

## Redescription of *Arnoglossus yamanakai* (Pleuronectiformes, Bothidae) with Description of the Adults

Atsushi Fukui,<sup>1,2</sup> Umeyoshi Yamada<sup>3</sup> and Takakazu Ozawa<sup>1</sup>

<sup>1</sup> Faculty of Fisheries, Kagoshima University, 4-50-20 Shimoarata, Kagoshima 890, Japan

<sup>2</sup> Present address: Japan NUS Co. Ltd., 3-6-12 Shinyokohama, Kōhoku-ku, Yokohama 222, Japan

<sup>3</sup> Seikai Regional Fisheries Research Laboratory, 49 Kokubu-machi, Nagasaki 850, Japan

**Abstract** The original description of *Arnoglossus yamanakai* was unsatisfactory, being based on larval specimens, written in Japanese and without designation of the holotype. In this paper, the lectotype is designated, and types and adult specimens are fully described. In adults, this species is distinguished from other *Arnoglossus* species by 11 (rarely 12) abdominal vertebrae, slender gill rakers with serrated spinules on the upper margin, and in males, a black band on the distal margin of the anterior part of the dorsal fin. This species is distributed in the East and South China Seas.

The genus *Arnoglossus* of the family Bothidae lives on the sea bottom in depths less than about 400 m, and is widely distributed in tropical and temperate waters of the world. Since Norman (1934) reviewed the genus and recognized 24 species, many taxonomic works have been carried out (Kamohara, 1938; Norman, 1939; Whitley, 1950; Kurth, 1954; Torchio, 1959, 1961; Stauch, 1965, 1967; Amaoka, 1969, 1971; Scott, 1975; Colman, 1976; Kotthaus, 1977; Parin, 1983; Klausewitz and Schneider, 1986). Among 31 species (one species is divided into 2 subspecies) now recognized in the genus, 6 species have been recorded from Japanese waters (Kamohara, 1938; Amaoka, 1969, 1971, 1984).

Ozawa and Fukui (1986) found larvae similar to, but distinctly different from *Arnoglossus japonicus* Hubbs in the number of abdominal vertebrae and melanophore pattern, and described them as *Arnoglossus* sp. A. In the same year, Yamada (1986) reported adult specimens as *Arnoglossus* sp. from the East China Sea. Later, Fukui and Ozawa (1988) gave a new species name *Arnoglossus yamanakai* Fukui, Yamada et Ozawa to those larvae with a description in Japanese and figures. Although they did not intend to describe a new species, Fukui and Ozawa (1988) fulfilled the minimum necessary conditions for a new species description. This paper designates the largest specimen of Fukui and Ozawa (1988), 49.0 mm in standard length, as the lectotype of *A. yamanakai* and the remaining three as paralectotypes, and redescribes them together with adult specimens collected in the East China Sea.

Measuring and counting methods are the same as Amaoka (1969).

*Arnoglossus yamanakai* Fukui, Yamada  
et Ozawa, 1988  
(Japanese name: Tokai-nagadarumagarei)  
(Figs. 1-3)

*Arnoglossus japonicus* Hubbs, 1915: 454-456 (in part, paratype); Amaoka, 1971: 29-30, pl. IIIb; ? Shen, 1983: 30.

*Arnoglossus* sp.: Yamada, 1986: 376-377.

*Arnoglossus* sp. A: Ozawa and Fukui, 1986: 384-387, 409, pls. 18-20, 23 (larvae).

*Arnoglossus yamanakai* Fukui, Yamada et Ozawa in Fukui and Ozawa, 1988: 923-924 (larvae).

*Psettina ijimae* (Jordan et Starks)?: Uchida, 1936: 497-501 (larvae).

**Lectotype.** NSMT-P (Department of Zoology, National Science Museum (Nat. Hist.), Tokyo) 45058 (specimen d of Fukui and Ozawa, 1988: 924), 49.0 mm SL, taken by R. V. Hakuho-maru, Ocean Research Institute, University of Tokyo, in South China Sea (21°24.3'N, 118°10.4'E), at surface, Mar. 19, 1973, in Eel cruise (KH-73-2: Feb.-Mar., 1973) with 1.6 m diameter round plankton net.

**Paralectotypes.** NSMT-P 31526 (specimen a of Fukui and Ozawa, 1988), 3.4 mm SL, taken by T. S. Kagoshima-maru, Kagoshima University, off Yaku Island (30°17.3'N, 130°44.2'E), at sub-surface (depth 20-30 m), Oct. 11, 1979, with 1.6 m diameter round plankton net; NSMT-P 31527 and 31528 (specimen b and c of Fukui and Ozawa, 1988), 8.0 mm and 18.1 mm SL, taken by R. V. Hakuho-maru, in South China Sea (21°53.0'N, 116°29.2'E), Mar. 11, 1973 in Eel cruise with 4 m diameter round

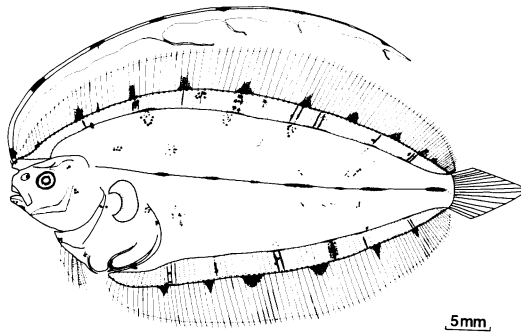


Fig. 1. *Arnoglossus yamanakai*, lectotype, NSMT-P 45058, 49.0 mm SL (from Ozawa and Fukui, 1986).

plankton net.

**Other materials (adults).** CAS (California Academy of Sciences, (SU)) 22528 (radiograph), 89 mm SL, paratype of *A. japonicus* (misidentification), Suruga Bay (34°40.5'N, 138°16.2'E), depth 71 m, Oct. 16, 1906, Albatross; FAKU (Department of Fisheries, Faculty of Agriculture, Kyoto University) 56688-56698, SRFL (Seikai Regional Fisheries Research Laboratory) 70-75 and 81-86, NSMT-P 45070, 24 specimens, 89-117 mm SL, East China Sea (29°13.3'N, 124°14.6'E), depth 74 m, Oct. 22, 1982, trawled by R.V. Yoko-maru; NSMT-P 45059 and 45062, 116 mm and 123 mm SL, East China Sea, (28°56.5'N, 124°52.9'E), depth 90 m, Oct. 30, 1986, trawled by R.V. Yoko-maru; NSMT-P 45060 and 45063, 121 mm and 114 mm SL, East China Sea (28°57.6'N, 124°06.0'E), depth 82 m, Oct. 30, 1986, trawled by R. V. Yoko-maru; NSMT-P 45061 and 45064, 105 mm and 110 mm SL, East China Sea (30°15.0'N, 126°45.0'E), depth 90 m, Oct. 30, 1985, trawled by R. V. Yoko-maru.

**Comparative materials.** *Arnoglossus japonicus*: holotype, USNM (United States National Museum) 75671 (radiograph), 106 mm SL; *A. entomorphynchus* Stauch, holotype, MNHN (Muséum National d'Histoire Naturelle de Paris) 1965-546 (radiograph), 127 mm SL.

**Diagnosis.** This species is easily distinguished from other species of *Arnoglossus* by the combination of the following characters: long and slender gill rakers with serrated spinules on upper margin; 2 rows of teeth on both jaws; 11 (rarely 12) abdominal vertebrae; 63-68 scales in lateral line; in males, a black distal margin on anterior part of dorsal fin and an elongate and slightly filamentous 2nd dorsal fin ray.

**Description of the lectotype (larva).** Meristic counts and proportional measurements are given in Table 1. Body strongly compressed and highest slightly behind posterior wall of abdominal cavity; its

depth about 2.1 of head length. Origin of dorsal fin base thick and remarkably projected anteriorly, forming a rostrum above snout. Caudal peduncle slightly less than 1/5 of body depth. Anus located slightly before 1/4 of SL.

Snout distinctly concave and longer than eye diameter. Eyes ellipsoidal; right eye located slightly above left one; their greatest width slightly shorter than upper jaw. Nostrils on each side located in front of upper margin of eye: anterior pore small and tubular with a flap; posterior one large and elliptical without a flap. Mouth small in size; maxillary ending slightly before a vertical from anterior margin of eye; its length about 1/4 of head length. Some small conical teeth arranged in a row on both jaws. Gill rakers present only on lower limb, elongate, slender, and without serrated spinules on distal half of upper margin.

Scales and lateral line not yet developed.

Origin of dorsal fin located on anterior margin of rostrum above snout: fin rays, except 1st to 3rd, becoming longer toward 2/3 of body, and shorter posteriorly; 1st ray very short; 2nd string-like in shape, remarkably long (its length about 1.1 of SL), and with 4 membranous branches along the hind margin. Anal fin originating just behind anus, and similar in shape to dorsal fin, except 1st to 3rd rays. Pectoral fins equal in size on both sides, fan-shaped, and membranous. Pelvic fin on left side originating slightly behind a vertical through posterior margin of eye; 1st pelvic ray on right side located slightly behind 4th ray on left side; the base on left side much longer than that on right side (the latter 2.13 in the former). Caudal fin pointed with some branched middle rays.

Exposed part of urohyal bone small. Posterior basipterygial process of pelvic girdle curved outward smoothly and its length shorter than eye diameter.

Melanophore pattern: 7 longitudinally slender and internal masses along entire midlateral line; 11 and 6 nearly triangular masses along dorsal and anal bases, respectively; 7 slender masses arranged in regular interval from base to tip of 2nd dorsal fin ray; small masses of punctate and stellate melanophores on dorsal rostrum, brain, lower border of lower jaw, gill cover, basal part of pelvic fin, exposed part of urohyal bone, gut (4 parts), and upper cleithrum (2 parts) of left side; circular or slender masses scattered over whole body surface of left side.

**Description of the paralectotypes (larvae).** Meristic counts and proportional measurements are

given in Table 1.

3.4 mm SL: Body elongate. Anus located slightly behind 1/2 of SL. The elongate dorsal fin ray thread-like in shape (its length about 0.8 of SL). A large stellate melanophore present on the ventral contour of body between 25th and 28th myomeres.

8.0 mm SL: Body elongate and highest at anus. Anus located slightly before 1/2 of SL. Eyes circular, their width shorter than upper jaw. The elongate

dorsal fin ray string-like in shape (its length about 1.2 of SL). 77 rays formed on dorsal and 50 on anal fins. Melanophore absent.

18.1 mm SL: Body elongate and highest just behind anus. Anus located slightly behind 1/3 of SL. Eyes ellipsoidal, their greatest width slightly shorter than upper jaw. The elongate dorsal fin ray with 5 membranous branches along the hind margin, its length about 1.1 of SL. Melanophores present as

Table 1. Meristic counts and proportional measurements of body parts of *Arnoglossus yamanakai*. \*From Hubbs (1915).

	Lectotype	Paralectotypes				Adults	
	NSMT-P 45058	NSMT-P 31526	NSMT-P 31527	NSMT-P 31528	CAS(SU) 22528	Male/Female (n=16/14)	
Standard length (mm)	49.0	3.4	8.0	18.1	89	94–121/89–123	
Vertebrae (myomeres)	11+33=44	(15+27=42)	11+33=44	11+33=44	11+33=44	11–12+32–34=43–45	
Dorsal fin rays	104			102	103	102–106	
Anal fin rays	80			78	79	78–84	
Caudal fin rays	17			17	17	17–18	
Pectoral fin rays							
ocular side						11–13	
blind side						9–11	
Pelvic fin rays	6					6	
Scales in lateral line					63*	63–68	
Gill rakers	0+8					0+7–10	
In standard length							
Head	4.80	6.86	4.44	4.31	4.04	4.02–4.50	
Body depth (average)	2.23	8.58	4.44	3.69	2.68	2.53–2.91/2.78–3.04 (2.79/2.90)	
In head length							
Snout	3.65		3.60	4.20		3.73–5.00	
Eye							
left or ocular side (average)	5.00		4.09	5.06		3.31–3.69/3.59–3.92 (3.44/3.71)	
right or blind side (average)	5.07		4.09	4.94		3.31–3.69/3.59–3.95 (3.44/3.73)	
Upper jaw							
left or ocular side	4.17				2.62	2.34–2.80	
right or blind side	4.15					2.31–2.55	
Depth of caudal peduncle	2.86					2.58–3.14	
Longest dorsal ray except second	1.72					2.02–2.47	
Length of second dorsal ray (average)	0.19	0.20	0.20	0.21		1.82–3.58/4.00–4.70 (2.65/4.30)	
Longest anal ray	1.79					2.02–2.48	
Longest pelvic ray							
left or ocular side	3.12					2.84–3.53	
right or blind side	3.03					2.66–3.26	
Length of pelvic fin base							
left or ocular side	3.13					3.09–3.81	
right or blind side	6.67					6.91–11.95	
Length of pectoral fin							
ocular side						1.52–1.81	
blind side						3.02–4.07	

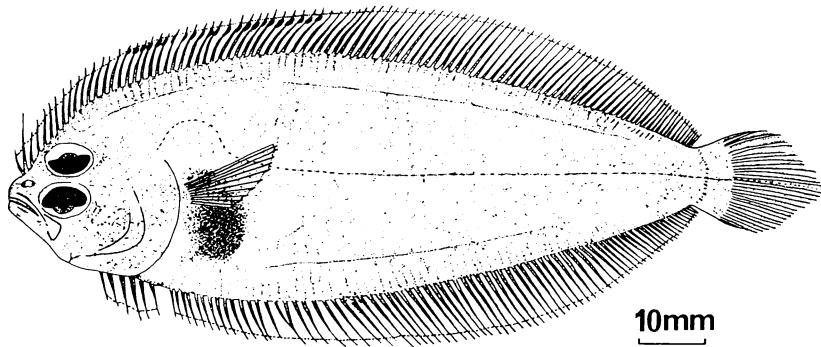


Fig. 2. *Arnoglossus yamanakai*, NSMT-P 45070, male, 104 mm SL (from Yamada, 1986: 376).

follows: 3 longitudinally slender masses along mid-lateral line; 7 slender masses arranged at regular intervals from base to tip of the elongate dorsal fin ray; small masses of punctate and stellate melanophores on dorsal wall of air bladder.

**Description of the adults.** Meristic counts and proportional measurements are given in Table 1. Body elliptical, elongate, strongly compressed, and highest slightly behind posterior end of pectoral fin, its depth about 1.6 of head length. Depth of caudal peduncle slightly less than 1/4 of body depth.

Upper margin between snout and upper eye slightly concave. Snout pointed and slightly shorter than lower eye diameter. Eyes about 1.4 in length of upper jaw, separated from each other by a narrow, low, bony ridge; upper eye located close to dorsal margin of head, lower eye slightly anterior to upper eye. Nostrils on ocular side located in front of upper margin of lower eye; anterior pore with an antrorse slender flap; posterior one without a flap. Nostrils on blind side located slightly before a vertical from origin of dorsal fin; anterior pore with a slender flap; posterior one without a flap.

Mouth oblique, slightly curved downwards and moderate in size; maxillary almost reaching below middle of lower eye, and slightly longer than 1/3 of head length. Teeth on both jaws conical and in 2 rows (Fig. 3); number of outer row teeth on upper jaw 55–71 (ocular side) and 53–62 (blind side); number of outer row teeth on lower jaw 23–35 (ocular side) and 34–49 (blind side); teeth of inner row very small, numerous, and covered by membrane. Gill rakers present only on lower limb, elongate and slender with serrated spinules on distal half of upper margin; number of spinules of longest gill raker 8–14 (Fig. 3).

Scales deciduous on both sides; those of lateral line

rather large and feebly ctenoid with 2 to 5 ctenii (Fig. 3). Lateral line present only on ocular side, with a strong curve (about 2/5 of head length) above pectoral fin, the curved portion thereafter straight reaching the posterior end of the caudal fin (Fig. 2).

Origin of dorsal fin on blind side, on a level with lower margin of upper eye; fin rays, except 1st to 3rd, becoming longer toward 2/3 of body, and shorter posteriorly. Anal fin originating slightly before a vertical through upper insertion of pectoral fin, and similar in shape to dorsal fin, except 1st to 3rd rays. Pectoral fin of ocular side with 3rd ray longest, much longer than half of head length; that of blind side shorter than 1/3 of head length. Pelvic fin on ocular side inserted slightly behind a vertical through posterior margin of lower eye; its base on ocular side much longer than that on blind side (the latter 2.17–2.73 in the former); 1st pelvic ray on blind side located slightly behind 4th ray on ocular side. Caudal fin pointed, with 11–12 branched rays, 2–3 simple ones in the upper lobe and 3 simple ones in the lower.

Anus above origin of anal fin, on blind side. Genital papilla just before origin of anal fin, on ocular side.

Color just after collection: body nearly transparent, uniformly light brownish, with dark brownish peritoneum (Yamada, 1986).

Color in 10% formalin: body uniformly pale brownish on ocular side, with narrow dark bands on scale pockets, white on blind side. A black band present on distal margin of dorsal fin, from posterior part of head to middle of body in males.

**Sexual dimorphism.** The present species shows secondary sexual dimorphism as follows. Second dorsal ray elongate in males, but not in females.

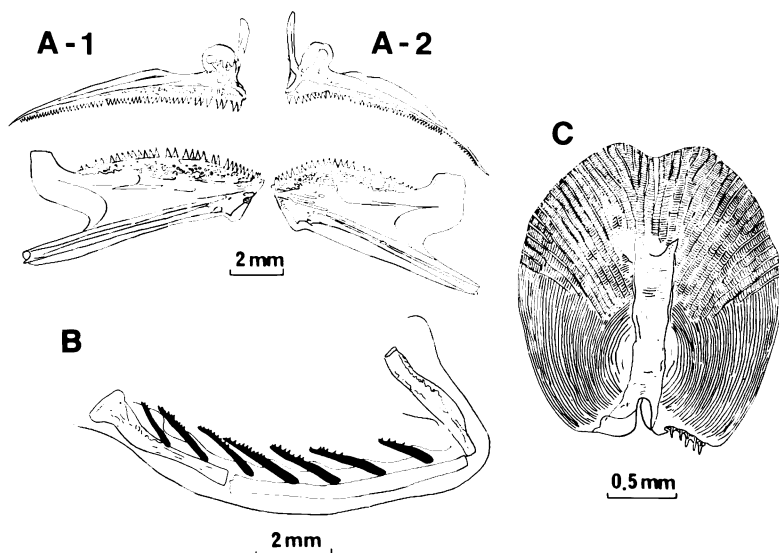


Fig. 3. Lateral aspect of jaw apparatus (A, SRFL 82, female, 103 mm SL; A-1, on blind side; A-2, on ocular side), outer side of the first gill arch on ocular side (B, SRFL 75, male, 103 mm SL), and lateral line scale on middle part of ocular side of body (C, FAKU 56694, female, 109 mm SL) (B and C from Yamada, 1986: 377).

Body depth in SL and eye diameter in head length of males slightly lower than those of females (Table 1). A black band present on distal margin of dorsal fin, from posterior part of head to middle of body in males, but not in females.

**Identity of the larvae with the adults.** Ozawa and Fukui (1986) compared the numbers of dorsal and anal fin rays, and vertebrae, between larvae and adults of this species (as *Arnoglossus* sp. A.). There is no problem about their identity.

**Etymology.** The species name, *yamanakai*, refers to Mr. Kan'ichi Yamanaka, the former captain of R. V. Yoko-maru.

**Remarks.** Fukui and Ozawa (1988) outlined an early ontogeny with four larvae, under a new species name *Arnoglossus yamanakai*. Although they did not intend to describe new species, Fukui and Ozawa (1988) fulfilled the minimum necessary conditions for a new species description. The four larvae of Fukui and Ozawa (1988) should be regarded as syntypes according to Art. 72.(a)(i) and (b)(i) of ICZN. In this paper, the largest specimen of Fukui and Ozawa (1988: 924, fig. d) is designated as the lectotype of *A. yamanakai*.

This species is most closely related to *A. japonicus* Hubbs, in sharing a filamentous 2nd dorsal ray in males, and with pectoral and pelvic fins without

blackish markings. Counts of dorsal and anal fin rays, caudal vertebrae, and lateral line scales are also similar (Table 2). Differences are found in some characters shown in Table 2 (number of abdominal vertebrae, sizes of head and upper jaw on ocular side, number of rows of jaw teeth, nature of scales, and shape of caudal fin), the shape and size of the gill rakers (compare Fig. 3 with Amaoka, 1969: 196, fig. 79C), and the shortest distance between the upper eye and the dorsal margin of the head (about 1/3 of diameter of upper eye in *A. yamanakai* whereas about 1/2 in *A. japonicus*: see Amaoka, 1969: 195, fig. 78).

Type specimens of *A. japonicus* are actually composed of two species. We examined their radiographs and found that the holotype (true *A. japonicus*, USNM 75671) has the following characters: VN 10+33=43, head 3.66 and body depth 2.51 in SL, and upper jaw 2.20 in head length. However the paratype (CAS (SU) 22528) has a different VN, head, and body depth in SL, and upper jaw in head length as shown in Table 1. The paratype is not *A. japonicus* and corresponds to *A. yamanakai*. *A. japonicus* reported by Amaoka (1971) from the South China Sea seems to have been *A. yamanakai* because it had 11 abdominal vertebrae, large eyes, and the upper eye very close to the dorsal margin of

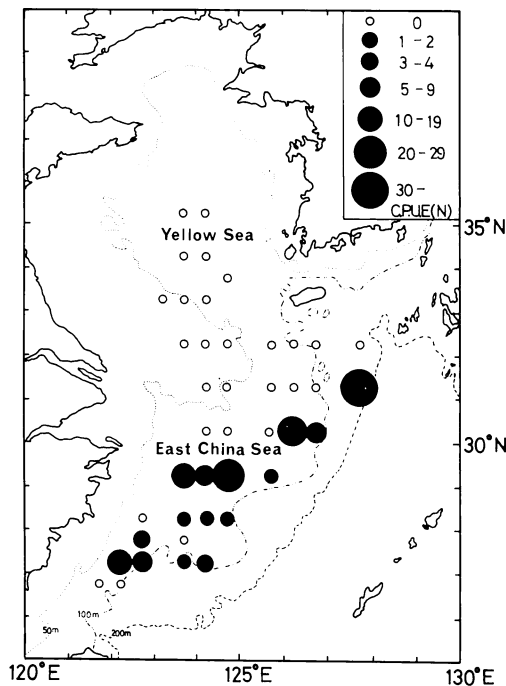


Fig. 4. Distribution of *Arnoglossus yamanakai* from trawl survey data (Oct.–Nov., 1980–1982) by R. V. Yoko-maru in the East China and Yellow Seas (from Yamada, 1986: 377). C.P.U.E.(N) indicates average number of individuals caught per haul.

the head. Also *A. japonicus* reported by Shen (1983) from around Formosa may be *A. yamanakai*, because they share characteristically long, pointed gill rakers, the upper eye very close to the dorsal margin of the head, a small head, shallow body depth and a short upper jaw (head 4.09 and body depth 2.77 in SL, and upper jaw 2.44 in head length). However, *A. yamanakai* differs from Shen's specimen which was reported to have cycloid scales, a rounded caudal fin, and one row of teeth on the jaws. The larvae questionably ascribed to *Psettina iijimae* by Uchida (1936), were regarded as *A. japonicus* by Ochiai and Amaoka (1963), and Amaoka (1973). However they seem to belong to *A. yamanakai*, because their melanophore pattern is of the latter species, not of *A. japonicus* (Ozawa and Fukui, 1986).

*A. yamanakai* differs from the other 4 Japanese *Arnoglossus* species in several characters, as shown in Table 2. *A. orientalis* Kamohara has not been collected since its first description (Kamohara, 1938), and seems to belong to *Neolaeops* because of its

counts and proportions. Further, like *Neolaeops micropthalmus*, the head has a deep concavity in front of the upper eye.

This species is clearly different from the following 9 species out of 10 Euro-African *Arnoglossus* species, and 13 species (one species divided into 2 subspecies) in the remaining 15 Indo-Pacific species, in number of abdominal vertebrae and/or scales in the lateral line. Euro-African *A. grohmanni* (Bonaparte), *A. kessleri* Schmidt, *A. thori* Kyle, *A. laterna* (Walbaum), and *A. blachei* Stauch, and Indo-Pacific *A. fisoni* Ogilby, *A. aspilos aspilos* (Bleeker), *A. aspilos praeteritus* Whitley, *A. waitei* Norman, *A. arabicus* Norman, and *A. profundus* Kotthaus have a distinctly lower number of lateral line scales, 38–60 (Norman, 1934, 1939; Whitley, 1950; Stauch, 1965; Kotthaus, 1977; Tarp and Kailola, 1985). Euro-African *A. rueppellii* (Cocco), and Indo-Pacific *A. bassensis* Norman, *A. andrewsi* Kurth, *A. dalglishi* (Von Bonde), *A. debilis* (Gilbert), *A. scapha* (Schneider), *A. armstrongi* Scott, and *A. multi-rastri* Parin have a distinctly higher number of lateral line scales, 70–98 (Norman, 1934; Kurth, 1954; Scott, 1975; Colman, 1976; Parin, 1983; Tarp and Kailola, 1985; Ozawa and Fukui, 1986). Euro-African *A. moltonii* Torchio, *A. imperialis* (Rafinesque), and *A. entomorphynchus* Stauch, and Indo-Pacific *A. marisrubri* Klausewitz et Schneider have 10 abdominal vertebrae (Norman, 1934; Torchio, 1961; Klausewitz and Schneider, 1986; radiograph examined by the present authors).

The remaining Euro-African species, *A. capensis* Boulenger, and Indo-Pacific species, *A. elongatus* Weber and *A. muelleri* (Klunzinger), have lateral line scales overlapping in number with the present species, and their number of abdominal vertebrae has not been examined (Norman, 1934; Tarp and Kailola, 1985). However, these species clearly differ in the following characters from the present species: in *A. capensis*, D 96–100 with 1st–5th rays elongate, body depth (2.25–2.40 in SL) and upper jaw length (3.00–3.25 in head length) (Norman, 1934); in *A. elongatus*, 2nd–4th dorsal rays elongate, sizes of head (3.50–3.66 in SL) and upper eye (3.0–3.1 in head length), and body with a blotch just behind the curved lateral line (Norman, 1934; Tarp and Kailola, 1985); and in *A. muelleri*, D 90–97, A 72–75, body depth (2.25–2.50 in SL) and size of upper eye (4–5 in head length) (Norman, 1934).

**Distribution and habitat.** Adults of this species were collected on the edge of the continental shelf in

Table 2. Comparison of meristic counts, proportional measurements of body parts, and selected characters between *Arnoglossus yamanakai* and the other 5 Japanese species. <sup>1</sup>From Hubbs (1915), Amaoka (1969) and Ozawa and Fukui (1986). <sup>2</sup>From Norman (1934), Amaoka (1969) and Ozawa and Fukui (1986). <sup>3</sup>From Norman (1934) and Amaoka (1969). <sup>4</sup>From Amaoka (1969). <sup>5</sup>From Norman (1934) and Amaoka (1971).

Species name	<i>A. yamanakai</i>	<i>A. japonicus</i> <sup>1</sup>	<i>A. tenuis</i> <sup>2</sup>	<i>A. polyspilus</i> <sup>3</sup>	<i>A. oxyrhynchus</i> <sup>4</sup>	<i>A. tapeinosoma</i> <sup>5</sup>
Vertebrae	11-12+32-34=43-45	10+32-34=42-44	10+30-31=40-41	10+30-32=40-42	11+35=46	10+31-32=41-42
Dorsal fin rays	102-106	99-106	90-98	100-114	108-113	89-98
Anal fin rays	78-84	76-83	70-74	78-91	84-89	67-76
Scales in lateral line	63-68	65-73	49-54	70-81	87-94	48-57
Gill rakers	0+7-10	0+7-9	0+8-9	1-2+8-9	0+8-9	0+8-12
In standard length						
Head	4.02-4.50	3.60-3.90	4.05-4.32	3.78-4.19	3.97-4.55	3.68-3.86
Body depth	2.53-3.04	2.45-2.65	2.49-2.92	2.45-2.72	2.41-2.71	2.65-2.73
In head length						
Upper eye	3.31-3.92	3.62-4.22	3.27-4.09	3.12-3.97	3.67-3.98	3.18-3.31
Upper jaw on ocular side	2.34-2.80	2.04-2.32	2.61-2.91	2.30-2.60	2.11-2.30	2.52-2.58
Number of rows of jaw teeth	2	1	1	1	1-2	1
Scales on lateral line	feebly ctenoid	cycloid	feebly ctenoid	feebly ctenoid	feebly ctenoid	feebly ctenoid
Shape of caudal fin	pointed	rounded	pointed	rounded	rounded	pointed

the East China Sea, from off the western part of Kyushu to off the northern part of Formosa, but not in the Yellow Sea (Fig. 4). The depth range was from 65 to 130 m. Bottom water temperatures of the habitat varied between 18.5 and 20.5°C. This species seems to occur also in the South China Sea. Ozawa and Fukui (1986) recorded the larvae of this species (as *Arnoglossus* sp. A) from continental waters of the East and South China Seas and their adjacent regions. The most closely related species, *A. japonicus*, is distributed on the Pacific coasts of southern Honshu, Shikoku, Kyushu, and Ryukyu Islands (Ochiai and Amaoka, 1963; Amaoka, 1969, 1973; Ozawa and Fukui, 1986).

There seems to be no overlap of distribution between the two species. Amaoka (1984) noted that *A. japonicus* was distributed from southern Japan to the South China Sea. As shown above, *A. japonicus* reported from the South China Sea by Amaoka (1971) can be regarded as *A. yamanakai*. True *A. japonicus* is not distributed in the East China Sea.

There is some doubt about the collection locality of the paratype of *A. japonicus* (= *A. yamanakai*), Suruga Bay on the Pacific coast of Honshu (Hubbs, 1915), because no larvae and adults identifiable as *A. yamanakai* have since been recorded around the Pacific coast of Honshu.

#### Acknowledgments

We wish to thank Drs. Hiroshi Mako, Shin'ichi Mio and Mr. Masaru Tagawa, Seikai Regional Fisheries Research Laboratory, for supporting the study, and Mr. Kan'ichi Yamanaka, the former captain of R. V. Yoko-maru and the members of the vessel for giving us many facilities for collecting specimens. To Drs. Kunio Amaoka, Hokkaido University, Tetsuji Nakabo, Kyoto University, Muneo Okiyama, Ocean Research Institute, University of Tokyo, and Yoshiaki Tominaga, University of Tokyo, we express our gratitude for their helpful advice.

Grateful thanks are also due to Drs. Keiichi Matsuura, National Science Museum, Kiyoshi Fujita, Tokyo University of Fisheries, and Mr. Hisashi Imamura, Hokkaido University, for giving us copies of literature, and Drs. Bruce B. Collete, U.S. National Museum of Natural History and M. Eric Anderson, California Academy of Sciences, and Dr. M. Desoutter, Muséum National d'Histoire Naturelle, for providing radiographs on type specimens of

*A. japonicus* and *A. entomorphynchus*, respectively.

#### Literature cited

- Amaoka, K. 1969. Studies on the sinistral flounders found in the waters around Japan—taxonomy, anatomy and phylogeny—. J. Shimomoseki Univ. Fish., 18(2): 65–340.
- Amaoka, K. 1971. Eleven species of flounders collected from the South China Sea. J. Shimomoseki Univ. Fish., 20(1): 19–33, pls. 1–4.
- Amaoka, K. 1973. Studies on the larvae and juveniles of the sinistral flounders—IV. *Arnoglossus japonicus*. Japan. J. Ichthyol., 20(3): 145–156.
- Amaoka, K. 1984. Family Bothidae. Pages 347–350, pls. 312–313, 368–369 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.
- Colman, J. A. 1976. *Arnoglossus boops* (Hector): a synonym of *A. scapha* (Schneider) (Pisces: Heterosomata: Bothidae). N. Z. J. Mar. Freshw. Res., 10(4): 693–697.
- Fukui, A. and T. Ozawa. 1988. *Arnoglossus yamanakai*. Pages 923–924 in M. Okiyama ed. An atlas of the early stage fishes in Japan. Tokai Univ. Press, Tokyo. (In Japanese.)
- Hubbs, C. L. 1915. Flounders and soles from Japan collected by the United States Bureau of Fisheries Steamer "Albatross" in 1906. Proc. U.S. Natn. Mus., 48(2082): 449–496, pls. 25–27.
- Kamohara, T. 1938. On the offshore bottom-fishes of Prov. Tosa, Shikoku, Japan. Maruzen, Tokyo, 86 pp.
- Klauswitz, W. and M. Schneider. 1986. Tiefenwasser und Tiefseefische aus dem Roten Meer. XII. *Arnoglossus marisrubri* n. sp. aus dem Mesobenthos des zentralen Roten Meeres und *A. kotthausi* nom. nov. vom Epibenthos des nordwestlichen Indischen Ozeans. Senckenb. Marit., 18(3/6): 217–227.
- Kotthaus, A. 1977. Fische des Indischen Ozeans. Ergebnisse der ichthyologischen Untersuchungen während der Expedition des Forschungsschiffes "Meteor" in den Indischen Ozean, Oktober 1964 bis Mai 1965. A. Systematischer Teil, XX. Pleuronectiformes (Heterosomata). "Meteor" Forsch.-Ergebn., Reihe D, (26): 1–20.
- Kurth, D. E. 1954. A new bothid fish from eastern Tasmania. Pap. Proc. Roy. Soc. Tasm., 88: 45–47.
- Norman, J. R. 1934. A systematic monograph of the flatfishes (Heterosomata). I. Psettodidae, Bothidae, Pleuronectidae. British Mus., London, viii + 459 pp.
- Norman, J. R. 1939. Fishes. John Murray Expedition, 1933–34. Sci. Rep., Brit. Mus. (Nat. Hist.), 7(1), 116 pp.
- Ochiai, A. and K. Amaoka. 1963. Description of larvae and young of four species of flatfishes referable to subfamily Bothinae. Bull. Japan. Soc. Sci. Fish., 29(2): 127–134. (In Japanese.)
- Ozawa, T. and A. Fukui. 1986. Studies on the development



- and distribution of the bothid larvae in the western North Pacific. Pages 321–420, pls. 1–23 in T. Ozawa ed. Studies on the oceanic ichthyoplankton in the western North Pacific. Kyushu Univ. Press, Fukuoka.
- Parin, N. V. 1983. Two new species of bothid flatfishes (Bothidae, Pleuronectiformes) from the Nazca submarine ridge. Bull. Mosk. Obsch. Ispyt. Prir. (Otd. Biol.), 88(4): 90–96. (In Russian.)
- Scott, E. O. G. 1975. Observations on some Tasmanian fishes: part XXI. Pap. Proc. Roy. Soc. Tasm., 109: 127–173.
- Shen, S.-C. 1983. Study on the bothid fishes (Family Bothidae) from Taiwan. J. Taiwan Mus., 36(1): 1–42.
- Stauch, A. 1965. Sur la répartition géographique d'*Arnoglossus imperialis* (Raf. 1810) et description d'une espèce nouvelle, *Arnoglossus blachei* (Pisces, Teleostei, Heterosomata, Bothidae). Bull. Mus. Natn. Hist. Nat. Paris, Sér. 2, 37: 252–260.
- Stauch, A. 1967. Description d'une nouvelle espèce de Bothinae: *Arnoglossus entomorhynchus* n. sp. (Pisces, Teleostei, Heterosomata). Bull. Mus. Natn. Hist. Nat. Paris, Sér. 2, 39: 660–664.
- Tarp, T. G. and P. J. Kailola. 1985. Trawled fishes of southern Indonesia and northwestern Australia. Australian Development Assistance Bureau, Directorate General of Fisheries, Indonesia, and German Agency for Technical Cooperation, xvi + 405 pp., pls. 1–3.
- Torchio, M. 1959. Revisione degli *Arnoglossus* (Pisces Pleuronectiformes) del Mar Ligure. Doriana, 3(102): 1–11.
- Torchio, M. 1961. *Arnoglossus moltonii*, nuova specie di Bothidae del Mediterraneo (Pisces Pleuronectiformes). Atti Soc. It. Sc. Nat., 100: 213–224.
- Uchida, K. 1936. Note on two remarkable heterosomatous postlarvae with a greatly elongated and branched dorsal ray. Zool. Mag., 48(8/10): 497–501. (In Japanese.)
- Whitley, G. P. 1950. Some rare Australian fishes. Proc. Roy. Zool. Soc. N.S.W., [1948–49]: 32–34.
- Yamada, U. 1986. Family Bothidae. Pages 374–377 in U. Yamada, M. Tagawa, S. Kishida and K. Honjo. Fishes of the East China Sea and the Yellow Sea. Seikai Regional Fisheries Research Lab., Nagasaki. (In Japanese.)

(Received August 11, 1988; accepted August 3, 1990)

*Arnoglossus yamanakai* (ダルマガレイ科) の再記載, ならびに成魚の形態的特徴

福井 篤・山田梅芳・小沢貴和

福井・小沢 (1988) はダルマガレイ科の幼期発育の解説の中で、ナガダルマガレイ属の1種をトウカイナガダルマガレイ *Arnoglossus yamanakai* として記載した。しかしその原記載では模式標本が指定されておらず、成魚の形態も記載されていない。そこで、福井・小沢 (1988) における最大個体を後模式標本と指定し、東シナ海で採集された成魚と共に記載を行なった。本種は腹椎数 11 本 (まれに 12 本)、小棘のある細長い鰓耙、および雄で背鰭前方背縁近くにある黒色縦走帯により、同属の他種から識別される。本種は東シナ海および南シナ海に分布する。

(福井・小沢: 890 鹿児島市下荒田 鹿児島大学水産学部; 福井, 現住所: 222 横浜市港北区新横浜 3-6-12 日本エヌ・ユー・エス株式会社; 山田: 850 長崎市国分町 49 西海区水産研究所)