

Embryonic Development and Pre-Larva of a Gobiid Fish *Priolepis naraharae*

Tomoki Sunobe and Akinobu Nakazono

(Received February 25, 1988)

Priolepis naraharae (Snyder) is a small goby, distributed from Kanagawa Pref. to Okino-erabu I. and to the east coast of South Africa (Prince Akihito, 1984). This species inhabits coral or rocky reefs and is usually found in an upside-down posture on the ceilings of caves.

Among the five species of the genus *Priolepis* reported from Japan (Prince Akihito, 1984), the embryonic development and larvae of *P. semidoliatus* and *P. boreus* were studied by Sonoda and Imai (1971) and Shiogaki and Dotsu (1974), respectively (both were mistakenly called *Zonogobius* in the original papers). In this paper, we describe the development of eggs and larvae of *P. naraharae* to clarify its early life history and to discuss the morphological characteristics of the present species in comparison with those of the two species previously reported.

Materials and methods

The specimens of *Priolepis naraharae* (a male and a female, both 42.5 mm in standard length) were collected with a hand net at Cape Sata, Kagoshima Pref., Japan on Aug. 25, 1983.

Methods of rearing and observation followed Sunobe and Nakazono (1987), except for the size of the spawning shelter and water temperature. The spawning shelter was an opaque vinyl chloride pipe, 7.2 cm in inside diameter and 10 cm long. Water temperature ranged from 25 to 29°C during the observation period, i.e. from spawning to embryonic and larval development. Measurements through of eggs and larvae were made by means of a binocular microscope with a micrometer. Figures were drawn with the aid of a camera lucida.

Results

Spawning was observed from 7:00 to 8:00 a.m. on Sep. 22, 1983. Nearly, 1,700 eggs were spawned by the female in a single layer on the ceiling of the shelter, and the male stayed in the shelter

and guarded the egg mass.

Morphological characteristics of the eggs, embryonic development and larvae are as follows. The eggs are elliptic measuring 0.76–1.12 mm (mean 0.92 mm) in length and 0.41–0.52 mm (mean 0.46 mm) in width, with a bundle of adherent threads at their base. The surface of the eggs is smooth.

The first cleavage divides the blastodisc into two cells of equal size 3 hrs. after fertilization (Fig. 1A). It takes 4 hrs. from fertilization to the 16-cell stage (Fig. 1B), and 6 hrs. to the morula stage (Fig. 1C). In the early gastrula stage, 10 hrs. after fertilization (Fig. 1D), the blastodermal cup begins to spread over the surface of the yolk. By 12 hrs. after fertilization (Fig. 1E), the rim of the germ ring covers about 2/3 of the yolk. Fifteen hrs. after fertilization (Fig. 1F), the blastopore closes and an embryonic body is formed. A pair of optic vesicles and a Kupffer's vesicle appear after 19 hrs. (Fig. 1G). The Kupffer's vesicle enlarges and four pairs of myomeres can be recognized 20 hrs. after fertilization (Fig. 1H).

After 25 hrs., a pair of otic vesicles appear and granules are observed on the surface of the embryo. The notochord is visible as a slight tail bud (Fig. 1I). Brain differentiation can be recognized, and the heart is formed in front of the yolk 28 hrs. after fertilization. The Kupffer's vesicle has disappeared (Fig. 1J).

The numerous small oil globules in the yolk gather and unite into a large one, and a pair of pectoral fin buds appears 52 hrs. after fertilization (Fig. 1K). Melanophores are present on the ventral part of the abdomen and on the tail region.

At 11:00 a.m., 98 hrs. after fertilization, a small number of larvae begin to hatch, and all the larvae have hatched out by 8:00 p.m. An empty egg capsule with a hatching cleft is shown in Fig. 1L.

Some of the embryos present their heads to the bases of their egg capsules (Fig. 1H–J), but they develop normally.

The newly hatched pre-larvae (Fig. 1M) measure 1.98–2.01 mm in total length (mean 1.99 mm). They have 8+17 myomeres (adult: 10+16). The mouth has opened. Peristalsis of the digestive tract can be seen. The larvae show positive phototaxis. Seven pairs of cupulae and free neuromasts are recognized (Fig. 1M-2). The cupulae easily fall off after fixation with 5%

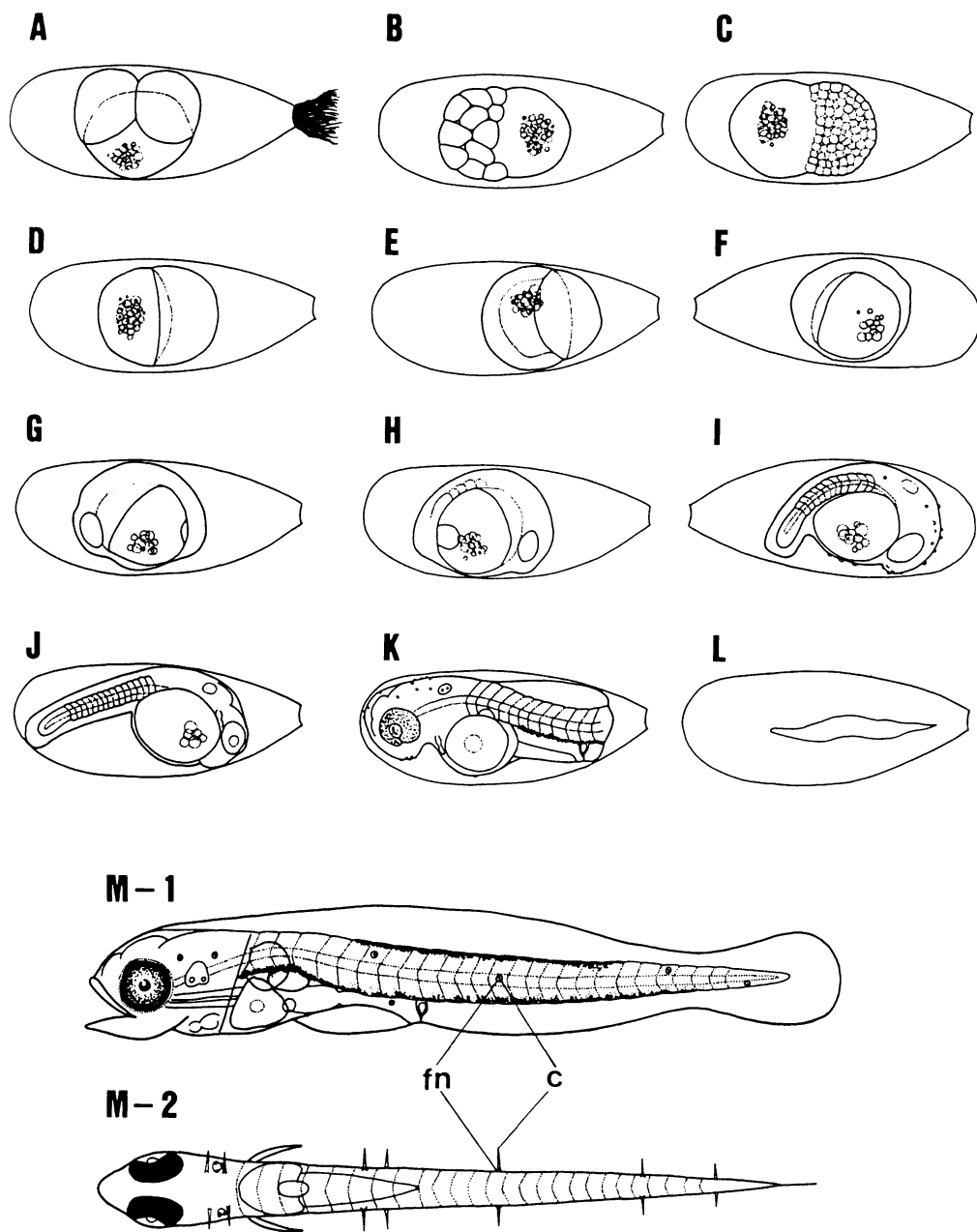


Fig. 1. Embryonic development and a newly hatched pre-larva of *Priolepis naraharae*. A, 3 hrs. after fertilization; B, 4 hrs. after; C, 6 hrs. after; D, 10 hrs. after; E, 12 hrs. after; F, 15 hrs. after; G, 19 hrs. after; H, 20 hrs. after; I, 25 hrs. after; J, 28 hrs. after; K, 52 hrs. after; L, empty egg capsule with a hatching cleft; M-1, newly hatched prelarva, 2.00 mm in total length; M-2, dorsal view of the same specimen. c, cupula; fn, free neuromast.

formalin. Melanophores are observed on the dorsal region of the body, the dorsal part of the abdomen, the post ventral part of the body and the gas bladder. Sixteen to eighteen dendritic

xanthophores can be seen from the dorsal of the abdomen to the tail.

One day after hatching, the yolk has been absorbed.

Although the larvae were given oyster larvae, they died by the 3rd day after hatching without feeding.

Discussion

Characteristics of the eggs and embryos of three *Priolepis* species are shown in Table 1. Length and width of the egg of *P. naraharae* are the smallest among the three species of *Priolepis*. The Kupffer's vesicle was not described in *P. semidoliatus* by Sonoda and Imai (1971), but should be re-examined, since the Kupffer's vesicle occurs in *P. boreus* (Shiogaki and Dotsu, 1974) and *P. naraharae*. Granules on the surface of the embryonic body appear in *P. naraharae* alone. In all of the three species, small oil globules merge to form a large one, and the surface of the eggs is smooth lacking numerous minute processes observed in *Eviota* species (Sunobe and Nakazono, 1987).

Characteristics of the larvae of *Priolepis* are shown in Table 2. The total length of the newly hatched larva of *Priolepis boreus* is larger than those of the two other species. The total lengths of the larvae of *P. naraharae* and *P. semidoliatus* are similar. *P. semidoliatus* is distinguished from

P. naraharae and *P. boreus* by the lack of melanophores on the dorsal region of the body. When *P. boreus* and *P. naraharae* are compared with each other, the latter is characterized by the smaller melanophores from the dorsal part of the abdomen to the ventral part of the tail, the presence of those on pre-dorsal and the lack of those on the yolk. Xanthophores are observed in all of them. The cupulae and the free neuromasts were not described in *P. semidoliatus* and *P. boreus* by Sonoda and Imai (1971) nor Shiogaki and Dotsu (1974). However, further investigations are required concerning the arrangement and number of cupulae and free neuromasts in these two species, for they are observed in the related species, *P. naraharae*, *Eviota abax* and *E. starthynx* (Sunobe and Nakazono, 1987) and three species of *Trimma* (Sunobe and Nakazono, in prep.).

Acknowledgments

We are indebted to Dr. Douglas Ferrell of the University of Sydney and Dr. Takeo Okuda of Kyushu University for their kind review of the manuscript. Thanks are also due to Dr. Akihiko Shinomiya of Kagoshima University for his valuable advice.

Table 1. Characteristics of the eggs and embryos of *Priolepis naraharae*, *P. semidoliatus* and *P. boreus*. ¹⁾ After Sonoda and Imai (1971); ²⁾ after Shiogaki and Dotsu (1974).

| Species | Egg size | | Kupffer's vesicle | Granules on the surface of the embryonic body | Mergence of oil globules | Surface of the egg |
|--------------------------------------|-------------|------------|-------------------|---|--------------------------|--------------------|
| | Length (mm) | Width (mm) | | | | |
| <i>P. naraharae</i> | 0.76–1.12 | 0.41–0.52 | + | + | + | smooth |
| <i>P. semidoliatus</i> ¹⁾ | 0.94–1.14 | 0.50–0.59 | — | — | + | smooth |
| <i>P. boreus</i> ²⁾ | 1.20–1.45 | 0.51–0.55 | + | — | + | smooth |

Table 2. Characteristics of the pre-larvae of *Priolepis naraharae*, *P. semidoliatus* and *P. boreus*. ey, eye; gb, gas bladder; yk, yolk; da, dorsal part of the abdomen; va, ventral part of the abdomen; pvt, post ventral part of the body; prd, pre-dorsal; pod, post-dorsal. ¹⁾ after Sonoda and Imai (1971); ²⁾ after Shiogaki and Dotsu (1974).

| Species | Total length (mm) | Melanophores | | | | | | | | Xanthophores | | Cupulae |
|--------------------------------------|-------------------|--------------|----|----|----|----|-----|-----|-----|--------------|-----|---------|
| | | ey | gb | yk | da | va | pvt | prd | pod | da | pvt | |
| <i>P. naraharae</i> | 1.98–2.01 | + | + | — | + | — | + | + | + | + | + | + |
| <i>P. semidoliatus</i> ¹⁾ | 1.96–2.05 | + | + | + | + | — | + | — | — | + | + | — |
| <i>P. boreus</i> ²⁾ | 2.07–2.52 | + | + | + | + | + | + | — | + | — | + | — |

Literature cited

- Akihito, Prince. 1984. Genus *Priolepis*. Pages 248–249, plate 239 in H. Masuda, K. Amaoka, C. Araga, T. Uyeno and T. Yoshino, eds. The fishes of the Japanese Archipelago. English text and plates. Tokai Univ. Press, Tokyo.
- Shiogaki, M. and Y. Dotsu. 1974. The life history of the gobiid fish, *Zonogobius boreus*. Bull. Fac. Fish., Nagasaki Univ., (37): 1–8. (In Japanese with English summary.)
- Sonoda, T. and S. Imai. 1971. On the spawning and embryonic development of a marine goby, *Zonogobius semidoliatus* (Valenciennes). Mem. Fac. Fish., Kagoshima Univ., 20(1): 197–202. (In Japanese with English summary.)
- Sunobe, T. and A. Nakazono. 1987. Embryonic development and larvae of genus *Eviota* (Pisces: Gobiidae) I. *Eviota abax* and *E. storthynx*. J. Fac.

Agr. Kyushu Univ., 31(3): 287–295.

(Fisheries Laboratory, Faculty of Agriculture, Kyushu University, Hakozaki, Higashi-ku, Fukuoka 812, Japan)

ペンケイハゼの卵内発生と前期仔魚

須之部友基・中園明信

ペンケイハゼ *Priolepis naraharae* (Snyder) の雌雄一対を水槽で飼育し、産卵実験を行い、卵内発生過程及び卵・前期仔魚の形態を記載した。卵は沈性付着卵で、長径 0.76–1.12 mm, 短径 0.41–0.52 mm の長楕円形である。水温 25–29°C で受精後 98–106 時間で孵化する。孵化仔魚は全長 1.9–2.1 mm で体側に 7 対の頂対と遊離感丘を備える。同属のイレズミハゼやミサキスジハゼの仔魚に比べると、本種は黒色素胞が体背縁部に存在すること、卵黄部には出現しないことで区別される。

(812 福岡市東区箱崎 九州大学農学部水産学第二教室)