

Institute for Fisheries Research
University Museums
UNIVERSITY OF MICHIGAN
Ann Arbor, Michigan

April 8, 1930

Report No. 6 (first installment)

INVESTIGATION OF DISEASE IN TROUT FRY AT THOMPSON HATCHERY

On April 1 the Institute was notified of a serious outbreak of disease in the hatchery at Thompson. Mr. Wendell H. Krull, instructor in the Zoology Department of the University, kindly agreed to make an investigation of the trouble and went north the following morning, equipped with apparatus for water analysis, microscope, etc. He made a thorough investigation, with the efficient aid of Superintendent Schust, and succeeded in diagnosing the disease with scarcely a doubt; in treating the disease with apparent success, and in contributing to our understanding of it.

Mr. Krull reports that his investigation has made him quite confident that the death of the brook trout fry in the Thompson Hatchery is caused by a virulent bacterial infection. The symptoms of the disease are exactly those described for the new gill disease of trout by Dr. H. S. Davis, in the Transactions of the American Fisheries Society for 1926 (pages 156-160), and further discussed in the same Transactions for 1927 (pages 210-216), and in the recent bulletin on "Care and diseases of trout" (Bureau of Fisheries Document No. 1061, pages 158-160). The attention of the Department is directed to these publications.

The peculiarities in the fluctuation in mortality, as described by Davis, were found to be shown by the fry at Thompson. Rod-shaped bacteria were found in countless numbers in smears from the surface of the gills. A great increase in the mucus on the gills must hinder the circulation of water through gill-tissues. This clogging of the gills is hastened by the collecting of debris and sand in the mucus coat. Eventually this

leads to a complete covering of the gills, and death presumably follows from suffocation. Before death, the gills become so swollen as to greatly distend the gill covers. The body behind the gill region appears abnormally compressed sidewise, so that there is a very abrupt contrast between the width of the head and that of the body. The blood vessels in the gill become distended, as Davis mentioned. The fins of the fry are attacked by the bacteria only in the last stages of the disease.

All of the trout in the hatchery are affected to a greater or less degree. The brook trout from certain hatcheries are very badly diseased, and many of these show other indications of weakness, especially sinuous malformation of the head. Others show high resistance, as do also the brown trout. From the healthy brook trout, which showed no mucus accumulation on the gills, none of the bacteria could be isolated.

The history of the hatchery, analyses of the dissolved gases (oxygen and carbon dioxide) in the water, and the small amount of air bubbles liberated (in April), do not justify the view that the trouble is caused by supersaturation of gas. The apparent pop-eyed condition of many of the diseased weaklings is due, we think, to malformation of the head. The nature of the symptoms, and the abundance and the character of the bacteria, indicate clearly that the disease is a bacterial one. No evidence that the trouble is caused by parasitic worms was found.

The treatment of the fish with copper sulphate was refined and modified by Mr. Schust at the suggestions of Mr. Krull. Preliminary tests of treatment seem successful. We hope that Davis' optimism as to the easy control of this otherwise fatal malady may be justified.

It is not improbable that this disease has existed for years in Michigan hatcheries. Davis points out emphatically and we think with wisdom, that it is wide-spread; that it is very difficult to recognize or identify; that it probably has been one of the most serious causes of wholesale loss of trout

in hatcheries, and that such losses were probably often attributed to the character of the water supply.

Mr. Krull found Superintendent Schust diligent, industrious, conscientious and intelligent in his efforts to cope with this serious outbreak of disease in his new hatchery. Some of the other employes through ignorance were found to work in such a way as to spread the disease. Once they were seen to use a brush from an infected trough on another trough, and once they rinsed infected equipment in the spring which feeds the whole house. Mr. Krull took the liberty of pointing out to Mr. Schust directly, means of making further spread of the disease less probable.

Mr. Krull points out that the completion of the building, especially of a concrete floor, would make it easier to maintain sanitary precautions in the event of a recurrence of the trouble. He is also of the opinion that a well-trained foreman would be of high value in checking the spread of the disease, as the hatchery is clearly too large for one man to superintend the entire work, at all times and in all parts of the building.

It is quite probable that the relatively high temperature of the waters at the new Thompson hatchery has contributed to the epidemic. Davis quotes instances of the appearance of the disease as the water temperature rose. It could be determined just what relation this bacterium and the disease it causes bear to temperature. Although it is quite probable that means for the control of the disease can be developed, this point may have a bearing on the advisability of using warm water for hatching trout. Whether this drawback, if real, would overbalance the advantages of using warm water, would still be doubtful and in need of consideration.

Further studies of the disease are being carried on by Mr. Krull, along the following lines-

1. Methods of treatment: experiments planned by Mr. Krull are being

continued by Mr. Schust.

2. Method of transference of the disease: bacteria found in the slime of affected troughs look like those on the gills, and will be further compared in the laboratory.

3. Possible carriers of the disease: experiments are under way (at Thompson) to determine whether the resistant brown trout can carry the disease without harm to themselves, and thus infect brook trout.

4. The origin of the disease: thought will be given as to the possibility of the introduction of the disease to Thompson by the equipment moved over from the Sault hatchery, or by the eggs shipped in. In this connection, the Institute requests an early report on whether any similar trouble was experienced at the Sault hatchery. The spring supply at Thompson so far as could be determined is free of the bacteria.

5. Mode of action of the bacteria; a microscopic study will be made to obtain some better evidence on the way the bacteria kill the fish. Preliminary examination has not confirmed Davis' statement that the gill tissues are actually destroyed.

6. Identification of the bacteria: the loan of slides made by Davis has been requested, so that it may be seen on comparison whether the disease^o producing bacteria at Thompson are, as we are lead to assume, like those described by Davis.

This first installment of the report is prepared now to make the main results of the investigation at once available. Further report on the phases being still investigated will follow shortly, as soon as the results of the necessary further laboratory studies become available.

(SIGNED) Carl L. Hubbs.
Director.

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Report No. 6. (second installment).

As the result of a telegram from Mr. Shust at the Thompson Hatchery, stating that the treated fish were dying faster than the fish which were not treated, we had occasion to return to the Hatchery for further observations.

It was true that the fish for several days after treatment died more rapidly, but by the time we arrived the reverse was true.

We attempted to find a cause for the fact that the treated fish were dying faster and confined our efforts to the largest fry. We thought that copper sulphate was probably the cause, but after we found that healthy fish could be left in the solution of copper sulphate for 35 minutes and in an accidental case all night without any apparent harm we were forced to change our minds. H. S. Davis says in this connection that, "Healthy, vigorous trout will survive immersion in a 1 to 2000 solution of copper sulphate for several minutes". In a written communication from him he says that the fry will stand the sulphate treatment as well as older fish. Furthermore he states that at one hatchery by mistake a 1 to 500 solution was used on three successive days, without loss.

The fish which we treated were hopelessly sick with the gill disease bacteria and also the fin disease described from the Hart Hatchery (Report No. 10) but since the fin disease was not of long standing the fins were not entirely destroyed, although large areas were effected. Therefore it was predicted that there would be a heavy loss. Several troughs were kept as controls and a steady heavy loss was noticed. In several of the treated troughs the losses were very small and in others heavy. These dying fish were carefully examined for gill disease bacteria, but none could be found, indicating that the copper sulphate is very effective, in removing the bacteria. While no sections of these fish have been made to determine the extent of the injury of the bacteria to the opercula and gills, naked eye and microscope observations seem to indicate extensive injury. If this is true, shock and probably poisoning, are sufficient to cause death.

H. S. Davis says in connection with the treatment of fin disease of trout caused by a rod-shaped bacterium that, "this treatment has been found to be effective in early stages of the disease, but after the bacteria have gained entrance to the tissues they are out of reach of the chemical baths". We conclude from this that since our fish had the gill disease in addition to a fin disease he might have destroyed all of them.

Although the copper sulphate has perhaps never been used in such a severe epidemic, and though our faith in copper sulphate is somewhat shaken we are continuing our experiments with the efficient aid of Mr. Shust order to attempt to determine just what its value is in this connection if it has any.

Several troughs are being maintained for controls, some treated weekly, and some daily, and this work is being done by Mr. Shust personally. This will no doubt give up some data on the advisability of using routine copper sulphate treatment instead of salt in hatcheries, when bacterial diseases are known to occur.

We are trying the same treatment on a batch of very small fry which are hopelessly sick and have never made normal growth.

A trough method of treatment was also devised which does not necessitate the handling of fish at all and makes it possible to treat many troughs in a comparatively short time. In carrying out this treatment the water is turned off. The amount of water in the trough at a certain level is known and to it is added, by pouring along in the trough, the amount of copper sulphate, necessary for the desired strength of solution. The sulphate is dissolved in a small amount of water before being added to the trough. By the activity of the fish and by moving one's hand through the water from one end of the trough to the other the chemical is quickly distributed. After one minute the water is turned on and the healthy more vigorous fish swim to the head of the trough into fresh water immediately while the weaker, sickly ones at the other end of the trough are forced many times to stay in the solution as long as four minutes. In actual practice this method of treatment works out very well.

Experiments which were begun during the first visit produced results, but are really not of sufficient magnitude to warrant final conclusions being based on them.

It is interesting to note that at the Thompson Hatchery the albino fry were isolated in a trough, possibly thirty or forty specimens. They were apparently doing well until the day prior to our departure, when three of the fish died and one was dead the following morning. Microscopic examination showed massive infections of gill disease bacteria.

Concerning the fin disease, it might be added that it had not spread through the whole hatchery but was confined more or less to two shipments which were adjacent to one another.

In regard to the gill disease it was found that the workmen claimed that heavy losses were cyclic and recurrent.

The organism responsible for the gill infection was seen in the living condition and found to be non-motile. These organisms have also been tested by Gram's method and found to be "gram-negative," which increase our difficulties in making stained gill sections. A stained smear of the gill disease bacteria described by H. S. Davis has been loaned to us by the author, and comparison with our specimens indicates that they are morphologically the same.

During the second visit at the hatchery two brook trout were discovered in the spring which is the source of water supply. We were unable to catch those at the time, but we requested that they be caught as soon as possible and that they be preserved for us. This finding, of course, gives us another possible source of infection in the hatchery. We urge that every care be taken to keep all fish out of the spring, and to prevent its contamination in any way whatever.

Wendell H. Krull
Fish Pathologist

Approved: (Signed) Carl L. Hubbs

Carl L. Hubbs
Director