Schismatogobius (Gobiidae) from Indonesia, with description of four new species

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by

Philippe KEITH* (1), Clara LORD (1), Hadi DARHUDDIN (2), Gino LIMMON (3), Tedjo SUKMONO (4), Renny HADIATY (2) & Nicolas HUBERT (5)

Abstract. – The species of *Schismatogobius* from Indonesia are reviewed and compared to the known species described from the area. Eight species are recognized including four new species. These are described using genetic and morphomeristic approaches. The species differ by a high percentage of genetic divergence in partial COI gene (652 bp) and by several characters including the number of pectoral fin rays, the pattern of the ventral surface of the head in males and/or females, the pectoral fin colour pattern, the jaw length/head length ratio or the jaw length of male and/or female.

Résumé. – Revue des *Schismatogobius* (Teleostei: Gobiidae) d'Indonésie, avec description de quatre espèces nouvelles.

Des collections de spécimens de *Schismatogobius* provenant d'Indonésie ont été étudiées et comparées aux espèces décrites de la région. Huit espèces ont été répertoriées dont quatre nouvelles. Celles-ci sont décrites en utilisant des approches génétique et morphoméristique. Elles diffèrent par un fort pourcentage de divergence de la séquence partielle du gène COI (652 pb) et par plusieurs caractères incluant, principalement, le nombre de rayons aux nageoires pectorales, la coloration de la surface ventrale de la tête du mâle et/ou de la femelle, le ratio longueur de la mâchoire/longueur de la tête ou la longueur de la mâchoire du mâle et/ou de la femelle.

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Key words
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The species of *Schismatogobius* de Beaufort, 1912, are distinctive scaleless freshwater gobies found in the tropical Indo-West Pacific. The genus has been collected in many freshwater streams, almost always above tidal influence. Recently, Keith *et al*. (2017) reviewed the species found between Papua New Guinea and Samoa, described seven new species, and gave diagnostic features for *Schismatogobius*.

In the region neighbouring Indonesian area, five species are presently assigned to *Schismatogobius*: *S. marmoratus* (Peters, 1868), described from Samar Island, Philippines; *S. bruynisi* de Beaufort, 1912, described from Ceram, Indonesia; *S. insignus* (Herre, 1927), described from Negros Island, Philippines; *S. roxasi* Herre, 1936, described from Panay, Philippines and *S. ampluvinculus* Chen, Fang & Shao, 1995, described from Taiwan.

Even if *S. insignus* and *S. roxasi* are considered to be valid by some authors (Kottelat, 2013; Eschmeyer *et al*., 2016), their status is unclear. Indeed, the syntypes of *S. insignus* were destroyed during WWII and the diagnosis given by Herre (1927; 1936) for these two species did not mention some of the main diagnostic characters now used such as the number of pectoral fin rays, the distinctive markings on the ventral surface of head (mentum and isthmus), breast, frenum and pelvic fins (which are sexually dichromatic and generally, although slightly variable, unique to each species or a group of species), and the jaw length measurements in both sexes. Koumans (1940), who examined the syntypes of *S. insignus* before their destruction, placed them in *S. bruynisi* although some characters given by Herre (1927), as the banded pectoral fin drawing, did not agree with this species. Herre (1927), in his description of *S. insignus,* wrote at the end: 'As this copy leaves my hands, Mr. Reveche, of Antique Province (= Panay), sends me four handsome specimens, 38 to 44 mm in length; they are ready to spawn. February 1926.' So he considered these four specimens to be *S. insignus*. But later, in his description paper (Herre, 1936) of *S. roxasi,* he

(1) Muséum national d'Histoire naturelle, UMR BOREA 7208 (MNHN-CNRS-UPMC-IRD-UCB-UA), CP 026, 57 rue Cuvier, 75231 Paris CEDEX 05, France. [claralord@mnhn.fr].
(2) Museum Zoologicum Bogoriense (MZB), Division of Zoology, Research Center for Biology, Indonesian Institute of Sciences (LIPI), Jalan Raya Bogor Km46, Cibinong 16911, Jawa Barat, Indonesia. [rkhadiaty@gmail.com] [hdahruddin@yahoo.com]
(3) Universitas Pattimura, Maritime and Marine Science Center of Excellence, Jalan Wim Reawaru 9C, 678267 Ambon, Moluccas, Indonesia. [gino.limmon@gmail.com]
(4) Universitas Jambi, Department of Biology, Jalan Lintas Jambi - Muara Bulian Km15, 36122 Jambi, Sumatra, Indonesia. [Sukmonotedjo@gmail.com]
(5) Institut de Recherche pour le Développement (IRD), UMR226 ISE-M, Bât. 22 – CC065, Place Eugène Bataillon, 34095 Montpellier CEDEX 5, France. [nicolas.hubert@ird.fr]
* Corresponding author [keith@mnhn.fr]

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used the 44 mm specimen cited above (a male) as the holotype and wrote 'it is close to *Gobiosoma insignum* but differs in the extraordinary development of the maxillary'. Herre separated this species from *S. insignus* mainly with this character as the others in the description are not diagnostic. He ignored at this time that in *Schismatogobius* the jaw lengths in males are always much greater than in females, and the other three specimens 'ready to spawn' were probably females. Considering all of this, these four specimens from Panay were probably the same species *i.e. S. insignus*, as stated first by Herre (1927), and *S. roxasi* is thus considered here as a probable synonym of *S. insignus*.

Many surveys of rivers have been carried out in Indonesia during the last seven years with numerous *Schismatogobius* specimens being collected, particularly during collaborative work between the Institute for Research and Development (IRD), the Indonesian Institute of Sciences (LIPI) and the National Museum of Natural History of Paris (MNHN). These expeditions into remote areas (West Papua, Sulawesi, Sumatra, Java, Lombok, Bali, Ambon and Ceram) have resulted in the collection of many gobies and the discovery of several new species (Pouyaud *et al.*, 2012; Keith *et al.*, 2012a, 2012b, 2014a, 2104b; Larson *et al.,* 2014; Hoese *et al.*, 2015). The *Schismatogobius* collections of many museums (AMS, ASIP, AUM, BLIP, CAS, MNHN, MZB, NTM, QM, RMNH, SMF, UF, USNM, WAM and ZMB) have been also examined.

The purpose of this paper is to review those *Schismatogobius* species found in Indonesia, using genetic and morphometric approaches, and to give descriptions of four new species. A key for the species of the area is also provided.

MATERIALS AND METHODS

DNA Barcode analysis

Material examined

A total of 61 *Schismatogobius* specimens were used for this analysis (see Tab. I).

Schismatogobius bruynisi: 32 specimens: MZB (uncatalogued): BIF 185 to 188, Kab Sukabumi, Ci Maja, West Java, Indonesia, 20 Nov. 2012, Hubert *et al*. coll. BIF 234 to 237, Kab Sukabumi, Ci Tiis, West Java, Indonesia, 21 Nov. 2012, Hubert *et al*. coll. BIF 400 to 402, Kab Sukabumi, Ci Haur, West

Table I. – Specimens used for the DNA barcode analysis (names, sequences and Barcode Index Numbers).

Species	Sample ID	Sequence ID	BIN
Schismatogobius ampluvinculus	Panay4	BIFFA001-17	BOLD:ADB0451
Schismatogobius arscuttoli	12193	BIFFA007-17	BOLD:ADG5049
Schismatogobius bruynisi	BIF0185	BIFB160-13	BOLD:ACP9882
Schismatogobius bruynisi	BIF0186	BIFB161-13	BOLD:ACP9882
Schismatogobius bruynisi	BIF0187	BIFB162-13	BOLD:ACP9882
Schismatogobius bruynisi	BIF0188	BIFB163-13	BOLD:ACP9882
Schismatogobius bruynisi	BIF0234	BIFB209-13	BOLD:ACP9882
Schismatogobius bruynisi	BIF0235	BIFB210-13	BOLD:ACP9882
Schismatogobius bruynisi	BIF0236	BIFB211-13	BOLD:ACP9882
Schismatogobius bruynisi	BIF0237	BIFB212-13	BOLD:ACP9882
Schismatogobius bruynisi	BIF0400	BIFB375-13	BOLD:ACP9882
Schismatogobius bruynisi	BIF0401	BIFB376-13	BOLD:ACP9882
Schismatogobius bruynisi	BIF0402	BIFB377-13	BOLD:ACP9882
Schismatogobius bruynisi	BIF1637	BIFD1198-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF1638	BIFD1199-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF1639	BIFD1200-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF1640	BIFD1201-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF1641	BIFD1202-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF1693	BIFD1254-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF2366	BIFD1926-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF2367	BIFD1927-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF2368	BIFD1928-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF2369	BIFD1929-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF2370	BIFD1930-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF2372	BIFD1932-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF2434	BIFD1994-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF2436	BIFD1996-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF2438	BIFD1998-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF2545	BIFD2105-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF2546	BIFD2106-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF2547	BIFD2107-14	BOLD:ACP9882
Schismatogobius bruynisi	BIF5311	BIFD4430-16	BOLD:ACP9882
Schismatogobius bruynisi	6948	BIFFA002-17	BOLD:ACP9882
Schismatogobius bruynisi	12164	BIFFA003-17	BOLD:ACP9882
Schismatogobius bussoni	BIF5086b	BIFD4206-16	BOLD:ADF3589
Schismatogobius bussoni	BIF5290	BIFD4409-16	BOLD:ADF3589
Schismatogobius bussoni	BIF5348	BIFD4467-16	BOLD:ADF3589
Schismatogobius bussoni	BIF5349	BIFD4468-16	BOLD:ADF3589
Schismatogobius bussoni	BIF5412	BIFD4531-16	BOLD:ADF3589
Schismatogobius insignus	BIF3783	BIFD2903-16	BOLD:ADF3590
Schismatogobius insignus	12196	BIFFA005-17	BOLD:ADF3590
Schismatogobius insignus	12197	BIFFA006-17	BOLD:ADF3590
Schismatogobius marmoratus	Panay Phil	BIFFA008-17	BOLD:ADG7314
Schismatogobius risdawatiae	BIF6032	BIFD5151-16	BOLD:ADF3588
Schismatogobius risdawatiae	BIF6033	BIFD5152-16	BOLD:ADF3588
Schismatogobius risdawatiae	BIF6034	BIFD5153-16	BOLD:ADF3588
Schismatogobius risdawatiae	BIF6035	BIFD5154-16	BOLD:ADF3588
Schismatogobius risdawatiae	BIF6036	BIFD5155-16	BOLD:ADF3588

Table I. Continued.

Species	Sample ID	Sequence ID	BIN
Schismatogobius risdawatiae	BIF6038	BIFD5157-16	BOLD:ADF3588
Schismatogobius risdawatiae	BIF6039	BIFD5158-16	BOLD:ADF3588
Schismatogobius saurii	BIF1444	BIFD1005-14	BOLD:ACP9881
Schismatogobius saurii	BIF1445	BIFD1006-14	BOLD:ACP9881
Schismatogobius saurii	BIF1497	BIFD1058-14	BOLD:ACP9881
Schismatogobius saurii	BIF2548	BIFD2108-14	BOLD:ACP9881
Schismatogobius saurii	BIF2549	BIFD2109-14	BOLD:ACP9881
Schismatogobius saurii	BIF2550	BIFD2110-14	BOLD:ACP9881
Schismatogobius saurii	BIF2835	BIFD2395-14	BOLD:ACP9881
Schismatogobius saurii	BIF2836	BIFD2396-14	BOLD:ACP9881
Schismatogobius saurii	BIF4170	BIFD3290-16	BOLD:ACP9881
Schismatogobius saurii	BIF5089	BIFD4210-16	BOLD:ACP9881
Schismatogobius saurii	Panay2	BIFFA004-17	BOLD:ACP9881

Java, Indonesia, 24 Nov. 2012, Hubert *et al*. coll. BIF 1637 to 1641, Banten, Kab Lebak, Cibareno, Indonesia, 10 Dec. 2013, Hubert *et al*. coll. BIF 1693, Kab Sukabumi, Citiis, West Java, Indonesia, 11 Dec. 2013, Hubert *et al*. coll. BIF 2366 to 2370 & 2372, Kab Jembrana, Nbang, West Bali, Indonesia, 15 Apr. 2014, Hubert *et al*. coll. BIF 2434, 2436 & 2438, Kab Jembrana, Yeh Sumbul, West Bali, Indonesia, 16 Apr. 2014, Hubert *et al*. coll. BIF 2545 to 2547, Kab Buleleng, Tukad Banyuraras, West Bali, Indonesia, 18 Apr. 2014, coll. Hubert *et al*. BIF 5311, Ceram Tengah, Wai Hetu, Moluccas, Indonesia, 28 Mar. 2016, Hubert *et al*. coll. MNHN 2016-0269 (tag 06948), Liva River, Kolobangara Island, Solomon Islands, 11 Nov. 2015, Keith *et al*. coll. MNHN 2016-0302 (tag 12164), Ceram Tengah, Wai Tuni, Moluccas, Indonesia, 29 Mar. 2016, Hubert *et al*. coll.

Schismatogobius cf. *marmoratus* (*S. saurii* nsp, this paper): 11 specimens; MZB 23794, holotype, Kab Buleleng, Tukad Banyuraras, West Bali, Indonesia, 18 Apr. 2014, coll. Hubert *et al*.; BIF 2549. MNHN 2016-0304; same data as holotype; BIF 2548. MNHN 2016-0303, Lampung Barat, Wai Ngarip, Sumatra, Indonesia, 22 May 2015, coll. Hubert *et al*.; BIF 4176. BIF 2835 & 2836 (*in* MZB 23796), Kab Kelungkung, Tukad Unda, West Bali, Indonesia, 22 Apr. 2014, Hubert *et al*. coll. MNHN 2016-0299, Panay Island 2, Philippines. MZB (uncatalogued): BIF 2550; same data as holotype. BIF 1444 & 1445, Kab Pandeglang, Cibeber, Banten, Java, Indonesia, 7 Dec. 2013, Hubert *et al*. coll. BIF 1497, Kab Pandeglang, Cisiih, Banten, Java, Indonesia, 8 Dec. 2013, Hubert *et al*. coll. BIF 5089, Ambon, Solepai, Moluccas, Indonesia, 25 Mar. 2016, Hubert *et al*. coll.

Schismatogobius ampluvinculus: 1 specimen*;* MNHN 2016-0300, Panay Island 4, Philippines.

Schismatogobius insignus: 3 specimens; MNHN 2016-0301 (tags 12197 & 12196), Panay Island, Philippines; MZB (uncatalogued): BIF 3861, Lombok Utara, 29 Mar. 2015, Hubert *et al*. coll.

Schismatogobius nsp *Moluk* (*S. bussoni* nsp, this paper): 5 specimens; BIF 5349 (*in* MZB 23799), Ceram Tengah, Wai Tuni, Ceram, Indonesia, 30 Mar. 2016, Hubert *et al*. coll. MZB (uncatalogued): BIF 5348, Ceram Tengah, Wai Tuni, Ceram, Indonesia, 30 Mar. 2016, Hubert *et al*. coll. BIF 5290, Ceram Tengah, Wai Sia, Ceram, Indonesia, 28 Mar. 2016, Hubert *et al*. coll. BIF 5412, Ceram Tengah, Wai Sia, Ceram, Indonesia, 1 Apr. 2016, Hubert *et al*. coll. BIF 5086, Solepai River Mamala, Ambon, Indonesia, 25 Mar. 2016, Hubert *et al*. coll.

Schismatogobius marmoratus: 1 specimen; MNHN (uncatalogued), Panay Phil, Philippines.

Schismatogobius nsp1 *Sumatra* (*S. risdawatiae* nsp, this paper): 7 specimens; MZB 23800, holotype, Padang, Air Terjun Lubuk Hitam, West Sumatra, Indonesia, 1 May 2016, Hubert *et al*. coll. BIF 6032. MZB 23801, same data as holotype; BIF 6033, 6035, 6036, 6038. MNHN 2016-0309; same data as holotype; BIF 6034, 6039.

Schismatogobius nsp2 *Sumatra* (*S. arscuttoli*, this paper): 1 specimen; MNHN 2016-0306 (tag 12193), Sumatra, Indonesia, 2016, Negrini coll.

DNA extraction and amplification

Pectoral fin tissue was used to extract total genomic DNA from the 19 individuals using the Macherey & Nagel NucleoSpin® Tissue kits following the manufacturer's instructions on an Eppendorf EpMotion 5075.

The DNA barcode fragment of the cytochrome oxydase I (COI) mitochondrial gene was amplified using primers FishF1-5'TCAACCAACCACAAAGACATTGGCAC3' and FishR1-5'ACTTCAGGGTGACCGAAGAATCAGAA3' (Ward *et al*., 2005). All PCRs were performed on Biometra thermocyclers in a 25 µl volume of 5% of DMSO, 5 µg of bovine serum albumin, 300 µM of each dNTP, 0.3 µM of Taq DNA polymerase from Qiagen, 2.5 µl of the corresponding buffer, and 1.7 pM of each of the two primers. After a 2-minute denaturation at 94°C, the PCR ran 50 cycles of 25 seconds at 94°C, 25 seconds at 52°C and 1 minute at 72°C, with a 3-minute terminal elongation. Purification and Sanger sequencing of PCR products were performed by Eurofins (http://www.eurofins.fr) using the same forward and reverse PCR primers. Chromatograms were assembled and edited using Geneious 8.1.5. All the sequences were aligned with MAFFT Alignment (implemented in Geneious). The percentage of identity between sequences was calculated on Geneious 8.1.5. The translation into amino acids was checked for the partial fragment of COI gene, using the vertebrate mitochondrial genetic code. After translation, one or two bases were discarded at the beginning and the end of the sequences and as a result all the sequences in the alignment started and ended with a codon. All the sequences have been deposited in the barcode of life data system (www.boldsystems.org; projects BIFB and BIFFA) as well as GenBank (accession numbers accessible through BOLD).

Phylogenetic relationships were inferred using the Maximum Likelihood (ML) algorithm as implemented in phyml 3.0.1 (Guindon and Gascuel, 2003). The optimization of the ML tree topology was conducted using the BEST tree rearrangement option combining both Nearest-Neighbor Interchange (NNI) and Subtree Pruning and Regrafting (SPR). The best-fit ML substitution model was selected among 88 models according to the Bayesian Information Criterion (BIC) as implemented in jmodeltest 2.1.7 (Darriba *et al*., 2012). The statistical support of the tree topology was estimated through 2000 replicates of nonparametric bootstrapping (BP) as implemented in phyml 3.0.1. Delineation of mitochondrial lineages with independent evolutionary dynamics was performed using the Refined Single Linkage (RESL) algorithm as implemented in BOLD and each cluster of sequence was assigned to a Barcode Index Number (BIN) in BOLD (Ratnasingham and Hebert, 2013).

Morphomeristics

Methods follow Keith *et al*. (2017). Measurements were taken with a dial calliper to the nearest tenth of a millimetre. All counts were taken from the right side. The size is given in standard length (SL). Abbreviation are as follow: P, Pectoral rays; D, Dorsal rays; A, Anal rays; PDL, Predorsal length (% SL); PAL, Preanal length (% SL); HL, Head length (% SL); JL, jaw length (% SL); CPL, Caudal peduncle length (% SL); Pect-L, Pectoral fin length (% SL); BDa, Body depth at anus (% SL); SDFL, Second dorsal fin length (% SL); AFL, Anal fin length (% SL); CFL, Caudal fin length (% SL); SL, Standard length (SL) (mm).

Teeth were always counted to the right of the symphysis, from the tooth closest to the symphysis to the posteriormost dentary or premaxillary tooth; outer row of teeth were counted in the upper jaw and inner row counted in the lower jaw.

Abbreviations used to represent cephalic sensory pores follow Akihito (1986) and sensory papilla rows as in Sanzo (1911). Most *Schismatogobius* have a cephalic sensory pore system of B, D, F, K, L, N and O, with pore D singular and all others paired, and with the oculoscapular canal absent between pores F and K. The sensory papillae are generally as described by Akihito *et al*. (1988) and Chen *et al*. (2001).

Abbreviations for institutions and collections cited follow the American Society of Ichthyologists and Herpetologists (http://www.asih.org/sites/default/files/documents/resources/symbolic_codes_for_ collections_v5.0_sabajperez_2014.pdf).

Morphomeristic data are summarized in tables II to IV.

RESULTS

DNA Barcode analysis

A total of 652 base pairs were amplified for the COI gene. The most likely substitution model selected by jmodeltest was TrN + I. The ML tree (Fig. 1A) allowed delimiting eight species, each corresponding to a distinct mitochondrial lineage as evidenced by the RESL algorithm (Tab. I). (BOLD:ACP9881, BOLD:ADF3589, BOLD:ADF3588, BOLD:ACP9882, BOLD:ADF3590, BOLD:ADB0451, BOLD:ADG5049, BOLD:ADG7314). The TrN+I genetic distance among the 8 species examined here is high ranging from 0,10 to 0.58 and averaging 0.389. By contrast, the TrN+I genetic distance averaged 0.003 and ranged from 0 to .0.016 within species and showed no overlap with the distribution of genetic distance among species (Fig. 1B).

Morphomeristics

Specimen examination led to our recognising eight species. Four of them have been already described: *S. marmoratus* (Peters, 1868) described from Samar Island and found in other Philippines islands; *S. insignus* (Herre, 1927), described from Negros, Philippines and found in Panay (Philippines) and Lombok (Indonesia); *S. ampluvinculus* Chen, Fang & Shao, 1995, described from Taiwan and found in Panay and *S. bruynisi* de Beaufort, 1912, described from Ceram, Indonesia, but now also known from PNG, Solomon Islands (Keith *et al*., 2017) and Java, Bali, Lombok, Sumatra and Ambon (fig. 4 and this paper). Four are new to science and their descriptions are given herein.

Schismatogobius saurii, n. sp. Keith, Lord, Hadiaty & Hubert

(Figs 1-4; Tabs I-III)

Material examined. – Thirteen specimens from Indonesia and Philippines with a size range of 27.2-40 mm SL.

Holotype. – MZB 23794, male (36.1 mm SL); West Bali, Kab Buleleng, Tukad Banyuraras, Indonesia, 18 Apr. 2014, coll. Hubert, Keith, Busson, Sauri, Hadiaty; BIF 2549.

Paratypes. – UF 162773, 1 female, 2 males (28-33.5 mm SL); Lampung Barat, Wai Ngarip, Sumatra, Indonesia, 25 Oct. 2005, coll. Page *et al*. UF 190868, 1 male (27.2 mm SL); Way Cangup at research station, Bukit Barisan Selatan National Park, Sumatra, Indonesia, 22 Oct. 2005, coll. Page *et al*. MZB 23795, 1 female (40 mm SL); same data as holotype; BIF 2547. MZB 23796, 1 male, 2 females (29.3-36.7 mm SL); West Bali, Kab Kelungkung, Tukad Unda, Indonesia, 22 Apr. 2014, coll. Hubert, Keith, Busson, Sauri, Hadiaty; BIF 2835 to 2837. MZB 23797, 1 female (35 mm SL); Lampung Barat, Wai Ngarip, Sumatra, Indonesia, 22 May 2015, coll. Hubert, Busson, Darhuddin *et al*., BIF 4172.

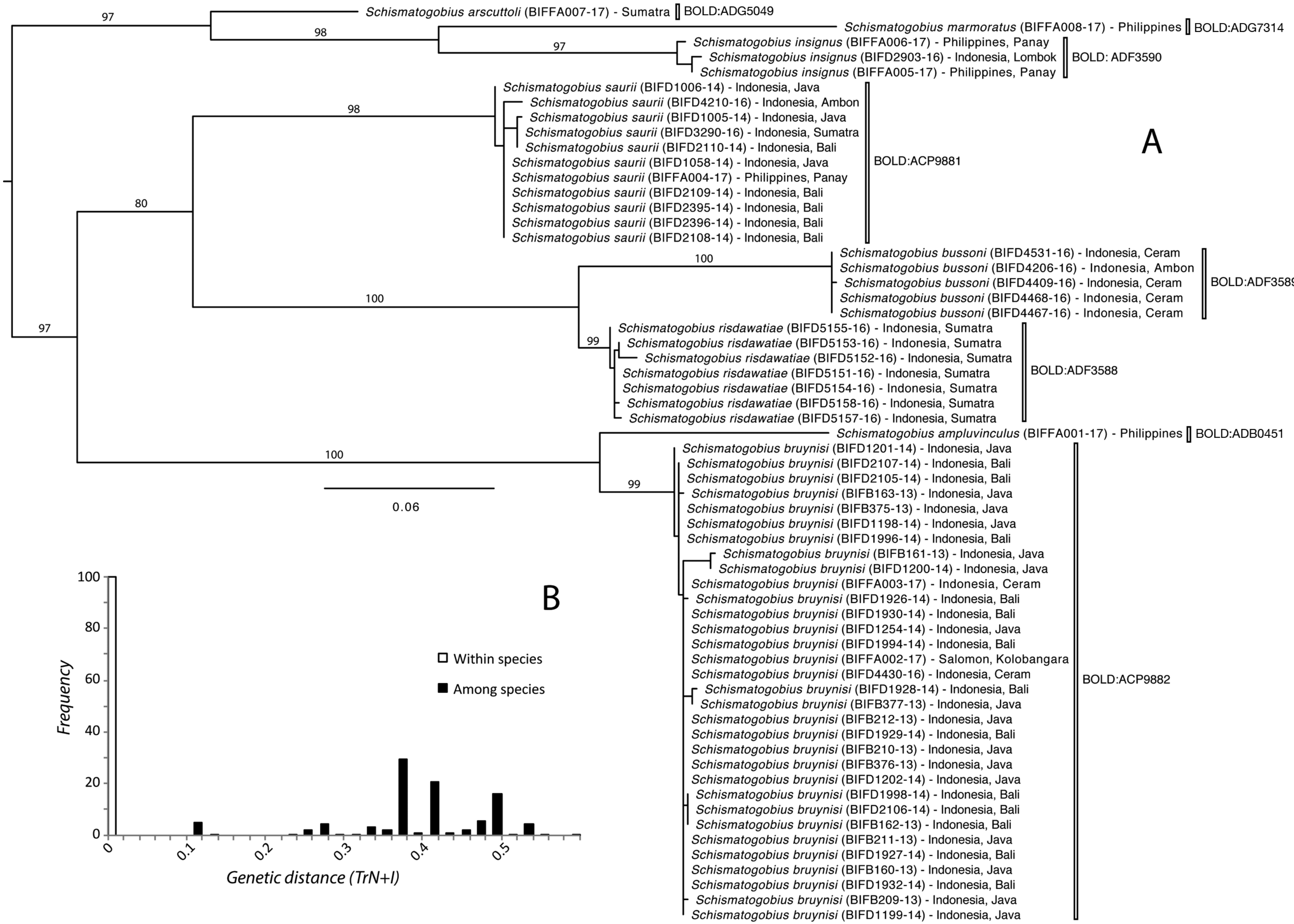


Figure 1. – **A**: Most likely ML tree inferred using the TrN+I model (-lnL = 2888.77, I = 0.655, f(A) = 0.23025, f(C) = 0.31193, f(G) = 0.17856, f(T) = 0.2926, AC = AT = CG = GT = 1.0; AG = 13.12; CT = 6.72). BP are given above each branches. **B**: Distribution of TrN+I genetic distance within and among species.

MNHN 2016-0304, 1 male (37 mm SL); same data as holotype; BIF 2548. MNHN 2016-0303, 1 female (37.5 mm SL); Lampung Barat, Wai Ngarip, Sumatra, Indonesia, 22 May 2015, coll. Hubert, Busson, Darhuddin *et al*.; BIF 4176. MNHN 2016-0299, 1 female (31.2 mm SL); Alegre River, Panay Island, Philippines.

Diagnosis

14-15 pectoral rays; pectoral fins banded with rows of dark spots. First dorsal fin membrane posterior to spine 6 connected to base of spine of second dorsal fin. Anal fin I,9. Ventral surface of head in male whitish and slightly pigmented on the mentum and frenum or entirely brownish. Ventral surface of head in female whitish with a blackish or brownish mentum. A single mitochondrial lineage (BOLD:ACP9881).

Table II. – Number of pectoral rays of *Schismatogobius* species from Indonesia. *: 3 specimens with 16 rays on one pectoral fin and 17 on the other.

Pectoral rays	14	15	16	17
S. saurii	4	9		
S. bussoni	1	9		
S. bruynisi	2	10		
S. ampluvinculus		5	3	
S. risdawatiae		2	7	
S. marmoratus			8	
S. arscuttoli			10	3*
S. insignus			1	6

Description

A large *Schismatogobius* (average adult size > 35 mm SL). Body naked, slender, almost circular in cross-section. Head rounded, snout rather pointed. Mouth oblique, lower lip more prominent. Jaw lengths in males much greater than in females; jaw length 65.4-71% of HL in males and 34.8-42.8% of HL in females. Lower jaw reaching vertical of 1/2 of the eye in female and exceeding (for more than eye diameter) a vertical of posterior margin of eye in male. Eyes high on head, close together with interorbital width about less to half eye diameter. Anterior nostril short and tube-like.

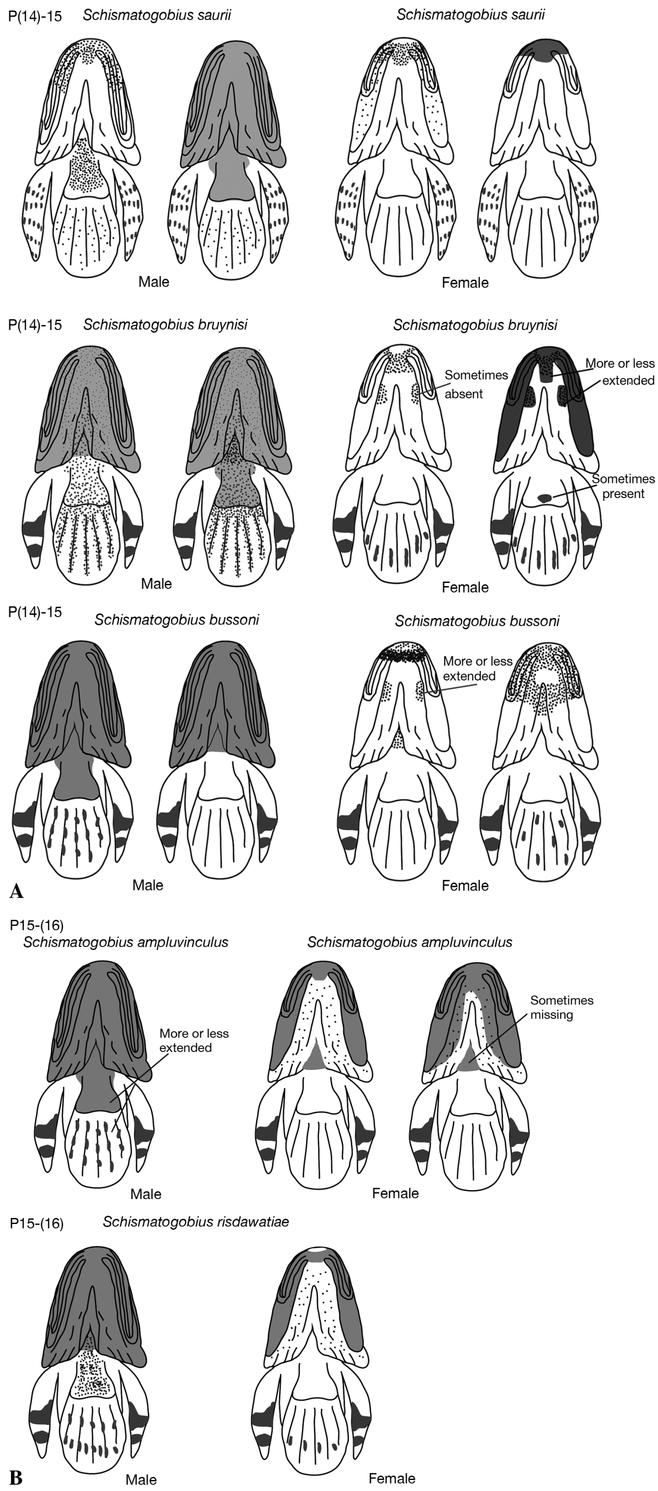
Dorsal fins VI-I,9, membrane in first dorsal fin posterior to spine 6 connected to base of spine of second dorsal fin. D1 with all spines about equal in length. Anal fin I,9, origin directly opposite to second dorsal fin origin. Caudal fin with 12 branched rays, posterior margin rounded. Pectoral fins oblong with posterior margin rounded and 14(4)-15(9) rays (Tab. II), ventralmost ray unbranched. Pelvic fins always I,5, with both fins joined together for their entire length between fifth rays to form a strong cup-like disc and a well developed frenum between spines, fins not extending beyond anus. Morphomeristic data given in table III.

Tongue bilobed. Teeth in upper jaw (19-30) usually in two rows, teeth conical and slightly recurved. Teeth in lower jaw (4-15) usually in two rows anteriorly and single row laterally, all teeth conical with outer row teeth only slightly enlarged and somewhat recurved.

Cephalic sensory pore system always with pores B, D, F, K, L, N and O, pore D singular with all other pores paired;

Table III. – Morphomeristics of the new *Schismatogobius* species. Morphometrics are given as percentages of standard length, except JL/HL.

	S. saurii		*S. bussoni*		*S. risdawatiae*		*S. arscuttoli*	
	Holotype	Paratypes	Holotype	Paratypes	Holotype	Paratypes	Holotype	Paratypes
P	15	14-15	15	14-15	16	15-16	16	16-17
D	VI 9	VI 9	VI 9	VI 9	VI 9	VI 9	VI 9	VI 9
A	I9	I9	I9	I9	I9	I9	I9	I9
PDL	41.3	36.3-41.3	38.6	37.9-44.9	43.2	37.9-42.6	37.4	38.1-40.7
PAL	61.8	55.4-60.4	60.9	60-65.2	59.7	59.2-65.9	60.4	59.6-64.9
HL male	30.2	27.1-30.1	29.1	26.3-30.6	31.4	32	34.8	32.1-34.6
JL male	18.4	17.7-20.5	16.4	13.4-14.7	19.8	17.8	24.2	19.6-20
JL/HL male	60.9	65.4-71	56.2	47.6-57.6	63.1	55.6	69.6	56.6-62.2
HL female	_	23.6-26.9	_	23.9-28.7	_	27-30.8	_	29-32.5
JL female	_	9-10.5	_	7.8-10.9	_	8.4-9.7	_	10.9-13.5
JL/HL female	_	34.8-42.8	_	31.7-39.7	_	27.4-33	_	36.5-41.8
CPD	7.5	6.4-8.9	6.4	6.9-10.3	8.3	8.3-9.9	7.8	6.9-8.2
Pect L	23	22-26.4	26.4	26.5-30.7	20.0	16.4-22.2	20.4	21.1-30.2
BDa	15.4	13-17.9	11.4	12.2-17.4	14.7	14.1-17.2	12.2	13.8-16.7
SDFL	37.6	34.5-41.4	30.2	28.3-34.7	33.0	30.8-35.5	30.4	31.2-38.4
AFL	32.2	29.9-34.1	26.8	23.9-33.9	26.7	25.5-29.9	25.9	30.2-32.2
CFL	20.8	19.3-23.2	20.9	22.2-26.9	21.8	20.2-22.9	24.1	23.1-27.5



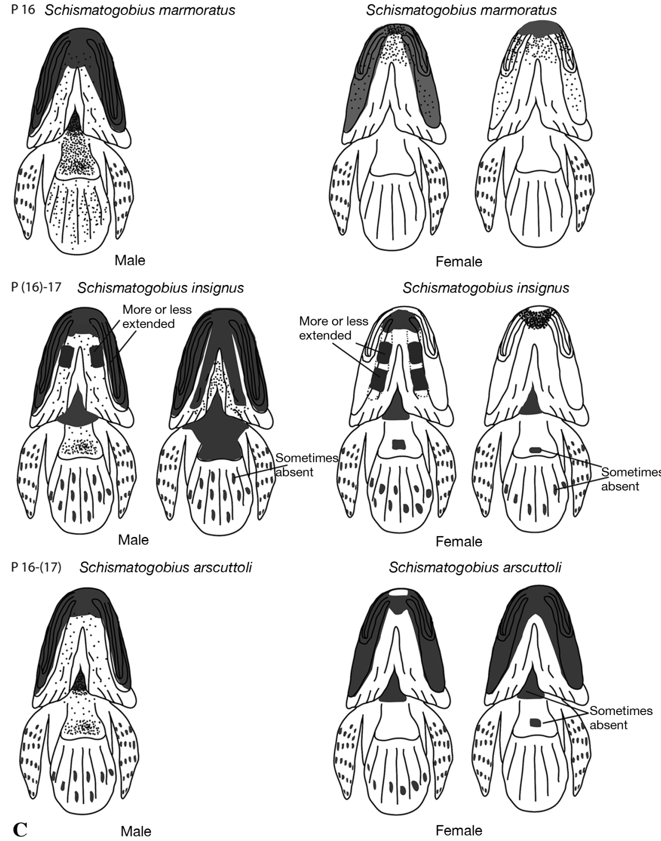


Figure 2. – Schematic drawings of the ventral surface of head of *Schismatogobius* species from Indonesia. **A**: 14-15 pectoral rays; **B**: 15-16 pectoral rays; **C**: 16-17 pectoral rays.

oculoscapular canal absent between pores F and K. Anterior interorbital extension of anterior oculoscapular canal with double terminal pores B slightly posterior to posterior nostril. D pore at rear of intertorbital. Posterior extension of anterior oculoscapular canal terminating laterally on each side of head at pore F, just behind posterior edge of eye. Posterior oculoscapular canal with 2 terminal pores, K and L; preopercular canal with 2 pores, N and O. Cutaneous sensory papillae not well developed and inconspicuous in several specimens due to preservation.

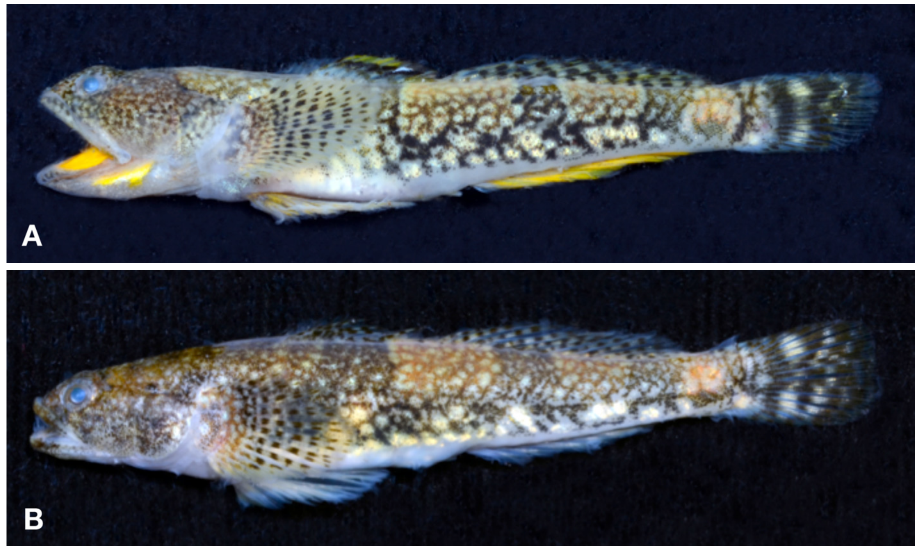


Figure 3. – **A**: *Schismatogobius saurii* n. sp., male, paratype MNHN 2016-0304, BIF 2548 (Photo N. Hubert). **B**: *Schismatogobius saurii* n. sp., female, paratype MZB 23795, BIF 2547 (Photo N. Hubert).

Sexual dimorphism fairly well developed with male having jaws longer than females and a different colour pattern on ventral surface of head. Urogenital papilla broadly rounded in females and slightly pointed in males.

Colour in preservation

Usually four vertical black bands in dorsal view; first band below first dorsal fin, second and third bands below second dorsal fin and fourth band at hypural crease. Lateral body colour markings variable with individual patterns of marbled brown to grey to black. Head dusky grey. Ventral surface of head in male whitish and slightly pigmented on the mentum or entirely brownish. Ventral surface of head in female whitish with a blackish or brownish mentum (Fig. 2A). First dorsal fin with two horizontal rows of black spots. Second dorsal fin mostly cream with three horizontal rows of black spots. Caudal fin black and white, with black spot at centre of hypural crease and two white spots posteriorly. Anal fin mostly cream. Pectoral fins banded with 4-7 rows of dark spots; small dark blotch present dorsoposteriorly.

Colour in life (Fig. 3)

Male: Four vertical black bands in dorsal view; first band below first dorsal fin, second and third bands below second dorsal fin and fourth band at hypural crease. Lateral and dorsal parts of the body between vertical black bands mottled and brownish to orange, and the black bands themselves are mottled with whitish and joined together below mid-line. Mottling on the head and the cheeks denser and dark brown to black. Belly whitish. Ventral surface of head dusky grey. First dorsal fin translucent at the base, with a central longitudinal black band and a distal longitudinal yellow band. Second dorsal fin translucent with a series of about four black spots on each ray. Caudal fin mainly black, with two median white spots dorsally and ventrally. Anal fin bright yellow. Pelvic disc mostly translucent, but yellow at the base. Pectoral fins translucent with about 4-5 irregular blackish bars. Inside of the mouth bright orange. Female: Four vertical black bands in dorsal view; first band below first dorsal fin, second and third bands below second dorsal fin and fourth band at hypural crease. Lateral and dorsal parts of the body between vertical black bands mottled and brownish-red. Cheeks and snout blackish. Belly whitish. Ventral surface of head and isthmus dusky grey. First and second dorsal fins translucent with a series of about four black spots on each ray. Anal fin greyish. Caudal fin marbled, black at hypural base and with two median white spots dorsally and ventrally. Caudal and pectoral fins translucent. Pectoral fins banded with 5-7 rows of dark spots. Inside of mouth grey.

Habitat

Schismatogobius saurii has been collected in freshwater streams with moderate to fast flow in shallow areas of gravel and boulders (depth 0.4-0.6 m), usually at low altitude (< 10 m), and sometimes with *S bruynisi*.

Etymology

The new species is named *saurii* in dedication to Sopian Sauri from LIPI, who helped us to collect freshwater fishes all around Indonesia.

Affinities

S. saurii differs from the other species sequenced and present in the area by displaying reciprocal monophyly from its closest relatives and high TrN+I genetic distances to its relatives at COI gene (0.257 to its closest relative *S. risdawatiae*), and from these species, except *S. bruynisi* and

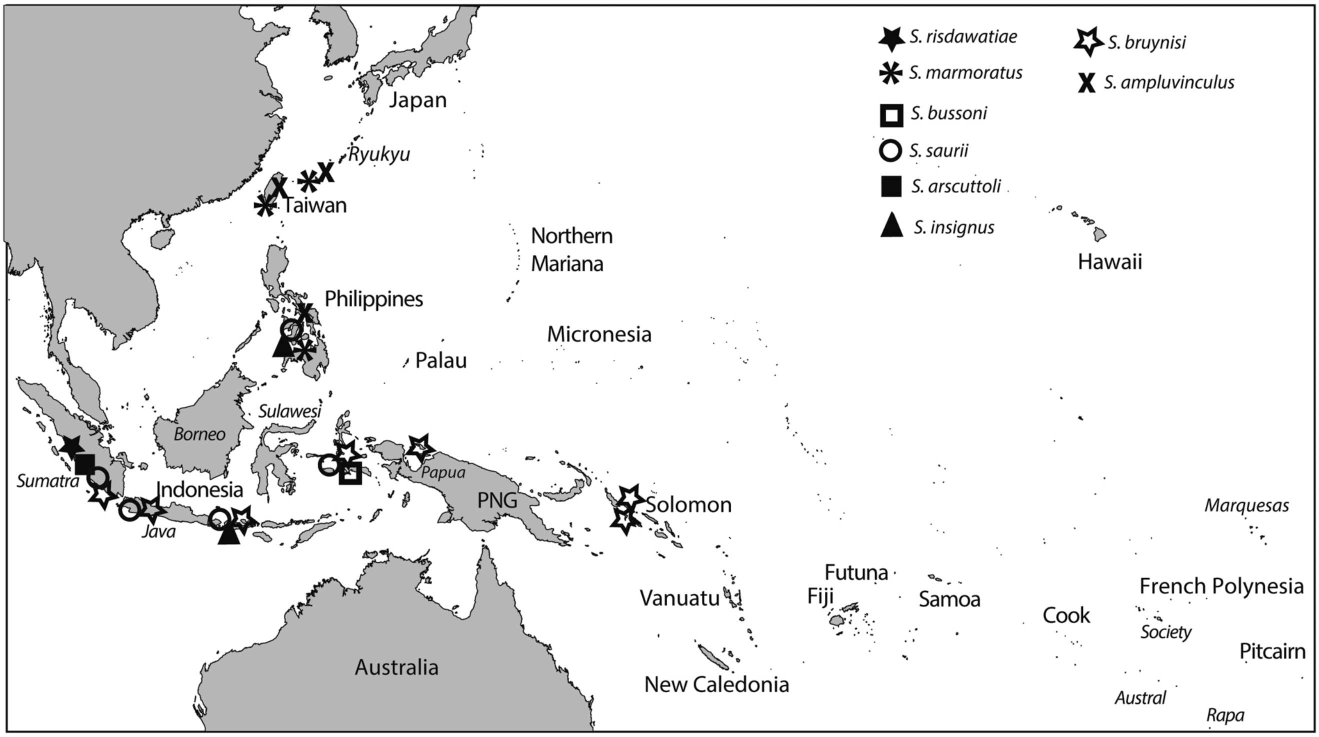


Figure 4. – Distribution area of *Schismatogobius* species from Indonesia.

S. saurii n. sp., in having 14-15 pectoral rays. It differs from *S. bruynisi* in having pectoral fins banded with rows of dark spots *versus* pectoral fins with a large dorsal black band, a smaller jaw length in female (9-10.5% *vs* 11.1-12.6% SL), a smaller jaw length/head length ratio in female (34.8-42.8% *vs* 42.5-47.5%) (Tabs III, IV), and a different colour pattern of ventral surface of head and frenum in female (Fig. 2A). It differs from *S. bussoni* n. sp. in having pectoral fins banded with rows of dark spots *versus* pectoral fins with a large dorsal black band (Fig. 2A), a larger size (average adult size more than 35 mm SL *vs* < 24 mm SL), a greater jaw length in male (17.7-20.5 % *vs* 13.4-14.7 % SL), and a greater jaw length/head length ratio in male (65.4-71% *vs* 47.6-57.6%) (Tab. III).

Distribution

S. saurii is known from Sumatra, Java, Bali, Lombok, Ambon and Panay (Fig. 4).

Schismatogobius bussoni, n. sp. Keith, Hubert, Limmon & Darhuddin

(Figs 1-2; 4-5; Tabs I-III)

Material examined. – Eleven specimens from Moluccas with a size range of 16-24.3 mm SL.

Holotype. – MZB 23798, male (22 mm SL); Ambon, Wai Kalauli, Moluccas, 3 Apr. 2016, coll. Hubert, Keith, Busson, Darhuddin *et al*.; BIF 5547.

Paratypes. – MZB 23799, 1 male, 4 females (17.4-24.3 mm SL); Ceram Tengah, Wai Tuni, Moluccas, 29 Mar. 2016, coll. Hubert *et al*.; BIF 5349 to 5353. MNHN 2016-0305, 1 female, 4 males (16-24.2 mm SL); Ceram Tengah, Wai Tuni, Moluccas, 29 Mar. 2016, coll. Hubert *et al*.; tags 12162, 12167, 12168, 12169, 12173.

Diagnosis

Usually 15 pectoral rays; pectoral fins with a large oval transverse dorsal black band. First dorsal fin membrane posterior to spine 6 not connected to base of spine of second dorsal fin. Ventral surface of head in male, and sometimes frenum, blackish. Ventral surface of head in female whitish, slightly pigmented with dark dots around the mouth and usually with a blackish ring around mentum. A single mitochondrial lineage (BOLD:ADF3589).

Description

A small sized *Schismatogobius* (average adult size < 25 mm SL). Body naked, slender, almost circular in cross-section. Head rounded, snout rather pointed. Mouth oblique, lower lip more prominent. Jaw lengths in male much greater than in female; jaw length 47.6-57.6% of HL in males and 31.7-39.7% of HL in females. Lower jaw reaching vertical of 1/3 of the eye in female and exceeding (for 1/4 to 1/3 of eye diameter) a vertical of posterior margin of eye in male. Eyes high on head, close together with interorbital width about equal to 1/3 eye diameter. Anterior nostril short and tube-like.

Dorsal fins VI-I,9, membrane in first dorsal fin posterior to spine 6 not connected to base of spine of second dorsal fin. D1 with all spines about equal in length. Anal fin I,9, origin directly opposite second dorsal fin origin. Caudal fin with 11-12 branched rays, posterior margin rounded. Pectoral fins oblong with posterior margin pointed and 14(1)-15(9) rays (Tab. II), ventralmost ray unbranched. Pelvic fins always I,5, with both fins joined together for their entire length between fifth rays to form a strong cup-like disc and a well developed and lobed frenum between spines, fins not extending beyond anus. Morphomeristic data given in table III.

Tongue bilobed. Teeth in upper jaw (20-25) in two rows, teeth conical and slightly recurved. Teeth in lower jaw (6-14) in two rows anteriorly and single row laterally, all teeth conical with outer row teeth only slightly enlarged and somewhat recurved.

Cephalic sensory pore system always with pores B, D, F, K, L, N and O, pore D singular with all other pores paired; oculoscapular canal absent between pores F and K. Anterior interorbital extension of anterior oculoscapular canal with double terminal pores B slightly posterior to posterior nostril. D pore at rear of intertorbital. Posterior extension of anterior oculoscapular canal terminating laterally on each side of head at pore F, just behind posterior edge of eye. Posterior oculoscapular canal with 2 terminal pores, K and L; preopercular canal with 2 pores, N and O. Cutaneous sensory papillae not well developed and inconspicuous due to preservation.

Sexual dimorphism fairly well developed with male having jaws longer than female and a different colour pattern on ventral surface of head. Urogenital papilla oval in female and slightly pointed in male.

Colour in preservation

Usually four vertical black bands in dorsal view; first band below first dorsal fin, second and third bands below second dorsal fin and fourth band at hypural crease. These lateral black body markings alternate with 3 vertical white to grey stripes. Head dusky grey. Ventral surface of head in male, and sometimes frenum, blackish. Ventral surface of head in female whitish, slightly pigmented with dark dots around the mouth and usually with a blackish ring around mentum (Fig. 2A).

First dorsal fin with large horizontal black band. Second dorsal fin mostly cream with rows of black spots on rays. Caudal fin black and white, with black spot at centre of hypural crease and two white spots posteriorly. Anal fin mostly cream. Pectoral fins with a large oval transverse dorsal black band; a dark blotch present dorsoposteriorly.

Colour in life (Fig. 5)

Male: usually four vertical black bands in dorsal view; these bands and upper parts of body mottling of various colours. First band below first dorsal fin, second and third bands below second dorsal fin and fourth band at hypural crease, so the two middle bands are very close to each other. Black bands and upper part of body has mottling of various colours. Colour of body between each band whitish to rose. Head and cheeks mottled with closely spaced spots and marking, and an overall shade of orange-brown. Belly whitish to greyish. First dorsal fin with large horizontal black band. Second dorsal fin with rows of black spots on rays. Caudal fin mainly black with two median white spots dorsally and ventrally. Pectoral fin translucent with a large black spot at the base dorsally. Caudal and pectoral fins translucent. Inside of mouth bright orange. Female: usually four vertical black bands in dorsal view; first band below first dorsal fin, second and third bands below second dorsal fin and fourth band at hypural crease, so the two middle bands are very close to each other. Colour of body between each band mottled and brownish-red. Nape orange. Cheeks and snout marbled with black and dusky markings. Belly greyish to yellow. Caudal fin mainly black with two median white spots dorsally and ventrally. Pectoral fins translucent with a large black spot at the base dorsally. Caudal and pectoral fins translucent. Inside of mouth grey.

Table IV. – Morphomeristics of the known *Schismatogobius* species of the studied area. Morphometrics are given as percentages of standard length, except JL/HL.

	S. bruynisi	*S. ampluvinculus*	*S. marmoratus*	*S. insignus*
P	(14)-15	15-16	16	(16)-17
D	VI,I9	VI,I9	VI,I9	VI,I9
A	I9	I9	I9	I8-9
PDL	35.6-42	34.6-41.7	36.2-38.3	37.9-43.2
PAL	55.8-64.6	57.7-65.2	62-65	57.6-66
HL male	26-32	25.4-30.7	31.3	28.8-34.3
JL male	17.5-21.7	12.8-16.7	19.4	16.6-23
JL/HL male	57.9-69.2	48.9-54.8	61.9	57.6-69.4
HL female	25-27.9	27.1-28.5	27.2-29.1	27.3-30.8
JL female	11.1-12.6	8.3-9.6	10.7-13.1	12.2-15.1
JL/HL female	42.5-47.5	31.4-34.2	38-44.2	42.7-49
CPD	6.8-8.8	6.1-8.3	8.4-10	7.1-8.9
Pect L	20.2-26.7	16.4-22.8	20.7-23.9	21.8-27.7
BDa	13.5-18.4	9-12.8	15.5-17.7	14.8-17.7
SDFL	30.6-37.9	24.2-33.6	30.1-35.2	32.2-41.2
AFL	29.7-32.6	22.2-29.9	25.8-29.3	25.5-32.3
CFL	19.5-28.3	19.3-22.6	20-22	21.8-28.5

Habitat

Schismatogobius bussoni has been collected in freshwater streams with moderate to fast flow in shallow areas of rocks and gravel (depth 0.3-0.4 m), just above tidal influence, and sometimes with *S bruynisi* and *S. saurii*.

Etymology

The new species is named *bussoni* in dedication to Frédéric Busson from MNHN, for all his work to improve our knowledge on Indonesian freshwater fishes.

Affinities

S. bussoni differs from the other species sequenced and present in the area studied displaying reciprocal monophyly from its closest relatives and high TrN+I genetic distances to its relatives at COI gene (0.125 to its closest relative *S. risdawatiae*), and from these species, except *S. bruynisi* and *S. saurii* n. sp., in having usually 15 pectoral rays. It differs from *S. bruynisi* in having a smaller jaw length in male (13.4-16.4 *vs* 17.5-21.7% SL) and female (7.8-10.9% *vs* 11.1-12.6% SL), a smaller jaw length/head length ratio in male (47.6-57.6% *vs*. 57.9-69.2%) and female (31.7-39.7% *vs* 42.5-47.5%) (Tabs III, IV), and a different colour pattern of ventral surface of head and frenum in female (Fig. 2A). It differs from *saurii* n sp. in having pectoral fins with a dorsal black band *versus* pectoral fins banded with rows of dark spots, a smaller size (average adult size < 25 mm SL *vs* > 35 mm SL), a smaller jaw length in male (13.4-16.4 % *vs* 17.7-20.5 % SL), a smaller jaw length/head length ratio in male (47.6-57.6% *vs* 65.4-71%.) (Tab. III), and a different colour pattern of ventral surface of head, pelvic disk and frenum in female (Fig. 2A).

Distribution

S. bussoni is known only from Moluccas (Ceram and Ambon) (Fig. 4).

***Schismatogobius risdawatiae*, n. sp. Keith, Darhuddin, Sukmono & Hubert**

(Figs 1-2; 4; 6; Tabs I-III)

Material examined. – Nine specimens from Sumatra with a size range of 25.1-30.2 mm SL.

Holotype. – MZB 23800, male (27 mm SL); Padang, Air Terjun Lubuk Hitam, West Sumatra, Indonesia, 1 May 2016, coll. Hubert *et al*.; BIF 6032.

Paratypes. – MZB 23801, 5 females (25.1-26.8 mm SL); same data as holotype; BIF 6033, 6035 to 6038. MNHN 2016-0309, 1 male, 1 female (27-30.2 mm SL); same data as holotype; BIF 6034, 6039. MNHN 2016-0621, 1 female (23.5 mm SL); Sumatra, 2016, coll. Negrini; tag 12944.

Diagnosis

Usually 16 pectoral rays; pectoral fins with a broad dorsal black band. Membrane in first dorsal fin posterior to spine 6 partly connected to base of spine of second dorsal fin in male and not in female. Ventral surface of head in male brownish, frenum slightly pigmented. Ventral surface of head in female whitish with a blackish border and a white mentum; frenum and pelvic disk whitish. A single mitochondrial lineage (BOLD:ADF3588).

Description

A medium sized *Schismatogobius* (average adult size 27 mm SL). Body naked, slender, almost circular in cross-section. Head rounded, snout rather pointed. Mouth oblique, lower lip more prominent. Jaw lengths in male much greater than in females; 55.6-63.1% in male (in HL), 27.4-33% in females. Lower jaw reaching a vertical of 1/3 to 1/2 in female and exceeding (for 1/4 of eye diameter) a vertical of posterior part of the eye in male. Eyes high on head, close together with interorbital width about a quarter to one third of the eye diameter. Anterior nostril short and tube-like.

Dorsal fins VI-I,9, membrane of first dorsal fin posterior to spine 6 partly connected to base of spine of second dorsal fin in male and not in female. D1 with all spines about equal in length. Anal fin I,9, origin directly opposite to second dorsal fin origin. Caudal fin with 11-12 branched rays, posterior margin rounded. Pectoral fins oblong with posterior margin pointed and 15(2)-16(7) rays (Tab. II), ventralmost ray unbranched. Pelvic fins always I,5, with both fins joined together their entire length between rays 5, forming strong cup-like disc; a well developed frenum between spines slightly lobed ; fin not extending beyond anus. Morphomeristics data given in table III.

Tongue bilobed. Teeth in upper jaw (11-22) usually in two or three rows, teeth conical and slightly recurved. Teeth in lower jaw (6-14) in one or two rows of teeth anteriorly and single row laterally, all teeth conical with outer row teeth only slightly enlarged and somewhat recurved.

Cephalic sensory pore system generally with pores B, D and F; pore D singular with other pores paired. Anterior interorbital extension of anterior oculoscapular canal with double terminal pores B slightly posterior to posterior nostril. D pore at rear of intertobital. Posterior extension of anterior oculoscapular canal terminating laterally on each side of head at pore F, just behind posterior edge of eye. Many specimens lacking the preopercular canal and associated pores N and O, while some individuals also lack the posterior section of the oculoscapular canal and its associated pores K and L. Cutaneous sensory papillae not well developed but similar to pattern described by Akihito *et al*. (1988).

Sexual dimorphism fairly well developed with male having jaws longer than female. Urogenital papilla broadly rounded in females and slightly triangular in male.

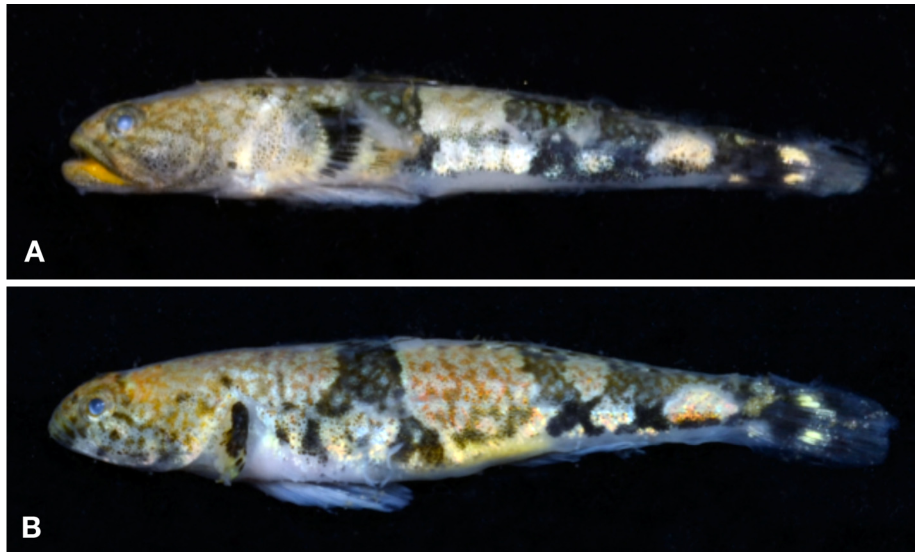


Figure 5. – **A**: *Schismatogobius bussoni* n. sp., male, paratype *in* MZB 23799, BIF 5353 (Photo N. Hubert). **B**: *Schismatogobius bussoni* n. sp., female, paratype *in* MZB 23799, BIF 5349 (Photo N. Hubert).

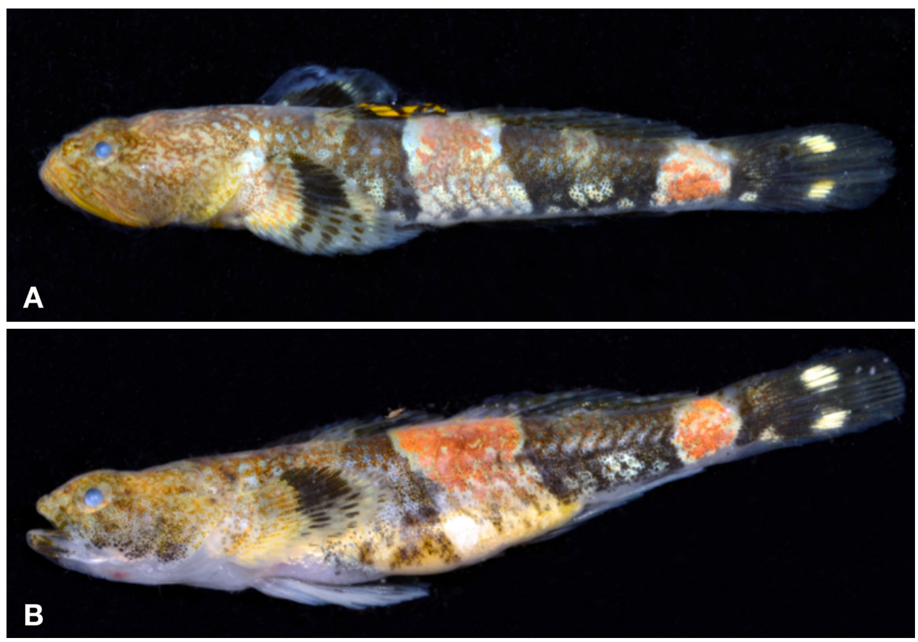


Figure 6. – **A**: *Schismatogobius risdawatiae* n. sp., male, paratype in MNHN 2016-0309, BIF 6039 (Photo N. Hubert). **B**: *Schismatogobius risdawatiae* n. sp., female, paratype *in* MZB 23801, BIF 6035 (Photo N. Hubert).

Colour in preservation

Usually three vertical black bands in dorsal view; first band below first dorsal fin, second below second dorsal fin and third one at hypural crease. These lateral black body markings alternate with 3 vertical white to grey stripes. Head dusky grey. Ventral surface of head in male brownish, frenum slightly pigmented. Ventral surface of head in female whitish with a blackish border and a white mentum; frenum and pelvic disk whitish (Fig. 2B). First dorsal fin with two horizontal black bands. Second dorsal fin mostly cream with horizontal rows of black spots. Caudal fin black and white, with black spot at centre of hypural crease and two white spots posteriorly. Anal fin mostly cream. Pectoral fins with a large dorsal and distal black band; a dark blotch present dorsoposteriorly.

Colour in life (Fig. 6)

Male: Usually three vertical black bands in dorsal view; first band below first dorsal fin, second below second dorsal fin and third one at hypural crease. Body red-orange between the black bands; shades of bright electric blue at the border of the black bands. Head and cheeks mottled with brown and orange spots and markings. First dorsal fin translucent at the base, with a superposition of a longitudinal black band and a distal longitudinal orange band. Second dorsal fin translucent with a series of black spots on each ray. Caudal fin

Figure 7. – **A**: *Schismatogobius arscuttoli* n. sp., male, holotype MNHN 2016-0306 (Photo P. Keith). **B**: *Schismatogobius arscuttoli* n. sp., female (Photo P. Keith).

black with two median white spots dorsally and ventrally. Pectoral fins orange at the base; median black spot on the dorsal half of the fin, splitting into three vertical bands ventrally; distal margin translucent. Inside of the mouth bright orange. Female: Usually three vertical black bands in dorsal view; first band below first dorsal fin, second below second dorsal fin and third one at hypural crease. Body red between the black bands; shades of bright electric blue at the border of the black bands. Head and nape mottled with brown and orange spots and markings. Cheeks blackish. First and second dorsal fins translucent with black spots along the rays. Caudal fin black with two median white spots dorsally and ventrally. Pectoral fins brownish at the base; median black spot on the dorsal half of the fin, splitting into two vertical bands ventrally; distal margin translucent. Caudal and pectoral fins translucent. Belly brownish-beige. Ventral surface of head dusky grey. Inside of mouth grey.

Habitat

Schismatogobius risdawatiae has been collected in freshwater streams with moderate to fast flow in shallow areas of gravel and boulders, just above the tidal influence at elevation ranging from 16 to 45 m.

Etymology

The new species is named *risdawatiae* in dedication to Ms Renny Risdawati from Padang University, who helped us to collect freshwater fishes in Padang, Sumatra.

Affinities

S. risdawatiae differs from the other species sequenced and present in the area studied by displaying reciprocal monophyly from its closest relatives and high TrN+I genetic distances to its relatives at COI gene (0.125 to its closest relative *S. bussoni*), and from these species, except *S. ampluvinculus,* in having 15-16 pectoral rays. It differs from *S. ampluvinculus* in having a greater jaw length in male (17.8-19.8% *vs* 12.8-16.7% SL), a greater jaw length/head length ratio in male (55.6-63.1% *vs* 48.9-54.8%), a greater body depth length at anus (14.1-17.2% vs 9-12.8% SL) (Tabs III, IV), and a different colour pattern of the ventral surface of head, pelvic disk and frenum in female (Fig. 2B).

Distribution

S. risdawatiae is known from Sumatra (Fig. 4).

Schismatogobius arscuttoli, n. sp. Keith, Lord & Hubert

(Figs 1-2; 4; 7; Tabs I-III)

Material examined. – Ten specimens from Sumatra with a size range of 26.7-32.7 mm SL.

Holotype. – MNHN 2016-0306, male (28.5 mm SL); Sumatra, Indonesia, 2016, coll. Negrini.

Paratypes. – MZB 23802, 1 female (30.3 mm SL); Lampung Barat, Way Pamerihan, Sumatra, Indonesia, 24 Oct. 2005, coll. Page *et al*. UF 162774, 2 females (26.7-28.4 mm SL); Lampung County, Way Ngarip, Sumatra, Indonesia, 25 Oct. 2005, coll. Page *et al*. MNHN 2016-0308, 1 female (32 mm SL); Way Cangup at research station, Bukit Barisan Selatan National Park, Sumatra, Indonesia, 22 Oct. 2005, coll. Page *et al*. UF 162772, 1 male, 2 females (28-28.8 mm SL); Lampung Barat, Way Pamerihan, Sumatra, Indonesia, 24 Oct. 2005, coll. Page *et al*. MNHN 2016-0620, 1 female (30.5 mm SL); Lampung Barat, Way Pamerihan, Sumatra, Indonesia, 24 Oct. 2005, coll. Page *et al*. QM I 38570, 1 male (32.7 mm SL), North Sumatra, Indonesia, 15 Jul. 2003, coll. Smith.

Diagnosis

Usually 16 pectoral rays; pectoral fins banded with rows of dark spots. Membrane in first dorsal fin posterior to spine 6 connected to base of spine of second dorsal fin. Ventral surface of head in male whitish with a blackish border, black mentum and isthmus; frenum slightly pigmented. Ventral surface of head in female whitish with a blackish border, sometimes with a white mentum; frenum and pelvic disk generally whitish. A single mitochondrial lineage (BOLD:ADG5049).

Description

A medium sized *Schismatogobius* (average adult size 28 mm SL). Body naked, slender, almost circular in cross-section. Head rounded, snout rather pointed. Mouth oblique, lower lip more prominent. Jaw lengths in male much greater than in females; 56.6-69.6% in male (in HL), 36.5-41.8% in females. Lower jaw reaching a vertical of 1/2 in female and exceeding (for 1/3 to 1/2 of eye diameter) a vertical of posterior part of the eye in male. Eyes high on head, close together with interorbital width about one third of the eye diameter. Anterior nostril short and tube-like.

Dorsal fins VI-I,9, membrane of first dorsal fin posterior to spine 6 connected to base of spine of second dorsal fin. D1 with all spines about equal in length. Anal fin I,9, origin directly opposite to second dorsal fin origin. Caudal fin usually with 11 branched rays, posterior margin rounded. Pectoral fins oblong with posterior margin rounded and usually 16 rays (Tab. II), 3 specimens with 16 rays on one pectoral fin and 17 on the other; ventralmost ray unbranched. Pelvic fins always I,5, with both fins joined together their entire length between rays 5, forming strong cup-like disc; a well developed frenum between spines, fin not extending beyond anus. Morphomeristics data given in table III.

Tongue bilobed. Teeth in upper jaw (22-25) usually in two or three rows, teeth conical and slightly recurved. Teeth in lower jaw (9-15) in two rows of teeth anteriorly and single row laterally, all teeth conical with outer row teeth only slightly enlarged and somewhat recurved.

Cephalic sensory pore system always with pores B, D, F, K, L, N and O, pore D singular with all other pores paired; oculoscapular canal absent between pores F and K. Anterior interorbital extension of anterior oculoscapular canal with double terminal pores B slightly posterior to posterior nostril. D pore at rear of intertorbital. Posterior extension of anterior oculoscapular canal terminating laterally on each side of head at pore F, just behind posterior edge of eye. Posterior oculoscapular canal with 2 terminal pores, K and L; preopercular canal with 2 pores, N and O. Cutaneous sensory papillae not well developed but similar to pattern described by Akihito *et al*. (1988).

Sexual dimorphism fairly well developed with male having jaws longer than female. Urogenital papilla broadly rounded in females and slightly triangular in male.

Colour in preservation (Fig. 7A)

Usually four vertical black bands in dorsal view; first band below first dorsal fin, second and third bands below second dorsal fin and fourth band at hypural crease. These lateral body black markings alternate with 3 vertical brown stripes. Head dusky grey. Ventral surface of head in male whitish with a blackish border, black mentum and isthmus; frenum slightly pigmented. Ventral surface of head in female whitish with a blackish border, sometimes with a white mentum; frenum and pelvic disk whitish (Fig. 2C).

First dorsal fin with two horizontal black bands. Second dorsal fin mostly cream with horizontal rows of black spots. Caudal fin black and white, with black spot at centre of hypural crease and two white spots posteriorly. Anal fin mostly cream. Pectoral fins banded with rows of dark spots; no dark blotch present dorsoposteriorly.

Colour in life (Fig. 7B)

Female (no live male observed): Usually four vertical black bands in dorsal view; first band below first dorsal fin, second and third bands below second dorsal fin and fourth band at hypural crease. Colour of body between black bands rather grey; pink between the two posterior bands. Entire dorsal part of the body, from nape to hypural base, punctuated with bright electric blue spots. Lower half of body marbled with black, white and pinkish markings. Belly and ventral surface of head dusky. First and second dorsal fins with a few black spots evenly distributed on each ray. Pectoral fins banded with rows of dark spots; no dark blotch present dorsoposteriorly. Caudal fin translucent, with a black hypural base and two median vertical rows of black spots. Inside of mouth grey.

Habitat

Schismatogobius arscuttoli has been collected in freshwater streams with moderate to fast flow in shallow areas of gravel.

Etymology

The name for the new species, as a noun in apposition, is dedicated to Ars-Cuttoli Foundation who funded our research in Indonesia.

Affinities

S. arscuttoli differs from the other species sequenced and present in the area studied by displaying high TrN+I genetic distances to its relatives at COI gene (0.231 to its closest relative *S. insignus*), and from these species, except *S. marmoratus* and *S. insignus* in having 16-17 pectoral rays. It differs from these two species in having a smaller adult average size (< 28 mm SL *vs* > 33 mm SL). Moreover, it differs from *S. marmoratus* in having a greater head length in female (29-32.5% *vs* 27.2-29.1% SL), a smaller caudal peduncle depth (6.9-8.2% *vs* 8.4-10% SL) (Tabs III, IV), and a different colour pattern of ventral surface of head, pelvic disk and frenum in female (Fig. 2C). It differs from *S. insignus* in having usually 16 pectoral fins rays *vs*. usually 17, a smaller jaw length/head length ratio in female (36.5-41.8% *vs*. 42.7-49%) (Tabs III, IV), and a different colour pattern of the ventral surface of head, pelvic disk and frenum in male and female (Fig. 2C).

Distribution

S. arscuttoli is known from Sumatra (Fig. 4).

Key to species from Indonesian area

1a: Pectoral rays 14-15 or 15-16, fins with broad black blotch anteriorly **2**

1b: Pectoral rays 14-15, fins banded, membrane in first dorsal fin posterior to spine 6 connected to base of spine in second dorsal fin. . . . . ***S. saurii***

1c: Pectoral rays 16-17, fins banded **5**

2a: Jaw length in male 12.8-16.7 % SL, jaw length in head length in male 47.6-57.6 % **3**

2b: Jaw length in male 17.5-21.7 % SL; jaw length in head length in male 55.6-69.2 % **4**

3a: Pectoral length 26.4-30.7 % SL; body depth at anus 11.4-17.4 % SL . . . . ***S. bussoni***

3b: Pectoral length 16.4-22.8 % SL; body depth at anus 9-12.8 % SL. . . . . ***S. ampluvinculus***

4a: Jaw length in female 11.1-12.6 % SL; jaw length in head length in female 42.5-47.5 % . . . . ***S. bruynisi***

4b: Jaw length in female 8.4-9.7 % SL; jaw length in head length in female 27.4-33 % . . . . ***S. risdawatiae***

5a: Pectoral rays usually 16; jaw length in head length in female 36.5-44.2 %; ventral surface of head in female usually whitish with a blackish border **6**

5b: Pectoral rays usually 17; jaw length in head length in female 42.7-49 %; ventral surface of head in female without a blackish border . . . . ***S. insignus***

6a: Head length in female 29-32.5 % SL, caudal peduncle depth 6.9-8.2 %. Adult average size < 28 mm SL . . . . ***S. arscuttoli***

6b: Head length in female 27.2-29.1 % SL, caudal peduncle depth 8.4-10 %. Adult average size > 33 mm SL . . . . ***S. marmoratus***

Comparative material

Schismatogobius bruynisi. ZMA 111196, holotype, Eme River, Honitetu, Western Ceram, Indonesia. MNHN 2016-0291, 1 spm, Vanga River, Kolombangara (= Kolobangara), Solomon Islands, 18 Nov. 2015, tag 11926, coll. Keith *et al*. MNHN 2016-0289, 1 spm, Lokapava River, Choiseul, Solomon Islands, 21 Oct. 2014, tag 11933 coll. Keith *et al*. MNHN 2016-0290, 1 spm, Lokapava River, Choiseul, Solomon Islands, 21 Oct. 2014, tag 11938, coll. Keith *et al*. MZB (uncatalogued), BIF 0185 to 0189, 5 spms, Maja, West Java, Indonesia, 20 Nov. 2012, Hubert *et al*. MZB (uncatalogued), BIF 2544 to 2546, 3 spms, Tukad Banyuraras, West Bali, Indonesia, 18 Apr. 2014, coll. Hubert *et al*.

Schismatogobius marmoratus. ZMB 6756, holotype, Loquilócun, Samar Island, Philippines, coll. F. Tagor. MNHN, uncatalogued, 2 spms.

Schismatogobius vanuatuensis. MNHN 2003-1557, holotype, Matentas River, Santo Island, 23 Jul. 2003, coll. Keith, Marquet and Keith. MNHN 2003-1558, Paratypes, 5 spms, Matentas River, Santo Island, 23 Jul. 2003, coll. Keith, Marquet and Keith. MNHN 2016-0283 (tag 6916), 1 spm, Manga River, Kolombangara Island, Solomon Islands, 19 Nov. 2015, coll. Keith *et al*. MNHN 2016-0284 (tag 05484), 1 spm, Vanga River, Kolombangara, Solomon, 18 Nov. 2016, coll. Keith *et al*. MNHN 2016-0285 (tag 06936), 1 spm, Poitete River, Kolombangara, Solomon, 15 Nov. 2016, coll. Keith *et al*. MNHN 2016-0286 (tag 06911), 1 spm, Poitete River, Kolombangara, Solomon, 15 Nov. 2016, coll. Keith *et al*. MNHN 2016-0287, 1 spm, tag 05487, Liva River, Kolombangara, Solomon, 11 Nov. 2016, coll. Keith *et al*. NTM S.16447-001, 2 spms, Tetepare Island, Solomon, 2 Sep. 2006, coll. Jenkins & Boseto.

Schismatogobius fuligimentus. MNHN 2002-149 to MNHN 2002-151, 3 spms, Lembi River, New Caledonia, 1999, coll. Marquet. MNHN 2002-152, 1 spm, Pourina River, New Caledonia, Jul. 2000, coll. Chloé 3. MNHN 2016-0288 (tags 13629, 13631, 13633, 13634), 4 spms, New Caledonia, 2014.

Schismatogobius ampluvinculus. ASIZP0072682, 1 spm, Taiwan, 10 Oct. 2011, coll. Chang. ASIZP0072683, 1 spm, Taiwan, 10 Oct. 2011, coll. Chang. ASIZP0072684, 1 spm, 10 Oct. 2011, Taiwan, coll. Chang. BLIH 19890087, 1 spm, Iriomote-jima Island, Okinawa, Japan, 22 Aug. 1989, coll. Aizawa *et al*. BLIH 19890761, 5 spms, Nakama River (upstream), Iriomote-jima Island, Okinawa, Japan, 10 Oct. 1989, coll. Sakamoto *et al*. BLIH 19930057, 8 spms, Nakama River (upstream), Iriomote-jima Island, Okinawa, Japan, 12 Sep. 1993, coll. Sakamoto *et al*. BLIH 1989761, 2 of 5 spms, Iriomote-jima, Japan, 10-20 Oct. 1981. NMMBA 1183, 1 spm, Ta-wu River, Taitung, Taiwan, 12 Nov. 2002, coll. Han. MNHN 2016-0300, 1 spm, Panay Island4, Philippines.

Schismatogobius vitiensis. WAM P32351.001, paratypes, 5 spms, Buca River, Viti Levu, Fiji, 29 Aug. 2003, coll. Pogonowski and Koto. AMS I.42900-001, 1 spm, Savura Creek, Viti Levu Island, Fiji, 11 Feb. 2003, Boseto and Malo coll.

Schismatogobius deraniyagalai. SMF 24057, 1 of 3 spms, Sri Lanka, Jonklass leg. SMF 24058, 10 of 24 spms, Atweltota, Sri Lanka, Sep. 1989. USNM 268297, 2 of 3 spms, tributary of Gin Ganga, Kanneliya Forest, Sri Lanka, 8 Jul. 1969, coll. Smith-Vaniz.

Schismatogobius roxasi. CAS 30968, holotype, San Jose, Panay, Philippines, Feb. 1926, coll. F. Reveche.

Schismatogobius insignus.- MNHN 2016-0301 (tags 12196, 12197), 2 spms, Panay, Philippines. MNHN 2016-0307 (tag 6904), 1 spm, Panay, Alegre River, Philippines. MZB uncatalogued (BIF 3783, 3861, 4059, 4060), 4 spms, Lombok Utara, Sidutan, Indonesia, 28 Mar. 2015, coll. Hubert, Keith, Busson, Hadiaty *et al*.

Gobiosoma pallida. CAS 12869 (SU 28609), holotype, Sitankai, Sulu Archipelago, Philippines, Aug. 1931, coll. Herre; SU 16962, paratype, 1 of 3 spms, Philippines.

Schismatogobius tuimanua. MNHN 2016-0263, holotype, Luatuanuu River, Samoa, 21 Feb. 2013, coll. Keith *et al*. MNHN 2016-0264, paratype, 1 spm, Tavea River, Samoa, 22 Feb. 2013, coll. Keith *et al*. BLIP 19800196, paratype, 1 spm, Nuvuli, Papa Stream, Tutuila Island, American Samoa, Aug. 1980, coll. Carl and Ford.

Schismatogobius tiola. MNHN 2016-0265, holotype, Poitete River, Kolombangara Island, Solomon Islands, 14 Nov. 2015, coll. Keith *et al*. MNHN 2016-0266, paratypes, 2 spms, Poitete River, Kolombangara Island, Solomon Islands, 11 & 13 Nov. 2015, coll. Keith *et al*. QM I.40660, paratype, 1 spm, Vanga River, Kolombangara Island, Solomon Islands, 18 Nov. 2015, coll. Keith *et al*. MNHN 2016-0292, paratype, 1 spm, Maravari River, Vella Lavella Island, Solomon Islands, 31 Oct. 2016, coll. Keith *et al*. MNHN 2016-0294, paratype, 1 spm, Mondo River, Ranongga Island, Solomon Islands, 26 Oct. 2016, coll. Keith *et al*. MNHN 2016-0295, paratype, 1 spm, Poro River, Ranongga Island, Solomon Islands, 23 Oct. 2016, coll. Keith *et al*.

Schismatogobius essi. MNHN 2016-0267, holotype, Vage River, Kolombangara Island, Solomon Islands, 11 Nov. 2015, coll. Keith *et al*. MNHN 2016-0268, paratypes, 5 spms, Vage River, Kolombangara Island, Solomon Islands, 11 Nov. 2015, coll. Keith *et al*. AMS I.47237.001, paratype, 1 spm, Vage River, Kolombangara Island, Solomon Islands, 10 Nov. 2015, coll. Keith *et al*. NTM 16447-002, paratype, 1 spm, Erava River, Tetepare Island, Solomon Islands, 12 Sep. 2006, coll. Jenkins and Boseto. QM I38030, paratype, 1 spm, Tinahula River, Guadalcanal, Solomon Islands, Jul. 2006, coll. Smith. MNHN 2016-0296, paratypes, 2 spms, Valakadju River, Vella Lavella Island, Solomon Islands, 28 Oct. 2016, coll. Keith *et al*.

Schismatogobius mondo. MNHN 2016-0297, holotype, Mondo River, Ranongga Island, Solomon Islands, 26 Oct. 2015, coll. Keith *et al*. MNHN 2016-0298, paratype, 1 spm, Dae River, Ranongga Island, Solomon Islands, 24 Oct. 2015, coll. Keith *et al*.

Schismatogobius baitabag. NTM S13675-011, holotype, Baitabag Village, Nagada River, Madang, Papua New Guinea, 13 Oct. 1992, coll. Larson, Mizeu, Matthew and villagers. NTM S13675-001, paratype, 1 spm, same data as holotype. WAM P29613-015, paratype, 1 spm, Bogia, 4.5 N. road to Awar, Papua New Guinea, 19 Oct. 1987, coll. Allen and Parenti.

Schismatogobius hoesei. AMS I.21272-011, holotype, 1 spm, South branch of Endeavour River, west of Cooktown, Queensland, Australia, 19 Sep. 1979, coll. Hoese; and all paratypes, see Keith *et al*. (2017).

Schismatogobius alleni. QM I.39304, holotype, Uruf Creek, tributary of Markham River, Papua New Guinea, 3 Jul. 2012, coll. Webb. AUM 47579, paratype 1 spm, Ularimbin Creek, East Sepik, Papua New Guinea, 7 Oct. 2007, coll. Armbruster *et al*.

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