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NOTES ON THE NATURAL REPRODUCTION OF THE WALLEYED PIKE IN LAKE GOGEBIC

by

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Lake Gogebic, the largest of the inland lakes of the Upper Peninsula of Michigan, has its surface area of 14,781 acres approximately equally divided between Ontonagon and Gogebic counties. It is about 12 miles long, is between 1 and 2½ miles wide, and is of relatively shallow depth, with a maximum of 37 feet. The area of the drainage basin is 160 square miles, served by several inlet streams, the largest of which is the Slate River, a stream 75 feet wide at its mouth. The water is dark brown, coming chiefly from swamp areas lying south and west of the lake, whose southern extremity it enters. The lake's single outlet, crossed by a dam 30 inches high near the northeast end of the lake, is the West Branch of the Ontonagon River.

Shoal areas of the lake have a mixed sand, gravel and rubble bottom type, and are very productive of invertebrate food organisms. The water is quite soft (methyl orange alkalinity of 18 to 34 p.p.m.), slightly alkaline, and light brown in color. Shoal areas have moderate amounts of vegetation, chiefly of submergent types.

Lake Gogebic is a designated pike lake, with walleyed pike, northern pike, and yellow perch dominating the game fish population. Black crappies,

smallmouth bass, largemouth bass, rock bass, cisco, and an occasional brook trout complete the game fish population.

The forage fish population in the lake is very limited in numbers and somewhat limited in species composition. The list includes the johnny darter (scarce), mud minnow (relatively common), western long-nosed dace (rare), straw-colored shiner (rare), common shiner (relatively common), trout-perch (relatively common), stickleback (relatively common), and top-minnow (rare). Suckers and lawyers complete the known population.

Smallmouth bass, largemouth bass, bluegills and sunfish comprised the principal game fishes previous to 1900. In the late 1890's, northern pike were introduced and subsequently became the dominant game fish species of the lake, until about 1920, when the walleyed pike, which had been introduced in 1913 as fry, became of first importance in the lake. With its relative, the yellow perch, this species has continued in this position since that time, with the northern pike dwindling in numbers and the centrarchid species becoming increasingly scarce. The relative position of the fish species is to some extent revealed in the results of an intensive creel census conducted in 1940 and 1941. The game fish catch for the two years is shown in Table I. Little perch fishing is done in the lake, so numbers of perch appearing in the census results do not present a true index of their abundance.

Table I

Game Fish Catch in Lake Gogebic, 1940 and 1941
(Estimated 80% coverage of fishing)

Species	1940	1941
Walleyed pike	2,359	
Northern pike	367	
Smallmouth bass	72	
Yellow perch	71	
Black crappie	31	
Rock bass	7	
Largemouth bass	7	

Walleyed pike in Lake Gogebic, with which this paper deals, have been stocked in numbers ranging from 1 to 3 million fry per year during the 10 years previous to 1941. Natural spawning of walleyed pike in the lake has been suspected by local residents for several years, and Richard Bohland, in charge of the creel census during 1940, made brief observations of walleyes which were thought to be exhibiting spawning behavior.*/

In view of the relatively scant information yet available concerning the life history of this important species, the abundance of walleyes in Lake Gogebic, the relative clearness of the water which permits easy observation of fish activity on the shoal areas, and the proximity of the lake to the District Fisheries Biologist's headquarters at Watersmeet, led to a more detailed study of this species by the writer during the spring and summer of 1941. An account of the observations made is included in the following pages of this report.

Field investigations of the spawning of walleyed pike and subsequent development of the fry and fingerlings were undertaken intermittently during the period extending from April 25 to October 20, 1941. Conditions proved to be particularly good for such investigations during the period concerned, as the spawning season was attended by very mild weather, facilitating observations on the usually rough lake, and collections of fry and fingerlings were assuredly wild fish, since no walleyes were planted in Lake Gogebic in 1941.

The ice cover left Lake Gogebic on April 16. By April 13 the Slate River had opened a 1,000-foot long channel into the south end of the lake, and by the following day a wide gap had appeared between the shoreline and the edge of the ice cover. A few floes remained until April 17.

The first inspection of a portion of the area in which the walleyes were said to spawn each year was made on April 25 in the company of

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*/ Bohland, Richard. "Notes on Wall-eye Spawning in Lake Gogebic," Institute for Fisheries Research, 1940 (manuscript).

Mr. Roy Johnston, Supervisor of Fisheries Operations in District No. 1. The area was the same as that at which Richard Bohland had made brief observations the preceding year, along the eastern shore of the lake, near the north boundary of Section 23 (T. 47 N., R. 42 W.). This area, like most of the east shore of Lake Gogebic, has a gradual declivity from the shore to the depths and a bottom type of rubble. Between the rounded boulders is found coarse gravel, underlain with finer gravel and sand. The entire shore is exposed to the prevailing wind, and the rubble is kept washed very clean by almost constant wave action.

Approximately 45 to 50 adult walleyes were seen along the 800 feet of shoreline examined. (Observations were made from a boat, with the aid of a spotlight, at about 11 p.m.) The fish appeared largely singly and in pairs, at depths of from 18 inches to about 4 feet. Besides the singles and pairs, there were seen 4 groups of walleyes in which 4 to 5 fish were grouped rather compactly, in shallow water about 18 inches deep. Immediately upon being placed under the spotlight, the fish leisurely swam outward toward deeper water and disappeared. No actual spawning was observed. The fish could be seen to be heavy with spawn as they passed under the light. Subsequent observations at later dates make it seem probable that spawning was taking place among the grouped walleyes seen. The temperature of the water on the shoals was 39.5°F. Air temperature was 33°F.

Observations were next made on April 28th, from 8:30 p.m. to 1:00 a.m., along a portion of shoreline extending northward from the south boundary of Section 23.

Many fish were observed on the shoals, divided chiefly into closely-aggregated groups of from 3 to 14 fish each. One group of ~~fish~~ walleyes examined in detail consisted of 6 fish, 1 of which was 2 to 3 inches larger than the others, which ranged from 15 to 18 inches in length. The fish were

seen leisurely swimming in the same direction with bodies paralleling the lake shore (although all fish were not abreast of each other), in an area about 5 feet wide by 10 feet long, which was partially enclosed and protected from direct wave action by heavy rock boulders and a driftwood log about 5 inches in diameter. The water averaged 10½ inches in depth and had a temperature of 48°F. The bottom type was rough gravel and rubble.

A second group of 9 fish was seen in a similar semi-enclosed area, about 11 feet by 10 feet, with water 7 to 8 inches deep, at a temperature of 46°F.

Many additional groups of walleyes were noted in water ranging from a foot to 2 inches in depth. Some groups of fish were seen with their dorsal fins and portions of their backs protruding from the water. Considerable splashing was heard along much of the lake shore, apparently caused by milling walleyes attempting to get back to deeper water after they had partially stranded themselves on the shoals. The individuals composing various groups were counted to determine the average numbers found in a typical group. As taken from the field notes, the numbers of fish composing groups, counted as they swam toward deeper water when a light was placed on them, follow: 7, 5, 8, 7, 3, 7, 6, 5, 9, 6, 7, 4, 5, 7, 5, 3, 7, 7, 8, 2, 6, 11, 13, 7, 6, 5, 8, 7, 9, 10, 5, 9, 4, 4, 9, 8, 14, 6, 8, 13. These figures indicate an average of 6.7 fish per group, with 7 being the number most commonly observed. Much effort was expended in attempting to trap with a seine an entire group to determine its size, age, and sex composition, but this information could not be collected during the course of the observations. Several adult fish were captured with a common sense seine, but the rubble bottom made seining difficult and permitted most of each group to escape. The groups were undisturbed by relatively close approach as long as no light was used. Entire groups

might be captured by enclosing the sides of a known spawning area with suitable structures during daylight hours, and completing the enclosure, after the fish have taken their positions, after dark, with a seine stretched across the lake-ward side of the "trap." A smaller seine could then be used to remove the trapped fish.

The number of groups was counted along an area of shoreline extanding from the north boundary of section 26 northward to the middle of section 14 (1½ miles). One hundred thirty-seven groups were seen. (At 6.7 fish per group, this would amount to 918 fish. Singles and doubles were not counted, however).

Two fish were collected by spearing. The first was a male 13½ inches in length, weighing 15 1/4 ounces, taken from a group of 6 which had been grouped over about 6 inches of water at 46°F. The second, a 16 3/4 inch male, weighing 1 pound, 13 3/4 ounces, was taken from among 13 walleyes milling about in water 8 to 13 inches deep, at the same temperature. Rubble and coarse gravel was the bottom type in both cases.

Eggs were sought on the bottom shoal areas but none were found.

On April 29, observations extended from 7 p.m. to 12 p.m., at an air temperature ranging from 54°F. to 50°F. The first group of walleyes was seen at 7:15 p.m. Water temperature on the shoals was 48°F.

A 13 3/4 inch, 14 3/4 ounce male was collected as he left the spawning area toward deeper water.

The fourth fish collected and preserved was a 24 inch, 4 pound 12 ounce female. This fish was seen swimming leisurely over rubble (among which were boulders up to 2 feet in diameter), at a depth of from 2 to 3 feet. Four smaller fish, from 14 to 16 inches in length, darted above, below and beside her, within close range, but no actual spawning was observed. Upon collection, eggs flowed freely from her vent upon the slightest touch of

her sides. The vent was normal in appearance.

The first collection of eggs was made near the north boundary of Section 14. A group of 10 to 15 walleyes was seen swimming about in a close group in shallow water, and it was strongly sensed that spawning had been taking place. The area concerned was backed by an 8 inch log on the shore side and had a bottom type of coarse gravel. The average water depth was 4 1/2 inches. To secure the eggs, the topmost layer of gravel was removed, revealing a substratum of fine gravel and sand. The back of the opened hand was placed on the bottom and then suddenly closed, to cause an upward swirl in the water and bring up sand fragments, debris, and eggs from the bottom. The eggs were collected in the palm of the hand as they floated back down through the water. They did not appear to be at all adhesive. Their specific gravity was only slightly greater than water. They were quite hard when held between the fingers. A few eggs were left to return to the bottom from the surface. Upon hitting a boulder, an egg would stop temporarily in its downward movement, but the gentle wash of the waves would jar it loose and it would slowly filter down through the boulders and gravel until the firmer substratum was reached. All eggs were seen only singly, and never adhered in groups. Apparently each egg filtered down through the rubble as it was laid, its descent being assisted by waves and the water disturbances originated by the movements of the parents.

It should be stated here that later observations revealed that some, although not the majority, of eggs are somewhat adhesive, and actually adhere to the rocks and pebbles on the bottom. One rock about 2 inches in diameter had adhering to its upper and lateral surfaces 20 such individual eggs. A slight touch of the finger was sufficient to dislodge them, although a "swish" of the rock through the water did not always do

so. The reason why some eggs adhered while others were perfectly free could not be ascertained. Possibly those adhering were more recently deposited.

Many bottom organisms were present on the shoals, but no egg predators in the form of young fish or minnows were seen at any time during the course of the observations.

On April 30, an attempt was made to determine at what depths spawning had occurred. Eggs were collected from the bottom at measured depths ranging from 2 1/2 to 49 inches. It was difficult to take samples at greater depths, and the latter figure may not represent an extreme. Although no quantitative checks were made, it appeared that eggs were most abundant in water depths ranging from 5 to 7 inches. Upwards of 50 per cent of the eggs collected were cloudy or had white spots (infertile?).

The walleyes were seen during the daylight hours, and none had appeared on the beds by 7:30 p.m., by which time it had become too dark to see below the surface of the water without an artificial light. The suspicion that walleyes were purely nocturnal spawners was verified on the following day, when observations were begun at daybreak (about 4:30 a.m.). As the walleye spawning beds were approached and some of them passed with an outboard motor at a distance of about 20 yards, an occasional, infrequent swirl could be seen near shore, where a fish was leaving the shoal, being frightened by the motor. It was immediately evident that by far the most of the fish had already left the shoreward areas. As soon as it became sufficiently light to see beneath the surface, the shoreline was carefully approached from the land, but no walleyes were seen along about 800 feet of shoreline examined, where walleyes had been seen in large numbers during previous nights. By 5 a.m., then, there were no longer any walleyes on the shoals. That spawning may continue to occur at depths above 5 feet, during

the day, where it cannot be observed, is a possibility that should be considered.

On April 30, the rubble was carefully removed from an area along the shoreline on which walleyes had been seen spawning. A strip of fine-count cheesecloth was laid down on the gravel and sand substratum, covering an effective area of 28 inches by 82 inches, after which the rubble was carefully replaced. Water covered the plot to depths of from 2 to 6 inches. On May 1, the rubble was again removed and the eggs were found to be present lying loosely. This sample was preserved. (In separating the eggs from the bits of sand and gravel, it was found best to place a portion of the mixture in a white enameled pan, shake it back and forth vigorously, and then quickly pour off the water (and eggs) through a fine mesh sieve(or cheese-cloth.) The eggs remained in suspension long enough to permit them to be poured off readily with the water, while the heavier rocks, sand and debris remained in the enameled pan.) A count revealed that 9,050 eggs had been laid on the area between 7:30 p.m. on April 30 and 5:00 a.m. on May 1. Water temperatures ranged from 47° to 50° during the course of the night. On the night of May 1, a group of 5 walleyes was seen over the area which the sample plot had covered. It was not possible to determine whether this group was alone responsible for the deposition of the eggs collected. The matter of whether walleyes return to an identical spot night after night to spawn, or remain in one location throughout an entire night remains to be determined.

On May 1, observations were carried on from 5 p.m. to 2 a.m. Air temperature at 7:30 p.m. was 56°; shoal water temperature 47°. The first walleyes appeared on the shoals at 7:40 p.m.

Observations were made to determine the extent of the spawning grounds. Walleyes were seen along the shore from the north boundary of Section 26 (a few scattered fish south of this point) to the intersection of the east line of Section 4 with the lake shore, about 1 mile northwest of 6-Mile Bay. One exception was noted in 6-Mile Bay. This bay is very shallow, with a wide shoal of pure sand. It is somewhat protected from wind action. No walleyes were seen along the quarter-mile of shoreline having these characteristics, and which bounds the main "bulge," or "pocket" of the Bay. Walleyes were extremely abundant on the shoals north of Montgomery Point. On several occasions, upwards of 30 to 50 walleyes could be seen within a length of 50 feet of shoreline, forming what looked like a single, extended, contiguous group.

The point mentioned did not represent the northern extremity of the spawning grounds, so a further check was made at a later date (May 17). Walleyes were seen in undiminished numbers up to the south line of Section 7, at which point they diminished in numbers and disappeared within the next 1,000 feet. At this point the rubble ceases to be washed clean by wave action, and considerable silt is present. Several attempts to locate any signs of walleye spawning on the west shore of the lake failed, and no natives have ever reported seeing walleyes along the west shore.

On May 1, it was further decided to census by actual count the numbers of walleyes along a typical mile of shoreline. This was done between the north and south boundaries of Section 14, which were located by Forest Service markers. The boat was rowed along at a distance of about 20 feet from shore, with a man with a spotlight in the front end of the boat. The light penetrated the water to a depth of about 4 feet. The unmistakable orange-red, semi-irridescent gleam of the eyes of the walleyes as the light

was thrown upon them made counting relatively simple, with a possible error of 4 or 5 per cent. In this manner, 862 walleyes were counted along the mile of shoreline. (The meandering lake shore would make the length of shoreline covered considerably more than a mile, however.) This same mile of shoreline was censused on the night of May 3, when 1,016 fish were seen. (By counting measured lengths of shoreline selected at random throughout the length of the spawning area, not only could the true height of the spawning season be accurately determined, but something of an estimate of the total number of adult fish in the lake might be arrived at.)

The actual spawning act was first seen on the night of May 1. In the first observation, only 2 fish were involved. One was about 18 inches long and the other 2 to 3 inches shorter. Three submerged rocks, of a diameter of about 10 inches each, formed a rough triangle on the bottom. The space between them was just large enough to hold the two fish. A gravel bottom covered the area between the rocks. It was covered by 4 inches of water. The two fish when first observed were lying parallel with each other, facing in the same direction, out toward the lake. Their bodies were not closely appressed when first seen, but were within a half inch of each other. The fish were lying quietly in the water, with barely perceptible motions of the tail and fins. Suddenly and simultaneously each fish tilted its body slightly toward the other in a manner such that their vents became closely appressed. Fanning with the tail became somewhat more vigorous and a slight quivering of the bellies was observed. The action lasted about 2 seconds, after which time the fish resumed their original position, became alarmed, and left for deeper water. It could not be observed whether any eggs or milt were showered from the vents, but it was without question the spawning act.

The second detailed observation was made of a group of 5 fish. They were swimming abreast in about 2 feet of water, over a rubble bottom. Between 2 large boulders, over a small area of coarse gravel, the group stopped its very slow forward progress. All 5 bodies, facing in the same direction, became very closely approximated, to the point of touching, as nearly as could be observed. This position was held again for about 2 seconds, after which the fish were alarmed by the light and swam toward deeper water.

Two fish were again involved in the third observation of the spawning act. As the light first shown on them, they were swimming leisurely along in about 2 feet of water, over a rubble and coarse gravel bottom. Between 2 boulders they stopped and settled slightly closer to the bottom. Again as in the first observation, both bodies turned slightly sidewise so that their vents formed the vertex of a somewhat acute angle formed by the short axis of their bodies. There was a quickening of fin and tail action, and a very slight quiver of the bodies. After holding the position for a moment, the normal upright position was again assumed and the fish proceeded forward as before. At this point they were frightened by the light and dispersed.

It will be only after several complete spawning groups have been captured and the sex of the individuals composing the groups determined that much can be said about the various ramifications of the spawning act. Whether each sex is about equally represented in the groups has not yet been determined. The observations permit one to conclude, however, that the spawning act may take place with only two fish, a male and a female, or with more than 2, of unknown sex. It is believed that 4 of the 5 fish seen exhibiting what was interpreted as spawning behavior were males, but this could not be checked.

The next observations were made on May 10. Shoal temperatures had risen to 54.5°F. (2:00 p.m.). A collection of eyed eggs was made and preserved. Bodies of fry within the egg were well developed, and the eggs seemed to be within 2 or 3 days of hatching. The collection was made in water from 1 to 3½ feet deep, near the north boundary of Section 14. In making the collection, boulders were moved with the foot, a "swish" was made across the area with the foot to cause a swirl of the water to keep the eggs in suspension for a moment, and a fine-mesh scap was drawn through the swirl to obtain the eggs.

On May 14 the shoal temperature was 54.5° and the air temperature at 7 p.m. was 63°F. Walleyes were still on the beds in groups, but in somewhat diminished numbers. Eggs which were apparently very freshly laid were found on the immediate area where groups of fish were seen. No fry could be located.

On May 17 and May 19, groups of walleyes were still seen on the shoals, and very recently deposited eggs were collected on the rubble beneath the immediate point of aggregation of some of the groups.

No furtherobservations were made at night due to continued inclement weather. On May 21, 5 adult male walleyes were collected from the immediate vicinity of the spawning beds (by angling). Gonads were still large and distended and milt ran freely upon the slightest touch of their distended sides.

Table II shows air and shoal water temperatures during at least the principal portion of the spawning period.

By June 16, an extensive collection of what were thought to be walleye fry was taken but later identification proved that they were yellow perch. The shoal water temperature in the vicinity of the spawning beds

had risen to 66°F. (11:00 a.m.; air 63°).

Table II

Water and Air Temperatures During Spawning Season

Of Walleyed Pike in Lake Gogebic

(Fahrenheit)

Date	Time	Air	Water (on shoals)
April 25	11:00 p.m.	33°	39.5
April 28	8:30 p.m.	59°	46° - 48°
April 29	1:00 a.m.	49°	
April 29	7:00 p.m.	54°	48°
April 29	12:00 midnight	50°	48°
April 30	7:30 p.m.		50°
May 1	7:30 a.m.		47°
May 1	7:30 p.m.	56°	47°
May 10	2:00 p.m.		54.5°
May 14	7:00 p.m.	63°	54.5°

The first collection of walleye fry was made on June 25. Two specimens were taken near the north boundary of Section 14. The walleyes were in close association with young-of-the-year perch, schooling with them (1 or 2 walleyes to a school of 10 to 30 perch). The fish appeared to be feeding on plankton (a heavy algal "bloom" was on the lake) near the surface. The collection was as follows:

Standard length	Total length	Weight
29 mm.	36 mm.	0.4 gr.
32 mm.	40 mm.	0.5 gr.

The perch with which the walleyes were associated averaged almost 30 millimeters in total length.

The fish were collected with a fine-mesh seap. The water temperature on the shoals was 79° (11:00 a.m.)

A second collection of walleyes was made on July 8. A number of fry were seen with perch schools, but the seap used on June 24 proved inadequate

to capture them. Two fry were taken--one was found dead on the surface, and the other had an injured eye. The collection follows:

Standard length	Total length	Weight
36 mm.	45 mm.	0.9 gr.
44 mm.	54 mm.	1.5 gr.

That the dead and injured walleyes collected were below average size for their age was shown in a more extensive collection made on July 10. Attempts at collection of walleyes were begun in 6-Mile Bay, with a common sense 1/8-inch mesh 6 feet by 4 feet minnow seine. Many perch and 2 walleyes had been collected by the time the middle of Section 14 had been reached (along the lake shore). The first of these was secured under a log extending out into the water, and a second taken with some perch among some large boulders.

Near the middle of Section 14, a small cove, about 200 feet wide at the mouth and extending back about 250 feet interrupts the relatively straight shoreline. Water is from 2 to 6 inches deep. In this cove, 18 walleyes were collected.

A number of schools of perch (young of the year) were seen, and each school, or at least each of the several schools observed, was accompanied by from 1 to 5 walleyes. The latter seemed to be participating members of the perch schools, and seemed to be actively feeding with them. No walleyes were seen feeding on the surface, as the perch sometimes did, however. Their feeding range seemed to be restricted to water well below the surface (4 to 6 inches). The walleyes in the schools could be easily distinguished from the perch because of their larger size, lighter color, translucent body sheen, and absence of vertical striping. When a school fled from pursuit, the walleyes were frequently at the head of the group, being faster as a result of their larger size. Each seine haul in the cove produced from 1 to 4 walleyes and 10 to 40 perch. No other species

were seen. Water temperature at the time of collection was 77°F.

Further observations were made from a dock near the pike hatchery at the south end of Lake Gogebic. In about 18 inches of water, a group of 14 walleyes was seen feeding, rather closely grouped, with no perch in the school, even though perch were in the vicinity. One walleye was collected to insure correct identity of the school. The group was feeding in vegetation (lily pads and rushes) of light density. As the school swam about in the water, various of its members could be seen to dart slightly forward from time to time, to supposedly capture a plankter. The school remained close together as a rule, and although it temporarily broke up into 2 or 3 smaller groups at times, the entire number always reassembled. They stayed within 25 feet of the spot at which they were originally seen throughout the afternoon.

In the same immediate vicinity, and covering much the same territory in its movements as the above-described school, there was a school of about 15 perch, accompanied by 4 walleyes actively feeding and swimming with the perch, as noted above. The walleyes showed no disposition to move over to the pure walleye school nearby.

Since both types of groups were seen, mixed and pure, it might be assumed that the point had been reached in the life history of the walleye at which the species discontinued association with the perch (which it had by this time considerably outgrown, the average total length of 43 perch preserved on July 8 and 10 being only 43 millimeters), and formed schools of its own. On the other hand, there may have been pure schools of walleyes at earlier stages which went unobserved. Further research will clarify this detail.

The walleyes observed near the hatchery were the first ones observed which were far distant from the known spawning grounds. The fish were

about 2 3/4 miles from the closest known spawning area.

The entire collection of July 10 follows:

Table III

Walleye Collection of July 10, 1941

Standard length (millimeters)	Total length (millimeters)	Weight in grams
53	65	2.3
53	64	2.3
48	58	1.5
57	68	2.7
63	76	3.5
66	75	4.4
60	72	3.2
61	74	3.6
58	70	2.8
53	65	2.1
53	65	2.3
57	68	2.8
52	62	1.9
58	70	2.7
51	61	2.0
53	64	2.1
58	69	2.7
53	64	2.2
48	58	1.5
45	56	1.5
49	59	1.6

A walleye collection was again made on August 2. No walleyes could be taken along the east shore where previous collections had been made, or in small bayous and inlet streams where seining was attempted.

The fish were finally located just off the south side of a small sand bar extending from near the pike hatchery out into the mouth of the Slate River. A 40-foot, 1/4-inch mesh seine was used. The walleyes were found to be about 20 feet from shore, in about 3 feet of water. The single seine haul brought in about 50 walleyes (of which 37 were preserved), 6 to 10 young-of-the-year smallmouth bass, about 6 to 8 young-of-the-year perch, about 10 yearling perch, several large common shiners, and a few young-of-the-year suckers. These must all be regarded as having been to some degree

in association with the walleyes at the time of seining. Although the identity was not certain, it is believed that the walleyes were seen in a single school, darting along near the bottom. A school of yearling perch feeding on the surface as the seine was encircling them was not accompanied by young walleyes, although representatives of the two groups were of much the same size.

Water temperature on the sunny, sandy shoal was 81.5°F. at the surface at 2 p.m. Air temperature was 71°F.

Weights and measurements of the walleyes preserved are shown in Table IV. The extent to which the walleyes had by this time outstripped the young-of-the-year perch is indicated by measurements of 34 of the latter which were collected on the same day. Their average total length was 57.7 millimeters.

Table IV

Weights and Lengths of Walleyes Collected

at Lake Gogebic on August 2, 1941

Standard length (millimeters)	Total length (millimeters)	Weight (grams)
88	106	10.0
88	105	11.1
92	110	12.4
85	103	10.7
83	101	8.7
94	113	13.5
96	116	13.9
92	111	12.2
91	109	12.9
90	109	11.7
86	105	10.3
86	104	10.2
86	101	9.6
81	98	8.6
82	100	8.2
75	91	7.3
85	103	9.5
78	96	7.5
79	96	7.2
87	100	8.6
87	103	10.5

Standard length (millimeters)	Total length (millimeters)	Weight (grams)
96	116	13.8
92	111	11.7
89	106	11.0
89	107	10.1
85	103	9.5
90	108	11.2
92	111	11.7
88	107	10.8
76	91	7.2
82	99	9.3
81	97	8.3
78	95	7.8
85	103	9.4
78	96	8.2
78	95	7.9
80	96	8.3

A further collection of walleyes was made during the period extending from October 16 to October 21. A 200-foot, 3/4-inch mesh gill net was set out from the hatchery, crossing the shallow sandy area where the August 2 collection had been made. Three young walleyes were taken on October 17, 5 on October 18, and 2 on October 20. Never were two fish taken within 25 feet of each other in the net. This would not indicate very compact schooling of the fish, if that takes place at all at this time. All fish were caught within 6 inches of the bottom of the net, at points where it was set in from 4 to 6 feet of water. Three young of the year perch were taken in the net during the period. Six of the 10 walleyes had been attacked by northern pike or/and walleyes after being caught in the net. Three adult northern pike and 3 adult walleyes were taken in the immediate vicinity of captured walleyes, when they apparently grabbed a mouthful of twine in their attempts to capture the young walleyes. It would appear from this that young walleyes form very acceptable food items for their parents, as well as northern pike, at this stage in their existence.

Statistical data concerning the walleyes collected are shown in Table V.

Table V

Walleyes Collected in Lake Gogebic

from October 16-21, 1941

Standard length	Total length	Weight
144	172	41.1
126	153	31.7
135	167	37.2
120	146	26.6
121	148	27.9
124	151	26.9
132	158	32.1
135	165	38.3
125	152	30.0
127	157	31.0

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