

Title: The Biomanipulation of the Carstens Lake to Rehabilitate the Fishery.

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Survey Purpose: Test the effectiveness of mechanical removal of problem species while restoring the fishery by stocking.

Background of Carstens Lake:

Carsten Lake (WBIC-0066800) is a seepage lake located in eastern Manitowoc County (T18N, R23E, Section 17). The lake has a surface area of 20 acres, a maximum depth of 30 feet, and a shoreline development factor of 1.23. The water is turbid and the bottom consists of muck and patches of gravel.

Carstens Lake was surveyed in 1955 (Cline 1955). The lake was found to have no cottages or residences but one boat livery was found to be renting up to eleven boats. Access to the lake could be obtained through a private road located on the south end of the lake. The lake was described as containing largemouth bass, northern pike, bluegill, crappie and perch according to local anglers. Fishing pressure was described as moderate to light. A public access on Carstens Lake was purchased in 1958.

A fisheries survey was conducted on Carstens Lake in 1959, utilizing a barge seine. The survey seine caught largemouth bass, northern pike, bluegill, black crappie, common sunfish and golden shiner. The survey failed to catch common carp, yellow perch and bullhead spp. even though they were known to be in the lake.

A fisheries survey using a boom-electroshocking boat was conducted on Carstens Lake in 1963. The survey noted the water was extremely turbid, limiting visibility to about six inches. The survey found largemouth bass, bluegill, black crappie, white sucker and common carp. Largemouth bass were believed to be in good condition but panfish were described as being in relatively poor condition "thin for their length". The Fisheries Biologist recommendations stated that the lake was a mess, and needed a chemical treatment to provide any kind of decent fishery.

The first known winterkill on Carstens Lake occurred during the winter of 1976-1977. Substantial numbers of dead common carp, golden shiners, black bullhead, largemouth bass and black crappies were observed at ice out in the spring of 1977. A subsequent spring fyke netting survey found large numbers of golden shiners, a common carp and a few black bullhead. A restocking plan requested largemouth bass, northern pike, and panfish. The state fish hatchery provided 30,000 northern pike fry and 1,000, 6 inch black crappie in the spring of 1977.

A fishery survey was conducted on Carstens Lake in the fall of 1977. The electrical shocker survey found very high abundance of young of the year (YOY) common carp, YOY black crappie and adult golden shiners.

Findings of the 1978-1980 Survey:

A Carstens Lake management plan (1978) was developed to test the effectiveness of mechanical removal of problem species while restoring the fishery by stocking largemouth bass, bluegill and yellow perch. If the management plan failed to meet fisheries management goals, a fish eradication management effort by chemical means would then occur.

Five fyke nets were fished in Carstens Lake from April 14, 1978 through May 5, 1978 and May 15, 1978 through May 19, 1978 for a total of 95 net nights. Nine species were identified with a total of 55,111 fish captured. An estimated 32,316 black bullhead and 21,497 common carp were removed from Carstens Lake. A total of 809 black crappie and 58 northern pike were captured. Yellow perch and bluegill were rarely caught.

Carstens Lake was electrical shocked around its circumference twice on October 26, 1978. Eight species were captured with a total of 49 fish captured. Black bullhead, common carp and black crappie dominated the catch.

Two fyke nets were fished in Carsten Lake from May 15, 1979 through May 18, 1979, for a total of 6 net nights. Eight species were handled for a total of 764 fish captured. A total of 391 common carp, 319 black crappie and 59 black bullhead were netted. Other species were caught at low levels.

Carsten Lake was electrical shocked around its circumference on October 22, 1980. Seven species were captured for a total of 111 fish netted. Black bullhead, black crappie and common carp dominated the catch followed by substantially fewer, bluegill, pumpkinseed, largemouth bass and golden shiner.

Conclusions:

Ten fish species were encountered during the three year survey period. Most numerous were black bullhead and common carp. Lesser numbers of black crappie, northern pike, largemouth bass, pumpkinseed, bluegill, yellow perch, white sucker and golden shiners were also encountered.

The Carsten Lake management efforts tested the effectiveness of removal of problem species by fyke net. The removal attempt failed to meet fisheries management goals, it was clear that the lake was still dominated by common carp, black bullhead and black crappie. The attempts to shift the fish population toward a more desirable balance of northern pike, largemouth bass, bluegill and yellow perch failed even though stocking occurred. On September 16, 1982 Carstens Lake was chemically treated with the fish suffocant Rotenone.

Introduction:

Carstens Lake (WBIC-0066800) is a seepage lake located in eastern Manitowoc County (T18N, R23E, Section 17). The lake has a surface area of 20 acres, a maximum depth of 30 feet, and a shoreline development factor of 1.23 (Figure 1). The water is turbid and the bottom consists of muck and patches of gravel. Carstens Lake has hard water and is surrounded by agricultural land. The lake is moderately developed with residences and has access available through a town road and county park its west side. Adjacent wetlands total six acres and the lake drains to Waack Lake, Grosshuesch Lake and constitutes the headwaters of Pine Creek.

Carstens Lake was surveyed in 1955 (Cline 1955). The lake was found to have no cottages or residences but one boat livery was found to be renting up to eleven boats. Access to the lake could be obtained through a private road located on the south end of the lake. Land use was described as consisting of 50% hardwood and 50% pasture and cropland buffered by a narrow band of marsh. Inlake vegetation was described as a confined narrow band near shore consisting of abundant pondweed (*P. longiligulatus*), coontail (*Ceratophyllum*), moderate abundance of yellow water lily (*Nuphar advena*), white water lily (*Nymphaea odorata*) and other undescribed plant species listed as scarce. Free floating algae was listed as abundant. The lake was described as containing largemouth bass, northern pike, bluegill, crappie and perch according to local anglers. Fishing pressure was described as moderate to light.

A public access on Carstens Lake was purchased in 1958 (Wisconsin Conservation Department, 1960). The access consisted of 111 feet of frontage and a 66 foot road. In total the land and initial improvements cost \$1,676.05 funded by Manitowoc County, Manitowoc Co. Fish and Game Assoc. and the Izaak Walton League.

A fisheries survey conducted on Carstens Lake in 1959 utilized a barge seine that measured 700 feet long by 22 feet deep (Schultz, 1959). The survey also noted that the new public access was large enough for 15 – 20 cars, a private boat livery was available to rent up to 10 boats and that cottages and residences were absent. The land use was described as 50% hardwoods (American Elm) and 50% pasture and cropland. Fishing pressure was described as heavy for bluegill in spring. The lake was found difficult to seine because of heavy growth of filamentous algae, stumps, logs, and bog shoreline. Seining success was described as only fair. The survey seine caught largemouth bass, northern pike, bluegill, black crappie, common sunfish and golden shiner (Appendix 1, Appendix 2). The survey failed to catch common carp, yellow perch and bullhead spp. even though they were known to be in the lake. The survey recommendation included targeted carp removal and stocking of northern pike. Chemical treatment was discussed but was not recommended due to general angler satisfaction with the present fishery.

A fisheries survey using an boom-electroshocking boat was conducted on Carstens Lake in 1963 (Schultz, 1964). The survey noted the water was extremely turbid, limiting visibility to about six inches. Further floating mats of filamentous algae in the shallow areas made the survey difficult. The survey found largemouth bass, bluegill, black crappie, white sucker and common carp (Appendix 1, Appendix 3). Largemouth bass were believed to be in good condition but panfish were described as being in relatively poor condition “thin for their length”. The Fisheries Biologist described the lake as being fairly heavily fished and survey recommendations stated that the lake was a mess, and contained a very poor fish population that is in drastic need of chemical treatment to provide any kind of decent fishery.

Carstens Lake was surveyed in the year 1964 (Wisconsin Conservation Dept., 1964). The lake was found to have one permanently placed trailer, no cottages or residences and one boat livery. Land use was described as consisting of 10% swamp and 90% cropland buffered by a narrow band of marsh and swamp hardwoods (Elm). The lake outlet was described as being 8 feet wide and 4 inches deep with a very flat gradient. Inlake vegetation was described as moderate consisting of abundant filamentous algae, yellow water lily (*Nuphar advena*), white water lily (*Nymphaea odorata*), moderate to abundant coontail, and a scarce amount of duckweed. Further, the lake was described as experiencing heavy free-floating alga blooms with a secchi disc reading of 3 feet 9 inches. The report noted that a few anglers were complaining of small panfish sizes.

A fisheries survey was conducted on Carstens Lake in 1975 (Wisconsin Conservation Department, 1975). The electrical shocker survey found largemouth bass, northern pike, bluegill, black crappie, pumpkinseed, white sucker, common carp, black bullhead and golden shiner (Appendix 1, Appendix 4). Gamefish and panfish were found to be small in size and large size common carp were present. Survey recommendations were not made.

The first known winterkill on Carstens Lake occurred during the winter of 1976-1977 (Belonger, 1978). Substantial numbers of dead common carp, golden shiners, black bullhead, largemouth bass and black crappies were observed at ice out in the spring of 1977. The fish kill was thought to be extensive. A subsequent spring fyke netting survey found large numbers of golden shiners, a common carp and a few black bullhead. A restocking plan requested largemouth bass, northern pike, and panfish. The state fish hatchery provided 30,000 northern pike fry and 1,000, 6 inch black crappie in the spring of 1977 (Appendix 6).

A fishery survey was conducted on Carstens Lake in the fall of 1977 (Belonger, 1978). The electrical shocker survey found very high abundance of young of the year (YOY) common carp, YOY black crappie and adult golden shiners (Appendix 1, Appendix 5). Low numbers of black bullhead, northern pike, adult black crappie and central mudminnow was also found. The survey findings discussed the high recruitment of common carp, black crappie and golden shiner after the winterkill.

A Carstens Lake management plan was developed to test the effectiveness of mechanical removal of problem species while restoring the fishery by stocking largemouth bass, bluegill and yellow perch. (Belonger, 1978). It was proposed to remove by fyke net common carp, black crappie and black bullhead. If the management plan failed to meet fisheries management goals, a fish eradication management effort by chemical means would then occur. (WDNR, 1976).

The Carstens Lake management proposal was approved and implementation began during the spring of 1978 with common carp and black bullhead targeted for removal. Fish restoration efforts included stocking: 1,000 adult bluegill on May 9, 1978, 500 adult yellow perch in May 2, 1978 and 3,000 largemouth bass fingerlings on October 3, 1978 (Appendix 6). The remainder of this paper examines the survey findings and management actions.

Methods

Five standard-fyke nets were set in Carstens Lake on April 14, 1978 (Figure 2). The nets were removed from the lake on May 5, 1978 and fished again from May 15, 1978 through May 19, 1978. Survey design dictated that all fish captured on the first days would be marked (finclipped) and released back into the lake. A portion of the carp and black bullhead population was measured and weighted to determine length frequency statistics and to determine fish per pound equivalents. Carp and bullhead, which were removed from the population, were accounted for by weight (pounds). All other fish were identified to species, measured, marked and returned to the lake.

On October 26, 1978 Carstens Lake was electrical shocked at night around its entire circumference twice to evaluate the removal effort. All fish were netted, measured and examined for finclip prior to being released back into the lake.

On May 15, 1979 two standard fyke nets were set in Carstens Lake to evaluate the lakes fish population and removal success. The nets were removed from the lake on May 18, 1979. Captured fish were identified to species and measured and returned back into the lake.

On October 22, 1980 Carstens Lake was electrical shocked once around its circumference to evaluate removal efforts and the lake's fish population. Only a small portion of the black bullhead were netted and measured. All other fish species encountered were netted and measured.

Results

Spring Standard Fyke Net Survey, 1978

Five fyke nets were fished in Carstens Lake from April 14, 1978 through May 5, 1978 and May 15, 1978 through May 19, 1978 for a total of 95 net nights. Nine species were identified (Table 1) with a total of 55,111 fish captured (Table 2). Black bullhead and common carp dominated the catch followed by substantially fewer black crappie, yellow perch, bluegill, pumpkinseed, golden shiner, white sucker and northern pike. The survey CPE averaged 580 fish per net night.

An estimated 32,316 black bullhead were removed from Carstens Lake totaling 497 pounds (Table 2). Bullhead had an initial CPE of 2,318 fish per net night and on the last day of the survey their CPE had declined to 32 fish per net night. The average CPE was 340 fish per net night. Bullhead ranged in length from 3.0 inches to 11.4 inches (Table 3). Small bullhead, averaging 81 fish to the pound accounted for 396 pounds of the total catch.

An estimated 21,497 common carp were removed from Carstens Lake totaling 1,995 pounds (Table 2). Carp had an initial CPE of 606.3 fish per net night and on the last day of the effort their CPE had declined to 47.1 fish per net night. The average CPE was 226.3 fish per net night. Carp averaged 6.0 inches in length and ranged in length from 3.9 inches to 8.6 inches (Table 3). Common carp were found to average 10.7 fish to the pound. A total of 196 carp were marked and released back into the lake on April 18, 1978. The survey subsequently recovered and removed 89 marked carp equaling 45 percent of the marked population.

A total of 809 black crappie were captured (Table 2). CPE averaged 8.5 fish per net night. Black crappie averaged 6.9 inches in length and ranged in length from 2.9 inches to 10.0 inches (Table 3).

Yellow perch were rarely caught in the survey from April 14, 1978 through May 1, 1978, a total of four individuals were netted for a CPE of 0.1 fish per net night. On May 2, 1978 500 hatchery raised yellow perch were stocked into Carstens Lake. Three hundred and fifty two individuals were captured after May 1, 1978 (Table 2). Yellow perch CPE averaged 3.7 fish per net night. Perch ranged in size from 3.6 inches to 9.5 inches and averaged 5.5 inches in total length (Table 3).

Bluegills were not caught in the survey from April 14, 1978 through May 5, 1978. One thousand bluegill were transferred from Round Lake, Calumet County and stocked into Carsten Lake on May 9, 1978. After May 9, 1978 45 individuals were captured, for an average CPE of 0.5 fish per net night (Table 2). Bluegill averaged 5.4 inches in total length (Table 3).

A total of 58 northern pike were captured for a CPE of 0.6 fish per net night (Table 2). Pike averaged 17.6 inches in length and ranged in size from 13.0 inches to 25.3 inches (Table 3). Peak northern pike CPE of 7.5 fish per net night most likely coincided with peak spawning activities.

Three other fish species were found in low numbers. The survey found 11 white sucker, 14 golden shiner and 5 pumpkinseed (Table 2).

Fall Electrical Shocking Survey, 1978

Carstens Lake was electrical shocked around its circumference twice on October 26, 1978. Eight species were captured (Table 1) with a total of 49 fish captured (Table 2). The overall CPE was 29.1 fish per mile shocked. Black bullhead, common carp and black crappie dominated the catch followed by substantially fewer, yellow perch, bluegill, pumpkinseed and northern pike.

A total of 21 black bullhead were captured for a CPE of 12.5 fish per mile shocked (Table 2). Bullhead averaged 4.4 inches in total length and ranged in length from 3.4 inches to 6.2 inches (Table 4).

A total of 10 common carp were captured for a CPE of 5.9 fish per mile shocked (Table 2). Carp averaged 9.2 inches in total length and ranged in length from 6.6 inches to 11.2 inches (Table 4). Further, two marked carp from the 1978 spring fyke netting effort were also observed.

A total of 8 black crappies were captured for a CPE of 4.8 per mile shocked (Table 2). Crappie averaged 5.9 inches in length and ranged in length from 3.2 inches to 10.0 inches (Table 4).

Low numbers of other species were encountered. The survey caught 1 northern pike, 2 yellow perch, 2 bluegill, 3 pumpkinseed, and 2 white suckers (Table 2).

Spring Standard Fyke Net Survey, 1979

Two fyke nets were fished in Carstens Lake from May 15, 1979 through May 18, 1979, for a total of 6 net nights. Eight species were handled (Table 1) for a total of 764 fish captured (Table 2). The overall CPE was 127.3 fish per net night. Common carp, black crappie and black bullhead dominated the catch followed by substantially fewer northern pike, yellow perch, bluegill, pumpkinseed and white sucker.

A total of 391 common carp were netted for a CPE of 65.0 fish per net night (Table 2). Carp averaged 8.5 inches in length and ranged in length from 5.2 inches to 11.5 inches (Table 5).

A total of 319 black crappie were netted for a CPE of 53.2 fish per net night (Table 2). Crappie averaged 6.1 inches in length and ranged in length from 4.5 inches to 11.5 inches (Table 5).

A total of 59 black bullhead were netted for a CPE of 9.8 fish per net night (Table 2). Bullhead averaged 7.6 inches in length and ranged in length from 5.0 inches to 11.9 inches (Table 5).

Other species were caught at low levels (Table 2). The survey found 4 northern pike, 3 yellow perch, 2 bluegill, 2 pumpkinseed and 3 white sucker.

Fall Electrical Shocking Survey, 1980

Carstens Lake was electrical shocked around its circumference on October 22, 1980. Seven species were captured (Table 1) for a total of 111 fish netted (Table 2). The overall CPE was 132 fish per mile shocked. Black bullhead, black crappie and common carp dominated the catch followed by substantially fewer, bluegill, pumpkinseed, largemouth bass and golden shiner.

Black bullhead was found to be most numerous. After a sample of bullhead was captured, subsequent fish were not netted. The 50 bullhead that were netted had a CPE of 59.4 fish per mile shocked (Table 2). Bullhead averaged 5.2 inches in total length and ranged in size from 4.3 inches to 9.5 inches (Table 6).

A total of 23 common carp were captured for a CPE of 27.3 fish per mile shocked (Table 2). Carp averaged 11.3 inches in total length and ranged in length from 10.2 inches to 14.0 inches (Table 6).

A total of 28 black crappie were captured for a CPE of 33.3 fish per acre shocked (Table 2). Crappie averaged 5.9 inches in total length and ranged in length from 5.4 inches to 6.2 inches (Table 6).

Other species were caught a low levels (Table 2). The survey found 5 white sucker, 3 pumpkinseed, 1 golden shiner and 1 largemouth bass.

Fisheries Management Discussion and Conclusion

The 1978–1980 Carstens Lake management efforts were proposed to test the effectiveness of mechanical removal of problem species by fyke net from small lakes. It was proposed to remove common carp and black bullhead. If the removal attempt failed to meet fisheries management goals the proposed activity would satisfy the requirements needed to proceed with a chemical removal effort.

Ten fish species were encountered during the three year survey period (Table 1). Most numerous were black bullhead and common carp (Table 2). Lesser numbers of black crappie, northern pike, largemouth bass, pumpkinseed, bluegill, yellow perch, white sucker and golden shiners were also encountered.

Common Carp

Common carp were first introduced into Manitowoc County in the year 1881 (Becker 1983). It is unknown when common carp were introduced into Carstens Lake. The 1959 barge seine survey didn't encounter carp but the specie was well represented in the 1963 electrical shocking survey (Appendix 1). Common carp are known to survive under a wide range of conditions.

Common Carp Standard Spring Fyke Net Comparison, 1977-1979

The 1977 winterkill netting investigation caught common carp at the low rate of 0.3 fish per net night (Appendix 1). The one fish, that was encountered, was an adult. The 1978 netting removal effort caught carp at an average rate of 226.3 fish per net night (Table 2). The 1979 fyke net effort caught carp at the reduced rate of 62.0 fish per net night.

Common Carp Electrical Shocking Survey Comparison, 1963-1980

The 1963 and 1975, pre-winterkill electrical shocking efforts encountered common carp at the rate of 2.4 to 47.5 fish per mile shocked (Appendix 1). The carp population changed dramatically after the 1976-1977 winterkill. An electrical shocking survey in the fall of 1977 encountered thousands of YOY carp at a rate greater than 594.1 fish per mile shocked. The electrical shocking surveys conducted in 1978 and 1980 found that carp CPE declined to former levels of between 5.9 fish per mile in 1978 and 27.3 fish per mile in 1980 (Table 1).

Common Carp Trend

Common carp were successfully removed from the lake, however the management effort failed to reduce their prevalence below problematic levels.

Black Bullhead

Black bullhead was first documented in the 1975 (Appendix 1). However, stocking records indicate that a small number of bullhead spp. was introduced as early as 1962 (Appendix 6). Black bullhead is the most abundant Wisconsin bullhead species. It is tolerant of agricultural situations and in waters where winterkill is prevalent, it is frequently the only survivor (Becker 1983).

Black Bullhead Standard Spring Fyke Net Comparison, 1977-1979

The 1977 winterkill netting investigation caught black bullhead at the low rate of 1.0 fish per net night (Appendix 1). The 1978 netting removal effort caught bullhead at an average rate of 340.2 fish per net night (Table 1). The 1979 netting effort caught bullhead at the reduced rate of 9.8 fish per net night.

Black Bullhead Electrical Shocking Survey Comparison, 1963-1980

The 1975 pre-winterkill electrical shocking efforts encountered black bullhead at the rate of 1.8 fish per mile shocked (Appendix 1). A post winterkill electrical shocking survey in the fall of 1977 encountered larger numbers of YOY bullhead and adults at a rate greater than 8.9 fish per mile shocked. Electrical shocking surveys in 1978 and 1980 caught bullhead at the rate of 12.5 fish per mile and >59.4 fish per mile (Table 1).

Black Bullhead Trend

Black bullhead was successfully removed from the lake but the management success was short lived and by 1980 bullhead numbers rebounded to problematic levels.

Black Crappie

The 1959 barge seine survey encountered good numbers of yearling and adult black crappie in Carstens Lake (Appendix 1). Black crappie is tolerant of low oxygen conditions and can survive in waters where winterkill is prevalent (Becker 1983).

Black Crappie Standard Spring Fyke Net Comparison, 1977-1979

The 1977 winterkill netting investigation failed to catch black crappie and a restoration effort stocked 1000 pre-spawning adult crappie into Carstens Lake (Appendix 1, Appendix 6). The 1978 netting removal effort caught crappie at an average rate of 8.5 fish per net night (Table 1). The 1979 Fyke net effort caught crappie at an average rate of 53.2 fish per net night.

Black Crappie Electrical Shocking Survey Comparison, 1963-1980

The 1963 and 1975 pre-winterkill electrical shocking efforts encountered black crappie at the rate of 3.6 to 10.1 fish per mile shocked (Appendix 1). An electrical shocking survey in the fall of 1977 encountered good numbers of YOY and adults crappie at a rate of 30.3 fish per mile shocked. Electrical shocking surveys in 1978 and 1980 found that crappie CPE ranged between 4.8 fish per mile shocked and 33.3 fish per mile in 1980 (Table 1).

Black Crappie Trend

The black crappie population recovered quickly following reintroduction. Post winterkill year classes reached 5.9 inches on average by 1980 (Table 6).

Bluegill

The 1959 barge seine survey encountered good numbers of yearling and adult bluegill in Carstens Lake (Appendix 1). Bluegills will not tolerate low oxygen nearly as well as northern pike, yellow perch and bullhead and are often the first to die in a winterkill lake (Snow 1962).

Bluegill Standard Spring Fyke Net Comparison, 1977-1979

The 1977 winterkill netting investigation failed to catch bluegill (Appendix 1). The 1978 removal effort also failed to encounter bluegill until 1000 individuals was stocked into Carstens Lake near the end of the survey (Table 1, Appendix 6). Those introduced fish were caught at a rate of .5 fish per net night. The 1979 fyke netting effort caught bluegill at an average rate of .3 fish per net night.

Bluegill Electrical Shocking Survey Comparison, 1963-1980

The 1963 and 1975 electrical shocking efforts encountered bluegill at the rate of 85.5 to 25.0 fish per mile shocked (Appendix 1). An electrical shocking survey in the fall of 1977 failed to encounter bluegill. Electrical shocking surveys in 1978 and 1980 found that bluegill CPE ranged between 1.2 fish per mile and 0.0 fish per mile (Table 1).

Bluegill Trend

The bluegill stock was greatly impacted by the winterkill event. The population failed to recover even though reintroduction by stocking occurred (Appendix 6). Poor water quality and intra-species competition was likely limiting factors in the stock recovery effort, the 1980 electrical shocking survey failed to find bluegill (Table 1).

Yellow perch

Fisheries management surveys first documented yellow perch in 1978, the historic absence or rare occurrence of yellow perch suggests that the stock was small in size or not naturally occurring in the lake (Appendix 1, Table 2). The yellow perch is quite tolerant of low oxygen levels, and has been known to survive winterkill conditions under which bluegills, largemouth bass and walleyes have suffocated (Herman 1959).

Yellow perch Standard Spring Fyke Net Comparison, 1977-1979

The 1978 fyke net removal effort found yellow perch to be present in very low numbers, 4 large adults were captured before stocking occurred (Appendix 6). Yellow perch were caught at an average overall CPE of 3.7 fish per net night for the entire survey period (Table 2). The 1979 Fyke net effort caught yellow perch at an average rate of .5 fish per net night.

Yellow perch Electrical Shocking Survey Comparison, 1963-1980

The electrical shocking surveys in 1978 and 1980 caught yellow perch at a CPE rate between 1.2 fish per mile and 0.0 fish per mile (Table 2).

Yellow perch Trend

Yellow perch reintroduction efforts failed to result in a measurable self reproducing population and the 1980 survey failed to find any perch (Table 2). Yellow perch recruitment is at least being limited by marginal spawning habitat, poor water quality and intra-species competition.

Largemouth bass

Largemouth bass were first encountered in the 1959 barge seine survey (Appendix 1). Largemouth bass are often the first to die in a winterkill lake (Snow 1962).

Largemouth bass Standard Spring Fyke Net Comparison, 1977-1979

The fyke net efforts failed to catch any largemouth bass throughout the survey years, however this survey gear is a poor indicator of bass abundance. Largemouth bass are thought to avoid passive netting techniques such as fyke nets.

Largemouth bass Electrical Shocking Survey Comparison, 1963-1980

The 1963 and 1975 electrical shocking efforts encountered largemouth bass at the rate of 19.0 to 7.1 fish per mile shocked (Appendix 1). An electrical shocking survey in the fall of 1977 failed to encounter bass. Electrical shocking surveys in 1978 and 1980 found that bass CPE rates ranged between 0.0 fish per mile shocked and 1.2 fish per mile (Table 2).

Largemouth bass Trend

Largemouth Bass stocking failed to reestablish the stock (Appendix 6). The 1980 survey captured only one adult bass and documented that stock recruitment was absent or very small. Poor water quality, intra-species competition and forage fish limitations are likely a limiting factor.

Northern pike

Northern pike were first described in the 1959 barge seine survey (Appendix 1). Pike are quite tolerant of low oxygen conditions and will withstand levels as low as .3 ppm (Cooper and Washburn 1949).

Northern pike Standard Spring Fyke Net Comparison, 1977-1979

The 1977 winterkill fyke netting investigation failed to catch northern pike (Appendix 1). The 1978 fyke net removal effort, encounter pike at the rate of .6 fish per net night and the 1979 fyke net effort caught pike at an average rate of .7 fish per net night. (Table 2).

Northern pike Electrical Shocking Survey Comparison, 1963-1980

The 1963 and 1975 electrical shocking efforts encountered northern pike at the rate of 0.0 to 0.6 fish per mile shocked (Appendix 1). An electrical shocking survey in the fall of 1977 encountered pike at a rate of 1.7 fish per mile. Electrical shocking surveys following the removal efforts in 1978 and 1980 caught pike at the CPE rate of 0.6 fish per mile and 0.0 fish per mile (Table 2). This electrical shocking is a poor indicator of pike abundance. Northern pike are difficult to obtain through conventional electrical shocking techniques and easily avoid capture.

Northern pike Trend

Historical data suggest that the northern pike stock was small. The post winterkill stocking of 30,000 fry likely increased population size but the study suggests that little additional recruitment was occurring during the time period (Appendix 6, Table 3 and Table 5). The likely limiting factors include poor water quality, limited spawning habitat, intra-species competition and limited forage fish stocks.

Conclusion

The Carstens Lake management efforts tested the effectiveness of removal of problem species by fyke net. The removal attempt failed to meet fisheries management goals, it was clear that the lake was still dominated by common carp, black bullhead and black crappie. The attempts to shift the fish population toward a more desirable balance of northern pike, largemouth bass, bluegill and yellow perch failed even though stocking occurred.

On September 16, 1982 Carstens Lake was chemically treated with the fish suffocant Rotenone at 5 ppm (Peeters, 1982). On September 17, 1982 approximately 12,000 pounds of dead fish were picked up and removed from the lake. It was estimated that approximately 85% of those fish were common carp by weight. The remaining 15 percent were black crappie, black bullhead, common sucker, bluegill and pumpkinseed in decreasing order.

Reference:

Becker, G.C. 1983. Fishes of Wisconsin. The University of Wisconsin Press. Madison Wisconsin. 1052 pages.

Belonger, B. 1978. Survey of Carsten Lake, Intra-Departmental Memorandum. Wisconsin Department of Natural Resources. 3 pages.

Cline, C. 1955 Survey of Carsten Lake. Manitowoc County. Unpublished Report. Wisconsin Conservation Department. 4 pages.

Cooper G.P. and G.N. Washburn 1949. Relation of Dissolved Oxygen to Winter Mortality of Fish in Lakes. Tran. Am. Fish. Soc. 76(1949): 23-33.

Herman, E.F., W.Wisby and M. Burdick 1959. The Yellow Perch-its Life History, Ecology, and Management. Wisconsin Conservation Department Pub. 228. 14 pages

Peeters P. 1982. Carsten Lake Project, Manitowoc County. Unpublished, Correspondence Memorandum. Wisconsin Department of Natural Resources. 23 pages.

Schultz. P.T. 1959. Survey of Carsten Lake, Manitowoc County. Unpublished, Lake Survey Work Sheet. 7 pages.

Schultz. P.T. 1964. Survey of Carsten Lake, Manitowoc County. Unpublished Intra-Departmental Memorandum. Wisconsin Conservation Department. 4 pages.

Snow H., A. Ensign, and Klingbiel 1962. The Bluegill-its Life History, Ecology and Management. Wisconsin Conservation Department Pub. 230. 14 pages.

Wisconsin Conservation Department 1960. Intra-Departmental Memorandum. 5 pages.

Wisconsin Conservation Department 1964. Unpublished Lake Sheet Worksheet. 6 pages.

Wisconsin Conservation Department 1975. Unpublished Fish Distribution Study. 5 pages.

Table 1. Species composition for each survey type on Carsten Lake from 1978-1980.

Group	Common Name	Scientific Name	Standard Fyke net 1978	Fall Shock 1978	Standard Fyke net 1979	Fall Shock 1980
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Pike	Northern pike	<i>Esox lucius</i>	X	X	X	
Sucker	White sucker	<i>Catostomus commersoni</i>	X	X	X	X
Bullheads	Black bullhead	<i>Ameiurus melas</i>	X	X	X	X
Sunfishes	Largemouth bass	<i>Micropterus salmoides</i>				X
	Pumpkinseed	<i>Lepomis gibbosus</i>	X	X	X	X
	Bluegill	<i>Lepomis macrochirus</i>	X	X	X	
	Black crappie	<i>Pomoxis nigromaculatus</i>	X	X	X	X
Perches	Yellow perch	<i>Perca flavescens</i>	X	X	X	
Minnows	Golden shiner	<i>Notemigonus crysoleucas</i>	X			X
	Common carp	<i>Cyprinus carpio</i>	X	X	X	X

Table 2. Survey Catch Summary and Catch Per Effort for Carstens Lake, 1978-1980.

Species	Spring Fyke net 1978	Electrical Shocking Fall 1978	Spring Fyke net 1979	Electrical Shocking Fall 1980
Northern pike	58 (0.6)**	1 (0.6)*	4 (0.7)**	
Largemouth bass				1 (1.2)*
White sucker	11 (0.1)**	2 (1.2)*	3 (0.5)**	5 (5.9)*
Black bullhead	32,316 (340.2)**	21 (12.5)*	59 (9.8)**	50 plus (>59.4)*
Pumpkinseed	5 (0.1)**	3 (1.8)*	2 (0.3)**	3 (3.6)*
Bluegill	45 (0.5)**	2 (1.2)*	2 (0.3)**	
Black crappie	809 (8.5)**	8 (4.8)*	319 (53.2)**	28 (33.3)*
Yellow perch	356 (3.7)**	2 (1.2)*	3 (0.5)**	
Golden shiner	14 (0.2)**			1 (1.2)*
Common carp	21,497 (226.3)**	10 (5.9)*	372 (62.0)**	23 (27.3)*
Total	55,111	49	764	106
Effort	95 net night	1.68 miles	6 net night	.84 miles
Overall CPE	580.1**	29.2*	127.3**	126.2*

* Catch per effort expressed as Fish Per Mile

**Catch per effort expressed as Fish per Net Night

Table 3. Carsten Lake Standard Fyke Net Survey Length Frequency, April 14, 1978 – May 19, 1978.

Length (inches)			Common Carp	Black Bullhead	Black Crappie	Bluegill	Pumpkin-seed	Yellow Perch	Northern Pike	Golden Shiner	White Sucker
2.5	-	2.9			1						
3.0	-	3.4		6	118						
3.5	-	3.9	1	5	166	2		17			
4.0	-	4.4	6	1	11	3	1	44			
4.5	-	4.9	8		10	4		57			3
5.0	-	5.4	33		7	11	3	66			2
5.5	-	5.9	58		1	18		45		4	1
6.0	-	6.4	55			7	1	48		2	1
6.5	-	6.9	31					52		2	1
7.0	-	7.4	15					15		4	
7.5	-	7.9	6	6	3			5		2	
8.0	-	8.4	5	7	19			2			
8.5	-	8.9	1	17	144			1			
9.0	-	9.4		30	265			2			
9.5	-	9.9		10	62			2			
10.0	-	10.4		13	2						
10.5	-	10.9		18							
11.0	-	11.4		4							1
11.5	-	11.9									
12.0	-	12.4									
12.5	-	12.9									
13.0	-	13.4							1		
13.5	-	13.9									1
14.0	-	14.4							1		
14.5	-	14.9									
15.0	-	15.4							2		
15.5	-	15.9									
16.0	-	16.4							8		1
16.5	-	16.9							8		
17.0	-	17.4							7		
17.5	-	17.9							6		
18.0	-	18.4							7		
18.5	-	18.9							2		
19.0	-	19.4							13		
19.5	-	19.9							1		
20.0	-	20.4							1		
20.5	-	20.9									
21.0	-	21.4									
21.5	-	21.9									
22.0	-	22.4									
22.5	-	22.9									
23.0	-	23.4									
23.5	-	23.9									
24.0	-	24.4									
24.5	-	24.9									
25.0	-	25.4							1		
25.5	-	25.9									
26.0	-	26.4									
26.5	-	26.9									
27.0	-										
Total			219	117	809	45	5	356	58	14	11
Average			6.0	8.8	6.9	5.4	5.3	5.5	17.6	6.7	7.7
Minimum			3.9	3.0	2.9	3.6	4.3	3.6	13.0	5.6	4.8
Maximum			8.6	11.4	10.0	6.2	6.0	9.5	25.3	7.6	16.4

Table 4. Carsten Lake Electrical Shocking Survey Length Frequency, October 26, 1978.

Length (inches)			Common Carp	Black Bullhead	Black Crappie	Bluegill	Pumpkin-seed	Yellow Perch	Northern pike	White sucker
2.5	-	2.9								
3.0	-	3.4		2	2					
3.5	-	3.9		4						
4.0	-	4.4		7						
4.5	-	4.9		4	1					
5.0	-	5.4		2	2	1	1			
5.5	-	5.9		1	1	1	2			
6.0	-	6.4		1						
6.5	-	6.9	1					1		
7.0	-	7.4	1					1		
7.5	-	7.9								
8.0	-	8.4	1							2
8.5	-	8.9	2							
9.0	-	9.4								
9.5	-	9.9	2		1					
10.0	-	10.4			1					
10.5	-	10.9	2							
11.0	-	11.4	1							
11.5	-	11.9								
12.0	-	12.4								
12.5	-	12.9								
13.0	-	13.4								
13.5	-	13.9								
14.0	-	14.4								
14.5	-	14.9								
15.0	-	15.4								
15.5	-	15.9								
16.0	-	16.4								
16.5	-	16.9								
17.0	-	17.4								
17.5	-	17.9								
18.0	-	18.4								
18.5	-	18.9								
19.0	-	19.4								
19.5	-	19.9							1	
20.0	-	20.4								
20.5	-	20.9								
21.0	-	21.4								
21.5	-	21.9								
22.0	-	22.4								
22.5	-	22.9								
23.0	-	23.4								
23.5	-	23.9								
24.0	-	24.4								
24.5	-	24.9								
25.0	-	25.4								
25.5	-	25.9								
26.0	-	26.4								
26.5	-	26.9								
27.0	-									
Total			10	21	8	2	3	2	1	2
Average			9.2	4.4	5.9	5.6	5.4	7.0	19.6	8.4
Minimum			6.6	3.4	3.2	5.4	5.0	6.6	19.6	8.4
Maximum			11.2	6.2	10.0	5.7	5.7	7.3	19.6	8.4

Table 5. Carsten Lake Standard Fyke Net Survey Length Frequency, May 15, 1979 – May 18, 1979.

Length (inches)			Common Carp	Black Bullhead	Black Crappie	Bluegill	Pumpkin-seed	Yellow Perch	Northern Pike	White Sucker
2.5	-	2.9								
3.0	-	3.4								
3.5	-	3.9								
4.0	-	4.4								
4.5	-	4.9			14	1				
5.0	-	5.4	1	4	235	1	1			
5.5	-	5.9		3	16		1			
6.0	-	6.4	2	12				1		
6.5	-	6.9	2	3				1		
7.0	-	7.4	25	9						
7.5	-	7.9	60	5						
8.0	-	8.4	87	8	1			1		
8.5	-	8.9	94	2	2					
9.0	-	9.4	57	2	3					1
9.5	-	9.9	27	3	6					
10.0	-	10.4	7	3	12					
10.5	-	10.9	5		15					
11.0	-	11.4	4	4	12					
11.5	-	11.9	1	1	3					
12.0	-	12.4								
12.5	-	12.9								
13.0	-	13.4								
13.5	-	13.9								
14.0	-	14.4								
14.5	-	14.9								2
15.0	-	15.4								
15.5	-	15.9								
16.0	-	16.4								
16.5	-	16.9								
17.0	-	17.4								
17.5	-	17.9								
18.0	-	18.4								
18.5	-	18.9								
19.0	-	19.4								
19.5	-	19.9							1	
20.0	-	20.4							1	
20.5	-	20.9								
21.0	-	21.4								
21.5	-	21.9								
22.0	-	22.4							1	
22.5	-	22.9								
23.0	-	23.4								
23.5	-	23.9								
24.0	-	24.4								
24.5	-	24.9								
25.0	-	25.4								
25.5	-	25.9							1	
26.0	-	26.4								
26.5	-	26.9								
27.0	-									
Total			372	59	319	2	2	3	4	3
Average			8.5	7.6	6.1	5.1	5.3	7.0	21.8	12.8
Minimum			5.2	5.0	4.5	4.9	5.0	6.3	19.6	9.0
Maximum			11.5	11.9	11.5	5.2	5.5	8.0	25.5	14.9

Table 6. Carsten Lake Electrical Shocking Survey Length Frequency, October, 22 1980.

Length (inches)			Common Carp	Black Bullhead	Black Crappie	Pumpkin-seed	Largemouth Bass	Golden Shiner	White Sucker
2.5	-	2.9							
3.0	-	3.4							
3.5	-	3.9							
4.0	-	4.4		2		1			
4.5	-	4.9		19		2			
5.0	-	5.4		18			1		
5.5	-	5.9		5	17				
6.0	-	6.4		2	11				
6.5	-	6.9		2					
7.0	-	7.4							
7.5	-	7.9		1					
8.0	-	8.4							
8.5	-	8.9							
9.0	-	9.4							
9.5	-	9.9		1					
10.0	-	10.4	3						
10.5	-	10.9	5						
11.0	-	11.4	8						
11.5	-	11.9	3						2
12.0	-	12.4	2						1
12.5	-	12.9	1						1
13.0	-	13.4							1
13.5	-	13.9							
14.0	-	14.4	1						
14.5	-	14.9							
15.0	-	15.4					1		
15.5	-	15.9							
16.0	-	16.4							
16.5	-	16.9							
17.0	-	17.4							
17.5	-	17.9							
18.0	-	18.4							
18.5	-	18.9							
19.0	-	19.4							
19.5	-	19.9							
20.0	-	20.4							
20.5	-	20.9							
21.0	-	21.4							
21.5	-	21.9							
22.0	-	22.4							
22.5	-	22.9							
23.0	-	23.4							
23.5	-	23.9							
24.0	-	24.4							
24.5	-	24.9							
25.0	-	25.4							
25.5	-	25.9							
26.0	-	26.4							
26.5	-	26.9							
27.0	-								
Total			23	50	28	3	1	1	5
Average			11.3	5.2	5.9	4.7	15.0	5.0	12.3
Minimum			10.2	4.3	5.5	4.3	15.0	5.0	11.6
Maximum			14.0	9.5	6.3	4.9	15.0	5.0	13.0

Appendix 1. Survey Catch Summary and Catch per Effort for Carstens Lake, 1959-1977.

Species	Barge Seine June, 1959	Electrical Shocking June, 1963	Electrical Shocking June, 1975	Spring Fyke Net 1977	Electrical Shocking Fall 1977
Northern pike	3		1 (0.6)*		3 (1.7)*
Largemouth bass	9	16 (19.0)*	12 (7.1)*		
White sucker		3 (3.6)*	6 (3.6)*		
Black bullhead			3 (1.8)*	3 (1.0)**	15 (8.9)*
Pumpkinseed	5		6 (3.6)*		
Bluegill	302	72 (85.5)*	42 (25.0)*		
Black crappie	252	3 (3.6)*	17 (10.1)*		51 (30.3)*
Yellow perch					
Golden shiner	42		10 (5.9)*	320 (106.7)**	7 (4.2)*
Common carp		40 (47.5)*	4 (2.4)*	1 (0.3)**	1000's (>594.1)*
Central mudminnow					3 (1.8)*
Total	613	134	101	324	
Effort		.84 miles	1.68 miles	3 Net Night	1.68 miles
Overall CPE		159.5*	60.1*	108**	

* Catch per effort expressed as Fish Per Mile

**Catch per effort expressed as Fish per Net Night

**Appendix 2. Carsten Lake Seine Survey Length Frequency,
June 5, 1959.**

Length (inches)		Black Crappie	Bluegill	Pumpkin-seed	Largemouth Bass	Northern Pike	Golden Shiner	
2.5	-	2.9	17	36				
3.0	-	3.4	40	65	1			
3.5	-	3.9	30	11	1	4		
4.0	-	4.4	2	19	2			
4.5	-	4.9	10	41				
5.0	-	5.4	6	7	1		7	
5.5	-	5.9	22	29	1		14	
6.0	-	6.4	31	45			17	
6.5	-	6.9	7	45				
7.0	-	7.4	9	3				
7.5	-	7.9	22	1			4	
8.0	-	8.4	34		1			
8.5	-	8.9	16		1			
9.0	-	9.4	5					
9.5	-	9.9	1					
10.0	-	10.4						
10.5	-	10.9						
11.0	-	11.4						
11.5	-	11.9						
12.0	-	12.4						
12.5	-	12.9						
13.0	-	13.4						
13.5	-	13.9						
14.0	-	14.4						
14.5	-	14.9						
15.0	-	15.4				1		
15.5	-	15.9						
16.0	-	16.4				1		
16.5	-	16.9			1			
17.0	-	17.4						
17.5	-	17.9						
18.0	-	18.4						
18.5	-	18.9			1			
19.0	-	19.4						
19.5	-	19.9						
20.0	-	20.4						
20.5	-	20.9						
21.0	-	21.4						
21.5	-	21.9						
22.0	-	22.4						
22.5	-	22.9						
23.0	-	23.4						
23.5	-	23.9						
24.0	-	24.4						
24.5	-	24.9						
25.0	-	25.4						
25.5	-	25.9				1		
26.0	-	26.4						
26.5	-	26.9						
27.0	-							
Total			252	302	5	9	3	42
Average			5.7	4.7	4.7	7.9	18.9	5.5
Minimum			2.5	2.5	3.9	3.3	14.9	4.7
Maximum			9.7	7.5	5.5	18.9	25.9	7.3

Appendix 3. Carsten Lake Electrical Shocking Survey Length Frequency, June 20, 1963.

Length (inches)	Common Carp	Black Crappie	Bluegill	Largemouth Bass	White Sucker
2.5 - 2.9					
3.0 - 3.4			2		
3.5 - 3.9			3		
4.0 - 4.4			7		
4.5 - 4.9			16	1	
5.0 - 5.4			10	1	
5.5 - 5.9			10	1	
6.0 - 6.4			1	1	
6.5 - 6.9			2	2	
7.0 - 7.4		1	1		
7.5 - 7.9		1			
8.0 - 8.4		1			1
8.5 - 8.9				1	
9.0 - 9.4					
9.5 - 9.9					
10.0 - 10.4					1
10.5 - 10.9				1	
11.0 - 11.4					
11.5 - 11.9				1	
12.0 - 12.4					
12.5 - 12.9				1	
13.0 - 13.4					
13.5 - 13.9				3	
14.0 - 14.4					
14.5 - 14.9					
15.0 - 15.4					
15.5 - 15.9					
16.0 - 16.4					
16.5 - 16.9				1	
17.0 - 17.4					
17.5 - 17.9				2	
18.0 - 18.4					
18.5 - 18.9					
19.0 - 19.4					
19.5 - 19.9					
20.0 - 20.4					
20.5 - 20.9					
21.0 - 21.4					
21.5 - 21.9					
22.0 - 22.4					
22.5 - 22.9					
23.0 - 23.4					
23.5 - 23.9					
24.0 - 24.4	1				
24.5 - 24.9					
25.0 - 25.4					
25.5 - 25.9					
26.0 - 26.4					
26.5 - 26.9	2				
27.0 -	1				
Total	4	3	52	16	2
Average	26.3	7.7	5.0	10.8	9.3
Minimum	24.3	7.3	3.3	4.9	8.3
Maximum	27.1	8.1	7.3	17.7	10.2

**Appendix 4. Carsten Lake Electrical Shocking Survey Length Frequency,
June 23, 1975.**

Length (inches)	Common Carp	Black Crappie	Black Bullhead	Bluegill	Pumpkin- seed	Largemouth Bass	Northern Pike	Golden Shiner	White Sucker
2.5 - 2.9									
3.0 - 3.4				1					
3.5 - 3.9						1			
4.0 - 4.4				2	5				
4.5 - 4.9				10	1			2	
5.0 - 5.4				16				2	
5.5 - 5.9				13				4	
6.0 - 6.4				1		1		1	
6.5 - 6.9		3				3		1	
7.0 - 7.4		9							
7.5 - 7.9		4	2						
8.0 - 8.4		1	1						
8.5 - 8.9									
9.0 - 9.4						2			
9.5 - 9.9						2			2
10.0 - 10.4						1			
10.5 - 10.9									
11.0 - 11.4									1
11.5 - 11.9									2
12.0 - 12.4									
12.5 - 12.9							1		
13.0 - 13.4									1
13.5 - 13.9									
14.0 - 14.4									
14.5 - 14.9									
15.0 - 15.4									
15.5 - 15.9									
16.0 - 16.4									
16.5 - 16.9									
17.0 - 17.4									
17.5 - 17.9						1			
18.0 - 18.4									
18.5 - 18.9									
19.0 - 19.4									
19.5 - 19.9									
20.0 - 20.4									
20.5 - 20.9						1			
21.0 - 21.4	1								
21.5 - 21.9									
22.0 - 22.4									
22.5 - 22.9									
23.0 - 23.4									
23.5 - 23.9									
24.0 - 24.4	1								
24.5 - 24.9									
25.0 - 25.4									
25.5 - 25.9									
26.0 - 26.4									
26.5 - 26.9	1								
27.0 -	1								
Total	4	17	3	43	6	12	1	10	6
Average	25.0	7.3	7.9	5.2	4.2	9.6	12.9	5.5	11.2
Minimum	21.3	6.9	7.8	3.3	4.0	3.5	12.9	4.7	9.7
Maximum	28.2	8.2	8.0	6.0	4.6	20	12.9	6.7	13.2

Appendix 5. Carsten Lake Electrical Shocking Survey Length Frequency, September 21, 1977.

Length (inches)	Common Carp	Black Bullhead	Black Crappie	Northern Pike	Golden Shiner	Central Mudminnow
2.5 - 2.9		2	8			2
3.0 - 3.4	2	3	31		2	
3.5 - 3.9	6					1
4.0 - 4.4	22	1				
4.5 - 4.9	28					
5.0 - 5.4	36					
5.5 - 5.9	20				3	
6.0 - 6.4	14	1				
6.5 - 6.9	5				1	
7.0 - 7.4	2					
7.5 - 7.9	1					
8.0 - 8.4						
8.5 - 8.9			1			
9.0 - 9.4			4			
9.5 - 9.9		3				
10.0 - 10.4		1				
10.5 - 10.9		4				
11.0 - 11.4						
11.5 - 11.9						
12.0 - 12.4						
12.5 - 12.9						
13.0 - 13.4						
13.5 - 13.9						
14.0 - 14.4						
14.5 - 14.9				1		
15.0 - 15.4						
15.5 - 15.9						
16.0 - 16.4				1		
16.5 - 16.9						
17.0 - 17.4						
17.5 - 17.9						
18.0 - 18.4						
18.5 - 18.9						
19.0 - 19.4						
19.5 - 19.9						
20.0 - 20.4						
20.5 - 20.9						
21.0 - 21.4						
21.5 - 21.9						
22.0 - 22.4						
22.5 - 22.9						
23.0 - 23.4						
23.5 - 23.9						
24.0 - 24.4						
24.5 - 24.9						
25.0 - 25.4						
25.5 - 25.9						
26.0 - 26.4						
26.5 - 26.9						
27.0 -						
Total	136	15	44	2	6	3
Average	5.1	7.0	3.8	15.7	5.0	2.9
Minimum	3.0	2.0	3.4	14.5	3.2	2.5
Maximum	7.6	10.8	9.4	16.8	6.6	3.6

**Appendix 6. Fish stocking summary for Carstens Lake, Manitowoc County.
Years 1934-1978.**

Year	SPECIES	SIZE &/OR AGE	NUMBER
1934	Largemouth bass		196
1943	Largemouth bass	FGL.	300
1944	Largemouth bass	FGL.	1,000
1946	Largemouth bass	FGL.	1,000
1947	Largemouth bass	FGL.	500
1948	Largemouth bass	FGL.	500
1950	Largemouth bass	FGL.	400
1953	Largemouth bass	FGL.	500
1962	Largemouth bass	6-17"	24
1962	Bullhead spp.	10-14"	21
1962	Northern pike	12-23"	4
1965	Northern pike	14-24"	100
1966	Northern pike	6-16"	100
1971	Northern pike	YLG. 13-15"	100
1974	Northern pike	YLG. 11-18"	100
1975	Northern pike	YLG. 10-18"	100
1975	Northern pike	YLG. 11"	100
1977	Black Crappie	ADU. 6"	1,000
1977	Northern pike	FRY 1"	30,000
1978	Largemouth bass	FGL. 3"	3,000
1978	Bluegill	ADU. 1-3"	1000
1978	Yellow perch		500