TABLE 8.—RETURNS FROM BUYING AND SELLING CHANNEL CATFISH.

Costs		
Bought 672 pounds @ $0.40 per pound	$	268.80
Delivery costs, 200 miles @ $0.15 per mile		30.00
Salary for driver		15.00
Dressing fish, 4 people took 4½ hours @ $1.25 per hour... (fish dressed out 59%)		22.52
Total Costs	$	336.32
Gross Returns		
396½ pounds of fish sold for $0.95 per pound	$	376.67
Net Returns—to management	$	40.35

USE OF ANTIMYCIN AS A FISH TOXICANT WITH EMPHASIS ON REMOVING TRASH FISH FROM CATFISH PONDS [1]

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ABSTRACT

Antimycin was applied to five fresh-water ponds at 3, 4, or 5 ppb, and to two salt-water ponds at 10 ppb. Undesirable fish, including four centrarchids and one cyprinid, were eliminated from four of five fresh-water ponds. Undesirable fish, including a centrarchid and a livebearer, were eliminated from both salt-water ponds. Mosquitofish, *Gambusia affinis*, were killed in five ponds, but were eliminated in none. Channel catfish, *Ictalurus punctatus*, that were in four ponds, were not killed. Antimycin showed real promise as a fish toxicant particularly for removing trash fish from catfish ponds. Antimycin, under the trade name fintrol, is registered as a fish toxicant by the Food and Drug Administration and by the U. S. Department of Agriculture. The retail cost to treat one acre-foot of water with 3 ppb antimycin was approximately $4.50.

INTRODUCTION

Trash fish in catfish ponds can be a major problem in fish farming. Fish such as green sunfish, *Lepomis cyanellus*, compete with catfish for food, space, oxygen, and may also introduce parasites (Hogan, 1966). Green sunfish compete with catfish for feed; this can be costly. They must be separated from catfish at draining; this requires extra labor and expense. Antimycin shows real promise for removing undesirable fish

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from catfish ponds without killing catfish. This paper discusses experiments conducted in seven ponds, four of which contained channel catfish, *Ictalurus punctatus.*

Antimycin has received much attention of late as a fish toxicant. Dunshee, Leben, Keitt, and Strong (1949) isolated and identified the bacteria. It was called antimycin because it was toxic to fungus. The bacteria was also found to be toxic to fish in very low concentrations. Strong (1956) reported that it retarded respiration of cells by inhibition of the electron transport in the oxidation-phosphorylation system. Use of antimycin as a fish toxicant was reported by Derse and Strong (1963), Walker, Lennon, and Berger (1964), Loeb (1964), Berger (1965), Hogan (1966), Lennon (1966), Powers and Schneberger (1967), and Radonski (1967). Herr, Greslin, and Chappel (1967) reported that antimycin had a relatively low toxicity for mammals.

Berger (1965), from laboratory tests, reported that antimycin killed some fish species at concentrations as low as 1 ppb. Some of these fish included gizzard shad, *Dorosoma cepedianum;* carp, *Cyprinus carpio;* golden shiner, *Notemigonus crysoleucas;* fathead minnow, *Pimephales promelas;* bluegill, *L. macrochirus*; largemouth bass, *Micropterus salmoides;* and green sunfish. Channel catfish were not killed until the concentration of antimycin was increased to 20 ppb. In other tests Hogan (1966) found that channel catfish eggs, fry, and fingerlings were much more tolerant to antimycin than those of other fish species.

Antimycin is now produced commercially under the trade name fintrol. The toxicant consists of 1 per cent antimycin and 99 per cent inactive ingredients including 400-mesh sand and Carbowax (Lennon, Berger, and Gilderhus, 1967). The retail cost of fintrol is presently $48.00 per 8.25 pound can. Cost to research and government units is $35.00. Fintrol used in our tests was furnished through the courtesy of Ayerst Laboratories, Veterinary Medical Division, 685 Third Avenue, New York, N. Y. 10017.

MATERIALS AND METHODS

Seven ponds containing undesirable fish were used in this study with antimycin. Five were fresh-water ponds and two were salt-water ponds. Two of the five contained channel catfish and trash fish. The other three ponds contained populations that were unbalanced because of trash fish. The two salt-water ponds contained channel catfish plus trash fish. Salt-water ponds were located at the Rockefeller Wildlife Refuge in Grand Chenier, Louisiana, whereas fresh-water ponds were located near Baton Rouge, Louisiana.

Prior to treatment with antimycin, all ponds were seined to determine the species of fish present. Following this, water quality was determined. Between 9:30 a.m. and 10:30 a.m. total hardness, dissolved oxygen, pH, and temperature were determined from the epilimnion. In addition salinities were determined from salt-water ponds. Phytoplankton blooms and turbidities were noted in all ponds.

Fresh-water ponds were treated with the following concentration: two ponds with 3 ppb antimycin, two with 4 ppb, and one with 5 ppb. Both salt-water ponds were treated with 10 ppb. The method of application was simple. A hole was punched in the can containing the desired amount of antimycin. The material was allowed to sift into the water over the side of a moving boat. There was no need for pumps or sprayers, and it took only 15 minutes to treat an acre pond. In four ponds, antimycin was broadcasted by hand from shore.

After treatment daily checks were made to see how long the water remained toxic in fresh-water ponds, but not in salt-water ponds. Golden shiners were held in treated water from ponds. These fish were removed as they died, and replaced with live fish. When fish stopped dying, it was assumed that the water was no longer toxic.

RESULTS AND DISCUSSION

All in all the results were gratifying. Sick fish appeared only minutes after treatment with antimycin. Undesirable fish were eliminated from four of five fresh-water ponds. The species of fish killed included green sunfish, bluegill, largemouth bass, golden shiner, mosquitofish, *Gambusia affinis*, and redear sunfish, *L. microlophus*. In one pond, treated with 4 ppb antimycin, one green sunfish and two sunfish hybrids were seined following treatment. In the same pond bluegills and golden shiners were eliminated. No explanation can be given for the survival. The pond was treated with 2 ppm of 5 per cent rotenone six months previous to treatment with antimycin. Not all sunfish were killed at that time. The pond was in the middle of a field and no ditch or stream was nearby. This would rule out recontamination from such sources.

Mosquitofish were killed in three fresh-water ponds but were eliminated in none. In one pond dead mosquitofish covered the surface after the pond was treated. Yet one week later they were found alive in the seine. Again one would suspect recontaminaton, particularly in the case of mosquitofish. This is doubtful, however, because two of the ponds were isolated.

Two of five fresh-water ponds treated with antimycin contained channel catfish. Trash fish were eliminated in both but no catfish were killed. In fact they were readily caught by hook and line three days after treatment and again one month later.

Antimycin did not kill crawfish, or cause ill effects.

Two ponds that were muddy cleared after treatment with antimycin. Apparently decomposing fish resulted in flocculation of clay particles. Despite decomposition of dead fish there was no oxygen depletion in these two ponds or in any of the others. Moreover, phytoplankton blooms were not noticeably affected.

The water remained toxic for about 10 days. Prior to this golden shiners were killed when put in a sample of water from treated ponds. This agrees with Berger (1965) who reported that degradation of antimycin occurred in warm, moderately hard waters in two to seven days, whereas in cool, soft waters up to two weeks were required. Moreover, degradation is slower as pH decreases. Results of water quality in ponds, prior to treatment with antimycin, are given below:

Pond	Total (ppm) hardness	Dissolved oxygen (ppm)	Temperature °F	pH	Turbidity	Salinity ppt.
1	20	3.4	76	7.1	bloom	..
2	20	5.8	84	7.0	muddy	..
3	20	5.4	84	7.1	muddy	..
4	20	5.0	76	7.2	clear	..
5	32	5.2	76	6.8	bloom	..
6	1480	7.5	88	8.0	bloom	11
7	1256	7.4	88	8.0	bloom	10

Trash fish were eliminated from both salt-water ponds without killing channel catfish in either. Trash fish killed included warmouth, *Chaenobryttus gulosus*, and sailfin molly, *Mollienesia latipinna*. Again, mosquitofish were killed in both ponds but were not eliminated in either.

Both salt-water ponds were treated by hand from the bank with 10 ppb antimycin. Sick fish appeared within an hour. Warmouth began dying soon after treatment, but were still dying one day later. Seining one week later turned up only channel catfish and mosquitofish.

SUMMARY AND CONCLUSIONS

1. Antimycin eliminated undesirable fish from four of five fresh-water ponds and from two salt-water ponds.
2. Channel catfish, that were in four ponds, were not killed by antimycin.

3. Mosquitofish were killed in five ponds but were eliminated in none.
4. The water remained toxic for about 10 days in fresh-water ponds with an average pH of 7.0, total hardness of 22 ppm, and water temperature of 79°F.
5. Antimycin did not noticeably affect crawfish, phytoplankton blooms, or dissolved oxygen.
6. The retail cost to treat one acre-foot of water with 3 ppb antimycin was approximately $4.50. If we assume a one-acre pond with an average depth of 4 feet, it would cost $18.00 to treat the pond.
7. Antimycin, under the trade name fintrol, is registered as a fish toxicant by the Food and Drug Administration and by the U. S. Department of Agriculture.
8. Antimycin showed real promise as a fish toxicant, particularly for removing trash fish from catfish ponds. It was also useful in eliminating undesirable fish before catfish were stocked.

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LITERATURE CITED

Berger, Bernard L. 1965. Antimycin, fintrol, as a fish toxicant. Proceedings of the 19th Annual Conference Southeastern Association of Game and Fish Commissioners 19:300-301.

Derse, P. H., and F. M. Strong. 1963. Toxicity of antimycin to fish. Nature 200(4906):600-601.

Dunshee, B. R., C. Leben, G. W. Keitt, and F. M. Strong. 1949. Isolation and properties of antimycin A. Journal of the American Chemical Society 71:2436-2437.

Herr, F., E. Greslin, and C. Chappel. 1967. Toxicology studies of Antimycin, a fish eradicant. Transactions American Fisheries Society 96:320-326.

Hogan, James W. 1966. Antimycin as a fish toxicant in catfish culture. Proceedings of the 20th Annual Conference Southeastern Association of Game and Fish Commissioners (in press).

Lennon, Robert E. 1966. Antimycin—A new fishery tool. Wisconsin Conservation Bulletin. March-April 1966.

Lennon, Robert E., Bernard L. Berger, and Philip A. Gilderhus. 1967. A powered spreader for antimycin. Progressive Fish-Culturist 29(2):110-113.

Loeb, H. A. 1964. Some notes concerning the toxicity of Antimycin A to carp and other fish. New York Fish and Game Journal 11:160-161.

Powers, James E., and Edward Schneberger. 1967. Antimycin: Promising in carp control. Wisconsin Conservation Bulletin 32(2):1.

Radonski, Gilbert. 1967. Antimycin: Useful in perch control. Wisconsin Conservation Bulletin 32(2):3-4.

Strong, F. M. 1956. Topics in microbial chemistry. John Wiley and Sons, Inc., New York, 166 p.

Walker, Charles R., Robert E. Lennon, and Bernard L. Berger. 1964. Investigations in Fish Control: 2. Preliminary observations on the toxicity of antimycin A to fish and other aquatic animals. Bureau of Sport Fisheries and Wildlife, Circular 186, 18 p.