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Zoology. — “A new case of parental care among fishes.” By Prof. MAX WEBER.

Cases of parental care are some of the remarkable phenomena among lower animals which have attracted very little attention — though amongst fishes they are so numerous that the well-known American naturalist TH. GILL has devoted an extensive article to: “Parental care among fresh-water fishes”¹⁾. But this phenomenon is also found among sea fishes, although in these cases it more easily escapes observation.

The usual idea is that fishes are indifferent to the fate of their eggs and off-spring, that their care for both, if it does exist, generally does not extend further than a search for a suitable place for their development and that only in rare cases more care is bestowed, for instance by fastening the eggs on a suitable place, or by building a nest for them or by taking care of them in some other way.

Closer observation teaches us that such care can be shown not only in a more active but especially in a more lasting way.

It is known for instance that the male of the marine stickleback weaves a nest as large as a fist of vegetable parts and threads of slime, a secretion of its kidneys, which hardens when in water — in which nest the eggs and afterwards the fry are kept and bravely defended. In fact many cases are known of guarding and defending the brood and generally this is done by the male. But he can also concern himself in another way with the fate of the eggs and can give them what the Germans so aptly call: “Brutpflege”. The male of the lumpsucker (*Cyclopterus lumpus*), whilst taking care of the large cluster of eggs, keeps the water round them refreshed and in circulation and also keeps poking his snout in the cluster of eggs so that the surface changes. In the same way the freshwater fish *Leucaspis delinatus* keeps the plants on which he has fastened the eggs, in constant motion by beating his tail against them so that the eggs may have enough oxygen.

Still more intimate is the connection between parents and eggs in a number of fishes (*Cichlidae*, *Siluridae*, *Apogonidae*). Sometimes the female, sometimes the male, more often the latter, hatches its eggs in its mouth cavity and when in danger even the young fishes can safely hide there.

No less peculiar is the phenomenon of the eggs being stuck to the skin of the abdomen of the male. In the male of the *Aspredidae* it grows in such a way round the eggs that these come to be pedunculated.

¹⁾ TH. GILL. SMITHSONIAN. Report 1905. p. 404.

Something like this is shown by the males of the sea-horses and needlefish (*Syngnathidae*). In the simplest cases the eggs are stuck by slime in two or more rows to the abdominal surface, in other cases the female brings the eggs into a brood-pouch which is developed during the time of propagation along the ventral surface of the male's tail.

In this short sketch the different methods of parental care (generally by the male) have not by a long way all been described.

The knowledge of one of the most remarkable cases is due to the two glorious expeditions to Dutch South New Guinea under leadership of Mr. H. A. LORENTZ. Both expeditions had their working basis in the Lorentz (Noord) river, which was navigated up very high and which had its fish fauna thoroughly investigated. It was then that the *Kurtus Gulliveri* de Castelnau which is remarkable as well for its shape as for its internal build, was discovered in that river; formerly it was only known from the Norman and the Strickland River, a side stream of the Fly River in British New Guinea. A second species *Kurtus indicus*, which is much smaller, (specimens of 430 mm. length were brought home of *Kurtus Gulliveri*) lives round the coasts of the Indian Archipelago and British India. Together they form the small family of *Kurtidae* with the single genus *Kurtus*, one of whose characteristics is that the male, when fullgrown, has on its occiput a bony hook which is bent forward (Fig. 1). It comes from the supraoccipital and carries the remains of rudimentary dorsal spines. The females have no sign of this apparatus; in the male it develops gradually during the growth of the individual and appears only to reach its full size during propagation when the

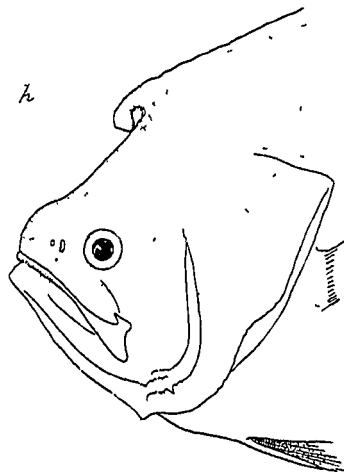


Fig. 1.

skin round the hook swells in a rind-like way. At any rate in *Kurtus Gulliveri*, the end of the hook becomes in this way so large that, as it bends downwards and forwards, it nearly touches the head and in this way forms an eye in which the eggs are carried. This is done by a round string which is held fast by the eye mentioned above and which branches off on either side, first in coarse branches, then in finer ones and finally in very fine fibres, at the ends of which the eggs are fastened, each in its strong but transparent membrane.

All the eggs together form a more or less round mass which rests on either side of the male's head. In this way the eggs develop till they are hatched. In one of the two clusters of eggs which I had at my disposal the eggs had nearly reached this stage — the young fishes had eyes, a well-developed tail and the yolk sack was on the point of disappearing.

There are more cases known of fishes' eggs being stuck together by some stuff formed by ovarium or oviduct and secreted in a more or less fluid or slimy condition with the eggs, but which hardens in water.

Probably in *Kurtus Gulliveri* the united ends of the two oviducts secrete the connecting string, and its collateral continuations with the ramifying branches that carry the eggs, are formed in the respective oviducts and ovaries. Then it must be supposed that at a certain moment this apparatus is discharged as a whole by the genital porus after which by the contact with water, those parts that carry the eggs harden.

Before trying to answer the difficult question of how this apparatus comes underneath and behind the male's hook I must point out that during the expedition of 1907 on October 6th the fishing net brought to the surface a specimen of *Kurtus Gulliveri* of 390 mm. length with its hook but slightly open whilst the net also contained an egg-apparatus. Mr. J. W. VAN NOUHUYS, Mr. LORENTZ's companion then suggested that the cluster of eggs had possibly been carried behind the hook. This was confirmed by the capture on March 3^d 1910 of a specimen of 420 mm. length, that in fact still carried the eggs, as the accompanying illustration (Fig. 2) shows. On this specimen the hook and the head form together a nearly closed eye.

After removal of the thickened skin the hook is seen to consist of a sickle-shaped process of the supraoccipital which is composed in front of a very narrow, laterally compressed bone. Its appearance leads us to suppose that it had its origin in ossification of the subcutaneous connecting tissue and gradually gained in measurements during the growth of the fish. The first indication of the hook in

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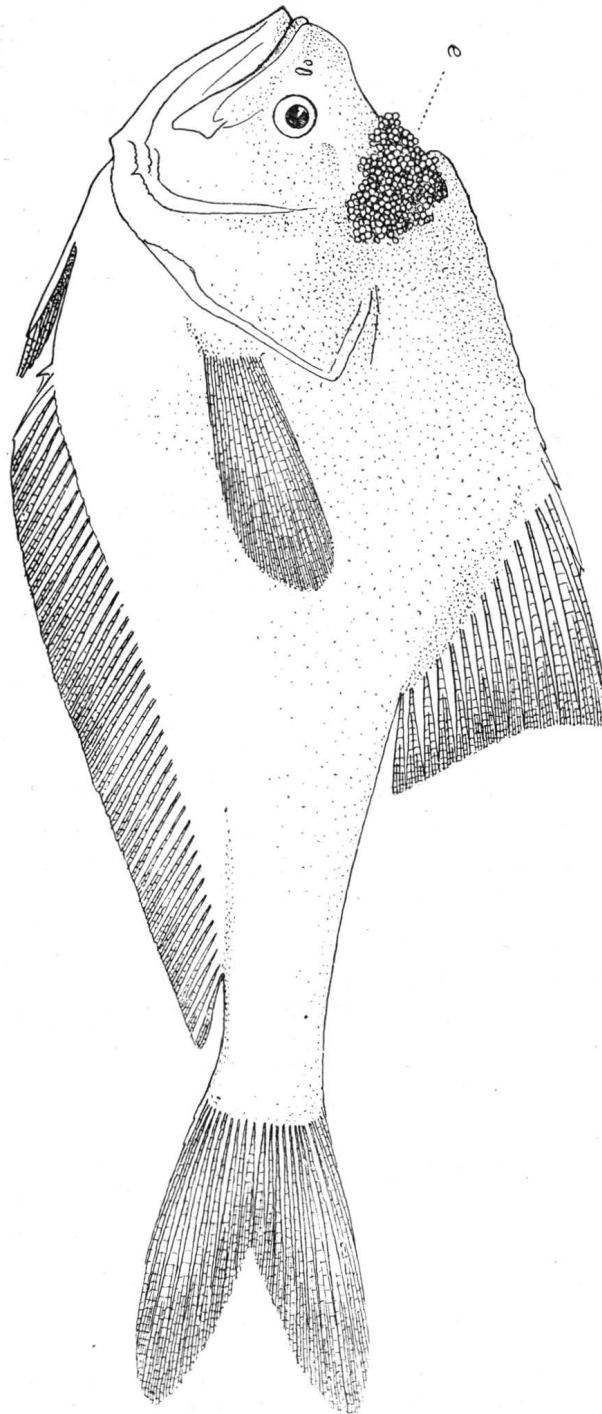


Fig. 2.

the young male is only visible as a slight protuberance, that in older specimens slowly takes the shape sketched above.

It will be superfluous to mention particularly that further investigation confirmed that only the males possess the hook.

This curious apparatus first reminds us of the frontal clasper in males of different kinds of *Chimaera*. But this is movable and provided in front with dermal teeth and supported by a piece of cartilage that can be retracted into a dermal pouch. Though its function is not known, it certainly has nothing to do with the carrying of eggs. So functionally the two apparatuses are not to be compared either.

It appears to me one might sooner draw a comparison with the crestlike elevation of the occipital in *Selene* which gains in height with the growth of the individual; also with *Naseus (Acanthurus) nasicornis*, whose skull sends out a bony horn above the eye, which grows longer as the fish grows older.

A question not easy to find an answer to is how the hook in *Kurtus Gulliveri* is set to work, how in fact the short string with on either side its cluster of eggs, comes to lie under the hook in such a way that the two clusters hang symmetrically on the head of the male. The only line of action I can imagine the couple concerned in the laying of the eggs to take, is that the male should take up a vertical position under the female's genital porus. As soon as this ejaculates the string with its two clusters of eggs — the string now being still soft — it is caught by the male's head and pushed under the hook, possibly by a forward movement on the part of the male.

This is a purely hypothetical explanation — but I know of no better one for the intricate manoeuvres necessary to bring the eggs in the desired place. The advantage for the eggs, when once in that position, is apparent especially in a stream as the Lorentz River, which is a quick flowing stream and even more so as it floods its banks whenever there is a heavy fall of rain. When carried by the strong parent, there is small danger for the eggs of being swept against the banks or buried under mud and stones or of being harmed in some other way.

But this is not an answer to the question what the origin was of this strange line of action and many other questions in connection with this. It is not known if *Kurtus indicus* uses his hook in the same way.

Physics. — “*The electromotive force of the WESTON Normal Cell*”.

By Prof. H. HAGA and J. BOEREMA.

At the international Conference on electrical Units and Standards held in London in Oct. 1908, some directions were given for the construction of the WESTON cell, as a standard of electromotive force. For its E. M. F. at 20° 1.0184 international volts, was taken provisionally, till further measurements shall give a more accurate value.