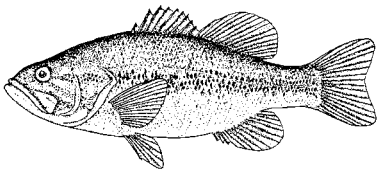
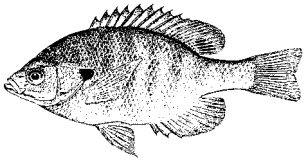
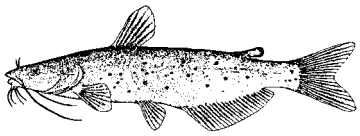
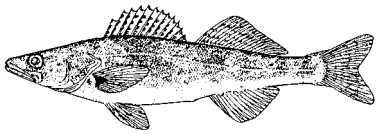




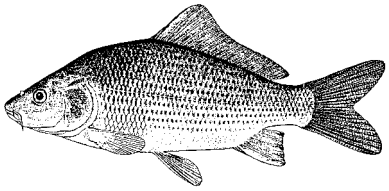
FISHERY MANAGEMENT REPORT

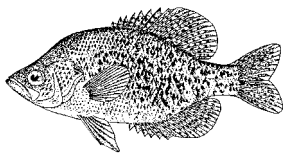


SWAN LAKE NATIONAL WILDLIFE REFUGE
Sumner, Missouri



Jim Milligan & Joanne Grady
U.S. Fish and Wildlife Service
Columbia Fisheries Resources Office
March 1997





INTRODUCTION

The most recent fishery survey on Silver Lake, Swan Lake National Wildlife Refuge, was completed on July 30 - August 1, 1996 by Jim Milligan and Joanne Grady of the Columbia Fishery Resources Office. The purpose of the survey was to monitor species composition and relative abundance of the resident fish community.

METHODS

The inshore fish community of several areas in Silver Lake was sampled using a boom-mounted electrofishing boat and pulsed DC current (884 Volts, 6 amps, 4.5-millisecond pulse width, 60 pulses per second) on July 30, 1996. All fish collected during 60 minutes (1 hour) of sampling were weighed (g), and measured (mm). Scales were removed from representative samples of white crappie and black crappie. Water conductivity was 170 mmho/cm. Water temperature was 80 degrees F., Secchi disc was 0.15 meters, and air temperature was 80 degrees F with east-northeast winds ranging from 2-5 mph.

Four experimental gill nets and eight set lines were set on July 30, 1996. The nets and lines fished throughout the night and were pulled the following morning. The gill nets were 150 feet long with 25 foot panels of ½, 1, 1 ½, 2, 2 ½, and 3-inch mesh. The set lines were 250 feet long with 20 hooks spaced ten feet apart.

RESULTS

The following fish species were collected in Silver Lake:

Code	Common Name	Species Name	Role
BIB	Bigmouth Buffalo	*Ictiobus cyprinellus*	Commercial fish
BLB	Black Bullhead	*Ameiurus melas*	Sport fish
BLC	Black Crappie	*Pomoxis nigromaculatus*	Sport or forage fish
BLG	Bluegill	*Lepomis macrochirus*	Sport or forage fish
CAP	Common Carp	*Cyprinus carpio*	Commercial fish
CCF	Channel Catfish	*Ictalurus punctatus*	Sport fish
FRD	Freshwater Drum	*Aplodinotys grunniens*	Sport fish
GSF	Green Sunfish	*Lepomis cyanellus*	Sport or forage fish
GZS	Gizzard Shad	*Dorosoma cepedianum*	Forage fish
Code	Common Name	Species Name	Role
LMB	Largemouth Bass	*Micropterus salmoides*	Sport fish

QCS	Quillback Carpsucker	*Carpiodes cyprinus*	Forage fish
RSH	Red Shiner	*Notropis lutrensis*	Forage fish
SAB	Smallmouth Buffalo	*Ictiobus bubalus*	Commercial fish
SNG	Shortnose Gar	*Lepisosteus platostomus*	Sport or forage fish
WHC	White Crappie	*Pomoxis annularis*	Sport or forage fish
YEB	Yellow Bullhead	*Ameiurus natalis*	Sport fish

Other species are known to inhabit Silver Lake but were not collected in this sample. Golden shiners, river carpsuckers, longnose gar, and flathead catfish were collected in 1986.

Table 1. Fish collected by electrofishing in Silver Lake, Swan Lake National Wildlife Refuge on July 30, 1996 using pulse DC current (total effort 60 minutes (1 hour)).

Species	Number	Total Weight (kg)	Average Weight (g)	Average Total Length (mm)	Total Length Range (mm)	Percent Total Weight	Percent Total Number	CPUE No./Hr.	Number* Harvestable and (%)
BIB	4	2.34	586.0	274.5	138-416	5.90	2.5	4	2(50)
BLC	7	0.50	70.9	161.7	154-167	1.3	4.4	7	0
BLG	28	1.59	56.7	130.4	72-183	4.0	17.7	28	12(43)
CAP	16	19.29	1205.7	930.3	215-793	48.8	10.1	16	8(50)
FRD	32	10.38	324.6	245.7	57-465	26.3	20.3	32	
GSF	2	0.03	14.0	88.5	84-93	0.08	1.3	2	0
LMB	11	1.79	163.1	215.3	159-257	4.5	7.0	11	0
WHC	24	3.11	135.1	181.5	38-288	7.9	15.2	24	7(29)
YEB	2	0.32	161.0	224.5	203-255	0.8	1.3	2	0
RSH	1		3.0	66	66	0.008	0.06	1	
GZS	31			71	44-103	0.4	19.6	31	N/A
TOTAL	158	39.493							

* Bluegill & other sunfish - 15 cm & Greater
Flathead Catfish - 40 cm & Greater
Largemouth Bass - 30 cm & Greater
Bullhead & Crappie - 20 cm & Greater
Walleye, Carp & Buffalo - 30 cm & Greater
Catfish - 25 cm & Greater

One hundred fifty-eight fish of eleven species weighing 39.49 kg (87.1 lbs.) were collected by electrofishing (Table 1). Freshwater drum, gizzard shad, bluegill, and white crappie were the most numerically abundant species at 20, 20, 18, and 15 percent of the sample. Common carp and freshwater drum represented 49 and 26 percent of the total weight of fish collected. Centrarchid sport fishes, largemouth bass, bluegill, black crappie, white crappie, and green sunfish made up 17.8% of the sample weight and 45.6% of the fish collected.

Table 2. Fish collected by gill nets in Silver Lake, Swan Lake National Wildlife Refuge on July 30-August 1, 1996 (total effort 4 net-nights (75.42 hours)).

Species	Number	Total Weight (kg)	Average Weight (g)	Average Total Length (mm)	Total Length Range (mm)	Percent Total Weight	Percent Total Number	CPUE No./Hr.	Number* Harvestable and (%)
BIB	20	26.92	1345.85	423.0	300-567	21.83	8.3	0.27	20(100)
BLC	4	0.19	47.5	145.5	140-153	0.15	1.7	0.05	0
BLG	1	0.08	83	163	163	0.06	0.4	0.01	1(100)
CAP	16	26.34	1645.94	489.75	275-594	21.36	6.6	0.21	14(88)
FRD	5	2.16	431.6	310.0	248-454	1.75	2.1	0.07	
QCS	6	2.38	395.8	306	287-323	1.93	2.6	0.08	
SNG	125	45.18	361.4	466.2	377-755	36.64	51.9	1.66	
WHC	14	2.38	169.5	207.5	99-285	1.93	5.8	0.19	5(36)
BLB	12	3.42	284.8	271.8	249-313	2.77	5.0	0.16	2(17)
SAB	1	0.86	855	387	387	0.70	0.4	0.01	1(100)
GZS	26	3.73	143.6	221.5	88-365	3.03	10.8	0.35	N/A
CCF	11	9.66	878.1	460.4	353-501	7.83	4.6	0.15	11(100)
TOTAL	241	123.3							

* Bluegill & other sunfish - 15 cm & Greater
Bullhead & Crappie - 20 cm & Greater
Flathead Catfish - 40 cm & Greater
Walleye, Carp & Buffalo - 30 cm & Greater
Largemouth Bass - 30 cm & Greater
Catfish - 25 cm & Greater

Two hundred forty-one fish of twelve species weighing 123.3 kg (271.8 lbs.) were collected with gillnets (Table 2). Shortnose gar, gizzard shad, and common carp comprised 71 percent of the total number fish sampled in gill nets in 1996 (Table 2). Shortnose gar, bigmouth buffalo, and common carp comprised 79.8 percent of the sample weight. Sport fishes, black crappie, bluegill, white crappie, channel catfish, and black bullhead made up 12.7% of the sample weight and 17.5% of the fish collected.

Five channel catfish, four black bullhead, and three yellow bullhead were collected on set lines. The eight lines fished a total of 141.98 hours.

Established indices developed from long-term databases are used to evaluate the Silver Lake fishery. Several assumptions are made when using statistical indices to evaluate fish populations. Two of these are: all fish species are equally susceptible to the collecting gear used, and all sizes of fish within a species are equally susceptible to the collecting gear. Although these assumptions are made in the statistical realm, they are not true in the biological realm. In reality, larger fish of a species are more susceptible to electrofishing than smaller fish, and some fish species are more susceptible to electrofishing than others. Species such as gizzard shad, which occupy the open offshore area known as the pelagic zone, are generally out of an electrofisher's range and are not collected in proportion to their abundance. Crappie species, which occupy areas a little deeper and farther offshore than other sunfishes, are most effectively collected with trapnets when they move inshore to spawn in the spring.

When sampling a water body annually it is also beneficial to look at trends in relative abundance and catch per unit effort over time. Relative abundance data must be interpreted cautiously since it can be biased by non-random distribution and gear selectivity, but it does serve as useful trend indicators. Catch per unit effort is the number of fish caught per period of sampling. In this case it is the number of fish caught per hour. These trends help indicate whether a fish species is increasing or decreasing in numbers from year to year. However, these numbers should not be viewed independently. Silver Lake was drained by refuge staff in 1988, a drought year. This eliminated fish from Silver Lake. Therefore, the fish population sampled after 1988 is essentially a different population than that sampled before 1988. Fish sampled after 1988 are probably not the genetic descendants of fish sampled prior to 1988. The Midwest was impacted by heavy rainfall and severe flooding in the spring and summer of 1993 and in 1995. Flooding events such as these aid in introducing and replenishing fish species in Silver Lake. The higher CPUE of several species (including bluegill, white crappie, and freshwater drum) in electrofishing samples in 1996 may be partially attributed to these flood events (Figure 1A). The lower relative abundance of white crappie netted in 1996 is likely due to a change in net sampling methods (Figure 2B). Net samples previous to 1996 include trap net sampling, a more effective sampling technique for crappie. Trap nets were not used in the 1996 sampling effort.

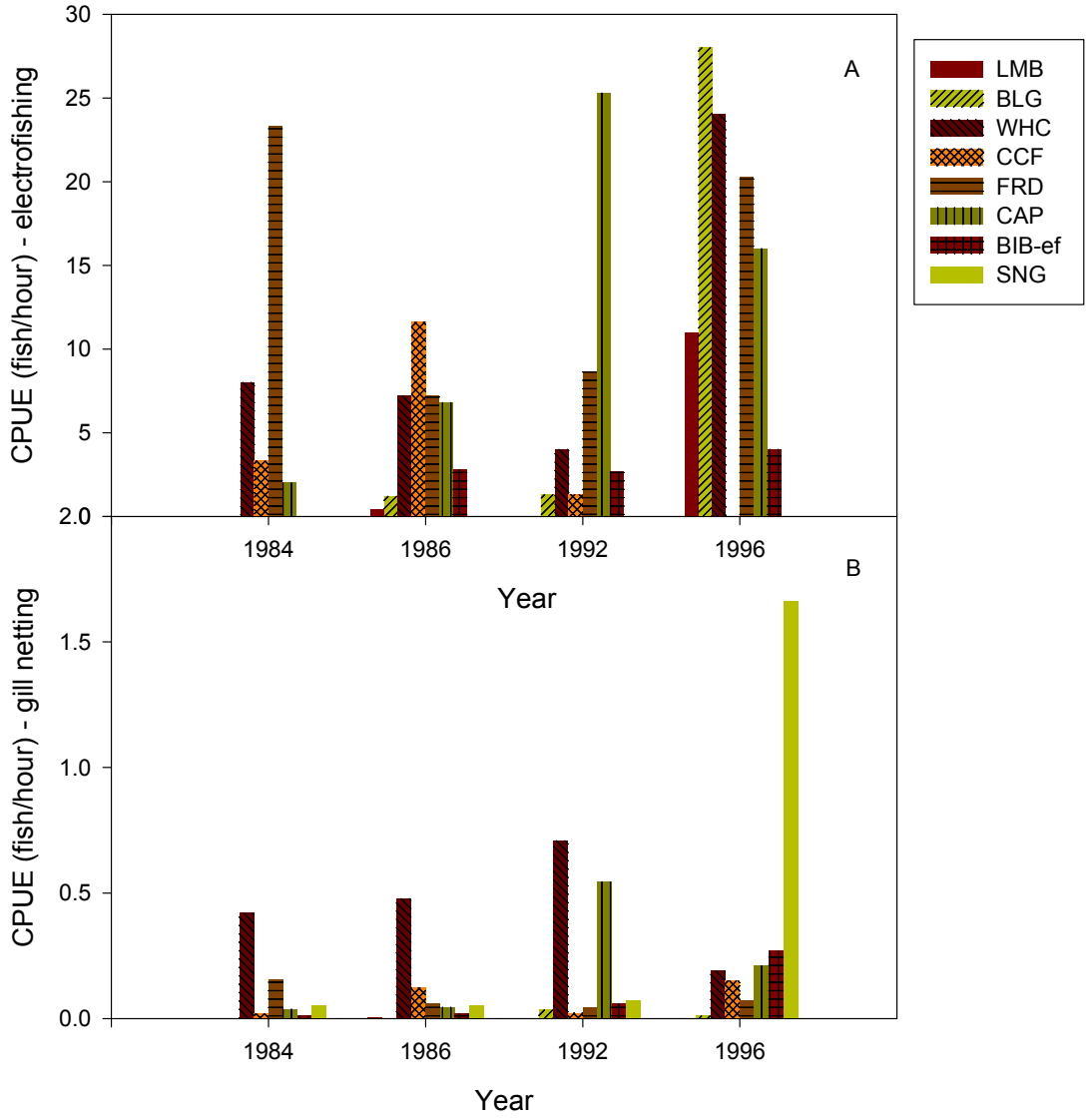


Figure 1. CPUE of several fish species collected by A. electrofishing and B. nets in Silver Lake, Swan Lake National Wildlife Refuge. Nets prior to 1996 include trap nets.

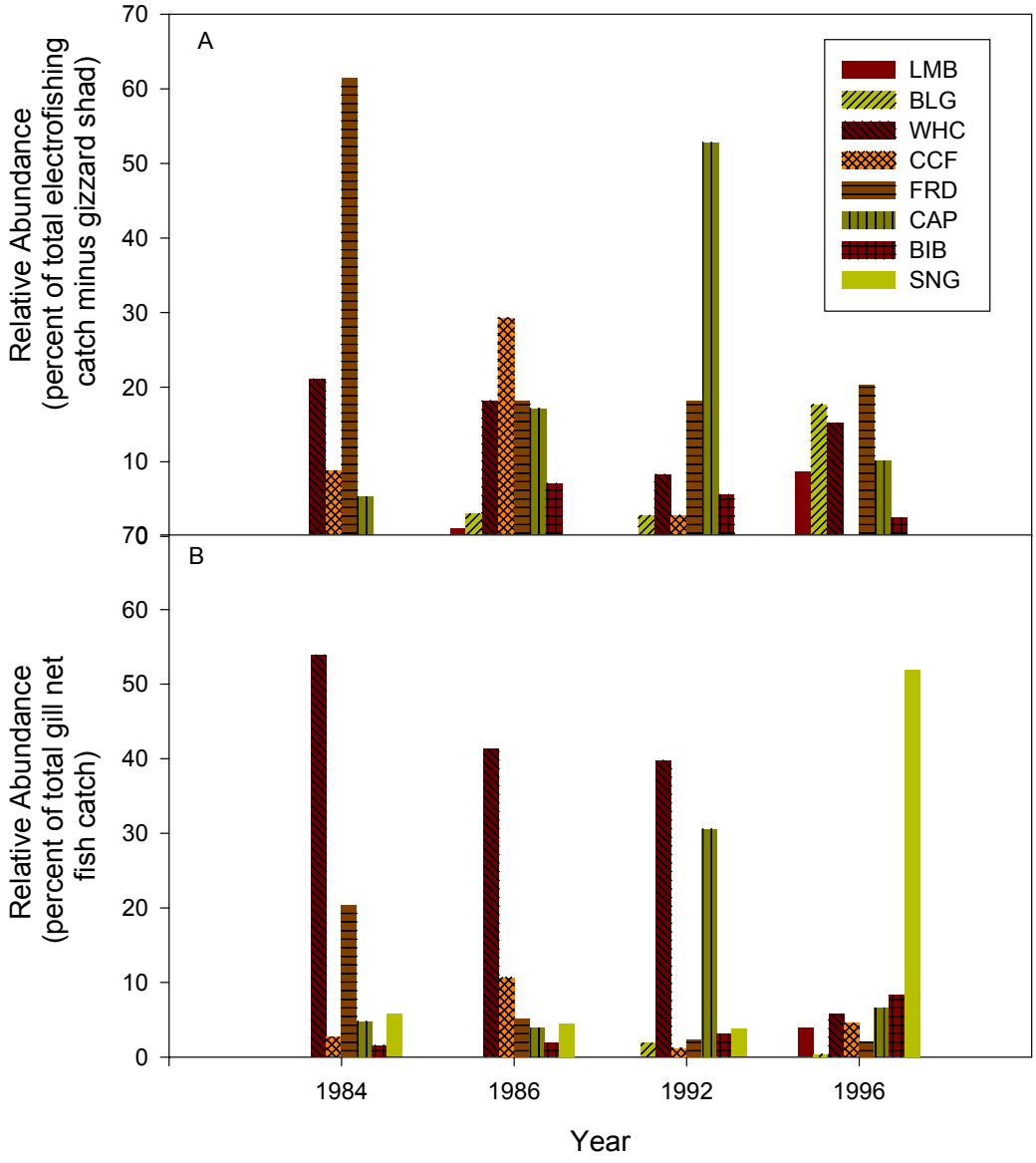


Figure 2. Relative abundance of several fish species collected in Silver Lake, Swan Lake National Wildlife Refuge, by A. electrofishing and B. nets. Nets prior to 1996 included trap nets. Data in graph A. do not include gizzard shad as they are not collected in proportion to their abundance with this gear.

Relative Weight (Wr) is a measure of body condition. The measured weight of a fish is compared to an established standard weight of a fish the same length. Wr values greater than 100 indicate the individual fish weighs more than the standard weight. The preferred or target range of Wr values is 90-110. Mean or average Wr values close to 100 indicate fish populations or cohorts are in balance with their food supply. Fish with Wr values less than 85 are underweight, while fish with Wr values greater than 110 are overweight. Either of these extremes indicates that predator:prey ratios are not balanced and that there may be a problem with food supply or water quality.

Proportional Stock Density (PSD) is a measure of the size structure of a population. It is an index of community balance based upon rates of reproduction, recruitment, growth, and mortality. It also represents the percentage of fish that are attractive to an angler. The larger the percentage, the greater the proportion of large fish. PSD is calculated by dividing the number of fish $\geq$ quality size by the number of fish $\geq$ stock size X 100 (Flickinger and Bulow 1993). Sizes are based on percentages of world record length. This standardization allows for the discussion and comparison of fish populations from different water bodies and regions. The maximum lengths for minimum stock (S), quality (Q), preferred (P), memorable (M), and trophy (T) sizes are identified for individual fish species in graphs found further in this report.

Relative Stock Density (RSD) is the proportion of fish of any designated size group of fish. RSD is generally followed by a subscript indicating the size group (P, M, T) or by the minimum length considered in parentheses. All references to RSD in this report are RSD_P, or the relative stock density of fishes in the preferred or larger size groups.

Largemouth Bass

Largemouth bass is usually the dominant predator in warmwater fish communities in the Midwest. They are very important to maintaining desirable predator-prey equilibrium and serve as indicators of overall status of recreational fishery resources in small to medium size impoundments. However, largemouth bass seem to have been replaced in this function by shortnose gar in Silver Lake.

Eleven largemouth bass were collected by electrofishing in 1996. This is the largest number of bass collected in a Silver Lake fishery survey. Two largemouth bass were collected in the 1986 survey, one by electrofishing and one in a gill net. As can be seen in Figure 3, the largemouth bass sampled in 1996 consisted mostly of young fish, between 200 and 230 mm (8 to 9.5 inches). The large numbers of small fish indicate adult bass somewhere are reproducing well. However, larger fish have never been encountered in a Silver Lake fishery survey. It is possible that the 8-9.5 inch bass may

be the broodstock in Silver Lake. It is also possible that largemouth bass populations in watershed streams and ponds may be the sources of young bass which wash in during flood pulses. Largemouth bass are very difficult to sample in highly turbid water such as that found in Silver Lake. The bass sampled were in good condition, with an average relative weight (Wr) of 121.8 (Figure 3).

For largemouth bass, PSD is the percentage of those fish in a population sample greater than 203 mm (8 inches) which are also greater than 304 mm (12 inches). The desirable range for bass is 40-60%. PSD values larger than 60% would indicate that too many fish were larger than 12 inches. PSD values smaller than 40% would indicate a lack of large fish. Relative Stock Density (RSD) is a measure of the size structure of fish > 15 inches. RSD is the percentage of a sample greater than 304 mm which is also greater than 380 mm (15 inches). Ideal ranges are 20-30%. Unfortunately, both PSD and RSD values of this sample were zero. No bass of harvestable size (greater than 12 inches) were collected.

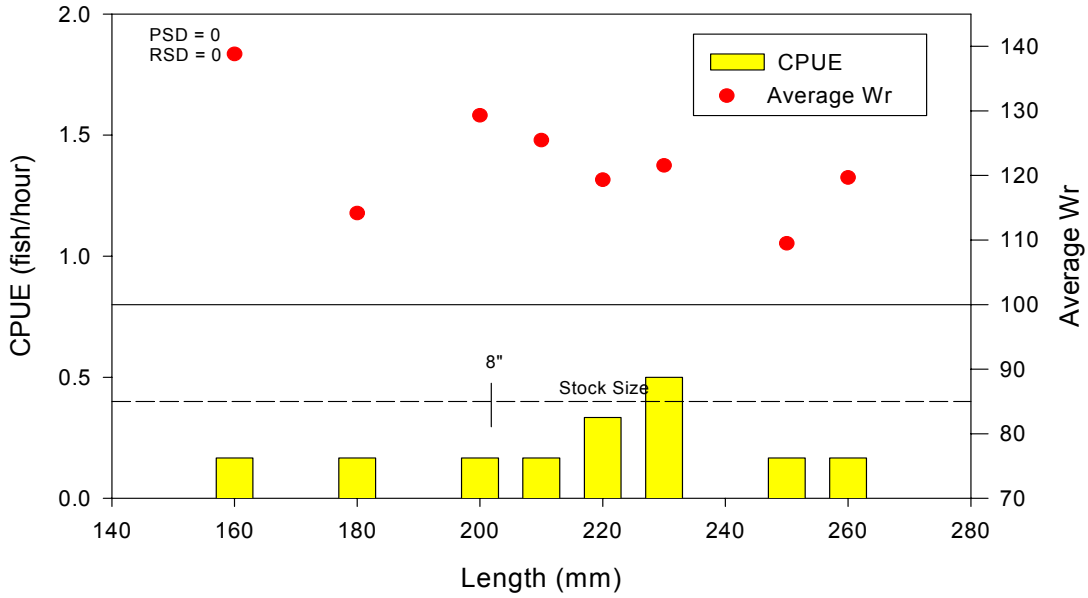


Figure 3. Largemouth bass collected by electrofishing in Silver Lake, Swan Lake National Wildife Refuge, on July 30, 1996.

Bluegill

The relative abundance of bluegill (17.7% of the total catch, 22.2% of the total catch without gizzard shad) collected by electrofishing was the highest in recent fishery surveys (Figure 2A). The CPUE of bluegill increased from 0 fish/hour in 1984 to 28 fish/hour in 1996 (Figure 1A). This dramatic increase is probably the result of increased habitat and productivity from flood events in 1993 and 1995. Bluegill flushed into Silver Lake from watershed streams and ponds likely contributed to this increase. Forty-three percent of the bluegill collected were of harvestable size (6 inches or greater). Harvestable size is the length at which anglers will generally decide a fish is worth keeping.

PSD of this sample was 44.4%, just above the ideal range of 20-40%. Most of the fish sampled were in the quality size range and should grow into the preferred size range in 1997. There is no RSD value for this population as no bluegill of preferred (8 inches), memorable (10 inches), or trophy size (12 inches) were collected (Figure 4). The condition of individual bluegill is good with an average Wr of 106.3, within the 90-110% range (Figure 4).

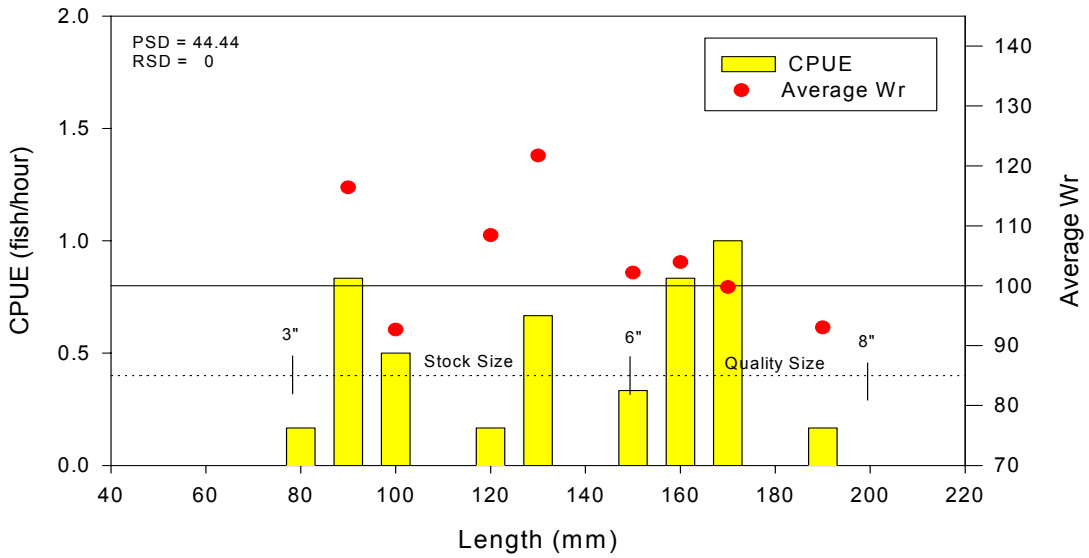


Figure 4. Bluegill collected by electrofishing in Silver Lake, Swan Lake National Wildlife Refuge, on July 30, 1996.

White Crappie

The largest number of white crappie sampled by electrofishing (24 fish/hour) were collected in 1996 (Figure 1A). Alternately, the smallest crappie sample ever collected in gill nets (0.19 fish/hour) was in 1996 (Figure 1B). This sample also exhibited the small relative abundance (5.8%) of net sampling (Figure 2B). The low relative abundance and CPUE of crappie in net samples is partially attributable to gear selectivity. Net samples in 1984, 1986, and 1992 were a combination of gill netting and trap netting while 1996 involved gill netting only. Trap nets are a much more effective crappie sampling gear.

The crappie sampled were in good condition with an average Wr of 118.5 in electrofishing samples and 120 in gill nets. The PSD of this sample was 33.3%, while the RSD was 28.6% (Figure 5). The majority of white crappie were stock or preferred size (6-8 or 10-12 inches). Twenty-nine percent of the white crappie collected by electrofishing and thirty-six percent of the white crappie collected in gill nets were of harvestable size (8 inches or larger). The number of harvestable and preferred size crappie should provide anglers with good fishing for this species.

Scales were removed from fourteen white crappie to determine the age structure of the population. One scale sample was unreadable due to scale regeneration. This occurs when scales are previously removed from the area due to sampling or injury. The oldest white crappie sampled were four years old and would have been spawned in the spring of 1992 (Figure 6). Growth rates fall midway within the acceptable range for white crappie in the Midwest (Carlander 1977).

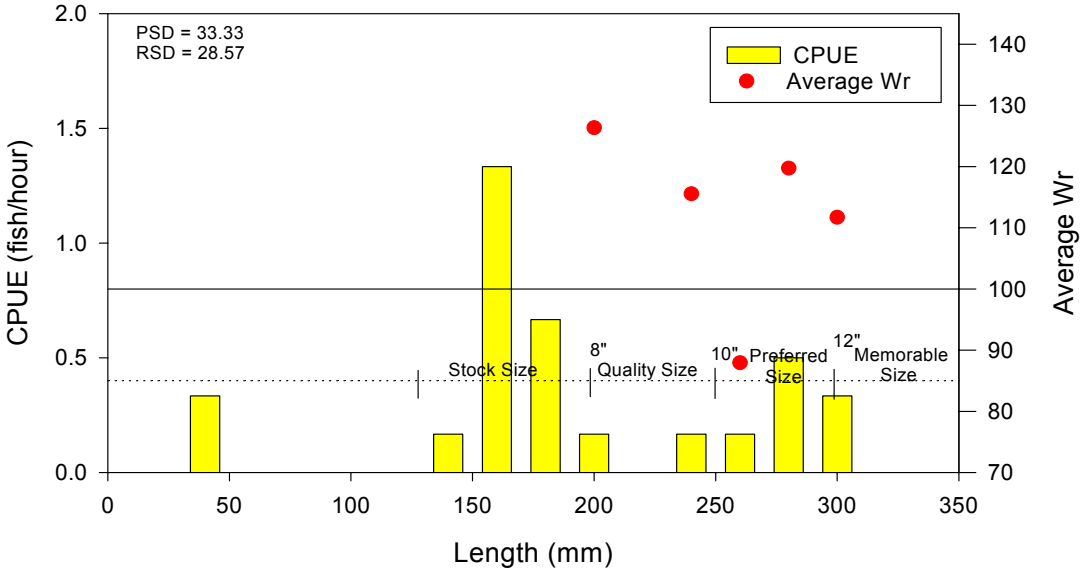


Figure 5. White crappie collected by electrofishing in Silver Lake, Swan Lake National Wildlife Refuge, on July 30, 1996.

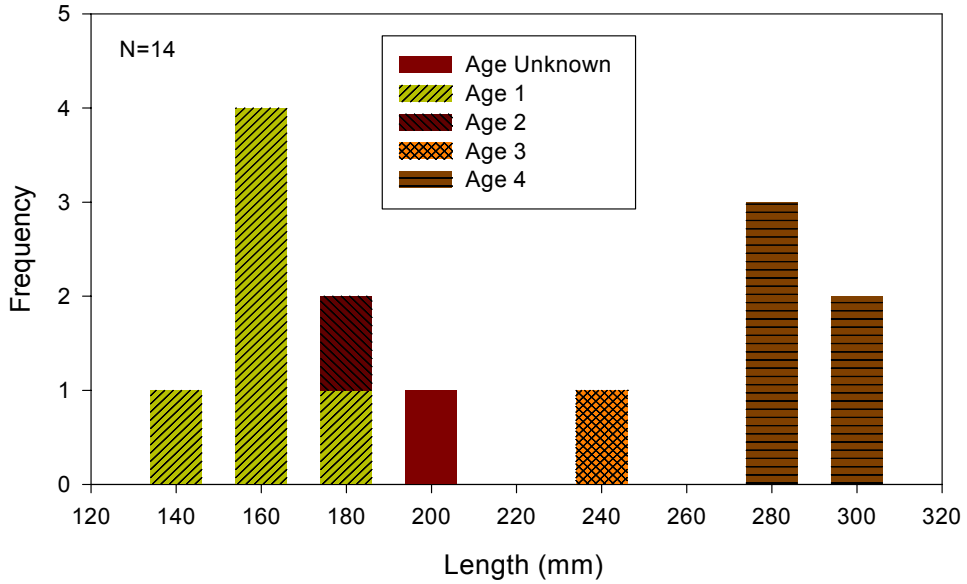


Figure 4. Derived ages of white crappie collected in Silver Lake, Swan Lake National Wildlife Refuge on July 30-31, 1996.

Common Carp

The CPUE of carp collected in both electrofishing and gill net samples increased markedly after Silver Lake was drawn down in 1988 (Figures 1A and 1B). CPUE in electrofishing samples increased from 2 fish/hour in 1984 to 25 fish/hour in 1992 and dropped to 16 fish/hour in 1996. CPUE in gill nets increased from 0.04 fish/hour in 1984 to a high of 0.54 fish/hour in 1992. CPUE in 1996 was 0.21 fish/hour. Relative abundance of carp looks relatively similar pre- and post-1988. The relative abundance in electrofishing samples decreased from 53% in the 1995 sample to 10% of the sample in 1996 (Figure 2A). Relative abundance of carp in gill nets decreased from a high of 31% in 1992 to 6.6% in 1996 (Figure 2B). Fifty percent of the carp sampled by electrofishing and eighty-eight percent sampled with gill nets were of harvestable size (greater than 12 inches). The large PSD (66.7% in electrofishing; 86.7% in gill nets) values are indicative of a population which is dominated by fish quality size (16 inches) or larger (Figures 7 and 8). The RSD (44.4% in electrofishing and 40% in gill nets) values indicate that several carp are also preferred size (21 inches) or larger. However, the carp were in poor condition with an average Wr of 79.4% in electrofishing samples and 80.7% in gill net samples (Figures 7 and 8). Commercial fishermen usually do not have a market for low quality fish.

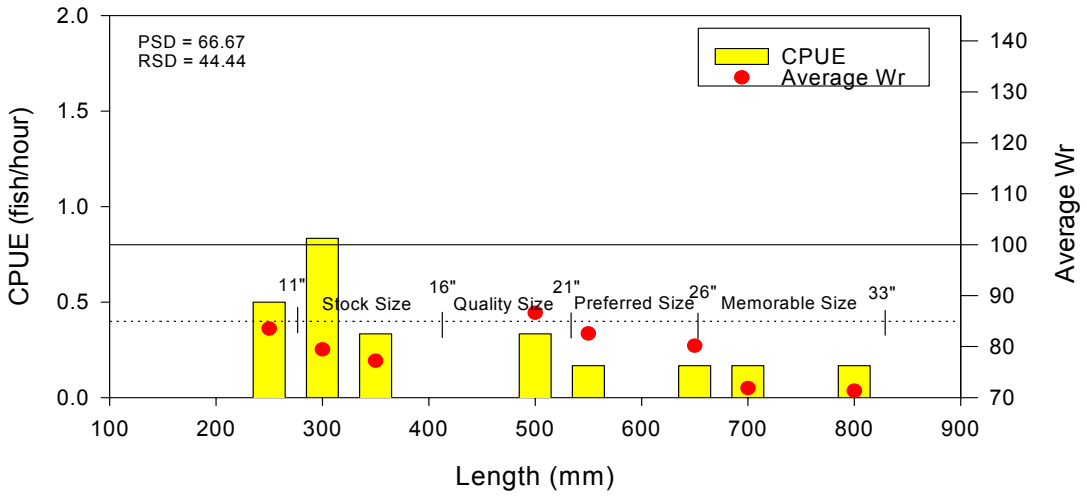


Figure 7. Common carp collected by electrofishing in Silver Lake, Swan Lake National Wildlife Refuge, on July 30, 1996.

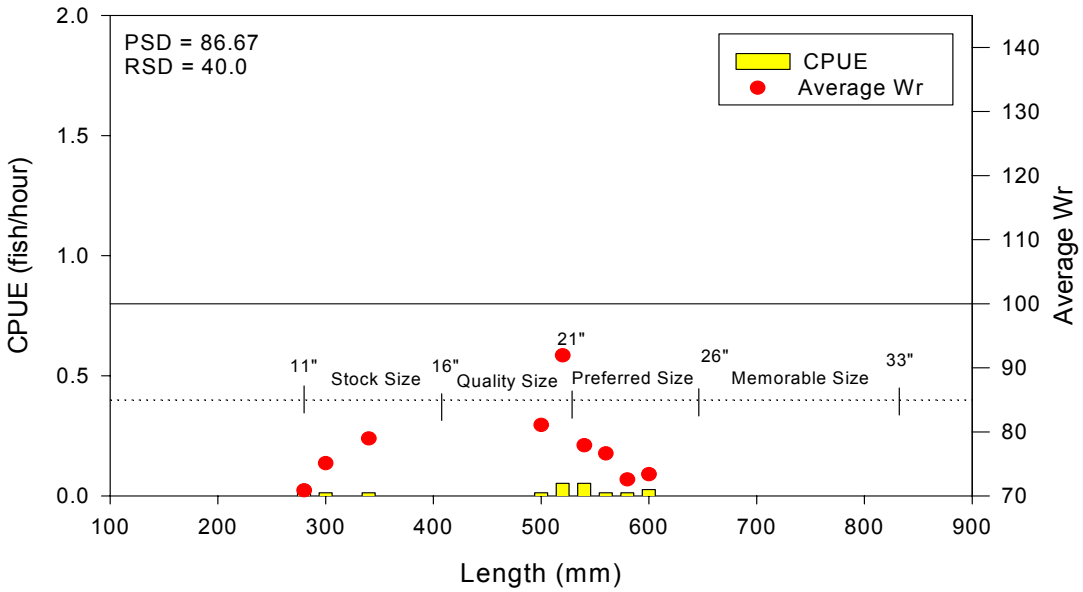


Figure 8. Common carp collected with gill nets in Silver Lake, Swan Lake National Wildlife Refuge, on July 30-31, 1996.

Catfishes

Electrofishing is generally not very effective for catfishes. No catfish were collected by electrofishing in Silver Lake. Eleven channel catfish were collected by gill nets. All of them exceeded the minimum harvestable size of 10 inches (250 mm). These fish were in poor condition with an average Wr of 83.2. Channel catfish are highly sought after by local anglers many of whom fish with set (trot) lines. Five channel catfish were collected by set lines. These fish also exceeded the minimum harvestable size and were in poor condition with an average Wr of 75.8. PSD of the combined catfish catch was 72.7, indicating that the majority of the catfish collected were quality size (Figure 9). The RSD value of 0 indicates that no channel catfish of preferred (24 inches or greater), memorable (28 inches or greater) or trophy (36 inches or greater) sizes were collected.

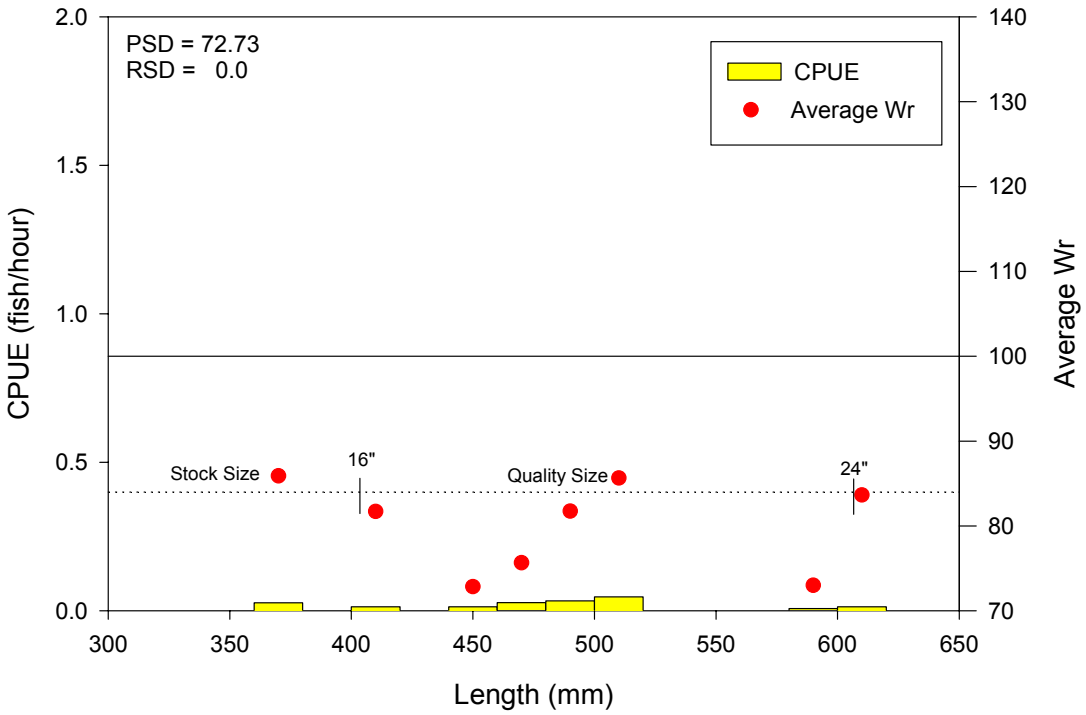


Figure 9. Channel catfish collected with gill nets and set lines in Silver Lake, Swan Lake National Wildlife Refuge on July 30-31, 1996.

Shortnose Gar

The shortnose gar is more tolerant of silt, high turbidity and poor water quality than other gars (Robison and Buchanan 1992). It is most abundant in quiet backwaters with sand and mud bottoms like Silver Lake. The shortnose gar may fill an important predator role in maintaining balanced fish populations in some waters (Robison and Buchanan 1992). It appears that this may be true in Silver Lake. While shortnose gar contributed the bulk of the gill net catch, relative weights and PSDs of forage species such as bluegill and black crappie were representative of balanced populations. Shortnose gar probably fill the trophic niche of top predator in shallow water environments with poor water quality such as Silver Lake. The shortnose gar has not been extensively studied, therefore, Wr, PSD, and RSD formulas have not been developed for this species.

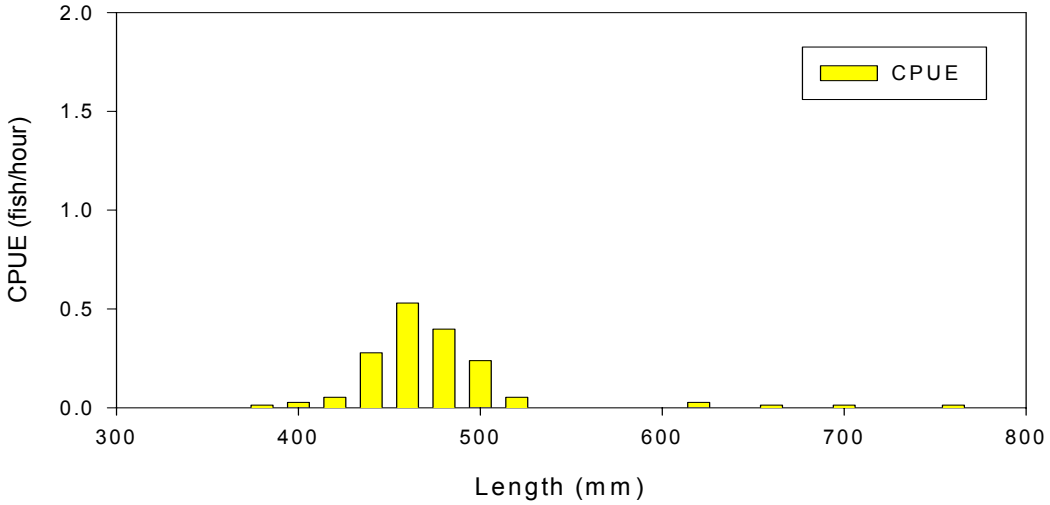


Figure 10. Shortnose gar collected with gill nets in Silver Lake, Swan Lake National Wildlife Refuge on July 30-31, 1996.

Discussion

The balance of Silver Lake appears to be skewed toward forage, commercial, and non-sport predator species. Carp, freshwater drum, shortnose gar, and bigmouth buffalo make up the majority of the fish sampled. However, the data indicate that approximately 15-20% of the fish community is comprised of species of interest to local anglers such as channel catfish, black bullhead, white crappie, black crappie, freshwater drum, and largemouth bass.

There is little that can be done to improve water quality in Silver Lake for sport fishes. Poor water quality is due to wind generated suspension and resuspension of sediments, high flushing rates from watershed runoff, and periodic backwater flooding from the Grand River system. However, extreme drawdown or draining approximately every 10 years may help consolidate sediments and rejuvenate the fish community. Currently, shortnose gar seem to be maintaining the predator:prey balance. Evidence for this exists in the Wr, PSD, and RSD values for bluegill and white crappie. Several

memorable size white crappie were collected in the fishery survey.

The most immediate need of the Silver Lake sport fishery is access. Most anglers fish from the rip-rap shore along the roads on the south and west sides of the lake. This terrain is inaccessible to disabled anglers. The boat ramp also needs to be rebuilt and deepened to facilitate launching.

Fish habitat such as brush piles should also be added near new fishing access points. Most of the beneficial fish habitat is in the northeast corner of Silver Lake and is inaccessible to shore anglers. Adding fish habitat may draw some desirable fish species to the access points particularly if water greater than 6-ft deep is available.

Recommendations

1. Increase access to Silver Lake. Replace and improve the boat ramp and launch area and provide disabled angler access where feasible.

2. Increase fish habitat, particularly near areas developed for angling access.

3. Monitor recreational and forage fish populations.

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Flickinger, S.A. and F.J. Bulow. 1993. Small Impoundments. Pages 469-492 in Kohler, C.C. and W.A. Hubert, editors. Inland Fisheries Management in North America. American Fisheries Society, Bethesda, Maryland.

Robison, H.W., and T.M. Buchanan. 1992. Fishes of Arkansas. The University of Arkansas Press, Fayetteville, Arkansas. 536 pp.

Appendix A. Fishes Collected in Silver Lake, Swan Lake National Wildlife Refuge, during previous fisheries surveys, 1984, 1986, and 1992.

Table 1A. Fish collected by electrofishing in Silver Lake, Swan Lake National Wildlife Refuge on, September 19-20, 1984 using pulse DC current (total effort 90 minutes (1.5 hours)).

Species	Number	Total Weight (kg)	Average Weight (g)	Average Total Length (mm)	Total Length Range (mm)	Percent Total Weight [2]	Percent Total Number [2]	CPUE No./Hr.	Number [1] Harvestable and (%)
CAP	3	3.72	1240.0	435.0	357-580	34.3	5.3	2	3(100)
CCF	5	1.27	254.6	302.8	147-380	11.7	8.8	3.3	4(80)
FRD	35	4.14	118.2	199.9	87-386	38.2	61.4	23.3	
SAB	2	0.13	65.0	171.0	170-172	1.2	3.5	1.3	0
WHC	12	1.59	132.5	159.2	71-326	14.7	21.1	8	4(33)
TOTAL[2]	57	10.85						38	
GZS	2	0.01	6.5	96.0	84-108				

1 Bluegill & other sunfish - 15 cm & Greater
Bullhead & Crappie - 20 cm & Greater
Flathead Catfish - 40 cm & Greater
Walleye, Carp & Buffalo - 30 cm & Greater
Largemouth Bass - 30 cm & Greater
Catfish - 25 cm & Greater

2. The total number of fish collected, percent total weight, and percent total number do not include gizzard shad as these fish were not collected in proportion to their abundance.

Table 2A. Fish collected by gill nets and trap nets in Silver Lake, Swan Lake National Wildlife Refuge on , September 19-20, 1984 (total effort 12 net-nights (245 hours)).

Species	Number	Total Weight (kg)	Average Weight (g)	Average Total Length (mm)	Total Length Range (mm)	Percent Total Weight	Percent Total Number	CPUE No./Hr.	Number [1] Harvestable and (%)
BIB	3	3.87	1290.0	431.0	402-454	11.0	1.6	0.012	3(100)
BLB	5	0.52	103.4	199.6	125-276	1.5	2.6	0.020	0
CAP	9	7.58	842.4	393.2	246-557	21.5	4.7	0.037	8(89)
CCF	5	2.77	553.2	335.8	158-625	7.9	2.6	0.020	4(80)
FRD	38	0.75	19.8	111.1	75-251	2.1	19.9	0.155	
GZS	5	0.06	12.0	110.0	84-133	0.2	2.6	0.020	
RCS	6	1.77	294.8	229.5	132-385	5.0	3.1	0.024	
SAB	2	1.19	595.0	322.0	248-396	3.4	1.0	0.008	1(50)
SNG	11	9.99	908.3	600.3	333-610	28.3	5.8	0.045	
WHC	103	6.43	62.4	124.7	66-332	18.2	53.9	0.420	40(39)
YEB	4	0.33	81.5	178.0	140-222	0.9	2.1	0.016	1(25)
TOTAL	191	35.32						0.759	

1 Bluegill & other sunfish - 15 cm & Greater
Bullhead & Crappie - 20 cm & Greater
Flathead Catfish - 40 cm & Greater
Walleye, Carp & Buffalo - 30 cm & Greater
Largemouth Bass - 30 cm & Greater
Catfish - 25 cm & Greater

Table 3A. Fish collected by electrofishing in Silver Lake, Swan Lake National Wildlife Refuge on August 6-7, 1986 using pulse DC current (total effort 150 minutes (2.5 hours)).

Species	Number	Total Weight (kg)	Average Weight (g)	Average Total Length (mm)	Total Length Range (mm)	Percent Total Weight [2]	Percent Total Number [2]	CPUE No./Hr.	Number [1] Harvestable and (%)
BIB	7	8.43	1204.3	414.7	366-472	15.8	7.1	2.8	7100)
BLG	3	0.23	77.0	149.0	141-156	0.4	3.03	1.2	2(67)
CAP	17	27.57	1621.8	500.4	392-566	51.5	17.17	6.8	17(100)
CCF	29	9.8	338.1	332.4	163-487	18.3	29.3	11.6	27(93)
FCF	3	0.17	55.0	171.3	155-190	0.3	3.03	1.2	0
FRD	18	4.75	263.8	257.4	93-445	8.9	18.2	7.2	
LMB	1	0.04	40	145	145	0.07	1.0	0.4	0
LNG	1	0.09	90	320	320	0.2	1.0	0.4	
WHC	18	2.26	112.4	182.9	55-270	4.2	18.2	7.2	7(39)
YEB	2	0.18	91.5	190.5	166-215	0.3	2.0	0.8	1(50)
TOTAL[2]	99	53.52						39.6	
GZS	78	0.23	2.9	58.4	52-115				N/A

1 Bluegill & other sunfish - 15 cm & Greater
Bullhead & Crappie - 20 cm & Greater
Flathead Catfish - 40 cm & Greater
Walleye, Carp & Buffalo - 30 cm & Greater
Largemouth Bass - 30 cm & Greater
Catfish - 25 cm & Greater

2. The total number of fish collected, percent total weight, and percent total number do not include gizzard shad as these fish were not collected in proportion to their abundance.

Table 4A. Fish collected by gill nets and trap nets in Silver Lake, Swan Lake National Wildlife Refuge on August 05-06, 1986 (total effort 12 net-nights (268.5 hours)).

Species	Number	Total Weight (kg)	Average Weight (g)	Average Total Length (mm)	Total Length Range (mm)	Percent Total Weight	Percent Total Number	CPUE No./Hr.	Number [1] Harvestable and (%)
BIB	6	5.44	907.0	323.0	85-485	8.3	1.9	0.022	4(67)
BLB	12	1.0	83.0	170.8	91-255	1.5	3.9	0.045	0
CAP	12	14.5	1208.5	415.1	116-575	22.2	3.9	0.045	9(75)
CCF	33	9.52	288.5	317.0	116-572	14.6	10.7	0.123	29(88)
FRD	16	2.48	154.8	212.5	77-305	3.8	5.2	0.060	
GSF	3	0.04	12.7	88.7	84-92	0.06	1.0	0.011	0
GZS	79	1.1	13.8	105.4	60-316	1.7	25.5	0.294	N/A
LMB	1	0.02	19	112	112	0.03	0.3	0.004	0
RCS	1	0.98	980	386	386	1.5	0.3	0.004	
SAB	2	1.19	595.0	322.0	248-396	3.4	1.0	0.008	1(50)
SNG	14	12.5	892.9	600.9	330-727	19.2	4.5	0.052	
WHC	128	16.46	128.6	192.4	60-346	25.2	41.3	0.477	62(48)
YEB	5	1.21	242.0	249.0	205-300	1.9	1.6	0.019	5(100)
TOTAL	310	65.25						1.155	

1 Bluegill & other sunfish - 15 cm & Greater
Bullhead & Crappie - 20 cm & Greater
Flathead Catfish - 40 cm & Greater
Walleye, Carp & Buffalo - 30 cm & Greater
Largemouth Bass - 30 cm & Greater
Catfish - 25 cm & Greater

Table 5A. Fish collected by electrofishing in Silver Lake, Swan Lake National Wildlife Refuge on July 21 and 23, 1992 using pulse DC current (total effort 90 minutes (1.5 hours)).

Species	Number	Total Weight (kg)	Average Weight (g)	Average Total Length (mm)	Total Length Range (mm)	Percent Total Weight[2]	Percent Total Number[2]	CPUE No./Hr.	Number[1] Harvestable and (%)
BIB	4	1.54	383.8	229.5	48-402	7.0	5.6	2.67	1(25)
BLB	5	0.45	89.0	177.4	165-202	2.1	6.9	3.3	0
BLG	2	0.09	46.5	129.0	125-133	0.4	2.8	1.3	0
CAP	38	18.23	479.6	296.0	226-718	83.5	52.8	25.3	6(16)
CCF	2	0.14	68.5	204.0	174-234	0.6	2.8	1.3	0
FRD	13	0.75	58.0	173.2	148-198	3.4	18.1	8.67	
RSH	1	0.004	4	60	60	0.02	1.4	0.67	
WHC	6	0.53	88.2	184.3	162-241	2.4	8.3	4.0	1(17)
YEB	1	0.11	110	193	193	0.5	1.4	0.67	
TOTAL[2]	72	21.844							
GZS	229	1.28	5.6	80.7	38-207			152.7	N/A

1 Bluegill & other sunfish - 15 cm & Greater
Bullhead & Crappie - 20 cm & Greater
Flathead Catfish - 40 cm & Greater
Walleye, Carp & Buffalo - 30 cm & Greater
Largemouth Bass - 30 cm & Greater
Catfish - 25 cm & Greater

2. The total number of fish collected, percent total weight, and percent total number do not include gizzard shad as these fish were not collected in proportion to their abundance.

Table 6A. Fish collected by gill nets and trap nets in Silver Lake, Swan Lake National Wildlife Refuge on July 20-21 and 22-23, 1992 (total effort 12 net-nights (237.42 hours)).

Species	Number	Total Weight (kg)	Average Weight (g)	Average Total Length (mm)	Total Length Range (mm)	Percent Total Weight	Percent Total Number	CPUE No./Hr.	Number [1] Harvestable and (%)
BIB	13	4.58	352.5	256.3	60-457	4.56	3.1	0.055	2(15)
BLB	49	4.36	88.9	185.2	135-252	4.34	11.6	0.206	0
BLG	8	0.25	31.6	117.8	93-182	0.25	1.9	0.034	1(13)
CAP	129	57.43	445.2	301.5	203-710	57.14	30.6	0.543	95(74)
CCF	5	2.94	587.8	247.0	117-605	2.92	1.2	0.021	1(20)
FRD	10	0.38	38.3	138.3	73-192	0.38	2.4	0.042	
GOS	3	0.12	39.3	143.3	105-215	0.12	0.7	0.013	N/A
GZS	2	0.07	33.5	139.5	92-187	0.07	0.5	0.008	N/A
RSH	1	0.006	6	78	78	0.006	0.2	0.004	N/A
SAB	1	0.38	378	300	300	0.38	0.2	0.004	1(100)
SNG	16	14.63	914.9	596.9	523-773	14.56	3.8	0.067	
WHC	168	12.87	76.6	143.1	55-263	12.80	39.8	0.708	17(10)
YEB	17	2.50	147.1	204.9	84-300	2.49	4.0	0.072	7(41)
TOTAL	422	100.516						1.777	

1 Bluegill & other sunfish - 15 cm & Greater
Bullhead & Crappie - 20 cm & Greater
Flathead Catfish - 40 cm & Greater
Walleye, Carp & Buffalo - 30 cm & Greater
Largemouth Bass - 30 cm & Greater
Catfish - 25 cm & Greater