

JOB COMPLETION REPORT  
INVESTIGATIONS PROJECTS

State of Montana

Project No. F-8-R-2                      Work Plan No. III                      Job No. III-B

Title of Job: Treatment of the diseases and schooling hatcherymen  
in their diagnosis.

Objectives:

This phase of the project will be directly concerned with preventing excessive and avoidable losses of hatchery stock through diseases.

Techniques Used:

A review of all literature available on trout diseases is being made by the project leader. It is planned that summaries of this review will be multilithed and distributed by increments to all state hatcheries. This will provide each hatchery foreman with the known facts on disease prevention and treatment in trout hatcheries. Demonstrations or assistance in the use of the methods described will be made by the project leader upon request.

The occurrence of a bacterial gill disease at Arlee fish hatchery warranted several weeks effort in developing a satisfactory prophylactic treatment.

High mortality rates due to gill disease at Arlee usually began about 10 weeks after hatching time. The fish became sluggish, had little or no interest in food and surroundings, and their gills became swollen and congested with mucous which was heavily infected with myxobacteria. Myxobacteria could also be isolated from the liver and kidney and the protozoan, Hexamita salmomonis (Octomitus) was often abundant in the intestines during later stages.

Three chemical compounds were tested in prophylactic treatments which began July 8, 1952 and were terminated October 6, 1952. These were: copper sulfate, PMA (pyridylmercuric acetate Technical), and DN-111 of which 20 percent is the dicyclohexylamine salt of 2-cyclohexyl-4, 6-dinitrophenol and 80 percent is inert materials. Copper sulfate was administered as a flush twice weekly using one quart of stock solution in the upper end of the trough. The stock solution contained one-fifth pound of copper sulfate per gallon of water. The PMA treatment was a one hour exposure to a concentration of 1:500,000 once a week. A one hour treatment was also used once each week with DN-111 at a concentration of 1:400,000. It was determined by experiment that young of the year rainbow and cutthroat trout at Arlee are killed by a one hour exposure to 1:100,000 DN-111 but

can survive one hour treatments at 1:200,000 of greater dilutions. In addition to these prophylactic treatments, aurofac 2-A (supplied by Lederle Laboratories) and veterinary grade sulfamerazine were added to the food of several experimental lots.

Sulfamerazine was added to the food at the rate of approximately 12 grams per one hundred pounds of fish on alternate weeks only. Aurofac was incorporated into the food as 2½ percent of the diet. The diet for all experimental lots was a 50:50 mixture of beef liver and hearts fed through a hand ricer. A control lot was maintained for each species. The controls were not treated chemically and were not fed diet supplements. The rainbow trout were six weeks old and the cutthroat trout were three weeks old at the beginning of the experiment. Each experimental lot of rainbows contained about 5500 fish and the cutthroat lots contained approximately 10,000 fish. Water temperature ranged from 49 to 50° F.

#### Findings:

PMA-- Three lots of cutthroat trout and three lots of rainbow trout were treated once a week with PMA. Average weekly losses on these lots ranged from 1.2 to 2.1 percent and never exceeded 3.6 percent during any week of the experiment (Table 1). The fish appeared healthy and consumed their food well.

Copper sulfate -- Average weekly losses on two lots of cutthroat trout treated with the copper sulfate flush were 2.5 and 3.8 percent. The mortality rate during the first two weeks was exceptionally high on these two lots but after the second week, weekly loss never exceeded 4.1 percent.

DN-111 -- The use of DN-111 had the adverse effect of causing the gills to become even more congested with mucous than usual and when gill disease appeared in these lots, the treatment only aggravated the situation. Average weekly loss was 4.0 and 6.6 percent in two lots so treated and had risen to 25.3 percent in one lot by the time the fish were 11 weeks old. The weekly loss in the other lot was 9.4 percent at the conclusion of the experiment and was still rising. PMA was used on these lots at age 11 and 14 weeks respectively and the mortality rates immediately took a definite downward trend.

Aurofac -- Aurofac was administered to two lots of cutthroat trout, one of which was also treated every week with PMA. The average weekly loss was 1.9 percent on the treated lot and 3.1 percent on the untreated lot. The maximum loss for any seven day period was 3.5 percent of the PMA-treated fish. The rising mortality rate in the untreated lot reached its maximum of 8.8 percent at age 11 weeks. PMA was then administered and the mortality rate decreased thereafter.

Sulfamerazine -- Sulfamerazine was fed to four lots of cutthroat trout and two lots of rainbow trout. One lot of

each species received no other treatment and gill disease appeared in both at age 10 weeks. Mortality rates at age 11 weeks had risen to 58.7 percent in the rainbow trout and 31.5 percent in the cutthroat trout. The cutthroat trout were then treated with PMA and the mortality rate declined throughout the remainder of the experiment. The gill disease was allowed to go on unchecked in the rainbow lot and 92.5 percent of these fish died. Sulfamerazine was also fed to each of three lots of cutthroat trout which were treated each week PMA, copper sulfate, and DN-111 respectively and to one lot of rainbow trout which was treated every week with PMA. Average weekly mortalities on these lots indicated that sulfamerazine did have a slightly beneficial effect when used along with the proper chemical treatment (Table 1). The sulfamerazine fed lots were all in lower troughs while the lots that received only the chemical treatments and no sulfa were all in upper troughs.

Controls -- Losses caused by bacterial gill disease began to occur in both the rainbow and cutthroat control lots at age 12 weeks. The rainbow trout were treated with PMA after the 13th week when the weekly mortality rate had risen to 14.8 percent. The cutthroat trout control was never treated with PMA. At the termination of the experiment, 45.2 percent of this lot had died and the mortality rate was still increasing.

#### Analysis and Recommendations:

Weekly prophylactic treatments using either PMA or copper sulfate were successful in preventing excessive mortalities due to gill disease among the rainbow and cutthroat trout at the Arlee Hatchery. No readily apparent benefit was obtained through the use of aurofac diet supplement.

Despite the fact that PMA is said to be too toxic to use for treating rainbow trout, the data here presented point to PMA as the recommended prophylactic to use against bacterial gill disease among both rainbow and cutthroat trout at Arlee. Copper sulfate flush treatments considerably reduced the number of mortalities due to gill disease at Arlee, but cannot be considered as satisfactory as the prolonged type of treatment with PMA. When gill disease at the Arlee Hatchery was controlled by chemical prophylaxis, a further slight reduction in mortalities was effected by the use of sulfamerazine diet supplement.

Table 1. Treatments and percentage losses of cutthroat and rainbow trout at the Arlee Fish Hatchery, 1952.

Treatment	Species	Average weekly loss (%)	Maximum weekly loss (%)	Total loss (%)
PMA	Rb	2.0	3.6	19.7
PMA and Sulfa	Rb	1.2	1.8	12.3
Control	Rb	4.1	14.8	36.5
Sulfamerazine	Rb	18.1	58.7	92.5
PMA	Ct	2.1	2.9	21.5
PMA and Sulfa	Ct	1.5	1.9	16.9
Control	Ct	5.2	11.9	45.2
Sulfamerazine	Ct	10.5	31.5	65.6
Copper Sulfate	Ct	3.8	4.1	36.6
Copper sulfate and sulfa	Ct	2.5	4.1	25.8
DN- lll	Ct	4.0	9.4	37.1
DN-lll and sulfa	Ct	6.6	25.3	54.9
Aurofac and PMA	Ct	1.9	3.5	18.7
Aurofac	Ct	3.1	8.8	29.0

Summary:

Three chemical treatments and two diet supplements were tested on rainbow and cutthroat trout at the Arlee Fish Hatchery for their value in reducing losses due to bacterial gill disease. Weekly treatments with one hour exposure to 1:500,000 PMA (pyridylmercuric acetate Technical) was an effective prophylaxis in these tests. Copper sulfate flush treatments administered twice weekly were also effective but not as satisfactory as the prolonged treatments with PMA. The third chemical treatment contained as its active ingredient the dicyclohexylamine salt of 2-cyclohexyl-4, 6-dinitrophenol. Use of this chemical caused the characteristic symptoms of bacterial gill disease to be even more severe than ever, and was therefore detrimental rather than beneficial. Sulfamerazine diet supplement was useless when used by itself against gill disease but appeared to reduce losses somewhat among lots that were being treated with either PMA or copper sulfate. Aurofac diet supplement did not prevent excessive losses due to gill disease.

Data and Reports:

Original data and reports are in the custody of the project leader in Missoula, Montana.

Prepared by Jack E. Bailey Approved by \_\_\_\_\_

Date April 16, 1953