1999 Crystal Lake Fishery Survey
(MWBC 978900)

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SUMMARY

During the previous 10-12 years, rising water levels in Crystal Lake has allowed it to change from a marsh to a lake and become known as a "panfish factory". Springtime fishing has been observed to be phenomenal. The fishery was evaluated in 1999 to determine fish population abundance, age-growth and size structure. Springtime fishing pressure, catch, harvest, exploitation and size distribution of the harvest were assessed to determine the effect of angling .

Bluegill were the dominant species in the lake, followed by largemouth bass, pumpkinseed, black crappie and yellow perch. Growth for all panfish species was faster than the average statewide growth rate, allowing for the above average size of panfish harvested. Fishing pressure was found to be as high on Crystal Lake, during the springtime as on other area lakes year round. Catch and harvest of bluegill were higher on Crystal Lake (527 ac) than on Lake Monona (3,274 ac), Dane County. Angler exploitation (~33%) was determined to not be allowing abundance of quality size panfish to accrue, as the larger sizes are being harvested in the same proportion as they are present in spring fyke nets. Restrictive size limits would likely improve the abundance of large size panfish.

Largemouth bass are extremely abundant, yet growth is similar to the average, statewide growth rate. Exploitation of bass is high (31%), with a sharp decline of fish around the 14" minimum size limit. Illegal harvest of bass is a significant factor. High abundance of smaller largemouth bass is likely keeping the panfish from becoming overly abundant, which is contributing to the excellent panfish growth. The bass population needs to be monitored on a regular basis to ensure that their condition does not decline.

INTRODUCTION

Crystal Lake (527 acres), located on the Dane-Columbia County boarder, in southern Wisconsin, is a shallow, eutrophic, seepage lake. It has a dense growth of nearshore macrophytes in some areas. Species include curly-leaf pondweed (P. crispus), sago pondweed (P. pectinatus), eurasian watermilfoil (M. spicatum), arrowhead (S. latifolia), yellow pond lily (N. advena), white water lily (N. odorata) and a variety of duckweeds (Lemna). Dense algal blooms occur during mid to late summer.

Historical evaluation of the fishery is limited. Prior to a dramatic increase in water level of about 4 feet, the lake had been a marsh, with winterkill a common occurrence. In June 1970, a electrofishing assessment found few fish. Another

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electrofishing survey in June, 1985, found black bullhead most abundant, golden shiners and fathead minnows present and a very low number of panfish. No largemouth bass were documented. During the mid 1980s the lake level began rising and continues even today. This has eliminated winterkill and allowed for conversion of the bullhead, minnow fishery to one dominated by panfish species and largemouth bass. For the past 10 years Crystal Lake has been one of the most popular fishing spots in southern Wisconsin. This 1999 fishery assessment and angler survey was conducted to evaluate fish population abundance, size structure and growth and to document the amount and impact of angling pressure on the fishery.

METHODS

Largemouth bass and panfish were collected using electrofishing and fyke nets during a three week period in April and early May. Panfish >5.5" (perceived size at harvest) and all largemouth bass were marked with a fin clip. Fish were recaptured by follow-up sampling with the same gear and the population estimate calculated using the Peterson method for bass and the Schnabel method on panfish. Lengths of fish were recorded to the nearest half-inch and a subsample of scales was collected from fish in each half-inch group for determination of mean length at age. Fish growth was compared to the statewide average.

A 40 hour week roving creel survey of anglers was used to document daytime, angling pressure, catch and harvest during the latter half of April and the entire months of May and June. Instantaneous counts were made twice a day and only completed angler trips were used in calculating catch and harvest. Angler exploitation of panfish (except yellow perch) was calculated by comparing the estimated number of marked fish harvested by anglers to the original number of fish marked in the survey. Exploitation for yellow perch and largemouth bass was determined by comparing the estimated angler harvest of fish to the population estimate because of a lower variance of the estimated harvest than the harvested, marked fish and a very good confidence level of the population estimate. A subsample of fish was measured by the creel clerk to determine the size structure of fish harvested by anglers. Size distributions of harvested fish were compared to size distributions of fish collected by sampling.

RESULTS

Fish Abundance

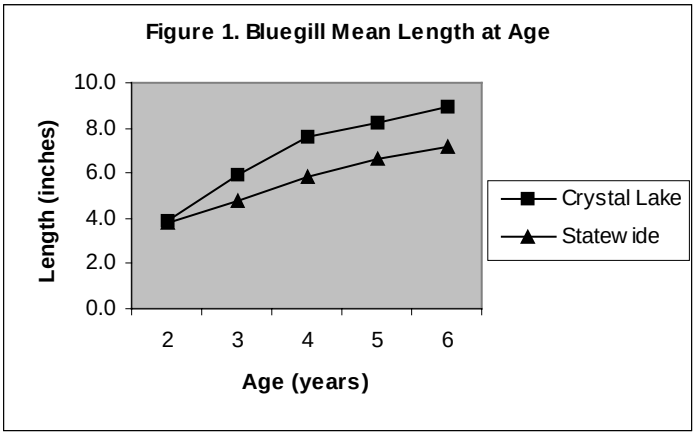
Bluegill were the most abundant of the panfish , estimated at 348 fish/acre, greater than 5.5". Pumpkinseed were next at 22/ac and black crappie and perch both about 3/ac (Table 1). The low population estimate for black crappie does not reflect the age 2, 5-6", fish which were not vulnerable to the spring fyke nets, yet were being caught by anglers. Yellow perch were least abundant, despite having the narrowest confidence limits.

Largemouth bass and northern pike were the only gamefish found in Crystal Lake. The 1999 electrofishing survey indicated that abundance of largemouth bass greater than 10" was 18,340 (35/acre) and fish 5-10" 7,808 (15/acre). An estimate of 50/acre is a very high bass population. Too few northern pike were captured to calculate an estimate.

Table 1. Populaton Estimates of Fish in Crystal Lake, Spring 1999

Fish Species	Abundance	Lower 95% CI*	Upper 95% CI
Bluegill	183,611	123,517	357,584
Pumpkinseed	7,922	5,695	13,010
Black Crappie	1,491	770	23,097
Yellow Perch	1,357	1,107	1,755
LM Bass <10”	7,808	5,101	13,397
LM Bass >10”	18,340	14,628	23,630

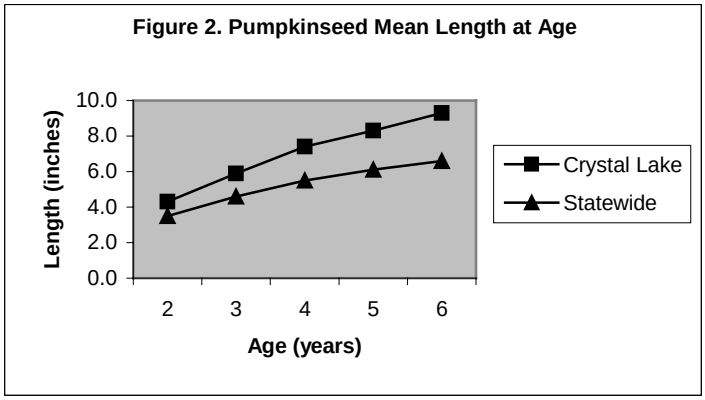
*CI – Confidence Interval



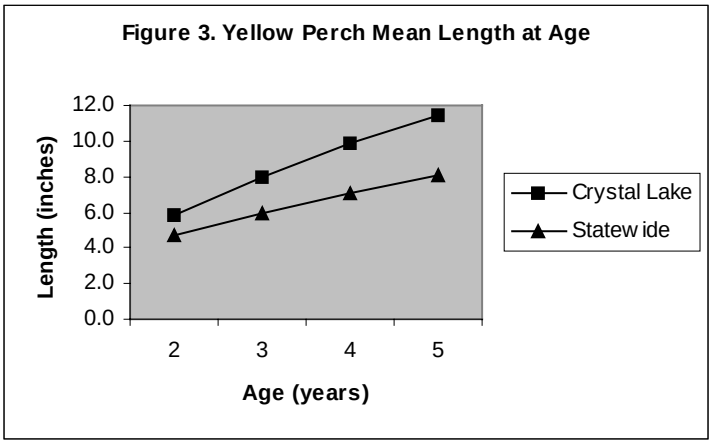
Fish Growth

Crystal Lake panfish grew faster than the Statewide average for all species (Appendix 1) and only one crappie was aged older than 6 years. Possibly the adage, “the faster cold blooded animals grow, the faster they burn out”, applies. Bluegill reached 5.9” after just 3 years and over 8” after 5 years (Figure 1).

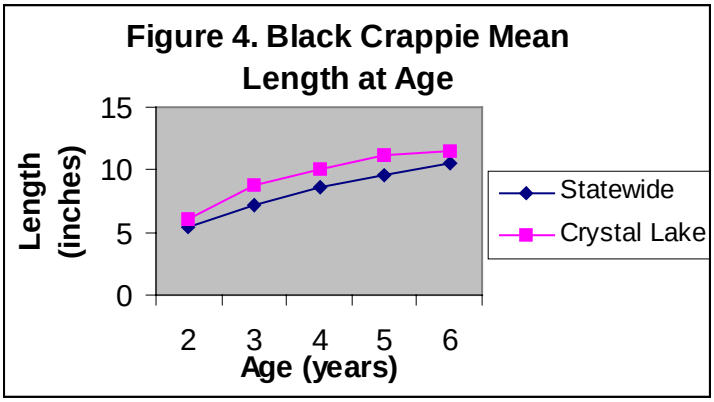
The pumpkinseed growth rate was fast for all ages (Figure 2). Fish reached the size harvested by anglers (5 inches) between the ages of 2 and 3. Growth slowed little as the mean length of age 6 was 9.3”. This is phenomenal growth for pumpkinseed.



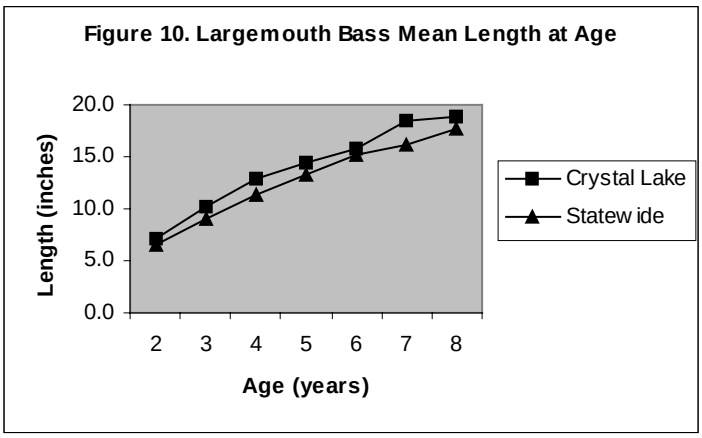
Yellow perch growth was extremely fast, hardly slowing as they aged (Figure 3). They grew at a faster rate than their counterparts in lakes, statewide. Fish reached the size harvest by anglers (8 inches) during their third year of life. Age 5 fish averaged 11.4" .



Black crappie from Crystal Lake, too, grew considerably faster than the statewide average. Fish reached 10" after 4 years (Figure 4), equal to growth on, 9,000 ac., Lake Wisconsin. One 15.5" fish was aged at 7 years.

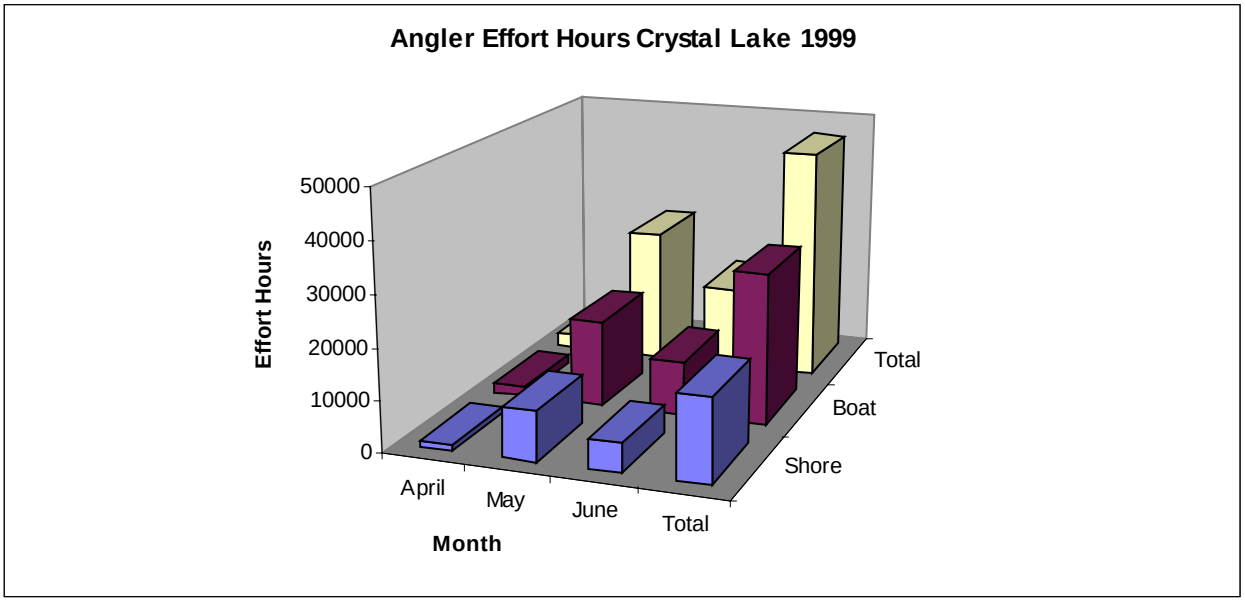


Although the population of largemouth bass in Crystal Lake was high, growth rates were still good and slightly better than the Statewide average (Figure 5). Fish reached harvestable size (14 inches) between the ages of 4 and 5.



Angler Effort

Angler effort is extremely high on Crystal Lake. This survey focused on spring fishing when the majority of angling is known to occur. Anglers fished a total of 45,991 hours (87 hours/acre) from April 15 through the end of June. Angler effort totaled 3,064 hours during the last two weeks of April, peaked at 26,559 hours in May and was 16,369 hours during June (Figure 6). A higher percentage of anglers fished by boat (64%) versus from the shore. Anglers fished a total of 16,399 hours from shore and 29,592 hours by boat. Effort during May-June 1999 was 42,927 hours on Crystal's 527 acres, compared to 47,677 hours during the same time period on 3,274 acre Lake Monona in Dane County. The 1999 springtime effort on Crystal of 87 hours/acre compared to year round effort on other Dane County lakes of 94 hours/acre on Lake Mendota in 1993, 98 hours/acre on Lake Waubesa in 1995 and 52 hours/acre/year on Fish and Mud Lakes during 1991-1993, though in 1994 Mud Lake pressure, alone, rose to 132 hours/acre.



Angler Catch and Harvest

Anglers caught more bluegill than all other fish species combined in Crystal Lake, at a catch rate of nearly 5 fish per angler hour (Table 2). Nearly half of all bluegill caught were harvested. Catch and harvest of bluegill in May and June were much higher on Crystal Lake compared to the 1999 survey of Lake Monona in Dane County. Catch and harvest of all sizes of bluegill on Crystal Lake was 181,980 and 89,450, respectively, while on Lake Monona catch was 53,697 and harvest 21,663. Black crappie was the second most commonly caught panfish (7,133, 0.4/hr) with anglers harvesting nearly half of the total catch. Pumpkinseed was next with 6,342 caught and 4,678 harvested. Few perch were caught in 1999, but anglers harvested over 70% of the catch. Total catch (30,093) and catch rate (1.4/hr) for largemouth bass were high, but less than 2% of the catch was harvested. It was not uncommon for knowledgeable bass anglers (2 anglers/boat) to catch 50-100 per trip (4-8hrs) during the May – June period.

Table 2. Catch and Harvest of Fishes from Crystal L. April 15 - June 30 1999

Species	Total Catch	Catch Rate/Hr *	Total Harvest	Harvest Rate/Hr *
Bluegill	187,840	4.7	91,464	2.3
Y. Perch	1,173	0.7	881	0.05
Pumpkinseed	6,342	0.16	4,658	0.1
Blk Crappie	7,133	0.47	3,333	0.3
Bullheads	1,447	0.06	772	0
Lm Bass	30,093	1.4	465	0.01
N. Pike	70	0	0	0

* Catch and harvest rates based on hours of fishing specifically for that species

Angler Exploitation

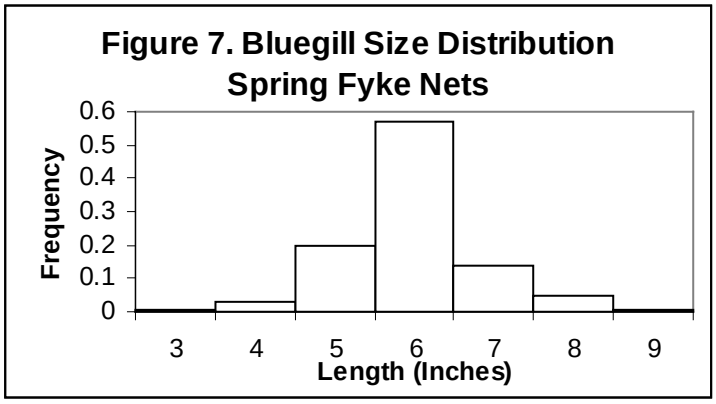
Angler exploitation of bluegill was 33%, a moderate to high rate for panfish populations (Table 3). Exploitation rates for pumpkinseed and black crappie were similar to bluegill. The rate was higher for yellow perch (65%) and 31% for largemouth bass. Exploitation rates were selected based on the variability level of the method used to calculate the value (Appendix 2).

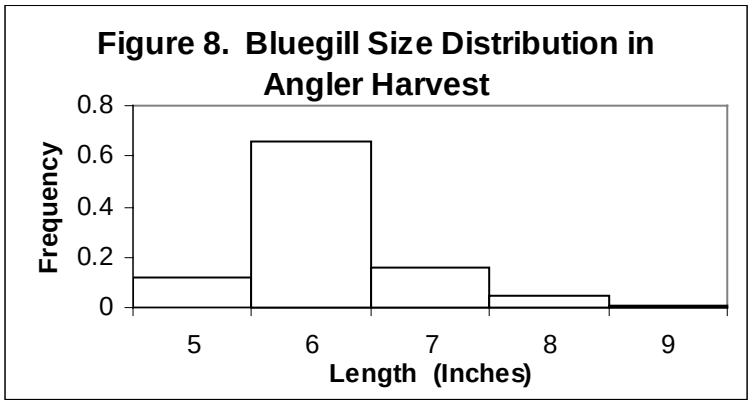
Table 3. Estimated Angler Exploitation of Crystal Lake Fish, April 15 - June 30, 1999

Species	Exploitation Rate (%)
Bluegill	33
Pumpkinseed	37
Black Crappie	31
Yellow Perch	65
Largemouth Bass	31

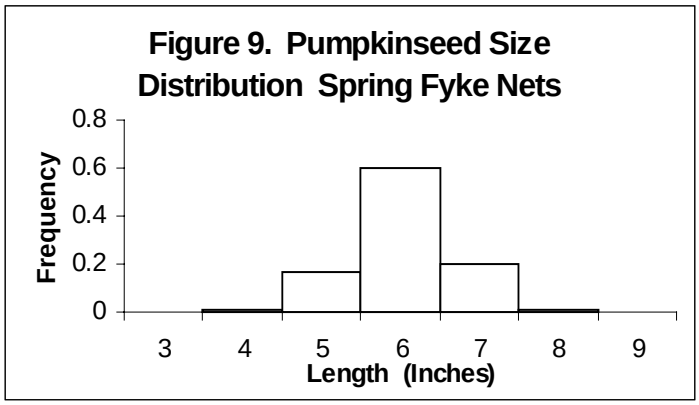
Fish Size Distribution

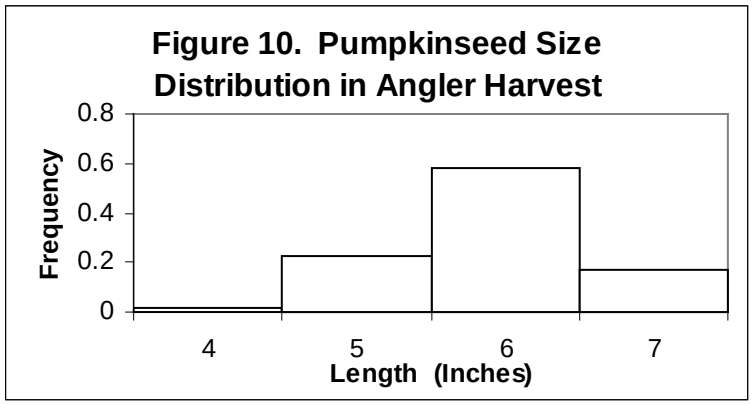
Bluegill in Crystal lake ranged in size up to 9 inches (Figure 7). Mean length of bluegill over 3.0" was 6.4", with 57% of the population 6", 14% - 7", 5% - 8" and 0.4% >9.0". Bluegill measured from a group of Wisconsin lakes in 1991 found that mean length was just under 6 inches and that 7.5% of the population >3" was over 8.0". Size of harvested bluegill was dominated by the 6" group (66%), 7" – 16%, and 8"+ - 5% (Figure 8). Thus anglers are cropping the bluegill in Crystal Lake in about the same proportion as they are represented in spring fyke nets.





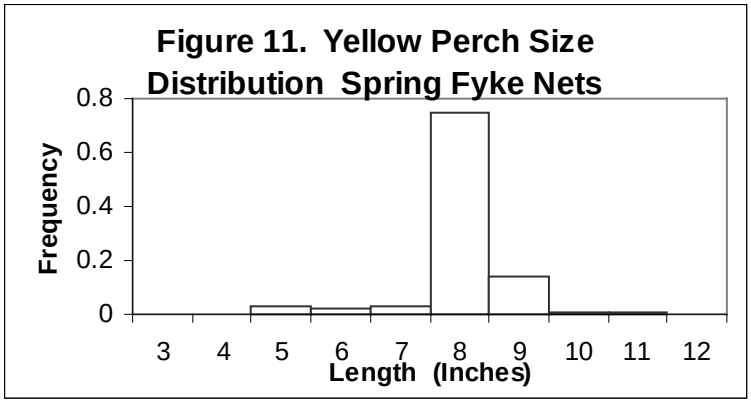
Pumpkinseed, sampled by spring fyke nets, were comprised of 5" – 18%, 6" – 60%, 7" – 20% and 8"+ 1.3% (Figure 9). Fish over 7" (21%) were slightly higher in comparison to bluegill over 7" (19.4%). Given a similar growth rate as

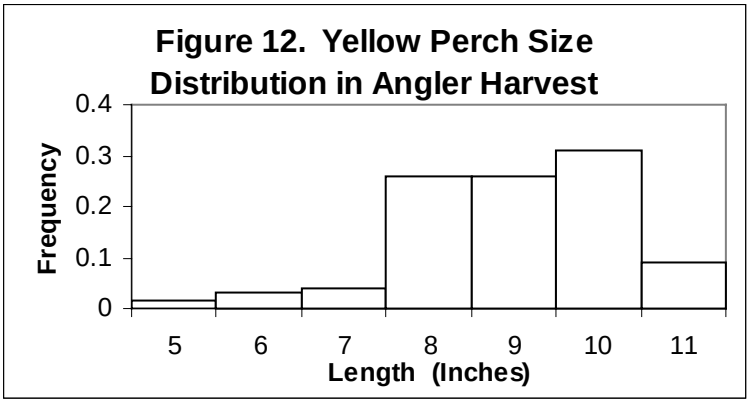




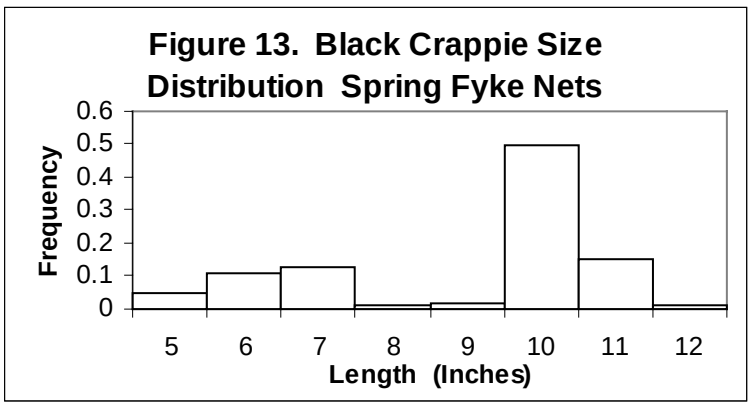
bluegill, an equivalent size distribution is expected. This is not typically observed on most other waters. Pumpkinseed just don't grow as large as bluegill. The length distribution of harvested pumpkinseed indicated that 17% of fish were greater than 7" (Figure 10). The proportion of pumpkinseed greater than 7" in the spring sample was slightly more at 21%.

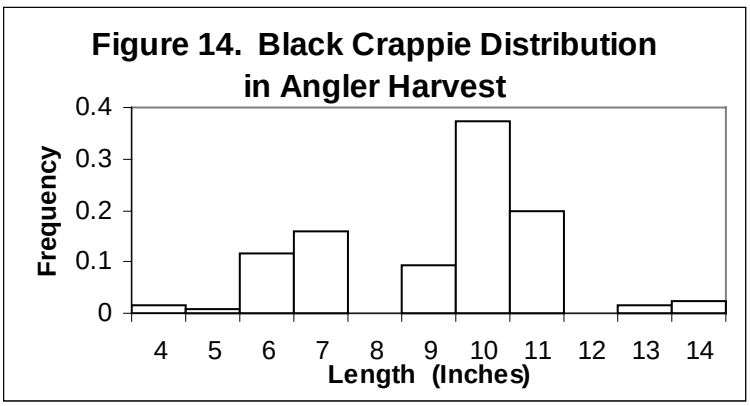
The average size of spring netted perch was 8.5". The size distribution showed that 90% of the fish range in size from 7.5 to 9 inches (Figure 11), indicating poor perch reproduction during 1997 and 1998, as perch as small as 4" are typically caught in spring fyke nets. The composition of sampled yellow perch greater than 9.0 inches was only 16% while the length distribution of harvested fish indicated that 64% were 9 inches or larger (Figure 12). Anglers were targeting larger fish and as noted earlier the perch population was low.





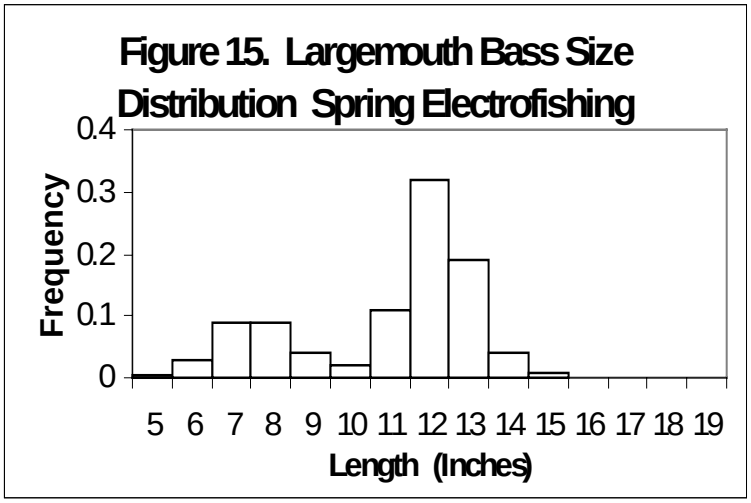
There are two modal lengths of black crappie in Crystal Lake, one group from 5.5 to 7.5 inches (25%) and another 9.5 to 11.5 inches (68%, Figure 13). A lack of fish in the 8.0 to 9.4 inch length range indicates poor reproduction in 1997. Crappies are being harvested in about the same proportion as they were found present ie. 66% 9-11" (Figure 14).

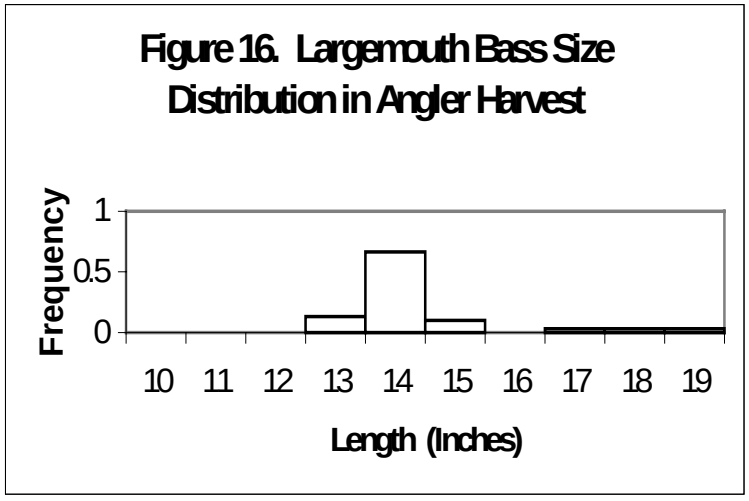




While the population of largemouth bass over 10 inches in Crystal Lake is high, the size distribution indicates that only 8% of fish >10 inches were greater than harvestable size, 14 inches, (Figure 15). Reproduction of largemouth bass is excellent with a high proportion (62%) of fish in the sampled population ranging in length from 11 to 13.9 inches, indicating two large year classes from 1995 and 1996 are currently just below the minimum size limit of 14 inches.

Most fish harvested (67%) were just at the legal minimum of 14 inches (Figure 16). A fair amount of illegal harvest of largemouth bass was documented on Crystal Lake, ie. 13% of the harvested fish were below 14 inches. Illegal harvest is likely underestimated since few anglers share this information with the creel clerk. Typically it is the panfishermen who harvest the bass, with many pure bass anglers practicing catch and release. Ten percent of the bass harvested were 15" and 10% were greater than 16".





DISCUSSION

Populations of bluegill and largemouth bass were found in high abundance. Bluegill over 5.5" numbered 348/acre and bass 50/ac (15/ac <10", 35/ac >10"). Pumpkinseed were next highest at 15/ac, with black crappie and yellow perch at about 3/ac each. However they typically display more swings in population abundance than bluegill and pumpkinseed. Historically both crappie and perch have been very abundant at times. It is speculated that their reproduction is more variable due to the fact they spawn earlier in the spring when water temperatures fluctuate. Temperatures are more stable in June when bluegill and pumpkinseed spawn, thus allowing for more constant recruitment.

Crystal Lake has become known as a "panfish factory". This is because of the exceptional fast growth rate documented by all panfish species which allows harvestable size fish to be rapidly recruited into the fishery. Prior to this survey it was suspected the harvest rate may have been much higher, observing the high use and amount of fish being harvested. However, this study has found the harvest level is compatable with the production capability of the lake, though angling pressure and harvest are high enough to prevent a buildup of larger size panfish. Data shows that the larger fish are being harvested in the same proportion as they are present in the spring fyke net sample. The creel census indicates 50% of the estimated bluegill population was harvested during this 2.5 month survey, however population estimates are highly

variable (Table 1). Angler exploitation was 33% as determined by comparing an estimate of harvested marked bluegill to the actual number fin clipped. This would be a conservative estimate as it doesn't account for marked fish lost to natural mortality. Similar estimates were in the 30% range for pumpkinseed and crappie, with yellow perch showing a higher rate at 65%.

The largemouth bass population is an important factor in the fishery. Bass numbers for fish under the 14" size limit are extremely high. Their predation, especially on the smaller size panfish, keep the panfish populations in check allowing for the excellent growth, which in turn allows for the observed panfish production and harvest levels. This is a delicate balance. A high abundance is needed to control panfish numbers, but if there are too many bass for the available food the bass population runs the risk of crashing. This may be on the verge of occurring. The past two years, especially the larger bass (>12") have appeared somewhat "skinny". During late summer of 2000 there were angler reports of a die-off of small panfish along with some bass. A sample of bass was collected on October 20, 2000. Most appeared in average condition, but of three autopsied, none had any mesenteric fat and one an off color gall bladder which indicated it had not fed in at least one week. How to best maintain the bass population at an optimal level to provide panfish control, yet maintain bass health, is a challenge.

Bass harvest appears limited, ie. 465 fish, but the 31% exploitation rate causes a definite decline in the length distribution at the 14" size limit. This sharp drop at 14" might also be explained by the extremely abundant 1995 and 1996 year classes, most of which were 12-14" during 1999. As these fish grow, more larger fish will appear in the population.

Columnaris, a bacterial disease, is another factor in the management of the fishery. When spring water temperatures reach 70 degrees, Columnaris, populations explode. At that time bluegill and crappie can be under stress from spawning and very susceptible to disease. Almost annually, significant crappie and/or bluegill mortality occurs from this disease. While large numbers can die-off, this probably better serves to also help keep panfish numbers lower and maintain good growth. The DNR fish disease specialist points out that surviving fish gain an immunity to Columnaris.

MANAGEMENT RECOMMENDATIONS

1. Status quo of the fishery is not all bad. Paramount is maintaining a healthy bass population. The bass fishery should be monitored in May and August. In May a population estimate should be conducted. A good PE requires 4 days of marking and 1 day of recapture with the big shocker and 2 dippers. Length frequency should also be noted and growth rate checked periodically. The August sample should assess condition of the fish. Condition factor data would be ideal. If bass become overabundant, either removal or a brief period of a relaxed size limit might be tired. Panfish length frequency and growth rate data obtained from spring fyke netting should also be compared periodically.

2. If there is interest in managing for larger size panfish, this would be a candidate lake because of the rapid growth rates. A high size limit may be detrimental for bluegill and pumpkinseed as it may slow growth. Rather a protected slot, ie. 6.5 – 8.0", would allow for the important reduction of smaller fish and delay harvest of the more desired larger fish. However is the Wisconsin "meat angler" ready for such management? A higher size limit may work better on perch and crappie, which typically don't have large year classes every year. As long as their growth isn't impacted, a 10" size limit would essentially delay harvest one more year, allowing them to grow from 8" to 10". This would be similar to the Quality Deer Management philosophy of letting 1½ year bucks reach 2½ year, when they have considerably larger antlers.

3. Past removal of a few thousand panfish, by volunteers, has been conducted. These fish have beeen transferred to kids fishing ponds to help promote angling. This amount of removal has no impact on the existing fishery. Intermediate size fish (5-6") should be used, rather than larger sizes.

4. The public access for Crystal Lake is not adequate. On spring weekends over 70 boat trailers are typically parked on the township road by the 15 parking space, DNR boat landing. A second boat ramp would greatly improve launching and loading at busy times, such as at dark and during approaching storms. Additional land for parking is not available at this time, thus a second boat access should be sought. Shore fishing is also popular along the road on the south side. There has been rumor of a township ordinance prohibiting shore fishing because of littering and safety issues. Shore fishing access should also be sought.

Appendix 1. Growth Rates - Crystal Lake 1999

Bluegill

	Age 2	3	4	5	6
Sample Size	11	13	7	5	4
Minimum	2.9	4.9	7.1	7.2	8
Maximum	4.8	6.8	8	8.7	9.4
Mean	3.9	5.9	7.6	8.2	8.9
Statewide Mean	3.8	4.8	5.8	6.6	7.2

Pumpkinseed

	Age 2	3	4	5	6
Sample Size	5	8	5	6	2
Minimum	3.7	5.2	7	8	9.1
Maximum	4.7	6.5	7.7	9.1	9.4
Mean	4.3	5.9	7.4	8.3	9.3
Statewide Mean	3.5	4.6	5.5	6.1	6.6

Black Crappie

	Age 2	3	4	5	6	7
Sample Size	10	1	16	8	4	1
Minimum	5.2		9.5	10.7	10.8	
Maximum	7.3		10.8	11.5	12	
Mean	6.1	8.8	10.1	11.1	11.5	15.5
Statewide Mean	5.4	7.2	8.6	9.5	10.5	

Yellow Perch

	Age 2	3	4	5
Sample Size	18	10	15	2
Minimum	4.8	7.1	8.4	11.1
Maximum	6.6	9.4	11.7	11.6
Mean	5.8	8	9.9	11.4
Statewide Mean	4.7	6	7.1	8.1

Largemouth Bass

	Age 2	3	4	5	6	7	8
Sample Size	34	14	10	6	6	4	3
Minimum	4.8	6.4	11.3	13	14.5	17.7	17.3
Maximum	9.1	12.2	15.5	15.7	17.5	19	19.6
Mean	7.2	10	12.9	14.5	15.7	18.4	18.8
Statewide Mean	6.5	9	11.4	13.3	15.1	16.3	17.6

Appendix 2. Angler Exploitation

Method 1 Estimate of Harvested Marked Fish / Actual Number of Marked Fish

		SD of Harvested Marked Fish
Bluegill	951/2903 = 33%	269 or 269/951 = 28%
Pumpkinseed	290/781 = 37%	69 or 69/290 = 24%
Black Crappie	37/118 = 31%	17 or 17/31 = 55%
Yellow Perch	80/537 = 15%	30 or 30/80 = 38%
LM Bass >14"	42/220 = 19%	22 or 22/42 = 52%

Method 2 Estimated Harvest / Estimated Population

Bluegill

	SD Harvest	95% CL Population Estimate	
90,513 unmarked	7%	Lower CL	Upper Cl
951 marked		33%	64%

91,464 total harvest / 183,611 population = 50% exploitation

Pumpkinseed

	SD Harvest	95% CL Population Estimate	
4,368 unmarked	11%	Lower CL	Upper Cl
290 marked		28%	64%

4,658 total harvest / 7,922 population = 59% exploitation

Black Crappie

	SD Harvest	95% CL Population Estimate	
3,296 unmarked	27%	Lower CL	Upper CL
37 marked		48%	1449%

3,333 total harvest / 1,491 population = 223% exploitation

Yellow Perch

	SD Harvest	95% CL Population Estimate	
801 unmarked	18%	Lower CL	Upper CL
80 marked		18%	29%

881 total harvest / 1,357 population = 65% exploitation

LM Bass >14"

	SD Harvest	95% CL Population Estimate	
423 unmarked	27%	Lower CL	Upper CL
42 marked		20%	29%

465 total harvest / 1,503 population = 31% exploitation