

## Records of Three Shrimp-goby Species (Teleostei, Perciformes, Gobiidae) from the Ryukyu Archipelago, Japan

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**Abstract** Three shrimp-associated gobies, *Cryptocentrus fasciatus*, *Flabelligobius russus* and *Flabelligobius smithi*, were recently collected from Iriomote-jima Island, Yaeyama Islands of the Ryukyu Archipelago, Japan. Their occurrences represent the first record from Japanese waters and, also, the northernmost record for these species. Morphological features of the Japanese specimens of these species are described. *F. russus* has been frequently placed in *Cryptocentrus* in previous literature, but the species has a longitudinal pattern of sensory-papillae rows on the cheek (vs. distinct transverse pattern in *Cryptocentrus*), a uniserial transverse row of sensory papillae just behind the chin (vs. a pair of short longitudinal rows of sensory papillae), and the well-developed membrane between ventral arm of first gill arch and inner surface of buccal cavity (vs. not developed), characters which agree with the current diagnosis of *Flabelligobius*. The Japanese specimen of *F. smithi* has an intermediate condition between *F. smithi* (previously known only by three specimens from Taiwan) and its closest congener, *F. fourmanoiri* (known only by the holotype from Madagascar), in some proportional measurements and meristic counts. The Japanese specimen is, however, provisionally identified here as *F. smithi*, judging from other diagnostic characters listed in the original description (e.g., number of pectoral-fin rays and configuration of sensory-papillae rows on cheek) and by a new character: elongation of first dorsal-fin spines, viz., anterior two spines elongate and filiform in *F. fourmanoiri* vs. only a single (=first) spine elongate in *F. smithi*.

**Key words:** *Cryptocentrus fasciatus*, *Flabelligobius russus*, *Flabelligobius smithi*, new record, Japan.

Recently, a single specimen each of three shrimp-associated goby species, i.e., *Cryptocentrus fasciatus*, *Flabelligobius russus* and *Flabelligobius smithi*, all of which had not been formally recorded from the Japanese waters by voucher specimens, were collected from Iriomote-jima Island, Yaeyama Islands of the Ryukyu Archipelago, Japan. We report here these species as first record from Japanese waters, and describe their morphological aspects in detail.

### Materials and Methods

All specimens examined are housed in the following institutions: Kanagawa Prefectural Muse-

um, Odawara (KPM); National Science Museum, Tokyo (NSMT); Natural History Museum, London (BMNH); Osaka Museum of Natural History, Osaka (OMNH); University of the Ryukyus, Okinawa (URM).

Measurements were made point-to-point with calipers under a dissecting microscope to the nearest 0.01 mm. The methods for measurements follow those of Hubbs and Lagler (1958), with exceptions given below (the snout tip refers to the mid-anteriormost point of the upper lip): interorbital width is the least width between innermost rims of right and left eyes; jaw length is measured between the snout tip and the posteriormost point of lip; head width and depth are

measured at preopercular margin; body depth is measured at the anal-fin origin; nape width is measured between dorsalmost ends of gill openings; preanal and prepelvic lengths are measured from the snout tip to the origin of each fin; pectoral-fin length is measured from the base to the tip of the longest ray; pelvic-fin length is measured between the base of pelvic-fin spine and the distal tip of the longest segmented ray; heights of pelvic-fin frenum and connecting membrane are least heights; lengths of fin spines and rays are measured between the base to distal tip of each ray. Methods for counts follow Akihito (1984), except for the following: longitudinal scale count is the number of oblique (anterodorsal to posteroventral) scale rows and is taken from just dorsal to the upper attachment of the opercular membrane posteriorly to the mid-base of caudal fin; three methods of transverse scale count are taken (see descriptive accounts); circumpeduncular scale count is the number of scales along a zigzag vertical line through the narrowest point of the caudal peduncle; gill rakers are counted on the outer side of first arch, including all rudiments; count of pseudobranchial filaments includes all rudiments. Scales (except for predorsal and circumpecuncular scales) and paired-fin rays are counted bilaterally; in the descriptions of *Cryptocentrus fasciatus* and *Flabelligobius smithi* (based only on a single specimen each), the values are separated by a slash, the first value representing the left count. Osteological features are observed from radiographs. The methods of Akihito (1984) are used in describing the pattern of the interdigitation of the dorsal-fin pterygiophores between the neural spines ("P-V"). Cephalic sensory canals and papillae are observed on specimens stained with Cyanine Blue, and notations on them follow Akihito (1984) and Miller (1986), respectively. All fish lengths given are standard lengths (SL). Species are arranged in alphabetical order.

*Cryptocentrus fasciatus* (Playfair in Playfair & Günther, 1867)

(New Japanese name: Murasame-haze)

(Figs. 1A & 2A; Table 1)

*Gobiosoma fasciatum* Playfair in Playfair and Günther, 1867: 72 (original description; type locality, Zanzibar).  
*Cryptocentrus* sp. 2: Senou *et al.*, 2004: 325 (Iriomotejima Island, Japan)

*Material examined.* OMNH-P 15518, 1 specimen (male), 48.0 mm SL, off Midara, Iriomotejima Island, Yaeyama Island of Ryukyu Archipelago, Japan, 12 m depth, 6 Nov. 2000, collected by K. Yano.

*Description.* Following description based only on the Japanese specimen examined (OMNH-P 15518).

Dorsal-fin rays VI-I, 10; anal-fin rays I, 9; pectoral-fin rays 16/16; pelvic-fin rays I, 5/I, 5; segmented caudal-fin rays 9+8, including 7+6 branched rays; upper and lower unsegmented caudal-fin rays 5 and 5, respectively; longitudinal scales 79/77; transverse scales from anal-fin origin upward and forward to base of first dorsal fin 33/31; transverse scales from anal-fin origin upward and backward to base of second dorsal fin 27/26; transverse scales from origin of second dorsal fin downward and backward to anal-fin base 28/29; circumpeduncular scales 34; gill rakers 2+11; pseudobranchial filaments 12; vertebrae 10+16=26; P-V 3/II II I I 0/9; anal-fin pterygiophores anterior to first haemal spine 2; epural 1.

Proportional measurements are given in Table 1. Head subcylindrical, slightly compressed (its width 81.5% of depth). Snout slightly longer than eye diameter (snout length 104.2% of eye diameter). Interorbital space concave, its width narrower than pupil diameter. Distinct, V-shaped deep trough on occipital just behind eyes. Jaws equal; posterior end of jaws extending slightly beyond vertical line through posterior margin of eye. Posteroventral margin of lower lip interrupted at symphysis. Anterior nasal opening a short tube at anterior margin of snout; no fleshy flap at tip of anterior naris; posterior nasal opening a pore, lo-

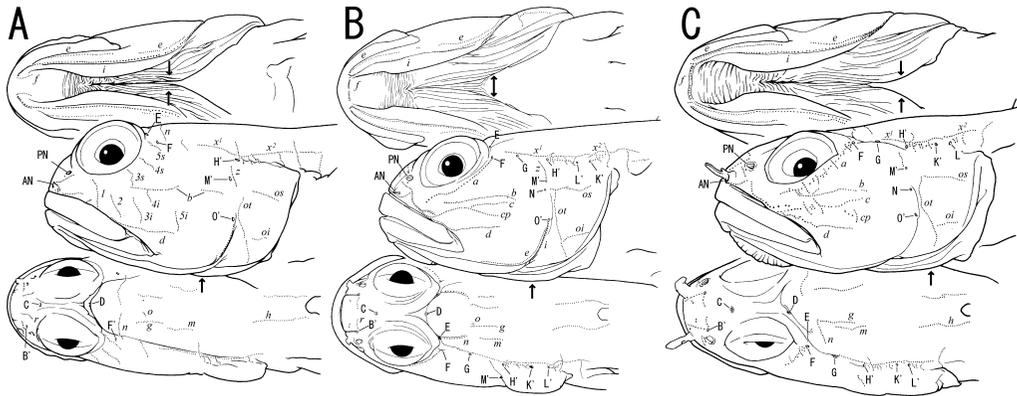


Fig. 1. Ventral (top), lateral (middle), and dorsal (bottom) views of heads of three shrimp-associated gobies from Japan, showing cephalic sensory canal pores (open circles with roman uppercase letters, except for AN and PN) and papillae (dots with roman lowercase letters). A) *Cryptocentrus fasciatus*, OMNH-P 15518, 48.0 mm SL; B) *Flabelligobius russus*, OMNH-P 18055, female, 60.8 mm SL; C) *Flabelligobius smithi*, NSMT-P 68764, male, 54.5 mm SL. AN and PN, anterior and posterior nostrils, respectively. Arrows show position where gill membrane is attached to isthmus. Drawn by K. Shibukawa.

Table 1. Proportional measurements of three shrimp-associated goby species

|                                  | <i>Cryptocentrus fasciatus</i> |              | <i>Flabelligobius russus</i> |                    | <i>Flabelligobius smithi</i> |
|----------------------------------|--------------------------------|--------------|------------------------------|--------------------|------------------------------|
|                                  | OMNH-P 15518                   | OMNH-P 18055 | All 17                       | specimens examined | NSMT-P 68764                 |
|                                  | Male                           | Female       |                              |                    | Male                         |
| SL (mm)                          | 48.0                           | 60.8         | 60.8–101.1                   |                    | 57.5                         |
| Measurements in % of SL          |                                |              |                              |                    |                              |
| Head length                      | 31.4                           | 29.0         | 26.4–30.9                    |                    | 29.2                         |
| Snout length                     | 7.8                            | 7.3          | 6.0–7.9                      |                    | 5.8                          |
| Eye diameter                     | 7.4                            | 7.6          | 5.8–8.3                      |                    | 6.9                          |
| Interorbital width               | 1.8                            | 2.2          | 1.5–2.5                      |                    | 2.2                          |
| Nape width                       | 11.9                           | 7.8          | 11.5–13.1                    |                    | 10.9                         |
| Head width                       | 15.0                           | 15.9         | 14.0–16.1                    |                    | 14.9                         |
| Head depth                       | 18.4                           | 18.1         | 17.5–19.4                    |                    | 15.8                         |
| Jaw length                       | 15.8                           | 13.5         | 11.8–13.8                    |                    | 13.2                         |
| Body depth                       | 16.1                           | 16.6         | 16.3–19.5                    |                    | 13.7                         |
| Body width                       | 12.0                           | 13.0         | 11.5–19.7                    |                    | 12.0                         |
| Predorsal length                 | 37.6                           | 33.8         | 29.9–34.8                    |                    | 30.9                         |
| Prepelvic length                 | 33.6                           | 34.2         | 29.1–34.2                    |                    | 31.5                         |
| Preanal length                   | 60.2                           | 59.8         | 57.4–61.9                    |                    | 59.9                         |
| Caudal-peduncle length           | 17.3                           | 16.4         | 15.2–17.8                    |                    | 13.1                         |
| Caudal-peduncle depth            | 10.2                           | 10.6         | 10.4–11.7                    |                    | 8.9                          |
| Length of first dorsal-fin base  | 20.3                           | 21.8         | 21.5–25.6                    |                    | 24.6                         |
| Length of second dorsal-fin base | 30.9                           | 30.5         | 27.6–32.9                    |                    | 36.4                         |
| Length of anal-fin base          | 24.2                           | 25.4         | 23.3–28.2                    |                    | 30.2                         |
| Pectoral-fin length              | 22.4                           | 23.0         | 18.8–24.3                    |                    | 22.5                         |
| Pelvic-fin length                | 25.0                           | 21.6         | 17.8–21.6                    |                    | 22.3                         |
| Caudal-fin length                | 28.1                           | 31.7         | 27.8–38.4                    |                    | 28.7                         |

cated at a point slightly closer to eye than to base of anterior nasal tube. Tip of tongue blunt, without distinct notch in anterior margin, free from floor of mouth. Gill opening wide, extending anteriorly beyond vertical line through posterior margin of preopercle; gill membranes attach to isthmus. Gill rakers on outer surface of ventral arm of first arch moderately developed, long and thin; rakers on outer surface of dorsal arm of first arch rudimentary; first gill slit well open.

Scales on body small and cycloid; nape fully scaled, scales on predorsal midline reaching anteriorly to slightly behind eye; scales on midline before pelvic fin extending anteriorly to a vertical through posterior margin of preopercle; head and pectoral-fin base naked.

Teeth in both jaws unicuspid, slightly inwardly curved; on both jaws, teeth on outermost row larger than teeth on inner rows; upper jaw with 3–4 rows of teeth anteriorly, narrowing to single row posteriorly; teeth on anterolateral part of outermost row of upper jaw largest; teeth on innermost row slightly larger than teeth on just outer row, strongly inwardly curved; lower jaw with 5–6 rows of teeth anteriorly, narrowing to single row posteriorly; 3–4 enlarged teeth on middle part of middle row (anterior second tooth of these largest within lower-jaw teeth); no teeth on vomer or palatine.

Pattern of cephalic sensory systems are illustrated in Fig. 1A. Posterior oculoscapular canal absent; anterior oculoscapular canal with pores B', C (unpaired); D (unpaired); E, F and H'; preopercular canal with pores M' and O'. Sensory-papillae rows on cheek forming well-developed transverse pattern; five rows of transverse rows of sensory papillae below eye (i.e., rows 1–5), posterior three transverse rows (i.e., rows 3, 4 and 5) interrupted at midway by longitudinal sensory-papillae row b; a pair of short longitudinal rows of sensory papillae just behind chin (=row f).

*Coloration of freshly collected material (based on color slide, Fig. 2A).* Ground color of head and body dull-yellowish orange (becoming darker dorsally) with light or pale yellow pectoral-fin base, breast and belly; numerous dense, short, di-

agonal dull pale-sky blue lines on head, nape and occipital regions; iris pale gold; several minute pale sky-blue spots on base of pectoral fin; first dorsal fin dull yellowish-orange, with narrow pale area just behind each of first to fifth spines; transversely-elongate blackish blotch between first and second spines of first dorsal fin; ground color of second dorsal fin dull-yellowish orange, becoming paler distally; narrow pale sky-blue submarginal stripe on distal part of second dorsal fin; 5–7 irregular rows of pale sky-blue short transverse lines on each interradiation membrane of second dorsal fin; anal fin dull yellowish-orange basally, dark grayish brown distally, with four rows of pale sky or sky blue broken lines; caudal fin dull yellowish-orange; pectoral fin with dull yellowish-orange rays and translucent membrane; pelvic fin dull-yellowish orange, becoming darker distally, with numerous pale sky-blue spots.

*Color in alcohol.* Similar to freshly-collected coloration, except as follows: general coloration of head, body and fins becoming paler; color tinged with blue or yellow on head, body and fins faded.

*Distribution and habitat.* Red Sea and Indo-West Pacific from east coast of Africa to Melanesia, Great Barrier Reef (Randall *et al.*, 1993); Iriomote-jima Island, Yaeyama Islands of Ryukyu Archipelago, Japan (present study).

The present specimen was collected from the sandy-mud bottom with small pieces of dead-coral rubble. Symbiotic association with the snapping shrimp, *Alpheus bellulus*, was confirmed by KY before the specimen was collected. In the habitat, several other shrimp-associated gobies, e.g., species of *Cryptocentrus* (*C. sp. B sensu Senou et al.*, 2004), *Vanderhorstia* (*V. ambanoro*, *V. ornatissima*, and *V. sp. A sensu Senou et al.*, 2004), *Myersina nigirivirgata*, and *Tomiyamichthys oni* were also found.

*Remarks.* Almost all features of the present specimen agree well with the original description of *Gobiosoma fasciatum* made by Playfair in Playfair and Gunther (1876), as well as the descriptions and figures of *Cryptocentrus fasciatus* provided by subsequent authors (e.g., Smith, 1959; Polunin & Lubbock, 1977; Randall *et al.*,

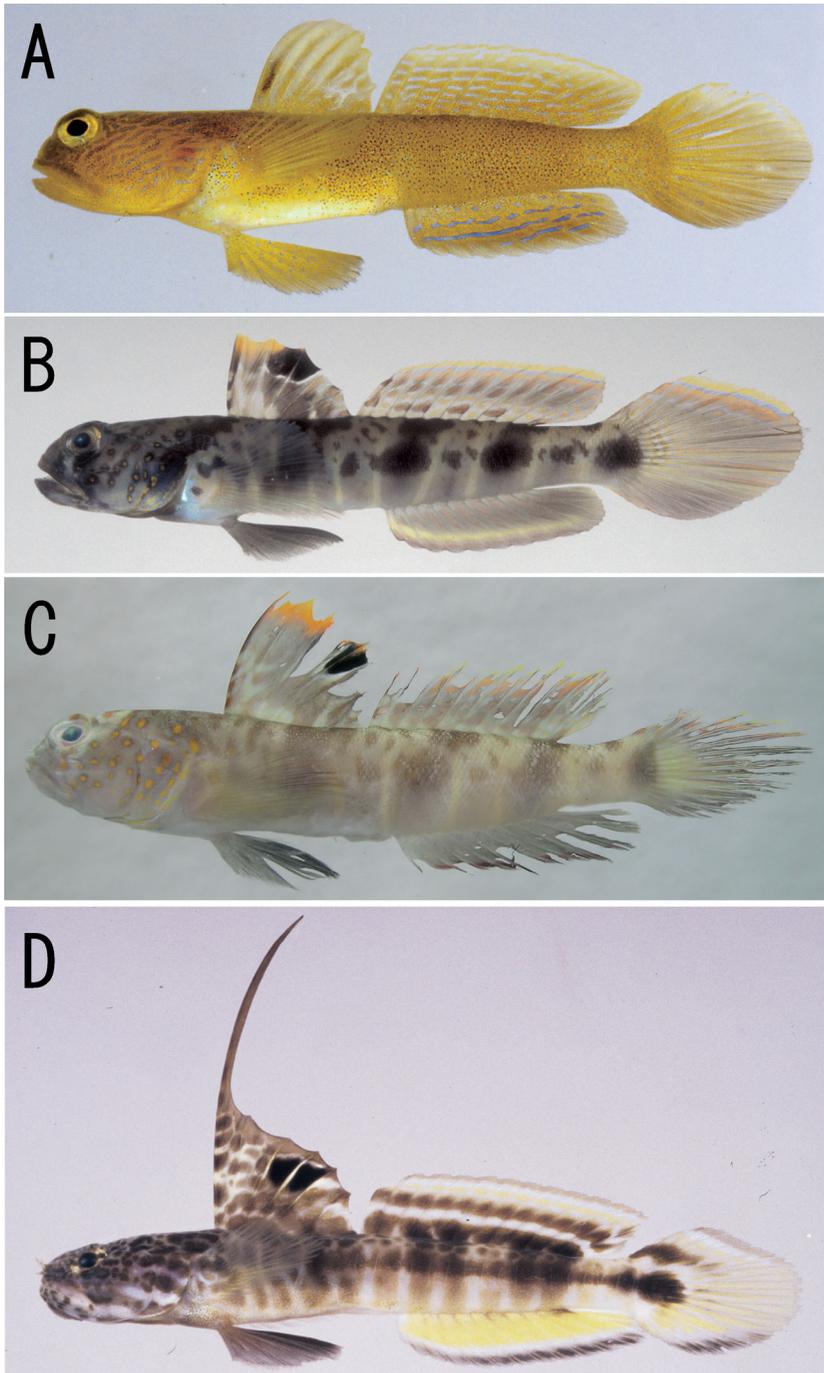


Fig. 2. Fresh specimens of three shrimp-associated goby species. A) *Cryptocentrus fasciatus*, OMNH-P 15518, 48.0 mm SL, male, Iriomote-jima Island, Yaeyama Islands, Ryukyu Archipelago, Japan (photo by T. Suzuki); B) *Flabelligobius russus*, OMNH-P 18055, female, 60.8 mm SL, Iriomote-jima Island, Yaeyama Islands, Ryukyu Archipelago, Japan (photo by T. Suzuki); C) *F. russus*, NSMT-P 72242, male, 70.4 mm SL, Nha Trang, Vietnam (photo by K. Shibukawa); D) *F. smithi*, NSMT-P 68764, male, 54.5 mm SL, Iriomote-jima Island, Yaeyama Islands, Ryukyu Archipelago, Japan (photo by T. Suzuki).

1994, 1997; Randall & Goren, 1993; Randall, 1995, 2005).

Although some of these authors reported the species had scales on the base of the pectoral fin (Randall *et al.*, 1994; Randall, 1995) and/or upper part of operculum (Randall & Goren, 1993; Randall, 1995), the present specimen lacked scales on both of these parts. At least with regard to the squamation on upper part of operculum, intraspecific variation may occur because this area appears to be naked in the holotype (Smith, 1959) and the specimen from the Arabian Gulf (Randall *et al.*, 1994).

Smith (1959) noted *Cryptocentrus fasciatus* has “Anal and caudal yellowish” as if he quoted from the original description, and Polunin and Lubbock (1977) subsequently stated that their specimen disagreed with Smith’s (1959) description. In the original description, nevertheless, Playfair *in* Playfair and Gunther (1867) actually noted “anal blackish brown, with seven blue longitudinal bands,” which agrees with the features of the present specimen and specimens identified as *Cryptocentrus fasciatus* by the other recent authors (Randall *et al.*, 1994, 1997; Randall & Goren, 1993; Randall, 1995, 2005). [*Note.* — Intraspecific variation appears to be found in the number of bluish lines on the anal fin in this species; our specimen has four lines.]

The present specimen differs from the original description of *Gobiosoma fasciatum* in having numerous dense, short diagonal sky-blue lines on the head (vs. “numerous small blue ocelli, edged with purplish” in the original description). On the other hand, the present specimen has a blackish blotch between the first and second spines of the first dorsal fin; this feature has not been mentioned by previous authors. We surveyed the figures and images found in the publications, pictorial books, and the Image Database of Fishes in the KPM, and concluded that the shape of head markings (e.g., spot-like or diagonal lines) and presence/absence (or shading) of the blackish blotch on first dorsal fin are variable within this species.

Within the genus, *Cryptocentrus fasciatus* re-

sembles *C. cinctus* (Herre, 1936) in having a relatively short body, low, more or less rounded first dorsal fin without elongate spines, scales on the body cycloid only, no distinct bony ventral projection from the operculum, five rows of papillae radiating from the eye (=rows 1–5), and, when alive or fresh, numerous dense sky-blue markings on the cheek and front part of body. *C. fasciatus* is, however, readily distinguished from *C. cinctus* in having: nape and occipital regions fully scaled (vs. naked in the latter); no posterior oculoscapular canal (vs. present); two pores on preopercular canal (vs. three); first dorsal fin with indistinct transversely banded pattern (vs. numerous minute whitish spots arranged in longitudinal rows); when alive or fresh, few to several longitudinal bluish lines on the anal fin (vs. minute bluish spots or transverse lines along fin rays).

***Flabelligobius russus* (Cantor, 1849)**

(New Japanese name: Ushi-oni-haze)

(Figs. 1B, 2B, 2C & 3; Table 1)

*Gobius russus* Cantor, 1849: 1168 [original description; type locality: Sea of Pinang (Penang), Malaysia].

*Flabelligobius* sp. 2: Senou *et al.*, 2004: 290 (Iriomote-jima Island, Yaeyama Archipelago, Japan).

*Materials examined* Japanese specimen. — OMNH-P 18055, 1 specimen (female), 60.8 mm SL, mouth of Urauchi-gawa River, Iriomote-jima Island, Yaeyama Islands of Ryukyu Archipelago, Japan, 2 m depth, 7 Dec. 2002, collected by K. Yano.

Specimens from the other areas. — BMNH 1860.3.19.5731, 2 specimens (syntypes *Gobius russus* Cantor, 1849, based on digital images taken by K. Matsuura and D.F. Hoese), Penang, Malaysia; NSMT-P 72242, 1 specimen (male) 70.4 mm SL, fish landing port at Nha Trang, Vietnam, 7 Oct. 2004, collected by K. Shibukawa; URM-P 8931–8933 and 8991–8993, 6 specimens (females), 72.8–86.1 mm SL, Songkhla, Thailand, 6 Apr. 1984, collected by T. Yoshino, H. Senou and C. Vidthayanon; URM-P 9015–9017, 3 specimens (females), 76.9–100.6 mm SL, Songkhla, Thailand, 9 Sept. 1984, collected by T.



Fig. 3. Syntypes of *Gobius russus*, BMNH 1860.3.19.5731, Sea of Pinang (=Penang), Malaysia (photo by K. Matsuura).

Yoshino, H. Senou and C. Vidthayanon; URM-P 12488, 1 specimen (female), 83.4 mm SL, Songkhla, Thailand, 25 Oct. 1983, collected by H. Senou, C. Vidthayanon, Kohn; URM-P 12513, 12514 and 12516, 3 specimens (males), 77.7–101.1 mm SL, 26 Oct. 1983, collected by H. Senou, C. Vidthayanon, Kohn; URM-P 14358, 1 specimen (sex indeterminable), 68.2 mm SL, Kapoe District, Ranong, Thailand, 1 Mar. 1984, collected by H. Senou; URM-P 14976, 1 specimen (female), 65.3 mm SL, Songkhla, Thailand, 7 Apr. 1984, collected by T. Yoshino, H. Senou and C. Vidthayanon.

*Description.* The following description is based on all examined specimens from Thailand, Vietnam and Japan (i.e., all examined specimens

other than syntypes); the counts of the Japanese specimen (OMNH-P 18055) is indicated by an asterisk, and the frequency of each count is given in parentheses following the relevant count (counts of syntypes are not included here).

Dorsal-fin rays VI-I, 10\* (17); anal-fin rays I, 10\* (17); pectoral-fin rays 15 (1), 17\* (1), 18\* (8) or 19 (24); pelvic-fin rays I, 5\* (34); segmented caudal-fin rays 9+8\* (17), including 7+6\* (34) branched rays; upper unsegmented caudal-fin rays 6 (4) or 7\* (13); lower unsegmented caudal-fin rays 5 (1), 6 (12) or 7\* (4); longitudinal scales 77 (1), 79 (1), 80 (1), 82 (1), 83 (1), 84 (2), 85 (4), 86 (3), 87 (4), 88 (1), 90\* (2), 91 (4), 92\* (2), 93 (1), 94 (2), 95 (1), 97 (3); transverse scales from anal-fin origin upward and forward

to base of first dorsal fin 29 (1), 30 (2), 31 (5), 32\* (6), 33 (4), 34 (6), 35 (2), 36 (2), 37 (2), 38 (1), 40 (1); transverse scales from anal-fin origin upward and backward to base of second dorsal fin 22 (1), 24 (1), 25 (2), 26 (4), 27 (7), 28\* (8), 29\* (7), 30 (3), 31 (1); transverse scales from origin of second dorsal fin downward and backward to anal-fin base 25 (1), 26 (1), 28 (3), 29 (3), 30\* (8), 31\* (8), 32 (7), 33 (3); predorsal scales 0 (2), 2\* (3), 3 (1), 4 (3), 5 (1), 6 (1), 7 (1), 8 (1), 9 (1), 12 (2), 14 (1); circumpeduncular scales 26 (1), 30\* (1), 32 (3), 34 (1), 36 (9), 38 (2); gill rakers 3+4 (1), 3+5 (2), 3+6\* (4), 4+4 (1), 4+5 (1), 4+6 (1), 5+5 (2), 5+6 (1); pseudobranchial filaments 12 (7), 13 (5), 14 (4), 15 (1); vertebrae 10+16=26\* (17); P-V 3/II II I I 0/9\* (17); anal-fin pterygiophores anterior to first haemal spine 2\* (16); epural 1\* (17).

Proportional measurements are given in Table 1. Head subcylindrical, slightly compressed (width 77.7–88.8% of depth). Snout slightly shorter, subequal or longer than eye diameter (snout length 87.7–123.6% of eye diameter). Interorbital space shallowly concaved, its width narrower than pupil diameter. Shallow V-shaped trough on occipital just behind eyes. Jaws equal; posterior end of jaws extending to a vertical line through posterior margin of pupil or slightly beyond. Posteroventral margin of lower lip interrupted at symphysis. Anterior nasal opening a short tube at anterior margin of snout; no fleshy flap at tip of anterior naris; posterior nasal opening a pore, located at about mid-point between posterior margin of base of anterior nasal tube and eye. Tip of tongue blunt, without distinct notch in anterior margin, free from floor of mouth. Gill opening wide, extending anteriorly beyond vertical line through posterior margin of preopercle; gill membranes attach to isthmus. Gill rakers on outer surface of first arch short; thin membrane developed between ventral half of ventral arm of first gill arch and inner surface of buccal cavity.

Scales on body cycloid anteriorly, ctenoid posteriorly; anterior end of ctenoid-scaled area extending anteriorly to vertical line through middle

or posterior end of base of first dorsal fin; scaled area on nape extending anteriorly to vertical line through middle of operculum or posterior margin or preopercle; head naked; pectoral-fin base typically naked, but, in some specimens, few to several very small cycloid scales found on middle or lower part.

Teeth in both jaws unicuspid, slightly inwardly curved; on both jaws, teeth on outermost row distinctly larger than teeth on inner rows; upper jaw with 4–5 rows of teeth anteriorly, narrowing to single row posteriorly; in upper jaw, teeth on anterolateral part of outermost row largest; teeth on innermost row slightly larger than teeth on outer row, strongly inwardly curved; lower jaw with four rows of teeth anteriorly, narrowing to single row posteriorly; in lower jaw, posteriormost tooth of outermost row (i.e., tooth on midlateral part of lower jaw) largest; a series of enlarged teeth on innermost row of lower jaw; no teeth on vomer or palatine.

Pattern of cephalic sensory systems is illustrated in Fig. 1B. Anterior oculoscapular canal with pores B', C (unpaired), D (unpaired), E, F, G and H'; posterior oculoscapular canal with pores K' and L'; preopercular canal with pores M', N and O' (in the specimens from Thailand and Vietnam, pore N present on both sides in six specimens, present on one side in four specimens, and absent in six specimens). Sensory-papillae rows on cheek forming well-developed longitudinal pattern; four longitudinal rows of sensory papillae on cheek (i.e., rows *a*, *b*, *c* and *d*), in addition to short row *cp*; uniserial transverse row of sensory papillae just behind chin (=row *f*).

*Coloration of freshly collected material (based on color slides, e.g., Fig. 2B and C).* Ground color of head and body yellowish gray, sometimes tinged with pink, with pale breast and belly; a series of four dark grayish brown or black blotches, subequal or slightly larger than eye, mid laterally on body; these blotches, other than those at caudal-fin base, frequently continuous with similar-colored saddle-like blotches crossing dorsum; on interspaces between these blotches, ca. 8–9 narrow yellowish vertical bars

(bounded anteriorly or posteriorly by sides of dark blotches) typically present, in addition to few to several minute irregular grayish brown or black spots; dark grayish brown blotch (usually continuous with similarly-colored blotch covering operculum) present just above dorsal end of gill opening; two radiating dark grayish brown or black bars from eye to middle and posterior part of jaw usually present; numerous minute, dark-edged yellow or orange spots scattered on cheek, operculum and sides of predorsal area; ground color of first dorsal fin grayish white or light gray; dark gray brown blotch (continuous with similar-colored saddle like blotch on body) at midbase of first dorsal fin; conspicuous black spot, with narrow white ventral margin, at distal part of first dorsal fin between third and fifth spines; distal margin of dorsal fin yellow or orange; first spine of first dorsal fin with 2–3 blackish brown spots on proximal half, entirely blackish brown on distal half; second dorsal fin grayish white or light gray, with two series of dusky spots (on ventral half) and a series of reddish orange spots (on distal half), as well as yellow distal margin edged ventrally by narrow pale sky blue; anal fin light gray tinged with yellow, with a narrow yellow submarginal line and narrow dusky distal margin; ground color of caudal fin light gray with yellow mid-anterior area; posterodorsal part of caudal fin with yellow margin, in addition to narrow reddish orange submarginal band edged by narrow pale sky blue dorsally and ventrally; pectoral fin transparent, with yellowish rays; pelvic fin light to dark gray.

*Color in alcohol.* Similar to freshly-collected coloration, but the color tinged with blue, orange or yellow on head, body and fins faded. Black spot on first dorsal fin variable in size; typically spreading between third and fifth spines, although in some specimens examined from Thailand, restricted between fourth and fifth spines.

*Distribution and habitat.* Indo-West Pacific (Koumans, 1953); Iriomote-jima Island, Yaeyama Islands of Ryukyu Archipelago, Japan (present study).

The Japanese specimen was collected from a

muddy bottom in shallow estuarine water (2 m depth); at Iriomote-jima Island, KY also observed this species on the soft-mud slope on the inner part of a protected bay (20 m depth). Symbiotic association with snapping shrimps (“*Alpheus* sp. E” and “*Alpheus* sp. G” of Senou *et al.*, 2004) was confirmed by KY before the specimen was collected.

*Remarks.* Features of the Japanese specimen agree well with the original description of *Gobius russus* made by Cantor (1849), description of *Cryptocentrus russus* made by Koumans (1953), and the images of two syntypes housed in the BMNH (Fig. 3).

As indicated by Hoese and Larson (2004), there are six nominal species possibly related to this species, i.e., *Gobius polyophthalmus* Bleeker, 1853, *Gobius voigtii* Bleeker, 1854, *Gobius xanthotaenia* Bleeker, 1855, *Gobius papuanus* Peters, 1877, *Cryptocentrus cingulatus* Herre, 1934 and *Cryptocentrus callopterus* Smith, 1945. The status of these nominal species is currently being studied by D.F. Hoese and H.K. Larson (D.F. Hoese, personal communication). Until they resolve this matter, we provisionally use the oldest name, *russus*, for this species.

Although this species has been frequently placed in *Cryptocentrus* (Koumans, 1940, 1953; Fowler, 1961; Kuitert & Debelius, 1994; Kuitert & Tonozuka, 2001), some recent authors indicated that the cephalic sensory-papillae arrangement and/or the osteological features agree with those of *Flabelligobius* rather than *Cryptocentrus* (Hoese & Larson, 2004; Senou *et al.*, 2004; Shibukawa & Iwata, 2005). For example, as in the present specimen, this species has longitudinal pattern of sensory-papillae rows on cheek (vs. well-developed transverse pattern in *Cryptocentrus*) and uniserial transverse sensory-papillae row just behind the lower-jaw symphysis (vs. a pair of short longitudinal rows). In addition, judging from its closed first gill slit condition, we provisionally assign this species to *Flabelligobius* (see also below).

*Flabelligobius* is close to another shrimp-goby genus, *Tomiyamichthys*, and, in the abstract of the

7th Indo-Pacific Fish Conference (held in Taipei in 2005), Shibukawa and Iwata (2005) concluded that these two genera were synonymous. Although their result has been not yet formally published, we provisionally follow the generic assignment made by Shibukawa and Iwata (2005). According to them, *Flabelligobius* appears to be closely related to several Indo-Pacific shrimp-associated goby genera (i.e., *Mahidolia*, *Myersina*, *Psilogobius*, *Stonogobiops*, and at least a part of *Cryptocentrus*), and is unique within this assemblage in having: ventral one-third or more (typically half or more) of the lower part of first gill slit closed by membrane; gill rakers on outer surface of first arch rudimentary or relatively short, 11 or fewer in total number; well-developed longitudinal pattern of sensory-papillae rows on cheek (some species have several irregular short branches in each row); and a uniserial transverse row of sensory papillae just behind the chin. As well as these shrimp-goby genera, no other gobiine genera (*sensu* Pezold, 1993) are known to have this combination of features.

The genus *Flabelligobius* (*sensu* Shibukawa & Iwata, 2005) is currently being revised by A. Iwata and the first author (except for above-noted problem surrounding “*russus*” undertaken by D.F. Hoese and H.K. Larson). *F. russus* is readily distinguished from the other congeners in having the following combination of characters: VI-I, 10 dorsal fin rays; I, 10 anal-fin rays; 77–97 longitudinal scales; ctenoid scales on posterior part of body; and conspicuous ocellated spot on first dorsal fin.

***Flabelligobius smithi* Chen and Fang, 2003**

(New Japanese name: Oni-tsuno-haze)

(Figs. 1C & 2D; Table 1)

*Flabelligobius smithi* Chen and Fang, 2003: 334, figs. 1–3 (original description; type locality: Taiwan Strait off Tongkang, Pingtung, Taiwan).

*Flabelligobius* sp. 1: Senou *et al.*, 2004: 289 (Iriomotejima Island, Yaeyama Archipelago, Japan).

*Material examined.* NSMT-P 68764, 1 specimen (male), 57.5 mm SL, Funauki Bay, Iriomote-

jima Island, Yaeyama Islands of Ryukyu Archipelago, Japan, 16 m depth, 21 Aug. 2001, collected by K. Yano.

*Description.* Following description based only on the Japanese specimen examined (NSMT-P 68764).

Dorsal-fin rays VI-I, 12; anal-fin rays I, 12; pectoral-fin rays 18/18; pelvic-fin rays I, 5/I, 5; segmented caudal-fin rays 9+8, including 7+6 branched rays; upper unbranched caudal-fin rays 5; lower unbranched caudal-fin rays 4; longitudinal scales 96/93; transverse scales from anal-fin origin upward and forward to base of first dorsal fin 28/27; transverse scales from anal-fin origin upward and backward to base of second dorsal fin 24/22; transverse scales from origin of second dorsal-fin downward and backward to anal fin base 25/23; predorsal scales 0; circumpeduncular scales 40; gill rakers 2+6; pseudobranchial filaments 12; vertebrae 10+16=26; P-V 3/II II I I 0/9; anal-fin pterygiophores anterior to first haemal spine 3; epural 1.

Proportional measurements are given in Table 1. Head subcylindrical, slightly compressed (its width 94.5% of depth). Snout slightly shorter than eye diameter (snout length 84.8% of eye diameter). Interorbital space more or less flat, not forming deep groove; interorbital width narrower than pupil diameter. Deep V-shaped trough on occipital just behind eyes. Jaws equal; posterior end of jaws extending slightly beyond a vertical line through posterior margin of pupil. Posteroventral margin of lower lip interrupted at symphysis (shallow transverse groove just behind lower jaw symphysis, but its edge not continuous with edge of lower lip). Anterior nasal opening a short tube at anterior margin of snout; broad, long fleshy flap at tip of anterior naris (flap on left side abnormally with a short lateral branch), its length slightly shorter than pupil diameter; posterior nasal opening a pore, located at about mid-point between posterior margin of base of anterior nasal tube and eye (rather closer to eye than posterior margin of base of anterior nasal tube). Tip of tongue blunt, without a distinct notch in the anterior margin, free from floor of

mouth. Gill opening relatively narrow, not extending anteriorly to a vertical line through posterior margin of preopercle; gill membranes attach to isthmus. Gill rakers on outer surface of first arch short; thin membrane developed between ventral two-thirds of ventral arm of first gill arch and inner surface of buccal cavity. Caudal peduncle moderately slender, its depth 67.9% of its length. Pelvic fins united medially by well developed frenum (between spines) and interradial membrane (between innermost segmented rays); pelvic frenum moderately thin, with smooth posterior margin; pelvic fin not reaching posteriorly to anus when adpressed.

All scales on body very small cycloid, more or less shallowly embedded under skin, non-imbriate; head, pectoral-fin base, predorsal and pre-pelvic regions naked.

Teeth in both jaws unicuspid; on both jaws, teeth of outermost row distinctly larger than teeth of inner rows; upper jaw with three rows of teeth anteriorly, narrowing to single row posteriorly; in upper jaw, teeth on anterolateral part of outermost row largest; teeth in innermost row slightly larger than teeth on outer row, strongly inwardly curved; lower jaw with 3–4 rows of teeth anteriorly, narrowing to single row posteriorly; in lower jaw, posteriormost tooth of outermost row (i.e., tooth on midlateral part of lower jaw) largest; no teeth on vomer or palatine.

Pattern of cephalic sensory systems are illustrated in Fig. 1C. Anterior oculoscapular canal with pores B', C (unpaired), D (unpaired), E, F, G and H'; posterior oculoscapular canal with pores K' and L'; preopercular canal with pores M', N and O'. Sensory-papillae rows on cheek forming essentially longitudinal pattern, comprising four rows of sensory papillae, i.e., rows *a*, *b*, *c* and *d*, in addition to row *cp*; rows *a*, *b* and *c* with several short transverse branches, as well as *cp* with a single transverse row posteriorly; uniserial transverse row of sensory papillae just behind lower-jaw symphysis (=row *f*).

*Coloration of freshly collected material (based on color slides, e.g., Fig. 2C).* Ground color of head and body yellowish gray dorsally, becoming

pale ventrally; numerous dense, pupil-sized dark-grayish brown or blackish spots on dorsal side of head and body, lips and lower jaw; three longitudinal (or slightly inclined) dark grayish-brown bands (containing several small blackish spots) from cheek to operculum; narrow dark grayish-brown longitudinal stripe midlaterally on body, stripe crossing ca. 13 dark (dorsal part) to light (ventral part) grayish-brown vertical bands; first dorsal fin pale with dense dark grayish-brown spots, forming reticulated pattern; two close-set, vivid black submarginal spots between third and fifth spines of first dorsal fin; distal part of first dorsal fin (including filamentous part of first dorsal fin) olive gray; a series of six close-set dark grayish-brown or blackish spots, edged dorsally by narrow sky blue, along base of second dorsal fin; middle part of second dorsal fin with a series of 13 close-set, small dark grayish-brown spots (forming longitudinal stripe); distal part of second dorsal fin with a series of ca. 11 close-set, yellow spots (forming submarginal longitudinal stripe), edged by narrow sky-blue dorsally and ventrally, in addition to olive gray margin; proximal two-thirds of anal fin yellow; distal margin of anal fin blackish, edged proximally by narrow pale sky-blue; ground color of caudal fin pale gray, tinged with yellow, with pale sky-blue lines along with rays; mid-base of caudal fin with a black blotch (as large as eye), bounded by pale spots dorsally and ventrally; horizontally-elongate dark grayish-brown blotch above mid-basal spot on caudal fin; dorsal and ventral part of caudal fin with dark grayish-brown or blackish margin, edged proximally by narrow pale sky-blue; pectoral fin transparent; pelvic fin dark gray, tinged by brown proximally.

*Color in alcohol.* Similar to freshly-collected coloration, except for the colors tinged with yellow, brown and blue on head, body and fins faded.

*Distribution and habitat.* Off southern coast of Taiwan (Chen & Fang, 2003) and Iriomotejima Island, Yaeyama Islands of the Ryukyu Archipelago, Japan (present study). In the Image Database of Fishes in the KPM, there is a single

underwater photograph, identified as this species, taken at Mindoro Island, Philippines (KPM-NR 61857).

The present specimen was collected from a soft-mud slope at the inner part of a protected bay (16 m depths); in the Iriomote-jima Island, KY observed this species in similar habitat at depths of 14–23 m. Symbiotic association with snapping shrimp (“*Alpheus* sp. G” of Senou *et al.*, 2004) was confirmed by KY before the specimen was collected. In the habitat, several specimens of the other shrimp-associated goby, *Amblyeleotris fontanesii*, were observed.

**Remarks.** Chen and Fang (2003) described the new species *Flabelligobius smithi* based on three specimens from off southern Taiwan. They stated that *F. smithi* could be distinguished from its most similar congener *F. fourmanoiri* Smith, 1956 (known only by the holotype from Madagascar) by having the following features: 1) both lips about equal (vs. lower jaw distinctly prominent in *F. fourmanoiri*); 2) modally 18 pectoral-fin rays (vs. 16); 3) 64–72 longitudinal scales (vs. 94–98); 4) many well-developed transverse extension crossing row *a* and *c* (vs. few papillae present as transverse extensions of row *a* and only some reduced rows below row *c*); 5) cheek depth 12.6–14.4 (mean 13.8) % of head length (vs. 9.0%); and 6) caudal-peduncle depth 70.6–75.9 (mean 73.7)% of its length (vs. 64.5%). These two species are readily distinguished from their congeners by the following combination of features (Shibukawa & Iwata, unpublished data): VI-I, 12 dorsal-fin rays; I, 12 anal-fin rays; all scales on body cycloid; well-developed, long fleshy flap at tip of anterior nasal tube; posterior oculoscapular canal and associated pores K' and L'. On the characteristics of the genus, see also “Remarks” of *Flabelligobius russus*, above.

Almost all features of the present specimen agree with the original description of *Flabelligobius smithi* made by Chen and Fang (2003). However, in the distinguishing features listed by Chen and Fang (2003), some features of the present specimen are more similar to *F. fourmanoiri* than *F. smithi*. Namely, it has: 1) both lips about

equal (as in *F. smithi*); 2) 18 pectoral-fin rays (as in *F. smithi*); 3) 93–96 longitudinal scales (similar to *F. fourmanoiri*); many transverse extension crossing row *a* and *c* (as in *F. smithi*); 5) cheek depth 14.1 % of head length (as in *F. smithi*); and 6) caudal-peduncle depth 67.9% (intermediate between *F. fourmanoiri* and *F. smithi*). Furthermore, the jaw of the holotype of *F. fourmanoiri* (see Chen & Fang, 2003, fig. 1A) appears to be distorted, and it is doubtful that the condition is normal in this species.

On these aspects, the present specimen seems to represent an intermediate condition between *Flabelligobius fourmanoiri* (known only by the holotype from Madagascar) and *F. smithi* (known only by three type specimens from Taiwan). This might cast doubt upon the validity of the junior nominal species, *F. smithi*. Other than the diagnostic features listed by Chen and Fang (2003), however, these two species are possibly distinguished by the elongate of first-dorsal fin spines; namely, the anterior two spines of the first dorsal fin are elongate and filiform in *F. fourmanoiri* (Smith, 1956), whereas only first spine is elongate and filiform in the specimens from the West Pacific (Chen & Fang, 2003; present study). Although further research based on more specimens is clearly needed, we tentatively recognize that these two are valid species. And, we herein identify the present specimen as *F. smithi*, judging from its geographic distribution and morphological features (except for longitudinal-scale count and depth of caudal peduncle).

#### Acknowledgements

We wish to express our sincere thanks to the following persons for loaning us the specimens and providing valuable comments: K. Hatooka (OMNH); D.F. Hoese (AMS); A. Hosokawa (Kawanishi, Hyogo, Japan); A. Iwata (Kyoto University, Japan); K. Matsuura (NSMT); T. Yoshino and the students in his laboratory (URM). K. Matsuura and D.F. Hoese also provide the images of syntypes of *Gobius russus* for our study. Thanks are also offered to H.K. Larson

(Museum and Art Gallery of the Northern Territory, Australia) for her critical comments on the manuscript.

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