

## 58.—ON THE PROPRIETY OF DEPOSITING WHITEFISH MINNOWS OFF THE HARBOR OF CLEVELAND, OHIO.\*

By FRANK N. CLARK and SEYMOUR BOWER.

It is no doubt true that whitefish seldom approach Cleveland Harbor. And yet it does not follow that the place is unfavorable to the early stages of whitefish life, if the minnows are set free in clear, deep water, wholly beyond the influence of sewage and refuse, as they were in the present instance. It is quite probable that the bottom in that vicinity is not at all adapted to spawning purposes, and that it furnishes only a very meager supply of crustacean food; hence but few adult whitefish are attracted to that locality. But these conditions are inimical to the requirements of the minnows, as the range and character of food demanded by the latter are widely at variance with the demands of the same individuals at partial maturity or adult life. The latter, in common with all sucker-mouth species, are bottom feeders, while the food of the minnows consists of minute organisms existing in the water. Now, it is claimed that the temperature of the water is a potent agency in the development of these organisms; that they are far more abundant at certain seasons of the year than at others; but manifestly it would be unreasonable to claim a like fluctuation for *localities* in a body of water like Lake Erie. One place is therefore as good as another, so far as the question of food for the young is concerned. It is also safe to say that the parent whitefish are powerless either to destroy or protect their young. Manifestly, then, neither the absence or presence of the adults nor their food and spawning requirements can be regarded as a factor in the problem of successfully planting the minnows in waters to which the species is indigenous.

Admitting that this is true, the question very naturally arises, what is the object of depositing the fish in different sections of the lake? Why not place them all at some point most conveniently approached from the hatchery, and thus save the expense and trouble of carrying them farther? This most certainly is the very plan that would be followed if multiplication of the fish were the sole object in view. But it is desirable not only to enrich the waters, but, in so doing, to create new fishing grounds for the most valuable food species; and new grounds cannot be created simply by restocking the old, even in a continuous body of water like Lake Erie. In such waters the only way to attain this object is to enlarge the migratory range by taking advantage of

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\*A million young whitefish which had been hatched by the United States Fish Commission at Northville, Mich., under the direction of Mr. Clark, were to be planted in Lake Erie. Mr. Clark was authorized to select the place and make the deposit. On page 302 will be found a protest against putting them in Cleveland Harbor, to which protest this article is a reply.—C. W. S.

that instinct which impels the adult fish to return, for the purpose of spawning, to the place where they were liberated in infancy. In a state of nature the minnows are released only from spawning beds; and the area of grounds adapted to spawning purposes is quite limited. But we are permitted to introduce the young at will, and thus establish new migratory routes on which they may be intercepted by the devices of man.

It is not at all probable that the parent fish will deposit their eggs in unsuitable places, though it is where they were first set free and they have returned for that purpose. It is far more likely that they will continue on the move until appropriate grounds are found. Some of the best whitefishing grounds of Lake Erie are neither spawning nor feeding grounds. We refer more particularly to the shore grounds between Sandusky, Ohio, and Monroe, Mich. Thousands of whitefish are taken here every fall from the runs setting toward the spawning beds of the Detroit River. Comparatively few ripe fish, however, are taken below Monroe; at Monroe the percentage of ripe fish is a little better; but the Detroit River is reached before the spawning has become general. The best spawning grounds of the lake are the island shoals between Sandusky and the Canada shore; and the runs thereto set in, apparently, direct from the deep waters lying eastward, and from the Canada shore.

The statement in reference to the abundance of saugers in the locality referred to by Dr. Sterling is substantially true; but the conclusion that in consequence "no other fish can exist" is manifestly at fault. Some other cause must be given for the scarcity of whitefish in that locality. Thousands of saugers are taken every fall from some of the best whitefishing grounds of the lake. From the spawning shoals around the Bass islands they are brought in with every lift during the spawning season of the whitefish, besides herring to the proportion of fifty herring to one whitefish. Again, in the spring, not far from the time the young whitefish are rising from the spawning beds, the saugers are even more numerous, to say nothing of the hundreds of basses and pikes that comprise the best part of the spring catch. It is safe to say that predatory fishes abound in greater numbers near these spawning beds, both at spawning time and soon after the fry are set free, if not continuously, than where the Cleveland plant was made. And yet the young whitefish are always set free, in a state of nature, in the very midst of these apparent dangers without diminution of the species.

It might be argued that the great fecundity of the species would more than offset these manifold dangers; but this, in turn, is more than offset by the fact that by far the greatest losses of all occur during the embryonic stage of development. Conferva, against which artificial manipulation alone is able to cope, is the fell destroyer—the octopus within whose grasp countless thousands of embryos annually perish. Only the comparatively few that are completely isolated can escape destruc

tion; so that but a very small percentage of the eggs deposited by the parent fish bring forth living minnows.

Nature has also accorded a very frail and feeble existence to the infancy of whitefish life. It would hardly seem possible that a single minnow could survive this period, were they pursued as prey by the thousands of predaceous fishes with which they must mingle upon rising from the spawning beds. Indeed, it may be stated without fear of successful contradiction that not only the whitefish minnows but those of many other species would be speedily sacrificed to predaceous and cannibalistic tendencies, were there no compensating conditions coexistent with that apparently defenseless period of their existence. But nature, in her economy, appears to strive to guard against extinction. Thus, it is said that certain defenseless species have the power of vision developed to that degree that they are enabled, with due vigilance, to keep a safe distance between themselves and their rapacious but short-sighted enemies; that others are so identified in color and appearance with the waters they inhabit as to be scarcely discernible; and that others still are so surrounded with incidental protective agencies that they enjoy some degree of immunity from the ravages of predaceous species. Of course the circumstances which afford protection in one case may be entirely inoperative to protect fish at another stage of development or belonging to another species. Minnow life may emerge unharmed from surroundings that would insure total destruction to the same individuals at later stages of maturity. Thus, the frailty and insignificance of whitefish minnows are, of themselves, ample safeguards against destruction by the larger deep-water fishes with which they instinctively seek to associate from the moment they are released from their shell inclosures. For several weeks they are so minute, to say nothing of their being nearly transparent and invisible, as to render it quite unlikely that they are preyed upon by anything within the range of deep-water fishes. Doubtless there is some loss by starvation, and some are strained out by gill-rakers, along with fish-food collected in this way. Such losses, however, are merely incidental.

These same minnows would doubtless be destroyed by the "chubs" and "shiners" that swarm inshore by the thousands, evidently to keep out of the way of the larger rapacious fishes. But from actual observation I am able to say that the whitefish minnows invariably go to deep water when planted in shoal places. In such cases they settle towards the bottom, heading to deep water, and soon pass out of sight. I have noticed also that when deposited in deep water they do not remain at the surface, but almost immediately work down out of sight.

We grant that the sauger is not a large fish; but obviously it is too large to pay any attention to the minute whitefish minnow. It is very doubtful if even the fry of brook trout would be molested by the saugers, and yet the relative size of trout and whitefish fry is such that the latter speedily disappear in the presence of the former. A dozen trout

two months old will clean out a tank containing a thousand whitefish of the same age in an incredibly short time, simply by picking them off like particles or small shreds of liver on which they are usually fed. But these same whitefish are perfectly safe in the presence of trout 3 or 4 years old—they are too small to be noticed. Experiments demonstrating these facts have been tried repeatedly at the Northville Hatchery.

Every trout breeder well understands that food for pond fish should not be too minutely subdivided, as pieces much larger than whitefish minnows go unnoticed by the fish, and, subsiding to the bottom, foul the ponds. It is well understood, even by the barefooted boy, that the morsel of bait with which he would entice our small native fishes from their haunts must not be too insignificant.

We do not know what success one might have in angling for saugers with whitefish minnows as bait, but I venture to say that a thousand hooks baited with these minnows, and each manipulated by an expert angler, would fail to secure a score of fish a day, even though a dozen minnows were used at a single baiting. Angling for saugers, either for pleasure or profit, with particles of bait no larger than the whitefish are for six weeks after leaving our hatcheries, would be attended with such meager results that it would speedily cease.

We are aware that it is freely maintained that, to secure the best possible results, all minnows should be released near the natural spawning beds of their species, so that they might have at least an equal chance with the indigenous minnows. This theory sounds plausible enough, but it remains to be shown that such localities possess any special advantages for minnow life. The conditions necessary to the existence of embryos and minnows are entirely different. Now, it would be absurd to claim that the honey-combed rocks and reefs always selected by the coregoni for spawning beds are in any way connected with the necessities of the minnows; and yet it is absolutely necessary, if the species is to be perpetuated in a state of nature, that the eggs should be deposited on beds of this character; since, in view of the long period of incubation, and the rapid development and insidious nature of conferva, they must all perish but for the complete isolation the numerous cells of these rocks and reefs afford. As the minnows are no better provided for at such points than elsewhere, it is evident that nature directs the parent fish to select spawning beds wholly with reference to the demands of the embryos. The absence of appropriate beds is doubtless the missing link in the chain of conditions necessary to perpetuate the species in many of our small inland waters where all the other links are present.

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