

57.—NOTES UPON THE INCREASE AND DECREASE OF FISH.*

By A. HÜBNER.

The Werbellin Lake, which is about 28 fathoms deep and has very clear water, contained among other fish up to 1850 many marenas (*marüne*, a kind of *Coregonus*) and sticklebacks. During the next ten years the marenas gradually decreased and nearly disappeared, so that during the twenty years from 1860 to 1880 only a few, at most fifteen, were caught per year. From the year 1880 they again increased, without any known human agency, so that in the autumn of 1882 several hundredweights were taken, and in 1885 about 10,000 pounds. The fisheries are carried on in nearly the same way as forty years ago, only transportation to Berlin has become easier and more rapid. As this lake has a season of prohibition in spring, the fisheries were continued (also since 1880) during the autumn, when the marena spawns. It is sufficiently proved that these fisheries have not done any injury, and that the marenas having begun to disappear gradually thirty years ago, without any indication of disease, may possibly have been the work of the sticklebacks. These fish, which in former years were caught in enormous masses, to be used and dried as fish-food, probably ate the spawn of the marenas, so that there was not enough left for reproduction. In favor of this supposition we may cite the fact that when (during the ten years from 1860 to 1870) the sticklebacks also began to decrease the marenas again made their appearance. Nevertheless they again appeared in enormous numbers, when five years previously there was hardly any trace left of them. On the other hand, it is very strange that of the artificially raised marenas which were planted in this lake about eight years ago not one has been seen again. While there were no marenas in Lake Werbellin the public forgot this fish, so that at present no one wants to buy them. Hence they do not bring a high price. The same is true at the large fish-market in Berlin. When alive these fish will not sell at all, and when dead they at most fetch 20 pfennige [5 cents] per pound in the Berlin market. If the sticklebacks have caused the disappearance of the marenas, what has caused the disappearance of the sticklebacks? Is it because they no longer found as food any spawn of the marenas? But, then, the marenas had long since disappeared, when the sticklebacks were still flourishing. Owing to their sharp fins, sticklebacks are not attacked by other fish, and the meshes of the nets used in this lake are too wide to permit of the supposition that most of the sticklebacks had been caught. The fishermen do not know what cause to assign, and are only glad that they have got rid of them.

* "*Rätselhaftes Vermehren oder Verschwinden einzelner Fischgattungen.*" From the *Deutsche Fischerei-Zeitung*, Vol. IX, Nos. 1 and 2, Stettin, January 5 and 12, 1886. Translated from the German by HERMAN JACOBSON.

Besides marenas hake were also found in this lake, and their number was likewise subject to great changes. Whenever in a certain year the spawning process is successfully accomplished and the young fry manages to get through the first summer, the fish from this year can generally be traced all through the fisheries until they have grown to maturity. This process, however, is not so rapid as with the carp, and it takes about ten years or longer before the hake in this lake reach the weight of $1\frac{1}{2}$ to 2 pounds. As frequently many years pass before there is a good spawning year, the set of hake which just happens to be about the right size has to make up for all deficiencies. And if there are several good years in succession, the fishermen are happy. But it also happens frequently that a very numerous set of fish from a certain year does not seem to make any progress, and disappears all of a sudden. Thus one year the quantity of bream spawn, measuring 15 centimeters [nearly 6 inches], in the Lehnitz Lake was so great as to impede the fisheries and keep the fishermen busy removing the little fish from their nets. At one haul during winter I caught 2,500 pounds of this kind of fish, but not a single one was of a salable size. I knew that the quantity of spawn was too great for a lake having an area of about 250 acres. I therefore asked permission of the authorities at Potsdam to catch some of these small fish and transfer them to Lake Werbellin. This permission was granted; but much time had been consumed in getting it, and as I had to let the winter pass, I found but little spawn of the bream in the following spring, and the intended transfer could not be effected. Although the Lehnitz Lake contained some pike and bass, it could hardly be supposed that they had exterminated the young bream. Probably the food of the bream became scarce, so that most of the bream perished, giving the survivors a better chance to grow and develop. A similar case occurred as regards perch in the Gross Schauener Lake. One summer I caught regularly many small perch which had barely the regulation size. They were too good to be thrown away, and too small for the market. I therefore put them back into the lake, hoping to catch better fish during the following year. When summer came I did not catch any perch, either small or great. The numerous set from the preceding year had dwindled down, and but few remained. I do not mean to say that this will prove an injury to the lake; on the contrary, I hope that thereby the more valuable young bass will flourish all the more. In all these cases I have not succeeded in ascertaining or even in estimating the age and annual increase of the fish, because I did not notice the different sets, until they had become young fish having almost the regulation size. I think, however, that I am prepared to give some account of the growth of the bass in open waters. Even here I can only state the annual increase with absolute certainty from the time when the young bass had almost reached the regulation size; but I possess enough data to enable me to fix the year 1877 as the spawning year. In the autumn of 1881, large masses of these young bass were caught in

the Gross Schauener Lake, which had barely the regulation size—35 centimeters [$13\frac{3}{4}$ inches]—and weighed $\frac{1}{2}$ pound apiece. As my predecessor had to give up the lake in the following year, he took out as many of the then 4-year-old bass as he could possibly get. But their number seemed to have been but little decreased thereby; and as but few bass, either larger or smaller than these, could be noticed, the growth of the fish which had been hatched in 1877 could be traced distinctly. By next year, in the autumn of 1882, these bass had reached a weight of $\frac{3}{4}$ to 1 pound; in the following autumn, $1\frac{1}{4}$ to $1\frac{1}{2}$ pounds; in 1884, 2 pounds; and this autumn (1885) these eight and a half years old bass weigh fully 3 pounds, so that evidently the largest increase of weight has been this year. If I had caught many of the young bream referred to above a year sooner, or taken out the young perch sooner, both these kinds would possibly not have disappeared. It probably has not been a mistake to take the young bass so soon, as otherwise they would have died out of themselves. As it is, they have so far been caught in large numbers every year; and in spite of this there are many left, while but few older or younger bass are caught. But the most convincing proof of the fact that extensive fishing is not injurious as long as there is a good stock of fish, is furnished by the quantity of marenas in the Werbellin Lake.

These and similar cases have not been thus far generally made known, although the fishermen could give many such instances. A general and sudden dying out of fish becomes known much quicker, because it is more striking, and because the proofs of the occurrence are evident. The causes of such occurrences are frequently ascertained to be impure or poisoned water. The lack of fresh air also is dangerous, especially in winter when the ice is thick. But it also happens that only one kind of fish dies out, while others continue to live and flourish. Thus eight or ten years ago all the bass in the Strauss Lake died at the same time; and it was impossible to surmise the cause, for it can hardly be supposed that it should have been caused by a thunder-storm; and as the lake is very large and deep, it is not easy for its water to become impure or too warm in summer. In consequence those fish of which there is an abundance have to be caught more freely; but, on the other hand, it will be advisable to aid those fish which are not found in such large numbers by prohibitory measures, or by planting young fry. In this respect I can record rapid success as regards tench and eels. But as this can be done only in inclosed waters, or wherever the fisheries are managed by joint stock companies—of either of which we have none too many—we shall hardly be able to look for any rational fisheries.

If we ask how it comes that in one year there is so much young fry, and again in several successive years hardly any, many different answers may be given. In one case there may be a lack of good spawning places; then again the weather may have been unfavorable; and in other cases

some poisonous matter or mold may have attacked the eggs. Much harm to the eggs and fry is done by the different enemies of fish and by the fish themselves. One spring I impregnated bass eggs and fixed them on juniper branches in wicker-work baskets, which were placed in the water. For three days everything progressed favorably, but on the fourth day I found in the baskets several thousand maggots, which had completely devoured all the eggs. Later I took, for hatching young bass, boxes of fine wire-work, and arranged them in such a manner that they did not touch the bottom but floated in the water, but even then the maggots collected in the boxes and ate the eggs off the juniper branches. It seems, therefore, that these maggots scent the fish eggs. Later they began to attack the young fry. After I had obtained from these wire boxes quite a large quantity of young fry—more, in fact, than I was able to ship at the time—I placed some of them in a puddle in one of my meadows, in order to observe their growth. But I was not to enjoy this pleasure very long. The puddle was full of all sorts of worms, one devouring the other, and all of them attacking the young fry of the fish as soon as they had become stronger than the fry.

It should be remembered that young bass fry are so small and transparent that during the first days they can hardly be seen with the naked eye. In order to learn to know as many as possible of the enemies of fish, I put some specimens of every kind of aquatic animals found in the puddle in a glass and added some hake fry, which can be seen better. At once a fierce war began, one endeavoring to devour the other; but the fry seemed to be sought after by all of them. Thus a salamander, three inches long, had devoured in one hour about forty little fish, both when taking in water and by pouncing upon them. Even a heavy tadpole caught several little fish. Quickly moving and glittering water-beetles and other insects devoured large numbers of fish, while the maggots referred to above seemed to go more for the dead fish, and only occasionally got a few live ones. Of the entire number of small animals and fish, only the salamander and a few beetles remained as conquerors, all the rest having been killed and devoured.

But, on the other hand, the fish themselves are not a whit better than their enemies. Large fish will devour small ones, and their eggs are most eagerly sought after by small and young fish. As young fish, after they have lost their umbilical sac, principally eat small, almost invisible animalcules, as they grow they will take larger food, among the rest the delicate fry of bass. If we consider these known and unknown enemies, and other injurious circumstances, we can easily understand why in many years there is no increase in the number of fish, so that the good years have to make up for the poor ones.

KÖLLNITZ, *December, 1885,*