

12.—OBSERVATIONS ON THE HATCHING OF THE YELLOW PERCH.

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In the month of March, 1889, a number of yellow perch (*Perca flavescens*) spawned in the aquaria at Central Station, and with but very slight attention quite a number of fry were produced. At my suggestion the parent fish had been procured, in the absence of better specimens, to replenish the stock of aquarium fish in anticipation of the throng of visitors at the inauguration ceremonies.

The following year it seemed desirable, in view of possible future wants, to undertake such a systematic series of observations as would furnish full records of the main conditions under which favorable results could be secured; for, however remote the necessity of applying the methods of artificial propagation to this abundant species, the marked simplicity of the spawning habits of the yellow perch seemed alone sufficient to arrest the attention of fish-cultural investigators. Accordingly, with the Commissioner's sanction, 243 ordinary-sized specimens were bought from fishermen at Fort Washington, Maryland, and on February 7, 1890, were conveyed to the tanks at Central Station.

The outlay incident to this study was so inconsiderable, in view of the data obtained and the practical release of nearly a million fry, that the cost should be mentioned. The purchase price of the adult fish, together with the freights and fares incurred in their transfer (that is, all items), amounted to but \$15.80.

On the 21st of February 236 specimens, surviving the bruises received in capture, were about equally divided into four glass collector-aquaria of running water, the contents of each aquarium being about thirty-five gallons. Apparently there were 130 females, and these were placed in the aquaria along with about an equal number of males. The water supply was from the city pipes, *i. e.*, from the Potomac, and was then at 44° F. Subsequent changes in temperature are noted farther on, under the table of egg-production.

Thus confined, with but little more water space than a half gallon to each specimen, the parent fish remained from this date throughout the spawning period and here dropped their eggs. Spawning commenced March 10 and ended April 3, eggs being dropped on eighteen days between dates. Nearly all of the eggs were deposited during the night or early in the morning and as soon as observed through the glass

panels they were taken up with a hand net and transferred to universal jars for development. Fertilization was in every case accomplished by the fish themselves and to a degree of perfection that was quite surprising. It was very rare that impregnation failed.

The spawn from a fish consisted of a single free mass, light gray in color, tough and gelatinous. Figs. 1 and 2 accompanying represent the eggs before and after they were spawned. The forked extremity (Fig. 1) represents the anterior or forward end of the roe. After the roe had been spawned and fertilization and water hardness were accomplished its appearance was greatly changed (Fig. 2). On March 19 one of the fertilized and distended lobes of eggs was found to measure 26 inches. On the 20th William Maynard, night watchman, entered on his report: "Found string of eggs from a large perch, measuring 47 inches long by $1\frac{3}{4}$ inches wide." And again, on the 30th: "Found spawn from a large perch, measuring 7 feet 4 inches long by 4 inches wide at one end and 2 at the other, and weighing $2\frac{1}{2}$ pounds." Continuing, he says: "After the act of spawning the old fish lay on her side for some time as if she would die." "Also found," he says, "that the strings of eggs are like an old-fashioned knitted coin purse, that is, a pocket closed at the ends."

When one of these lobes of eggs was found directly after being spawned the existence of numerous transverse folds allowed the drawing or stretching-out of the mass to many times its original length. After being drawn out and again released it would partially contract and with the hands could be shoved back so nearly into the original compass that it approximately resumed the shape it had previously inside the parent fish (Fig. 1). The arrangement of the transverse folds corresponds in structure to the leather sides of the bellows or accordion. As soon as plumped up by water absorption these numerous folds became so greatly distended as to stand prominently out in rounded curves to meet the surrounding element at every portion of the surface.

Close examination of the egg-lobe revealed the existence of an interior passage throughout its length. The inner cavity was almost entirely closed, being, however, slightly open to outside communication by means of occasional small apertures in the walls. These openings were so unimportant in size and number and of such irregular shape and occurrence that they were at first regarded as accidental. Commissioner McDonald, however, suggested that they formed a part of the system of natural circulation and therefore were probably essential to aëration, and further examination tended to support this view. The egg-lobe was characterized by great springiness, being in fact so highly vibratory that the least agitation of the surrounding water put the whole in motion. This movement evidently forces the water out and in, and hence the apertures seem to be a part of the design, which is a variety of pumping apparatus, for throwing out the stale water and taking in fresh supplies. Whether, in nature, the aërating vibrations are dependent upon the fin-motion of the parents standing sentinel or on external agitation, as the motion from waves or currents, was not determined.

The eggs of the yellow perch are slightly smaller than those of shad, but to make allowance for tissue those under immediate consideration were measured on the shad-egg basis, viz: 28,000 to the liquid quart. The measuring was done the first week in April, some days after the spawning was completed. Practically there was no loss during development and hatching except that brought about voluntarily in examinations. Of the eggs, 91,000, of March 23, were destroyed in making drawings and in

undergoing inspection. The remaining loss occurred among the fry which were held in the aquaria under observation one and two weeks. Probably no other eggs ever handled by the Commission were so hardy as these.

After becoming water-hard the yellow-perch egg-strings are larger than the parent fish. The 88-inch string previously referred to weighed 41 ounces avoirdupois, while the parent fish would not have exceeded 14 ounces previous to spawning. The length and weight of her eggs, as well as the size of the spawning fish, were personally verified by me. The eggs being of less specific gravity occupy relatively more space than the yellow perch themselves.

Table of yellow-perch egg-production at Central Station, Washington, D. C., 1890.

Date.	When deposited or found.	No. of strings of spawn.	No. of eggs.	Water temperature.
				° Fahr.
Mar. 10	11 a. m.	1	2,000	44
16	12 midnight.....	2	15,000	47
17	Night	2	10,000	40
18	8 a. m.	2	10,000	45
18	12 midnight to 8 a. m.	5	21,000	45
19	2 p. m.	2	14,000	45
20	12 midnight to 8 a. m.	5	75,000	45
21	...do.....	5	65,000	45
22	...do.....	6	80,000	46
23	...do.....	6	91,000	45
23	...do.....	6	25,000	45
24	...do.....	7	15,000	47
25	...do.....	8	55,000	47
26	...do.....	5	14,000	47
26	3 p. m.	3	37,000	47
27	Night	6	84,000	48
27	...do.....	1	12,000	48
28	8 a. m.	8	100,000	48
29	Night	8	100,000	49
30	...do.....	4	20,000	48
31	8 a. m.	5	21,000	48
Apr. 3	Night	1	90,000	48
	Total	98	956,000

This large yield of eggs was far beyond my most ardent expectations, producing for actual introduction into the streams 754,000 fry. The eggs were developed in twenty-two of the universal hatching jars, their weight being sufficient to keep them well down at the bottoms. No eggs could have been a less care, it being only necessary to prevent them from being enveloped in sediment. This was done by increasing the current at times and keeping them in rapid motion till the mud was washed away. No jar motion was employed in the hatching.

While undergoing hatching the young, as in shad-hatching operations, were automatically separated into the collectors. When any dead eggs were discovered, a rare occurrence, it was usually found that the whole lobe was defective. As the lobe could be removed intact and with one motion of the hand-net, the picking was no trouble whatever. Therefore, in simplicity of manipulation, economy of labor in attendance, and in turning out a large percentage in hatching, the yellow perch may be said to rank at the head of the list.

Four, three, and two weeks were occupied in hatching, the period being modified by temperature. On the 17th of April 754,000 fry were released, 704,000 in the Potomac and 50,000, as an experimental plant, in a private pond near Washington. The parent fish, after all spawning was concluded, were set free again in the Potomac.

It may be said, in conclusion, that with the knowledge gained of the spawning habits of the yellow perch the species might be hatched with success and in indefinite numbers by any person of care in the regions of its abundance. Nothing could be simpler. The operation would consist in storing the adult fish in live-boxes by the middle of March (latitude of Washington, D. C.) and the subsequent daily transfer of the eggs, laid the previous night, to separate compartments to undergo hatching. Beyond being water-tight and tar-coated the hatching vessels would require no further accessories than clean running water and a cheesecloth outlet-strainer, the latter for restraining the premature escape of the fry. Nor is it immoderate to say that it would be practicable, if desirable, for the Fish Commission to hatch 150,000,000 a year at the shad stations on the Potomac, Susquehanna, and Delaware at a cost below \$3,000. Two men at either of those stations, sixty days, would amply fulfill the requirements in collecting the adult fish and in hatching out the eggs, while their operations with this species would precede, so as not to interfere with, the regular work with the shad.

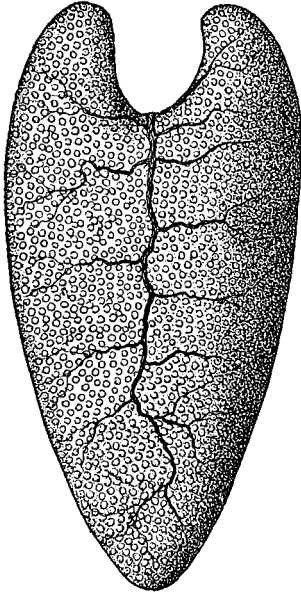


FIG. 1.

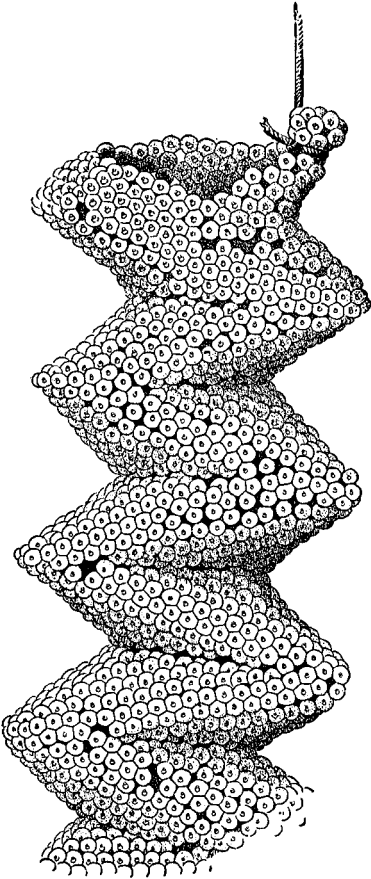


FIG. 2.