# Minong Flowage Comprehensive Fishery Survey, Washburn County, Wisconsin 2016

WBIC 2692900

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## Executive Summary

A comprehensive survey of the Minong Flowage, Washburn County, was conducted during the 2016 sampling season. The primary objective of this study focused on assessing the status of gamefish and panfish populations in the Minong Flowage. The secondary objective was to evaluate any potential fisheries impacts from the 2013 drawdown (March 2013 – April 2014).

The 2016 adult walleye population was estimated at 8,903 fish or 5.7 fish/acre. This population was similar to 2010 and decreased from 2005. The adult walleye density was higher than the Ceded Territory average for lakes that are sustained by natural reproduction.

Northern pike, largemouth bass, smallmouth bass, bluegill, and other panfish were also collected during 2016. A total of 187 northern pike were collected ranging in length from 10.5 to 39.0 inches (in). A total of 35 bass were collected ranging from 5.5 to 19.0 in. Forty-eight smallmouth bass were collected ranging from 7.5 to 17.0 in. A total of 81 bluegill were collected ranging from 1.6 to 9.5 in. Other panfish species collected were less abundant in the flowage.

Summary and management recommendations include: 1) The no minimum, one fish greater than 14 in limit should help improve walleye growth in the future. 2) Walleye recruitment is excellent. 3) The northern pike density is lower compared to 2005, which is likely related to habitat changes induced by the drawdown. 4) Largemouth bass are not common in the Minong Flowage 5) The smallmouth bass population saw a modest increase in 2013 compared to 2010. 6) There were fewer bluegill under 6 in collected in this survey than 2010, suggesting habitat changes associated with the drawdown impacted bluegill. 7) Based on available data, the 2013 drawdown did have some positive and negative impacts on the Minong Flowage's fishery that need to be considered during planning for future drawdown events. 8) Preventing the

establishment of new invasive species and monitoring of established invasive species should continue. 9) Habitat preservation/reestablishment should be encouraged.

## Introduction

The Minong Flowage is a 1,564-acre impoundment of the Totagatic River located on the Douglas County/Washburn County border. The flowage is shallow with a maximum depth of 21 feet and a mean depth of 9 feet. The Totagatic River is the main inlet and outlet of the flowage. Cranberry Lake, a 169-acre drainage lake connected to Minong Flowage's north end, is not considered part of the flowage. The Minong Flowage is classified as a complex cool-turbid waterbody; complex meaning it has more than three species of gamefish and cool-turbid referring the water quality based on seasonal temperatures and water clarity (Wisconsin Department of Natural Resources, unpublished data).

Trophic state index (TSI) is an index for evaluating the trophic state or nutrient condition of lakes (Carlson 1977; Lillie et al. 1993). The Minong Flowage is considered a eutrophic or productive lake according to its TSI index (WDNR 2016). The Minong Flowage substrate is mostly composed of sand with some muck bottom bays. Aquatic vegetation is common in these bays. Stumps and woody debris are also common in the flowage, especially on the northern end.

The Minong Flowage's fishery consists of these gamefish: walleye *Sander vitreus,* northern pike *Esox lucius*, smallmouth bass *Micropterus dolomieu*, and largemouth bass *Micropterus salmoides*. Panfish present are bluegill *Lepomis macrochirus*, black crappie *Pomoxis negromaculatus*, yellow perch *Perca flavescens*, rock bass *Ambloplites rupestris*, and pumpkinseed *L. gibbosus*. Common forage species are golden redhorse *Moxostoma erythrurum*, shorthead redhorse *M. macrolepidotum*, and white sucker *Catostomus commersoni*. Invasive

species present include: common carp *Cyprinus carpio*, Chinese mystery snail *Bellamy chinensis*, rusty crayfish *Orconectes rusticus*, Eurasian water-milfoil *Myriophyllum spicatum*, and curly-leaf pondweed *Potamogeton crispus*.

Bass and walleye angling regulations have recently changed. Largemouth and smallmouth bass length limits were changed from a 14 inch (in) minimum length limit to no minimum length limit in 2012. Walleye have undergone the most changes with both size and bag regulations. In 1990, the length limit changed from no minimum to a 15 in minimum length limit on the Minong Flowage. The 15 in minimum length limit stayed in place until 2014, when it was changed to no minimum length limit, but only one fish can be over 14 in. For bag limits, the flowage is in the ceded territory and is subject to tribal harvest, which means it was managed with a sliding bag system since 1985. From 1985 until 2014, the walleye daily bag limits varied from two to five fish. In 2014, a fixed three bag limit was put into place. A list of current regulations is provided in Table 1.

Fisheries management by the Wisconsin Department of Natural Resources (WDNR) has consisted of fish surveys and stocking. In its early history, the Minong Flowage received walleye (1942-1949) and muskellunge (1942-1947) stocking (Bass 2006). Muskellunge stocking was discontinued in 1948 due to poor survival (DNR communication 1973). Walleye natural reproduction was more than enough to sustain a healthy walleye fishery. Rainbow trout were stocked during the 1990s, but that stocking was also discontinued. Since then, fingerling lake sturgeon were stocked in 2010 (2,730) and 2011 (828). Fish surveys have taken place sporadically since the flowage was built in 1936-37. Walleye population estimates took place in 1988, 1989, 2005, and 2010. This comprehensive survey primarily focused on assessing both

gamefish and panfish populations in the Minong Flowage. The secondary objective was to evaluate any potential fisheries impacts from the 2013 drawdown (March 2013 – April 2014).

## Methods

### *Field Sampling*

Spring sampling started in late March following WDNR lake sampling protocols (Simonson et al. 2008). After ice out, four fyke-nets (4 x 6 ft frame) were set on 21 March in the northeastern portion of the flowage. Nets were placed on shorelines favorable for northern pike spawning. Four to six nets were fished until 31 March for a total of 57 net nights. Data was collected on northern pike and walleye. All fish were given a left ventral (LV) fin clip.

The primary walleye sampling effort took place approximately 1.72 miles upstream of the Minong Flowage in the Totagatic River using daytime pulsed direct current (DC) electrofishing. Sampling took place during 12 days from 21 March until 14 April. Adult walleye were marked with a LV fin clip each sampling day to increase the number-at-large for a population estimate. A recapture electrofishing run took place 15 April which concluded river sampling.

Late spring electrofishing took place 26 May within the Minong Flowage. Three two-mile gamefish stations were sampled with a focus on collecting both bass species. Each two-mile station had a ½ mile index station embedded within it where panfish were collected in addition to gamefish.

Fall electrofishing took place 22 September to assess natural recruitment of walleye in Minong Flowage. This sampling took place once surface water temperature dropped below 70° F. Walleye less than 12.0 in were collected in the sample.

### *Age and Statistical Analysis*

All walleye, smallmouth bass, largemouth bass, and northern pike were measured to the nearest half inch. Panfish were measured to the nearest tenth of an inch. Age structures were collected from walleye, smallmouth bass, largemouth bass, bluegill, and northern pike. Scale samples were taken on walleye less than 15 in and bass less than 12 in. Dorsal spines were taken on all larger walleye and bass sampled. Pectoral fin rays/scale samples were taken on all northern pike under 24 in. Aging samples were only taken on young northern pike to assess year class strength during the drawdown.

Size structure quality of species sampled was determined by using the indices proportional stock densities (PSD) (Neumann et al. 2013). The PSD 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. Catch per unit effort (CPE) was calculated as the number of fish captured divided by the appropriate unit of sampling effort for that species (i.e. net night, mile of shoreline). The descending limb of a catch curve regression was used to estimate total annual mortality for walleye (Ricker 1975). The percent of aging sample was used to assess year class strength for young northern pike (< 24 in), largemouth bass, smallmouth bass, and bluegill.

## Results

### *Early Spring Fyke-Netting and Electrofishing*

*Walleye.* The 2016 walleye population was estimated at 8,903 fish (C.V. = .11) or 5.7 fish/acre. This population estimate was similar to 2010 (5.5 fish/acre) and decreased from 2005 (7.0 fish/acre) (Table 2). The adult walleye density was higher than the Ceded Territory average, which is 3.2 fish/acre for lakes that are sustained by natural reproduction (Cichosz 2016). A total of 1,864 walleye were captured during netting and electrofishing. The electrofishing catch rate

decreased slightly between 2010 (99.3 fish/mile) and 2016 (95.5 fish/mile). Since a low number of fish were collected netting, a catch rate was not calculated for that gear.

Adult walleye ranged in length from 11.7 to 27.2 in (Figure 1). The 2016 size structure was similar to the 2005 and 2010 survey (Figure 2). Mean length of male and female walleye was 14.6 in (standard deviation (SD) = 1.4) and 16.6 in (SD = 2.1), respectively. Overall average length was 14.9 in (SD = 1.6), which was slightly lower than 2010 (15.1 in avg.). Adult walleye captured in 2016 were on average 3.6 in (SD=1.8) below Northwest Wisconsin averages for walleye age-5 to 14. PSD-14 decreased from 85 (2010) to 69 (2016) and PSD-20 decreased from 3(2010) to 1(2016). Male, female, and combined mean length-at-ages were comparable between the 2005, 2010, and 2016 surveys (Figures 3-5). Survival was estimated at 73% (age 4 - 14) for adult walleye in 2016. This survival rate is an increase from 2010 (69%; age 4 – 14).

*Northern pike.* A total of 187 northern pike were collected in the Minong Flowage in 2016. They ranged in length from 10.5 to 39.0 in (Figure 6). Mean length of male and female northern pike was 15.9 in (SD = 6.6) and 26.9 in (SD = 3.7). Adult average length increased from 18.3 in (SD = 5.0; 2005) to 19.7 in (SD= 7.3; 2016) (Figure 7). Northern pike PSD increased from 23 (2005) to 45 (2016). PSD-28 increased from 6 (2005) to 23 (2016). Catch rate decreased from 9 fish/net night (2005) to 3 fish/net night (2016). Age-2 to 4 northern pike grew near northern district average, while age 5 to 7 was below the Northern Region average (Figure 8). For northern pike collected under 24 in, Age-2 and 3 northern pike made up 62% and 10% of the aging sample, respectively.

*Late-spring electrofishing*

*Largemouth bass.* A total of 35 largemouth bass were collected in 2016. They ranged in length from 5.5 to 19.0 in (Figure 9). Average length increased from 13.6 in (SD=2.0; 2010) to 14.7 in

(SD=2.3; 2016). Catch rate decreased from 9.3 fish/mile (2010) to 5.8 fish/mile (2016). PSD was not calculated for largemouth bass due to small sample size. Age-3 to Age-7 largemouth bass grew at or above average for the Northern Region in 2016 before dropping below average. This trend was similar in 2010 and 2005 (Figure 10). There was not a large difference between age-3 largemouth bass abundance in the aging sample between 2016 and 2010 (Figure 11).

Smallmouth bass. A total of 46 smallmouth bass were collected in 2016. They ranged in length from 7.5 to 17.0 in (Figure 12). Average length stayed similar between 2010 (11.2 in; SD=2.5) and 2016 (10.9 in; SD=2.2). Catch rate increased from 2.2 fish/mile (2010) to 7.7 fish/mile (2016). PSD was not calculated for smallmouth bass due to small sample size. Age-2 to age-5 smallmouth bass in 2016 were larger than 2010 and Northern Region averages (Figure 13). Age-3 (drawdown year) smallmouth bass made up 68% of the aging sample.

*Bluegill*. A total of 81 bluegill were collected in 2016.They ranged in length from 1.6 to 9.5 in (Figure 14). Average length increased from 2010 (5.8 in; SD=1.6) to 2016 (7.2 in; SD=1.5). Catch rate decreased slightly from 56.7 fish/mile (2010) to 54.0 fish/mile (2016). PSD increased from 56 (2010) to 95 (2016). Age-3 to Age-10 bluegill grew above Northern Region averages (Figure 15). Age-3 (drawdown year) bluegill represented only 3% of the aging sample collected (Figure 16).

*Other fishes*. Both black crappie (n=6) and yellow perch (n=3) had very low sample sizes in 2016. These species were also found in low abundances in 2010. One 44.3 in muskellunge was captured during early spring fyke-netting. This muskellunge is the first one documented by DNR.

*Common carp*. A total of 10 common carp were observed in fyke-nets and electrofishing in the Minong Flowage. Five carp were collected during spring fyke-net sampling and five were

observed in late-spring night electrofishing. This catch is similar to previous surveys in the flowage with ten carp captured during an electrofishing survey in 1980 and three carp captured in fyke-nets in 1949. The 2016 catch rates were 0.1 fish/net night for nets and 0.8 fish/mile for electrofishing.

### *Fall Walleye Recruitment Survey*

The catch rate of young-of-year (YOY) walleye was 88.0 fish/mile, exceeding the Ceded Territory average of 12.3 fish/mile for populations sustained by natural reproduction (Cichosz 2015) (Figure 17). This catch rate is above the long-term average for Minong Flowage of 61.8 fish/mile. Age-1 walleye also had an above average year at 36.8 fish/mile (Figure 18).

## Discussion

The Minong Flowage continues to maintain an excellent population of walleye compared to other lakes in Northwest Wisconsin. The current population is higher than it was in 1989 (4.5 fish/acre; WDNR Treaty unpublished data 1989). The walleye population estimate was 5.7 fish/acre falling within the range of 4.5 to 7.0 fish/acre from surveys dating back to1989. The biggest concern with walleye in the flowage is slow growth. Adult walleye grew below average for almost all ages collected. However, there are positive trends with younger adult walleye displaying improved growth at age-3 and 4.

Strong natural reproduction continues to bolster the walleye population in the Minong Flowage. The past three year classes (post-drawdown) have ranged between 88 fish/mile to 136 fish/mile and represent first, third, and fourth highest year classes since 2000. Survival to age-1 was also excellent. This strong natural reproduction should translate to harvestable size walleye

in the next year or two. It is unclear whether the drawdown, the regulation change, or both factors helped boost natural reproduction levels in the last three years.

The northern pike density has changed since 2005. The most noticeable differences are a higher percentage of fish over 30 inches and a larger average size. The increase in size may be explained by the lower relative density in the flowage. Catch rates fell by 66% when compared to 2005. However, there are numerous factors that could have impacted the pike population the past 11 years. These factors include habitat changes in vegetation, shoreline alteration/development (Holland and Huston 1984), possible increased fishing pressure (Pierce et. al 1995), and impacts from the drawdown.

We intentionally took scales/rays from pike under 24 inches to limit potential aging error common in pike but document any impacts from the drawdown on young northern pike. Margenau et al. (1998) and Laine (1991) both state that aging larger northern pike becomes prone to error. We found a strong year class of two-year-old northern pike suggesting a good hatch in 2014. However, age-3 fish (drawdown year) were less abundant, while other year classes were still relatively strong (until 24 inch cut-off). If the drawdown was the cause of lower recruitment in 2013 it seems northern pike have rebounded.

There is a low density of largemouth bass in the Minong Flowage. In 2010 (n=56) and 2016 (n=35), DNR staff collected less than 100 fish during night electrofishing. These are both very low sample sizes, which make drawing conclusions more difficult. Largemouth bass size structure and growth did have a noticeable improvement between 2010 and 2016.

In 2016, there is a noticeable lack of largemouth bass less than 12 inches. Aging data suggests low numbers of fish under four years old. This trend also occurred in 2010 suggesting it may be tied to poor recruitment and not to the drawdown. Habitat in the flowage does not

favor good largemouth bass recruitment due to high turbidity, current, and changes in aquatic vegetation. The drawdown likely had some impact on largemouth bass recruitment, since they prefer warm vegetated/woody habitat without current (Durocher et. al 1984; Ontario Freshwater Fish Database 2017). These areas were likely limited or dry during the 2013 season. It is difficult to speculate whether these numbers are tied to the new regulation, the 2013 drawdown, or conditional poor recruitment.

It is clear that smallmouth bass benefitted from the drawdown. The 2013 year class was the largest portion of the smallmouth aging sample. Smallmouth bass prefer a riverine environment (Ontario Freshwater Fish Database 2017) and likely had a good recruitment year in 2013 for this reason. This year class is already catchable and should provide good smallmouth bass angling opportunities.

The Minong Flowage's bluegill size structure also improved over the past six years. This change is demonstrated by the 1.4 in increase in average size. This size improvement may have been caused by a lower density of small bluegill in the flowage. Only nine percent of the sample was composed of bluegill less than 6 inches (48% in 2010). Bluegill aging suggests the 2013 year class was less abundant than other year classes. For this reason, it appears the drawdown negatively impacted the bluegill population abundance in 2013 with a concomitant increase in individual growth.

If future drawdowns are utilized as a management tool to control Eurasian water milfoil, consequences for the centrarchids and northern pike should be considered. Severe reductions of the bluegill population could create a situation where common carp are more successful in the flowage. Bluegills have been found to prey heavily on carp eggs/larvae and therefore are important for keeping the carp population in check (Bajer et al.2012). At this point, common

carp are at low densities in the Minong Flowage but have the potential to increase dramatically as observed in Clam Lake, Burnett County during 2005 (Wendel 2011). Northern pike may have been impacted by the 2013 drawdown based on aging data, but recovered in the subsequent year. It is unclear if largemouth bass saw large impacts resulting from the drawdown. Timing and frequency of a vegetation management drawdown will be a very important consideration. The drawdown likely impacted centrarchids the most by separating those species from littoral/spawning habitat and increasing mortality for juveniles that year (Miranda 2001). Overall, the Minong Flowage underwent some changes but still holds a sustainable quality fishery.

## Summary and Management Recommendations

1) Walleye are the most abundant sportfish in the Minong Flowage and remain the primary interest of management. The newly implemented no minimum, one fish over 14 in size limit should help walleye growth improve in the future.
2) Walleye recruitment has been excellent. Walleye recruitment surveys should be performed periodically to make sure the lake is maintaining good levels of natural reproduction.
3) The northern pike population density was lower than 2005. However, data suggests there is a good level of recruitment and healthy population. The current regulation is likely not the factor that created the lower density, so a regulation change is not warranted. The population should be monitored during the next survey to ensure further declines do not occur.

4) Largemouth bass are a low density fish in the Minong Flowage. The size regulation is likely not a driver in this population. Instead, the habitat in the flowage plays a bigger role (turbidity, changes in vegetation, drawdown, etc.).
5) The smallmouth bass population saw a modest increase in 2013. As with largemouth bass, the smallmouth bass population is likely being driven by changes in habitat (temporary riverine state in 2013) and not the current regulation.
6) The overall bluegill density stayed similar to 2010. However, there were fewer fish under 6 in. Bluegill ageing data suggests habitat changes had an impact on the bluegill population. Bluegill should be evaluated again during the next general survey. Preserving good numbers of this species may be important for preventing the common carp population from increasing in the flowage.
7) Based on fisheries, aquatic vegetation, and water level data, the 2013 drawdown did have some positive and negative impacts on the fishery in the Minong Flowage. If drawdowns are used in the future as an aquatic plant management tool, the fishery impacts need to be considered. Timing and frequency of future drawdowns will be important for reducing potential impacts to centrarchids.
8) Prevention and monitoring of invasive species should continue in the lake and at boat launches/accesses. Establishment of future invasive species could be detrimental to the system.
9) Efforts to increase habitat complexity should be strongly encouraged in main lake littoral areas. Input of coarse woody debris, protection/promotion of aquatic vegetation, and maintenance or restoration of 35 ft. vegetative buffers are some examples of work that can increase habitat complexity.

## Acknowledgements

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Table 1. General Fishing Regulations for Minong Flowage, Washburn County, Wisconsin, in 2016.

| Fish Species | Daily Limit | Minimum Length (in) |
|---|---|---|
| Walleye | 3 | 1>14 |
| Largemouth and Smallmouth Bass | 5 | NONE |
| Muskellunge | 1 | 40 |
| Northern Pike | 5 | NONE |
| Panfish | 25 | NONE |

Table 2. Walleye population estimates in Minong Flowage, Washburn County, Wisconsin. (P.E. - population estimate, C.V. - Coefficient of Variation.)

| | 1989 | 2005 | 2010 | 2016 |
|---|---|---|---|---|
| P.E. | 7,107 | 10,954 | 8,679 | 8,903 |
| C.V. | NA | 0.15 | 0.19 | 0.11 |
| fish/acre | 4.5 | 7.0 | 5.5 | 5.7 |

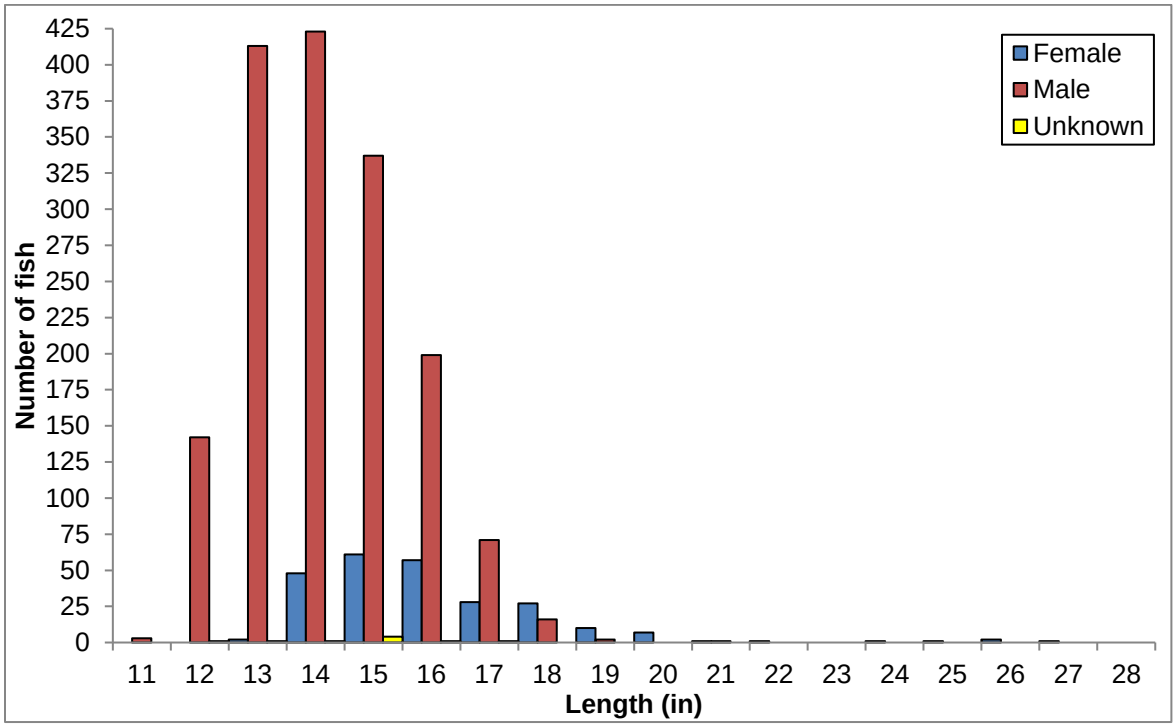

Figure 1. Length frequency of adult walleye captured in spring 2016 in Minong Flowage, Washburn County, Wisconsin.

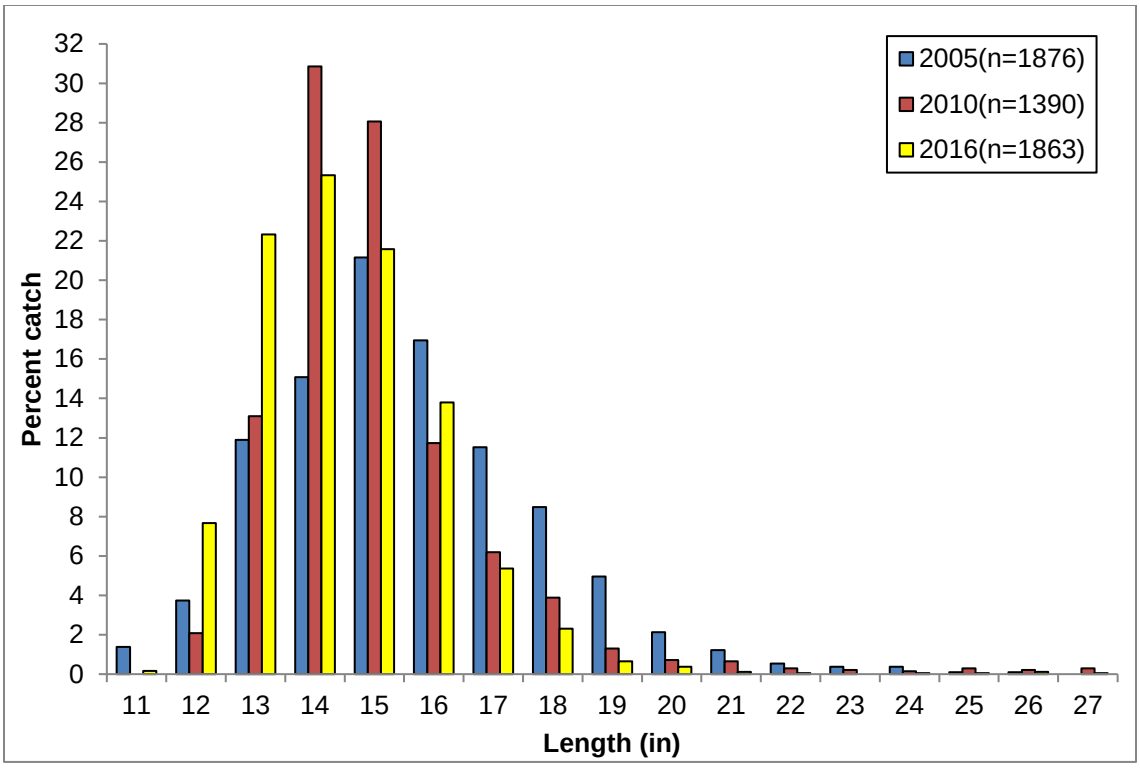


Figure 2. Relative length frequency of spawning walleye in Minong Flowage, Washburn County, Wisconsin.

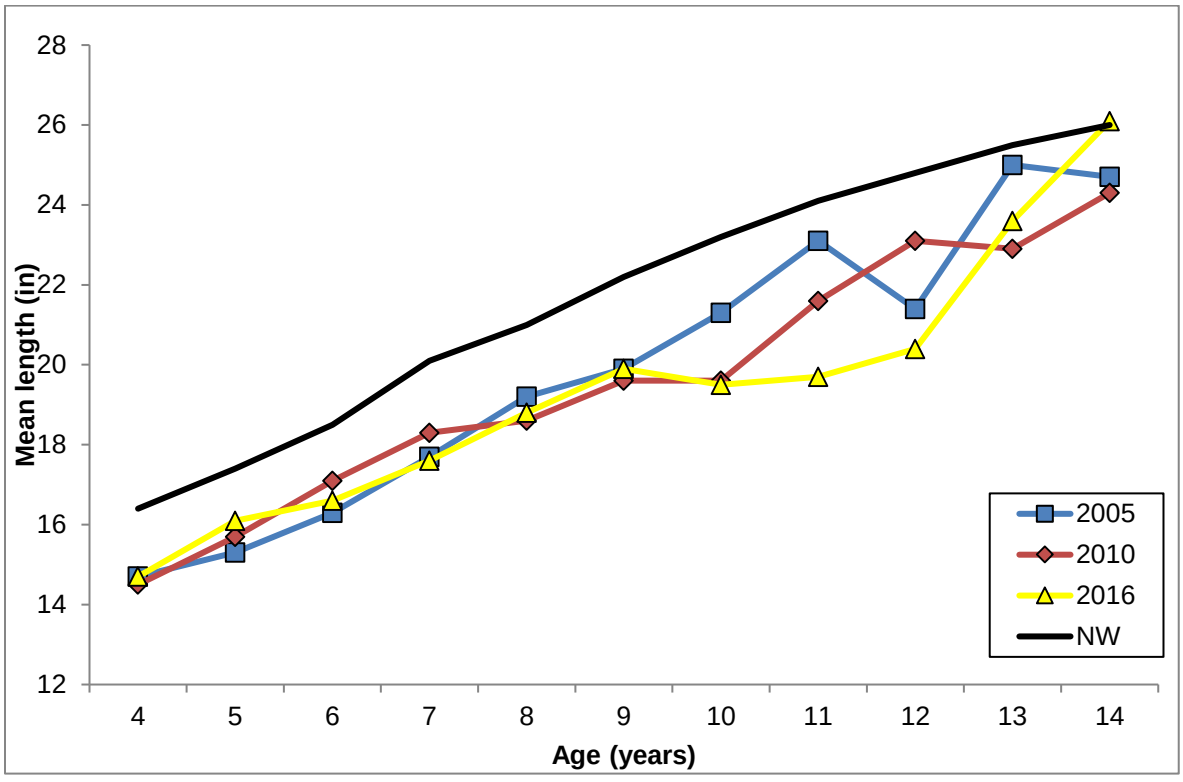


Figure 3. Mean length-at-age for female walleye in Minong Flowage, Washburn County, Wisconsin compared with the Northwest Wisconsin Average (NW). A black symbol represents a single fish age.

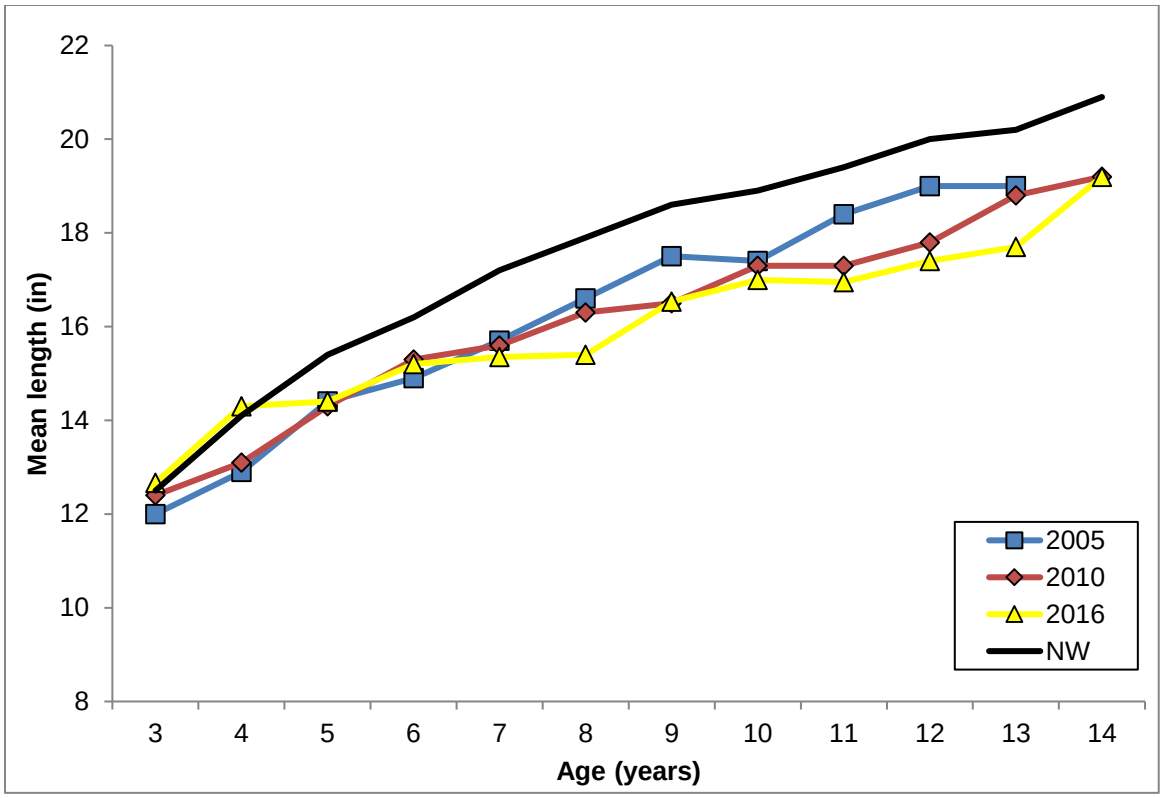

Figure 4. Mean length-at-age for male walleye in Minong Flowage, Washburn County, Wisconsin compared with the Northwest Wisconsin average (NW). A black symbol represents a single fish aged.

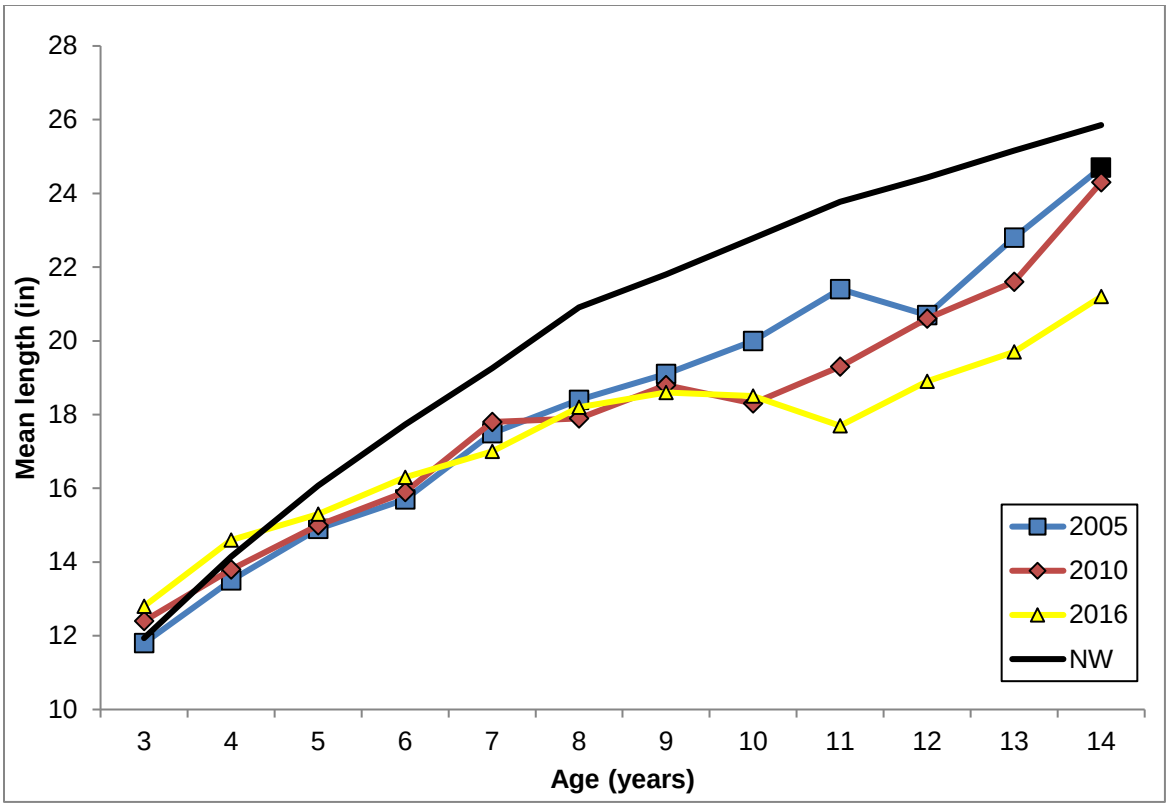


Figure 5. Mean length-at-age for walleye (both sexes) in Minong Flowage, Washburn County, Wisconsin compared with the Northwest Wisconsin average (NW). A black symbol represents a single fish aged.

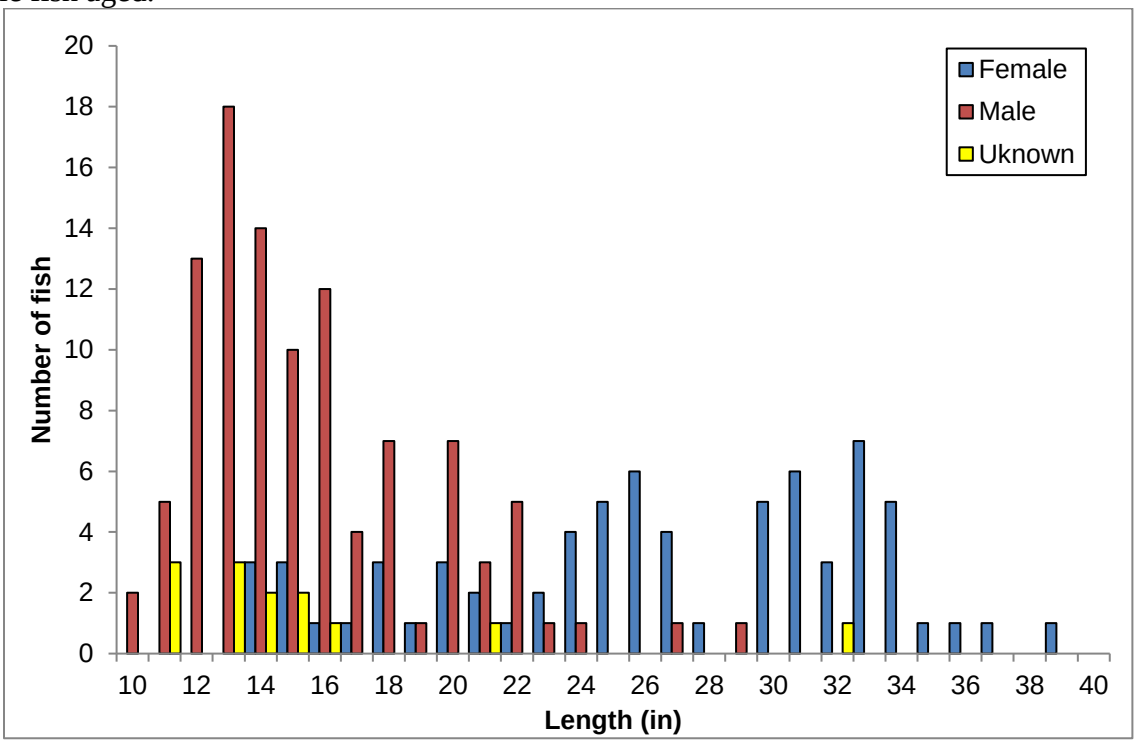


Figure 6. Length frequency of adult northern pike captured in spring 2016 in Minong Flowage, Washburn County, Wisconsin.

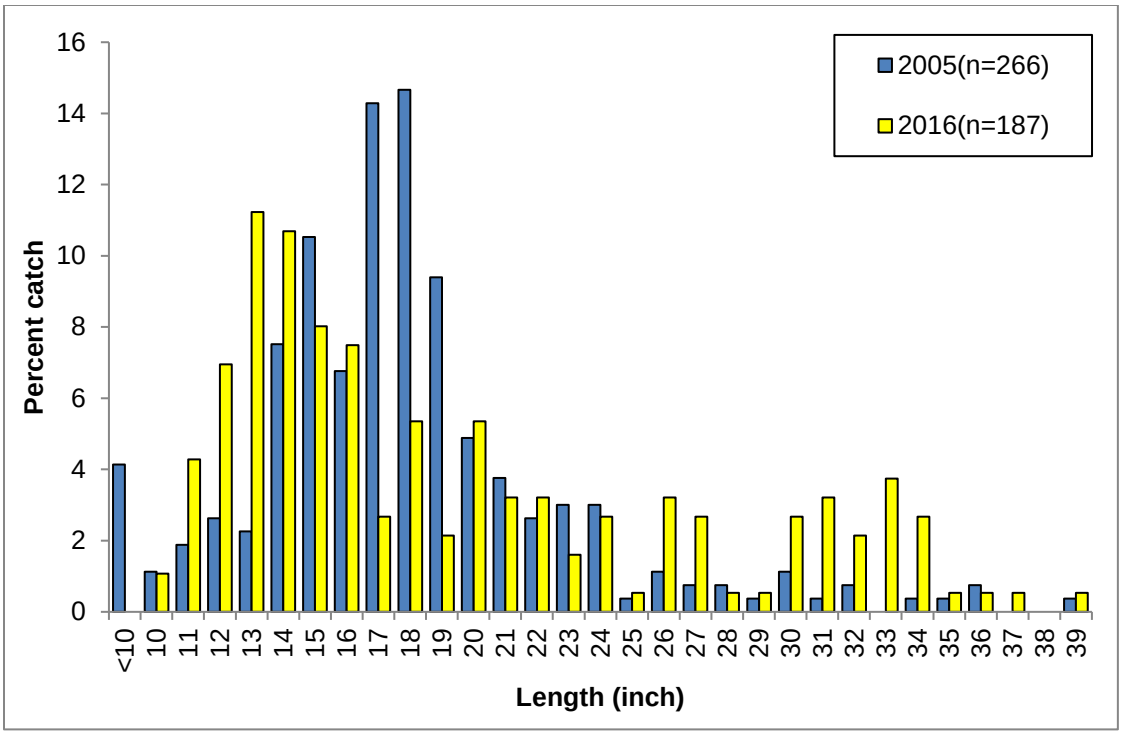


Figure 7. Relative length frequency of northern pike captured in 2005 and 2016 in Minong Flowage, Washburn County, Wisconsin.

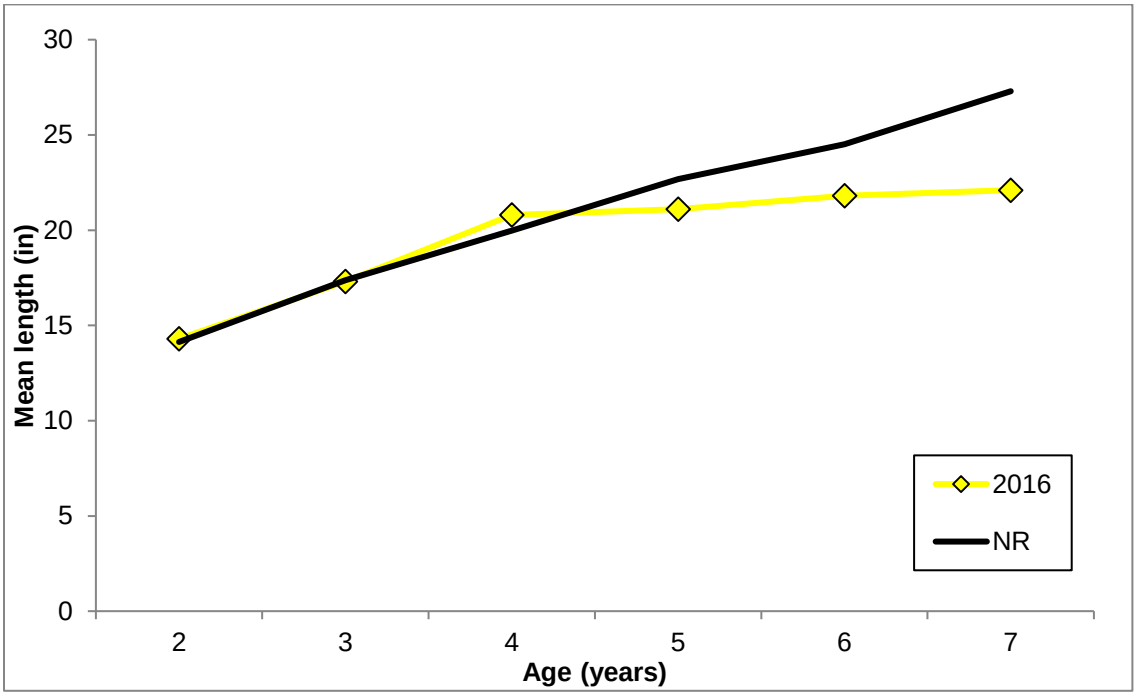


Figure 8. Mean length-at-age for northern pike in Minong Flowage, Washburn County, Wisconsin compared with the Northern Region average (NR).

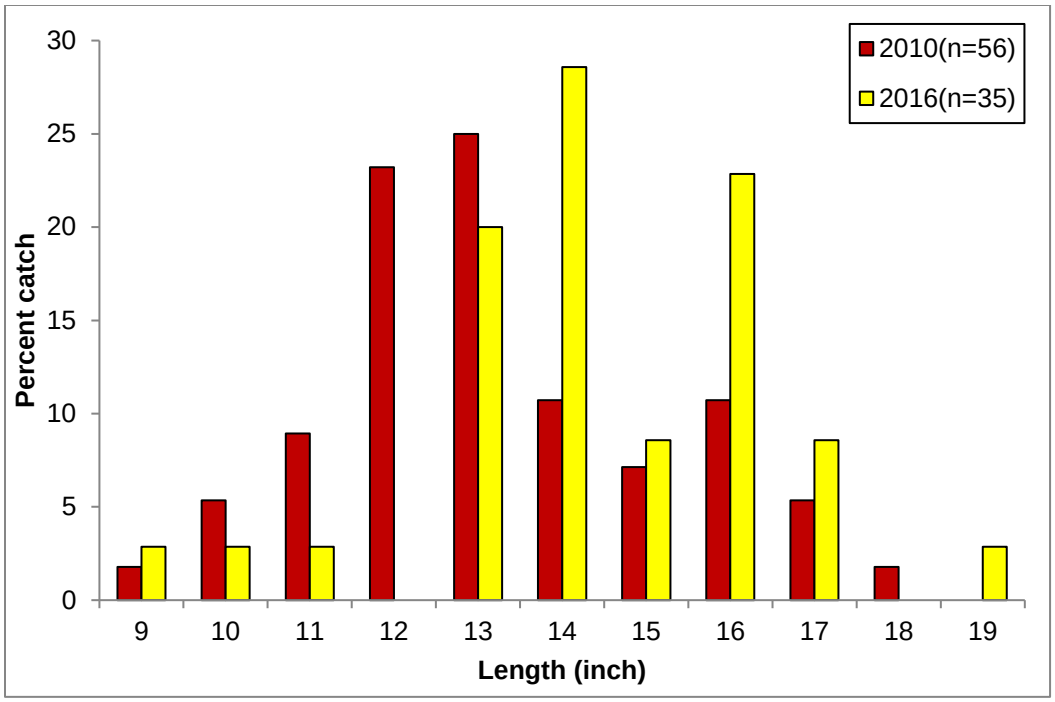

Figure 9. Relative length frequency of largemouth bass captured in 2010 and 2016 in Minong Flowage, Washburn County, Wisconsin.

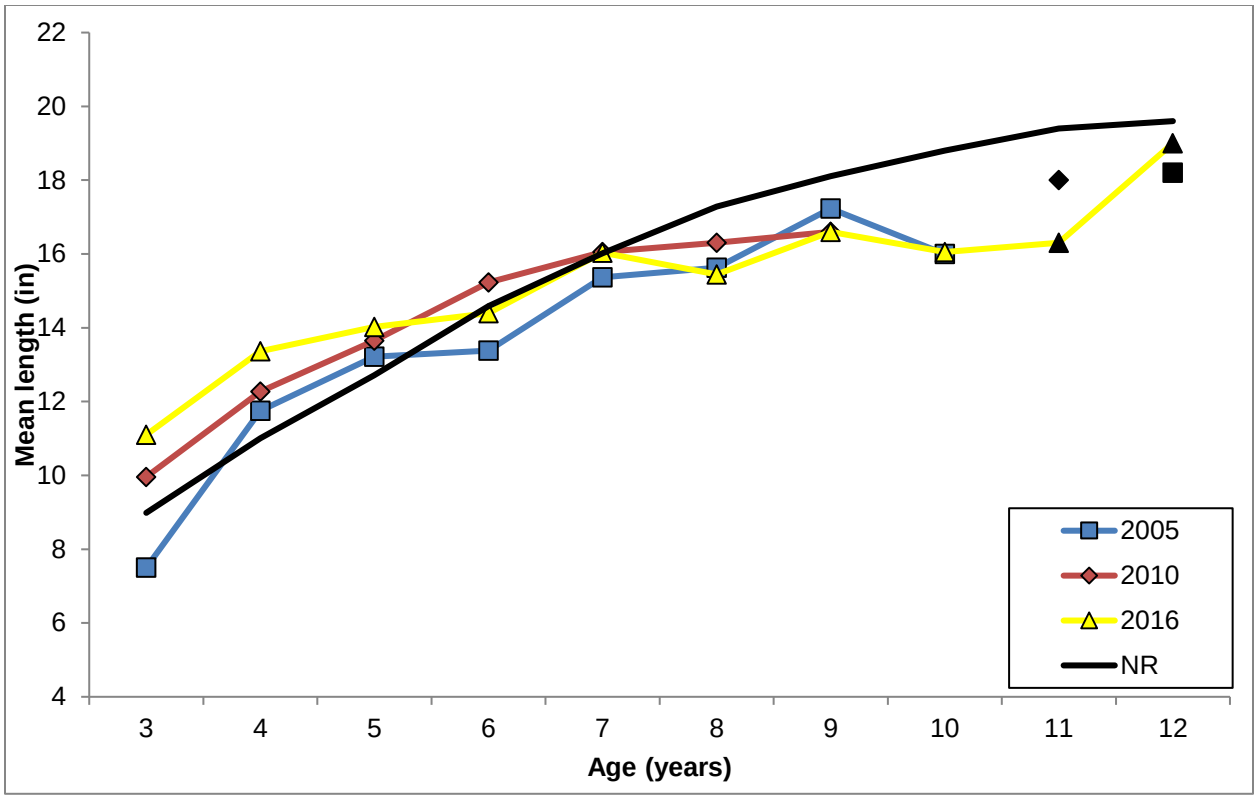

Figure 10. Mean length-at-age for largemouth bass in Minong Flowage, Washburn County, Wisconsin compared with the Northern Region average (NR). A black symbol represents a single fish aged.

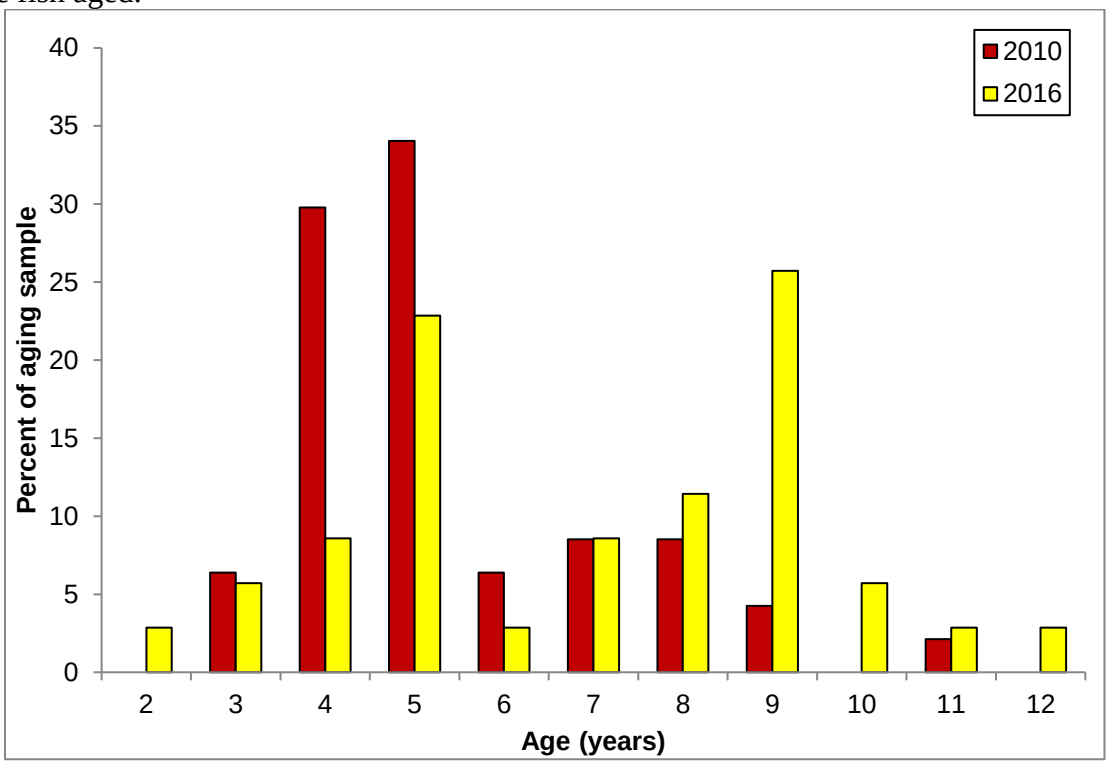

Figure 11. Percent of largemouth bass aging sample to demonstrate year class strength for 2010 and 2016 sampling in Minong Flowage, Washburn County, Wisconsin.

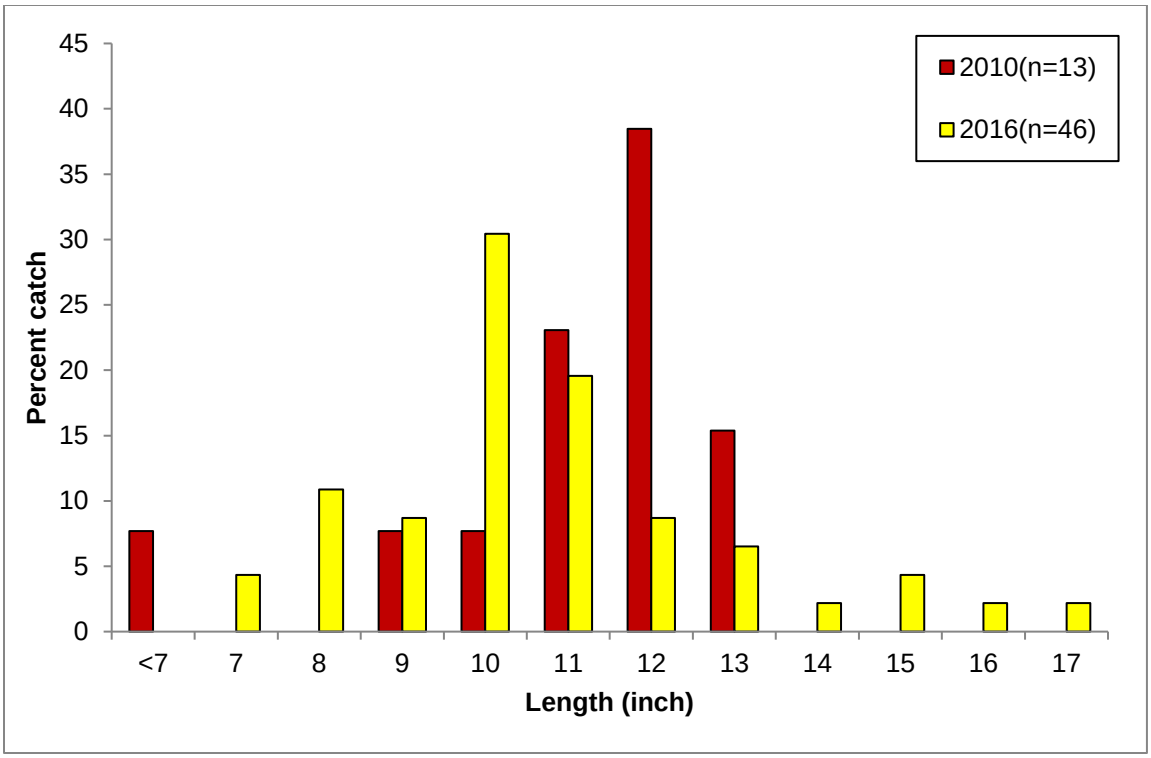


Figure 12. Relative length frequency of smallmouth bass captured in 2010 and 2016 in Minong Flowage, Washburn County, Wisconsin.

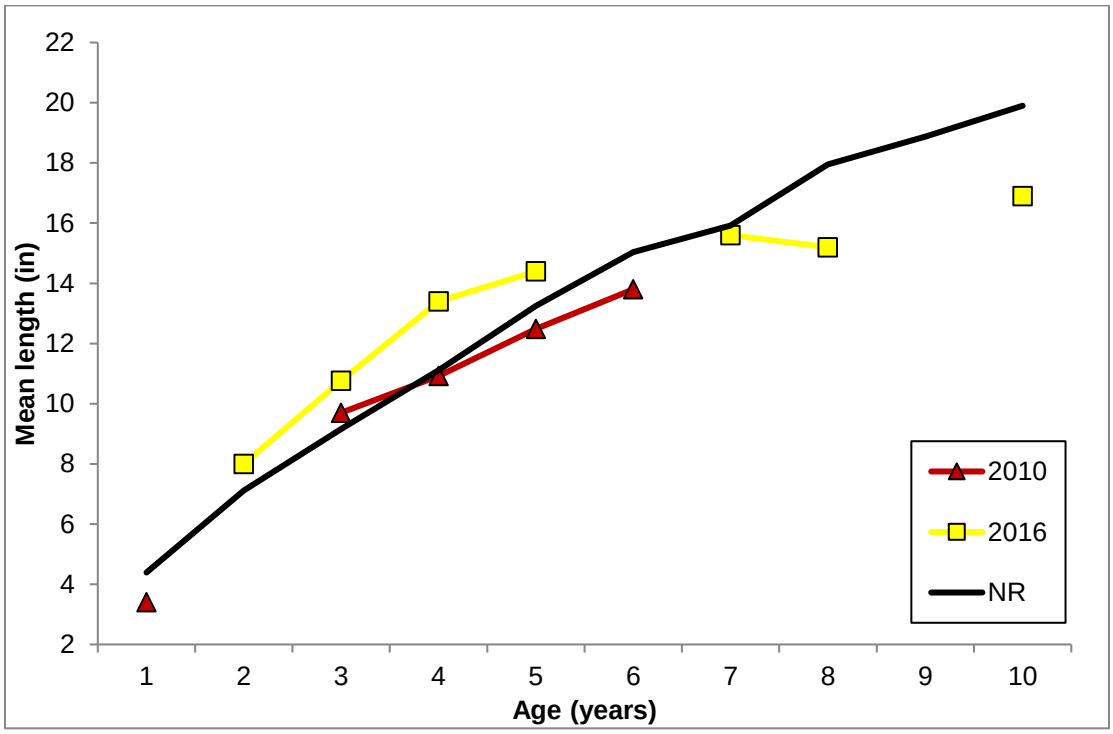


Figure 13. Mean length-at-age for smallmouth bass in Minong Flowage, Washburn County, Wisconsin compared with the Northern Region average (NR).

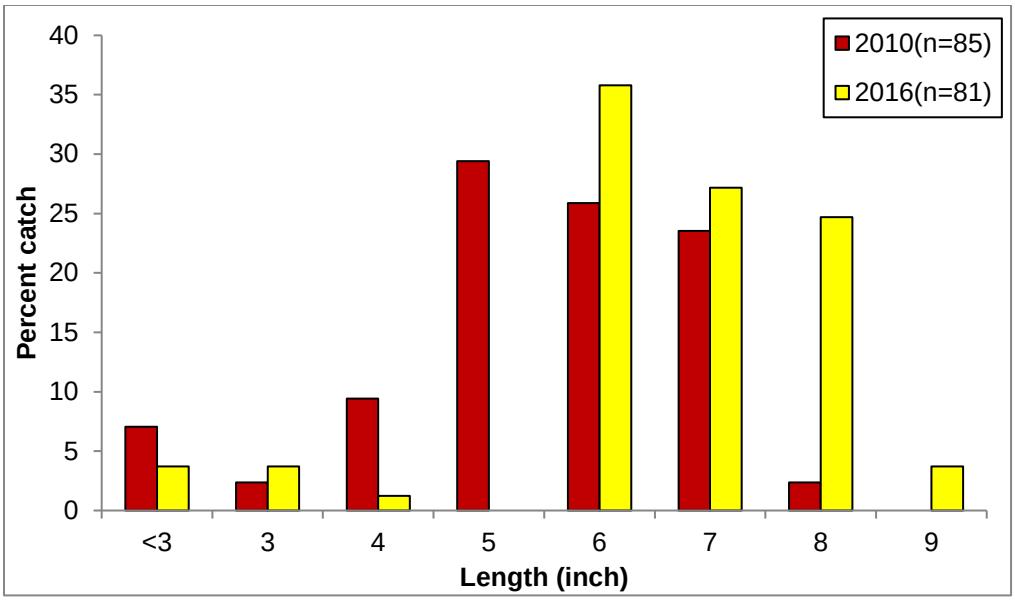


Figure 14. Relative length frequency of smallmouth bass captured in 2010 and 2016 in Minong Flowage, Washburn County, Wisconsin.

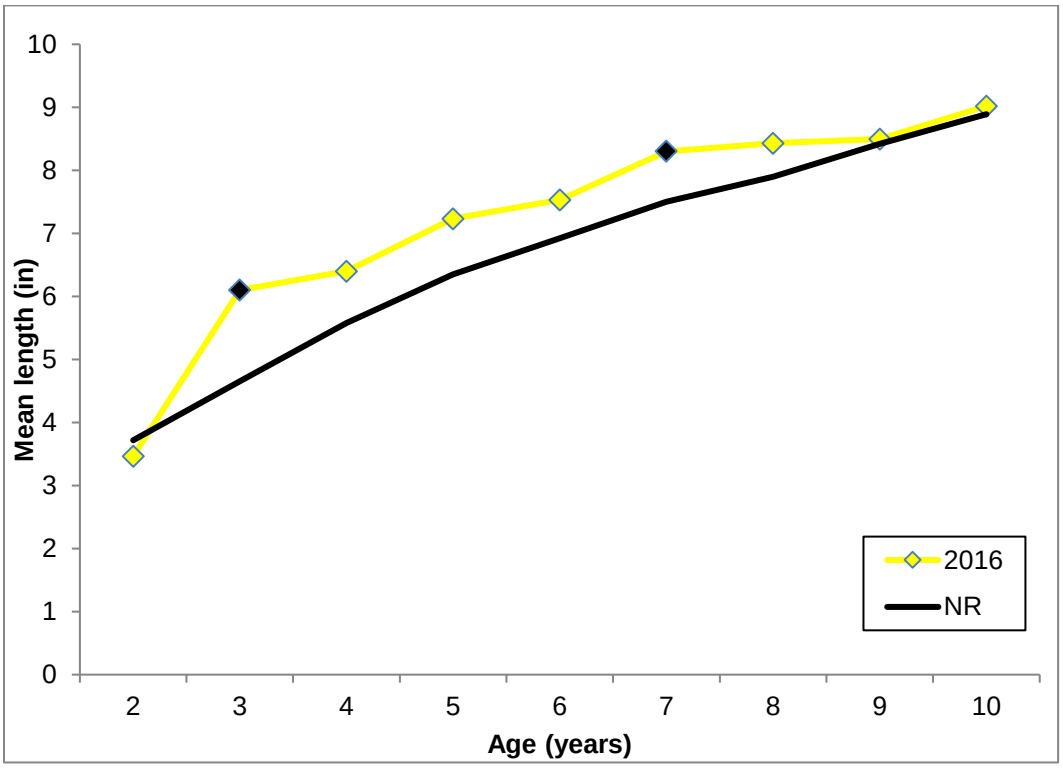


Figure 15. Mean length-at-age for bluegill in Minong Flowage, Washburn County, Wisconsin compared with the Northern Region average (NR). A black symbol represents a single fished aged.

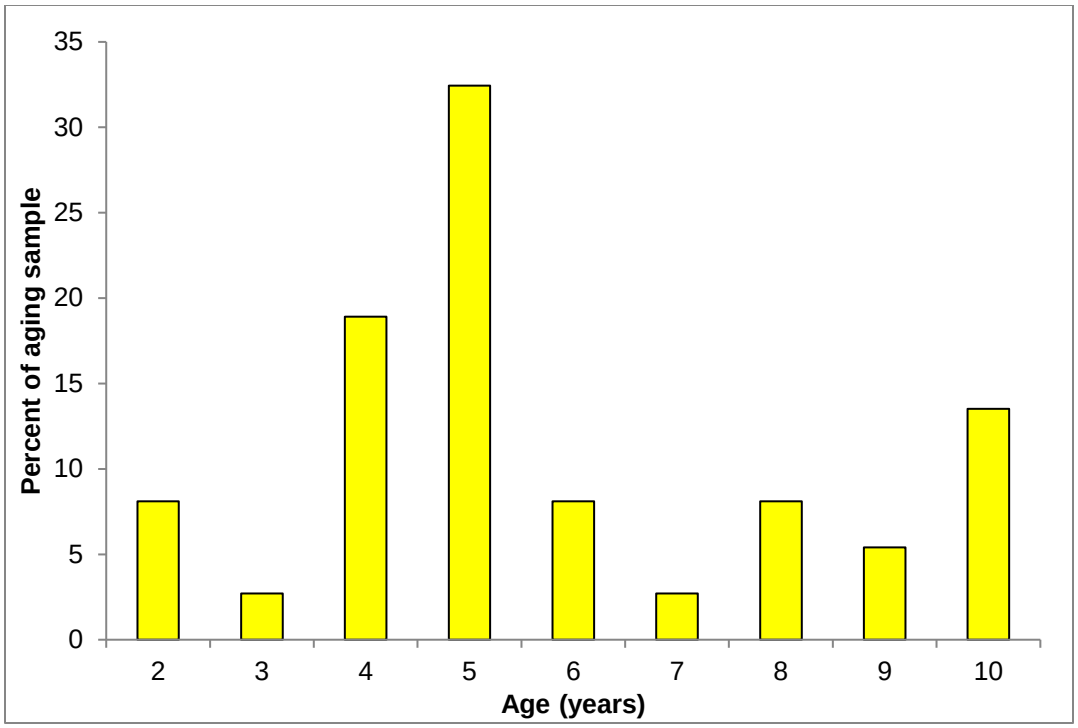

Figure 16. Percent of bluegill aging sample to demonstrate year class strength for the 2016 sampling in Minong Flowage, Washburn County, Wisconsin.

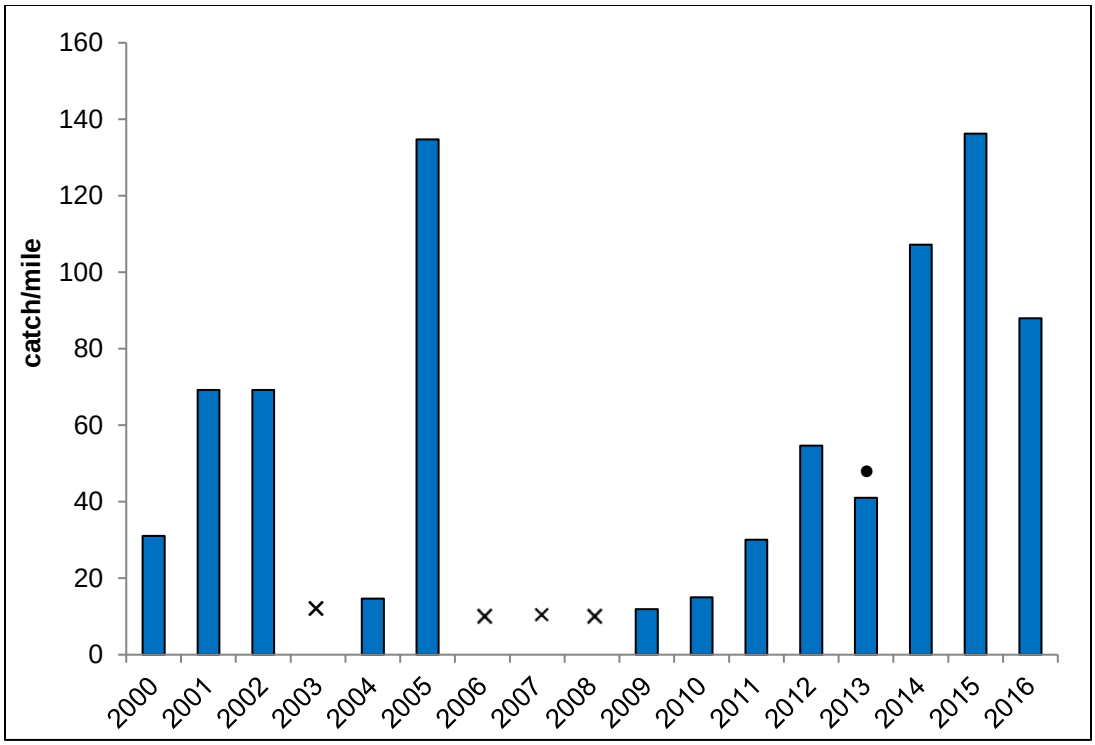

Figure 17. Young-of-year walleye relative abundances determined by fall electrofishing surveys in Minong Flowage, Washburn County, Wisconsin. (× - represents years without a fall survey. • - represents the year of drawdown.)

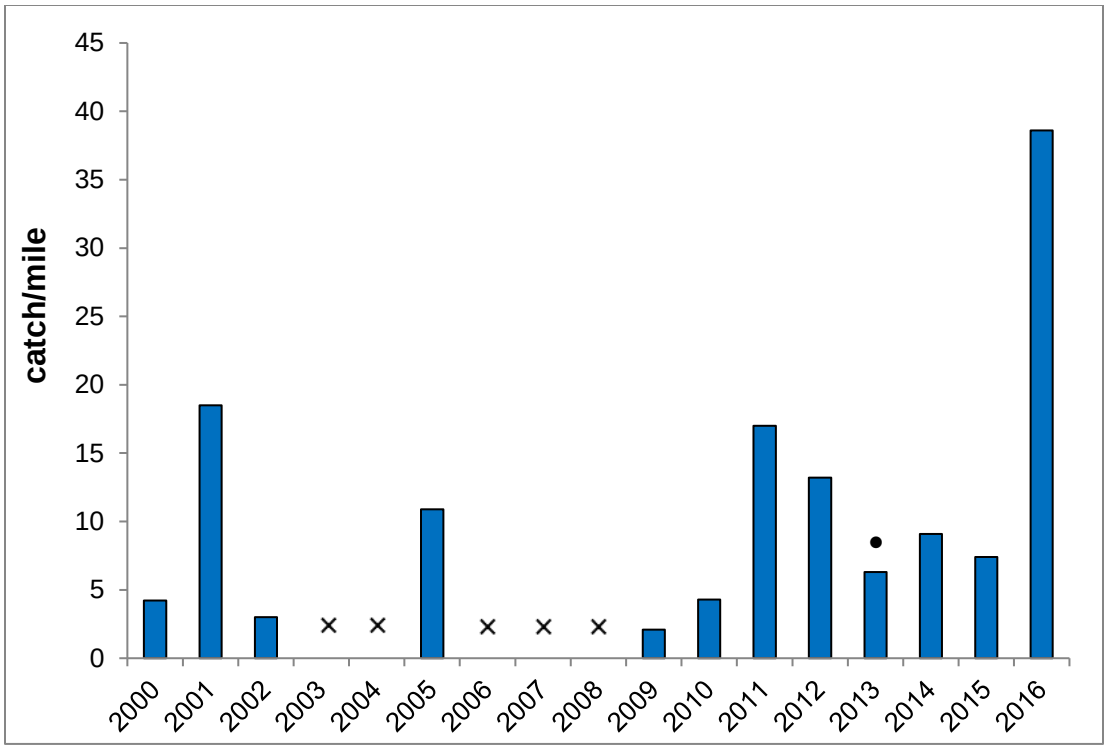


Figure 18. Age-1 walleye relative abundances determined by fall electrofishing surveys on Minong Flowage, Washburn County, Wisconsin. **(**× - represents years without a fall survey/age-1 data. • - represents the year of drawdown.)