King Lake Management Report
Polk County, Wisconsin
2007
(MWBIC: 2472300)

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March 2009

Executive Summary

King Lake is a 49 acre lake, located approximately four miles southwest of Amery, Wisconsin in southeastern Polk County and has a long history of periodic winterkills. In 2007, an aeration system was installed to prevent future winterkills and the lake was surveyed following Wisconsin Department of Natural Resources baseline lakes sampling protocol. Sampling efficiency was low, but results indicate that a quality fishery exists for both largemouth bass and bluegill with individuals larger than 17.0 in and 8.0 in, respectively, in the fishery. Northern pike, black crappie and yellow perch were also present and provide additional angling opportunities. Based on the survey and history of winterkills, the aeration system should be operated annually and the fish population managed by current statewide bag and length limits.

Introduction

The aeration of small winterkill lakes has been an important management tool in Barron and Polk Counties (Cornelius 2006). King Lake is a 49 acre half moon shaped lake, with approximately 2.0 miles of shoreline and a maximum depth of 14 feet, located approximately four miles southwest of Amery, Wisconsin in southeastern Polk County. The water is relatively clear and infertile with an alkalinity of 18 ppm, a conductance of 72.6 umhos, and is subject to periodic severe winterkill conditions (Sather and Threinen 1961). The shoreline topography is relatively steep except along the southeast end and marsh area to the northeast. Shoreline substrate consists of mostly sand/gravel along the steep shorelines to muck in the southeast end and mouth of the marsh. Aquatic vegetation observed during the survey consisted of water shield Brasenia, several species of pondweed Potamogeton, coontail Ceratophyllum, bulrushes Scirpus, cattail Typha, and arrowhead Sagittaria. King Lake, along with other lakes in this area, is subject to frequent water level fluctuations from precipitation to groundwater fluctuations, which is common to lakes of this part of Polk County (Sather and Threinen 1961). Prior to the summer of 2006 there was an unimproved access located on the Town of Black Brook property along the southwest shoreline. In 2007, the access was upgraded by the Town of Black Brook to include a gravel boat ramp and a small parking area for several car/trailer units.

Historically, King Lake has contained walleye Sander vitreus, northern pike Esox lucius, largemouth bass Micropterus salmoides, bluegill Lepomis macrochirus, black crappie Lepomis nigromaculatus, yellow perch Perca flavescens, white sucker Catostomus commersoni , bullheads Merus spp., and various species of minnows. Past

management efforts have involved stocking of gamefish species (Table 1), fish surveys in 1946, 1972, 1981, 1983, limited winter dissolved oxygen monitoring, and documentation of winterkill following reports of dead fish in the spring made by lake residents.

Current management efforts involved the planning and implementation of a cooperative aeration project between the King Lake Association, Town of Black Brook and Wisconsin Department of Natural Resources (WDNR), conducting a pre-aeration fisheries survey to document the current fish population status and obtain fish community data for future management, periodic winter dissolved oxygen monitoring, and monitoring the aeration system operation and compliance with open water barricading requirements.

The purpose of this report is to provide a summary of the cooperative aeration project operated on King Lake, by the lake association and Town of Black Brook during the winter months, to compare the pre-aeration treatment fish survey information with historical evaluations, and provide management recommendations.

Methods

Aeration planning efforts began during the summer of 2006 with a contact made by a concerned lake resident about the possibility of aerating King lake to prevent winter fish kill. Anecdotal information from lake residents indicated that a quality fishery had developed for largemouth bass, northern pike and panfish species during the past few years of high water levels and mild winters.

Project planning involved the following: determining a suitable location and riparian landowner permission for aeration system, formation of a lake association by King lake

residents, completion of a cooperative aeration agreement between the Town of Black Brook and WDNR for operation and maintenance of the system, and obtaining a Chapter 30 permit. Funding was obtained by WDNR from an aeration development project submitted during the 2007-2009 biennial work planning and budget process.

Aeration project implementation consisted of installation of electrical power, circuit breaker box and 230 volt 25 amp twist lock plug. The aerator was a 3 hp surface aspirator supported by a 30 in by 60 in poly float and moored by 3 cement filled blocks attached by rope, 2 in front and 1 in the rear (see cover photo). Aerator installation involved laying out approximately 200 ft. of water proof power cord with waterproof connections on the ice to locate the aerator. The ice is removed by cutting a rectangular hole in the ice with chain saws once the ice is approximately 8 - 12 in thick and pushing the cut blocks under the ice. The aerator is assembled on the float, power cord is attached, and placed in the hole with the anchors attached and stretched out to anchor the aerator with the thrust going in the desired direction. Mooring of the unit is achieved during the course of operation as the anchors fall on their own through the open water created by the unit to the bottom of the lake. Power is turned on and several holes are drilled with an ice auger at various distances from 2 ft to 6 ft in front of the aerator to relieve water pressure and back spray and facilitate the opening of the open water hole. The resultant open water created by aeration was barricaded according to instructions in Wisconsin State Statue 167.26. The open water barricade in King lake was constructed from 5/8 in by 5 ft fiberglass electric fence posts that have 3M reflective tape attached for visibility. Two 3 in by 3 in foam net floats are attached to the bottom of the posts which serves two purposes; to help stand up the post, and float the post after the ice goes out.

The rope was 10 mm black "niteline", which has a reflective filament running throughout the rope making it highly visible. The barricade was installed by laying out the rope in the desired shape in sufficient size to completely encompass the open-water hole. Posts are spaced approximately 25 feet apart and holes are drilled, in the ice, approximately 6 in deep with an electric drill and 3/4 in auger bit. The posts are placed upright in the holes and the rope is attached to the posts with metal clips and electrical zip ties approximately 3 ft above the surface of the ice. Every 5th post receives an 8 in by 12 in black corroplast plastic placard attached to the top of the posts to provide daytime visibility. A warning sign is placed at the public boat landing to inform people about the aerator in operation and open water. The unit is operated until all ice has left the lake to prevent blowing ice from damaging the blower unit. Immediately upon ice out the aerator and all components are removed by boat and stored at the Town of Black Brook maintenance shop.

Dissolved oxygen monitoring occurred approximately once per month, from the formation of safe ice until ice conditions become unsafe in the spring. Monitoring occurred by drilling a hole through the ice using an ice auger and measuring the water temperature (C) and dissolved oxygen concentration (mg/L) with an YSI model 550A meter in 1ft increments until the bottom is reached.

Prior to implementation of the aeration system an electrofishing survey was conducted on the night of Sept 10, 2007 to collect data on the status of the fish population. Following the WDNR protocol for fall baseline lake sampling guidance (Simonson 2006) the lake was divided into 2 random substations, 1.5 mile game-fish station and a 0.5 mile game/pan-fish index station. An attempt was made to capture all gamefish in both substations measuring them to the nearest 0.5 in. In the game/panfish substation all fish

species were collected with panfish being measured to the nearest 0.1 in. The entire shoreline was sampled (hrs = 0.83) by utilizing a boat-mounted AC boom-shocker operated at 485 volts and 2.5 amps with 2 dip-netters using 0.375 in mesh dip-nets. Water temperature at the beginning of sampling was 70 F, which was 5 degrees above the recommended sampling threshold of 65 F, but due to scheduling and workload the lake was surveyed as scheduled. A subsample of age structures, scales and spines, and weights to the 0.01 pound were also collected following guidelines in the fish management handbook of 5 per 1/2 inch group per species. In addition, larger panfish were also collected during the gamefish substation for additional age and growth data because of poor catch rates and low sampling efficiency. Growth comparisons were with regional (18 county WDNR Northern Region) and statewide means using the WDNR Fisheries Management statewide database. For the purposes of this report only catch per hour (CPE) data from the 1981and 1983 surveys, which were both fall shoreline electrofishing surveys, and the 2007 survey were compared. Size distributions for largemouth bass and bluegill were summarized using proportional stock density (PSD) and relative stock density (RSD) values (Anderson and Neumann 1996). Both PSD and RSD are the proportion of fish greater than a quality size (e.g. largemouth bass 12 in and bluegill 6 in) or a designated length (e.g. 14 in and 8 in) respectively in relation to the stock size (e.g. largemouth bass 8 in and bluegill 3 in) with the value expressed as a percentage.

Results

The aeration system for King Lake was installed in January of 2007 utilizing King lake association members, Town of Black Brook staff, and WDNR Barron fisheries management staff functioning as trainers for the installation of both the aerator and open water barrier fence. Dissolved oxygen readings were good with a mean of 6.3 mg/L (SD = 3.2) during the winter 2007-2008 while the aerator was operating (Table 2). The aerator and barrier fence materials were all removed in May of 2008 following ice out by King Lake association members and Town of Black Brook staff with assistance and training provided by WDNR Barron fisheries management staff. Installation of the aerator occurred again in late January of 2009 due to severe cold and limited availability of lake association members and Town of Black Brook staff to install the unit earlier in the winter. Dissolved oxygen readings during the winter of 2008-2009 were lower than the previous winter with a mean of 3.6 mg/L (SD = 2.3) due to the severity of this winter season with early ice formation and snow cover conditions coupled with severe cold (Table 2).

During the 2007 pre-treatment survey a total of 17 largemouth bass ranging in size from 5.0 in to 17.4 in, mean length 8.7 in (SD = 4.3), were captured. Largemouth bass catch per unit effort (CPE) was 20.4 fish/hr. compared with zero largemouth bass in the 1983 and 1981 surveys, respectively. Proportional stock density (PSD) for largemouth bass was 80 while RSD-14 was 60. Largemouth bass growth rates were comparable with regional and statewide means (Table 3).

Three northern pike were collected ranging in length from 23.0 in to 25.0 in, mean length 24.5 in (SD = 1.1). Low number of northern pike were also collected in the 1983

and 1981 surveys (1983, N = 3; 1981, N = 0). Northern pike 2007 CPE was 3.6 fish/hr compared with 4.3fish/hr in 1983 and zero in 1981. Growth rates for northern pike were average and comparable with regional and statewide means. No walleye were captured during the current survey, however two walleye ranging in size from 6.0 in to 9.4 in were captured in 1983, and none in 1981.

The most abundant panfish captured was bluegill, (N = 45) followed by black crappie (N = 13) and yellow perch (N = 8). Bluegill ranged in length from 2.1 in to 8.8 in, mean length 5.2 in (SD = 1.7), with a CPE during the 2007 survey of 54.2 fish/hr. PSD was 27 with an RSD-8 of 11. Growth rates for bluegill in King lake were average, to above average for larger fish, and comparable with regional and statewide means (Table 4). Black crappie ranged in length from 5.3 in to 6.3 in, mean length 5.7 in (SD = 0.27) with a CPE of 15.6 fish/hr. Yellow perch captured ranged in length from 5.9 in to 7.2 in., mean length 6.6 in (SD = 0.39) and CPE of 9.6 fish/hr. Growth rates for both black crappie and yellow perch were comparable with regional and statewide means.

During the 1983 survey panfish were not collected, however survey notes indicate that bluegill and black crappie were observed to be abundant, and that small size yellow perch were common. In 1981, a sub-sample of panfish was collected, but records did not indicate quantifiable electro-fishing hours to calculate CPE. Total catches in 1981 were similar to the 2007 survey for bluegill (N = 58), black crappie (N = 2) and yellow perch (N = 22).

Discussion

Management of King lake has been limited to stocking of fish due to the periodic winterkill events which have not allowed stable fish populations to develop. Past management recommendations have focused on public access development and the addition of an aeration system to curb winterkill (Cornelius 1977, 1982, 1984). In 1970 a large stocking of walleye created a year class and subsequent natural reproduction of walleye occurred, but was not documented in surveys. Only anecdotal information from lake residents and anglers indicated that the stocking had been a success as evidenced by the large numbers of dead walleyes of different length ranges observed after the severe winterkill of 1977 (file correspondence). Stocking of walleye since that time has met with limited success, likely at least in part because of winterkill. The last stocking of walleye occurred in 1985 and since that time the lake has been managed mainly for largemouth bass, northern pike, and panfish species. No stocking has occurred since 2004 when largemouth bass fingerlings were stocked.

The main limiting factor in King Lake for sustaining quality fish populations has been the periodic winterkills. With the installation and yearly operation of an aeration system in King Lake the winterkill issue has been addressed and should allow a more stable fishery to develop.

Because sampling efficiency was low for all fish species during the 2007 survey caution should be taken in interpreting too much from the one night survey data. Our survey did suggest there was a quality largemouth bass population in low to moderate numbers. Largemouth bass size structure was good, but the lack of small fish could indicate a possible recruitment problem, but is more likely related to the low sample size.

Northern pike were present in low numbers. There is suitable habitat for northern pike natural reproduction to occur in the marsh area along the north side of the lake. Interest has been expressed by the lake association for the WDNR to resume stocking of walleyes in King lake to increase the diversity of the gamefish population. While WDNR does not have plans to resume walleye stocking in King lake, the lake association could pursue a permit on their own and purchase extended growth walleyes from a private fish hatchery.

Panfish numbers were low in general, but a quality bluegill fishery was present with 8 in individuals in the population. Only one year class of black crappie was sampled, but lake residents and fisherman claim a quality crappie fishery was also present. Yellow perch probably provide additional forage and diversity to the panfish fishery.

Management Recommendations

1. Yearly operation of the aeration system to prevent fish winterkill by the Town of Black Brook and King Lake Association.
2. WDNR will provide technical assistance on the aeration system, periodic dissolved oxygen monitoring during the winter months and inspection of the open water barricade for compliance with state statutes.
3. Manage King Lake for largemouth bass, northern pike, and panfish utilizing current statewide inland fisheries seasons, bag and length limits.
4. Allow for stocking of extended growth walleye by lake association if purchased from and outside vendor and stocked by the lake association.

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Table 1. Stocking History of King Lake Polk County, Wisconsin

Date	Species	Number	Length
1945	*pike**	200,000	fry
10/13/1970	walleye	1,350	6 in fingerling (fgl)
09/16/1974	largemouth bass	3,000	3 in fgl
10/02/1975	largemouth bass	3,000	3 in fgl
08/11/1977	walleye	2,485	3 in fgl
08/11 1978	walleye	2,500	3 in fgl
10/22/1981	walleye	2,380	5 in fgl
05/08/1982	northern pike	49,000	fry
05/14/1982	walleye	50,000	fry
07/08/1982	walleye	2,450	3 in fgl
08/24/1982	northern pike	300	11 in
09/14/1982	walleye	2,400	3 in fgl
05/17/1983	walleye	100,000	fry
07/01/1983	northern pike	242	7 in
08/16/1983	walleye	2,400	3 in
08/30/1984	walleye	2,500	3 in
09/14/1984	northern pike	245	9 in
08/02/1985	northern pike	645	7 in
09/03/1985	walleye	2,496	5 in
05/11/2001	northern pike	85,000	fry
07/03/2001	northern pike	268	7 in
07/27/2001	largemouth bass	1,174	2.3 in
08/04/2004	largemouth bass	1,225	1.6 in

* Actual species that was stocked is unclear because references to both northern pike and walleye pike were made in the file at that time, but stocking was listed as just pike.

Table 2. Dissolved oxygen (D.O.) for King Lake, Polk County, during winter 2007-2008 and 2008-2009.

Date Depth ft	12/19/07 D.O. mg/L	12/19/08 D.O. mg/L	1/18/08 D.O. mg/L	1/28/09 D.O. mg/L	3/06/08 D.O. mg/L	3/04/09 D.O. mg/L
1	14.2	10.0	11.5	6.4	9.7	6.2
2	9.4	7.4	9.2	6.2	9.9	5.9
3	8.5	5.7	7.2	3.0	6.8	5.3
4	6.6	4.1	6.7	1.9	5.8	5.1
5	6.6	3.9	6.1	1.1	5.3	4.2
6	6.5	3.8	3.2	0.7	4.1	2.1
7(bottom)	----	---	1.1	0.5	1.0	1.4

Table 3. Comparison of largemouth bass mean length at age, King Lake, Polk County, 2007 with regional and statewide means.

Age	N	King Lake mean	SD	Northern Region mean	Statewide mean	SD
3	12	6.2	0.49	9.0	9.3	2.0
4	2	11.5	2.9	11.0	11.2	2.0
6	1	17.3	---	15.0	14.7	2.0
8	1	17.2	---	18.0	17.5	2.2
10	1	15.9	---	18.7	18.8	1.5

Table 4. Comparison of bluegill mean length at age, King Lake, Polk County, 2007 with regional and statewide means.

Age	N	King Lake mean	SD	Northern Region mean	Statewide mean	SD
2	24	4.2	0.69	4.0	4.0	1.1
3	2	6.9	0.57	4.8	4.8	1.3
4	4	7.5	0.44	5.8	5.8	1.3
5	1	7.8	---	6.6	6.4	1.2
6	1	8.2	---	7.2	7.0	1.1
7	3	8.6	0.16	7.9	7.6	1.0
8	1	8.8	---	8.3	8.0	1.0