THE EFFECT OF GASOLINE AND BENZINE ON THE PARASITIC COPEPOD, SALMINCOLA EDWARDSII OLSSON, PARASITIC ON THE GILLS OF THE BROOK TROUT.

By JOHN N. LOWE.

On or about July 8, 1916, Mr. James Nevin, Chairman of the Conservation Commission, requested me to perform experiments with gasoline with a view of determining whether it would destroy the parasitic copepod (Salmincola edwardsii Olsson) which is parasitic on the gills of the brook trout (Salvelinus fontinalis).

Three hatcheries were visited during the investigation, viz. Madison, Wild Rose and Bayfield.

The hatchery at Wild Rose presented the most extensive infection, the adult trout being most affected, but the young fish (fry) were found to be infested with one or more parasites. At Madison the adult fish were not as extensively infected as at Wild Rose but the condition was serious. The young fish (fry and year old) were found to be entirely free from the parasite. The young fish are kept in ponds which are entirely free from all sources of contamination. The Bayfield hatchery presented a different problem and has conditions which are more difficult to overcome. The water coming from Pike's creek is a constant source of infection as it was found that the "wild" trout were infected by the parasite. Nevertheless, it was found upon examination of the fish that the percentage of fish attacked by the parasite was less than at Wild Rose.

The experiments were performed at the Madison and Wild Rose hatcheries. The fish were exposed to gasoline and benzine for varying periods of time. A stop watch was used for recording time. The copepods were examined with a pocket lens magnifying 14 diameters, or with the lower power (⅔) of a compound microscope.

The fish placed in gasoline or benzine did not show any discomfort for the first fifteen or thirty seconds. After this period they jumped a great deal and gasped. In about two or three minutes they were suffocated or nearly so. The mucus secreted by the glands covered the entire body. It was creamy white due to the coagulation.

The recovery of the fish was interesting in these experiments. The gaoline penetrated into the tissues of the fish. The gills were covered with an oily film, which inhibited the respiratory functions of the fish and its recovery for a short time. When the fish were returned from gasoline to water, they remained on their sides from five to twenty-five minutes, depending upon the length of time they were kept in the gasoline and

benzine. There was a spasmodic gasping for a while (3 to 40 or more minutes), when the fish would make an uncoördinated dash forward, the distance covered varying with the individual fish. The usual distance was from two to four feet, when they fell on their sides. After a rest of two or three minutes another start would be made. After this period of rest the fish would right themselves and swim about in a more or less coördinated manner and finally recover.

Benzine was tried because it has a greater evaporating power than gasoline. It was found that fish treated with benzine recovered more rapidly than those treated with gasoline.

The fish treated with gasoline, benzine, or a mixture of the two were apt to die after partial or complete recovery. The muscles in the tail region would begin to stiffen and slowly all the muscles of the body became involved. The heart continued to beat from three to four hours after the muscles of the body had stiffened. The parasites examined on a fish in this condition were found to be in a healthy condition, and continued to live for hours after the fish were dead.

Most of the fish that were exposed to gasoline, benzine, or mixtures of the two, from one to five minutes recovered completely. The fish that died were individuals which were heavily parasitized or had been weakened by the parasites some time previously. There were a very few fish that lived after a six to ten minute exposure.

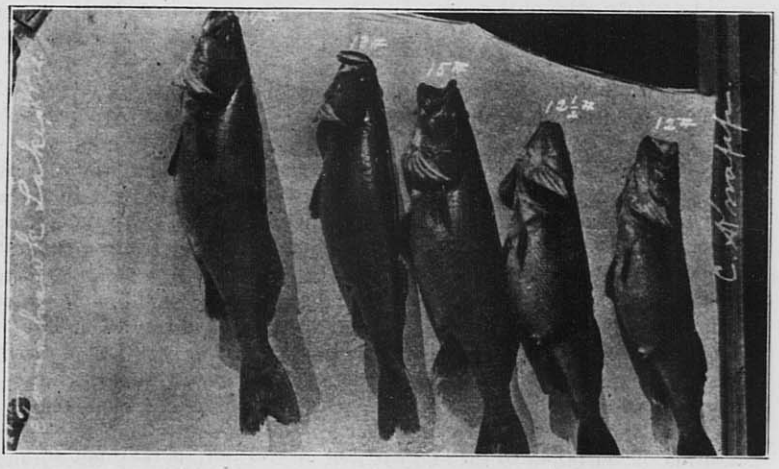
In regard to the effect of gasoline and benzine on the copepod, it is clear from a study of the experiments listed, that the parasite can withstand the effects of gasoline and benzine for a longer period than any of the brook trout can, even those in the best condition. Very few brook trout can live in gasoline or benzine more than ten minutes, but the parasites live in them from seventeen to twenty-eight minutes. A few of the copepods die when exposed to gasoline or benzine from three to ten minutes, but the number affected is so small that for all practical purposes the results are negative. Careful examination of the parasites killed by gasoline or benzine showed them to be very young individuals or females that had shed their first or second batch of eggs. Probably the ruptured egg sacs permit the gasoline to penetrate into the vitals of the copepod. The vigorous females with their first egg sacs developing are not killed by gasoline or benzine.

The life cycle of the female copepod is about three months. After this period death ensues and the dead parasite and the affected gill undergo deterioration. This reduces the number of functioning gill filaments, and the respiratory functions of the fish. The dead copepod and the affected gill filament serve as a locus for bacterial and fungus infections. Many of the fish examined had no paraistes on their gills, but from the white color of the degenerated gill filaments showed conclusively that they had been heavily infected. It was fish in this condition that died first, even a three minute exposure to gasoline or benzine causing death.

The affected gill filament appears white in color and is very firm to touch. This hardness is probably due to the formation of the scar tissue. The whiteness of the gill filaments is caused by the destruction of the very fine capillaries of the gill filaments. With this impoverished circulation and respiration the vitality of the fish is very much reduced.

The fish having a large number of white and hard gill filaments were found to be in very poor physical condition. There was no fat on the intestine or body wall. The fish were lean and the muscles were firm. The fish that had not been affected by the parasites showed the intestines surrounded with fat and the body cavity was lined with a thin layer of fat. The muscles had a firmness characteristic of fish in prime condition. This observation has an economic bearing.

It is a known fact that fish in nature put on extra amount of fat before their spawning season. This reserve of fat is used up during the maturation of the ova. Therefore, the number and quality of eggs produced by the



FOUR WALL-EYED PIKE. TOTAL WEIGHT 66½ POUNDS. TAKEN FROM TOMAHAWK LAKE, ONEIDA COUNTY, WISCONSIN

individual fish is dependent upon its physical condition. The high death rate of infected fish during or after the spawning season is no doubt due to the weakened condition of the fish by the parasite. The constant handling of the fish during this period is also a contributory cause as the weaker fish are not able to withstand the stripping.

The parasites are more numerous upon the old fish. A few parasites are harmful to the fish. Even a single parasite withdraws from the trout just enough blood for its own sustenance. The amount of blood required may be small but it is a loss, and it weakens the fish by just so much, and if the parasite dies this gill filament is functionless. When we consider that there are found from 125 to 200 copepods on the gills of a single fish we are forced to conclude that the drain on the fish's vitality is enormous. With this constant drain there is no energy left for the production of eggs.