2 copies to Briggs. "Conclusions" not included on these copies

Report 256 September 17, 1934

REPORT ON THE POISONING WITH ROTONONE OF TWO SMALL PONDS ON THE W. O. BRIGGS ESTATE

On the W. O. Briggs estate, situated in Bloomfield Township, Oakland County, Michigan, are two small ponds. As there were many frogs about these ponds which created much disturbance and as the ponds also contained too many fish, which roiled the water making it partly unfit for watering purposes, it was thought best to destroy both the frogs and the fish. This was done with the use of powdered derris root, which contains 5% of rotenone (the lethal agent) as described later in this report.

Descriptions and method of poisoning the two ponds

Description of the smaller of the two ponds — The upper and smaller of the two ponds on the Briggs estate drains directly into the lower and larger pond and is purely an artificial body of water. Its greatest length at the time the powdered derris root was applied was approximately 600 feet; its greatest width 150 feet; and greatest depth 5 feet, while the average depth was about 3 feet. It therefore contained some 270,000 cubic feet of water, which weighed about 16,875,000 pounds. The pond contained but few large aquatic plants as only an occasional pond weed, hornwort, or water weed could be found. There was a small stand of cattail at one side. The water before and during the application of powdered derris root was somewhat roily in appearance—due largely to the movements of the great numbers of carp and goldfish it contained. The chief source of the water supply is through wells, the water being pumped in. There are also a few springs which supply aid in supplying water.

Methods of poisoning the small pond

On July 17, 1934 at 8:30 A.M. 30 pounds of powdered derris root, containing a 5% rotenone content was mixed with 100 pounds of water, making a total weight of 130 pounds.

The next day July 18 1/3 or about 43 pounds of this mixture was placed in another tub, 1/3 of a two pound package of Chipso soap flakes was added, together with a third more water, this thinning the mixture so that it would pour easily. This mixture was poured into the waters of the lake from a sprinkling can, without a spray nozzle, directly behind the propeller of an outboard motor which was running about the lake at top speed. Care was taken to cover as much of the lake surface as possible, and after the mixture had been distributed the outboard was kept going around the lake to keep the water agitated.

Results of pouring 1/3 of this mixture in the small lake

The pouring of the mixture into the lake was completed at 8:25 A.M., the air temperature at that time being 78°F., the water 76°F. (Later in the day the air temperature rose to above 90°F. and the water to 82°F.) The first signs (about 8:38 A.M.) noted of sick animals were two large water snakes (Natrix sipedon sipedon) which began swimming slowly about the surface of the water and later attempting to avoid the men along the shores and get out of the water. One of these snakes was finally taken from the surface of the water so weak that it was unable to offer any resistance. A few moments after the appearance of the snake, musk turtles (Sternotherus odoratus), snapping turtles (Chelydra serpentina) Blanding's turtles (Emys blandingii) and painted turtles (Chrysemys bellii marginata) began sticking their heads above the surface of the water, in spite of the confusion taking place on the shores of the pond. At about the same time leopard frogs (Rana pipiens) began to hop out of the water upon the shores where they were caught by the men surrounding the lake. The first sign of fish mortality was noted at 8:45 A.M., when a 3-inch Green Sunfish (Apomotis cyanellus) was found floating dead upon the surface of the water though by this same time dozens of small goldfish (Carassius auratus) could be seen jumping about on the surface of the water or poking their heads blindly against the shores.

Results of placing the remaining 2/3 of this mixture in to the small pond

At 9:45 A.M. the second third of the powdered derris root mixture (mixed with 1/3 of the 2 pound box of Chipso and thinned with water as with the first third) was placed in the lake, followed at 10:05 A.M. by the remaining third. These two thirds were poured into the lake behind the running outboard motor. At 10:15 A.M. the surface of the water quite suddenly became agitated by great numbers of goldfish from 1 to 9 inches long, green sunfish 1 to 5 inches long, and carp (Cyprinus carpio) from 1 to 36 inches long, as they rolled, leaped or dashed about the waters' surface or jumped onto the shores. At this time two men in the boat took some 25 carp in less than 15 minutes, that were rolling or dead upon the water's surface, then in the next 45minutes took 40 more. The average weight of these carp was about 3 pounds, and the largest weighed over 8 pounds.

At 11:00 A.M. a seine haul with a 100 foot seine of 1 inch mesh, taken at the lower end of the pond and covering about 1/20 of the pond area, produced at least 2 bushels of dead or dying goldfish and carp, mostly under 12 inches in length, a small snapping turtle and a Blanding's turtle. Apparently the turtles, which were still alive though too weak to offer any resistance, had buried themselves in the mud.

At noon there was estimated to be at least 7,000 fish, mostly goldfish and carp, lying dead or dying along the shores.

At 2:00 P.M. another seine haul was made at the upper end of the pond over about 1/5 of the pond area, resulting in some 3 bushels of fish being taken. By this time fish were rising dead or dying, from all parts of the lake and drifting downward to the lower edge of the lake where they drifted into large windrows.

At 3 P.M. at least 40 bushels of fish were lying along the shores. As these fish were being removed to a waiting truck a count was made of several bushels which averaged 1,800 fish to the bushel. Therefore there were at least 60,000 fish lying about the shores of this pond, 98% of these were goldfish from 3 to 6 inches long, the other 2% were carp with a sprinkling of green sunfish. Besides these, at least 100 carp averaging 3 pounds were also taken. It is curious that so few young carp

were found and that they were so outnumbered by the goldfish, despite the fact that the pond contained a fine brood stock of carp.

Mr. Haycock, manager of the estate, stated that in the following two days his men picked up an additional 32 bushels of fish. This gives an estimated additional 48,000 fish, making an estimated total of 198,000 goldfish (98%), carp (2%) and green sunfish (less than 100 individuals) taken from this pond.

Not all the fish were killed in this pond however, as 1/20 of the area of this pond was seined on the afternoon of July 23, (in the presence of Dr. John Van Oosten, Dr. R. Hile and Mr. H. J. Deason of the U. S. Bureau of Fisheries), and 25 apparently healthy small goldfish were taken. It is therefore evident that a 100% kill of fish was not made.

As it is estimated that this pond at the time of poisoning contained 16,875,000 pounds of water and as 30 pounds of powdered derris root was used, the ratio of derris root is one part to 562,500 parts of water. As this powdered derris root contained 5% of rotenone (the lethal agent) the ratio was 1 part of rotenone to 11,250,000 parts of water.

It might be added that goldfish have been placed in this pond at various intervals during the past five years, while in the fall of 1930, 400, more or less, large carp were planted in the pond. The only other species of fish noted, the green sunfish, was not knowingly planted—probably it worked its way into this pond from the lower and larger pond with which it is connected.

At least 100 frogs (practically all leopard frogs) were taken about the shores of the pond.

Description of the larger of the two ponds

The lower and larger of the two ponds on the Briggs estate was several years ago a small pot hole lake of less than an acre of water, and without an outlet. At present it has been dammed and the water level raised several feet. Its greatest length at that time of poisoning with rotenone was approximately 1000 feet, its greatest WIDTH 300 feet, and maximum depth 20 feet, while its average depth was 5 feet or less. It was

estimated to have 1,500,000 cubic feet of water which weighed 93,750,000 pounds. The pond also contained a vast amount of submerged aquatic vegetation, principally hornwort (Ceratophyllum), water milfoil (Myriophyllum), and pondweeds (Potamogeton), together with a moderate amount of white water lily (Castalia); these forming dense beds everywhere except on the original deep pothole. The water before and during the application of the powdered derris root was quite clear, it being possible to see distinctly small objects on the bottom at a depth of 10 feet. The source of water supply is from the upper pond and originally comes from wells though some surface and spring water also enters it.

Methods of poisoning the large pond — On July 23, 1934 at 8:00 A.M., Mr. Haycock and his assistants began placing 70 pounds of powdered derris root (mixed in the same manner with soap and water as that used in the smaller pond) into this large pond. At first the outboard motor was used to distribute, but due to the mass of vegetation and old stumps on the pond this method had to be discontinued, and from then on was poured upon the water both from the boat without the aid of the outboard motor and from the shore. This process of distributing took about one hour or until 9:00 A.M. At this time the air temperature was 81°F. and the water temperature 76° though later in the day the air temperature was over 94°F. while the water temperature rose to 79°F.

Results of poisoning the large pond — Shortly after the beginning of the addition of the derris root mixture into the lake, the water snakes (Natrix sipedon sipedon) began to come to the surface of the water, and several large ones up to inches in length were captured. Some painted turtles and a musk turtle began to stick their heads above the water's surface. At the same time large numbers of fish, among which were several 12 to 14 inch large-mouth bass (Aplites salmoides), began to show signs of distress.

By 10 A.M. the fish, mostly green sunfish, goldfish, carp, large-mouth bass and black bullheads (Ameiurus melas melas) began to die in considerable numbers. Many leopard frogs together with a few green frogs (Rana clamitans) began to leave the water also.

By 11:00 A.M. thousands of dead and dying fish could be found caught in the aquatic vegetation or drifting about the surface of the water. At this time an area of 25 feet square (625 square feet) was blocked off and all the dead fish within this square were counted. It was found to contain 302 dead or dying green sunfish from 1 to 3 inches long, 2 small pumpkinseeds (Lepomotis gibbosus); 2 yearling black bullheads (Ameiurus melas melas) 6" long, and 4 small fingerling large-mouth bass 2 to 4 inches long. At 12:30 P.M. another area of similar size on the opposite of the pond was examined in the same manner and 462 green sunfish, 2 6-inch goldfish; 11 black bullheads, 1 yearling large-mouth bass and 10 fingerling large-mouth bass were counted. As this pond contains some 300,000 square feet of surface, 480 squares each 25 feet square are present, though due to the deep hole occupying about 1/2 of the area, only about 240 of these contained vegetation and are comparable otherwise to the two squares examined. Assuming that each of these 240 squares contained an average number of 400 green sunfish per square (a conservative estimate), as afterwards over 30 more green sunfish were removed from each of these two worked areas, and these uncounted squares appeared to have just as many fish on the average as the counted squares), there would be a total of 96,000 green sunfish lying about in the vegetation and upon the surface of half of this pond. Unfortunately, no practical method of estimating the numbers of green sunfish killed and remaining in the deeper, less vegetated half of the pond could be taken. That at least 100,000 green sunfish were killed is virtually certain and it is very possible that 50,000 more were killed. Of the thousands noted only five individuals were over 3 1/2 inches in total length, the average being above 2 1/2" total length. These small 2 1/2 inch sunfish had all the appearances of adults and as the larger fish were so in the minority, it is logical to assume that they were the breed stock of this species. It might be added that this type of concentration and dwarfing of the green sunfish in ponds of this type has been noted by the writer elsewhere.

By 3:00 P.M., 26 large-mouth bass had been collected ranging from 1 1/2 to 2 1/2 pounds in weight. They appeared in excellent condition and showed some evidence of rapid growth. Using the average of the two counted 25 feet squares, which contained 5 yearling and 7 fingerling large-mouth bass per square, the total number of young bass

in the 240 squares were 120 yearling and 1,680 fingerlings. This number appears rather low when the 26 adults are considered, but this ratio of adults to young is probably nearly correct, as the competition for food between the green sunfish and baby bass must have been great, while many bass fry must have been eaten by the large-mouthed green sunfish.

During the day and up to 3:30 P.M. over 15 carp weighing from 1 to 3 pounds were taken. Due to their habit of remaining in the deeper, less vegetated areas of the pond and to the large size of the carp and goldfish, these two species were noted and picked up more readily than the smaller, inconspicuous green sunfish. By 4:00 P.M. at least 10 bushels of goldfish, and a few smaller carp, both species averaging 5 inches in length, had been gathered, and obviously more than that still remained on the pond.

At least several hundred black bullheads ranging in size from four to twelve inches total length but mostly under 7 inches, were killed. If we take the average of 6.8 individuals for each of the two squares counted and multiply it by the 240 such squares in the pond we have a total of 1,440 bullheads killed, though most probably the actual figure was higher than this.

One mud minnow (Umbra limi) was also taken.

At least 400 leopard frogs and a few green frogs were killed by men along banks.

Undoubtedly, a fair percentage of the fish originally in the pond survived as only approximately 1 part of rotenone to 26,785,714 parts of water was used. Also, the rank aquatic vegetation made it impossible to uniformly poison the whole pond, while many fish may have sought refuge in the deeper and less disturbed waters.

Before it was dammed and enlarged, the small original pot hole lake was said to have contained a fish fauna quite similar to that of other potholes of like nature. Later, when the water was dammed and the pond area increased, the goldfish and carp were either planted in the pond or else escaped from the upper pond into it. As can be seen by the fishes present only a few of the species of fish normally occuring in this type of pond were noted, and only one of these, the green sunfish, had become a dominant form. Also the goldfish and carp were well established and in a few more years might have domin-

ated the entire pond, as environmental conditions for these two forms appeared extremely favorable.

Three members of the U. S. Bureau of Fisheries, Dr. John Van Oosten, Dr. Ralph Hile and Mr. H. J. Deason assisted in making the observations on the large pond recorded above.

Conclusions

From the standpoint of conservation, the above experiments should prove quite valuable. They may lead to a successful method of recording the exact numbers of individuals and species of fish in a given stretch of stream; recording trout or the game fish abundance and their average concentrations; and in removing undesirable, runt and diseased perch or other fish from a small lake or stream in order to plant more desirable species, such as trout.

As powdered derris root is becoming widely sold in America for insecticidal purposes, the possibility of outlaws obtaining this fish poison and using it for catching fish increased. Realizing this, a great many of the poisoned fish have been saved for future examination, in order to discover, if possible, if any peculiar physical changes have occurred in their body. Then later, if poisoned fish are sent in to the Institute by the Conservation Department, the death of these poisoned fish can be correctly determined.

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