

# FISH MANAGEMENT REPORT 130

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SUMMER CREEL SURVEY OF  
COSGROVE AND ELWOOD LAKES,  
FLORENCE COUNTY, WISCONSIN, 1979

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## ABSTRACT

A random stratified creel survey was conducted from 5 May through 30 September 1979 on Cosgrove and Elwood lakes, two northeastern Wisconsin lakes in Florence County.

Cosgrove Lake fishing pressure during the survey period was estimated at 4,210 angler hours, or 45.9 angler hours/acre. Total angler catch was estimated at 9,715 fish with an estimated harvest of 5,381. The overall catch rate was 2.22 fish/hour with a harvest rate of 1.26 fish/hour. The majority of the fish caught and harvested were panfish, with black crappie and bluegill composing 87% of the total fish harvested. A population estimate of smallmouth bass over 6 inches was 180 (95% confidence interval (CI) = 77-242).

Elwood Lake fishing pressure was estimated at 4,544 angler hours or 34.5 angler hours/acre. Total angler catch was estimated at 10,995 fish with an estimated harvest of 6,906. The overall catch rate was 2.42 fish/hour with a harvest rate of 1.56 fish/hour. Most of the fish caught and harvested were panfish, with yellow perch and bluegills composing 79% of the total fish harvested. Population estimates for largemouth and smallmouth bass were 816 (95% CI = 479-1,153) and 228 (95% CI = 71-385), respectively. Mortality of largemouth bass between 3 and 6 years of age was 30% and angler exploitation was 44%.

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## INTRODUCTION

A creel survey was conducted on Cosgrove and Elwood lakes in Florence County from 5 May to 30 September 1979. These lakes are located approximately 5 miles east of Florence, Wisconsin, and 8 miles west of Iron Mountain - Kingsford, Michigan (Fig. 1). The purpose of the survey was to obtain population and harvest data on two "bass, panfish" lakes located in northeastern Wisconsin. Limited information on this lake type is available, and additional studies were needed on which to base management decisions concerning largemouth and smallmouth bass.

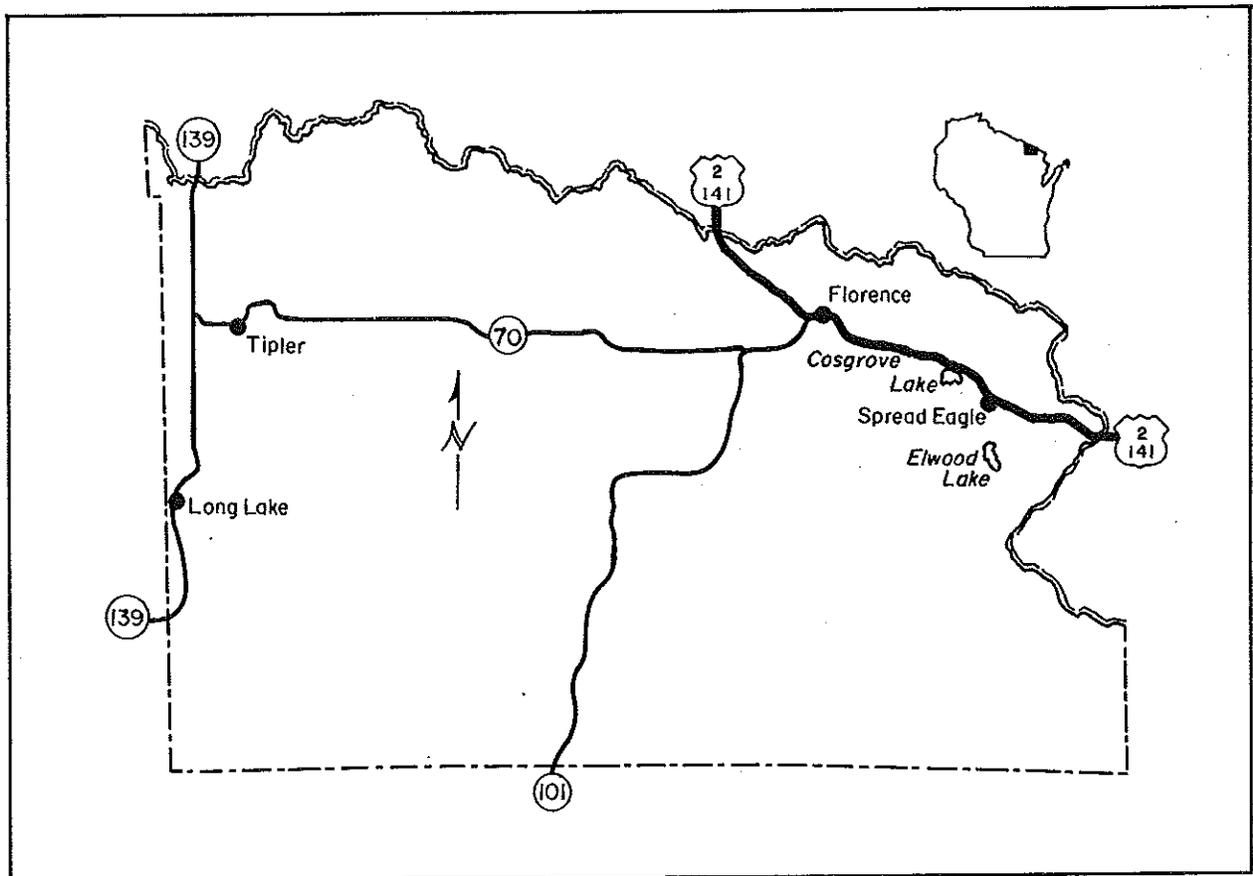


FIGURE 1. Location of Cosgrove and Elwood lakes in Florence County, Wisconsin.

## STUDY AREA

Cosgrove Lake is a 91.8-acre, medium hard water, seepage lake with a maximum depth of 26 ft (Table 1, Fig. 2). The lake has neutral (pH 7), clear water which is highly transparent. The littoral area of the lake is composed of 75% sand, 20% muck, and 5% gravel. Cosgrove Lake's shoreline is 98% highland consisting of upland hardwoods and conifers with the remainder being open marsh. The lake is accessible from an unimproved area adjacent to the road along the east shore and from an improved site located on the southern extension commonly called Railroad Lake.

Elwood Lake is a 131.9-acre, hard water, seepage lake which has slightly alkaline, clear water of high transparency (Table 1, Fig. 2). The lake has a maximum depth of 25 ft with littoral materials consisting of 85% sand, 10% gravel, 3% rubble, and 2% muck. The entire shoreline is upland consisting of mixed hardwoods and conifers. The lake is accessible from one semi-improved site located in the southwest corner of the lake.

More detailed information on each lake is available from the Wisconsin Department of Natural Resources (DNR) surface water inventory for Florence County (Carlson et al. 1971) and unpublished netting and electrofishing inventories conducted in conjunction with this survey (Wis. Dep. Nat. Resour. 1979). A fish species listing for each lake can be found in Table 2.

TABLE 1. Physical characteristics of the study lakes.

	Cosgrove Lake	Elwood Lake
Water area (acres)	91.8	131.96
Under 3 ft	31%	8%
Over 30 ft	1%	26%
Maximum depth (ft)	26	25
Total alkalinity (ppm)	48	102

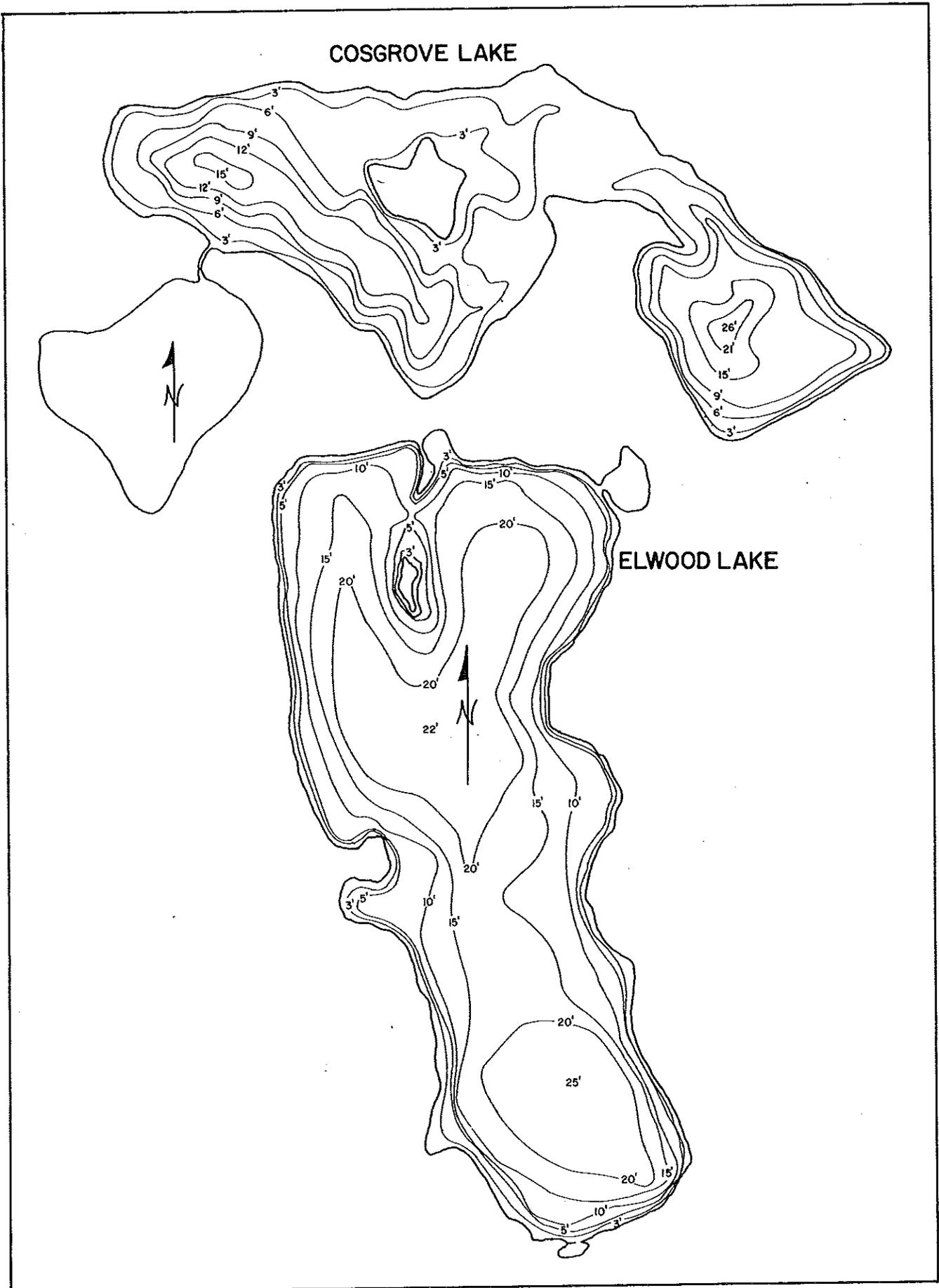


FIGURE 2. Depth contour maps of Cosgrove and Elwood lakes, Wisconsin.

TABLE 2. Fish species composition of Cosgrove and Elwood lakes.

Species	Scientific Name	Cosgrove Lake	Elwood Lake
<u>Game Fish</u>			
Largemouth bass	<u>Micropterus salmoides</u>	x	x
Smallmouth bass	<u>Micropterus dolomieu</u>	x	x
Northern pike	<u>Esox lucius</u>	x	x
Walleye	<u>Stizostedion vitreum</u>	x	x
<u>Panfish</u>			
Bluegill	<u>Lepomis macrochirus</u>	x	x
Black crappie	<u>Pomoxis nigromaculatus</u>	x	x
Green sunfish	<u>Lepomis cyaneus</u>	x	
Pumpkinseed	<u>Lepomis gibbosus</u>		x
Rock bass	<u>Ambloplites rupestris</u>	x	x
Yellow perch	<u>Perca flavescens</u>	x	x
<u>Other</u>			
Bluntnose minnow	<u>Pimephales notatus</u>	x	x
Common shiner	<u>Notropis cornutus</u>	x	x
Golden shiner	<u>Notemigonus crysoleucas</u>	x	x
White sucker	<u>Catostomus commersoni</u>	x	x

## METHODS

### Creel Survey

A random stratified sampling schedule was developed to survey each lake from 5 May through 30 September 1979, following methods described by Lambou (1961). More survey effort was given to weekend days than weekdays, and holidays were treated as weekend days. An equal amount of effort was given to each month and to each hourly time period. The entire opening weekend of the 1979 fishing season was surveyed. Half the remaining weekend periods and 30% of the weekday periods were surveyed. Weekday and weekend data were analyzed separately, as was the data for each month.

Angler counts were made at 2-hour intervals beginning at 7:00 a.m. and continuing through 9:00 p.m. The creel clerk was able to make complete angler counts on both lakes within 15 min of the angler count period. After the angler counts were completed, the clerk spent the remainder of the 2-hour survey period interviewing anglers and recording catch data. Information on fishing pressure and harvest was recorded on the forms found in Appendix Figures 1 and 2.

The length of all fish harvested was recorded by the clerk, along with information on the angler's age, sex, residence, time spent fishing, fishing methods, and bait used. One interview sheet was completed for each angler contacted. If an angler was interviewed more than once in the same day, after the first interview only the time fished and the catch since the previous contact were recorded. Most of the angler contacts were made on the water while the fishing trips were still in progress.

The average daily fishing pressure on both lakes was determined by multiplying the average number of anglers/count by the length of periods between counts and by the total number of counts/day. Total fishing pressure/month was determined by multiplying the average daily fishing pressure for the month by the number of days in the month.

Catch and harvest rates were obtained by taking the total number of fish caught or harvested, as recorded on the angler interview forms, and dividing it by the total number of hours fished for all species. The term "catch" refers to the number of fish caught, both those kept and released. The term "harvest" refers only to those fish which were creeled. The total number of each species caught and harvested was obtained by multiplying the catch and harvest rates by the estimated total fishing pressure. Catch and harvest rates were determined from catch data obtained from both complete and incomplete fishing trips.

#### Population Estimates

During the survey, population estimates for largemouth and smallmouth bass were calculated, using the Bailey modification of the Peterson mark and recapture estimate (Ricker 1958):

$$N = \frac{M(C+1)}{R+1}$$

where: M = the number of fish marked in the population,

C = the number of fish caught during the survey, and

R = the number of marked fish caught during the survey.

In the spring of 1979, trap netting and shoreline electrofishing were used as the marking run for the bass populations in both lakes. The creel survey was used to obtain harvest information and a recapture run for the population estimate.

During my study, shoreline electrofishing was the easiest way to catch bass for marking. Considerable effort was expended in an attempt to capture bass through fyke netting; however, few were captured even though nets were set before and during the spawning period.

The bass collected during the marking period were given either a left pelvic fin clip for those less than 10 inches or a right pelvic fin clip and a numbered Floy dart tag inserted along the dorsal fin for those larger than 10 inches.

### Exploitation

Ricker (1958) defined the rate of exploitation as "the fraction by number of the fish in a population at a given time, which is caught and killed by man during a specified time interval immediately following." Kempinger et al. (1975) indicated that the numbers of marked fish in a given size range, expressed as a percent, which are caught by anglers during the year after marking can be used as a direct estimate of the annual exploitation rate. Exploitation in my survey was calculated as defined by Kempinger et al. (1975).

## RESULTS AND DISCUSSION

### Fishing Pressure

Of the 633 anglers interviewed on Cosgrove Lake, 232 had completed their fishing trips. The average completed fishing trip lasted 1.6 hours, while incomplete trips averaged 1.1 hours. Anglers fished an estimated 4,210 angler hours or 45.9 angler hours/acre/year and made approximately 2,567 angler trips during the survey period.

On Elwood Lake, 168 of the 647 anglers interviewed had completed fishing. The average completed fishing trip lasted 1.8 hours, while incomplete trips averaged 1.3 hours. Anglers fished an estimated 4,544 angler hours or 34.5 angler hours/acre/year and made approximately 2,524 trips during the survey period. Because this survey covered only the summer months and daylight hours, it is recognized that these figures do not reflect the total annual fishing pressure on either lake.

Pressure was greatest for both lakes on weekdays during the months of June, July, and August (Fig. 3). Weekend days were more popular in the spring and fall, before and after the peak vacation period. Weekend anglers preferred fishing the midmorning and mid- to late afternoon hours on Cosgrove Lake and the midmorning and afternoon hours on Elwood Lake (Fig. 4). Weekday angling pressure was quite uniform on Cosgrove Lake, with the most anglers observed during the late afternoon hours (Fig. 4). A slight increase in pressure was observed on Elwood Lake during the mid- and late afternoon hours on weekdays, but overall weekday pressure was quite uniform for the entire fishing season (Fig. 4).

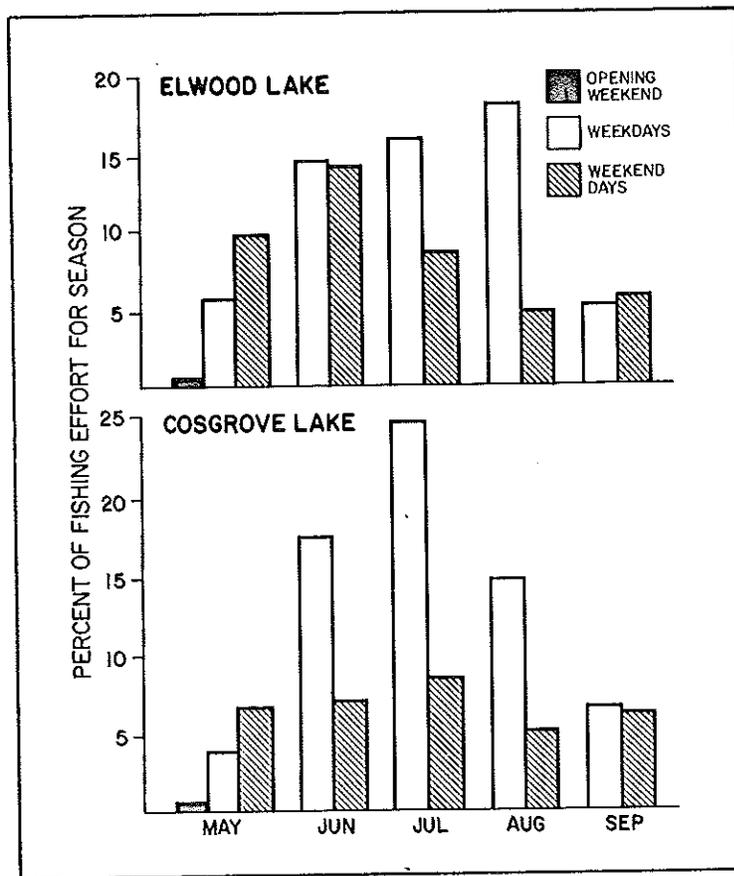


FIGURE 3. Percent of total fishing effort by month in Cosgrove and Elwood lakes, 5 May through 30 September 1979.

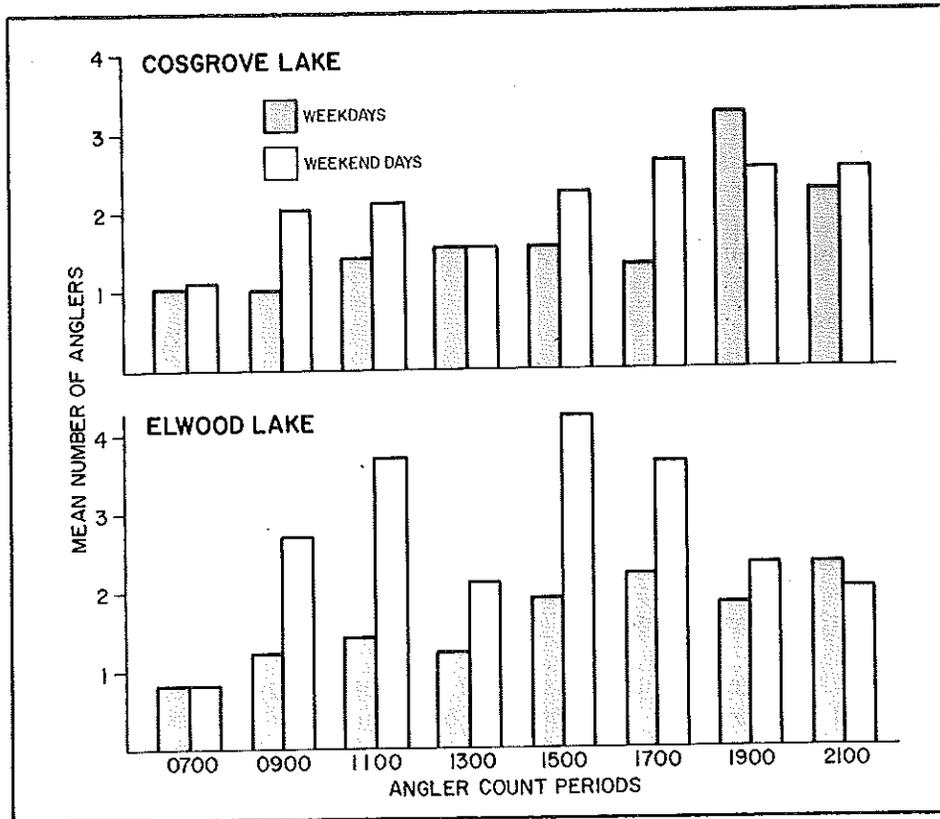


FIGURE 4. Distribution of fishing effort (angler numbers) between 7:00 a.m. and 9:00 p.m. observed on Cosgrove and Elwood lakes.

### Catch and Harvest

On Cosgrove Lake, black crappies and bluegills dominated the catch followed by smallmouth bass and walleyes (Table 3). On Elwood Lake, the panfish catch was dominated by yellow perch and bluegills followed by pumpkinseed and rock bass (Table 3). The game fish harvest was dominated in both lakes by largemouth and smallmouth bass (Table 3). Catch and harvest were greater in Elwood Lake than in Cosgrove Lake (Table 3).

On Cosgrove Lake, the overall catch rate for all species was 2.22 fish/hour with an overall harvest rate of 1.25 fish/hour (Table 4). Cosgrove Lake anglers caught an estimated 106 fish/acre, but retained only 59 fish/acre in their creels. In general, anglers were not particular as to what they caught; 43% indicated they were fishing for anything they could catch (Fig. 5). Of the remaining anglers, 35% sought game fish and 22% sought panfish.

On Elwood Lake, the overall catch rate was 2.42 fish/hour with an overall harvest rate of 1.56 fish/hour (Table 4). Elwood Lake anglers caught an estimated 83 fish/acre, but retained only 52 fish/acre in the creel. Anglers interviewed on Elwood Lake were also not particular in their catch; 54% indicated they were fishing for anything. Of the remaining anglers, 31% sought game fish and 15% sought panfish (Fig. 5).

Although more anglers indicated they were seeking game fish, the majority of the fish caught and harvested were panfish. Angler success, as measured by the retention of any fish in the creel, was similar on both lakes. Successful anglers outnumbered unsuccessful angler 65% to 35% on Cosgrove Lake and 64% to 36% on Elwood Lake.

Bass harvest on Cosgrove and Elwood lakes also occurred at a similar season as observed on Murphy Flowage (Snow 1971). Most of the largemouth bass harvested in Murphy Flowage were taken during May, June, and July (73.1%). The same 3-month period yielded 67% of the smallmouth bass and 85% of the largemouth bass harvested from Cosgrove and Elwood lakes (Fig. 6). May and June were the most successful months for bass fishing on both lakes. The survey data indicated largemouth and smallmouth bass were most susceptible to harvest during the spring spawning period.

### Population Estimates

On Cosgrove Lake, 33 smallmouth bass were captured and marked during the netting and shoreline electrofishing surveys. During the creel survey, 48 smallmouth bass were harvested, of which only 8 had been marked previously. Applying Bailey's modification of the Peterson population formula, the smallmouth bass population of Cosgrove Lake was estimated at 180 (95% confidence interval (CI) = 77-242). No estimate of the largemouth bass population in Cosgrove Lake was made since none were captured during the marking period. One largemouth bass was reported caught during the survey, but the population status remains unknown.

On Elwood Lake, 156 largemouth bass and 38 smallmouth bass were marked. During the creel survey, 95 largemouth bass and 35 smallmouth bass were harvested. Of these, 17 largemouth bass and 5 smallmouth bass had been previously marked. Populations estimates were 816 largemouth bass (95% CI = 479-1,153) and 228 smallmouth bass (95% CI = 71-385) in Elwood Lake.

TABLE 3. Estimated total number of fish caught and harvested from 5 May to 30 September 1979 in Cosgrove and Elwood Lakes.

Species	Number Caught	Number Harvested
<u>COSGROVE LAKE</u>		
Panfish		
Bluegill	4,247	4,247
Yellow perch	477	128
Black crappie	4,188	2,500
Rock bass	246	88
Game Fish		
Smallmouth bass	308	215
Largemouth bass	4	4
Walleye	241	195
Northern pike	4	4
TOTAL	9,715	5,381
<u>ELWOOD LAKE</u>		
Panfish		
Bluegill	3,329	2,192
Yellow perch	4,722	3,175
Black crappie	121	73
Pumpkinseed	941	569
Rock bass	910	293
Game Fish		
Game Fish		
Smallmouth bass	279	152
Largemouth bass	678	439
Northern pike	15	13
TOTAL	10,995	6,906

TABLE 4. Harvest rates by month of fish species taken from Cosgrove and Elwood lakes.

Species	Harvest Rate (fish/hour)					
	Overall	May	Jun	Jul	Aug	Sep
<u>Cosgrove Lake</u>						
Smallmouth bass	0.05	0.06	0.07	0.05	0.03	0.08
Walleye	0.04	0.22	0.07	0.01	0.01	
Northern pike	0.001	--	--	--	--	0.007
Largemouth bass	0.001	--	0.004	--	--	--
Black crappie	0.55	0.65	0.46	0.94	0.41	0.19
Bluegill	0.53	0.37	0.20	0.66	0.80	0.58
Rock bass	0.02	0.01	0.02	0.008	0.03	0.05
Yellow perch	0.06	0.01	0.01	0.02	0.09	0.02
All species	1.25	1.32	0.83	1.69	1.37	0.93
<u>Elwood Lake</u>						
Smallmouth bass	0.03	0.04	0.05	0.01	0.04	0.02
Northern pike	0.003	--	0.006	--	0.004	--
Largemouth bass	0.09	0.19	0.14	0.05	0.05	0.02
Black crappie	0.01	0.04	0.03	0.01	--	--
Bluegill	0.48	0.26	0.55	0.38	0.73	0.26
Rock bass	0.07	0.06	0.11	0.04	0.04	0.05
Yellow perch	0.76	0.84	0.04	0.28	0.96	2.69
Pumpkinseed	0.12	0.23	0.15	0.10	0.09	0.02
All species	1.56	1.66	1.08	0.87	1.91	3.06

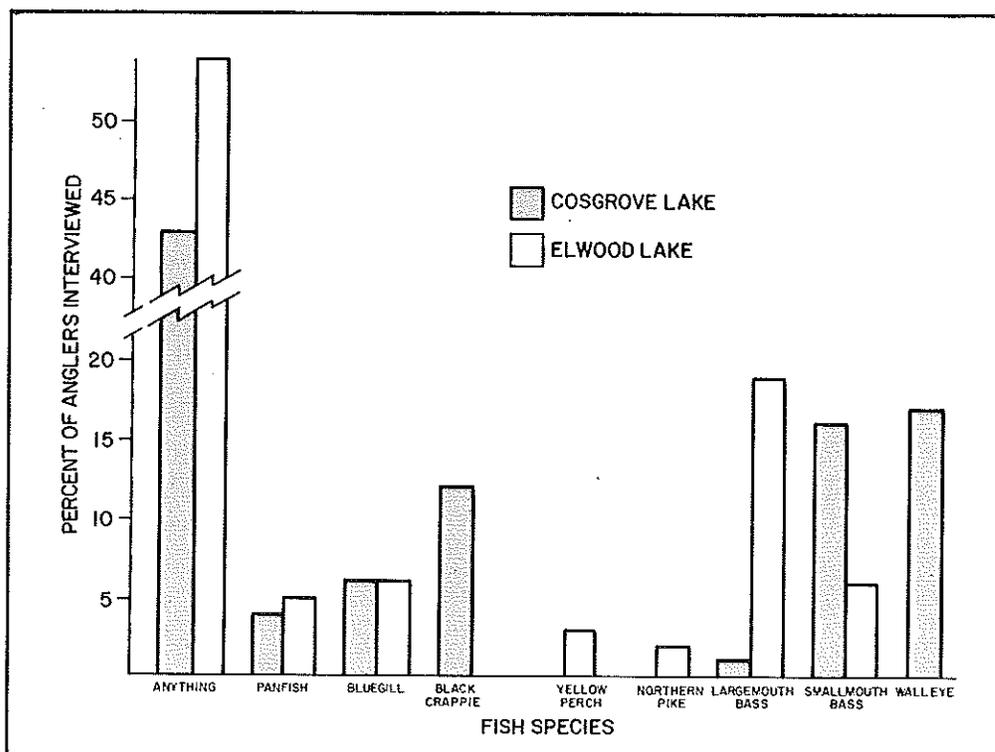


FIGURE 5. Fish species sought by anglers on Cosgrove and Elwood lakes.

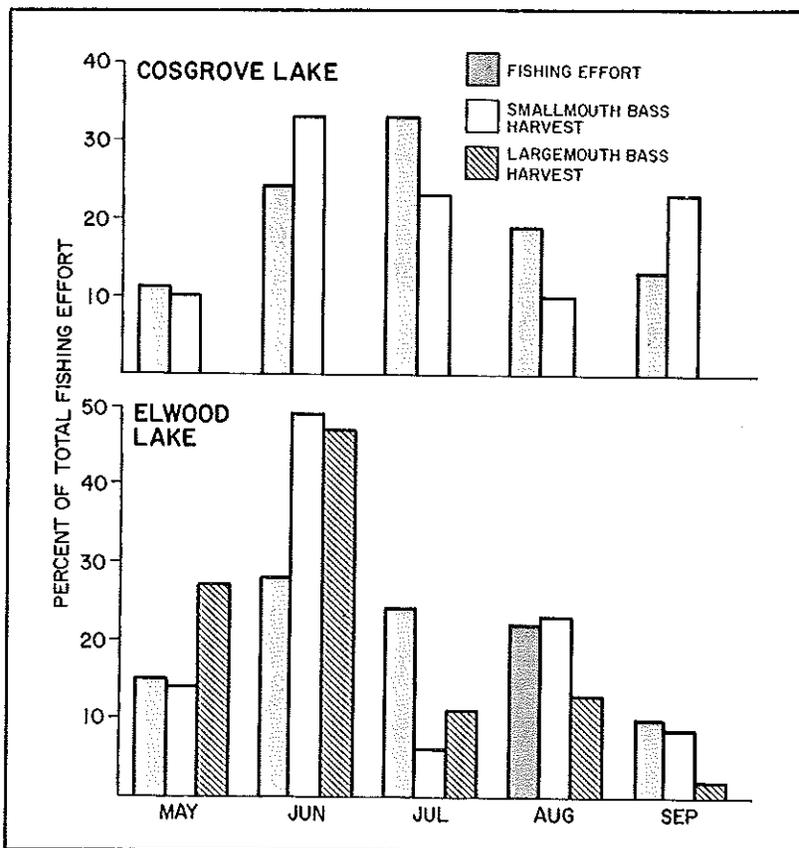


FIGURE 6. Monthly distribution of total fishing effort and bass harvest from Cosgrove and Elwood lakes.

### Exploitation

On Elwood Lake, largemouth bass exploitation was 44%. No exploitation rates could be determined for smallmouth bass from either lake due to the small sample of marked bass obtained during the creel survey.

Little information is available on largemouth or smallmouth bass exploitation in the Midwest (Table 5). Largemouth bass exploitation of 18-48% was reported by Goudy (1981) in three lower Michigan lakes. Snow (1971) reported that largemouth bass exploitation in Murphy Flowage was 27%. Marimac (1976) indicated smallmouth bass exploitation in Clear Lake was 39% in 1974 and 48% in 1975. These studies indicate there is considerable variability in exploitation among lakes. The exploitation rate of largemouth bass from Elwood Lake appeared consistent with the results reported in the other studies.

### Mortality

Estimated total mortality for Elwood Lake largemouth bass 3-6 years old was 30%. Smallmouth bass mortality could not be determined for either lake because of the small sample size and limited number of year-classes captured.

TABLE 5. Fishing pressure and harvest in midwestern lakes.

Reference	Lake	Acres	Fishing Pressure (hours/acre)	Harvest (fish/hour)	Bass Exploitation
Bennett and Durham (1951)	Ridge Lake, IL	18	187	0.48	--
Christensen (1953)	12 lakes, MI	4,506	120	1.25	--
Goudy (1981)	Pontiac Lake, MI	593	80	--	LMB 34%
	Whitmore Lake, MI	685	94	--	LMB 48%
	Kent Lake, MI	1,013	189	--	LMB 18%
Patriarche (1960)	8 lakes, MI	1,130	21	0.81	--
Moyle et al. (1950)	12 lakes, MN	15,134	33	0.83	--
Olson (1958)	Many Point Lake, MN	1,716	17	0.54	--
Marimac (1976)	Clear Lake, WI	846	121	--	SMB 39%
	Clear Lake, WI	846	89	--	SMB 48%
McKnight and Serns (1974)	Black Oak Lake, WI	584	19	0.74	--
	Laura Lake, WI	599	20	0.58	--
	Stormy Lake, WI	522	16	0.62	--
Heizer (this study)	Cosgrove Lake, WI	92	46	1.22	--
	Elwood Lake, WI	132	35	1.60	LMB 44%
Snow (1971, 1978)	Murphy Flowage, WI	180	74	1.88	LMB 27%
Wisconsin DNR (1979)	10 lakes, WI	3,529	93	0.87	--

## Angler Characteristics

Many angler characteristics were found to be similar for both lakes. Male anglers composed the majority of those fishing on both Cosgrove and Elwood lakes (Fig. 7). Most were 16-64 years old; however, anglers younger than 16 outnumbered those over 64.

During the interview, anglers were asked which baits they were using. On Cosgrove Lake, 55% fished with live bait, 23% used artificial lures, and the remaining 22% used several baits in combination. On Elwood Lake, 66% used live bait, 15% used artificial lures, and the remaining 19% fished with a combination. On both lakes, anglers using live bait were usually fishing with worms or minnows.

Angler methods were similar for both lakes, with 82% of the anglers on Cosgrove Lake and 64% on Elwood Lake fishing from boats. The number of anglers/boat averaged 1.7 on Cosgrove Lake and 2.1 on Elwood Lake.

Anglers interviewed on both lakes were found to reside at locations throughout Wisconsin and Upper Michigan (Fig. 7). Nonresidents made up 47% of the anglers contacted on Cosgrove Lake and 37% on Elwood Lake. Many of these resided more than 25 miles away. Resident anglers traveling more than 50 miles composed 24% of the angling pressure on Cosgrove Lake and 27% on Elwood Lake.

Both Cosgrove and Elwood lakes were shown by the survey to be popular with lake residents, as well as people from the surrounding area. Because of their proximity to a popular vacation area, many of the anglers interviewed were probably on vacations of 1 or more weeks. The survey data also indicated the lakes attracted a significant number of nonresident anglers from the Iron Mountain--Kingsford, Michigan area.

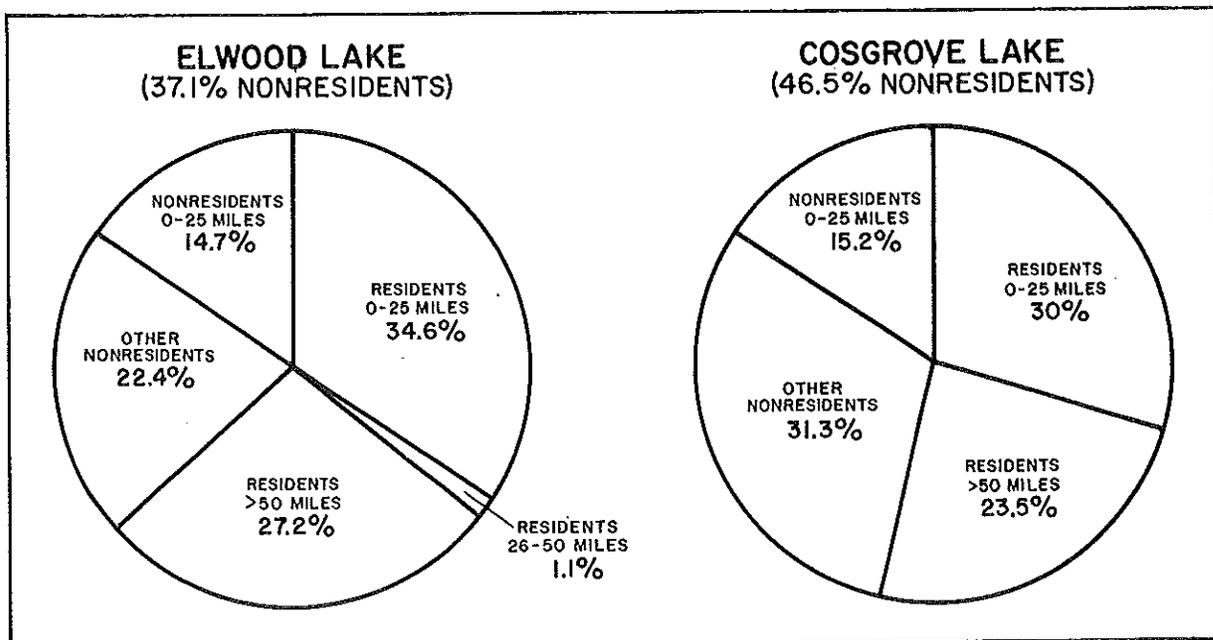


FIGURE 7. Residence characteristics of anglers fishing on Cosgrove and Elwood lakes.

Although not formally surveyed, angler attitudes indicated that residents and nonresidents enjoyed fishing these lakes because they were successful in catching fish. Several anglers also indicated they enjoyed fishing these lakes because they were less crowded than some other area waters. For this reason I suspect that most of the anglers preferred fishing in the morning, late afternoon, or evening hours when pleasure boating was at a minimum. Many anglers also believed that at these times the water would be calmer and fishing more productive.

## MANAGEMENT IMPLICATIONS

There are three generally accepted means of controlling fish harvest: size limit, bag limit, and closed season. Wisconsin is currently using all three methods to control the harvest of largemouth and smallmouth bass (Klingbiel 1981). Throughout Wisconsin, largemouth and smallmouth bass angling is on the increase. The question fish managers face is: do these fish need greater protection from harvest or could the population bear greater exploitation? Looking at our results on Cosgrove and Elwood lakes, it did not appear that the bass of either lake were being overharvested.

### Size Limits

My study indicated that a 10-inch size limit would have reduced smallmouth bass harvest from Cosgrove Lake by 17% (Fig. 8). The Elwood Lake harvest of smallmouth bass would have dropped by 31% and largemouth bass harvest by 40% using the same size limit (Fig. 9).

The theory behind size limits is that fish are protected from angling mortality during the period of their most rapid growth. The need for size limits has been debated quite strongly for many years. Opponents of size restrictions point out that few bass are needed to maintain a population, and since natural mortality takes a greater percentage of young fish than the angler, the need for this type of protection is questionable. Proponents believe that protecting the young fish from harvest during their early life will provide more harvestable fish of desirable size and increase the number of mature adult fish to serve as brood stock.

My study showed that the harvest of smallmouth bass from Cosgrove Lake would have declined by 33% if a 12-to 15-inch slot size limit had been used (Fig. 8). Elwood Lake harvest of smallmouth bass would have fallen by 31% and largemouth bass by 23% using the same slot limit (Fig. 9). The theory behind this regulation is that spawning stocks are protected from harvest between the established length limits.

### Closed Seasons

A closed season from March until May is currently employed in Wisconsin. The intent of this regulation is to protect the species from harvest during the spawning period. Male largemouth and smallmouth bass are particularly vulnerable to harvest during this period, so some form of protection is necessary.

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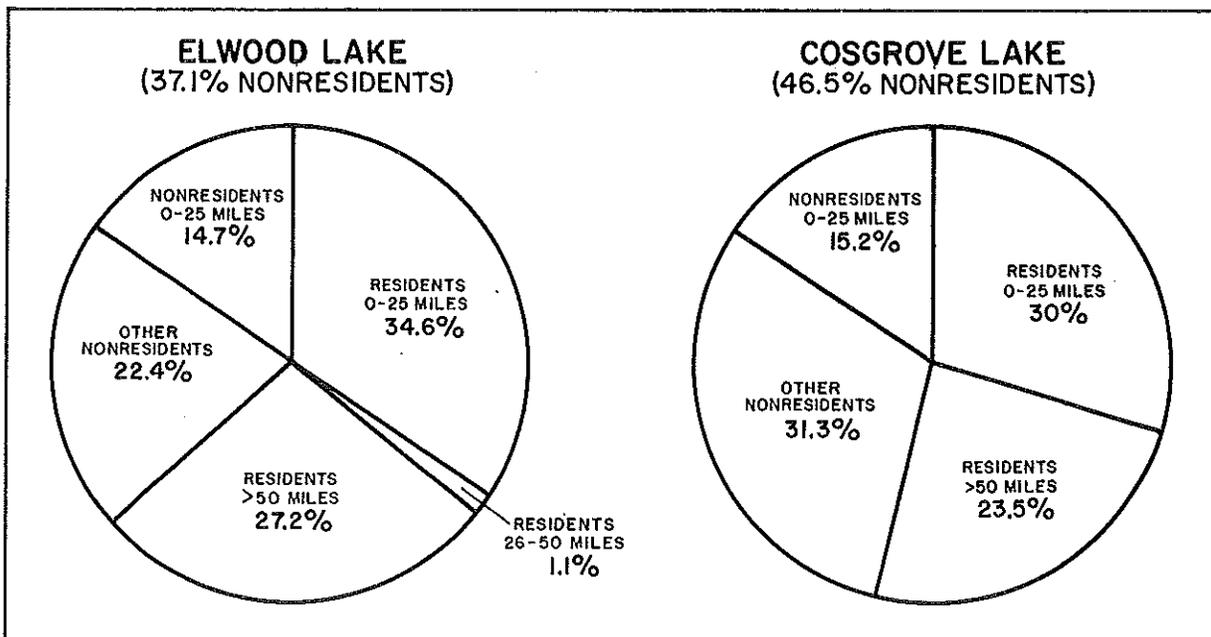


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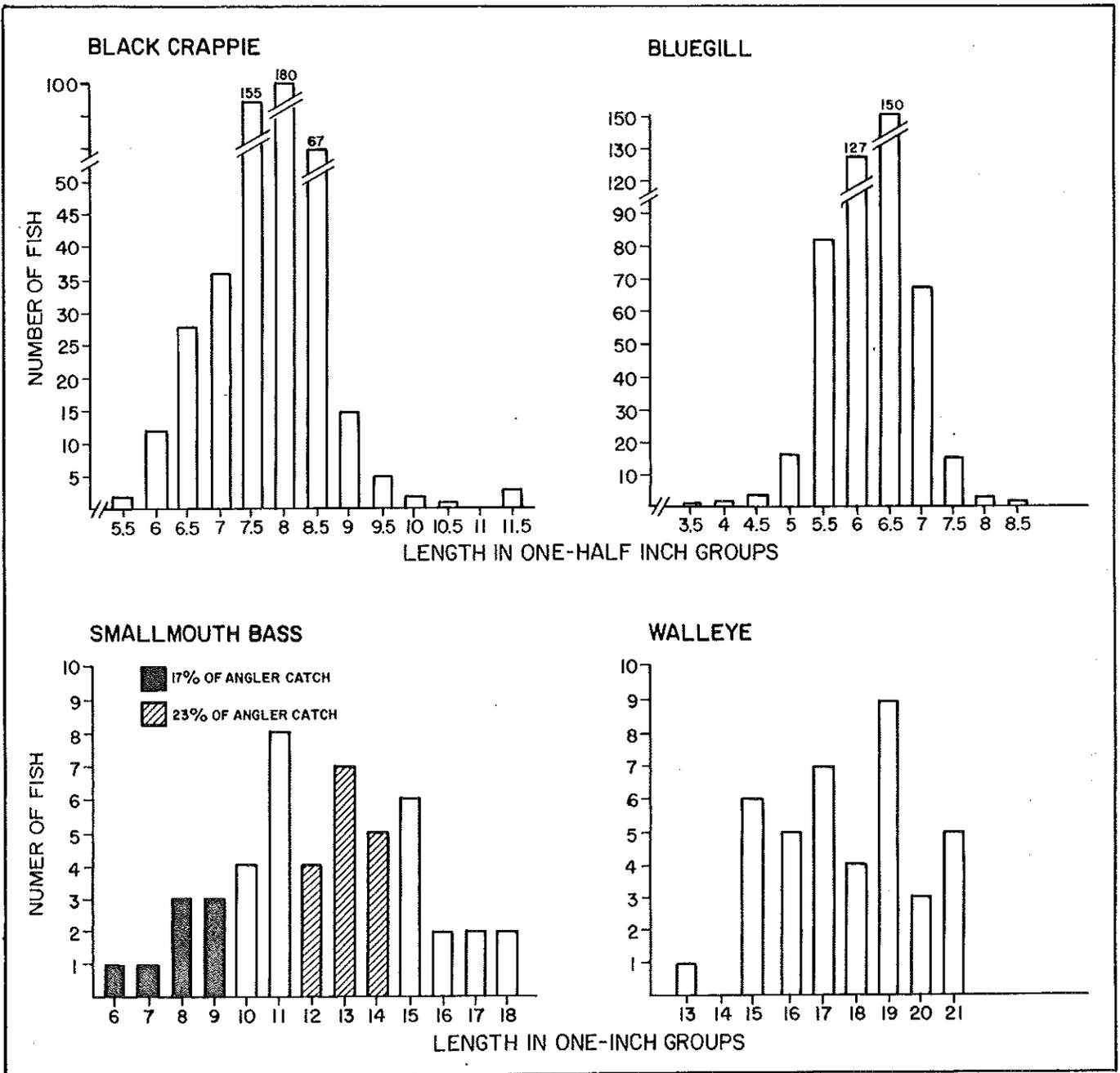


FIGURE 8. Length frequency of angler-caught fish on Cosgrove Lake.

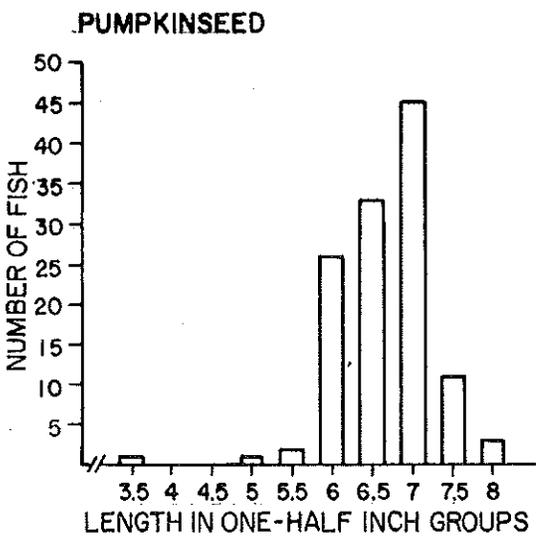
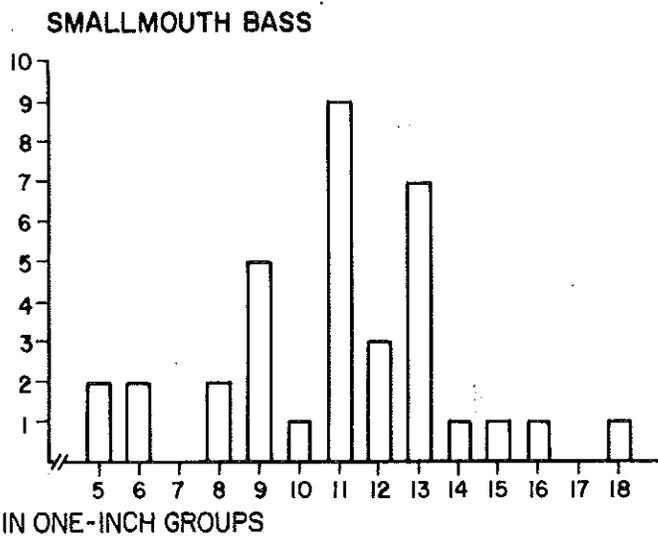
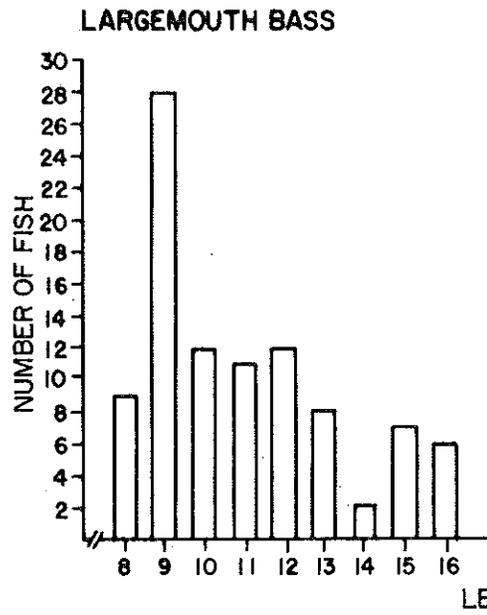
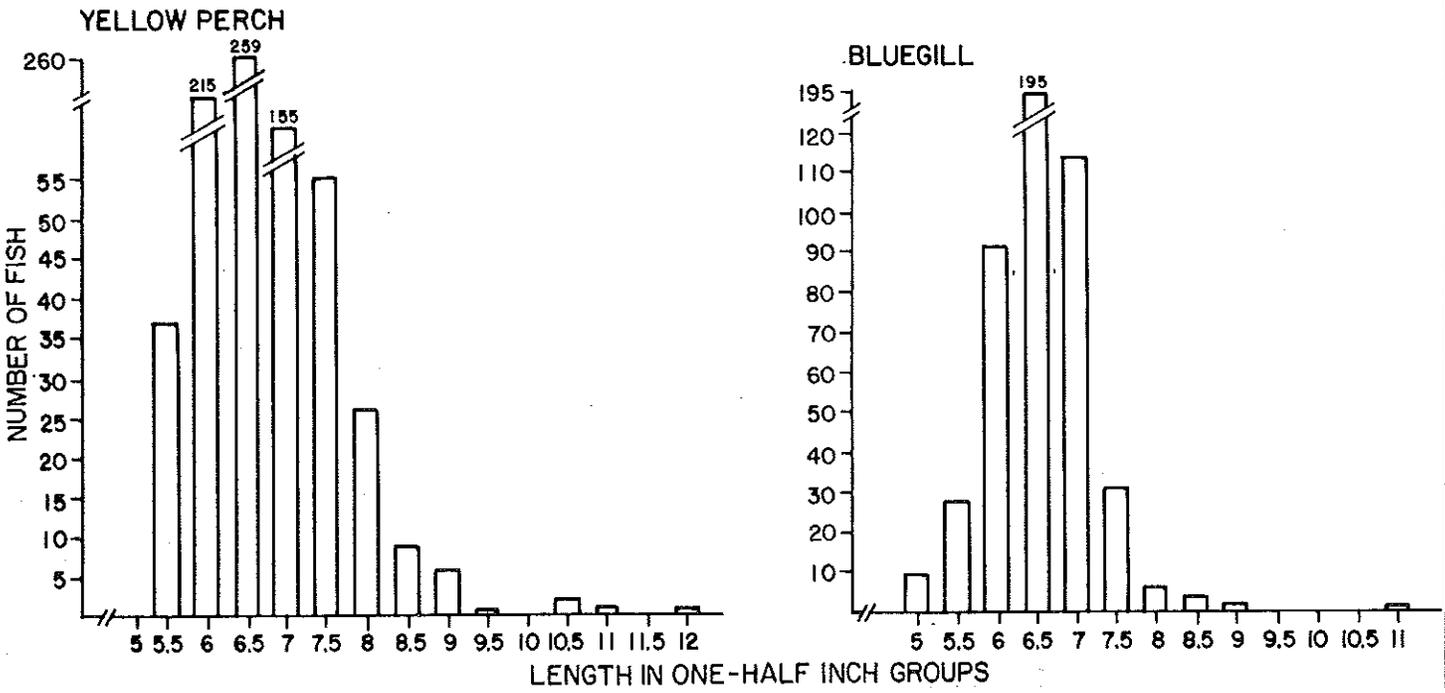


FIGURE 9. Length frequency of angler-caught fish on Elwood Lake.

In 1979, the 1 May opening date provided the Cosgrove and Elwood lakes bass populations little protection, since much of the spawning season occurred after the opening date. The high harvest of bass observed during May and June in this study was probably due to spawning bass being harvested.

### Bag Limits

The third technique used in Wisconsin to control bass harvest is bag limit. The purpose of a bag limit is to protect the population from overharvest by limiting the number of fish an angler can creel. Generally, bag limits are thought to be ineffective since few anglers consistently catch their limit. In my study only 1 limit of bass was taken from either lake. The data shows, however, that during the spawning period of late May and June, both largemouth and smallmouth bass were effectively harvested. The total number of bass taken during this period represented over half the total harvested for the entire survey. The results indicate that the current bag limit had little effect in controlling the harvest of bass from these waters during the 1979 fishing season.

### Stocking

In many lakes, maintenance stocking has become routine for maintaining a fishable population of various species. With increasing interest in bass fishing, many groups are requesting more planting of bass to insure a harvestable population. The stocking of both largemouth and smallmouth bass in Wisconsin has largely involved the transfer of adult bass from one lake to another. The only fingerling or fry stocking involved new introductions into chemically rehabilitated waters.

The results of this study indicate that neither lake appears to have a problem with over-exploitation of largemouth or smallmouth bass. Based on these observations, it is not felt that bass stocking would enhance the bass populations of either lake.

## LITERATURE CITED

- Bennett, G. W. and L. Durham  
1951. Cost of bass fishing at Ridge Lake, Coles County, Illinois. Ill. Nat. Hist. Surv. Biol. Notes No. 23.
- Carlson, H., L. M. Andrews, and C. W. Threinen  
1971. Surface water resources of Florence County. Wis. Dep. Nat. Resour., Madison. 84 pp.
- Christensen, K. E.  
1953. Fishing in twelve Michigan lakes under experimental regulations. Mich. Dep. Conserv. Inst. Fish. Res. Misc. Publ. No. 7.
- Goudy, G. W.  
1981. The exploitation, harvest and abundance of largemouth bass populations in three southeastern Michigan lakes. Mich. Dep. Nat. Resour. Fish. Res. Rep. No. 1896.
- Kempinger, J. J., W. S. Churchill, G. R. Priegel, and L. M. Christensen  
1975. Estimate of abundance, harvest and exploitation of the fish population of Escanaba Lake, Wisconsin, 1946-69. Wis. Dep. Nat. Resour. Tech. Bull. No. 84. 30 pp.
- Klingbiel, J.  
1981. The status of bass management. Wis. Dep. Nat. Resour. Fish Manage. Adm. Rep. No. 12. 11 pp.
- Lambou, V. W.  
1961. Determination of fishing pressure from fishermen or party counts with a discussion of sampling problems. Proc. Ann. Conf. Southeast Game Fish Comm.
- Marimac, P.  
1976. The smallmouth bass population and fishing in a northern fishery in a northern Wisconsin lake, Clear Lake, Oneida County. M.S. Thesis, Univ. Wis., Stevens Point.
- McKnight, T. and S. L. Serns  
1974. A summer creel census of Stormy, Black Oak and Laura Lakes, Vilas County. Wis. Dep. Nat. Resour. Fish Manage. Rep. No. 71. 27 pp.
- Moyle, J. B., J. H. Kuehm, and C. R. Burrows  
1950. Fish population and catch data from Minnesota lakes. Trans. Am. Fish. Soc. 78.
- Olson, D. D.  
1958. Statistics of a walleye sport fishery in a Minnesota lake. Trans. Am. Fish. Soc. 87.

- Patriarche, M. H.  
1960. A 12-year history of fishing in the lakes of the Rifle River area, Ogemaw County, Michigan 1945-56. Mich. Dep. Conserv. Misc. Publ. No. 13.
- Ricker, W. E.  
1958. Computation and interpretation of biological statistics of fish populations. Fish. Res. Board Can. Bull. No. 119. 382 pp.
- Snow, H. E.  
1971. Harvest and feeding habits of largemouth bass in Murphy Flowage, Wisconsin. Wis. Dep. Nat. Resour. Tech. Bull. No. 50. 24 pp.  
1978. A 15-year study of the harvest, exploitation and mortality of fishes in Murphy Flowage, Wisconsin. Wis. Dep. Nat. Resour. Tech. Bull. No. 103. 22 pp.
- Wisconsin Department of Natural Resources  
1979. Wisconsin Department of Natural Resources records, Marinette, Wis. (unpubl. data).

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Edited by Donna Mears.

NAME OF CLERK _____	DATE (MO.-DAY-YR.) ____/____/____
---------------------	--------------------------------------

**GENERAL INFORMATION**

1. NAME OF WATER _____ CODE _____	2. COUNTY _____ CODE _____
3. WATER TYPE <input type="checkbox"/> 1. LAKE <input type="checkbox"/> 2. STREAM <input type="checkbox"/> 3. IMPOUNDMENT	4. LOCATION OF CENSUS SITE/GRID _____
5. POOL/SECTION NUMBER _____ CODE _____	6. WAS DATE OF CREEL CENSUS A: <input type="checkbox"/> WEEKDAY <input type="checkbox"/> WEEKEND <input type="checkbox"/> HOLIDAY
7. GENERAL WEATHER CONDITIONS: _____ _____	

8. GENERAL COMMENTS:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**COUNTS**

UNIT OF MEASURE	TIME						
	_____	_____	_____	_____	_____	_____	_____
	COUNT						
1. NUMBER OF WADING ANGLERS							
2. NUMBER OF SHORE ANGLERS							
3. NUMBER OF BOAT ANGLERS							
4. NUMBER OF PIER/ BREAKWATER ANGLERS							
5. NUMBER OF FISHING BOATS							
6. NUMBER OF PLEASURE BOATS							
7. NUMBER OF ICE SHANTIES							
8. NUMBER OF OPEN ICE ANGLERS							
9. NUMBER OF SNOWMOBILES							
10. NUMBER OF CARS W/O TRAILERS							
11. NUMBER OF CAR/TRAILER UNITS							
12. NUMBER OF MOTORCYCLES							
13. NUMBER OF BICYCLES							
OTHER							

APPENDIX FIGURE 1.

COUNTY \_\_\_\_\_ CODE \_\_\_\_\_ NAME OF WATER \_\_\_\_\_ CODE \_\_\_\_\_ DATE (MO.-DAY-YR.) \_\_\_\_\_  
 WATER TYPE  1. LAKE  2. STREAM  3. IMPOUNDMENT SHEET NUMBER \_\_\_\_\_

FISH SPECIES CODE

L. STURGEON 010  
 SHOVELNOSE 012  
 L. WHITEFISH 082  
 COHO 090  
 CHINOOK 091  
 RAINBOW 092  
 ATLANTIC SAL. 093  
 BROWN 094  
 BROOK 095  
 LAKE T. 096  
 TIGER T. 097  
 NORTHERN P. 121  
 MUSKIE 122  
 HYB. MUSKIE 123  
 CARP 134  
 WHT. SUCKER 194  
 BLACK BH 221  
 YELLOW BH 222  
 BROWN BH 223  
 CHANNEL CAT 224  
 FLATHEAD CAT 229  
 BURBOT 260  
 WHITE BASS 300  
 YELLOW BASS 301  
 ROCK BASS 310  
 GREEN SF 311  
 PUMPK IN S. 312  
 WARMOUTH 313  
 BLUEGILL 315  
 SM BASS 318  
 LM BASS 319  
 W. CRAPPIE 320  
 B. CRAPPIE 321  
 Y. PERCH 343  
 SAUGER 349  
 WALLEYE 350  
 FW DRUM 360  
 OTHER

1. PARTY INTERVIEWED \_\_\_\_\_  
 NUMBER OF ANGLERS IN PARTY .... \_\_\_\_\_  
 2. WERE ANGLERS THE:  
 DRIVER ..... \_\_\_\_\_  
 PASSENGER ..... \_\_\_\_\_  
 NO CAR ..... \_\_\_\_\_  
 3. AGE:  
 UNDER 16 ..... \_\_\_\_\_  
 16-64 ..... \_\_\_\_\_  
 65 AND OVER ..... \_\_\_\_\_  
 4. SEX ..... \_\_\_\_\_  
 5. ANGLER RESIDENCE:  
 CITY ..... \_\_\_\_\_  
 COUNTY ..... \_\_\_\_\_  
 STATE ..... \_\_\_\_\_  
 RANGE CODE .. \_ \_  
 6. LICENSE:  
 NONE ..... NON-RES. ANN. \_\_\_\_\_  
 RES. .... NON-RES. FAM. \_\_\_\_\_  
 PERM. RES. .... NON-RES. 15 D \_\_\_\_\_  
 RES. COMB. .... NON-RES. 4 D \_\_\_\_\_  
 RES. SPORT \_\_\_\_\_  
 7. TIME STARTED FISHING \_\_\_\_\_  
 TIME ENDED FISHING \_\_\_\_\_  
 TIME INTERVIEWED \_\_\_\_\_  
 COMPLETED FISHING  YES  NO  
 8. SPECIFICALLY FISHING FOR: (CODE)  
 A. \_\_\_\_\_  
 B. \_\_\_\_\_  
 9. ANGLING METHOD USED:  
 BAIT CAST. \_\_\_\_\_ JIG-POLE \_\_\_\_\_  
 FLY ..... TIP-UP..... \_\_\_\_\_  
 SPIN ..... SNAGGING \_\_\_\_\_  
 STILL ..... SPEARING \_\_\_\_\_  
 TROLL ..... OTHER..... \_\_\_\_\_  
 10. FISHING WAS FROM:  
 PIER ..... BOAT ..... \_\_\_\_\_  
 SHORE ..... ICE..... \_\_\_\_\_  
 WADING .... \_\_\_\_\_  
 11. BAITS USED:  
 WORM ..... MINNOW ..... \_\_\_\_\_  
 PREPARED BAIT \_\_\_\_\_ FLY ..... \_\_\_\_\_  
 PLUG ..... SPOON..... \_\_\_\_\_  
 SPINNER.... JIG ..... \_\_\_\_\_  
 OTHER \_\_\_\_\_  
 12. COMMENTS: \_\_\_\_\_

13.	SPECIES CODE							
14.	NO. OF FISH KEPT							
15.	NO. OF FISH RELEASED							
16.	SPECIES	LENGTH	WEIGHT	TAG TYPE	TAG/FINCLIP	OLD SCARS	FRESH WOUNDS	OTHER
A.								
B.								
C.								
D.								
E.								
F.								
G.								
H.								
I.								
J.								
K.								
L.								
M.								
N.								
O.								

APPENDIX FIGURE 2.