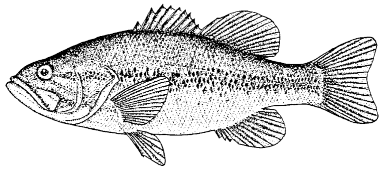
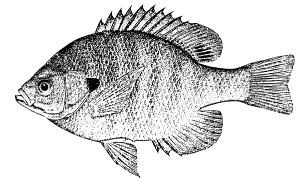
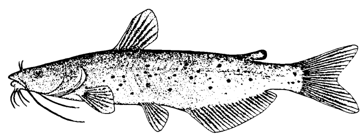
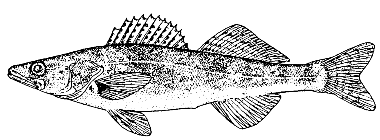




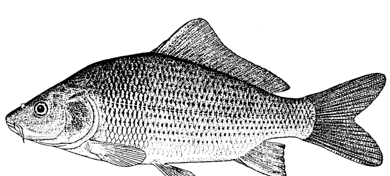
FISHERY MANAGEMENT REPORT

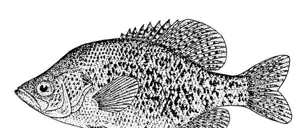


KEITHSBURG DIVISION, WAPELLO DISTRICT
MARK TWAIN NATIONAL WILDLIFE REFUGE
Mercer County, Illinois



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





INTRODUCTION

Fishery resource surveys are conducted annually at the Keithsburg Division, Mark Twain National Wildlife Refuge by the U.S. Fish and Wildlife Service's Fisheries Resources Office, Columbia, Missouri and Illinois Department of Natural Resources fisheries personnel. The following report describes the results of the 1996 survey, compares the results to those of previous years, and discusses potential fishery management alternatives. Fish were sampled in two distinct locations, South End and Spring Slough. Water levels were approximately two feet higher than normal. This provided habitat for fish in the terrestrial vegetation and significantly reduced the effectiveness of electrofishing.

METHODS

The inshore fish community of several areas in Keithsburg Lake was sampled using a boom mounted electrofishing boat. Pulsed DC current (707 Volts, 7 amps, 60 pulses per second, 4 ms pulse width) was used by USFWS staff on July 16-17, 1996. All fish species were weighed (g), and measured (mm). Scale samples were removed from representative samples of largemouth bass and black crappie collected in the South End to assist in year-class determination. Water quality parameters were tested on July 16, 1996. Water temperature was 26 degrees C. Conductivity was 330 mmho/cm. Water clarity, measured with a Secchi disk, was 1.1 m. The Secchi reading was the highest number seen in the 1990s. This water clarity was likely due to the large volume of water present in 1996.

Two gill nets and one trammel net were set on July 16, 1996. The nets fished throughout the night and were pulled the following morning. The gill nets were 125 feet long with 25 foot panels of 3/4, 1, 1 1/4, 1 ½, and 2-inch mesh. The trammel net was 300 feet long and 6 feet deep with a 16-inch outer mesh and a 3-inch inner mesh.

RESULTS

The total numbers of fish and species diversity were much less in July 1996 than in previous years due to the lack of access to the flooded timber inhabited by the fish. The number of fish collected was not sufficient to perform any statistical tests on parameters between South End and Spring Slough. Therefore, the data was combined for this report.

The following twenty-two fish species were collected at the Keithsburg District in 1996:

Abbreviation	Common Name	Scientific Name	Role
BLG	Bluegill	*Lepomis macrochirus*	Sport or forage fish
BLC	Black Crappie	*Pomoxis nigromaculatus*	Sport or forage fish
CAP	Common carp	*Cyprinus carpio*	Commercial fish
LMB	Largemouth Bass	*Micropterus salmoides*	Sport fish
BIB	Bigmouth Buffalo	*Ictiobus cyprinellus*	Commercial fish
SAB	Smallmouth Buffalo	*Ictiobus bubalus*	Commercial fish
WHC	White Crappie	*Pomoxis annularis*	Sport or forage fish
GRH	Golden Redhorse	*Moxostoma erythrurum*	Forage fish
FRD	Freshwater Drum	*Aplodinotys grunniens*	Commercial or sport fish
WHB	White Bass	*Morone chrysops*	Sport or forage fish
QCS	Quillback Carpsucker	*Carpiodes cyprinus*	Forage fish
YLB	Yellow Bass	*Morone mississipiensis*	Forage fish
BON	Bowfin	*Amia calva*	Commercial or sport fish
GOS	Golden Shiner	*Notemigonus crysoleucas*	Forage fish
GZS	Gizzard Shad	*Dorosoma cepedianum*	Forage fish
CCF	Channel Catfish	*Ictalurus punctatus*	Commercial or sport fish
FCF	Flathead Catfish	*Pylodictis olivaris*	Commercial or sport fish
SNG	Shortnose Gar	*Lepisosteus platostomus*	Sport or forage fish
RCS	River Carpsucker	*Carpiodes carpio*	Commercial or forage fish
WAR	Warmouth	*Lepomis gulosus*	Sport or forage fish
GOF	Goldfish	*Carassius auratus*	Forage fish
BBU	Black Buffalo	*Ictiobus niger*	Commercial fish

Other species are known to inhabit Keithsburg Lake but were not collected in this sample. Black bullhead, yellow bullhead, shorthead redhorse, spotted sucker, walleye, sauger, emerald shiner, river shiner, and spotfin shiner were collected in 1994. The collection of several of these riverine species may be due to the connection between Keithsburg Lake and the Mississippi River in 1993. Black buffalo, an Illinois State Species of Concern, have also been collected in past surveys.

A total of 157 fish of fifteen species weighing 63.2 kg (139.3 lbs.) were collected by electrofishing in Keithsburg Lake on July 16-17, 1996 (Table 1). Bluegill, largemouth bass, common carp, and black crappie were the most numerically abundant species making up respectively 27, 21, 17, and 12 percent of the population. Common carp and bigmouth buffalo represented 56 and 19 percent of the total weight of fish collected.

One hundred sixteen fish of seventeen species weighing 121.1 kg (266.9 lbs.) were collected by gill nets and trammel nets (Table 2). Bigmouth buffalo, black crappie, yellow bass, and common carp were the most numerically abundant species at 25, 17, 15, and 14 percent of the sample. Bigmouth buffalo and common carp represented 53 and 25 percent of the total weight of fish collected.

Table 1. Fish collected by electrofishing at Keithsburg District on July 16, 1996 using pulse DC current (total effort 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 (fish/ hour)	Number* Harvestable and (%)
BLG	31	1.29	41.7	108.4	24-190	2.0	26.7	31	9(29)
BLC	14	1.74	124.3	198.4	174-216	2.8	12.1	14	9 (64)
CAP	20	35.52	1776.2	503.1	385-775	56.2	17.2	20	20(100)
LMB	24	2.89	120.5	183.4	53-343	4.6	20.7	24	0
BIB	7	11.88	1697.1	462.0	366-536	18.8	6.0	7	7(100)
SAB	2	0.57	285.0	262.5	250-275	0.9	1.7	2	0
WHC	3	0.27	90.3	183.3	143-208	0.4	2.6	3	0
GRH	1	0.83	830	188	188	1.3	0.9	1	
FRD	3	0.59	197.0	238.0	180-275	0.9	2.6	3	
WHB	3	0.27	89.3	152.7	93-193	0.4	2.6	3	
QCS	1	0.85	850	383	383	1.3	0.9	1	
YLB	1	0.10	103	190	190	0.2	0.9	1	1(100)
BON	3	6.39	2130.0	613.0	559-701	10.1	2.6	3	
GOS	3	0.01	3.3	38.7	33-46	0.02	2.6	3	N/A
TOTAL	116	63.2							
GZS	41	2.16	52.7	94.8	47-344			41	N/A

*				
	Bluegill and other sunfish	- 15 cm & Greater	Bullhead	- 20 cm & Greater
	Crappie	- 20 cm & Greater	Carp & Buffalo	- 30 cm & Greater
	Largemouth Bass	- 35 cm & Greater	Walleye	- 30 cm & Greater
	Catfish	- 25 cm & Greater	Flathead Catfish	- 40 cm & Greater

It should be noted in the following discussion that data previous to 1995 includes fish collected by Illinois Department of Natural Resources staff with three-phase AC electrofishing. Data from June 1995 and July 1996 does not include their effort as personnel were unavailable at that time.

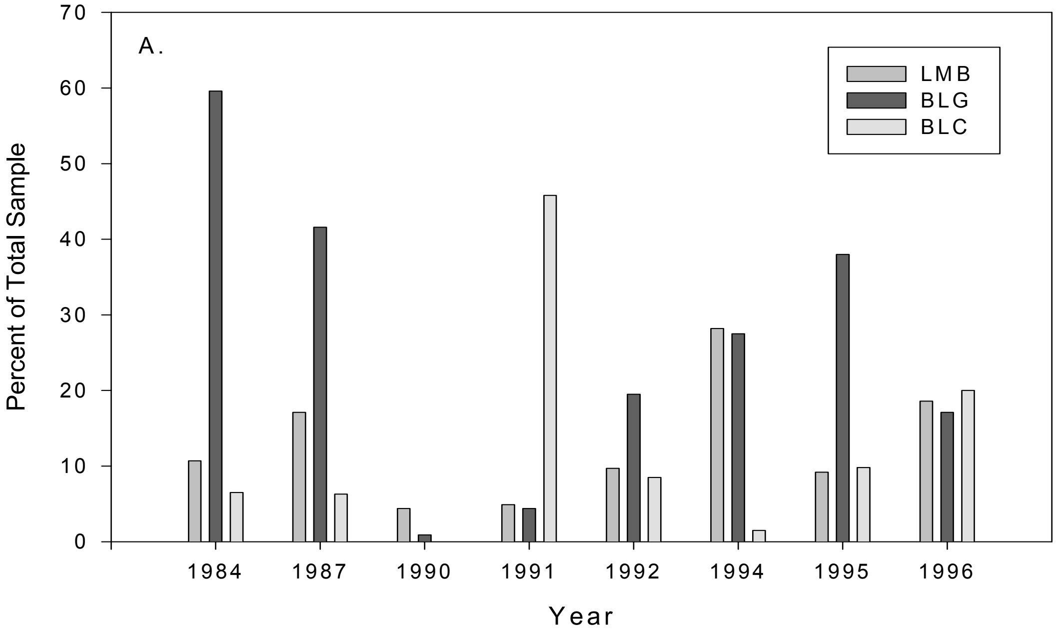
Table 2. Fish collected by gill nets and trammel nets at Keithsburg District on July 16-17, 1996 (total effort 3 net-nights (51.6 hours))

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 (%)
BLG	1	0.08	80	150	150	0.07	0.9	0.02	1(100)
BLC	18	2.21	122.6	196.5	143-221	1.9	16.5	0.35	11(61)
CAP	15	28.97	1931.3	513.5	392-687	24.5	13.8	0.29	15(100)
LMB	4	3.80	948.8	337.0	177-508	3.2	3.7	0.08	2(50)
BIB	27	62.17	2302.4	488.2	412-683	52.5	24.8	0.52	27(100)
SAB	1	0.04	35	127	127	0.03	0.9	0.02	
WHC	4	0.22	54.3	155	150-175	0.2	3.7	0.08	0
YLB	16	1.78	111.5	194.9	185-205	1.5	14.7	0.31	16(100)
BON	5	8.22	1643	573	500-616	6.9	4.6	0.10	
CCF	9	3.52	390.8	333.8	232-437	3.0	8.3	0.17	8(89)
FCF	1	2.49	2490	595	595	0.5	0.9	0.02	1(100)
BBU	1	1.99	1985	517	517	1.7	0.9	0.02	1(100)
SNG	1	0.58	582	547	547	0.5	0.9	0.02	
RCS	3	3.58	1193.3	421.3	395-449	3.0	2.8	0.06	
WAR	2	0.12	61.5	132	124-140	0.1	1.8	0.04	0
GOF	1	0.51	505	236	236	0.4	0.9	0.02	
TOTAL	109	118.39							
GZS	7	2.66	380.4	365.8	201-380				N/A

* Bluegill and other sunfish - 15 cm & Greater; Crappie - 20 cm & Greater; Largemouth Bass - 35 cm & Greater; Catfish - 25 cm & Greater; Bullhead - 20 cm & Greater; Carp & Buffalo - 30 cm & Greater; Walleye - 30 cm & Greater; Flathead Catfish - 40 cm & Greater

Established indices developed from long-term databases are used to evaluate the Keithsburg District 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. Fish species such as gizzard shad, which occupy the open off-shore 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. 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. Catch per unit effort trends are reviewed for the major sport fish species in this report. Relative abundance of a species is percentage of the total catch. 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. For example, largemouth bass relative abundance was highest in 1994. The Midwest was impacted by heavy rainfall and severe flooding in the spring and summer of 1993. It is possible this created increased largemouth bass spawning and rearing habitat allowing for increased survival of young bass.



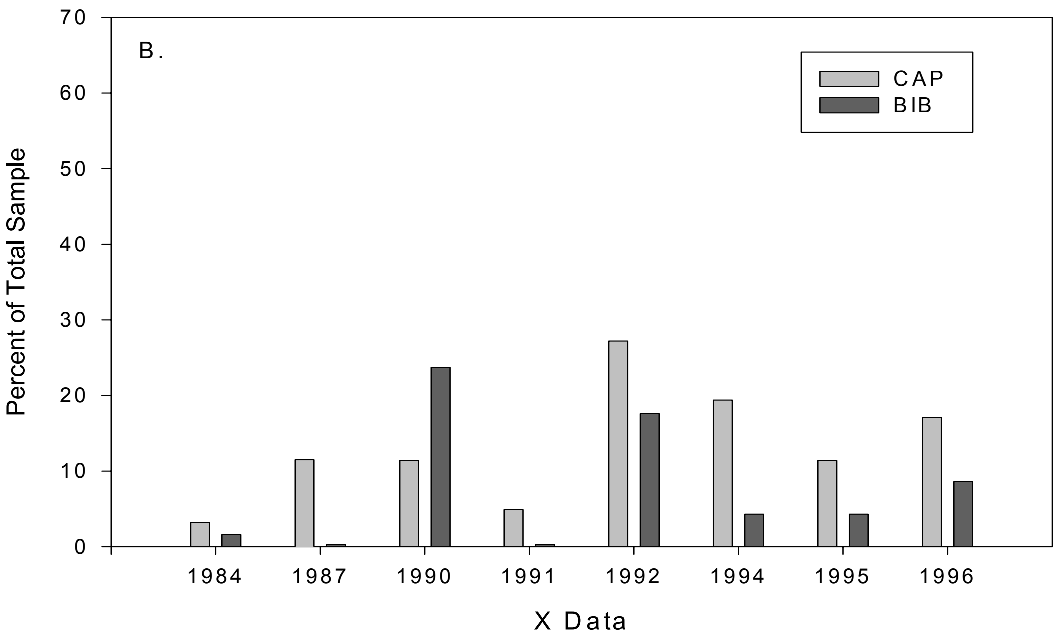


Figure 1. Relative abundance of total fish sampled for (a) selected sportfish species and (b) selected rough fish species collected in Keithsburg District, 1984-1996.

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 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 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

The largemouth bass sampled were in good condition, with an average Wr of 106.6, within the ideal range of 90-110. (Figure 2). More largemouth bass were present in Keithsburg Lake in 1996 than in 1995 as evidenced by both the increased relative abundance (percent of sample) and catch per unit effort (number of fish per hour) in both electrofishing and net samples (Figures 1 and 3). Relative abundance increased 44%, from 9% to 20.7% in electrofishing samples, and from 1.6% to 3.7% in net samples. Catch per unit effort increased from 11.3 fish/hour to 24 fish/hour in electrofishing and from 0.02 fish/hour to 0.08 fish/hour in net samples.

The PSD value of bass was low (18.2%). The desirable range for bass is 40-60%. This indicates that the majority of largemouth bass greater than 203 mm (8 inches) in length (stock size) are less than 304 mm (12 inches) in length (quality size). Relative Stock Density (RSD) is a measure of the size structure of bass > 380 mm (15 inches). Desirable ranges are 20-30%. The RSD value of this sample was zero. No bass greater than 13 inches were collected in Keithsburg Lake (Figure 2). This is not an accurate picture of the largemouth bass population and is likely due to the bass inhabiting flooded timber areas inaccessible to our sampling gear. Similar PSD and RSD values were obtained in 1994, another high water year. A low PSD in 1994 (15.5%) indicated large numbers of fish 8-12 inches. The higher PSD of 57.1, accompanied by a low RSD of 14.3 in the 1995 sample, indicated largemouth bass had grown into the 12-15 inch range. None of these fish were evident in the 1996 sample.

Scales were removed from nine largemouth bass to determine the age structure of the population. The oldest largemouth bass sampled was five years old and would have been spawned in the spring of 1991 (Figure 4). Growth rates fall midway within the accepted range for largemouth bass in Illinois (Carlander 1977). Three and four year old bass were not collected in this sample. This may indicate missing year classes, but is likely an artifact of small sample size and the difficulty of sampling flooded timber habitat.

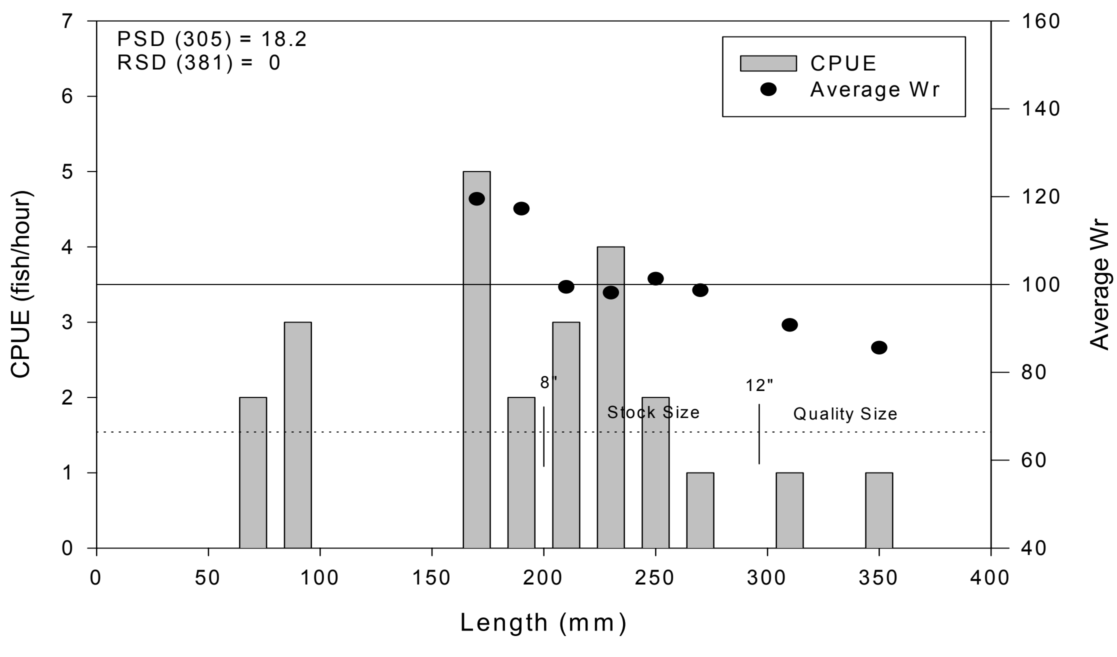


Figure 2. Largemouth bass collected by electrofishing at the Keithsburg District of the Mark Twain National Wildlife Refuge on July 16-17, 1996.

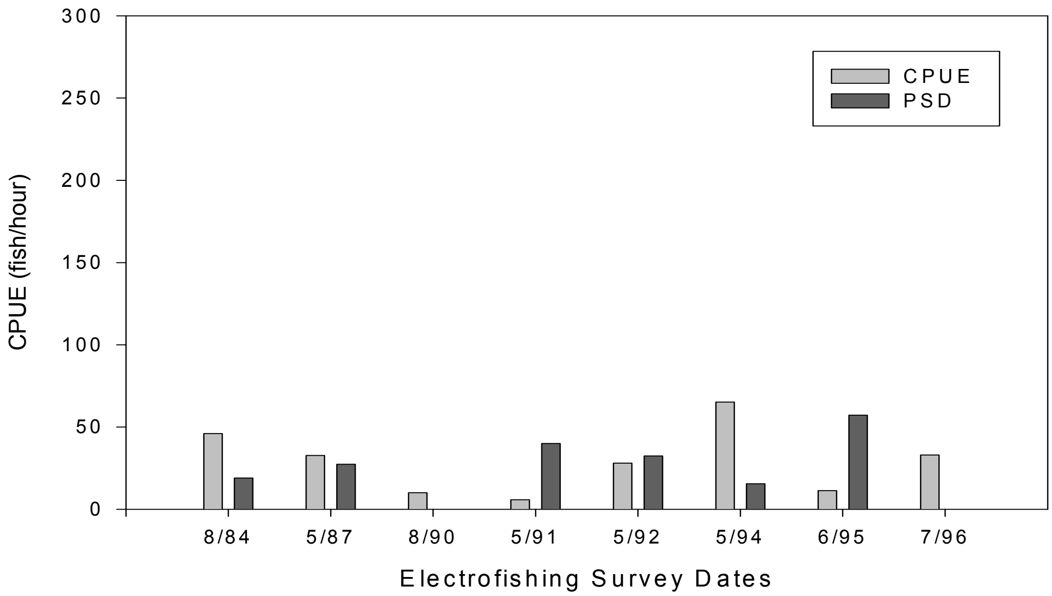


Figure 3. Catch per unit effort and PSDs of largemouth bass collected by electrofishing at Keithsburg District, Mark Twain National Wildlife Refuge, 1984-1996.

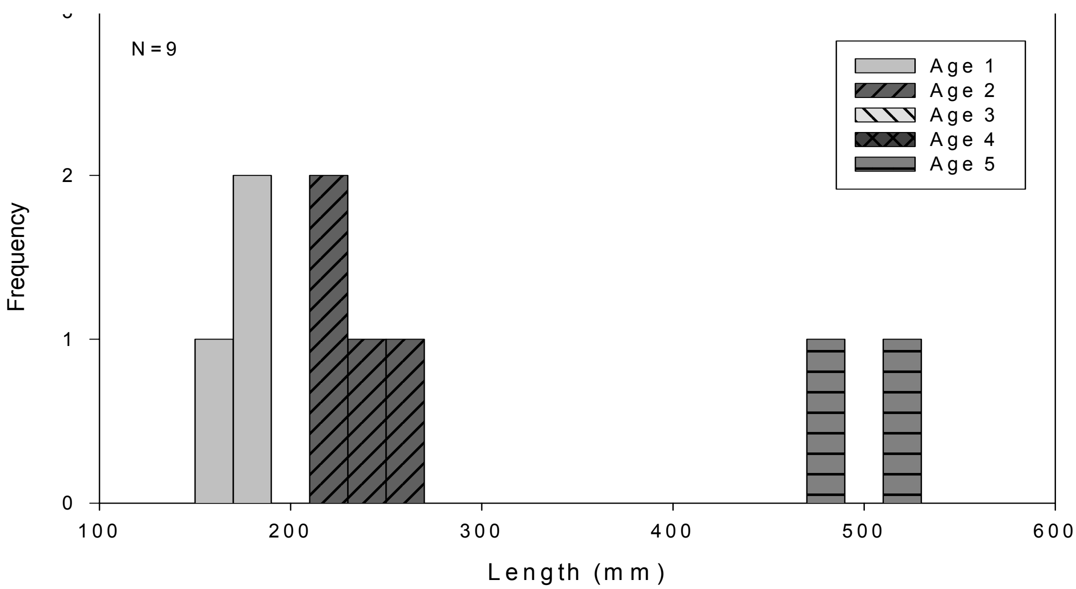


Figure 4. Derived ages of largemouth bass collected by electrofishing and trammel net at the Keithsburg District, Mark Twain National Wildlife Refuge on July 16-17, 1996.

Bluegill

The relative abundance of bluegill decreased from 38% in 1995 to 26.7% in 1996 (Figure 1). Bluegill had been increasing in relative abundance, from a low of 1% in 1990 to 38% in 1995. The apparent decrease in 1996 may be due to the inability to collect this species. CPUE increased between 1990 and 1992, but declined from 72.0 fish/hour in 1992 to 47.3 fish/hour in 1995 (Figure 6). CPUE decreased even further to 18 fish/hour in 1996.

PSD of bluegill is the number of fish greater than 76 mm (3 inches) that are also greater than 152 mm (6 inches). PSDs for bluegill should range between 20% - 40%. PSD for bluegill in 1996 was still high at 45 (Figure 5). This indicates a large proportion of fish in the 152-203 mm (6-8 inch) size range. PSD values have been higher than desired since the 1993 Flood (Figure 6). The large numbers of small bluegills may be due to the increased spawning habitat available in flooded timber areas in recent years. Twenty-nine percent of the bluegill sampled were of harvestable size (greater than 6 inches). Harvestable size is the length at which anglers will generally decide a fish is worth keeping. 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 5).

The condition of individual bluegill is good with an average Wr of 109.3 indicating good growth (Figure 6). Stunting in bluegills is a common problem in Midwestern impoundments. Stunting generally results from reduced predator communities and overcrowding which leads to slow growth. Historically, Keithsburg has had a good predator community and bluegills have exhibited good growth at all sizes indicating stunting has not been a problem. Angler reports indicate fishing has been good for the past three years.

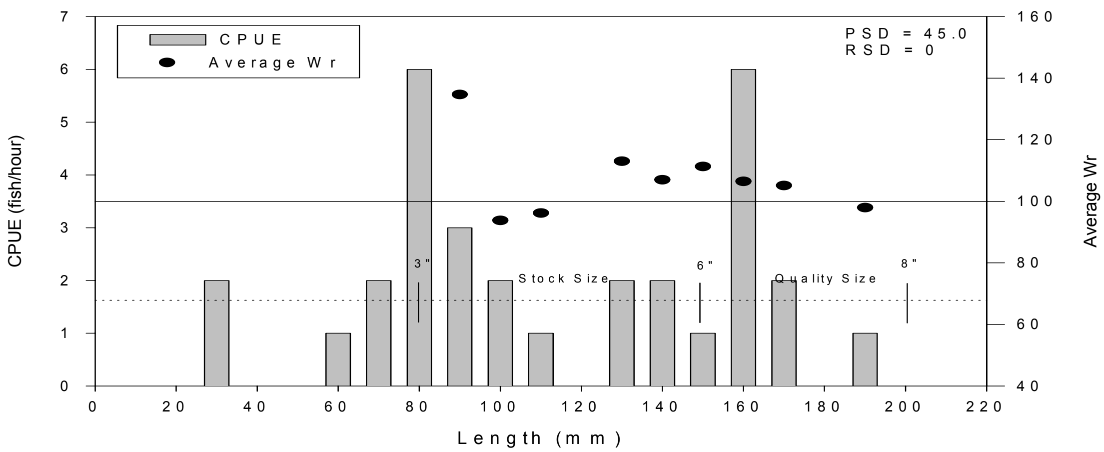


Figure 5. Bluegill collected by electrofishing at the Keithsburg District, Mark Twain National Wildlife Refuge on July 16-17, 1996.

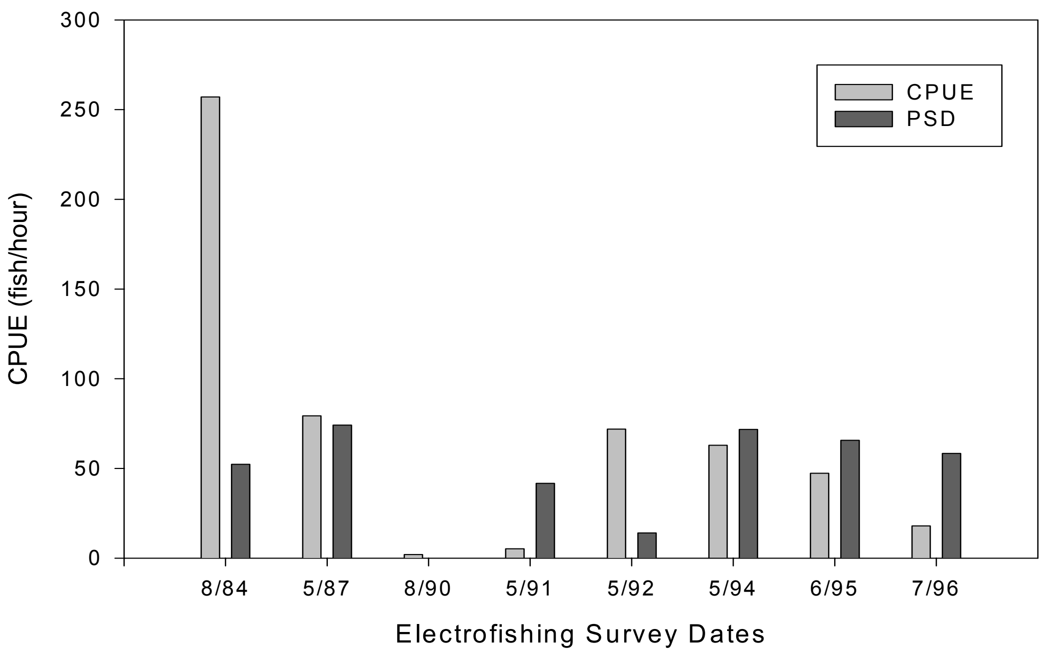


Figure 6. Catch per unit effort and PSDs of bluegill collected by electrofishing at Keithsburg District, Mark Twain National Wildlife Refuge, 1984-1996.

Black Crappie

Relative abundance of black crappie in electrofishing samples increased from 1.5% in 1994 to 12.1% in 1996 while increasing from 3.1% to 16.5% in net samples (Figure 1). CPUE of black crappie in electrofishing samples increased from 12 fish/hour in 1995 to 14 fish/hour in 1996 (Figure 9). The increase in CPUE of black crappie in net samples was more dramatic, from 0.04 fish/hour in 1995 to 0.35 fish/hour in 1996.

PSD of black crappie is the number of fish greater than 127 mm (5 inches) that are also greater than 203 mm (8 inches). PSD for crappie should range between 20-40%. The PSD values of the electrofishing and net samples were 64.3% and 55.6%, far above the desirable range. This indicates that the majority of fish greater than 5 inches are also greater than 8 inches. Figures 7 and 8 show the majority of black crappie sampled were in the quality size range (8-12 inches). There is no RSD value for this population as no black crappie of preferred (10 inches), memorable (12 inches), or trophy size (15 inches) were collected (Figures 7 and 8). The individual crappie sampled were in good condition with average Wrs of 104.7 in the electrofishing sample and 106.3 in the net sample (Figures 7 and 8).

Scales were removed from ten black crappie to determine the age structure of the population. Two scale samples were unreadable due to scale regeneration. This occurs when scales are previously removed from the area due to sampling or injury. The oldest black crappie sampled was three years old and would have been spawned in the spring of 1993 (Figure 10). Growth rates fall midway within the accepted range for black crappie in Illinois (Carlander 1977). This black crappie population appears to exhibit pulses, or sets of strong year-classes. While the majority of crappie collected in 1996 were from the 1993 year-class (Figure 9), the majority of crappie collected in 1994 were from the 1990 year-class. These strong year-classes are typically followed by 2 to 3 small or missing year-classes (Figure 1). This is a common characteristic of crappie populations sharing impoundments with shad.

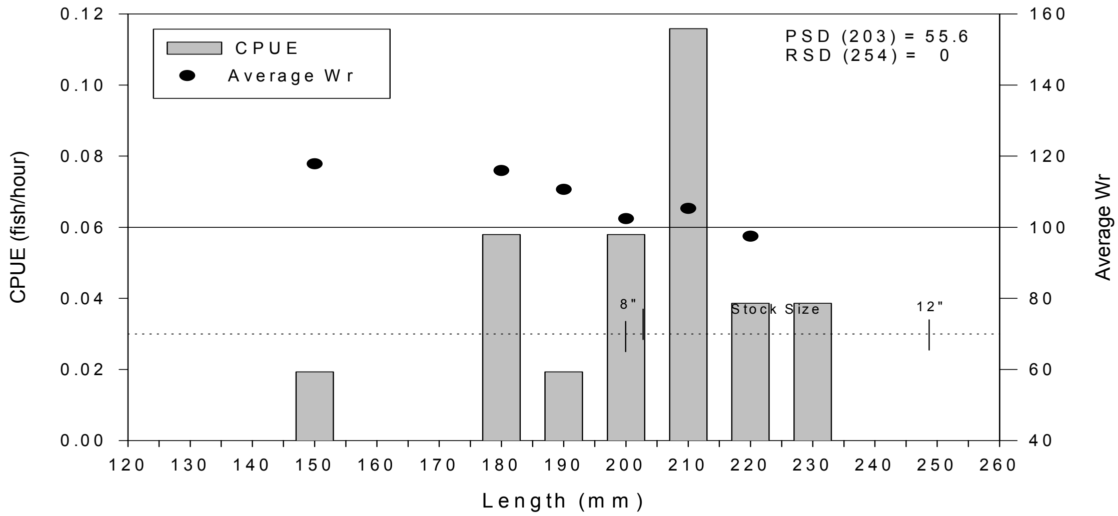


Figure 8. Black crappie collected with gill nets and trap nets at the Keithsburg District, Mark Twain National Wildlife Refuge on July 16-17, 1996.

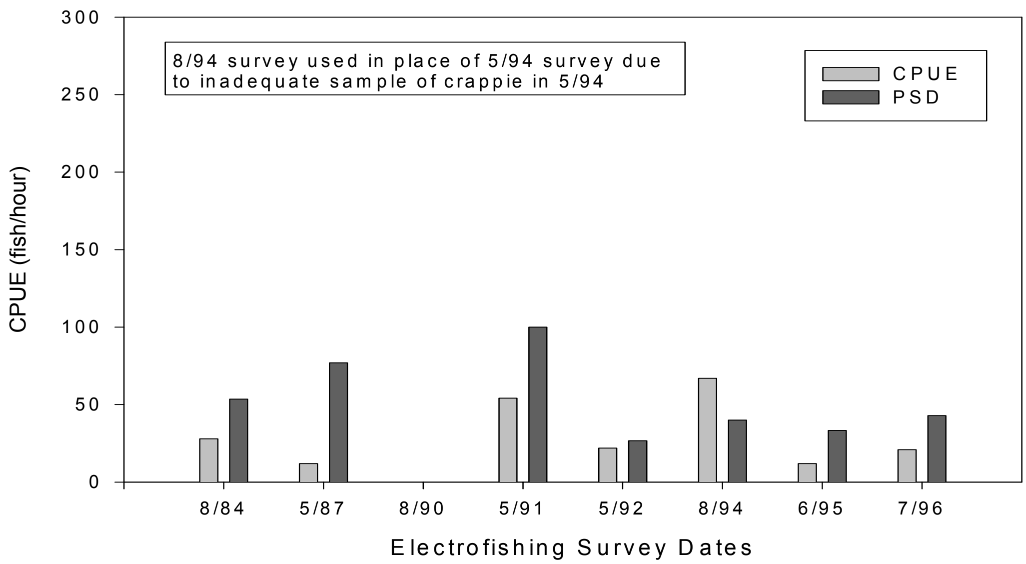


Figure 9. Catch per unit effort and PSDs of black crappie collected by electrofishing at Keithsburg District, Mark Twain National Wildlife Refuge, 1984-1996.

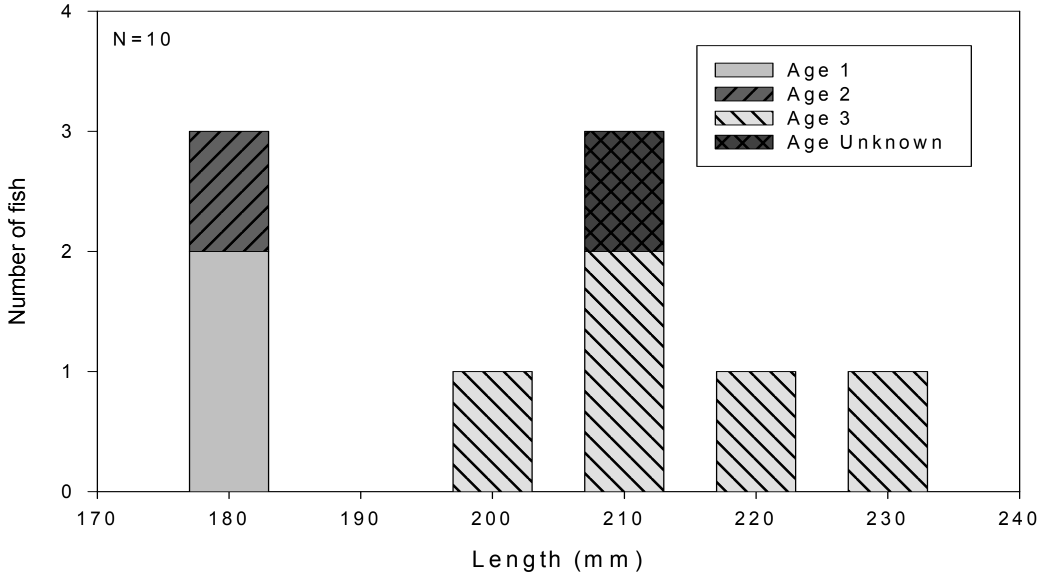


Figure 10. Derived ages of black crappie collected by electrofishing at the Keithsburg District, Mark Twain National Wildlife Refuge on July 16-17, 1996.

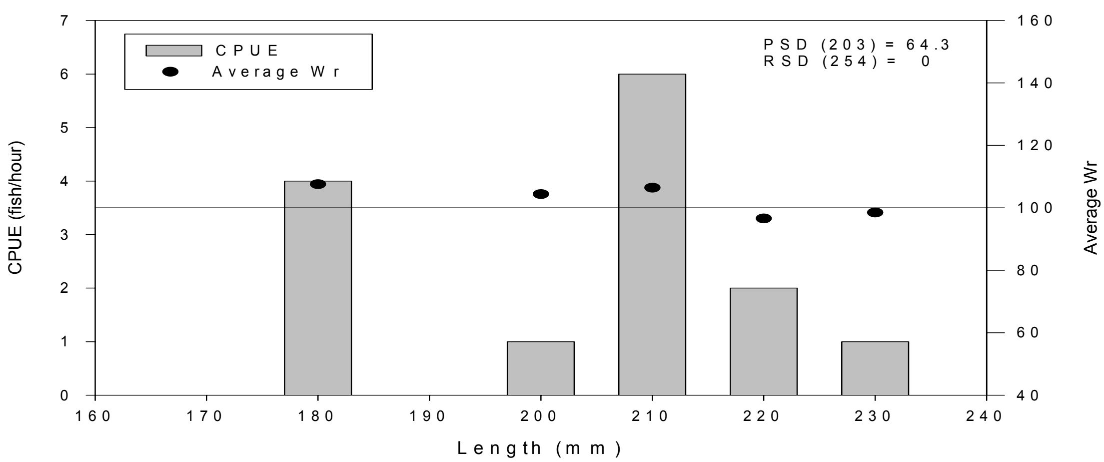


Figure 7. Black crappie collected by electrofishing at the Keithsburg District, Mark Twain National Wildlife Refuge on July 16-17, 1996.

Common Carp and Bigmouth Buffalo

Commercially harvestable populations of carp and buffalo are present. Encouraging commercial harvest would capitalize on this underutilized resource.

Relative abundance of carp collected by electrofishing increased from 11.4% in 1995 to 17.2% in 1996, but was still lower than in 1992 or 1994 (Figure 1). CPUE also increased in electrofishing samples from 14 fish/hour in 1995 to 20 fish/hour in 1996. Gill net and trammel net samples showed the opposite trend with relative abundance dropping from 46.9% to 13.8% and CPUE declining from 0.62 fish/hour to 0.29 fish/hour. All carp sampled in 1996 were of harvestable size (greater than 12 inches), but were in less than ideal condition with an average Wr of 80.9% in the electrofishing sample and 87.8% in the net sample (Figures 11 and 12). Commercial fishermen may have a difficult time finding a market for such low quality fish.

The relative abundance (6%) of bigmouth buffalo caught by electrofishing increased from 4.3% in 1994 and 1995 but was lower than 17.6% in 1992 (Figure 1). CPUE of both electrofishing and net samples increased from 1995 to 1996. The electrofishing sample increased from 5.3 fish/hour to 7 fish/hour while the net sample doubled from 0.25 fish/hour to 0.52 fish/hour. Relative abundance of bigmouth buffalo in net samples increased from 18.8% in 1995 to 24.8% in 1996. Bigmouth buffalo were in better condition than carp with an average Wr of 102.2 in electrofishing samples and 118.2 in net samples (Figures 13 and 14). It is important to note the negative slope of the length:average Wr relationship. While relative weights are in the ideal range for fish in the quality size range, relative weights are below this range for larger fish. Although the sample size of large fish is relatively small, this may indicate an insufficient food supply for larger bigmouth buffalo.

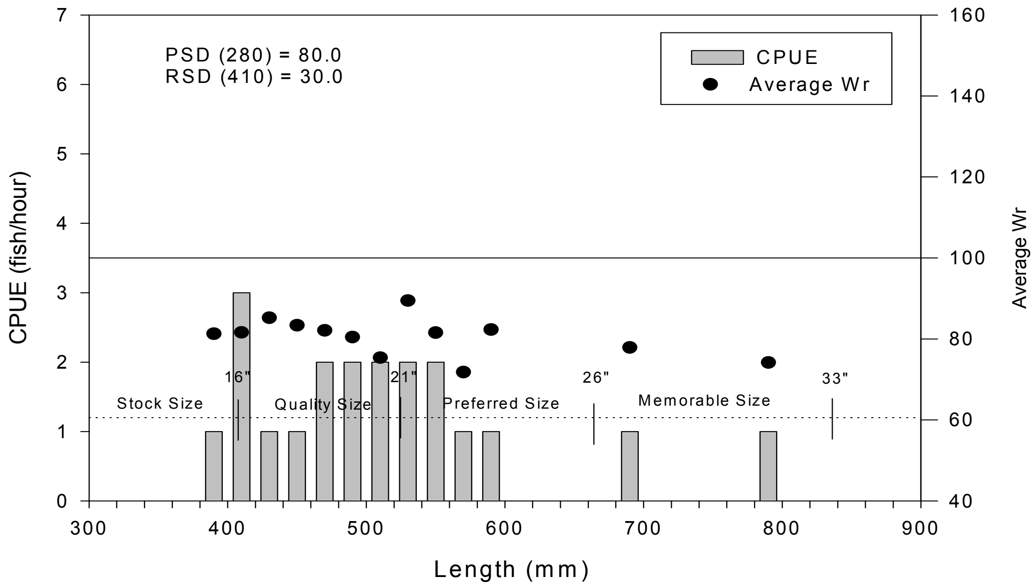


Figure 11. Common carp collected by electrofishing at the Keithsburg District, Mark Twain National Wildlife Refuge on July 16-17, 1996.

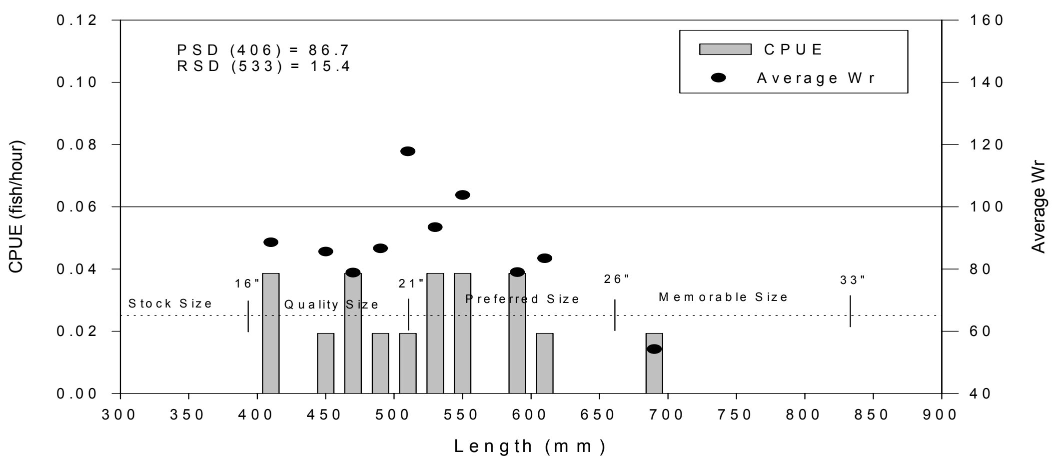


Figure 12. Common carp collected by gill nets and trap nets at the Keithsburg District, Mark Twain National Wildlife Refuge on July 16-17, 1996.

Trends

The levee breach in the flood of 1986 and subsequent post flood conditions have had a large impact on fish populations at Keithsburg. Following the levee break in 1986, a drought in 1987 lowered Mississippi river levels allowing most of the water to be drawn off at Keithsburg. Water levels remained low until levee repairs were completed in 1989. Few sportfish survived this period of low water, however, roughfish prospered. A 1990 fish survey found high populations of goldfish, carp, buffalo, and golden shiner. These species comprised 87% of all fish collected.

When the water level returned to normal in 1990 several species produced large year classes. These species included carp, buffalo, bluegill, and black crappie. These young-of-year fish had little competition for resources and grew well. In 1994 these large cohorts made up most of the harvestable size fish for these species.

High flows in the Mississippi River system in 1995 and 1996 created higher than normal water levels in the Keithsburg District. This high water flooded the timber for an extended period in 1996 providing fish habitat in areas not adequately sampled with traditional sampling gears historically used on the District. Therefore, survey data for 1996 does not truly reflect sport fish abundance or riverine species benefits in the Keithsburg District.

Conclusions

Sportfish populations were doing well in 1995. It is unclear if this trend continued in 1996 as no sportfish of any species greater than quality size were collected. A large 1993 year class of black crappie sampled in previous years should have provided a few specimens if fish were sampled in proportion to their abundance. Increased numbers of high quality bigmouth buffalo could provide a valuable commercial fishing asset. Encouraging commercial harvest would capitalize on this underutilized resource.

The flood of 1993 has had a positive impact on the fishery at Keithsburg. Bass and panfish populations appear to be increasing. Riverine species such as walleye, sauger, white bass, flathead and channel catfish have been added to the gamefish community. As long as Keithsburg is allowed to remain connected to the Mississippi River, fishing for these species will improve. The connection to the Mississippi River will provide access to spawning and nursery habitat for riverine fish during high flow events and contribute to the process of reestablishing vital links between the river and its floodplain.

Recommendations

1) Efforts should be made to sample the Keithsburg District when water levels are more normal to support the efficiency of traditional sampling gears.

2) Solicit and encourage commercial fishing for carp and buffalo. Allow use of 3 inch or larger mesh trammel nets only. Close netting during waterfowl migration.

3) If the damaged railroad levee on the south end of Keithsburg is to be repaired, consider constructing a high flow spillway or notch(es) to retain connectivity to the Mississippi River at elevations consistent with the existing conditions.

Literature Cited

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