

THE ARTIFICIAL PROPAGATION OF THE STRIPED BASS (*ROCCUS LINEATUS*) ON ALBEMARLE SOUND.

By S. G. WORTH.

OFFICE SUPERINTENDENT FISH AND FISHERIES,
Morganton, N. C., September 22, 1881.

Hon. S. F. BAIRD,

U. S. Commissioner of Fisheries, Washington, D. C.:

DEAR SIR: Some months ago I promised to write you fully upon the subject of the fertilization and hatching of rock-fish or striped bass eggs taken by me on the Albemarle Sound in the spring of 1880. Circumstances have in different ways prevented my doing so at an earlier date, but I finally undertake the task, which is one of pleasure. I shall feel more than repaid if my observations shall tend in the least to further inquiry in the same direction.

The rock fish or striped bass (*Roccus lineatus*) is found in considerable abundance in the Albemarle Sound, but it has not so frequently occurred there in the spawning state, owing perhaps to the suspension of operations at the large fisheries about or before the time the eggs ripen.

I was superintending a shad-hatching force at Avoca, and having at that time but few men who could strip shad well, had attended the seine hauls at Sutton fishery, where I took the most of the eggs myself. At eleven o'clock on the night of April 28, among a scant haul of shad and herring I found a large spawning rock-fish. I had a large number of impregnating pans ready to receive eggs, and after I had taken eggs in seven of them, commenced to apply the milt. There were only five or six males and but a portion of them ripe, and I exhausted the milt in the sixth pan. None of the males were more than 16 inches in length, and the milt was very scarce. I did not apply more than one-fourth as much as is usually applied to shad eggs. By accident, the tin dippers had been left at the hatchery, and when I discovered this I was afraid that the milt would stand too long, and I put water to the eggs by dipping each pan into the open water of the sound. An easterly storm brought heavy waves on the beach which were full of sand, small bits of wood, and other injurious substances in the form of fish scales and offal washed upon the beach where herring were cut. In the act of immersing the pans into the waves violent motion was given them in the riding and jumping sustained, and after a survey of their unfavorable handling and a comparison with the handling carefully guarded in impregnating shad eggs, I despaired of success. Finding that it was not possible to get further rock milt for the seventh pan, I took a male shad and applied to the eggs in it. All of the eggs were watered and washed, a tin pan being used as a dipper, in the same general manner adopted

with shad ova, and in an hour's time were placed into buckets and carried to a small boat. They underwent a journey of two miles, one-half of which was in the open sound, the boat's course being in the troughs of the waves. This seemed but another means of destruction that awaited them, but they were unaffected throughout. The parent fish weighed 57 pounds, and I pressed the eggs out as she lay upon the beach. In this position considerable pressure was required. The eggs were quite small, smaller than those of shad, and they possessed a decided green color. When fertilized they became transparent, and in the water could be seen only as small oily globules, which glistened brightly both in solar and lamp light. I measured the diameter of those impregnated, somewhat rudely. I found them seven and a half diameters to the inch. Finding the difference in the size of these and shad eggs (which are eight diameters), I made an estimate of the number taken. In a dipper which had been found to contain 40,000 of the latter I measured the rock-fish eggs, estimating them at 30,000 to each dipper. The contents of the seven pans, or in other words the eggs taken, amounted to 700,000. They were placed into six shad cones, a smaller number being placed in a floating box in the creek.

I bought the mature fish, and on the morning of the 29th cut her open and removed her ovaries. I removed with slight pressure an additional quantity of more than a quart of eggs. To determine the comparative bulk removed on the night preceding, I filled them at the natural openings with water. I found that the difference between the last bulk of eggs, just removed, and a bulk of water sufficient to fill the ovaries was about as four to five, or, in other words, the eggs removed for impregnation were to the eggs unused as one to four, and thereupon I based the total contents at 3,000,000.

It was not until the evening of the 29th that I believed the eggs taken to be fertilized. Then I found that fully 90 per cent. were good, the cone containing those impregnated with shad milt, however, being very low in impregnation, perhaps as many as 5 to 6 per cent. being good. At this stage they showed a less specific gravity than shad eggs, rising to the surface with but a small current from below. Great difficulty arose in the development of this new feature, as the eggs crowded the screens above on all their surface. On the night of the 30th they commenced hatching. The fry immediately began to escape through the perforated screens, and pieces of cloth were bound over the screens to arrest them. They soon clogged, and the water supply had to be reduced proportionately to prevent the cones from overflowing. Within forty-two hours all the eggs were hatched, the fish being mostly dead, owing to the reduction in volume of water. They were perfect fish, clearly out of the eggs, and many quarts in bulk. Their bodies were very small and the sack large proportionately. I removed about 40,000 alive and placed them into the floating box, where about 10,000 additional ones had hatched. I kept them two days, but there was no

current in the creek and the sun beamed down on them, destroying some, and the others followed presumably from the putrid water. There were 4,000,000 shad eggs and fish in the hatchery at the time, and the rock fry died from neglect. Two thousand hybrids were removed and kept in a shipping can for twelve days. They were watered ever two to four hours, but survived under conditions that shad fry could not have done, being near the boiler and machinery, in a high temperature all the while. They were carried to Raleigh, where it was designed to put them into a fresh-water pond, but they died at the depot on the twelfth night after they were hatched. They had sacks of good size still remaining upon them. The temperature of the water during hatching was 66° to 67° Fahrenheit.

From the recital above it may be inferred that rock-fish eggs are as easily fertilized as those of shad, and it would in addition appear that a less amount of milt is necessary. It would further appear that they are more hardy, even admitting large amounts of sand and other mechanical substances into the water while undergoing impregnation.

These points being as well determined as the limited experiments with a single lot of eggs would admit, it occurs that it only remains to ascertain the spawning localities of the parent fish when their propagation will follow. As an aid to discovering these localities it may be well to mention the capture of three spawning fish at Scotch Hall fishery in 1879. This fishery is only two miles from Avoca. In 1880 five were captured within four miles, and in 1881 three were captured at Cason and Wood's fishery, six miles from Avoca, and near the town of Edenton. All of these were of large size, probably averaging 55 pounds.

No specific mode is adopted for the capture of rock fish in these waters. Twelve of the large seines, of one and a quarter to one and a half miles in length, aggregate about 150,000 pounds per year. A great number ascend the Roanoke, the main tributary of the sound, which stream is preferred by them in their ascent. More than a hundred fishermen are engaged at intervals in the spring, fishing for them with dip-nets from dug-out boats below the falls at Weldon. They consume or sell the catch at home, but a small number being shipped away.

Dr. W. R. Capehart, the proprietor of the Avoca fisheries, made an experimental haul on May 6, 1876, which was called to notice by the late Mr. James W. Milner. His fishing operations had closed, but being induced for some cause to make the haul, he cast one of his large seines. Eight hundred and forty rock were captured, which weighed 35,000 pounds. Three hundred and fifty averaged 65 pounds, and many of these ran to 80 and 90 pounds. The roe from one female weighed 24 pounds, which must have contained, on comparative estimate, six to eight million eggs. Dr. C. had not given any attention to artificial propagation at that time, and does not know if any were ripe. In this connection it may not be inappropriate to mention that rock-fish eggs were taken at Scotch Hall fishery in 1879. Dr. Capehart, assisted by

Mr. E. H. Walke, took a large number of eggs and applied the milt. Their attention being drawn to the fishery, however, the eggs were left two or more hours in the water unchanged. They were so much crowded together, and so long unattended, that the impregnation was not very good. They were placed into the cones of the United States steamer Lookout, and were only discarded when a more perfect impregnation was attained by Mr. William Hamlin in a separate and perhaps more recent lot of eggs. Mr. Hamlin belonged to the corps of Hon. T. B. Ferguson.

Some preliminary arrangements will be made next spring toward the propagation of this fine fish, by the sub-department of fish and fisheries of North Carolina, which I have the honor to represent.

I am, yours, very respectfully,

S. G. WORTH.

ON THE RETARDATION OF THE DEVELOPMENT OF THE OVA OF THE SHAD (*ALOSA SAPIDISSIMA*), WITH OBSERVATIONS ON THE EGG-FUNGUS AND BACTERIA.

By JOHN A. RYDER.

Several series of experiments at different times were undertaken by persons connected with the United States Fish Commission, having for their object the solution of the following problems: "Is it possible to lower the temperature of the water in which shad eggs are incubated so as to greatly retard and prolong the process?" "Is it possible to prolong the period of incubation so that large quantities of embryonized ova may be carried for long distances by land or water so as to effectively stock distant or foreign waters?" These two queries, I think, clearly state the objects of the experiments, and also tacitly indicate the important results which would follow in case practical results should be attained.

That a decrease in temperature would impede or retard the development of ova has been known for a long time, and, without encumbering this essay with references, it may be asserted as a truth based on physical reasons and facts. Physiologists and biological philosophers, such as H. Milne-Edwards and Herbert Spencer, have recognized and discussed the influence of fluctuations of temperature on physiological processes. Every genus, and perhaps even every species of fishes, in the course of the early development of its ova, appears to present some idiosyncrasy of behavior which demands that its characteristics shall be studied before it is ventured to proceed with experiments of this character. Practically the peculiarities of the ovum of the shad are perhaps as well known as those of any species we are called upon to deal with.

Shad eggs after impregnation are relatively large, measuring from one-eighth to one-seventh of an inch in diameter. When first extruded