



<http://dx.doi.org/10.11646/zootaxa.4018.3.3>

<http://zoobank.org/urn:lsid:zoobank.org:pub:07D5711E-F7E0-457A-8360-D4D3E7B95DD7>

A new species of the genus *Stiphodon* from Palawan, Philippines (Gobiidae: Sicydiinae)

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Abstract

Palawan is an island in the western Philippines, and the freshwater fish fauna of this island has received limited research attention. In the present study, a new goby species, *Stiphodon palawanensis*, is described on the basis of 57 specimens collected from freshwater streams on the island. This species can be distinguished from its congeners by having nine segmented rays in the second dorsal fin, 15 rays in the pectoral fin, a pointed first dorsal fin in males, premaxilla with 45–71 tricuspid teeth, the nape and posterior half of the occipital region covered by cycloid scales, 9–11 dusky transverse bars laterally on the trunk and tail, a line of black blotches (in male) or a black band (in female) on the distal part of the second dorsal fin, and the first dorsal and pectoral fins lacking distinctive markings. The new species has been found only on the Sulu Sea side of central Palawan. Three congeners, *S. percnopterygiomus*, *S. atropurpureus*, and *S. pulchellus* have also been recorded from Palawan.

Key words: *Stiphodon palawanensis*, taxonomy, freshwater fish

Introduction

Sicydiine gobies of the genus *Stiphodon* are distributed in tropical and subtropical freshwater streams from Sri Lanka and the western coast of Sumatra in the Indian Ocean to southern Japan, north-eastern Australia, and French Polynesia (Watson, 1995; Ebner & Thuesen, 2010; Maeda & Tan, 2013; Maeda *et al.*, 2015). Although more than 30 species of *Stiphodon* are considered valid, the taxonomy of this genus is not yet well understood (Maeda, 2013).

Herre (1927) described three new species of goby belonging to the genus *Microsicydium* Bleeker based on specimens from the Philippines: *Microsicydium atropurpureum* Herre (type locality, Santa Ines, Rizal, Luzon), *Microsicydium formosum* Herre (type locality, Kolambugan, Lanao del Norte, Mindanao), and *Microsicydium pulchellum* Herre (type locality, Dumaguete, Negros Oriental). These three species were later placed in *Stiphodon* by Herre (1934). These were the first reports of the genus *Stiphodon* from the Philippines.

Watson & Kottelat (1995) reviewed the taxonomy of *Stiphodon* from the Philippines with specimens collected from Leyte. They re-described *Stiphodon atropurpureus* (Herre) and assigned *M. formosum* as a junior synonym of *S. atropurpureus*. They also described two new species: *Stiphodon olivaceus* Watson & Kottelat and *S. sarrufus* Watson & Kottelat; Leyte is the type locality for both species. Maeda *et al.* (2012a) re-described *Stiphodon pulchellus* (Herre) and designated *S. olivaceus* as a junior synonym of *S. pulchellus*. Thus, three valid species of *Stiphodon* are currently known from the Philippines: *S. atropurpureus*, *S. pulchellus*, and *S. sarrufus*.

Palawan is an island in the western Philippines, and located between the South China and Sulu Seas. One specimen of *S. pulchellus* collected from Palawan was included in the material examined for the re-description of this species (Maeda *et al.*, 2012a). To the best of our knowledge, this was the only report of *Stiphodon* from Palawan. We conducted a survey of freshwater and estuarine fish at three sites on Palawan in May, 2015, and found four *Stiphodon* species, including an undescribed species. This undescribed species was also found in collections of the National Museum of Nature and Science, Ibaraki, Japan (NSMT), the General Research Center of Okinawa

Churashima Foundation, Okinawa, Japan (URM), and Dr. Maurice Kottelat, Cornol, Switzerland (CMK). All of these specimens were collected on Palawan. In the present study, a new species is described with 57 specimens collected from Palawan, and a review of other *Stiphodon* species found on Palawan is also provided.

Material and methods

Measurements and counts were taken from the right side of each fish, unless the right side was damaged; then the left side was used. Measurements were made point-to-point, to the nearest 0.1 mm using dial calipers or dividers under a stereomicroscope and expressed as a percentage of standard length (SL). Measurements and counts followed Nakabo (2002), with the following modifications. Body depth was measured at both the pelvic- and anal-fin origins. First and second dorsal- and anal-fin lengths were measured from the origin of each fin to the farthest point when the fin was depressed. Caudal-fin length was measured as the length of the longest ray in the middle part of the caudal fin. The interval between the first and second dorsal-fin bases was measured from the posterior end of the first dorsal-fin base to the second dorsal-fin origin. The anus to anal-fin length was measured from the center of the anus to the anal-fin origin. Scales in a longitudinal series were counted along a single, contiguous scale row on the lateral midline from the middle of the posterior end of the hypurals to behind the pectoral-fin base. Scales in a transverse series were counted along a diagonal line extending posteriorly and ventrally from the first scale anterior to the second dorsal fin, including one scale on the dorsal midline and another scale at the anal-fin base. Circumpeduncular scales were counted along the circumference of the narrowest point of the caudal peduncle in a zigzag manner. Tooth counts of the upper and lower jaws were taken from the right side of the symphysis, with dentition terms following Watson (2008). Symbolic codes used to represent collections and institutions cited follow Sabaj Prez (2014). The WPU-PPC collection will be deposited at the WPU Museum (currently under construction) at Western Philippines University, Puerto Princesa Campus.

Stiphodon palawanensis, new species

(Figs. 1–5; Table 1)

Material examined. 57 specimens (24 males and 33 females, 27.0–63.9 mm SL) collected from Palawan, Philippines.

Holotype. WPU-PPC-P 5, male (62.2 mm SL), Balsahan Stream in the Iwahig Prison and Penal Farm, Puerto Princesa City, Palawan, 18 May 2015, coll. K. Maeda and H. P. Palla.

Paratypes. CMK 11966, 2 males (37.3 and 43.1 mm SL) and 8 females (28.5–47.2 mm SL), Malatgao River, Narra, Palawan, 29 September 1994, coll. J. Margraf; CMK 11974, 3 females (41.9–48.5 mm SL), Estrella Falls (tributary of Malatgao River), Narra, Palawan, 29 September 1994, coll. J. Margraf; NSMT-P 45091, 45092, and 45094, 2 males (27.7 and 38.8 mm SL) and female (36.6 mm SL), Iwahig River, Puerto Princesa City, Palawan, 13 November 1988, coll. K. Matsuura; URM-P 31438, female (27.0 mm SL), Nagsagoiri River, Palawan, 9 August 1985, coll. S. Shokita; URM-P 31439, 6 males (34.1–36.8 mm SL) and 7 females (32.4–36.2 mm SL), Papait River, Palawan, 9 August 1985, coll. S. Shokita; URM-P 31440, 2 females (38.6 and 40.7 mm SL), Iraan River, Palawan, 5 August 1985, coll. S. Shokita; URM-P 31441, 6 males (31.3–41.4 mm SL) and 3 females (30.7–39.1 mm SL), Tagbariri, Palawan, 9 August 1985, coll. S. Shokita; URM-P 48659–48662, 2 males (46.2 and 51.1 mm SL) and 2 females (41.1 and 47.2 mm SL), Barake Stream (tributary of Aborlan River), Barangay Magbabadil, Aborlan, Palawan, 15 May 2015, coll. K. Maeda and H. P. Palla; URM-P 48663–48666, 2 males (59.7 and 63.9 mm SL) and 2 females (58.5 and 63.6 mm SL), same data as holotype; WPU-PPC-P 2–4, 2 males (52.6 and 59.2 mm SL) and female (46.3 mm SL), Barake Stream (tributary of Aborlan River), Barangay Magbabadil, Aborlan, Palawan, 15 May 2015, coll. K. Maeda and H. P. Palla; WPU-PPC-P 6–9, male (59.4 mm SL) and 3 females (57.5–62.1 mm SL), same data as holotype.

Diagnosis. Second dorsal fin usually with one spine and nine segmented rays, pectoral fin usually with 15 segmented rays; first dorsal fin pointed in male; relatively large caudal fin (26–34% of SL) in male; premaxilla with 45–71 tricuspid teeth, dentary with 2–6 (male) or 1–4 (female) symphyseal teeth and 45–79 unicuspid horizontal teeth; nape and posterior part of occipital region covered by cycloid scales; 9–11 dusky transverse bars

laterally on trunk and tail; first dorsal fin gray or dusky after preservation (orange or reddish brown in life) without any distinct markings, having a line of black blotches (male) or a black band (female) on distal part of second dorsal fin; pectoral fin without clear markings.

Description. Morphometric measurements given in Table 1. Body elongate, cylindrical anteriorly and somewhat compressed posteriorly. Head somewhat depressed with a round snout protruding beyond upper lip. Anterior nostril tubular and short, posterior nostril round or oblong, not tubular. Mouth inferior with upper jaw projecting beyond lower jaw. Upper lip thick with small medial cleft. Premaxillary teeth 45–71, fine and tricuspid. Dentary with canine-like symphyseal teeth (number of teeth 2–6 in male, 1–4 in female) and a row of unicuspid horizontal teeth enclosed in fleshy sheath (number of teeth 45–79). Larger fish having more premaxillary and horizontal teeth (Fig. 2). Urogenital papilla in male rounded with one cleft at posterior tip; that in female rectangular, bearing one small projection at each corner of the posterior margin.

TABLE 1. Morphometrics of *Stiphodon palawanensis*, expressed as a percentage of standard length. D₁, first dorsal fin; D₂, second dorsal fin; A, anal fin; C, caudal fin; P₁, pectoral fin; P₂, pelvic fin.

Sex	Holotype	Paratype	
	Male	Male	Female
Number of specimens measured	1	23	33
Standard length (mm)	62.2	27.7–63.9	27.0–63.6
Head length	22.8	21.5–23.9	20.8–25.2
Snout length	9.2	6.8–9.0	6.8–9.2
Eye diameter	4.3	4.1–6.0	4.4–7.0
Postorbital length of head	10.9	9.8–12.0	9.4–12.0
Upper jaw length	10.3	9.0–11.2	9.1–10.8
Body depth at P ₂ origin	15.4	12.9–15.2	13.0–15.6
Body depth at A origin	16.2	14.9–17.2	15.3–17.9
Depth of caudal peduncle	13.0	11.3–12.6	10.5–12.3
Length of caudal peduncle	19.3	18.2–21.1	18.3–21.4
Predorsal length	32.0	31.9–35.0	33.0–37.0
Length of D ₁ base	18.6	16.6–21.7	17.0–23.0
D ₁ length	35.4	25.3–41.7	18.1–23.0
Length of longest spine of D ₁	30.5	18.4–35.9	13.4–17.8
Interval between D ₁ and D ₂ bases	3.2	1.7–5.4	2.5–7.2
Length of D ₂ base	26.7	23.6–27.2	21.4–25.7
D ₂ length	45.3	37.2–46.8	28.5–36.7
Length of longest ray of D ₂	21.1	14.4–21.5	12.7–16.7
Preanal length	51.4	49.5–54.0	49.4–56.0
Length of A base	29.4	26.5–30.3	18.6–27.5
A length	43.9	38.6–47.0	31.6–37.7
Length of longest ray of A	18.2	13.7–18.3	11.1–14.4
Length from anus to A	3.5	2.9–4.2	3.0–5.6
Length of longest ray of P ₁	20.7	18.2–23.7	17.9–21.9
C length	31.4	26.4–34.2	21.3–26.1

First dorsal fin with six spines, except two specimens with five spines; second dorsal fin usually with one spine and nine segmented rays (one specimen with one spine and eight segmented rays). In female, first dorsal fin rounded, almost semicircular, usually second and/or third spines longest, but its posteriormost tip never extending to origin of second dorsal fin. In male, first dorsal fin spines elongate (usually fourth spine longest) and

posteriormost point of first dorsal fin (tip of fourth spine) extending to base of first to sixth segmented ray of second dorsal fin when depressed. Anal fin with one spine and ten segmented rays. In female, usually first or second and second or third segmented rays longest in second dorsal and anal fins, respectively; in male, posterior rays longer than anterior rays (last ray and/or penultimate ray usually longest). Caudal fin usually with 17 segmented rays, including 13 branched rays, posterior margin rounded; caudal fin relatively larger in male than in female (caudal-fin length 26–34% of SL in male, 21–26% of SL in female). Pectoral fin with 14 (n=7), 15 (n=47), or 16 (n=3) rays. Pelvic fin with one spine and five segmented rays; pelvic fins joined together to form strong, cup-like disk with fleshy frenum.



FIGURE 1. *Stiphodon palawanensis* immediately after fixation. a, WPU-PPC-P 5, holotype (male, 62.2 mm SL); b, URM-P 48659, paratype (male, 51.1 mm SL); c, URM-P 48666, paratype (female, 58.5 mm SL); d, URM-P 48661, paratype (female, 41.1 mm SL).

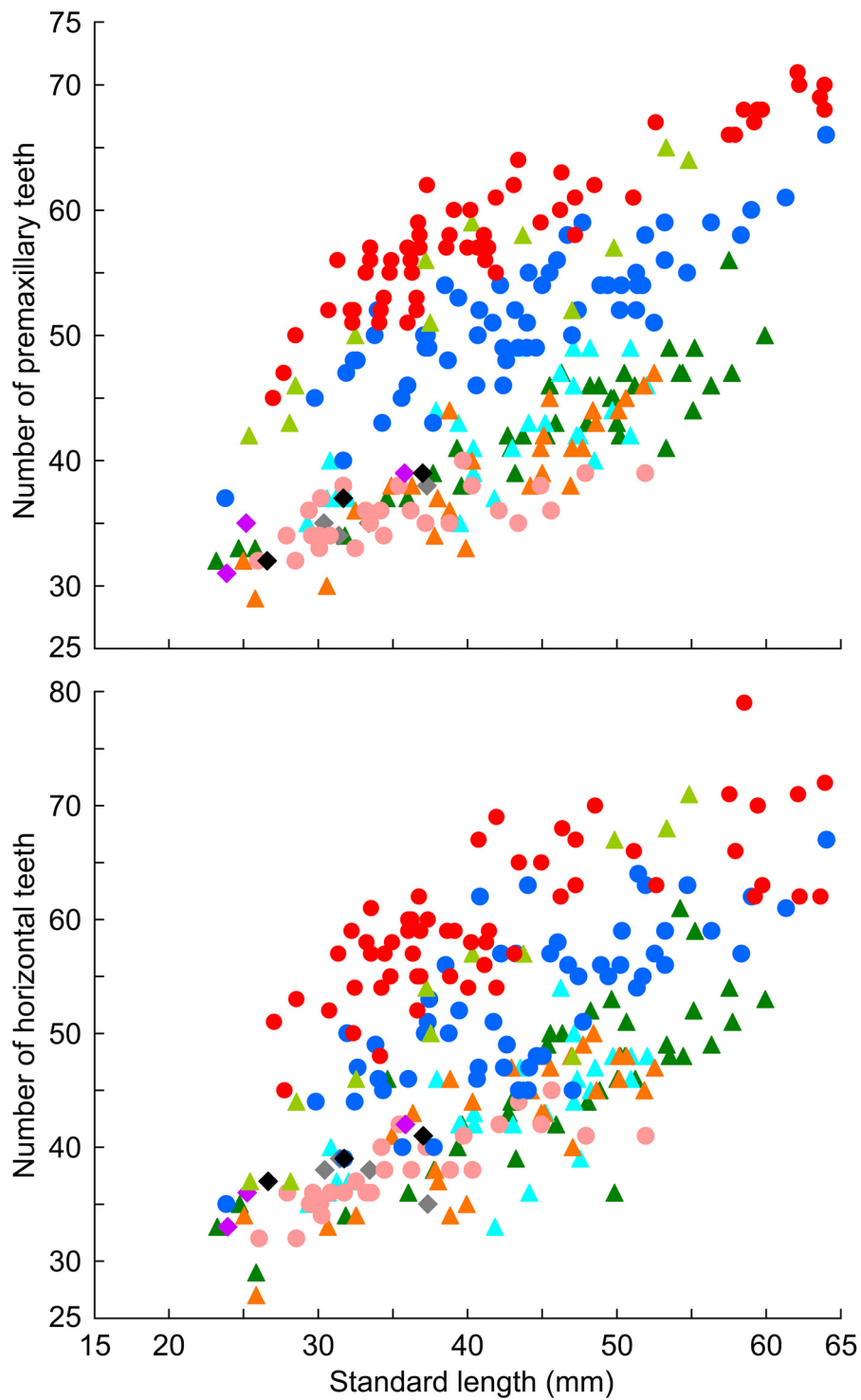


FIGURE 2. Number of premaxillary and horizontal dentary teeth of *Stiphodon palawanensis* (red circles), *S. alcedo* (pink circles), *S. atratus* (black diamonds), *S. imperioientis* (light blue triangles), *S. maculidorsalis* (light green triangles), *S. multisquamus* (deep blue circles), *S. ornatus* (orange triangles), *S. pelewensis* (gray diamonds), *S. pulchellus* (deep green triangles), and *S. weberi* (purple diamonds).

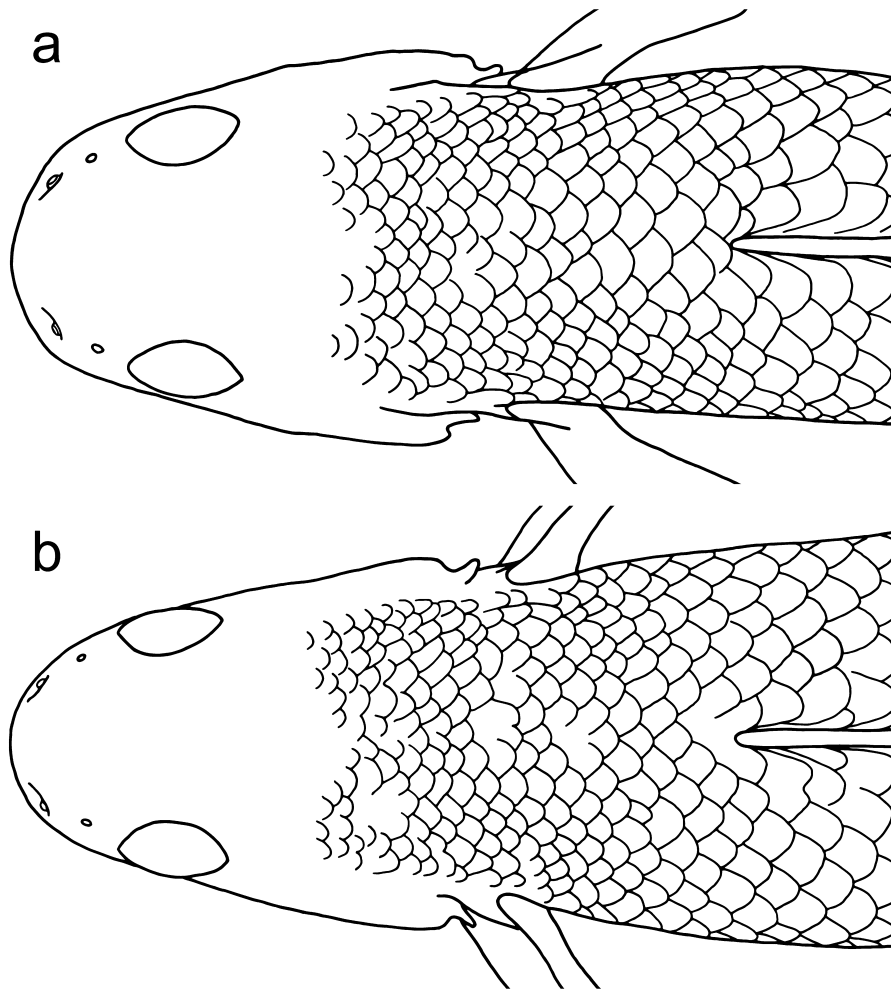


FIGURE 3. Dorsal scalation on head and nape in *Stiphodon palawanensis*. a, male (43.1 mm SL, CMK 11966); b, female (41.9 mm SL, CMK 11966).

Scales in a longitudinal series 29 (n=4), 30 (n=13), 31 (n=19), 32 (n=15, including holotype), or 33 (n=6); scales in a transverse series 9 (n=1), 10 (n=3), 11 (n=52, including holotype), 12 (n=1); circumpeduncular scales 15 (n=1) or 16 (n=55) (not including one broken specimen). Ctenoid scales covering tail, sides and dorsum of posterior trunk. Pectoral-fin base naked. Small naked area behind pectoral-fin base; some anteriormost scales on lateral sides of trunk cycloid. Belly covered with cycloid scales. Nape and posterior part of occipital region covered by cycloid scales (Fig. 3); in female, scaled area slightly exceeding middle of occipital region; male similar, but sometimes not exceeding the middle. Cycloid scales also occurring on first and second dorsal-fin bases, anal-fin base, caudal-fin base, and proximal part of caudal fin.

Cephalic sensory pore system always with A', B, C, D(S), F, H', K', L', N', and O' (Fig. 4). Oculoscapular canal interrupted between pores H' and K'. Cutaneous sensory papillae developed over dorsal, lateral, and ventral surface of head (Fig. 4).

The largest male and female specimens were 63.9 and 63.6 mm SL (82.9 and 77.9 mm in total length), respectively.

Color in preservative. In male, background brown; 9–11 (usually 10) dusky transverse bars laterally and dorsally on trunk and tail. First dorsal fin gray or dusky without distinct markings. Second dorsal fin gray or dusky; each ray having a black blotch surrounded by a translucent margin, these black blotches forming a line along second dorsal fin margin, but posterior part of the fin sometimes lacking this black blotch. Anal fin gray or dusky. Caudal fin with dusky longitudinal band on upper part; dorsal to this band, gray; ventrally along this band translucent; middle and lower parts of caudal fin gray. Pectoral fin pale gray without clear markings, but sometimes with one to four obscure, dusky spots on each of middle rays. Pelvic disk dusky, but margin of anterior and middle parts translucent.

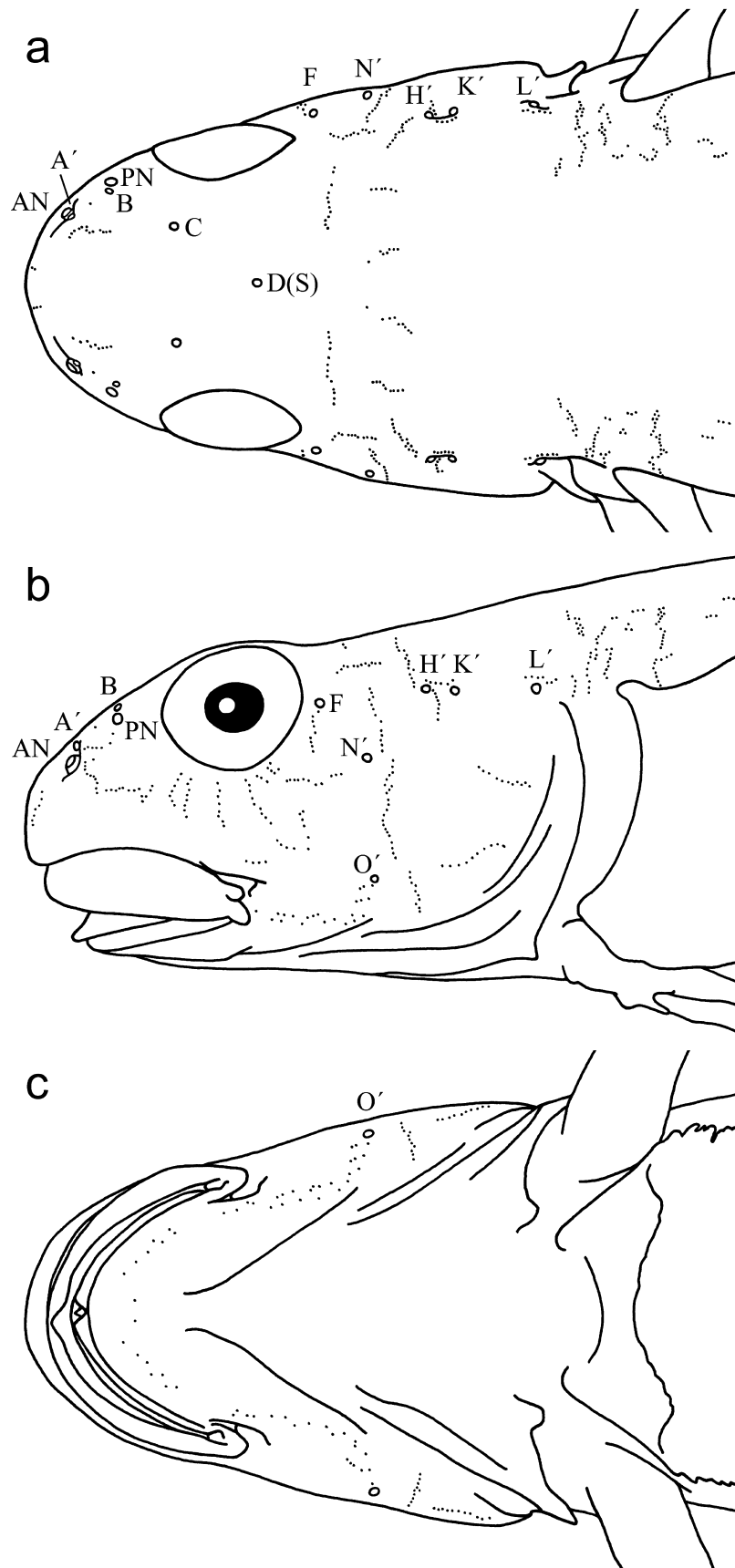


FIGURE 4. Diagrammatic illustration of head showing arrangement of cephalic sensory pores and cutaneous sensory papillae in *Stiphodon palawanensis* (41.9 mm SL, CMK 11966). a, dorsal view; b, lateral view; c, ventral view. AN, anterior nostril; PN, posterior nostril.



FIGURE 5. Males (a–d) and females (e, f) of live *Stiphodon palawanensis* observed in Balsahan Stream, Puerto Princesa City (b, e, f, 18 May 2015; a, c, 19 May 2015) and Barake Stream, Aborlan (d, 15 May 2015).

In female, background brown or yellowish brown; blackish longitudinal band extending from snout and upper lip to below eye and to middle of pectoral-fin base, band continuing from behind pectoral-fin base to posterior end of caudal peduncle through lateral midline; nine or ten (usually ten) dusky transverse bars laterally on trunk and tail intersecting with the mid-lateral longitudinal band. The longitudinal band often unclear if the transverse bars accentuated, and transverse bars often unclear if the longitudinal band accentuated. Additional blackish longitudinal band above the mid-lateral band from dorsoposterior edge of eye to base of upper procurrent caudal-fin rays, but often obscure. First dorsal-fin gray without distinct markings. Second dorsal and anal fins gray with a black submarginal band and translucent margin; the black band on second dorsal fin thicker than that on anal fin.

Black blotch on middle of proximal part of caudal fin; other part of caudal fin translucent with a black band (upside-down “L” shape) along dorsal and posterior margins and one to four black vertical stripes on middle part. Pectoral fin pale gray without clear markings, but sometimes with one or two obscure, dusky spots along middle rays. Pelvic fin translucent, but middle parts of rays, membranes, and frenum often dusky, forming a ring in ventral view.

Color in life. Body and fin markings of male and female similar to those of preserved specimens, but in male (Fig. 5a–d), background of body grayish, purplish, or yellowish brown; first and second dorsal fins orange or reddish brown; black blotches on second dorsal fin surrounded by white or yellow margins; anal fin brown, gray, or orange; and dorsal part of caudal fin reddish or yellowish with bluish-white margin. In female (Fig. 5e, f), first dorsal fin reddish brown; second dorsal fin reddish brown with a black submarginal band and bluish white margin; white spots often lining proximal side of this band; anal fin brown with a black submarginal band and bluish white margin; upper and middle parts of caudal fin fringed by bluish white margin; area between the white margin and the black band orange.

Distribution. The new species is currently known only from Palawan, in the western Philippines. All known habitats are streams flowing into the Sulu Sea in the central part of the island (Fig. 6). When we explored the Iwahig River where it flows into the South China Sea at Quezon (Fig. 6) for two days in May 2015, *S. palawanensis* was not found, but other areas, such as the northern and southern parts of the island, have not yet been explored. Given its amphidromous life cycle with the high dispersal ability of the larvae suggested in this genus (Yamasaki *et al.*, 2007; Maeda *et al.*, 2012b), and the geographically limited survey made to date, *S. palawanensis* is expected to be found elsewhere in the region in the future.

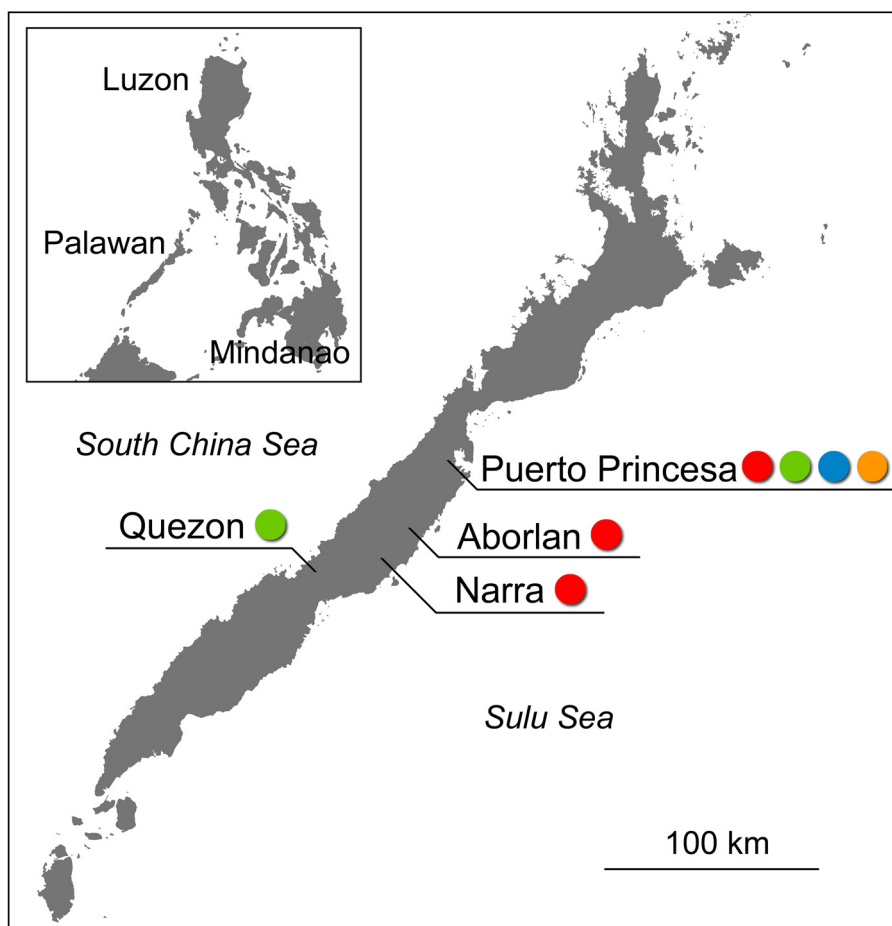


FIGURE 6. Location of Palawan in the Philippines (inset map) and sites where *Stiphodon* species have been found on Palawan. Red circles, *S. palawanensis*; green circles, *S. pulchellus*; blue circle, *S. atropurpureus*; and orange circle, *S. percnopterygiomus*.

Ecology. The new species was one of the dominant fish species observed in the middle reaches of Balsahan Stream (Puerto Princesa City) and Barake Stream (Aborlan) in May 2015. *Stiphodon palawanensis* inhabits pools with a substrate that is a mixture of boulders, gravel, and pebbles with exposed bedrock in some places. It also inhabits rapids. The water was clear. The fish were clinging to the rocks while feeding on algae. When disturbed, they swam to nearby rocks or hid in crevices under or between rocks. The maximum water depth of the sites was 1.5 m in May, but it could reach 3.0 m during the wet season. Normally, that occurs from June to December, while the dry season runs from January to May. In these two sites sampled, two cyprinid species *Barbodes palawanensis* (Boulenger) and *Rasbora everetti* Boulenger were very abundant with *S. palawanensis*. Other common species at these sites were two gobioids, *Glossogobius illimis* Hoese & Allen and *Redigobius* sp., and a halfbeak *Dermogenys palawanensis* Meisner.

Etymology. The name of the new species is derived from Palawan, the type locality, and the Latin suffix *-ensis*.

Comparison. The new species was compared with congeners sharing the second dorsal- and pectoral-fin ray counts (one spine and nine segmented rays in the second dorsal fin, and usually 15 or 16 rays in the pectoral fin). *Stiphodon palawanensis* shares 9–11 dusky transverse bars laterally on the trunk and tail with *S. maculidorsalis* Maeda & Tan and *S. multisquamus* Wu & Ni, but it differs from *S. maculidorsalis* in the lack of clear markings on the pectoral fin (vs. having fine black spots along rays), dorsal markings (black spots scattered dorsally on the head and tail of *S. maculidorsalis*, but not on *S. palawanensis*), and predorsal scalation (the posterior part of the occipital region is scaled in *S. palawanensis*, Fig. 3, vs. an occipital region that is almost naked in *S. maculidorsalis*); and from *S. multisquamus* by the lack of distinct markings on the first dorsal and pectoral fins (vs. having a black blotch on the posterior part of the first dorsal fin in males, thick dusky lines along spines of the first dorsal fin in females, and fine black spots along the pectoral-fin rays in both sexes), having a line of black blotches (in males) or a black band (in females) on the distal part of the second dorsal fin (vs. no such black markings), and predorsal scalation of males (posterior part of the occipital region scaled in *S. palawanensis*, Fig. 3, vs. an occipital region that is almost naked in *S. multisquamus*).

Stiphodon niraikanaiensis Maeda males have black longitudinal bands on the second dorsal and caudal fins, but females lack them. Although a line of black blotches on the second dorsal fin in *S. palawanensis* males resembles a black band when the fin is not fully open, *S. palawanensis* differs from *S. niraikanaiensis* also by the lack of conspicuous markings on the first dorsal and pectoral fins (vs. having black spots), and in the mode of the pectoral-fin ray count (15 vs. 16).

Stiphodon palawanensis differs from *S. alcedo* Maeda, Mukai & Tachihara by having a line of black blotches (in males) or a black band (in females) on the distal part of the second dorsal fin (vs. no such markings), having more premaxillary and horizontal teeth (Fig. 2), and the mode of the pectoral-fin ray count (15 vs. 16); from *S. martenstyni* Watson (of which only the male holotype is known) by lack of clear markings on the first dorsal fin (vs. having two to five dusky spots along each spine) and having a line of black blotches on the second dorsal fin (vs. lack of it); from *S. atratus* Watson, *S. imperioorientis* Watson & Chen, *S. ornatus* Meinken, *S. pelewensis* Herre, *S. pulchellus*, and *S. weberi* Watson, Allen & Kottelat by lack of distinct markings on the pectoral fin (vs. having many black spots along rays), having a line of black blotches (in males) or a black band (in females) on the second dorsal fin (vs. lack of it), and having more premaxillary and horizontal teeth (Fig. 2); and from *S. atropurpureus*, *S. carisa* Watson, *S. kalfatak* Keith, Marquet & Watson, *S. larson* Watson, and *S. semoni* Weber by having a line of black blotches (in males) or a black band (in females) on the second dorsal fin (vs. lack of it), a pointed first dorsal fin in males (vs. rounded, except *S. carisa* males having a pointed fin), and the predorsal scalation of males (the posterior part of the occipital region is scaled, Fig. 3, vs. an occipital region that is almost naked).

Briefly, the new species is most easily distinguished by its unique fin markings: any *Stiphodon* with a line of black blotches (in males) or a black band (in females) on the distal part of the second dorsal fin, and without distinct markings on the first dorsal and pectoral fins can be identified as *S. palawanensis*.

Other *Stiphodon* species found in Palawan. During our two-day exploration in the type locality of the new species (Balsahan Stream in the Iwahig Prison and Penal Farm, Sulu Sea side of Puerto Princesa City) in May 2015, two other *Stiphodon* species were found; three female individuals of *S. atropurpureus* and one male individual of *S. percnopterygionus* Watson & Chen (Fig. 6). Two of the three *S. atropurpureus* individuals were collected (Fig. 7c) and listed as comparative material in this paper. *Stiphodon percnopterygionus* was not collected, however a wild individual was identified on site by snorkel based observation of characteristic markings of the body and fins (Fig. 8) and its unique, high triangular first dorsal fin. While *S. palawanensis* was very abundant, both *S. atropurpureus* and *S. percnopterygionus* were rare at this site.



FIGURE 7. *Stiphodon pulchellus* (a, WPU-PPC-P 29, male, 45.9 mm SL; b, URM-P 48681, female, 39.6 mm SL) and *Stiphodon atropurpureus* (c, WPU-PPC-P 10, female, 43.7 mm SL) specimens collected from Palawan immediately after fixation.

Four *Stiphodon* specimens collected in the Iwahig River at Puerto Princesa City in 1988 have been deposited in the National Museum of Nature and Science (Ibaraki, Japan). The Iwahig is a relatively large river next to the Balsahan Stream. The specimens are composed of three *S. palawanensis* (NSMT-P 45091, 45092, and 45094) and one *S. pulchellus* (NSMT-P 45093), but the latter species was not found in our exploration in Balsahan Stream in May 2015.

In Barake Stream (Sulu Sea side of Aborlan), the only *Stiphodon* species found during our one-day exploration was *S. palawanensis*. All collections from Aborlan and Narra, examined in the present study (CMK and URM), also comprised entirely of individuals of *S. palawanensis* (Fig. 6).

We also explored another river bearing the name Iwahig at Quezon, on the South China Sea side of the island (Fig. 6) in May 2015. *Stiphodon pulchellus* (Fig. 7a, b) was abundant, but *S. palawanensis* could not be found there.

Thus, the species composition of any *Stiphodon* assemblage seems to depend on the location on the island. *Stiphodon palawanensis* may be the dominant species in some areas, whereas *S. pulchellus* may be dominant in others. However, because only a small survey effort has been applied at each site and only a small part of the island has been explored so far, comprehensive surveys will be required to understand the distribution of *Stiphodon* species on Palawan.



FIGURE 8. *Stiphodon percnopterygionus* (a) with *Stiphodon palawanensis* observed in Balsahan Stream, Puerto Princesa City, Palawan, on 18 May 2015.

Discussion

Maeda *et al.* (2015) reported that *S. multisquamus* is the largest species in this genus and that it is abundant in continental habitats in central Vietnam, where it co-occurs with non-diadromous cyprinids and loaches. It suggested that the larger body size is probably one of the traits that allows it to coexist with non-diadromous freshwater fishes. The new species, *S. palawanensis*, attains almost the same size as *S. multisquamus* (maximum specimen is 63.9 mm SL in *S. palawanensis*, vs. 64.0 mm SL in *S. multisquamus*). Although Palawan is not a continent, its freshwater habitats are occupied by cyprinids. It could support the idea that a larger body is advantageous for *Stiphodon* to dominate habitats where cyprinids are abundant.

Stiphodon percnopterygionus is widely distributed in north-western Pacific. The known ranges include southern Japan, Taiwan, China (Guangdong), Guam, and Palau (Watson & Chen, 1998; Nip, 2010), but it had not been reported from the Philippines previously. Because the present study added two species (*S. palawanensis* and *S. percnopterygionus*), five *Stiphodon* species have now been recorded in the Philippines. Although *S. atropurpureus* is likely to be the most abundant member of this genus in Luzon and the Visayan Islands, it is rarely found in Palawan, where *S. palawanensis* and *S. pulchellus* are abundant. Thus, the distribution of each species seems to differ throughout the Philippines. However, available information is insufficient to show the precise distribution of each species. Moreover, additional species will be found in the Philippines, since larger numbers of species have been reported in regions surrounding the Philippines (for example, seven and nine species from Japan and Indonesia, respectively; Watson *et al.*, 1998; Watson, 2008; Maeda, 2013; Maeda & Saeki, 2013; Maeda & Tan, 2013; Keith & Hadiaty, 2015). Thorough studies will be required to understand the entire picture of this genus in the Philippines.

Comparative material

Stiphodon alcedo: NSMT-P 103600, holotype, 30.8 mm SL, Okinawa Island, Japan, 10 Nov. 2008; BLIH 20110001, paratype, 29.7 mm SL, Okinawa Island, 27 Oct. 2006; BLIH 20110002, paratype, 33.2 mm SL, Okinawa Island, 13 Dec. 2006; BLIH 20110003, paratype, 47.9 mm SL, Iriomote Island, Japan, 20 Oct. 2009; BLIH 20110004, paratype, 40.3 mm SL, Iriomote Island, 5 July 2010; NSMT-P 103601–103603, 3 paratypes, 27.9–32.5 mm SL, same data as holotype; NSMT-P 103604, paratype, 33.5 mm SL, Okinawa Island, 5 Nov. 2006; NSMT-P 103605, paratype, 30.1 mm SL, Okinawa Island, 13 Dec. 2006; NSMT-P 103606, paratype, 45.6 mm SL, Iriomote Island, 20 Oct. 2009; NSMT-P 103607, 103608, 2 paratypes, 36.2 and 42.1 mm SL, Okinawa Island, 29 Nov. 2009; NSMT-P 103609, paratype, 39.7 mm SL, Iriomote Island, 5 July 2010; URM-P 46066, paratype, 30.1 mm SL, Okinawa Island, 27 Oct. 2006; URM-P 46067, paratype, 34.2 mm SL, Okinawa Island, 13 Dec. 2006; URM-P 46068, 46069, 2 paratypes, 29.4 and 29.6 mm SL, Okinawa Island, 24 Nov. 2008; URM-P 46070, 46071, 2 paratypes, 34.4 and 37.2 mm SL, Okinawa Island, 27 Sept. 2009; URM-P 46072, paratype, 38.8 mm SL, Okinawa Island, 7 Nov. 2009; URM-P 46073, paratype, 35.4 mm SL, Iriomote Island, 9 Nov. 2009; URM-P 46074, paratype, 31.7 mm SL, Iriomote Island, 10 Nov. 2009; URM-P 46075–46078, 4 paratypes, 26.0–44.9 mm SL, Okinawa Island, 3 Sept. 2010; OMNH-P 15609, 51.9 mm SL, Iriomote Island, 13 Aug. 1999.

Stiphodon atratus: SMF 27242, holotype, 37.0 mm SL, Waigeo Island, Indonesia, Apr. 1990; WAM P.27862-006, 2 paratypes, 26.6 and 31.7 mm SL, Papua, Indonesia, 15 Nov. 1982.

Stiphodon atropurpureus: ZRC 38392, neotype, 33.1 mm SL, Leyte, Philippines, 29 June 1993; URM-P 46058, 46059, 2 specimens, 33.6 and 42.2 mm SL, Okinawa Island, Japan, 13 Dec. 2006; URM-P 46060–46063, 4 specimens, 24.3–36.0 mm SL, Okinawa Island, 10 Nov. 2008; URM-P 46064, 46065, 2 specimens, 30.2 and 36.0 mm SL, Okinawa Island, 29 Nov. 2009; URM-P 48667, 47.6 mm SL, Palawan, Philippines, 19 May 2015; WPU-PPC-P 10, 43.7 mm SL, Palawan, 18 May 2015; ZRC 46555, 47.0 mm SL, Pulau Tioman, Malaysia, 18 July 2001.

Stiphodon carisa: MNHN 2006-1604, 2006-1605, 2006-1606, 2006-1607, 4 paratypes, 26.9–35.2 mm SL, Sumatra, Indonesia, 25 Oct. 2005.

Stiphodon imperorientis: NSMT-P 48063, holotype, 48.5 mm SL, Iriomote Island, Japan, 2 Sept. 1986; BLIH 19810202, paratype, 43.0 mm SL, Iriomote Island, 10 July 1981; BLIH 19860400, paratype, 44.1 mm SL, same data as holotype; BLIH 19950002, 19950028, 2 paratypes, 37.9 and 43.5 mm SL, Iriomote Island, 4 Nov. 1995; URM-P 3205, 3206, 2 paratypes, 41.8 and 47.5 mm SL, Iriomote Island, 4 June 1982; URM-P 4823–4825, 3 paratypes, 50.9–52.0 mm SL, Iriomote Island, 13 Sept. 1982; OMNH-P 34657, 32.0 mm SL, Okinawa Island, Japan, 29 July 2008; OMNH-P 34937, 29.3 mm SL, Okinawa Island, 15 Nov. 2008; OMNH-P 35471, 48.2 mm SL, Iriomote Island, 28 July 1997; OMNH-P 35472, 39.5 mm SL, Iriomote Island, 8 Aug. 2000; URM-P 32169–32171, 3 specimens, 45.2–49.7 mm SL, Iriomote Island, 29–30 July 1994; URM-P 36457, 39.4 mm SL, Iriomote Island, 20 Aug. 1996; URM-P 46079, 30.6 mm SL, Okinawa Island, 27 Oct. 2006; URM-P 46957, 46958, 2 specimens, 30.8 and 31.2 mm SL, Okinawa Island, 23 Dec. 2011; URM-P 46959–46962, 4 specimens, 40.4–47.1 mm SL, Iriomote Island, 16 Aug. 2012; URM-P 48228, 40.4 mm SL, Okinawa Island, 12 Dec. 2013.

Stiphodon kalfatak: MNHN 2006-0805, holotype, 21.2 mm SL, Santo, Vanuatu, 22 July 2003; MNHN 2006-0806, 7 paratypes, 19.8–23.8 mm SL, same data as holotype.

Stiphodon larsen: WAM P.29602-013, 20 of 50 paratypes, 24.2–29.6 mm SL, Papua New Guinea, 10 Oct. 1987.

Stiphodon maculidorsalis: MZB 17213, holotype, 43.7 mm SL, Sumatra, Indonesia, Sept. 2004; ZRC 51445, 4 paratypes, 25.4–32.5 mm SL, Sumatra, 18 Mar. 2008; ZRC 51822, 4 paratypes, 37.2–47.0 mm SL, same data as holotype; ZRC 51836, 3 paratypes, 49.8–54.8 mm SL, Sumatra, 22 Jan. 2009.

Stiphodon martenstyni: SMF 27049, holotype, 34.5 mm SL, Sabaragamuwa Province, Sri Lanka, Jan. 1981.

Stiphodon multisquamus: NSMT-P 114246, 40.6 mm SL, Okinawa Island, Japan, 12 Oct. 2012; NSMT-P 114247, 31.7 mm SL, Okinawa Island, 25 Nov. 2012; URM-P 46082, 37.7 mm SL, Okinawa Island, 6 Oct. 2011; URM-P 46083, 35.6 mm SL, Okinawa Island, 7 Oct. 2011; URM-P 48179, 48181, 2 specimens, 29.8 and 33.8 mm SL, Da Nang, Vietnam, 12 Jan. 2013; URM-P 48199–48207, 9 specimens, 40.7–61.3 mm SL, Da Nang, 13 Jan. 2013; URM-P 48214–48216, 48218–48221, 48224, 48225, 9 specimens, 31.9–43.2 mm SL, Da Nang, 14 Jan. 2013; ZRC 45409, 2 specimens, 51.7 and 58.3 mm SL, Pulau Tioman, Malaysia, 25 June 1999; ZRC 45410, 45.4 mm SL, Pulau Tioman, 24 June 1999; ZRC 46414, 42.4 mm SL, Pulau Tioman, June 1999; ZRC 50267, 24 specimens, 37.1–64.0 mm SL, Da Nang, 27 Feb. 2005; ZRC 54194, 5 specimens, 42.6–44.6 mm SL, Pulau Tioman, 16 July 2013.

Stiphodon niraikanaiensis: NSMT-P 114244, holotype, 27.1 mm SL, Okinawa Island, Japan, 14 Nov. 2012; NSMT-P 114245, Paratype, 30.0 mm SL, Okinawa Island, 25 Nov. 2012; URM-P 46084, paratype, 36.0 mm SL, Okinawa Island, 7 June 2013; URM-P 48227, 36.6 mm SL, Okinawa Island, 12 Dec. 2013.

Stiphodon ornatus: SMF 12493, 2 syntypes, 37.8 and 39.5 mm SL, Sumatra, Indonesia, 1973; SMF 12494, 4 specimens, 25.0–42.9 mm SL, Sumatra, 1973; SMF 17932, 30.6 mm SL, Sumatra, Nov. 1971; ZRC 46620, 11 specimens, 44.9–51.8 mm SL, Sumatra, Sept. 2001; ZRC 51821, 7 specimens, 38.8–52.5 mm SL, Sumatra, Sept. 2004; ZRC 54113, 4 specimens, 34.9–38.8 mm SL, Sumatra, 21 July 1997.

Stiphodon pelewensis: OMNH-P 34791, 34792, 35269, 35270, 4 specimens, 30.4–37.3 mm SL, Babelthup Island, Palau, 17 Aug. 2008.

Stiphodon pulchellus: CAS-SU 26360, neotype, 50.5 mm SL; Negros, Philippines, 15 June 1931; CAS-SU 26359, 9 specimens, 45.5–59.9 mm SL, Culion, Philippines; 19 Apr. 1931; CAS-SU 26362, 55.2 mm SL, Culion, 28 Apr. 1931; CAS-SU 38618, 3 specimens, 37.7–50.6 mm SL, Busuanga, Philippines, 21 June 1940; CAS-SU 38622, 48.0 mm SL, Busuanga, 24 June 1940; CAS-SU 69760, 69898, 3 specimens, 34.6–57.5 mm SL, same data as neotype; CMK 9986, 6 specimens, 23.2–45.3 mm SL, Leyte, Philippines, 9 July 1993; NSMT-P 45093, 51.2 mm SL, Palawan, Philippines; 13 Nov. 1988; URM-P 48678–48681, 4 specimens, 39.6–50.0 mm SL, Palawan, 12 May 2015; WPU-PPC-P 29–32, 4 specimens, 39.3–48.8 mm SL, Palawan, 12 May 2015; ZRC 38396, 38397, 4 specimens, 24.7–53.5 mm SL, Leyte, 6 July 1993.

Stiphodon semoni: ZMA 110.972, lectotype, 29.0 mm SL, Ambon, Indonesia, 1893; ZMA 121.252, 3 paralectotypes, 27.0–28.6 mm SL, same data as lectotype; ZMA 121.254, paralectotype, 30.1 mm SL, same data as lectotype; ZRC 54112, 12 specimens, 26.2–35.0 mm SL, Sumatra, 18 Mar. 2008; ZRC 46979, 3 specimens, 23.5–23.8 mm SL, Sumatra, 4 Feb. 2002.

Stiphodon weberi: ZMA 121.253, holotype, 35.8 mm SL, Ambon, Indonesia, 1893; WAM P.31038-002, 2 paratypes, 23.9 and 25.2 mm SL, Yapen, Indonesia, 10 July 1995.

Acknowledgments

This study was conducted under a Memorandum of Agreement for joint research between Okinawa Institute of Science and Technology Graduate University (OIST) and Western Philippines University (WPU). We thank Elsa P. Manarpaac, Lota A. Creencia, Benjamin J. Gonzales (WPU), Jonathan Dorfan, Hiroyo Clemente (OIST), Filipina B. Sotto, and Joepette J. Hermosilla (University of San Carlos) for their support of this collaboration. We are grateful to Nelson P. Devanadera, Nino Rey C. Estoya, Beth Lagrada, and Aira Bayron (Palawan Council for Sustainable Development, PCSD) for providing a Wildlife Gratuitous Permit (No. 2014-17) and a wildlife Export Certification (No. 15-03); Lucilo R. Bayron (Puerto Princesa City), Carlos C. Magtalas (Iwahig Prison and Penal Farm), Jaime M. Ortega (Municipality of Aborlan), Benedicto Garciano (Barangay Magbabadil, Aborlan), Ronilo B. Caputilla (Municipality of Quezon), and Nelson A. Cabrestante (Barangay Maasin, Quezon) for providing a Prior Informed Consent Certificate; Armen Molleno, Edgar C. Abrea (Aborlan), Eddie A. Seniaga (Barangay Maasin), Buddy A. Venturillo, and all local residents who supported our survey. We are grateful to Tilman J. Alpermann (SMF), David Catania (CAS), Kiyotaka Hatooka (OMNH), Yuji Ikeda (BLIH), Philippe Keith (MNHN), Maurice Kottelat (Cornol, Switzerland), Kelvin K. P. Lim, Heok Hui Tan (ZRC), Sue Morrison (formerly of WAM), Ronald de Ruyter (RMNH), Gento Shinohara, Keiichi Matsuura (NSMT), Toshiyuki Suzuki (Kawanishi-midoridai High School, Hyogo, Japan), and all of the museum staff members who supported our investigation and who loaned specimens. We appreciate Steven D. Aird (OIST) for editing the manuscript, and Nori Satoh and members of Marine Genomics Unit (OIST), Katsunori Tachihara (University of the Ryukyus), and Tetsuo Yoshino (Okinawa Churashima Foundation) for their kind support of our study. This study was supported by JSPS KAKENHI Grant Number 24780200 and by the Okinawa Institute of Science and Technology Graduate University.

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