

165.—GREAT RESULTS OBTAINED WITH LITTLE WATER.*

By Dr. BRUMME.

I am of opinion that nothing is so much calculated to advance the interests of the fisheries, and more especially of artificial fish-culture, as truthful accounts of the establishment and working of artificial fish-hatcheries. I presume that most readers have, like myself, perused with pleasure and attention the various reports on practical experiments, without in the least disparaging theoretical treatises on different subjects connected with fish-culture, whose value and proper place in fish-cultural literature no one will deny. For the practical man and the fisherman, however, communications regarding the experiences of others will be of special interest; for they will cause him to think and institute comparisons with his own experiences, and may help him in making the best use of the natural conditions of his own locality.

I myself owe to such accounts and reports relative to different fish-cultural establishments as have frequently been given in these columns, the impetus and directions for creating a hatching and feeding establishment for trout and salmonoids, under such peculiar circumstances that a description of these and a brief account of my little establishment will perhaps be found welcome by some.

There is a small spring at my disposal which rises under a neighboring water-mill, and which, even during a rainy season, yields only 20 to 25 liters [about 6 gallons] of water per minute. The water is perfectly clear all the time, and both in summer and winter its temperature is constantly $7\frac{3}{4}^{\circ}$ R. [$49\frac{1}{2}^{\circ}$ F.]. For about 60 paces the water runs under ground, through wooden pipes lined with zinc, and then flows into my grounds. My entire establishment consists of three basins laid in cement, the first holding 1.1, the second 13, and the third 20 cubic meters of water. The water in all these basins is renewed in about twenty-five hours. Although the change of water is exceedingly slow (there is absolutely no current inside the basins), the temperature of the water—even during a period of excessively hot weather, such as we had during last July—will never be higher than 10° R. ($54\frac{1}{2}^{\circ}$ F.), because the basins are in the ground and their sides are, consequently, not exposed to the rays of the sun; and because, in view of the possibility that the rays of the sun may be very hot, the entire establishment is surrounded by an earth wall 6 feet high, planted with shrubs and trees. During midsummer only the declining sun of the evening reaches the surface of the water in the basins, while the fish can enjoy the cool shade during the other part of the day. The water in the basins is 80 centimeters deep, with the exception of the first and smallest basin, into which the spring

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enters, and which, by various subdivisions, has been transformed into a meandering ditch, which serves for hatching the eggs and raising the young fish. This ditch is only from 12 to 15 inches broad, and its sides are lined with turf. Its fall varies; here and there it widens out into deeper, pond-like places, and it is covered with a dense growth of cresses and other plants which thrive in cold water. Its bottom is covered with fine gravel; in some places it is muddy, and, by placing in it pieces of clayey slate, numerous hiding-places for the small fish have been provided. The two other basins have a gravelly bottom, occasionally mixed with mud, of which, as I think, the trout is very fond. In these basins numerous hiding-places have also been provided, as well as small hillocks, with diminutive caverns and tunnels of pieces of limestone. All around the edges of the basins there are banks of moss and turf, whose roots and blades reach into the water, and thereby serve to increase the number of worms, larvæ, &c. While the water in these two basins is always kept at a depth of from 80 to 100 centimeters [about 32 to 40 inches], the depth of water in the first basin or ditch is never more than from 3 to 5 centimeters [$1\frac{1}{2}$ to 2 inches]; thereby a lively current is produced, which is an indispensable condition for feeding the young fish, for the food intended for fish of that age should be moved along by the current, so as to make it appear alive. If necessary the current in the ditch, as well as the depth of water in the basins, can be increased or diminished.

As I live in a very flat country without forests or brooks, the creation of a trout-hatchery became the subject of many discussions and discouraging remarks. Like Noah, when he built his ark, I had to bear many a sneer; but the results have changed all this, and the mockers are now all on my side. I have once more furnished the proof that much can be done with little water, if it is only good, for I have succeeded in raising in my small basins or ditches about five hundred trout, which I received as young fry from Einsiedel during last March. I put out one thousand, but one hundred soon perished through a grave mistake, and the other four hundred were caught by kingfishers and wag-tails. These fry grew, during seven months, to be fish measuring from 12 to 18 centimeters [about 5 to 7 inches], and weighing as many grams [about half an ounce]. I also succeeded in feeding several hundred two and three-year-old trout so as to make them fine food-fish, some of which weighed $1\frac{1}{2}$ kilograms [$3\frac{1}{2}$ pounds]. I now commence to hatch several thousand eggs of salmonoids and hybrids in simple wooden boxes, whose inside has been charred, and I have no doubt that I shall succeed in that experiment as well as in raising young fish in inclosed basins, a fact which so far does not seem to be generally credited.

As regards the method employed in managing my little hatching and raising establishment I would state the following: As food for young fry, I have successfully employed fresh white cheese, meat chopped fine, and especially the young of amphipods and other small aquatic ani-

mals, thousands of which were soon caught in the neighboring mill-pond by means of a gauze net. I can also recommend a mixture of white cheese and ground meal with a little water, kneaded into balls. For the further development of the young fish which have grown up this summer, I have provided a small basin, connected with the others, measuring 1 meter [39.37 inches] in breadth, 2 meters in length, and 1 meter in depth, and by placing in it small stone hillocks, and making biding-places, it has become a pleasant place of sojourn for fish. Hence the fish can again ascend to the basin originally inhabited by them, and thus live either in shallow or deep water.

As food for trout which are several years old, I have very successfully employed a mixture of white cheese and Nicklas's fish-food, in a proportion of 3 to 2. These two substances must, of course, be kneaded together by means of water and then be fed to the fish in the shape of noodles. The large fish also get raw meat, frog larvæ, small frogs, worms, snails, amphipods, &c. There is nothing better for fish than to vary their food from time to time. Too large a quantity of substances containing much nitrogen seems to cause diseases among the trout. The old adage, *variatio delectat* (variety is pleasing), also applies in this case. In place of Nicklas's food I have recently begun to use, also, the American ground meat (meat-flour, which is frequently used as food for cattle. It is my opinion, however, that this food should be employed cautiously. I shall at any rate continue my experiments with this ground meat and with Nicklas's food, and at some later date report as to the results. One thing I can state even now; this is, that my trout did not seem to like Nicklas's food when given to them by itself. For days they will leave the food untouched, and most of it is eaten by the crawfish which I have placed in my basins in large numbers as guardians of public order, and which have to see to it that nothing is wasted.

This is, in brief, my hatching and feeding establishment, consisting, therefore, of a very small spring, three basins, and two wooden hatching boxes, without the trace of a hatching-house; and up to spring, 1884, I expect to have raised in it about 10,000 eggs of different kinds of trout and hybrids, so that, in all probability, I shall have next summer about 10,000 fine food-fish. Only by closely following the rules laid down by nature for the life of trout, and by making use of all the hints given both in this paper and in other publications, have I succeeded in furthering the interest of the fisheries in a country like ours, which has been but little favored by nature; and in making, within a space of only 100 square meters, the best use of a spring, which thus furnishes now not only a cooling draft, but a fine fish for the table.

Would that this communication might aid in awakening greater interest in Germany for the important fishery industries! Much money is still lying hid in out-of-the-way nooks and corners of our country.

LÖREJUN, NEAR HALLE ON THE SALLE.