

## Notes on the Reproductive Behavior of the Lizardfish *Synodus ulae* at Miyake-jima, Japan

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The lizardfish *Synodus ulae* Schultz (Synodontidae) is known from Japan and Hawaii (Schultz, 1953). It is the most common and perhaps the only species of synodontid occurring at Miyake-jima, one of the Izu Islands of Japan (34°05'N, 139°30'E). Species identity was determined on the basis of examination of material from Miyake-jima by Dr. Roger Cressey, Smithsonian Institution, who is currently revising the genus. *S. ulae* can be most easily distinguished from *S. variegatus*, with which it is often confused, by its larger number of lateral line scales.

Thresher (in press) reports that the spawning behavior of synodontid fishes has not been previously reported. Spawning of *Synodus ulae* was observed at 18:04 h, 7 Sep 1980, in Igaya Bay, Miyake-jima. High tide was at 16:44 h. The spawning site was at a depth of 14 m and consisted of a substrate of sand and mixed volcanic and coral rubble and was immediately adjacent to a large, conspicuous boulder (2.5 m in height). Frequently a moderate current flows past the spawning site and out to sea, but no current was noticeable at the time of spawning. The water temperature was 29°C. Spawning involved a pair of fish, each individual roughly 20 cm in total length. Both fish were identical in appearance and we were unable to distinguish male from female. When we first noticed the pair, they were about 50 cm above the substrate and rising very rapidly upward in the water column. They appeared to have risen from slightly different locations on the sand. At a height of approximately 1 m, the fish moved very close together, perhaps even with sides or abdomens touching. They dashed at about a 70° angle upward to a point approximately 4 m above the substrate, then turned and swam down separately at a slightly slower speed. Both individuals quickly disappeared from sight after reaching the substrate. At the apex of the upward dash, a surprisingly large and conspicuous cloud of gametes was released. Spawn-

ing occurred exactly 4 min after sunset (18:00 h) and two days before the new moon (9 Sep).

Although spawning was observed only on the above occasion, we frequently observed what appeared to be courtship and interactions between males. Often two individuals were seen lying on the substrate with bodies close together or touching. The male, determined by his active role at other times in the apparent courtship sequence, often touched the female with his caudal or pectoral fins. He frequently rested his throat or anterior portions of his body over the female's caudal peduncle. They sometimes stayed in this posture for more than an hour with no movement by either fish (Fig. 1A). The terms "male" and "female" are used hereafter based upon active or passive roles in interactions between conspecifics.

Occasionally, a more active courtship display was observed. The male suddenly flared the opercula and hyomandibulars, giving the appearance of a puffed-out throat (Fig. 1C). With the throat puffed in this manner, the male moved around the female, sometimes swimming, sometimes scurrying along the substrate on his pelvic fins. When the circling courtship occurred at mid-day, it frequently was followed by the female slowly swimming away slightly above the substrate with the male following close behind. These movements covered distances of up to 100 m, but usually were from 10~30 m. The female then settled on the substrate and the male rested on top of or near her as described above. Courtship was observed at all hours of the day. Males were seen interacting with females smaller, the same size, and larger than themselves.

Two males were commonly seen resting near or on a single female. These situations often resulted in agonistic behavior between males. One or both of them flared their throats and circled each other in a posture very similar to the courtship display (Fig. 1B, C). Usually one of the males (the larger when they were of different sizes) rushed the other, initiating a rapid, aggressive chase. After driving away his rival, the attacking male returned to the female. Very frequently, the female would depart during the chase, and the aggressive male would return to rest near where she had been.

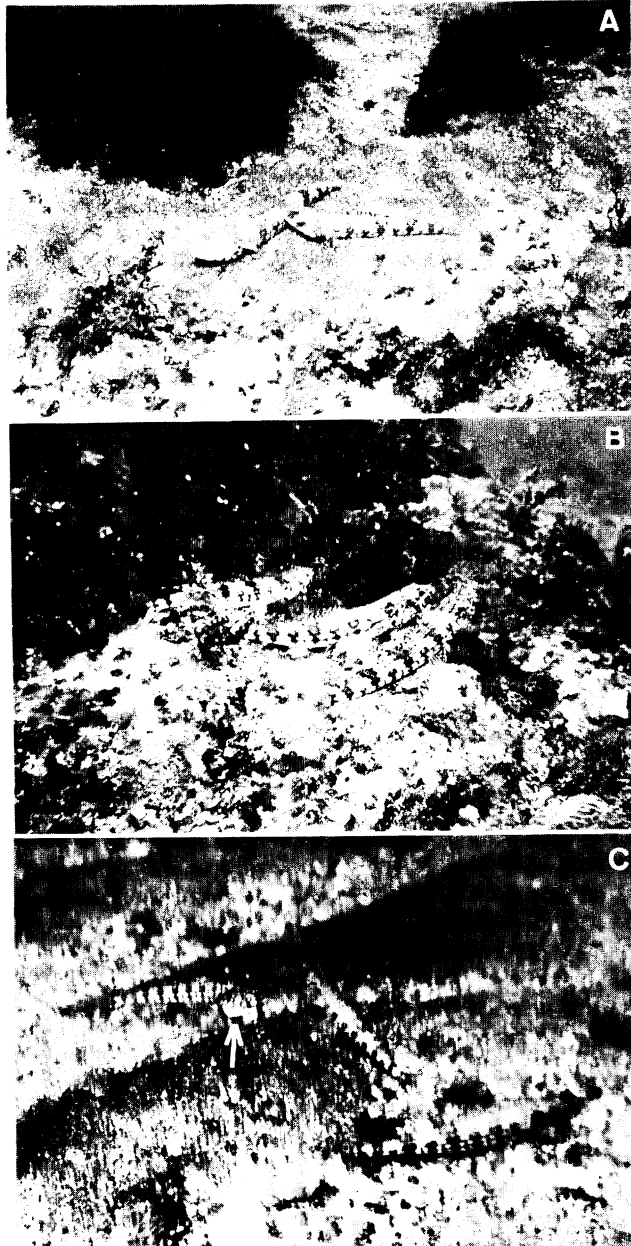


Fig. 1. A: Male *Synodus ulae* rests close to female. B: Two males (left and center) resting near female. C: Male (left) displays agonistically to rival male (center). Note puffed-throat display. Female rests on sand (right). From color transparencies by M. J. Zaiser (A) and J. T. Moyer (B, C).

### Discussion

Many authors have discussed the rapid upward spawning rush of a variety of reef fishes (Randall and Randall, 1963; Ehrlich, 1975; Robertson and Hoffman, 1977; Johannes, 1978). This

method of spawning seems to reduce the chances of successful predation on the fish or the spawn. It also permits the gametes to be rapidly dispersed in the moving waters above the substrate.

The upward spawning rush of *Synodus ulae* is of interest because it is exceptionally high. Tide

times on the date of our observations suggest that the spawning was not influenced by tidal rhythms. It is risky to assume that *S. ulae* spawns only during the crepuscular period on the basis of a single observation. However, even though apogonids and *Canthigaster* spp. are active near the substrate, well-known egg-predators such as labrids and pomacentrids are relatively inactive at this time (see Hobson, 1974), and egg predation is at a minimum. In terms of egg predation, it is a good time to spawn. The high spawning rush at the crepuscular hour probably further reduces the threat of spawn predators.

Many piscivorous predators are active during the period of day-night changeover (Hobson, 1974). A lizardfish's only defenses against predation are its fast speed and maneuverability, its cryptic coloration when on the substrate, and its ability to conceal itself in the sand. The extremely rapid speed of the spawning rush diminishes the chance of predation.

As in other gamete-launching species, spawning of *S. ulae* was observed in an area of moderate currents. The selective advantages of this are discussed by Randall and Randall (1963), Robertson and Hoffman (1977) and Johannes (1978).

Male-male conflicts have been observed only in the presence of females. These agonistic displays quickly end when the female leaves. This suggests that the aggression between males is related to access of females. Evidence of territoriality is lacking.

*Synodus ulae* is frequently found over boulders when sardines are common in the water column above, at labrid spawning sites when the wrasses are spawning, and over wide sandy areas (Meyer, 1977; personal observations). It is an opportunistic predator, moving to locations where food is most readily available. Furthermore, its food supply is unpredictable in time and space. The species is not densely populated. These factors suggest that wide and broadly overlapping home ranges are necessary to permit access to both food and mates. In many ways, the social organization of *S. ulae* appears similar to that of *Dendrochirus zebra*, investigated by Moyer and Zaiser (1981).

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#### 三宅島におけるエソ科 *Synodus ulae* の産卵習性

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三宅島沿岸で観察されたエソ科魚類 *Synodus ulae* の産卵行動について報告する。本科魚類の産卵習性は未知であった。本種の産卵は 1980 年 9 月 7 日 18 時 04 分に三宅島伊ヶ谷湾水深 14 m で観察された。産卵時の水温は 29°C、潮流はほとんどなかった。産卵は

雌雄一対（全長約 20cm）によってなされたが、雌雄の外見による識別は困難であった。雌雄は海底から約 1m 上昇し体側または腹部を互いに接触させたまま約 4m 急上昇して旋回し、雌雄別々に海底に戻る。急上昇の頂点で産卵が行われ雲状の生殖体が多量に放出される。産卵観察は 1 例だけであったが、求愛行動はしばしば目撃された。即ち雌雄が砂底上に体を接触させ

て静止し、雄はときどき咽喉部をふくらませて雌の周囲をまわる。薄暮時の急上昇による本種の産卵行動は産卵時の捕食圧を防ぐための適応と考えられ、この点について論議を行った。

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