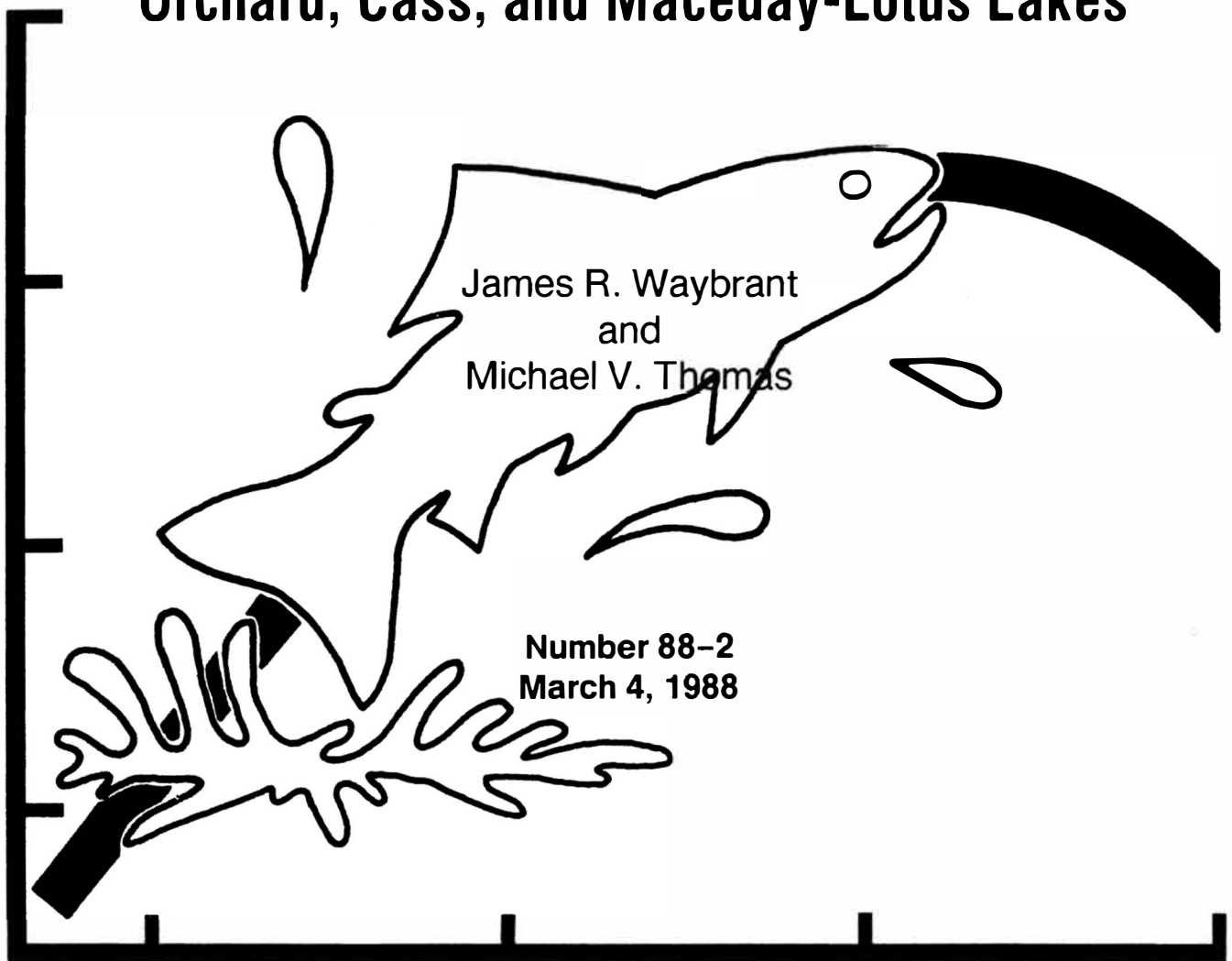


# FISHERIES DIVISION

## TECHNICAL REPORT

### Results of the 1986 Creel Census on Orchard, Cass, and Maceday-Lotus Lakes



James R. Waybrant  
and  
Michael V. Thomas

Number 88-2  
March 4, 1988



Michigan Department of  
Natural Resources

**MICHIGAN DEPARTMENT OF NATURAL RESOURCES  
FISHERIES DIVISION**

**Fisheries Technical Report No. 88-2**

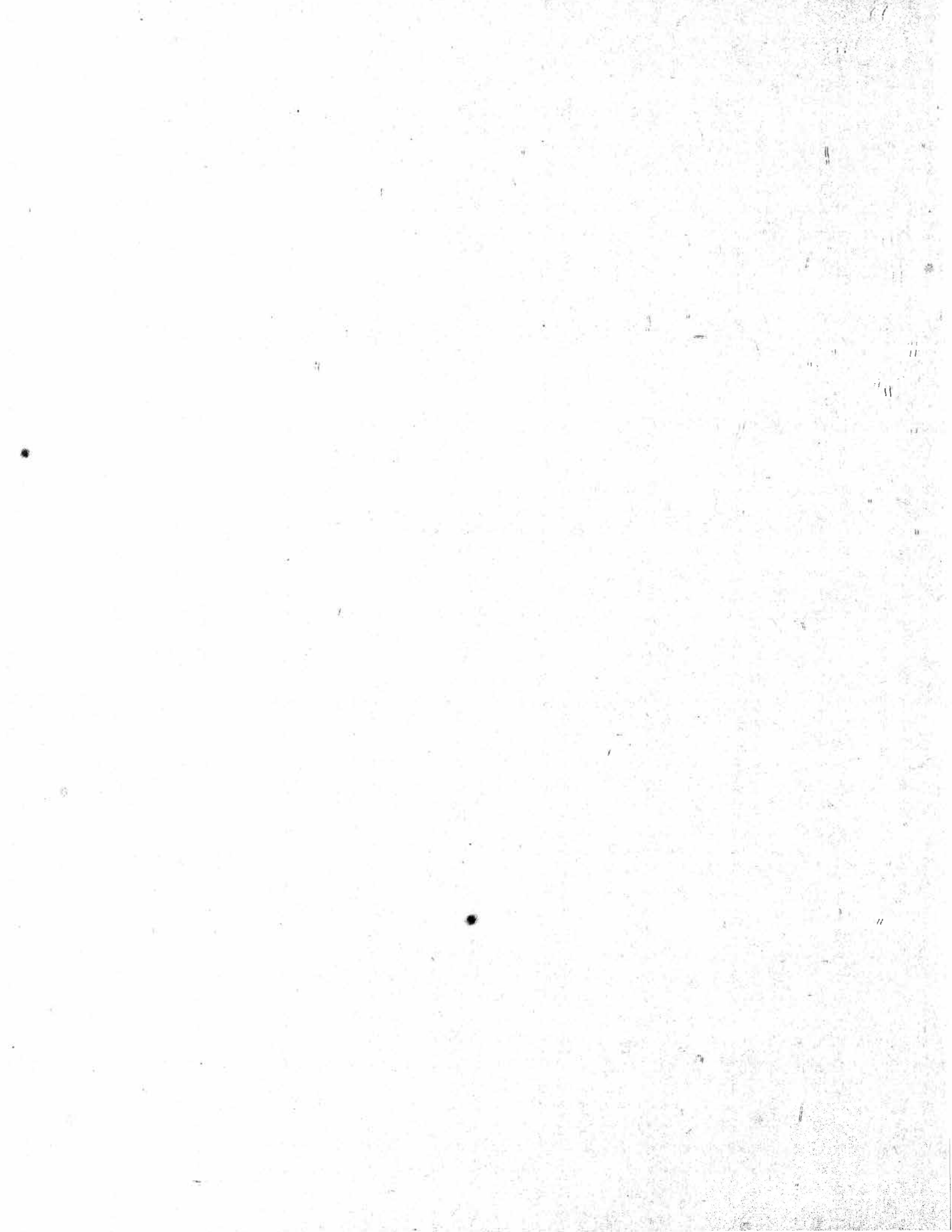
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**RESULTS OF THE 1986 CREEL CENSUS ON  
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## INTRODUCTION

Fish managers have long used creel census as an effective method of evaluating fish populations and fisheries management programs. During 1986, fisheries personnel from the Pontiac District Office of the Michigan Department of Natural Resources carried out an intensive creel census on Orchard, Cass, Maceday-Lotus lakes. Maceday and Lotus lakes are so broadly connected that in this report they will be referred to as a single lake unit (Maceday-Lotus). Objectives of the creel census were to: (1) evaluate angler success, (2) determine angler pressure, (3) evaluate the benefits of current stocking programs in the lakes, and (4) assess the potential for improving fishing opportunities in the lakes.

Orchard, Cass, and Maceday-Lotus lakes are all natural, glacial lakes located in rolling hills in the Clinton River watershed, Oakland County, Michigan. They are situated in an urban setting.

Morphometrically the lakes are quite similar, with limited areas of shallow littoral zone bordered by sharp contour breaks. All three lake units attain maximum depths of over 100 feet, maintain dissolved oxygen levels sufficient to support fish at depths of at least 50 feet during the summer, and in general maintain good water quality.

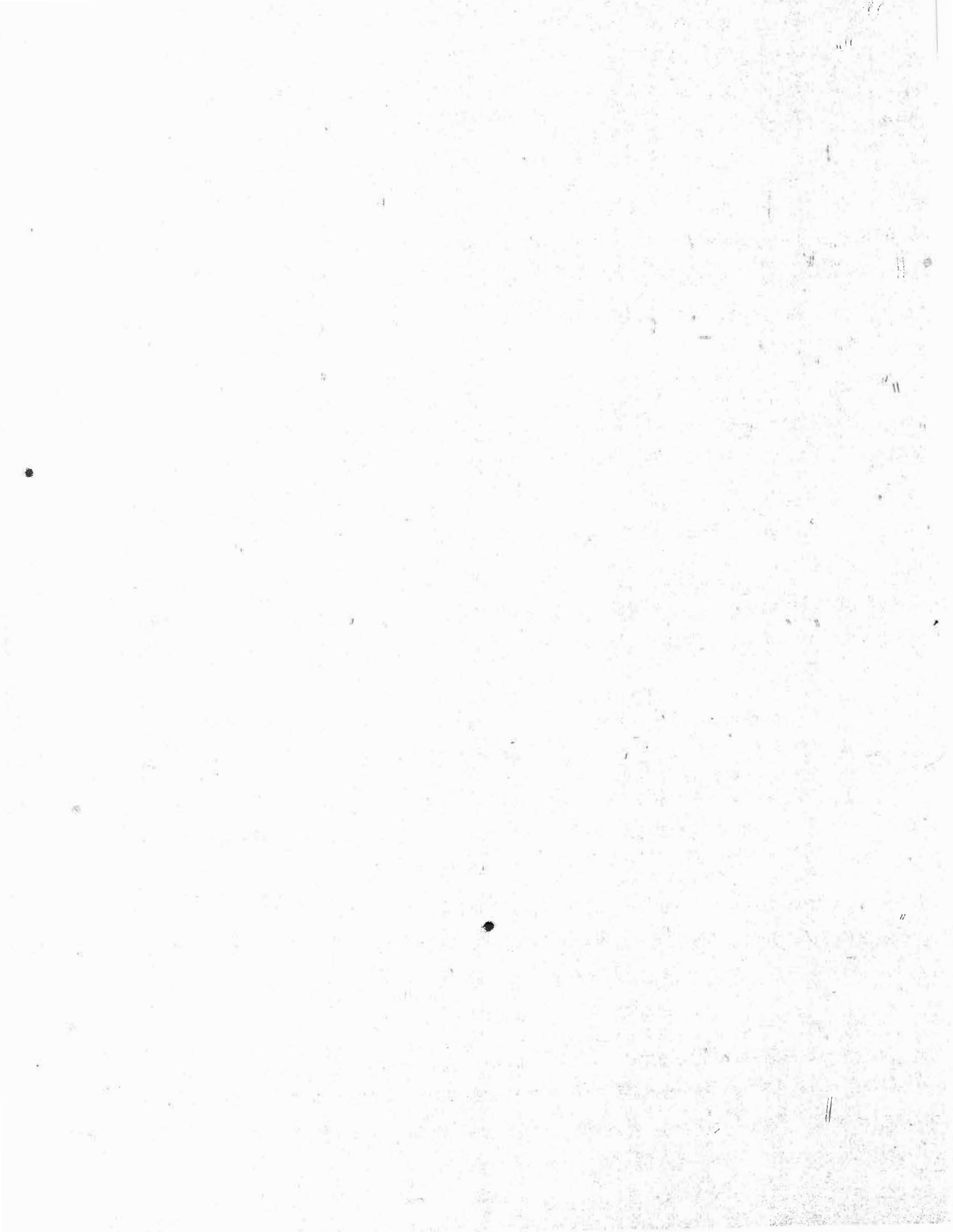
Orchard Lake covers 788 acres and reaches a maximum depth of 110 feet. The only inlet is an unnamed creek. The outlet is a reversible pumped discharge to Cass Lake. The village of Orchard Lake borders the southeast side of the lake. Orchard Lake contains good populations of largemouth bass, smallmouth bass, northern pike, bluegill, yellow perch, pumpkinseed, and black crappie. The only species stocked during the last 5 years was brown trout.

Cass Lake is 1,280 acres in area. The lake consists of four major basins with a maximum depth of 121 feet. Much of the bottom substrate is sand and gravel. The village of Keego Harbor lies on the southern shore. Major fish populations in Cass Lake include bluegill, crappie, largemouth bass, smallmouth bass, cisco, northern pike, and yellow perch. In addition, walleye, brown trout, and splake have been stocked in the past 5 years.

Maceday-Lotus Lake share three contiguous basins. Maceday Lake is relatively deep and Lotus Lake is relatively shallow. Fish can freely move between the basins. The maximum depth is 117 feet and the total surface area is 419 acres. Maceday-Lotus Lake contains major populations of largemouth bass, yellow perch, bluegill, crappie, and cisco. Fish species stocked in the past 5 years include walleye, rainbow trout, and splake.

## CENSUS METHODS

Biologists, technicians, and temporary workers conducted the census based on a semi-random stratified sampling schedule developed with the aid of Research and Assessment Section personnel. The census consisted of interviewing anglers to determine how long they fished and



what they caught, and of making periodic counts of anglers to determine fishing pressure. General methodology is given by Ryckman (1981). In addition, periodic counts of non-fishing boats were made to determine the ratio of fishing boats to power/pleasure boats. The period covered, January 1 to November 15, 1986, included virtually all the fishing which occurred on these lakes during 1986. The census was conducted during daylight hours, 5 days a week, at all three lakes. All weekend days and holidays were censused. The order of lakes sampled, sampling period (morning or afternoon), and time of counts were semi-randomly determined to insure a representative sampling of angling at the lakes.

Angler interviews were made at public access sites and offshore with the aid of snowmobiles and boats. Clerks recorded fish they observed in possession as "harvested". In addition, they asked anglers how many legal and sublegal game fish (northern pike, smallmouth bass, largemouth bass, and walleye) they caught and released and recorded these as "released". The minimum legal size limits in effect were: northern pike—20 inches, bass—12 inches, and walleye—15 inches. The statistics on released fish are less reliable because they depend on the angler's recall and his ability to correctly identify look-alike fish such as largemouth bass and smallmouth bass.

## RESULTS

### Orchard Lake

Creel clerks interviewed 847 anglers on Orchard Lake. Anglers caught an estimated 8,649 fish, comprising 9 species (Table 1, Appendix 1). Nearly 50% of all fish caught were subsequently released. Total catch per acre for the entire census period was 10.98 (Table 2).

The bluegill was the most abundant species creel at Orchard Lake, accounting for 32% of the total. Other major species caught were crappie, pumpkinseed, largemouth bass, northern pike, and smallmouth bass. Yellow perch and bullhead contributed low numbers to the angler harvest.

Largemouth and smallmouth bass were the major game fish caught and released by anglers at Orchard Lake. Sublegal largemouth bass made up 60% of the total number released. Numerous northern pike were caught and released by anglers also.

Ice anglers accounted for 7% of the total annual catch at Orchard Lake and 5% of the annual fishing hours. Northern pike comprised 30% of the winter catch. Other major species in the winter fishery were pumpkinseed and crappie.

Anglers made 6,484 trips to Orchard Lake and fished a total of 24,422 hours (3.8 hours/trip). Overall catch per hour was 0.35 fish. Angler pressure over the census period was 31 hours per acre.

Orchard Lake anglers resided primarily in three southeastern Michigan counties (Table 3). Nearly 66% of the anglers interviewed lived in Oakland County, 29% in Wayne County, and 3% in Macomb County.

Anglers at Orchard Lake could be grouped in four major categories according to species sought (Table 4). Over 38% of the anglers were pursuing largemouth bass, 9% fished exclusively for pike, about 9% sought panfish species, and another 42% were after “multiple species”.

### **Cass Lake**

Creel clerks interviewed 1,085 anglers on Cass Lake. Based on these interviews, anglers caught an estimated 17,753 fish in 1986, comprising 10 species (Table 1, Appendix 2). Nearly 23% of the fish caught were subsequently released. Total catch per acre for the entire census period was 13.86 fish (Table 2).

Bluegill predominated in the harvest, accounting for 61.7% of the total; 24.3% was crappie. Other important species in the total harvest included largemouth bass, smallmouth bass, pumpkinseed, and walleye. In addition, rock bass, northern pike, yellow perch, and bullhead made minor contributions to the harvest.

Largemouth and smallmouth bass were the major game species caught and released by anglers at Cass Lake. Sublegal largemouth bass made up 37.6% of the total number released. Some legal and sublegal northern pike and walleye were caught and released.

Ice fishers accounted for 39% of the total annual catch. Bluegill and crappie predominated in the winter fishery. Other species adding to the winter fishery were northern pike, pumpkinseed, and yellow perch.

Anglers made 10,116 trips to Cass Lake, accumulating 39,205 hours of fishing pressure (3.9 hours/trip). Angler pressure for the census period was 30.6 hours per acre. Average annual estimated catch per hour was 0.45 fish.

Cass Lake anglers resided mainly in three southeastern Michigan counties (Table 3). Approximately 73% of the interviewed anglers lived in Oakland County, while about 18% resided in Wayne County and 3% hailed from Macomb County. Almost 6% of the anglers came from outside the immediate three-county area to fish Cass Lake.

Cass Lake supported two distinct groups of anglers. Those fishing during the winter fished for pike, bluegill, and crappie (Table 5). Those fishing the open waters were after bass, walleye, trout, and “anything”.

### **Maceday-Lotus Lake**

Creel clerks interviewed 1,318 anglers. Based on these interviews, anglers caught an estimated 40,283 fish, comprised of 9 species (Table 1, Appendix 3). About 10% of the fish caught were subsequently released. This lake system was very productive, with a total catch per acre of over 96 fish (Table 2).

Bluegill, by far the most abundant species, accounted for over 72% of the harvest. Yellow perch, black crappie, and pumpkinseed combined for 14% of the harvest. Maceday Lake supported a significant trout fishery, with trout species comprising 1.6% of the total harvest. Because much of the trout fishery was at night, census clerks worked occasional late shifts to evaluate that specific fishery. Release data were not taken for trout. Walleye, bass, and northern pike provided less harvest than the trout species.

A total of 3,726 largemouth bass were released, 205 of which were of legal size. Although no legal smallmouth bass were caught, 381 sublegals were reportedly caught and released. An estimated 106 walleye were released, 15 of which were legal size. Only 12 walleye were kept.

Northern pike were almost exclusively caught through the ice, while the trout species, rock bass, walleye, and largemouth bass were caught mainly during the open-water season. Bluegill were harvested equally by the ice- and open-water fisheries. Black crappie and yellow perch were caught during both periods, but were predominantly caught in the open-water season.

Anglers made 11,921 trips to Maceday-Lotus Lake, for a total pressure of 37,010 hours. The lake supported an average pressure of 88.3 hours/acre. The average trip length was 3.1 hours, and the lake yielded 1.09 fish per hour.

Anglers were mostly local residents (Table 3). About 85% lived in Oakland County, 11% in Wayne County, and 2.5% in Macomb County.

Most anglers (66%) sought bluegill, pumpkinseed, crappie, or "anything" (Table 6). Just 18% of the anglers fished for bass. Pike anglers were scarce, contributing only 3% to the total. About 9% of the fishermen sought trout.

## **DISCUSSION**

### **Orchard Lake**

Census results indicate a sparse ice fishery on Orchard Lake, mainly for northern pike. An ongoing ban against permanent ice shanties on the lake has played a significant role in the absence of winter activity. The total annual catch was only 11 fish per acre, of which 5.59 were released game fish. Compared with the 88 fish per acre actually harvested from Maceday-Lotus Lake, Orchard Lake seems to be poorly utilized. One method of increasing the fishery



would be to allow permanent ice fishing shanties to be placed on the lake. The ban is a local ordinance, however, and probably not easily removed.

Other interesting results deal with catch-and-release fishing. Legal-sized northern pike were released in a ratio of one kept to one released, while many more legal largemouth bass were released than kept. However, only one-half as many legal-sized smallmouth bass were released as were kept. Combined releases of both black bass species by size were in the ratio of three sublegal to one legal, while the northern pike size ratio was one sublegal to two legal-sized. Many bass tournaments took place on the lake, which possibly skewed the legal-size results in favor of releases. Compared with the ratio of one pike kept to one released at Orchard Lake, the ratio was almost 12 kept to 1 released at Maceday-Lotus Lake. Maceday-Lotus Lake was also fished by a larger percentage of local anglers (85%), many of which lived on the lake. Orchard Lake was fished by very few local residents, and 29% of all anglers came from Wayne County.

### **Cass Lake**

Fishing success at Cass Lake was excellent for smallmouth bass, walleye, and crappie. Smallmouth bass catch and harvest were twice that of Orchard Lake and many times that of Maceday-Lotus Lake. Although 1,500 smallmouths were caught, only 371 were harvested. Of that 1,500, 609 were of legal size. In addition to the good smallmouth bass fishery, crappie catch at Cass Lake was twice that of Maceday-Lotus Lake, and four times that of Orchard Lake. Because Maceday-Lotus Lake is much smaller than Cass Lake, its catch per acre was greater (Table 7).

Walleye also were caught in much greater numbers from Cass Lake than from the other two lakes. Cass Lake has long supported a small walleye population, and in recent years it has been augmented by stocking fingerling walleye on an alternate year schedule. Walleye stocking just began at Maceday-Lotus Lake so the population is still small. In several years the walleye fishery of Maceday-Lotus Lake (also of White, Loon, Oakland, and Union lakes which are being stocked) may develop into one similar to, or better than, that in Cass Lake.

Brown trout, splake, and self-sustaining lake trout populations presumably exist in Cass Lake due to fingerling stocking in past years. However, no trout of any species were recorded in the Cass Lake creel census. Furthermore, these fish were sought by only 1% of the anglers. Therefore we recommend that trout planting be discontinued.

Netting surveys have documented a large native population of cisco in the lake. This is the same fish that causes so much excitement in northern Lake Huron and the St. Marys River, where it is known as the lake herring. Cisco found in our inland lakes are much deeper-bodied than those from the Great Lakes, and should fight well and taste good. At present, however, the Cass Lake population is unexploited.

Angler activity and success at Cass Lake are reduced by water use competition with powerboaters. Many boat anglers have complained about harassment received from speedboaters while trying to fish the lake. They also have trouble obtaining parking spots at the access site. Some anglers avoid Cass Lake because of these problems. From August to November, census clerks counted all types of boats on the lake, and found that over 90% of the boats were used for non-fishing water sports. Intense boating pressure generally forced anglers into small bays and canals, away from deep-water plateaus and submerged islands. For that reason, some excellent fishing areas were relatively unfished.

### **Maceday-Lotus Lake**

Anglers on Maceday-Lotus Lake enjoyed good success. Their average catch per hour was more than double that of either Cass or Orchard lakes. Bluegill, pumpkinseed, and yellow perch were the most abundant species caught. Comparative success between the three lakes is even more striking when sizes are factored in, since Maceday-Lotus Lake is only one-third the size of Cass Lake and one-half that of Orchard Lake.

Approximately 50% of the legal-sized largemouth bass caught were released. Sublegal largemouths caught and released outnumbered legal-size largemouths almost seven to one. Smallmouth bass were not caught in legal sizes (even though there is a substantial native population), but were reported in the sublegal catch. Perhaps the legal catch of smallmouths will increase over the next couple of years as these sublegal fish recruit into the catchable stock.

Anglers targeting trout species (rainbow trout and splake) had good success in 1986. Most success came via a night fishery during late summer; success through the ice was low. Enough fish were caught, and enough anglers were targeting them, that we recommend continuation of these plantings.

Netting surveys have proven the presence of lake trout and cisco. Lake trout collected during these surveys were too young to have been survivors of plantings made many years ago, indicating that a self-sustaining population has developed. Several captured and released by netting crews were well over 30 inches long. Maceday-Lotus Lake cisco are also quite large, much larger than the cisco in Cass Lake, and are present in good quantity. Both of these species could develop into interesting fisheries.

### **Comparison with Other Lakes**

Creel census statistics—such as catch per acre, angler hours per acre, and catch per hour—vary widely between lakes, regions, and years (Ryckman and Lockwood 1985; Schneider and Lockwood 1979). A statewide summary of on-site creel surveys between 1975 and 1982 indicated that the largest lakes tended to have the lowest average catch per acre and catch rate.

It was also noted that the largest lakes tended to have the lowest pressure in angler hours per acre. The 1986 census results from Cass, Orchard, and Maceday-Lotus lakes follow these trends precisely. The most recent estimates of statewide averages for catch per acre and catch rate indicate both Cass and Orchard lakes are below average, while Maceday-Lotus Lake is slightly above average (Ryckman and Lockwood 1985).

A 1980 creel census of three southeastern Michigan lakes (Pontiac, Kent, and Whitmore) resulted in estimates of catch per acre ranging from 35.8 to 128.8, angler hours per acre from 80.9 to 191.1, and catch rates from 0.29 to 0.67 (Goudy 1981). Comparatively, Cass Lake and Orchard Lake had considerably lower catch rates and pressure rates, but in other respects fisheries at Cass, Orchard, and Maceday-Lotus lakes were similar to the lakes studied in 1980.

### **Economic Impacts from Angling**

The economic benefit from angling on these lakes was estimated by assuming that each angler spent an average of \$35.47 per fishing day. That dollar value is the average day-trip expenditures of all Michigan anglers targeting yellow perch, bass, panfish, and walleye (Mahoney et al. 1986).

Maceday-Lotus Lake, with its excellent fishery and concurrent large number of angler trips per year, contributed the greatest economic benefit. An estimated \$422,838 were spent by anglers fishing Maceday-Lotus Lake (Table 2). In addition, when one considers the estimated amount spent per acre, this fishery seems to contribute several times the economic benefit of the other two fisheries.

Orchard Lake anglers contributed least to the local economy due to fewer angler trips per year. Although it is smaller than Cass Lake estimated expenditures per acre were similar.

Actual returns to the local economies were much smaller than these figures because they include at-home, travel, and local expenses. Local expenses probably averaged \$6.25 per trip, the statewide figure developed by Mahoney et al. (1986). This projects to annual local expenditures of \$74,506 for Maceday-Lotus Lake, \$63,225 for Cass Lake, and \$40,525 for Orchard Lake.

Implications from these estimates are that maintaining good fisheries, and allowing angler access to those fish, will increase economic returns to the local area. If powerboaters could somehow coexist with anglers on Cass Lake, and if shanty fishermen were welcomed on Orchard Lake, we predict that the local economies would benefit.

### **CONCLUSIONS**

Orchard Lake appears to have an underutilized fishery, due in part to a ban against permanent ice fishing shanties. That ban was set by local residents, and may prove either hard

or impossible to reverse. With the advent of easily portable shanties, fishing may become more popular on the lake in spite of that ban.

Another forage fish species is needed to improve the Orchard Lake fish community. Smelt, unsuccessfully planted several years ago, could be reintroduced. Other potential forage fish species are being considered. They must be compatible with the predator and prey fish already present. More intensive study must be completed before finalizing an introduction.

Cass Lake supports an excellent fish community. Numbers and diversity are well suited to the size, morphology, and water conditions present. The primary management concerns are not those of biology, but those of socio-political origin. Water usage competition between fishermen and powerboaters is intense, making it almost impossible for the anglers to approach good fishing areas. In addition, open hours at the single public access site (Dodge 4 State Park) have not been angler-oriented in the past. However, during 1986 the park opened its boat ramp earlier (6:30 A.M.) each morning. Since anglers took advantage of that early schedule, it will be continued in 1987.

Cass Lake, like Belleville and Kent lakes, has one of the best inland walleye populations in southeastern Michigan. Walleye stocking at Cass Lake should be continued and this fishery should be promoted. In 1987, 45 adult walleye were tagged and released and prizes were offered to anglers for reporting tag recaptures. As of January 1, 1988, only two tagged walleye had been caught but about 100 untagged had been reported.

Maceday-Lotus Lake supports a large fishery for bluegill, perch, and pumpkinseed. Bass and walleye are present and appear to be growing to legal size in good numbers. In addition, the lake supports a trout population and numbers of anglers who target trout specifically. We recommend continued planting of rainbow trout, splake, and walleye into Maceday-Lotus Lake.

#### **ACKNOWLEDGMENTS**

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Table 1. Estimated number of fish harvested, released, and caught (total), January-November 1986 (two standard errors in parentheses).

Species	Lake		
	Orchard	Cass	Maceday-Lotus
<b>Harvested catch</b>			
Rainbow trout	0 (0)	0 (0)	509 (378)
Splake	0 (0)	0 (0)	144 (119)
Northern pike	281 (235)	122 (116)	106 (90)
Yellow perch	191 (165)	106 (123)	2,121 (751)
Walleye	0 (0)	241 (284)	12 (20)
Smallmouth bass	184 (138)	371 (249)	0 (0)
Largemouth bass	563 (306)	581 (346)	267 (199)
Bluegill	1,406 (936)	8,486 (3,031)	29,086 (6,386)
Rock bass	150 (153)	137 (147)	269 (277)
Pumpkinseed	743 (535)	325 (207)	1,665 (1,153)
Black crappie	880 (1,191)	3,342 (1,914)	1,843 (716)
Bullhead spp.	4 (9)	34 (42)	0 (0)
Total harvested	4,402	13,745	36,022
<b>Released catch</b>			
Largemouth bass			
Legal	799 (378)	866 (467)	205 (134)
Sublegal	2,531 (971)	1,507 (620)	3,521 (1,155)
Smallmouth bass			
Legal	108 (112)	238 (202)	0 (0)
Sublegal	444 (269)	891 (485)	381 (380)

Table 1. Continued:

Species	Lake		
	Orchard	Cass	Maceday-Lotus
Northern Pike			
Legal	246 (149)	75 (61)	9 (16)
Sublegal	119 (75)	337 (242)	39 (75)
Walleye			
Legal	0 (0)	5 (10)	15 (25)
Sublegal	0 (0)	89 (104)	91 (98)
Total released	4,247	4,008	4,261
Total catch all species	8,649 (1,999)	17,753 (3,763)	40,283 (6,707)
Percent released	49.10	22.58	10.58

Table 2. General summary of fishing pressure, success, and expenses.

Characteristic	Lake		
	Orchard	Cass	Maceday-Lotus
Angler-boat percentage <sup>1</sup>	18	13	24
Angler trips	6,484	10,116	11,921
Trips/acre	8.23	7.90	28.40
Hours/trip	3.80	3.90	3.10
Angler hours	24,422	39,205	37,010
Hours/acre			
Open water	29.4	25.1	68.3
Ice	1.6	5.5	20.3
Total	31.0	30.6	88.6
Total catch	8,649	17,753	40,283
Fish/trip	1.33	1.75	3.38
Catch/acre	10.98	13.86	96.10
Catch/hour	0.35	0.45	1.09
Angler expense/year	229,987	358,815	422,838
Amount spent/acre	292	280	1,009
Amount spent locally	40,525	63,225	74,506

<sup>1</sup> Angler-boat percentage is the estimated fraction of the total annual boating traffic on the lake due to fishing boats.

Table 3. Angler county of residence in percent.

County	Lake		
	Orchard	Cass	Maceday-Lotus
Oakland	66.0	73.2	84.8
Wayne	29.1	17.7	10.7
Macomb	3.2	3.4	2.4
Other	1.8	5.7	2.1

Table 4. Species sought by anglers at Orchard Lake.

Species	Months			Total	
	Jan-Mar	Apr-Jul	Aug-Nov	Number	Percent
Lake trout	0	2	0	2	0.3
Northern pike	39	31	5	75	8.8
Yellow perch	3	4	3	10	1.2
Smallmouth bass	0	14	9	23	2.7
Largemouth bass	0	182	143	325	38.4
Bluegill	4	13	2	19	2.2
Pumpkinseed	0	30	0	30	3.5
Black crappie	4	5	0	9	1.1
Pike and perch	11	0	0	11	1.3
Pike and panfish	9	0	0	9	1.1
Bluegill and crappie	1	13	0	14	1.6
Anything	0	193	127	320	37.8
Total	71	487	289	847	100.0



Table 5. Species sought by anglers at Cass Lake.

Species	Months			Total	
	Jan-Mar	Apr-Jul	Aug-Nov	Number	Percent
Rainbow trout	0	2	0	2	0.2
Lake trout	3	2	0	5	0.5
Splake	3	1	0	4	0.4
Brown trout	0	1	0	1	0.1
Northern pike	45	5	0	50	4.6
Yellow perch	2	1	0	3	0.3
Walleye	1	18	23	42	3.8
Smallmouth bass	0	29	24	53	4.9
Largemouth bass	0	164	91	255	23.5
Bluegill	107	12	2	121	11.2
Pumpkinseed	0	18	15	33	3.0
Black crappie	33	3	2	38	3.5
Carp	0	2	0	2	0.2
Pike and panfish	74	5	0	79	7.3
Bluegill and crappie	36	15	0	51	4.7
Anything	14	208	124	346	31.9
<b>Total</b>	<b>318</b>	<b>486</b>	<b>281</b>	<b>1,085</b>	<b>100.0</b>

Table 6. Species sought by anglers at Maceday-Lotus Lake.

Species	Months			Total	
	Jan-Mar	Apr-Jul	Aug-Nov	Number	Percent
Rainbow trout	3	45	15	63	4.8
Lake trout	5	4	0	9	0.7
Splake	32	13	0	45	3.4
Northern pike	34	3	3	40	3.0
Yellow perch	8	2	10	20	1.5
Walleye	0	3	0	3	0.2
Smallmouth bass	0	0	5	5	0.4
Largemouth bass	0	144	87	231	17.5
Bluegill	217	42	18	277	21.0
Pumpkinseed	0	68	6	74	5.6
Black crappie	6	3	2	11	0.8
Pike and panfish	33	3	0	36	2.7
Bluegill and crappie	27	60	0	87	6.6
Anything	28	249	142	419	31.7
Total	393	639	288	1,320	100.0

Table 7. Fish caught per acre, January-November 1986.

Species	Lake		
	Orchard	Cass	Maceday-Lotus
All trout species	0.00	0.00	1.55
Yellow perch	0.24	0.08	5.06
Bluegill	1.78	6.63	69.40
Pumpkinseed	0.94	0.25	3.97
Black crappie	1.17	2.61	4.40
Northern pike			
Harvested	0.36	0.10	0.25
Legal released	0.31	0.06	0.02
Sublegal released	0.15	0.26	0.09
Total catch	0.82	0.42	0.36
Walleye			
Harvested	0.00	0.19	0.03
Legal released	0.00	0.01	0.04
Sublegal released	0.00	0.07	0.22
Total catch	0.00	0.27	0.29
Smallmouth bass			
Harvested	0.23	0.29	0.00
Legal released	0.14	0.19	0.00
Sublegal released	0.56	0.70	0.91
Total catch	0.93	1.18	0.91
Largemouth bass			
Harvested	0.71	0.45	0.64
Legal released	1.01	0.68	0.49
Sublegal released	3.21	1.17	8.40
Total catch	4.93	2.30	9.53
All species	10.98	13.86	96.10

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Approved by W. C. Latta

Typed by G. M. Zurek

Appendix 1. Estimated catch per hour, number of fish harvested or released and fishing pressure, by month and season in 1986, for Orchard Lake, Oakland County. (Two standard errors in parentheses.)

Species	Total catch per hour	Month											Season
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
<b>Harvested</b>													
Northern pike	0.0115 (0.0098)	103 (152)	77 (84)	0 (0)	0 (0)	43 (76)	0 (0)	0 (0)	38 (55)	0 (0)	20 (127)	0 (0)	281 (235)
Yellow perch	0.0078 (0.0069)	106 (133)	19 (39)	0 (0)	0 (0)	18 (27)	8 (16)	40 (83)	0 (0)	0 (0)	0 (0)	0 (0)	191 (165)
Smallmouth bass	0.0075 (0.0058)	0 (0)	0 (0)	0 (0)	0 (0)	9 (22)	53 (83)	57 (87)	35 (52)	19 (29)	11 (25)	0 (0)	184 (138)
Largemouth bass	0.0231 (0.0131)	0 (0)	0 (0)	0 (0)	26 (56)	0 (0)	181 (164)	13 (19)	153 (189)	173 (161)	17 (37)	0 (0)	563 (306)
Bluegill	0.0576 (0.0396)	0 (0)	9 (19)	0 (0)	13 (28)	196 (201)	284 (292)	712 (832)	175 (236)	17 (36)	0 (0)	0 (0)	1,406 (936)
Rock bass	0.0061 (0.0064)	0 (0)	0 (0)	0 (0)	0 (0)	64 (84)	46 (98)	40 (83)	0 (0)	0 (0)	0 (0)	0 (0)	150 (153)
Pumpkinseed	0.0304 (0.0225)	0 (0)	142 (306)	0 (0)	0 (0)	145 (204)	277 (276)	179 (274)	0 (0)	0 (0)	0 (0)	0 (0)	743 (535)
Crappie	0.0360 (0.0492)	0 (0)	144 (179)	0 (0)	0 (0)	634 (1,170)	38 (82)	0 (0)	17 (34)	47 (99)	0 (0)	0 (0)	880 (1,191)
Bullhead	0.0002 (0.0004)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	4 (9)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	4 (9)

Appendix 1. Continued:

Species	Total catch per hour	Month											Season
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
<b>Released</b>													
<b>Largemouth bass</b>													
Legal	0.0327 (0.0165)	0 (0)	0 (0)	0 (0)	0 (0)	56 (62)	218 (195)	164 (189)	73 (79)	169 (197)	119 (143)	0 (0)	799 (378)
Sublegal	0.1036 (0.0436)	0 (0)	0 (0)	0 (0)	39 (84)	243 (350)	480 (320)	672 (556)	761 (542)	247 (315)	89 (98)	0 (0)	2,531 (971)
<b>Smallmouth bass</b>													
Legal	0.0044 (0.0046)	0 (0)	0 (0)	0 (0)	0 (0)	9 (19)	31 (54)	5 (8)	0 (0)	41 (73)	22 (62)	0 (0)	108 (112)
Sublegal	0.0182 (0.0114)	0 (0)	0 (0)	0 (0)	0 (0)	11 (17)	89 (105)	142 (186)	115 (128)	70 (94)	17 (37)	0 (0)	444 (269)
<b>Northern pike</b>													
Legal	0.0101 (0.0063)	0 (0)	0 (0)	0 (0)	0 (0)	18 (28)	116 (117)	5 (8)	8 (6)	44 (54)	55 (67)	0 (0)	246 (149)
Sublegal	0.0049 (0.0032)	0 (0)	0 (0)	0 (0)	0 (0)	17 (20)	38 (43)	16 (33)	0 (0)	43 (46)	5 (11)	0 (0)	119 (75)
Angler hours		578 (353)	569 (296)	75 (111)	604 (420)	3,245 (1,504)	5,686 (2,742)	5,059 (1,631)	5,451 (1,608)	2,189 (1,233)	924 (788)	42 (84)	24,422 (4,192)
Angler trips		224 (162)	246 (160)	25 (42)	188 (135)	1,027 (493)	1,090 (482)	1,228 (438)	1,690 (578)	450 (259)	302 (275)	14 (28)	6,484 (1,103)

Appendix 2. Estimated catch per hour, number of fish harvested or released and fishing pressure, by month and season in 1986, for Cass Lake, Oakland County. (Two standard errors in parentheses.)

Species	Total catch per hour	Month											Season
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
<b>Harvested</b>													
Northern pike	0.0031 (0.0030)	68 (86)	4 (9)	0 (0)	0 (0)	0 (0)	0 (0)	45 (76)	0 (0)	0 (0)	5 (11)	0 (0)	122 (116)
Yellow perch	0.0027 (0.0032)	4 (6)	21 (27)	5 (11)	0 (0)	58 (113)	0 (0)	18 (38)	0 (0)	0 (0)	0 (0)	0 (0)	106 (123)
Walleye	0.0061 (0.0073)	0 (0)	0 (0)	0 (0)	0 (0)	7 (15)	34 (46)	74 (93)	126 (265)	0 (0)	0 (0)	0 (0)	241 (284)
Smallmouth bass	0.0095 (0.0065)	0 (0)	0 (0)	0 (0)	0 (0)	22 (27)	13 (26)	197 (208)	56 (93)	47 (76)	36 (52)	0 (0)	371 (249)
Largemouth bass	0.0148 (0.0090)	0 (0)	0 (0)	0 (0)	0 (0)	57 (89)	152 (205)	250 (205)	61 (112)	56 (123)	5 (11)	0 (0)	581 (346)
Bluegill	0.2165 (0.0819)	2,993 (1,804)	969 (863)	1,232 (875)	0 (0)	224 (305)	688 (873)	1,604 (1,711)	316 (547)	175 (309)	254 (489)	31 (65)	8,486 (3,031)
Rock bass	0.0035 (0.0038)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	137 (147)	0 (0)	0 (0)	0 (0)	0 (0)	137 (147)
Pumpkinseed	0.0083 (0.0054)	74 (123)	11 (24)	18 (39)	0 (0)	0 (0)	0 (0)	204 (156)	0 (0)	0 (0)	18 (37)	0 (0)	325 (207)
Crappie	0.0852 (0.0500)	983 (542)	287 (323)	265 (291)	0 (0)	77 (100)	38 (79)	766 (783)	762 (1,590)	77 (109)	22 (45)	65 (91)	3,342 (1,914)
Bullhead	0.0009 (0.0011)	0 (0)	0 (0)	0 (0)	0 (0)	8 (16)	15 (32)	11 (22)	0 (0)	0 (0)	0 (0)	0 (0)	34 (42)

Appendix 2. Continued:

Species	Total catch per hour	Month											Season
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
<b>Released</b>													
<b>Largemouth bass</b>													
Legal	0.0221 (0.0122)	0 (0)	0 (0)	0 (0)	31 (45)	135 (190)	258 (159)	205 (356)	24 (49)	23 (42)	160 (150)	30 (35)	866 (467)
Sublegal	0.0384 (0.0165)	0 (0)	0 (0)	0 (0)	14 (28)	217 (203)	712 (508)	178 (147)	14 (30)	168 (162)	163 (183)	41 (44)	1,507 (620)
<b>Smallmouth bass</b>													
Legal	0.0061 (0.0052)	0 (0)	0 (0)	0 (0)	0 (0)	102 (180)	48 (44)	0 (0)	0 (0)	33 (62)	48 (50)	7 (15)	238 (202)
Sublegal	0.0227 (0.0127)	0 (0)	0 (0)	0 (0)	0 (0)	226 (274)	143 (134)	98 (95)	58 (83)	150 (259)	216 (243)	0 (0)	891 (485)
<b>Northern pike</b>													
Legal	0.0019 (0.0016)	0 (0)	0 (0)	0 (0)	17 (35)	13 (29)	37 (38)	0 (0)	0 (0)	0 (0)	8 (16)	0 (0)	75 (61)
Sublegal	0.0086 (0.0063)	0 (0)	0 (0)	0 (0)	39 (59)	50 (58)	115 (192)	44 (88)	8 (17)	22 (49)	59 (68)	0 (0)	337 (242)
<b>Walleye</b>													
Legal	0.0001 (0.0003)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (10)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (10)
Sublegal	0.0023 (0.0027)	0 (0)	0 (0)	0 (0)	0 (0)	6 (12)	5 (10)	0 (0)	56 (93)	22 (44)	0 (0)	0 (0)	89 (104)
Angler hours		4,140 (1,912)	1,855 (1,108)	1,046 (580)	1,597 (548)	6,859 (2,496)	7,256 (2,374)	6,556 (1,412)	4,481 (1,528)	3,226 (1,281)	1,786 (869)	403 (282)	39,205 (4,918)
Angler trips		1,216 (510)	552 (306)	242 (155)	499 (186)	1,715 (641)	1,473 (535)	1,880 (742)	1,268 (1,024)	802 (360)	411 (238)	58 (41)	10,116 (1,702)



Appendix 3. Estimated catch per hour, number of fish harvested or released and fishing pressure, by month and season in 1986, for Maceday-Lotus Lake, Oakland County. (Two standard errors in parentheses.)

Species	Total catch per hour	Month											Season
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
<b>Harvested</b>													
Rainbow trout	0.0138 (0.0103)	25 (51)	0 (0)	0 (0)	0 (0)	0 (0)	5 (11)	274 (318)	201 (197)	0 (0)	0 (0)	4 (11)	509 (378)
Splake	0.0039 (0.0032)	36 (56)	0 (0)	12 (26)	14 (28)	0 (0)	34 (49)	41 (84)	0 (0)	0 (0)	0 (0)	7 (15)	144 (119)
Northern pike	0.0029 (0.0025)	50 (68)	48 (57)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	8 (15)	0 (0)	0 (0)	106 (90)
Yellow perch	0.0573 (0.0213)	415 (258)	226 (225)	198 (218)	0 (0)	97 (128)	219 (152)	381 (414)	72 (106)	440 (406)	73 (109)	0 (0)	2,121 (751)
Walleye	0.0003 (0.0005)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	9 (19)	0 (0)	3 (6)	0 (0)	0 (0)	12 (20)
Largemouth bass	0.0072 (0.0054)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	22 (23)	214 (195)	22 (28)	9 (19)	0 (0)	0 (0)	267 (199)
Bluegill	0.7859 (0.1940)	11,900 (3,777)	4,025 (1,984)	1,555 (1,509)	0 (0)	1,968 (1,928)	3,274 (1,842)	2,737 (2,273)	1,771 (2,221)	1,583 (1,726)	273 (313)	0 (0)	29,086 (6,386)
Rock bass	0.0073 (0.0075)	0 (0)	0 (0)	0 (0)	0 (0)	18 (27)	234 (275)	11 (18)	0 (0)	6 (12)	0 (0)	0 (0)	269 (277)
Pumpkinseed	0.0450 (0.0316)	56 (63)	10 (21)	10 (22)	0 (0)	0 (0)	508 (602)	894 (945)	61 (92)	115 (244)	11 (18)	0 (0)	1,665 (1,153)
Crappie	0.0498 (0.0201)	912 (424)	87 (86)	66 (111)	14 (28)	120 (205)	238 (315)	191 (183)	0 (0)	193 (368)	22 (40)	0 (0)	1,843 (716)

Appendix 3. Continued:

Species	Total catch per hour	Month											Season
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
<b>Released</b>													
<b>Largemouth bass</b>													
Legal	0.0055 (0.0037)	0 (0)	0 (0)	0 (0)	3 (6)	12 (18)	39 (65)	24 (36)	10 (20)	44 (57)	73 (92)	0 (0)	205 (134)
Sublegal	0.0951 (0.0330)	0 (0)	0 (0)	0 (0)	81 (170)	236 (223)	742 (497)	1,020 (636)	483 (535)	717 (451)	236 (339)	6 (13)	3,521 (1,155)
<b>Smallmouth bass</b>													
Sublegal	0.0103 (0.0103)	0 (0)	0 (0)	0 (0)	9 (20)	0 (0)	21 (43)	351 (377)	0 (0)	0 (0)	0 (0)	0 (0)	381 (380)
<b>Northern pike</b>													
Legal	0.0002 (0.0004)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (5)	0 (0)	0 (0)	7 (15)	9 (16)
Sublegal	0.0011 (0.0020)	0 (0)	0 (0)	0 (0)	0 (0)	3 (6)	0 (0)	36 (75)	0 (0)	0 (0)	0 (0)	0 (0)	39 (75)
<b>Walleye</b>													
Legal	0.0004 (0.0007)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (7)	0 (0)	0 (0)	12 (24)	0 (0)	0 (0)	15 (25)
Sublegal	0.0025 (0.0027)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	91 (98)	0 (0)	0 (0)	0 (0)	0 (0)	91 (98)
Angler hours		5,146 (1,144)	2,706 (781)	548 (278)	995 (505)	4,430 (1,801)	6,433 (1,485)	9,187 (2,657)	3,422 (1,198)	3,085 (967)	875 (552)	183 (100)	37,010 (4,177)
Angler trips		1,609 (384)	1,028 (348)	222 (128)	292 (155)	1,317 (577)	1,888 (475)	2,656 (830)	1,771 (614)	864 (329)	181 (123)	93 (56)	11,921 (1,435)