Japanese Journal of Ichthyology
Vol. 21, No. 3. 1974

魚類学雑誌
21巻3号 1974年

Studies on the Larvae and Juveniles of the Sinistral Flounders—V. *Arnoglossus tenuis*

Kunio Amaoka

(Received July 29, 1974)

Abstract A postlarva at the early metamorphic stage was taken from off southern Japan. It was identified as *Arnoglossus tenuis* Günther on a combination of meristic and other characters. A description and figure of the postlarva are presented.

Introduction

In the course of a study of larval and juvenile flounders collected from off southern Japan during 1961 to 1967, the author found a postlarva which is clearly different from *A. japonicus* as described by Amaoka (1973) in numbers of dorsal and anal rays and vertebrae, though it has a similar external appearance. The postlarva had an elongate body, a short and sharp first dorsal spine, an elongate and stringlike second dorsal spine, and smooth ventral margins of the urohyal and pelvic bones. These indicate that it belongs to the genus *Arnoglossus* as described by many authors (Kyle, 1913; Uchida, 1936; Ochiai and Amaoka, 1963; Pertseva-Ostroumova, 1965; Amaoka (1973). The postlarva was identified as *Arnoglossus tenuis* Günther, 1880 on the basis of the numbers of dorsal rays, anal rays and vertebrae.

The adult form of the species is widely distributed from southern Japan to the South China Sea, and lives in shallow waters. It is a dwarf species of the genus, growing to only about 120 mm in standard length.

As the postlarva of this species has not been previously reported, it is here described and figured, and also compared with that of *A. japonicus*.

Material and methods

The postlarva was taken at position 30°51′N, 129°01′E off southern Japan by an Isaacs-Kidd midwater trawl in the training ship of Shimonoseki University of Fisheries at a depth of 32 m on August 9, 1966. The specimen was preserved in 10% formalin, and deposited in Department of Biology and Aquiculture, Shimonoseki University of Fisheries (SUF).

Counts and measurements of the body were made in accordance with the method used by Norman (1934). In vertebral counts the urostyle is counted as one. The figure of the postlarva was made by tracing the image from projection.

Description

SUF No. 66-J-4, 25.7 mm in total length, 21.6 mm in standard length (Fig. 1).

Counts and proportional measurements are shown in Table 1.

Body elongate, elliptical, highest at anterior 1/3 of body, its depth a little less than half body length. Dorsal contour with a small projection above snout, gently arching; ventral one steeply descending to anus, and then somewhat gently and evenly rising. Caudal peduncle rather low, a little higher than 1/5 depth of body.

Head rather small, about as long as 1/4 length of body. Snout blunt, longer than eye diameter. A projection (rostral beak) surrounded by a strong, fanlike muscle supporting first short spine and second elongate spine anteriorly. Eye situated on each side of body, symmetrical, right eye a little popped-out. Large nostrils on left side with longitudinal or somewhat radiate olfactory lamellae set in front of eye, anterior nostril with tubelike opening; the posterior one large, not tubular; nostrils on right side symmetrical position to those on left side, but small, without lamellae.

Mouth moderate, and subequal on both sides, maxillary barely extending to below anterior margin of eye; teeth on both jaws sparcely arranged in a row, the lower teeth slightly stronger than the upper, about 10 in

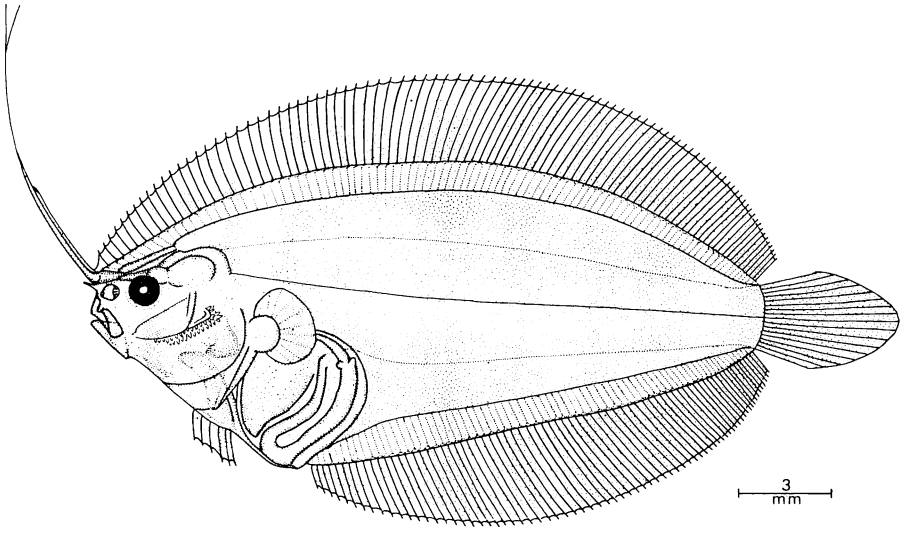

Fig. 1. Postlarva of *Arnoglossus tenuis* in early metamorphic stage: SUF No. 66-J-4, 21.6 mm in standard length.

the upper jaw and about 7 in the lower. Scales and lateral line not yet developed.

Dorsal fin originating on anterior margin of projection above snout; first spine very sharp, tapering and very short, about half eye diameter; second spine just above the first, stringlike, heavy at base, steeply tapering and greatly elongate, about twice length of head; lower half of posterior margin of spine covered by membrane, but remaining half lacking (bifulcation at tip and lack of membrane may result from damage); rays starting somewhat behind second dorsal spine, gradually becoming higher near posterior 1/3 of body, and then shortening evenly. Anal fin originating on anterior 1/3 of body, similar in shape and structure to rayed part of dorsal fin. Pectoral fin symmetrical, paddlelike, having heavy fleshy base surrounded by thin transparent membrane with some opaque lines; distinct ray undeveloped. Pelvic fin well developed on both sides, asymmetrical in position and shape; that on left side starting considerably behind eye, and also remotely separated from anal origin; first ray on right side opposite the fourth on the left. Caudal fin slender, rather elongate, a little shorter than head length; rays all simple.

Urohyal placed in front of and on pelvic bone, shaped like fan; its anterior tip extending to below posterior margin of eye; ventral margin of bone entirely smooth. Pelvic bone well developed, subtriangular; upper process attached to mid-cleithrum, and posterior process slender and tapering, surrounding ventral margin of liver and bend of intestinal coil, and extending to above origin of anal fin; ventral margin of process not serrate. Liver and intestinal coil not greatly extended beyond body margin.

Brain, digestive organ, and heart visible externally; muscle extending forward from near lower part of cleithrum, and cheek muscle well developed.

Color in formalin: General ground color uniformly yellowish white, except for a dark spot on posterior membrane in the middle of second dorsal spine.

Discussion

The postlarvae of species belonging to the genus *Arnoglossus* have already been reported by many ichthyologists and their characters are now well known. The larvae are mainly characterized by the elongate body form, the elongate first or second dorsal spine, the smooth ventral margin of the urohyal and posterior process of the pelvic bone, and the ventral margins of the liver and intestine not greatly extended beyond the body.

The present postlarva is closely related to that of the early metamorphic stage of *A.*

japonicus (Amaoka, 1973) characterized by the elliptical body, and the first short and the second elongate stringlike dorsal spines. Therefore, it is sure that the larva is of a species of the genus *Arnoglossus*. Its meristic characters (dorsal II, 92; anal 73; vertebrae 10+30=40) show that it could not be *A. japonicus*.

The species of *Arnoglossus* occurring in the waters around Japan are represented by four species with the following meristic characters: *A. tenuis* (dorsal rays 90~95, anal rays 70~74, vertebrae 10+30=40), *A. polyspilus* (100~114, 78~91, 10+30~32=40~42), *A. japonicus* (99~106, 76~83, 10+32~33=42~43), and *A. oxyrhinchus* (108~113, 84~89, 11+35=46) (Amaoka, 1969). The present postlarva clearly disagrees with any of the latter three species with large numbers of dorsal and anal fin rays and vertebrae, though in the vertebral counts only the postlarva falls in range of *A. polyspilus*.

The meristic characters of the postlarva agree well only with those of adult of *A. tenuis*. The author, therefore, concludes that the postlarva is of this species, which is widely distributed from southern Japan to the South China Sea.

When the present postlarva is compared with the postlarvae of all stages from the early metamorphic to the late metamorphic in *A. japonicus* shown by Amaoka (1973), it corresponds to those at the early metamorphic stage (19.8~32.1 mm in standard length). Especially, the present *A. tenuis* postlarva 21.6 mm in standard length corresponds well with an *A. japonicus* postlarva of 30.5 mm standard length (Fig. 2), when the developmental degree of nostrils and olfactory lamellae are considered. These are useful characters for subdivision of postlarvae in the early metamorphic stage (Amaoka, 1973).

Bothid postlarvae generally show such marked variation in proportions of body and other characters that it is difficult to distinguish between postlarvae of the different species, especially on the proportional characters. However, when postlarvae of the present species and *A. japonicus* are compared at the same developmental stage, the present postlarva generally tends to have a deeper body and shorter snout, eye, lower jaw, and dorsal and anal rays (Table 1). As to the other characters, the present postlarva has a larger number of teeth on both jaws (10 on upper and 7 on lower instead of 8 and 5), and the rostral beak is less projected forward (its length about 1/4 of eye diameter instead of about equal to it) (Fig. 2). Moreover, though there are 7 branches on the second dorsal spine in the postlarvae of *A. japonicus*, they are not seen in *A. tenuis*, but the spine is bifurcated at the tip. However, they may be broken because of feeble and fine structure as shown by Amaoka (1973). It is therefore, thought that the postlarva

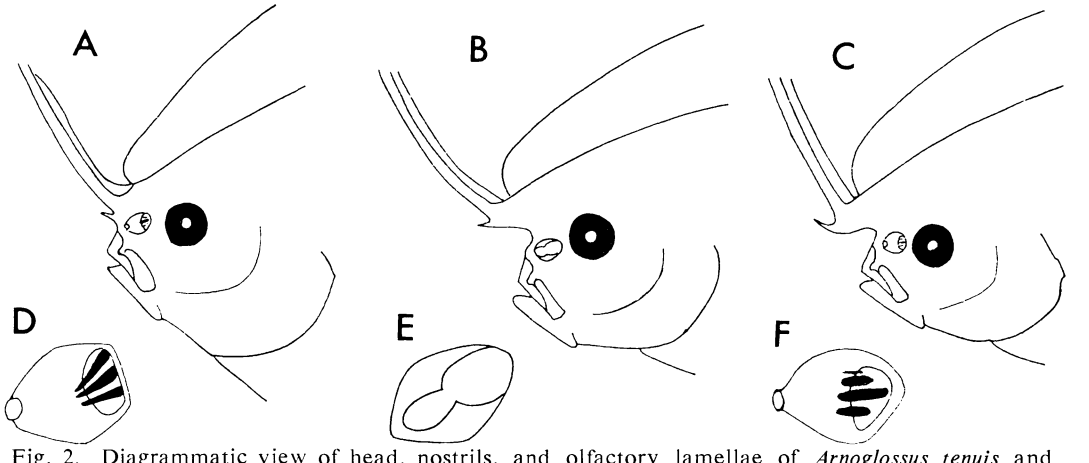

Fig. 2. Diagrammatic view of head, nostrils, and olfactory lamellae of *Arnoglossus tenuis* and *A. japonicus*; showing degree of projection of the rostral beak of the two species. A, D show *A. tenuis* postlarva 21.6 mm in standard length; B, E and C, F show *A. japonicus* postlarvae 20.0 and 30.5 mm in standard lengths respectively.

Table 1. Comparison of lengths, counts, and proportional measurements between *A. tenuis* postlarva and *A. japonicus* postlarvae at early metamorphic stage of about same length and developmental stage.

Species name	*A. tenuis*	*A. japonicus*			
SUF No.	66-J-4	67-8-A	61-8-D	63-7-A	61-6-25
Total length (mm)	25.7	23.4	24.1	35.5	37.0
Standard length (mm)	21.6	19.8	20.0	30.5	32.1
In standard length:					
Depth	2.30	2.83	3.08	2.56	2.68
Head	4.25	4.0	4.4	4.48	4.46
In head length:					
Snout	4.0	3.13	3.46	3.40	3.27
Eye diameter (on each side)	5.2	5.0	4.5	4.25	3.79
Maxillary (on each side)	3.71	4.17	3.75	3.4	3.43
Lower jaw (on each side)	2.94	2.78	2.5	2.83	2.88
Depth of caudal peduncle	2.36	2.5	2.25	2.13	2.32
Longest dorsal ray	1.73	1.56	1.5	1.51	1.50
Longest anal ray	1.79	1.61	1.5	1.51	1.44
Pectoral (on each side)	2.48	2.63	2.25	3.24	2.48
Pelvic (on left side)	4.73	5.0	4.5	3.58	3.6
Pelvic (on right side)	5.2	7.14	6.4	3.78	3.6
Base of pelvic (on left side)	3.47	5.56	5.0	3.58	3.13
Base of pelvic (on right side)	7.43	8.33	9.0	6.8	6.55
Dorsal fin	II, 92	II, 100	II, 100	II, 101	II, 102
Anal fin	73	78	78	79	80
Vertebrae	10+30=40	10+33=43	10+32=42	10+32=42	10+32=42

probably had specific numbers of branches regularly arranged on the second dorsal spine.

Acknowledgments

The author wishes to express his sincere gratitude to former Professor Shun Okada, Hokkaido University for his kind guidance, and to Drs. Isao Matsui and Toru Takai of Shimonoseki University of Fisheries for their helpful advice, and to Dr. Gordon R. Williamson, formerly of Fisheries Research Station of Hong Kong for his critical reading of the manuscript. He is also grateful to the crew of the training ship of Shimonoseki University of Fisheries for supplying him with the specimen.

Literature cited

Amaoka, K. 1969. Studies on the sinistral flounders found in the waters around Japan. —Taxonomy, anatomy and phylogeny—. J. Shimonoseki Univ. Fish., 18(2): 65~340, figs. 1~131.

Amaoka, K. 1973. Studies on the larvae and juveniles of the sinistral flounders—IV. *Arnoglossus japonicus*. Japan. J. Ichthyol. 20(3): 145~156, figs. 1~7.

Kyle, H. M. 1913. Flat-fishes (Heterosomata). Rep. Danish. Ocean. Exped. 1908-10, to the Mediterranean and adjacent seas, 2, Biol., 1~150, figs. 1~30, pls. 1~3.

Norman, J. R. 1934. A systematic monograph of the flatfishes (Heterosomata). 1. Psettodidae, Bothidae, Pleuronectidae. Brit. Mus. London, viii+459 pp., 317 figs.

Ochiai A. and K. Amaoka. 1963. Description of larvae and young of four species of flatfishes referable to subfamily Bothinae. Bull. Jap. Soc. Sci. Fish., 29(2): 127~134, figs. 1~4. In Japanese.

Pertseva-Ostroumova, T. A. 1935. Flatfishes larvae from the Gulf of Tonking. Trudy Instituta Okeanologii, 80: 177~220, figs. 1~11. In Russian.

Uchida, K. 1936. Notes on two remarkable heterosomatous postlarvae with a greatly elongated and branched dorsal ray. Zool. Mag., 48(8~10): 497~501, fig. 1. In Japanese.

(Laboratory of Marine Zoology, Faculty of Fisheries, Hokkaido University, Hakodate, Hokkaido, 040, Japan)

ヒラメ類の稚仔魚の研究—V. ナガダルマガレイ

尼岡　邦夫

種子島近海 (30°51′N, 129°01′E) の中層で，水深 32 m から採集された 1 個体のダルマガレイ科 (Bothidae) の後期仔魚 (体長 21.6 mm) を調査した．この仔魚は体が長だ円形で，短い背鰭第 1 棘と伸長した第 2 棘をもち，尾舌骨と腰骨の腹縁に鋸歯を欠くなど明らかにナガダルマガレイ属 (*Arnoglossus*) の特徴をもっている．日本近海には本属の 4 種，ニホンダルマガレイ，ハナトゴダルマ，ナンヨウダルマ，ナガダルマガレイが生息している．この仔魚はすでに知られているニホンダルマガレイの仔魚によく似ているが，背鰭条数 (II, 92)，臀鰭条数 (73) および脊椎骨数 (10+30=40) が少ない．これらの体節的形質に基づいて，この仔魚は南日本から南シナ海に広く分布するナガダルマガレイに同定される．また，この仔魚と同じ発育段階にあるニホンダルマガレイの仔魚と比較した結果，これらの体節的形質以外に，ナガダルマガレイの仔魚は体が高く，吻・眼径・下顎・背鰭軟条・臀鰭軟条が短く，吻突起がほとんど発達しないなどの相違のあることが判明した．

(040 函館市港町 3-1-1　北海道大学水産学部水産動物学教室)