STATE Texas

PROJECT NO. F-7-R-1, Job E-1

PERIOD June 15, 1953-May 31, 1954

Job Completion Report for Segment 1

by

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TITLE

Experimental Control of Undesirable Fish Species.

OBJECTIVES

To develop methods for the selective control of undesirable fish species.

TECHNIQUES

Original plans called for laboratory and field experimentation in the above subject. In general, the following outline was followed as closely as possible, though we were hampered in some respects by lack of equipment.

A. Laboratory experimentation.

1. Representative fish species of Region B-1 will be subjected to different concentrations of fish toxicants to determine toxicity limits of each species to each toxicant.

2. These experiments will be conducted for each different water quality type in Region B-1 and at varied temperatures.

3. Reactions of each species to electrical shock, treated baits, small scale models of nets and traps, etc., will be determined in laboratory vats.

B. Field experimentation.

1. The practical application of the information obtained by laboratory experimentation will be determined by further expermentation in the field.

2. Accurate measurements will be made on ponds and small lakes in Region B-1 which contain excessive populations of undersirable fish. Chemical methods will be attempted as a means of control by utilizing information obtained in the laboratory as a basis.

3. Efforts will be made to concentrate different species of undesirable fishes into a suitable harvest area by treated baits, driving or "herding" devices, habitat alterations, etc.

4. Experimental nets and traps will be rigged and set to simplify and increase rough fish removal.

HISTORY OF PROJECT PRIOR TO FEDERAL AID

The possibility of selective control of rough fish species was presented by a fortuitous event during routine fisheries work in January, 1953. A fish population check was made of the Lamar Fain Lake near Wichita Falls, Texas. Gill nets, ranging from 1½ to 3 inches in mesh size, were set across the lake and since it was not possible to check the lake with a minnow seine, a small cove on the north east shore was rotenoned to check on the forage fish population. The water temperature at this time was 11° C (51.8° F). During the night a strong southwest wind, blowing directly down the long axis of the cove, developed and continued for 48 hours. Apparently the wind blew the rotenone out of the cove and wave action dispersed it over the entire lake in a uniform concentration. The next morning the gill nets and the northeastern shore of the lake were heavily laden with dead gizzard shad. The nets,when checked, contained living, healthy, black bass, channel catfish, European carp and white crappie but no live gizzard shad. Most of the stomachs of the larger black bass and catfish contained shad. One eight pound catfish contained 22 shad, averaging 4 inches in length. The lake was drained and seined two weeks after the treatment and it was noted that no fish other than shad had been affected by the rotenone. All shad were dead.

Consideration of the size of the pond and the amount of rotenone used revealed that the shad had been killed with less than .2 pound of the toxicant per acre foot of water.

Following the accidental shad kill in the Lamar Fain Lake an attempt was made to duplicate the event. The 6½ acre Jerry Vinson Lake, also near Wichita Falls, was treated with .3 pounds of rotenone per acre foot of water. Again the water temperature was 11° C. Gizzard shad began to die in large numbers twelve hours later and continued to die for the next ten days. Two weeks later the lake was checked with gill nets but no living shad were found.

The possibility that the gizzard shad, at least, could be selectively poisoned, was thus suggested, and laboratory experiments followed. A fish transport vat, complete with circulator, was borrowed from the Dundee Fish Hatchery and used, in these experiments, with 100 gallons of water. Test animals included gar, gizzard shad, black bullhead catfish, channel catfish, white bass, sunfish and drum. Concentrations of rotenone used ranged from the equivalent of .2 pounds per acre foot of water through gradual increases to one pound per acre foot. Effects on the test animals were recorded for 36 hours. Water temperature varied from 9.5° C to 11° C. Briefly summarized, the results were:

(1) At .2 pounds per acre foot (.07 ppm) to .4 pounds per acre foot (.14 ppm) gizzard shad were all killed but other species of fish appeared to be unaffected.

(2) At .5 lbs. per acre ft. (.18 ppm) all shad were killed, most white bass were moribund after 36 hours, and some drum appeared to be in distress. Other species appeared to be unaffected.

(3) At .7 lbs./ acre ft., all fish except one large sunfish and gar were dead within 36 hours.

(4) At 1.0 lbs./ acre ft., all fish but gar were dead within 36 hours.

These results were encouraging, as were the results of some other samll field experiments. However, possibilities of error existed in virtually all aspects of these experiments that required accurate measurements. In the laboratory experiments, reliable apparatus was not available while we had no accurate methods of measuring the experimental ponds and samll lakes used in our field work. It was obvious that much experimental work was needed before the action of the toxicants used in different water types and at different temperature could be understood. Further work was postponed until funds and equipment could be obtained.

Opportunity to continue this research became available through funds provided by the Dingell-Johnson Act.

WORK COMPLETED DURING THIS PROJECT PERIOD

Laboratory Work and Experiments

Progress on this aspect has been seriously hampered by lack of essential laboratory apparatus. Only recently have the necessary agitators and electrical air pumps for laboratory and transport vats been obtained. Transport vats suitable for our work have been improvised from 30 and 55 gallon oil drums. Some large battery jars were obtained from the Rockport Marine Laboratory, but adequate laboratory vats are not yet on hand. It is expected, however, that suitable apparatus will be available for the next project period.

Field Experiments

It was planned, originally, to conduct laboratory experiments before each field experiment, using water and fishes from the pond or lake concerned. However, as explained above, these ideal conditions were not realized because the essential laboratory apparatus and accurate lake measuring devices were lacking until recent weeks.

Nevertheless, advantage was taken of several opportunities to carry on field experiments where landowners so requested and furnished measurements of the waters concerned. Only two of these experiments are here discussed in detail.

By early June, 1953, Lake Wichita near Wichita Falls, has been reduced by drought to approximately 1,425 acre-feet from its capacity of 13,964 acre-feet. The lake was heavily overpopulated with several species of rough fishes, among which the gizzard shad and drum dominated. As a result of low water level and large rough fish population, a situation critical to the survival of the game species was brought about. When treatment was begun, the surface acre measured 475 acres and water temperature was 22.5° C (72.5° F). Rotenone at a concentration of approximately .35 pounds to the acre-foot of water was distributed.

Almost immediately after treatment, large numbers of shad and drum began to die. Both species were observed on the surface in a moribund condition but only drum were being washed ashore in large numbers. Apparently most of the shad were sinking after death.

During the night the shad, which had sunk during the day, floated to shore. The next day there was a striking stratification of dead fish, with drum forming a broad bank highest on the beaches and shad forming another broad bank beneath the drum and forming thick windows in the shallows. The thousands of drum ranged from three to twenty inches in length but were underweight and obviously in poor

condition. The shad, on the other hand, were fat and apparently in excellent health. They ranged from eight to sixteen inches in length; apparently all mature fish.

Several days were required to clean up the dead fish. For the first twodays they were hauled to a rendering plant, in dump trucks and pickup truck, where they were weighed and rendered. After the second day they were hauled to abandoned gravel pits and covered over with bulldozers. Observations were made during the pick-up period as to the species killed and their sizes. The total weight of fish killed, based on number of trucks employed and average load per truck, is estimated at 36.5 tons (73,000 lbs).

The treatment was effective almost entirely on drum and shad. Not more than one per cent of the fish killed consisted of all other species conbined. The river carpsucker made up most of this one per cent. A few small mouth buffalo, white bass and channel catfish were also killed. Crappie, small shad and minnows were strikingly absent. Indeed, seining during the picking-up period of the dead fish showed minnows to be abundant and apparently in the best of health.

Ten days later, the high turbidity and muddy color of the lake had abated and the water appeared rich blue. Word had spread that the lake had been poisoned and few fishermen tried their luck. The lingering odor of decayed fish kept others away. Pole-and-line fishermen reported nothing but gars being caught. Trotline fishermen, however, reported better than average catches. Check-seining at this time showed most species in their usual proportions but drum and shad were very scarce.

The presence of any drum and shad was surprising. It is possible that these fish were unusually healthly individuals that had survived the rotenone. It is perhaps more likely that they had been in certain shallow parts of the lake we were unable to treat with rotenone, or they may have entered the lake after the treatment from irrigation ditches. A local fisherman aptly described the treatment as a "spring tonic for a sick lake."

The Lake Wichita experiment was by far the most spectacular from the standpoint of quality of water treated and of rough fishes killed. Another interesting experiment, involving the use of slightly larger concentrations of rotenone, was carried out with the Louis Sykes Lake, located at the southern city limits of Wichita Falls. The lake has a surface area of 35 acres and was treated with .5 pounds of rotenone per acre-foot of water. The temperature at the time of treatment, April 26, 1954, was 23° C (73.4° F). The treatment was rapidly effective and within three hours after the distribution of the rotenone, large numbers of shad and drum were observed dead and dying on the surface of the lake. A few carp, smallmouth buffalo and river carpsuckers were noted in a moribund condition.

The lake was checked twenty-five hours after treatment. Apparently all the fish susceptible to rotenone in the concentration used had died by this time. An accurate count of the various species of dead and partially decayed fish was not possible but it was obvious that the dead animals consisted almost entirely of rough fishes with a very few game fishes. Shad and drum were by far the most numerous while carpsuckers, European carp and smallmouth buffalo were less abundant. Several black bullhead catfish, channel catfish, crappie and sunfish were noted, especially in the shallow, upper end of the lake where a heavier concentration or rotenone was accidentally applied. Workmen in charge of the cleanup work estimated that more shad and drum were killed than any other species combined, but that by weight, carp and sucker made up the bulk of the kill.

The following day the lake was checked with gill nets and seines. All those species detected before treatment were also found after the treatment. However, shad were very rare (only one was taken) and drum were scarce. Carp, carpsuckers and buffalo were present in obviously reduced numbers.

These two experiments are considered valid, in large part because quite accurate measures of water volume and surface area were available. Several additional, less dependable, experiments were completed in which we were forced to estimate surface area and water volume by crude methods. A brief summary of the pertinent findings follows:

(1) In three instances when rotenone equivalent of .3 lb/ acre-ft. was applied, only gizzard shad were killed.

(2) In January, 1954 a concentration of .5 lb/ acre-ft. was applied to the Gordon Cummins Lake in the Texas Panhandle. Water temperature was 2° C. and it was necessary to break a thin layer of ice to distribute the rotenone. The treatment was ineffective.

(3) In this same lake, when the water temperature was 5° C., .5 lb/acre-ft. killed approximately equal numbers of gizzard shad and European Carp as well as a small number of bullhead catfish, small sunfish and one crappie.

(4) In most instances when a .5/lb acre-ft. was applied to water with temperatures greater than 21° C., white bass, drum, carp, young black bass, crappie and sunfish as well as gizzard shad were killed.

PREPARATIONS FOR FUTURE WORK

Consent of a number of landowners has been secured for future field experiments, and the water quality and fish populations of some of these ponds and lakes has been determined. Equipment and apparatus for laboratory work is now largely on hand. Field experiments are hampered by lack of adequate measuring devices (plane table, alidade, etc.), essential to the computation of water volume. Such equipment now has been ordered.

Pertinent literature has been reviewed in search of information on the toxicity of various chemicals to fish, natural history and food habits of rough fish species, fish harvesting methods, and other subjects that might have some applications to selective control of undesirable fish species. Correspondence has been initiated with other fisheries biologists and individuals working with various aspects of rough fish control methods.

SUMMARY

The possibility of selective removal of gizzard shad by chemical methods was revealed in 1953 when accidental application of about .2 pounds of rotenone per acre-foot of water killed all the gizzard shad in a small lake. Rough checks in the field and laboratory validated these first findings, but funds and apparatus were lacking for carrying the work further at that time.

In the past project period, further research has been carried on. Much of the needed materials and apparatus is now on hand or ordered. Several field experiments, including one that involved a moderately large lake, have been successful. It has been found that rough fishes can be killed with rotenone concentrations up to a .5/lb acre-ft., without endangering game fishes to any great extent. under certain conditions. Gizzard shad can be killed with rotenone concen-

trations as low as .3 lb/acre-ft. Water temperature seems to be an important factor. At 2° C., treatment with .5 lb/acre-ft. was not effective but the same concentration was highly effective on rough fishes at a temperature of 5°C. This same concentration at temperatures greater than 21° C killed game species as well as rough fishes. Preparations for further experiments are under way.