

ON A REMARKABLE MODE OF GESTATION IN AN UN-
DESCRIBED SPECIES OF ARIUS (*A. Boakeii*). By WM.
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THE various plans resorted to by fish of depositing their ova, and protecting them during the period of incubation, have not unfrequently attracted the attention of naturalists. One of the most curious and interesting observations made on this subject was brought before the Boston Society of Natural History, about nine years ago, by Dr Jeffries Wyman. He states² that when walking through the market of Paramaribo, in Dutch Guyana, he found the mouths of several species of Siluroid fish belonging to the genus *Bagrus*, or to one closely allied, distended with ova, sometimes between twenty and thirty in number. The eggs were in various stages of development, some recently deposited, others with the embryo very considerably advanced. The eggs were always in the mouths of males, and were not bruised, and none were found in the stomach. In the fifth volume of his Catalogue of Fishes in the British Museum³, Dr Günther relates that, whilst examining some specimens of *Arius fissus* from Cayenne, presented to the Museum by Professor Owen, he was surprised to find their mouths and gill-chambers distended with about twenty eggs rather larger than an ordinary pea. The eggs were perfectly uninjured, and the embryos in a forward state of development. These specimens were also males. Again, Professor Agassiz, writing from the river Amazon, September 22, 1865⁴, states that he has observed a species of *Geophagus*, *G. pedroinus*, a fish belonging to the family Chromidæ, in which the mouth and a pocket-like pouch, formed by the superior pharyngians, contained a number of ova. How the eggs get into the mouth he is quite ignorant; but there they remain until the young are in a fit state to take care of themselves. In all the above cases the fish are denizens of the South American continent; and, except the species described by Agassiz, belong to the Siluroid family.

The observations to which I shall now direct attention prove that this remarkable egg-carrying habit is not confined to certain species of fish dwelling in the new world, but is shared by some of the fish of the old world also. In the month of April of the present year I received for examination, from the eminent botanist, the late Dr Greville, some specimens of Siluroid fish, which had been sent him

¹ Read before the British Association for the Advancement of Science, August 23, 1866.

² *Proceedings of Boston Society of Natural History*, Sept. 15, 1857, and *American Journal of Science*, Vol. LXXVI. 1859.

³ London, 1864.

⁴ *Quarterly Journal of Science*, p. 302. April, 1866.

by the Rev. Barcroft Boake, of Ceylon. The specimens were accompanied by a copy of the literary supplement to the *Ceylon Examiner*, to which Mr Boake had communicated "An account (dated April 20, 1865,) of some peculiarities in the habits of certain species of fish that are found in the waters of Ceylon." The most interesting portion of this narrative consists of an account of the habit of a fish caught at Caltura in that island. When held up by the tail it emits from the mouth a quantity of eggs, which, when many fish are captured, are fried, and used for food by the natives. The fishermen suppose that the regular mode of bringing forth the young is through the mouth; but Mr Boake satisfied himself that the fish produce their eggs in the ordinary way; and that, after being deposited, they are immediately taken into the mouth, either by the fish that has laid them, or by another of the same species, where they are kept until they are hatched.

The specimens given to me were two males and one female. The female had no ova in her mouth; but from the appearance of the abdomen it was evident that the ovaries were distended; and on opening into the cavity I found a large sac-like ovary on each side of the middle line. Each ovary measured $2\frac{1}{2}$ inches in length, and extended forwards almost as far as the pectoral fin, where it formed a rounded free end, whilst posteriorly it was somewhat constricted, and opened by an orifice common to it and its fellow immediately behind the anus. The ovisac contained a very large number of eggs in various stages of growth; some were like minute granules, others, and these were very numerous, like medium-sized shot, whilst a third set equalled in size grapes or small cherries and very materially exceeded therefore the size usually attained by the eggs of osseous fish. These last, only six in number in each ovary, had evidently almost reached the full period of intra-ovarian growth. Each ovum was attached to the inner wall of the ovisac by an independent pedicle, the atrophy of which would necessarily precede the discharge of the egg.

The mouth and branchial chamber of one of the male fish were distended with ten ova as large as those found in the ovarium, which were so closely packed together that water, or minute particles of food, could only pass backwards to the gills or œsophagus by filtering through the narrow interspaces between the eggs. In each ovum the development of the embryo had advanced so far that the eyes, chorda dorsalis, and cerebro-spinal nervous axis, could without difficulty be distinguished, and from the ventral surface of the embryo numerous vessels were seen ramifying over the surface of the yelk. The embryos measured from $\frac{1}{2}$ to $\frac{7}{10}$ ths of an inch in length. Only one of the ten eggs had sustained any injury, its investing membrane

being ruptured, so that a portion of its contents had escaped. It is interesting to note that the palatine teeth of the fish are granular, so that their form is well adapted for permitting the retention of the ova in the mouth with a minimum of injury.

Mr Boake's observations show that the eggs are not placed in the mouths of the fish by the natives for purposes of deception, but that the instinct of the animal prompts it to take them into that cavity; and it is, as these specimens show, by the male, and not by the female, that this act is performed. In this respect this Cingalese fish agrees with those already described by Drs Wyman and Günther. Opinions may differ as to the reason of this remarkable habit. It may be supposed that the male uses the eggs for food, or that he takes them into his mouth for temporary protection, discharging them again when the danger no longer exists, or that their presence in that cavity is connected with the process of incubation. The last of these suppositions seems to me most probable, for the habit of distending the mouth with eggs appears to be so common in this species of fish, that it is a matter of ordinary observation amongst the natives; the eggs are not torn or bruised as they would have been if subjected to the process of mastication, the stomach does not contain any fragments, and in each ovum is situated an embryo in a more or less advanced stage of development. Again, naturalists are acquainted with other fish which play a part in the incubation of their ova; the male pipe-fish, the male hippocampus, and the *Aspredo levis*, described by Wyman, possess special arrangements for receiving and carrying about the eggs until they are hatched. A close relation apparently exists between the number of eggs which come to maturity at a given time, and the number which the male can carry in his mouth. In the female I examined twelve eggs are evidently reaching their full growth, whilst the male has ten in his mouth; and from another specimen examined by Mr Boake, as many as thirteen were shaken out. This is a smaller number than was observed by Drs Wyman and Günther in their Siluroids, but the eggs are in this species of much larger size. As the distended condition of the mouth would necessarily materially interfere with the reception of food by the male fish, it may be a question if he does not eject them during feeding, or perhaps during the time he plays the part of a dry nurse the quantity of food he takes may be almost *nil*.

The following are some anatomical and zoological details.

Stomach pendulous in abdomen and empty. Duodenum curved from left to right, then passed backwards and succeeded by the convolutions of the small intestine, behind which the gut again became

straight on its course to the anal orifice. Liver consisted of two almost symmetrically placed lateral lobes united by a median isthmus lying below the œsophagus. Gall-bladder to the right in the interval between the liver and duodenal curve, its duct arched to the left side, almost parallel to the duodenum, into which it opened, just above the pyloric end of the stomach. Spleen of a triangular form, not connected with the stomach, but situated on the left of the convoluted small intestine. Kidneys placed at posterior part of abdomen in close relation to swimming bladder, each terminated anteriorly in a pointed end, whilst posteriorly they blended together behind the swimming bladder, and formed together a crescent-shaped mass; at the point of junction a tongue-like process passed backwards, and out of this two opaque white ureters proceeded, which joined almost immediately and formed a single and much wider canal which opened posteriorly behind the oviduct. Testicles a pair of elongated glands, somewhat more than an inch long, separated by a peritoneal fold anteriorly, but lying side by side in their posterior halves, and extending backwards between the rectum and ureter to their termination. The swimming bladder was a capacious sac, which occupied a large extent of the dorsal part of the abdomen. It was imperfectly subdivided into alveoli by an antero-posterior and several transverse septa, the former terminated in front in a crescentic margin, so that the lateral halves freely communicated anteriorly. From the middle line of the ventral surface of the swimming bladder a short duct proceeded, which passed to the dorsal wall of the œsophagus. In the interval between the anterior end of the swimming bladder and the branchiæ was a soft greyish gland-like mass, which possessed a transverse diameter of nearly one inch. It was enclosed in a delicate capsule, and subdivided into a number of granular lobules. Examined microscopically these lobules were found to consist mainly of colourless corpuscles, like those entering so largely into the structure of the thymus, from which circumstance, whether we apply to it the descriptive name of thymus or not, it ought to be referred to the group of glands of which the thymus and suprarenal capsules are such well-known representatives.

The fish belongs to the genus *Arius*, but as it differs in some of its characters from the species already recorded, an opinion in which I am supported by the high authority of Dr Günther, to whom I showed the specimens in the month of June, I purpose describing it as a new species, and to connect with it the name of the gentleman by whom it has been sent to this country¹.

¹ Dr Günther writes me that since I showed him my specimens he has examined a collection of fish from Ceylon recently sent to the British Museum, and finds that not only does it contain *A. Boakeii*, but another species of egg-bearing *Arius*.

Arius Boakeii. D. 1/7, A. 19, P. 1/10.

Body, without caudal fin, five times longer than high, and between three and four times longer than the head. Breadth of head somewhat more than its height, its greatest breadth nearly $\frac{2}{3}$ rds its length. Upper surface of head finely granulated, and divided into two lateral halves by a smooth, narrow, lanceolate groove, which extends quite as far back as the base of the occipital process. Occipital process triangular, lateral margins straight, longer than broad, and with a fine keel along the middle. Each half of the intermaxillary band of teeth rather more than twice as broad as long. No vomerine teeth. Palatine teeth granular, arranged in two distinct patches of a triangular form with rounded angles: posterior margin or base of the patch concave, outer margin convex, inner almost parallel to its fellow posteriorly, but diverges from it anteriorly. Maxillary barbels pass beyond the base of the pectoral spine. Dorsal spine strong and serrated on both margins, about equals the height of the body, though the fin is prolonged much higher through a slender filamentous process just behind the spine. Adipose fin short with black patches. Caudal fin deeply forked: lateral line bifurcating at root of caudal fin. Pectoral spine not so long as the head: it equals in length the dorsal spine, and extends slightly beyond a vertical line drawn from the last ray of the dorsal fin. External mandibular barbel passes as far back as the gill-cleft. Sides of body silvery. Male carries developing ova in mouth.

Length of male without caudal fin.....6·4 inches.
 female7·5

Habitat, Ceylon.