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REPORT ON CURDLING DIFFICULTIES WHILE TAKING
SPAWN AT GRAYLING

In response to a request from the Department of Conservation for an investigation into the cause of "curdling" in the spawn taken at the Grayling Fish Hatchery.

We arrived there on November 10, and spent the greater part of the week at the station.

During the time at the station a steady rise in temperature of the water was noted and with it an increase in the number of fresh "boils" on the fish, caused by furunculosis. If the high temperature continues the disease, no doubt, will bring about the death of more fish. Even though a drop in temperature takes place, many fish from the previous infection will continue to die during the winter or in the spring when water conditions change.

The disease at the hatchery which is causing the "curdling" is called "Inflamation" by German workers.

Since the disease "furunculosis" is also present at the hatchery and the incidence of infection high we should probably say concerning the above disease, "Inflamation with complications" since, as will be pointed later, under the circumstances it is mighty hard to determine the exact relationship of furunculosis to the other disease and the amount of damage done by it. Judging from what Davis (1929) says concerning furunculosis it

may be assumed that the sex products are not interfered with seriously.

Inflamation manifests itself during the time of stripping, when the symptoms of the disease are quite pronounced. The genital pore is usually inflamed. When the fish is stripped, a colorless fluid accompanies the eggs which usually, but not always, turns white in the presences of water and produces what may appear to be a curd. Many times tissue shreds appear in the fluid, and bloody eggs are quite common. The fluid whether clear or cloudy with its tissue shreds may in the presence of water be so extensive as to glue the eggs together in a mass. Internal examination of a rather typical case shows the ovary to be rather extensive, stretching to the posterior end of the body cavity and containing many small developing eggs about the size of pin heads. It is reddish and edematous in appearance. The other organs including the body cavity may also be reddish due to inflamation. A drop of fluid from a mild case when examined with the naked eye contains quite a bit of granular material. When a drop of water is added it promptly becomes white, the whitish material being fibrous or granular. Degenerating eggs present another symptom of the disease. Eggs in advanced stages can be quickly detected when in the water since they quickly turn white. Out of 400 oz. of eggs taken from old brook trout in which the condition was bad, 31 oz. of eggs, about 8 %, were picked immediately when trayed. This, of course, does not include those just beginning to degenerate in which the germ probably is only weakened and does not include the collapsed egg shells of which there were many. The former could not be detected and in the case of the latter there is a possibility of them being held over from the year before.

To what extent the male, if at all, is affected is not known because of the difficulties in detection. Inflamed testes were noted in autopsies and there is good reason to believe that male germ cells may be seriously weakened.

A comparatively small number of the trout being stripped for the first time are affected, the large old trout are nearly one hundred percent affected to some degree. Brown trout were not affected and the sex products looked fine.

According to German workers such a phenomenon is brought about by improper care; such as improper living conditions in crowded or narrow ponds, improper feeding or injury in uneventful stripping. Under feeding conditions several warnings are given. They emphasize emphatically the discontinuing of feeding (or feeding very sparingly) during the last six or eight weeks prior to stripping for the production of good eggs. According to them, overfeeding leads to degeneration of the sex products. They warn individuals against the instinct of the fish's desire to eat stating that this desire is falsified by the state of captivity. They also state that fish fed on slaughter-house refuse (mammal flesh) or prepared fish meals do not produce good eggs, even if fish are put through a fasting period prior to stripping. It is also stated that many breeders overdo the feeding of Salmonoid fishes and extend it into the spawning time when moderation is of greatest importance.

According to them these eggs should not be used to produce breeding stock and they continue by saying that the majority of the eggs are worthless.

Trout are decidedly injured by captivity and the degree of injury varies greatly with the species. Rainbow trout can be kept for several years to advantage. It is commonly acknowledged by the Germans that brown trout should be bred from wild stock, and not held many years for if they are, only a part of the eggs from them are capable of being fertilized, and many of those which are fertilized are not capable of developing, and die before hatching even though the eggs when taken are seemingly very good eggs.

Plehn, leading German investigator of fish diseases, (1924), says that in the case of this inflamed condition of the female, the eggs may be so changed as to be recognized as a diseased condition as indicated and described in the case of the old trout at Grayling. On the other hand, one may be misled and find perfect eggs which may even be unusually large. Many times these can be told however, by being easily clouded and by their thicker shell. It is entirely possible that such a condition may prevail among the eggs taken from the young trout at Grayling, for the eggs look exceptionally good.

Plehn (1924), says that bad conditions in eggs may be brought about by stripping females which are too young. Stating that development takes place much faster in ponds and that in two years considerable eggs may be taken but that they are worthless and die sooner or later. We gather from this information that possibly brook trout should not be stripped too early and not very many seasons. An actual illustration from nature recorded by Plehn is interesting in this connection. In the west part of Norway the trout mature exceptionally early and produce small and worthless eggs, in the eastern part the development is slower, the fish decidedly larger, sex products less numerous but significantly stronger and of greater worth.

After seeing conditions at Grayling we think that it will be remarkable if 50% of the eggs taken will reach the eyed-egg stage. It also seems quite reasonable to assume that there will be a great variation in the progress of development at the time when the first of the eggs reach the eyed-egg stage. No doubt many fish will hatch and die because of lack of vitality but a few good fingerlings may be expected.

According to Mr. Zalsman a low percentage of fertilized eggs has been experienced at Grayling for the last three years. This would indicate that perhaps other factors are involved. In questioning Mr. Zalsman, we found that the trout have been crossed among themselves since 1926. We also learned that the only other new stock came from eggs of brook trout from the Cascapelia River in Canada. The first of these eggs were hatched in 1919. As these trout and those of succeeding years reached maturity they were crossed with the resident trout. This probably explains the variation in shape of the fish at the station at the present time.

According to Mr. Zalsman, the trout from the Cascapelia River are not marked the same as our native trout. Dr. Carl Hubbs informs me that the variations are constant and is the basis for his making it a subspecies. Some of the eggs from the Cascapelia River trout were also hatched at Harrietta and many of the fish developing from the eggs were found to be barren. At Grayling, however, some of the fish which were thought to be barren were held over the third year when they produced sex products, which indicates

that it took three years for maturity. Whether the crosses resulting from the Cascapelias were beneficial or not seems to be questionable.

It is also worth while mentioning the fact that no female brook trout have been released from the hatchery in the last three years. So spawn has been taken from the fish for a number of seasons.

While at Grayling a number of experiments were begun which will give us information as to whether or not a greater percentage of eggs can actually be fertilized under existing conditions. In the last two years several individuals have taken spawn and last year Mr. Zalsman personally took spawn but his result was no different than the result obtained by other individuals. During our visit at the hatchery, conditions were ideal for taking spawn. We think that it is rather remarkable that any of the eggs from the older badly affected trout are impregnated. It seems that the mechanical interference alone would be sufficient to prevent fertilization of the eggs.

We believe that the condition present in the trout is due to a complex of causes, possibly including in a minor degree, those already mentioned. The degree of care in handling of the fish in taking spawn at Grayling is what we would expect at the average hatchery. In this connection we have nothing to compare it with since we have not seen this procedure at other places. The apparently perfect condition of the Brown trout seems to be good evidence that the fish are handled properly. Yet to exonerate this possibility altogether under the circumstances would seem rather absurd for we know that a certain amount of inflammation may exist in furunculosis and who knows perhaps these fish should not be handled at all. Feeding of the trout, no doubt, is carried out as in other hatcheries and experience possibly indicates that this is correct when no complications exist. We are quite sure that Mr. Zalsman will agree with us that there are plenty of fish in some of the ponds especially since there was a lack of water during the summer. Just how serious this may be can possibly be better determined by Mr. Zalsman.

In addition to these factors we think that possibly the introduction of trout eggs

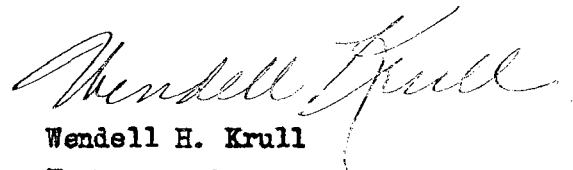
from the Cascapelia River, the crossing of fish resulting from these eggs with the resident fish, and continuation of the inbreeding may be contributing factors in the present existing conditions. Furunculosis may be a very important factor in this connection although under existing conditions it would be very difficult to prove. That furunculosis is not altogether to blame seems to be brought out by the fact, that a limited number of females showing bad external lesions when stripped, produced eggs that appeared to be normal. It is to be granted, however, that the eggs may be seriously weakened. In this connection it may be mentioned that females fatally affected with furunculosis were comparatively scarce indicating that the egg production was not seriously decreased because of the furunculosis epidemic.

Besides these we really do not know the exact constitutional effect of the low water and exceptionally high temperature on these fish. The fact remains, however, that there is serious difficulty, and judging from what is known, a complex of causes is the most plausible explanation.

On the basis of what was learned from Mr. Zalsman concerning experiences with eggs the last three years, and existing conditions at the present time, recommendations should probably be more drastic than we make them. For a serious epidemic such as occurred at Grayling, Davis (1929) apparently would recommend the destruction of all infected fish at once. He says, "the only logical method of control is to destroy all infected fish at once". With these other complications we are inclined to believe that it would be best to dispose of all the brook trout which are more than two years old. We also think that the young stock which is retained should by all means be kept well separated from any new stock which may be brought in or reared at the station for brood stock.

Results of experiments undertaken at Grayling will be included in a future report.

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