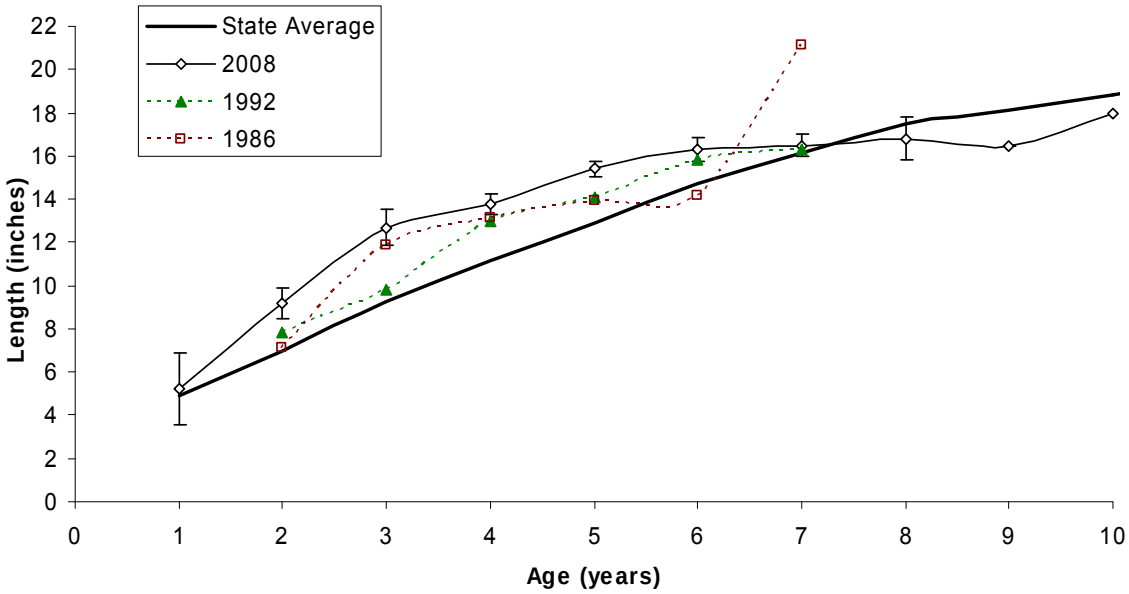

Figure 11. Mean lengths at age for largemouth bass captured during spring surveys on Yellow Lake, Burnett County, Wisconsin. Regional averages are displayed for comparison.

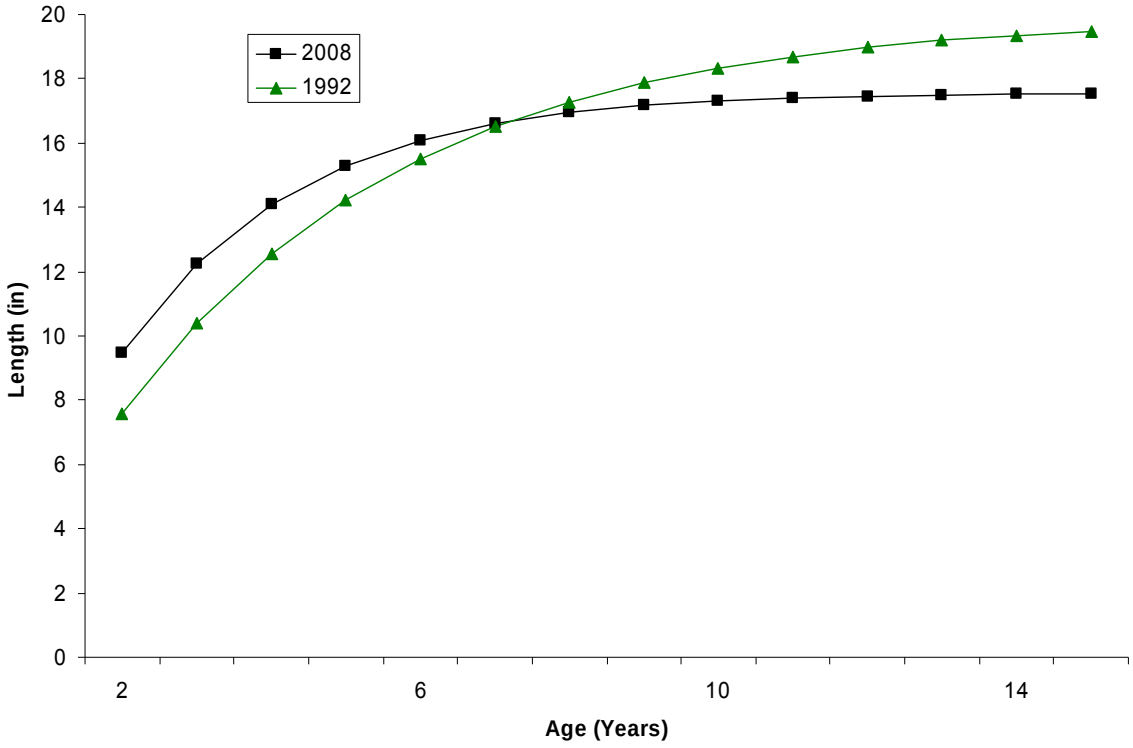

Figure 12. Yellow Lake, Burnett County, Wisconsin, von Bertalanffy growth curves for largemouth bass captured during spring surveys.

Appendix Table 1. Fish stocking records for Little Yellow Lake and Yellow Lake, Burnett County, Wisconsin, since 1974.

Waterbody Name	Year	Species	Age Class	Number Fish Stocked	Avg Fish Length (IN)
YELLOW LAKE	1974	WALLEYE	FINGERLING	41,508	4.2
YELLOW LAKE	1976	MUSKELLUNGE	FINGERLING	3,770	9.7
YELLOW LAKE	1977	MUSKELLUNGE	FINGERLING	2,000	3
YELLOW LAKE	1977	MUSKELLUNGE	FINGERLING	1,287	12.3
YELLOW LAKE	1978	MUSKELLUNGE	FINGERLING	1,000	13
YELLOW LAKE	1979	MUSKELLUNGE	FINGERLING	3,365	8.3
YELLOW LAKE	1980	MUSKELLUNGE	FINGERLING	1,018	11
LITTLE YELLOW LAKE	1981	MUSKELLUNGE	FINGERLING	110	9
YELLOW LAKE	1981	MUSKELLUNGE	FINGERLING	580	10
LITTLE YELLOW LAKE	1982	MUSKELLUNGE	FINGERLING	300	9
YELLOW LAKE	1982	MUSKELLUNGE	FINGERLING	1,282	9
YELLOW LAKE	1982	WALLEYE	FINGERLING	49,050	3
YELLOW LAKE	1982	WALLEYE	FRY	500,000	
LITTLE YELLOW LAKE	1983	MUSKELLUNGE	FINGERLING	300	11
YELLOW LAKE	1983	MUSKELLUNGE	FINGERLING	2321	9.7
YELLOW LAKE	1983	WALLEYE	FRY	1,024,000	1
LITTLE YELLOW LAKE	1984	MUSKELLUNGE	FINGERLING	280	10
YELLOW LAKE	1984	MUSKELLUNGE	FINGERLING	2,300	11.8
YELLOW LAKE	1985	MUSKELLUNGE	FINGERLING	2,500	10
LITTLE YELLOW LAKE	1986	MUSKELLUNGE	FINGERLING	230	7
YELLOW LAKE	1986	MUSKELLUNGE	FINGERLING	2,300	7
YELLOW LAKE	1986	WALLEYE	FINGERLING	80,460	3
YELLOW LAKE	1986	WALLEYE	FRY	500,000	1
YELLOW LAKE	1987	MUSKELLUNGE	FINGERLING	6,900	10

Appendix Table 1 (continued).

Waterbody Name	Year	Species	Age Class	Number Fish Stocked	Avg Fish Length (IN)
YELLOW LAKE	1987	WALLEYE	FINGERLING	144,932	3
LITTLE YELLOW LAKE	1988	MUSKELLUNGE	FINGERLING	230	9
YELLOW LAKE	1988	MUSKELLUNGE	FINGERLING	2,300	9
YELLOW LAKE	1988	WALLEYE	FINGERLING	70,979	3
YELLOW LAKE	1988	WALLEYE	FINGERLING	8,840	3
LITTLE YELLOW LAKE	1989	MUSKELLUNGE	FINGERLING	150	11
YELLOW LAKE	1989	MUSKELLUNGE	FINGERLING	2,300	8.3
YELLOW LAKE	1989	WALLEYE	FINGERLING	80,342	3
YELLOW LAKE	1990	WALLEYE	FINGERLING	27,608	3.5
LITTLE YELLOW LAKE	1991	MUSKELLUNGE	FINGERLING	300	10
YELLOW LAKE	1991	MUSKELLUNGE	FINGERLING	3,300	10.7
YELLOW LAKE	1991	WALLEYE	FINGERLING	16,368	3.5
LITTLE YELLOW LAKE	1992	MUSKELLUNGE	FINGERLING	696	8
YELLOW LAKE	1992	MUSKELLUNGE	FRY	20,000	1
YELLOW LAKE	1992	WALLEYE	FINGERLING	50,700	3
YELLOW LAKE	1992	WALLEYE	FINGERLING	18939	2.5
YELLOW LAKE	1992	WALLEYE	FRY	130,000	0
LITTLE YELLOW LAKE	1993	MUSKELLUNGE	FINGERLING	350	12
YELLOW LAKE	1993	MUSKELLUNGE	FINGERLING	3,558	11.3
YELLOW LAKE	1994	WALLEYE	FINGERLING	5,610	3.1
YELLOW LAKE	1994	WALLEYE	FINGERLING	50,170	2.9
YELLOW LAKE	1995	LAKE STURGEON	FINGERLING	1,000	5.9
YELLOW LAKE	1995	MUSKELLUNGE	FINGERLING	2,289	11.6
LITTLE YELLOW LAKE	1996	MUSKELLUNGE	FINGERLING	350	10.8

Appendix Table 1 (continued).

Waterbody Name	Year	Species	Age Class	Number Fish Stocked	Avg Fish Length (IN)
YELLOW LAKE	1996	WALLEYE	FINGERLING	32,775	2.3
YELLOW LAKE	1996	WALLEYE	FINGERLING	101,000	1.3
YELLOW LAKE	1996	WALLEYE	FINGERLING	14,793	2.4
YELLOW LAKE	1997	MUSKELLUNGE	LARGE FINGERLING	4,250	11.3
LITTLE YELLOW LAKE	1998	MUSKELLUNGE	LARGE FINGERLING	350	11.6
YELLOW LAKE	1998	WALLEYE	SMALL FINGERLING	100,000	1.4
YELLOW LAKE	1999	MUSKELLUNGE	LARGE FINGERLING	1,500	11.2
LITTLE YELLOW LAKE	2000	WALLEYE	SMALL FINGERLING	3,491	2.5
YELLOW LAKE	2000	WALLEYE	SMALL FINGERLING	24,345	2.6
YELLOW LAKE	2000	WALLEYE	SMALL FINGERLING	100,000	1.5
YELLOW LAKE	2002	MUSKELLUNGE	LARGE FINGERLING	1,444	10.6
YELLOW LAKE	2002	WALLEYE	SMALL FINGERLING	114,330	1.5
YELLOW LAKE	2004	MUSKELLUNGE	LARGE FINGERLING	1,445	10.7
YELLOW LAKE	2004	WALLEYE	SMALL FINGERLING	114,565	1.2
YELLOW LAKE	2004	WALLEYE	SMALL FINGERLING	67,987	2.9
LITTLE YELLOW LAKE	2005	WALLEYE	SMALL FINGERLING	15,705	2.6
YELLOW LAKE	2006	MUSKELLUNGE	LARGE FINGERLING	801	11.6
YELLOW LAKE	2008	MUSKELLUNGE	LARGE FINGERLING	1,444	9.5
YELLOW LAKE	2010	MUSKELLUNGE	LARGE FINGERLING	1,392	12.2

Appendix Table 2. General Fishing Regulations for Yellow and Little Yellow Lake, Burnett County, Wisconsin, in 2008.

Fish Species	Open Season	Daily Limit	Minimum Length
Walleye	May 03-March01	2	15”
Largemouth and Smallmouth Bass	May 03-March01	5	14”
Muskellunge	May 24-November 30	1	40”
Northern Pike	May 03-March01	5	NONE
Lake Sturgeon	September 1-September 30	1	60”
Panfish	Open Season Year Round	25	NONE

Appendix Table 3. Size cutoffs used to determine whether primary or secondary fin clips should be applied to gamefish when gender could not be determined.

Fish Species	Primary Fin Clip	Secondary Fin Clip
Walleye	≥15 in	≥ 7" < 15" (TC Clip)
Bass	≥8 in	< 8” (TC Clip)
Muskellunge	≥30 in	Immature fish < 30” (TC Clip)
Northern Pike	≥12 in	< 12" (TC Clip)

Appendix Table 4. Values used in proportional and relative stock density calculations.

Fish Species	Stock Size (in)	Quality Size (in)	Preferred Size (in)
Largemouth Bass	8	12	15
Northern Pike	14	21	28
Walleye	10	15	20