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MICHIGAN DEPARTMENT OF CONSERVATION
Research and Development Report No. 16*

October 8, 1964

BIENNIAL REPORT OF THE INSTITUTE FOR FISHERIES RESEARCH, 1963-1964[1]

Compiled by Clarence M. Taube

* Institute for Fisheries Research Report No. 1697

[1] Contribution from Dingell-Johnson Project F-27-R, Michigan

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The Institute for Fisheries Research is responsible for studies on fish and of methods for improving the fisheries. The facilities of this unit consist of the main office and laboratory at Ann Arbor and six field stations. Some of the work is conducted cooperatively with the State's universities. A major portion of the research done during these two years was largely financed with federal funds provided by the Dingell-Johnson Act.

Lake Mapping and Lake and Stream Inventories

The research unit's concern with these activities has declined as participation in them by fish management units has increased. During the last biennium, the Institute routinely inventoried three lakes, mapped six others, and drafted and arranged for the printing of 75 lake maps drawn by other Department personnel.

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Surveys were made in 1963 of five southern streams that are affected by pollution; this work was financed by a grant provided by the Water Resources Commission. Other inventories concerned with pollution problems were conducted on the Montreal (Gogebic County) and Brule-Iron (Iron County) river systems. Work was done on two rivers in 1964 to develop methods for determining the size of fish populations in streams. Also in 1964, the Detroit River was netted near Stony Island to appraise the importance of fish and fishing in an area for which a soil fill had been proposed.

Fish Mortality and Disease

The pathologist performed a number of routine jobs such as autopsy of fish, investigation of mortalities in lakes and streams, diagnosed diseases among hatchery fish and prescribed treatments. Brief comments on several of his research problems follow.

Further study of the "red worm," a nematode (Philometra cylindracea) that occurs in Great Lakes yellow perch, has indicated that abundance of the parasite is associated with large centers of human population. This circumstance may be due to human wastes whose nutrients cause the intermediate host (Cyclops ?) to prosper.

Additional experiments with cataract in lake trout indicate that vitamins added to the diet do not prevent affliction among fish exposed to direct sunlight.

Tests have been in progress to assess the value of certain chemicals for control of diseases at hatcheries. Various diets are compared to determine the one most valuable for hatchery trout.

The "yellow grub" (Clinostomum marginatum) has been found to stay alive at least a year in the flesh of fish. Experiments on this organism are continuing.

The biology of the gill louse (Salmincola edwardsii) and influence of the parasite on survival of infested brook trout are being investigated in lakes near the Pigeon River Station. New information has been obtained on its biology under winter conditions.

Sea Lamprey Investigations

Research on the sea lamprey, particularly the immature forms (larvae or ammocoetes), is conducted at the Marquette Station.

An estimate of the size of the ammocoete population in McKay Bay of Lake Huron, following an intensive survey, tentatively placed the number at 13,000.

From a study made in hatchery ponds, it was found that sea lamprey larvae grow while metamorphosing and that various changes in color and structures occur during transformation.

A method of marking ammocoetes by subcutaneous injection of dyes (cadmium sulfide and mercuric sulfide) was developed as an aid in studies on the duration of the larval stage, population features, and

migration. Among injected lampreys recovered as larvae, the dye marks have remained externally discernible at least four years.

A creel census has been conducted on Keweenaw Bay since February 1964 to determine the origin of captured lake trout (whether wild or hatchery fish), the numbers caught, and the extent of scarring caused by lampreys. From observations made between February 11 and April 24, 1964, it was calculated that 535 lake trout (mostly from 1960 and 1961 plantings) were caught by sport fishermen.

A study to evaluate the biological effects from treating streams with lampricides commenced in 1964 on the Chocolay River. The initial work included a fish population survey of the stream prior to treatment. Effects on fish-food organisms as well as fish will be considered.

Rainbow Trout Studies

Rainbow trout of the Black River, Mackinac County, which migrate to and from Lake Michigan, have been studied a long time. A report now under preparation relates to age and growth of the parr; the information likely will be applicable to rainbow trout parr of other Michigan populations.

An experiment of planting marked rainbow trout of three categories (Michigan wild, Michigan hatchery, and West Coast steelhead) during 1955-1959, either in the Great Lakes or near the mouths of tributary streams, gave these results: (1) about 3 percent of the trout were recovered by anglers, half of them shortly after stocking, and the rest one to two years

later as fish that exceeded two pounds; (2) the highest return came from plantings made in May; (3) differences in the rate of capture among the three categories of fish were insignificant; (4) recovery as related to planting sites was highly variable (zero to 6.2 percent); (5) plantings made in the lakes provided a higher rate of return than those made in streams; (6) the growth of the fish was rapid, and similar to that of wild rainbow trout in the Great Lakes.

A long-term study was begun in 1958 on three lakes (Bass, Dickinson County; Stager, Iron County; Sporley, Marquette County) to determine factors responsible for success or failure of rainbow trout introductions in lakes. The work during the last biennium consisted mostly of identifying and measuring food organisms and preparing reports on the outcome. One point of interest is that the trout and yellow perch (the main warm-water species) in Stager Lake consumed the same kinds of food and in similar proportions.

Walleye Investigations

Although the investigation of the walleye fishery in the Bay de Noc area of Lake Michigan is still in progress, no appreciable amount of tagging was done since the spring of 1962. Results to date indicate: (1) the sport fishery accounts for the major share of the harvest; (2) that anglers and commercial fishermen are exploiting the same walleye populations; (3) that the entire walleye population of this area is composed of numerous sub-populations.

Lakes in which results of stocking fingerling walleyes are to be evaluated have been reduced to two--Bear (Manistee County) and Fife (Grand Traverse County). Population estimates, creel census, scale samples, and planting in alternate years will provide information on survival, growth, harvest, natural reproduction, and the contribution of planted fish to the catch. A population survey made on Fife Lake in June 1964 indicated the presence of about 2, 500 walleyes over 14 inches long.

Hunt Creek Trout Research Station

This Station recently has been particularly concerned with the causes of trout mortality and the effects of special regulations on angling and trout populations. All of the research projects yield information that bears on these two principal objectives. Current investigations include creel censuses, periodical population surveys on the experimental streams, studies on trout movements, survival, and exploitation through tagging done during population surveys, food habits and predator studies.

The main features of the anglers' catches from the waters of the Hunt Creek area are shown in the following table.

Water	Season	Fishing trips	Hours fished	Trout caught				Total pounds	Trout per hour
				Wild brook	Hatchery brook	Rain-bow	Brown		
Hunt Creek°	1962	702	1,344	1,049	4	16	2	185	0.80
(Sections Z,A,B,C,D)	1963	712	1,423	614	...	6	1	104	0.44
Fuller Creek°	1962	152	299	161	...	1	...	25	0.54
	1963	216	501	106	...	...	...	16	0.21
Fuller Creek Pond*	1962	59	150	...	69	...	...	32	0.46
	1963	158	540	8	57	82	...	110	0.27
East Fish Lake*	1962	500	1,861	20	148	298	...	348	0.25
	1963	525	2,074	3	173	252	...	359	0.21
Middle Fish Lake°	1962	...	...	...	...	...	...	...	...
	1963	55	131	...	24	34	37	30	0.72
West Fish Lake°	1962	...	...	...	...	...	...	...	...
	1963	154	459	...	57	89	71	59	0.47

° General trout fishing regulations.

* Ten-inch minimum size, 5 trout daily.

Yields from Hunt and Fuller creeks were well within the ranges of the past two decades. On East Fish Lake, where 300 legal-size rainbow trout and 300 brook trout are stocked annually in the fall, rainbow trout compose the major portion of the catch, mainly because of their better over-winter survival. Experience with Middle and West Fish lakes offers evidence that many of our small lakes, heretofore considered unsuited for trout, can provide some trout fishing when planted during the cool seasons and exploited before midsummer.

An evaluation was completed of results from special fishing regulations on experimental sections of the North Branch of the Au Sable River. This experiment included reversal of the special rules (9-inch minimum size, 5 fish daily, and flies only) and the general rules (7-inch size, 10 fish, any lure) on two of the sections after three years; the special rules applied to the third section throughout the course of the study.

The outcomes were these: angling pressure was reduced about 50 percent by special regulations; the catch of trout at least 12 inches long was no greater than that on comparable waters under general regulations, and the total catch decreased sharply; the average sizes of trout larger than 9 inches were similar; fall populations increased significantly in special waters, but declined greatly before the following fishing season; the catch per hour of trout larger than 9 inches was better with special regulations mainly because the angling pressure was only one-half as great as under general rules. The greatest amount of

recreation, as measured by angling pressure, was provided by the general regulations.

Specific data on this investigation appear below.

Stream section	Period	Regulation	Average yearly angling pressure and numbers of trout caught per mile			
			Hours per mile	7.0"-8.9"	9.0" and larger	Total legal catch
Dam 2 to County Line (4.2 miles)	1958-1960	General	1,007	419	123	542
	1961-1963	Special	541	339	116	116
County Line to Eaman's (6.9 miles)	1958-1960	Special	1,939	1,056	277	277
	1961-1963	General	3,427	1,121	421	1,542
Eaman's to Kellogg Bridge (8.7 miles)	1958-1960	Special	1,052	515	141	141
	1961-1963	Special	1,145	582	131	131

Station personnel spent much time at collecting and observing predators--mergansers, blue herons, kingfishers, otters, and large brown trout. Many stomachs of brown trout (12-24 inches) were examined for food content. Detailed study of the digestion rate of large brown trout was begun in 1964.

Pigeon River Trout Research Station

Research is conducted from this facility on six miles of the Pigeon River in Otsego County and on seven small lakes. A complete creel census is obtained on these waters which, besides providing a continuous inventory of the fishing results, helps evaluate various management experiments. The trout population in this part of the Pigeon River consists almost entirely of brook and brown trout; only brook trout occur in the lakes. A summary of angling statistics for the experimental portion of the river follows.

Season	Fishing trips	Hours fished	Trout caught	Pounds	Trout per hour
1962	1,776	4,692	954	294	0.20
1963	1,890	5,094	807	210	0.13

These studies have been in progress on the stream: (1) Annual population surveys in the spring and fall. (2) Calculation of growth and mortality rates. (3) Evaluation of special angling regulations.

(4) Determination of causes of natural mortality among trout. (5) Evaluation of stream improvement practices upon the catch and standing crop of trout.

The following investigations apply to the lakes: (1) Annual spring-fall population surveys. (2) Calculation of growth and mortality rates of brook trout in Ford and Hemlock lakes. (3) Evaluation of restriction of lures to flies in Ford Lake. (4) Determination of causes of natural mortality among trout. (5) Evaluation of stocking procedures (various numbers and sizes of brook trout and time of planting). (6) Study of the gill louse of brook trout under natural conditions.

Descriptions and results of these projects appear in the Station's annual reports.

The table below summarizes angling results on the lakes (Ford, Section 4, Hemlock, Lost, West Lost, North Twin, South Twin).

Season	Fishing trips	Hours fished	Trout caught	Pounds	Trout per hour
1962	1,561	4,271	1,259	368	0.26
1963	1,553	4,195	1,027	327	0.21

Rifle River Fisheries Research Station

The administration of the 4,318-acre tract in Ogemaw County on which this Station is situated was transferred from the Fish Section to the Parks Section on June 14, 1963. The tract is now called the Rifle River Recreation Area. Research is carried on here as it was before the transfer. Over 30,000 people visited the Area in 1962, and nearly 35,000 in 1963, a record number; each year, between 60 and 65 percent of the visitors were sightseers.

Name changes for some of the lakes and streams within the Area were approved by the U. S. Board of Geographic Names late in 1962. Old and new names are listed below.

Devils Wash Basin	Devils Washbasin
North Lake	Grousehaven Lake
Spring Lake	Grebe Lake
Dollar Lake	Jewett Lake
Loon Lake	Lodge Lake
Teal Lake	Scaup Lake
Fontinalis Creek	Vaughn Creek
Brown Trout Creek	Oyster Creek

Records on fishing on waters within the Area were obtained by a complete creel census for the eighteenth and nineteenth consecutive years. Angling pressure on the lakeswas appreciably greater in 1962 and 1963 than it had been the preceding two years, but the total catches were little different, and the rate of success was somewhat lower. In 1962, yellow perch comprised 34 percent of the total catch, bluegills 28 percent, and hatchery rainbow trout 17 percent, while none of the 13 kinds of fish contributed as much as 5 percent. The percentages in 1963 were 61 for perch, 12 for bluegills, and not over 5 for each of the 13 other species. The table below summarizes the lake fishing. The lakes concerned are Devoe, Grousehaven, Jewett, Lodge, Grebe, Scaup, and South Pond. However, no records were obtained on Jewett Lake in 1963 because it had been treated chemically the year before, and only little fishing was done in 1963 on South Pond for the same reason.

Season	Fishing trips	Hours fished	Fish caught		Fish per hour
			Number	Pounds	
1962	2,759	8,324	2,388	899	0.33
1963	3,223	9,226	2,670	944	0.29

The total fishing pressure and catch in 1962 on the six trout streams were intermediate between what they had been in 1960 and 1961, and lower in 1963. The catch of native trout per hour per angler was 0.06 in 1962 and

0.08 in 1963, compared to 0.13 (1960) and 0.09 (1961). The following table summarizes data on the streams (Rifle River, Gamble Creek Diversion, and Gamble, Houghton, Vaughn, and Oyster creeks).

Season	Fishing trips	Hours fished	Trout caught			Other fish caught	Pounds, trout	Pounds, other
			Brook	Brown	Rainbow			
1962	3,181	7,939	30	866	397	323	841	340
1963	2,815	6,584	19	770	18	61	467	67

The principal research projects carried on at this Station during the past two years are as follows: (1) Trout stream population surveys (continued annual surveys). (2) Growth rate and mortality investigations. (3) Estimation of fish populations in lakes and evaluation of estimate methods. (4) Evaluation of watershed and stream improvement practices (completed). (5) Experiments on lakes subject to extreme oxygen depletion. (6) Evaluation of population manipulation on angling success and fish growth. (7) Determination of indices of basic productivity for lakes. (8) Development and management of bluegill populations. (9) Development of more efficient electronic fishing gear.

Details on this work and other activities appear in the annual formal reports of the Station's activities.

Marquette Fisheries Research Station

The biologists at this unit are mainly concerned with studies on the sea lamprey and rainbow trout, which are outlined in preceding sections of the report.

An investigation to assess the effects of later opening and closing of the brook trout season was resumed in 1964 on Airport, Moccasin, and Swanzy lakes, Marquette County. The special season extends from May 15 to October 15; under the general law, trout fishing commences on the last Saturday in April and ends the second Sunday in September. The results will be weighed by a creel census. A similar study was conducted on these lakes in 1959-1961, and a report on the outcome was completed recently. Another test is being made because the earlier one did not provide conclusive results.

Hastings Fisheries Research Station

Research on the management of warm-water fish is the chief concern of this facility. During the biennium, major emphasis was placed on the projects which are numbered and briefly described below.

(1) Analysis of bluegill growth rates before and after lakes were subjected to various levels of rotenone treatment between 1956 and 1958 was completed. Correlations between the degree of kill and the duration of improved growth are shown in the following table.

Percent of kill	Number of lakes	Average percent of growth improvement first year after treatment	Average duration of growth improvement in years
<20	1	4	0.0
20- 40	4	20	1.2
40- 80	4	92	2.2
80-100	7	168	3.4

In two lakes that were treated at a 95-percent level and where the number of northern pike increased greatly, growth improvement among bluegills lasted five years.

(2) A cooperative voluntary census in the summer of 1963 and a stratified random census in the winter of 1964 were conducted at Lake St. Clair to gain information on the harvest of muskellunge. A summary follows on the data from the American and Canadian waters combined. (No spearing is permitted on the Canadian side of the lake.)

	Estimated catch of muskellunge	Average number of hours per catch	Average length of muskellunge
Summer, 1963 (hook and line)	6,600	22.0	35.2
Winter, 1964 (spear)	2,200	59.8	37.2

(3) An experiment on control of bluegills by regulating reproduction was concluded. Copper sulfate crystals were applied semi-weekly to nests in four Barry County lakes in 1962. Four similar lakes served as controls, and all of them were seined at 12 locations in the falls of 1960 and 1961 (before treatment) and 1962 (after treatment). Comparisons showed that the applications resulted in no significant decrease in abundance of young-of-year bluegills.

(4) A study of the feeding habits of northern pike continued in the laboratory and was extended to two small lakes to compare the growth of pike on diets of bluegills and golden shiners.

(5) Populations consisting only of bluegills were established in three large ponds at Belmont, Kent County, to observe the effects from high rates of artificial harvest on growth and productivity.

(6) Pike-marsh research was completed in 1963 at Townline Lake, Montcalm County, and in 1964 at Otsego Lake, Otsego County.

Other projects included: stocking of muskellunge on the bases of introduction and maintenance; analysis of growth rates and food habits of pike at Fletcher Floodwater; and development of breeding stock from an extremely robust type of bluegill.

General Creel Census

The general creel census, which has been continuous since 1927, provides a state-wide sample of the sport fishing. Conservation officers

secure catch records from most of the principal waters. During 1962, they interviewed 69, 385 anglers who had fished 145, 987 hours and had caught 164, 351 legal-size fish. In 1963, the totals were 63, 047 fishermen, 133, 889 hours, and 141, 943 fish. The average catch per hour was 1.1 fish both years.

The brook trout dominated in the catch from trout waters. Of 9, 460 trout reported in 1962, 62 percent were brook trout, 26 percent were rainbow trout, and 13 percent were brown trout. The percentages for the respective species were 58, 28, and 14 in 1963 when 8, 780 trout were observed. The rate of catch in both years was 0. 5 trout per hour.

Bluegills were caught most frequently in inland non-trout waters; this species constituted 35 percent of the total catch in 1962, and 39 percent in 1963. Yellow perch and bluegills combined comprised 66 and 62 percent of the harvest in the respective years. The catch per hour in non-trout waters was 1.1 fish both years.

In the Great Lakes and connecting waters, yellow perch comprised 78 percent of the catch in 1962, and 91 percent in 1963. The catch per hour for all species was 1.7 fish in 1962, and 1.6 in 1963.

Creel Census on Experimental Lakes

Creel censuses for testing the value of long-established and new regulations on fishing were begun on a number of warm-water lakes in 1946, and included other lakes in succeeding years. All but a few of the

inventories have been discontinued, and those which are still active mainly serve other purposes. A comprehensive report is being prepared on the early work.

Censuses help test experimental management practices for northern pike on Otsego Lake and Fletcher Floodwater. The censuses on Bear Lake (Manistee County) and Fife Lake (Grand Traverse County) presently are utilized in studies on the walleye.

Age and Growth of Fish

A revision of growth rate averages for most of the game fish and of some other species in Michigan has been completed. Determinations were made on average lengths attained monthly by age groups of the bluegill, yellow perch, and largemouth bass, as well as on correlations between growth rates of these species and the mean depths, areas, alkalinities, and turbidity of lakes. No significant relationships were found between these environmental factors and growth rates.

Limnological Studies

Studies on productivity at the Winnewana impoundment have been curtailed by winterkill of fish in 1963 and low water levels. An experiment of recharging oxygen-depleted water by circulating it with outboard motors was conducted here and on a neighboring lake; the method showed some promise of being useful to forestall winterkills.

Research on the bottom fauna of Sugarloaf Lake continues. A current job involves comparison of benthic production within and outside a fish exclosure.

Measurements and identification of benthic organisms collected from Saginaw Bay have been completed. This work is part of an investigation to assess the abundance of fish-food organisms here, and to determine if water pollution, benthic productivity, and reduced harvest of fish in the bay are related.

Water samples from a number of lakes were subjected to chromatography to gain information on natural organic substances. Amines were found that affected the growth of algae in the laboratory, and these amines may be related to the productivity of lakes.

Other limnological investigations are described under "Rainbow Trout Studies" and "Cooperative Projects."

Special Studies on Warm-water Fish

Investigations on population ecology began in 1964 on two lakes in Washtenaw County. On Mill Lake, which contains various kinds of fish, basic information will be gathered on such subjects as population size, egg production, growth, and survival rates. Population manipulation will be attempted after some understanding of the population has been achieved. Cassidy Lake will harbor but one species of fish, and information similar to that from Mill Lake is to be sought here for comparison with data on the multiple-species population. Population estimates by various methods

were made for Cassidy Lake before and after its treatment with rotenone in the summer of 1964. The lake is to be restocked with yellow perch.

Fish Toxicants

Research was continued on the use of toxaphene or chlorinated camphene as a fish management tool. Late in the summer of 1962, this chemical was used to eradicate the fish in two lakes in Grand Traverse County, and low concentrations were applied to four southern lakes in the fall of 1963 to reduce numbers of small fish. Samples of water and mud were analyzed to learn how long treated lakes remain toxic.

Aquatic Plant Control

Observations were made on an application of "Aqualin" to White Lake, Muskegon County, by a licensed operator. Of seven new aquatic herbicides tested in 1963, three were effective on the vegetation that was treated.

Cooperative Projects

Michigan State University

Limnological investigations of productivity in the West Branch of the Sturgeon River, Cheboygan County, were continued under the co-sponsorship of the University, the Institute, and the Atomic Energy Commission. Included in this work were studies of earlier treatments

with fertilizer that were traced with radioactive isotopes. Effects of the treatments on the growth and survival of trout were considered. A report on upstream movement of benthic organisms was published.

The Institute gave financial aid to two graduate students during 1963-1964. Two projects were carried on at the University's Lake City Experiment Station. One, which commenced in 1964, deals with the influence of pesticides on aquatic organisms; toxicants carried in run-off from agricultural plots were traced into a series of ponds, through the food chain, and into the fish population. The other study, which began in 1963 and continued into 1964, involved the effects of aquatic herbicides (sodium arsenite and copper sulfate) on fish, fish-food organisms, vegetation, and pond metabolism.

The University of Michigan

Three graduate students received financial aid through the Institute in 1963-1964.

One study concerned evaluation of fish population estimate procedures. Largemouth bass in two small ponds were sampled with hook and line, seines, and electric shocker, and estimates were made by separate and combined use of the collecting methods. Estimates were obtained by statistical procedures, the results were evaluated, and methods were recommended for future work.

Another project involved bottom fauna of Sugarloaf Lake, Washtenaw County. A master's thesis was written on the outcome of a second (1958)

synoptic survey of the lake, and the results were compared with those of an earlier (1955) survey. The standing crop of benthos in 1958 amounted to about 184 pounds per acre, and about 223 pounds in 1955.

A doctoral study was completed on the crayfish, Orconectes virilis, in West Lost Lake, Otsego County. Population dynamics were investigated in particular. The standing crops of crayfish and of other invertebrates were estimated to be about 82 pounds and 6 pounds, respectively. When brook trout reached the length of 9 inches, they began to feed on crayfish. They ate many of them in late summer and midwinter.

INSTITUTE FOR FISHERIES RESEARCH

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