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A Revision of the Japanese Sillaginid Fishes

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Abstract Japanese sillaginid fishes are identified as the following four species: *Sillago japonica*, *S. sihama*, *S. parvisquamis* and *S. maculata*. *S. japonica* is the most common species in Japan among the four species, whereas *S. sihama* is rare and is distributed in only the Ryukyu Islands. *S. sihama* previously recorded from coastal waters of Japan by many authors is considered to be misidentification of *S. japonica*.

Japanese sillaginid fishes, which are represented by only one genus *Sillago*, have been recognized as consisting of four species by many authors (e.g., Matsubara, 1955): *S. japonica* Temminck et Schlegel, *S. sihama* (Forsskål), *S. parvisquamis* Gill and *S. maculata* Quoy et Gaimard. However, there has been much taxonomic confusion between the former two species. Since most of *Sillago* specimens collected from Japan have been identified as *S. sihama* according to keys such as Jordan and Snyder (1902) and Matsubara (1955), many workers have believed that this species is very common in Japanese waters compared with *S. japonica*. Tomiyama and Abe (1958) suggested, on the contrary, that the most common species of the genus is not *S. sihama* but *S. japonica*, and that the Japanese *S. sihama* of other authors is more or less doubtfully identified.

In the present paper, to resolve the taxonomic confusion, we examine in detail many Japanese specimens of *Sillago* and give a revised key to the Japanese species of the genus, a detailed description for each species, and a comparison with Taiwan material.

Methods

Counting and measuring procedures follow those used by Hubbs and Lagler (1958). Counts for vertebrae, vertical fin rays and pleural ribs and examination of shape of haemal spines were made from X-ray photographs. Shape of the air bladder and relationships between air bladder and vertebrae were examined in specimens dissected, cleared and stained with Alizarin red-S.

Some of the modified haemal spines are referred to as "L-shaped haemal spines" in the present paper, which are defined as follows: one-third or more of the outer part of the haemal spine runs parallel to the vertebral column.

Abbreviations of museums and institutes are as follows; FUMT: Department of Fisheries, University Museum, University of Tokyo; USNM: U. S. National Museum of Natural History; CAS: California Academy of Sciences; LSJU: L. Stanford Junior University, U. S. A.; URM: Department of Marine Sciences, University of the Ryukyus; YCM: Yokosuka City Museum, Japan; IORD: Institute of Oceanic Research and Development, Tokai University.

A key to the Japanese species of *Sillago*

A_1. Body with blackish blotches on side; anal fin rays 18 or 19.....*S. maculata*

A_2. Body without blackish blotches on side; anal fin rays 21–24.

B_1. Lateral-line scales 78–82; scales above lateral line 7–9; total vertebrae 38 or 39 .....*S. parvisquamis*

B_2. Lateral-line scales 67–73; scales above lateral line 3–6; total vertebrae 33–36.

C_1. Scales above lateral line 5 or 6; cheek scales mostly cycloid; L-shaped haemal spine absent (Taiwan specimens with 0 or sometimes 3–5 L-shaped haemal spines); total vertebrae 33 or 34 (mostly 34)....*S. sihama*

C_2. Scales above lateral line 3 or 4; cheek scales mostly ctenoid; L-shaped haemal spines 7–9; total vertebrae 34–36 (mostly 35) .....*S. japonica*

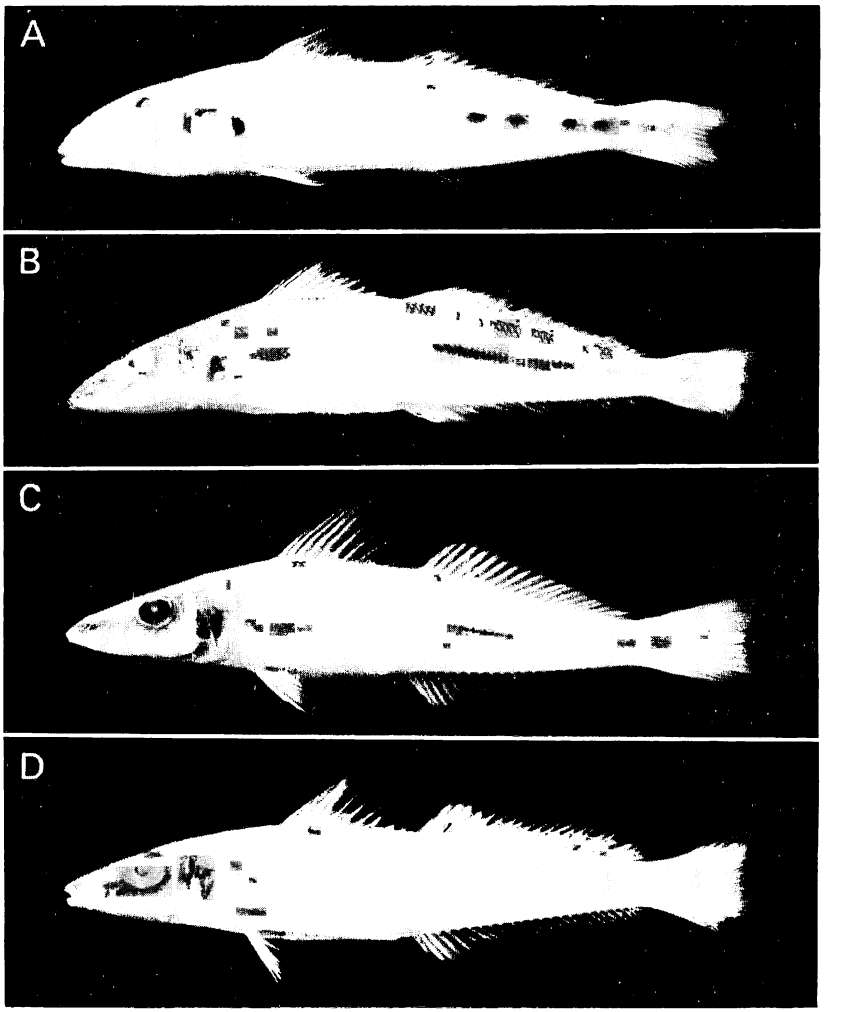

Fig. 1. Four species of *Sillago* from Japan. A, *S. maculata*, FUMT-P 3483, 142 mm SL; B, *S. parvisquamis*, FUMT-P 3471, 178 mm SL; C, *S. sihama*, URM-P 3505, 190 mm SL; D, *S. japonica*, FUMT-P 3401-3, 161 mm SL,

Sillago maculata Quoy et Gaimard
(Japanese name: Hoshigisu)
(Fig. 1A)

Sillago maculata Quoy and Gaimard, 1824: 261, pl. 53, fig. 2 (type locality: Port Jackson, Sydney).

Sillago maculata: Günther, 1860: 245; Gill, 1861: 503, 504 (key and listed); Bleeker, 1877: pl. 389, fig. 5; Pellegrin, 1905: 83 (listed); Fowler, 1929a: 611 (listed); Weber and de Beaufort, 1931: 174; Fowler, 1933: 423; Martin and Montalban, 1934: 224, pl. 1, fig. 2; Anonymous, 1962: 349, fig. 293; Munro, 1967: 347, pl. 47, fig. 560; Fisher and Whitehead, 1974; McKay, 1976: 383; Shao and Chang, 1978: 5, pl. 1, fig. 1 and pl. 2, fig. 1; Masuda et al., 1980: 54 fig. D, 226.

Sillago aeolus Jordan and Evermann, 1902: 360, fig. 24; Jordan and Richardson, 1909: 192, fig. 18.

Material examined. FUMT-P 3476, 3477, 3484, 3490, 4 specimens, 112–138 mm SL (standard length), Ishikawa Beach, Okinawa I., Ryukyu Is., Dec. 13, 1981; FUMT-P 3483, 1 specimen, 142 mm SL, Oura, Okinawa I., Dec. 13, 1981; FUMT-P 3569, 3572, 11 specimens, 101–220 mm SL, Haneji, Okinawa I., Nov. 7, 1982; FUMT-P 4412, 4 specimens, 133–212 mm SL, Tanegashima, Kagoshima Pref., Mar., 1983.

Comparative material. Uncatalogued 2 specimens, 116, 151 mm SL, Taiwan, date unknown.

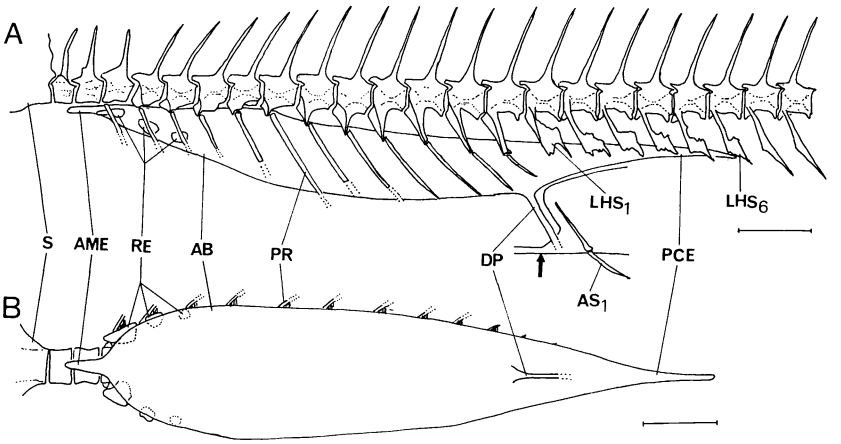

Fig. 2. Air bladder of *Sillago maculata*, FUMT-P 3572-4, 201 mm SL. A, lateral view; B, ventral view. S, skull; PR, pleural rib; AB, air bladder; AME, anterior median extension; PCE, posterior post-coelomic extension; DP, duct-like process; RE, rudimentary extension; ↑, anus; AS_1, 1st anal spine; LHS_n, *n*th L-shaped haemal spine. Scale bars: 10 mm.

Description. Counts and proportional measurements are shown in Table 1.

Body elongate, slightly compressed, tapering from origin of first dorsal fin to caudal peduncle; predorsal profile slightly convex. Snout long, pointed. Interorbital space flat. Mouth small, terminal, somewhat oblique; lower jaw included within the upper; maxillary not reaching below anterior nostril. Both jaws with broad bands of villiform teeth. Vomer with a patch of villiform teeth. Palatine toothless. Nostrils close-set, the anterior with a small flap posteriorly. Posterior edge of preopercle with weak crenulations; a small, conspicuous flat spine on opercle.

Dorsal fins completely separated; the first one higher than the second; first and/or second spines of the first dorsal longest; first ray of the second dorsal longest, other rays gradually decreasing in length posteriorly. Anal fin similar to the second dorsal in shape; origin of the anal opposite that of the second dorsal, both fins subequal in basal length; second ray of the anal longest, sometimes as long as the third one. Pectoral and pelvic fins short, pointed. Caudal fin emarginate.

Body covered with fine ctenoid scales. Head scaly, except for snout and anterior part of the ventral region; cheek with three or four rows of cycloid scales; interorbital space with both cycloid and ctenoid. Dorsal and anal fins without a basal scaly sheath, with a single row of small scales on the membrane just behind each spine and ray. Pectoral, pelvic and caudal fins with small scales.

Air bladder. See Fig. 2. The anterior part with a short median extension (AME), terminating below first or second vertebra; three rudimentary extensions (RE) at the antero-dorsal part of each side; posterior post-coelomic extension (PCE) single, tapering to a point, covered and suspended by L-shaped haemal spines; a duct-like process (DP) filled with gelatinous matter, extending from below 14th or 15th vertebra to near posterior margin of anus.

Color in alcohol: Head and body grayish-brown dorsally, whitish-yellow ventrally. A faint brownish or grayish longitudinal band running on middle of body from behind head to caudal fin base; about 7 or 8 irregular blackish blotches on middle of body and about 8 or 9 oblique blackish bars on back. Upper half of first dorsal fin blackish, the lower half with two blackish longitudinal stripes; two similar blackish stripes on second dorsal fin with a blackish margin (Fig. 3A). Caudal fin yellowish-gray, sometimes the upper and/or lower margins black. Pectoral and pelvic fins whitish-yellow, a black spot at base of the pectoral.

In life, blackish blotches on back and middle of body not apparent; anal and pelvic fins bright

Table 1. Counts and proportional measurements of four species of *Sillago* from Japan.

Characters	*S. maculata*		*S. parvisquamis*		*S. sihama*		*S. japonica*	
	Range	Mean (n)	Range	Mean (n)	Range	Mean (n)	Range	Mean (n)
Standard length in mm	101–220	160 (20)	141–313	216 (25)	104–233	195 (11)	93–198	139 (38)
Counts								
Dorsal fin rays	XI–XII-I, 19–20	XI-I, 19 (20)	XII–XIII-I, 21–23	XII-I, 22 (25)	XI–XII-I, 20–21	XI-I, 21 (11)	X–XIII-I, 21–22	XI-I, 22 (38)
Anal fin rays	II, 18–19	II, 18 (20)	II, 22–24	II, 23 (25)	II, 21–22	II, 22 (11)	II, 21–24	II, 23 (38)
Pectoral fin rays	15–17	16 (20)	15–17	16 (25)	14–16	16 (11)	15–17	16 (37)
Lateral-line scales	69–72	70 (19)	78–82	80 (25)	67–69	68 (11)	70–73	72 (37)
Transverse scales	6–8/11–13	7 (17)/ 12 (18)	7–9/13–15	8 (25)/ 14 (19)	5–6/11	5 (11)/ 11 (11)	3–4/11–12	4 (35)/ 11 (32)
Gill rakers (upper+middle+lower)	1–2+ 1+5–7	2+1+7 (20)	1–2+ 1+5–8	2+1+7 (23)	1–3+ 1+7–9	3+1+8 (4)	2–4+ 1+8–11	3+1+10 (35)
Vertebrae	34	34 (20)	38–39	39 (20)	33–34	34 (11)	34–36	35 (37)
Pleural ribs	11–12	11 (20)	13–14	14 (20)	10–12	11 (11)	11–13	12 (36)
L-shaped haemal spines	3–6	5 (20)	0–4	1 (19)	0	0 (11)	7–9	8 (38)
Measurements in standard length								
Head length	3.18–3.55	3.40 (20)	3.46–3.98	3.79 (25)	3.34–3.64	3.50 (11)	3.13–3.70	3.53 (38)
Body depth	4.45–6.00	5.21 (19)	5.28–7.42	5.83 (21)	4.66–6.12	5.39 (10)	5.14–7.15	5.83 (21)
Snout to origin of dorsal fin base	2.62–2.89	2.78 (20)	2.75–3.07	2.94 (25)	2.71–2.89	2.78 (11)	2.59–3.11	2.85 (38)
Snout to end of dorsal fin base	1.11–1.15	1.13 (20)	1.04–1.13	1.10 (25)	1.08–1.12	1.10 (11)	1.04–1.12	1.10 (38)
Snout to origin of anal fin base	1.56–1.77	1.67 (19)	1.60–1.91	1.77 (25)	1.68–1.86	1.76 (11)	1.67–1.88	1.78 (37)
Snout to end of anal fin base	1.11–1.16	1.14 (20)	1.03–1.12	1.10 (25)	1.09–1.11	1.10 (11)	1.03–1.12	1.09 (37)
Snout to pectoral insertion	3.06–3.40	3.27 (20)	3.28–3.86	3.65 (25)	3.15–3.51	3.38 (11)	3.13–3.63	3.38 (37)
Snout to pelvic insertion	2.86–3.29	3.08 (20)	3.08–3.57	3.40 (25)	2.80–3.35	3.18 (11)	2.94–3.43	3.22 (38)
Measurements in head length								
Snout length	2.05–2.35	2.15 (20)	1.83–2.38	2.26 (25)	2.11–2.31	2.21 (11)	2.25–2.67	2.42 (38)
Eye diameter	3.71–4.89	4.26 (20)	5.29–7.67	6.15 (25)	4.00–5.17	4.76 (11)	4.13–5.50	4.97 (34)
Interorbital space	5.25–6.23	5.65 (20)	4.25–5.43	4.93 (25)	4.82–6.00	5.32 (11)	4.36–5.80	5.10 (38)
Upper jaw length	3.61–4.33	3.95 (19)	4.20–4.93	4.49 (18)	4.29–4.83	4.52 (11)	3.92–4.80	4.28 (38)
Caudal peduncle depth	3.65–4.23	3.91 (20)	4.04–4.93	4.40 (25)	3.73–4.29	3.90 (11)	3.38–4.38	3.81 (38)
Length of first D_1 spine	1.81–2.31	2.12 (20)	1.61–2.00	1.80 (15)	1.60–1.83	1.69 (9)	1.77–2.38	2.05 (35)
Length of second D_1 spine	1.87–2.36	2.09 (19)	1.64–2.03	1.84 (19)	1.57–1.83	1.67 (10)	1.92–2.44	2.09 (33)
Length of first D_2 ray	2.37–3.11	2.75 (20)	2.33–2.93	2.65 (17)	2.41–3.00	2.61 (11)	2.50–3.35	2.85 (33)
Length of second anal spine	4.43–6.25	4.98 (19)	4.09–5.31	4.71 (15)	4.78–6.11	5.48 (10)	4.00–5.80	4.86 (34)
Length of first anal ray	2.95–3.80	3.33 (19)	2.94–4.06	3.39 (20)	3.12–4.46	3.54 (8)	2.85–3.84	3.41 (35)
Length of pectoral fin	1.56–1.81	1.66 (20)	1.59–1.91	1.76 (18)	1.57–2.00	1.69 (11)	1.61–2.06	1.78 (33)
Length of pelvic fin spine	2.54–3.17	2.78 (19)	2.53–3.14	2.89 (16)	2.65–3.22	2.88 (10)	2.61–3.80	3.06 (31)

Table 2. Counts and proportional measurements of four species of *Sillago* from Taiwan.

Characters	*S. maculata*		*S. parvisquamis*		*S. sihama*		*S. japonica*	
					Range	Mean (n)		
Standard length in mm	116	151	144	159	78–195	126 (17)	149	171
Counts								
Dorsal fin rays	XI-I, 19	XI-I, 19	XII-I, 22	XII-I, 21	XI-I, 20–21	XI-I, 21(17)	XI-I, 22	XI-I, 22
Anal fin rays	II, 18	II, 18	II, 23	II, 23	II, 21–22	II, 22 (17)	II, 23	II, 23
Pectoral fin rays	16	16	16	16	15–17	16 (17)	17	16
Lateral-line scales	70	69	79	80	67–71	69 (17)	71	71
Transverse scales	broken	broken/12	7/14	7/14	5–6/10–12	5(17)/11(15)	broken	4/11
Gill rakers (upper+middle+lower)	2+1+6	2+1+5	2+1+6	1+1+6	2–3+1+7–9	2+1+8(12)	3+1+10	4+1+9
Vertebrae	34	34	39	39	33–35	34 (17)	35	35
Pleural ribs	11	11	14	14	11	11 (17)	12	12
L-shaped haemal spines	5	4	0	0	0–5	2 (17)	8	9
Measurements in standard length								
Head length	3.52	3.28	3.60	3.79	3.39–3.71	3.49 (17)	3.67	3.72
Body depth	5.80	4.87	6.00	6.36	5.23–6.79	5.88 (11)	broken	broken
Snout to origin of dorsal fin base	2.86	2.60	2.82	2.94	2.67–2.88	2.81 (17)	2.97	2.95
Snout to end of dorsal fin base	1.12	1.12	1.10	1.14	1.08–1.12	1.10 (17)	1.08	1.10
Snout to origin of anal fin base	1.66	1.70	1.78	1.79	1.69–1.88	1.77 (17)	1.81	1.87
Snout to end of anal fin base	1.14	1.14	1.11	1.14	1.08–1.11	1.10 (17)	1.09	1.10
Snout to pectoral insertion	3.31	3.21	3.51	3.53	3.28–3.52	3.38 (17)	3.45	3.60
Snout to pelvic insertion	3.22	3.21	3.27	3.12	3.02–3.29	3.19 (17)	3.38	3.42
Measurements in head length								
Snout length	2.28	2.24	2.22	2.21	2.17–2.60	2.34 (17)	2.38	2.30
Eye diameter	3.30	4.18	4.21	4.67	3.83–5.50	4.52 (17)	4.26	4.18
Interorbital space	5.50	5.11	5.71	6.00	5.08–6.50	5.71 (17)	5.06	5.41
Upper jaw length	3.88	3.83	4.00	3.82	4.08–4.92	4.46 (16)	4.05	4.38
Caudal peduncle depth	4.13	4.18	5.00	4.94	3.50–4.58	4.10 (17)	4.05	4.38
Length of first D_1 spine	2.28	2.30	1.82	1.91	1.65–2.10	1.83 (16)	1.84	broken
Length of second D_1 spine	2.00	2.04	1.82	2.00	1.56–1.96	1.76 (17)	1.98	2.00
Length of first D_2 ray	3.67	3.68	2.67	2.63	2.26–3.11	2.71 (17)	2.70	2.88
Length of second anal spine	4.71	4.60	5.33	6.00	4.58–6.38	5.24 (15)	4.76	4.18
Length of first anal ray	3.30	3.54	4.00	4.00	3.20–4.45	3.59 (15)	3.38	3.29
Length of pectoral fin	1.65	1.61	1.82	1.79	1.67–2.00	1.76 (16)	broken	broken
Length of pelvic fin spine	2.64	2.71	2.96	3.00	2.57–3.38	2.96 (15)	2.89	broken

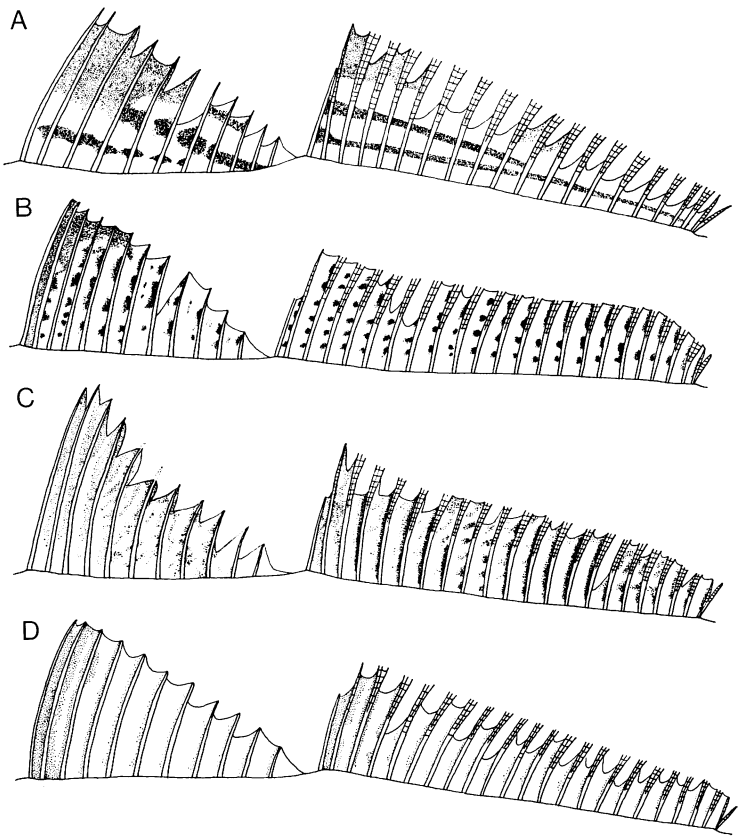

Fig. 3. Dorsal fins of four Japanese species of *Sillago*. A, *S. maculata*, FUMT-P 3483, 142 mm SL; B, *S. parvisquamis*, FUMT-P 3487, 179 mm SL; C, *S. sihama*, FUMT-P 3675, 213 mm SL; D, *S. japonica*, FUMT-P 3406-2, 150 mm SL.

yellow.

Remarks. Most morphological characters of Japanese *S. maculata* agree well with those from Taiwan (Tables 1, 2).

According to the FAO Species Identification Sheet edited by Fisher and Whitehead (1974) and to McKay (personal communication), *S. maculata*, which is widely distributed in the Indo-West Pacific, is separated into three subspecies: *S. m. maculata* Quoy et Gaimard, *S. m. aeolus* Jordan et Evermann and *S. m. burrus* Richardson. McKay informed us that Japanese *S. maculata* is *S. m. aeolus*. In the present paper, however, we do not classify the Japanese *S. maculata* into subspecies, because we were unable to examine any specimens except for those from Japan and Taiwan, and also because McKay is currently preparing a paper on the revision of Indo-Pacific Sillaginidae, including the three subspecies of *S. maculata*.

The Japanese *S. maculata* occurs in Tanegashima and the Ryukyu Islands.

Sillago parvisquamis Gill

(Japanese name: Aogisu, or sometimes Yagisu)

(Fig. 1B)

Sillago parvisquamis Gill, 1861: 505 (type locality: Kanagawa (Tokyo Bay), Japan).

Sillago parvisquamis: Jordan and Snyder, 1902: 487; Franz, 1910: 83 (listed); Jordan et al., 1913: 187 (listed); Jordan and Hubbs, 1925: 248; Tanaka, 1930: 30 (listed); Fowler, 1933: 427; Chang and Chen, 1974: 35, figs. 1, 2; Shao and Chang, 1978: 5, pl. 1, fig. 2 and pl. 2, fig. 2.

Sillago sihama: Tanaka, 1913: 241, pl. 68, fig. 244.

Material examined. FUMT-P 781, 5 specimens,

218–237 mm SL, Morie Bay, Oita Pref., July 2–3, 1980; FUMT-P 782–786, 5 specimens, 223–313 mm SL, mouth of Yoshino River, Tokushima Pref., June–July, 1980; FUMT-P 3471, 1 specimen, 178 mm SL, Morie Bay, Oita Pref., June 11, 1982; FUMT-P 3485, 1 specimen, 254 mm SL, Kita-ku, Kitakyushu, Fukuoka Pref., May 30, 1982; FUMT-P 3486–3488, 3 specimens, 174–179 mm SL, Morie Bay, Oita Pref., June 11, 1982; FUMT-P 4413, 4 specimens, 166–220 mm SL, Fukiage-hama, Kaseda, Kagoshima Pref., June 26, 1982; FUMT-P 4902, 1 specimen, 258 mm SL, Nakatsu, Oita Pref., June 3, 1981; CAS 7092, 2 specimens, 141, 186 mm SL, Tokyo, date unknown; LSJU 7095, 3 specimens, 187–198 mm SL, Wakanoura, Wakayama Pref., date unknown (at CAS now).

Comparative material. Uncatalogued 2 specimens, 144, 159 mm SL, Taiwan, date unknown.

Description. Counts and proportional measurements are shown in Table 1.

Body elongate, slightly compressed, tapering from origin of first dorsal fin to snout tip and caudal fin base. Snout long, conical, pointed. Interorbital space flat. Mouth small, terminal, somewhat oblique; lower jaw included within the upper; maxillary not reaching below anterior nostril. Both jaws with broad bands of villiform teeth, those in the outer rows slightly larger and somewhat conical. Vomer with a patch of villiform teeth. Palatine toothless. Nostrils close-set in front of eye, the anterior with a small flap posteriorly. Posterior edge of preopercle with fine crenulations; opercle with a small, conspicuous flat spine; lower part of posterior edge of subopercle and upper part of posterior edge of interopercle with weak crenulations. Lateral line single, slightly curved in trunk and posteriorly running along middle of body to caudal fin base.

Dorsal fins completely separated, the first one higher than the second; origin of the first above middle of pectoral fin; all spines of the first weak, flexible; the first and/or second spines longest; first ray of the second longest, other rays gradually decreasing in length posteriorly. Anal fin similar to the second dorsal in shape; origin of the anal opposite that of the second dorsal, both fins subequal in basal length; second ray of the anal longest. Pectoral fin pointed, reaching below base of sixth or seventh dorsal spine. Pelvic fin short, not reaching to anus. Caudal fin slightly emarginate, the upper lobe slightly longer than the lower.

Body covered with fine ctenoid scales. Head scaly, except for snout and anterior part of the ventral region; cheek with three or four rows of ctenoid scales, but sometimes with both ctenoid and cycloid; interorbital space with ctenoid. Dorsal and anal fins without a basal scaly sheath, with a single row of small scales on the membrane just behind each spine and ray except for eighth or ninth to last spine of the first dorsal and except for fourth to last ray of anal fin. Pectoral, pelvic and caudal fins with small scales.

Air bladder. See Fig. 4. The anterior part with two long median extensions (AME), terminating on or near each side of the basioccipital (basioccipital not modified in shape); a long complex-branched tube (LTE) at the anterodorsal part of each side, extending anteriorly for a short distance and posteriorly along lateral wall of abdominal cavity, reaching beyond first L-shaped haemal spine; posterior post-coelomic extension (PCE) double, tapering to a point, covered and suspended by L-shaped and modified haemal spines, sometimes one extension longer than the other; a duct-like process (DP) filled with gelatinous matter, extending from below 15th or 16th vertebra to near posterior margin of anus.

Color in alcohol: Head and body grayish-brown dorsally, whitish-yellow ventrally. A faint grayish longitudinal band running on middle of body from behind head to caudal fin base. First dorsal fin with ill-defined blackish spots, sometimes forming a vertical stripe on the membrane in front of each spine; second dorsal fin also with the similar blackish spots on the membrane just in front of each ray (Fig. 3B). Caudal fin yellowish-gray. Anal fin translucent. Pectoral and pelvic fins whitish-yellow.

In fresh specimens, anal and pelvic fins bright yellow.

Remarks. Most morphological characters of Japanese *S. parvisquamis* agree well with those from Taiwan (Tables 1, 2).

In the course of the present study, *S. parvisquamis* is recognized to be locally distributed in Kyushu and Shikoku (Yoshino River), but not in Tokyo Bay, Ise Bay and Wakanoura, where this species was commonly found until about the 1960's.

Our collecting data indicates that the habitat

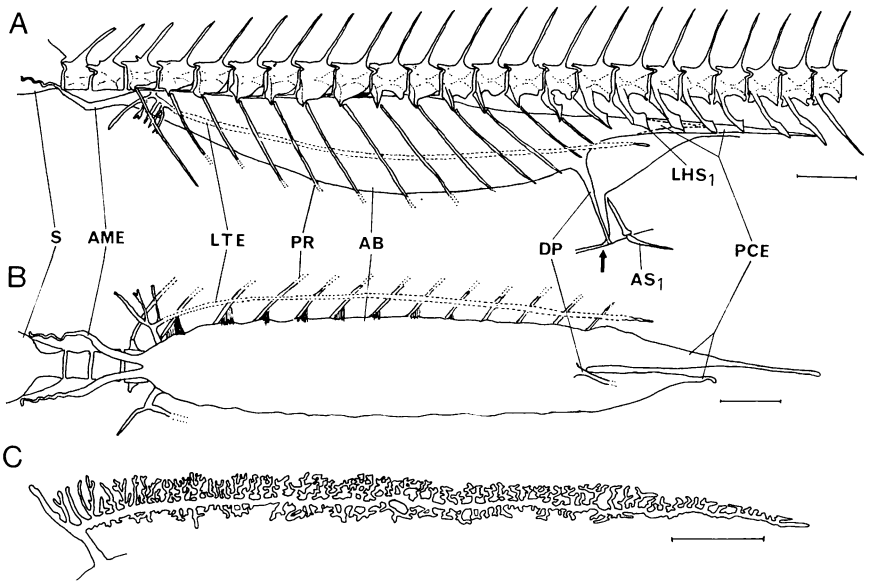

Fig. 4. Air bladder of *Sillago parvisquamis*, FUMT-P 782, 264 mm SL. A, lateral view; B, ventral view; C, inner lateral view of left lateral tubular extension (LTE). Abbreviations are the same as in Fig. 2. This specimen has only one L-shaped haemal spine. Scale bars: 10 mm.

of *S. parvisquamis* is the estuary zone near large rivers where tidelands are well developed. To our regret, in recent years this habitat has been destroyed by reclamation and river and coastal water pollution, especially in Tokyo Bay and Ise Bay.

Sillago sihama (Forsskål)
(Japanese name: Motogisu)
(Fig. 1C)

Atherina sihama Forsskål, 1775: 70 (type locality: Lohajae, Red Sea).

Sillago sihama: Rüppell, 1828: 9, pl. 3, fig. 1; Bleeker, 1877: pl. 389, fig. 4; Fowler and Bean, 1923: 68; Weber and de Beaufort, 1931: 172, fig. 33; Fowler, 1933: 417; Martin and Montalban, 1934: 222, pl. 1, fig. 1; Anonymous, 1962: 350, fig. 294; Chu et al., 1963: 239, fig. 184; Munro, 1967: 347, pl. 47, fig. 652; Fisher and Whitehead, 1974; McKay, 1976: 381, fig. 1; Shao and Chang, 1978: 9, pl. 1, fig. 3 and pl. 2, fig. 3; Senou and Suzuki, 1980: 67, pl. 2, fig. A.

? *Sillago sihama*: Günther, 1860: 243; Gill, 1861: 503, 504 (key and listed); Jordan and Evermann, 1902: 360 (listed); Pellegrin, 1905: 83 (listed); Jordan and Richardson, 1909: 192 (listed); Fowler, 1927: 286 (listed); Fowler, 1928: 235; Fowler, 1929a: 611 (listed); Fowler, 1929b: 654 (listed); Fowler, 1931: 302 (listed).

Material examined. URM-P 3006, 3007, 2 specimens, 208, 204 mm SL, Haneji, Okinawa I., Mar. 21, 1982; URM-P 3502–3505, 4 specimens, 190–206 mm SL, mouth of Teima River, Okinawa I., July 5, 1982; URM-P 3526, 1 specimen, 193 mm SL, Haneji, Okinawa I., July 19, 1982; YCM-SSP 10127, 1 specimen, 104 mm SL, mouth of Yonada River, Iriomote I., Ryukyu Is., July 27, 1980; IORD 81-104, 1 specimen, 233 mm SL, mouth of Ayanda River, Iriomote I., July 27, 1981; FUMT-P 3675, 3676, 2 specimens, 213, 194 mm SL, mouth of Teima River, Okinawa I., July 3, 1982.

Comparative material. Uncatalogued 2 specimens, 109, 113 mm SL, Taiwan, date unknown; FUMT-P 1916–1921, 10 specimens, 78–195 mm SL, Tongxiao, Taiwan, July 18, 1981; YCM-P 7821, 5 specimens, 105–149 mm SL, Kaushun, Taiwan, Dec. 4, 1977.

Description. Counts and proportional measurements are shown in Table 1.

Body elongate, slightly compressed, tapering from origin of first dorsal fin to snout tip and caudal peduncle. Snout long, conical, pointed. Interorbital space flat. Mouth small, terminal, somewhat oblique; lower jaw included within the upper; maxillary not reaching below anterior nostril. Both jaws with broad bands of villiform teeth, those in the outer rows slightly enlarged and rather conical. Vomer with a patch of villiform teeth. Palatine toothless.

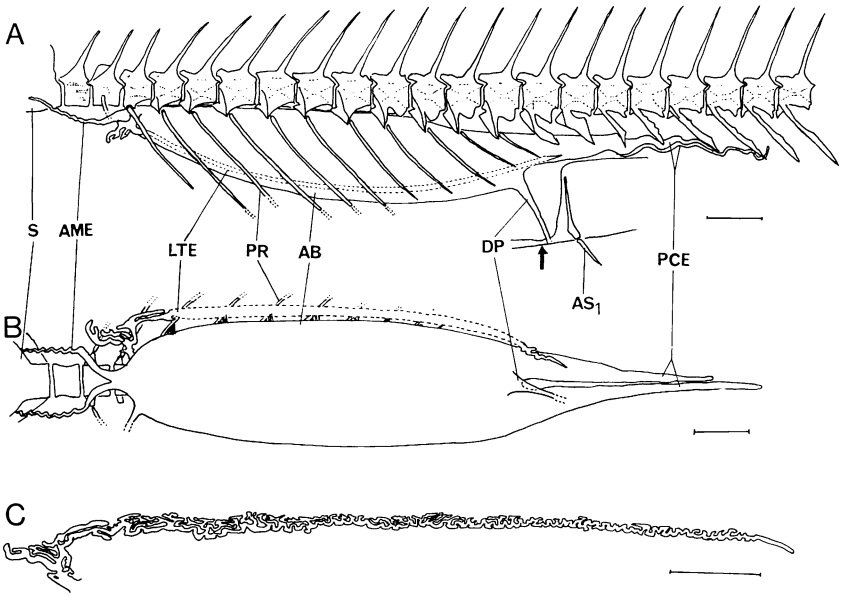

Fig. 5. Air bladder of *Sillago sihama*, FUMT-P 3675, 213 mm SL. A, lateral view; B, ventral view; C, inner lateral view of left lateral tubular extension (LTE). Abbreviations are the same as in Fig. 2. This Japanese specimen has no L-shaped haemal spine. Scale bars: 10 mm.

Nostrils close-set in front of eye, the anterior with a small flap posteriorly. Posterior edge of preopercle with weak crenulations; a small, conspicuous flat spine on opercle; posterior edges of subopercle and interopercle smooth or sometimes with weak crenulations. Lateral line single, slightly curved in trunk and posteriorly running along middle of body to caudal fin base.

Dorsal fins completely separated; the first one higher than the second; origin of the first above middle of pectoral fin; all spines of the first weak, flexible; the first and/or second spines longest; first ray of the second longest, other rays gradually decreasing in length posteriorly. Anal fin similar to the second dorsal in shape; origin of the anal opposite that of the second dorsal, both fins subequal in basal length; second ray of the anal longest, sometimes as long as the third one. Pectoral fin pointed, reaching below base of seventh or eighth dorsal spine. Pelvic fin short, not reaching to anus. Caudal fin slightly emarginate, the upper lobe slightly longer than the lower.

Body covered with fine ctenoid scales. Head scaly, except for snout and anterior part of the ventral region; cheek with two or three rows of cycloid scales, but sometimes partly with ctenoid scales; interorbital space with both cycloid and ctenoid scales. Dorsal and anal fins without a basal scaly sheath, with a single row of small scales on the membrane just behind each spine and ray. Pectoral, pelvic and caudal fins with small scales.

Air bladder. See Fig. 5. The anterior part with two long median extensions (AME), terminating on or near each side of basioccipital (basioccipital not modified in shape); a long complex-branched tube (LTE) at the antero-dorsal part of each side, extending anteriorly for a short distance and posteriorly along lateral wall of abdominal cavity, reaching near 14th vertebra; posterior post-coelomic extension (PCE) double, tapering to a point, covered and suspended by modified (not L-shaped) haemal spines, sometimes one extension longer than the other; a duct-like process (DP) filled with gelatinous matter, extending from below 13th or 14th vertebra to near posterior margin of anus.

Color in alcohol: Head and body grayish-brown dorsally, whitish-yellow ventrally. A faint brownish or grayish longitudinal band running on middle of body from behind head to caudal fin base. Dorsal fins blackish, minute dots on the membrane; the dots of the second

dorsal forming a blackish vertical stripe in front of each ray (Fig. 3C). Caudal fin yellowish-gray, sometimes the upper and/or lower margins black. Anal fin translucent. Pectoral and pelvic fins whitish-yellow.

In fresh specimens, anal and pelvic fins bright yellow.

Remarks. Most morphological characters of Japanese *S. sihama* agree well with those from Taiwan except for the L-shaped haemal spine: ten Taiwan specimens of the 17 examined lack L-shaped haemal spines, and the others have three to five L-shaped haemal spines (all Japanese specimens without any L-shaped ones) (Tables 1, 2).

Both *S. sihama* and *S. japonica* have been recorded as being widely distributed in Japanese coastal waters by many authors (e.g., Steindachner and Döderlein, 1884; Jordan and Snyder, 1902; Jordan et al., 1913; Jordan and Thompson, 1914; Matsubara, 1955). Their *S.* "*sihama*" has been distinguished from *S.* "*japonica*" in having four or rarely five scales above lateral line (three scales in *S.* "*japonica*") and cycloid scales on cheek and interorbital space (ctenoid scales in *S.* "*japonica*").

However, the following three reasons lead us to the conclusion that their *S.* "*sihama*" is probably a misidentification of *S. japonica*: 1) *S. sihama* has five or six scales above the lateral line, whereas *S. japonica* has three or four scales, as noted by Munro (1967) and McKay in Fisher and Whitehead (1974) (see Table 1); 2) it is possible that many authors noticed cycloid scales on cheek and interorbital space of *S. japonica*, since these areas are sometimes covered with both ctenoid and cycloid scales, as mentioned by Kakuda (1970); 3) our examination suggests that *S. sihama* occurs only in the Ryukyu Islands, while *S. japonica* is widely distributed around Japan except for northern Hokkaido and the Ryukyu Islands.

The junior author, K. Mochizuki, reexamined two specimens (USNM 49804, 59669) collected from Tokyo and Yamagawa (probably Yanagawa, Fukuoka Pref.) and identified as *S.* "*sihama*" by Fowler and Bean (1923). He found them to be *S. japonica*. McKay (personal communication) also had not found *S. sihama* in many specimens reported to be that species from Japan.

Sillago japonica Temminck et Schlegel
(Japanese name: Shirogisu)
(Fig. 1D)

Sillago japonica Temminck and Schlegel, 1842: 23, pl. 10, fig. 1 (type locality: Japan).

Sillago japonica: Richardson, 1845: 223; Bleeker, 1858: 11; Günther, 1860: 244; Gill, 1861: 503, 504 (key and listed); Bleeker, 1877: pl. 389, fig. 6; Steindachner and Döderlein, 1884: 24; Nyström, 1887: 29 (listed); Steindachner, 1896: 208; Jordan and Snyder, 1901: 369 (listed); Jordan and Snyder, 1902: 487; Smith and Pope, 1906: 478 (listed); Franz, 1910: 83 (listed); Jordan et al., 1913: 187 (listed); Jordan and Thompson, 1914: 260 (listed); Fowler and Bean, 1923: 69; Jordan and Hubbs, 1925: 248; Fowler, 1929b: 654 (listed); Schmidt and Lindberg, 1930: 1141 (listed); Fowler, 1931: 302 (listed); Schmidt, 1931a: 112 (listed); Schmidt, 1931b: 77 (listed); Weber and de Beaufort, 1931: 173; Fowler, 1933: 425; Tomiyama and Abe, 1958: 1171, pl. 229, fig. 581; Anonymous, 1962: 351, fig. 295; Chu et al., 1963: 240, fig. 185; Munro, 1967: 347, pl. 47, fig. 651; Shao and Chang, 1978: 9, pl. 1, fig. 5 and pl. 2, fig. 5; Masuda et al., 1980: 54 fig. C, 226.

Sillago acuta: Bleeker, 1853: 28.

? *Sillago sihama*: Steindachner and Döderlein, 1884: 24.

Sillago sihama: Jordan and Snyder, 1902: 486; Smith and Pope, 1906: 478 (listed); Franz, 1910: 83 (listed); Jordan et al., 1913: 187 (listed); Jordan and Thompson, 1914: 259 (listed); Tanaka, 1930: 30 (listed).

Material examined. FUMT-P 3401, 4 specimens, 103–161 mm SL, Shiga, Ishikawa Pref., June 27, 1982; FUMT-P 3402, 3 specimens, 149–184 mm SL, Kada, Mie Pref., June 28, 1982; FUMT-P 3403, 2 specimens, 149, 198 mm SL, Tanabe, Wakayama Pref., June 27, 1982; FUMT-P 3404, 4 specimens, 101–173 mm SL, Meiwa, Mie Pref., June 27, 1982; FUMT-P 3405, 3 specimens, 97–131 mm SL, Awajishima, Hyogo Pref., June 27, 1982; FUMT-P 3406, 3 specimens, 144–150 mm SL, Kasumi, Hyogo Pref., June 27, 1982; FUMT-P 3407, 4 specimens, 96–152 mm SL, Irako, Aichi Pref., June 27, 1982; FUMT-P 3408, 3 specimens, 118–181 mm SL, Koto, Kamitsushima, Nagasaki Pref., June 27, 1982; FUMT-P 3409, 3 specimens, 123–185 mm SL, Susa, Yamaguchi Pref., June 27, 1982; FUMT-P 3410, 2 specimens, 170, 175 mm SL, Niihama, Hiroshima Pref., June 27, 1982; FUMT-P 3411, 3 specimens, 98–137 mm SL, Mikuni, Fukui Pref., June 25, 1982; FUMT-P 3473, 3489, 2 specimens, 125, 115 mm SL, Morie Bay, Oita Pref., June 11, 1982; FUMT-P 3513, 1 specimen, 200 mm SL, Nishinoshima, Oki, Shimane

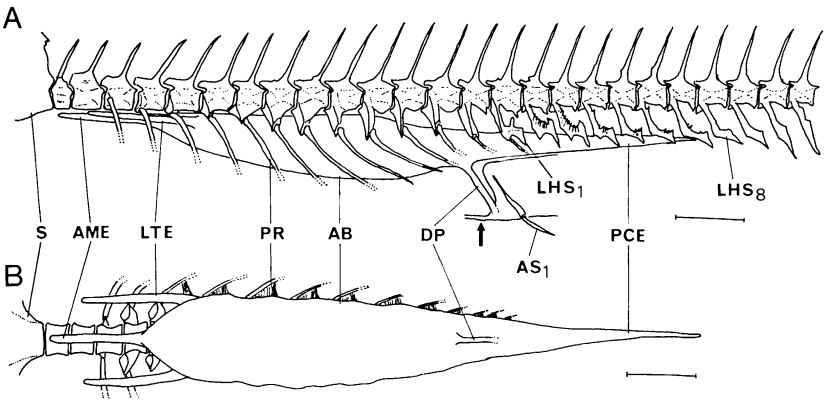

Fig. 6. Air bladder of *Sillago japonica*, FUMT-P 3513, 200 mm SL. A, lateral view; B, ventral view. Abbreviations are the same as in Figs. 2 and 4. Scale bars: 10 mm.

Pref., June 27, 1982 (not measured but dissected, cleared and stained); USNM 49804, 1 specimen, 150 mm SL, Tokyo, date unknown; USNM 59669, 1 specimen, 93 mm SL, Yamagawa (probably Yanagawa, Fukuoka Pref.), 1903.

Comparative material. Uncatalogued 2 specimens, 149, 171 mm SL, Taiwan, date unknown.

Description. Counts and proportional measurements are shown in Table 1.

Body elongate, slightly compressed, tapering from origin of first dorsal fin to snout tip and caudal peduncle. Both jaws and vomer with broad bands and a patch of villiform teeth, respectively. Palatine toothless. Posterior edge of preopercle with weak crenulations; a small, conspicuous flat spine on opercle. Caudal fin slightly emarginate.

Body covered with fine ctenoid scales. Head scaly, except for snout and anterior part of the ventral region; cheek with three rows of ctenoid scales, but sometimes partly with cycloid scales; interorbital space with ctenoid, and sometimes cycloid scales. Dorsal and anal fins without a basal scaly sheath, but with a single row of small scales on the membrane just behind each spine and ray.

Air bladder. See Fig. 6. The anterior part with a median extension (AME), terminating below first vertebra; a short, simple extension (LTE) at the antero-dorsal part of each side, extending anteriorly to second vertebra; posterior post-coelomic extension (PCE) single, tapering to a point, covered and suspended by L-shaped haemal spines; a duct-like process (DP) filled with gelatinous matter, extending from below 13th or 14th vertebra to near posterior margin of anus.

Color in alcohol: Head and body grayish-brown dorsally, whitish-yellow ventrally. A faint brownish or grayish longitudinal band running on middle of body from behind head to caudal fin base. Anterior parts of first and second dorsal fins blackish, remainder transparent with minute blackish dots partly (Fig. 3D). Caudal fin yellowish gray, sometimes the upper and/or lower margins black. Anal fin translucent. Pectoral and pelvic fins whitish-yellow.

Remarks. See remarks on *S. sihama*. Most morphological characters of Japanese *S. japonica* agree well with those from Taiwan (Tables 1, 2).

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日本産キス類の再検討

佐野光彦・望月賢二

日本産キス類について再検討したところ，*Sillago japonica* シロギス，*S. sihama* モトギス，*S. parvisquamis* アオギス（別名ヤギス），*S. maculata* ホシギスの 4 種を区別することができた．従来，日本から

S. "*sihama*" として報告されてきたものは *S. japonica* の誤同定であると考えられる．*S. japonica* は日本各地の沿岸で極く普通に見られるが，*S. sihama* は琉球列島以南に分布しており，それ以外の日本各地からは発見できなかった．

以上の4種の記載を行ない，key を作製した．

(佐野：113 東京都文京区弥生 1-1-1 東京大学農学部水産学科； 望月：113 東京都文京区本郷 7-3-1 東京大学総合研究資料館水産動物部門)