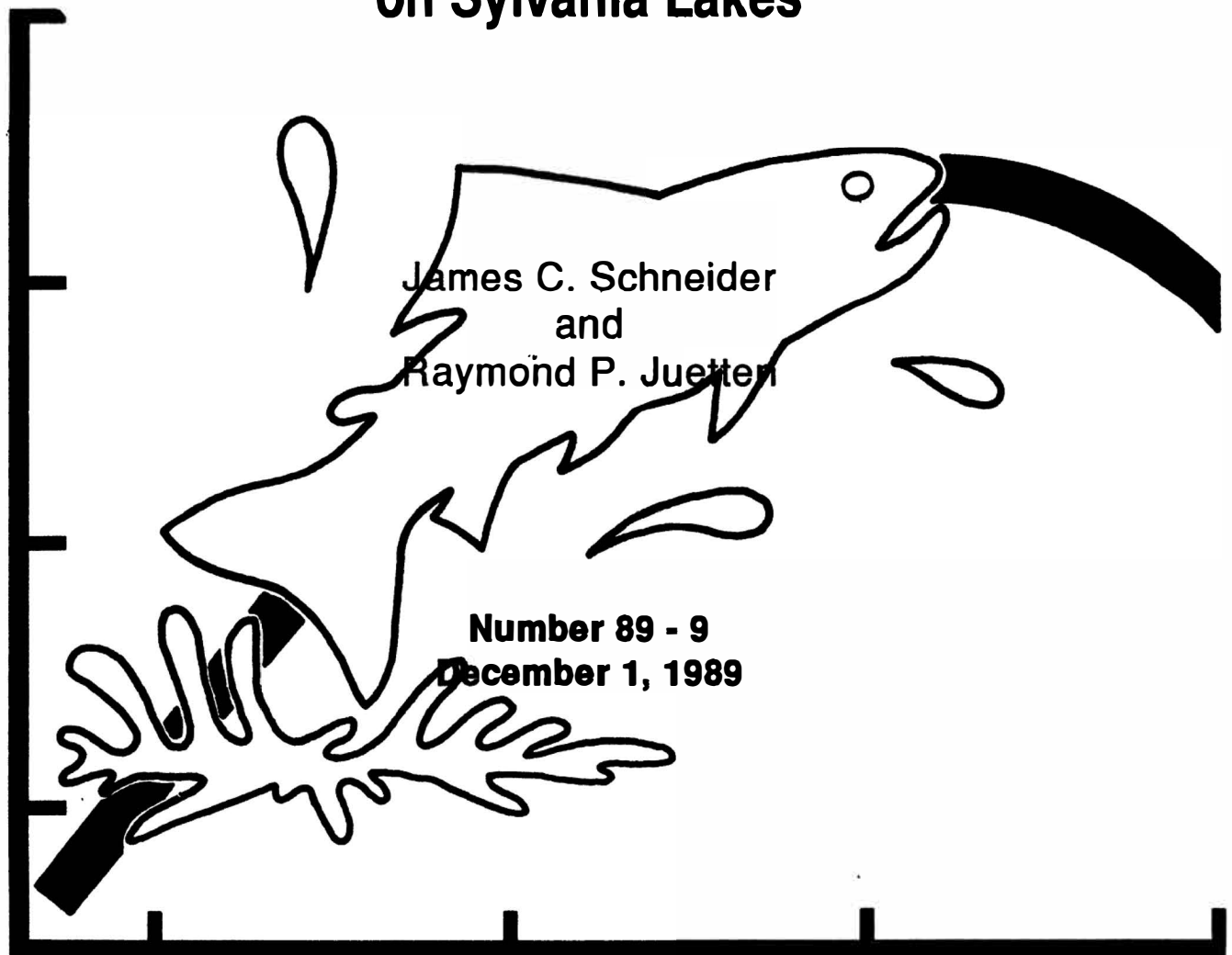


FISHERIES DIVISION

TECHNICAL REPORT

An Evaluation of Special Fishing Regulations on Sylvania Lakes



Michigan Department of
Natural Resources

An Evaluation of Special Fishing Regulations on Sylvania Lakes

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Abstract.--Limited access and special fishing regulations have maintained a semi-wilderness aura and preserved unique populations of large-sized bass and other game fish in the lakes of the Sylvania Recreation Area. Smallmouth bass populations, not adequately protected by trophy fishing regulations, have recovered under no-kill regulations. As of the 1980s, large bass were as frequent at four out of five lakes as they had been in 1966, the baseline year. The walleye population in Whitefish Lake, protected to some extent by trophy regulations, has been maintained. Trophy lake trout have apparently become rare in Clark Lake but 10- to 30-inch trout have probably been protected to a considerable extent. Compared to lakes with normal statewide fishing regulations, both on the Sylvania boundary and elsewhere in Michigan, the populations and fisheries of Sylvania lakes are outstanding.

The Sylvania Recreation Area is a 21,000-acre tract in the Ottawa National Forest, Gogebic County, in Michigan's Upper Peninsula. It contains 36 named lakes of diverse physical and chemical characteristics but most are landlocked and have low biological productivity (Crumrine and Beeton 1975). The United States Forest Service has managed Sylvania as a semi-wilderness area with restrictions on access and use since it entered public ownership in 1966. In keeping with the wilderness concept, fishing within the area has also been restricted by means of special regulations to protect unique, "climax" populations of large and old fish (especially smallmouth bass) which

existed in some (but not all) of the lakes. These fish had accumulated while the lakes were privately owned and lightly fished. From the outset it was appreciated that the bass were easily caught by hook and line and, because the waters are unproductive and fish grow slowly, that the populations could be easily overexploited. Clady (1970) demonstrated at three Sylvania test lakes (Cub, Katherine, and Marsh) that harvest rates as low as 11-20% per year would be excessive because the total biological production of all sizes of bass was only 2-4 lb • acre⁻¹ • year⁻¹.

At first, beginning in 1967, some lakes were managed under "fish-for-fun" (no-kill)

regulations and other lakes under "trophy" regulations (Clady et al. 1975; Latta 1975). Under the fish-for-fun regulation all fish had to be returned to the water. Under the trophy regulations, for game fish species minimum size limits (MSL) were 18 inches for bass, 30 inches for lake trout, 20 inches for walleye, and 30 inches for northern pike, and their combined possession limit was two fish; for panfish species there were no MSLs and their combined possession limit was 10 fish. Only artificial lures could be used for either set of regulations.

In addition, three boundary lakes (Crooked, Big Bateau, and Long) that had some private ownership remained on normal, state-wide regulations, which were much less restrictive. Up through 1975 these regulations included a 10-inch MSL on bass, a 13-inch MSL on walleye, and a combined possession limit of five fish. Since 1976, the MSLs have been 12 inches on bass and 15 inches on walleye. These lakes serve, in effect, as controls.

By the early 1970s, results of test netting at some of the trophy lakes indicated that bass populations were declining (Clady et al. 1975; Latta 1975). Consequently, beginning in 1975, bass populations in the trophy lakes also were given total protection by a fish-for-fun, no-kill designation. For lake trout, walleye, and northern pike, the trophy MSLs mentioned above were retained but the possession limit was reduced to one fish.

The purpose of this report is to evaluate the status of the Sylvania game fish populations during the 1980s and determine if the special regulations have served to protect or enhance them. More specifically, the purpose is to determine if the number of large fish and the quality of fishing have been maintained. Without protection from the special regulations, the expected scenario was that trophy-sized fish would be eliminated in the first year or two, size-frequency distributions of the sport fish populations would shift towards smaller fish, and fishing quality would decline steeply until it was comparable to lakes which receive a normal amount of fishing. Such a scenario had

occurred at lakes in the Rifle River Area when opened to public fishing under state-wide regulations (Patriarche 1960).

Methods

Periodic netting surveys have been made at some of the lakes since 1966. The 1966 surveys represent the lightly fished, baseline condition, and surveys since then are assumed to represent fish population trends caused by the effects of more intensive public fishing. Some of the survey data from the 1980s have been pooled to increase sample size. Because of difficult access and the desire to maintain wildness, many of the lakes have been sampled very little and there is scant data suitable for determining the status of fish populations, much less trends.

From 1966 to 1973, the standard survey method was to collect fish with experimental-mesh monofilament gill nets set in late fall. The nets were 125 feet long by 6 feet deep and consisted of five 25-foot panels of 1 1/2-, 2-, 2 1/2-, 3-, and 4-inch stretched mesh. This method was very effective for many fish, especially large bass, and provided a series of standardized catch-per-net-hour data (CPE) which was the basis for determining changes in fish abundance in the 1975 analyses. However, concern about incidental mortality in gill nets prompted conversion to fyke nets with either 1/2- or 3/4-inch stretched-mesh pots. These were set in June, when big bass are usually inshore and vulnerable to the nets. In addition, some samples have been taken with electrofishing gear.

Because the CPEs from gill nets, fyke nets, and electrofishing cannot be compared, we have used only length-frequency data to determine if there have been shifts in the size structure of the fish populations. To reduce bias caused by a size selectivity of the gear, only fish longer than 8 inches were considered. Length-frequency analysis addresses the primary question of whether or not large fish were still relatively abundant during the 1980s, but does not rule out possible changes in their absolute abundance.

Another difficulty in the interpretation of these data is that the failure to obtain large fish in a sample does not prove they were not present in the lake. For example, no bass over 14 inches long were collected from Deer Island Lake in 1966 (sample size only 7), but trophy-sized bass (18 inches and larger) were surely present because they were taken in 1971, 1982, and 1988 (Table 1).

A ranking system was devised to simplify the interpretation of the length-frequency distributions of the principle species--smallmouth bass, largemouth bass, walleye, and lake trout. Ranking was done sequentially, beginning with "excellent", according to the criteria listed below:

Bass

"Excellent": more than 9% were ≥ 18.0 inches in length;

"Good": more than 15% were ≥ 14.0 inches in length.

Walleye

"Excellent": more than 9% were ≥ 20.0 inches in length;

"Good": more than 30% were ≥ 16.0 inches in length.

Lake trout

"Excellent": more than 9% were ≥ 30.0 inches in length;

"Good": more than 30% were ≥ 20.0 inches in length.

"Poor" size distributions for each species were those which, by default, did not meet the "excellent" or "good" criteria.

Results and Discussion

Length-frequency distributions for those species and lakes which have the best series of data are shown in Tables 1-3. The largest data set is for smallmouth bass, which are the

most important sport fish in several of the lakes (Table 1). Walleye occur only in Long and Whitefish lakes (Table 2), and lake trout only in Clark Lake (Table 3) and High Lake (Table 4). No walleye or lake trout length-frequencies were considered to be poor.

Largemouth bass occur in many Sylvania lakes, but sampling has not been adequate to determine their population trends (Table 4). All of the largemouth bass populations are in the poor-good range. Northern pike are relatively rare in Sylvania and have not been adequately monitored.

For smallmouth bass, the special regulations have clearly served to protect four out of five populations (Table 4). Three lakes (Clark, Loon, and Deer Island) still had excellent size structures with many trophy bass in the 1980s. One other lake (Mountain) has remained good. The ranking for Whitefish Lake slid from excellent to good because no trophy bass have been caught since the initial survey. Four other lakes (High, Marsh, Cub, Katherine) have not been netted since 1966, but fishing reports suggest they have remained about the same, poor-good.

By contrast, smallmouth bass populations in two boundary lakes with normal regulations seem to have lost their largest bass. Rankings slid from excellent to good for Long Lake and from good to poor for Big Bateau Lake. These judgements are based on meager samples but are consistent. Survey data for the third control lake, Crooked, are insufficient to determine trends in either smallmouth or largemouth bass populations.

Furthermore, changing from trophy regulations to no-kill regulations in 1975 stopped the downward shift in smallmouth bass size and has allowed trophy bass to accumulate at two out of three lakes (Table 1). Clark and Loon lakes have clearly improved (Figures 1 and 2). Whitefish Lake, which experienced the same decline, apparently has not recouped. We suspected this lake may be poached more than the other lakes. Poaching was a significant

factor in all trophy lakes as evidenced by the decline in "protected" 16-17 inch bass during the late 1960s and early 1970s. Deer Island Lake, which has been given no-kill protection since 1967, experienced no decline and seems to have improved with time.

Two walleye lakes have been monitored: Whitefish Lake, with trophy regulations (20-inch MSL and a possession limit of one fish), and Long Lake, with normal regulations (Table 2). At Whitefish Lake the frequency of 20-inch and larger fish has been maintained in the excellent range, at 12-21%. The special regulations have probably helped; however, other factors relating to potential exploitation rate may have played an important role, too: (a) walleyes are more difficult than bass for most anglers to catch (especially when restricted to artificial lures), and (b) the lake receives light fishing pressure. This walleye population has never been exceptional, and no walleye larger than 24 inches have ever been collected there. The walleye population in Long Lake still ranks as excellent also, but has shifted toward smaller fish. This shift is probably more due to consistent recruitment in recent years than to higher exploitation.

For lake trout, the trophy regulations (30-inch MSL, a possession limit of one fish) have probably helped maintain quality populations in the two lakes where they occur. At Clark Lake, no trophy trout have been netted since 1969, but good-sized trout are still plentiful (Table 3). This suggests that (a) trout are being intensively cropped at about 30 inches, (b) exploitation is potentially high, and (c) trout between 10 inches (normal regulation) and 30 inches are being afforded considerable protection by the trophy regulation. The current status of lake trout in High Lake is not known, but they have probably been completely protected by the 30-inch MSL. The largest trout netted there to date (1971) was 27 inches long and, because the lake is so small (68 acres), it has little potential to produce larger trout.

Creel census data and fishermen reports substantiate that the special regulations are working to provide exceptionally high fishing

quality at Sylvania lakes with special bass regulations. Creel census data collected from five lakes during the summers of 1979 and 1980, tabulated by Edde (ms), are summarized in Table 5.¹ For smallmouth and largemouth bass combined, all sizes, average total catch rates ranged from 0.60 to 0.88 per hour at the no-kill lakes (Clark, Loon, Deer Island, and Mountain). At a normal regulation lake (Crooked) the rate was 90% less, 0.06 bass per hour. Furthermore, the average size of bass caught by anglers from the no-kill lakes is an impressive 14 inches.

A statewide review of bass creel census data from inland lakes confirms the effectiveness of no-kill regulations at maintaining high total catch rates (Table 6). At five no-kill lakes (four lakes in Sylvania plus Wakeley Lake, a new no-kill lake in the Lower Peninsula) total catch rates were 0.42-0.88 bass per hour--several times higher than for lakes with normal regulations. At lakes with normal regulations, total catch rates for bass ranged from 0.05 to 0.19 per hour and harvest rates for bass ranged from 0 to 0.07 per hour.

A potential source of error in all creel surveys of no-kill fisheries, probably small, is that anglers may not accurately recall or identify released fish. Beginning in 1989, fishermen entering the Sylvania area will be asked to record catch and effort in a diary and to turn in the diary when leaving. This may prove to be a more accurate and economical method of monitoring angling quality.

Fishing pressure within the Sylvania tract generally varies according to accessibility and type of regulation. Estimates of angler hours per acre for 1979 and 1980 (June 2-August 11 only) ranged from 2 to 9 for Loon, Deer Island, and Clark lakes, 16 to 30 for Mountain Lake, and 26 to 44 for Crooked Lake (Table 5). Loon and Deer Island lakes have special regulations and can

¹Creel census was also taken in 1968 and 1969 but the results are considered to be less reliable because over-night campers were excluded (J. Edde; personal communication).

only be reached by portaging. Clark and Mountain lakes have special regulations also, but are more accessible from boundary roads. Crooked Lake has normal regulations, many private cottages, and a public launching ramp which may be used by motorized boats.

These fishing pressure estimates are in line with estimates from other lakes in the region. A comparable figure for the same months (but different years, 1977-78) was 24 to 29 hours per acre for the nearby Cisco Lake chain (Ryckman and Lockwood 1985). This represented 50% of the annual bass season pressure (Memorial Day-October) of 54 to 56 hours per acre. Elsewhere in the Upper Peninsula, annual fishing pressure was 5-55 hours per acre for six small bass lakes (Wagner 1988).

We attribute the success at maintaining quality fish populations and fisheries at Sylvania to several factors:

1. Total government ownership, so that a bold management plan could be developed that was uncompromised by private vested interests.
2. Special regulations were applied immediately, while large fish were still plentiful, and before any public fishing was permitted. Consequently, the challenge was simply to maintain large fish, a task which appears to be much easier than trying to restore them. Additionally, immediate application of special regulations probably avoided some public relations problems. Anglers may not have been as willing to accept special regulations if they had become accustomed to fishing these lakes under normal regulations or if the fish populations had not been exceptional.
3. Non-motorized access and a semi-wilderness designation enhanced the aura of uniqueness. This may have attracted people more appreciative of the management goals and less inclined to poach. The trophy regulations on bass may have

been ineffective, in part, because they led to the expectation that each angler "should" be able to harvest a couple large bass. However, because bass were so easily caught and so slowly replaced, virtually any harvest caused a significant decline in the populations. At present, poaching and accidental hooking mortality probably balance biological production, maintaining population status quo.

4. Reasonably liberal harvest regulations on panfish (no MSL and creel limit of 10 fish), plus the opportunity to harvest game fish from boundary lakes, may have satisfied the subsistence needs of campers within the area and lessened their temptation to poach bass. Entering campers should be made aware that it is wise to pack in all the food they will need so they won't have to depend on successful panfishing.

The success at Sylvania contrasts with the difficulties at managing fisheries in the Craig Lakes State Park, only 50 miles away, which came into public ownership at about the same time (Unpublished data and observations). Bass and other predator fish were introduced into the Craig lakes during the late 1940s and 1950s and had not clearly established climax populations before they were opened to the public. Furthermore, by all accounts, the lake with the largest bass, Crooked, was fished considerably before special regulations took effect. The special bass regulations tested were 10- to 14-inch slot size limit (1972-73) and 18-inch MSL (1974-present) with a bag limit of two game fish. These have not served to improve the bass populations between the initial surveys (1970) and the most recent surveys (1980s). Two lakes (Keewaydin and Claire) now appear to be overpopulated with small bass, and two other lakes (Crooked and Craig) still rank only as good. The walleye population in Craig Lake, which has had little protection from a 13-inch MSL throughout the years, still contains few large fish. Poaching is

much more prevalent at the Craig lakes than at Sylvania according to law enforcement personnel, and access is easier because the primary lakes have motor boat launching ramps. Given these negatives and low productivity, it will be difficult to build up trophy fish populations in the Craig Lakes State Park even by means of no-kill regulations.

In summary, protective fishing regulations combined with limited access have protected unique, "climax" populations of smallmouth bass and other species and created high quality fisheries. The concept should be applied to other unique areas whenever the opportunity arises.

Acknowledgments

Numerous personnel of the U. S. Forest Service and the Michigan Department of Natural Resources have contributed to the management of the Sylvania tract and to the collection of data used in this report. We acknowledge especially the contributions of DeWayne Campbell, Jerry Edde, William Deephouse, and John Norcross.

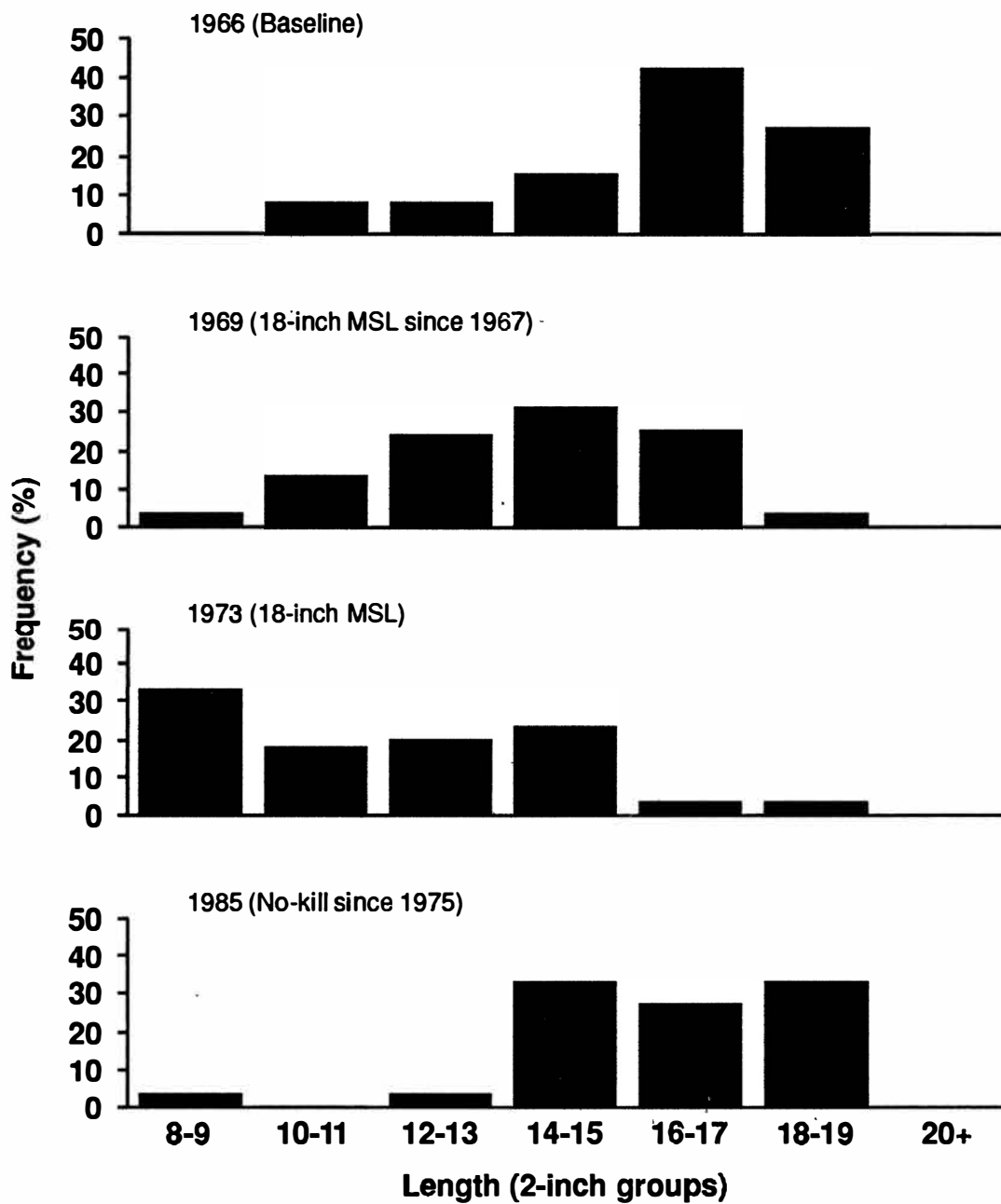


Figure 1. Length-frequency distributions of smallmouth bass 8 inches and longer collected from Clark Lake with gill nets, 1966-85.

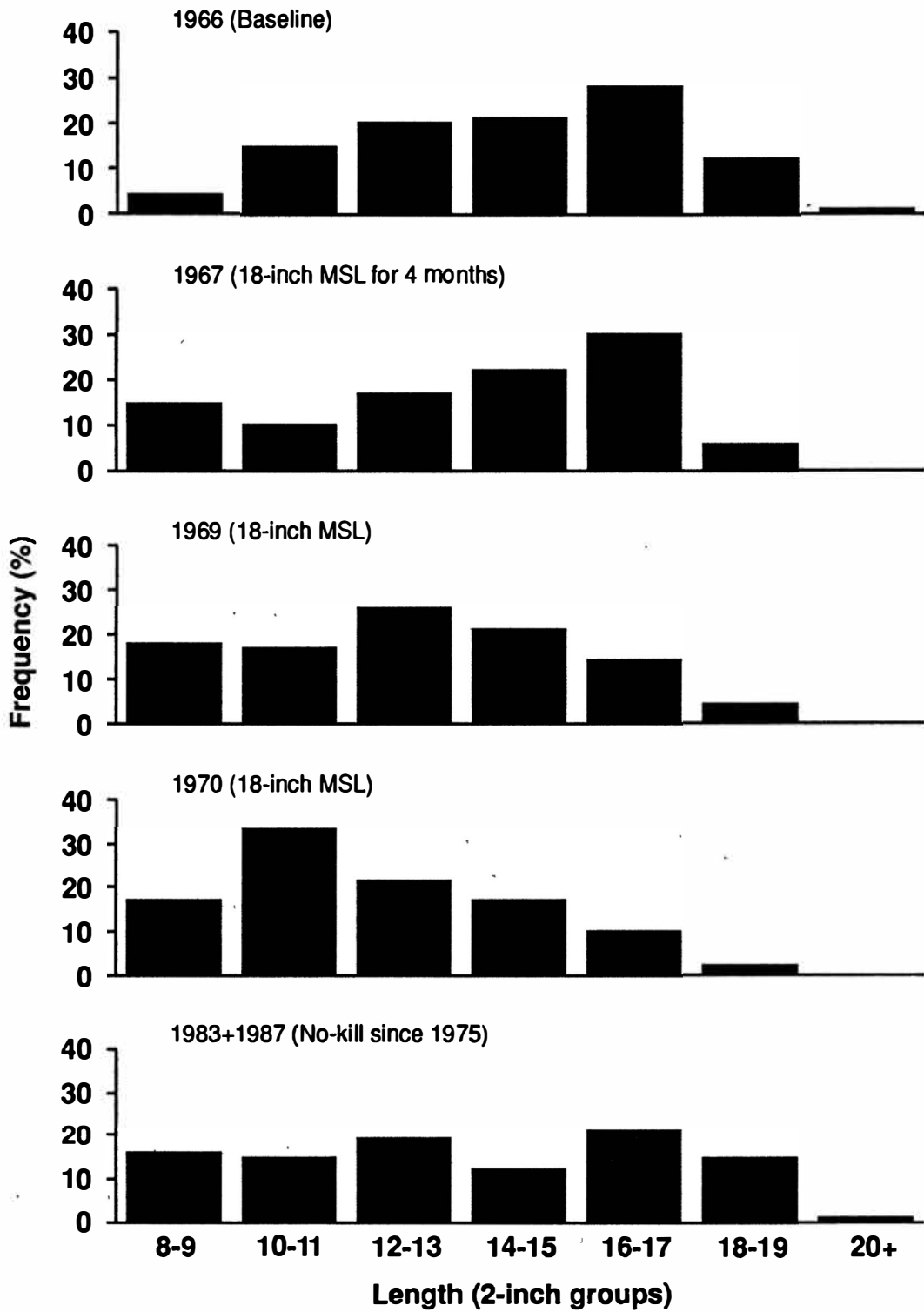


Figure 2. Length-frequency distributions of smallmouth bass 8 inches and longer collected from Loon Lake with gill nets (1966-72) and fyke nets (1983 and 1987) combined.

Table 1. Length-frequency distributions for smallmouth bass 8 inches and larger by regulation type, lake, year, and gear type. The 1966 surveys represent the lightly fished, baseline condition.

Regulation and lake	Year	Gear ²	N	Frequency (percent) by 2-inch size groups ¹						
				8-9	10-11	12-13	14-15	16-17	18-19	20+
Normal regulations (10- to 12-inch minimum size limit)										
Long	1966	G	44	0	11	7	43	30	7	2
	1981,86	G,F	15	67	13	0	13	7	0	0
Big Bateau	1966	G	3	33	0	33	33	0	0	0
	1987	F	96	69	21	5	4	1	0	0
Trophy regulations (18-inch minimum size limit) to no-kill regulations in 1975										
Clark	1966	G	48	0	8	8	15	42	27	0
	1969	G	67	3	13	24	31	25	3	0
	1973	G	66	33	18	20	23	3	3	0
	1985	G	33	3	0	3	33	27	33	0
	1985	f	17	71	18	0	6	6	0	0
	1986	f	21	52	33	10	5	0	0	0
Loon	1989	f	23	52	0	4	9	13	22	0
	1966	G	107	4	15	20	21	28	12	1
	1967	G	109	15	10	17	22	30	6	0
	1969	G	180	18	17	26	21	14	4	0
	1970	G	204	17	33	21	17	10	2	0
	1972	G	23	0	17	35	26	17	4	0
Whitefish	1983,87	F,f	73	16	15	19	12	21	15	1
	1966	G	10	0	10	10	50	20	10	0
	1970	G	24	4	29	38	17	13	0	0
	1982	E,F,f	51	27	8	31	33	0	0	0
	1989	f	24	13	8	33	38	8	0	0
No-kill regulations										
Deer Island	1966	G	7	29	29	43	0	0	0	0
	1971	G	253	46	15	4	17	13	4	0
	1982	F,f	119	8	12	3	34	35	8	0
	1988	F	137	3	9	28	40	9	10	0
Mountain	1966	G	3	0	0	33	0	67	0	0
	1984	f	69	41	35	10	12	3	0	0

¹Size groups: 8-9 = 8.0-9.9 inches; 10-11 = 10.0-11.9 inches; etc.

²Gear codes: G = gill net; f = 1/2-inch fyke net; F = 3/4-inch fyke net; E = electrofishing. Some catches were pooled to improve sample size.

Table 2. Length-frequency distributions for walleye 8 inches and larger by regulation type, lake, year, and gear type. The 1966 surveys represent the lightly fished, baseline condition.

Regulation and lake	Year	Gear ²	N	Frequency (percent) by 2-inch size groups ¹						
				8-9	10-11	12-13	14-15	16-17	18-19	20+
Normal Regulations (13- to 15-inch minimum size limit)										
Long	1966	G	10	0	0	0	0	0	40	60
	1981,86	G,F	28	14	21	7	11	32	4	11
Trophy regulations (20-inch minimum size limit)										
Whitefish	1966	G	39	23	3	0	10	23	26	15
	1970	G	38	16	0	13	26	21	3	21
	1982	E,F,f	83	33	22	17	1	5	10	12
	1989	f	70	54	4	9	4	3	7	19

¹Size groups: 8-9 = 8.0-9.9 inches; 10-11 = 10.0-11.9 inches; etc.

²Gear codes: G = gill net; f = 1/2-inch fyke net; F = 3/4-inch fyke net; E = electrofishing. Some catches were pooled to improve sample size.

Table 3. Length-frequency distributions (percent) for lake trout 8 inches and larger collected from Clark Lake with gill nets, 1966-85. (30-inch minimum size limit). The 1966 survey represents the lightly fished, baseline condition.

Inch group ¹	Year			
	1966	1969	1973	1985
8	--	--	3	--
9	--	--	3	--
10	--	--	5	--
11	--	--	2	--
12	--	--	2	--
13	--	--	13	--
14	--	--	8	10
15	--	--	5	20
16	--	--	5	--
17	16	--	3	--
18	4	--	12	10
19	16	--	7	--
20	--	--	3	--
21	8	--	2	--
22	8	--	2	--
23	4	3	3	10
24	8	13	8	--
25	4	23	7	10
26	--	13	3	--
27	--	20	2	20
28	8	7	2	20
29	4	7	--	--
30	4	--	--	--
31	8	--	--	--
32	--	7	--	--
33	--	--	--	--
34	4	7	--	--
35	--	--	--	--
36	4	--	--	--
Total number	26	30	60	10

¹Inch groups: 8 = 8.0-8.9 inches; 9 = 9.0-9.9 inches; etc.

Table 4. Rankings for Sylvania fish populations based on length-frequency samples in 1966 compared to samples in the 1980s. Question marks denote samples of less than 20 fish; dashes denote no samples taken or species absent. E = Excellent; G = Good; P = Poor.¹

Lake	Smallmouth bass		Largemouth bass		Walleye		Lake trout	
	1966	1980s	1966	1980s	1966	1980s	1966	1980s
Normal regulations								
Big Bateau	G?	P	--	P	--	--	--	--
Long	E	G?	--	--	E	G	--	--
Crooked ²	G?	--	G?	--	--	--	--	--
Special regulations³								
Clark	E	E	--	--	--	--	E	G
Loon	E	E	--	--	--	--	--	--
Deer Island	E ⁴	E	--	--	--	--	--	--
Mountain	G?	G	--	G	--	--	--	--
Whitefish	E?	G	--	--	E	E	--	--
Helen	--	G	G?	P	--	--	--	--
High	G	--	--	--	--	--	G?	--
Golden Silence	--	--	P	--	--	--	--	--
West Bear	--	--	G	--	--	--	--	--
East Bear	--	--	P?	--	--	--	--	--
Marsh	G	--	--	--	--	--	--	--
Cub	P	--	P	--	--	--	--	--
Katherine	P	--	--	--	--	--	--	--
Corey	--	--	G	--	--	--	--	--

¹See Methods for definitions of ranks.

²Samples taken in 1968 and 1969 instead of 1966.

³Includes both no-kill and trophy regulations.

⁴Excellent ranking based on 1971 survey; large sizes were apparently missed in 1966 sample of only seven bass.

Table 5. Creel census estimates of total bass catch rates and total fishing pressure on Sylvania area lakes, 1979-80. Data from Edde (ms).

Regulation and lake	Species	June 2- August 11 1979	June 3- August 11 1980	Average
Bass catch per angler hour (all sizes, released + harvested)				
<i>No-kill regulations</i>				
Clark	smallmouth	0.55	1.06	
	largemouth	0.05	0.10	
	both	0.60	1.16	0.88
Loon	smallmouth	0.49	0.69	
	largemouth	0.03	---	
	both	0.52	0.69	0.60
Deer Island	smallmouth	0.74	0.58	
	largemouth	0.03	0.04	
	both	0.77	0.62	0.70
Mountain	smallmouth	0.40	0.54	
	largemouth	0.09	0.34	
	both	0.49	0.88	0.69
<i>Normal regulations</i>				
Crooked	smallmouth	0.03	0.05	
	largemouth	0.03	0.02	
	both	0.06	0.07	0.06
Total estimated angler hours per acre				
<i>No-kill regulations</i>				
Clark		5	2	3
Loon		8	2	5
Deer Island		9	3	6
Mountain		30	16	24
<i>Normal regulations</i>				
Crooked		44	26	35

Table 6. Ranges in summer or open-water season catch-per-angler-hour rates for smallmouth and largemouth bass combined for some Michigan lakes with no-kill or normal bass regulations.¹

Regulations and lake	Number of lakes	Type of catch data		
		Released	Harvested	Released + harvested
<i>No-kill regulations</i>				
Sylvania lakes	4	0.60 - 0.88	---	---
Wakeley Lake	1	0.42	---	---
<i>Normal regulations</i>				
Crooked Lake	1	---	0.02	0.06
Region I lakes	12	---	0 - 0.07	---
Region II lakes	12	---	0 - 0.07	---
Region III lakes	20	---	0.01 - 0.05	0.05 - 0.19

¹Data sources : Sylvania lakes and Crooked Lake--Edde (ms); Wakeley Lake--Schneider (unpublished); Region I, II, and III lakes--Laarman (1980), Ryckman and Lockwood (1985), Schneider and Lockwood (1979), Wagner (1988), and Waybrandt and Thomas (1988).

Literature Cited

- Clady, M. D. 1970. Regulation of fish populations in three lightly exploited lakes in northern Michigan. The University of Michigan, Ann Arbor, Ph.D. thesis.
- Clady, M. D., Campbell, D. E., and G. P. Cooper. 1975. The effect of trophy angling on unexploited populations of smallmouth bass in four lakes in northern Michigan. Pages 425-429 in R. H. Stroud and H. Clepper (eds), National Symposium on the Biology and Management of the Centrarchid Bases, Sport Fishing Institute, Washington, D.C.
- Crumrine, J. P. and A. M. Beeton. 1975. Limnology of lakes of the Sylvania Recreation Area, Ottawa national forest. The University of Wisconsin-Milwaukee, Center for Great Lakes Studies, Special Report No. 24.
- Edde, J. ms. Undated reports entitled: "Preliminary Summary, Sylvania Creel Census" and "Results of 1980 Creel Census". United States Forest Service, Ironwood, Michigan.
- Laarman, P. W. 1980. Vital statistics of the fish population in Manistee Lake, Kalkaska County, with special emphasis on mortality and exploitation of stocked 15-cm walleye fingerlings. Michigan Department of Natural Resources, Fisheries Research Report 1881, Ann Arbor.
- Latta, W. C. 1975. Effects of "trophy" and "fish-for fun" regulations on fish populations in lakes of Sylvania. Michigan Department of Natural Resources, Fisheries Research Report 1826, Ann Arbor.
- Patriarche, M. H. 1960. A twelve-year history of fishing in the lakes of the Rifle River Area, Ogemaw County, Michigan, 1945-1956. Michigan Department of Conservation, Institute for Fisheries Research Miscellaneous Publication 13, Ann Arbor.
- Ryckman, J. R. and R. N. Lockwood. 1985. On-site creel surveys in Michigan, 1975-82. Michigan Department of Natural Resources, Fisheries Research Report 1922, Ann Arbor.
- Schneider, J. C. and R. N. Lockwood. 1979. Effects of regulations on the fisheries of Michigan lakes, 1946-65. Michigan Department of Natural Resources, Fisheries Research Report 1872, Ann Arbor.
- Schneider, J. C. Unpublished. Michigan Department of Natural Resources Interoffice Communication dated March 8, 1988, from James C. Schneider to Steve Sendek and Ron Dunlap entitled "More on Wakeley Lake fish and fishing".
- Wagner, W. C. 1988. Largemouth bass in Michigan's Upper Peninsula lakes. Michigan Department of Natural Resources, Fisheries Research Report 1945, Ann Arbor.
- Waybrant, J. R. and M. V. Thomas. 1988. Results of the 1986 creel census on Orchard, Cass, and Maceday-Lotus lakes. Michigan Department of Natural Resources, Fisheries Technical Report 88-2, Ann Arbor.

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