

1/

Experimental Hatching of Steelhead Eggs
in the Presence of Oligochaete Worms
with a Suggested Program of Further Investigation

By J. B. Kimsey
Inland Fisheries Branch
California Department of Fish and Game

J. C. Briggs (1952), during his work on the salmon and steelhead in Prairie Creek, Humboldt County, noted abnormally high losses of eggs in redds where a species of oligochaete worm was found. The average egg mortality in 4 silver salmon redds was 55.8% in the infected redds as compared to an egg mortality of 14.8% in redds where there were no oligochaetes. There was a similar mortality of 55.4% for 7 infected steelhead redds as compared to a 13.7% mortality in 6 uninfected redds. As many as 400 worms were taken from one redd. In addition it was observed that heavy concentrations were found only in areas where eggs had been deposited. The oligochaete appeared to peak in abundance during February and May, thereby causing no known losses in the King salmon redds.

A hatchery experiment by Briggs seemed to bear out his field observations although King salmon eggs were substituted for silver salmon eggs. He placed in gravel, 50 King salmon eggs and 20 oligochaete worms in a metal cannister about 3" x 4" in size. A control without oligochaetes was prepared similarly. Thirty days later all the eggs were dead in the can with oligochaetes and only seven larvae and 3 eyed eggs were still alive in the control. Because the holes placed in the can to allow water circulation had rusted shut a similar experiment was made by Briggs using steelhead eggs, but with larger circulating holes which were periodically cleared of rust. Similar results (summarized in Table 1) were obtained.

An observed field mortality in eggs of 55.8% for silver salmon and 55.4% for steelhead as against average mortalities in uninfected nests of 14.7% and 13.7% respectively is serious and it was believed the situation warranted further attention.

The hatchery experiment of Briggs was not believed to have been adequate and was in any case awkward to use. Accordingly, in the early spring of 1951 another hatchery experiment was set up. The purpose of this was to develop a method whereby observations could be made on the way the oligochaetes attacked (if they did so) the eggs; to make a more natural controlled check on the oligochaete mortalities; to devise a method whereby a series of experiments using various chemicals could be run under reasonably natural conditions in an effort to find some way to control the oligochaete.

Table 1

RESUME OF BRIGGS' EXPERIMENT

King Salmon (30 days)

Can #1 Can #2 (Oligochaetes 1/)

Total eggs	50	50
Total Dead eggs	40	50
Total Live eggs	3	0
Total Live fry	7	0
% live fry	14.0	0
% live eggs	6.0	0
% total mortality	80.0	100.0

Steelhead 2/

1st Experiment Can #1 Can #2 (20 Oligochaetes)

Total eggs	50	50
Total dead eggs	4	49
% dead eggs	8.0	98.0

2nd Experiment Can #1 Can #2

Total eggs	50	50
Total dead eggs	17	49
% dead eggs	34.0	98.0

The results of the experiment are as follows: In the first experiment, the mortality rate was 80% in the control group and 100% in the group with oligochaetes. In the second experiment, the mortality rate was 8% in the control group and 98% in the group with oligochaetes. The results indicate that oligochaetes are highly effective in killing King Salmon and Steelhead eggs and fry.

The results of the experiment are as follows: In the first experiment, the mortality rate was 80% in the control group and 100% in the group with oligochaetes. In the second experiment, the mortality rate was 8% in the control group and 98% in the group with oligochaetes. The results indicate that oligochaetes are highly effective in killing King Salmon and Steelhead eggs and fry.

The results of the experiment are as follows: In the first experiment, the mortality rate was 80% in the control group and 100% in the group with oligochaetes. In the second experiment, the mortality rate was 8% in the control group and 98% in the group with oligochaetes. The results indicate that oligochaetes are highly effective in killing King Salmon and Steelhead eggs and fry.

1/ Number indicated as a "mass".

2/ Length of experiment not known.

METHOD

Two hatching boxes (fig.1) about 6" x 16" x 24" were constructed with a glass window approximately 4" x 12" in one side. These were made of 1" rough redwood planking and the joints water-proofed with a sealing compound. They were built so as to sit on a standard California hatching trough. Water was run from the upper trough into the first box by a small aluminum bottomed trough. A similar trough ran the overflow water from the first box into the second one so that only one hatchery trough was inconvenienced. These boxes were installed in Prairie Creek Hatchery through the cooperative courtesy of S. C. Smedley, Foreman.

A nest substrate similar to the kind utilized by wild fish was prepared and steelhead eggs were taken and fertilized at Sweasy Dam on March 24, 1952. The eggs were placed in the boxes about 3 hours and 10 minutes after fertilization and covered with gravel, similar in size and quality to that found in natural nests. A prior introduction of steelhead eggs from a series already fertilized and in the hatchery failed because the eggs were more tender than was first realized. Approximately 700 eggs (692 and 700) were placed in each box with an additional 700 eggs from the same group being held in a standard wire hatching basket. On April 4, 1952, a mass of oligochaete worms was introduced into what was called hatching box #2. These worms were collected from one steelhead redd in Prairie Creek at the north end of the Prairie Creek State Park camping area. It is difficult to count individual worms in such a mass without killing them, but at least 100 worms were estimated to have been introduced. They were found 10 inches below the surface of the redd. } *note*

RESULTS

On May 12, 1952, only six dead eggs were left in the hatching basket; all the others having been removed as they died or hatched. As this basket had been placed in a trough where other eggs were being hatched the actual number of living fry produced is not known as those dying after emergence would have been picked up with the dead from the other baskets.

Although a catch net was placed on the overflow of each box 28.5% of the eggs in the uninfected box (I) and 20.2% of those in the infected box (II) were unaccounted for. These are assumed to have been unfertilized or to have died at the beginning of the experiment and decomposed. Others may have been present but dead and decomposed to the extent they were overlooked. This loss also may have been due to faulty flowage of water through the hatching boxes.

Table 2

RESULTS OF 1952 OLIGOCHAETE EXPERIMENT				
	Box I	Box II	Basket	
Total eggs introduced	692	700	700	
Total live fry	399	264	264	
Total dead fry	13	237	237	
Total dead eggs	82	56	75	
Total unaccounted for	198	143	143	
Total mortality	293	436	75	
% live fry	57.6	37.7	37.7	
% dead eggs	11.8	8.0	10.7	
% dead fry	1.88	33.9	33.9	
% unaccounted for	28.6	20.4	20.4	
% total mortality	42.4	62.3	62.3	
% eggs hatched <u>1/</u>	59.5	71.6	71.6	

1/ Includes live and dead fry.

There is a high degree of significance in mortality between the two groups of eggs. This carries through all combinations although somewhat lower in the dead egg and unaccounted for categories. Briggs' experiment of course showed the same high degree of significance. As was stated before, we were merely trying to devise a more suitable laboratory method for testing various agents for the control of the oligochaete.

Table 3

RECAPITULATION OF TOTAL MORTALITIES (STEELHEAD)				
	Natural Redd	Briggs' Exp.	1952 Hatchery Exp.	
		#1 #2	Box	Basket
% Mortality without oligochaetes	13.7%	8% 34%	42.4	10.7
% Mortality with oligochaetes	55.4%	98% 98%	62.3	

DISCUSSION

While this method was relatively successful the window in the side gave virtually no aid in our efforts to determine how the worms attacked the eggs. Eggs were visible at first but the algae and silt accumulation on the glass soon prevented further observation. A small curtain was placed over the window to exclude light but it did not prevent the algae formation.

A full scale experimental program was planned for the following season but was called off because of the reorganization of the department as it was quite uncertain as to where personnel would be located. In this program it was proposed to use full size hatchery troughs at a location in Prairie Creek State Park. A series of twenty-four artificial redds would have been constructed in which oligochaetes were to be introduced. An additional twenty-four would not have oligochaetes. It was proposed to use four to six surplus troughs.

In this program it was planned to test a series of agents that might control the oligochaete and not harm the eggs. We also wanted a substance that would be as nearly specific for the oligochaete as possible so that the normal invertebrate fauna of the stream would not be entirely destroyed. It seems unlikely that all the oligochaetes could be removed but it is entirely possible they could be held at a low enough level of abundance that the high mortality of eggs in the redds they infested could be reduced.

Correspondence on possible agents was never carried out. We did propose however, to try common salt (Na Cl) and perhaps some of the other metal salts such as CuSO₄.

The method of application would have been an adaptation of the constant flow siphon described by Burrows (1949). Batteries of these could have been placed at intervals on Prairie Creek should our experiments have proved control feasible.

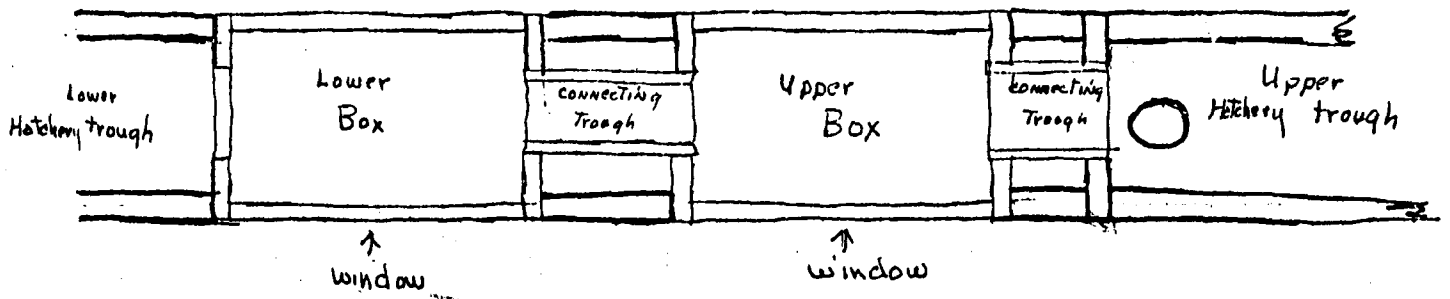
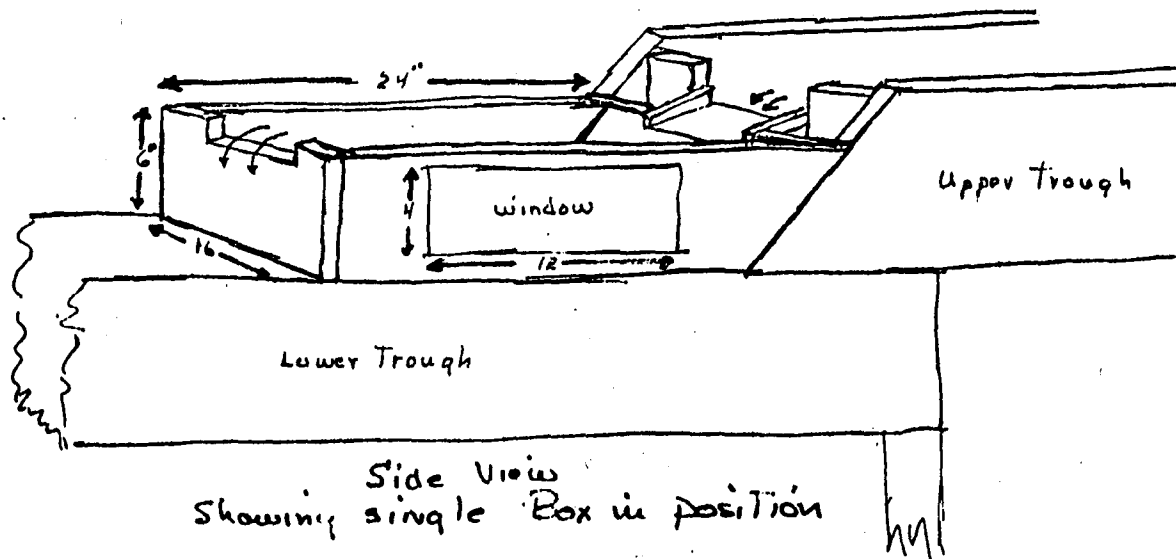
The loss is great enough from this organism that the proposed experimental program should still be given consideration either by regional personnel or by staff research people under the Dingell-Johnson program.

A survey to determine the extent of the range of the oligochaete should be carried out. Prairie Creek is one of the streams we can expect to remain in production as a natural spawning area indefinitely as it is nearly completely protected by the State Park. Even if the survey showed only the Prairie Creek complex to be seriously affected it would still be worthwhile to devise a method of control.

Literature Cited

- Briggs, John C. 1953 The behavior and reproduction of salmonid fishes in a small coastal stream, California Department of Fish and Game, Fish Bull. No. 94, 62 pp., 5 figs.
- Burrows, Roger E. 1949 Prophylactic treatment for control of fungus (*Saprolegnia parasitica*) on salmon eggs. Prog. Fish Cult. Vol. II, No. 2, p. 97-103.

Figure 1.



Top View
Showing tandem arrangement of
Experimental Watching Boxes

Mr. Elton Bailey,
Region I Headquarters

627 Cypress St

Redding, Calif.

April 15, 1917

Dear Mr. Bailey:-

A Mr. Vestal of S.F. suggested that I write you in regards to something that has my interest and that of Dr. G.E. Gates a well known worm expert. Recently I found a worm in S.F. that has the first report from North & South America and also I found a new small species that was named after me. I found other ones also. The worm however that has never been ~~named~~ ^{classified}

is one that is found underwater and was found in Prairie Creek near ORICK. 17 years ago or so some immature specimens were sent to Dr. Gates and naturally could not give an accurate description, because maturity may show up many new features.

These worms were destroying eggs in redds of the stream bed ~~at the area~~ at a high rate. The Fish Bulletin # 94 State of Calif. Dept. of Fish & Game by John C. Briggs tells about these worms. Look at Pages 47, 48, 49, 50 and 58.

About April 15 to May 15 should be a good time to possibly find some mature worms (must have a well developed clitellum [that is a swollen ring around its belly near the head of the worm.

Perhaps since 17 years ago some of the men of the hatchery at Prairie Creek Hatchery have been aware of this worm and tried possibly find some mature specimens. It would make Dr. Gates happy to get an opportunity to classify it.

I almost died of a ruptured appendix ^{the fall} 13 ~~and~~ and suffered complications but I am recovering fast.

I would like to have the name of the head man at the Prairie Hatchery. Also if I could ~~physically~~ come there, could I get permission ^{over}

What are my chances of finding these worms?

If I took a trip there, I may have to spend 3 or 4 days looking for them around the spots on Prairie Creek near Goodwin Creek and Elk Prairie Creek. (Look at map on page 10)

These worms are immature ~~in~~ March but might be mature in the latter part of April. †

Also if there are "baby" worms there must be mature worms somewhere nearby.

Possibly I might get some immature worms and enclose them in "screened" cans full of the pebble environment and the dead eggs of fish, and keep the cans in running creek water until they develop fully.

I shall highly appreciate any help, guidance or suggestions from you.

Sincerely,

Sal Billeci
Retired School Teacher
S.F. DISTRICT

SALVATORE BILLECI
740 Cayuga Avenue
San Francisco, Calif. 94112

RECEIVED
APR 15 1970
Department of Fish & Game
Region 1