Notes on the mating system of *Omobranchus elegans* and *O. fasciolatoceps* (Blenniidae) at Maizuru, Japan

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(Received 9 October 1997; in revised form 19 January 1998; accepted 7 March 1998)

Ichthyological Research
The Ichthyological Society of Japan 1998

Sunobe, T. 1998. Notes on the mating system of *Omobranchus elegans* and *O. fasciolatoceps* (Blenniidae) at Maizuru, Japan. Ichthyol. Res., 45 (3): 319–321.

Key words. — Blenniidae; *Omobranchus*; mating system; home range; females' visit.

Blennies (Blenniidae), which occur mainly on coral and rocky reefs of tropical and temperate shallow waters, include the genus *Omobranchus*, of which 6 species are known from Japan (Aizawa, 1993).

Although the breeding habits and early development of *Omobranchus elegans*, *O. anolius*, *O. japonicus* and *O. loxozonus* have been reported by Yabe (1936), Thompson and Bennett (1953), Rao (1970) and Dotsu and Oota (1973), respectively, the mating system and social structure of *Omobranchus* have remained unknown. In this paper, I will describe the mating system and social structure of *O. elegans* and the sympatric species *O. fasciolatoceps* at Maizuru, Kyoto Prefecture, Japan.

O. elegans is distributed from southern Hokkaido to southern Kyushu, and around the Korean Peninsula and Shantung Peninsula, China. *O. fasciolatoceps* is found in brackish areas, being distributed around the southern half of Japan, Taiwan and along the coast of China (Aizawa, 1993).

Materials and Methods

The study was conducted at the Fisheries Research Laboratory, Kyoto University, Maizuru, Kyoto Prefecture, Japan (35°29′10″N, 135°22′20″E). The study site was located in front of the boat house, where four rails had been set in place for boat launching. Oysters (*Crassostrea gigas*) and mussels (*Mytilus edulis*) were attached to the sides of the rails, bottom being covered with pebbles, shells and rocks. As *Omobranchus elegans* and *O. fasciolatoceps* were abundant in this area, the study site, measuring approximately 2×15 m, was set up between two of the rails (Fig. 1). The water temperature varied from 20 to 25°C. Snorkeling observations were made daily from 8:00 to 15:00 from June 21 to July 8, 1992. Individuals were sexed according to nuptial coloration (Fig. 2) and sexual behavior, and were identified on the basis of size and body color pattern. Individuals identified were caught with a hand net for total length (TL, mm) measurement, and then returned to the point of capture. The location of each individual was recorded 1–5 times a day to confirm its home range. When courtship and spawning behavior were observed, the time, duration of the females' stay in the males' nest, and identity of the participants were recorded.

Results and Discussion

Omobranchus elegans appeared at deeper locations than *O. fasciolatoceps*, home ranges of the former occurring between 45–120 cm depth, and of the latter between 20–60 cm depth (i.e. partly overlapping) (Fig. 1). Aggressive interactions were not observed between the species; neither did males exhibit courtship displays toward females of the other species. Males of both species occupied only empty oyster (*Crassostrea gigas*) shells as nests for spawning.

Fourteen male and 28 female *O. elegans* occurred at the study site, their total lengths being 67 mm ± 6 SD (range = 55–80 mm) and 59 mm ± 6 SD (range = 45–75 mm), respectively, the males being significantly larger than the females (t-test, d.f. = 41, t = 4.60, $p<0.01$). Figure 1A shows that the home ranges of the females were larger than those of the males. Although individual home ranges overlapped, aggressive interactions were not observed. The males did not change their nest sites during the study period. All males and 11 females were found every day at the study site, but the other 17 females less often. The home ranges of the latter may have extended beyond the limits of the study site.

Coloration in the two sexes differed during the observation period, the ground color of the body in males being dark with conspicuous vertical white bars and spots (Fig. 2A), and in females, yellow with vertical brown bars (Fig. 2B).

Reproductive behavior took place between 8:00 to 14:00. Before spawning, a female approached a males' nest to within 30 cm, at which point the male appeared from the nest and exhibited courtship dis-

different males on 14, 2 and 1 occasion, respectively.

The males' courtship display induced the females to enter the nest, the period of their stay varying from immediate departure (0+) to 95 min. The duration of stay by females was divided into two major groups: short stays (SS) (0+ to 22 min, $n=52$) and long stay (LS) (41 to 95 min, $n=16$). No visits were made of 23–40 min duration, although the duration of 9 visits are unknown as the time of entry or departure were not observed.

As the narrow opening to the nests did not permit the observation of behavior in the nests, spawning could not be confirmed. During the LSs, spawnings may have taken place. In the Mediterranean blenny, *Aidablennius sphynx*, a female approaches males' nest and spawns only 1–10 eggs (Kraak and van den Berghe, 1992). If these eggs disappear within a day, the female does not spawn additional eggs in that nest. Kraak and van den Berghe (1992) hypothesized that this indicates the testing of the quality of paternal care by the female. Female redlip blennies (*Ophioblennius atlanticus*) do not spawn in the nests of younger males after entering, as the older males guard eggs for a longer period. In this case, the female may assess male age in the nest (Côte and Hunte, 1993). During the SSs, the females may lay small clutches of eggs or check the quality of the male and/or the spawning site.

In the case of *O. fasciolatoceps*, 2 males (52 and 55 mm TL) and 3 females (50, 55 and 58 mm TL) occurred at the study area. Although their home ranges overlapped (Fig. 1B), aggressive interactions were not observed. The males did not change their nest sites during the study period.

Coloration in the two sexes differed during the observation period, the ground color of the body in males being gray with vertical bars on the head (Fig. 2C), and in females, pale yellow with vertical white bars on the head (Fig. 2D).

Reproductive behavior was observed between 10:00–13:00. Unlike in *O. elegans*, female *O. fasciolatoceps* did not initiate visits to the male nests. The following courtship display was observed on 4 occasions; males swam in a zigzag pattern so as to approach females, which had entered formers' home range, and darted back to the nest (Fig. 3B). The females followed the males, but did not enter the nests.

Reasons for the non-spawning of the female *O. fasciolatoceps* are unclear. As a female specimen collected on July 6, 1992, contained ripe eggs, it was apparent that the observation period corresponded with the reproductive season of the species. However, 3 of the 4 courtship bouts, the males courted larger females. As females of many species generally prefer larger males (Côte and Hunte, 1993), the female *O. fasciolatoceps* may have chosen not to mate with the smaller males.

Acknowledgments. — I wish to thank I. Nakamura, I. Kinoshita, M. Tanaka, T. Seikai and other staff of the Fisheries Research Laboratory, Kyoto University for their cooperation during the study.

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