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A COMPARISON OF ANGLER DAY BENEFITS FOR VARIOUS FISH
MANAGEMENT PRACTICES ON MICHIGAN LAKES AND STREAMS

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SUMMARY

The 1970 mail census of fishing effort in Michigan provided data for individual waters which had been subjected to various management practices. This report compares the relative benefits in angler days from four different lake and two stream management practices against the better unmanaged waters of the same type. Total chemical reclamation or partial treatments of warmwater lakes consistently provided the most angler days per acre when compared to other management practices. Similarly, chemical reclamation on trout lakes and trout streams appeared to support more angler days per acre than maintenance stocking.

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A COMPARISON OF ANGLER DAY* BENEFITS FOR VARIOUS FISH MANAGEMENT PRACTICES ON MICHIGAN LAKES AND STREAMS

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INTRODUCTION

Michigan has used chemicals to reconstruct fish populations in its lakes and streams since 1934 (Latta, 1973). A variety of chemicals including rotenone, toxaphene, Bayluscide, cresol, copper sulfate and antimycin have been used in the past; however, only rotenone and antimycin are presently authorized for treatment in Michigan. Since 1960, 23,135 acres of lakes and 840 miles of streams have been chemically treated and restocked with game fish. During the past ten years, this program has progressed to include an average of 2,100 acres of lakes and 60 miles of streams annually.

Michigan has used complete treatments on lakes to provide one of two forms of management. Lakes in Michigan's Upper Peninsula (Region I) and the northern half of the Lower Peninsula (Region II) have been treated and restocked to provide trout-only fishing (Figure 1). Other lakes throughout the state have been completely treated and restocked to provide sport fishing for warmwater game fish.

Michigan has also been engaged in a partial (selective) lake treatment program aimed at thinning fish populations. The objective of this program has been to improve game fish growth and population structure by reducing white sucker populations where they compete with game fish, or by thinning yellow perch and bluegill populations where their growth is stunted. Over 9,500 acres of water have been partially treated in the last ten years.

Michigan also has a chemical treatment program on its streams. A program to treat marginal trout waters was initiated in 1968 to provide increased trout fishing opportunities, particularly in the populated areas of Region III. Eight hundred and forty miles of streams have been chemically treated and restocked with trout. Few streams in Michigan were treated to re-establish warmwater fish populations prior to 1970. However, since 1970, 220 miles of streams and three reservoirs of approximately 1,000 acres each were treated to enhance warmwater stream fishing.

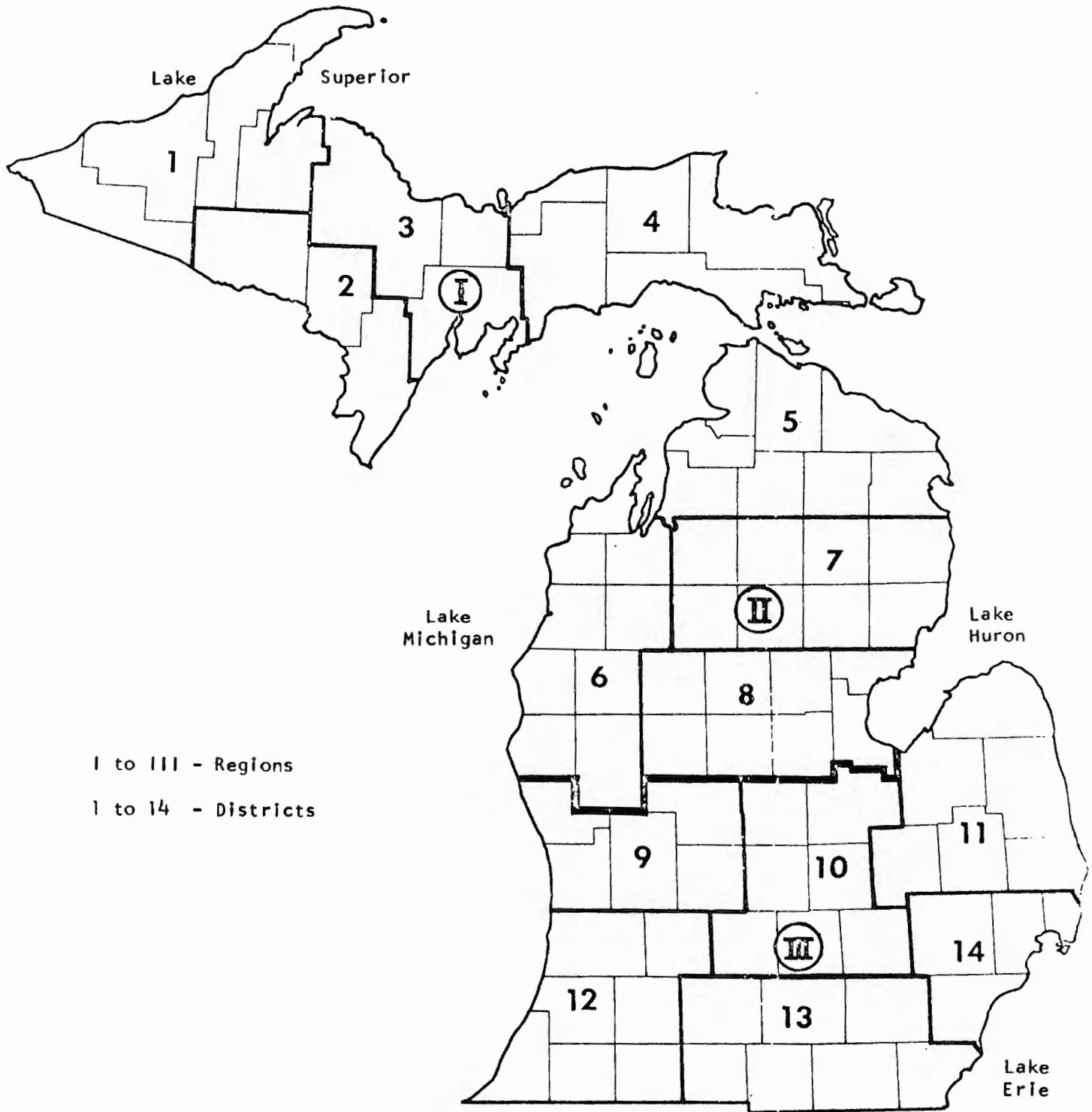
Many papers in the past have dealt with the fish population changes that occur after chemical treatment of lakes and streams. This paper emphasizes changes in angler use that occur after chemical treatments.

METHODS

Michigan had 1.1 million resident and non-resident licensed anglers in 1970, of which twenty thousand were surveyed by mail questionnaire. This survey determined that licensed anglers fished 15.4 million days.

*Angler days as used in this report represent licensed fishermen. Children under seventeen and wives are not required to purchase a license and were not considered in this report.

Figure 1
Fish Management Districts and Regions



I to III - Regions
1 to 14 - Districts

Seventy-two percent of these days (11.1 million days) were spent fishing on inland lakes and streams (Borgeson, 1970, and Jansen, et al., 1970, 1971a, 1971b).

Data was summarized for the best fishing waters in each county in the 1970 sport fishing survey. The most recent management practice, if any, used on these waters was supplied by district fisheries biologists. The following is a comparison between angler day use on chemically reclaimed waters and waters which received either another form of intensive management (maintenance stocking, pike marsh management) or were not intensively managed because they contained acceptable fish populations.

TROUT LAKES

Trout stocking has occurred in Michigan lakes since the 1930's. Trout are now stocked in approximately 225 lakes annually. Management guidelines now restrict plantings. Trout are not stocked to provide put-and-take fishing, but only in water where growth and survival are good. Trout are the dominant fish species in about half of the 225 lakes stocked. These "designated trout-only lakes" are subject to an April through September season. Trout-only lakes range in size from less than one acre to more than 300 acres and are chemically treated periodically when competition from rough fish, small cyprinids or other warmwater species interfere with trout management. Approximately twenty trout-only lakes are treated annually. These relatively sterile lakes have a standing crop of from ten to thirty pounds per acre. Typically before treatment, the dominant species are yellow perch, rock bass, black bullheads, white suckers and various small cyprinids.

Trout-only lakes are stocked annually with 2 to 5 inch brook, rainbow, brown trout or splake fingerlings at a rate of 50 to 150 per acre. Brown trout are stocked only in lakes where fishing pressure is excessive. In lakes, brown trout are less susceptible to harvest than other trout species.

Angling use was obtained on forty-nine trout-only lakes having 2,273 acres which appeared on the 1970 sport fishing survey. All these lakes were completely treated at least once between 1960 and 1970. In 1970, these lakes provided 57,870 angler days or an average of 25.5 angler days per acre. All of these lakes are located in Regions I and II (Figure 1). Compared to the angler days generated on trout-only lakes which were completely treated, fishing pressure was less on ninety-four lakes in the same Regions that were stocked with trout species without chemical treatment. These untreated trout lakes, having 59,740 acres of water, provided 240,950 angler days for an average use of 4.0 angler days per acre for all species in 1970. This was 21.5 (86%) fewer angler days per acre than for the treated lakes (Table 1).

The untreated lakes stocked with trout are generally two-story lakes, containing both warmwater fish populations and trout. These mesotrophic lakes are usually more than fifty acres in size and of a character such that the warmwater species do not severely compete with the trout. Rainbow, brown, lake trout and splake are stocked in two-story lakes at

TABLE 1. A summary of angler use on trout lakes based on the 1970 Michigan sport fishing survey results

	Number of Lakes	Acreage	Total Angler Days	Angler Days Per Acre
Region I				
Total Treatments	35	1,621	33,130	20.4
Maintenance Stocking	45	2,811	35,540	12.6
Region II				
Total Treatments	14	652	24,740	37.9
Maintenance Stocking	49	56,929	205,410	3.6
Region III				
Total Treatments	12	511	48,110	94.2
Maintenance Stocking	44	8,229	332,300	40.4
Statewide Totals				
Total Treatments	61	2,784	105,980	38.1
Maintenance Stocking	138	67,969	573,250	8.4

5 to 7 inches and are open to year-round fishing with a 10 inch size limit. Two-story lakes, with standing crops of 30 to 70 pounds per acre, are generally more productive than trout-only lakes. Yellow perch, bluegills, suckers, walleye, whitefish, smelt, smallmouth bass and small cyprinids are the most common species. A few of these lakes are also completely treated and stocked with both trout and warmwater species.

From our 1970 Michigan sport fishing survey, we learned that forty-four two-story lakes containing 8,299 acres of water in Region III which were routinely stocked provided an average of 40.4 angler days per acre. However, twelve lakes which were treated between 1960 and 1970 and then stocked with trout provided 94.2 angler days per acre in 1970 (Table 1). It should be pointed out that these lakes in Region III are in close proximity to the population centers of the state.

WARMWATER LAKES

The vast majority of Michigan's lakes are classified as warmwater. There are approximately 400,000 acres of manageable water in this category. Several alternatives for management of warmwater lakes are available to the district fisheries biologist, including: (1) complete chemical reclamations; (2) partial chemical reclamations; (3) predator stocking; and (4) northern pike or walleye spawning or rearing marsh management.

Michigan completely treats an average of 1,250 acres of warmwater lakes annually. Most of these lakes are located in Regions II and III. Rotenone is used on most complete reclamations in Michigan, mainly because of hard water and the presence of bullheads which are not susceptible to antimycin in low concentrations. Lakes are considered for complete reclamations when they have large undesirable populations of white suckers, carp, bullheads, bluegills or perch. The standing crop of fish in these lakes ranges from 50 to 400 plus pounds per acre before treatment. In two reservoirs in southern Michigan treated in 1973, 1,000 pounds per acre and 975 pounds per acre of fish (primarily carp) were physically removed and buried following treatment.

Partial (selective) chemical treatments are conducted on approximately 2,000 acres of water in Michigan annually. Partial treatments are used to thin stunted panfish populations or to kill competitors such as white suckers at spawning time. Selective treatments to remove carp are now being evaluated.

Rotenone has been successfully used for partial treatments on many lakes; however, rotenone is non-selective and usually kills large numbers of desirable predator fish as well as the target species.

Antimycin has been used for partial treatments since 1969. We have found it highly selective to size and species. With practice it appears that the biologist can thin populations of panfish and suckers, while having little affect on desirable predator fish. The antimycin is either applied to the total shoreline or over the total lake surface area. From 10 to 150 pounds per acre of stunted panfish or competitive suckers have been removed with antimycin in recent partial treatments. (Table 2)

TABLE 2. A summary of angler use on warmwater lakes based on the 1970 Michigan sport fishing survey results

	Number of Lakes	Acreage	Total Angler Days	Angler Days Per Acre
Region I				
Not managed	93	72,724	192,870	2.7
Total treatments	2	98	700	7.1
Partial treatments	2	201	140	.7
Maintenance stocking	27	36,450	81,290	2.2
Northern pike/walleye marsh	4	17,378	74,500	4.3
Region II				
Not managed	148	104,007	1,031,950	9.9
Total treatments	10	2,519	33,160	13.2
Partial treatments	2	63	1,960	31.1
Maintenance stocking	31	65,644	390,250	5.9
Northern pike/walleye marsh	15	24,957	287,010	11.5
Region III				
Not managed	168	46,110	1,801,740	39.1
Total treatments	16	2,402	156,110	65.0
Partial treatments	5	899	35,630	39.6
Maintenance stocking	15	9,645	295,790	30.7
Northern pike/walleye marsh	6	4,310	164,550	38.2
Statewide totals				
Not managed	407	222,841	3,026,560	13.6
Total treatments	28	5,019	189,970	37.9
Partial treatments	9	1,163	37,730	32.4
Maintenance stocking	73	111,739	767,330	6.9
Northern pike/walleye marsh	25	46,645	526,060	11.3

TROUT STREAMS

Michigan has approximately 8,000 miles of trout streams with completely self-sustaining populations. An additional 1,000 miles of streams receive annual stockings of brook, brown or rainbow trout to supplement existing natural reproduction. These are typically sizeable mainstream trout waters.

Michigan also has approximately 4,000 miles of water we refer to as "marginal trout waters." These streams may naturally contain some trout, but the major portion of the standing crop of fish is comprised of small cyprinids and suckers. The standing crop of fish in these streams ranges from 15 to 150 pounds per acre. Summer temperatures in these waters may approach 80°. Michigan has initiated a chemical treatment program on marginal streams near population centers for the purpose of increasing the stream trout angling opportunities.

A total of 840 miles of marginal trout waters have been chemically treated in Michigan since 1963. According to our present policy, these streams are treated on a three- or four-year cycle depending upon the degree of reinfestation. Shortly after treatment, these streams are stocked with approximately 200 brown or rainbow trout fingerlings per acre. This planting is followed the second year with a stocking of about 100 yearling trout per acre (the exact number varies with the productivity of the stream). The stocking of yearlings continues until one year prior to retreatment.

The results of this relatively new program in Michigan have been satisfying. The 1970 sport fishing survey results showed chemically treated marginal trout streams in Region III generated 59.1 angler days per acre in 1970 (Table 3). This compares with an average of 53.6 angler days per acre on self-sustaining trout streams and 50.2 angler days per acre on maintenance stocked untreated streams. The marginal trout streams received very little angler use prior to chemical treatment.

WARMWATER STREAMS

There are approximately 20,239 miles of warmwater streams in Michigan located mainly in Region II and Region III. These streams typically contain a large assortment of fish species, including: northern pike, large and smallmouth bass, black crappies, rock bass, carp, suckers, catfish and small cyprinids. The standing crop in these streams is high, ranging from 150 to 250 pounds per acre.

Only one warmwater stream was chemically treated between 1960 and 1970. This stream provided 55.7 angler days per acre in 1970 (Table 4). This compares with 29.2 angler days per acre on non-managed warmwater streams and 76.2 angler days per acre on three streams receiving predator stocking.

From 1970 to 1973, 225 miles of warmwater streams were chemically treated and restocked. We expect that the angler use on these streams should approach or exceed the angling pressure observed on marginal trout streams (59.1 angler days).

TABLE 3. A summary of angler use on trout streams based on the 1970 Michigan sport fishing survey results

	Number Of Streams	Acreage	Total Angler Days	Angler Days Per Acres
Region I				
Not managed	56	2,325	49,710	21.4
Total treatments	-	-	-	-
Maintenance stocking	54	4,747	136,080	28.7
Region II				
Not managed	143	2,860	226,160	79.1
Total treatments	-	-	-	-
Maintenance stocking	32	2,710	255,290	94.2
Region III				
Not managed	35	625	35,380	56.6
Total treatments	7	332	19,620	59.1
Maintenance stocking	34	1,157	41,140	35.6
Statewide totals				
Not managed	234	5,810	311,250	53.6
Total treatments	7	332	19,620	59.1
Maintenance stocking	120	8,614	432,510	50.2

TABLE 4. A summary of angler use on warmwater streams based on the 1970 Michigan sport fishing survey results

	Number Of Streams	Acreage	Total Angler Days	Angler Days Per Acre
Region I				
Not managed	25	2,523	50,940	20.2
Total treatments	-	-	-	-
Maintenance stocking	1	103	6,320	61.4
Region II				
Not managed	39	2,468	54,630	22.1
Total treatments	-	-	-	-
Maintenance stocking	2	48	5,180	107.9
Region III				
Not managed	80	13,377	430,790	32.2
Total treatments	1	224	12,470	55.7
Maintenance stocking	-	-	-	-
Statewide totals				
Not managed	144	18,368	536,360	29.2
Total treatments	1	224	12,470	55.7
Maintenance stocking	3	151	11,500	76.2

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