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A FISHERIES SURVEY OF ROLAND AND GERALD LAKES,

HOUGHTON COUNTY

by

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Roland Lake and Gerald Lake (Twin Lakes) are located in Elm River Township, Houghton County, in the western portion of the Upper Peninsula of Michigan. The former lake covers portions of sections 14, 15, 22, 23, and 27 of T. 52 N., R. 36 W., and the latter occupies a part of the area of sections 13, 14, 23, and 24 of the same town and range. The outlet of Gerald Lake flows into Roland Lake. Both lie near the eastern headwaters of the Misery River. The southwest end of Gerald Lake is within a few hundred feet of the northeast end of Roland Lake.

The Village of Donken is situated about 4 miles north of Twin Lakes, and the Village of Mass is 15 miles to the southwest. Highway M-26 passes just to the west of both lakes, as does a branch of the Copper Range Railroad. Sandy and Emily Lakes are 3 miles south of Roland Lake and Gerald Lake.

The maps of Roland and Gerald Lakes, showing shorelines, shore features, depth contours and bottom types, were prepared by an Institute for Fisheries Research lake survey party in August of 1937. Regular

* The survey party included: Franklin Bond, leader; John Greenbank, Wm. Beckman and Ted Monti, assistants.

chemical and biological inventories were made by the same party on Gerald Lake, August 24-26, 1937, and on Roland Lake on August 22-24 of the same year.

These lakes are not known to have been used for any industrial purposes in the past. Roland Lake has, for some years, been the site of Twin Lakes County Park, and its increasing development for recreational purposes, as well as that of the nearby Gerald Lake, has more or less paralleled increasing use of the park. At the time of the survey, there were 32 cottages on the shore of Roland Lake and 26 on the Gerald Lake shore. These numbers have increased somewhat since that time. There is a boat livery at each lake. The extensive sandy beaches found on both lakes are much used for swimming.

Little is known concerning the past history of the fishing in these lakes. They have for many years been fished principally for smallmouth bass and have provided fair to good fishing. Other species of fish were seldom taken in goodly numbers.

Roland and Gerald Lakes are at present among the more important fishing waters of the Upper Peninsula, and they will very probably continue to be much frequented by anglers and other recreationists in the future.

Physical Characters of Roland and Gerald Lakes

Roland and Gerald Lakes are fairly large lakes, relatively shallow in depth and irregular in shape. The former has an area of 292 acres while the latter has an acreage of 255. Each has a maximum depth of 41 feet. Roland Lake has a single major depression, located in the south-central portion of the lake. Gerald Lake is practically subdivided into 2 different lakes, separated by a narrow neck of water less than 5 feet in depth. The larger eastern bay of this lake has a maximum depth

of 41 feet, while the smaller western section (sometimes called Little Gerald Lake) reaches a depth of 26 feet. Roland Lake has a shoreline development of 1.78, while that of Gerald Lake is 2.03. This means that the lakes have 78 per cent (1.78 times) and 103 per cent (2.03 times) more shoreline, respectively, than perfectly circular lakes of the same areas. Ordinarily, lakes with extensive shorelines (which provide food, shelter and spawning facilities for many species of fish) are more productive than are lakes with low shoreline developments.

Roland and Gerald Lakes are very probably of glacial origin. However, nothing is known about their geological past.

The country surrounding these lakes, including all of their drainage area, is from moderately to densely wooded and has essentially sandy soils.

The water level in Roland and Gerald Lakes is controlled by a dam in the outlet of the latter, which backs up about a 2-foot head of water. The dam is not passable to fish. Fluctuations in the levels of Roland and Gerald Lakes are limited to about 2 feet, according to the report of the survey party. It is not known whether this fluctuation is due to the operation of the dam or occurs only during the spring runoff or during times of heavy precipitation.

Gerald Lake obtains its water supply from direct runoff and from 2 small, intermittent streams. Direct runoff and the outlet of Gerald Lake supply Roland Lake with its water. The drainages of the two lakes is limited to about 3 square miles.

About 20 per cent of the areas of both Roland and Gerald Lakes is sufficiently shallow to be potentially capable of producing aquatic plants. The shallow portions of the lake, extending down to depths of about 25 feet, have sandy soils. No gravel beds are known to be present in either

lake. The deeper waters in both lakes have a pulpy peat substratum. Small patches of fibrous peat cover the sand in a few places.

Water in both Roland and Gerald Lakes was light brown in color at the time of the survey. A Secchi disk (small, white disk about 6 inches in diameter), when lowered into the water, disappeared from view at an average depth of 9 feet in Gerald Lake and at a depth of $8\frac{1}{2}$ feet in Roland Lake. The degree of transparency of the water is an important factor in determining the depth to which aquatic plants will grow in a given lake. None of the higher aquatic plants are able to survive in the continued absence of light.

Temperature and Chemical Characters

As a part of the surveys conducted on Roland and Gerald Lakes, various temperature and chemical data concerning the lake water itself were collected. Temperature of the water at various depths was observed, the amount of dissolved oxygen and minerals in the water was determined, and other chemical data were obtained. Such information is frequently very important in determining the degree of suitability of a lake for the various fish species.

A summary of the temperature and chemical data obtained at Roland and Gerald Lakes during the surveys is shown in Table I.

Table I
Summary of Chemical and Temperature Conditions
in Roland and Gerald Lakes,
August, 1937

| Lake | Roland | | Gerald | |
|--------------------------|-------------------------------|---------------------|---------------------|---------------------|
| Station | 1 | 1 | 1 | 2 |
| Location | South-central portion of lake | Center of small bay | Center of small bay | Center of large bay |
| Date | 8/24/37 | 8/25/37 | 8/25/37 | 8/25/37 |
| Air temperature, °F. | 73 | 70 | 70 | 70 |
| Surface temperature, °F. | 70 | 71 | 71 | 72 |
| Bottom temperature, °F. | 53 | 58 | 58 | 54 |
| Maximum depth, feet | 40 | 21 | 21 | 40 |
| Thermocline | | | | |
| Location | 20-30 | 16-21 | 16-21 | 20-30 |
| Temperature, °F. | | | | |
| Top of | 67 | 67 | 67 | 67 |
| Bottom of | 54 | 58 | 58 | 55 |
| Oxygen, p.p.m. | | | | |
| Surface | 6.9 | 7.2 | 7.2 | 7.2 |
| Bottom | 0.2 | 0.8 | 0.8 | 0.4 |
| Methyl Orange Alkalinity | | | | |
| Surface | 11 | 13 | 13 | 13 |
| Bottom | 31 | 40 | 40 | 31 |
| pH | | | | |
| Surface | 5.8 | 5.8 | 5.8 | 5.8 |
| Bottom | 5.6 | 5.8 | 5.8 | 5.6 |

Water temperatures in Roland Lake range from 53° to 70°F., and in Gerald Lake from 54° to 72°F. Both lakes have a thermocline (zone of rapid change of temperature, e.g., 1°C. or more per meter of depth).

Oxygen is adequate for all species of fish in the area above the thermocline, but is insufficient in amount to support fish life below the top few feet of this zone. A slight taste of hydrogen sulfide, a decomposition product, was observed in bottom samples taken from Roland Lake.

Methyl Orange Alkalinity tests, made to determine the amounts of certain minerals and salts dissolved in the water, showed Roland and Gerald Lakes to be quite soft. A dissolved mineral and salt content

of from 11 to 31 parts per million was found in Roland Lake, while in Gerald Lake the range was from 13 to 40. Moderately hard waters are ordinarily more productive of fish than are soft waters. A Methyl Orange Alkalinity of from 100 to 200 parts per million is generally considered necessary for high productivity.

The water of Roland and Gerald Lakes is moderately acid. The pH (hydrogen ion concentration) of Gerald Lake ranged from 5.3 to 5.8, and in Roland Lake the range was from 5.6 to 5.8 (7.0 is neutral). Moderately alkaline waters are ordinarily more productive than are waters with an acid reaction.

No pollution was found to be present in Roland and Gerald Lakes. There are no sources of industrial pollution in the vicinity, and the very small amounts of domestic wastes which probably reach the lakes are insufficient in amount to significantly affect the fisheries there.

Biological Characters

In determining the biological nature of Roland and Gerald Lakes, several types of data were collected. Representatives of the various species of vegetation in the lake were gathered and identified. Samples of plankton (microscopic free swimming and floating plant and animal life) were collected and the invertebrate bottom foods present in the lake were studied. Fish collections, including a sample of the various sizes and species present in the lakes, were made for studies of growth, condition, parasitism, etc. Spawning facilities for the various species were evaluated.

Roland and Gerald Lakes were found to support a fairly good growth of aquatic vegetation for acid, soft-water lakes. Gerald Lake has the most water plants, both in numbers and species, probably largely because

it has several well protected bays on the windward side of the lake. Although some of the more exposed areas of sandy beach have almost no vegetation, a thin strip of aquatic plants (essentially emergent forms) skirts most of the shoreline of both lakes. A summary of the species of vegetation found in the two lakes, with an estimate of their abundance, is shown in Table II.

Table II
Species of Vegetation Collected At
Roland and Gerald Lakes.

| Species | Abundance | |
|---|-------------|-------------|
| | Roland Lake | Gerald Lake |
| Bulrush (<u>Scirpus acutus</u>) | Abundant | Abundant |
| Bulrush (<u>Scirpus subterminalis</u>) | ... | Common |
| Yellow water lily (<u>Nuphar advena</u>) | Very common | Abundant |
| White water lily (<u>Nymphaea odorata</u>) | Very common | Common |
| Coontail (<u>Ceratophyllum demersum</u>) | Common | Sparse |
| Dusky pondweed (<u>Najas flexilis</u>) | Sparse | ... |
| Water shield (<u>Brasenia Schreberi</u>) | Common | Sparse |
| Bur reed (<u>Sparganium sp.</u>) | Common | Common |
| Bladderwort (<u>Utricularia intermedia</u>) | ... | Sparse |
| Bladderwort (<u>Utricularia vulgaris</u> var. <u>americana</u>) | Sparse | Sparse |
| Cattail (<u>Typha latifolia</u>) | Sparse | Sparse |
| Wapato (<u>Sagittaria latifolia</u>) | ... | Sparse |
| Sedge (<u>Carex sp.</u>) | ... | Sparse |
| Creeping spike rush (<u>Eleocharis palustris</u>) | ... | Sparse |
| Horsetail (<u>Equisetum limosum</u>) | ... | Sparse |
| Water milfoil (<u>Myriophyllum Farwellii</u>) | ... | Sparse |
| Leafy pondweed (<u>Potamogeton epihydrus</u>) | Sparse | Sparse |
| Variable pondweed (<u>Potamogeton gramineus</u>) | ... | Sparse |
| Floating-leaf pondweed (<u>Potamogeton natans</u>) | ... | Sparse |
| Pondweed (<u>Potamogeton pusillus</u>) | Sparse | Sparse |
| Stonewort (<u>Chara</u>) | ... | Sparse |
| Stonewort (<u>Nitella</u>) | ... | Sparse |

Plankton was found to be very abundant in the smaller bay of Gerald Lake, and fairly abundant in its larger bay, as well as in Roland Lake. However, records based upon collections made during a single short survey period provide insufficient data upon which to base an estimate of general plankton abundance throughout the year.

Invertebrate bottom foods in Roland and Gerald Lakes are relatively scarce, judging from several samples taken by the survey party. Two $1/4$ square foot samples in Gerald Lake yielded 9 phantom midge larvae, 14 other midge larvae, and one aquatic earthworm. A similar sample taken in Roland Lake yielded 9 aquatic earthworms, 3 phantom midge and 3 other midge larvae. The vegetation in the lakes probably shelters a large number of other aquatic organisms. No samples were taken by the survey party in the shallow areas of either lake. Crayfish are common in both lakes and add to the available food supply.

A list of the species of fish collected by the survey party, with an estimate of their abundance at the time of the survey and a record of artificial stocking for the 4-year period immediately preceding the survey are shown in Table III.

The fish of Roland and Gerald Lakes have approximately the same species composition, except that the rock bass is not known to occur in Roland Lake and the sturgeon sucker was not collected in Gerald Lake. Largemouth bass, perch, suckers and mudminnows appeared from the survey records to be more numerous in Roland Lake than in Gerald Lake, while in the case of bluegills the reverse appeared to be true.

Table III
List of Fishes Collected in Roland and Gerald Lakes;
Their Abundance and Artificial Stocking

| Species | Roland Lake | | Gerald Lake | |
|---------------------|-------------|----------|-------------|----------|
| | Abundance | Stocking | Abundance | Stocking |
| GAME FISH | | | | |
| Smallmouth bass | Very common | 1,500 | Very common | 1,500 |
| Largemouth bass | Common | 5,900 | Occasional | 5,700 |
| Pumpkinseed sunfish | Common | ... | Common | ... |
| Bluegills | Occasional | 38,000 | Common | 39,000 |
| Black crappies | Occasional | ... | Occasional | ... |
| Rockbass | ... | ... | Common | ... |
| Perch | Very common | 16,400 | Occasional | 9,600 |
| FORAGE FISH | | | | |
| Mudminnow | Common | ... | Rare | ... |
| COARSE FISH | | | | |
| Sucker | Abundant | ... | Common | ... |
| Sturgeon sucker | Rare | ... | ... | ... |
| Yellow bullhead | Occasional | ... | Occasional | ... |
| Brown bullhead | Common | ... | Rare | ... |

The populations of both lakes are seen to be composed almost entirely of centrarchid species, with smallmouth bass being probably the dominant species in both lakes. This is further illustrated by creel census records which were taken by Conservation officers from 1928 to 1936. The records are insufficient to give an accurate idea of the quality of the fishing during the period which they partly cover, but some indication is given regarding the species which occurred in anglers' catches in the past. A summary of the records taken to date is shown in Table IV. Largemouth bass appeared in anglers' catches more often in Roland Lake than did smallmouth bass. This is not believed to be the general rule, however.

Table IV
A Summary of Creel Census Records Taken at
Roland Lake and Gerald Lake, 1928 to 1936*

| Year | Hours fished | Legal fish caught | Catch per hour | Smallmouth bass | | Largemouth bass | | Bluegill | | Pumpkinseed | | Rockbass | | Crappie | | Perch | |
|--------------------|-----------------|-------------------------|----------------------|-----------------|-----------------|-----------------|-----------------|----------|-----------------|-------------|-----------------|----------|-----------------|---------|-----------------|-------|-----------------|
| | | | | No. | Average size | No. | Average size | No. | Average size | No. | Average size | No. | Average size | No. | Average size | No. | Average size |
| <u>ROLAND LAKE</u> | | | | | | | | | | | | | | | | | |
| 1928 | 26.00 | 7 | 0.27 | 4 | 13.0 | 3 | 13.0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 1929 | 2.75 | 0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 1930 | 38.50 | 19 | 0.50 | ... | ... | 1 | 13.0 | ... | ... | ... | ... | ... | ... | ... | ... | 18 | 8.1 |
| 1932 | 17.00 | 11 | 0.65 | 6 | 17.7 | 5 | 15.4 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 1933 | 14.00 | 6 | 0.43 | ... | ... | 6 | 10.8 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 1935 | 14.00 | 6 | 0.43 | ... | ... | 6 | 12.0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 1936 | 4.00 | 2 | 0.50 | ... | ... | 2 | 11.0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Totals | 116.25 | 51 | 0.44 | 10 | 15.8 | 23 | 12.5 | ... | ... | ... | ... | ... | ... | ... | ... | 18 | 8.1 |
| <u>GERALD LAKE</u> | | | | | | | | | | | | | | | | | |
| 1928 | 74.50 | 38 | 0.51 | 8 | 13.3 | 19 | 15.1 | 2 | 8.5 | ... | ... | 9 | 8.0 | ... | ... | ... | ... |
| 1929 | 89.75 | 115 | 1.37 | 35 | 14.8 | 1 | 15.0 | 6 | 7.4 | 23 | 7.3 | 45 | 8.0 | ... | ... | 5 | 7.8 |
| 1930 | 28.00 | 21 | 0.77 | ... | ... | ... | ... | ... | ... | ... | ... | 13 | 8.7 | ... | ... | 8 | 8.4 |
| 1932 | 40.50 | 57 | 1.40 | 2 | 15.0 | 1 | 10.4 | 3 | 7.0 | ... | ... | 2 | 8.0 | ... | ... | 49 | 6.7 |
| 1933 | 13.00 | 7 | 0.53 | ... | ... | 5 | 12.4 | ... | ... | ... | ... | ... | ... | 2 | 6.5 | ... | ... |
| 1934 | 9.00 | 4 | 0.44 | ... | ... | 4 | 12.0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 1936 | 4.00 | 3 | 0.75 | ... | ... | 3 | 11.3 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Totals | 258.75 | 245 | 0.95 | 45 | 14.5 | 33 | 13.8 | 11 | 7.5 | 23 | 7.3 | 69 | 8.1 | 2 | 6.5 | 62 | 7.1 |

* Summaries made by Helen Staebler.

It is interesting to note from seining records of the survey party that young-of-the-year were collected of all game species occurring in each lake. This gives evidence that all the species present reproduce naturally in the lakes.

A study of the growth rate of game fish occurring in Roland and Gerald Lakes was made. A summary of the findings is shown in Table V. Since the fish were collected in late August, they were almost a full growing season older than is shown by the number of annuli, as listed in the table. The number of specimens upon which each average is based is also shown. Most of the age groups are too poorly represented to give good averages. However, when considered in combination with adjacent age groups, some indication is given of the growth of the various species in the lake.

Table V
Growth Rate of Game Fish of Roland and Gerald Lakes

| Annuli | Roland Lake | | | Gerald Lake | | |
|-----------------|--------------------|-------------------------------|-------------------------|--------------------|-------------------------------|-------------------------|
| | Number individuals | Average total length (inches) | Average weight (ounces) | Number individuals | Average total length (inches) | Average weight (ounces) |
| Smallmouth bass | | | | | | |
| II | ... | ... | ... | 1 | 11 1/8 | 12.2 |
| III | 1 | 11 7/8 | 14.8 | 1 | 12 | 13.6 |
| IV | 1 | 15 3/4 | 31.2 | 2 | 12 1/2 | 15.0 |
| V | 1 | 19 | 52.0 | ... | ... | ... |
| VI | 1 | 17 1/2 | 34.9 | ... | ... | ... |
| VII | ... | ... | ... | 1 | 15 1/4 | 25.0 |
| Common sunfish | | | | | | |
| IV | ... | ... | ... | 1 | 7 3/4 | 6.7 |
| V | 1 | 7 7/8 | 5.8 | ... | ... | ... |
| Bluegill | | | | | | |
| III | ... | ... | ... | 3 | 7 5/8 | 4.9 |
| Perch | | | | | | |
| II | 2 | 5 1/8 | 0.7 | ... | ... | ... |
| III | 6 | 6 1/4 | 1.4 | ... | ... | ... |
| IV | 5 | 7 1/2 | 2.4 | ... | ... | ... |
| V | 3 | 8 3/8 | 3.5 | ... | ... | ... |
| Rockbass | | | | | | |
| IV | ... | ... | ... | 1 | 8 1/8 | 6.0 |
| V | ... | ... | ... | 2 | 8 5/8 | 6.8 |
| VI | ... | ... | ... | 1 | 9 5/8 | 11.2 |
| VII | ... | ... | ... | 2 | 9 3/4 | 10.1 |

* Age determinations by W. C. Beckman.

According to the State averages determined by Dr. W. C. Beckman, the smallmouth bass reaches legal size (10 inches) during the 3rd summer of life, the common sunfish and bluegill (6 inches) during their 4th, the perch (6 inches) during its 3rd, and the rockbass (6 inches) during its 5th. Inspection of Table V shows that all species in Roland and Gerald Lakes, except the perch, are growing at an average or better than average rate. Further comparison with tables of state averages shows that all of the species shown in the table, except perch, have very near average or above average weight in comparison to their lengths. In other words, most of the fish in Roland and Gerald Lakes are growing well and are in good condition. All age groups of perch are stunted in growth, being not only short in length for their age, but also light in weight for their length.

In view of the presence of young-of-the-year of all game species in Roland Lake and Gerald Lake before the usual fall stocking had occurred, there can be little doubt of the successful natural propagation of all species present. No gravel was found in either lake by the survey party, but apparently both smallmouth bass and rockbass are reproducing successfully.

Management Suggestions

Roland and Gerald Lakes are at the present time in the "all others" classification. The survey data show this to be the proper designation, and no change is recommended.

Since, as has been noted above, all the game species in Roland and Gerald Lakes (except perch in Roland Lake) are growing well and are in average or better condition, and are furnishing fairly good fishing, any special management seems unnecessary. However, in view of the fact that

all the game species appear to be reproducing well at the lakes, it does not appear probable that^a future stocking program is necessary. Once centrarchid species become established in a lake, it is the exception rather than the rule when natural reproduction is inadequate to insure continued maintenance of their numbers. In view of the apparent adequacy of spawning facilities in the lake for all the species which it is desirable to perpetuate, it is suggested that all stocking be discontinued in the lakes for a period of 3 years. During this period the district fisheries biologist should check the lakes each summer to determine the extent and adequacy of natural reproduction of the various species. If it is seen to be insufficient, artificial stocking should be resumed. Under no circumstances should perch ever again be stocked in either lake.

In view of the very significant departure from the past stocking policy which the above recommendation prescribes, some unfavorable comment from those interested in Roland and Gerald Lakes may possibly be forthcoming. It should be pointed out here that any fluctuation in the quality of the fishing during the next three years will not be a reflection of the change in stocking policy, since at least three years are required for a given year's production of young to reach legal size. If adequate observations are made in the interim, a decrease in the numbers of young would become evident before any significant damage to the fishing itself had occurred.

One bittern and several kingfishers were seen by the survey party, and some evidence of the presence of great blue herons in the vicinity was observed. No significant damage is done by these or any other birds or mammals which might occur at the lakes, in their capacity as predators.

However, water birds are final hosts of two of the parasites (black spot and yellow grub) which occur at the lake, and in this capacity they do affect the fisheries. Although there are no records from Roland Lake, it was found that 3 types of fish parasites occur at Gerald Lake (very probably these also occur in the fish of Roland Lake). Black spots (Neascus) were found in small numbers in the skin and fins of rock bass, and the skin of common sunfish, bluegills and smallmouth bass. A few yellow grubs (Clinostomum) were found in the musculature of the latter species. The larval bass tapeworm (Proteocephalus) was found in abundance in the gonads, intestine, liver, and peritoneal cavity of older specimens of smallmouth bass. Younger fish of this species were less severely affected. The parasitism in Roland and Gerald Lakes is insufficiently heavy to substantially reduce the quality of the fish for eating (none of the parasites found are harmful to man), and the organisms have no apparent effect upon the growth and development of the fish themselves (the bass tapeworm may, in cases of heavy infection, attack the gonads and prevent reproduction of its host. Apparently this occurs only rarely at Roland and Gerald Lakes). In view of the small extent of the damage being caused, and the fact that control of the parasites under natural conditions is both difficult and impracticable, no control measures are here recommended.

Cover present in Roland and Gerald Lakes appears to be adequate to meet the needs of the fish population there, and no improvements seem necessary. Spawning facilities are also believed to be adequate, as has been discussed earlier in this report.

INSTITUTE FOR FISHERIES RESEARCH

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