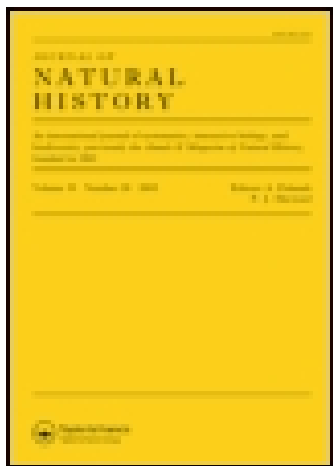


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Annals and Magazine of Natural History: Series 6

Publication details, including instructions
for authors and subscription information:
<http://www.tandfonline.com/loi/tnah12>

On the habits of *Gobius minutus*

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Published online: 12 Oct 2009.

To cite this article: Frédéric Guitel (1891) On the habits of *Gobius minutus*, *Annals and Magazine of Natural History: Series 6*, 8:47, 407-409, DOI: [10.1080/00222939109460460](http://dx.doi.org/10.1080/00222939109460460)

To link to this article: <http://dx.doi.org/10.1080/00222939109460460>

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"Eupodosaurus longobardicus."

The specimen noticed and figured under the above name in the last number of the 'Annals' (p. 292) turns out to belong to *Lariosaurus Balsami*, and has been figured by Curioni (Mem. Ist. Lomb. ix. 1863, pl. vii. fig. 1). I am indebted to the inquiries made at the Milan Museum by my friend Dr. J. de Bedriaga for this identification. Although I had examined the foot on the plaster cast of the entire *Lariosaurus Balsami* in the British Museum, the appearance, especially of the distal phalanges, differed so greatly from the one at the College of Surgeons specimen that the identification of the two never occurred to me.

G. A. BOULENGER.

Oct. 13, 1891.

On the Habits of Gobius minutus *. By FRÉDÉRIC GUITEL.

Gobius minutus is found in abundance in the pools of water left by the ebbing sea on the sandy beaches of Roscoff. The habits of this little fish at the time of reproduction are extremely curious; they have been observed with the greatest accuracy, owing to the extremely favourable conditions afforded by the great aquarium of the station at Roscoff for this kind of observation. The water flowing in abundance through the tanks, the animals live in them as in the natural state.

The sexes are distinguished by constant differences in the coloration of the dorsal and anal fins. In the female the two dorsals are transparent and only marked with some small black dots situated upon their rays; the anal is perfectly transparent. In the male, on the contrary, the two dorsals bear three or four almost horizontal white bands, separated by two or three black bands. Moreover the first dorsal, which, as in the female, has six rays, presents two spots of a fine blue, each limited towards the base by a black crescent which is outlined by a white crescent. One of these spots is situated between the fourth and fifth rays, the other between the fifth and sixth; sometimes the second is wanting. Finally the anal is largely bordered with black.

If a female ready to lay, a male in the reproductive state, and a shell of *Cardium* or of *Tapes* are placed in an aquarium with its bottom covered with sand, the male is not long in introducing himself beneath the shell, only letting his head protrude beneath its rim. From time to time he enters his little mansion, drives out a large part of the sand which it contains by a rapid agitation of his tail, and even brings in his mouth small stones, shell debris, or small quantities of sand which he shoots out over the threshold of his domicile. Then he sets to work to conceal his shell completely. For this purpose he leaves it, places himself above, and, steering in a straight line, moves over the sand with a rapid agitation of his pectorals and his tail, so as to project behind him a wave of sand which accumulates on the shell. The track of his passage in the sand is marked by a deep furrow.

After he has scooped out the first furrow he reenters his house,

* The observations which form the subject of this note were made in the aquarium of the Laboratory at Roscoff (Finistère).

throws out the sand that has fallen on the passage to his door, and then comes out again at the end of some minutes to scoop out a second furrow in another direction. When this manœuvre has been repeated eight or ten times the shell is completely buried under a little hill of sand with rounded top, trenched with furrows disposed starwise, and pierced by a hole giving access to its concavity.

This hole is, in general, perfectly round, and just large enough to allow the master of the house to pass. Such a hole could not preserve its shape in sand if the grains forming its walls were not agglutinated by the mucus secreted by the skin of the animal when lying in its hole.

When his house is constructed—a house which, as we shall see, is a true nest—the male endeavours to entice the female to his home. For this purpose he comes out of his sanctuary, swims rapidly towards her, draws near her by little jerky bounds, pushes her frequently with his snout, and then returns rapidly towards his nest as if to show her the way to it. If the female, as usually happens, refuses to follow he returns to the charge, touches her again with his snout, and again makes a pretence of returning to his den; often he repeats this manœuvre five or six times together: then, discouraged by the indifference of the female, he reenters his dwelling, but not for long; for, at the end of a minute or two, often less, he comes out of it again and recommences his solicitations. One evening I observed a male who, in the space of three hours, came out of his hole seventy-eight times, and invited the female a hundred and sixty-eight times to share his nest.

When the male approaches the female to solicit her to follow him his colours suddenly become brighter, he erects his dorsals, raises his head vigorously, and spreads his opercles; at times also his body is agitated by a very visible trembling. When he has returned to his nest, his head, which he lets project out of the hole, becomes quite white, and he respires with a febrile activity which is in complete contrast with the normal respiratory rhythm. If the female approaches the agitation of the male becomes extreme; he retires quickly into his hole several times in succession, as if to call her in; but often the female retreats without deigning to respond to these advances; then he resumes his station, and soon recommences the solicitations described above.

At length, if the female decides to enter the shell with him, he remains at the entrance to the nest and waits for her to lay in a state of extreme agitation; but often she escapes immediately, in spite of the manifest efforts which he makes to prevent her from going out by extending his pectorals transversely. When the female consents to remain the laying commences. To do this she proceeds to the ceiling of the nest by the aid of the cupping-disk which she bears on her ventral surface and deposits her eggs by the way, which cling to the internal face of the shell by means of glutinous filaments regularly disposed at one of their poles. These filaments, secreted by the cells of the follicle, harden after remaining for some hours in sea-water.

After a certain number of eggs have been laid the female resumes

her natural position on the floor of the nest, and the male, proceeding in his turn to the ceiling, fecundates the eggs which she has fixed there. This manœuvre is repeated during an hour or two until all the ripe eggs have been expelled*.

When the process of laying is completed the female abandons the nuptial domicile, never to return; but the male remains and watches over the eggs until the young are hatched; for the small Crustacea which abound on the sandy shores, and on which *Gobius minutus* subsists (*Crangon*, *Mysis*), would eat the eggs were they not vigilantly guarded by him.

During the time that the development of the young is proceeding the male vibrates his tail and pectorals, so as to set up currents under the shell, which ensure the renewal of the water in it.

If after a male has made choice of a domicile under a shell we turn the concavity upwards, he restores it to its original position in the following manner:—

He begins by passing under the edge of the shell, rakes up the sand about it if necessary, then placing himself at the side opposite to the hinge, he nips one of the sides gently, and by a rapid movement of his tail describes a semicircle in the surrounding water in such manner as to swing round the shell till its concavity is underneath. Then he clears this at some point in its contour, and introduces himself beneath; he then throws out the superfluous sand in the interior and covers it as has been described above. When the male is guarding the clutch that he has fecundated the experiment is still more certain of success.

If we drive away a male from the nest he has prepared he is not long in returning to it, even if other shells resembling his own are placed near his dwelling for the purpose of deceiving him. If when a male is watching over the eggs which he has fecundated we drive him away and replace his shell by another, leaving the first at a little distance, when he returns he enters the shell which occupies the position the first had without hesitation; but he is not long in perceiving that it does not contain his eggs; then he quits it to seek for and retake possession of the first. He does not scruple to fight furiously if during the experiment another male has possessed himself of the shell containing his offspring.—*Comptes Rendus*, Aug. 10, 1891, p. 293.

On the Excretory Apparatus of the Carididæ, and on the Renal Secretion of the Crustacea †. By M. P. MARCHAL.

I. In a previous note I briefly described the excretory apparatus of *Palaemon*. I have since examined a few other Carididæ, which exhibit, in this respect, certain important differences. In *Nika edulis* the labyrinth is wanting; the gland is formed solely by the

* To make the observations respecting the laying, instead of supplying shells to the males I gave them watch-glasses, which I covered or uncovered at will by means of a brush.

† The investigations were carried out at the Arago laboratory (Banyuls-sur-Mer).