

## XXX.—HOW CAN OUR LAKES AND RIVERS BE AGAIN STOCKED WITH FISH IN THE SHORTEST POSSIBLE TIME?\*

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The decline of our fisheries is only in part to be ascribed to the progress of civilization; for, to a great extent, it has been caused by the senseless manner in which the fisheries have been carried on. If, therefore, the fisheries are carried on in a rational manner, it would certainly be easy to stock our waters completely, especially if we take into consideration the extraordinary fruitfulness and the rapid growth of fish. Mr. Horak, the superintendent of the immense ponds at Wittingau in Bohemia (covering an area of about 15,043 acres), told me he was confident that he could in a few years stock the Elbe to its utmost capacity with fish, if a stop were put to the plundering of the river; and I am thoroughly convinced that Mr. Horak is right.

The first question to be settled would be what kinds of fish would be best suited for making our waters productive. We have migratory fish, like the salmon and the May-fish, which live in the sea, but spawn and spend their first youth in the rivers; for the brooks with gravelly bottom, we have the trout and the grayling; and for the deep lakes, the saibling, the different varieties of the *muræna*, the *raaken*, &c., are of importance. For shallow lakes, and for rivers and brooks which have no gravelly bottom and flow slowly, the carp is undoubtedly the most suitable fish. We will now devote our attention to the last-mentioned kinds of waters.

Our lakes and rivers contain fish which require very different food, and we accordingly divide the fish into *fish of prey* and *peaceful fish*, or into *fish living on fish*, those *living on insects*, and those *living on plants*. The pike chiefly lives on fish, the perch lives on fish and insects, and the carp on plants and insects. In the household of nature, the occurrence of fish of prey and peaceful fish side by side is of the utmost importance. Those fish which live on plants are important, because they find most of their food in the water, and consequently produce the greatest quantity of flesh in a given sheet of water. But if their number exceeds a certain limit, so that the quantity of food does no longer suffice to supply the demand, the fish not only decrease in size but also in number, so that the total weight of fish produced by that sheet of water declines steadily from year to year. This is remedied by the fish of prey, especially the pike, not only because they eat the small fish, but also because they

\* From Circular No. 1, 1876, of the Deutsche Fischer-Verein.

prevent the fully-matured fish, particularly the carp, from spawning. In lakes where one wishes to produce a great quantity of young fish, it will, therefore, be advantageous to have no fish of prey; but where one intends to produce large and heavy fish by preventing the water from one lake to enter another, the presence of fish of prey offers the double advantage, that they make use of the small and worthless fish, and that they further the growth of the other fish by diminishing the number.

Among the fish living on plants, the carp is the most valuable, on account of its rapid growth and its great value for the table. It has, moreover, the following qualities, which are very desirable for the pisciculturist: it is very easy to produce a very great quantity of young carps; the carp is a very hardy fish, and has but few wants; and, finally, there is scarcely a fish with whose conditions and mode of living we are so well acquainted, as it has been raised for centuries and has almost become a domestic animal.

The carp flourishes so well in our stagnating and slow-flowing waters that, more than any other fish, it is suited to make our fisheries productive in a very short time.

For producing great quantities of young carps, shallow ponds are required, which contain no fish of prey, and can be drained entirely. It will be well to protect the young fish from fish of prey for one year, and place fish two years old into the open waters. They are at that age so large that fish of prey cannot hurt them much. If there are no ponds where the young fish can be placed, thus making it necessary to let the young fish free at an age of one year, this should, if it is in any way possible, be done in spring. During winter, the carp is in a state of torpor, and is so lazy that it becomes an easy prey to the pike, which is particularly voracious at that season. In spring, on the other hand, the carp is lively, while the pike, on account of his spawning, has become languid and sickly.

Unless the country is perfectly level, there is nearly everywhere a chance to make ponds for the young fish ("*Streichteiche*"), as nearly every flowing water is suitable for filling such ponds, and as in case of necessity even rain and snow will supply the required quantity of water.

We will now, in accordance with the experiments made on the estate of Cottbus-Peitz, in Lusatia, calculate what sized sheets of water can be stocked in one year from a pond of a given size. The areas of the different ponds at Peitz are as follows:

For fish of the first year, (spawning and young fish), 1 *Morgen*\*.

For fish of the second year, (growing fish), 2 *Morgen*.

For fish of the third year, 3.4 *Morgen*.

For fish of the fourth year, (when the fish reach their full size), 12 *Morgen*.

If one wishes to raise two-year-old fish for the market, 15.4 *Morgen* water-area would be required for the next two years for every 3 *Mor-*

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\* One *Morgen* = 0.6838 of an acre.

*gen*, occupied the first year with young fish, if such ponds are used as the ones in Peitz. If, as I propose, the open waters shall be used for the complete development of the young fish, the fact must be taken into account that our lakes and rivers contain fish of prey, and that, because they cannot be drained, they can never become so entirely exhausted as the ponds. The open waters can, therefore, not be stocked as fully as the "*Abwachsteiche*" (ponds where the fish reach their full size) without running the risk of crowding them too much, particularly as the increase of the carp in the open water must be taken into account. I would, therefore, propose that ponds used for raising two-year-old carp for the market should every year stock an area ten times their size, believing that such an area will then get its full supply of fish.

If, for instance, the Wittingau lakes in Bohemia, which have an area of 15,043 acres, were to be used for restocking the open waters with fish, 150,430 acres would have to be completely stocked every year, and in ten years 100 German square miles of water would be fully supplied with fish.

All our waters could doubtless reach the highest degree of productiveness in a few years, if we were to raise two-year-old carp in our ponds, and let the open waters take the place of the ponds where the fish reach their full size.

That the owners of ponds would be fully repaid for their trouble will be evident from the following instance: On the estate of Baron von Rothschild, in Upper Silesia, 2 to 3 feet deep puddles in the villages are used as ponds for raising two-year-old carp for stocking-purposes, and are drained every year. These ponds, by the sale of such two-year-old carp, yield annually a net profit of 150 *Mark* (about \$37.50) per *Morgen*. They yield, consequently, ten times as much as good carp-ponds, in which fish are raised for the table, and more than the best arable land. An owner of ponds can, therefore, best increase his income by favoring as much as possible the production of two-year-old carp for stocking-purposes.

As many proprietors of fisheries fear that it would be difficult to catch carp in the open water, I can assure them, from personal experience, that if the waters are well stocked, large quantities of fish can be caught with the different nets, both in winter and summer.

In accordance with the above, 1 *Morgen* would have to be stocked with about sixty two-year-old carp.

