

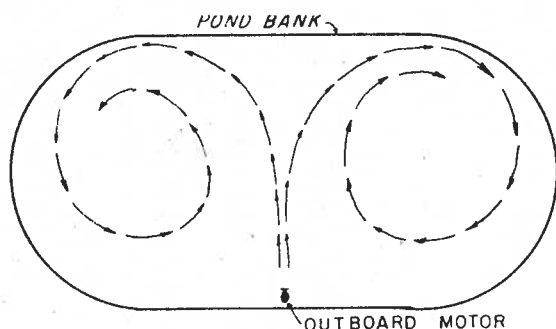
## THE USE OF ROTENONE FOR RECOVERY OF LIVE FISH

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THE LAKE VIEW EXPERIMENTAL POND AREA, located near Lake View, Sac County, Iowa, was a warm-water fish production station for more than 30 years. In 1960 this area was converted to an experimental area comprising 30 non-drainable gravel-pit ponds. One of the first projects initiated was to develop and test a rotenone recovery technique which would be effective in removing fish from a pond and leave it devoid of fish for the next experiment.

The technique, which has been applied to ponds on 33 occasions during the past 3 years, is described here.

An outboard motor (5 to 10 horsepower for ponds up to 1 acre in size) is placed along shore on a stand so that the propwash will be directed toward the center of the pond and produce a circulation pattern like that shown below:



After the circulation has been established, diluted emulsified rotenone is discharged into the propwash. The discharge rate and dilution are adjusted to produce a calculated concentration of 0.5 p.p.m. of

rotenone in no less than one-half hour. The success of this technique depends on slowly increasing the dosage of rotenone so that each fish is picked up soon after its individual sensitivity threshold has been reached. As soon as the fish are showing at the surface and along the shore in good numbers, the chemical application should be suspended, while circulation is maintained until the affected fish are collected by net and placed in fresh aerated water. Bluegills, largemouth bass, and channel catfish start to surface in 20 to 30 minutes. When most of the fish have been collected, the chemical is again applied slowly until the calculated lethal dose has been reached. The fish usually are picked up in 1.5 to 2 hours, but this period may be extended by low water temperature at the time of treatment.

Use of fish distribution units or other facilities with auxiliary aeration reduces the time of recovery and increases the rate of survival.

In 1960, the rotenone recovery technique was used on nine ponds that had previously been seined to remove largemouth bass fingerlings (table 1). All the ponds were harvested late in the fall of 1960. This experiment showed that the rotenone technique was an effective means of removing largemouth bass fingerlings from nondrainable ponds.

The temperature of the pond apparently is a factor affecting survival of the fish being recovered. In 18 ponds which contained largemouth bass (including several ponds where the bass were in combination with other species), there was a recovery

of 6,685 fish, of which 5,398 (or 80.7 percent) survived. Table 2 shows the effect of temperature on the rate of survival. All but one of the experiments conducted with water temperatures at or above 52° F. resulted in above-average survival, and the one exception had survival approximately equal to the average. Since these experiments are arranged in chronological order, the results indicate a possible improvement in the technique as experience was accumulated.

Results were similar for the other species tried. The survival rates of carp, bluegills, bullheads, and channel catfish were also high. More than 95 percent of the carp and bullheads recovered survived. The survival rate for bluegills was the lowest of the species used in tests of the recovery technique. Subadult channel catfish survival was excellent and compared favorably with that of the largemouth bass.

#### Recovery

In 1962 and 1963, ponds were inspected at least once a day after being rotenoned, to determine how many fish had not been recovered during each experiment. Eight ponds containing largemouth bass fingerlings were rotenoned in 1962 and 1963, and later checked to determine the number of fish in the pond so that recovery could be estimated: there was no survival evident in any pond after treatment. Live carp and bullheads were recovered up to 36 hours after treatment. All largemouth bass, bluegills, and

TABLE 1.--Ponds rotenoned in 1960 to reclaim largemouth bass fingerlings not harvested by seine

Pond number	Fish taken with seine	Percent of total	Fish taken with rotenone	Percent of survival	Water temperature (°F.)
28	713	61	456	10	51
18	49	63	29	60	48
9	456	72	178	90	48
4	460	53	410	70	50
3	31	74	11	90	52
20	952	99	10	100	48
2	131	10	1,247	91	53
15	363	16	2,052	58	43
23	71	59	65	52	40

<sup>1</sup>The fish in this experiment were thought to be dead, and were destroyed.

TABLE 2.--Recovery of largemouth bass fingerlings by rotenone technique at various water temperatures

Experiment number	Largemouth bass recovered	Fingerlings survived	Percent of survival	Water temperature (°F.)
1	29	17	60	48
2	178	160	90	48
3	410	287	70	50
4	11	10	90	52
5	10	10	100	48
6	1,247	1,127	91	53
7	2,052	1,190	58	43
8	65	34	52	40
9	162	162	100	42
10	346	290	84	75
11	909	900	99	68
12	292	289	99	46
13	91	73	80	70
14	83	73	88	70
15	409	407	99	60
16	187	178	95	65
17	94	82	98	65
18	110	109	99	63
Total--	6,685	5,398	-----	-----

channel catfish picked up 12 hours after treatment--and later--were dead. The estimated recovery ranged from 60 to 100 percent for the largemouth fingerlings. Of 2,922 fish accounted for, 2,229 were

TABLE 3.--Estimated recovery of largemouth bass fingerlings by use of rotenone technique

Experiment number	Number fish in pond <sup>1</sup>	Number fish recovered	Percent recovered
1	433	346	80
2	1,377	909	60
3	118	91	77
4	<sup>2</sup> 83	83	100
5	<sup>2</sup> 413	409	98
6	246	187	76
7	125	94	75
8	127	110	86
Total--	2,922	2,229	-----

<sup>1</sup>Estimated.

<sup>2</sup>The ponds in experiments 4 and 5 did not contain other species.

recovered by using the rotenone technique for an overall recovery of 77 percent. The highest recovery was obtained in two ponds that contained no other species of fish (table 3).

More than 98 percent of the adult carp were recovered by the rotenone technique. Bullhead and channel catfish recovery was comparable to that of largemouth bass. Bluegill recovery was poor: 88 percent of the adults were not recovered in at least

one pond, and 83 percent of the fingerlings were left in another pond. Fish were considered to have recovered if they appeared to be in good health 24 hours after being taken from a pond. There was no latent death among fish held for 2 weeks. Some adult carp and largemouth bass were used for 3 successive years during rotenone-technique experiments. The final dose of rotenone (calculated on a volume basis) was 2 p.p.m. of 5 percent emulsifiable rotenone. This was increased to 3 p.p.m. in those experiments where carp and bullheads were present and the water temperature was 55° F. or colder.

### Discussion

We believe that this technique is applicable to ponds with regular shore lines, up to at least 5 acres. It is especially valuable when using nondrainable ponds to produce fingerling largemouth bass where they are needed for new or chemically treated waters. The rotenone recovery technique is less expensive and more efficient than seining in most nondrainable ponds. It can also be used in harvesting fish in rearing areas where water supply is a limiting factor in fish production.

This technique can be used for salvaging desirable fish in water areas where undesirable species are being eliminated.



A bacterium classified as belonging in the genus Flavobacterium--a gram-negative, non-motile rod, producing a yellow non-water-soluble pigment--has caused pathogenic and chronic infection in black mollies.

When it became necessary to remove excess male chinook salmon from a holding pond in order to conserve space, 174 adult males were placed in an 8x80 raceway. After being held overnight in the raceway, they were killed and weighed. The oxygen requirement of these salmon was determined to be 0.42 p.p.m. of oxygen per gallon per minute of inflow per pound of fish at 50° F. This requirement is considered to be very close to the maximum demand of the fish, as they were continually milling about in the shallow water and confined area in which they were held.