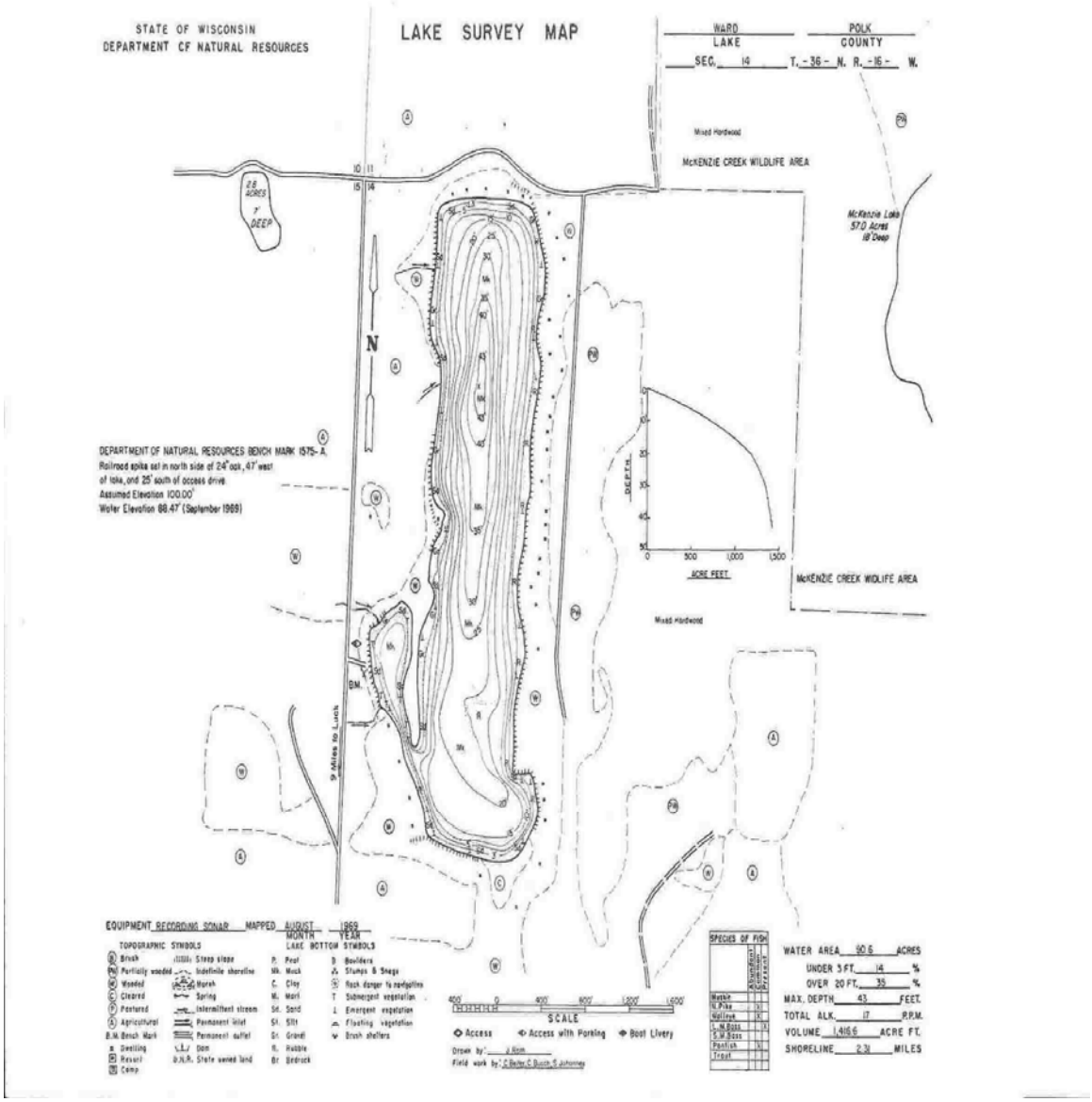
Changes in the Gamefish Community of a Small Northwestern Wisconsin Lake Over a 25-Year Period. Ward Lake, Polk County, Wisconsin.
(WBIC 2599400)



Heath M. Benike
Senior Fisheries Biologist
Wisconsin Department of Natural Resources
Northern Region-Barron
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Executive Summary

Ward Lake is a small 91-acre seepage lake located in northern Polk County, Wisconsin. Ward Lake was stocked with walleye from 1938-1953 although walleye were not likely native. Walleye stocking was terminated in 1953 because a healthy naturally reproducing walleye population was present.

Fisheries surveys in 1978 and 1989 indicated that an abundant walleye population was present that was sustained by natural reproduction. In addition, a low density naturally reproducing largemouth bass and northern pike population was also present. Subsequent fisheries surveys in 1998, 2003 and 2005 indicated a substantial decline in walleye abundance. From 1978 to 2005 walleye abundance has decreased 96%. During this same time period, a dramatic increase of largemouth bass abundance occurred.

Largemouth bass relative abundance has increased 980% from 1978 to 2005. Age and growth information also suggest largemouth bass have become so abundant that growth rates decreased considerably.

Small fingerling walleye were stocked in 2000, 2002 and 2004 in an effort to increase walleye recruitment and abundance. These stockings failed to produce any measurable year class based on subsequent surveys in 2003 and 2005.

Possible explanations for the decrease in walleye abundance are likely related to the increase in largemouth bass abundance. The increase in largemouth bass has likely increased predation on naturally reproducing and stocked walleye. Over a 25 year period, Ward Lake has converted from a walleye dominated gamefishery to a gamefishery dominated by largemouth bass.

Several management efforts are recommended to improve walleye abundance as well as improve largemouth bass growth and size structure. The first recommendation consists of converting from small walleye fingerling stocking to extended growth fingerling stocking during 2006, 2008 and 2010 in an effort to increase fall walleye electrofishing relative abundance to at least 10 fish/hr $\geq$ age 1. The second management recommendation consists of requesting an exemption to bass size limits in an effort to reduce bass densities, improve bass growth, size structure and possibly minimize predation on stocked walleye.

Introduction

Ward Lake is a small 91-acre seepage lake with a maximum and mean depth of 43 and 16 ft respectively, located south of Clam Falls, Wisconsin. Ward Lake has one small public access on the western shoreline. Periodic fall electrofishing surveys have been conducted in 1978, 1989, 1998, 2003 and 2005 in an effort to assess the status of the sportfishery in Ward Lake. Ward Lake was stocked with walleye (*Sander vitreum*) in the late 1930s and into the early 1950s even though walleye were not likely a native species to lakes in Polk County (Becker 1983). Walleye stocking was terminated in 1953 because adequate natural reproduction was present to sustain a desirable fishery. Starting in 2000, small fingerling walleye stocking (1-2 in) was re-initiated at a rate of 75 fish/acre in an effort to improve walleye recruitment into the fishery, because a 1998 survey indicated walleye abundance decreased considerably compared to survey data from 1978 and 1989 (Cornelius 1999). In addition, three small walleye spawning reefs (50 feet in width by 25 feet in length) which consisted of 2 to 8 in diameter washed field stone were placed on an eastern wind-swept shoreline in 1 to 4 feet of water during February of 2002 in an effort to improve walleye spawning habitat in Ward Lake. Tribal spearing has not occurred on Ward Lake. Other fish species present in Ward Lake are largemouth bass (*Micropterus salmoides*), northern pike (*Esox lucius*), bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*), pumpkinseed (*Lepomis gibbosus*), rock bass (*Ambloplites rupestris*) and yellow perch (*Perca flavescens*). The objective of this report was to document changes in the sport fishery from 1978 to 2005 and to provide insight into fish community interactions in Ward Lake. Secondary objectives were to summarize the status of the fish community over the five sampling periods, evaluate the response of the walleye fishery from recent stocking of small fingerling walleye, determine if any benefits in walleye recruitment have occurred from the installation of the walleye spawning reefs and to develop a plan for future fisheries management activities.

Methods

Fall electrofishing surveys were conducted in 1978, 1989, 1998, 2003 and 2005 for walleye, largemouth bass and northern pike (gamefishery). Electrofishing surveys consisted of a single-pass night time electrofishing run using an AC maxi-boom shocker operating at approximately 485 volts and 2 amps, with two dip netters. All fish were measured to the nearest 0.5 in group. Effort was calculated by species and reported in a Catch per Unit of Effort (CPUE) per hr. Scale samples were also collected from fish during the 1998 and 2005 sampling periods to assess fish age and growth. Largemouth bass size distribution was summarized using proportional (PSD) and relative stock density (RSD) values (Anderson and Neumann 1996). Cost analysis for stocked walleye were provided by WDNR (1999).

Results

Walleye relative abundance declined since surveys conducted during 1978 and 1989 and has decreased 96% from 1978 to 2005. Only four walleye were captured in 2005 (4 fish/hr) and only one walleye was captured in the 2003 survey (1 fish/hr). In comparison, walleye total catch/hr in 1998, 1989 and 1978 was 13, 157, and 102 fish/hr respectively (Figure 1). Legal length walleye ($\geq$ 15 in) catch/hr in 2005 and 2003 was also 4 fish/hr and 1 fish/hr respectively. In comparison, legal walleye catch/hr in 1998, 1989 and 1978 was 4, 14, 31 fish/hr respectively (Figure 2). Conversely, from 1978 to 2005 largemouth bass abundance has increased 980%. Largemouth bass total catch/hr in 2005 and 2003 was 108 and 50 fish/hr respectively. In comparison, largemouth bass total catch/hr in 1998, 1989 and 1978 was 133 fish/hr, 10 fish/hr and 10 fish/hr respectively (Figure 1). Legal largemouth bass ($\geq$ 14 in) catch/hr in 2005 and 2003 was 8 and 7 fish/hr respectively. In comparison, legal largemouth bass catch/hr in 1998, 1989 and 1978 was 25, 5, and 1 fish/hr (Figure 2). Northern pike catch/hour in 2005 and 2003 was 8 and 21 fish/hr respectively. In comparison, northern pike catch/hr in 1998, 1989 and 1978 was 13 fish/hr, 5 fish/hr, and 6 fish/hr respectively (Figure 1).

Age and growth information was collected from 72 largemouth bass ranging in size from 5.6-17.5 in (Table 1). The mean length of a 6 year old largemouth bass was only 11.3 inches in length. This is 2.7 inches lower than the size limit exemption threshold for the southern bass management zone established by the WDNR. In addition, it takes on average, 9 years before largemouth bass attain the 14 inch minimum

length limit. In comparison, in 1998, largemouth bass growth was good and were reaching the minimum length limit of 14 inches at age 5 (Table 1).

Size structure on largemouth bass increased for smaller fish but decreased for larger fish from 1998 and 2005. PSD values increased from 41 to 54 from 1998 to 2005 respectively. However, RSD_{14} values decreased from 21 to 8 over the same time period.

Discussion

There appeared to be an inverse relationship with walleye abundance and largemouth bass abundance in Ward Lake. Walleye relative abundance has decreased in 1998, 2003 and 2005 when compared to 1989 and 1978. During this same time period, the relative abundance of largemouth bass has increased. This suggests that the community dynamics of top predators in Ward Lake has shifted from a walleye dominated gamefishery in the late 1970s and 1980s, to a present date gamefishery dominated by largemouth bass. The stocking of small fingerling walleye in 2000, 2002 and 2004 did not provide any measurable recruitment of walleye into the fishery. Similarly, it also appears that the walleye spawning reef that was installed in 2002 did not provide for any additional recruitment of walleye into the fishery based on the fact no age 0 or 1 fish were detected in 2003 and 2005.

Negative interactions between walleye and largemouth bass have been suspected in other Polk County lakes. Similar decreases in walleye abundance and an increase in largemouth bass densities have been reported in nearby Half Moon Lake in Polk County (Benike 2005). Most recently, (Fayram et al. 2005) documented that largemouth bass interact strongly with walleye populations through predation as well as, limit stocked walleye survivialship. The authors further suggest that management goals seeking to simultaneously maximize both largemouth bass and walleye populations may be unrealistic. Nate et al. (2003) indicated that high largemouth bass and northern pike densities characterized lakes with walleye populations that are maintained by stocking versus natural reproduction. In addition, Brooking et al. (2001) stated that when other top predators such as largemouth bass and northern pike increase in relative abundance in a lake, the likelihood of increased predation on small fingerling walleye is high and likely hinders stocking success. Considering there is a strong relationship between the decrease in the walleye

fishery with the subsequent increase in the largemouth bass population in Ward Lake, it is unlikely given the current gamefish assemblage that the walleye fishery will be restored to previous levels anytime soon.

The stocking of small fingerling walleye in 2000, 2002 and 2004 appears to have also been unsuccessful in increasing recruitment and should be re-evaluated. Predation by largemouth bass and other fishes are likely the main limiting factor on stocked walleye survival. Largemouth bass have been shown to be an effective predator on stocked small fingerling muskellunge (Stein et al. 1981). Cornelius (1993) documented a large increase in largemouth bass abundance since the inception of a 14-in minimum length limit on six Polk County Lakes. An alternative walleye stocking strategy would be to convert from small walleye fingerlings to extended growth walleye fingerlings. While some studies suggest large fingerling stocking is not always the best option (Pratt and Fox 2002), some circumstances may require the stocking of larger fish to improve survival if predation by other fish is considered to be a major limiting factor (WDNR 1999). The goal of this stocking change would not be to create a fishery similar to that present in 1978 or 1989, but to provide a low to moderate density walleye fishery with a fall CPUE range of at least 10 fish/hr $\geq$ age 1.

Age and growth information obtained from this surveyed documented that largemouth bass growth was sub-optimal and currently meets exemption criteria that is outlined by the WDNR. The determining factor for the bass size limit exemption based on growth is as follows: In the northern zone; bass populations that do not reach 12 inches in length by age 5 or in the southern zone; bass populations that do not reach 14 inches by age 6.

The mean length of a 6 year old largemouth bass was only 11.3 inches in length. This is 2.7 inches lower than the exemption threshold for the southern bass management zone. In addition, it takes on average, 9 years before largemouth bass attain the 14 inch minimum length limit. The largemouth bass population is very abundant and currently growth rates are considerably lower based on the size limit exemption criteria established by the Department. In addition, the majority of largemouth bass collected in the 2005 survey were less than 14 inches in length. More specifically, RSD_{14} values were 21 in 1998 and decreased to 8 in 2005. At this time it appears a high density, stunted largemouth bass fishery is present, with very few larger fish in the population. In an effort to increase harvest and reduce recruitment of largemouth bass, the size limit exemption should be explored. It would seem reasonable that if the size

limit were removed, angler harvest of smaller size bass in the 10-14 in range would increase. This would hopefully provide three benefits. The first benefit would be to recreational anglers by increasing harvest opportunities. Under the current 14 inch minimum length limit, harvest opportunities are limited and this regulation is creating an abundant but very slow growing bass population. The second benefit would be a reduction in the abundance of largemouth bass. This should ultimately reduce intraspecific competition and improve growth rates and the size structure for those bass that remain in the population. Lastly, it is possible that reducing largemouth bass abundance could possibly improve walleye recruitment by minimizing predation on stocked fish.

Management Recommendations

1. Walleye stocking should be converted from small fingerlings to extended growth fingerlings in 2006, 2008 and 2010 and then be re-evaluated. If walleye catch can not be improved to at least 5 young of the year (YOY)/mile during two of the three stocking years or if catch/hr does not increase to 10 fish/hr $\geq$ age 1 by 2010 walleye stocking and future walleye management should be discontinued for Ward Lake. Fall electrofishing surveys should occur during stocked years to monitor the success of the proposed stocking change.
2. No measurable year class of walleye was produced following the installation of the walleye spawning reef in 2002 based on survey data in 2003 and 2005. At this time there is no evidence to suggest that the installation of the walleye spawning reefs have improved walleye recruitment in Ward Lake.
3. Largemouth bass are very abundant; however the majority of fish were less than 14 inches. In addition, growth is very poor and exceeds size limit exemption criteria established by the Department. It is recommended that a bass size limit exemption be pursued for Ward Lake. The primary goal of this exemption would be to increase angler harvest by lowering largemouth bass abundance (especially for bass in the 10-14 in range) in an effort to improve growth in order to meet statewide growth criteria. Secondary goals would be to improve the size structure of bass by reducing interaspecific competition for the available forage and lastly potentially reduce predation on stocked walleye and improve walleye recruitment. Target largemouth bass relative abundance values for fall electrofishing surveys should be 10-15 bass/hr with RSD_{14} values ranging between 20-40% by 2010.

4. Northern pike abundance has been variable overtime. No changes are recommended at this time and the fishery should provide adequate angling opportunities.

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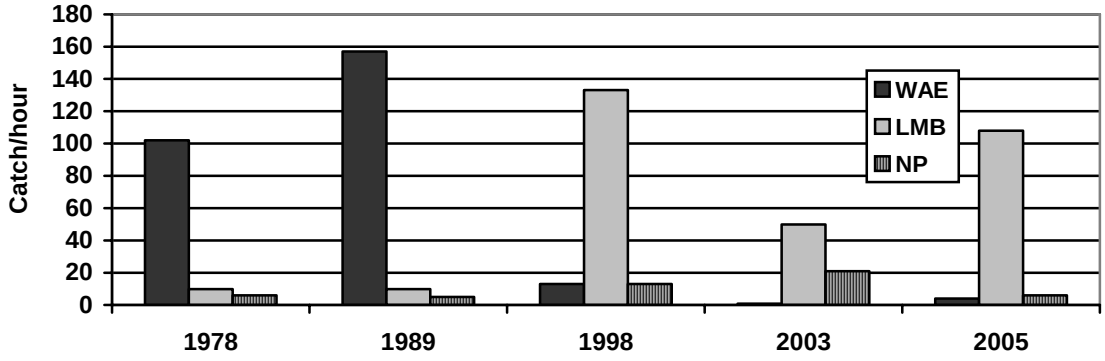

Figure 1. Relative abundance (catch/hr) from fall electrofishing of walleye (WAE), largemouth bass (LMB), and northern pike (NP) in 1978, 1989, 1998, 2003 and 2005 in Ward Lake, Polk County, Wisconsin.

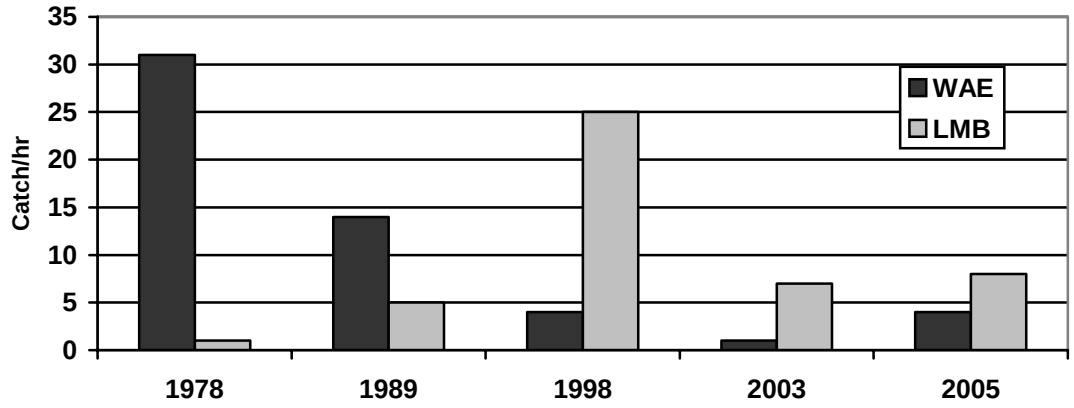

Figure 2. Relative abundance (catch/hr) from fall electrofishing of legal (>14.9 in) walleye (WAE) and legal (> 13.9 in) largemouth bass (LMB) in 1978, 1989, 1998, 2003 and 2005 in Ward Lake, Polk County, Wisconsin.

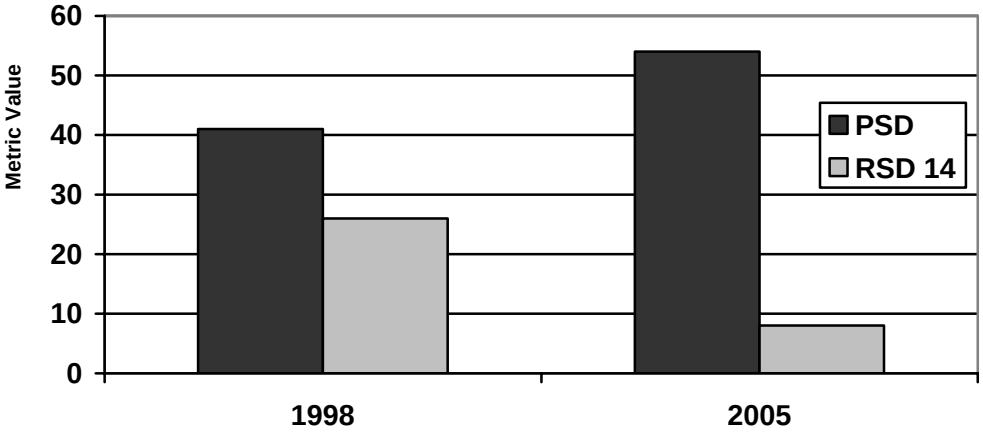

Figure 3: Largemouth bass PSD and RSD_{14} values, 1998 and 2005. Ward Lake, Polk County, WI.

Table 1. Largemouth bass age and growth overtime; Ward Lake, Polk County, Wisconsin.

2005 Age	N	Mean Length (in)	1998 Age	N	Mean Length (in)
2	2	5.8	2	16	7.0
3	8	6.9	3	35	10.2
4	7	8.7	4	7	12.9
5	12	10.2	5	15	14.4
6	14	11.3	6	4	15.3
7	14	12.8			
8	9	13.3			
9	4	15.3			
10	2	16.2			