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29.—WHAT FISH CULTURE HAS FIRST TO ACCOMPLISH.*

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An impression sometimes prevails that fish culture proposes to immediately fill all our streams with fish, to such an extent that the supply will be practically inexhaustible. In order to show that this is an extravagant expectation, attention is called to the following facts.

Any tract of country needs to be but sparsely populated in order that its inhabitants may soon exhaust it of desirable food-fishes. The native powers of the fish for reproduction and growth are not sufficient to withstand the inroads of man, when added, to any considerable extent, to the natural enemies with which they are surrounded. Very early in the history of the United States, its leading rivers were mostly depopulated of the best fish. A hundred years ago nearly all the streams of New York which emptied into the Great Lakes were visited annually by salmon in such enormous quantities that their numbers seem to us incredible. There are most authentic accounts which point to the water being fairly alive with them in many places, when seeking the upper waters of these streams for the purpose of spawning. It is well know, also, that the Connecticut, Hudson, and Susquehanna Rivers were at that early time visited by vast schools of shad, and the former, at least, by considerable quantities of salmon. Such a population as the Atlantic States contained seventy-five years ago was sufficient to exhaust these rivers of the more valuable food-fishes, and before artificial fish culture was undertaken many streams had remained in this exhausted condition for a considerable length of time.

The first and great task of fish culture, therefore, is not so much to increase the number of edible fishes in any given stream as to withstand the enormous forces which are at work to produce their entire annihilation. As illustrative of this the presence of shad in the Potomac River may be cited. For some years prior to the war of 1861–'65 the shad fisheries of the Potomac had been practically exhausted. They had reached so low a limit that it was very unprofitable to fish the stream, and its barrenness helped to deter men from fishing; but the occupation of the banks of the river by hostile forces for the period of nearly four years made fishing practically impossible and gave nature an opportunity to restore the fisheries. As a consequence, at the close of the war it was found that the river had been restocked to such an extent that the yield for a few years was very large indeed. The presence of large

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numbers of fish, however, called out the fishermen, and there was a steady decline annually in the yield, and had it not been for artificial propagation there would not be shad enough remaining in the river at present to warrant any fisherman in using a hundred-fathom seine. Fish culture, however, was brought in as a restorative. Each year since 1873 the United States Fish Commission has hatched and deposited from one million to ten million, the numbers increasing annually. The principal result, however, has been to prevent annihilation rather than to cause considerable increase in the fisheries. The number of shad received at the Washington market annually for the past five years was as follows:

1879	311,585
1880	320,799
1881	521,368
1882	350,292
1883	261,474

In spite of the best efforts possible during these years the catch has declined. That for 1883 is smaller than might reasonably have been expected, because the temperature of the river happened to be unusually low during the spawning season, and there is good reason to believe that many fish were diverted to other tributaries of the Chesapeake which would legitimately have come into the Potomac as a fruit of fish-culture on that river.

The fish of our rivers have not only to contend with enemies within the water, such as a great variety of carnivorous fishes, the destruction of their eggs by numerous forms of aquatic animals, the injuries of abnormal temperature and sudden changes thereof, and the damage produced by sawdust, sewage, and other filth introduced into the rivers, but the aggressive character of our citizens has told against the food-fishes in increasing ratio annually. The increase of population produces a corresponding increase in the demand for these fishes, but the numerous facilities which modern inventions have brought to the aid of the fishermen in the way of wholesale appliances for capturing this kind of food, complicate the question exceedingly. If fishing with rude appliances a hundred years ago was sufficient to exhaust a river of shad, what may be said of the ingenious traps and the miles of netting operated by horse-power with which fish are met to-day? To successfully run the gantlet of a series of nets, but a few rods or miles apart, upon a considerable portion of the length of the river, and to elude the fishermen even on a flood tide at midnight, has become practically impossible. Fish culture thus has all the natural disadvantages of a hundred years ago to contend with, and has the accumulated ingenuity of nineteen centuries to circumvent, in order even to maintain a decent supply of food-fishes.

A striking example of the task of fish culture may be found at the

Great Lakes. He would indeed be rash who would call upon the half-developed science of fish culture under existing circumstances to materially increase the supply of food-fishes in the Great Lakes. Its mission is rather to try and keep the supply up to three-fourths, two-thirds, or even one-half of what these lakes formerly yielded. In 1871 there were 281 pound-nets being used in Lake Michigan, and 481 gill-nets. These appliances were sufficient to cause a continual decrease in the number of fish contained in these enormous bodies of water, and, fish culture aside, were sufficient to practically exterminate the fish in forty years. But in 1879 the 281 pound-nets had been replaced by 476 pound-nets and the 450 gill-nets by 24,599 gill-nets. Steam-tugs devoted to fishing, scarcely used in 1871, numbered 30 in that lake in 1879. Furthermore, the larger fish of the lake having been caught, it became necessary to decrease the size of mesh of the nets, and to lengthen the nets. So that, without doubt, there have been for several years nets enough in use on Lake Michigan to reach entirely around the lake. Fish culture aside, and without any additional efficiency in apparatus, it is only a question of some ten years when the whitefish and trout fisheries will be entirely exhausted.

Fish culture is practically a science of the past fifteen years. It has not yet reached a stage of efficiency which can cope with any such state of affairs as present themselves on these great lakes. Even if $5,000,000 and fifty men are placed at the service of the State fish commissioners in the interest of fish culture, what are these in the contest with 50,000,000 of people demanding food, and millions upon millions of capital naturally drawn upon to supply their need. The fruits of fish culture, like bread thrown upon the water, must return after many days. It must wait the coming of the young fish to maturity before results are apparent. The fishermen, however, reap the fruit of their labors on the same day, if at all, and thus know the degree of success they are attaining at any hour. With them it is largely a question of muscle; they put down their nets and haul up their fish. With fish culture it is a serious question of scientific knowledge. It has not professed to yet know many of the needed facts with reference to the embryonic life of fishes, suitable temperatures of water, how to secure proper forms and kinds of food, &c. These are questions which must be solved by careful and continued study; and, while the past ten years have been well spent in this respect, there yet remains an enormous deal to be learned. It is as if all agricultural implements, all knowledge in regard to seeds, soils, climate, and treatment of vegetables were blotted out of existence, and we had in ten or fifteen years to bring the science of agriculture from nothingness up to where it could supply the wants of 50,000,000, while but fifty or a hundred people were engaged in the effort, and all the remainder of the 50,000,000 were arranged practically in hostility to their efforts.

As illustrative of what present apparatus worked by skilled fishermen at the instance of very thickly settled regions will do, I will cite the Farmington River, in Connecticut. Artificial hatching was carried on there for several years previous to 1879. That year it was discontinued. The catch was affected as follows:

Catch of shad:

1881	11,505
1882	3,800
1883	1,155

Bearing in mind that three years are required for shad to mature, the effect will be observable. In 1879 the Connecticut commissioners prophesied just what has occurred there. In 1881 hatching was resumed, and a consequent increase for 1884 is predicted.

The salmon propagation in California affords one of the most remarkable of the successes thus far attained. The salmon canneries of the Sacramento River annually increased in number until, by 1870, the entire run of salmon was being caught and utilized. The greatest natural capacity of the river under these circumstances may be considered to have been reached in 1875, when the yield to the canneries was 5,098,781 pounds. The first possible fruits of fish culture were in 1876, when the young of 1873 may be supposed to have returned. The United States hatchery was established in the latter year at Baird, Shasta County, California, and a half a million young released in 1873, and again in 1874. In 1875 the number was increased to 850,000, in 1876 to 1,500,000, and during each of the years 1877, 1878, 1879, 1880, 1881, 2,000,000 young fry were placed in this river. From an annual catch of 5,000,000 pounds the river has come up to the annual catch of over 9,500,000 pounds, which figure has been maintained during the past four years. The figures were:

	Pounds.
1880	10,837,000
1881	9,600,000
1882	9,605,000
1883	9,586,000

Allowing the three years which it takes for salmon to come to maturity and enter the rivers for spawning purposes, the increase in yield to the canneries for ten years has been almost exactly proportionate to the increase in the deposition of fry. Taking into consideration the cost of hatching 2,000,000 of salmon annually, and the value of the increase of 4,500,000 pounds, it will be seen that there is a very large per cent. of profit in artificial fish culture when conducted under circumstances as favorable as these.

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