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BIENNIAL REPORT OF THE INSTITUTE FOR FISHERIES RESEARCH, 1961-1962

The research section of the Fish Division has its main office at Ann Arbor, in quarters provided by The University of Michigan. It maintains six field stations, and has cooperative arrangements with The University of Michigan, Michigan State University, and the U. S. Fish and Wildlife Service.

A number of research projects were largely financed with federal funds provided by the Dingell-Johnson Act. Beginning in July 1962, Federal Aid funds supported a considerably larger portion of the Institute's activities.

Lake Mapping and Inventories

These activities were sharply curtailed during the last two years because of reduced budgets. One crew, largely composed of personnel from a work camp of the Department of Corrections, mapped six lakes in the winter of 1960-61. This section did no mapping in 1961-62. The Lake and Stream Improvement Section mapped 31 lakes in 1960-61 and 29 in 1961-62. The Institute drafted these maps and arranged to have them printed.

Very little field work was done on routine biological inventory of lakes.

Stream Inventories

Limited budgets also restricted this work during the biennium. One crew inventoried streams intermittently. In 1961, a fish population study was conducted on Canada Creek, Montmorency County, and a survey was made of Stony Creek, Macomb and Oakland counties. The latter investigation preceded the installation of dams on Stony Creek by the Huron-Clinton Metropolitan Authority. Two lakes will be formed by the dams. Various streams in the southern part of the State were sampled to find suitable sites for detailed studies on pollution. This activity commenced in 1961 and was intensified in 1962.

Fish Mortality and Disease

Investigations and research on diseases and parasites of fish and problems involving propagation of fish were conducted by the pathologist in the laboratory at the Grayling Hatchery and at hatcheries throughout the State as conditions demanded. Mortalities in lakes and streams were also investigated.

A study of the "red worm" (nematode: Philometra cylindracea) in yellow perch in Lake Huron has continued. Infestation is not expanding rapidly from the areas where it is already established, but is increasing within these areas.

Treatment of kidney disease among brook trout in hatcheries has been unsuccessful to date. An experiment conducted at the Watersmeet Hatchery to determine the effectiveness of erythromycin reduced mortality temporarily, but the disease was not eradicated, and losses of trout increased nearly to pre-treatment level within six weeks after treatment.

Experiments to determine the cause of cataract in hatchery-reared lake trout have demonstrated that exposure of fish from 1 1/2 to 2 1/2 years old to direct sunlight results in a high incidence of cataract. Protection from direct sunlight after the trout reach 3 years of age does not prevent increase of cataract among fish exposed previously. Experiments are in progress to determine the cause of occurrence of some cataract among lake trout held in nearly complete darkness. Several of these studies are being conducted in cooperation with the U. S. Bureau of Fisheries and Wildlife. Lake trout taken in test netting of Lake Superior will be examined to compare incidence of cataract among wild and hatchery-reared fish.

A disease of hatchery trout, infectious pancreatic necrosis, has recently invaded Michigan, presumably from the Atlantic states where it has been known in past years. It is caused by a virus for which no control methods are known, and inflicts large losses among young brook and rainbow trout up to two inches long. The disease is being studied to discover methods of control.

In cooperation with the U. S. Bureau of Sport Fisheries and Wildlife, trout in Michigan hatcheries are being observed for possible appearance of whirling disease, a disorder which may afflict brook and rainbow trout fry. The disease originated in central Europe, has spread to various European countries, and recently to Italy and the United States. A case was recently investigated in Connecticut wherein nearly 100 percent of 4,000 rainbow trout in one pond were infected. No proven chemotherapy is presently available, so if the disease should reach Michigan, early recognition of it is necessary to prevent its spread throughout the State.

Sea Lamprey Investigations

Studies on the size and distribution of larval populations of the sea lamprey included: (1) a population estimate in East Bay, Alger County; (2) a population study in McKay Bay and McKay Creek (the presumed source of the bay population), Mackinac County; and (3) a survey of the distribution of larvae in various lentic environments in the Upper Peninsula. The population in East Bay was estimated as 96,000. The results of this investigation have been published. The field work on McKay bay and creek is still in progress, but a tentative estimate of the numbers of larvae in the stream (exclusive of beaver impoundments) was 20,000. Studies in lentic areas of lakes Michigan, Superior, and Huron and connecting waters demonstrated the presence of sea lamprey larvae in 13 of the 29 areas surveyed. A paper on this subject has been accepted for publication.

Studies on the life history of the sea lamprey included investigations at Carp Lake River, Emmet County, on the duration of larval life, and observations in the laboratory of external changes that occur during metamorphosis. The project at Carp Lake River was terminated in May 1962; a report on it has been accepted for publication. The main conclusion was that the larval stage of at least some sea lampreys in this stream almost certainly lasted not less than seven years. Other information obtained at Carp Lake River will be presented in other reports. The study on external changes that accompany metamorphosis continues.

A final report was completed on the operation of a fish-barrier dam in the Black River, Mackinac County. At a head of 26 inches, the dam prevented upstream passage of sea lampreys, smelt, and suckers, yet permitted passage of rainbow trout.

Considerable effort was spent on improvement of collecting techniques and in evaluating a marking technique. An enclosure was developed for quantitative sampling of larvae at 2-20 feet. A check on the efficiency of the device showed that at least 80 percent of available larvae were caught. This equipment is much more effective than the orange-peel dredge previously used for quantitative sampling. The use of dye to mark larvae for identification was found satisfactory.

Rainbow Trout Studies

Analysis was begun on data collected during 1950-59 in a study of the life history of rainbow trout in the Black River, Mackinac County. Returns from plantings of marked rainbow trout in the Great Lakes in 1955-59 continued in 1961-62 but are now virtually complete; recovery by anglers has amounted to approximately 3 percent.

The study on rainbow trout being carried out on three lakes (Stager, Iron County; Bass, Dickinson County; Sporley, Marquette County) was curtailed for financial reasons. Collecting was reduced considerably in 1961, and discontinued in 1962. However, materials obtained from 1958 through 1961 continued to be analyzed. Three approaches were used: (1) Study of the extent that introduced rainbow trout exploit the bottom fauna and plankton populations. (2) Determination of the severity of competition among rainbow trout, white suckers, bluegills, and yellow perch for food. (3) Investigation of the influence of the trout on growth rates of indigenous game fish. To date, the first-named approach has received the most attention. Initial findings are that the midges Tendipes plumosa and Chaoborus were the main foods eaten by trout during July, August, and early September. Small fish were also important in 1959, the first summer after trout were introduced, but were of little significance the second summer. Chironomids and oligochaetes were the more abundant organisms in the bottom sediments. There were far fewer Tendipes plumosa in bottom samples in 1959 than the preceding summer, before the introduction of rainbow trout.

Walleye Investigations

A study of the walleye fishery in the Bay de Noc area, initiated in 1957 in cooperation with the U. S. Fish and Wildlife Service, was continued in 1961-62. Tagging has been a prime source of information. A total of 6,769 walleyes have been tagged since 1957, of which 2,079 were tagged in 1961-62.

Through June 30, 1962, anglers voluntarily reported the recapture of 341 (5.0 percent) and commercial fishermen 186 (2.7 percent) of the tagged walleyes. Of necessity, sampling procedures have been imperfect, but there is no doubt that anglers account for a major portion of the annual harvest of walleyes from Bay de Noc. The walleye population of this water consists of an aggregation of separate sub-populations. The sub-populations separate at spawning time, but mix during the rest of the year. Abundance of year classes is about the same in different sub-populations, but certain differences in growth rates have been noted. A paper was prepared on the movement and exploitation of these populations, and another paper, on homing behavior of walleyes, has been accepted for publication.

Experimental planting of walleyes has also continued. During the last biennium, 125,395 fingerlings were planted in seven lakes. In all, 60-some lakes have been involved in the program. Plantings have provided some fishing in about 15 of the lakes, walleyes have become established in one lake (Charlevoix), and a good walleye fishery has

been reestablished in one lake (East Twin, Montmorency County). In general, results of the program have been clouded by somewhat erratic production of fingerlings and by insufficient checking of lakes that have been stocked. It was decided recently to concentrate in the future on about 10 or 12 lakes in which results have been most promising.

Hunt Creek Trout Research Station

This unit, which is located east of Lewiston in Montmorency County, was chiefly concerned with these projects: (1) Intensive creel census on experimental waters of the Hunt Creek drainage for the 22nd and 23rd consecutive seasons; a stratified, random type of creel census on 19.8 miles of the North Branch of the Au Sable River for the 4th and 5th consecutive seasons; censuses of the latter type on sections of the Boardman River and Little South Branch of the Pere Marquette River during 1960 and 1961 (discontinued after the 1961 trout season because of budget considerations); continuation of similar censuses in 1962 on parts of the main stream and South Branch of the Au Sable River. The objective of the censuses conducted on waters other than those of the Hunt Creek drainage is to obtain information on the effects of special trout fishing regulations on angling pressure and quality; the regulations stipulate that lures be restricted to artificial flies, a daily limit of 5 trout, and a minimum size of either 9 or 10 inches. (2) Post-season population studies on four sample sections on the main stream and South Branch of the Au Sable, Little South Branch of the Pere Marquette,

and Boardman rivers during the falls of 1960 and 1961; population studies in the spring as well as in the fall on six sample sections of the North Branch of the Au Sable River and on 1.75 miles of Hunt Creek. (3) Detailed population estimates of brook trout and rainbow trout on East Fish Lake by periodical angling and electrofishing between the time the fish were planted and the fishing season commenced. The results (published in 1961) from the plantings of 1958 and 1959 were that few of the rainbow trout were lost and 80 percent were harvested; from 30 to 40 percent of the brook trout were lost in November, probably to predators. (4) Observation and collection of fish-eating birds on trout water during the winter. The station's staff, with cooperation from the Game and Field Administration divisions, made detailed investigations during the winter of 1961-62 on the numbers of mergansers and other waterfowl present on the 19.8-mile experimental section of the North Branch of the Au Sable River; they also collected 24 American Mergansers, Hooded Merganser, and 21 Goldeneyes for examination of foods eaten. (5) Collection of stomachs of trout from lakes and ponds on the Hunt Creek drainage. Following analysis of contents in the stomachs, the results are to be correlated with those from analysis of bottom samples taken in the same waters.

Results of fishing on Hunt Creek and associated waters during the 1960 and 1961 seasons appear in the following table.

Water	Season	Fishing trips	Hours fished	Trout caught: Wild brook	Trout caught: Hatchery brook	Trout caught: Rainbow	Total pounds	Trout per hour
Hunt Creek*	1960	868	1,719	1,183	113	6	244	0.76
(Sections Z, A, B, C, D)	1961	773	1,474	651	93	3	117	0.51
Fuller Creek*	1960	134	222	98	1	1	...	0.45
	1961	135	246	99	...	...	14	0.40
Fuller Creek Pond**	1960	104	288	47	42	63	57	0.53
	1961	48	112	21	...	...	10	0.19
East Fish Lake**	1960	376	1,205	9	68	244	245	0.27
	1961	457	1,548	21	158	287	375	0.30

* General trout fishing regulations.

** Ten-inch minimum size, 5 trout daily, use of minnows for bait prohibited.

Fuller Creek Pond was renovated in 1961 by removal of coarse fish with rotenone and improvement of its drainage system. A sheet-piled spillway was constructed at the dam to permit circulation of the water in the lower half of the pond, which the former outlet did not allow. Also, a Wolf trap was installed in the spill to control movement of fish from downstream.

Fishing statistics (hours of fishing and numbers of trout caught are estimates derived from sample counts) for experimental portions of the North Branch of the Au Sable River are recorded in the table below.

Test section	Season	Regulation	Hours fished per mile	Trout caught per mile		
				7.0-8.9"	9.0" and larger	Total legal catch
Dam 2 to county line (4.2 miles)	1960	General	737	315	93	408
	1961	Special*	327	165†	49	49
County line to Eaman's (6.9 miles)	1960	Special*	1,960	819†	399	399
	1961	General	3,126	652	233	885
Eaman's to Kellogg Bridge (8.7 miles)	1960	Special*	1,191	605†	228	228
	1961	Special*	990	417†	48	48

* Nine-inch minimum size, 5 trout daily, artificial flies only.

† Figure estimated from experimental fishing data and sublegal trout reported in creel census.

The fishing statistics (estimates derived from sample counts) for test sections of other streams on which special regulations have applied are presented in the third table.

A report for publication was prepared on the outcome of a regulation which restricted lures to artificial flies on sections Z and A of Hunt Creek during 1955-1959. The main results of this experiment were that in the "fly" water the catch per hour of brook trout increased significantly and the total catch slightly with increased fishing pressure, while in adjacent water where any kind of lure could be used the catch per hour increased slightly, and increases of the total catch and fishing pressure were great.

Stream and regulations for test sections		Season	Miles censused	Hours fished per mile	Trout caught per mile		
					7.0-9.9"	10.0" and larger	Total catch
Main stream, Au Sable River							
	Special*	1960	8.7	6,010	...	664	664
		1961	8.7	5,215	...	725	725
	General	1960	5.6	6,446	699	444	1,143
		1961	5.6	2,217	402	174	576
South Branch, Au Sable River							
(Upper)	Special*	1960	7.1	2,074	...	253	253
		1961	7.1	1,563	...	173	173
(Lower)	Special*	1960	9.0	1,622	...	340	340
		1961	9.0	1,329	...	161	161
Boardman River							
	Special*	1960	3.9	496	...	37	37
		1961	3.9	688	...	51	51
	General	1960	2.1	1,563	372	66	438
		1961	2.1	1,507	633	51	684
Little South Branch, Pere Marquette River							
	Special*	1960	4.2	537	...	181	181
		1961	4.2	708	...	200	200
	General	1960	5.2	897	307	126	433
		1961	5.2	1,237	102	188	290

* Ten-inch minimum size, 5 trout daily, artificial flies only.

Pigeon River Trout Research Station

This Station, 13 miles east of Vanderbilt in Otsego County, has six miles of the Pigeon River and seven small lakes under experimental control. Complete records on angling are obtained by a compulsory permit system. Population studies with D.C. electrofishing gear in the Pigeon River have been made each fall since 1949; estimates of population size were begun in 1960.

Creel census records and information from population studies were used in evaluation of the following experiments: (1) A 9-inch minimum size limit and a flies-only restriction on trout on two sections of the Pigeon River. The increased size limit was effective during 1951-1957, with no restriction on bait. In 1958, a flies-only provision was included. The experiment was concluded in 1962. (2) Influence of stream improvement practices on quality of fishing and density of trout populations. This study was begun in 1953. Because the results of a five-year test were inconclusive by 1958, the experiment was extended through 1964. In 1959, all man-made structures were removed from this section of the river, and sand was used to fill holes dug by deflectors. The next evaluation will compare data for a five-year period when structures were present with data for five years when structures were absent and natural cover was greatly reduced. (3) Planting of fingerling brook trout in lakes in the fall. This test was carried on from 1952 through 1962. The objectives were to determine the proper planting rate for best recovery, season of

greatest mortality, and causes of natural mortality. The results have not yet been evaluated. (4) A fly-fishing-only restriction on brook trout in Ford Lake. This experiment began in 1955 and was scheduled for completion in 1962. (5) Growth and harvest of brook trout planted as fry in Ford Lake in the spring (begun in 1952 and scheduled for completion in 1962).

Following are creel census data for experimental waters being studied at the Pigeon River Station.

Pigeon River

Season	Fishing trips	Hours fished	Trout caught	Trout per hour
1960	1,236	3,197	915	0.29
1961	1,543	4,196	941	0.22

Ford, Hemlock, Lost, West Lost, North Twin, South Twin, and Section 4 lakes

Season	Fishing trips	Hours fished	Trout caught	Trout per hour
1960	1,649	4,386	1,630	0.37
1961	1,864	5,316	1,588	0.30

Rifle River Fisheries Research Station

This Station is located on the Rifle River Area at the headwaters of the Rifle River in Ogemaw County. The Area is a 4,318-acre fenced tract of state-owned land within which are six lakes, several natural ponds, and about 9.5 miles of trout streams. Complete records of fishing, hunting, trapping, and sightseeing are obtained through a compulsory permit system. Pertinent information has been recorded on all fish and game taken from the Area since 1945. Visitors, of whom approximately two-thirds were sightseers, numbered over 25,000 in both 1960 and 1961.

There were only 1,973 fishing trips to the Area's lakes in 1960, the fewest since 1951. The total catch of fish dropped to an all-time low, continuing the downward trend begun after 1953. Greater yields in 1960 than in 1959 for four of the lakes were more than offset by reduced catches from Devoe and Dollar lakes, the most popular lakes on the Area. Fishing in Devoe Lake dropped off because no rainbow trout were planted in it until late in the fall. The low total yield from Dollar Lake resulted largely from a dramatic decline of the bluegill population since 1958, due to various factors discussed in the 1959-60 Biennial Report. The catch of largemouth bass, on the other hand, was the largest ever recorded for this water.

In 1961, total fishing pressure, yield, and success were greater than in the previous two years. In Dollar Lake, the bluegill catch nearly doubled that of 1960, and the harvest of largemouth bass nearly equalled the record catch of 1960. Hatchery-reared rainbow trout comprised 22 percent of the total fish catch from Devoe Lake. Nearly all of them were from either the 1961 spring planting or the late fall planting of 1960. A brief summary of the lake fishing follows:

Season	Fishing trips	Hours fished	Fish caught		Fish per hour
			Number	Pounds	
1960	1,973	5,523	1,886	498	0.34
1961	2,196	6,272	2,555	686	0.41

Fishing pressure and harvest of trout on Area streams in 1960 were about the same as in 1959. The catch of native trout increased from 612 in 1959 to 1,162 in 1960, but no hatchery trout were planted immediately before or during the 1960 season. As a result, only 126 trout of hatchery origin were caught compared to 665 in 1959 when plantings were made during the season.

Anglers made 17 percent more trips and caught 42 percent more trout in 1961 than in 1960. The greater catch is attributed primarily to a large planting of sublegal rainbow trout in the Rifle River within the Area early in the 1961 season. A total of 1,014 native trout were caught, or 13 percent fewer than in 1960. Angling quality for native fish dropped from 0.17 trout per hour in 1960 to 0.12 in 1961.

Creel census data for the trout streams are summarized as follows:

Season	Fishing trips	Hours fished	Trout caught			Other fish caught	Pounds, trout	Pounds, other	Trout per hour
			Brook	Brown	Rainbow				
1960	2,771	6,942	48	1,206	34	158	628	144	0.18
1961	3,246	8,689	30	1,099	701	354	583	393	0.21

Most of the research projects carried on during the preceding biennium have been continued, with some modifications, during 1961-62. They include: (1) Trout stream population studies. (2) Growth rate and mortality studies. (3) Estimation of fish population sizes in lakes. (4) Evaluation of watershed and stream improvement practices. (5) Experiments on lakes subject to extreme oxygen depletion. (6) Evaluation of effects of population manipulation on angling success and fish growth. (7) Creel census and exploitation studies. (8) Study of redear sunfish in northern lakes. (9) Survey of bottom fauna populations.

Marquette Fisheries Research Station

This Station is located on the grounds of the Marquette Hatchery. The work by the staff of this unit has mainly been on investigations concerned with brook trout, rainbow trout, and the sea lamprey. The studies conducted on the two latter species are described under separate headings which precede this section.

Research carried on here during the last two years on brook trout has involved tests to compare results between plantings of fingerling and legal-size fish in lakes and to determine the effects of a later opening (May 15) and a later closing (October 15) of the fishing season than are provided by the general regulations. The special season applies to Airport and Swanzy lakes, while the general season applies to Moccasin Lake. The creel census to determine the effects of the special season commenced in 1959, and was discontinued in 1962 because of curtailed funds. Hence, data collected from Airport and Swanzy lakes are insufficient to permit conclusions. However, because the study at Moccasin Lake continued under the same seasonal regulations which were in effect prior to 1959, results from 1959-1961 censuses can be combined with those of the previous years to assess the outcome here of stocking brook trout of different sizes.

Data collected at Moccasin Lake in 1954 and 1955 on legal-size plantings and from 1956 through 1961 on fingerling plantings showed that stocking of fingerlings had the following advantages: (1) considerably reduced the take of trout during the first few days of the season from what it had been when legal-size fish were planted; (2) caused the formerly disportionate early-season fishing pressure to be distributed over the first half of the summer when the trout were utilizing food in the lake; thus, fishing became much more attractive after the first two weeks of the season than it was when larger trout were planted; (3) the average size of the trout caught during the first two weeks of the season equalled

or exceeded the average of those planted at legal length; (4) resulted in the return of a greater poundage of fish per poundage planted.

Although the catch per hour of fish from legal-size plantings exceeded that for fingerling plantings, the difference is of little importance when it is considered that the bulk of the total catch from legal-size introductions (77 to 86 percent) was taken during the opening weekend of the season. Moreover, after the first weekend, the catch rate from fingerling plantings was higher.

These results differ somewhat from results reported in the Biennial Report for 1959-1960 because they are based on data collected only at Moccasin Lake, with the addition of data from 1959 through 1961.

Following is a comparison of seasonal averages for eight seasons (1954-61) of creel census at Moccasin Lake.

Size of trout stocked and years of stocking	Hours fished per season	Legal brook trout caught			Percent of plantings harvested	Trout per hour
		Number	Pounds	Average length		
Fingerlings (1955-59)	2,160	679	151	8.4	24.1	0.31
Legals (1953-54)	788	342	110	9.3	29.4	0.44

Hastings Fisheries Research Station

This Station, located at the town of Hastings, is mainly concerned with research in the management of warm-water fishes. The following projects have been underway (numbers 1 through 4 cooperatively with the Lake and Stream Improvement Section): (1) Follow-up studies on 20 lakes treated with rotenone or seined since 1956 for reduction of bluegills and/or carp. (2) Evaluation of production of northern pike fingerlings at Townline Lake, Montcalm County, and Otsego Lake, Otsego County, in marshes which were managed by various techniques, including provision of dams to prevent entry of other fish and to control water level, planting of brood stock, and fertilization. Marsh management commenced at Townline Lake in 1958, and at Otsego Lake in 1959. Production figures and abundance indices appear in the table below.

Lake	Year	Number of adult pike in spawning run to marsh	Fingerling production		Adult pike netting indices	
			Number	Average length (inches)	Number per seine haul	Number per gill net set
Townline	1958	67	16,700	2.6	4.0	...
	1959	17	1,785	2.0	2.8	...
	1960	313	824	1.2	11.5	...
	1961	535	34,776	1.3	21.5	...
	1962	580	75,000	1.1	...	...
Otsego	1949	...	...	...	...	3.16
	1958	...	...	...	...	0.05
	1959	34	1,112	2.7	...	...
	1960	23	32,300	2.3	...	...
	1961	117	78,700	2.3	...	...
	1962	518	11,763	3.1	...	1.22

(3) Checking on survival, growth, and reproduction of muskellunge introduced into seven lakes between 1955 and 1957. (4) Gathering basic information on abundance in the fall of young-of-the-year bluegills in eight lakes in 1960 and 1961; treatment, in 1962, of four of these lakes (Middle, Mill, Pl easant, and Podunk, Barry County) with copper sulfate to kill bluegill eggs and fry. (5) Continuation of the census, begun in 1956, of winter spearing for muskellunge at Gun Lake, Allegan and Barry counties, where maintenance stocking is being tested; a total of 10,000 fingerlings were planted here in 1961 and 1962. (6) Observations on the spawning habits, early life history, and growth rate of bowfins (dogfish). (7) Studies in lakes, ponds, and aquaria on feeding habits of predatory fish, especially in regard to food preferences and growth on various diets. (8) Analysis of age and growth data and stomachs of fish from Fletcher Floodwater to assist in management of northern pike in the impoundment. (9) Development of plans to test correlation between bluegill production and various intensities of controlled harvest. (10) Work on various reports, including publication of pamphlets on the muskellunge and sturgeon of Michigan.

A number of improvements were made during the last two years on the Station's buildings and equipment. A major addition was a set of three steel tanks, having a total capacity of 6,000 gallons, for holding fish and use in observational studies.

General Creel Census

Conservation officers have secured catch records of sport fishing since 1927. These records are sent to the Institute for tabulation and analysis. The census provides a sample of fishing conditions over the entire State. In 1960, the officers interviewed 85,259 fishermen who had fished 186,946 hours and caught 240,154 fish, at the rate of 1.3 fish per hour. The figures for 1961 were 74,048 anglers, 166,776 hours, 163,666 fish, and 1.0 fish per hour.

As in past years, brook trout predominated in the catch from trout lakes and streams. Of 14,592 trout reported in 1960 from these waters, 56 percent were brook trout, 33 percent were rainbow trout, and 11 percent were brown trout. Among the 11,708 trout examined in 1961, the percentages for the respective species were 62, 26, and 12 percent. The catch per hour was 0.6 trout in both 1960 and 1961.

Bluegills made up 39 percent (1960) and 37 percent (1961) of the total catch in non-trout inland waters. Bluegills and yellow perch combined constituted 71 percent of the catch in 1960, and 62 percent in 1961. The catch per hour of all species was 1.3 fish in 1960, and 1.0 in 1961.

Yellow perch comprised 86 percent of the catch from the Great Lakes and their connecting waters in 1960, and 74 percent in 1961. On the basis of catch per hour, fishing quality was best in these waters--2.2 in 1960, and 1.5 in 1961.

Creel Census on Experimental Lakes

Censuses are in progress for the following investigations: (1) Study of a 14-inch minimum size limit on black basses; also a ban on spearing in Fife Lake (Fife Lake, Grand Traverse and Kalkaska counties and Sugarloaf Lake, Washtenaw County). (2) Study of a special closed season on northern pike (March 1-June 15) and a ban on spearing (Bear Lake, Manistee County). (3) Evaluation of results from management of a pike-spawning marsh (Otsego Lake, Otsego County). (4) Accumulation of catch data for guidance in setting up a management plan for northern pike in the lake being censused (Fletcher Floodwater, Alpena and Montmorency counties). (5) Study of productivity in a new impoundment (Winnewana, Washtenaw County).

Projects have been discontinued on Houghton Lake (data for a 20-inch limit on northern pike), Corey and Birch lakes (winter fishing season and special stocking procedures for rainbow trout), Big Portage Lake (effects of increased water level), Pontiac and Whitmore lakes (year-round fishing for bass, special restrictions on pike), and Duck and Fine lakes (no size limits, except for pike). Collection of records was discontinued on the last four lakes because of budget limitations, but the experimental regulations are still in effect. Reports are being prepared on completed and interrupted projects.

Age and Growth of Fish

Numerous age and growth determinations were made to assist in management of lakes and streams. Other than this routine work, studies were begun on the monthly growth rates of warm-water fish and on possible correlation between growth and some ecological factors. Data are being entered on I. B. M. cards to facilitate analysis.

Laborers provided by the Department of Corrections prepared fish scales for examination by impressing them in plastic material.

Studies on Fish Food Organisms

An investigation of the effects of increasing the water level in Big Portage Lake, Jackson County, was completed. A report on the results is being prepared for publication. An increased amount of phosphorus persisted for two years after the change in level, but abundance of bottom fauna decreased under the higher level. Despite this apparent reduction among fish-food organisms, growth rates of bluegills, largemouth bass, and black crappies improved significantly.

A long-range study of the changes in productivity of the new Winnewana impoundment is being continued.

The bottom-dwelling organisms in a small area of Sugarloaf Lake, Washtenaw County, have been sampled intensively. The data from these samples will be used to evaluate the changes in abundance which occurred in the same area during a previous, extended investigation.

A study of shallow-water bottom fauna in Lake Huron was completed. It was designed to determine the extent to which fish-food resources will be damaged if the water level of the Great Lakes is lowered as proposed for the Chicago Diversion. The results indicated that certain bottom types in shallow depths possess a bottom fauna as rich as that found in smaller lakes. Work on the bottom fauna of a deeper part of Lake Huron (Saginaw Bay) has continued, and a report should soon be in final form.

Fish Toxicants

Research on the use of organic insecticides continued. A technical report was completed on the relationship between fish size and susceptibility to toxaphene. Differences between brook and rainbow trout in susceptibility to this chemical were demonstrated, the latter species being more sensitive. In 1961, four lakes were treated with toxaphene to eradicate the fish populations, and one lake was treated to reduce the numbers of small panfish. An experimental treatment has been made to test the quality of endrin as a fish toxicant. A chromatographic method to detect low concentrations of chlorinated hydrocarbons has been perfected.

Aquatic Plant Control

Experimental applications of three new aquatic herbicides and aerial applications of 2, 4-D pellets and copper sulfate were observed in 1962. During 1961, one new herbicide was tested, and

a chemical company was assisted in testing another material in the field. Further observations were made on experimental treatments with an herbicide which is quite toxic to fish.

Cooperative Projects with Michigan State University

The Department of Conservation gave financial aid to several graduate students who did research on fishery problems. Members of the faculty and the Institute's staff worked together on several projects.

Limnological studies

The investigation of productivity of the West Branch of the Sturgeon River in Cheboygan County has continued. This project is sponsored jointly by the Institute for Fisheries Research, the University's Department of Fisheries and Wildlife, and the U. S. Atomic Energy Commission. It has extended to nearly every phase of the biology of this stream. Besides analysis of the phosphorus cycle, the work has included study of the production of periphyton, bottom fauna, and fish. Certain portions of the data suggest that more phosphorus passes through the food chain into trout when it is present in the water in the particulate form than when it is present as a soluble ion.

Further work on chelating materials and their influence on lake and stream productivity was planned but has not progressed far because of insufficient equipment and funds. Laboratory work has begun on

isolating chelators that occur naturally and determining their effect upon biological productivity. This program will be accelerated when more funds and personnel are available.

A report was published which summarizes the first year's results of a study on pond productivity. This work is being done at the University's Experiment Station at Lake City. The objective is to identify the factors which determine whether plankton blooms or heavy growths of weeds develop in ponds. The procedure has been to compare production rates in ponds when weeds strongly predominate with rates when plankton algae are dominant.

Ecology of smallmouth bass in a polluted stream

This study began in 1960 and was to be concluded in 1962. It has dealt with the ecology of smallmouth bass in the Red Cedar River, a polluted warm-water stream. The pollutants are domestic and industrial wastes and silt from eroded land.

Domestic and industrial pollutants affect distribution and abundance of bass in areas near the sources of the effluents. Siltation and excessive turbidity strongly influence bass production in all parts of the stream. The adverse effects of turbidity are greatest after emergence of fry. Deposition of sediment is important in reducing pool depths, limiting spawning areas, and reducing production of benthic organisms. Growth rates of the bass have been less than the state average.

Cooperative Projects with The University of Michigan

Several graduate students carried on investigations with financial support from the Department of Conservation. Senior members of the Institute's staff have honorary faculty status.

Coarse fish removal

Field work of an investigation to determine the effects of removal of coarse and forage fish from a trout stream (Canada Creek, Montmorency County), which was begun in 1958, was completed in 1961. A final report on this project was scheduled for completion toward the end of 1962. At this time (when the data have not been completely analyzed) it appears that control of coarse and forage species resulted in accelerated growth of adult trout and improved the survival rate of fry. However, the trout fishery of this stream apparently is mainly restricted by high water temperatures in mid-summer and extremely low ones in midwinter. Corrective measures to improve the thermal conditions are feasible and will be described in the report.

Chestnut lamprey investigation

This study, conducted from 1959 to 1962, dealt with the life history and ecology of this native parasitic lamprey in the Manistee River, Crawford and Kalkaska counties. The stream contains a dense population of chestnut lampreys. It was determined that the parasite

could kill a substantial number of trout in the river each year. Recommendations were made for control of the pest.

Crayfish study

This project was undertaken recently. It is concerned with population dynamics of crayfish and the importance of these crustaceans as food for black bass. Techniques for marking crayfish have been developed.

INSTITUTE FOR FISHERIES RESEARCH

Compiled by
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Assistant Biologist

Report approved by W. R. Crowe

Typed by M. S. McClure

file

August 14, 1962

TO: A. B. Cook, Chief, Fish Division

FROM: C. M. Taube, Assistant Biologist, I. F. R.

SUBJECT: Biennial Report for 1961-1962

Accompanying this letter are three copies of Report No. 1648, "Biennial Report of the Institute for Fisheries Research, 1961-1962." Two copies are for the Fish Division, and one copy for Education-Game.

CMT:mam
cc: Extra enclosed
J. W. Leonard