

**A Population Assessment and Creel Survey of Lake Sturgeon in Yellow Lake,  
Burnett County, Wisconsin 2005-2008  
(MWIBC: 2675200)**



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## Executive Summary

Due to the importance of lake sturgeon both locally and regionally, an intensive survey of the Yellow Lake lake sturgeon population was conducted from 2005 through 2008. The goals of this survey were to assess angler effort, catch, and harvest directed towards lake sturgeon, estimate lake sturgeon abundance, and assess population demographics.

A total of 380 lake sturgeon were captured during this survey ranging in length from 15 -75 in (Total length). The average length of lake sturgeon sampled was 50.9 in and 63.8 in for males and females, respectively. Lake sturgeon abundance in Yellow Lake was estimated at 2,007 (1,628 for fish  $\geq$  45 in). [Note: Due to concerns with recapture methods, it is not recommended that this estimate be used for exploitation calculations or to set harvest quotas.]

The age structure of lake sturgeon from Yellow Lake was broad (3-74 years) with consistent year classes present in recent years. Lake sturgeon growth rates were similar to other populations in Wisconsin. However, lake sturgeon in Yellow Lake are not achieving their maximum size potential due to a lack of fish greater than 60 years of age in the population. This is likely due to poor recruitment and/or over harvesting from the 1920s through 1960. Total annual mortality was very low (3.2%).

Anglers directed an estimated 4,104 hours toward lake sturgeon during the 2008 season on Yellow Lake. The projected catch of lake sturgeon was 430 fish (0.10 fish/hr). Although an estimated 26 fish of legal harvest length were captured on Yellow Lake in 2008, no lake sturgeon were harvested by sport anglers.

The lake sturgeon population of Yellow Lake is showing signs of recovery. With continued low mortality and consistent recruitment, the population should continue expanding. Efforts to protect, enhance, and expand available habitat should continue. In particular, reconnecting the Yellow Lake and St. Croix lake sturgeon populations

should be evaluated. Also, future close monitoring of exploitation and population demographics need to continue to insure full recovery of the lake sturgeon fishery on Yellow Lake.

## Introduction

Lake sturgeon Acipenser fulvescens are considered threatened throughout much of their historic range due to overharvest, habitat loss and fragmentation by dams (WSCS 2005). The waters of Wisconsin collectively possess one of the largest self-sustaining populations of lake sturgeon in the world (WDNR 2000).

With a life strategy of slow growth and late maturation, lake sturgeon are particularly sensitive to stressors such as environmental change, barriers to fish passage, and over-exploitation. Female lake sturgeon become sexually mature at approximately 25 years and 55 in (Becker 1983). Once reaching maturity, females will typically spawn every 4-6 years. Male lake sturgeon typically reach sexual maturity at approximately 45 in and then spawn every year or every other year.

Wisconsin's lake sturgeon management plan (WDNR 2000) recommends managing for densities of Age 2+ fish at 250 fish/mile in inland rivers and 1.5 fish/acre in lake systems (combination in flowages). It also recommends populations should be ideally represented by males up to 40 years of age and females up to 70 years of age.

Yellow Lake is a large, hard water drainage lake in west central Burnett County (Figure 1). Yellow Lake is 2,287 acres with a maximum depth of 31 feet and mean depth of 19 feet. Water clarity is poor, with average summer secchi disk readings of five feet (WDNR (online) 2010). The shoreline is primarily privately owned and heavily developed. A water control structure on the Danbury Flowage maintains the lake level. This structure serves as a barrier to fish movement from the St. Croix River. Due to this barrier, lake sturgeon on Yellow Lake have been isolated from the St. Croix River sturgeon since the 1930s (Johannes 1988).

The Yellow River is a tributary of the St. Croix River than flows through Yellow Lake. The Yellow River originates as Crystal Brook and Beaver Brook in Washburn County. Upstream of Yellow Lake, the watershed of Yellow River is 206.4 square miles.

The portion of the Yellow River in this study included the area immediately above Yellow Lake upstream to Conners Bridge, a distance of 6.7 river miles (Figure 1).

Little information was known about the Yellow Lake lake sturgeon population until anglers caught two world record (hook and line) lake sturgeon from Yellow Lake in 1979 (Johannes 1988). Due to the publicity of these world records, angler effort increased dramatically in the following years. In response to this increased effort, a study of lake sturgeon in Yellow Lake was initiated in 1980 (Johannes 1988). That study found the lake sturgeon population in early stages of recovery, with most fish sampled less than 20 years of age.

Yellow Lake supports both a tribal and angler sport fishery. Tribal harvest is managed by a quota system, with a maximum of 5% of the estimated adult population ( $\geq 45$  in) available for annual harvest. The minimum length limit for sport anglers is currently 60 in (Table 1). Since 1983, a mandatory tagging and registration system has been in effect for all lake sturgeon harvested by sport anglers in Wisconsin. From 1983-2008, the number of lake sturgeon registered from Yellow Lake has ranged from 0-21 fish, with an average annual sport harvest of 9.3 fish (Figure 2). A total of 11 lake sturgeon were harvested by tribal spearers between 2000-2008, primarily from 2006-2008.

This study was initiated to evaluate the current status of the lake sturgeon population in Yellow Lake and Yellow River and provide additional information for making management decisions. The specific objectives were to (1) determine lake sturgeon population abundance, (2) assess angler effort, catch, and harvest for lake sturgeon, and (3) document age, growth, exploitation and size structure of the lake sturgeon population.

## Methods

Between 2005-2008, lake sturgeon were captured in the Yellow River by a variety of methods, including pulsed DC electrofishing, block nets, and dips nets. Sampling coincided with spring lake sturgeon spawning runs. Each sturgeon captured was measured to the nearest 0.1 in and sexed. All sturgeon were tagged with an individually numbered Carlin disc dangler tag at the base of the dorsal fin. Beginning in 2006, lake sturgeon were marked with both a Carlin disc dangler tag and a passive integrated transponder (PIT) tag that was injected near the base of the pectoral fin.

In addition to the spring sampling, creel survey data were collected during the sturgeon hook and line season in September 2007 and 2008. In 2007, DNR staff tagged angler released sturgeon. The goal of this tagging effort was to increase the number of marked fish, particularly juveniles, for a population estimate. In 2008, a random stratified roving access creel survey was conducted for all fish species on Yellow Lake following Wisconsin DNR protocol (Cichosz 2010). Starting 6 September, additional creel clerks were stationed at the lake to survey lake sturgeon anglers. The creel clerks working the supplemental shifts worked the am or pm weekend/holiday shift not worked by the regular creel clerk as well as a randomly selected am or pm weekday shift on the two weekdays not worked by the regular creel clerk. Instantaneous counts of anglers targeting lake sturgeon were conducted by creel clerks working both the regular and supplemental shifts. Only interviews of anglers targeting lake sturgeon were included in this assessment.

Abundance estimates for Yellow Lake sturgeon were calculated using fish tagged during spring surveys from 2005-2008 and angler caught fish in 2007 as the marked sample. No adjustments to marked fish at large were made for tag loss as that variable was not quantified. Known mortalities or harvested fish were removed from the marked sample and added back to the final population estimates. Lake sturgeon captured

during the creel survey in 2008 were used as the recapture sample. Population estimates were then calculated using the Chapman modification of the Petersen Estimator using the equation:

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

Where N is the population estimate, M is the number of fish marked, C is the total number of fish captured in the recapture, and R is the number of marked fish captured in the recapture. Separate population estimates were calculated for lake sturgeon < 45 in and  $\geq$  45 in. These population estimates were summed to calculate the total population estimate.

Lake sturgeon were aged by removing a section of pectoral fin spine similar to methods described by Rossiter et al. (1995). Fin rays were allowed to dry before a thin cross section was cut using a Buehler low speed Isomet saw (Buehler LTD). A compound microscope at 4-10X magnification was used to estimate age. Following the recommendation of Bruch et al. (2009), a power function was applied to estimated ages of lake sturgeon greater than 14 years of age using the following equation:

$$(\text{true age} = [\text{estimated age}]^{1.054796})$$

Mean length at age was used to assess growth using the following von Bertalanffy equation:

$$l_t = L_\infty(1 - e^{-K(t-t_0)})$$

Where  $l_t$  is length at time t,  $L_\infty$  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). Assuming dimorphic separation of length at age (Bruch 2008), growth equations were calculated separately for male and female lake sturgeon.

To assess relative body condition of lake sturgeon in Yellow Lake, Fulton's condition factor was applied using the following equation:

$$K = (W/L^3) \times 100,000$$

Where K is Fulton's condition factor, W is weight in grams, and L is length in mm (Anderson and Neuman 1996). To eliminate potentially biased weights of fish sampled during spawning, only lake sturgeon captured during the hook and line season in 2007 and 2008 were assessed for condition factor.

Catch curve analysis was used to determine lake sturgeon mortality. The descending limb of a catch curve regression was used to estimate total annual mortality (Ricker 1975). As aging materials were not taken for all fish, an age-length key was used to assign a sample age distribution. Since the age-length key assigned ages for some fish, age analysis was performed by age group rather than year class. Use of this method assumed that recruitment and survival did not vary at age over time. Lake sturgeon age classes 19-46 provided the strongest predictive power ( $r^2$ ) and were included in the catch curve regression.

## Results

A total of 380 lake sturgeon were sampled during this survey (including fish captured during spring spawning runs and by anglers), ranging in length from 15-75 in (Figure 3). Lake sturgeon from 45-55 in were captured in much greater proportion by anglers than fish sampled during spring spawning assessments (Figure 4). The average length of all lake sturgeon greater than or equal to 45 in was 57.7 (S.D. 7.5, N = 130) and 52.6 (S.D. 5.8, N = 128) in for spawning surveys and angler caught fish, respectively. During spring spawning assessments, male lake sturgeon lengths ranged from 43.5-59.5 in (mean 50.9, S.D. = 4.3, N = 46) while females ranged from 54.0-77.0 in (mean 63.8, S.D. = 5.0, N = 54; Figure 5).

Population abundance of lake sturgeon in 2008 greater than or equal to 45 in was 1,628 (95% C.I. 753-2,509, C.V. 0.28; Table 2). This estimate was substantially

higher than the 1986 estimate of 288 fish greater than or equal to 45 in (95% C.I. 143-630, C.V. 0.28). The estimated number of lake sturgeon less than 45 in was 379 (95% C.I. 145-718, C.V. 0.34), for a total population estimate of 2,059 (95% C.I. 1,135-2,982, C.V. 0.23) or 0.88 fish/acre. Due to the broad range of ages present in the population, estimates by age class were not calculated.

Of the 43 angler caught lake sturgeon marked in September 2007, 10 were recaptured by anglers in September 2008 (R/M=0.23). However, of the 134 lake sturgeon marked during spring spawning assessments, four were recaptured by anglers in September 2008 (R/M=0.03).

Age was determined on a total of 146 lake sturgeon and ranged from age 3 to 74 years (Table 3). The mean of mean lengths for ages 23-27 was established by Fortin et al. (1996) to compare lake sturgeon growth rates for populations in Canada and USA. The Yellow Lake lake sturgeon population mean of mean lengths for ages 23-27 was 54.4 in. Values from the von Bertalanffy growth equation indicate male and female lake sturgeon in Yellow Lake have slower growth than their Lake Winnebago counterparts (Table 4; Figure 6). However, values for the Yellow Lake population are likely biased by a lack of older and larger fish. The von Bertalanffy growth curve for all lake sturgeon assessed from Yellow Lake was similar to other populations (Figure 7).

Fulton's condition factor was assessed for 55 lake sturgeon captured by anglers in 2007-2008. Condition factors ranged from 0.43 to 0.85 with a mean of 0.63 (95% C.I. 0.44-1.07). Condition factor was slightly positively correlated with total length ( $r^2=0.30$ ; Figure 8). Mean condition factor was similar to other reported populations (Table 5).

Total instantaneous mortality (Z) for age classes 19-46 was 0.0328 ( $r^2=0.77$ ; Figure 9). Total annual mortality (A) for lake sturgeon was calculated to be 3.2%, with annual survival of 96.8%. This estimate of mortality was lower than reports from other surveys (Table 6).

Anglers directed an estimated 4,104 hours of effort (1.8 hours/acre) towards lake sturgeon during the open season in September, 2008. This amount of effort is much higher compared to creel surveys conducted on Yellow Lake in the 1980s (2,257-2,830 hrs; Table 7), even though the length of the season was shorter in 2008. Lake sturgeon catch rates and projected catch were also higher in the 2008 survey than any of the surveys from the 1980s (Table 7). Catch rate in 2008 was estimated at 0.10 fish/hr compared to 0.05 – 0.09 fish/hr from 1980 to 1986. Similarly, lake sturgeon catch in 2008 was estimated at 430 fish compared to 73-175 fish during the 1980s surveys. No lake sturgeon were registered as harvested from Yellow Lake in 2008.

The mean length of lake sturgeon caught by anglers on Yellow Lake in 2007-2008 was 43.9 in (N = 263, S.D. = 11.3), with a range of 16.0-71.2 inches (Figure 10). During the two years where angler lake sturgeon catch was examined, 93.9% of the fish were below the legal length limit of 60 in (Table 8). Applying this percentage to the overall estimated catch rates from the 2008 creel survey yields a value of .0061 legal lake sturgeon caught per hour (164 hours/fish) and a projected catch of 26 legal length lake sturgeon.

## **Discussion**

The lake sturgeon population in Yellow Lake shows no signs of overexploitation. Total annual mortality was estimated to be 3.4%, below the 5% exploitation recommended by the Wisconsin lake sturgeon management plan (WDNR 2000). Lake sturgeon harvest has averaged 9.7 fish per year since 1983. Harvest has remained relatively low due to the catch and release ethic of lake sturgeon anglers on Yellow Lake. For example, in 2008, sport angler harvest was zero, though an estimated 26 legal size lake sturgeon were caught.

The current 60 in minimum length limit focuses most lake sturgeon harvest on adult females as the largest male lake sturgeon sampled was 59.5 in. The Wisconsin lake sturgeon management plan recommends average annual exploitation of populations remains at or near 5%. Although calculating population estimates by gender would be very difficult, attempts should be made to ensure exploitation of female lake sturgeon does not exceed 5%.

Based on the recommendations of Wisconsin's lake sturgeon management plan (WDNR 2000), the lake sturgeon population of Yellow Lake is still in recovery phase. The estimated population of lake sturgeon in Yellow Lake (0.88 fish/acre) is well below the 1.5 fish/acre recommended by the management plan for lake systems. The age structure of the Yellow Lake population is close to or exceeding the management plan's recommendations of males up to 40 years and females up to 70 years of age. Adjusted ages of four males were greater than 40 years. Only one fish was aged at greater than 70 years.

The age structure of lake sturgeon in Yellow Lake has improved since the previous survey (Johannes 1988). In 1980, the lake sturgeon population was dominated by fish less than 20 years of age (Table 5). This lack of fish between 21-60 years of age (one 35 year old fish) suggests significant recruitment failures and/or over-exploitation occurred from the 1920s through 1950s on Yellow Lake. The lake sturgeon age structure in this survey was much broader, with many fish older than 30 years of age. Recruitment has also been very consistent in recent years, with few missing year classes under 45 years of age. This indicates the population is much more stable now than in 1980 and progressing towards full recovery.

Lake sturgeon on Yellow Lake do not appear to have reached their maximum length potential. The von Bertalanffy growth curve for female lake sturgeon was very close to linear, with a very high  $L_{\infty}$ , suggesting more maximum length potential. There

was a lack of fish aged over 60 years in this study which would correspond to fish closest to achieving their maximum length. This would correspond to fish hatched from the 1920s through the 1940s. Fish hatched in those years were also poorly represented in the 1980 survey (Johannes 1988). As more fish are able to survive past 60 years of age, the lake sturgeon population should have more fish attaining their maximum size.

Lake sturgeon growth rates for the Yellow Lake population appear to exceed regional averages. The Yellow Lake population's mean of mean lengths for ages 23-27 value of 54.7 in exceeded 29 of 32 populations reported by Fortin et al. (1996). However, Yellow Lake is located at a more southern latitude than many of these surveys and some of the variation in lake sturgeon size can be explained by latitude (Power and McKinley 1997).

Numerous challenges unique to lake sturgeon make calculating an accurate population estimate difficult. Lake sturgeon are highly vulnerable to sampling gear during spring spawning migrations up the relatively shallow Yellow River. However, periodicity of lake sturgeon spawning (Becker 1983) makes the objective of sampling the entire population unachievable at that time. Therefore, numerous years of sampling are required to assess an entire adult population but none could be used as a recapture sample as only a fraction of the population would be vulnerable.

In this study, the fall angling season was used as the recapture event. However, lake sturgeon captured by anglers in 2007 were much more likely to be recaptured by anglers in 2008 ( $R/M = 0.23$ ) than fish marked during spring surveys ( $R/M = 0.03$ ). These differences in recapture ratios may have been caused by anglers targeting specific segments of the population, lower catchability for mature fish, or very high rates of tag loss for adult lake sturgeon. Also, using fall angling as the recapture may bias the adult population estimate as immature sturgeon greater than 45 in would not be vulnerable to spring sampling assessments but may be part of the recapture sample.

Another possible source of error in generating a population estimate for this survey was that unmarked fish sampled during the 2008 recapture were not tagged. Therefore, if an unmarked fish were captured more than once, each time it was captured would be included in the population estimate. Given the high probability of lake sturgeon marked in 2007 to be recaptured in 2008 ( $R/M=0.23$ ), it is likely that some fish were captured more than once during the 2008 angler survey. This potentially could bias the recapture ratio and inflate the population estimate. With the bias and uncertainty in these estimates, we do not recommend calculating harvest quotas based off of these estimates.

Future work should focus on obtaining annual estimates of the male and female lake sturgeon population using tag and recapture data from spring surveys only. This would require the use of an open population model such as the Jolly Seber method outlined by Bruch (2008) for the Lake Winnebago sturgeon population. Due to the spawning periodicity of adult lake sturgeon, Bruch (2008) recommended not using the Jolly Seber model for the first two and last two years of surveys for females and first and last years of surveys for males. As such, no population estimates were calculated from data included in this report.

### **Conclusions and Management Recommendations**

1. Although the population of lake sturgeon is showing many positive signs toward recovery, it is recommended that it still be considered a recovering population. While there is a strong base of fish aged at 30-38 years, only four fish were >40 years old.
2. The lake sturgeon population of Yellow Lake has been isolated from the St. Croix population since the dam was created on the Danbury Flowage in the 1930s. Lake sturgeon have shown resilience to genetic impacts due to their long

- generation time (Wozney et al. 2011). However, reconnecting the Yellow Lake population to the St. Croix River population would insure maintenance of genetic diversity as well as link critical habitat for both populations. Efforts to allow fish passage at the Danbury Flowage dam should be evaluated.
3. No signs of over-exploitation have been exhibited to date. Close monitoring of sport and tribal harvest of lake sturgeon needs to continue. Any signs of over-exploitation need to be addressed through regulation changes or quota modifications.
  4. Continued monitoring of age, growth, and density is needed to document any population changes. Methods to assess lake sturgeon recruitment are lacking. Wading and haul-seine surveys have proven effective to sample age-0 lake sturgeon in areas characterized by low current velocity and high water clarity (Benson et al. 2005). Use of these methods for the Yellow Lake system should be explored.
  5. Critical lake sturgeon habitat, both in the Yellow River and Yellow Lake, need to be protected and enhanced where possible. Efforts should be made to work with the Yellow Lakes and River Association and lake sturgeon anglers stressing the importance of protecting critical lake sturgeon habitat.
  6. Outreach to sturgeon anglers and local lake and river groups should continue. Opportunities to educate the public about this unique fish are critical to lake sturgeon recovery.

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Table 1. Recent history of angling regulation on Yellow Lake, Burnett County, Wisconsin.

<b>Years</b>	<b>Season Limit/Angler</b>	<b>Size Limit</b>	<b>Length of Season</b>
1980-1990	1	45 in minimum	First Saturday in September- 10/15
1991-2006	1	50 in minimum	First Saturday in September- 10/15
2007-Present	1	60 in minimum	First Saturday in September- 9/30

Table 2. Summary of lake sturgeon population estimate for Yellow Lake, Burnett County, Wisconsin from 2005-2008. Three marked lake sturgeon > 45 in were harvested during this study. These fish were removed from the marked sample and added to the population estimate. Note: Population estimates are not recommended for use in calculating exploitation or setting harvest quotas.

<b>Parameter</b>	<b>M</b>	<b>C</b>	<b>R</b>	<b>Estimate</b>	<b>Lower Bound</b>	<b>Upper Bound</b>	<b>C.V.</b>
≤ 45 in total length	29	99	6	429	145	718	0.34
> 45 in total length	148	120	10	1,642	758	2,526	0.28
Total Population	176	219	16	2,071	1,143	3,002	0.23

Table 3. Mean length at age for lake sturgeon sampled on Yellow Lake, Burnett County, Wisconsin from 2005-2008 and 1980.

<b>Age (years)</b>	<b>Adjusted Age (years)</b>	<b>2005-08 Mean Length (in)</b>	<b>2005-08 Number Sampled</b>	<b>1980 Mean Length (in)</b>	<b>1980 Number Sampled</b>
2	2	NA	NA	13.5	2
3	3	20.5	2	25.0	1
4	4	26.2	4	32.0	1
5	5	30.5	7	32.5	2
6	6	30.7	4	NA	NA
7	7	34.9	4	35.0	1
8	8	38.6	1	NA	NA
9	9	39.8	4	40.5	3
10	10	41.6	5	44.0	8
11	11	45.1	6	46.6	3
12	12	45.1	6	45.3	3
13	13	47.2	6	45.6	4
14	14	45.0	1	46.0	1
15	17	NA	NA	49.6	4
16	19	51.5	1	NA	NA
17	20	50.0	4	54.3	2
18	21	47.7	3	NA	NA
19	22	52.7	1	NA	NA
20	24	54.0	5	51.0	1
21	25	52.4	8	NA	NA
22	26	55.8	3	NA	NA
23	27	56.6	3	NA	NA
24	29	53.8	4	NA	NA
25	30	55.7	4	NA	NA
26	31	56.4	4	NA	NA
27	32	49.7	3	NA	NA
28	34	61.8	4	NA	NA

Table 3 (cont.)

29	35	58.3	2	NA	NA
30	36	58.7	8	NA	NA
31	37	57.7	6	NA	NA
32	39	62.9	11	NA	NA
33	40	62.9	3	NA	NA
34	41	60.9	5	NA	NA
35	43	64.4	2	69.5	1
36	44	62.9	3	NA	NA
37	45	59.9	3	NA	NA
38	46	60.7	2	NA	NA
43	53	70.5	1	NA	NA
44	54	57.1	1	NA	NA
47	58	56.5	1	NA	NA
59	74	71.2	1	NA	NA

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Table 4. von Bertalanffy growth parameters for male and female lake sturgeon from Yellow Lake (current study), Burnett County, Wisconsin, and Lake Winnebago (Bruch 2008).

<b>Parameter</b>	<b>All Fish (Yellow Lake)</b>	<b>Males (Yellow Lake)</b>	<b>Males (Winnebago)</b>	<b>Females (Yellow Lake)</b>	<b>Females (Winnebago)</b>
$L_{\infty}$ (in)	63.86	63.54	65.51	105.80	74.38
K	.066	.028	.052	.011	.045
$T_0$	-4.6	-30.6	-4.5	-41.5	-2.5

Table 5. Fulton's condition factor values for the lake sturgeon population on Yellow Lake, Burnett County, Wisconsin, and compared to other populations.

<b>Population and Source</b>	<b>Mean condition factor (K)</b>	<b>Range (K)</b>
Yellow Lake (Present Study)	0.63	0.43-0.85
Lake of the Woods, MN (Stewig 2005)	0.674	0.07-1.14
Sturgeon Lake (Solomon and Baljko 2011)	0.56	0.42-0.75

Table 6. Lake sturgeon mortality rates estimated on Yellow Lake, Burnett County, Wisconsin, and compared to other populations. Age classes for the present study on Yellow Lake were adjusted based on the power function developed by Bruch et al. (2009).

Population and Source	Age Classes Assessed	A	r <sup>2</sup>
Yellow Lake (Present Study)	19-46	0.03	0.77
Lake of the Woods, MN (Stewig 2005)	20-31	0.12	0.77
Kettle River, MN (Dieterman et al. 2010)	11-35	0.20	NA
Lake St. Claire, MI (Thomas and Haas 2004)	NA	0.09	0.85
Rainy Lake, MN (Adams et al. 2006)	20-39	0.05	0.65

Table 7. Summary of lake sturgeon creel statistics for Yellow Lake, Burnett County, Wisconsin.

<b>Variable</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1986</b>	<b>2008</b>
Projected Total Effort						
During Sturgeon Season (hrs)	4,810	7,218	6,198	6,753	5,195	7,423
Directed Lake Sturgeon Effort (hrs)	2,612	2,830	2,257	2,636	791	4,104
Lake Sturgeon Catch Rate (fish/hr)	.07	.05	.07	.07	.09	.10
Projected Number of Lake Sturgeon Caught	175	150	158	174	73	430

Table 8. Proportion of angler caught lake sturgeon by 5 in size increment during 2007-2008, Yellow Lake, Burnett County, Wisconsin.

<b>Length</b>	<b>Percentage</b>	<b>Cumulative Percentage</b>
15	0.4	0.4
20	6.5	6.8
25	7.2	14.1
30	9.1	23.2
35	11.4	34.6
40	12.9	47.5
45	20.5	68.1
50	18.3	86.3
55	7.6	93.9
60	3.8	97.7
65	1.5	99.2
70	0.8	100



Figure 1. Map of study area, including Yellow Lake and Yellow River upstream to Conners Bridge, Burnett County, Wisconsin. Map created with Terrain Navigator software (Maptech 2001).

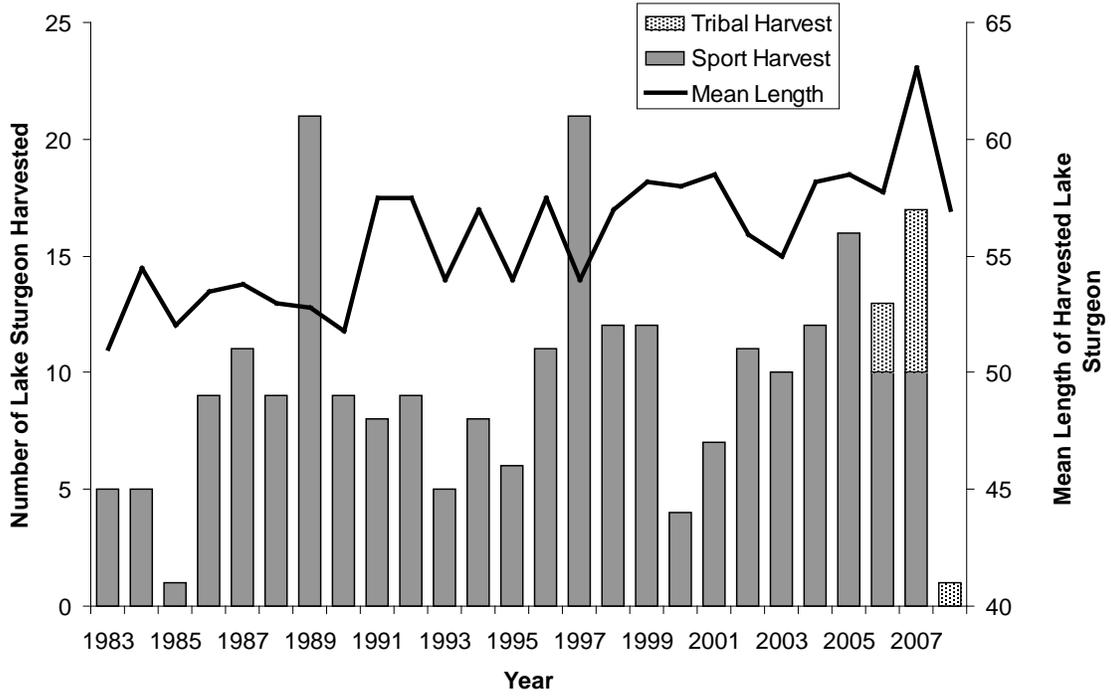


Figure 2. Sport and tribal lake sturgeon harvest on Yellow Lake, Burnett County, Wisconsin.

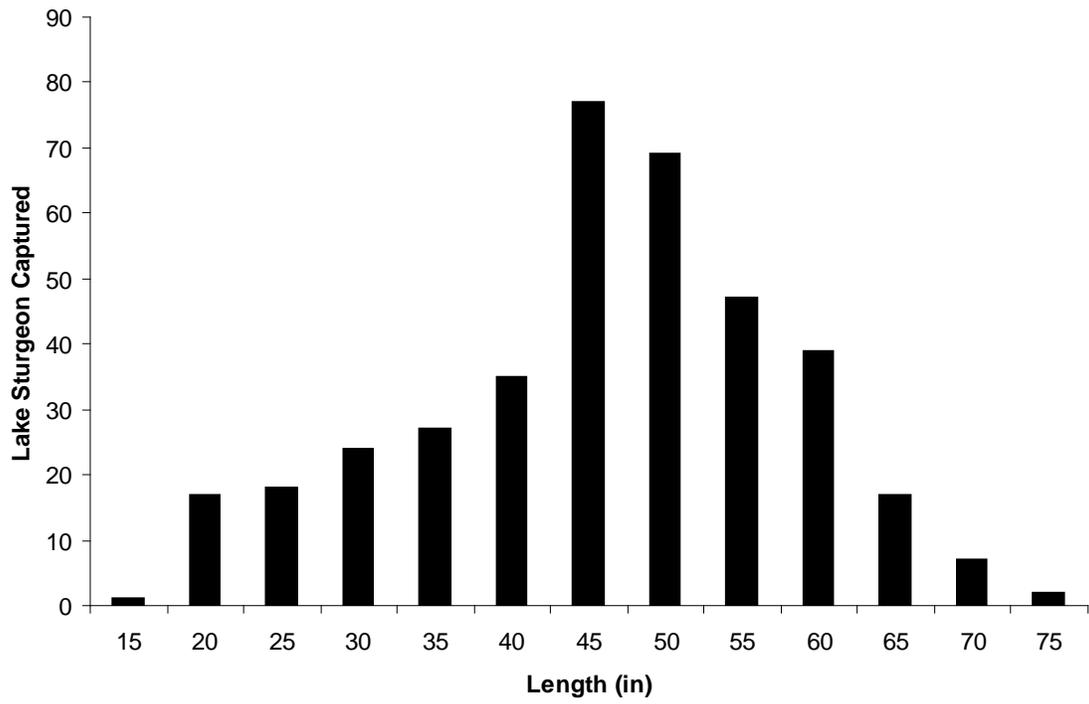


Figure 3. Length frequency of all lake sturgeon captured (N = 380) in Yellow Lake, Burnett County, Wisconsin from 2005-2008.

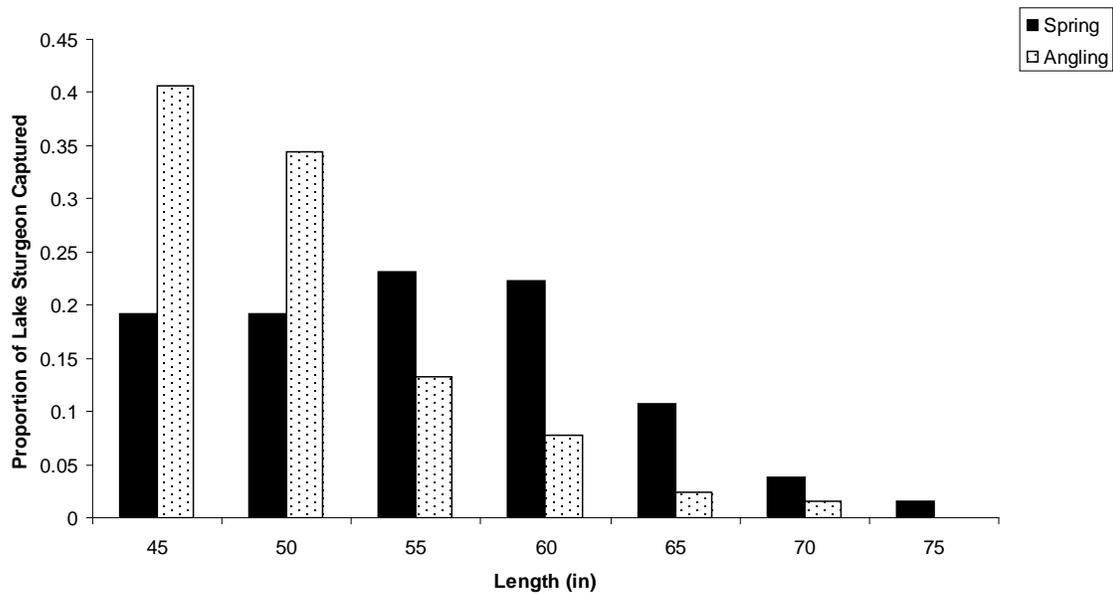


Figure 4. Proportion of lake sturgeon greater than or equal to 45 in captured by angling and during spring spawning (N = 258) in Yellow Lake, Burnett County, Wisconsin. Solid bars represent fish captured during spring spawning assessments from 2005-2008. Dotted bars represent fish captured by anglers during the 2007 and 2008 fall hook and line seasons.

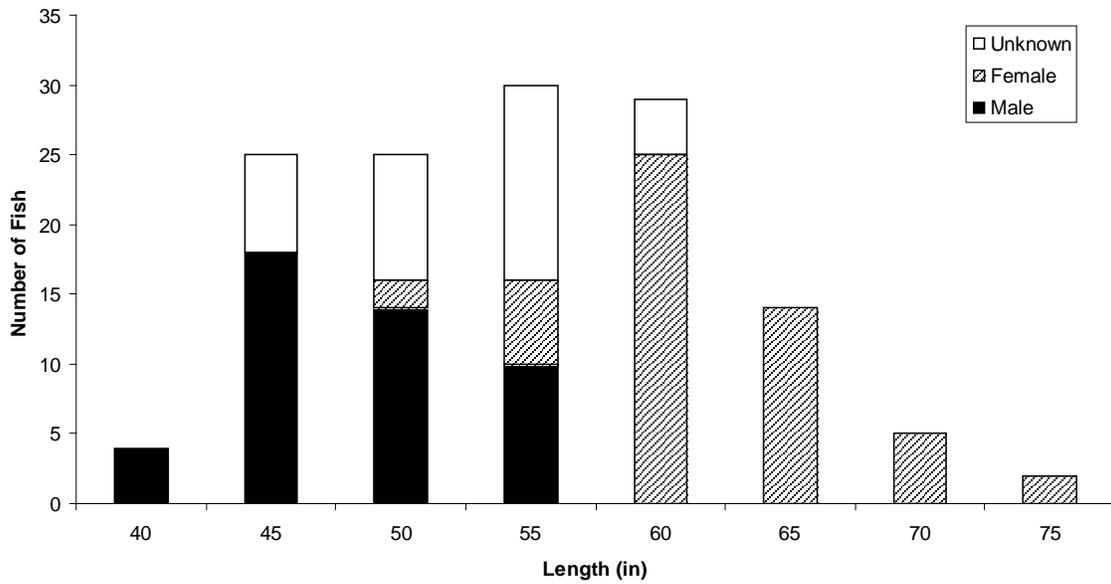


Figure 5. Length frequency of lake sturgeon captured during spring spawning population assessments from 2005-2008, by gender (Males, N = 46, Female, N = 54, Unknowns, N = 34), Yellow Lake, Burnett County, Wisconsin.

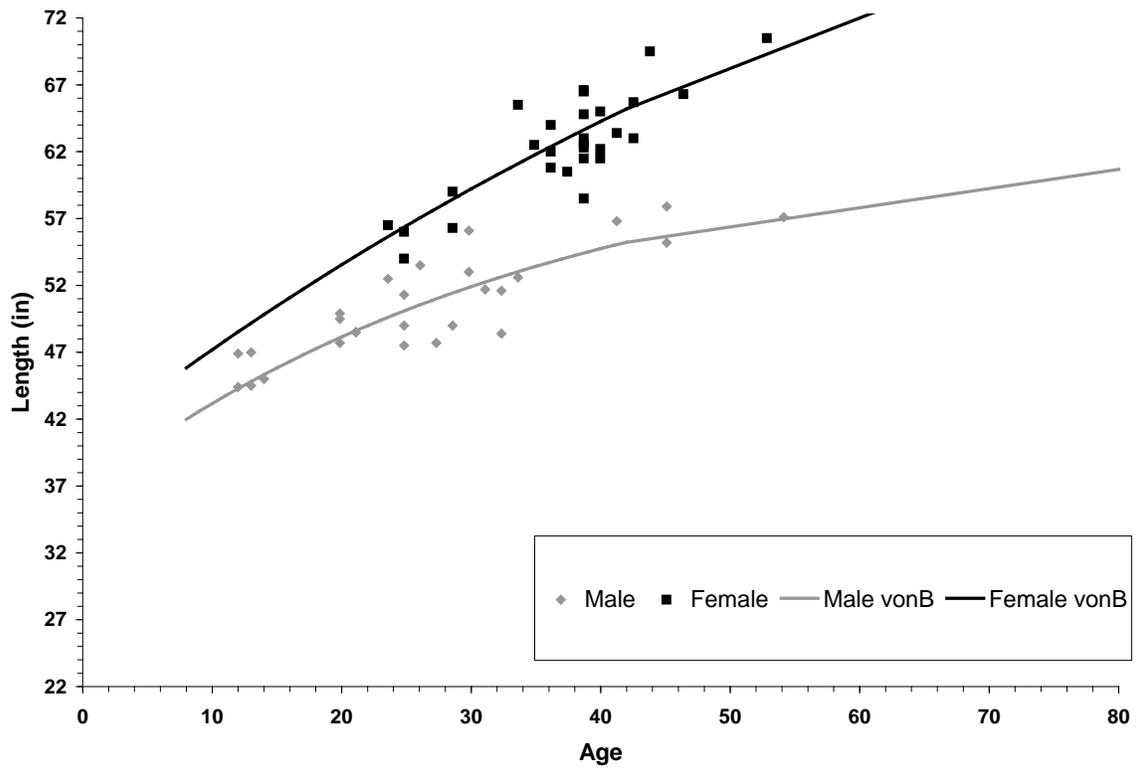


Figure 6. Length at age for male and female lake sturgeon sampled from 2005-2008 in Yellow Lake, Burnett County, Wisconsin. Age classes were adjusted based on the power function developed by Bruch et al. (2009).

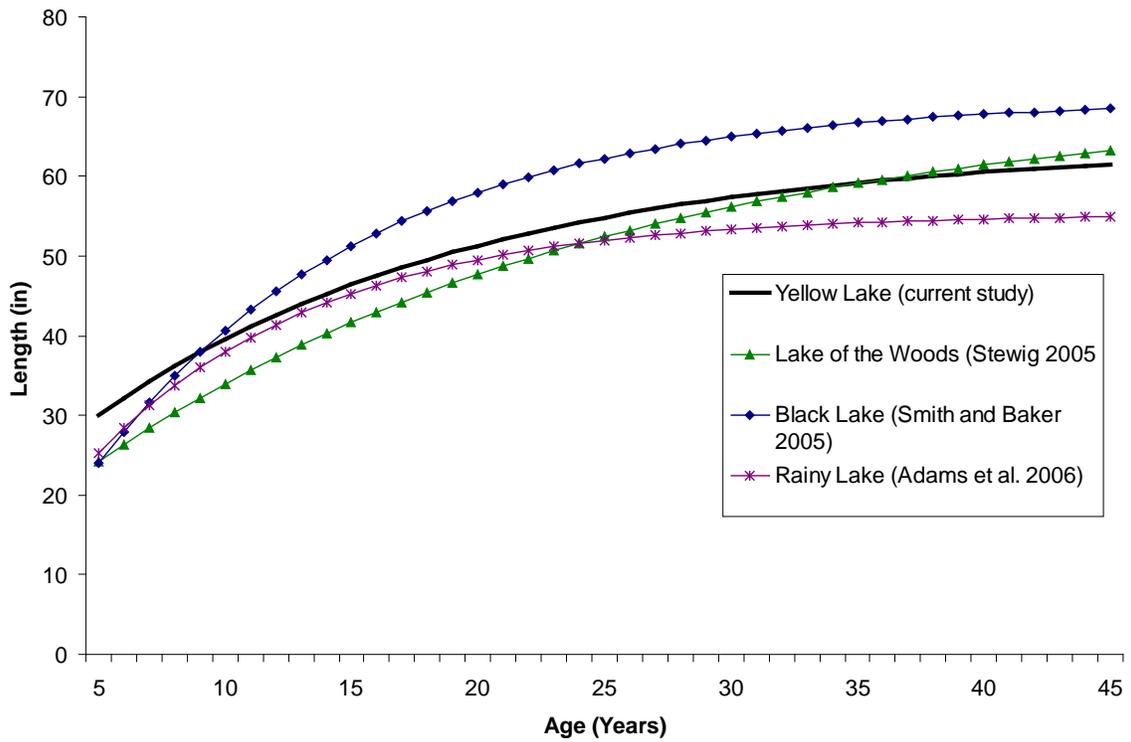


Figure 7. von Bertalanffy growth curves for Yellow Lake, Burnett County, Wisconsin compared to other populations. Growth curves include males, females, and unknown sex fish.

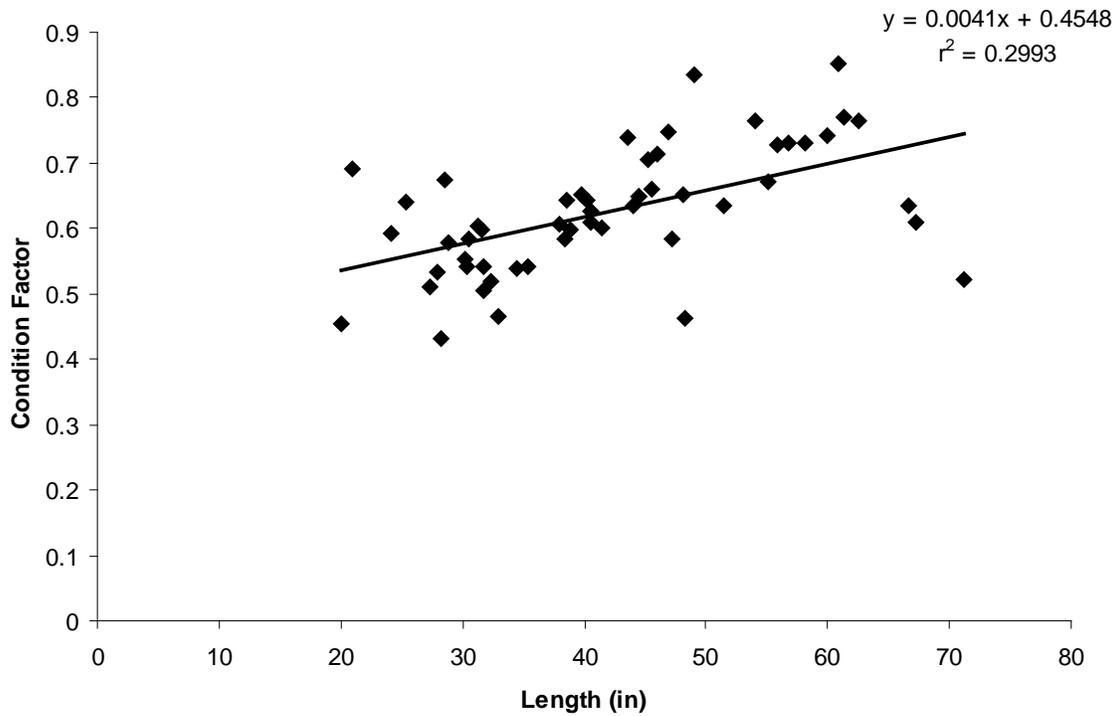


Figure 8. Fulton's condition factor for lake sturgeon sampled from Yellow Lake, Burnett County, Wisconsin.

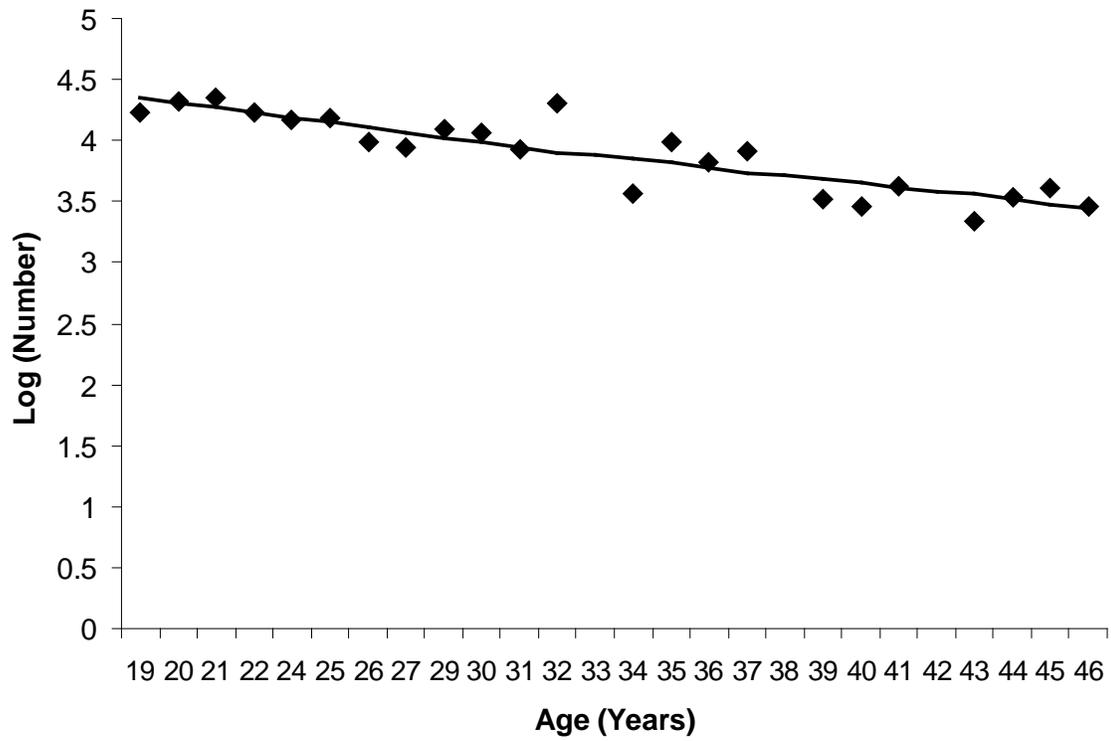


Figure 9. Catch curve for lake sturgeon sampled from Yellow Lake, Burnett County, Wisconsin. Age classes were adjusted based on the power function developed by Bruch et al. (2009).

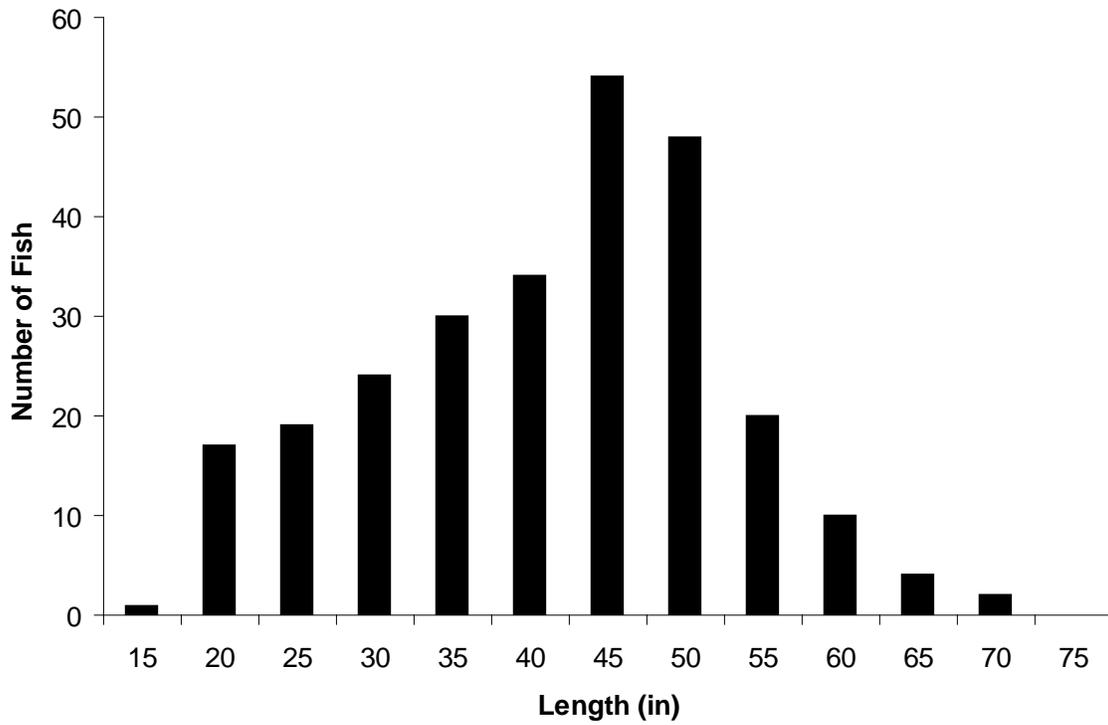


Figure 10. Length frequency of angler caught lake sturgeon (N = 263) in Yellow Lake, Burnett County, Wisconsin in 2007-2008.