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MICHIGAN DEPARTMENT OF CONSERVATION
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ADDRESS
UNIVERSITY MUSEUMS ANNEX
ANN ARBOR, MICHIGAN

August 24, 1954

Report No. 1430

SPAWN COLLECTION AND SPAWNING HABITS OF THE NORTHERN
MUSKELLUNGE IN GOGEBIC COUNTY DURING 1954

By

John E. Williams

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Abstract

During the spring of 1954, the Michigan Fish Division participated in a cooperative muskellunge spawn-collection venture with the Wisconsin Conservation Department in three lakes on or near the Wisconsin-Michigan border in Gogebic County, Michigan and Vilas County, Wisconsin. Wisconsin fyke nets were used in Lac Vieux Desert (T43N, R38, 39W, Michigan), and in West Bay and Crooked Lakes (T44N, R41W, Michigan) from April 21 to May 6.

The netting period was mostly cold, with considerable snow and rain. Water temperatures increased from 40° F. on April 21 to a high of 49° F. on May 1, then decreased to 39° F. near the end of the period.

Ten quarts of northern pike (Esox lucius) eggs were secured on April 27 and 28 in Lac Vieux Desert. Sixteen northern (or Wisconsin) muskellunge (Esox masquinongy immaculatus) were netted, including six from Lac Vieux Desert, two from West Bay Lake and eight from Crooked Lake. Muskies were caught, coincidental with the rising of the water temperatures to nearly 50° F., from May 1 to 4 in shallow, mucky bays. The sixteen fish ranged in length from 33 to 50 inches and in age from 5 to 13 years.

Five quarts of muskellunge eggs (approximately 400,000) were secured and fertilized and, with the pike eggs, were trucked to Drayton Plains State Fish Hatchery for rearing. Bad weather conditions made it impossible to fly the eggs downstate as planned. Only 10 muskellunge fry hatched from the 400,000 eggs. This poor survival was due primarily, it is believed, to the chilling of the eggs both during and before shipment. The pike eggs had an excellent hatching percentage (60 percent), presumably because they are not adversely affected by water temperatures below 40° F.

Details are included regarding artificial spawning technique and certain aspects of muskellunge rearing and management as practiced in Wisconsin.

Judging from the netting results, Lac Vieux Desert apparently contains a good population of large walleyes, northern pike, black crappies and yellow perch.

It is recommended that Michigan secure at least 10 fyke nets to use in future spawn collection.

It is also recommended that eggs secured from the Gogebic County border lakes, being of a distinct sub-species, be used only for introductory stocking. Because of the difference in spawning habits, the Great Lakes sub-species should be used for experimental maintenance stocking where this sub-species is already present.

The generous assistance and advice of the Wisconsin Conservation Department's Fish Management Division, and especially the staff of Woodruff Hatchery, were greatly appreciated.

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At the 10th annual Tri-State Fisheries Conference, held in November, 1953, the Wisconsin Conservation Department suggested that, in view of Michigan's disappointing results in the past with muskellunge propagation, they would be happy to cooperate with Michigan in a joint muskellunge spawn-collection operation at Lac Vieux Desert, Gogebic County (and Vilas County, Wisconsin). Arrangements were worked out between the two departments to carry out this project during the spring of 1954. While the project was mainly to collect muskellunge eggs for Michigan's propagation program, Wisconsin also welcomed the opportunity to obtain information on muskellunge in Lac Vieux Desert mainly from the standpoint of determining the lake's possibilities as an egg source. The author was assigned to this project to assist in the collection of eggs and to gather information concerning this sub-species of muskellunge. The border lakes in the Wisconsin River (Mississippi) watershed are the only place in Michigan where the northern or Wisconsin muskellunge (Esox masquinongy immaculatus Garrard) is found. All other locations inhabited by muskellunge in Michigan contain the Great Lakes or St. Lawrence muskellunge (Esox m. masquinongy Mitchill).

Most of the equipment, including fyke nets and boats, was furnished by the Wisconsin Conservation Department. They also furnished the services of Mr. Lynn Morgan, of Woodruff Hatchery, who has had considerable experience in muskellunge spawn taking. Michigan supplied living quarters for Mr. Morgan at Watersmeet State Fish Hatchery, in addition to furnishing whatever additional labor was necessary. Mr. Ted Monti, superintendent of Watersmeet Hatchery, under Mr. James Scully, Regional Fisheries Supervisor, furnished immediate supervision of the project.

Operations were begun on April 21, when 8 Wisconsin fyke nets were set in Lac Vieux Desert. Both 4- and 5-foot (diameter of hoops) nets were used in conjunction with 100-foot leads. No wings were used. In this net the first two hoops are made square, of pipe, so that they will stay on the bottom and give a wide, easily entered entrance for fish. No anchors were used. Rather, the leads were staked firmly to shore; the lead and net were set; and a head stake was either pushed or driven into the bottom to keep the net taut. Nets were always put in locations in which the entire float line of the lead would be at the surface. If possible, the net itself was set in deeper water.

A total of 15 net stations were fished in Lac Vieux Desert (Fig. 1). Since nets were put in early, before muskies would be taken, an effort was made to locate nets where large numbers of pike were present. It was desired to collect 10 quarts of pike eggs, for which a large number of pike were needed. It was believed that good pike locations would also produce muskies, especially when the water warmed. At the start of the operation, surface water temperature was 40° F. (Table I).

Nets were moved from Stations 1 and 2 on April 24, because they were catching large numbers of walleyes, suckers and other fish but were on hard bottom and were taking no pike. Catches of muskellunge made at

Figure 1.--Sketch of Lac Vieux Desert, Gogebic County, showing
15 net stations fished from April 21 to May 6, 1954

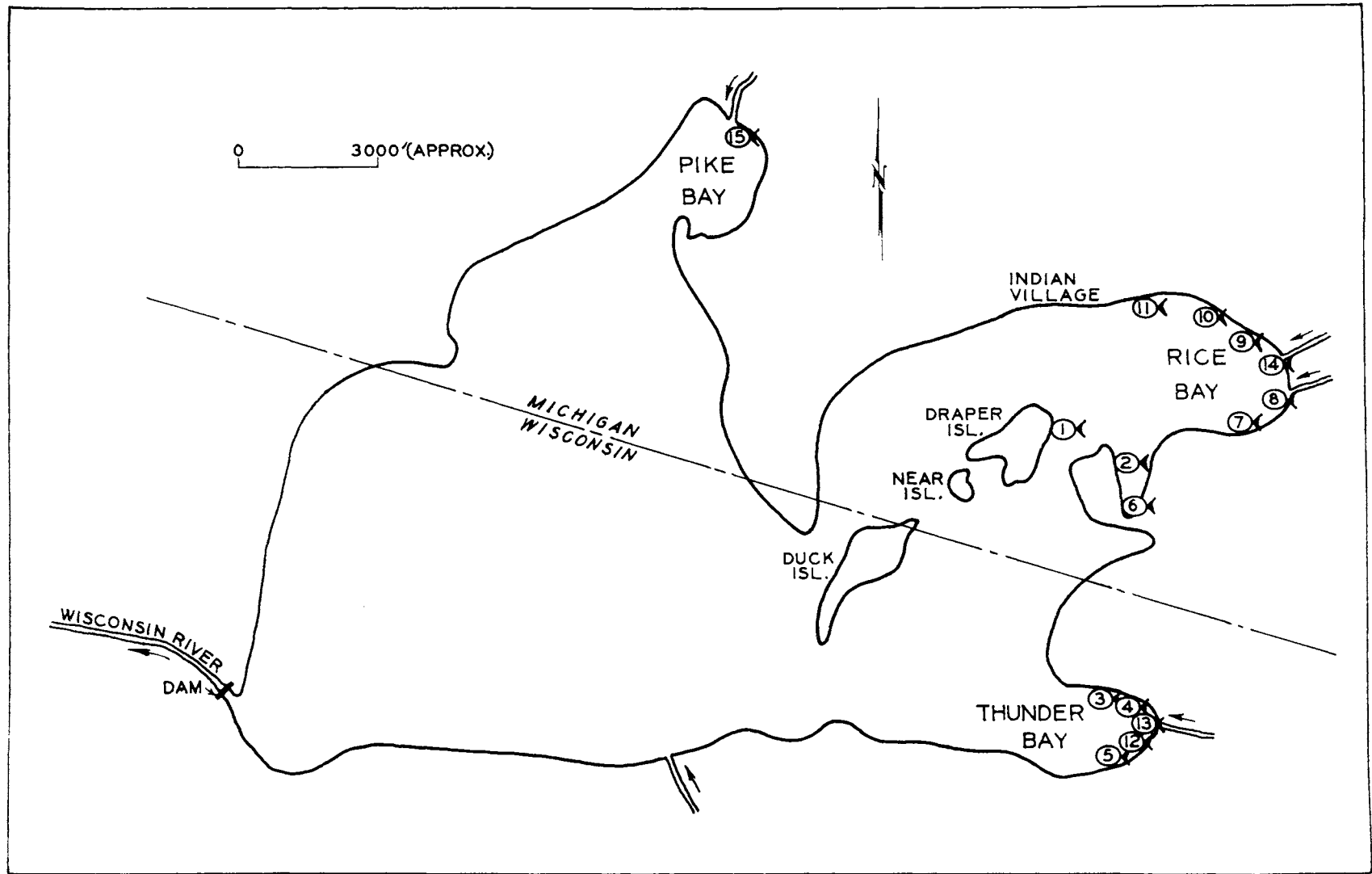


Table I.--Water temperatures (degrees Fahrenheit) in two Gogebic County lakes from April 23 to May 6, 1954

Date	Water temperatures (degrees Fahrenheit)		
	Lac Vieux Desert		West Bay Lake
	Thunder Bay	Rice Bay	
4-23	40		
4-24	40		
4-25	41		
4-26	43	42	
4-27	38		
4-28	43	42	46
4-29	44		
4-30	46		48
5-1	49	48	
5-2	43		44
5-3	40		41
5-4	39		39
5-5	--		
5-6	39		

individual stations, and number of days these stations were fished, are shown in Table II.

Some pike were ripe from April 22 on, but the majority of pike were not ripe until April 26. About 10 quarts of pike eggs were taken on April 27 and 28 from 103 pike (Figs. 2 and 3). Pike ranged from 1 to 6 pounds, and were about 50 percent infected by Chilodon parasite and about 10 percent with Neascus. About 50 pike were removed and stocked in Perch Lake (T45N, R40W, Sec's. 25, 26, 35), Gogebic County. Nets most productive of pike were those located in Thunder Bay, near the mouth of the inlet (Trout Creek), and those located in Rice Bay near the two small inlet streams entering here. Some ripe pike were still being taken by May 6.

From April 21 until April 28, the weather was generally cold with considerable rain. Water temperatures ranged from 38° to 43°. A warming trend from April 28 to May 1 brought water temperatures up to 49°. Coincidental with this rise in water temperature, muskellunge were caught for the first time in Lac Vieux Desert on May 1 in Thunder Bay (net No. 12). Three fish were taken, all of which were ripe males. Two of these fish were retained temporarily in net No. 10. On May 2, a large ripe female was taken in net No. 12 and one additional ripe male in No. 10. The two males which had been put in net No. 10 on May 1 had hardened up by May 2 and could not be stripped. Due to high wind, sleet and darkness, stripping was done inside a carryall truck. The large female produced 2 quarts of eggs which were fertilized with milt from the one ripe male. This male emitted copious amounts of milt.

By May 3, the weather had turned colder, with considerable snow, and the water temperature had dropped to 40°. However, a 50-inch ripe female (Fig. 4) was taken in Lac Vieux Desert in net No. 12. Since no ripe male

Table II.--Summary of muskellunge caught and net stations fished in three Gogebic County lakes, April 23 to May 6, 1954
For explanation, see footnotes

Date	Net stations																			Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
4-23	x	x	x	x	x	x	x	x												0
4-24	x	x	x	x	x	x	x	x												0
4-25			x	x	x	x	x	x	x	x	x									0
4-26			x	x	x	x	x	x	x	x	x									0
4-27			x	x				x	x	x	x	x	x	x	x					0
4-28			x	x				x	x	x	x	x	x	x	x	x	x			0
4-29			x	x				x	x	x	x	x	x	x	x	x	x			0
4-30			x	x				x	x	x	x	x	x	x	x	x	x			0
5-1			x	x				x	x	x	x	3			x	*	*	*	*	3
5-2			-	-				-	-	1	-	1			*	1	1	-	2	6
5-3			-	-				-	-	-	-	1			-	-	-	2	-	3
5-4			x	x				x	x	x	x	x			*	1	x	2	1	4
5-5			-	-				-	-	-	-	-			-	-	-	-	-	0
5-6			-	-				-	-	-	-	-			-	-	-	-	-	0
Total										1		5			2	1	4	3	16	

x = days on which net was checked and fish enumerated.

- = days on which net was checked but fish not enumerated.

* = days on which net was not checked.

Net stations No. 1-15 in Lac Vieux Desert, Gogebic County.

Net station No. 16 in West Bay Lake, Gogebic County.

Net stations No. 17-19 in Crooked Lake, Gogebic County.

Figure 2.--Stripping eggs from a female pike at Lac Vieux
Desert, April 28, 1954.

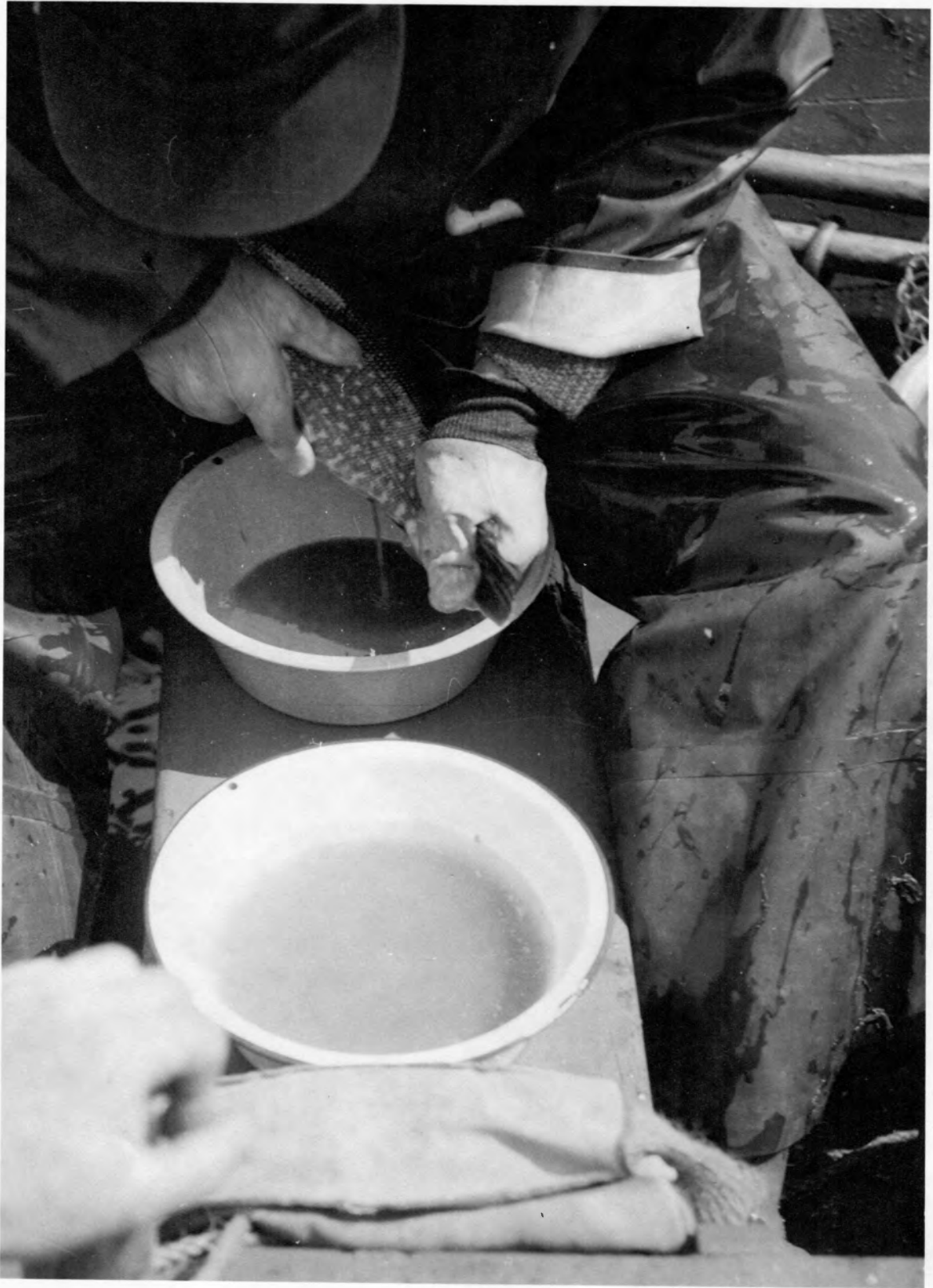


Figure 3.--Stripping a male pike and fertilizing eggs at Lac
Vieux Desert on April 28, 1954.



Figure 4.--A 50-inch ripe female (weighing about 35 pounds)
muskellunge taken in Lac Vieux Desert on May 2, 1954.



was obtained, she was returned to net No. 11. When no other muskellunge had been taken by May 6 in Lac Vieux Desert, this female was returned to the lake. Water temperatures were still 39°, as the unseasonable cold continued, and on May 6 all nets were removed from Lac Vieux Desert.

When no muskellunge had been taken by April 27 in Lac Vieux Desert, some concern was felt that possibly muskellunge were not numerous enough here to warrant netting. It was thought that the low temperatures were responsible for keeping muskellunge from moving into the shallow bays, but according to Wisconsin men a few muskellunge are usually taken early before the main run in this type bay. At the suggestion of Mr. Oehmcke (Area II Coordinator, Wisconsin), a test net was put, on April 27, in the north side (Michigan Bay) of West Bay Lake (T44N, R41W, Sec. 15), Gogebic County, which has a fair reputation for muskellunge. The net (No. 16, see Figs. 5 and 6) was placed amongst stumps and logs in a shallow mucky area between O'Neill's Island and the mainland. Access was gained to the lake from the O'Neill's Island dock (private property). West Bay Lake joins Crooked Lake to the east and, because of the abundance of islands, it is difficult to tell where one lake ends and the other begins. A net (No. 17) was also placed on April 27 in the north end of Crooked Lake near West Bay Lake. While West Bay Lake lies on the Michigan-Wisconsin border, Crooked Lake is entirely in Michigan. Both lakes, however, are in the Wisconsin River (Mississippi) watershed. On April 28, when the water temperature in these lakes was 46° to 47°, a total of 177 pike were taken in these 2 nets. Of these, 13 were females and 164 were males. All males were ripe, as were most of the females, and all fish were small (12-22 inches) and thin, and had a high rate of infection with both Neascus and Chilodon.

On April 30, 2 more nets (No.'s 18 and 19) were put in Crooked Lake, blocking the two access points to a large stump and cat-tail marsh behind

Figure 5.--A typical muskellunge spawning area in West Bay Lake, Gogebic County. Net number 16 is in left background.

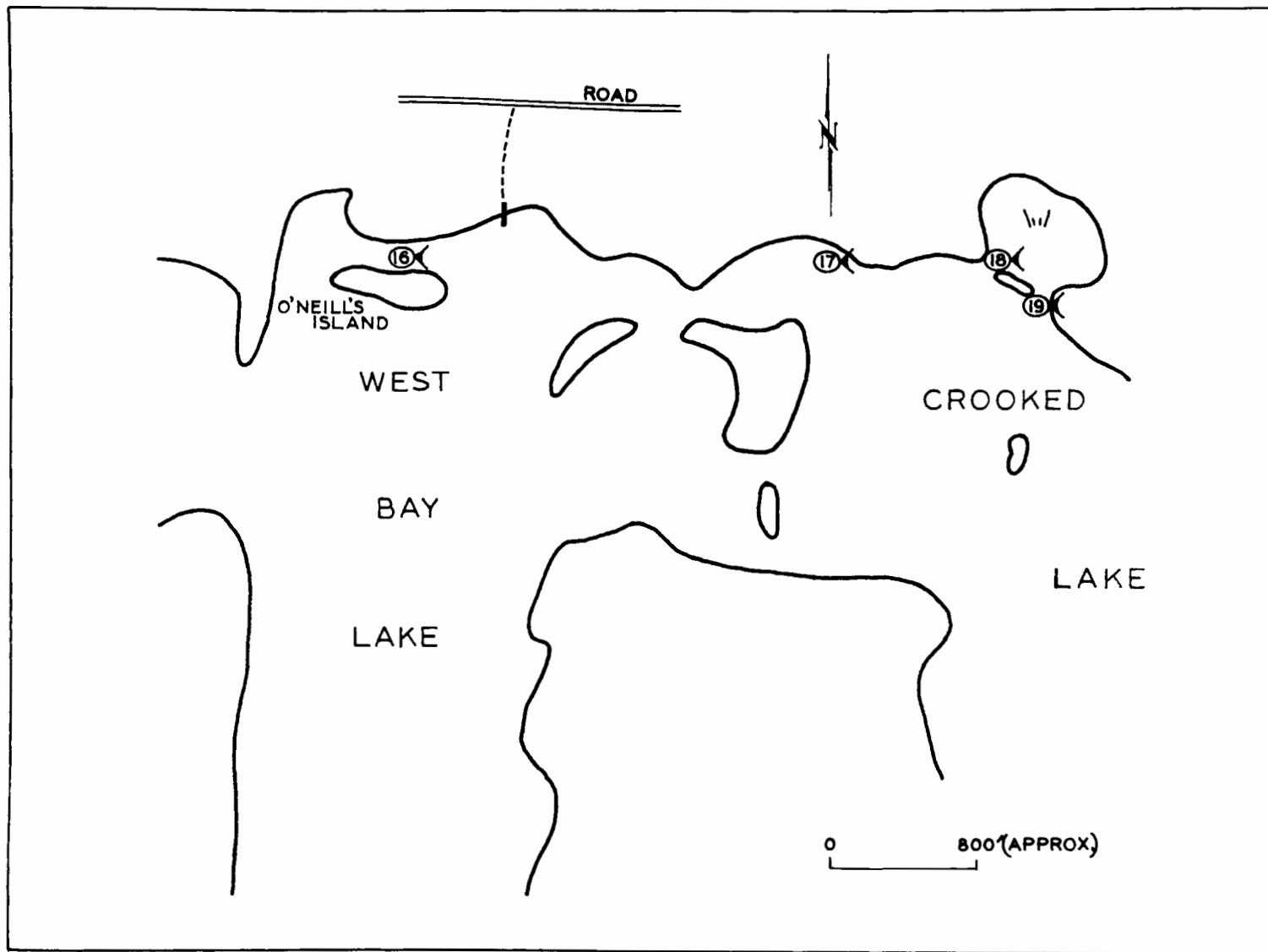


an island (Fig. 6). Water in these channels and marsh was up to 3 feet in depth. By April 30, water temperature here was 48° in the lake and 51° in the marsh. On May 1 the boat, normally tied up at O'Neill's dock, had been taken across to O'Neill's Island and time did not permit us to return to Lac Vieux Desert to get another boat. On May 2, when we recovered our boat, four muskellunge were found in the nets, 1 in No. 16 in West Bay Lake, 1 in No. 17 and 2 in No. 19 in Crooked Lake. Fish were all small (34-38 inches) and included two females (one green and one slightly ripe) and two ripe males. The slightly ripe female and one male were left in net No. 16. Water temperature on this date was 44°, but the lake had probably been 50° on May 1 (Lac Vieux Desert, Thunder Bay, May 1--43°; May 2--49°). Thus these muskellunge may have entered the net between April 30 and May 1, and the females may have hardened slightly in the nets before being checked on May 2.

May 3 was cold, with snow and a water temperature which had dropped to 41° in West Bay Lake. Notwithstanding the weather, three additional fish were taken, a male in No. 16 and a ripe male and a large ripe female in No. 18. One quart of eggs were taken from the female and well fertilized by the males. May 4 continued cold and water temperature here had dropped to 39°; but still, four additional muskellunge were taken, a ripe male in No. 16, a ripe female and a ripe male in No. 18, and a green female in No. 19. About one quart of eggs were taken from the ripe female and 1/2 pint from a small female retained in No. 16 since May 2 (when she was slightly ripe). Milt in sufficient quantity was obtained from the two ripe males. Because of continued cold weather, no additional muskellunge were taken in West Bay or Crooked Lakes up to May 6, when nets were lifted.

All muskellunge were dorsal fin-clipped when returned to the lakes, in order that recaptures in the nets might be noted. None were taken the

Figure 6.--Sketch of sections of the north side of West Bay Lake and Crooked Lake, (T⁴⁴N, R⁴¹W, Sec. 15), Gogebic County, showing 4 net stations fished from April 27 to May 6, 1954.



second time. No mortality was noted from the stripping. One large female, on being released, swam away but returned to the side of the boat 10 minutes later and allowed herself to be lifted into the boat by hand. Upon release the second time, she again swam away in good shape.

Of the total 16 muskellunge taken, nine were males and seven were females (Table III). The males ranged from 33 to 40 inches and averaged 35-1/2 inches, while the females ranged from 36 to 50 inches and averaged 43 inches. Males ranged in age from V years old (33 inches) to X years old (36 inches). Females ranged in age from VII years old (43 inches) to XIII years old (50 inches); the two smallest females were not aged.

The Wisconsin muskellunge observed in the present field work were strikingly different in color and markings from the Great Lakes muskellunge. These Gogebic-Vilas County fish, especially the males, had a metallic, coppery-green sheen which was very striking, being most prominent over the cheeks and gill-covers. The females, which averaged larger in size, were not so vividly marked as the males, and had indistinct dark green bars on a light olive background. The males had the same dark green bars, but the bars seemed more pronounced because the background color was almost white. Fish of both sexes occasionally had the bars broken into spots, especially on the caudal peduncle.

During the morning of May 1, the author went out with the Wisconsin muskellunge-spawning crew at Big Muskellunge Lake, Vilas County. This crew had about eight nets located in one end of the lake. Most of the nets were set perpendicular to marshy, cat-tail shores in shallow (3-4 feet) water with mucky bottom. No stump fields were present. During the preceding week, water temperature at Big Muskellunge Lake had varied from 46 to 48°, and eighteen quarts of eggs had been taken. Big Muskellunge Lake is 8 miles south and 25 miles west of Lac Vieux Desert; hence its warmer

Table III.--Lengths and ages by sexes of muskellunge taken from three Gogebic County lakes in May, 1954

Location	Date	Length in inches		Age*
		Male	Female	
Lac Vieux Desert	5-1	34-1/2		VIII
		36		X
		40		VII
	5-2		45	IX
	5-3		50	XIII
West Bay Lake	5-2		38	
	5-3	34		VII
	5-4	33		V
Crooked Lake	5-2		36	
			34	
			35	
	5-3	36		VII
			46	X
	5-4	37		VII
			43	VII
			44	VIII
Average	35-1/2	43		

*Indicates that one more annulus is included in the age than was present on the scales since the fish were collected in May before annulus formation.

water temperature apparently started the spawning sooner than in the border lakes. On May 1, the eight nets in Big Muskellunge Lake contained about fifteen muskellunge, and two quarts of eggs were obtained from about five ripe females. One of the fish was slightly infected with Chilodon, the first case the author had observed on a muskellunge.

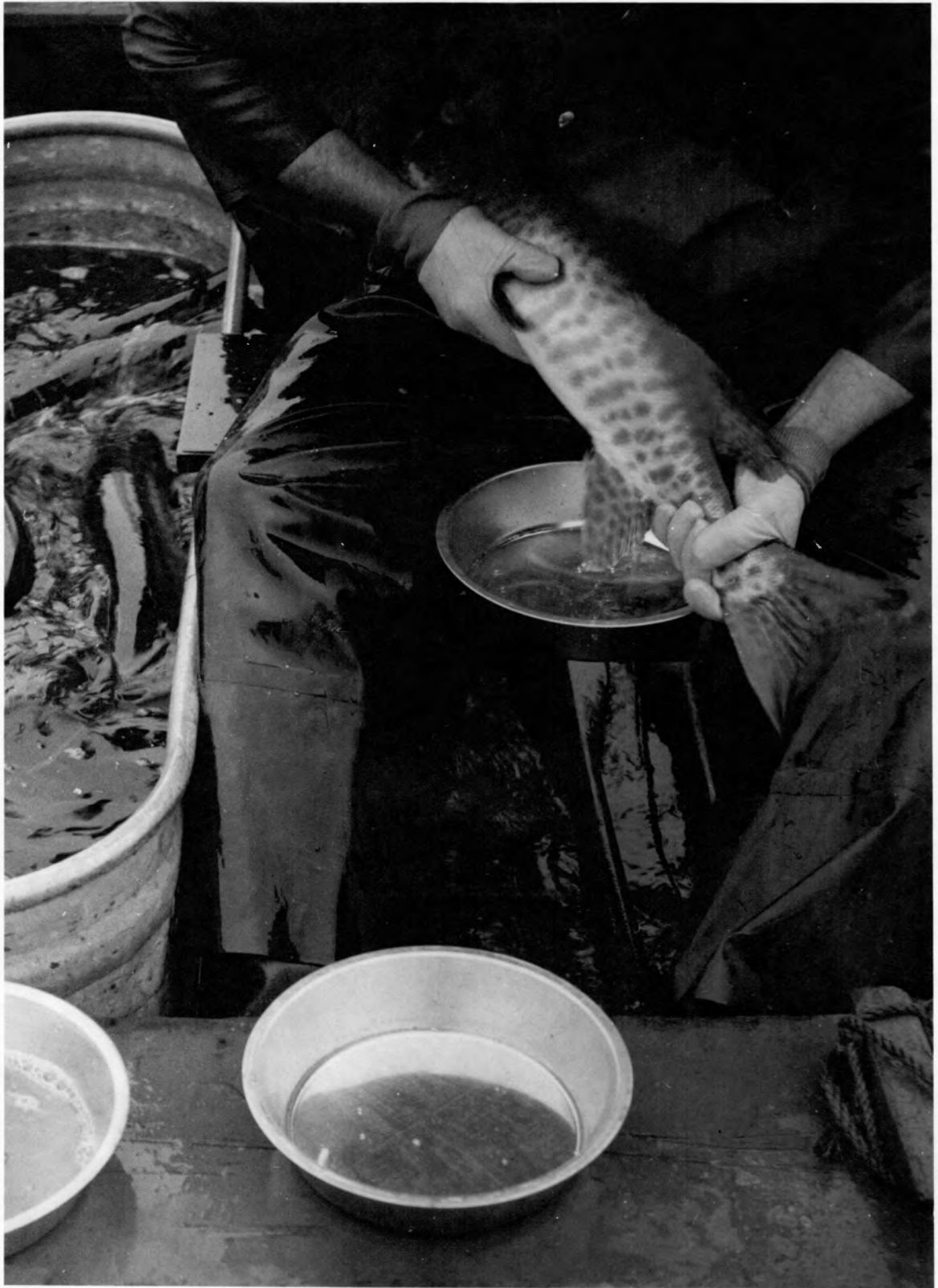
The spawn-taking technique, as practiced by Wisconsin, is time consuming and tedious; yet it must be nearly perfect, for hatches of 70 percent or over are commonplace. Mr. Bud Roberts, the spawn-taker at Big Muskellunge Lake, allowed the author to take 100 feet of colored movie film of the spawn-taking process. This film may be useful to hatchery employees in the future. The spawning procedure is fairly simple. Eggs are taken in shallow, enameled pans containing 1/2 inch of water. Milt is first stripped from a male. The eggs are then taken, as many as it is possible to take in a few minutes (but no more than 1/2 pan full). Immediately thereafter, another male is stripped onto the freshly taken eggs. The mixture is then stirred with a finger and set aside. After several pans have been taken (or no more eggs are forthcoming) and set aside, the first pan is washed clean of excess milt by pouring off the excess water and adding fresh. The other pans are treated in the same manner. At this time, more pans of eggs may be taken if available. The pans are alternately washed with fresh water for 15 minutes to 1/2 hour or until the eggs have hardened and have become completely separated. If the eggs remain well separated, the pans are filled with water by dipping in the lake. If the eggs are sticking to the pan or to each other, they may be loosened by pouring water into the pan from another pan. Muskellunge eggs do not seem to stick nearly so much as pike eggs which continually stick to the pan and to each other, especially when the weather is cold. The agitation necessary to loosen pike eggs may be the reason why an egg hatch of over 50 percent is rarely gotten on pike.

The technique of handling the fish deserves some discussion, since fish of 10 to 50 pounds are extremely difficult to handle by the inexperienced operator. Excessive dropping or flopping of the fish is to be avoided, not only because of the possibility of losing eggs already taken, but because of the possibility of injury to the fish. When fish are taken from the nets (Fig. 8), they are collected in a small sheep tank (about 4-1/2 feet x 1-1/2 feet x 1 foot deep) in the boat. When enough fish have been taken to warrant stripping, the water in the tank is changed and a quiet place selected to tie up the boat. The man doing the stripping sits on a board placed between the tank and the side of the boat, with the tank on his right. A pivoted board can be turned out from under the seat to hold the pan firmly between the stripper's knees. The second man stands behind the spawn-taker. Fish, when selected in the tank, are turned so that they face the opposite direction from that of the spawn-taker. Both men simultaneously grasp the fish; the spawner with his left hand around the caudal peduncle, and the assistant with both hands around the head at the gill flaps. The assistant holds the fish's head by pressing in with both palms on the fish's gill flaps, while holding a pectoral fin between the 2nd and index fingers of each hand. Each of his thumbs are over the nape of the head. Both men wear light, cotton gloves to enable them to hold the fish tightly. Both men lift the fish at the same time out of the tank, bringing the fish up between the spawner's right arm and body. The assistant holds the fish's head as high as possible to facilitate the flow of eggs. The spawner can hold the tail end of the fish easily by the caudal peduncle with his left hand, leaving his right free to strip the fish (Fig. 7 and 8). When green fish are discovered, they are immediately tossed into the lake, as are females that have produced as many eggs as possible.

Figure 7.--Stripping eggs from a female northern muskellunge taken in Big Muskellunge Lake, Vilas County, Wisconsin on May 1, 1954. Note sheep tank at left in which additional muskellunge are kept.



Figure 8.--Stripping a male northern muskellunge at Big Muskellunge Lake, Vilas County, Wisconsin on May 1, 1954. Notice the difference in color pattern between this fish and the female (Figure 7).



As soon as the eggs are water-hardened and completely separated, they are added to a 10-quart enameled pail. When traveling between nets, or to the hatchery, the pail is carried by one of the men to insure that they are not jarred. Upon reaching the hatchery, the eggs are immediately measured in a graduate and each day's take added to a separate hatching jar (two quarts or less per jar) which is labeled with the quantity, date and spawn-taker's name.

Mr. Morgan's technique was similar to that of Mr. Roberts, the only difference being that Mr. Morgan preferred to take the eggs dry (i.e., in a moist pan without water) and to add milt and a small amount of water only after the eggs were taken. Both spawn-takers were extremely careful to take enough time washing and rolling the eggs until they were completely hardened (swollen with water) and separated. No pans or pails were used which were chipped or dirty.

Until eggs could be transported to Drayton Plains Hatchery, they were kept in floating screen trays in a small creek flowing into Pike Bay, Lac Vieux Desert. The trays were tied downstream from a log across the stream which caused the water to well up into the trays, keeping the eggs rolling. It was planned to keep the eggs here only until the Field Administration Division plane from Marquette could come to Land O' Lakes airport and fly the eggs to Drayton Plains. Marquette was called on April 28, as soon as the pike eggs were secured. However, from April 29 to May 5, the plane was unable to fly due to snow and cloudiness. From May 2 on, muskellunge eggs were also kept in this stream in screen boxes. When Marquette reported no possibility of flying until May 7 at least, the author decided on May 5 to drive the eggs downstate. Water temperature of the stream had dropped to 32-1/2° due to the prolonged cold weather, and ice had formed on the top of the screen boxes. The eggs appeared in good shape, although the pike eggs

included a large percentage of white eggs. The eggs were carried in four 10-quart enameled pails which were set in wooden boxes containing a network of rubber straps to support the bottom of the pail. The top of the pail was supported on the rim of the boxes by inner tubes from a power mower. These tubes, when partially inflated, kept the pails from bouncing or from any shock. The eggs were rolled every 1/2 hour by pouring fresh stream water down the sides of the pails. Every hour the water was replaced with fresh water. The temperature was allowed to rise gradually over a period of eight hours from 32-1/2° to 40°, and ice was used to prevent a more rapid rise. At Mackinaw City, after crossing on the ferry, the eggs were turned over to Mr. Hughes, superintendent of Drayton Plains State Fish Hatchery for the remainder of the trip. Since Mr. Hughes had a pick-up truck and an assistant, the eggs were carried in the back of the truck. Since the last part of the trip took place at night, the temperature of the eggs dropped again to about 34°. After reaching the hatchery, they were tempered slowly to hatchery water temperature and added to the hatching jars.

On May 10, when the author returned to Ann Arbor, Drayton Plains Hatchery reported that many of the muskellunge eggs were developing white spots in them. On May 11, the author found that most of the eggs had either turned completely white, when they floated and were removed, or had small irregular white spots in them. Less than 5 percent of the eggs were clear, and amber in color, and showed developing embryos. By May 17, the good eggs were in the ring stage and about five had hatched. A small sample (about ten) of the eggs were taken and carried in the author's pocket for an hour before adding them to alcohol. All of the eggs in the sample had hatched by that time. However, the remaining eggs in the hatchery jars never survived past the ring stage, and only ten fry were available for

planting in a pond on May 18. None of the eggs with the white spots showed any sign of developing embryos. It is not known what the white spot was, but it was suspected that the eggs were weakened by the cold water temperatures which they were subjected to twice. It is known that muskellunge eggs do best on gradually warming water temperatures and that cold water is adverse. The pike eggs hatched at a rate of approximately 60 percent, which is exceptionally good. The fry were strong and healthy and produced good fingerlings. Pike eggs apparently are not so susceptible to cold water temperatures as are muskellunge eggs, for they are commonly laid in shallow water when the daily temperature range is often severe. Muskellunge eggs, however, being laid in deeper water, are not subjected to temperatures much below 40° and thus are not acclimated to water of 32-34°. Another possible explanation for the survival of the pike eggs, but not the muskellunge eggs, is that the pike eggs were from 7 to 8 days old when transported, while the muskellunge eggs were only 1 to 3 days old and may have been in a more tender stage.

A large number of other fish were taken, from Lac Vieux Desert especially, during the netting. In Lac Vieux Desert these included at least 6,405 perch, 744 pike, 450 white suckers, 267 walleyes, 247 black crappies, 165 pumpkinseed sunfish, 22 bluegills, 22 rock bass, 16 largemouth bass, 4 lawyers, 2 yellow bullheads, 2 muddlers, and 2 golden shiners. In West Bay Lake and Crooked Lake, at least 354 pike, 205 perch, 119 bluegill, 27 walleyes, 15 sunfish, 6 white suckers, 5 rock bass and 4 largemouth bass were taken. All fish, except rock bass, in Lac Vieux Desert were of extremely large size. Black crappies mostly ranged from 12 to 16 inches in length, yellow perch from 8 to 12 inches, largemouth bass from 17 to 21 inches, bluegills from 8 to 10 inches, pumpkinseed sunfish from 7 to 8 inches, walleyes from 16 to 28 inches, pike from 17 to 28 inches and white

suckers from 15 to 22 inches. A few fish, smaller than the above figures, were taken for all species except largemouth bass. In West Bay Lake and Crooked Lake all panfish except perch were small, averaging 6 to 8 inches, while perch mostly ran from 9 to 12 inches. Pike were also small in these lakes. Perch spawning was at its peak during this period, as was walleye spawning. Suckers were still green as of May 6. No hybrids (pike X muskellunge) were taken in any of the netting, although Lac Vieux Desert is reported to contain hybrids.

Woodruff Hatchery was visited on May 7, while the hatchery crew were seining up the last of the yearling muskellunge from the ponds for distribution. The fish ranged from 8 to 11 inches in length and were very clean and lively. The fish had large black spots, arranged in bars, on a light background, and exhibited the metallic green sheen characteristic of this sub-species. The ponds were only partially drawn down and were to be emptied and refilled before this year's fry were added, so that no yearlings remain in them. Inspection of the hatchery revealed about 20 quarts of muskellunge eggs which were not yet eyed-up but were clear and amber colored. Several jars of pike eggs were chocolate brown in color and ready to hatch. All jars had very few dead eggs, and the muskellunge hatch was expected to be 70 to 80 percent. All eggs had received a malachite green treatment for the prevention of fungus.

Mr. Oehmcke stated that experiments were to be done this year in several ponds with raising muskellunge fingerlings to about 4 inches, with no forage fish available, but fertilizing the pond to keep a good crustacea bloom and a good crop of insects. This idea has been obtained from Ontario where apparently large numbers of 4-inch fingerlings were raised in 1953 without the use of forage fish. The theory is that, if forage fish are not available, the muskellunge fingerlings will grow at a more even rate and will

not become cannibalistic. If forage fish are available, some muskellunge fingerlings eat them earlier, growing at a faster rate than those which are not feeding on the forage fish. The larger fish then soon start eating the smaller fingerlings. This Wisconsin experiment should be watched with interest.

Another Wisconsin experiment, which has already produced results, should also be watched carefully. In High Lake, Vilas County, 488 muskellunge yearlings were stocked in the spring of 1950. These fish were tagged with a red plastic insert tag in the body cavity. It was expected that these fish would reach legal size (30 inches) and appear in the creel by 1954 when they would be five years old. However, in 1953 anglers turned in fifteen tags from fish over 30 inches in length (four years old). These fifteen fish made up 42.9 percent of the total (35) muskellunge caught in High Lake in 1953. Since these fish had all been above the average size of 10.1 inches at planting time, it is expected that even more of these stocked fish will appear in angler's creels in 1954 than did in 1953. Additional yearlings stocked in Fishtrap Lake in 1951 should begin to enter the creel in 1954.

It is recommended that the Michigan Fish Division buy or have made 10 to 15 fyke nets similar in construction to those used by Wisconsin. Leads of 100 feet in length should be included, and these leads should be at least four feet high for four-foot hoops and five feet high for five-foot hoops. The four-foot size is recommended. The first two hoops (near the lead attachment) should be square or rectangular. There is some question in the writer's mind as to the fishability of the small trap nets used in Michigan, where muskellunge are concerned.

It is further recommended that any muskellunge reared in the future, from eggs secured in the Gogebic County border lakes (i.e., Esox masquinongy

immaculatus), should not be used for maintenance stocking anywhere where Esox m. masquinongy is present. The northern or Wisconsin muskellunge fingerlings should only be used for introductory purposes in Michigan, while only Great Lakes muskellunge fingerlings should be used for stocking lakes already containing this sub-species. Since the two sub-species are different in coloration, as well as in spawning habits, it is desired to keep them separated. If Wisconsin muskellunge fingerlings were stocked in a lake containing Great Lakes muskellunge, the Wisconsin sub-species, hatching earlier, may cause additional predation on the young Great Lakes muskellunge. It may be desired, of course, at a later date, to experiment with the two sub-species in a single isolated lake.

Great appreciation is expressed for Wisconsin's generous assistance and advise in this cooperative venture. The sparing of a man as skilled and proficient as Mr. Morgan, at this busy season, was generous cooperation. Mr. Morgan did everything in his power to insure the success of the operation, and he was in no way responsible for the failure of the muskellunge eggs to hatch.

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