INFORMATIONAL LEAFLET NO. 163

FINTROL (ACTIVE INGREDIENT-ANTIMYCIN A) A BIOASSAY EXPERIMENT

By

Edward T. McHenry

STATE OF ALASKA
William A. Egan - Governor
DEPARTMENT OF FISH AND GAME
James W. Brooks, Commissioner
Subport Building, Juneau 99801

August 1973

FINTROL (ACTIVE INGREDIENT-ANTIMYCIN A)

A BIOASSAY EXPERIMENT

by

Edward T. McHenry, Fishery Biologist

Division of Sport Fish

Seward, Alaska 99664

1969

FINTROL (ACTIVE INGREDIENT-ANTIMYCIN A) A BIOASSAY EXPERIMENT

by

Edward T. McHenry, Fishery Biologist
Division of Sport Fish
Seward, Alaska 99664

Introduction

A bioassay experiment kit was acquired from Ayerst Laboratories, New York, by the Alaska Department of Fish and Game to determine the feasibility of using Fintrol (Active ingredient-Antimycin A) for rehabilitating Alaskan lakes.

Antimycin is an antibiotic with a high toxicity to fish. Researchers (Berger, Lennon et al. 1969), who have conducted extensive laboratory and field tests in the development of antimycin as a piscicide, have found it has certain advantages over long-used, standard fish toxicants. The following is a brief summary of their conclusions.

Antimycin is easily and precisely formulated in liquid solution with acetone and in dry, Carbowax-coated fine sand which disperses the toxicant uniformly throughout various depths (Fintrol-5, -15). Liquid antimycin can be dispensed into the water by a metering pump or boat bailer and the sand formulation easily broadcasted by hand or by mechanical seed spreader. Antimycin is colorless and odorless and does not excite or repel fish. Its effect on fish is irreversible; once exposed sufficiently to show distress symptoms, they eventually die, even when placed in non-treated freshwater.

Antimycin's order of toxicity (i.e., different sensitivities between species) and effectiveness on various life stages (egg to adult) indicate its potential for partial or selective control of fish. Target fish-killing concentrations were not harmful to aquatic invertebrates (except rotifers, cladocerans and copepods) or vertebrates tested in quantities normally used as a piscicide.

Antimycin proved effective in a variety of water qualities. In soft, warm or low pH waters lesser toxicity may be required than in hard, cold or high pH waters. Concentrations greater than 10 ppb are required in waters of high pH (8.5 and above) and alkalinity.

Antimycin degrades rapidly, and most waters may be restocked with fish within two weeks after treatment. If faster degradation is necessary, potassium permanganate ($KMnO_4$) at 1.0 ppb or less will accelerate the breakdown process.

Procedure

Threespine stickleback (Gasterosteus aculeatus) were collected by seine and minnow traps along the Bear Lake shoreline one day prior to testing. On May 26, each of ten plastic bags was filled with 20 gallons of water from Bear Lake. The first bag was used as a control in which stickleback were placed with no Fintrol added. The desired amount of Fintrol was measured by titration burette (calibrated in 1.0 and 0.1 milliliter increments) into each bag to attain pre-determined toxicity levels ranging from 0.25 to 4.0 ppb. Approximately 0.17 lb (77.2 g) of stickleback was introduced into each bag to approximate an equal number of fish per bag. The bags were then sealed by wire and filament tape to prevent leakage or transfer of fresh water. A maximum-minimum thermometer was placed inside the control bag to record water temperature extremes during the course of the experiment. The sealed bags were tied together by a single line which was anchored at one end, and allowed to float in two to three feet of water. Setting up the experiment ran from 4:45 to 5:30 p.m. Air and surface water temperatures at 4:30 p.m., which were measured by pocket thermometer, were 47^{o} and 42^{o}F., respectively.

The experiment was repeated in a like manner on May 29, using 0.26 lb (118.0 g) stickleback per bag at toxicant levels from 3.0 to 8.0 ppb plus a control. Air and surface temperatures at 4 p.m. were 53^{o} and 45^{o}F., respectively.

At the conclusion of both experiments, each bag was examined for fish kills. In the bags containing partial fish kills, all stickleback were enumerated and noted as either dead or alive. In the bags containing either total kill or all fish alive, no fish were enumerated. Total stickleback in these bags were estimated on the basis of average fish per partial-kill bags.

Surface water samples were collected on June 3 (water temperature 45^{o}F.) to determine water chemistry of Bear Lake water. Chemical properties are as follows: D.O. 13 ppm, pH 6.9, CO_2 5 ppm, and Total Hardness 51 ppm. Due to failure of one indicator reagant, alkalinity could not be measured; however, from a previous determination made in March, 1965, total alkalinity in Bear Lake water is known to be low (41 ppm).

Results

On May 27, the sealed bags were cursorily examined for condition of the stickleback about 25 hours after initiation of the experiment. The control and bags of 0.5 ppb concentrate were "pulled" since all fish were alive and apparently healthy. After further inspection, it was discovered that some fish were still alive in the bag

containing the highest toxicant concentration (4.0 ppb); therefore, it was decided to allow the experiment to continue an additional 24 hours. Due to adverse weather at that time, none of the dead fish were removed from any bags. It is believed that this probably had little, if any, effect on the condition of live fish remaining in the bags. Since water temperatures were too low for any appreciable decay to add further toxicity to the already-toxic environments. Minimum (previous night) and maximum surface water temperatures were 38^{o} and 42^{o}F., respectively.

On May 28, the remaining bags were checked after approximately 24 hours duration since the previous day's examination. The results are presented in Table 1. Minimum and maximum surface water temperatures were identical to those recorded on May 27.

On May 30, the second series of toxicant levels were examined for fish kills approximately 25 hours after the experiment was performed on May 29. These results are shown in Table 2. The minimum (previous night) and maximum surface water temperatures were 40^{o} and 45^{o} F., respectively.

Table 1.--Fintrol Toxicant Levels and Resulting Fish Kills in 49 Hours, Bear Lake, May 26-28, 1969.

Fintrol (ml) per 20 gal. water	Toxicant level (ppb)	No. fish alive	No. fish dead	Total fish	Percent kill
---	Control	71 (est.)*	---	71 (est.)	---
0.1	0.25	61	---	61	---
0.2	0.50	71 (est.)*	---	71 (est.)	---
0.3	0.75	64	7	71	9.9
0.4	1.00	44	6	50	12.0
0.6	1.50	68	15	83	18.1
0.8	2.00	41	35	76	46.0
1.0	2.50	21	45	66	68.2

1.2	3.00	15	55	70	78.6
1.6	4.00	1	87	88	98.9

*These fish were released after 25 hours and were not enumerated; therefore, they were estimated by the average total fish per bag.

Table 2.--Fintrol Toxicant Levels and Resulting Fish Kills in 25 Hours, Bear Lake, May 29-30, 1969.

Fintrol (ml) per 20 gal. water	Toxicant level (ppb)	No. fish alive	No. fish dead	Total fish	Percent kill
---	Control	129 (est.)*	---	129 (est.)	---
1.2	3.00	78	56	134	41.8
1.6	4.00	49	90	139	64.7
2.0	5.00	11	103	114	90.4
2.4	6.00	4	126	130	96.9
2.8	7.00	129 (est.)*	all	129 (est.)	100.0
3.2	8.00	129 (est.)*	all	129 (est.)	100.0

*These fish were not counted, but estimated by the average total fish per bag.

Conclusions

The results in Table 2 indicate that the minimum lethal concentration of Fintrol required for a total kill of stickleback in Bear Lake is 7.0 ppb at water temperatures ranging from 40° to 45°F. Although these water temperatures are

low, it is noted that the lake's hypolimnion has a similar temperature range during early July, the optimum time to rehabilitate Bear Lake, as determined by baited minnow traps suspended in those depths.

Salmonids which inhabit Bear Lake in July, generally in juvenile stages, would be totally eliminated at a 7.0 ppb concentration. Berger, Lennon et al. (1969), found that salmonids were among the most sensitive to Antimycin of all species tested and died in concentrations of 5.0 ppb or less.

Ayerst Laboratories recommends that an additional 0.25 to 0.50 ppb Antimycin be added to the minimum lethal concentration predetermined by field bioassay when a complete fish kill is desired. This would indicate that a 7.25 to 7.50 ppb concentration level be used to eradicate all fish in Bear Lake.

NOTE: Further bioassay experiments should be prolonged to measure delay mortality factors by releasing live test fish to segregated holding boxes suspended in the lake for an additional 24-48 hours. Since antimycin toxicity is non-reversible, a delay in mortality may have been evident if test fish had remained under observation for an additional time period.

LITERATURE CITED

Berger, Bernard L., Robert E. Lennon, and James W. Hogan. 1969. Investigations in fish control: 26. Laboratory studies on Antimycin A as a fish toxicant. U.S. Bureau of Sport Fisheries and Wildlife. 19 pp.

Gilderhus, Philip A., Bernard L. Berger, and Robert E. Lennon. 1969. Investigations in fish control: 27. Field trials of Antimycin A as a fish toxicant. U.S. Bureau of Sport Fisheries and Wildlife. 21 pp.

Appendix A. Fintrol (Antimycin) Requirements for the Chemical Treatment of Waters in Elimination of Fish Populations.*

Desired Concentration	Fintrol-5		Fintrol-15		Fintrol-Concentrate	
ppb	lbs.	Units/AF	lbs.	Units/AF	ml	Units/AF
1.0	0.275	0.034	0.055	0.0079	12.63	0.0263
1.5	0.43	0.050	0.09	0.012	18.9	0.040
2.0	0.55	0.067	0.11	0.016	25.3	0.053
2.5	0.69	0.084	0.14	0.020	31.6	0.066
3.0	0.83	0.100	0.17	0.024	37.9	0.079
3.5	0.97	0.117	0.20	0.028	44.2	0.092
4.0	1.10	0.134	0.22	0.032	50.5	0.105
5.0	1.38	0.167	0.28	0.040	63.2	0.132
6.0	1.65	0.200	0.33	0.048	75.8	0.158
7.0	1.93	0.234	0.39	0.056	88.4	0.184
8.0	2.20	0.267	0.44	0.064	101.0	0.211
9.0	2.48	0.300	0.50	0.072	113.7	0.237
10.0	2.75	0.334	0.55	0.079	126.3	0.263

*Information taken and modified from Gilbert C. Radonski of Ayerst Laboratories work in the use of Fintrol.

This Appendix will assist you in determining the amount of Fintrol needed to treat any volume of water. The Appendix is based on the acre-foot. Examples for each formulation are provided.

Fintrol-5. Volume of water to be treated, 100 acre-feet. Desired concentration, 5.0 ppb, lbs./acre-ft. = 1.38; number of units required = 100 acre-ft. X 0.167 = 16.7 units of Fintrol-5.**

Fintrol-15. Volume of water to be treated, 100 acre-feet. Desired concentration, 5.0 ppb, lbs./acre-ft. = 0.28; number of units required = 100 acre-ft. X 0.0400 = 4.0 units of Fintrol.**

Fintrol-C. Volume of water to be treated, 100 acre-ft. Desired concentration, 5.0 ppb, milliliter/acre-ft. = 63.2; number of units required = 100 acre-ft. X 9.132 = 13.2 units of Fintrol Concentrate.**

** In all cases of fractional units round off at the next highest whole unit.

Appendix B. Base Formulation for Determining Dosage Amounts of Fintrol for Elimination of First Populations.

1. Fintrol-5 is a sand based formulation. Each unit contains 8.25 pounds of Fintrol-5 containing 37.42 grams of Antimycin A. Each unit will cover 30 acre-feet at a concentration of ppb.

Number of Units
1 - 49
50 - 99
100+

2. Fintrol-15 is a sand based formulation. Each unit contains 7.0 pounds of Fintrol-15 containing 158.76 grams of Antimycin A. Each unit will cover 127 acre-feet at a concentration of 1.0 ppb.

Number of Units
1 - 12
13 - 23
24 -

3. Fintrol-Concentrate is a liquid formulation. Each unit contains 480 mls. of Fintrol-Concentrate containing 48.0 grams of Antimycin A. Each unit will cover 38 acre-feet at a concentration of 1.0 ppb.

Number of Units
1 - 49
50 - 99
100+