

INSTITUTE FOR FISHERIES RESEARCH  
UNIVERSITY MUSEUMS  
UNIVERSITY OF MICHIGAN  
ANN ARBOR, MICHIGAN

Report 312

September 18, 1935

ROTENONE AS A FISH POISON IN A SMALL POND

This report deals with the lethal effects of rotenone on the fish life of a small pond. The observations, herein recorded, were made on April 23 and 24, 1935. The pond in question is located in an abandoned gravel pit at Utica, Macomb County, Michigan, and is locally known as Messmore's Pit Pond. At the time the following observations were made, the pond had an estimated average depth of 2 1/2 feet, and the pond dimensions, determined by "pacing-off" the distances, were 110 feet by 150 feet. On the basis of these dimensions the pond contained 41,250 cubic feet of water weighing 2,578,125 pounds. The pond had no functional inlet or outlet at the time of this experiment. Due to the small amount of organic fertilizer, the pond was low in biological productivity, and was supporting only a small population of small fishes.

The fish fauna of the pond, as determined by previous seining and by the examination of the fishes killed by the poisoning process to be described, consisted of three species, namely: the pumpkinseed sunfish (*Lepomis gibbosus*), the blunt-nosed minnow (*Hyborhynchus notatus*), and the fat-headed minnow (*Pimephales promelas promelas*).

The powdered derris root (containing 5% rotenone - the lethal agent) had been purchased about 6 months prior to its use in this experiment, and had been kept in the Institute Laboratory in a sealed paper sack.

Between 3:10 and 3:30 P.M. April 23, 1935, eight ounces of the powdered derris root were mixed (by shaking for 5 minutes) with 3 quarts of water, using 2 two-quart jars, and this mixture was scattered over the surface of the pond and mixed well with

the pond water by wading and violently churning the water.

Due to the small size of the pond and its shallowness, it was possible to obtain a thorough mixing. The concentration of derris root in the pond, resulting from this addition, was approximately 1 part per 5,000,000 by weight; of rotenone, the active agent, approximately 1 part per 100,000,000.

The following temperatures were recorded: air 14 1/2°C.; water 16 1/2°C. at 3 P.M.; water 16°C. at 6 P.M. Throughout the afternoon the sky was hazy, and there was a slight east wind.

At 4:40 P.M. a school of approximately 50 young sunfish (Lepomis gibbosus) was seen; these fish were apparently normal. The first indications of distress among the fish life appeared at 5:30 P.M., two hours after the introduction of the poison. These distressed fish swam near the surface of the water and also showed a definite tendency to swim blindly toward shore. The first sign of distress was the apparent loss of the sense of orientation, the fish swimming frantically in circles but maintaining their equilibrium; subsequently the sense of equilibrium was impaired and the fish swam sluggishly on their sides (sunfish) or belly-up (minnows). A large number of fish became distressed between 5:30 and 6:30 P.M. Some fish (bluntnose minnows and sunfish) had died by 6:30 P.M.

Between 6 and 6:30 P.M. some of the distressed fish (no dead ones) were placed in a 10-gallon can of freshwater, to determine whether or not the 2 1/2 to 3 hour exposure to the 1 to 100,000,000 concentration of the rotenone had been sufficient to cause the death of the fish. Of the 77 fish transferred to and kept in fresh water until 7:30 A.M., April 24 (approximately 13 hours), 26 fish died as the result of the poison and 51 survived its effects. The dead included 3 bluntnose minnows (average length 44 millimeters, range 39 to 51) and 23 pumpkinseed sunfish (average length 35 millimeters, range 23 to 66); the survivors included 10 bluntnose minnows (average length 52.9 millimeters, range 42 to 66), 28 pumpkinseed sunfish (average length 42.3 mm., range 25 to 122), and 13 fathead minnows (average length 37.8 mm., range 32 to 46). The effect of

the rotenone was greatest on the sunfish and least on the fathead minnows. Size within the species appears to be an important determining factor; the smaller individuals of two species (Eupomotis and Hyborhynchus) succumbed to the poison more readily than the larger ones.

At 6:30 P.M. April 23, 10 ounces of the derris root powder were mixed with a gallon of water and distributed throughout the pond, in the manner as previously described. This second addition was made to insure a 100% mortality of all fish present. This second addition increased the concentration of derris root to approximately 1 part per 2,300,000; of rotenone (the active agent), approximately 1 part to 46,000,000. practically all of the sunfish and bluntnose minnows were dead by 8 P.M. at which time observations were terminated due to darkness. About 80% of all fish which had been distressed or had died during these observations were collected and preserved. About 20% of the dead sunfish sank to the bottom and were not recovered; all dead or distressed bluntnose and fathead minnows floated to the surface of the water.

The pond was again seen from 7:00 to 7:30 A.M. on April 24. Observations at this time substantiated the belief that all sunfish and bluntnose minnows had been killed by 8 P.M. on the previous day. However, of several hundred fathead minnows, found about the margin of the pond, most had succumbed to the poison during the night, but about 30% of them were still breathing. While it appeared very probable that the 1 to 46,000,000 concentration of rotenone would have been lethal to all of the fathead minnows, there is no definite proof for this contention.

#### Summary

A concentration of rotenone (the active agent of the derris root) as 1 part to 100,000,000 was found to be lethal, within three hours, for about 30% of the populations of pumpkinseed sunfish and bluntnosed minnows; there was, however, no evidence that this strength will kill fathead minnows within three hours. This initial experiment was not continued long enough to test the final lethal effects of this concentration.

Increasing the rotenone concentration to 1 part to 46,000,000 resulted in a 100% mortality of all sunfish and bluntnose minnows in less than 5 hours after the initial introduction of the poison, and of 70% of the fathead minnows in less than 15 hours after the initial introduction. This concentration probably would have been eventually lethal to all of this latter species.

In general, the three species succumbed to the poison in the following order (based on the average time necessary to kill all individuals of the species): pumpkin-seed sunfish, bluntnose minnows, and fathead minnows.

In general the smaller individuals of each species were the first to succumb to the rotenone.

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