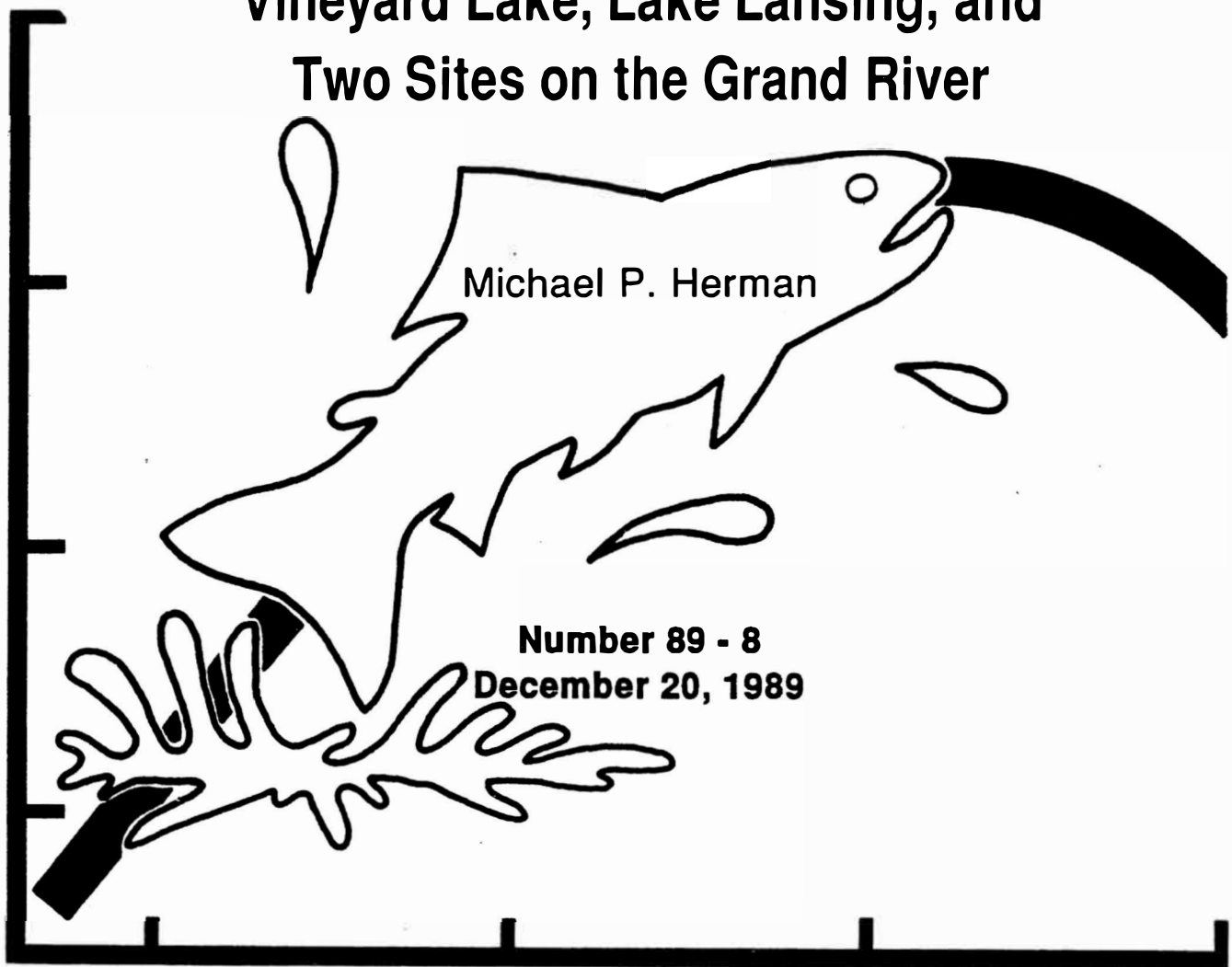


FISHERIES DIVISION

TECHNICAL REPORT

Results of the 1987 Creel Survey of Devils Lake,
Vineyard Lake, Lake Lansing, and
Two Sites on the Grand River



Michigan Department of
Natural Resources

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**RESULTS OF THE 1987 CREEL SURVEY OF DEVILS LAKE, VINEYARD LAKE,
LAKE LANSING, AND TWO SITES ON THE GRAND RIVER**

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Abstract.—This report summarizes the results of the 1987 creel survey conducted at Devils Lake, Vineyard Lake, and Lake Lansing as well as the Moore's Park and Grand River Park sites on the Grand River, located within the Lansing city limits. A total of 2,336 anglers were surveyed at the end of their fishing trips. Harvest and effort estimates were calculated by month for all sites. Harvest estimates ranged from a low of 0.21 fish per hour at Lake Lansing to a high of 0.45 fish per hour at Devils Lake. Devils Lake had the greatest amount of angler activity of the three lakes surveyed and Moore's River Park had the greatest amount of angler activity of the two river sites surveyed. Total harvest estimates for the entire survey season ranged from 1,906 to 19,032 fish for the surveyed lakes and from 2,432 to 3,502 fish for the surveyed river sites. The bluegill (*Lepomis macrochirus*) was the most common species creel at Devils Lake (62%), Vineyard Lake (50%) and Lake Lansing (50%). Pumpkinseed (*Lepomis gibbosus*) dominated the harvest at Moore's Park (37%) and Grand River Park (40%). Bluegills were the second most harvested species at each of the river sites, comprising 25% and 28% of the total harvest, respectively. Walleye (*Stizostedion vitreum*) stocking programs at Devils Lake and the two Grand River sites have proven to be successful and should be continued.

One of the most important tools available to fisheries managers is the creel survey. These surveys help them evaluate existing fish populations as well as past and present fisheries management programs. During the summer of 1987, fisheries personnel from the Jackson District Office of the Michigan Department of Natural Resources carried out an intensive creel survey on Devils Lake, Vineyard Lake, Lake Lansing, and two sites on the Grand River near Lansing. Objectives of the creel survey were to 1) estimate the amount of angling pressure on these waters, 2)

estimate angler harvest of the various fish species, and 3) to determine the return to the creel created by various fish stocking programs in these waters.

Study Sites

Devils Lake.—Devils Lake is a natural lake located in northwest Lenawee County. The shoreline of this lake is nearly completely developed with both summer and permanent residences. It is approximately 1,300 acres in

size and has a maximum depth of 63 feet. Inlets to Devils Lake include Horton Creek and two small unnamed streams which enter the lake at its northwest end. Bean Creek flows from Devils Lake at its southwest end and flows to Addison Mill Pond, the Tiffin River, and the Maumee River to the south. This lake is part of the Bean Creek watershed.

Devils Lake has the reputation as one of the better fishing lakes in Michigan and will be included in the next edition of "Michigan's 50 Best Fishing Lakes" published by the Michigan United Conservation Clubs. This lake contains good populations of largemouth bass (*Micropterus salmoides*), and smallmouth bass (*M. dolomieu*), bluegill (*Lepomis macrochirus*), yellow perch (*Perca flavescens*), walleye (*Stizostedion vitreum*), and pumpkinseed (*Lepomis gibbosus*). Fish stocked in Devils Lake in the last 5 years include tiger muskellunge (*Esox masquinongy x Esox lucius*), walleye and redear sunfish (*Lepomis microlophus*).

Vineyard Lake.—Vineyard Lake, also a natural lake, covers an area of 505 acres and is located in southeastern Jackson County. This lake has a maximum depth of 42 feet. There are two inlets to Vineyard Lake. The Plum Brook Drain enters the lake on its northwest side and a smaller, unnamed intermittent inlet flows into Vineyard Lake on its northeast end. The lake outlets directly into the River Raisin and is part of the River Raisin watershed.

Historically, Vineyard Lake has had a very good reputation for bluegill, black crappie (*Pomoxis nigromaculatus*), largemouth bass, and northern pike (*Esox lucius*) fishing. Walleye are the only species of fish that have been stocked in this lake within the last 5 years.

Lake Lansing.—Lake Lansing is located in northern Ingham County approximately 7 miles east of the city of Lansing and is part of the Red Cedar River watershed. This natural lake is 453 acres in size and has a maximum depth of 37 feet. Most of Lake Lansing's shoreline is developed with permanent residences. There are two small intermittent inlets which enter the lake on its northeast side. One small intermittent outlet is located

on the lake's western side and flows into the Red Cedar River.

Lake Lansing has had a poor fishing reputation for many years. Selective dredging of this lake was begun in the late 1970s and was completed in the early 1980s. Total treatment of the lake with rotenone had been considered for some time. Justification for this treatment was based on 1984 survey data which showed that 85% of the entire harvest, by weight, was composed of common carp (*Cyprinus carpio*). However, subsequent surveys in 1985, 1986, and 1987 showed that the average size, as well as the growth, of some game fish species was improving. Since 1984 the average length of bluegills had steadily increased. Bluegills surveyed prior to 1987 were reported as thin and slow growing. Bluegills observed in the 1987 survey appeared to be in good condition and did not appear thin as observed in previous years.

Presently, Lake Lansing contains good numbers of largemouth bass, bluegill, northern pike, and fair to good numbers of black crappie. Fish stocked in Lake Lansing in the last 5 years include tiger muskellunge and channel catfish (*Ictalurus punctatus*). Tiger muskies were stocked in Lake Lansing in 1982 and 1983. Subsequent surveys in 1984 and 1985 showed that relatively few fish survived and few were reported caught. The stocking of this species was discontinued in 1984.

Grand River.—Both Grand River creel survey sites, Moore's River Park and Grand River Park, are located within the city limits of Lansing. The headwaters of the Grand River system originate in northern Hillsdale County. The Grand is the longest river in the state and empties into Lake Michigan at Grand Haven.

Moore's River Park is a very popular shore, wading, and small boat fishery, which is easily accessible to many anglers because it is close to downtown Lansing. The dam at Moore's Park prevents upstream movements of fish and is a concentration point for many fish species.

Grand River Park has an adequate boat launching site with good parking facilities. Some boat fishing takes place here but most anglers fished from shore during the spring and summer of 1987.

Historically, the Grand River in the vicinity of Lansing has supported a modest but consistent fishery for channel catfish, largemouth bass, smallmouth bass, and panfish. Fish species planted in the Grand River near Lansing during the last 5 years include walleye, tiger muskellunge, chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and steelhead trout (*O. mykiss*).

Survey Methods

Two temporary workers conducted the creel surveys based on semi-random stratified sampling schedules that were developed with the assistance of Institute for Fisheries Research personnel. Survey clerks interviewed anglers to determine how long they fished and what they caught and made periodic instantaneous counts of anglers and boats to determine fishing pressure. The general methodology is given by Ryckman (1981).

The creel survey began on April 24 and ended on September 7, 1987. The survey was conducted 5 days a week during daylight hours at all five locations. Additionally, all weekend days and holidays were surveyed. The order of lakes sampled, sampling period (AM or PM), and the time of boat and angler counts were semi-randomly selected to insure a representative sampling of angling at each location.

Angler interviews were made at public access sites. These interviews provided information on numbers and kinds of fish caught, fish lengths, duration of the fishing trip, bait used, species sought, county of residence, and sex of the angler. These data were recorded by creel clerks on an angler interview form (Appendix 1). Count data for shore and boat anglers was recorded on a shore and boat count data sheet (Appendix 2).

The economic benefit of angling on the three study lakes and two river sites was estimated by assuming that an average of \$35.47 was spent by each angler per fishing day. This dollar value is the average daily trip expenditure for all Michigan anglers targeting

yellow perch, bass, panfish, and walleye (Mahoney et al. 1986).

Results and Discussion

Devils Lake

Results of the 1987 creel survey show that Devils Lake supports a variety of highly desirable sport fish. Listed in descending order of numbers of fish creeled, major fish species caught in Devils Lake during this survey include bluegill, rock bass, pumpkinseed, yellow perch, largemouth bass, smallmouth bass, white bass (*Morone chrysops*), walleye, and northern pike.

The creel clerk interviewed 738 anglers on Devils Lake. Anglers harvested an estimated 19,032 fish, comprising 11 species (Table 1, Appendix 3). Total harvest per acre for the entire survey period was 14.31 fish (Table 9).

Fishing success for bluegills was excellent at Devils Lake and this was the most abundant species creeled, accounting for 62% of the total. Bluegills were targeted by 34% of all anglers interviewed during the April to September survey season. From a sample of nearly 700 fish which were measured by the creel clerk, bluegills averaged over 8.25 inches. Other major species harvested were rock bass (*Ambloplites rupestris*) (12%), pumpkinseed (10%), and yellow perch (8%).

Devils Lake is unique in having a self-sustaining white bass population. Although the estimated total seasonal harvest was only 119 individuals, the creeled fish averaged nearly 15 inches each and one fish weighed over 2 pounds.

Anglers made 10,885 trips to Devils Lake and fished a total of 42,429 hours (3.9 hours per trip). Overall harvest per hour was 0.45 fish. Angler pressure over the survey period was 31.9 hours per acre.

Devils Lake anglers resided primarily in two southern Michigan counties (Table 3). Nearly 50% of the anglers interviewed lived in Lenawee County, 22% lived in Jackson County, and over 12% of Devils Lake anglers were from the state of Ohio.

Anglers at Devils Lake could be grouped into four major categories according to species sought (Table 4). Over 34% of the anglers fished for bluegill, 29% pursued largemouth bass, nearly 11% sought walleye, and another 14% were after multiple species.

Angler activity is undoubtedly reduced by competition with recreational boaters for water use. Many boat anglers have suggested restricted hours for powerboat use on this lake. Because of the fishermen/powerboat conflict on Devils Lake, much of the angling was concentrated during the early morning hours.

Vineyard Lake

The creel clerk interviewed 358 anglers on Vineyard Lake. Based on these interviews, anglers harvested an estimated 9,872 fish during the summer of 1987, comprising eight species (Table 1, Appendix 4). Total harvest per acre for the survey period was 19.5 fish (Table 9).

Fishing success at Vineyard Lake was excellent for bluegill. This species accounted for nearly 50% of all fish creeled and was sought by 33% of the interviewed anglers. Although nearly 30% of all anglers pursued largemouth bass, this species was a minor contributor to the estimated overall harvest (1.3%). Voluntary release of this species may be one explanation for this low value.

Angling success was moderately good for rock bass, pumpkinseed, crappie, yellow perch, and northern pike. With the exception of pike, all of the above listed fish species were likely incidental catches since few anglers specifically targeted these species.

Anglers made 7,324 trips to Vineyard Lake, accumulating 28,072 hours of fishing pressure (3.8 hours per trip). Angler pressure for the survey period was 55.6 hours per acre. Overall estimated harvest per hour was 0.35 fish.

Vineyard Lake anglers resided mainly in two southern Michigan counties (Table 3). Approximately 53% of the interviewed anglers lived in Jackson County and 14% resided in Lenawee County. Over 15% of the anglers

interviewed travelled from Wayne County to fish this lake.

Vineyard Lake supported four distinct groups of anglers according to species sought (Table 5). Nearly 33% of the anglers fished for bluegill, 28% pursued largemouth bass, and over 20% targeted northern pike. Twelve percent of all anglers interviewed fished for "anything".

Lake Lansing

Lake creel clerk interviewed 298 anglers at Lake Lansing. Based on these interviews, anglers harvested an estimated 1,906 fish, comprised of seven species (Table 1, Appendix 5). The total harvest per acre was 4.2 fish (Table 9).

Fishing success at Lake Lansing was only fair for bluegill, largemouth bass, crappie, yellow perch, pumpkinseed, and northern pike. Anglers harvested an estimated total of only 1,900 fish throughout the creel survey period. Bluegill, by far the most abundant species observed in the catch, accounted for over 50% of the total angler harvest. From a sample of 125 fish which were measured by the creel clerk, bluegills averaged nearly 7 inches. Other important species included largemouth bass (15%), black crappie (14%), and yellow perch (10%).

Anglers made 2,611 trips to Lake Lansing and averaged 3.4 hours per trip for a total fishing pressure of 8,959 hours. Angling pressure during the creel survey period was just 19.8 hours per acre. Lake Lansing yielded only 0.21 fish per hour.

Anglers were mostly local residents (Table 3). Over 87% lived in Ingham County. Other Lake Lansing anglers resided in Shiawassee County (6%), Clinton County (3%), Eaton County (3%), and Kent County (1%).

Most anglers (35%) pursued multiple fish species. Nearly 35% of the anglers targeted largemouth bass and over 17% fished for northern pike (Table 6). Although only 11% of the anglers interviewed indicated that they were fishing for bluegill, this species accounted for more than 50% of the total angler harvest.

Just over 1% of the anglers fished specifically for tiger muskellunge. No muskies were creeled by interviewed anglers during the survey period.

The harvest rate at Lake Lansing was the lowest (0.21) of all sites surveyed in 1987. However, a large percentage of anglers (34.6%) fished specifically for bass (Table 2, Appendix 5). Significant voluntary catch-and-release of this species could have contributed to a low harvest rate value.

Grand River: Moore's River Park

With the exception of an occasional carry-in boat fisherman, the majority of Moore's Park anglers waded or fished from shore. Although a few anglers fished up to 100 yards above and below Moore's dam, most angling occurred from the dam to approximately 450 feet downstream. The width of the Grand River in this area averages 200 feet and the total surface acreage is estimated at 2 acres.

The creel clerk interviewed 559 anglers at Moore's Park and they harvested an estimated 2,432 fish, comprising 11 species (Table 1, Appendix 6). Total harvest per acre for the entire survey period was 1,216 fish (Table 10).

The pumpkinseed was the most abundant species creeled at Moore's Park, accounting for 37% of the total. Other major species harvested were bluegill (25%) and channel catfish (20%). When combined, rock bass, smallmouth bass, and walleye represented 12% of the total harvest.

Anglers made 6,578 trips to Moore's River Park and fished a total of 11,128 hours (1.7 hours per trip). Overall harvest per hour was only 0.22 fish. Angler pressure over the survey period was 5,564 hours per acre.

Moore's Park anglers were mostly local residents (Table 3). All but one of the 559 anglers interviewed at this site lived in Ingham County.

Most anglers (80%) sought "any" fish species. Over 14% of anglers interviewed targeted walleye and less than 3% fished for channel catfish (Table 7).

Monthly daytime surface water temperatures at Moore's River Park were recorded by the creel clerk and ranged from 52°F in late April to 87°F in July. Daytime temperatures were taken several times during July and August in the impoundment above the dam at Moore's River Park, where the Eckert Plant of the Lansing Board of Water and Light discharges non-contact cooling waters directly into the river. Average temperatures ranged from 90°F to 95°F with a high of 97°F recorded. In addition, the clerk interviewed boat anglers who reported water temperatures had been as high as 105°F immediately in front of the power plant cooling towers. These extreme water temperatures undoubtedly have an effect upon the fish species which are found in the river during these times. No walleye or redhorse suckers (*Maxostoma* spp.) were caught during the period of June through September but these two species appeared in anglers' creels in April and May.

Despite the variable and relatively high water temperatures at Moore's Park, anglers enjoyed reasonably good fishing success for panfish and channel catfish and fair fishing success for largemouth and smallmouth bass (Appendix 6).

Only an estimated 69 legal-size walleye were harvested at Moore's Park during the summer of 1987, although the creel clerk observed many sublegal walleyes being released during the months of April and May. As water temperatures increased, the walleyes probably migrated to cooler water areas downstream.

During the month of May, an estimated nine rainbow trout were reported harvested by anglers at Moore's Park. These fish were probably yearling steelhead trout that were stocked in March 1987 at a site on the Grand River approximately two river miles downstream from Moore's Dam.

Grand River Park

According to the creel clerks' records, the vast majority of Grand River Park anglers fished between Creyts Road in Eaton County

and Logan Street south of US-27 in Ingham County. Total surface acreage for this section of the river is estimated to be 240 acres.

The creel clerk interviewed 383 anglers at Grand River Park. Based on these interviews, anglers harvested an estimated 3,502 fish during the summer of 1987, comprising nine species (Table 1, Appendix 7). Total harvest per acre for the entire survey period was 14.59 fish (Table 10).

Pumpkinseed dominated the harvest, accounting for nearly 40% of the total. Other important species in the harvest included bluegill (28%) and redhorse sucker (18%). Largemouth bass, smallmouth bass, rock bass, and crappie made minor contributions to the harvest.

Anglers made 4,582 trips to Grand River Park which accounted for 8,533 hours of fishing pressure (1.9 hours per trip). Angler pressure for the survey period was 35.55 hours per acre. The overall estimated harvest per hour was 0.41 fish.

Grand River Park anglers, like Moore's Park anglers, were mostly local residents (Table 3). Over 95% of the interviewed fishermen lived in Ingham County. Other Grand River Park anglers resided in Eaton, Clinton and Gratiot counties. Less than 1% of the interviewed anglers were from out-of-state.

Nearly 70% of all anglers sought "any" fish species. Approximately 17% of the anglers interviewed targeted largemouth bass and only 4% of the fishermen sought walleye (Table 8).

Anglers at Grand River Park enjoyed generally good fishing success for panfish, suckers (*Catostomus* spp.), largemouth bass, and smallmouth bass. Shore anglers accounted for over 76% of the total harvest and harvested mainly pumpkinseed and bluegill sunfish. Boat anglers accounted for approximately 24% of the total harvest and harvested mostly redhorse suckers and bluegill. Although largemouth bass were targeted by many anglers, this species accounted for only 4.3% of all fish harvested at this site. Voluntary catch-and-release of largemouth bass would help to explain this low value. Many bass fishermen practice bass

fishing for tournaments at this site. Bass tournaments are held here regularly, and the majority of these anglers release their catch during practice sessions and after tournaments.

Comparison with Other Lakes

Creel survey parameters such as harvest per acre, angler hours per acre, and harvest 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 showed that the largest lakes exhibited the lowest average harvest per acre and harvest rate (Ryckman and Lockwood 1985). The 1987 creel survey results from Vineyard Lake and Lake Lansing did not follow this trend.

Lake Lansing values for catch per hour and harvest per acre were significantly lower than the averages reported by Ryckman and Lockwood in 1985. One of the reasons for these low values may be directly attributable to the intense power boat use this lake has received in recent years. The Vineyard Lake value for harvest per acre is somewhat lower than the averages reported from creel surveys between 1975 and 1982, but harvest per hour was very comparable.

It was also noted by Ryckman and Lockwood (1985) that the largest lakes tend to have the lowest pressure in angler hours per acre. Lake Lansing is classified as a small lake (<500 acres), but it exhibited a much lower fishing rate (19.8 hours per acre) than was reported for creel surveys between the years of 1946-65 (77 hours per acre) or between the years of 1975-82 (208 hours per acre).

Devils Lake, Vineyard Lake, and Lake Lansing are similar in size to Pontiac, Kent, and Whitmore lakes. A 1980 creel survey of Pontiac, Kent, and Whitmore lakes resulted in estimates of harvest ranging from 35.8 to 128.8 fish per acre, angler effort ranged from 80.9 to 191.1 hours per acre, and harvest rates ranged from 0.29 to 0.67 fish per hour (Goudy 1981). Results of the 1987 creel survey show that Devils Lake, Vineyard Lake, and Lake Lansing all exhibit values of harvest per acre and

angler hours per acre that are much lower than those for Pontiac, Kent, and Whitmore lakes. However, harvest rates for Devils and Vineyard lakes are comparable with those from the 1980 creel survey.

Devils Lake, Vineyard Lake, and Lake Lansing are also similar in size to Cass Lake, Orchard Lake, and Maceday-Lotus Lake. These southeast Michigan lakes were creel surveyed in 1986. The 1986 creel survey resulted in open-water estimates of harvest ranging from 10.38 to 46.10 fish per acre, angler effort from 25.1 to 68.3 hours per acre, and harvest rates from 0.35 to 0.67 fish per hour (Waybrant and Thomas 1988). Devils Lake and Vineyard Lake compare well with Orchard and Cass lakes with regard to the estimates for harvest per acre and harvest rates. However, anglers on Devils and Vineyard lakes spent more hours fishing per acre than did anglers on Orchard and Cass lakes (Table 2). Lake Lansing anglers harvested significantly fewer fish per acre, spent less time angling per acre, and had a lower harvest rate than all three lakes creel surveyed in 1986.

An intensive creel survey of the Devils Lake fishery was conducted from the spring of 1950 through the winter of 1953-54 (Schneider and Lockwood 1979). For purposes of comparison, only the spring and summer data (last Saturday in April through Labor Day) from the 1950 creel survey were used. Anglers in 1987 made only about half as many trips to Devils Lake as in the 1950s. Fishermen spent more hours per trip in 1987, but they fished fewer total hours than anglers in the 1950s. Fewer fish were harvested per hour in 1987 although anglers harvested similar numbers of fish per trip. Statistics for harvest per acre and total number of fish harvested by 1987 anglers were much lower than those reported in the 1950s. The average harvest per hour from the creel survey conducted in the early 1950s was over two times larger than the harvest rate calculated from the 1987 creel survey (Table 12).

It is interesting to note that during the creel survey in the 1950s, nearly 60% of the Devils Lake summer anglers were from Indiana and Ohio. In 1987, only 12% of the

anglers traveled from these two states to fish Devils Lake.

Economic Impacts from Angling

Devils Lake contributed the greatest economic benefit compared to the other lakes surveyed. An estimated \$386,091 was spent by Devils Lake anglers during the 1987 creel survey season (Table 11). Devils Lake supports an excellent fishery and anglers made more trips to this lake than any other site surveyed in 1987. Vineyard Lake anglers contributed the second largest economic benefit. These anglers spent an estimated \$259,782 throughout the survey season. Lake Lansing contributed the least to the local economy, mainly because anglers made fewer trips to this lake.

Actual returns to local economies were much smaller than the above figures, because they include at-home, travel, and local expenses. Local expenses likely averaged \$6.25 per trip which is the statewide figure developed by Mahoney et al. (1986). This value of \$6.25 per trip resulted in local expenditures of \$68,031 for Devils Lake, \$45,775 for Vineyard Lake, \$16,319 for Lake Lansing, \$41,113 for Moore's River Park, and \$28,638 for Grand River Park.

Conclusions

Devils Lake supports a varied and fast-growing fish community. Historically, fish growth has been consistently above the state average for most species. The current walleye stocking program has proven to be somewhat successful. A modest but viable walleye fishery has developed as a result of these introductions. Continued stocking and evaluation of this species is recommended.

Although the creel survey did not show it, anglers report modest but consistent tiger muskellunge catches, mainly in the winter. Reports of anglers catching "tigers" up to 46 inches during the winter of 1987-88 have been received by the Jackson District Office. Since anglers have limited opportunities to catch

trophy-size fish in this part of the state, the alternate-year stocking of this species should be continued.

Vineyard Lake presently supports a good variety of catchable game fish. Although use of the cooperative northern pike marsh near Vineyard Lake has been discontinued because of poor water quality, the existing lake habitat appears favorable for northern pike growth and survival. It appears this lake could benefit from the stocking of northern pike fingerlings. Over 20% of all anglers interviewed sought northern pike, although this species accounted for less than 2% of the total estimated harvest.

Despite intensive walleye stocking efforts, Vineyard Lake has failed to produce a walleye fishery. The 1987 creel survey indicated that no legal size walleyes were harvested. Additionally, electrofishing and netting surveys in 1984 and 1988, respectively, produced no walleyes. Because of the poor success of walleye fingerling plants, walleye stocking has been discontinued.

Lake Lansing is one of the largest bodies of water with public access in the mid-Michigan area. Because of its proximity to the highly populated city of Lansing, the lake attracts large numbers of high speed watercraft. Intense competition between fishing and powerboats is probably a major contributor to the relatively light fishing pressure this lake received during the 1987 creel survey season. Although anglers took advantage of early morning hours, the creel clerk reported that most fishermen were literally forced off the lake by mid-morning on weekend days. Most anglers that were interviewed strongly recommended and supported restricted hours for powerboat use on this lake.

Netting surveys have shown that the average size and growth rates of the bluegill population have increased since Lake Lansing was dredged in the late 1970s and early 1980s. The fish populations in the lake appear to be recovering. This improved fishery will probably advertise itself over time, and it is expected that an increasing number of anglers

will take advantage of the underutilized fishing opportunities that are available in this lake.

Moore's River Park provides a large number of boatless anglers with an opportunity to fish from shore. The stocking of walleye fingerlings has proven to be successful here and should be continued, even though these fish seem to disappear as summer progresses and water temperatures increase. Channel catfish were harvested in relatively large numbers throughout the summer. This species was the most commonly harvested large fish during the summer when water temperatures were highest. Consideration should be given to supplementing the existing population of channel catfish with stocked fish as they become available.

In cooperation with the Surface Water Quality Division of the Michigan Department of Natural Resources, the Eckert Plant of the Lansing Board of Water and Light is currently conducting a study of the thermal plume in the Grand River impoundment just above Moore's Dam. Results of this study may require the plant to install additional cooling towers, which should benefit the fish populations in the impoundment and tailwater area downstream from the dam.

Results of a trap-net and fyke-net survey of the Grand River near Grand River Park in 1982 showed that relatively unfished populations of channel catfish, walleye, largemouth bass, smallmouth bass, and various panfish species existed. Results of the 1987 creel survey of this section of the Grand River indicate that anglers took advantage of the panfish, but were only moderately successful for largemouth and smallmouth bass. No walleye or channel catfish were creeled during the survey period. A summer 1989 trap-net and electrofishing survey of this section of the river once again confirmed good numbers of walleye and channel catfish available to anglers. Of all the anglers interviewed at this site, less than 5% specifically targeted walleye and less than 1% targeted channel catfish.

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Table 1.—Estimated numbers of fish harvested, by species, during an April-September 1987 creel survey on five southern Michigan waters. Two standard errors are given in parentheses.

Species	Fishing site				
	Devils Lake	Vineyard Lake	Lake Lansing	Moore's River Park	Grand River Park
Bluegill	11,785 (4,199)	4,889 (2,836)	960 (648)	616 (418)	976 (732)
Rock bass	2,206 (989)	1,631 (1,758)	0 (0)	115 (131)	129 (134)
Pumpkinseed	1,875 (1,084)	1,454 (1,004)	126 (118)	892 (631)	1,385 (870)
Yellow perch	1,593 (773)	684 (527)	194 (191)	0 (0)	0 (0)
Black crappie	0 (0)	894 (1,195)	257 (248)	0 (0)	31 (43)
Largemouth bass	839 (393)	132 (116)	279 (140)	55 (75)	148 (194)
Smallmouth bass	370 (240)	15 (31)	0 (0)	94 (91)	86 (80)
Walleye	68 (108)	0 (0)	0 (0)	69 (72)	0 (0)
Northern pike	7 (13)	173 (238)	88 (101)	0 (0)	0 (0)
Bullhead spp.	161 (130)	0 (0)	2 (4)	60 (101)	16 (31)
White bass	119 (184)	0 (0)	0 (0)	0 (0)	0 (0)
Longnose gar	9 (21)	0 (0)	0 (0)	0 (0)	0 (0)
Channel catfish	0 (0)	0 (0)	0 (0)	483 (367)	0 (0)
Redhorse spp.	0 (0)	0 (0)	0 (0)	26 (45)	622 (1,190)
Common carp	0 (0)	0 (0)	0 (0)	13 (27)	108 (146)
Rainbow trout	0 (0)	0 (0)	0 (0)	9 (18)	0 (0)
Total harvested (all species)	19,032 (4,544)	9,872 (1,195)	8,959 (1,872)	2,432 (870)	3,501 (1,672)

Table 2.—Summary of fishing pressure and success from the April-September 1987 creel survey of five southern Michigan waters. Two standard errors are given in parentheses.

Characteristic	Fishing site				
	Devils Lake (1,330 acres)	Vineyard Lake (505 acres)	Lake Lansing (453 acres)	Moore's River Park (2 acres)	Grand River Park (240 acres)
Angler trips	10,886 (1,741)	7,324 (1,078)	2,611 (552)	6,578 (1,899)	4,582 (1,092)
Trips/acre	8.18 (1.31)	14.50 (2.13)	5.76 (1.22)	3,289 (950)	19.09 (4.55)
Hours/trip	3.90 (0.90)	3.83 (0.80)	3.43 (1.02)	1.69 (0.63)	1.86 (0.58)
Angler hours	42,428 (7,082)	28,070 (4,129)	8,959 (1,872)	11,128 (2,583)	8,534 (1,720)
Hours/acre	31.90 (5.32)	55.58 (8.18)	19.78 (4.13)	5,564 (1,292)	35.56 (7.17)
Total harvest	19,032 (4,544)	9,872 (3,730)	1,906 (749)	2,432 (870)	3,501 (1,672)
Fish/trip	1.75 (0.50)	1.35 (0.55)	0.73 (0.33)	0.37 (0.17)	0.76 (0.41)
Harvest/acre	14.31 (3.42)	19.55 (7.39)	4.21 (1.65)	1,216 (435)	14.59 (6.97)
Harvest/hour	0.45 (0.13)	0.35 (0.14)	0.21 (0.09)	0.22 (0.09)	0.41 (0.21)

Table 3.—County of residence (percent) of anglers interviewed during an April-September 1987 creel survey on five southern Michigan waters.

County	Fishing site				
	Devils Lake	Vineyard Lake	Lake Lansing	Moore's River Park	Grand River Park
Branch	0.3	---	---	---	---
Calhoun	0.2	---	---	---	---
Clinton	---	---	3.0	---	0.5
Eaton	0.2	---	2.7	---	2.1
Gratiot	---	---	---	---	1.3
Hillsdale	3.0	0.3	---	---	---
Ingham	1.0	1.1	87.3	99.8	95.6
Jackson	22.2	52.8	---	---	---
Kalamazoo	1.0	---	---	---	---
Kent	---	---	1.0	---	---
Lenawee	48.2	14.3	---	---	---
Monroe	2.6	5.0	---	---	---
St. Clair	0.3	---	---	---	---
Shiawassee	---	---	6.0	---	---
Washtenaw	3.5	3.9	---	---	---
Wayne	5.2	15.1	---	---	---
Ohio	12.3	7.5	---	---	---
Indiana	---	---	---	---	0.5
Out-of-state (other)	---	---	---	0.2	---

Table 4.—Number of anglers targeting particular fish species at Devils Lake, Lenawee County, during an April-September 1987 creel survey.

Species	Month						Total	
	Apr	May	Jun	Jul	Aug	Sep	Number	Percent
Northern pike	12	20	3	9	3	0	47	6.4
Yellow perch	5	5	0	0	2	0	12	1.6
Walleye	12	7	32	9	17	2	79	10.7
Smallmouth bass	0	5	3	0	0	0	8	1.1
Largemouth bass	2	46	36	63	60	8	215	29.1
Bluegill	15	49	39	34	89	26	252	34.2
Rock bass	0	2	0	2	0	0	4	0.5
Sunfish spp.	2	1	0	0	0	0	3	0.4
Black crappie	2	9	0	0	2	0	13	1.8
White bass	0	0	1	2	0	0	3	0.4
Anything	11	28	33	18	9	3	102	13.8
Total	61	172	147	137	182	39	738	100.0

Table 5.—Number of anglers targeting particular fish species at Vineyard Lake, Jackson County, during an April-September 1987 creel survey.

Species	Month						Total	
	Apr	May	Jun	Jul	Aug	Sep	Number	Percent
Northern pike	17	12	20	12	12	0	73	20.4
Walleye	3	2	3	0	0	0	8	2.2
Largemouth bass	0	29	17	15	34	6	101	28.2
Bluegill	4	40	27	24	13	10	118	33.0
Rock bass	0	0	0	4	0	0	4	1.1
Pumpkinseed	0	0	2	1	0	0	3	0.8
Black crappie	0	1	3	2	0	0	6	1.7
Anything	2	5	23	5	6	4	45	12.6
Total	26	89	95	63	65	20	358	100.0

Table 6.—Number of anglers targeting particular fish species at Lake Lansing, Ingham County, during an April-September 1987 creel survey.

Species	Month						Total	
	Apr	May	Jun	Jul	Aug	Sep	Number	Percent
Northern pike	9	31	6	2	2	3	53	17.8
Tiger muskellunge	0	0	0	4	0	0	4	1.3
Largemouth bass	0	34	26	32	8	3	103	34.6
Bluegill	1	20	2	8	2	0	33	11.1
Anything	6	36	16	26	17	4	105	35.2
Total	16	121	50	72	29	10	298	100.0

Table 7.—Number of anglers targeting particular fish species in the Grand River at Moore's River Park, Ingham County, during an April-September 1987 creel survey.

Species	Month						Total	
	Apr	May	Jun	Jul	Aug	Sep	Number	Percent
Walleye	12	44	13	4	9	0	82	14.6
Smallmouth bass	0	0	0	0	3	0	3	0.5
Largemouth bass	0	0	1	0	3	1	5	0.9
Bluegill	1	3	1	0	0	0	5	0.9
Rock bass	0	2	0	0	0	0	2	0.4
Common carp	1	0	0	0	0	0	1	0.2
Channel catfish	0	2	2	2	2	6	14	2.5
Anything	33	126	106	91	84	7	447	80.0
Total	47	177	123	97	101	14	559	100.0

Table 8.—Number of anglers targeting particular fish species in the Grand River at Grand River Park, Ingham County, during an April-September 1987 creel survey.

Species	Month						Total	
	Apr	May	Jun	Jul	Aug	Sep	Number	Percent
Northern pike	0	4	4	0	0	0	8	2.1
Walleye	0	15	0	0	2	0	17	4.4
Smallmouth bass	0	0	0	0	6	2	8	2.1
Largemouth bass	0	38	12	7	6	2	65	16.9
Bluegill	0	2	2	0	0	0	4	1.0
Common carp	3	9	0	0	2	0	14	3.7
Channel catfish	0	0	0	0	0	1	1	0.3
Anything	9	88	55	48	58	8	266	69.5
Total	12	156	73	55	74	13	383	100.0

Table 9.—Estimated number of fish harvested per acre, by species, in Devils Lake, Vineyard Lake, and Lake Lansing, during the April-September 1987 creel survey period.

Species	Lake		
	Devils (1,330 acres)	Vineyard (505 acres)	Lansing (453 acres)
Bluegill	8.86	9.68	2.12
Rock bass	1.65	3.23	0.00
Pumpkinseed	1.41	2.88	0.28
Yellow perch	1.20	1.35	0.42
Black crappie	0.00	1.77	0.57
Largemouth bass	0.63	0.26	0.62
Smallmouth bass	0.28	0.03	0.00
Walleye	0.05	0.00	0.00
Northern pike	0.01	0.34	0.19
Bullhead spp.	0.12	0.00	0.01
White bass	0.09	0.00	0.00
Longnose gar	0.01	0.00	0.00
All species	14.31	19.54	4.21

Table 10.—Number of fish harvested per acre, by species, at two sites on the Grand River, Ingham County, during the April-September 1987 creel survey period.

Species	River site	
	Moore's River Park (2 acres)	Grand River Park River (240 acres)
Bluegill	308	4.06
Rock bass	57	0.54
Pumpkinseed	446	5.77
Black crappie	0	0.13
Largemouth bass	27	0.62
Smallmouth bass	47	0.36
Walleye	34	0.00
Bullhead spp.	30	0.07
Channel catfish	242	0.00
Redhorse spp.	13	2.59
Common carp	7	0.45
Rainbow Trout	5	0.00
All species	1,216	14.59

Table 11.—Monthly estimates of total angler expenses and the amount spent locally based on the April-September 1987 creel survey on five southern Michigan waters. These estimates assume that an average of \$35.47 was spent by each angler per fishing day, and that local expenses averaged \$6.25 per trip (Mahoney et al. 1986).

Month	Fishing site				
	Devils Lake	Vineyard Lake	Lake Lansing	Moore's River Park	Grand River Park
	Total angler expenses				
April	7,555	6,810	4,930	10,817	11,883
May	85,341	46,146	26,070	93,251	28,553
June	89,207	61,115	18,764	41,855	33,377
July	100,025	84,809	25,645	36,641	42,599
August	81,936	48,700	10,428	34,264	34,406
September	22,027	12,202	6,775	16,494	11,705
Total	386,091	259,782	92,612	233,322	162,523
	Amount spent locally				
April	1,331	1,200	868	1,907	2,094
May	15,038	8,131	4,594	16,431	5,031
June	15,719	10,769	3,306	7,375	5,881
July	17,625	14,944	4,519	6,456	7,506
August	14,437	8,581	1,838	6,038	6,063
September	3,881	2,150	1,194	2,906	2,063
Total	68,031	45,775	16,319	41,113	28,638

Table 12.—Comparison of fishing pressure and success of anglers at Devils Lake, Lenawee County, based on creel survey surveys in 1987 and the early 1950s (Schneider and Lockwood 1979). Two standard errors are given in parentheses.

Characteristic	Year				
	1987	1950	1951	1952	1953
Angler trips	10,886 (1,741)	24,186	25,552	19,479	21,848
Trips/acre	8.18 (1.31)	18.20	19.20	14.60	16.40
Hours/trip	3.90 (0.90)	2.90	2.60	3.10	2.60
Angler hours	42,428 (7,082)	70,561	67,104	60,962	57,602
Hours/acre	31.90 (5.32)	53.10	50.50	45.80	43.30
Total harvest	19,032 (4,544)	45,985	46,111	106,996	62,626
Fish/trip	1.75 (0.50)	1.90	1.80	5.50	2.90
Harvest/acre	14.31 (3.42)	34.60	34.70	80.10	47.10
Harvest/hour	0.45 (0.13)	0.65	0.69	1.76	1.09

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APPENDIX

Appendix 1.—Angler interview form used in the 1987 creel survey on five southern Michigan waters.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
SITE			MONTH		DAY OF MONTH		YEAR		DAY OF WEEK	BOAT 1 SHORE 2 PIER 3	RESIDENCE		Trips per day	County Fished		Gr. L. #	Anad. #	COMPLETE
19	20	21	22	23	24	25	26	BAIT USED				SPECIES SOUGHT						
LIC ♂		UNLIC ♂		LIC ♀		UNLIC ♀												

31	32	33	34	35	36	37	38	39	40	41														
TIME FISHED			START				FINISH				AM MORNING NOON EVENING PM													

SPECIES	CODE	# OF FISH	SPECIES	CODE	# OF FISH	SPECIES	CODE	# OF FISH	SPECIES	CODE	# OF FISH
Rainbow Tr.	011		Menominee	112		L. M. Bass	212		White Sucker	313	
Brown Tr.	012		Cisco	113		Bluegill	213		Redhorse Sp.	314	
Brook Tr.	013		Smelt	114		Rockbass	214		L. N. Sucker	315	
Lake Trout	014		N. Pike	115		Sunfish Sp.	215		Bullhead Sp.	316	
Solake	015		Musky	116		Crappie Sp.	216		Channel Cat	317	
Coho Salmon	017		T. Musky	117		White Bass	217		Quillback	318	
Chinook S.	018		Y. Perch	119		Drum	219		Gar Sp.	319	
Atlantic S.	019		Walleye	119		Caro	310		Sturgeon	410	
Pink Salmon	110		Sauger	210		Goldfish	311		Burbot	411	
L. Whitefish	111		S. M. Bass	211		Bowfin	312		Buffalo Sp.	414	

Appendix 3.—Estimated harvest per hour, number of fish harvested and fishing pressure, by species, month, and season in 1987, for Devils Lake, Lenawee County. Two standard errors are given in parentheses.

Species	Total harvest per hour	Month						Season
		Apr	May	Jun	Jul	Aug	Sep	
Northern pike	0.0002 (0.0003)	0 (0)	0 (0)	0 (0)	0 (0)	7 (13)	0 (0)	7 (13)
Yellow perch	0.0375 (0.0193)	0 (0)	221 (186)	828 (661)	170 (163)	232 (247)	142 (194)	1,593 (773)
Walleye	0.0016 (0.0026)	0 (0)	5 (10)	0 (0)	63 (108)	0 (0)	0 (0)	68 (108)
Smallmouth bass	0.0087 (0.0058)	0 (0)	56 (52)	92 (92)	184 (212)	29 (35)	9 (19)	370 (240)
Largemouth bass	0.0198 (0.0098)	0 (0)	139 (120)	220 (173)	324 (314)	130 (96)	26 (53)	839 (393)
Bluegill	0.2778 (0.1093)	12 (25)	3,519 (2,521)	1,396 (1,126)	1,595 (1,545)	4,439 (2,579)	824 (983)	11,785 (4,199)
Rock bass	0.0520 (0.0249)	0 (0)	705 (543)	746 (597)	451 (471)	158 (180)	146 (269)	2,206 (989)
Sunfish spp.	0.0442 (0.0266)	0 (0)	360 (423)	856 (913)	371 (312)	118 (90)	170 (242)	1,875 (1,084)
White bass	0.0028 (0.0044)	0 (0)	0 (0)	91 (175)	0 (0)	28 (57)	0 (0)	119 (184)
Bullhead spp.	0.0038 (0.0031)	0 (0)	7 (14)	18 (36)	0 (0)	80 (84)	56 (91)	161 (130)
Longnose gar	0.0002 (0.0005)	0 (0)	0 (0)	9 (21)	0 (0)	0 (0)	0 (0)	9 (21)
Total	0.4486 (0.1307)	12 (25)	5,012 (2,623)	4,256 (1,722)	3,158 (1,699)	5,221 (2,602)	1,373 (1,070)	19,032 (4,544)
Angler hours		775 (498)	8,948 (1,966)	9,506 (4,002)	11,221 (4,814)	9,183 (2,123)	2,795 (1,533)	42,428 (7,082)
Angler trips		213 (134)	2,406 (534)	2,515 (994)	2,820 (1,148)	2,310 (529)	622 (375)	10,886 (1,741)

Appendix 4.—Estimated harvest per hour, number of fish harvested and fishing pressure, by species, month, and season in 1987, for Vineyard Lake, Jackson County. Two standard errors are given in parentheses.

Species	Total harvest per hour	Month						Season
		Apr	May	Jun	Jul	Aug	Sep	
Northern pike	0.0062 (0.0085)	0 (0)	7 (15)	12 (19)	15 (30)	139 (235)	0 (0)	173 (238)
Yellow perch	0.0244 (0.0191)	0 (0)	119 (244)	409 (433)	123 (163)	0 (0)	33 (67)	684 (527)
Smallmouth bass	0.0005 (0.0011)	0 (0)	15 (31)	0 (0)	0 (0)	0 (0)	0 (0)	15 (31)
Largemouth bass	0.0047 (0.0042)	0 (0)	61 (97)	42 (47)	15 (30)	14 (29)	0 (0)	132 (116)
Bluegill	0.1742 (0.1042)	35 (75)	925 (680)	2,461 (2,178)	789 (1,363)	222 (431)	457 (886)	4,889 (2,836)
Rock bass	0.0581 (0.0632)	0 (0)	300 (276)	182 (220)	1 149 (1,722)	0 (0)	0 (0)	1,631 (1,758)
Sunfish spp.	0.0518 (0.0366)	0 (0)	313 (271)	522 (472)	589 (842)	0 (0)	30 (46)	1,454 (1,004)
Black crappie	0.0318 (0.0428)	0 (0)	504 (1,041)	117 (172)	273 (562)	0 (0)	0 (0)	894 (1,195)
Total	0.3517 (0.1426)	35 (74)	2,244 (1,329)	3,745 (2,288)	2,953 (2,424)	375 (492)	520 (890)	9,872 (3,730)
Angler hours		600 (378)	5,435 (1,998)	7,212 (2,109)	8,598 (2,360)	5,036 (1,641)	1,189 (447)	28,070 (4,129)
Angler trips		192 (123)	1,301 (432)	1,723 (520)	2,391 (694)	1,373 (433)	344 (145)	7,324 (1,078)

Appendix 5.—Estimated harvest per hour, number of fish harvested and fishing pressure, by species, month, and season in 1987, for Lake Lansing, Ingham County. Two standard errors are given in parentheses.

Species	Total harvest per hour	Month						Season
		Apr	May	Jun	Jul	Aug	Sep	
Northern pike	0.0098 (0.0115)	0 (0)	48 (81)	18 (40)	22 (45)	0 (0)	0 (0)	88 (101)
Yellow perch	0.0217 (0.0218)	0 (0)	9 (18)	0 (0)	130 (167)	55 (92)	0 (0)	194 (191)
Largemouth bass	0.0311 (0.0169)	0 (0)	98 (74)	81 (77)	63 (57)	37 (69)	0 (0)	279 (140)
Bluegill	0.1072 (0.0757)	82 (187)	356 (488)	157 (200)	263 (277)	102 (174)	0 (0)	960 (648)
Sunfish spp.	0.0141 (0.0135)	0 (0)	61 (91)	26 (57)	39 (49)	0 (0)	0 (0)	126 (118)
Black crappie	0.0287 (0.0283)	0 (0)	105 (185)	79 (133)	68 (99)	5 (12)	0 (0)	257 (248)
Bullhead spp.	0.0002 (0.0004)	0 (0)	2 (4)	0 (0)	0 (0)	0 (0)	0 (0)	2 (4)
Total	0.2127 (0.0947)	82 (186)	679 (541)	361 (261)	585 (349)	199 (208)	0 (0)	1,906 (749)
Angler hours		517 (469)	2,663 (829)	1,734 (947)	2,602 (1,103)	894 (594)	549 (363)	8,959 (1,872)
Angler trips		139 (128)	735 (238)	529 (277)	723 (313)	294 (207)	191 (117)	2,611 (552)

Appendix 6.—Estimated harvest per hour, number of fish harvested and fishing pressure, by species, month, and season in 1987, for Moore's River Park, Ingham County. Two standard errors are given in parentheses.

Species	Total harvest per hour	Month						Season
		Apr	May	Jun	Jul	Aug	Sep	
Rainbow trout	0.0008 (0.0016)	0 (0)	9 (18)	0 (0)	0 (0)	0 (0)	0 (0)	9 (18)
Walleye	0.0062 (0.0066)	10 (24)	59 (68)	0 (0)	0 (0)	0 (0)	0 (0)	69 (72)
Smallmouth bass	0.0084 (0.0084)	0 (0)	10 (21)	14 (21)	20 (42)	50 (75)	0 (0)	94 (91)
Largemouth bass	0.0049 (0.0068)	0 (0)	0 (0)	31 (66)	11 (24)	13 (27)	0 (0)	55 (75)
Bluegill	0.0554 (0.0397)	14 (30)	199 (284)	58 (103)	60 (98)	133 (151)	152 (224)	616 (418)
Rock bass	0.0103 (0.0120)	3 (7)	32 (66)	0 (0)	0 (0)	4 (8)	76 (112)	115 (131)
Sunfish spp.	0.0802 (0.0597)	3 (7)	122 (203)	219 (255)	345 (514)	184 (163)	19 (40)	892 (631)
Common carp	0.0012 (0.0024)	0 (0)	0 (0)	0 (0)	0 (0)	13 (27)	0 (0)	13 (27)
Redhorse spp.	0.0023 (0.0041)	7 (18)	19 (41)	0 (0)	0 (0)	0 (0)	0 (0)	26 (45)
Bullhead spp.	0.0054 (0.0092)	0 (0)	9 (18)	47 (99)	0 (0)	4 (8)	0 (0)	60 (101)
Channel catfish	0.0434 (0.0345)	0 (0)	144 (217)	130 (205)	142 (198)	39 (54)	28 (57)	483 (367)
Total	0.2185 (0.0932)	37 (43)	603 (425)	499 (363)	578 (561)	440 (243)	275 (259)	2,432 (870)
Angler hours		322 (297)	3,893 (1,866)	2,211 (1,020)	1,997 (1,112)	1,865 (832)	840 (365)	11,128 (2,583)
Angler trips		305 (304)	2,629 (1,610)	1,180 (557)	1,033 (579)	966 (479)	465 (218)	6,578 (1,899)

Appendix 7.—Estimated harvest per hour, number of fish harvested and fishing pressure, by species, month, and season in 1987, for Grand River Park, Ingham County. Two standard errors are given in parentheses.

Species	Total harvest per hour	Month						Season
		Apr	May	Jun	Jul	Aug	Sep	
Smallmouth bass	0.0101 (0.0096)	0 (0)	21 (36)	14 (29)	2 (4)	32 (50)	17 (42)	86 (80)
Largemouth bass	0.0173 (0.0230)	0 (0)	72 (148)	0 (0)	5 (8)	0 (0)	71 (125)	148 (194)
Bluegill	0.1143 (0.0888)	0 (0)	33 (38)	0 (0)	30 (46)	549 (483)	364 (547)	976 (732)
Rock bass	0.0151 (0.0160)	0 (0)	29 (44)	0 (0)	90 (125)	10 (21)	0 (0)	129 (134)
Sunfish spp.	0.1623 (0.1071)	0 (0)	140 (173)	212 (258)	256 (329)	758 (742)	19 (46)	1,385 (870)
Black crappie	0.0036 (0.0051)	0 (0)	13 (17)	0 (0)	0 (0)	18 (40)	0 (0)	31 (43)
Common carp	0.0127 (0.0173)	41 (91)	14 (30)	0 (0)	0 (0)	53 (110)	0 (0)	108 (146)
Redhorse spp.	0.0729 (0.1402)	529 (1,185)	16 (35)	11 (24)	0 (0)	66 (95)	0 (0)	622 (1,190)
Bullhead spp.	0.0019 (0.0037)	0 (0)	14 (30)	0 (0)	2 (6)	0 (0)	0 (0)	16 (31)
Total	0.4102 (0.2127)	570 (1,188)	352 (245)	237 (261)	385 (355)	1,486 (900)	471 (565)	3,501 (1,672)
Angler hours		896 (696)	2,265 (956)	1,731 (690)	1,330 (627)	1,640 (642)	672 (529)	8,534 (1,720)
Angler trips		335 (204)	805 (424)	941 (470)	1,201 (673)	970 (458)	330 (296)	4,582 (1,092)