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Revision of an armored searobin genus *Scalicus* Jordan 1923 (Actinopterygii: Teleostei: Peristediidae) with a single new species

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Abstract The Indo-Pacific peristediid genus *Scalicus* Jordan 1923 is taxonomically revised with six species including a single new species: *Scalicus engyceros* (Günther 1872), *Scalicus hians* (Gilbert and Cramer 1897), *Scalicus orientalis* (Fowler 1938), *Scalicus paucibarbatus* sp. nov., *Scalicus quadratorostratus* (Fourmanoir and Rivaton 1979) and *Scalicus serrulatus* (Alcock 1898). The new species differs from its congeners in having a stick-like rostral projection with ball-like fleshy mass at the tip, rostral projection width 2.12–4.60 in rostral projection length; 4 lip and 3 chin barbels; 8–11 branches on filamentous barbel; filamentous barbel lacking membrane between its each branch, its length 13.1–20.4% of standard length; posteriormost chin barbel simple (rarely divided into two branches at the base); and presence of antrorse spines on posterior bony plates of upper lateral row. It is clear that *Scalicus amiscus* (Jordan and Starks 1904) and *Scalicus investigatoris* (Alcock 1898) are junior synonyms of *S. hians*, respectively, and *Scalicus gilberti* (Jordan 1921) is a junior synonym of *S. engyceros*. A key to the species of *Scalicus* is presented. In addition, lectotypes are designated for *S. hians*, *S. quadratorostratus* and *S. serrulatus*, respectively.

Keywords *Scalicus paucibarbatus* sp. nov. · Indo-Pacific · Synonym · *Nemaperistedion* · Deep-sea fish

Introduction

The family Peristediidae (armored searobins or armored gurnards) currently comprises 6 valid genera (*Peristedion* Lacepède 1801, *Satyrichthys* Kaup 1873, *Gargariscus* Smith 1917, *Heminodus* Smith 1917, *Scalicus* Jordan 1923, and *Paraheminodus* Kamohara 1957) and 47 valid species from tropical to temperate waters in bottoms of world oceans (Kawai 2008; Fricke et al. 2019). The family is characterized in having the body entirely encased by mainly four rows of heavy spine-bearing bony plates on each side, mouth inferior, preorbitals each with a forward rostral projection, the lower two pectoral fin rays free and barbels on the lower jaw (Kawai 2008; Nelson et al. 2016).

The Indo-Pacific peristediid genus *Scalicus* was established as having a shovel-shaped snout without horns at the angles with *Peristedion amiscus* Jordan and Starks 1904 as the type species (Jordan 1923). Since then, most ichthyologists have not recognized this genus because the type species has been referred to the genus *Satyrichthys* in many studies (e.g., Miller 1974; Ochiai and Yatou 1984; Richards 1999; Yamada 2002). Recently, Kawai (2008) demonstrated the monophyly of *Scalicus* based on his study of the phylogenetic relationships of the Peristediidae, where he synonymized *Nemaperistedion* Fowler 1938 with *Scalicus*. *Scalicus* is characterized as follows: upper jaw toothless, lateral margin of head smooth, posterior pairs of lower lateral rows of bony plates separated from each other, barbels on lower jaw not branched except for posteriormost lip and chin barbels, and counts of dorsal and anal fin soft rays greater than 19 (Kawai 2008, 2013).

Materials and methods

Counts and proportional measurements follow Kawai et al. (2004). Preopercular spine length follows Kawai et al. (2008). Rostral projection width was measured at the level of anterior margin of the upper jaw. Measurements were made to the nearest 0.1 mm, with a caliper. Terminology and counts for bony plates counting all plates in each row, and those for barbels (Fig. 1) follow Yatou and Okamura (1985). The filamentous barbel is the lateralmost lip barbel. Gill rakers, including all rudiments, were counted on the outer side of the first arch on the right side. Terminology of cranial spines follows Miller (1967). Standard and head lengths are abbreviated as SL and HL, respectively. Institutional codes follow Fricke and Eschmeyer (2019) with addition of National Marine Biodiversity Institute of Korea, Janghang, South Korea (MABIK).

Scalicus **Jordan 1923**

Scalicus Jordan 1923: 216 (type species: *Peristethus amiscus* Jordan and Starks 1904).

Nemaperistedion Fowler 1938: 126 (type species: *Nemaperistedion orientale* Fowler 1938).

Diagnosis. Upper jaw teeth absent; lateral margin of head smooth; posterior pairs of lower lateral rows of bony plates separated from each other; barbels on lower jaw not branched except for posteriormost lip (= filamentous barbel) and chin barbels; counts of dorsal and anal fin soft rays greater than 18 (Kawai 2008; present study).

Remarks. *Scalicus* easily differs from *Peristedion* in having posterior pairs of bony plates in lower lateral rows separated from each other [vs. contralaterally sutured along the mid-line: see fig. 18 in Kawai (2008)], and from *Gargariscus*, *Heminodus* and *Paraheminodus* in lacking teeth on upper jaw [vs. having: see fig. 4 in Kawai (2008)]. On the other hand,

although *Scalicus* is similar with *Satyrichthys* by both characters mentioned above, the former genus was distinguished from the latter in having lower number of dorsal and anal fin soft rays [greater than 19 in *Scalicus* vs. fewer than 20 in *Satyrichthys*: Kawai (2008, 2013)]. However, CAS 108523 identified as *Scalicus engyceros* (Günther 1872) has 19 dorsal fin soft rays and USNM 55265 (107.1 mm SL) has 19 anal fin soft rays in this study. Therefore, both genera cannot be separated clearly from each other by these characters. In any case, these characters must be very helpful for identification of both genera because only single specimen of *Satyrichthys welchi* (Herre 1925) and single specimen of *Satyrichthys moluccensis* (Bleeker 1850) have 19 dorsal and 19 anal fin soft rays, respectively (Kawai 2013). Whereas, *Scalicus* certainly differs from *Satyrichthys* by osteological and myological characters, i.e. fifth infraorbital and hyomaidibula fused (vs. sutured in *Satyrichthys*), second pharyngobranchial and first epibranchial connected via ligament (vs. connected via interarcual cartilage), second epineural absent (vs. present), and obliquus dorsalis connected to third and fourth epibranchials by a long tendon (vs. directly connected without a tendon) (Kawai 2008).

Scalicus comprises 8 nominal species, viz. *S. amiscus*, *S. engyceros*, *S. gilberti* (Jordan 1921), *S. hians* (Gilbert and Cramer 1897), *S. investigatoris* (Alcock 1898), *S. orientalis*, *S. quadratorostratus* (Fourmanoir and Rivaton 1979), and *S. serrulatus* (Alcock 1898). My examination of specimens including all primary types, revealed 6 species are valid in this genus, including a single new species: *S. engyceros*, *S. hians*, *S. orientalis*, *S. paucibarbatus* sp. nov., *S. quadratorostratus* and *S. serrulatus*. In addition, it is clear that *S. amiscus* and *S. investigatoris* are junior synonyms of *S. hians*, respectively, and *S. gilberti* is a junior synonym of *S. engyceros*.

***Scalicus engyceros* (Günther 1872)**

(New Standard Japanese name: Touhousoko-kihoubou) (Figs. 1a, 2a, 5, 6; Tables 1–8)

Peristethus engyceros Günther 1872: 663, fig. in p. 662 (type locality: Hawaii).

Peristedion gilberti Jordan 1921: 655, fig. 8b (type locality: Hawaii).

Satyrichthys engyceros: FSFRL 1972: 114, fig. NORPAC-77 (Bering Sea: locality doubtful); Mundy 2005: 334 (Hawaii).

Scalicus engyceros: Kawai 2008: 27 (name listed).

Scalicus gilberti: Kawai 2008: 27 (name listed).

Material examined. Holotype of *Peristethus engyceros*: BMNH 2010.2.1.1, ca. 109 mm HL (impossible to measure SL because of damage), Hawaii, USA. Holotype of *Peristedion gilberti*: USNM 84102, 111.1 mm SL, Hawaii, 0–386 m depth, 27 Mar. 1902. Paratypes of *Peristedion gilberti*: CAS 108523, 151.3, Hawaii, 402–316 m, 22 May 1902; CAS 168633, 124.4, Hawaii, 463–516 m, 25 July 1902; CAS 168634, 127.2, Hawaii, 435–463 m, 21 July 1902; CAS 168635, 99.6, Hawaii, 402–435 m, 21 July 1902; CAS 168636, 2 specimens, 110.1–118.1, Hawaii, 326–369 m, 21 July 1902; CAS 168637, 99.8, Hawaii, 101–662 m, 11 June 1902. Non-types: BPBM 23702, 2, 155.8–164.2, Hawaii (20°35'N 156°53'W), 380–420 m; BPBM 23840, 2, 121.6–135.4, Hawaii (21°10'N 157°25'W), 179–183 m, 7 Apr. 1968; BPBM 24280, 232.0, Hawaii (21°04'N 156°28'W), 337–340 m, 22 Nov. 1968; BPBM 24309, 162.4, Hawaii (21°07'N 156°28'W), 446–454 m, 22 Nov. 1968; BPBM 33461, 243.2, Hawaii, 28 July 1986; FAKU 71557, 153.3, FAKU 71565, 62.2 mm HL (impossible to measure SL because of damage), Emperor Seamount Chain; HUMZ 59464, 151.4, HUMZ 157295, 183.3, HUMZ 157296, 205.4, HUMZ 157297, 164.7, locality unknown; HUMZ 69239, 186.4, HUMZ 93854, 135.4, Emperor Seamount Chain; HUMZ 99829, 172.1, HUMZ 99830, 156.5 (dissected), HUMZ 99831, 185.0, HUMZ 99832, 161.0 (dissected), HUMZ 99833, 181.6,

Hawaii (19°56.9'N 155°00.3'W), 379 m, otter trawl, 7 Feb. 1983; HUMZ 132295, 189.9, HUMZ 132296, 182.5, HUMZ 132297, 142.8, Yuryaku Seamount, Emperor Seamount Chain, 472 m, otter trawl, 7 Nov. 1993; MABIK 2144, 158.9, Emperor Seamount Chain, 9 Mar. 2016; MABIK 6061, 141.3, Emperor Seamount Chain (35°28'N 171°20'W), 15 Mar. 2016; NSMT-P 72882, 118.4, Emperor Seamount Chain, 23 Sep. 2005; NSMT-P 92791, 225.5, NSMT-P 92792, 231.0, off Africa, Indian Ocean (doubtful locality); USNM 51702, 253.5, Hawaii, USA; USNM 55265, 107.1–125.6, Hawaii, 5 Mar. 1906; USNM 84093, 251.5, Hawaii, USA, 6 Oct. 1919; USNM 125506, 164.4, Hawaii, USA, Mar. to Aug. 1902; USNM 422832, 132.5, Hawaii (22°45'30"N 160°56'00"W), 13 Jan. 1978.

Diagnosis. A species of *Scalicus* with stick-like rostral projection with ball-like fleshy mass at tip (rarely small mass) (Fig. 2a), rostral projection width 2.34–3.97 in rostral projection length; 4 (rarely 3) lip (having single branch on or near base of filamentous barbel) and 3 (rarely 4) chin barbels (Fig. 1a; Table 4); filamentous barbel with 13–18 branches (Table 5); filamentous barbel lacking membrane between its each branch, its length 13.1–26.7% SL (Table 8); posteriormost chin barbel divided into two branches at base (rarely not branched or with three branches) (Fig. 1a); presence of antrorse spines on posterior bony plates of upper lateral row (Fig. 3b).

Distribution. Emperor Seamount Chain and Hawaii at depth of 0–662 m (Fig. 4).

Remarks. *Peristethus engyceros* Günther 1872 was described on the basis of a head of a single damaged specimen (BMNH 2010.2.1.1: Fig. 5a) collected from Hawaiian waters. Although Jordan (1921) described *Peristedion gilberti* (Fig. 5b) from Hawaii without examining the holotype of *Peristethus engyceros*, he gave differences between the two species, with *Scalicus gilberti* having rigidly parallel and relatively long rostral projections (vs. not parallel and relatively short in *Scalicus engyceros*), the preopercular spine length 1.4 in rostral projection length (vs. 1.2), the interorbital width a little less than eye diameter (vs. broader),

shorter pectoral fin (vs. longer), and pelvic fin barely reaching the anus (vs. nearly reaching the anus). No taxonomic studies that included the examination of type specimens of both species have been conducted. The comparison of types of both species along with non-types revealed no significant differences between the two in the characters mentioned above. The rostral projections of both are rigid and almost parallel with lengths ca. 31% of HL in the holotype of *S. engyceros* vs. 30.3% in the holotype of *S. gilberti*, preopercular spine lengths 1.20 vs. 1.17 in rostral projection length, orbital diameter 0.68 vs. 0.73 in interorbital width, pectoral fin length 20.6–28.2% SL (not including the damaged holotype of *S. engyceros*), and pelvic fin not reaching or nearly reaching anus (not including the damaged holotype of *S. engyceros*) (Fig. 5; Table 8). Therefore, I concluded that *S. gilberti* is a junior synonym of *S. engyceros* (ICZN 1999: Art. 23).

Two specimens (NSMT-P 92791 and NSMT-P 92792) collected from the western Indian Ocean were moved to NSMT in 2008 from the Far Seas Fisheries Research Laboratory, Japan (FSFRL: now recognized as National Research Institute of Far Seas Fisheries) where the those specimens had been registered as N179 as N187, respectively. Although photos of specimens kept at the FSFRL have been published (FSFRL 1972, 1976), those of peristediids collected off Africa, Indian Ocean (FSFRL 1976: pp. 79–112) were not included. Although *Satyrichthys engyceros* (= *Scalicus engyceros*) was reported from Bering Sea, North Pacific (FSFRL 1972: p. 114), I believe this report is incorrect and capture data for the two specimens are doubtful. Although this species had been known in Japanese waters (e.g., Kamohara 1952; Yatou 1982c; Yamada and Yagishita 2013), these records are based on misidentifications of *Scalicus quadratorostratus* and / or *Scalicus paucibarbatus* sp. nov.

Intraspecific color variation is found in specimens between Hawaii, and the Emperor Seamount Chain and Africa (doubtful locality), such as dusky spots on the pectoral fin base in specimens of Hawaii (Fig. 6a) vs. absent in specimens of Emperor Seamount Chain and

Africa (Fig. 6b).

***Scalicus hians* (Gilbert and Cramer 1897)**

(Standard Japanese name: Hige-kihoubou) (Figs. 1b, 2b, 7; Tables 1–7, 9)

Peristedion hians Gilbert and Cramer 1897: 419, figs. 1, 2 in pl. 41 (type locality: Hawaii).

Peristethus investigatoris Alcock 1898: 152 (type locality: Andaman Sea); Alcock 1899: fig. 1, 1a in pl. 25 (Andaman Sea).

Peristedion amiscus Jordan and Starks 1904: 593, figs. 1, 2 in pl. 3 (type locality: Sagami Bay, Japan); Kamohara 1936: 440, pl. 30-7 (Japan); Kamohara 1950: 233, fig. 175 (Japan).

Satyrichthys amiscus: Kamohara 1952: 5, fig. 2 (Japan); Miller 1974: 70 (name listed); Yatou 1982a: 284, fig. (Kyushu-Palau Ridge); Ochiai and Yatou 1984: 320, pls. 301-H, I (Japan); Yatou 1985a: 584, fig. (East China Sea); Yatou 1997: 217, fig. 13 (Japan); Richards 1999: 2362 (western central Pacific); Richards 2000: 607 (South China Sea); Yamada 2002: 612 (Japan).

Satyrichthys hians: Miller 1974: 70 (name listed); Richards 1999: 2362 (western central Pacific); Richards 2000: 607 (South China Sea); Mundy 2005: 335 (Hawaii).

Satyrichthys investigatoris: Miller 1974: 70 (name listed); Heemstra 1982: 292, fig. 1 (South Africa); Heemstra 1986: 489, fig. (South Africa).

Peristedion investigatoris: Richards 1999: 2362 (western central Pacific); Richards 2000: 607 (South China Sea).

Scalicus hians: Kawai 2008: 27 (name listed); Kawai and Yato 2008: 61 (Hawaii).

Scalicus investigatoris: Kawai 2008: 27 (name listed); Kawai et al. 2017: 27, fig. 6 (Andaman Sea).

Scalicus amiscus: Kawai 2008: 27 (name listed); Yamada and Yagishita 2013: 729 (Japan).

Materials examined. Lectotype of *Peristedion hians* (designated here): USNM 47730, 154.7, Hawaii (21°12'N 157°49'W), 539 m, 4 Dec. 1891. Paralectotypes of *Peristedion hians*: CAS 104921, 4, 142.8–147.1, Hawaii (21°8.5'N 157°49'E), 627 m, 4 Dec. 1891; MCZ 35964, 117.8; USNM 203099, 5, 82.1–142.3, collected with the lectotype. Syntypes of *Peristethus investigatoris*: BMNH 1897.7.13.2, 82.0, ZSI 13037, 130.9, ZSI 13038, 74.1, Andaman Sea, 344–402 m, 1891. Holotype of *Peristedion amiscus*: USNM 51428, 79.7, Sagami Bay, Honshu, Japan, 280 m, 5 May 1900. Non-types: BMNH 1939.5.24.1655-1657, 3, 164.1–194.0, Zanzibar, Tanzania, 640–658 m, 15 Jan. 1934; BPBM 24001, 131.8, Hawaii (21°09'N 157°42'W), 585–649 m, 5 May 1968; BPBM 24293, 142.8, Hawaii (21°07'N 156°28'W), 441–457 m, 22 Nov. 1968; CAS SU8540, 5, 94.8–146.0, Hawaii, 4 Apr. to 1 Aug. 1902; HUMZ 194721, 157.1, HUMZ 194722, 151.1, Sumatra (5°50.7'S 102°39.0'E to 5°51.4'S 102°37.8'E), Indonesia, 603–622 m, 21 July 2005; HUMZ 194728, 147.4, Sumatra (5°20.8'N 94°03.0'E to 5°22.7'N 94°02.3'E), Indonesia, 561–526 m, 3 Aug. 2005; HUMZ 194735, 144.6, Java (8°37.9'S 112°15.3'E to 8°38.2'S 112°14.0'E), Indonesia, 708–705 m, 21 May 2005; NSMT-P 7002–7006, 5, 113.8–177.4, Suruga Bay, Honshu, Japan, 16–20 Sep. 1968; NSMT-P 10984, 87.2, Choshi, Honshu, Japan, 12 April 1971; NSMT-P 48282, 152.9, NSMT-P 48342, 121.3, Suruga Bay (34°45.6'N 138°29.5'E), Honshu, Japan, 240–410 m, 4 Oct. 1995; NSMT-P 48319, 4, 124.2–171.8, Suruga Bay (34°46.5'N 138°42.8'E), Honshu, Japan, 205–423 m, 5 Oct. 1995; NSMT-P 49957, 179.8, Suruga Bay (35°00.4'N 138°44.9'E), Honshu, Japan, 320–680 m, 10 Nov. 1996; NSMT-P 55388, 167.2, Tosa Bay (33°11.7'N 133°40.7'E), Shikoku, Japan, 537–528 m, 13 May 1997; NSMT-P 57407, 2, 76.2–78.9, Tosa Bay (33°13.1'N 133°37.7'E), Shikoku, Japan, 295–304 m, 9 Dec. 1998; NSMT-P 57424, 174.8, Tosa Bay (33°12.1'N 133°44.4'E), Shikoku, Japan, 654–686 m, 10 Dec. 1998; NSMT-P

65439, 152.9, Ibaraki (36°28.3'N 140°58.3'E), Honshu, Japan, 213–272 m, 24 Oct. 2002; NSMT-P 65667, 172.8, East China Sea (30°26.8'N 128°14.2'E), 499–500 m, 10 Nov. 2002; NSMT-P 67540, 115.4, East China Sea (31°20.7'N 128°23.3'E), 392 m, 4 Nov. 2003; NSMT-P 71804, 129.6, Enshu-nada, Honshu, Japan, 500 m, June 1975; NSMT-P 73371, 120.2, Fukushima, Honshu, Japan, 1935; NSMT-P 92788, 211.5, NSMT-P 92790, 205.1, off South Africa, Indian Ocean (33°07.0'S, 44°05.0'E), 780 m, 19 June 1977; USNM 231980, 125.0, Hawaii, USA, 1902; ZIN 51355, 3, 103.4–133.6, off Socotra (12°12.4'N 53°06.8'E), Arabian Sea, 320–330 m, 21 Dec. 1988; ZIN 51356, 109.5, off Socotra (11°31.4'N 53°01.2'E), Arabian Sea, 405–442 m, 25 Dec. 1988; ZSI F529-530/I, 101.4, Laccadive Sea, 410–519 m.

Diagnosis. A species of *Scalicus* with equilateral-triangular rostral projection (Fig. 2b), rostral projection width 0.79–1.25 in rostral projection length; 7 (rarely 6 or 8) lip (having single branch on or near base of filamentous barbel) and 3 (rarely 4) chin barbels (Fig. 1b; Table 4); filamentous barbel with 22–39 branches (Table 5); filamentous barbel lacking membrane between its each base, its length 16.2–48.2% SL (Table 9); posteriormost chin barbel divided into two branches at base (rarely not branched or with three branches) (Fig. 1b); antrorse spines on posterior bony plates of upper lateral row absent (Fig. 3a).

Distribution. Tropical to temperate waters from western Indian Ocean to Japan and Hawaii at depth of 205–780 m (Fig. 4).

Remarks. *Peristedion hians* Gilbert and Cramer 1897 (Fig. 7a), the first species recognized as having an equilateral-triangular rostral projection, was described based on 12 Hawaiian specimens (now 11 in existence). The following year, *Peristethus investigatoris* Alcock 1898 (Fig. 7b), collected from the Andaman Sea, Indian Ocean was described on the basis of three syntypes without any comparison with other peristediid species. No detailed examination of these syntypes has been conducted since the original description. Later, *Peristedion amiscus* Jordan and Starks 1904 (Fig. 7c) was described from Sagami Bay, Japan. Miller (1974)

suggested that three species may be synonyms, but provided no detailed comparisons of them. Based on a detailed examination of all extant type specimens of the three species along with additional comparative material of *Scalicus hians*, no interspecific differences were found (Tables 1–7, 9). Therefore, *Scalicus investigatoris* and *Scalicus amiscus* are considered as junior synonyms of *S. hians* (ICZN 1999: Art. 23). Although a label of USNM 47730 shows this specimen is a lectotype of *S. hians* designated by G. C. Miller, the manuscript about this designation has not been published. Therefore, USNM 47730 is still the syntype of *S. hians*. To avoid further confusion of this species, I herein confirm to designate USNM 47730 as lectotype of *S. hians*. Consequently, the remaining syntypes become paralectotypes of *S. hians* (ICZN 1999: Art. 74).

Scalicus orientalis **(Fowler 1938)**

(Standard Japanese name: Nanyou-kihoubou) (Figs. 1c, 2c, 3a, 8, 9; Tables 1–7, 10)

Nemaperistedion orientale Fowler 1938: 127, fig. 61 (type locality: Molucca Sea, Indonesia; Taiwan and Philippines); Yatou 1985b: 594, fig. (East China Sea).

Peristedion fowleri de Beaufort and Briggs 1962: 122 (Borneo and Philippines) (replacement name for *Nemaperistedion orientale* Fowler 1938).

Satyrichthys hians (not Gilbert and Cramer): Kamohara 1952: 6 (Japan); Ochiai and Yatou 1984: 321, pl. 301-J, K (Japan); Yamada 2002: 533 (Japan).

Satyrichthys orientale: Miller 1974: 70 (name listed); del Cerro and Lloris 1997: 96 (New Caledonia); Yatou 1997: 217, figs. (Japan); Richards 1999: 2362 (western central Pacific); Richards 2000: 607 (South China Sea); Fricke et al. 2011: 381 (New Caledonia).

Scalicus orientalis: Kawai 2008: 27 (name listed); Kawai and Yato 2008: 61 (Japan,

Indonesia); Yamada and Yagishita 2013: 729 (Japan).

Material examined: Holotype of *Nemaperistedion orientale*: USNM 98876, 146.1, Molucca Sea (0°16'30"N 127°30'00"E), Indonesia, 497 m, 29 Nov. 1909. Paratypes of *Nemaperistedion orientale*: USNM 98916, 108.3, San Andreas Island between Marinduque and Luzon islands, Philippines, 357 m, 24 Apr. 1908; USNM 98917, 144.2, South China Sea, Taiwan, 5 Nov. 1908; USNM 98918, 137.7, Molucca Sea, Indonesia, 421 m, 29 Nov. 1909; USNM 98919, 142.4, Sulu Archipelago, Philippines, 20 Feb. 1908; USNM 98920, 136.3, Molucca Sea, Indonesia, 485 m, 29 Nov. 1909; USNM 98921, 110.8, Bohol Sea, Philippines, 366 m, 9 Aug. 1909. Non-types: BMNH 1996.9.25.19, 106.9, Maldives; BSKU 353, 90.1, BSKU 363, 91.2, Mimase Fishing Port, Kochi, Shikoku, Japan, 11 Apr. 1951; BSKU 1608, 78.6, BSKU 1609, 90.3, Mimase Fishing Port, Kochi, Shikoku, Japan, 24 Jan. 1952; BSKU 29746, 175.4, Okinawa Trough (25°59.0'N 125°51.0'E), East China Sea, 430 m, 10 Oct. 1979; BSKU 40991, 70.5, Mimase Fishing Port, Kochi, Japan, ca. 250 m, 26 Feb. 1985; BSKU 41027, 81.5, Mimase Fishing Port, Kochi, Japan, 13 Mar. 1985; BSKU 43322, 121.8, Mimase Fishing Port, Kochi, Shikoku, Japan, 18 Oct. 1986; BSKU 58515, 84.7, BSKU 58516, 84.8, Mimase Fishing Port, Kochi, Shikoku, Japan, 10 Dec. 2001; BSKU 62260, 87.0, Mimase Fishing Port, Kochi, Shikoku, Japan, 13 Jan. 2003; HUMZ 190862, 138.3, Sumatra (3°24.19'S 100°21.06'E to 3°23.44'S 100°19.56'E), Indonesia, 396–453 m, 28 Sep. 2004; HUMZ 194095, 119.2, HUMZ 194101, 134.6, HUMZ 194102, 118.7, Sumatra (5°45.7'S 102°32.1'E to 5°46.6'S 102°33.3'E), Indonesia, 418–405 m, 31 May 2005; HUMZ 194535, 143.6, HUMZ 194536, 143.1, HUMZ 194537, 141.2, HUMZ 194538, 143.4, Sumatra (2°49.2'N 95°07.0'E to 2°48.6'N 95°08.8'E), Indonesia, 425–477 m, 29 July 2005; HUMZ 194632, 140.7, Java (8°22.5'S 109°43.4'E to 8°21.9'S 109°40.3'E), Indonesia, 368–409 m, 17 July 2005; SNFR 14518, 126.0, SNFR 14519, 132.4, SNFR 14520, 2, 125.5–127.6, East

China Sea, 15 Sep. 2009; ZIN 51357, 2, 99.8–133.3, off Socotra (12°09'N 54°12'E), Arabian Sea, 410 m, 30 Dec. 1988.

Diagnosis. A species of *Scalicus* with long-triangular rostral projection (Fig. 2c), rostral projection width 1.26–1.57 in rostral projection length; 5 (rarely 6) lip and 3 (rarely 4) chin barbels (Fig. 1c; Table 4); filamentous barbel with 22–31 branches (Table 5); posterior part of filamentous barbel with membrane on each base of the branches (Fig. 9), filamentous barbel length 34.0–55.7% SL (Table 10); posteriormost chin barbel simple or divided into two branches at base (Fig. 1c); antrorse spines on posterior bony plates of upper lateral row absent (Fig. 3a).

Distribution. Known from Arabian Sea, Maldives, Indonesia (Molucca Sea, Java and Sumatra), New Caledonia (see del Cerro and Lloris 1997), Philippines, Taiwan and Japan, at depth of 357–497 m (Fig. 4).

Remarks. This species was previously known only from the western Pacific (e.g., Richards 1999; Yamada and Yagishita 2013). Specimens collected from the Arabian Sea, Maldives, Java and Sumatra are the first records of this species in the Indian Ocean.

Peristedion fowleri de Beaufort and Briggs 1962 was proposed as a new replacement name for *Nemaperistedion orientale* Fowler 1938 to avoid a junior secondary homonym with *Peristedion orientale* Temminck and Schlegel 1843. However, *Nemaperistedion orientale* Fowler 1938 (= *Scalicus orientalis*) has been no longer considered as congeneric with *Peristedion orientale* Temminck and Schlegel 1843 (e.g., Kawai 2008; Yamada and Yagishita 2013). Therefore, *Scalicus orientalis* is reinstated as valid (ICZN 1999: Art 59.4).

***Scalicus paucibarbatus* sp. nov.**

(New standard Japanese name: usuhigesoko-kihoubou) (Figs. 1d, 2d, 3b, 11; Tables 1–7, 11)

Satyrichthys engyceros (not Günther): Yatou 1982c: 286, fig. (Kyushu-Palau Ridge).

Holotype. BSKU 30455, 205.8, Kyushu-Palau Ridge (26°05'N 135°50'E), 381 m, 16 Dec. 1979.

Paratypes. BSKU 26010, 174.8, Kyushu-Palau Ridge (28°05.0'N 134°38.5'E), 535 m, 19 Feb. 1978; BSKU 29322, 209.6, BSKU 29418, 256.9, Kyushu-Palau Ridge (26°11.05'N 135°45.04'E), 355–375 m, 16 Dec. 1979; FAKU KP63, 214.0, Kyushu-Palau Ridge (28°04.95'N 134°43.55'E), 26 Nov. 1979; FAKU KP1209, 227.7, Kyushu-Palau Ridge (28°05.04'N 134°39.69'E), 17 Jan. 1980; FAKU KP1690, 206.4, Kyushu-Palau Ridge (26°45.87'N 135°20.78'E), 19 Jan. 1980; FAKU KP1760, 259.2, Kyushu-Palau Ridge (26°06.1'N 135°49.8'E), 28 Nov. 1979; HUMZ 74898, 199.7, Kyushu-Palau Ridge (26°13.8'N 135°46.0'E to 26°8.0'N 135°49.8'E), 370 m, otter trawl, 25 Jan. 1978; HUMZ 74899, 215.5, Kyushu-Palau Ridge (26°11.2'N 135°48.0'E to 26°11.0'N 135°45.6'E), 370 m, otter trawl, 27 Jan. 1978; HUMZ 79219, 98.0 mm HL (impossible to measure SL because of damage), Kyushu-Palau Ridge (26°46.5'N 135°20.3'E to 26°46.6'N 135°20.8'E), 640–320 m, otter trawl, 18 Nov. 1978; HUMZ 80207, 223.1, Kyushu-Palau Ridge (26°46.9'N 135°20.4'E to 26°46.2'N 135°22.3'E), 360 m, otter trawl, 17 Nov. 1978; HUMZ 80239, 217.8, Kyushu-Palau Ridge (26°05.1'N 135°49.4'E to 26°10.8'N 135°45.7'E), 360 m, otter trawl, 20 Nov. 1978; HUMZ 194373, 171.6, Sumatra (5°21.6'N 94°05.7'E to 5°22.6'N 94°04.7'E), Indonesia, 384–426 m, otter trawl, 3 Aug. 2005; MNHN 1988-1530, 168.7, Madagascar (12°44'6"S 48°10'4.8"E), 563–570 m, 5 Mar. 1971; MUFS M6838, 203.3, MUFS M6839, 232.5, MUFS M6891, 174.9, Kyushu-Palau Ridge, trawl, 16 Dec. 1979; MUFS M7014, 244.2, MUFS M7077, 248.8, MUFS M7078, 241.1, MUFS M7079, 248.4, MUFS M 7080, 270.4, Kyushu-Palau Ridge, trawl, 17 Dec. 1979; NMMB-P 12029, 85.1, Nan-fang-ao, Yilan, Taiwan, 11 Mar. 2011.

Diagnosis. A species of *Scalicus* with stick-like rostral projection and ball-like fleshy mass at tip (Fig. 2d), rostral projection width 2.12–4.60 in rostral projection length; 4 lip (including filamentous barbel) and 3 chin barbels (Fig. 1d; Table 4); filamentous barbel with 8–11 branches (Table 5); filamentous barbel lacking a membrane between its each branch, its length 13.1–20.4% SL (Table 11); posteriormost chin barbel simple (rarely divided into two branches at base) (Fig. 1d); antrorse spines present on posterior bony plates of upper lateral row (Fig. 3b).

Description. Counts and proportional measurements (% SL) are listed in Tables 1–7, 11. Description is based on the holotype, followed by the paratypes in parentheses if different.

Body elongate, covered with bony plates. Head large and depressed. Lateral margin of head smooth. Snout broad with stick-like rostral projection on each side (Fig. 2d). Ball-like fleshy mass on tip of each rostral. Eye large. Interorbital concave. Mouth large and inferior without teeth on both jaws. Posterior margin of upper jaw anterior to anterior margin of orbit. Posterior tip of lower jaw below anterior margin of orbit. Vomer and palatine toothless. Four groups of barbels on lip (Fig. 1d): anterior three barbels without branches; posterior barbel filamentous with 11 (8–11) branches (Table 5). Three groups of barbels on chin (Fig. 1d): anterior two barbels without branches; posteriormost simple (rarely divided into two branches at base). Gill rakers slender and serrated. Gill membrane narrowly united to isthmus. No spines on base of rostral projection. Nasal spines 2 (2–3, rarely 6). Ethmoid spines 2 (1–5) on mid-line and 0 (0–1) spines on one or both sides. Lateral ethmoid spines 1 (1–3). Preocular spines 6 on left side and 3 on right side (2–9). Supraocular + postocular spines 4 on left side and 6 on right side (2–14). Frontal-1 spines single (rarely 2). Frontal-2 spines 1 on left side and 2 on right side (0–6). Parietal spines 2 (1–3). Sphenotic spines 1 (0–2). Pterotic spines 1 (0–5). Extrascapular spines 0 on left side and 1 on right side (0–1). Posttemporal spines 2 (rudimentary or 1–5 small spines). 4th infraorbital 1 spine on left side and 3 on right side (1–5

spines or with tiny ridge). Single large preopercular spine. Opercular spine with spiny ridge. Supraocular bone exposed between both sides of parietals on dorsal surface.

Bony plates on body mainly in 4 rows, each plate with single backwardly directed spine. Plates in 22nd to 34th (20–23rd to 31–33rd) upper lateral row with anteriorly directed spines (Fig. 2b). Anterior 5 plates in upper lateral row smaller. Posterior pairs of bony plates in lower lateral rows separated from each other. Two large plates before anus.

Dorsal fin originating on anterior part of second bony plate in dorsal row, ending at caudal peduncle. Anal fin originating posterior to anus, ending on caudal peduncle. Two detached ventral pectoral fin rays thick, shorter than length of connected pectoral fin. Posterior margin of pelvic fin reaching beyond first bony plate before anus. Caudal fin nearly truncate (truncate or weakly marginate).

Color in alcohol. Head and body yellowish brown with vermiculated pattern dorsally and dorsolaterally (faded in most paratypes). All fins almost light brown with the following exceptions: dorsal fin margin black; mid to posterior part (all in NMMB-P 12029) of pectoral fin black except for posterior margin.

Distribution. Madagascar, Sumatra, Taiwan and Kyushu-Palau Ridge at depth of 320–640 m (Fig. 10).

Etymology. The specific name *paucibarbatus* from Latin *pauci*, few, and Latin *barbatus*, barbel, refers to the few branches on its filamentous barbel.

Scalicus quadratorostratus (Fourmanoir and Rivaton 1979)

(Standard Japanese name: Soko-kihoubou) (Figs. 1e, 2e, 12; Tables 1–7, 12)

Peristedion engyceros (not Günther): Kamohara 1936: 438, pl. 29-4 (Japan); Kamohara

1950: 232 (Japan).

Satyrichthys engyceros (not Günther): Kamohara 1952: 8, fig. 5 (Japan).

Peristedion quadratorostratus Fourmanoir and Rivaton 1979: 423, fig. 15 (type locality: New Caledonia).

Satyrichthys quadratorostratus: del Cerro and Lloris 1997: 97 (New Caledonia); Fricke et al. 2011: 381 (New Caledonia).

Scalicus quadratorostratus: Kawai 2008: 27 (name listed).

Material examined: Lectotype of *Peristedion quadratorostratus* (designated here): MNHN 1978-0478, 107.0, New Caledonia (17°30'S 167°30'E), 360 m. Paralectotype of *Peristedion quadratorostratus*: MNHN 1982-0001, 105.4, collected with the lectotype. Non-types: BSKU 4595, 132.7, Mimase Fishing Port, Kochi, Shikoku, Japan, 30 Apr. 1955; BSKU 26617, 139.2, BSKU 26618, 136.6, East China Sea (26°23.3'N 125°04.0'E), 295–385 m, 24 Jan. 1978; FAKU 19572, 91.4, Nobeoka, Miyazaki, Kyushu, Japan, 10 Dec. 1952; FAKU 22062, 111.1, Mimase Fishing Port, Kochi, Shikoku, Japan, 10–20 Apr. 1954; FAKU 37395, 140.7, Nobeoka, Miyazaki, Kyushu, Japan, 10 Nov. 1965; FAKU 84129, 159.1, FAKU 84130, 116.1, FAKU 84131, 146.0, East China Sea (28°17.2'N 126°53.4'E to 28°19.1'N 126°54.6'E), 336–341 m, 11 Nov. 2002; FAKU 103290, 2, 69.8–127.6, locality unknown; FAKU 103818, 2, 76.5–131.9, Mimase Fishing Port, Kochi, Shikoku, Japan, 10 Jan. 1959; HUMZ 51712, 127.1, Miya Fish Market, Gamagori, Honshu, Japan, 10 Mar. 1976; MUFS 20927, 123.5, MUFS 20928, 1, 122.0, Nobeoka, Miyazaki, Kyushu, Japan, 27 Oct. 1997; NMMB-P 16283, 125.1, NMMB-P 16299, 3, 129.5–137.8, Nan-fang-ao, Yilan, Taiwan, 23 July 2010; NMMB-P 16311, 2, 114.5–136.3, Nan-fang-ao, Yilan, Taiwan, 20 July 2010; NMMB-P 17740, 112.2, NMMB-P 18000, 153.0, Senkaku, East China Sea, 12 Nov. 2012; NMMB-P 17741, 130.9, NMMB-P 17837, 138.1, Dasi, Yilan, Taiwan, 12 Nov. 2012; NSMT-P 8505, 119.0, Suruga Bay, Japan, 18 Feb. 1969; NSMT-P 65621, 147.4, NSMT-P

78191, 115.9, East China Sea (28°15.3'N 126°52.8'E to 28°19.1'N 126°54.6'E), 336–341 m, 11 Nov. 2002; NSMT-P 96020, 129.4, Ogasawara Islands (27°44.729'N 142°13.498'E to 27°43.932'N 142°14.184'E), 521–536 m, 7 June 1997; NSMT-P 98191, 149.6, Tokunoshima (28°3.79'N 128°56.3'E to 28°4.71'N 128°57.6'E), Kagoshima, Kyushu, Japan, 533–583 m, 14 May 2005; SNFR 11324, 4, 141.5–148.6, East China Sea, 14 July 1988; SNFR 11561, 108.0, East China Sea, 22 Oct. 1990; MNHN 1988-1554, 128.7, Madagascar (12°41'2.4"S 48°16'1.2"E), 308–314 m, 15 Apr. 1971; MNHN 1995-0488, 138.8, New Caledonia (22°10'58.8"S 167°15'00"E), 495–515 m, 9 Sep. 1985; MNHN 1995-0489, 121.6, New Caledonia (23°37'58.8"S 167°43'01.2"E), 418 m, 30 Oct. 1986; MNHN 1995-0496, 120.4, New Caledonia (22°46'58.8"S 167°15'00"E), 430–465 m, 30 Oct. 1985; MNHN 1995-0512, 116.5, New Caledonia (22°45'14.4"S 167°12'10.8"E), 380 m, 30 Aug. 1985; MNHN 2004-2251, 2, 125.0–138.7, New Caledonia (23°40'1.2"S 167°43'1.2"E), 456–478 m, 20 June 2001; MNHN 2004-2458, 129.9, New Caledonia (23°25'58.8"S 167°30'00"E), 458–680 m, 19 June 2001; MNHN 2014-0393, 124.6, New Caledonia (22°48'6.012"S 167°15'22.212"E), 460–490 m, 29 Oct. 2008.

Diagnosis. A species of *Scalicus* with stick-like rostral projection lacking ball-like fleshy mass at the tip (Fig. 2e), rostral projection width 2.24–4.28 in rostral projection length; 5 lip and 3 chin barbels (Fig. 1e; Table 4); filamentous barbel with 13–21 (rarely 9 or 11) branches (Table 5); filamentous barbel lacking membrane between its each base, its length 15.2–25.3% SL (Table 12); posteriormost chin barbel divided into two branches at the base (rarely not divided) (Fig. 1e); antrorse spines present on posterior bony plates of upper lateral row (Fig. 3b).

Distribution. Madagascar, New Caledonia, Taiwan and Japan at depth of 295–680 m (Fig. 10).

Remarks. Although this species had been previously known only around New Caledonian

(Fourmanoir and Rivaton 1979; del Cerro and Lloris 1997; Fricke et al. 2011), it has a wide distribution reaching Madagascar, Taiwan and Japan. To avoid further confusion of this species, I herein designate MNHN 1978-0478 as lectotype of *Scalicus quadratorostratus*. Consequently, the other syntype becomes paralectotype of *S. quadratorostratus* (ICZN 1999: Art. 74).

***Scalicus serrulatus* (Alcock 1898)**

(Standard Japanese name: Toge-kihoubou) (Figs. 1f, 2f, 13; Tables 1–7, 13)

Peristethus serrulatum Alcock 1898: 153 (type locality: Andaman Sea); Alcock 1899: fig. 2, 2a in pl. 25 (Andaman Sea).

Peristedion serrulatum: Kamohara 1936: 438, pl. 29-3 (Japan); Kamohara 1950: 233 (Japan).

Satyrichthys serrulatus: Kamohara 1952: 7, fig. 3 (Japan); Yatou 1982b: 285, fig. (Kyushu-Palau Ridge); Ochiai and Yatou 1984: 321, pl. 301-L, M (Japan); Yatou 1997: 217, fig. (Japan); Richards 1999: 2363 (western central Pacific); Richards 2000: 607 (name listed from South China Sea); Yamada 2002: 533 (Japan).

Scalicus serrulatus: Kawai 2008: 27 (name listed); Yamada and Yagishita 2013: 729 (Japan).

Material examined: Lectotype of *Peristethus serrulatum* (designated here): ZSI F296/1, 122.1, Andaman Sea (13°17'15"N 93°10'25"E), 338 m, 1897. Paralectotype of *Peristethus serrulatum*: ZSI F297/1, 119.8, collected with the lectotype. Non-types: BSKU 30795, 177.8, Kyushu-Palau Ridge (26°11.05'N 135°45.04'E), 355–375 m, 16 Dec. 1979; BSKU 70206, 176.3, Murotsu Fishing Port, Muroto, Shikoku, Japan, 22 Apr. 2004; BSKU 87644, 134.7,

Mimase Fishing Port, Kochi, Shikoku, Japan, ca. 300 m, 9 May 2000; BSKU 102958, 154.8, Mimase Fishing Port, Kochi, Shikoku, Japan, 250–400 m, 19 Apr. 2010; FAKU KP7, 145.3, Kyushu-Palau Ridge (26°46.3'N 135°21.1'E), 27 Nov. 1979; FAKU KP1764, 169.0, Kyushu-Palau Ridge (26°06.1'N 135°49.8'E), 28 Nov. 1979; FAKU S547, 104.7, Mimase Fishing Port, Kochi, Shikoku, Japan, 28 Dec. 1958; FAKU 20566, 135.6, Miya, Gamagouri, Honshu, Japan, 10 Apr. 1953; FAKU 34566, 145.9, Owase, Honshu, Japan, 12–14 Nov. 1961; FAKU 103286, 156.3, locality unknown; HUMZ 190193, 128.0, Sumatra (5°29.16'N 94°01.47'E to 5°27.49'N 94°01.52'E), Indonesia, 361–347 m, 13 Oct. 2004; HUMZ 190262, 187.3, Java (8°10.3'S 109°49.3'E to 8°9.4'S 109°48.8'E), Indonesia, 280–285 m, 13 Sep. 2004; HUMZ 191217, 173.4, Java (8°06.17'S 108°34.05'E to 8°04.22'S 108°34.00'E), Indonesia, 210–180 m, 6 Sep. 2004; HUMZ 193652, 143.0, Java (8°19.2'S 109°45.7'E to 8°19.1'S 109°44.0'E), Indonesia, 335–400 m, 10 May 2005; HUMZ 193908, 159.4, HUMZ 193912, 108.3, HUMZ 193913, 126.3, HUMZ 193914, 162.5, Java (8°18.8'S 109°49.0'E to 8°19.6'S 109°47.9'E), Indonesia, 305–330 m, 10 May 2005; HUMZ 194371, 154.7, Sumatra (5°21.6'N 94°5.7'E to 5°22.6'N 94°4.7'E), Indonesia, 426–384 m, 3 Aug. 2005; HUMZ 194502, 157.2, Java (8°19.9'S 109°45.3'E to 8°19.8'S 109°43.4'E), Indonesia, 320–342 m, 16 July 2005; HUMZ 194544, 171.7, Java (8°22.5'S 109°43.4'E to 8°21.9'S 109°40.3'E), Indonesia, 368–409 m, 17 July 2005; MABIK 2145, 152.2, Emperor Seamount Chain, 9 Mar. 2016; NSMT-P 59903, 127.8, Mimase Fishing Port, Kochi, Shikoku, Japan, 26 Nov. 1999; NSMT-P 75976, 132.2, Mimase Fishing Port, Kochi, Shikoku, Japan, 5 Dec. 1992; ZIN 49324, 141.6, Saya de Malha Bank, Indian Ocean, 18 Feb. 1974; ZIN 51353, 2, 124.8–140.3, Saya de Malha Bank, Indian Ocean, 1988; ZIN 51358, 2, 77.0–80.6, Saya de Malha Bank (9°59'S 62°12'E), Indian Ocean, 30 Sep. 1986.

Diagnosis. A species of *Scalicus* with stick-like rostral projection with or without tiny fleshy mass at tip (Fig. 2f), rostral projection width 2.14–4.15 in rostral projection length; 4

lip and 1 (rarely 2) chin barbels (Fig. 1f; Table 4); filamentous barbel with 7–11 branches (Table 5); filamentous barbel lacking membrane between its each base, its length 10.1–20.6% SL (Table 13); posteriormost chin barbel simple; antrorse spines present on posterior bony plates of upper lateral row (Fig. 3b).

Distribution. Saya de Malha Bank, Andaman Sea, Indonesia (Sumatra and Java), Kyushu-Palau Ridge, Japan and Emperor Seamount Chain at depth of 180–426 m (Fig. 10).

Remarks. In order to avoid confusion of this species, I designate ZSI F296/1 as lectotype of *Scalicus serrulatus*. Consequently, ZSI F297/1 becomes paralectotype of *S. serrulatus* (ICZN 1999: Art. 74).

Discussion

Diagnostic characters of species of *Scalicus* are listed in Table 14. Congeners of *Scalicus* divided into two groups. One is a short rostral group in having triangular and short rostral projection, its width 0.79–1.57 in its length, including *Scalicus hians* and *Scalicus orientalis* (Fig. 2b, c). The other is a long rostral group in having stick-like and long rostral projection, 2.12–4.60, including *Scalicus engyceros*, *Scalicus paucibarbatus* sp. nov., *Scalicus quadratorostratus* and *Scalicus serrulatus* (Fig. 2a, d–f). Both groups also differ from each other by antrorse spines on posterior bony plates of upper lateral row (absent in the former group vs. present in the latter: Fig. 3) and counts of branches on filamentous barbel (22–39 vs. 7–21: Table 5).

Short rostral group. *Scalicus hians* is distinguished from *S. orientalis* in having an equilateral-triangular rostral projection, its depth 0.79–1.25 in its length (vs. long and triangular, 1.26–1.57) (Fig. 2b, c) and 7 (rarely 6 or 8) lip barbels [vs. 5 (vs. rarely 6)] (Fig. 1b,

c; Table 4), and lacking membrane on each base of the branches of filamentous barbel (vs. having membrane on posterior part of filamentous barbel: Fig. 9).

Long rostral group. *Scalicus serrulatus* easily differs from *S. engyceros*, S. *paucibarbatus* sp. nov. and *S. quadratorostratus* in having 1 (rarely 2) chin barbels [vs. 3 (rarely 4) in *S. engyceros*, and 3 in *S. paucibarbatus* sp. nov. and *S. quadratorostratus*)] (Fig. 1a, d–f; Table 4). *Scalicus serrulatus* is distinguished from *S. engyceros* and *S. quadratorostratus* by greater number of branches on filamentous barbel (7–11 vs. 13–18 in *S. engyceros*, and 13–21, rarely 9 or 11, in *S. quadratorostratus*: Table 5). *Scalicus serrulatus* is separated from *S. engyceros* and *S. paucibarbatus* sp. nov. by ball-like fleshy mass at the tip of rostral projection (absent or tiny vs. present: Fig. 2a, d, f). In addition, *S. serrulatus* differs from *S. engyceros* by branch at base of filamentous barbel (absent vs. present: Fig. 1a, f), from *S. quadratorostratus* by number of lip barbel (4 vs. 5: Fig. 1e, f; Table 4), and almost from *S. paucibarbatus* sp. nov. by snout length (15.6–17.8% SL vs. 17.7–21.0) and lower jaw length (11.7–14.3% SL vs. 14.0–17.6%) (Tables 11, 13).

Scalicus quadratorostratus is easy to be distinguished from *S. engyceros* and *S. paucibarbatus* sp. nov. in having 5 lip barbels (vs. 4, rarely 3, in *S. engyceros* and 4 in *S. paucibarbatus* sp. nov. (Fig. 1a, d, e; Table 4) and by lacking ball-like fleshy mass at the tip of rostral projection (vs. in having ball-like fleshy mass in the two species) (Fig. 2a, d, e). In addition, *S. quadratorostratus* is differentiable from *S. engyceros* by branch at base of filamentous barbel (absent vs. present: Fig. 1a, e), and almost from *S. paucibarbatus* sp. nov. by counts of branches on filamentous barbel (8–11 vs. 13–21, rarely 9 or 11: Table 5).

Scalicus paucibarbatus sp. nov. is separable from *S. engyceros* in having 8–11 branches on the filamentous barbel (vs. 13–18) (Table 5), and in lacking a branch at base of filamentous barbel (vs. in having a branch) (Fig. 1a, d).

Key to the species of *Scalicus*

1a. Rostral projection triangular and short (Fig. 2b, c), rostral projection width 0.79–1.57 in rostral projection length; bony plates on upper lateral row without antrorse spines (Fig. 3a); 22–39 branches on filamentous barbel (Table 5)……... 2

1b. Rostral projection stick-like and long (Fig. 2a, d–f), rostral projection width 2.12–4.60 in rostral projection length; posterior bony plates on upper lateral row with antrorse spines (Fig. 3b); 7–21 branches on filamentous barbel (Table 5)…….. 3

2a. Rostral projection an equilateral-triangle (Fig. 2b), rostral projection width 0.79–1.25 in rostral projection length; filamentous barbel without membrane between its each branch; 7 (rarely 6 or 8) lip barbels (Fig. 1b; Table 4)…… *S. hians*

2b. Rostral projection long and triangular (Fig. 2c), rostral projection width 1.26–1.57 in rostral projection length; posterior part of filamentous barbel with membrane on each base of the branches (Fig. 9); 5 (rarely 6) lip barbels (Fig. 1c; Table 4)…….. *S. orientalis*

3a. Chin barbels 1 (rarely 2) (Fig. 1f; Table 4)…… *S. serrulatus*

3b. Chin barbels 3 (rarely 4) (Fig. 1a, d, e; Table 4)…….. 4

4a. Tip of rostral projection without ball-like fleshy mass (Fig. 2e); 5 lip barbels (Fig. 1e; Table 4)..... S. *quadratorostratus*

4b. Tip of rostral projection with ball-like fleshy mass (rarely small mass) (Fig. 2a, d); 4

(rarely 3) lip barbels (Fig. 1a, d; Table 4)..... 5

5a. Filamentous barbel with 13–18 branches (Table 5); filamentous barbel having branch at base (Fig. 1a)..... *S. engyceros*

5b. Filamentous barbel with 8–11 branches (Table 5); filamentous barbel lacking branch at base (Fig. 1d)..... *S. paucibarbatus* sp. nov.

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Figure Captions

Fig. 1 Barbels on lower jaw in six species of *Scalicus*. **a** *S. engyceros*, HUMZ 99833, 181.6 mm SL, **b** *S. hians*, HUMZ 194721, 157.1 mm SL, **c** *S. orientalis*, HUMZ 194535, 143.6 mm SL, **d** *S. paucibarbatus* sp. nov., HUMZ 74899, paratype, 215.5 mm SL, **e** *S. quadratorostratus*, NSMT-P 65621, 147.4 mm SL, **f** *S. serrulatus*, HUMZ 194544, 171.7 mm SL. *Red* and *blue arrowheads* indicate lip and chin barbels, respectively. *Black arrowhead* indicate branch at base of filamentous barbel. *Scale bars* 10 mm

Fig. 2 Lateral views of head showing rostral projection. **a** *S. engyceros*, HUMZ 99833, 181.6 mm SL, **b** *S. hians*, USNM 47730, lectotype, 154.7 mm SL, **c** *S. orientalis*, HUMZ 194095, 119.2 mm SL, **d** *S. paucibarbatus* sp. nov., BSKU 30455, holotype, 205.8 mm SL, **e** *S. quadratorostratus*, NSMT-P 65621, 147.4 mm SL, **f** *S. serrulatus*, HUMZ 190262, 187.3 mm SL

Fig. 3 Ventrolateral views of posterior part of bony plates on upper lateral row (anterior to the left). **a** *S. orientalis*, HUMZ 194102, 118.7 mm SL, **b** *S. paucibarbatus* sp. nov., BSKU 29322, paratype, 209.6 mm SL

Fig. 4 Distribution of *S. engyceros* (*circles*), *S. hians* (*triangles*) and *S. orientalis* (*squares*). *Solid symbols* showing type localities

Fig. 5 Dorsal views of *Scalicus engyceros*. **a** BMNH 2010.2.1.1, holotype of *Peristethus engyceros*, ca. 109 mm HL, Hawaii, **b** USNM 84102, holotype of *Peristedion gilberti*, 111.1 mm SL, Hawaii

Fig. 6 Dorsolateral views of *Scalicus engyceros* showing pectoral fin. **a** HUMZ 99829, 172.1 mm SL, Hawaii, **b** HUMZ 132295, 189.9 mm SL, Emperor Seamount Chain

Fig. 7 Dorsal views of *Scalicus hians*. **a** USNM 47730, lectotype of *Peristedion hians*, 154.7 mm SL, Hawaii, **b** ZSI 13037, syntype of *Peristethus investigatoris*, 130.9 mm SL, Andaman Sea, **c** USNM 51428, holotype of *Peristedion amiscus*, 79.7 mm SL, Japan

Fig. 8 Dorsal view of *Scalicus orientalis*. USNM 98876, holotype of *Nemaperistedion orientale*, 146.1 mm SL, Molucca Sea

Fig. 9 Membrane of filamentous barbel in *S. orientalis*, HUMZ 194095, 119.2 mm SL

Fig. 10 Distribution of *S. paucibarbatus* sp. nov. (*circles*), *S. quadratorostratus* (*triangles*) and *S. serrulatus* (*squares*). *Solid symbols* showing type localities

Fig. 11 *Scalicus paucibarbatus* sp. nov. BSKU 30455, holotype, 205.8 mm SL, Kyushu-Palau Ridge, **a** dorsal view, **b** lateral view (image reversal), **c** ventral view

Fig. 12 Dorsal views of *Scalicus quadratorostratus*. **a** MNHN 1978-0478, lectotype of *Peristedion quadratorostratus*, 107.0 mm SL, New Caledonia, **b** NSMT-P 65621, 147.4 mm SL, East China Sea

Fig. 13 Dorsal views of *Scalicus serrulatus*. **a** ZSI F296/1, lectotype of *Peristethus serrulatum*, 122.1 mm SL, Andaman Sea, **b** HUMZ 190262, 187.3 mm SL, Java

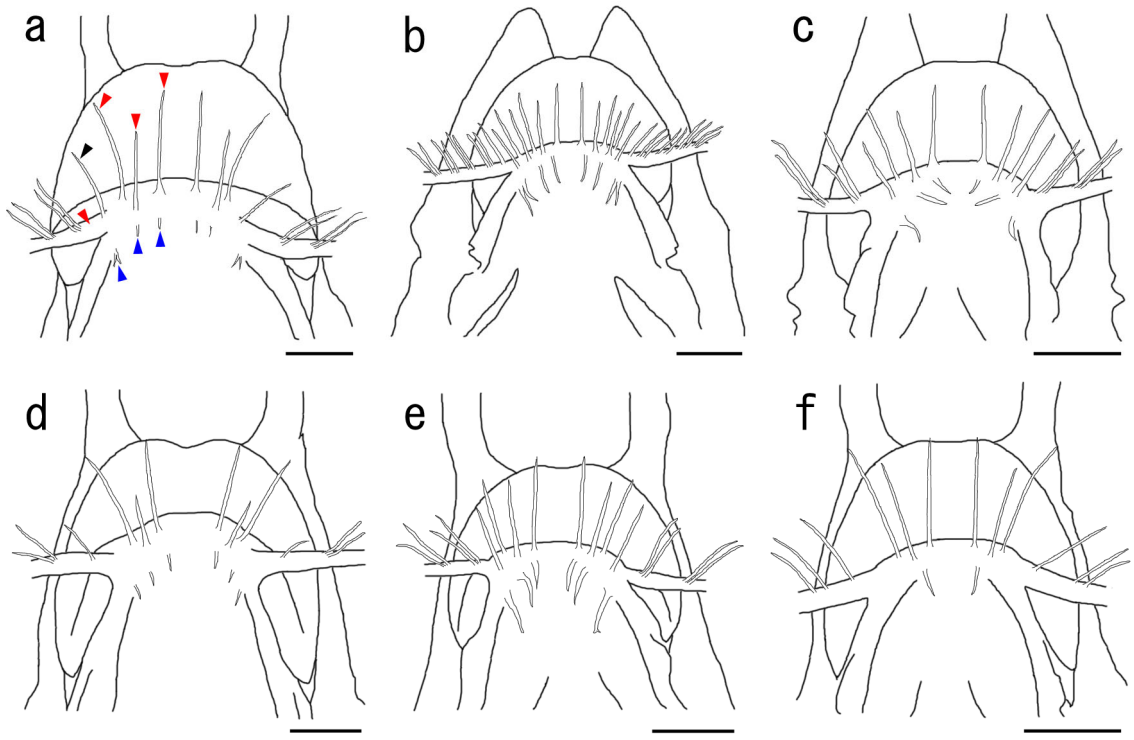


Fig. 1

150 mm

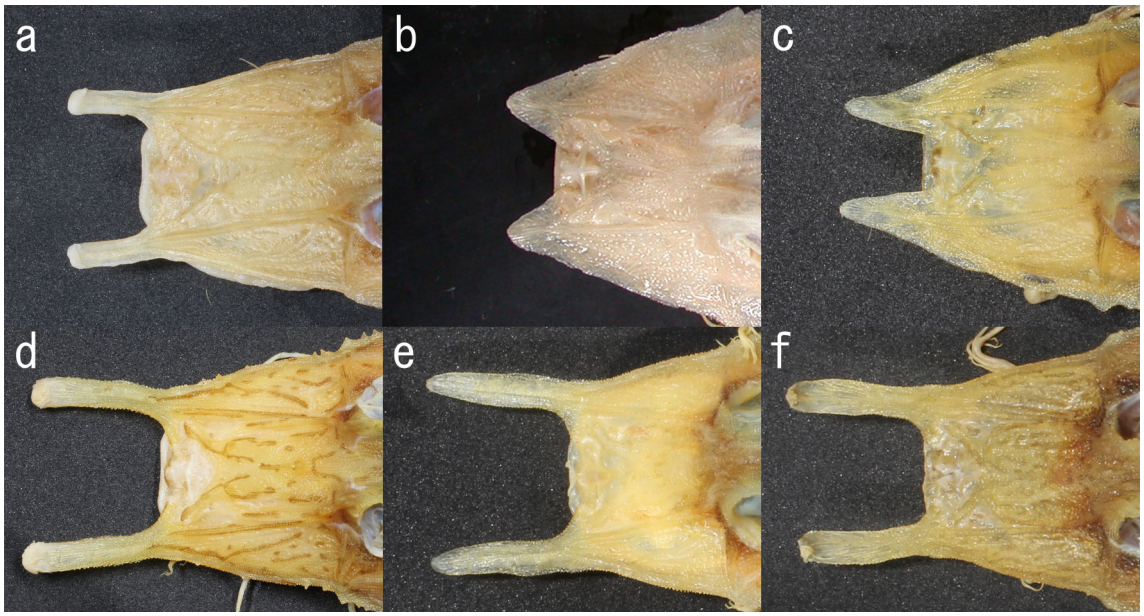


Fig. 2

150 mm

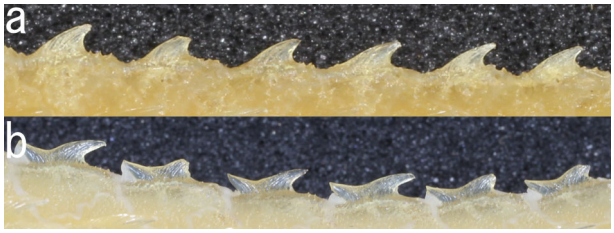


Fig. 3

80 mm

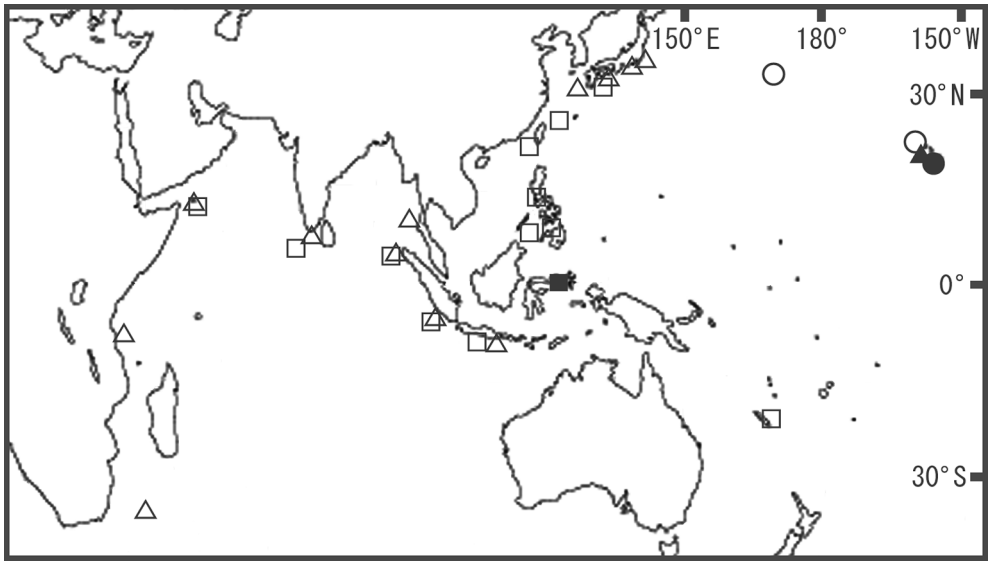


Fig. 4

130 mm

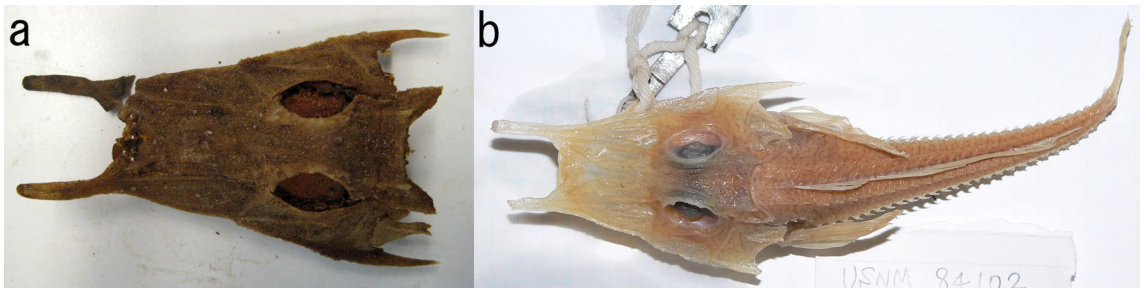


Fig. 5

150 mm

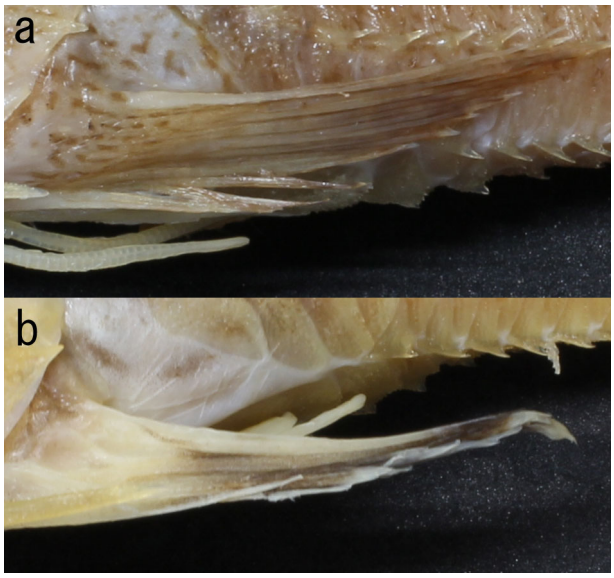


Fig. 6

80 mm

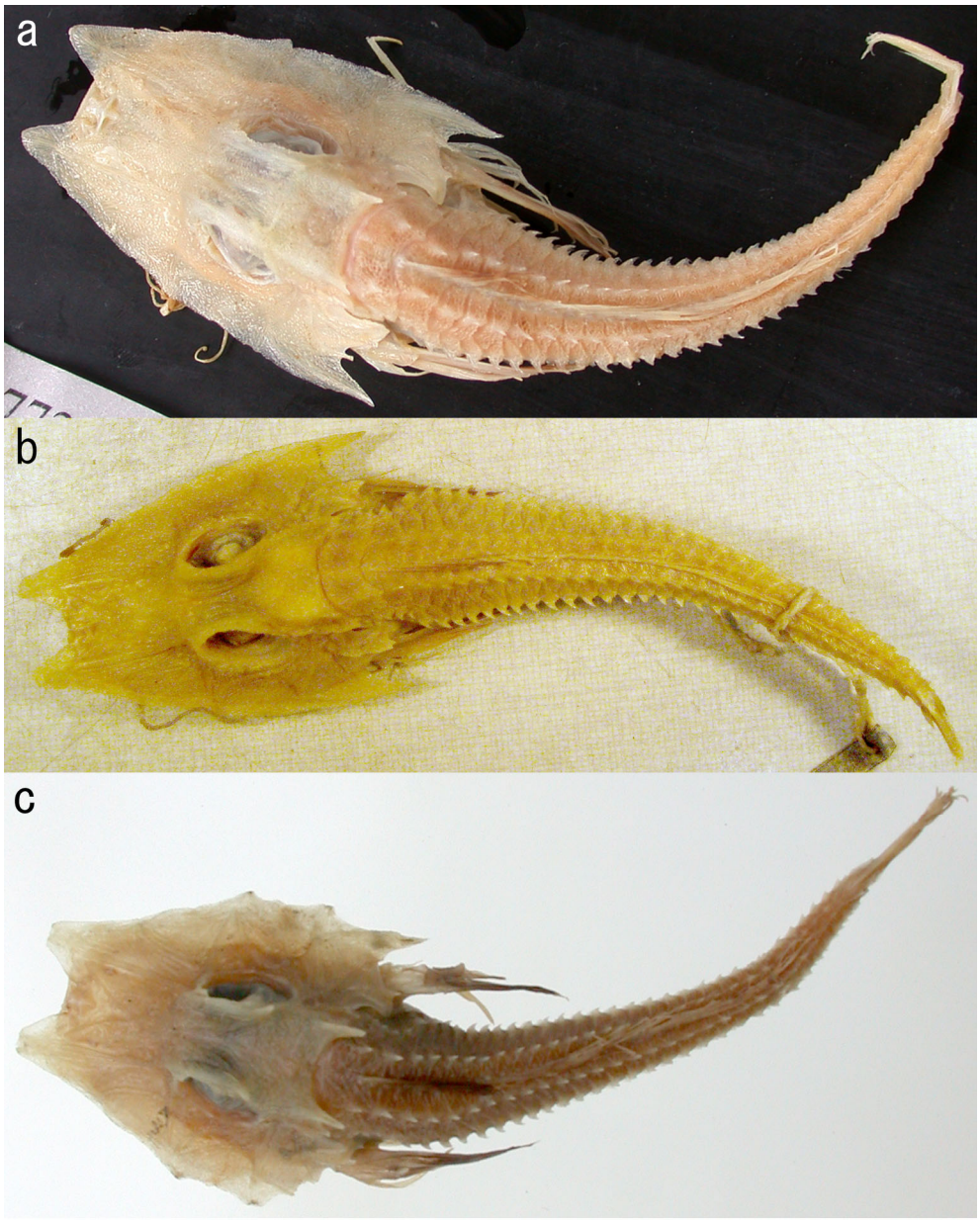


Fig. 7

130 mm

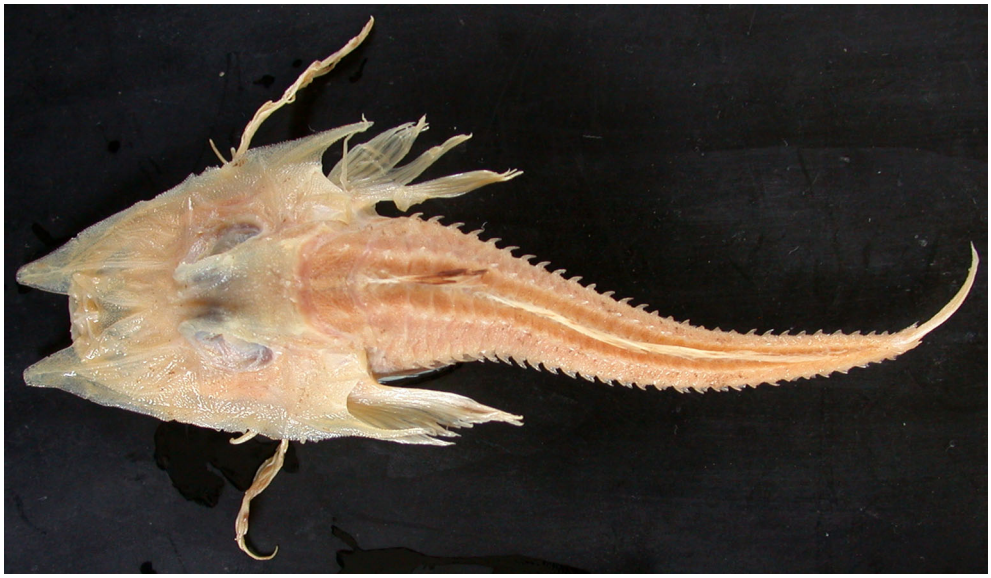


Fig. 8

130 mm



Fig. 9

80 mm

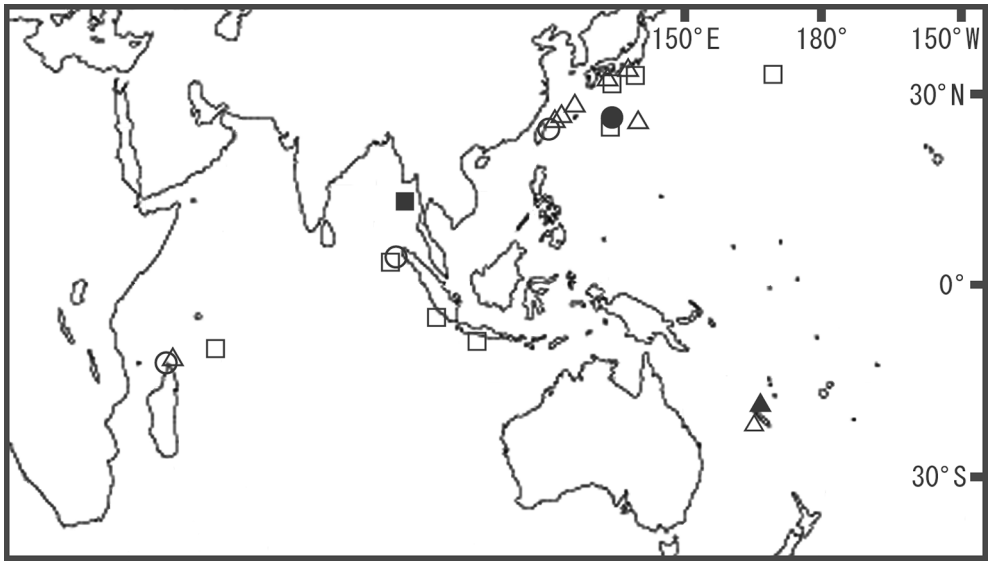


Fig. 10

150 mm



Fig. 11

150 mm



Fig. 12

130 mm

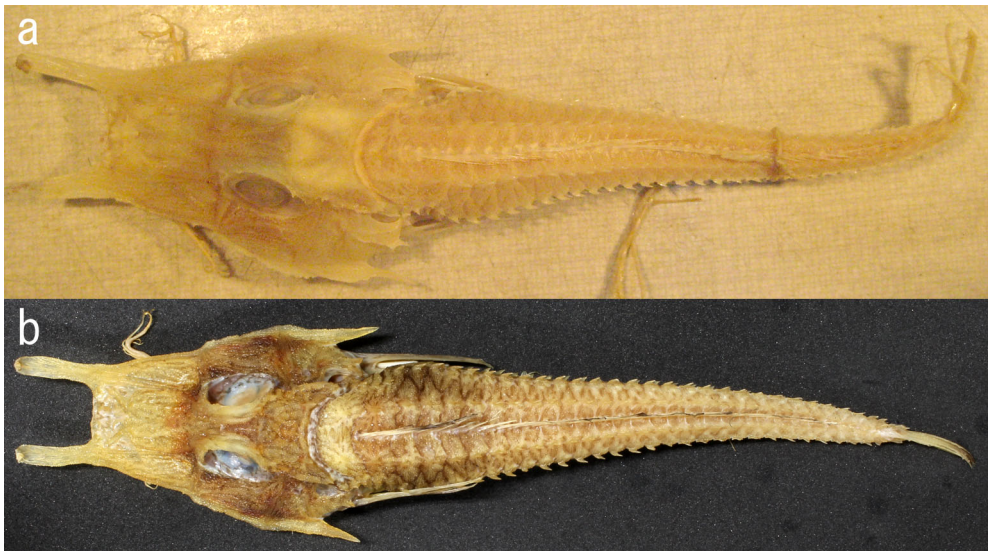


Fig. 13

130 mm

Table 1 Counts of dorsal, anal and pectoral rays in species of *Scalicus*

	Dorsal spines			Dorsal soft rays					Anal soft rays					Connected pectoral rays			
	6	7	8	19	20	21	22	23	19	20	21	22	23	13	14	15	16
S. engyceros (*n* = 45)	1	44		1	20	19	5		1	19	22	3		1	23	20	1
S. hians (*n* = 59)	1	**58**			4	**41**	14			2	**43**	14		1	**4**	48	6
S. orientalis (*n* = 34)		**34**			1	11	**20**	2		1	17	**15**	1	3	8	**22**	1
S. paucibarbatus sp. nov. (*n* = 24)		**23**	1		1	14	**8**				16	**7**			1	**21**	2
S. quadratorostratus (*n* = 47)		**47**			8	**34**	5			13	**31**	2			**3**	38	6
S. serrulatus (*n* = 31)		**31**				4	**23**	4			**12**	17	2	2	**10**	17	2

Holotypes and lectotypes of valid species in *boldface* where available

Table 2 Counts of bony plates of four rows in species of *Scalicus*

	Dorsal					Upper lateral						Lower lateral							Ventral					
	28	29	30	31	32	32	33	34	35	36	37	22	23	24	25	26	27	28	23	24	25	26	27	28
S. engyceros (*n* = 45)	1	24	19	1		1	1	19	22	2		3	24	17	1				1	7	31	6		
S. hians (*n* = 59)			39	**19**	1				14	**41**	4		2	21	**32**	3		1	1		9	**42**	7	
S. orientalis (*n* = 34)		3	18	**13**				1	12	**19**	2		2	11	**19**	1	1				7	20	**7**	
S. paucibarbatus sp. nov. (*n* = 23)			20	**3**				1	10	**12**				15	**8**						4	**19**		
S. quadratorostratus (*n* = 47)	2	34	**11**					8	**35**	4		1	18	**28**						6	**37**	4		
S. serrulatus (*n* = 31)			**17**	13	1			1	4	**23**	3			3	**23**	5						**21**	8	1

Holotypes and lectotypes of valid species in *boldface* where available

7

Table 3 Counts of bony plates before anus in species of *Scalicus*

8

	Left side		Right side	
	2	3	2	3
S. engyceros (*n* = 46)	**45**	1	**46**	
S. hians (*n* = 59)	**55**	4	**55**	4
S. orientalis (*n* = 34)	**33**	1	**32**	2
S. paucibarbatus sp. nov. (*n* = 24)	**24**		**24**	
S. quadratorostratus (*n* = 47)	**46**	1	**46**	1
S. serrulatus (*n* = 31)	**31**		**31**	

9

Holotypes and lectotypes of valid species in *boldface* where available

Table 4 Counts of barbels in species of *Scalicus*

	Left side on lip						Right side on lip				Left side on chin				Right side on chin			
	3	4	5	6	7	8	4	5	6	7	1	2	3	4	1	2	3	4
S. engyceros (*n* = 45)	1[1]	44					45						44	1			45	
S. hians (*n* = 59)				**1**	57	1				**59**			**58**	1			**56**	3
S. orientalis (*n* = 34)			**33**	1				**34**					**33**	1			**34**	
S. paucibarbatus sp. nov. (*n* = 24)		**24**					**24**						**24**				**24**	
S. quadratorostratus (*n* = 47)			**47**					**47**					**47**				**47**	
S. serrulatus (*n* = 31)		**31**					**31**				**26**	5			**26**	5		

Holotypes and lectotypes of valid species in *boldface* where available

[1]Lacking filamentous barbel

Table 5 Counts of branches on filamentous barbel in species of *Scalicus*

	Left side																														
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
S. engyceros (*n* = 34)							2	9	12	6	3	2																					
S. hians (*n* = 46)																1		3	6	7	16	**2**	1		4	1	2	1	1				1
S. orientalis (*n* = 20)																2	**2**	2	3	3	1	1	2	2	2								
S. paucibarbatus sp. nov. (*n* = 24)		2	7	9	**6**																												
S. quadratorostratus (*n* = 47)			1		1			2	6	11	**17**	5	1	1	2																		
S. serrulatus (*n* = 19)	4	2	7	5	1																												

	Right side																																
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
S. engyceros (*n* = 35)							3	9	9	9	2	3																					
S. hians (*n* = 44)																1	1	2	9	4	13	1	**6**	1	1	2		1			2		
S. orientalis (*n* = 23)																1	**4**	3	1	5	3		1	4	1								
S. paucibarbatus sp. nov. (*n* = 24)			4	9	**11**																												
S. quadratorostratus (*n* = 47)			1				1	2	4	13	**18**	3	3	1	1																		
S. serrulatus (*n* = 19)	5	1	10	2	1																												

Holotypes and lectotypes of valid species in *boldface* where available

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Table 6 Counts of branches of the posteriormost chin barbel in species of *Scalicus*

	Left side			Right side		
	1	2	3	1	2	3
S. engyceros (*n* = 45)	5	40		5	39	1
S. hians (*n* = 59)	1	**56**	2	1	**56**	2
S. orientalis (*n* = 34)	15	**19**		17	**17**	
S. paucibarbatus sp. nov. (*n* = 24)	**22**	2		**20**	4	
S. quadratorostratus (*n* = 47)	6	**41**		6	**41**	
S. serrulatus (*n* = 31)	**31**			**31**		

Holotypes and lectotypes of valid species in *boldface* where available

17

18

19

20

Table 7 Counts of gill rakers in species of *Scalicus*

	Upper					Lower including one middle											
	4	5	6	7	8	15	16	17	18	19	20	21	22	23	24	25	26
S. engyceros (*n* = 44)	13	28	3			1	13	19	10								
S. hians (*n* = 59)	1	**24**	28	6							4	12	17	**16**	4	3	1
S. orientalis (*n* = 34)		9	**18**	6	1				3	**5**	16	6	4				
S. paucibarbatus sp. nov. (*n* = 24)	1	**20**	3					4	7	**12**	1						
S. quadratorostratus (*n* = 46)	3	27	**15**	1			4	19	14	6	**2**		1				
S. serrulatus (*n* = 31)	6	20	**5**					5	13	**8**	5						

Holotypes and lectotypes of valid species in *boldface* where available

21

22

Table 8 Ranges for relative measurements of *Scalicus engyceros*

	Peristedion engyceros	*Peristedion gilberti*		Non-types			
	Holotype BMNH 2010.2.1.1	Holotype USNM 84102	Paratypes *n* = 7	Hawaii *n* = 21	Emperor Seamount Chain *n* = 10	Africa (doubtful) *n* = 2	Unknown *n* = 4
Standard length (mm)	Damaged	111.1	99.6–151.3	107.1–253.5	118.4–189.9	225.5–231.0	151.4–205.4
Head length (mm)	ca. 109	44.5	40.3–54.7	43.3–99.3	43.9–66.2	78.3–84.0	54.9–74.6
Measurements (% SL)							
Body depth	Damaged	19.3	16.1–18.2	14.5–19.1 (*n* = 20)	13.8–17.2 (*n* = 9)	13.6–14.7	13.6–18.1
Body width	Damaged	12.7	12.3–15.1	11.5–16.1 (*n* = 20)	11.4–15.7 (*n* = 9)	12.7–13.3	11.2–14.4
Head length	Damaged	40.1	36.2–41.1	37.4–41.7	34.9–37.1 (*n* = 9)	34.7–36.7	36.3–36.6
Head depth	Damaged	19.7	16.0–18.7	15.3–18.8 (*n* = 19)	13.6–16.6 (*n* = 9)	13.3–15.4	13.9–17.1
Head width	Damaged	30.6	29.8–31.6 (*n* = 6)	26.2–31.4 (*n* = 20)	24.9–28.4 (*n* = 7)	24.3–25.2	25.0–27.3 (*n* = 3)
Snout to dorsal fin origin	Damaged	38.4	37.5–41.2	37.5–41.7	34.9–37.9 (*n* = 9)	35.2–36.9	35.7–36.3
Snout to anal fin origin	Damaged	51.6	51.2–54.2	49.1–54.8 (*n* = 20)	48.4–50.7 (*n* = 9)	49.7–52.1	49.3–50.2
Snout to anus	Damaged	48.5	45.9–49.4	45.0–51.8 (*n* = 20)	43.4–46.0 (*n* = 9)	44.6–47.8	44.9–46.2
Snout length	Damaged	19.7	18.2–21.0	18.8–21.4	17.0–19.3 (*n* = 9)	17.3–18.5	17.7–18.0
Rostral projection length	Damaged	12.2	10.5–15.2	7.5–12.7 (*n* = 19)	7.8–11.3 (*n* = 7)	8.0 (*n* = 1)	9.5–10.1 (*n* = 2)
Rostral projection width	Damaged	4.5	3.2–4.6	2.9–4.7 (*n* = 19)	3.0–4.2 (*n* = 9)	3.2	2.6–3.8
Filamentous barbel length	Damaged	24.2	21.0–24.8	16.8–26.7 (*n* = 20)	13.1–18.5 (*n* = 9)	15.9–17.4	14.9–17.5
Upper jaw length	Damaged	17.5	15.1–18.4	14.5–19.0	13.2–15.0 (*n* = 9)	14.3–14.7	14.3–14.5
Lower jaw length	Damaged	16.2	14.3–17.1	14.6–19.9	13.7–15.8 (*n* = 9)	14.2–15.2	14.1–14.5
Orbital diameter	Damaged	9.7	8.9–10.9	8.0–10.0	7.6–9.0 (*n* = 9)	7.8–7.9	7.8–9.2
Interorbital width	Damaged	7.1	5.8–7.9	5.1–7.3	5.9–7.2 (*n* = 9)	5.9	5.6–6.8 (*n* = 3)
Preopercular spine length	Damaged	14.2	12.0–17.6	10.3–16.5	12.9–17.5 (*n* = 9)	12.1–12.8	12.0–14.1 (*n* = 3)
Pectoral fin length	Damaged	22.8	21.1–25.5	20.9–28.2	20.7–24.9 (*n* = 9)	20.6–22.3	19.8–22.5
Length of upper free pectoral fin ray	Damaged	23.0	22.1 (*n* = 1)	18.5–23.5 (*n* = 20)	18.5–22.4 (*n* = 8)	18.5–18.7	17.1–21.4

Length of lower free pectoral fin ray	Damaged	19.4	15.1–19.8 (*n* = 4)	15.6–20.4 (*n* = 20)	14.9–18.6 (*n* = 9)	15.6–15.8	16.3–18.2
Pelvic fin length	Damaged	19.3	17.5–20.4	16.9–20.8	15.8–20.1 (*n* = 8)	16.0	15.9–18.3
Length of first dorsal spine	Damaged	10.4	9.1–11.8 (*n* = 4)	7.6–11.3 (*n* = 18)	7.6–10.9 (*n* = 8)	7.4–9.2	8.6–9.0
Caudal peduncle length	Damaged	8.7	7.6–8.9	7.3–9.5	7.5–9.0 (*n* = 9)	7.5–8.2	6.1–8.1
Caudal peduncle width	Damaged	2.7	2.6–3.2	2.4–3.1	2.4–2.9 (*n* = 9)	2.6–2.7	2.4–2.8
Measurements (% HL)							
Head width	ca. 74	76.4	73.4–84.1 (*n* = 6)	67.8–78.8 (*n* = 20)	68.4–80.8 (*n* = 8)	69.2–69.9	68.9–74.5 (*n* = 3)
Snout length	ca. 52	49.2	49.0–51.6	48.0–53.2	48.2–52.0	49.9–50.8	48.4–49.7
Rostral projection length	ca. 31	30.3	25.7–37.3	17.9–32.9 (*n* = 19)	22.1–31.5 (*n* = 8)	23.0 (*n* = 1)	26.0–27.5 (*n* = 2)
Rostral projection width	ca. 11	11.2	8.5–11.5	7.0–11.5 (*n* = 19)	8.4–11.6	8.7–9.2	7.2–10.4
Upper jaw length	ca. 42	43.6	41.0–45.1	38.9–47.1	37.8–40.6	40.5–41.3	39.1–39.9
Lower jaw length	ca. 40	40.4	38.1–42.2	36.9–51.1	37.9–43.0	40.9–41.7	38.7–39.6
Orbital diameter	ca. 22	24.3	24.0–27.0	20.9–25.2	21.5–24.8	21.8–22.5	21.4–25.3
Interorbital width	ca. 15	17.8	15.9–19.4	12.8–17.9	16.7–19.4	16.3–16.9	15.5–18.6 (*n* = 3)
Preopercular spine length	ca. 37	35.5	29.9–43.2	25.9–42.9	34.9–47.2	34.7–35.2	33.0–39.0 (*n* = 3)
Caudal peduncle depth	ca. 8	6.7	6.5–7.9	5.9–8.0	6.6–8.2 (*n* = 9)	7.1–7.7	6.6–7.6

Table 9 Ranges for relative measurements of *Scalicus hians*

	Peristedion hians		*Peristedion investigatoris*	*Peristedion amiscus*	Non-types
	Lectotype USNM 47730	Paralectotypes *n* = 10	Syntypes *n* = 3	Holotype USNM 51428	*n* = 44
Standard length (mm)	154.7	82.1–147.1	74.1–130.9	79.7	76.2–211.5
Measurements (% SL)					
Body depth	17.3	15.4–18.1	15.6–17.6	17.1	13.2–20.9
Body width	12.2	10.5–12.3	10.1–13.0	10.3	10.0–19.0
Head length	40.0	38.4–42.6	36.1–38.7	39.5	35.6–41.4
Head depth	16.5	16.0–18.4	16.0–19.5	15.8	13.8–20.1
Head width	30.0	30.1–37.5	30.8–31.3	35.5	27.9–38.7 (*n* = 43)
Snout to dorsal fin origin	39.0	37.0–41.3	35.5–38.7	39.6	34.4–40.6
Snout to anal fin origin	50.7	47.9–51.2	43.9–49.3	52.1	43.3–54.1
Snout to anus	45.0	43.0–46.3	42.8–50.5	46.4	41.1–49.3
Snout length	19.1	18.9–21.2	17.0–19.4	18.9	16.0–20.2
Rostral projection length	5.8	5.6–7.8 (*n* = 9)	5.2–6.8 (*n* = 2)	Broken	4.6–8.8 (*n* = 43)
Rostral projection width	5.7	5.1–7.7	5.3–6.5	6.9	4.5–7.8
Filamentous barbel length	41.2	32.3–48.2	24.8–29.9	36.5	16.2–46.7
Upper jaw length	16.4	14.8–17.2	14.1–15.0	16.1	12.9–17.5
Lower jaw length	14.9	13.7–16.6	13.0–14.4	15.3	11.8–15.7
Orbital diameter	10.3	9.8–11.9	10.1–10.7	11.4	8.6–11.9
Interorbital width	8.6	7.3–8.7	6.6–8.9	8.9	5.9–9.2 (*n* = 43)
Preopercular spine length	12.5	12.6–15.7	12.3–12.9 (*n* = 2)	11.5	11.4–16.5 (*n* = 42)
Pectoral fin length	21.3	19.3–22.9	17.6–22.4	22.2	14.7–24.0
Length of upper free pectoral fin ray	21.8	19.9–26.3 (*n* = 9)	22.7–23.1	22.8	16.1–25.6 (*n* = 43)
Length of lower free pectoral fin ray	18.6	16.7–22.2 (*n* = 9)	19.4–19.9	18.7	14.7–21.4 (*n* = 43)
Pelvic fin length	17.0	15.6–19.7	17.7–19.0 (*n* = 2)	18.4	14.1–26.9 (*n* = 42)
Length of first dorsal spine	8.7	8.5–10.6 (*n* = 7)	10.5 (*n* = 1)	10.5	5.6–12.0 (*n* = 40)
Caudal peduncle length	10.2	7.7–10.5	9.0–9.7	9.3	7.0–11.5
Caudal peduncle depth	2.5	2.5–3.2	2.7	3.0	2.3–3.3

Table 10 Ranges for relative measurements of *Scalicus orientalis*

	Holotype	Paratypes	Non–types
	USNM 98876	*n* = 6	*n* = 27
Standard length (mm)	146.1	108.3–144.2	70.5–175.4
Measurements (% SL)			
Body depth	20.8	18.1–21.1	13.9–19.7
Body width	13.2	12.5–15.3	10.1–14.6
Head length	39.2	37.5–40.1	36.7–40.4
Head depth	20.5	16.1–20.4	14.7–19.7
Head width	33.7	30.9–36.2	26.3–36.8 (*n* = 26)
Snout to dorsal fin origin	41.0	37.4–39.9	36.6–40.6
Snout to anal fin origin	50.9	47.8–50.6	47.4–51.8
Snout to anus	45.6	43.5–46.5	41.6–46.9
Snout length	20.7	17.8–19.6	17.6–20.6
Rostral projection length	7.7	7.6–10.6 (*n* = 4)	7.0–9.2 (*n* = 16)
Rostral projection width	5.7	5.5–6.6	4.7–6.2 (*n* = 26)
Filamentous barbel length	44.1	34.0–52.8	35.1–55.7
Upper jaw length	17.7	14.8–17.1	14.5–17.2
Lower jaw length	15.5	13.9–15.1	13.2–15.9
Orbital diameter	9.7	9.7–10.4	8.8–11.6
Interorbital width	7.3	7.0–7.4	6.3–8.9
Preopercular spine length	15.7	12.1–17.2	9.8–15.1 (*n* = 26)
Pectoral fin length	19.8	17.4–22.9	17.6–25.5
Length of upper free pectoral fin ray	Damaged	19.3–24.4 (*n* = 5)	18.4–24.9 (*n* = 26)
Length of lower free pectoral fin ray	16.0	16.1–20.0 (*n* = 4)	15.5–20.7 (*n* = 26)
Pelvic fin length	17.4	15.8–18.6	14.9–19.9
Length of first dorsal spine	9.2	9.0–10.6	7.6–11.2 (*n* = 26)
Caudal peduncle length	8.4	7.5–9.7	7.5–10.3
Caudal peduncle depth	2.5	2.6–2.9	2.3–3.0

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Table 11 Ranges for relative measurements of *Scalicus paucibarbatus* sp. nov.

	Holotype	Paratypes
	BSKU 30455	*n* = 22
Standard length (mm)	205.8	85.1–270.4
Measurements (% SL)		
Body depth	15.5	12.8–17.0
Body width	13.6	11.4–16.1
Head length	36.8	35.3–41.5
Head depth	15.1	12.9–16.1
Head width	27.3	23.3–28.8 (*n* = 21)
Snout to dorsal fin origin	37.0	35.0–42.2
Snout to anal fin origin	48.4	48.4–52.6
Snout to anus	44.5	44.2–48.5
Snout length	18.7	17.7–21.0
Rostral projection length	11.5	7.2–17.6 (*n* = 18)
Rostral projection width	2.5	2.1–5.4 (*n* = 21)
Filamentous barbel length	15.9	13.1–20.4
Upper jaw length	15.0	13.1–16.5
Lower jaw length	15.3	14.0–17.6
Orbital diameter	8.1	7.3–10.3
Interorbital width	6.0	5.4–8.7 (*n* = 21)
Preopercular spine length	14.4	10.3–19.9 (*n* = 21)
Pectoral fin length	22.1	19.2–31.1
Length of upper free pectoral fin ray	22.1	19.0–29.5
Length of lower free pectoral fin ray	19.1	15.4–25.4
Pelvic fin length	15.9	15.5–24.8
Length of first dorsal spine	10.0	0.7–14.6 (*n* = 20)
Caudal peduncle length	7.7	7.0–9.0
Caudal peduncle depth	2.7	2.4–3.2

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Table 12 Ranges for relative measurements of *Scalicus quadratorostratus*

	Lectotype	Paralectotype	Non-types
	MNHN 1978-0478	*n* = 1	*n* = 44
Standard length (mm)	107.0	105.4	69.8–159.1
Measurements (% SL)			
Body depth	16.0	18.2	14.1–20.0
Body width	13.1	12.6	10.4–14.3
Head length	37.9	38.2	34.1–38.8
Head depth	15.9	19.4	14.0–19.9
Head width	27.7	27.9	23.1–30.7 (*n* = 42)
Snout to dorsal fin origin	37.9	37.1	34.0–39.6
Snout to anal fin origin	48.6	51.0	47.6–51.6
Snout to anus	44.3	47.5	41.6–46.2
Snout length	18.6	19.0	15.4–18.7
Rostral projection length	Damaged	15.5	10.0–14.7 (*n* = 39)
Rostral projection width	4.1	3.7	2.6–5.9
Filamentous barbel length	17.6	18.1	15.2–25.3
Upper jaw length	15.5	15.7	13.1–15.7
Lower jaw length	14.3	13.9	12.4–15.6
Orbital diameter	9.6	9.6	8.7–10.6
Interorbital width	6.4	7.0	5.6–8.6
Preopercular spine length	13.6	14.0	10.4–16.2
Pectoral fin length	24.4	23.2	17.2–26.2
Length of upper free pectoral fin ray	21.4	21.6	18.4–24.2
Length of lower free pectoral fin ray	18.5	18.4	15.7–21.3
Pelvic fin length	20.2	19.0	16.2–23.5
Length of first dorsal spine	Damaged	12.9	8.5–13.9 (*n* = 43)
Caudal peduncle length	9.3	8.2	7.2–10.6
Caudal peduncle depth	2.5	2.7	2.4–3.2

Table 13 Ranges for relative measurements of *Scalicus serrulatus*

	Lectotype	Paralectotype	Non-types
	ZSI		
	F296/1	n=1	*n* = 29
Standard length (mm)	122.1	119.8	77.0–187.3
Measurements (% SL)			
Body depth	14.2	14.5	12.3–17.8
Body width	13.7	11.2	10.9–14.8
Head length	36.4	37.0	32.2–36.4
Head depth	15.0	15.4	12.7–17.3
Head width	28.6	26.7	23.7–33.6 (*n* = 27)
Snout to dorsal fin origin	36.4	36.1	33.4–36.7
Snout to anal fin origin	49.5	49.4	45.9–50.3
Snout to anus	44.9	44.2	39.1–45.0
Snout length	17.8	17.7	15.6–17.7
Rostral projection length	12.5	11.8	8.6–14.8 (*n* = 28)
Rostral projection width	4.0	2.8	2.6–6.0
Filamentous barbel length	14.2	16.1	10.1–20.6
Upper jaw length	15.2	14.7	12.0–14.3
Lower jaw length	14.3	13.8	11.7–14.0
Orbital diameter	9.5	9.9	7.9–10.1
Interorbital width	6.7	6.2	4.9–8.2
Preopercular spine length	13.2	12.9	9.3–17.7 (*n* = 28)
Pectoral fin length	17.4	17.1	16.6–23.3
Length of upper free pectoral fin ray	25.0	Damaged	19.2–24.8
Length of lower free pectoral fin ray	21.4	20.8	16.7–21.7
Pelvic fin length	16.0	15.4	13.8–19.7
Length of first dorsal spine	9.7	8.8	6.9–11.1 (*n* = 27)
Caudal peduncle length	8.3	7.8	7.1–10.1
Caudal peduncle depth	2.5	2.4	2.1–3.1

Table 14 Diagnostic characters of species of *Scalicus*

	S. engyceos	*S. hians*	*S. orientalis*
Shape of rostral projection	Stick like	Equilateral triangular	Long triangular
Ball-like fleshy mass at the tip of rostral projection	Present	Absent	Absent
Rostral projection length / Rostral projection width	2.34–3.97	0.79–1.25	1.26–1.57
Count of lip + chin barbels	4 (rarely 3) +3 (rarely 4)	7 (rarely 6 or 8) + 3 (rarely 4)	5 (rarely 6) + 3 (rarely 4)
Count of branches on filamentous barbel	13–18	22–39	22–31
Membrane of posterior filamentous barbel	Absent	Absent	Present
Filamentous barbel length	13.1–26.7% SL	16.2–48.2% SL	34.0–55.7% SL
Posteriormost chin barbel	2 branches (rarely simple or 3 branches)	2 branches (rarely simple or 3 branches)	Simple or 2 branches
Antrorse spines on posterior bony plates of upper lateral row	Present	Absent	Absent

	S. paucibarbatus sp. nov.	*S. quadratorostratus*	*S. serrulatus*
Shape of rostral projection	Stick like	Stick like	Stick like
Ball-like fleshy mass at the tip of rostral projection	Present	Absent	Absent or tiny
Rostral projection length / Rostral projection width	2.12–4.60	2.24–4.28	2.14–4.15
Count of lip + chin barbels	4 + 3	5 + 3	4 + 1 (rarely 2)
Count of branches on filamentous barbel	8–11	13–21 (rarely 9 or 11)	7–11
Membrane of posterior filamentous barbel	Absent	Absent	Absent
Filamentous barbel length	13.1–20.4% SL	15.2–25.3% SL	10.1–20.6% SL
Posteriormost chin barbel	Simple (rarely 2 branches)	2 branches (rarely simple)	Simple
Antrorse spines on posterior bony plates of upper lateral row	Present	Present	Present