Neotropical Ichthyology, 2(3):163-166, 2004
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Scientific Note

Courtship behavior and spawning of the hairy blenny *Labrisomus nuchipinnis* (Labrisomidae) in southeastern Brazil

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Labrisomus nuchipinnis is a diurnal bottom-dwelling sit-and-wait carnivorous fish that inhabits holes and rifts of rocky areas in tropical shallow waters. Here we report on the courtship behavior and spawning of this hairy blenny in southeastern Brazil, with a detailed description and comparison with other Blennioidei. *Labrisomus nuchipinnis* is a territorial species that was observed courting with more than one female, and presenting a well defined pattern cycle related to reproductive behavior and paternal egg care. Adhesive demersal eggs are laid on small algae-covered rocks at sites with increased current velocity within the male's territory, which may enable higher egg survivorship and shorter developmental time.

Labrisomus nuchipinnis é um peixe bentônico e carnívoro de hábitos diurnos, que espreita suas presas e que habita tocas e frestas de ambientes rochosos em águas rasas tropicais. Registramos o comportamento de corte e desova deste amborê no sudeste do Brasil, descrevendo-o em detalhe e comparando-o com os de outros Blennioidei. *Labrisomus nuchipinnis* é uma espécie territorial que foi observada em corte com mais de uma fêmea, apresentando uma seqüência cíclica padrão relacionada ao comportamento reprodutivo, e cuidado paternal para com os ovos. Os ovos demersais adesivos são depositados em pequenas rochas cobertas por algas, em locais de elevada hidrodinâmica, localizados dentro do território do macho, o que deve proporcionar uma maior taxa de sobrevivência dos filhotes e menor tempo de desenvolvimento dos embriões.

Key words: mating behavior, oviposition, parental care, blennies, South Atlantic.

Blennioidei ("blennies") are elongate, generally robust fishes characterized by a very flexible body and a fluid swimming motion, pelvic fins inserted ahead of the pectorals, a long anal fin, and usually a single dorsal fin. Most are cryptically colored, which, combined with their small size, renders them relatively inconspicuous (Thresher, 1984). The Blennioidei are divided in six families, with 127 genera and at least 732 species (Nelson, 1994), and the reproduction of its members appears to exhibit some universal traits, such as the production of demersal eggs that are deposited in shelters defended by males that drive females away after spawning (Keenleyside, 1979; Thresher, 1984; Rasotto, 1995).

Labrisomus nuchipinnis is a diurnal bottom-dwelling sit-and-wait carnivorous fish that inhabits holes and rifts of rocky areas, usually near sites where there is dense algal growth. This species occurs in shallow waters (up to 12.5 m; FBS pers. obs.), from Florida (USA) to Santa Catarina, southern Brazil (Gibson, 1969; Sazima, 1986; Humann, 1994). Adult males are territorial and conspicuous during their reproductive periods, showing a yellowish to greenish body with an intense reddish cheek and belly, while females are spotted or reticulated, with distinguished bars on the body and a ventral brown area with irregular chestnut-colored spots (Springer, 1958; Humann, 1994; Sazima *et al*., 2002).

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Labrisomus nuchipinnis is very common and abundant in the Brazilian coast, and reproduces year-round, mostly in the summer. Eggs are deposited and fastened to the sides of rocks, which have been previously cleaned by males that exhibit parental care. Larvae are pelagic and, after an undetermined time in the plankton, metamorphose into juveniles and begin to live on the bottom (Carvalho-Filho, 1999:198-199). There is no detailed description of its courtship behavior and spawning in the field, and information on its life-history is vague (see Menezes & Figueiredo, 1985; Carvalho-Filho, 1999; Sazima *et al*., 2002).

Here we report, with quantitative data, on the courtship behavior of the hairy blenny in coastal shallow waters of Brazil, and describe its pattern and spawning, comparing it to other Blennioidei.

Field-work was done at the São Sebastião Channel (23º41' to 23º54'S and 45º19' to 45º30'W), a 25 km long stretch on the coast of São Paulo, southeastern Brazil, that includes rocky shores and reefs as well as sandy and muddy beaches (see Rodrigues & Rocha, 1993 for map). Mating of the hairy blenny was recorded at 1.5 m depth in a small rocky bay, highly influenced by tide levels and consequent water velocity, with 3 m of horizontal visibility and a water temperature of 31ºC. At this site the substrate is complex, with rocky areas mixed with sand and gravel. We recorded the reproductive behavior of *L. nuchipinnis* during a 60 min SCUBA dive, using *ad libitum*, focal animal and sequence samplings (see Lehner, 1979), on 21 February 2001 (summer), starting at 11:00 AM. The behavior was registered with pencil on plastic slates, timed with a stopwatch, and photographed. Voucher specimens were deposited in the fish collection of the Laboratório de Ictiologia de Ribeirão Preto (LIRP), FFCLRP-Universidade de São Paulo, Brazil (LIRP 1425-34).

Three adult individuals of *L. nuchipinnis* (up to 150 mm total length, TL) were observed engaged in mating activities, which were probably initiated before our observations. Mating activities involved, in 70% of observation time, one male and one female, but were also recorded with two females that were acting together or which alternated with a male. Mating began with two females, but one of them was driven away for up to 20 min of observation time, and only the other kept mating until the end.

During all the observation time, the individuals repeated without interruption what we call a "mating cycle" (Fig. 1a-e). Categories were based in Keenleyside (1979):

1) Courtship: "attraction and identification" - a hidden brown-spotted female and an exposed green-body, reddish-cheeked male were perpendicularly positioned on nearby shelters over a rocky/sandy bottom (male was positioned in the middle of the scene between the female and a 400 cm^2 rocky wall, that was later used to lay eggs) (Fig. 1a) (see Fig. 1d for male and female colorations and for a general view of the spawning site);

2) Courtship: "arousal and appeasement" - the female initiated mating activities, moving against the male and nudging him two or three times quickly on the upper side of head (Fig. 1b; time average 26.3 sec since 1a, standard deviation SD=3.2); the male reacted by nudging back the female, and then both moved to the rocky wall (cited above), the female followed by the male (Fig. 1c; time average 12 sec since 1b, SD=2.0);

3) Courtship: "synchrony" - while the female rubbed the wall, quivering her body against the rock, shaking her anal fin and keeping her dorsal fin erect, the male remained perpendicular, biting the sides of her body, dorsal fin and upper side of head, and sometimes rubbing her body laterally with his tail (Fig. 1d);

4) Parental egg care: "nest fanning" - after the female moved through the whole side of the wall, it left the rock and stopped in the same spot as in the beginning; the male followed the female by swimming over the rock, but not touching it, and flapping its pectoral fins, probably fanning the nest (Fig. 1e) (time average 27 sec since 1c, SD=5.6);

5) Parental egg care: "nest patrolling" - the male swam circulating the rock used to lay eggs (a radius of about 30 cm), defending the area against other fish species (potential egg predators); after he returned, the couple was at the same position as in the beginning of the cycle, and after a short pause, the cycle restarted (each cycle had 65.3 sec of average duration, SD=6.1). When there were two females, each cycle duration was shorter (average of 32 sec, SD=13.9).

One hour later, the male repulsed the female and continued guarding the eggs close to the site of oviposition at the rock wall (Fig. 1f). Male was seen taking with his mouth a peace of free drifting sargassum that has attached to the wall. Inquisitive or opportunistic fishes were attacked. In the study area, males of *L. nuchipinnis* defend their territory and seek shelter at rocky substrates covered by zoanthideans, bryozoans, sargassum, pink segmented algae, and other sessile benthic organisms (pers. obs.).

In September 2002, a mature 135 mm TL female captured and kept in captivity for 24h, laid about 5,000 adhesive mature yellow spherical oocytes each about one millimeter in diameter.

Reproduction of *L. nuchipinnis* is in accordance with the general pattern of the Blennioidei (i.e. the production of demersal eggs that are defended by males that drive females away after spawning; *cf.* Keenleyside, 1979; Thresher, 1984; Rasotto, 1995). According to Herrera & Lavenberg (1999), labrisomids have two modes of spawning; ovoviviparity in the tribe Starksiini, and oviparity in the other four tribes (including the genera *Labrisomus*), and all of the labrisomids, excluding the Starksiini members, exhibit some degree of courtship and spawn adhesive demersal eggs into a nest site, which is guarded by the parents.

Sazima *et al*. (2002) observed that *L. nuchipinnis* males tend harems and bite females during courtship, which is in accordance to our observations of two females mating with a single male that bit them during mating activities. Based on Emery & Labelle (1981), Sazima *et al*. (2002) pointed out that the distinct color displayed by adult breeding males is presumably related to both sexual and territorial advertisement.

In our study, spawning and fertilization probably occurred during "synchrony", as was reported for the labrisomid *Malacoctenus zonogaster*, in which females slowly glided along the substrate with wriggling movements when they deposited eggs, and males presumably fertilized the eggs when swimming into a position parallel and close to the females, performing quivering movements with their whole bodies (Wirtz, 1983).

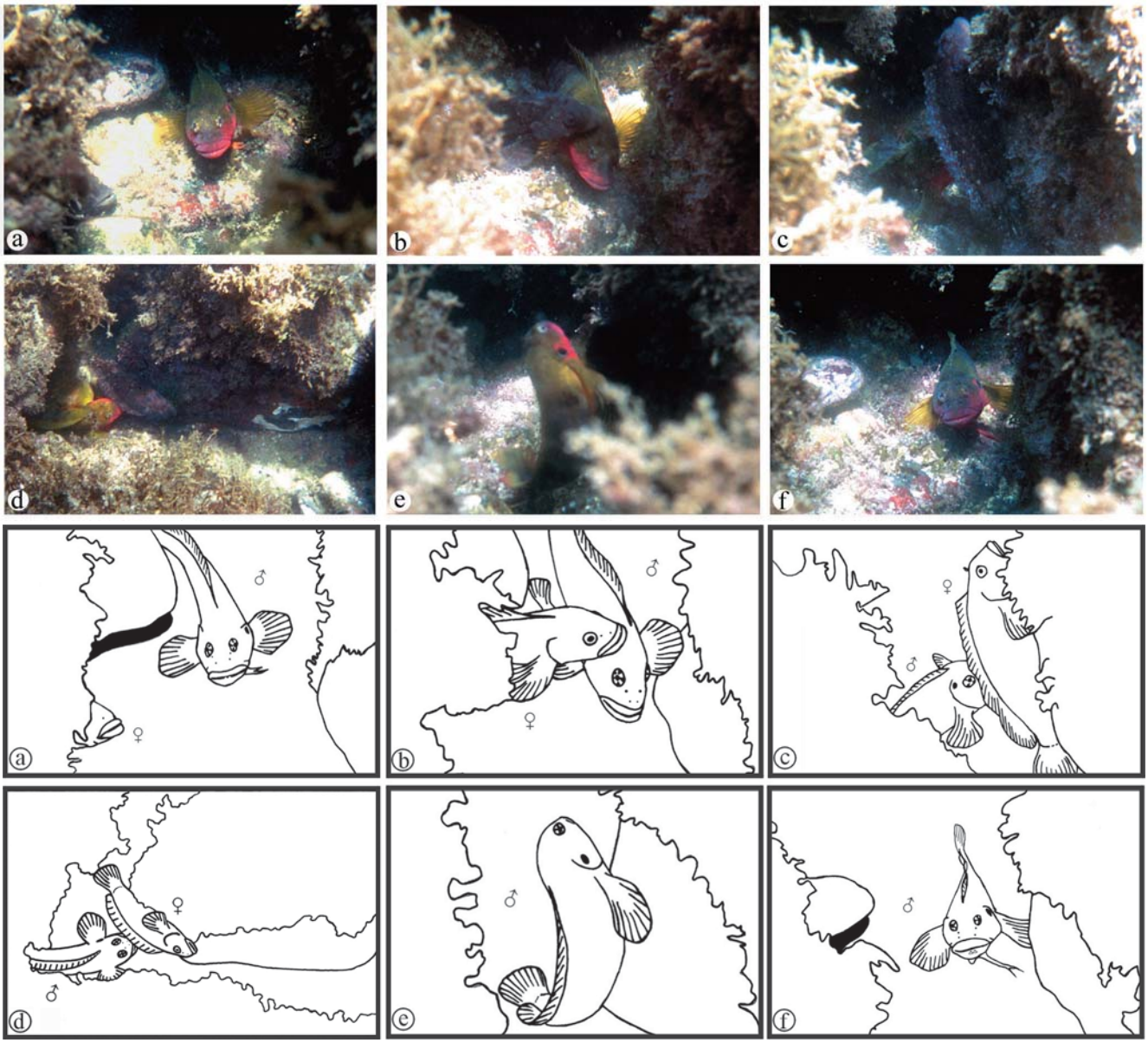

Fig. 1. A couple of *Labrisomus nuchipinnis* (about 150 mm TL) engaged in a "mating cycle" at São Sebastião Channel, São Paulo, southeastern Brazil. Photos and drawings: FZG & HFS.

Similar to *L. nuchipinnis*, *M. macropus* and *M. hubbsi* also rub their abdomen along the algae mat during spawning, producing a single violent quiver, and also repeated the sequence in a cyclic way. Males of this species occasionally nudged the females in their abdomens between quivers, and presumably released sperm during a slight quiver while positioned alongside the females (Petersen, 1988), as in our observations to *L. nuchipinnis* and by Wirtz (*op. cit.*) concerning the other *Malacoctenus* species. Bites and nudges performed by males apparently serve to incite females to spawn (Thresher, 1984).

Almada *et al.* (1983) pointed out that *Coryphoblennius galerita* (Blenniidae) (a species that lives in the tide zones of rocky shores of Portugal) also releases sperm and fertilizes eggs during periodic quivers in the nest, and as we observed for *L. nuchipinnis*, *C. galerita* also fans the nest during mating, a behavior that is related to nest cleaning and ventilation/oxygenation of the eggs (Keenleyside, 1979). *Paraclinus marmoratus* males (Labrisomidae) observed in captivity by Breder (1939; 1941), besides fanning and guarding eggs, pulled at the egg mass periodically in an apparent attempt to facilitate water flow, and usually deposited masses of adhesive eggs on sponges, sometimes into their lumen where they would have the advantage of the strong current which these sponges induce.

Labrisomus nuchipinnis females lays eggs on small rocks covered with algae and enclosed by others rocks in shallow waters, as do females of *M. macropus*, *M. hubbsi* (Labrisomidae) and *Forsterygion varium* (Tripterygiidae) (*cf.* Thompson, 1986; Petersen, 1988). Thompson (1986) hypothesized that the triplefin

F. varium female prefers male territories with large boulders because of the protection they provide against predators.

The polygamous behavior hypothesized for some blennies is also supported by the fact that the nests of some of its members often contained eggs at different stages of development, suggesting that males spawn with a succession of females (Breder, 1939; 1941). Besides Sazima *et al*. (2002) observations on harems of *L. nuchipinnis* males, Petersen (1988) also observed that within a male's territory, there were more than one female of *M. macropus* and *M. hubbsi* laying eggs at one time.

The adhesive eggs of *L. nuchipinnis*, deposited in small rocks covered by algae in shallow waters with increased current velocity, may have higher survivorship and/or shorter developmental time, as in other species of shallow water rocky-shore fishes (De Martini, 1978; De Martini & Patten, 1979 *apud* Petersen, 1988; Giorgi & Congleton, 1984). The tendency of Blennioidei to produce fairly large, heavy and attached eggs which are attended by one or both parents is probably related to their mode of life, so closely associated with a sea floor well populated with marauding invertebrates and fishes of a large variety (Breder, 1939), and despite the pelagic habits of the larvae of *L. nuchipinnis* (Carvalho-Filho, 1999: 198-199), Herrera & Lavenberg (1999) pointed out that the labrisomids larvae show no pronounced morphological specializations to pelagic life, what we believe that may limit their dispersion, facilitating geographic isolation of populations and resulting in speciation, giving rise to new and endemic species.

Acknowledgements

We thank Marcelo Rodrigues de Carvalho, Ricardo Cardoso Benine and Eduardo Bessa Pereira da Silva for critically reviewing the manuscript; Murilo de Carvalho for help with Fig. 1 edition; CEBIMar and FFCLRP-USP for logistical support; FAPESP (grants 00/06722-8 to FZG and 00/02624-1 to FBS), for essential financial support. This report is a part of the doctoral thesis of FZG and FBS. JS was supported by a grant from the Fundação Manoel de Barros.

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Received April 2004
Accepted July 2004