FISHERY MANAGEMENT REPORT
DESOTO NATIONAL WILDLIFE REFUGE
Missouri Valley, Iowa

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INTRODUCTION

DeSoto Lake is an 800-acre oxbow lake of DeSoto National Wildlife Refuge (DeSoto NWR) located along the Nebraska-Iowa border. Fishery surveys of the lake have been conducted by the Columbia Fishery Resources Office to assess changes in the fish community and to guide management efforts to enhance fishing opportunities for the public. Largemouth bass and crappie are the favored sport fish in the lake.

The most recent survey to assess the DeSoto Lake fish community was conducted May 22-24, 2001 in cooperation with the Iowa Department of Natural Resources (IADNR) Cold Springs fisheries office. Scales, otoliths, and spines were obtained from selected species to assess age and growth of the respective populations in the lake.

METHODS

The DeSoto Lake fish community was sampled using fyke nets and electrofishing various sites throughout the lake. Fourteen fyke nets were set for two days. Fyke nets consisted of a 40 ft. lead, two rectangular frames (30 in. X 48 in.), and five 2 ft. diameter hoops consisting of ½ in. mesh. One 30-minute and eight 15-minute electrofishing runs were conducted using a boom-mounted electrofishing boat. Settings used were pulsed DC current, 300-600 Volts, 7-11 amps, 20-millisecond pulse width with 60 pulses per second. Sampling sites are displayed in Figure 1.

Fish captured were identified to species, weighed (g) and measured (mm). Scales and otoliths were removed from representative samples of black crappie, white crappie and bluegill. Scales were removed from largemouth bass and scales and spines were collected from common carp. Age and growth data was processed by the IADNR fisheries office located in Spirit Lake, Iowa. Due to a backlog of samples, black crappie otoliths and scales were not processed, therefore, age and growth information was not presented in this report.

Air temperature during sampling was in the low 60s (F) with west winds ranging from 20-25 mph. Water temperature ranged from 63-66^{o}F, secchi disc readings ranged from 0.84-0.97 m and water conductivity was 550 mmho/cm.

Indices

Established indices developed from long-term databases are used to evaluate the DeSoto Lake fishery. Several assumptions are made when using statistical indices to evaluate fish populations. Although the assumptions are made that all fish species and all sizes within a species are equally susceptible to the collection gear in the statistical realm they are not true in the biological realm. 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, buffalo, white bass, and walleye, which occupy the open offshore area known as the pelagic zone, are generally out of the effective electrofishing range of 6ft of depth; so these species are not collected in proportion to their abundance. Crappie species, which occupy areas a little deeper and further offshore than other sunfishes, are most effectively collected with fyke nets when they move inshore to spawn in the spring.

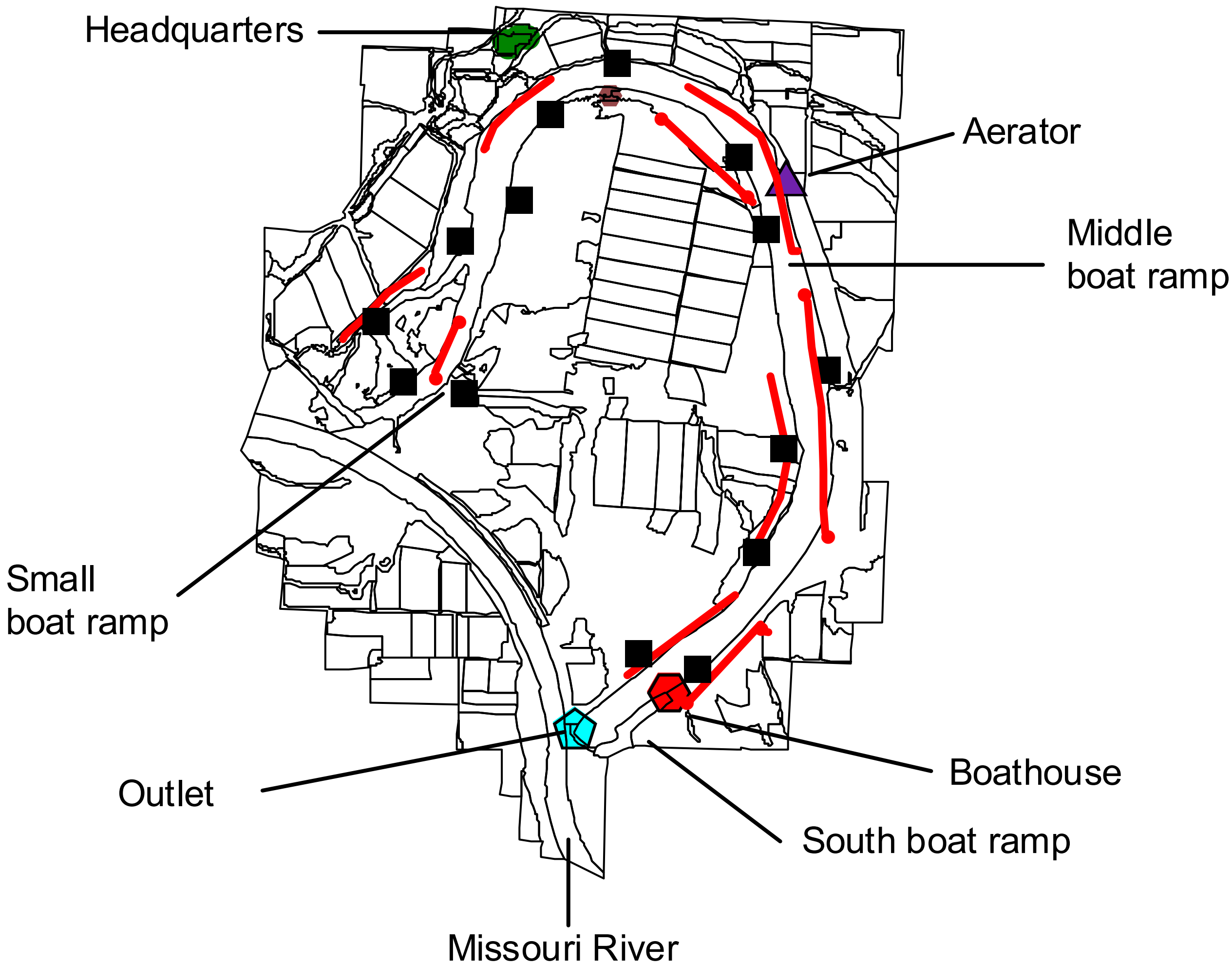


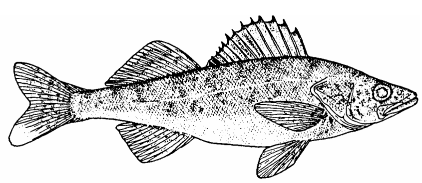
Figure 1. Sample locations for electrofishing runs and fyke nets, DeSoto Lake, DeSoto National Wildlife Refuge, 2001. Lines represent electrofishing runs and squares represent locations of fyke nets.

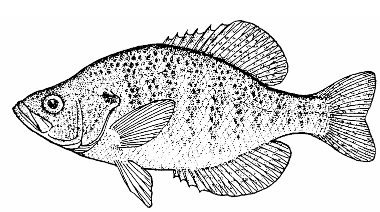
Relative abundance and catch per unit effort (CPUE) are two indices used to detect trends in DeSoto Lake. These trends may indicate whether a fish species is increasing or decreasing in abundance over time. Indices such as these must be interpreted cautiously since they can be biased by non-random fish distribution, timing of sampling and gear selectivity. For example, bigmouth buffalo appear to have declined since 1994; however, their true abundance is generally under-represented due to gear inefficiency.

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. Formulas used to calculate Wr are species specific. 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 indicate that predator:prey ratios are not balanced and 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 higher the percentage, the greater the proportion of large fish. PSD is calculated by dividing the number of fish ≥ quality size by the number of fish ≥ stock size multiplied by 100 (Flickinger and Bulow 1993). Sizes are based on percentages of world record length. This standardization allows for the discussion of different water bodies from different 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 presented 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.





RESULTS

Sampling effort in 2001 included 2.5 electrofishing hours and 644.5 fyke net hours. High water levels in the lake from heavy rains in the spring may have resulted in lower catches. Species collected in the 2001 survey are listed in Table 1.

Common carp and bluegill were numerically the dominant fish species collected in 2001 electrofishing samples comprising 39 percent and 19 percent of the electrofishing catch, respectively (Table 2). Common carp and largemouth bass dominated biomass comprising 72.3 percent and 9.3 percent of the total sample weight.

Black crappie and white crappie dominated fyke net samples comprising 47.5 percent and 21.3 percent of the fish sampled from fyke nets in 2001, respectively (Table 3). A single channel catfish and flathead catfish comprised the greatest percentage of the sample weight at 32.9 percent and 31.5 percent, respectively.

Table 1. The following fish species were collected in DeSoto Lake, De Soto National Wildlife Refuge in 2001.

Code	Common Name	Species Name	Role
BIB	Bigmouth buffalo	*Ictiobus cyprinellus*	Commercial fish
BLC	Black crappie	*Pomoxis nigromaculatus*	Sport or forage fish
BLG	Bluegill	*Lepomis macrochirus*	Sport or forage fish
CCF	Channel catfish	*Ictalurus punctatus*	Sport fish
CAP	Common carp	*Cyprinus carpio*	Commercial fish
FHC	Flathead catfish	*Pylodictis olivaris*	Sport fish
FRD	Freshwater drum	*Aplodinotus grunniens*	Sport fish
GSF	Green sunfish	*Lepomis cyanellus*	Sport or forage fish
GZS	Gizzard shad	*Dorosoma cepedianum*	Forage fish
LMB	Largemouth bass	*Micropterus salmoides*	Sport fish
WAE	Walleye	*Stizostedion vitreum*	Sport fish
WHC	White crappie	*Pomoxis annularis*	Sport or forage fish
WHB	White bass	*Morone chrysops*	Sport fish
YEB	Yellow bullhead	*Ameiurus natalis*	Sport fish

Table 2. Fish species collected from electrofishing DeSoto Lake, DeSoto National Wildlife Refuge, 2001.

Species	Number	Total Weight (kg)	Average Weight (g)	Length Range (mm)	Average Length (mm)	Percent Total Weight	Percent Total Number	CPUE No./Hr.	Percent harvestable
BIB	1	4.86	4858.81	665.48	665.48	2.2	0.3	0.40	100%
BLC	20	1.54	76.90	104.1 - 203.2	169.23	0.7	5.7	8.00	5%
BLG	66	3.13	47.40	55.9 - 248.9	113.32	1.4	18.9	26.40	21%
CAP	136	163.30	1200.73	285.8 - 635	461.22	72.3	38.9	54.40	99%
CCF	7	14.18	2025.53	419.1 - 767.1	531.95	6.3	2.0	2.80	100%
FRD	7	8.52	1216.96	342.9 - 533.4	435.43	3.8	2.0	2.80	-
GSF	31	1.60	51.48	58.42 - 160.0	114.14	0.7	8.9	12.40	-
GZS	2	1.31	653.76	375.9 - 383.5	379.73	0.6	0.6	0.80	-
LMB	63	20.96	332.65	101.6 - 490.2	268.21	9.3	18.0	25.20	10%
WAE	3	3.33	1111.37	408.9 - 533.4	490.22	1.5	0.9	1.20	100%
WHB	2	0.87	435.84	335.3 - 345.4	340.36	0.4	0.6	0.80	-
WHC	12	2.13	177.56	218.4 - 254.0	234.10	0.9	3.4	4.80	100%
TOTAL	350	225.72							

*Bluegill & other sunfish - ≥15 cm Bullhead & Crappie - ≥20 cm Flathead catfish - ≥40 cm Channel catfish - ≥ 25 cm Walleye, Carp & Buffalo - ≥30 cm Largemouth bass - ≥38 cm

Table 3. Fish species captured in fyke nets deployed in DeSoto Lake, DeSoto National Wildlife Refuge, 2001.

Species	Number	Total Weight (kg)	Average Weight (g)	Length Range (mm)	Average Length (mm)	Percent Total Weight	Percent Total Number	CPUE No./Hr.	Percent harvestable
BLC	58	4.6	79.4	81.3 - 266.7	168.2	15.92	47.54	0.089	1.7%
BLG	20	0.4	24.4	58.4 - 134.6	96.0	1.53	16.39	0.031	0
CCF	1	9.5	947.0	477.5	477.5	32.85	0.82	0.002	100%
FCF	1	9.1	9080.0	889	889.0	31.50	0.82	0.002	100%
GSF	13	N/A	N/A	N/A	N/A	N/A	10.66	0.020	-
WAE	1	1.483	1483.0	617.2	617.2	5.14	0.82	0.002	100%
WHB	1	77g	77.0	190.5	190.5	<1.0	0.82	0.002	-
WHC	26	3.762	144.7	137.2 - 304.8	217.8	13.05	21.31	0.040	69.2%
YEB	1	N/A	N/A	N/A	N/A	N/A	0.82	0.002	-
TOTAL	122	28.825							

*Bluegill & other sunfish - ≥15 cm Bullhead & Crappie - ≥20 cm Flathead catfish - ≥40 cm Channel catfish - ≥ 25 cm Walleye, Carp, & Buffalo - ≥30 cm Largemouth bass - ≥38 cm

Figure 2 and Figure 3 depict relative abundance and CPUE of selected fish species in the lake from electrofishing. Relative abundance and CPUE of common carp have been consistently and considerably high in comparison to other species captured throughout the years. Relative abundance of bigmouth buffalo has steadily declined since 1995. Electrofishing is not the most effective gear used to collect this species and underestimates true abundance. Trammel netting throughout the year by commercial fishermen may be more representative of the population in the lake.

Relative abundance and CPUE of black bullhead have declined significantly since 1994. Only a few were collected in fyke net samples in 1996 and 1997. No black bullheads were collected in 2001; however, one yellow bullhead was captured. Black crappie, bluegill and green sunfish abundance in the lake seems cyclic in nature. Relative abundance of walleye in DeSoto Lake surveys has been low due to gear inefficiency. Walleye have a habitat preference for deep water. The small walleye population in the lake is maintained through stockings because natural reproduction usually does not occur in Iowa lakes.

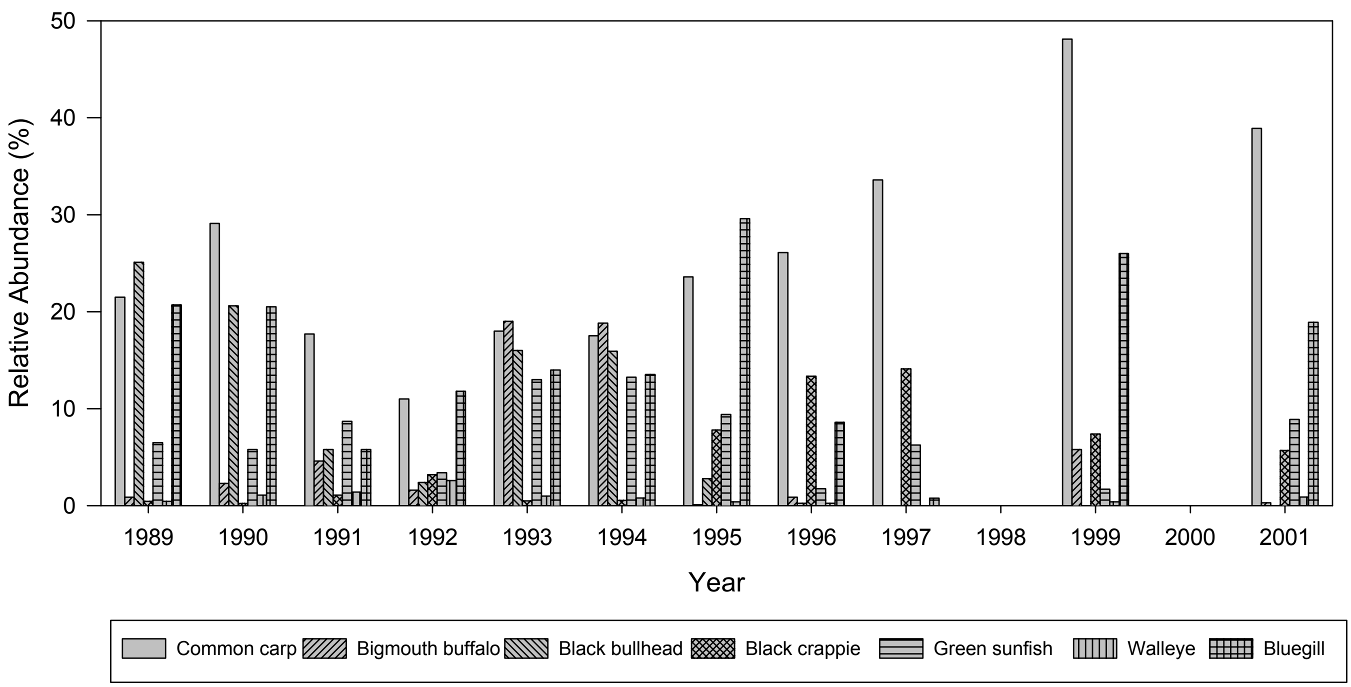


Figure 2. Relative abundance of selected fish species collected from electrofishing DeSoto Lake, DeSoto National Wildlife Refuge, 1989-2001.

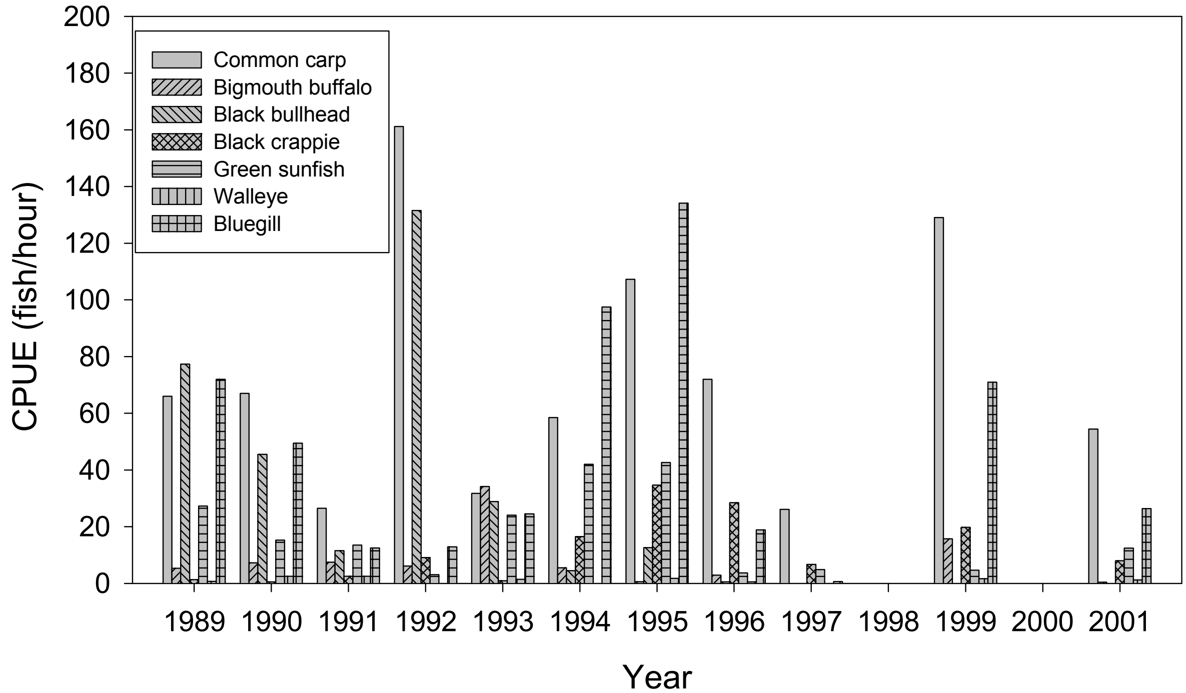
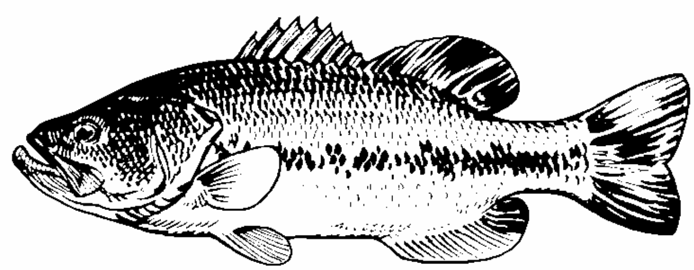


Figure 3. CPUE of sport fishes collected from electrofishing DeSoto Lake, DeSoto National Wildlife Refuge, 1989-2001.



Largemouth Bass

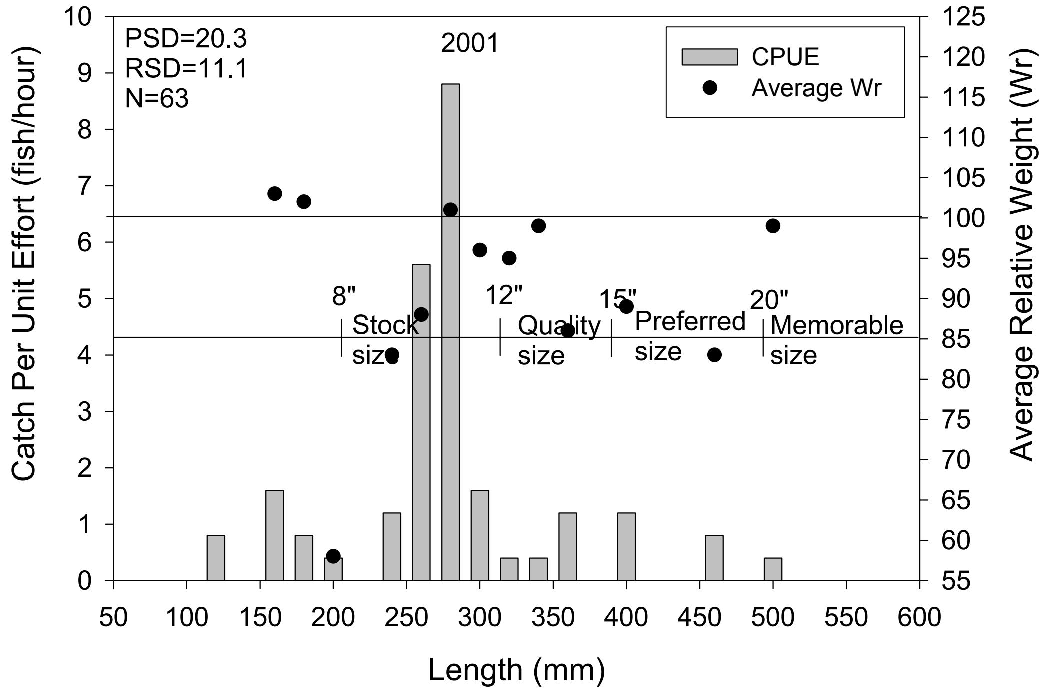
Largemouth bass are the most abundant and dominant predator of DeSoto Lake. They are important in maintaining desirable predator-prey equilibrium and serve as indicators of overall status of recreational fishery resources in small to medium size impoundments. Sixty-three largemouth bass were captured in the 2001 electrofishing survey comprising 10 percent of the total electrofishing catch. Average length of bass collected was 268 mm. This was a decrease from an average length of 328.5 mm in 1999.

The majority of bass (68 percent) collected in 2001 were between 203-304 mm (8-12 inches). Highest CPUE were bass in the 261-280 mm (10-11 inches) length group (Figure 4). In 1999, the majority of bass (52 percent) sampled were between 381 and 508 mm (15-20 inches) and highest CPUE were bass in the 431-440 mm (17-17.3 inches) length group. Largemouth bass were in good condition with an average Wr of 93.8. However, average body condition decreased over the last several fishery surveys. A decrease in the abundance of preferred prey size may be the reason for the decline in relative weights.

Figure 5 depicts electrofishing CPUE of bass over 150 mm (6 inches) and 380 mm (15 inches) across an eleven year period. Bass 150 mm in length are considered stock size. CPUE of bass greater than 150 mm increased in 2001 in comparison to the past several surveys of the lake; however CPUE of bass greater than 380 mm decreased to that similar in 1995 and 1996. Decline of bass over 380 mm in 2001 may be due to natural mortality or harvest. Current minimum length limit on bass is 380 mm with a daily bag limit of three. A decrease in CPUE of larger bass also may be an artifact of inefficient sampling due to high water in May.

PSD of the DeSoto largemouth bass population is the percentage of fish in the sample greater than 203 mm (8 inches), which is also greater than 304 mm (12 inches). A balanced bass population will have a PSD between 40 percent and 60 percent. RSD is a measure of the size structure of bass >380 mm in length. RSD is the percentage of a sample greater than 203 mm that is also greater than 380 mm. The ideal range is between 20 percent and 30 percent. PSD of this bass sample was 20.3 and RSD of the sample was 11.1 percent, both below the desirable ranges (Figure 6). This was the first sample year since 1989 that PSD and RSD levels dropped below the desirable ranges. Low PSD and RSD levels indicated a disproportionately low number of large bass in the population. Since the mid 1990s, the bass population has been dominated by intermediate and large size fish, providing a quality fishery for avid anglers. However, the relatively high PSD and RSD levels from 1994-1999 indicated that there was most likely a problem with young bass recruiting to the fishery (Milligan 1994; Milligan 1995; Grady and Milligan 1997). Low PSD and RSD levels from 2001 indicated that young bass, 203-304 mm, were currently dominating the population of the lake. This was a positive indication that a higher number of young bass survived the first winter and recruited to the fishery.

Scales were obtained from 35 largemouth bass to assess age structure and growth in the population. Bass Age II to Age IX were represented (Figure 7). The majority of bass collected were Age III from the 1998 year class. Few older bass, Ages VII through IX (1992-1994 year classes) were present, suggesting these fish either died from natural mortality or were removed by anglers, as previously mentioned. Age IV and Age V bass probably represented intermediate sizes (304 to 381 mm), but few were collected. Low abundance of these cohorts suggests that either spawning in those years (1995-1997) was not as successful due to some unfavorable environmental condition or recruitment was low due to predation or competition for preferred prey.



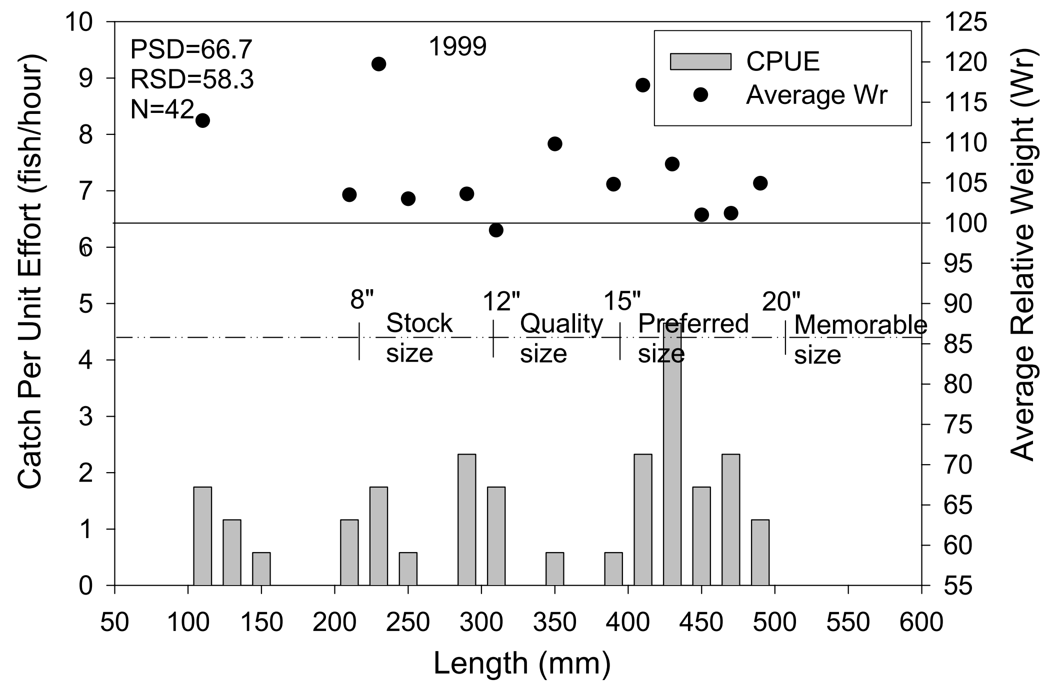


Figure 4. Largemouth bass collected from electrofishing DeSoto Lake, DeSoto National Wildlife Refuge in 2001 (upper) and 1999 (lower).

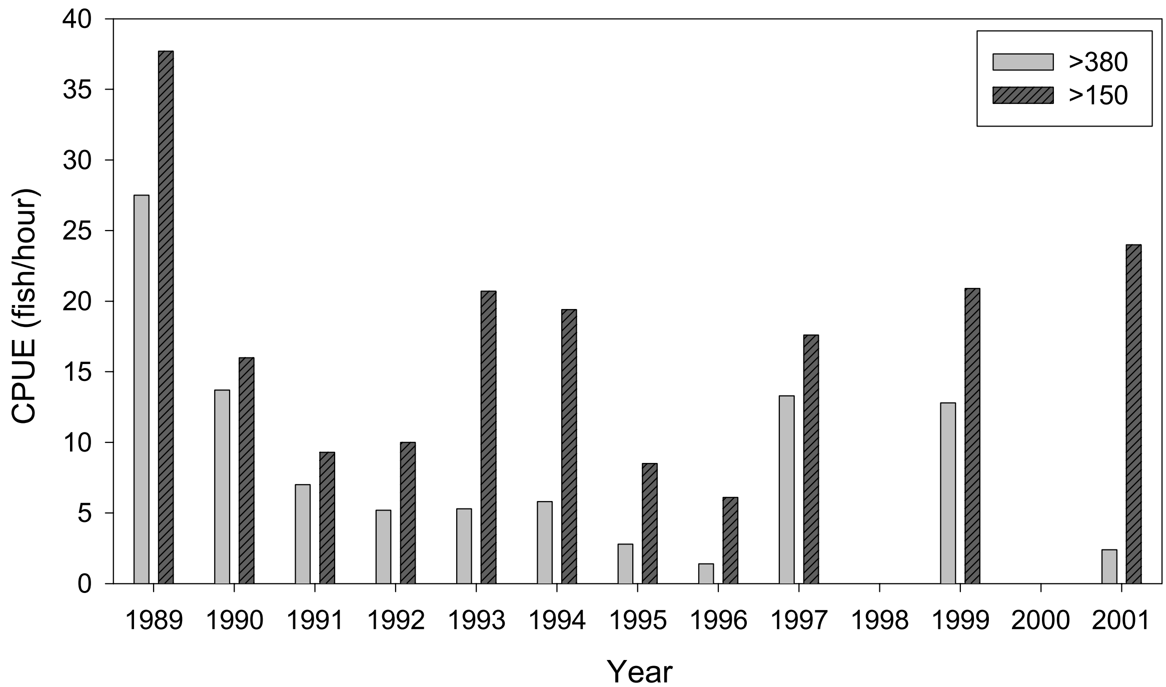


Figure 5. CPUE of largemouth bass captured in both community and bass samples from 1989-2001, DeSoto Lake, DeSoto National Wildlife Refuge.

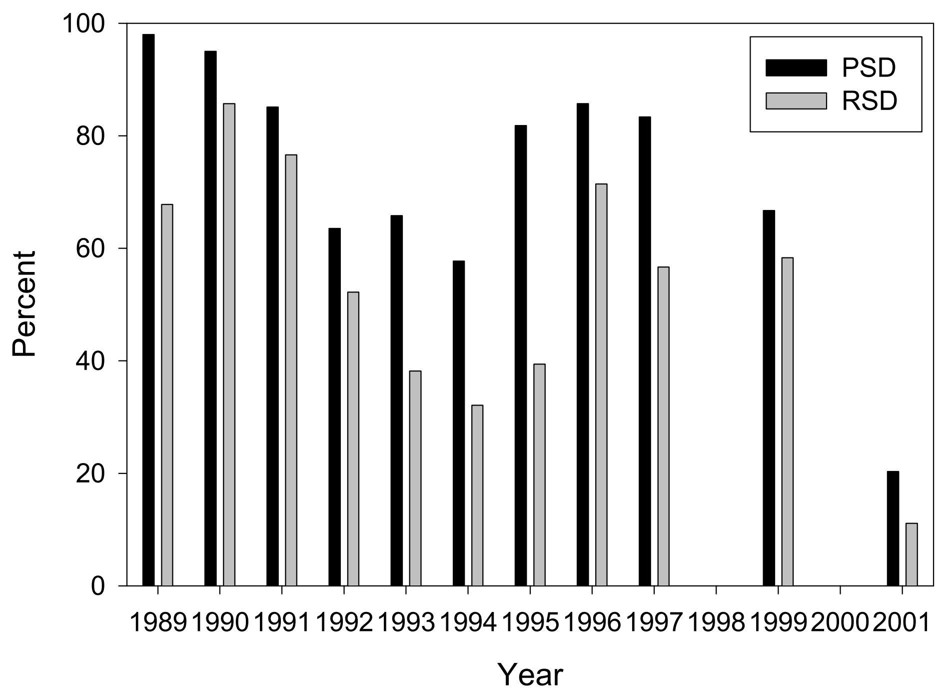


Figure 6. PSD and RSD of largemouth bass captured in both community and bass samples from 1989-2001, DeSoto Lake, DeSoto National Wildlife Refuge.

Largemouth bass typically average 102 to 150 mm (4-6 inches) in the first year, 203 to 304 mm (8-12 inches) in the second year and up to 432 mm (17 inches) in the third year (Harlan et al 1987). The ideal size of bass entering their first winter at DeSoto Lake is about 127-150 mm. Survival is highly dependent upon growth during the first year. Bass less than 127 mm in length may not have the energy reserves needed to make it through their first winter reducing survival rates of that cohort. Average young-of-the-year (YOY) growth of bass in this sample ranged from 78.7 to 150 mm (3.1-5.0 inches) for the 1992 to 1999 year classes (Figure 8; source:IADNR 2003)). Cohorts from 1997 and 1998 fell well below the size range of YOY bass in Iowa lakes. With exception of the 1997 and 1998 year classes, second year growth was within the average 203-304 mm (8-12 inches) range (Figure 9). Although there was a strong 1998 year class, slow growth in the first year may have been attributed to competition with bluegill for zooplankton and other benthic organisms or competition among high densities of YOY bass. If bass did not attain a large enough size to switch over to a piscivorous diet by the onset of winter, and individuals survived the winter, slow growth continued into the second year. The wide variation in size of the 1998 year class seen in Figure 7 was most likely the result of varied growth in the first and second year.

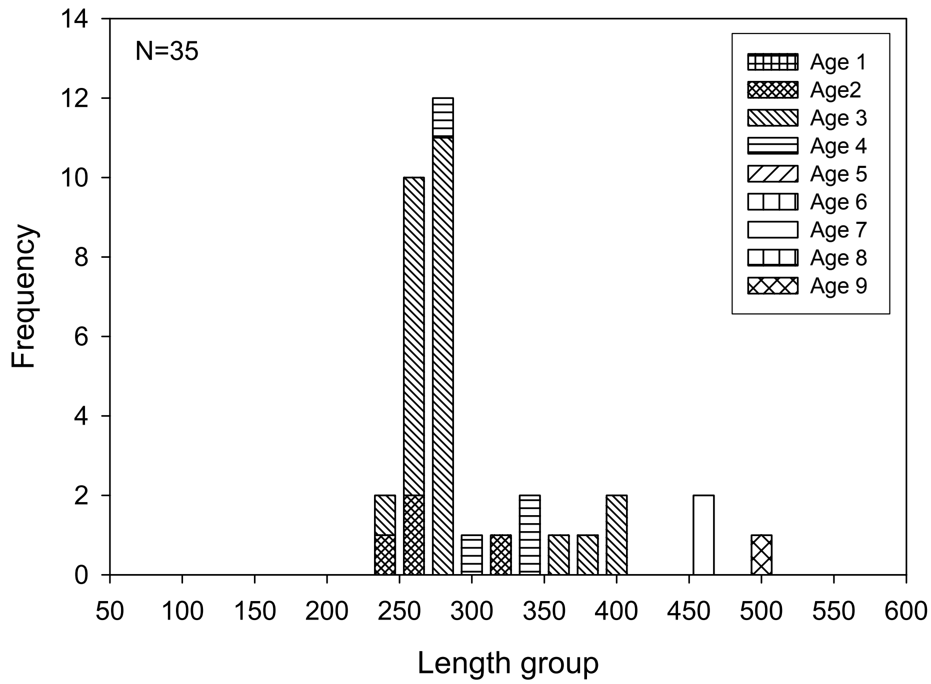


Figure 7. Age distribution of largemouth bass at various lengths collected from DeSoto Lake, DeSoto National Wildlife Refuge, 2001.

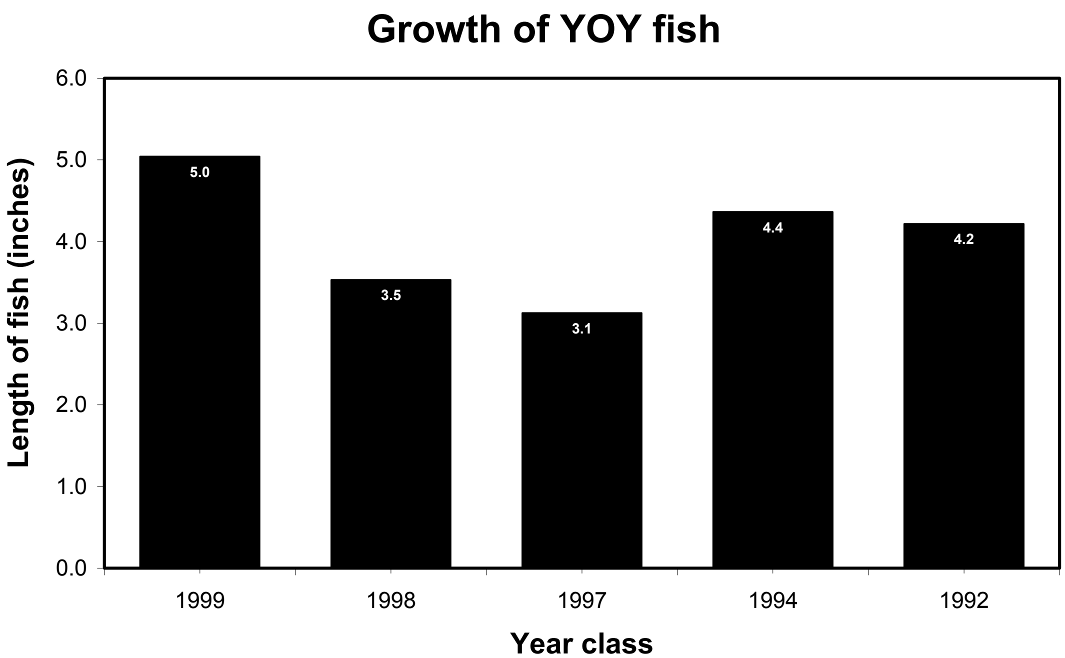


Figure 8. Average YOY growth of largemouth bass for each year class, DeSoto Lake, DeSoto National Wildlife Refuge, May 2001 (source: IADNR 2003).

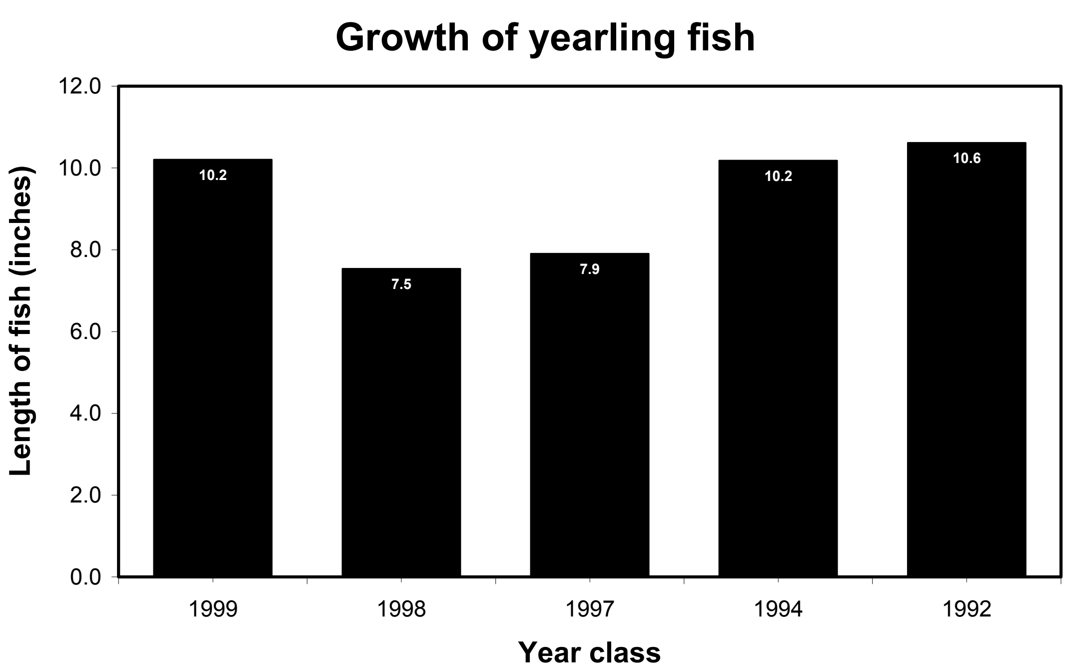


Figure 9. Average second year growth of largemouth bass for each year class, DeSoto Lake, DeSoto National Wildlife Refuge, May 2001 (source: IADNR 2003).

Bluegill

Relative abundance of bluegill in 2001 was 19.0 percent, down from 26.1 percent in 1999. Electrofishing CPUE of bluegill was 26.4 fish/hr. This was a decrease from 71 fish/hr in 1999. CPUE was highest for fish in the 60-70 mm (2.4-2.8 inch) range and 120-130 mm (4.7-5.1 inch) range at 5.2 fish/hr (Figure 10). Average size of bluegill collected was 113 mm, a decrease from 122 mm reported in 1999. There are no length limits on bluegill in the lake, but acceptable harvest size is about 150 mm or 6 inches. Twenty-one percent of the bluegill sampled in 2001 were considered harvestable size, a decrease from 37 percent in 1999. Bluegill overall were in very good condition with an average Wr of 118.

PSD of the DeSoto Lake bluegill population is the percentage of fish in the sample greater than 76 mm (3 inches) which is also greater than 150 mm (6 inches). Suggested PSD range of bluegill indicative of a balanced fishable population is 20-40% (Anderson 1980). PSD of bluegill captured by electrofishing in the 2001 survey was 30 percent, falling in the middle of the desirable range. In previous years, bluegill captured during surveys were not large enough in size to calculate RSD values. In 2001, a low RSD value of 2.2 was calculated. This was calculated from a single 203 mm (8 inches) fish.

Thirty-seven bluegill were aged using scales. Bluegill Age I through Age V are represented in Figure 11 with Ages I, II, and III dominating the sample. Based on size structure and age structure of the bluegill in this survey and from previous surveys of the lake, abundance of larger (>203 mm) older bluegill (>Age 4) have been consistently low from year to year.

Bluegill were reported small in size or stunted in previous fishery surveys. First year growth for year classes 1996 through 1999 corroborates that. Average first year growth ranged from 45.7 to 68.6 mm (1.8 to 2.8 inches) for year classes 1996-2000 (Figure 12; source:IADNR 2003). Average YOY growth in DeSoto Lake was much lower than the average 70 mm (2.7 inches) found in YOY bluegill in Iowa lakes (Carlander 1977), with exception of the 2000 year class. Average cumulative growth in the second year for various cohorts greatly improved, with growth falling in the upper range of those collected from Iowa lakes at 94 mm (3.7 inches). Slow growth of YOY may be due to the time of season in which individuals were hatched. Slow growth may also be attributed to high densities of bluegill competing for the same resources as well as competition with bass and gizzard shad.

White Crappie

A small population of white crappie are present in the lake. White crappie constituted 3.4 percent of electrofishing samples in 2001 and 21.3 percent of fyke net catches. Catch rates were highest for fish in the 220-280 mm (8.7-11 inches; Figure 13) range. Average size of white crappie collected was 217 mm, a decrease from 263.3 mm reported in 1999. No minimum size length exists for crappie at DeSoto Lake. A desirable size fish worth keeping to an angler is about 200 mm. Seventy-three percent of the white crappie collected by fyke nets were considered harvestable size. Sampled crappie were in good condition with an average Wr of 95.8.

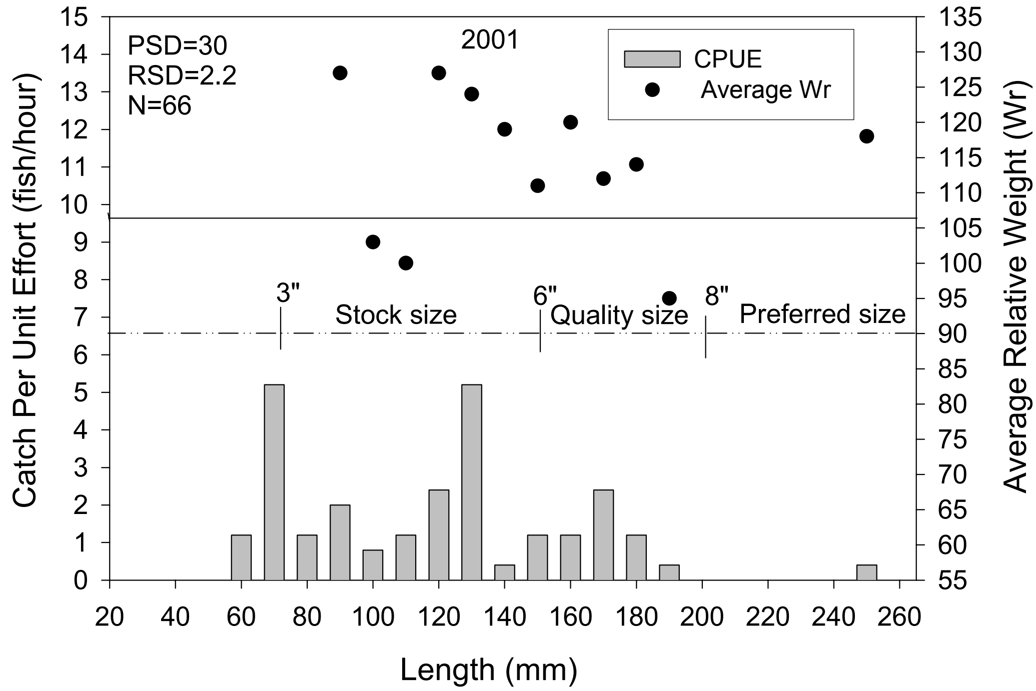


Figure 10. CPUE and average Wr of bluegill collected from electrofishing DeSoto Lake, DeSoto National Wildlife Refuge, 2001.

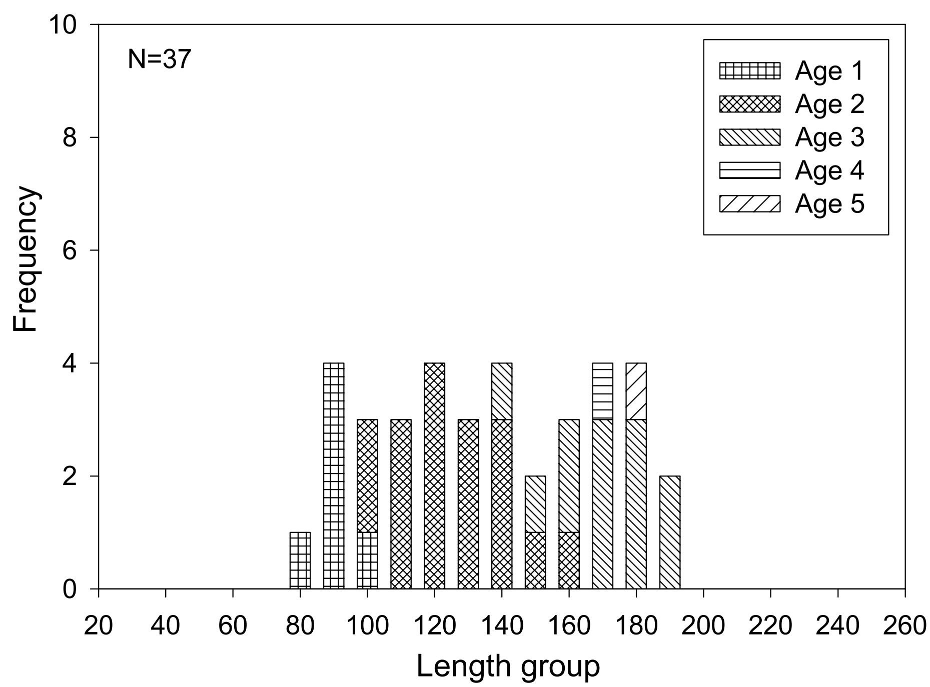


Figure 11. Age distribution of bluegill at various lengths collected in DeSoto Lake, DeSoto National Wildlife Refuge, 2001.

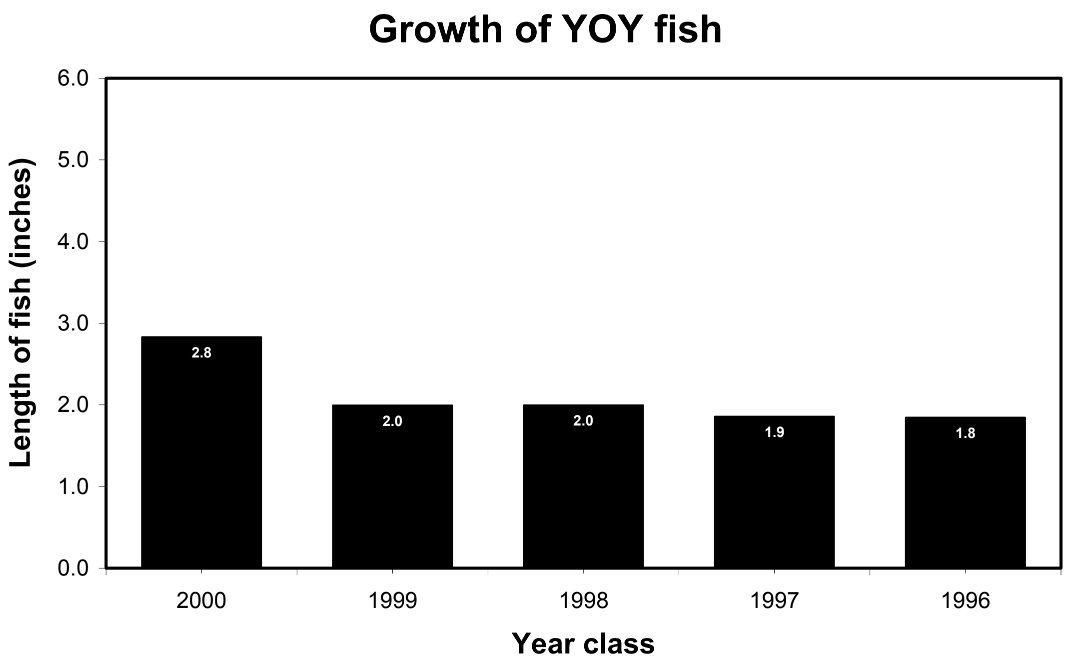


Figure 12. Average YOY growth of bluegill for each year class, DeSoto Lake, Desoto National Wildlife Refuge (source: IADNR 2003).

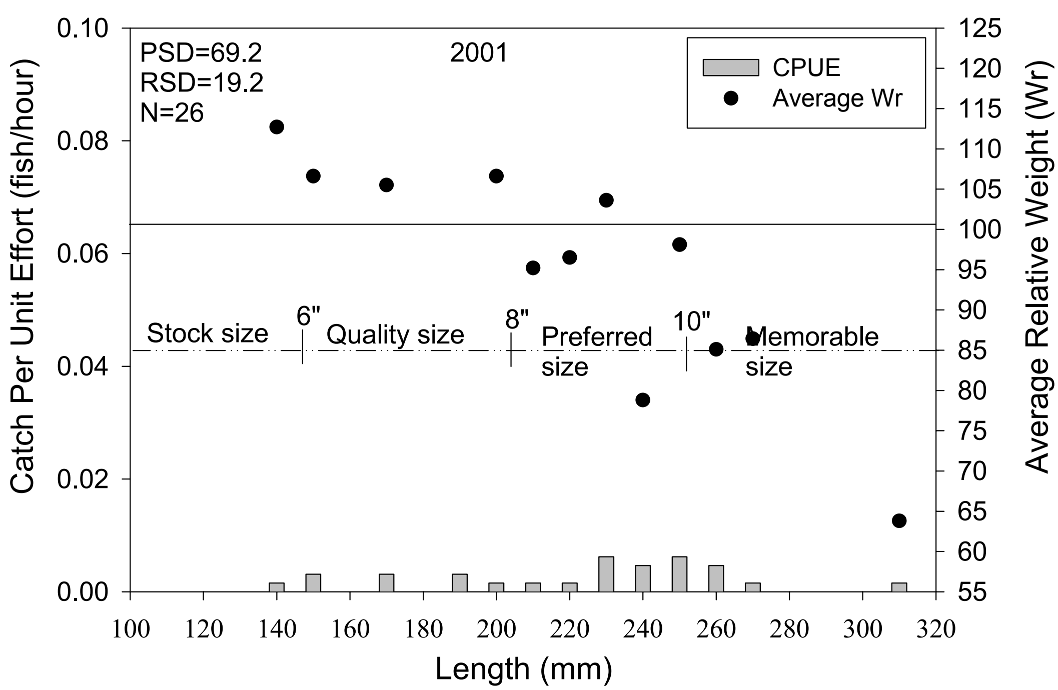


Figure 13. CPUE and average Wr of white crappie captured in fyke nets, DeSoto Lake, DeSoto National Wildlife Refuge, 2001.

Twenty-two white crappie were aged using otoliths. The majority of white crappie collected in the 2001 survey were Age II from the 1999 year class (Figure 14). Based on past survey observations, DeSoto Lake white crappie appear to have a life span of about five years. Few individuals Age III and older were represented in this survey. Generally, crappie in impoundments with shad exhibit pulses or dominant year classes every three to four years. These missing year classes may be part of a cycle. It is also possible that timing of sampling resulted in missed cohorts. White crappie usually mature at Age III in the Midwest. Older white crappie may have already spawned and moved back into deeper water out of sampling range.

DeSoto Lake white crappie grow exceptionally well in the first two growing seasons. Average YOY growth in Iowa lakes is about 78 mm (3.1 inches) and second year cumulative growth is about 153 mm (6 inches; Carlander 1977). White crappie in our sample averaged 122 mm (4.8 inches) as YOY and 226 mm (8.9 inches) in the second season. The 2000 year class had the highest growth at 137.2 mm (5.4 inches; Figure 15). Rapid growth rates for white crappie may be attributed to abundance of large prey.

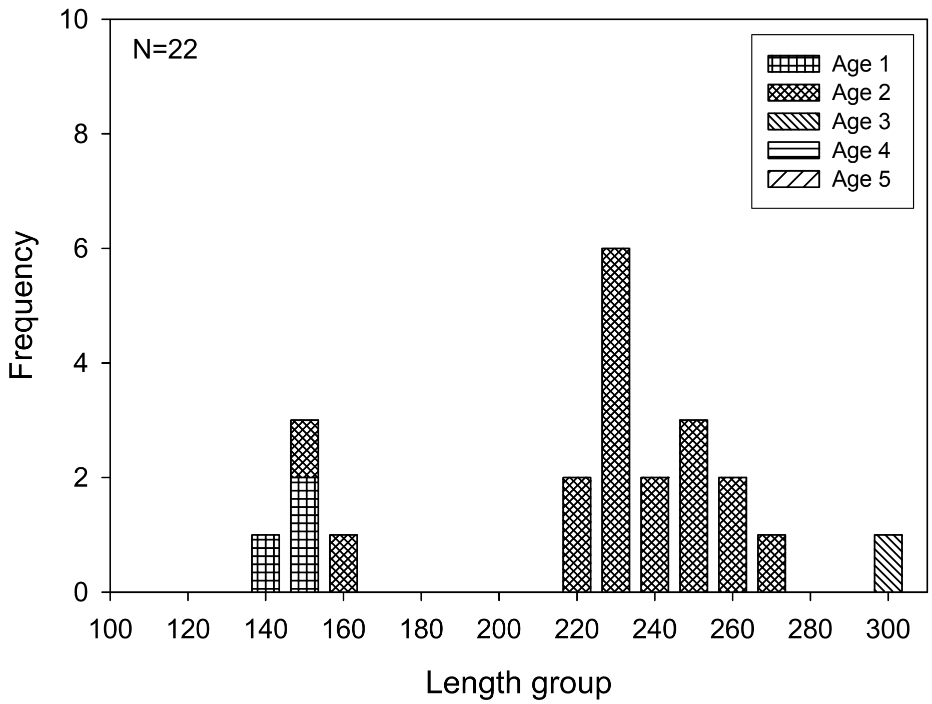


Figure 14. Age distribution of white crappie at various lengths collected from DeSoto Lake, DeSoto National Wildlife Refuge, 2001.

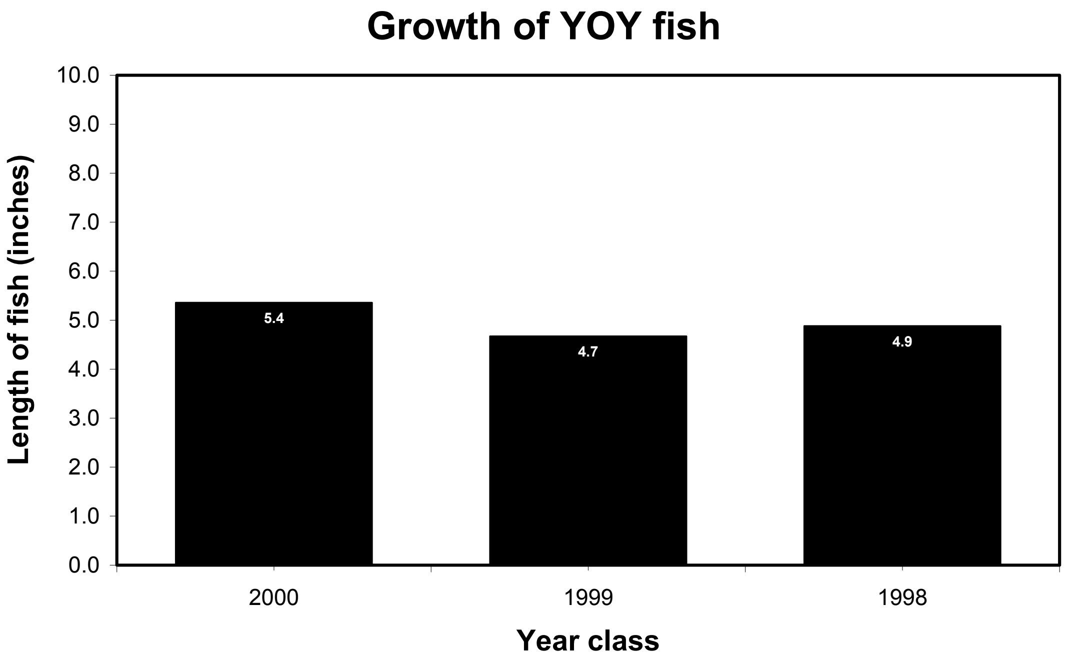


Figure 15. Average YOY growth of white crappie for each year class, DeSoto Lake, DeSoto National Wildlife Refuge, 2001 (source: IADNR 2003).

Black Crappie

Twenty black crappie were netted from electrofishing composing 5.7 percent of the total electrofishing catch. CPUE for black crappie was 8.0 fish/hr in 2001. This was a decrease from 19.8 fish/hr reported in 1999. Highest CPUE were fish in the 191-203 mm (7.5-8 inches) range at 2.4 fish/hr.

Fifty-eight black crappie were captured in fyke nets constituting 47.5 percent of the fyke net catch in 2001 (Table 2). Average size of black crappie collected from both gears was about 168.5 mm in 2001, less than the desirable 200 mm harvestable size and less than the average size of 223 mm reported in 1999.

Low PSD and RSD levels from both gears indicated a larger proportion of fish in the 150-203 mm (6-12 inches) range (Figure 16 and Figure 17). Percentage of harvestable size black crappie has clearly declined since the 1999 survey. About 9 percent of the total number of black crappie captured were harvestable. The decrease in average size, harvestable size and CPUE may be the result of increased fishing pressure on this popular sport fish. Black crappie collected from both gears were in good condition with an average Wr of 103.6 in electrofishing samples and 98.3 in fyke net samples.

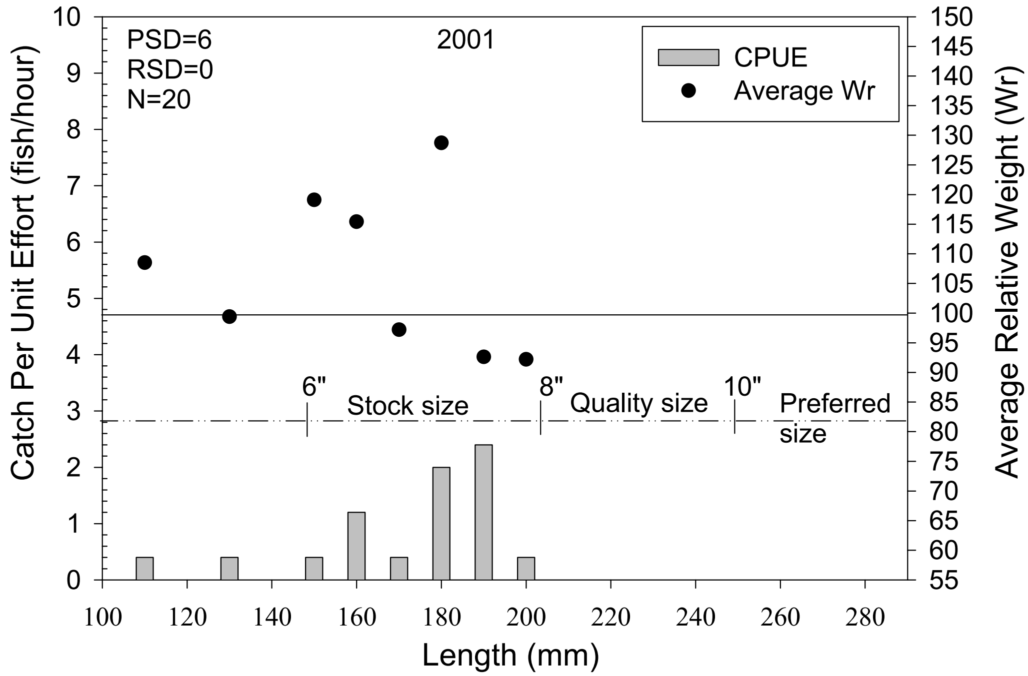


Figure 16. CPUE and average Wr of black crappie collected from electrofishing DeSoto Lake, DeSoto National Wildlife Refuge, 2001.

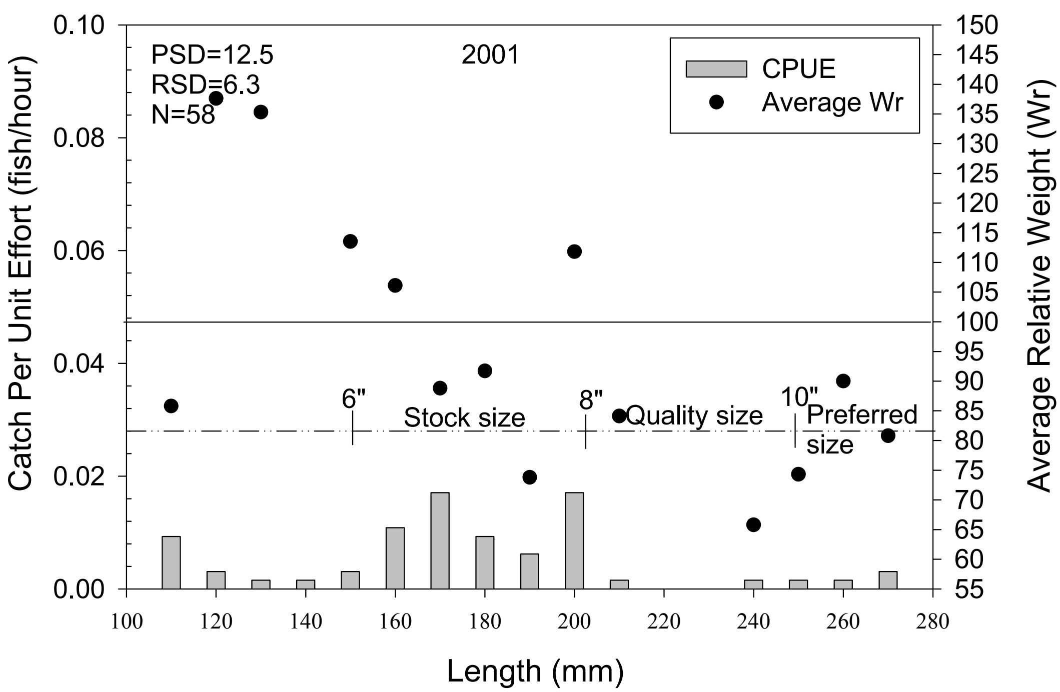


Figure 17. CPUE and average Wr of black crappie collected from fyke nets deployed in DeSoto Lake, DeSoto National Wildlife Refuge, 2001.

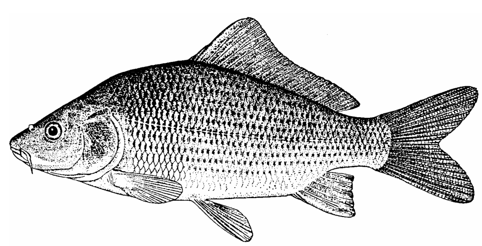
Common Carp

Relative abundance of this species captured from electrofishing, decreased from 48.3 percent in 1999 to 39 percent in 2001 (Figure 2). CPUE also declined from 129.07 fish/hr in 1999 to 54.4 fish/hr in 2001. Despite lower relative abundance and CPUE in this survey, carp continue to be a chronic problem in the lake.

Greatest CPUE were fish in the 451-470 mm range (17.8-18.5 inches) at 15.6 fish/hr (Figure 18). Ninety-nine percent of common carp sampled in 2001 were harvestable size (greater than 304 mm). Common carp in DeSoto Lake typically have been in very poor condition. Average body condition for carp captured in the 2001 survey remained poor at 72.5. High densities of this species in the lake competing for the same resources probably was the reason for such poor condition of the fish.

Scales were used to describe age structure of the carp population instead of spines. The majority of fish captured in the 406-533 mm (16-21 inches) range in Figure 19 were Age IV through Age VII, with the oldest cohort dating back to 1994. Common carp tend to grow rapidly the first few years of life (Panek 1987). As they reach maturity, like in other species, growth slows down. Pflieger (1997) reported first year growths of 165 mm (6.5 inches) in Missouri streams. DeSoto Lake carp exhibited fast growth in the first two growing seasons. Average YOY growth ranged from 178 to 198 mm (7.0 to 7.8 inches) for year classes 1994-1998 (Figure 20;source:IADNR 2003). Average cumulative growth in the second year ranged from 317.5 to 355.6 mm (12.5 to 14.3 inches). As carp reached Age III, growth dropped considerably thereafter. The extended overlap in size from Age III through Age VII was most likely due to high densities of the species competing for the same resources resulting in slower growth, and as mentioned previously, poor body condition.

Common carp comprised the majority of the biomass in this survey. Removal by commercial harvest continued to decline despite variable effort from year to year. Commercial harvest dropped from 1,645 pounds in 1996 to just 135 pounds in 2001 (Figure 21). Increase in the removal of this undesirable species is encouraged. DeSoto Lake refuge staff initiated an annual carp fest in 2001 removing close to 8,000 fish during the one day event in 2001 and approximately 1,500 carp in 2002 (Steve Van Riper, U.S. Fish and Wildlife Service, pers. comm.). This fest was initiated as a possible control measure of the species in the lake.



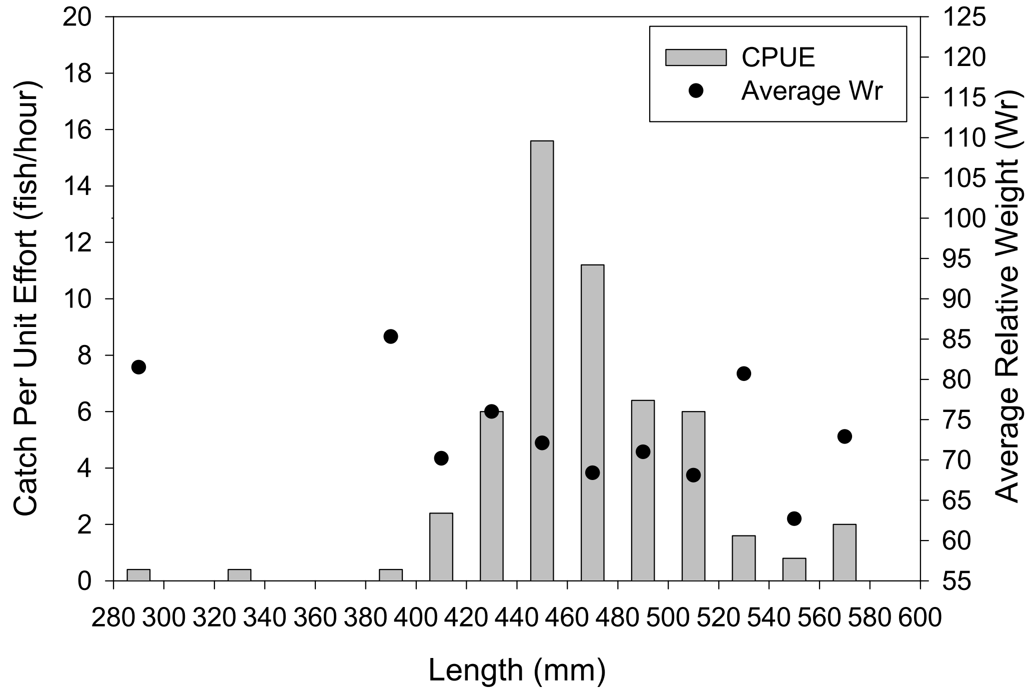


Figure 18. CPUE and average Wr of common carp collected from electrofishing DeSoto Lake, DeSoto National Wildlife Refuge, 2001.

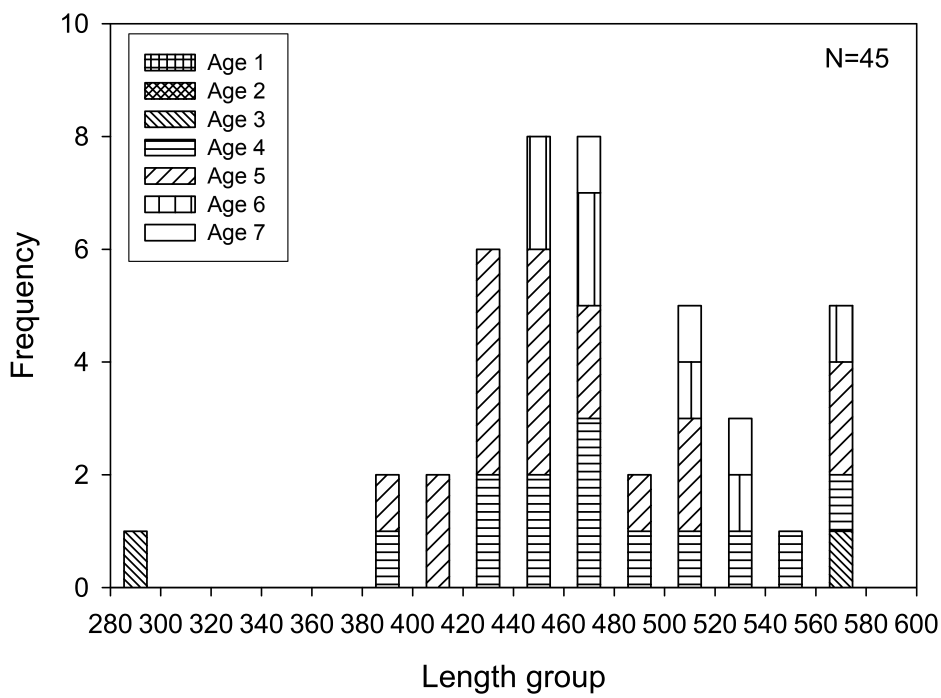


Figure 19. Age distribution of common carp at various lengths collected in DeSoto Lake, DeSoto National Wildlife Refuge, 2001.

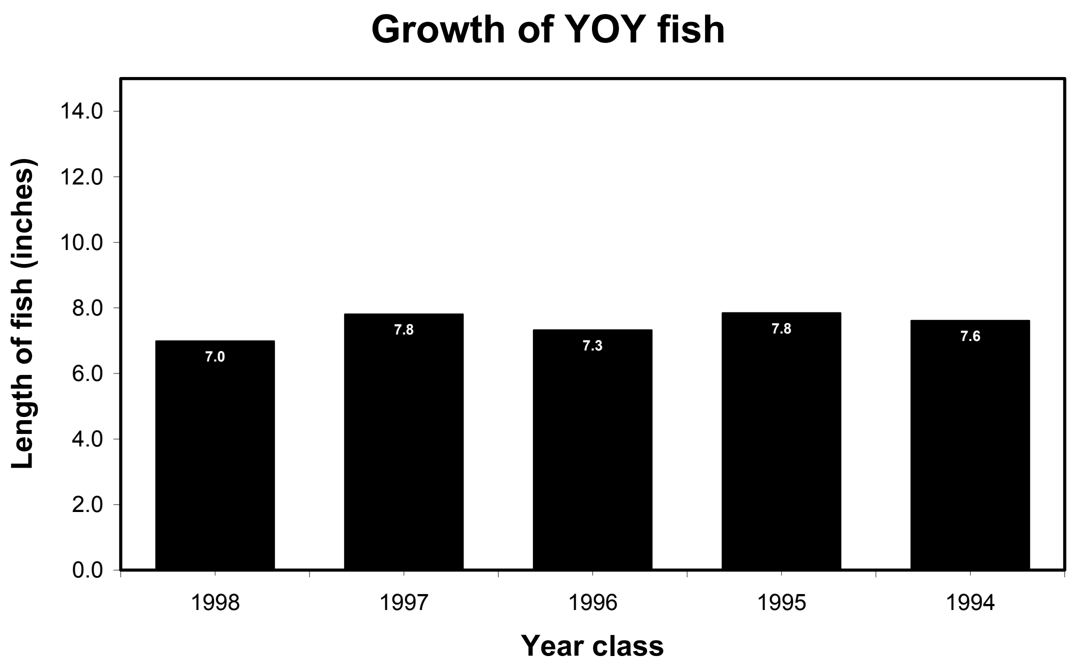


Figure 20. YOY growth of common carp for each year class, DeSoto Lake, DeSoto National Wildlife Refuge, 2001 (source: IADNR 2003).

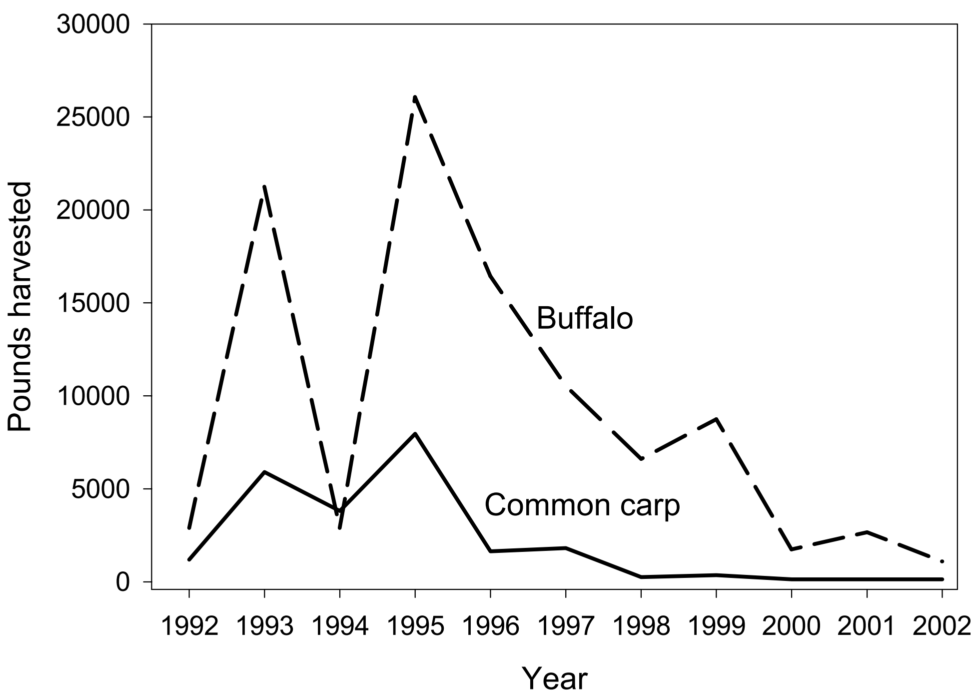


Figure 21. Reported pounds of common carp and buffalo harvested by commercial fishermen from DeSoto Lake, DeSoto National Wildlife Refuge, 1992-2002 (source:DeSoto National Wildlife Refuge 2002).

Bigmouth buffalo

Relative abundance of bigmouth buffalo was 5.8 percent of the total fish captured by electrofishing in 1999 and only 0.3 percent in 2001. Bigmouth buffalo catches have been consistently low in our sample efforts because of the types of gears used. Harvest of bigmouth buffalo continues to fall, dropping from 16,447 pounds in 1996 to just 2,670 pounds in 2001 (Figure 21).

Stocking efforts

Channel catfish, flathead catfish and walleye continued to be collected in low numbers. Reported commercial catch of channel and flathead catfish have been stable throughout the 1990s. Fingerling walleye (102-127 mm) and channel catfish (203 mm) are still stocked annually. Size and age structure of walleye should be addressed in the next fishery survey to determine if fingerling walleye are successfully recruiting to the adult population in the lake.

DISCUSSION

The largemouth bass population in DeSoto Lake is dominated by young bass 203 mm-304 mm. The shift from a larger older population to a smaller younger population is encouraging, showing signs that bass are surviving their first winter and recruiting to the fishery despite overall slow growth in the first year. These fish should reach harvestable size in the next year or two providing quality experiences for anglers. Supplemental stocking of bass began in 1999. In fall 2002, 1,380 bass (140 mm in length) were stocked in the lake. This stocked year class should give a boost to overall recruitment. Survival through the first year of a species usually determines the strength of a cohort (Diana 1995). Objectives of the next fishery survey should include assessing what portion of stocked bass are surviving their first year and contributing to the fishery.

DeSoto Lake bluegill exhibit slow growth and continue to be small and stunted. Stunting occurs in some species when too many individuals populate a lake, resulting in a density dependent decline in growth rates (Diana 1995). The population may reach a terminal size in which all fish beyond a certain age are approximately the same size. This is a common population response in freshwater fishes like pike, perch, and bluegill (Diana 1995). This may account for the low presence of bluegill exceeding 203 mm in past surveys. Diana (1995) suggests that stunted populations often exhibit earlier reproduction than normal populations which may in part be responsible for stunting in itself, because it results in less surplus energy available for growth. Heavy competition with gizzard shad and YOY largemouth bass, and competition by bluegill as they reach larger sizes may also result in a stunted bluegill population.

White crappie in the lake are dominated by Age II fish. This year class should reach maturity in 2002. White crappie grow exceptionally well in the first couple of years at DeSoto Lake. Quality size fish are present for those that enjoy crappie fishing. Although age information was not presented in this report for black crappie, fishing pressure may be heavy enough to have a serious impact on the reproductive portion of the population.

Common carp have been one of the most abundant fishes collected in the lake (Milligan 1994; Milligan 1995; Grady and Milligan 1997; Mauldin and Milligan 1999), making up a large proportion of the total weight of fish present in the surveys. Common carp affect other fishes mainly through their impacts on aquatic plants and turbidity through feeding behavior (Panek 1977). Carp eat a wide variety of plants and animals (Panek 1977; Pflieger 1997). The uprooting and consumption of vegetation by carp decreases spawning habitat for some species, and because of the reduction in cover, increases predation on smaller fish. High densities of carp in DeSoto Lake may cause turbidities to reach levels that would negatively impact the feeding efficiency of sight feeders like walleye, largemouth bass and other sunfishes. The displacement of game fishes is a serious concern for DeSoto Lake refuge managers.

Management strategies to control carp populations include introducing predators, using toxicants, netting, bait trapping, etc. These techniques all have varying degrees of success and since most of them are nonselective, their use is limited because of their effects on other fishes in the lake. Implementation of the above control measures usually reduces carp abundance soon afterwards; however, it does not take long for populations to rebound. Commercial fishing is often encouraged in waters with high-density populations (Panek 1977). Reported pounds harvested by commercial fishermen in DeSoto Lake though, have not really had a major impact on the carp population in the past. Low commercial harvest of carp may be due to inefficiency of legal gear used. One should also take into consideration that poor body condition that has been characteristic of DeSoto Lake carp makes this species fairly unprofitable for commercial harvest.

A combination of control measures is the best way to proceed in trying to keep carp abundance under control. Lowering water levels in the lake during a certain period of time in the spring may reduce shallow, weedy type habitat, typically used for spawning. Its success would depend on exposing these spawning areas and eggs to air. Drawdowns would have to be timed carefully and sustained for several months to be effective. High river stages prohibit spring/summer drawdowns in most years at DeSoto Lake, but it may be possible during drought conditions. Other control means to consider could include contracting a commercial fisherman to remove carp each year, offering a bounty for number of pounds removed exceeding a set minimum and awarding prizes for number of carp removed during selected periods in the spring and/or summer.

Past efforts to control other nuisance species have been more successful. Stocking predators such as northern pike, flathead catfish, white bass, and walleye have reduced bullhead and gizzard shad populations. Other management actions have included renovating the lake (1985) in the attempt to reduce rough fish and improve aquatic habitat; placing an aeration system in the lake to reduce winter kills; and dropping in cedar trees, Christmas trees and pallets, and forming rock piles in the lake to enhance habitat for game fish. The importance of such structures was demonstrated in 1994 and 1997 surveys when larger numbers of harvestable size crappie were collected around sunken trees and a beaver lodge. Habitat improvement projects should be pursued at every opportunity. Due to heavy silt loads in the lake, the addition of Christmas trees and pallets when possible is an inexpensive way to provide more habitat for the benefit of game fish in the lake.

Although a fish barrier is in place at DeSoto Lake, it is not one hundred percent effective. In recent years, commercial fishermen have reported catches of several bighead carp. The establishment of this exotic Asian carp species in the lake, or its close relative, the silver carp, could have devastating effects on the DeSoto Lake sport fishery. These species would be impossible to control once they became established. Bighead carp and silver carp would out-compete and displace native riverine species at all life stages. The bighead carp and silver carp are primarily planktivores, but can shift to detritus. Both exotic species could adversely influence the sport fishery by reducing the quantity and quality of zooplankton for larval fish like bluegill, largemouth bass, crappie, gizzard shad, white bass, and adult fish that are planktivorous like the bigmouth buffalo. It is imperative that the fish barrier be operational when manipulating water levels in the lake.

RECOMMENDATIONS

1.) Draw-down during peak spawning season in order to reduce common carp spawning habitat.
2.) Increase effort to encourage commercial harvest of carp.
3.) Continue annual carp fest.
4.) Add Christmas trees and pallets in various places within the lake to provide structure for bluegill and crappie.
5.) Assess recruitment of stocked largemouth bass in the lake.
6.) Assess recruitment of stocked walleye.
7.) Assess bighead carp and silver carp abundance in the lake.

ACKNOWLEDGEMENTS

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APPENDIX A. Post-Renovation Fish Stocking Record of DeSoto Lake, DeSoto NWR.

Date	Species	Number	Size (in)	No./(lb.)	WT.(lb.)	Source
8/15/85	BLG	96,480	1	2680	36	GNFH
8/15/85	FHM	43,200	1-2	800	54	GNFH
8/22/85	BLG	99,960	1	2380	42	GNFH
8/22/85	LMB	54,720	2.25	228	240	GNFH
8/26/85	LMB	44,688	2.25	228	196	GNFH
8/26/85	LMB	334	6	10	33	GNFH
8/26/85	LMB	162	17-19	(3.5 EA.)	567	GNFH
8/26/85	FHM	400,000	2	300	1333	ICC
9/30/85	BLG	1,600	6	3	533	GNFH
10/2/85	CCF	1,500	7	17	88	ICC
10/2/85	CCF	160,000	2	187	855	ICC
10/10/85	FCF	4,500	4-5	50	90	SNFH
10/10/85	BLG	170,000	1-2	1000	170	ICC
4/14/86	NOP	800,000	FRY	50,000	16	GNFH
4/15/86	NOP	200,000	FRY	100,000	2	GNFH
4/24/86	WAE	500,000	FRY	100,000	5	GNFH
4/28/86	WAE	1,200,000	FRY	109,100	11	GNFH
5/1/86	WAE	522,500	FRY	104,500	5	GNFH
6/10/86	CCF	8,000	3.5-7	25	320	ICC
6/12/86	LMB	120,000	1	23,000	52	GNFH
7/22/86	PAH	800	4-5	105	7.6	GNFH
4/2/87	WAE	10,450	6	25	418	MNDNR
4/18/87	NOP	880,000	FRY	62,587	14	GNFH
4/16/87	WAE	800,000	FRY	100,000	8	CORDOVA, IL
4/21/87	WAE	200,000	FRY	100,000	2	CORDOVA, IL
6/87	BLC	2,500	ADULT	3.5	715	IDNR

Date	Species	Number	Size (in)	No./(lb.)	WT.(lb.)	Source
10/29/87	CCF	8,450	6-7	10	845	SNFH
4/11/88	NOP	1,000,000	FRY	58,824	17	GNFH
4/18/88	WAE	1,250,000	FRY	138,888	9	CORDOVA, IL
4/21/88	WAE	1,200,000	FRY	133,333	9	GPNFH
5/88	BLC	800	ADULT	3.5	230	IADNR
4/13/89	NOP	1,300,000	FRY	60,000	21.7	GNFH
4/18/89	NOP	1,700,000	FRY	60,000	28.3	GNFH
4/24/89	WAE	800,000	FRY	130,000	6.2	CORDOVA, IL
4/27/89	WAE	1,600,000	FRY	120,000	3.3	GNFH
5/10/89	NOP	20,000	2-3	631	31.7	NG&P
8/29/89	CCF	8,000	6-10	7.5	1067	NG&P
8/29/89	FCF	10,000	2-3	245	41	MDC
3/26/90	NOP	3,000,000	FRY			GNFH
4/19/90	WAE	800,000	FRY			CORDOVA, IL
4/20/90	WAE	1,600,000	FRY			GNFH
6/6/90	WAE	8,000	1-2	6.7	1200	GPNFH
8/2/90	LMB	39,000	2-3			GNFH
10/11/90	WAE	10,000	4			IRNFH
4/91	NOP	3,000,000	FRY	35,714	84	GNFH
4/91	WAE	2,400,000	FRY	72,727	33	GNFH
9/91	CCF	6,327	9	4.5	1402	GNFH
4/7/92	NOP	3,067,000	FRY	38,345	80	GNFH
4/19/92	WAE	2,400,000	FRY	100,000	27	GNFH
6/11/92	LMB	58,914	1.0	3,273	18	GNFH
8/4/92	CCF	8,000	6-8			IADNR
9/25/92	WAE	9,360	4-5	468	20	RYDELL, NWR
4/20/93	NOP	3,074,200	0.2	4.6	80	GNFH

Date	Species	Number	Size (in)	No./(lb.)	WT.(lb.)	Source
9/27/93	NOP	1,219	14.6	0.6	762	GNFH
8/10/94	FCF	300	15			IADNR
9/15/94	CCF	8,000	4		54	GPNFH
9/29/94	WAE	1,100	8-10			RYDELL, NWR
10/25/94	CCF	2,800	7			RATHBURN, IA
07/25/96	FCF	350	4-15		75	IADNR
09/26/95	CCF	5,100	7		797	RATHBURN, IA
09/28/95	WAE	2,500	6		167	GNFH
04/30/96	WHB	327	10		450	GNFH
08/96	FCF	250	9-12			IADNR
09/19/96	WAE	2,240	4		56	GNFH
09/24/96	CCF	1,831	7-8			IADNR
04/23/97	WHB	400	11-15		550/0.73	GNFH
08/28/97	CCF	2400	7		248/0.13	IADNR
09/17/97	WAE	2100	5-6			GNFH
04/19/98	WHB	400	8		600/1.5	GNFH
10/06/98	WAE	2000	6		117/17	GNFH
09/21/98	CCF	3000	7			IADNR
04/19/99	WHB	327	10		400	GNFH
09/99	CCF	300	8			IADNR
09/13/99	WAE	2000	9		500	GNFH
9/14/99	BLG`	10,000	2.2		54	GNFH
9/14/99	LMB	5000	2.7		44	GNFH
9/20/00	LMB	13000	2.6		113	GNFH
4/24/01	WHB	325	11.0	1.6	203	GNFH
9/25/01	WAE	1500	8.1	6.2	241	GNFH
11/09/01	WAE	2000	4.7	33.33	60	GNFH

10/31/02	CCF	800	8.0	6.7	119.4	GNFH
10/31/02	LMB	1380	5.5	15.5	90	GNFH