

Report No. 77

On The Mortality of Fish in Michigan Lakes

Since we have had so many notices of fish mortality in the Lakes of the state this year it was thought useful to prepare a general report indicating, to the best of our knowledge, the reasons for such losses. This report is the result of the examination of many fish sent to us from a number of lakes as well as investigations made in the field. This, no doubt, will explain to some extent the losses except such as are caused by pollution or by natural decomposition in lakes with a very mucky bottom. In both such cases the oxygen supply may temporarily, at least be depleted.

The two factors which have been responsible, more than any others, for the unusual loss in some of the lakes are the lack of water and the low lake level which occurred at spawning time.

An individual may say, "well I know a lake which is three feet below normal and no fish died in it." This may be true and there may be any number of reasons for the condition. A few of the basic differences which cause one lake to suffer losses which another does not, may be suggested: number of fish in the lake, contour of the lake, general depth, size proportions of shallow and deep water, source of water supply (whether spring or stream fed), etc. These are enough to show that the problem confronting us is not a simple one, and for a solution the interaction of these various factors, to some extent, have to be unraveled.

The most noticeable single abnormal condition in the fish has been the increased amount of fungus. This is in some way associated with the lack of water, but just how, is another question. A mycologist

tells us that the spore of a particular kind of fungus does not differ in virulence, in spite of the fact, that the difference in virulence would be very helpful in explaining existing conditions. There may be, however, different strains which differ in virulence, there may be an increased number of spores (spore formation seems to be dependent upon water conditions), or the fish may lack their usual vitality, all or any one being responsible for the increased amount of fungus. Spear- ing through the ice, though somewhat remote from our subject, may have an effect on later fungus attacks. We know, from species which have been sent to us, that many fish are injured in spearing and fishermen will not take the fish with "white patches" on them. These are injured fish which have fungused and under cold water conditions will live for a long time, during which the fungus possibly disseminates many spores which are capable of germinating very readily, when the water is warmer. It is said that the fungus growing on a single dead fly may produce 40,000 spores in a day, which gives some idea of the importance of fungused fish in a lake. Fungus is extremely sensitive to changes in acidity and alkalinity of the water and this increases the difficulty of our problem.

Fungus is supposed always to be a secondary infection but from laboratory experiments this is seriously doubted. It is possible that there is on record one serious epidemic in which fungus was the primary cause of death of vast numbers of salmon. This was back in about 1878 when fungus broke out in the river Esk in the British Isles and in a three year period spread to all the important rivers. A statement from Huxley (1882) in which he discusses the salmon epidemic may be of interest in this connection.

"Although all the evidence leads to the conclusion that the

Saprolegnia is the immediate and primary cause of the salmon disease, and that, in the absence of the fungus, the disease never makes its appearance, however, polluted the water may be, or however, closely the fish may be crowded; yet, in this, as in other epidemics caused by parasitic organisms, the prevalence and the mortality of the malady, at any given time and in any given place, must be determined by a multitude of secondary conditions independent of the immediate cause of the disease."

Two secondary conditions such as lack of water and low water level with all their interrelations would make tremendous differences in the environment of fish.

Since the water level was low at the spawning time of common fish which are found most abundantly in our Michigan lakes and since they are particularly sensitive to water conditions, their spawning activities, no doubt, were interfered with, even to the extent of making some of the normal spawning beds unavailable for the fish. It may be mentioned in this connection that this was actually observed in Lake Michigan, Wexford county, where the black bass did not occupy their spawning beds this spring. Depriving fish of their spawning beds would, no doubt, increase injuries because of the increased strife among the fish, or at least decrease the resistance among them as a result of fighting, retention of sex products, etc. These conditions as well as spawning, temporary starvation, sudden changes in water temperature, sudden changes in oxygen content of the water are factors which influence the susceptibility of fish to disease, particularly to fungus which is the only disease that can be held accountable for the unusual fish epidemics this summer. This loss due to fungus, we think, is in various ways correlated with the changed

water conditions resulting from the unusual season and can only be explained by a complex of conditions, the effect of which is only partially known.

Very heavy mortalities are commonly reported from lakes having a large amount of shoal water. The combination of low water over the shoals and of very warm days this spring, has served to elevate the temperature of such waters to a point dangerous to the fish life, especially during the spawning period. The water is seldom warmed enough to cause the death of the fish, directly, but enough to decrease its resistance to disease, or to hasten the multiplication of the disease-causing organisms.

Many of the losses reported to us during or just after the spawning season we have to consider as normal losses. These losses look very large, especially in lakes which are productive and support many large fish. At other times the losses look large because the fish which die remain out in the lake until carried in by wave action. Sometimes after there has been no wind for a long time false impressions of the mortality are given because the fish which have died over a period of days wash into shore at one time. We suggest that before one says, "thousands of fish are dying", that he secure a more definite estimate. It is surprising what kind of a feeling is produced by one seeing a comparatively small number of large fish on a wind-swept beach, especially if some are in a state of putrefaction.

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