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INSTITUTE FOR FISHERIES RESEARCH
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ANN ARBOR, MICHIGAN

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FISH DIVISION

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Report 35

REPORT ON EPIDEMIC AMONG BROOK TROUT AT GRAYLING
STATE FISH HATCHERY

Notification of an epidemic at the Grayling Hatchery was received on the 17th of October and we arrived at Grayling the next morning.

The disease causing the loss among the fish has been definitely diagnosed as furunculosis as suggested by Mr. Zalsman in his letter to the Department of Conservation. The disease is caused by a bacterium called Bacterium salmonicida, described by Emmerich and Weibel in Germany in 1894. M. C. Marsh in 1902 described a similar disease in the U. S. and called the causative organism Bacterium truttae. The two diseases seem to be the same, therefore the name of the causative organism remains Bacterium salmonicida.

We have succeeded in isolating the organism in pure culture and will be able to verify conclusions arrived at by various authors and hope to be able to add to the existing information.

The disease was spread throughout the hatchery but was causing heavy losses only among the 3 and 4 year old brook trout, while only a few of the 1 1/2 year old trout were fatally affected. Definite lesions caused by the organisms were found in the

fingerling trout also, but apparently the loss is no greater than normal. The brood stock of brown trout was not severely affected while the rainbow trout seemed to be normal (immunity in the rainbow trout is only apparent and not real according to Davis, 1929).

Many of the diseased fish exhibited "boils" on the surface of the body where the skin was separated from the underlying tissue by a bloody fluid (sometimes dark and bloody, at other times more watery with a slight amount of blood). These boils vary in size from that of a pin-head to areas large enough to cover almost the entire side of the body. Some fish do not have the "boils" but may exhibit "ringworm-like areas" while others show bloody blotches or "pinkish" areas; the former apparently due to ruptured vessels while the latter are produced by dilation of vessels. The various kinds of areas are found on all parts of the body including fins, gills and inside of mouth. Some fish appear perfectly normal but stained smears of liver or spleen material of these specimens showed the organisms in great abundance.

The visceral organs of thirty-eight diseased fish were examined carefully for internal lesions. The blood vessels of the viscera, especially the posterior gut region, were decidedly congested. The liver was usually normal in size and occasionally in color. In the most extreme cases the liver showed numerous bloody blotches, sometimes a millimeter in diameter. The spleen was decidedly variable in size and in some trout had a very dark color and the surface roughened like stipple-board. Extreme abnormal kidney conditions (Davis 1929) were not observed.

Organisms could be recovered in abundance in kidney, spleen and liver smears and in relatively small numbers in heart blood or blood from the caudal vessels.

Diagnostic symptoms were very decidedly obscured by the fast-growing luxuriant covering of fungus (*Saprolegnia*). Many living fish were more than half covered with a blanket of fungus. Judging from the distribution of fungus, lesions are more abundant on the dorsal side of the fish. Abnormally dark, longitudinal streaks were

observed on diseased fish and on others which did not show visible signs of disease. Whether this is a characteristic of the infection or a condition prevalent during the "ripening" of sex products is not known.

A total of two hundred five dead brood stock brook trout were separated according to sex, and 62% were males. This difference is, no doubt, correlated with the injuries produced in fighting and incidentally suggests that the organisms may enter the host through these injured places. The manner in which the disease is transmitted has not been determined definitely.

The disease is essentially a blood disease and under prevailing conditions at Grayling cannot be exterminated from the hatchery since the trout in the water supply are infected. Mr. Zalsman in his letter to the Department mentioned the taking of a large infected brown trout. On the last morning of the visit to the hatchery Mr. Peterson took a sick brook trout (12 inches) from up creek. It showed fungus along the back and a real dark color. Heart blood smears were made and the organisms recovered.

In view of some reports (Davis, 1929) it seems rather remarkable that trout can be raised at Grayling with no unusual losses except under extreme conditions. Warm water and low water favor the development of the organisms and both these conditions were extreme throughout the summer. Ordinarily the infection appears to break out as an epidemic in June, when the water is usually warmest at Grayling. A heavy fall epidemic according to Mr. Zalsman is unusual. The exact effect of environmental conditions is not known. There are at least two possibilities-it may increase the virulence of the organism or reduce the vitality of the fish or both.

The optimum temperature for growth of the bacterium was estimated by Marsh as being about 68°F. as determined by experimental means. The organism is killed in a short time at a temperature of 98.6°F. and ceases to grow at 42°F. Since the water temperatures at the hatchery are below this temperature the present epidemic will cease to spread. We are of the opinion that many more of the fish will continue to die since

their lesions are quite pronounced and the fungus continues to thrive. The low water temperature prolongs the life of the sick fish which would otherwise be killed off in a short time.

Control measures to reduce the existing number of bacteria were advocated:

- (1) Removal of dead fish at once.
- (2) Burial of dead fish (as was already being done).
- (3) The removal (preferably by spearing) of badly fungused fish, and fish showing large boils, although these may be swimming normally, because they can not be expected to survive. The boils break and discharge the bacteria into the water in countless numbers increasing the chances of infection very decidedly. We were unable to do away with these sick fish effectively because of lack of equipment. We were given a spear cut out of a malleable piece of sheet iron. The tines would bend like lead and there were no barbs. We were told that it was issued to them by the Department. We suggest that hatcheries carrying brood stock be supplied with a good spear and that overseers be instructed to keep the ponds free from fungused fish, by spearing them rather than by seining and handling.

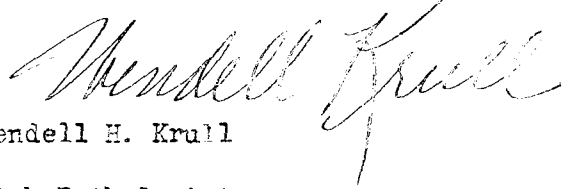
- (4) Continuation of Copper sulphate treatment. Strong salt treatment would no doubt be very beneficial but we were told that is not practical from an economical standpoint.

- (5) After the epidemic has subsided the ponds ought to be drained and treated thoroughly one by one with freshly prepared air-slacked lime, after being lowered as much as possible. The treated pond should then be shut off from the river for about two days, then slowly cleaned out by opening the head gate (to be sure that the trout in the stream are not harmed). The ponds theoretically ought to be left exposed to the sun for several days. This we understand is impossible at Grayling, since the ponds there cannot be drained completely. This is unfortunate. Wherever possible ponds should be so planned as to be thoroughly drainable.

Owing to the long continued infection of the trout in the Grayling hatchery with

furunculosis, and to the fact that the diseased fish often show no external indication of infection ("Carriers"), we would point out the danger of transferring any brood stock from this hatchery to any other.

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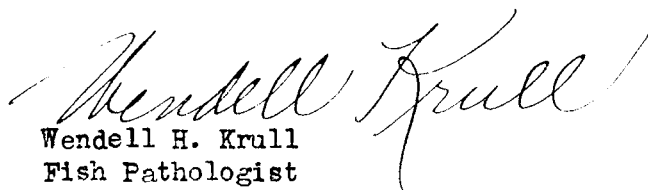
ON EPIDEMIC AMONG BROOK TROUT AT GRAYLING STATE FISH HATCHERY

We have just received a letter from Overseer Zalsman, Grayling Hatchery, in response to a request for information concerning the recent mortality in yearling brook trout which Mr. Cook has mentioned to us.

From this information it appears that the bacterial blood disease called furunculosis is causing the mortality (see Report No. 35). At the present time we have identified the same disease in fish from a Federal cooperative rearing station at Turtle Lake where losses have been just about as heavy as at Grayling.

When the living fish are sent to us the ones that are of most value to us usually die before they arrive and then we have to rely on fish which appear to be well to make our diagnosis. This can be done only by isolating and culturing the organism from the blood. We are equipped for field work in this connection and expect in the near future to have some idea of the distribution and destructiveness of this serious disease, which requires bacteriological procedure for definite diagnosis.

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