

A Specimen of the Ammodytid Genus *Ammodytoides* (Teleostei, Perciformes) from off Southern Shikoku Island, Japan

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(Received 18 September 2015; accepted 23 March 2016)

Abstract A juvenile specimen, 59.2 mm standard length (SL), of the ammodytid genus *Ammodytoides* was collected with a midwater trawl off Cape Ashizuri-misaki, Kochi Prefecture, Shikoku Island, Japan. This specimen has the following combination of characters: dorsal fin rays 48; anal fin rays 22; pectoral fin rays 15; pored lateral line scales ca. 95; gill rakers 5 + 22 = 27; vertebrae 33 + 24 = 57; head length 25.3% SL; predorsal length 26.7% SL; caudal peduncle depth 5.7% SL; 2 supratemporal pores; pale orange-red body with blackish dorsal and anal fins posteriorly when fresh. Among the 10 valid congeners, this specimen is similar to *A. gilli* (Bean, 1895) (tropical eastern Pacific), *A. kimurai* Ida and Randall, 1993 (Ogasawara Islands) and *A. kanazawai* Shibukawa and Ida, 2013 (Ogasawara Islands) in most counts and proportions, but differs from them by the combination of coloration when fresh, and counts of lateral line scales and supratemporal pores. The validity of *A. kanazawai* described from a juvenile is also discussed.

Key words: Ammodytidae, *Ammodytoides* sp., *A. gilli*, *A. kanazawai*, *A. kimurai*, Kochi, Japan.

Introduction

The ammodytid genus *Ammodytoides* Duncker and Mohr, 1939 is composed of 10 valid species (Shibukawa and Ida, 2013): *A. gilli* (Bean, 1895), *A. vagus* (McCulloch and Waite, 1916), *A. renniei* (Smith, 1957), *A. kimurai* Ida and Randall, 1993, *A. pylei* Randall, Ida and Earle, 1994, *A. leptus* Collette and Randall, 2000, *A. idai* Randall and Earle, 2008, *A. praematura* Randall and Earle, 2008, *A. xanthops* Randall and Earle, 2008, and *A. kanazawai* Shibukawa and Ida, 2013. One nominal species, *A. lucasanus* (Beebe and Teevan, 1938), is regarded as a junior synonym of *A. gilli* (Collette and Robertson, 2001; Shibukawa and Ida, 2013). The genus is distinguished from other ammodytid genera in having the following combination of characters: 45–50 dorsal fin rays,

21–25 anal fin rays, no teeth in the jaws, no developed ventro-lateral skin fold on the body, no pelvic fin, and expanded haemal and neural spines on the caudal vertebrae (for more detail, see Ida *et al.*, 1994; Shibukawa and Ida, 2013).

During midwater-trawl surveys carried out by the R/V *Soyo-maru* (National Research Institute of Fisheries Science, Fisheries Research Agency, Yokohama) in the western North Pacific off Kyusyu and Shikoku islands of Japan, an ammodytid specimen with numerous fine black dots on the dorsal and anal fins was collected off Cape Ashizuri-misaki in southern Shikoku Island (Fig. 1). The specimen is very close to three species of *Ammodytoides*, *A. gilli* distributed in the tropical eastern Pacific, and *A. kimurai* and *A. kanazawai*, both known only from types collected off the Ogasawara Islands, but different from them by

some counts, proportions, and coloration including fin pigmentation. We herein report it as *Ammodytoides* sp. and provide comments on the validity of *A. kanazawai*.

Materials and Methods

Methods for counts and measurements follow Ida and Randall (1993) and Randall *et al.* (1994). Vertical fin rays and vertebrae were counted from radiographs. Standard length is abbreviated as SL. Scales were observed with the aid of a scanning electron microscope (SEM; JEOL JSM-6380LV, JEOL Ltd., Tokyo). Lateral line systems were temporarily stained with cyanine blue (Saruwatari *et al.*, 1997). The skin for SEM was dehydrated with a graded series of ethanol and t-butyl alcohol, dried in a freeze dryer (JEOL JFD-300), and coated by a JEOL JFC-1600 with mixed platinum and palladium. Terminology of cephalic sensory canals and pores follows Shibukawa and Ida (2013). Counts for paired structures are the same on both sides unless noted.

The specimens examined here are deposited in the following institutions: Laboratory of Marine Biology, Faculty of Science, Kochi University, Kochi (BSKU); National Museum of Nature and Science, Tsukuba (NSMT); National Museum of Natural History, Smithsonian Institution, Washington DC (USNM).

Ammodytoides sp.

(Figs. 1–3, Tables 1, 2)

Material examined. BSKU 71207, 59.2 mm SL, 32°40.0'N, 133°34.2'E, off Cape Ashizurimisaki, Kochi Pref., Japan, midwater trawl, depth unknown (bottom depth: 912 m), R/V *Soyo-maru*, 25 April 2004, coll. by K. Kameda.

Description. Proportional measurements and counts are provided in Tables 1, 2. Dorsal fin rays 48; anal fin rays 22; pectoral fin rays 15; principal caudal fin rays 9 + 9 (uppermost and lowermost rays unbranched); tubed (pored) lateral line scales ca. 95, followed by 5 unpored scales in

left side, right side damaged; scales above lateral line to origin of dorsal fin 2; scales below lateral line to origin of anal fin ca. 11; predorsal scales 13; gill rakers 5 + 22; pseudobranchial filaments 14; branchiostegal rays 7; vertebrae 33 + 24 = 57; predorsal vertebrae 4; first two dorsal pterygiophores in space between 4th and 5th neural spines; neural and haemal spines of vertebrae of caudal peduncle expanded distally; postdorsal vertebrae 11; vertebrae posterior to anal fin 9.

Body elongate, slightly compressed. A longitudinal ventro-lateral fold not developed. Dorsal fin origin behind a vertical line through pectoral fin base. Anus just before anal fin origin. Caudal peduncle deep, its length more than half of body depth. Broad gap between second and third suborbitals. Posterior corner of dorsal fin not forming lobe. All dorsal and anal fin rays unbranched, except last rays branched at base. Pelvic fins absent. Snout pointed, compressed, its length longer than orbit diameter. Interorbital space wide, its width equal to orbit diameter. Jaws extending slightly behind vertical through anterior margin of eye. Lower jaw projecting, sharply pointed. No teeth on jaws. Gill opening broad, posterior edge of operculum slightly pointed. Gill rakers slender, longest at middle of 1st gill arch, slightly shorter than longest gill filament.

Scales small and weak, cycloid and arranged in diagonal straight rows. Four semi-circular ridges on scale, posterior edge of each scale serrated (Fig. 2). Ventrolateral skin fold undeveloped. Head naked. V-shaped patterns of scale rows on nape. Caudal fin base covered with small scales. Lateral line scales tubed (pored), except on caudal peduncle. Lateral line positioned dorsally on body, continuing to caudal fin.

Cephalic lateral line system as shown in Fig. 3. Nostrils small, located dorsally on snout; anterior nostril below anterior supraorbital pore, posterior nostril above anterior infraorbital pore; infraorbital canal broadly interrupted below eye; supratemporal commissure with 2 pores.

Color when fresh (Fig. 1A). Overall color of head and body pale orange-red. Snout, pectoral fin base, dorsal profile of body posteriorly, mid-

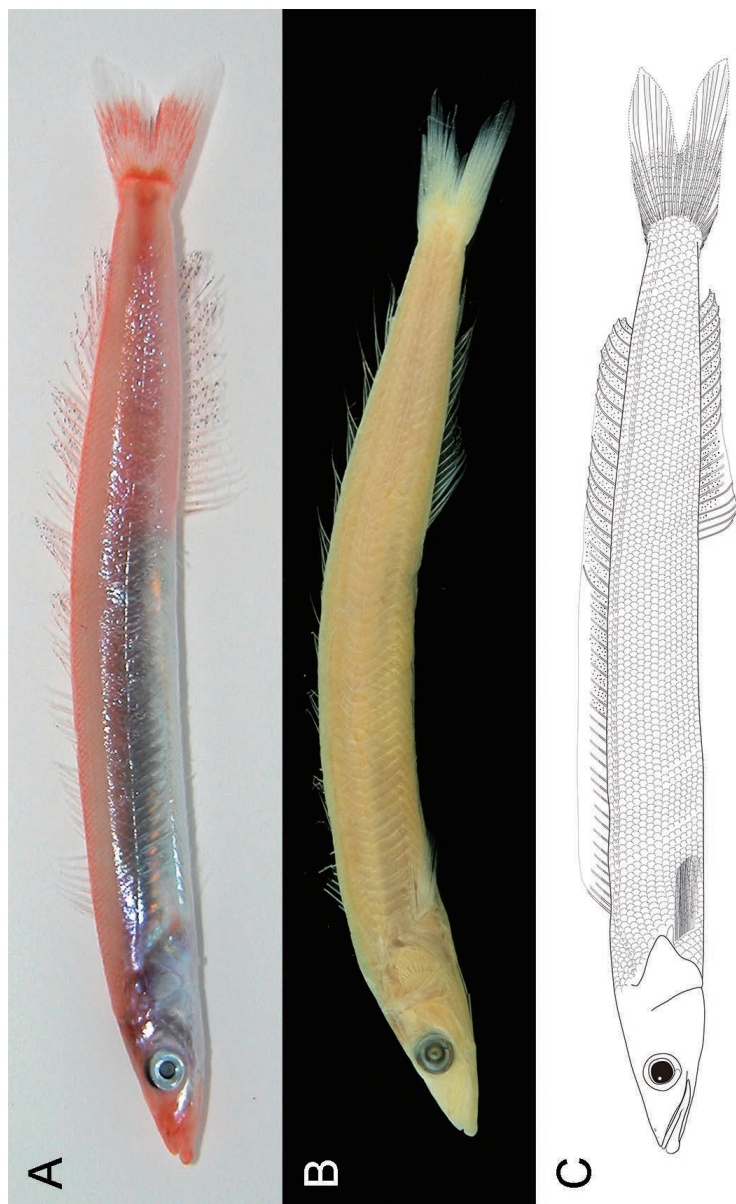


Fig. 1. *Ammodytoides* sp. collected off Cape Ashizuri-misaki, BSKU 71207, 59.2 mm SL.—A, fresh condition (photographed by K. Kameda), B, preserved condition; C, schematic illustration (drawn by E. Katayama).

lateral caudal peduncle, caudal fin base, and middle of caudal fin deep orange-red. Occipital area, preopercle, upper part of opercle, and mid-lateral trunk blackish to brownish internally. A broad silvery stripe mid-laterally on body. Suborbital and opercular region, underside of head, and ventro-lateral portion of abdomen silver. Membranes of dorsal, anal, and paired fins transparent, with numerous fine black dots scattered posterior to 18th and 3rd rays of dorsal and anal fins, respectively. Dorsal and anal fin rays pale orange-red. Anterior third of caudal fin pale orange-red with numerous black dots, broadly edged with deep orange-red posteriorly; posterior third of upper and lower lobes of caudal fin translucent.

Color in alcohol (Fig. 2B). Head and body uniformly pale cream yellow. Occiput and upper region of opercle somewhat darkish. Numerous fine black dots on vertical fins membranes; paired fins translucent. Fin rays whitish.

Remarks. The present specimen is clearly a species of *Ammodytoides* in having the following combination of characters: 48 dorsal fin rays (45–50 in the genus), 22 anal fin rays (21–25), no teeth in the jaws, no pelvic fins, undeveloped ventro-lateral skin fold, expanded haemal and neural spines of caudal vertebrae, and a discontinuous subocular canal below eye (see Ida *et al.*, 1994; Shibukawa and Ida, 2013). Among the 10 valid species in the genus, this specimen can be distinguished from all species except *A. gilli* by the following counts: dorsal fin rays 48 (vs. 50–53 in *A. leptus* and *A. renniei*), vertebrae 57 (vs. 61–63 in *A. leptus*), predorsal vertebrae 4 (vs. 6 in *A. idai*, *A. praematura*, and *A. xanthops*), gill rakers on upper limb 5 (vs. 10 in *A. renniei*), and pored lateral line scales ca. 95 (vs. 103–118 in the congeners except for *A. gilli*) [Table 2; data of nine species are from Collette and Randall (2000), Collette and Robertson (2001), Ida and Randall (1993), McCulloch and Waite (1916), Randall and Earle (2008), Randall *et al.* (1994), Randall and Heemstra (2008) and Smith (1957)]. All counts for fin rays, scales, gill rakers, and vertebrae in the present specimen however are included in or extensions of ranges

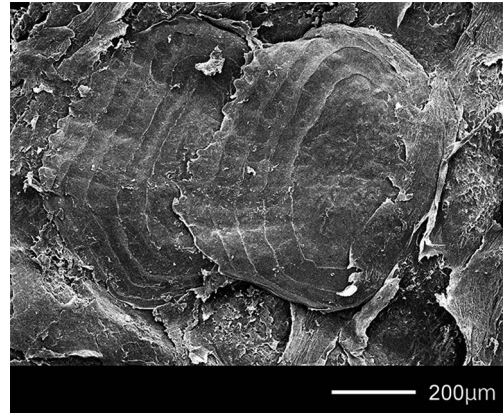


Fig. 2. SEM image of scales on lateral side of body (posterior to right pectoral fin) of *Ammodytoides* sp., BSKU 71207.

of *A. gilli* known from the tropical eastern Pacific. Furthermore, two pores on the supratemporal commissure are common to both species (Fig. 3A, C). Its pale orange-red coloration when fresh, however, is clearly different from the “translucent gray-white” color of *A. gilli* (Fig. 1; Collette and Robertson, 2001).

Collette and Robertson (2001) re-described *A. gilli* from 50 specimens ranging in length from 42.3 to 115 mm SL (including the lectotype), and provided ranges for counts (Table 2) and described two ontogenetic changes, a reduction of the proportional length of the expanded posterior dorsal fin lobe and an increase in number of branched dorsal and anal fin rays with growth. Furthermore, they observed that *A. gilli* has a yellow head and 1–5 large black blotches on the dorsal fin that appear in larger specimens (69.5–84.4 mm SL), but not in smaller ones (42.3–62.2 mm SL). The dorsal fin characters are therefore not useful for identifying the present specimen of 59.2 mm SL.

In the western North Pacific, this specimen is similar to *A. kimurai* and *A. kanazawai* known from the Ogasawara Islands in counts, with the exception of pored lateral line scales as well as, its fin pigmentation (Fig. 1, Table 2; Shibukawa and Ida, 2013: fig. 2). The present specimen differs from *A. kimurai* (98.3–116 mm SL) in three morphometric characters: a narrower body width

Table 1. Proportional measurements (% SL) for the present specimen and three species of *Ammodytoides*.

	<i>Ammodytoides</i> sp.			<i>A. kanazawai</i>			<i>A. kimurai</i>			<i>A. gilli</i>		
	BSKU 71207 Present specimen 59.2 mm SL	NSMT-P 48606 Holotype 62.4 mm SL	NSMT-P 50708 Holotype 98.3 mm SL	NSMT-P 52804 Paratype 104.9 mm SL	NSMT-P 52804 Paratype 116.2 mm SL	USNM 45384 Lectotype 87.2 mm SL	USNM 326833 Non-type 40.4 mm SL					
Head length	25.3	23.8	22.6	23.6	23.0	23.5	27.7					
Snout length	7.4	6.7	7.0	6.7	6.5	6.2	6.8					
Orbit diameter	4.5	4.2	3.8	3.4	3.1	3.8	5.5					
Interorbital width	4.2	3.7	4.3	4.4	4.2	3.2	3.9					
Upper jaw length	8.6	7.9	7.4	8.6	7.3	7.5	8.2					
Body depth	10.0	8.8	11.6	10.7	11.1	8.9	10.1					
Body width	6.2	5.7	8.1	8.4	7.9	6.7	4.9					
Predorsal length	26.7	25.6	23.9	23.3	23.4	26.7	28.5					
Preanal length	65.1	64.6	64.9	62.7	65.6	65.3	66.5					
Caudal length	10.2	8.1	10.7	13.5	9.5	11.6	10.6					
Caudal peduncle depth	5.7	5.2	4.5	4.4	4.9	4.6	6.0					
1st dorsal fin ray length	Damaged	3.5	2.7	Damaged	3.8	Damaged	3.9					
2nd dorsal fin ray length	Damaged	4.6	4.9	Damaged	4.8	Damaged	4.7					
Longest dorsal fin soft ray length	Damaged	7.6	6.2	5.0	5.2	Damaged	13.0					
Last dorsal fin length	5.1	4.5	4.1	4.0	5.0	Damaged	8.5					
1st anal fin length	4.3	4.5	5.1	Damaged	2.7	Damaged	5.1					
2nd anal fin soft ray length	6.8	5.7	5.8	7.5	Damaged	Damaged	8.1					
Longest anal fin soft ray length	Damaged	6.6	4.9	5.1	4.6	Damaged	8.1					
Pectoral fin length	Damaged	8.1*	9.3	8.7	8.9	Damaged	8.1					
Longest caudal fin ray length	14.1	13.5*	12.3	10.9	11.4	9.0	18.2					
Length of caudal concavity	6.0	6.3*	5.1	5.6	5.7	Damaged	7.4					

*Data from Shibukawa and Ida (2013)

Table 2. Counts for the present specimen and 10 valid species of *Ammodytoidea*. —CP, central Pacific; CWP, central western Pacific; EP, eastern Pacific; SP, South Pacific; WSI, western South Indian Ocean; WNP, western North Pacific; WSP, western South Pacific.

	<i>A. gilli</i>		<i>A. idai</i>		<i>A. kanazawai</i>		<i>A. kimurai</i>		<i>A. leptus</i>	
	Present specimen	Collette & Robertson (2001)	Randall & Earle (2008)	Present study	Present study	Present study, Ida & Randall (1993)	Collette & Randall (2000)			
	<i>n</i> = 1	<i>n</i> = 50	<i>n</i> = 10	<i>n</i> = 1	<i>n</i> = 3	<i>n</i> = 23				
Dorsal fin rays	48	44–47	44–46	50	48–49	50–53				
Anal fin rays	22	22–24	21–22	23	23–24	24–25				
Pectoral fin rays	15	14–15	14–16	16	14–15	16–17				
Lateral line scales (tubed + unpored)	ca. 95 + 5	85–94 + 2–5	103–107 + 4–6	ca. 107 or 108 + 5	104–109 + 6–8	114–118 + 4–6				
Predorsal scales	11	10–12	11	13	12	10–12				
Gill rakers on first arch	5 + 22	5–7 + 21–25	5–6 + 21–23	5 + 21	6 + 21–23	6–7 + 22–25				
Vertebrae	33 + 24 = 57	31–33 + 23–26 = 55–58	55–58	34 + 26 = 60	33–34 + 25–27 = 59–61	34–36 + 26–27 = 61–63				
Predoral vertebrae	4	4	6	4	4	No data				
Postdorsal vertebrae	11	11	10	11	12	No data				
Distribution	Shikoku I., Japan, WNP	Tropical EP	Papua New Guinea, CWP	Ogasawara Is., Japan, WNP	Ogasawara Is., Japan, WNP	Pitcairn I., SP				

	<i>A. pylei</i>		<i>A. praematura</i>		<i>A. remmiei</i>		<i>A. vagus</i>		<i>A. xanthops</i>	
	Randall <i>et al.</i> (1994)	Randall & Earle (2008)	Randall & Earle (2008)	Smith (1957)	McCulloch & Waite (1916)	Randall & Heemstra (2008)				
	<i>n</i> = 17	<i>n</i> = 1	<i>n</i> = 3	<i>n</i> = 1	<i>n</i> = 19					
Dorsal fin rays	48–52	48	50–51	48	48					
Anal fin rays	22–25	24	23–24	22	23					
Pectoral fin rays	15–17	14	No data	16	16					
Lateral line scales (tubed + unpored)	109–116 (total)	103–106 + 4	113–116 (tubed)	107 + 5	106–112 + 4					
Predorsal scales	10–13	No data	12	No data	11					
Gill rakers on first arch	5–7 + 23–25	5 + 23	10 + 1 + 20–21	6 + 21	5–6 + 22–25					
Vertebrae	34 + 25–26 = 59–60	58	32 + 26 = 57	No data	57–59					
Predoral vertebrae	4	6	4*	4*	6					
Postdorsal vertebrae	12	10	11*	12*	10					
Distribution	Hawaiian Is., CP	Chagos Arch., WSI	South Africa, WSI	Lord Howe I., WSP	Mozambique, WSI					

* Data from Ida *et al.* (1994)

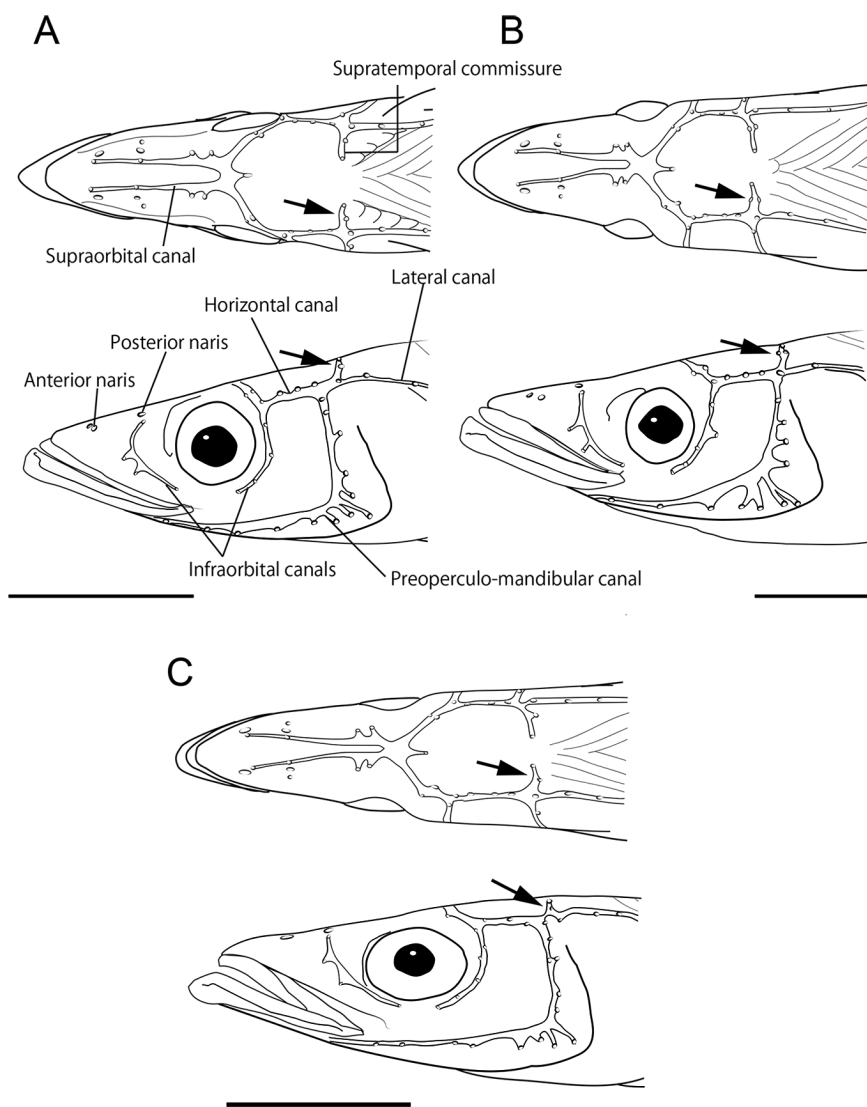


Fig. 3. Dorsal (above) and lateral (below) views of head of the present specimen and two species of *Ammodytoides*. —A: *A. sp.*, BSKU 71207, 59.2 mm SL, B: *A. kimurai*, paratype, 105 mm SL, C: *A. gilli*, USNM 326833, 40.4 mm SL. Bars indicate 5 mm. Arrows indicate pores of supra-temporal commissure.

(6.2% SL vs. 7.9–8.4), a longer predorsal (26.7% SL vs. 23.3–23.9), and deeper caudal peduncle (5.7% SL vs. 4.4–4.9) (Table 1). These differences, however, need further study to determine if proportional changes related with growth are involved as this specimen is smaller than available specimens identified as *A. kimurai*, with regard to coloration when fresh, the pale orange-red of this specimen readily differs from the “bluish gray” described for *A. kimurai* (Fig. 1;

Ida and Randall, 1993). The present specimen also resembles *A. kanazawai* known only from the holotype in the proportions, but differs from it in having 2 pores on the supra-temporal commissure (vs. 3; Fig. 3).

The original descriptions of *A. kimurai* and *A. kanazawai* state they have 2 or 3 pores on the supra-temporal commissure, respectively (Ida and Randall, 1993: fig. 2; Shibukawa and Ida, 2013: fig. 3), but our examination revealed that the holo-

type and two paratypes of *A. kimurai* have 3 pores (Fig. 4B). Hence, these two species are not separable by the character. The lack of branched dorsal fin rays in the holotype of *A. kanazawai* may be a juvenile feature as mentioned above for ontogenetic changes in *A. gilli*. In addition, differences of pigmentation of the dorsal fin in the two species, a series of black spots on the outer edge (absent in *A. kanazawai* at 63.2 mm SL vs. present in *A. kimurai* at 99.4–120.6 mm SL; Ida and Randall, 1993) and numerous fine black dots (present vs. absent), may be attributable to growth as in *A. gilli*. Consequently, additional specimens for the full ranges of size are required to elucidate the variation of these characters and confirm the validity of *A. kanazawai*.

Comparative materials. *Ammodytoides gilli*: USNM 45384, lectotype, 87.2 mm SL, “Dr. Stimpson’s collections from the Pacific, date unknown; USNM 326833, 40.4 mm SL, Panama, Azuero Peninsula, Playa Venao, small lagoon near Tuna Commission Laboratory, in rocky and sandy bottom 2–3 m depth, 29 Apr. 1990. *Ammodytoides kanazawai*: NSMT-P 48606, holotype, 63.2 mm SL, off southern Chichi-jima Island, Ogasawara Islands, Japan, 95–99 m depth, coll. by T. Kanazawa, 19 June 1995. *Ammodytoides kimurai*: NSMT-P 50708, holotype, 101.0 mm SL, off Minami-shima Island, Ogasawara Islands, Japan, coll. by H. Ida and R. L. Pyle, 1 June 1992; NSMT-P 52804 (formerly 2 of FSKU 920601, transferred from the School of Fisheries Sciences, Kitasato University, Iwate), paratypes, same collecting data as holotype, 104.9–116.2 mm SL.

Acknowledgements

We are grateful to Kazunari Kameda (Sea Turtle Association of Japan) for supplying the present specimen and the picture when fresh. We also thank Koichi Shibukawa (Museum of Natural and Environmental History, Shizuoka) for valuable suggestions and critical comments to early manuscript. Our special thanks go to Martin Gomon (Museum Victoria, Melbourne) for editing the English text. This study was partly sup-

ported by a grant from the Fujiwara Natural History Foundation, Tokyo (EK), a Grant-in-Aid for Scientific Research (B) from the Japan Society for the Promotion of Science, Tokyo (24370041) (HE), a Grant-in-Aid of the “Marine Science Project” of the Natural Science Cluster, Science Unit, Kochi University (HE), the “Kuroshio Sougou Project” of the National Museum of Nature and Science, Tsukuba (HE) and the MEXT KAKENHI Grant number 24120001 (GS).

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