

## A review of the gobiid fish genus *Redigobius* (Teleostei: Gobionellinae), with descriptions of two new species

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The gobiid fish genus *Redigobius*, with 44 putative species, was revised, and found to include 12 species, which are redescribed here. Two new species, from Fiji and from northern Australia and New Guinea, are described: *R. lekutu* and *R. nanus*. *Redigobius* belongs to the subfamily Gobionellinae, and is one of the most plesiomorphic genera of that subfamily. It is probably most closely related to *Pseudogobiopsis*.

*Redigobius* can be distinguished from other genera in the subfamily by a combination of characters, including: dorsal-fin rays I,6-8; anal-fin rays I,6-7; modally with one more ray in second dorsal fin than in anal fin; 17 segmented caudal rays; sensory canals on head with complete oculoscapular and preopercular canals and pores; sensory papillae arranged in longitudinal pattern, jaws terminal, males usually with enlarged mouths; 11-12 precaudal and 14-16 caudal vertebrae and usually three or four anal-fin pterygiophores before first caudal haemal spine. *Redigobius* occurs throughout the Indo-west Pacific, in estuarine to fresh water habitats, with *R. bikolanus* being the most widespread species.

### Introduction

Species of the gobiid fish genus *Redigobius* are found throughout the Indo-west Pacific, in estuarine and fresh waters, usually close to tidal influence. They are sometimes abundant, and several species have entered the aquarium trade. There appear to be 41 nominal species of *Redigobius*, some of which are dubious. These species are greatly confused in the literature, and have been placed by various authors in *Acentrogobius*, *Ctenogobius*, *Cyprinogobius*, *Gobius*, *Lophogobius*, *Mahidolia*, *Mugilogobius*, *Parvigobius*, *Pseudogobius*, *Stigmatogobius* and *Vaimosa*, as well as in *Redigobius* itself. Recently, *Redigobius* was shown to

belong to the gobiid subfamily Gobionellinae by Pezold (1993), and the genus was further defined by Larson (2001). A list of nominal species of *Redigobius* and their valid names is provided (Table 1).

Herre originally created the genus *Redigobius* in 1927, for *Gobius sternbergi*, compiling his description from Smith's (1902) original species description, in which he mis-counted the number of first dorsal fin spines, recording V instead of VI. Herre created the new genus based on this low number of dorsal spines, stating "*Redigo*, reduced in number, in allusion to the reduced number of spines" (Herre 1927: 98). Herre did consider that *G. sternbergi*, despite apparently

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having five spines, was very similar if not the same as *Gobius dispar* which Herre (1927) had placed in *Vaimosa*. This is probably why, of the 10 species now placed in *Redigobius* that Herre described, he placed them all in the genus *Vaimosa*, now considered to be a synonym of *Mugilogobius* (Larson 2001).

Koumans (1931) recognized *Redigobius*, and considered it to be closely allied to *Gnatholepis* Bleeker (also a gobionelline). He did not see types of *Gillichthys australis*, that Whitley placed in *Ostregobius*, so was unsure of its relationships.

Koumans (1931) also listed, tentatively under the genus *Stigmatogobius*, *Gobius tambujon*, and stated that Bleeker had identified it as *Microgobius*, an unavailable museum name (not *Microgobius* Poey). Koumans (1932) placed a number of *Redigobius* species under *Stigmatogobius*, including *S. isognathus*, *Gobius tambujon*, *S. amblyrhynchus*, and *Pseudogobius penango*.

In 1935, Koumans examined Weber's *Gobius roemeri* and considered it to be a *Pseudogobiopsis* (*Eugnathogobius* sensu Larson 2001), with *Vaimosa macrognathos*, listed as a junior synonym. The

**Table 1.** Nominal species of *Redigobius* and their status.

nominal species	taxonomic status
<i>Stigmatogobius amblyrhynchus</i> Bleeker, 1878	= <i>Redigobius</i> ?
<i>Stigmatogobius amblystoma</i> Zander, 1972	= <i>Redigobius</i> sp.
<i>Gillichthys australis</i> Ogilby, 1894	= <i>Redigobius macrostoma</i>
<i>Vaimosa balteata</i> Herre, 1935c	= <i>Redigobius balteatus</i>
<i>Acentrogobius balteatops</i> Smith, 1959	= <i>Redigobius balteatus</i>
<i>Vaimosa bikolana</i> Herre, 1927	= <i>Redigobius bikolanus</i>
<i>Vaimosa cardonensis</i> Herre, 1940	= <i>Redigobius tambujon</i>
<i>Vaimosa chinensis</i> Herre, 1935a	= <i>Redigobius bikolanus</i>
<i>Lophogobius chryosoma</i> Bleeker, 1875b	= <i>Redigobius chryosoma</i>
<i>Gobius detwaali</i> Weber, 1897	= <i>Redigobius detwaali</i>
<i>Gobius dispar</i> Peters, 1868	= <i>Redigobius dispar</i>
<i>Vaimosa horiae</i> Herre, 1936a	= <i>Redigobius tambujon</i>
<i>Vaimosa koumansii</i> Mukerji, 1935	= <i>Redigobius tambujon</i>
<i>Acentrogobius leptochilus</i> Bleeker, 1875b	= <i>Redigobius oyensi</i>
<i>Vaimosa leverii</i> Fowler, 1943	= <i>Redigobius leverii</i>
<i>Vaimosa macrognathos</i> Herre, 1927	= <i>Redigobius tambujon</i>
<i>Gobius macrostoma</i> Günther, 1861	= <i>Redigobius macrostoma</i>
<i>Gobius magniloquus</i> Day, 1876	= <i>Pseudogobius</i> ? or <i>Mugilogobius</i> ? or <i>Redigobius</i> ?
<i>Gobius maxillaris</i> Davies, 1949	= <i>Redigobius detwaali</i>
<i>Stigmatogobius micrognathus</i> Rao, 1971	= <i>Redigobius</i> ? or <i>Pseudogobius</i> ?
<i>Gobius micropthalmus</i> Günther, 1861	= <i>Redigobius macrostoma</i>
<i>Vaimosa microstomia</i> Seale, 1910	= <i>Pseudogobius</i> ? or <i>Redigobius</i> ?
<i>Stigmatogobius minutus</i> Takagi, 1957	= <i>Redigobius bikolanus</i>
<i>Vaimosa montalbani</i> Herre, 1936b	= <i>Redigobius bikolanus</i>
<i>Vaimosa novaehedborum</i> Fowler, 1944	= <i>Redigobius bikolanus</i>
<i>Vaimosa osgoodi</i> Herre, 1935	= <i>Redigobius bikolanus</i>
<i>Gobius oyensi</i> Beaufort, 1913	= <i>Redigobius oyensi</i>
<i>Mahidolia pogoensis</i> Schultz, 1943	= <i>Redigobius bikolanus</i>
<i>Mugilogobius pongolensis</i> Kok & Blaber, 1977	= <i>Redigobius detwaali</i>
<i>Gobius reticularis</i> Weber, 1911	= <i>Redigobius tambujon</i>
<i>Vaimosa rivalis</i> Herre, 1927	= <i>Redigobius</i> ? or <i>Pseudogobiopsis</i> ?
<i>Gobius roemeri</i> Weber, 1911	= <i>Redigobius tambujon</i>
<i>Gobius samberanoensis</i> Bleeker, 1867	= <i>Mugilogobius</i>
<i>Vaimosa sapanga</i> Herre, 1927	= <i>Redigobius tambujon</i>
<i>Gobius sternbergi</i> Smith, 1902	= <i>Redigobius dispar</i>
<i>Gobius tambujon</i> Bleeker, 1854	= <i>Redigobius tambujon</i>
<i>Vaimosa tessellata</i> Herre, 1927	= <i>Redigobius tambujon</i>
<i>Gobius vergeri</i> Bleeker, 1867	= <i>Redigobius</i> ?
<i>Stigmatogobius versicolor</i> Smith, 1959	= <i>Redigobius bikolanus</i>
<i>Lophogobius wera</i> Popta, 1922	= <i>Redigobius oyensi</i>

type of the latter species is lost, but was considered as a possible synonym of *Redigobius roemeri* by Larson (2001), not a *Pseudogobiopsis*.

The genus *Cyprinogobius* was created by Koumans (1937) for *Lophogobius chryzosoma* Bleeker. Koumans also included *Gobius microphthalmus* (= *Redigobius macrostomus*) and *Gobius dispar* (= *Redigobius dispar*) in *Cyprinogobius*.

Aurich (1938) presented an outline of his understanding of the different genera in this group of similar fishes; he considered *Brachygobius*, *Mugilogobius*, *Opuu*, *Thaigobiella*, *Cyprinogobius*, *Stigmatogobius*, *Parvigobius*, *Pseudogobius* and *Vaimosa* to be related. He used distinguishing characters such as head and body proportions, lateral line and predorsal scales, sensory papillae pattern and canal pores on the head. Aurich included most species of *Redigobius* under *Pseudogobius*.

In 1953, Koumans placed *Cyprinogobius* and *Ostreogobius* as junior synonyms of *Redigobius*, and *Parvigobius* and *Microgobius* (non Poey) as synonyms of *Stigmatogobius*.

Miller (1987) noted the close relationship of several gobiid genera, including *Redigobius*, to the freshwater species *Chlamydogobius eremius*. He demonstrated similarities in sensory papillae patterns, as well as suspensoria morphology, the possession of two epurals and dorsal pterygiophore arrangements of 2-12210.

Birdsong et al. (1988) placed *Redigobius* in their "Unassigned" group, which included problematical genera, and indicated that there was variation in precaudal and caudal vertebral numbers within *Redigobius*.

McKay (1993) carried out starch gel electrophoresis on six gobiionelline species, including a northern Australian species of *Redigobius*, and ran a cladistic analysis using seven gobiines as outgroup. His cladogram showed *Redigobius* as sister to *Pandaka*, which were placed above two species of *Pseudogobius*, and below two species of *Brachygobius*. Other analyses (Larson 2001) have indicated that *Brachygobius* and *Pandaka* are sister taxa, sharing more derived characters with each other than with *Redigobius*.

Pezold (1993) proposed the monophyly of the subfamily Gobiinae based on three synapomorphies, and he recognised the Gobiionellinae as a subfamily of the Gobiidae. His Gobiionellinae was not actually defined by apomorphies; it was implied that gobiionellines did not possess the combination of characters which defined the

Gobiinae. Pezold included *Redigobius* in his *Chasmichthys* Group of eight genera within the Gobiionellinae.

Hoese & Gill (1993) referred to *Redigobius* and *Pseudogobius* as "putatively primitive gobiine genera" in their discussion of eleotrid relationships, but did not discuss any defining characters (this was not the aim of their paper).

Larson (2001) found that *Redigobius* was the most plesiomorphic of 11 gobiionelline genera related to *Mugilogobius*, and gave a diagnosis the genus. Additional specimens of rare species plus two new species have since been found, prompting this review, which has actually taken much longer to complete than was initially thought probable, as more and more material came to light.

## Methods

**Morphometrics and measurements.** Measurements were taken using electronic callipers and dissecting microscope. Counts and methods generally follow Hubbs & Lagler (1970), except as indicated below. Counts are compiled in Tables 2-4. Papillae pattern terminology is based on that of Sanzo (1911), as it has been used for this group of gobiionellines by Miller (1987, 1989) and Larson (1999a-b, 2001). Pterygiophore formula follows Birdsong et al. (1988). Pectoral ray counts from each side of body were taken, but the count of the right-hand side is that used in descriptions and tables (unless unless the fin is damaged or missing). Transverse scale count is the number of scale rows from directly in front of the anal-fin origin diagonally upward and back toward the second dorsal fin base. Head length is taken to the upper attachment of the opercular membrane. In the descriptions, an asterisk indicates counts of the holotype (or lectotype). Numbers in parentheses after counts indicate the number of specimens with that count, or the range of counts. Vertebral counts and other osteological information were obtained by radiography and clearing and double-staining.

**Abbreviations.** Abbreviations for institutions referred to are as in Leviton et al. (1985), with the exceptions of: BLIP, Biological Laboratory, Imperial Palace, Tokyo; BMNH, The Natural History Museum, London; BSM, Bureau of Science, Manila; CMK, Collection Maurice Kottelat, Cornol; ZRC, Raffles Museum of Biodiversity, National University of Singapore. Other

abbreviations used: HL, head length; SL, standard length; TL, total length; TRB, number of scale rows from anal-fin origin diagonally upward and back toward the second dorsal fin base.

**Material examined.** Details of preserved specimens examined are provided under each species account, except for cleared and stained and X-rayed specimens, which are given here (C = cleared and stained specimen, X = radiograph): *Redigobius balteatus*: CMK 7184, X, 7, 26.5-36 mm SL; ex AMSI.1.22055-020, C, 3, 17-27 mm SL. *R. chrysosoma*: NTM unreg., C, 2, 36-38 mm SL; ex AMSI.1.24683-003, C, 2, 19-23.5 mm SL. *R. dewaali*: SAM 24154, X, 2, 23-25.5 mm SL; AMSI.1.27219-001, X, 1, 30 mm SL; ex AMSI.27220-001, C, 2, 25-25.5 mm SL. *R. dispar*: ZMB 6705, X, 5 syntypes, 31-33.5 mm SL; ZMB 6700, X, 6 syntypes, 40-41 mm SL; ZMB 6703, X, 2 syntypes, 30-36 mm SL; ZMB 6702, X, 4 syntypes, 38-42 mm SL; ex USNM 263330, C, 2, 21.5-25.5 mm SL. *R. bikolanus*: ex

AMSI.22041-014, C, 5, 18-19 mm SL; ex MNHN 1992.432, C, 1, 29 mm SL; ex NTM S.12110-017, C, 2, 17-21 mm SL. *R. leverii*: NTM unreg., X, 2, 32-36 mm SL; NTM unreg., X, 1, 41.5 mm SL; NTM unreg., X, 6, 22.5-44.5 mm SL. *R. macrostoma*: AMSI.1.16954-018, X, 9, 19-30 mm SL; ex AMSI.1.19341-002, C, 3, 28-35.5 mm SL. *R. nanus*: AMSI.1.25498-002, X, 8, 18-27 mm SL; AMSI.1.31627-004, X, 4, 19-24.5 mm SL; WAM P.30980-006, X, 4, 14-20 mm SL. *R. penango*: ex CMK 6143, C, 1, 37 mm SL; CMK 6143, X, 9, 27-39.5 mm SL; RMNH 12076, X, 2, 42-42.5 mm SL. *R. oyensi*: ex NTMS.14144-001, C, 2, 18-29 mm SL; WAM P.31463-006, X, 2, 38-43 mm SL; ex-FMNH 50948, X, 2, 34-37 mm SL; RMNH 11835, X, 2, 34-35 mm SL; CAS 33166, X, 4, 27-35 mm SL; WAM unreg., X, 3, 27.5-31 mm SL. *R. tambujon*: syntype, SMF 6703, X, 1, 24 mm SL; CAS 76087, X, 10, 26.5-39 mm SL; ex CAS 76087, C, 3, 28-37 mm SL; ex AMSI.1.24826-001, C, 2, 27-34 mm SL; NTM unreg., X, 1, 39 mm SL.

**Table 2.** Frequency distribution of fin ray counts in *Redigobius* species.

	second dorsal rays			anal rays				pectoral rays							
	6	7	8	5	6	7	8	14	15	16	17	18	19	20	
<i>R. balteatus</i>	1	34	-	-	35	-	-	-	1	13	18	3	-	-	
<i>R. bikolanus</i>	4	106	1	-	105	4	1	2	16	49	45	1	-	-	
<i>R. chrysosoma</i>	32	-	-	3	29	-	-	-	1	13	18	-	-	-	
<i>R. dewaali</i>	1	28	2	1	21	9	-	-	-	6	14	10	1	-	
<i>R. dispar</i>	-	22	4	-	2	23	-	-	1	-	6	15	2	2	
<i>R. lekutu</i>	-	16	6	-	3	19	4	-	18	7	1	-	-	-	
<i>R. leverii</i>	12	-	-	-	12	-	-	-	-	12	-	-	-	-	
<i>R. macrostoma</i>	-	42	1	1	41	1	-	-	4	21	15	1	-	-	
<i>R. nanus</i>	1	35	1	3	32	2	-	-	1	13	20	4	-	-	
<i>R. oyensi</i>	16	4	1	-	20	2	-	-	-	2	14	4	1	-	
<i>R. penango</i>	-	23	5	-	15	14	-	10	7	3	6	2	-	-	
<i>R. tambujon</i>	1	35	3	-	30	10	-	-	1	7	16	16	-	-	

**Table 3.** Frequency distribution of transverse backward scale counts in *Redigobius* species.

	7	8	9	10	11	12
<i>R. balteatus</i>	-	-	12	22	1	-
<i>R. bikolanus</i>	19	90	2	-	-	-
<i>R. chrysosoma</i>	-	28	4	-	-	-
<i>R. dewaali</i>	-	1	6	22	5	1
<i>R. dispar</i>	-	6	11	8	1	-
<i>R. lekutu</i>	-	-	23	3	-	-
<i>R. leverii</i>	4	7	1	-	-	-
<i>R. macrostoma</i>	-	-	7	19	16	1
<i>R. nanus</i>	8	22	6	1	-	-
<i>R. oyensi</i>	2	17	3	-	-	-
<i>R. penango</i>	1	21	6	2	-	-
<i>R. tambujon</i>	8	28	3	-	-	-

**Table 4.** Frequency distribution of lateral scale counts in *Redigobius* species.

	20	21	22	23	24	25	26	27	28	29	30	31
<i>R. balteatus</i>	-	-	-	3	27	5	-	-	-	-	-	-
<i>R. bikolanus</i>	-	2	12	71	21	2	-	1	-	-	-	-
<i>R. chrysosoma</i>	-	-	6	25	-	1	-	-	-	-	-	-
<i>R. dewaali</i>	-	-	-	6	17	7	1	-	-	-	-	-
<i>R. dispar</i>	-	-	-	2	5	8	4	2	3	1	1	1
<i>R. lekutu</i>	-	-	-	-	-	-	8	13	3	2	-	-
<i>R. leverii</i>	-	-	-	3	8	1	-	-	-	-	-	-
<i>R. macrostoma</i>	-	-	-	-	-	-	2	11	15	10	5	-
<i>R. nanus</i>	1	-	5	22	9	1	-	-	-	-	-	-
<i>R. oyensi</i>	-	-	-	3	12	3	3	-	-	-	-	-
<i>R. penango</i>	-	-	2	12	9	6	1	-	-	-	-	-
<i>R. tambujon</i>	-	-	3	17	14	5	-	-	-	-	-	-

## Systematics

## Family Gobiidae Cuvier

## Subfamily Gobionellinae Bleeker

*Redigobius* Herre

*Redigobius* Herre, 1927: 98 (type species *Gobius sternbergi* Smith, 1902: 169, by monotypy).

*Ostreogobius* Whitley, 1930: 122 (type species *Gillichthys australis* Ogilby, 1894: 367, by original designation).

*Parvigobius* Whitley, 1930: 122 (type species *Parvigobius immeritus* Whitley, 1930: 122, by original designation).

*Microgobius* Koumans, 1931: 101 (not available; listed as synonym of *Stigmatogobius*; preoccupied by *Microgobius* Poey, 1876).

*Cyprinogobius* Koumans, 1937: 11 (type species *Lophogobius chrysosoma* Bleeker, 1875b: 114, by original designation).

**Diagnosis.** *Redigobius* is distinguished from other gobionellines by the following combination of characters. Dorsal-fin rays I,6-8; anal-fin rays I,6-7; modally with one more ray in second dorsal fin than in anal fin; pectoral-fin rays 15-20; 17 segmented caudal-fin rays, in 9/8 pattern; lateral scales 22-30; transverse scales backward 7-11; predorsal scales often large, 6-16, extending close up to behind eyes; sensory canals on head with complete oculoscapular and preopercular canals and pores (Fig. 1); sensory papillae modally arranged in longitudinal pattern, one species with partly transverse pattern; rows *a* and *c* consisting of large, widely spaced papillae in some species, usually all papillae small and closely spaced; rows *b* and *d* always consisting of small close-set papillae; row *c* broken under eye, with rear portion of row modally consisting of one papilla; no fine villi on dorsal surface of head; pectoral girdle smooth, with few fleshy knobs or lobes, or with low flange on anterior edge of cleithrum; jaws terminal, males with (sometimes greatly) enlarged mouths, head may be enlarged also; lips smooth, lower lip free at sides, fused medially; anterior nasal opening in tube, close to edge of upper lip or overhanging lip; genital papilla variable in male, flattened and square, triangular or elongate in shape, and in female, short, rounded and bulbous; simple short gut with one loop present.

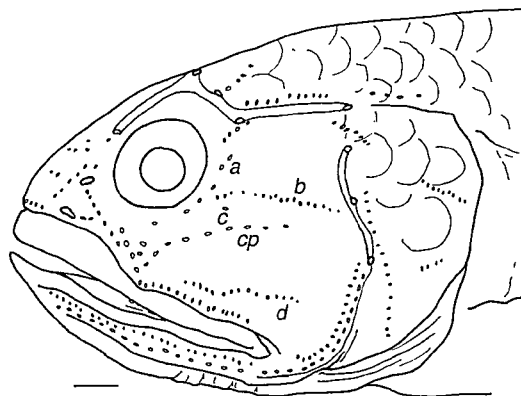


Fig. 1. *Redigobius dispar*, USNM 263330, male, 31.5 mm SL; headpores and papillae pattern. Scale bar: 1 mm.

Dorsal pterygiophore formula 3-12210; 25-27 vertebrae, 11-12 precaudal and 14-16 caudal; modally two epurals (may be partly or completely fused); three or four, rarely two, anal-fin pterygiophores before first caudal haemal spine; neural spines of first few vertebrae modally slender and pointed, occasionally bifid or slightly broadened at tip; palatine and pterygoid moderately slender, more elongate in adult males with

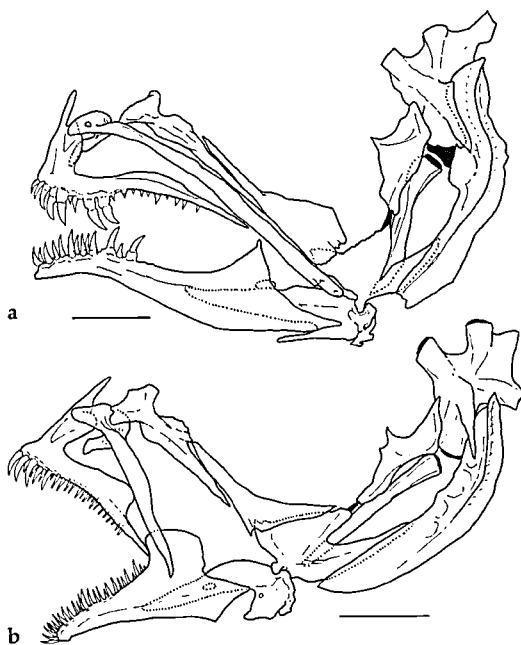


Fig. 2. Jaws and suspensorium of: **a**, *Redigobius dispar*, ex USNM 263330, male, 31.5 mm SL; **b**, *R. macrostoma*, ex AMS I.19341-002, female. Scale bar: 1 mm.

enlarged jaws (Fig. 2), palatine not quite reaching quadrate (may do so in *R. chryosoma*); metapterygoid short, triangular, expanded dorsally, not forming bridge to quadrate; rear edge of preopercle with posteriorly facing groove or ridge; fifth ceratobranchial stout, triangular, with stout teeth, short high flange on back; upper corner of scapula modally ossified above foramen; one to three gill-rakers ossified; first epineural inserting on or behind parapophysis of first vertebra.

### Key to species of *Redigobius*

(Works best with adults, especially males; some species may be difficult to distinguish by this key.)

- 1 - About four transverse rows of papillae under eye; dorsal and anal rays modally I,6 (sometimes anal rays I,5); distinct black and orange spot on first dorsal fin, and dark bar under eye (estuarine to freshwater; Borneo, New Guinea, northern Australia).  
..... *R. chryosoma*
- Papillae under eye always in longitudinal rows; dorsal rays I,6-8, usually I,7; anal rays I,6-7, usually I,6; colour variable.  
.....2
- 2 - Nasal pores absent, lateral canal and pore over preopercle usually absent; body with row of X-shaped blotches along midline; distinct blackish shoulder blotch present; predorsal scales 9-14, modally 11; circumpeduncular scales 12 (freshwater; Philippines).  
..... *R. dispar*
- Nasal pores present, lateral canal and pore over preopercle present; body colour not as above; predorsal scales 7-13; circumpeduncular scales 12-14.  
.....3
- 3 - Single broad dense black band extending downward and backward from first dorsal fin; distinct black band extending from eye diagonally across opercle to lower edge of pectoral fin base; circumpeduncular scales 14 (estuarine; Indo-west Pacific).  
..... *R. balteatus*
- Any body bands or bars present are brown, not dense black, and number more than one; no black band from eye to lower pectoral base; circumpeduncular scales 12-14.  
.....4
- 4 - Side of body with cycloid scales, posterior-most scales may be ctenoid; body pale with dusky scale margins, forming reticulate pattern, no diagonal dark bars in either sex; 14-18 pectoral rays, usually 14-15 (freshwater; Indonesia: Sulawesi).  
..... *R. penango*
- Side of body with ctenoid scales; body colour not as above; 15-19 pectoral rays.  
.....5
- 5 - Predorsal scales 14-16; lateral scales 25-30; body strongly compressed, with about 5-7 narrow diagonal dark bands posteriorly, beginning at anal fin origin and crossing entire side of body (estuarine to freshwater; eastern Australia).  
..... *R. macrostoma*
- Predorsal scales 6-13; lateral scales 22-26; if diagonal dark bands present on body, then not arranged as above; body not narrow and compressed.  
.....6
- 6 - D1 nearly always VII, third to fourth D1 spines longest; pectoral fin base naked; pectoral rays 15; D1 with dusky stripes in male, black spot posteriorly in female; body with red-speckled colour pattern and side of head plain brownish; pectoral fin base with short blackish horizontal bar dorsally; no dark blotch above pectoral fin base (freshwater; Fiji).  
..... *R. lekutu*
- D1 always VI, first to fourth D1 spines longest; pectoral fin base always scaled; pectoral rays 14-18, usually 16-18; colour pattern not as above.  
.....7
- 7 - Predorsal scales 8-11, usually 10-11; circumpeduncular scales 12-14, usually 13; 6 or 7 indistinct diagonal bars on side of body, more developed in males; 16-19 pectoral rays, usually 17-18 (freshwater; South Africa).  
..... *R. dewaali*
- Predorsal scales 5-8, usually 7-8; circumpeduncular scales nearly always 12; bars and /

- or blotches on side of body usually distinct, variable; pectoral ray counts variable.  
.....8
- 8 - Body colour relatively plain, scale margins dark, giving finely reticulate to speckled or faintly banded pattern, indistinct lateral dark spots and dorsal saddles, no rows of dark spots or stripes along side of body, living fish with fine blue spots and speckling on body and fins; first D1 spine nearly always longest, membrane pale, unmarked, spine elongate in males; fish not reaching more than 27 mm SL when mature (estuarine; northern Australia, southern New Guinea).  
..... *R. nanus*
- Colour pattern not as above; D1 spine membrane not as above, fish usually reaching more than 32 mm SL when mature, but if smaller than this and sexually mature, then colour not as above.  
.....9
- 9 - One or two narrow short black bars (may be reduced to black blotch or spot) across side of posterior part of abdomen, posteriormost blackish bar always present, lowest on body, may meet its counterpart at genital papilla, forming band; four blackish spots always present along mid-ventral line of caudal peduncle (estuarine to freshwater, Indo-west Pacific).  
..... *R. bikolanus*
- Short black bars absent from side of abdomen; dark spots along mid-ventral line of caudal peduncle may be visible in live specimens but not in preserved ones.  
.....10
- 10 - Second dorsal fin nearly always I,7; pectoral rays 15-18, usually 17-18; first spine of first dorsal fin usually longest, fin with two or three dark bands and black blotch or spot posteriorly; mouth gape very long in males, with narrow jaw reaching well back behind eye; row of short vertical brownish lines or blotches along midside of body which may form zigzag pattern or pairs of blotches, anteriormost blotch by pectoral fin base not darker than others; side of head with 5-7 oblique, sometimes curved, dark and light bars, less distinct in females (freshwater; Philippines, Palau, Indonesia, West Papua).  
..... *R. tambujon*
- Second dorsal fin I,6, rarely I,7; pectoral rays usually 16-17; 3<sup>rd</sup> to 4<sup>th</sup> dorsal fin spines longest, never first; mouth in males reaching back to rear of eye but jaws not slender nor greatly elongate; colour pattern not as above.  
.....11
- 11 - Pectoral rays 16-17, nearly always 16; distinctive colour pattern on side of body consisting of a regular pattern of interconnecting lines and squares, narrow vertical bars and ventral row of round spots; head pale with 5-8 oblique dark lines; elongate black blotch on pointed first dorsal fin (freshwater; Fiji).  
..... *R. leverii*
- Pectoral rays 16-18, usually 17; side of body with dusky to brownish paired blotches or indistinct rows of short vertical lines, anteriormost blotch usually darker than others, forming a dark grey to dense black W, V or U shape just above pectoral fin base; side of head with oblique to irregular dark lines (freshwater; Indonesia, West Papua, Palau).  
..... *R. oyensi*

***Redigobius balteatus* (Herre, 1935)**

(Figs. 3-4)

- Vaimosa balteata* Herre, 1935a: 419 (type locality: Majalibit Inlet, Waigiu Island).
- Acentrogobius balteata*: Koumans, 1940: 138, 155, 1953: 73-74.
- Acentrogobius balteatus*: Fowler, 1949: 103.
- Acentrogobius balteatops* Smith, 1959: 200, pl. 9G (type locality: Inhaca, Mozambique), 1960: 306.
- Redigobius balteatops*: Hoese & Winterbottom, 1979: 5; Kiener, 1963: 332; Hoese, 1986: 802; Maugé, 1986: 382; Pethiyagoda, 1991: 247-248 (Sri Lanka).
- Vaimosa* (= *Stigmatogobius?*) *balteata*: Roberts, 1989: 169.
- Redigobius balteatus*: Allen, 1989: 152, pl. 52; Kottelat, 1989: 19 (Malay peninsula); Blaber & Milton, 1990: 262 (Solomon Islands); Senou & Yano, 1991: 4-5 (Iriomote Island, Japan); Kottelat et al., 1993: 151; Séret, 1997: 374; Ng et

al., 1999: 182 (Pulau Tioman, Malaysia); Aki-hito et al., 2000: 1240, 1303 (Japan); Randall & Lim, 2000: 640; Larson, 2001: 205; Larson & Murdy, 2001: 3601; Allen et al., 2002: 283; Senou et al., 2004: 405; Tan & Lim, 2004: 111 (Anambas Islands); Keith et al., 2006: 220 (Mayotte); Hoese & Larson, 2006: 1681.

**Material examined.** MADAGASCAR: USNM 31689, 3, 17-22 mm SL; small stream entering Baie d' Ampasidava, near Marokibani; R. Bolin & party, 5 Aug 1964. MOZAMBIQUE: RUSI 206, holotype of *Acentrogobius balteatops*, 29 mm SL; Inhaca. SRI LANKA: USNM 164012, 2, 28-29 mm SL; probably from aquarium-fish trade; 1955. – CMK 7184, 8, 26.5-36 mm SL; Bolagoda Lake; R. Pethiyagoda, 14 Dec 1989.

PHILIPPINES: CMK 9909, 7, 17.5-27 mm SL; about 0.5 km from sea, side arm going S downriver of bridge on road to VISCA, Ambacan River at Baybay, Leyte; M. Kottelat, 2 Jul 1993. INDONESIA: CMK 6129, 2, 24.5-24.5 mm SL; mangrove forest along Sungai Bosa at Desa Karangkaranga, on road between Sengkang and Palopo, Sulawesi; M. Kottelat, 11 Jun 1988. WEST PAPUA: FMNH 17386, holotype of *Vaimosa balteata*, 21 mm SL; river flowing into Majabit Inlet, Waigiu; A. W. Herre, 7 Jun 1929.

AUSTRALIA: AMSI.22069-022, 15, 15-28.5 mm SL; Richter Creek, N of Cairns, near Holloways Beach boat ramp, Queensland; D. Hoese & H. Larson, 21 Sep 1980. – AMS I.22721-005, 15, 19.5-26.5 mm SL; mouth of N branch of Daintree River, Queensland; G. Hardy & A. Ayling, 26 Jun 1980. – AMSI.22041-013, 15, 18-27.5 mm SL; inland from highway crossing, Mowbray River, Queensland; D. Hoese, H. Larson & G. Allen, 13 Sep 1980.

**Material examined but no data taken.** MADAGASCAR: AMNH 228062, 1; stream by Hotel La Crique. THAILAND: KUMF unreg., 1; Tak Bai Canal, Narathiwat Province. PHILIPPINES: CAS 38627, 1; Zamboanga. – USNM 241868, 3; Siquijor Island, Negros Oriental.

REPUBLIC OF PALAU: CAS 76076, 1; Arakitaoch Stream, Babeldaob, Palau. – CAS 76078, 1; Babeldaob, Palau. FEDERATED STATES OF MICRONESIA: USNM 223260, 9; Jokaj River, Ponape. WEST PAPUA: USNM 297058, 2; Samei Island. PAPUA NEW GUINEA: USNM 297068, 7; Namboguru Creek, off Cape Wom, Wewak. – AMS I.16670-023, 2; Alexishafen, Madang. – NTM S.13664-008, 1; Nagada River, Madang. – Kanudi Fisheries Laboratory, Port Moresby F.01689, 2; SW of Lealea. TROBRIAND ISLANDS: USNM 341232, 4; E of Losvia, Kirwinna Island. SOLOMON ISLANDS: AMSI.31084-009, 1; Kolombangora Island. – AMSI.26938-001, 4; Ha'a Estuary, Tulagi. NEW CALEDONIA: MNHN 1992-439, 2; La Dumbea River.

AUSTRALIA: AMSI.23260-014, 1; Toomulla Dump, N of Townsville, Queensland. – AMS I.22041-013, 15;

Mowbray River. – QM I.13295, 1; Little Ramsay Bay, Hinchinbrook Island, Queensland. – AMS I.22878-014, 2; Whitsunday Island, Queensland. – AMS I.22037-002, 2; Kewarra Beach mangroves, Queensland. – AMS I.23261-017, 2; Kewarra Beach, Queensland. – AMS I.22069-012, 1; Richter Creek near Holloways Beach, Queensland. – NTM S.12738-001, 1; Coral Creek, Queensland. – WAM P.27779-004, 6; near Daintree River mouth, Queensland. – WAM P.27781-019, 1; Daintree River, Queensland. – AMS I.22055-020, 21; Bailey Creek, S of Cape Tribulation, Queensland. – QM I.23757, 6; Molongle Creek, E of Gumlu, Queensland. – AMS I.23263-005, 1; Cape York, Queensland. – AMS I.23319-004, 2; AIMS, Townsville. – AMS I.23313-007, 8; Three Mile Creek, Townsville. – AMS I.20785-004, 37; Hartley's Creek, Cairns, Queensland. – AMSI.19468-060, 2; mangrove, Lizard Island, Queensland. – AMSI.22051-003, 7; creek at Daintree River mouth, Queensland. – AMS I.22700-012, 6; AMS I.22722-049, 1; Daintree River mouth, Queensland. – USNM 316132, 8; creek W of Yirrkala, Northern Territory. – NTM S.13233-011, 4; Sphinx Head, Marchinbar Island, Northern Territory. – USNM 316131, 5; Little Lagoon, Groote Eylandt, Northern Territory. – USNM 316132, 8; W of Yirrkala.

**Diagnosis.** A moderate-sized *Redigobius*, easily identified by the single black band extending down and back from tip of first dorsal fin; distinct black band extending from eye diagonally across opercle to lower edge of pectoral fin base (visible even in old and faded museum material); first dorsal fin tall and elongate, third or fourth spine longest; opercle with small ctenoid scales; 14 circumpeduncular scales; second dorsal rays modally I,7; anal rays I,6; pectoral rays usually 16-17; longitudinal scales 23-25; TRB 9-11; predorsal scales 9-12. Widespread in fresh to estuarine waters of the Indo-Pacific.

**Description.** Based on 35 specimens, 19-33 mm SL. An asterisk indicates counts of the holotype of *Vaimosa balteata*.

First dorsal V (2), VI\* (33); second dorsal I,6\*-I,7 (usually I,7); anal I,6\*; pectoral rays 15-18 (usually 16-17\*); segmented caudal rays 17, caudal ray pattern nearly always 9/8\*; branched caudal rays ranging from 6/5 to 8/7, strongly modally 7/6 (tips damaged in holotype); procurrent caudal rays 7/6 (2), 8/7 (1); longitudinal scale count 23-25 (mean 24\*); TRB 9\*-11 (mean 10); predorsal scale count 9-12\* (mean 10); circumpeduncular scales 13-15 (mean 14\*). Gill rakers on outer face of first arch 1+7 (1), 2+5 (1), 2+6 (4), 2+7 (3), 3+5 (1), 3+6 (1). Vertebrae 11+14 (1), 12+14 (8), 12+15 (1). Neural spines of first and/or second vertebra



bifid at tip (6), or slender and pointed (3). Two epurals (9), one specimen with partly fused epurals; three anal pterygiophores before haemal spine of first caudal vertebra (9), 4 (1), 2 (1).

Body and head compressed (may be less so anteriorly), body width at anus 8.3-13.2 % SL (mean 11.6 %) (Table 5). Head deeper than wide, slightly broader ventrally, length 26.7-31.0 % SL (mean 29.2 %). Head depth at posterior preopercular margin 67.2-84.4 % HL (mean 74.0 %). Head width at posterior preopercular margin 53.6-77.4 % HL (mean 62.3 %). Mouth terminal, slightly oblique, forming an angle of about 20-25° with body axis; jaws generally reaching to below rear edge of eye in males (to well behind eye in large adults) and to below front half of eye in females. Upper jaw 30.1-65.6 % HL (mean 34.1 % in females, 50.0 % in males). Eye lateral, high on head, top of eye sometimes forming part of dorsal profile, 28.0-37.9 % HL (mean 32.5 %). Snout short, flat to slightly pointed, 20.7-31.6 % HL (mean 25.6 %). Interorbital narrow, 6.7-18.3 % HL (mean 12.4 %). Body depth at anal origin 20.7-25.5 % SL (mean 23.1 %). Caudal peduncle compressed, length 25.0-30.0 % SL (mean 27.6 %). Caudal peduncle depth 12.2-16.0 % SL (mean 13.9 %).

First dorsal fin long and pointed, second and third spines elongate, usually reaching back to second dorsal fin (in both sexes); spines longer in males than females, second dorsal spine may reach well past posterior insertion of second

dorsal fin when depressed. First dorsal spine always shorter than next (except in largest known specimen, a 33 mm SL male from Sri Lanka, spine length 48.8 % SL). Second dorsal spine length 17.9-45.0 % SL (mean 28.6 %). Third dorsal spine longest in one specimen, length 36.9 % SL. Second dorsal and anal fins moderate in height, pointed posteriorly, posteriormost rays longest, especially in males, rays not reaching caudal fin when depressed. Pectoral fin oval, rather slender, central rays longest, 21.6-27.9 % SL (mean 24.9 %); rays branched but for upper and lowermost. Pelvic fins rounded to oval, reaching half distance to anus in both sexes; fins may be larger in males, 23.4-29.8 % SL (mean 26.4 %). Caudal fin rounded posteriorly, 25.0-32.4 % SL (mean 28.3 %).

No mental frenum, chin may be flat or slightly inflated. Anterior nasal opening tubular, placed just behind upper lip, tube short, oriented down and forward; in large specimens preorbital may be produced forward slightly to accommodate tube. Posterior nasal opening oval, with low rim, close to front centre margin of eye. Gill opening extending forward to just under opercle. Inner edge of shoulder girdle with low thin bony to somewhat fleshy flange, occasionally edge smooth. Gill rakers on outer face of first arch very short, without spines, longest rakers near angle of arch, anteriormost rakers rudimentary. Tongue tip blunt. Teeth in upper jaw in 1-2 rows laterally, 2-3 rows across front of jaw, teeth at side of jaw

Table 5. Morphometrics of *Redigobius balteatus*.

	holotype	males (n=16)		females (n=19)	
		range	mean	range	mean
<b>Percentage of standard length</b>					
Head length	27.6	27.6-31.0	29.8	26.7-30.5	28.8
Body depth	22.9	21.4-25.5	23.3	20.7-24.9	22.9
Body width	-	8.3-13.2	11.5	9.8-13.2	11.6
Length of caudal peduncle	26.7	25.2-30.0	27.7	25.0-29.4	27.5
Depth of caudal peduncle	12.9	13.2-16.0	14.5	12.2-14.7	13.3
Length of pectoral fin	-	23.1-27.9	25.3	21.6-26.8	24.6
Length of pelvic fin	27.1	23.4-29.8	26.9	23.7-29.1	25.9
Length of caudal fin	22.9	27.3-32.4	29.5	22.9-30.6	27.2
Longest D1 spine (2 <sup>nd</sup> )	-	23.5-45.0	35.0	17.9-34.4	24.2
<b>Percentage of head length</b>					
Head depth	69.0	69.4-84.4	77.2	67.2-75.3	71.1
Head width	56.9	54.8-77.4	64.0	53.6-64.9	60.8
Snout length	20.7	23.4-31.6	27.1	20.7-30.1	24.2
Eye width	37.9	28.0-33.8	31.0	30.1-37.9	33.8
Jaw length	36.2	35.5-65.6	50.2	30.1-36.5	34.1
Interorbital width	8.6	6.7-18.3	13.1	8.1-16.9	11.9

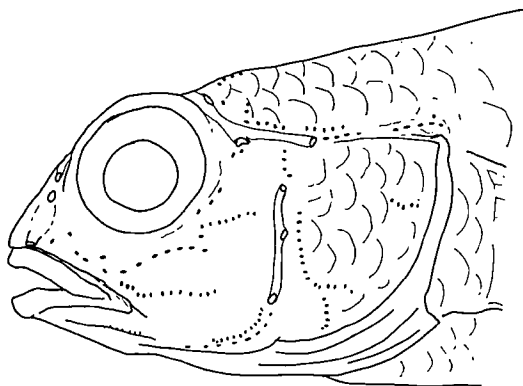


Fig. 3. *Redigobius balteatus*, AMS I.22721-005, female, 26.5 mm SL; headpores and papillae pattern.

small, sharp and evenly sized; outermost teeth across front of jaw large, stout, curved and sharp. Teeth in lower jaw similar to those in upper jaw but 3-4 rows present across front of jaw, teeth stout and sharp. In adult males with enlarged jaws, teeth at side of jaw mostly absent and front teeth enlarged and stoutly curved.

Ctenoid scales on side of body. Predorsal scales usually all ctenoid, rarely cycloid in midline (holotype of *Acentrogobius balteatops* apparently has all predorsal scales cycloid), reaching to close behind eyes. Operculum scales small, ctenoid. Cheek naked. Pectoral base covered with small cycloid scales. Prepelvic area covered with small cycloid scales. Belly scales ctenoid.

Male genital papilla a short rather flattened tube, tip rounded to pointed; occasionally elongate. Female genital papilla short, fleshy and somewhat bulbous, may have ventral groove or inward fold.

Head pores and sensory papillae pattern as shown in Figure 3. One specimen has an extra 'posterior' interorbital pore.

**Coloration of preserved material.** Head and body light yellowish, with scale margins on upper half of body variably edged with light brown to brown, forming irregular mottling and cross-hatching; about seven indistinct brown blotches in row mid-laterally; brown mottling may form irregular lines and staggered rows of small blotches (e.g. see Kottelat et al., 1993). Base of caudal fin with two small brown blotches, which may be prominent and coalesce above and below with posteriormost brown blotch of the mid-lateral series. Broad dark brown to black band

extending from base of first dorsal fin obliquely back to fade out on mid-belly before anus; black band occasionally diffuse to indistinct over several scales just below first dorsal fin.

Side of head with distinct dark brown to black band running from posteroventral edge of eye back over lower part of opercle, ending on lower half of pectoral fin base. Oblique dark brown band (often broken) running across rear corner of opercle and uppermost part of pectoral fin base. Diffuse brown bar extending from lower part of eye to middle of upper jaw and crossing lower jaw to meet its counterpart on chin; brown bar may be indistinct or blend into plain brown underside of head in adult males, or split into two bars. Top of eye with distinct dark brown to black bar crossing interorbital; may be one to three similarly coloured blotches or spots along top of eye. Lips plain dusky or banded (by bars from eye to chin).

First dorsal transparent anteriorly, leading edge of first spine dark brown, with broad black band across bases of fourth to sixth spines extending up fin to tips of third to fifth spines, membrane on either side of sixth spine dusky to translucent. Second dorsal fin translucent with two narrow brownish lines: lowermost running just above fin base and uppermost running along centre of fin; diffuse submarginal dusky band, tips of rays transparent. Anal fin plain brownish, darkest areas parallel to fin rays. Caudal fin translucent to dusky, may have some brown speckling or short streaks near base of fin. Pectoral fin transparent or with fin rays narrowly edged with brown. Pelvic fins translucent to dusky, with centre of disk dark brown to brownish, frenum unpigmented.

**Coloration of live material.** Live fish are not dissimilar to preserved specimens, but body translucent to whitish with pink and pale golden yellowish marbling and speckling (see pictures in Senou & Yano 1991; Allen et al., 2002; Senou et al., 2004); internal pinkish brown to dark brown pigment band along vertebral column (coalescing with mid-lateral blotches); five internal dark brown blotches along mid-ventral line running from just behind anal fin origin to just before caudal fin. Black oblique dark bands crossing side head and body. Pink or dark brown blotches on top of opercle and pectoral fin base. Iris gold to brown; top of eye with black to deep pink spots on either side of dense black bar crossing inter-



Fig. 4. *Redigobius balteatus*, ROM 68496, male, 26.5 mm SL; Australia: Queensland, Blacksand Creek near Townsville. Photograph by Rick Winterbottom.

orbital. Anterior half of first dorsal fin bright yellow to deep orange, black portion of fin may show iridescent blue patch in centre.

A freshly dead specimen is shown in Figure 4.

**Comparisons.** This is one of the most easily recognised species of *Redigobius*, due to the dense black body band, which is visible even in old and otherwise faded museum material. The elongate first dorsal fin, small ctenoid opercular scales and 14 circumpeduncular scales are also diagnostic.

**Distribution.** Widespread in the Indo-Pacific, known from Madagascar, Mozambique, Comoros (Mayotte), Sri Lanka, Indonesia, Thailand, Malaysia, Philippines, Japan, New Guinea, Trobriand Islands, Solomon Islands, Micronesia (Palau and Ponape), northern Australia (Wyndham to Townsville) and New Caledonia. The northernmost record of this species is from the Aira River, Iriomote-jima, Japan (Senou & Yano 1991).

**Ecology.** Found in fresh to brackish waters, in small streams and quiet mangrove estuarine habitats.

**Remarks.** In aquarium literature, this species is referred to as the “girdled goby” (in reference to its black “belt”) or the “rhino-horn goby” (in reference to the horn-like appearance formed by the black band sweeping up into the elongate first

dorsal fin) (see Hansen, in Monks, 2006). Horsthemke (1992) gives details of keeping this and several other species (*R. chryosoma* and *R. bikolanus*) in captivity.

The name *Gobius johnstoniensis* Koumans, 1940, is based on a ‘label’ name of De Vis’. The name is not available because it was treated as a junior synonym when first published by Koumans (Article 11.6 of the International Code of Zoological Nomenclature). Koumans described four specimens (AMS I.445, I.446, I.447) but stated that they were (or probably were) “*Stigmatogobius javanicus* (Blkr.)”. Later Whitley (1952) treated *Gobius johnstoniensis* as a valid species in *Stigmatogobius* and attributed the name to Koumans (1940). By doing this, Whitley made the name available (under Article 11.6.1 of the Code), with Koumans (1940) as author. Whitley figured one of the specimens examined by Koumans and labeled it ‘lectotype’; this fixes this specimen as lectotype. In the accompanying text (two sentences ...) Whitley noted “Here figured from the lectotype, being the largest of four cotypes [...] regd. no. I.447”. Larson placed *G. johnstoniensis* in *Redigobius*, based on Whitley’s illustration, but probably mistakenly wrote *R. bikolanus* for *R. balteatus* in her Appendix (Larson, 2001: 231). This mistake was continued in Hoese & Larson (2006: 1681). Specimen AMS I.447 was borrowed for examination in 2008. It is not the figured specimen and is actually a species of *Pseudogobius*, not a *Redigobius* (Koumans was correct). The specimen

Whitley illustrated is now labelled as one of the paralectotypes (AMS I.446). He says he chose the lectotype as the largest of the four specimens held at AMS. Koumans (1940) gives AMS I.446 as being the largest (33 mm), with the others being 16-32 mm. The lectotype is the figured 26 mm SL specimen, AMS I.446, regardless of the catalogue number given by Whitley). And therefore *S. johnstoniensis* is a synonym of *R. balteatus*.

*Redigobius bikolanus* (Herre, 1927)

(Figs. 5-6)

- ?*Stigmatogobius isognathus* Bleeker, 1878b: 203 (type locality: Singapore); Koumans, 1932: 6-7; Fowler 1938: 221.
- Gobius flavescens* De Vis, 1884: 689 (type locality: Moreton Bay, Queensland, Australia) (invalid, primary junior homonym of *Gobius flavescens* Fabricius, 1779).
- (*Gobius*) *flavescens*: McCulloch and Ogilby, 1919: 224-225, pl. 36 fig. 3.
- Vaimosa bikolana* Herre, 1927: 151, pl. 11 fig. 2 (type locality: Puru, Legaspi, Albay Province, Philippines).
- Parvigobius immeritus* Whitley, 1930: 122 (replacement name for *Gobius flavescens* De Vis, 1884), 1931: 122.
- Pseudogobius isognathus*: Koumans, 1932: 6-7 (type locality: Singapore).
- Vaimosa chinensis* Herre, 1935b: 287 (type locality: Hong Kong); Koumans, 1940: 149; Böhlke, 1953: 118.
- Vaimosa osgoodi* Herre, 1935a: 420 (type locality: Viti Levu Island, Suva Harbour, Fiji).
- Vaimosa horiae* Herre, 1936a: 280 (type locality: Bab-el-Thuap [Babeldoab], Pelew Group) (in part).
- Vaimosa montalbani* Herre, 1936b: 359, pl. 1, fig. 3 (type locality: Lake Naujan, Mindoro, Philippines).
- Gobius tessellata*: Tomiyama, 1936: 70 (Yakushima, Okinawa-jima, Japan).
- Pseudogobius bikolanus*: Aurich, 1938: 159-163, fig. 19 (Philippines).
- Mahidolia pagoensis* Schultz, 1943: 229, 240, fig. 20 (type locality: Pago Pago, Tutuila Island, Samoa).
- Vaimosa novae-hebendorum* Fowler, 1944: 180, figs 27-28 (type locality: New Hebrides).
- Stigmatogobius römeri*: Koumans, 1953: 113, 115 (in part).
- Gobius tessellata*: Aoyagi, 1957: 227 (Japan).
- Stigmatogobius minutus* Takagi, 1957: 114, fig. 5, pl. 6E (type locality: Tomari estuary, Satsuma Peninsula, Kagoshima Prefecture, Japan).
- Stigmatogobius versicolor* Smith, 1959: 197-198, fig. 12 (type locality: tidal stream at Mahe, Seychelles); Smith & Smith, 1969: 47; Kami, 1975: 118 (Guam, Acfayan River).
- ?*Bathygobius samberanoensis*: Kiener, 1963: 63; Maugé, 1986: 361.
- ?*Bathygobius vergeri*: Kiener, 1963: 63; Maugé, 1986: 361.
- Stigmatogobius amblystoma* Zander, 1972: 109, figs 1-3 (type locality: Vakvela, Ceylon).
- Stigmatogobius* sp.: Bayly et al., 1975: 10.
- Redigobius bikolanus*: Inger & Chin, 1962: 184; Akihito & Meguro, 1975: 49; Bright & June, 1981: 109 (Ghimel River, Palau); Merrick & Schmida, 1984: 313-314, fig. 259; Hoese, 1986: 803; Maciolek & Ford, 1987: 628 (Nanpil-Kiepw River, Ponape); Akihito et al., 1988: 269, pl. 247U (Shizuoka to Iriomote, Japan); Allen, 1989: 208-209, pl. 52; Erftemeijer et al., 1989: 125 (Bintuni River, West Papua); Allen, 1991: 192, pl. 15, no.15 (in part); Kottelat et al., 1993: 151; Donaldson et al., 1994: 330 (southern Marianas); Tan & Tan, 1994: 357 (Pulau Bintan, Sumatra); Séret, 1997: 374; Ng et al., 1999: 182 (Pulau Tioman, Malaysia); Larson & Williams, 1997: 370 (Northern Territory); Akihito et al., 2000: 1241, 1303 (Japan); Larson, 2001: 205-207; Larson & Murdy, 2001: 3601; Allen et al., 2002: 283; Senou et al., 2004: 406; Tan & Lim, 2004: 111 (Pulau Jemaja, Anambas; Pulau Natuna Besar); Rema Devi et al., 2005: 163 (Middle Andaman); Keith et al., 2006: 222 (Seychelles; Comores; Mauritius); Hoese & Larson, 2006: 1681.
- Gobius osgoodi*: Ryan, 1980: 65.
- Redigobius versicolor*: Maugé, 1986: 382; Stiassny & Raminosa, 1994: table I; Myers, 1988: 164.
- Redigobius isognathus*: Kottelat et al., 1993: 151; Lim & Larson, 1994: 261; Tan & Lim, 2004: 111 (Pulau Jemaja, Anambas; Pulau Natuna Besar); Larson & Lim, 2005: 145; Larson et al., 2008: 144.
- ? *Pseudogobius isognathus*: Rainboth, 1996: 207 (Mekong delta).
- Redigobius* sp.: Thollot, 1996: 71 (New Caledonia); Larson, 2005: 348.

**Material examined.** SEYCHELLES: RUSI 209, holotype of *Stigmatogobius versicolor*, male, 21.5 mm SL; RUSI 44, 1 paratype, 14 mm SL; small tidal stream at Mahé. – USNM 278010, 86, 11-23.5 mm SL; Rochon River, about 1 mile SE of Victoria, Mahé; H. A. Fehlmann & party, 10 Dec 1964. SRI LANKA: ZMH 4635, holotype of *Stigmatogobius amblystoma*, male, 27.5 mm; ZMH 7993, 2, 25-27 mm SL; river by Vakvella, SW Sri Lanka; G. Duncker, 7-9 Aug 1909. MYANMAR: NTMS.16759-001, 32, 13.5-26 mm SL; Rakhine district, Dalet Chaung; T. Roberts, 24 Apr 2004.

MALAYSIA: ZRC 45414, 24, 14-25 mm SL; Sungei Asah, Pulau Tioman; P. K. L. Ng & party, 24 Jun 1999. – ZRC 46556, 8, 17-27.5 mm SL; ZRC uncat., 10, 17.5-23 mm SL; Sungei Keliling, Pulau Tioman; H. H. Tan, 17 Jul 2001. SINGAPORE: RMNH 4551, 1 of 2, possible holotype of *Stigmatogobius isognathus*, female, 40 mm SL. – CMK 6014, 1, 16 mm SL; 'west coast', canal draining to sea, 500 m upstream; M. Kottelat & P. Ng, 21 May 1988. PHILIPPINES: CAS 30967, holotype of *Vaimosa montalbani*, male, 20 mm SL; Lake Naujan, Mindoro; A. W. Herre, 28 Nov 1933. – CMK 9962, 17, 16.5-31 mm SL; Sohoton Cave area, Basey River, about 20 km upstream from Basey, Samar Province; M. Kottelat, 6 Jul 1993. – CAS 38648, 7, 20.5-27.5 mm SL; Old Ayukitan, Dumaguete, Negros Oriental; A. W. Herre, 7 and 13 Aug 1940. – CAS 26377, 76, 10.5-21 mm SL; Lake Bombon [Lake Taal], Luzon; A. W. Herre, May 1931. – MNHN 1932-205, 1, 16 mm SL; Lake Bombon [Lake Taal], Luzon; A. W. Herre, 1931. – CMK 9773, 22, 11-28.5 mm SL; Calbiga-a Creek, N end of Visca, about 7 km N of Baybay, from upper tidal limit to about 300 m inland, Leyte; M. Kottelat & J. Margraf, 24 Jun 1993. CHINA: CAS 30966, holotype of *Vaimosa chinensis*, female, 20 mm SL; Hong Kong; A. W. Herre, Mar 1934.

REPUBLIC OF PALAU: FMNH 47241, 2 syntypes of *Vaimosa horiae*, 22-26 mm SL; CAS 29071, 7 of 9 syntypes, 21.5-28 mm SL; Babeldaob, Palau; Herre 1933 Pacific Expedition, 14 Oct 1933. WEST PAPUA: WAM P.31037-010, 2, 22.5-27.5 mm SL; Reifafeif River, SE coast of Yapen Island; G. R. Allen & D. Price, 7 Jul 1995. AUSTRALIA: Queensland: AMS I.38559-003, 2, 32.5-34 mm SL; Boyne River near Glangary; Boynedale; P. Unmack & G. Briggs. – NTM S.16058-001, 4, 19-27 mm SL; Bamboo Creek, Daintree River; F. Kroon, 11 Dec 2004. – NTM S.14191-002, 5, 28-37 mm SL; Douglas Creek, Daintree River. – NTM unreg., 6, 18-32.5 mm SL; Puthoo and Woralie Creeks, Fraser Island; B. Hansen, 21 Oct 1998. – QM I.31118, 7, Bool Creek, Fraser Island. FIJI: FMNH 17387, holotype of *Vaimosa osgoodi*, male, 16 mm SL; river flowing into Suva Harbour; A. W. Herre, 13 Mar 1929. SOLOMON ISLANDS: USNM 316134, 17, 17.5-34.5 mm SL; WNW of Honiara Bunia Point, Honiara Guadalcanal, Te Vega Cruise 6, station 250; W. P. Davis, 20 Mar 1965. – NTM S.16758-001, 12, 11.5-19.5 mm SL; Lake Bangatu, Tetepare; A. Jenkins & D. Boseto, 10 Sep 2006. AMERICAN SAMOA: USNM 116113, holotype of *Mahidolia pagoensis*, male, 15 mm SL; MCZ 37289, 1 paratype, 16 mm SL; stream at village

of Pago Pago, Tutuila Island; L. P. Schultz, 2 Jun 1939. VANUATU: ANSP 71392, holotype of *Vaimosa novaeheburorum*, female, 21 mm SL; E. L. Jackson. NEW CALEDONIA: MNHN 1992-428, 14, 22.5-29 mm SL; River Pirogues at end of Route 2, PEDCAL 62, 2 Oct 1991. JAPAN: AMS I.23502-002, 21, 15-29 mm SL; just above tidal influence, Aira River, Ryukyu Islands; D. Hoese & M. Hayashi, 31 May to 2 Jun 1980. – BLIP 20020408, 9, 23-31.5 mm SL; Ryukyu Islands.

**Material examined but no data taken.** COMORES: MNHN 2004-170, 1; Oouveni River, Mayotte. SEYCHELLES: USNM 316133, 18; Beau Vallon. – MNHN 2004-169, 4; Mahe. MAURITIUS: USNM 347783, 1; creek S of Tamarin. – USNM 317783, 1; MNHN 2003-113, 4; "rivière noire" estuary. SRI LANKA: USNM 341242, 33; USNM 341240, 4; ZMH 19342, 2; USNM 341229, 31.

JAPAN: NTM S.12110-017, 42; Iriomote-jima. – NTMS.12109-031, 6; Udaa River, Iriomote-jima. THAILAND: CAS 76063, 96; Aoa Kong Chow Bay, Gohkut Island. – KUMF unreg., 2; KUMF unreg., 1; USNM 341248, 9; KUMF unreg., 2; KUMF unreg., 4; Narathiwat Province. – CMK uncat. (ex 5385), 8; Ranong Province. – NTM unreg, 4; Phuket. VIETNAM: CAS 217638, 1; Thua Thien, Hue fish market. MALAYSIA: ZRC 37772, 2; Kuching, Sarawak. – ZRC 22756, 1; Pulau Redang, Trengganu. – ZRC 24422-35, 14; ZRC 26062-83, 22; ZRC 41425, 6; ZRC 24435, 14; Pulau Tioman, Pahang. – ZRC 48404, 2; ZRC 41439, 15; ZRC 45424, 1; Sungei Keliling, Pulau Tioman. – ZRC 46550, 10; Sungei Paya, Pulau Tioman; SINGAPORE: NTM S.16589-001, 1; Pulau Seletar. INDONESIA: ZMA 108.049, 1 syntype of *Gobius oyensi*; Buru and Ceram. – CMK 8920, 20; off Nirwana Beach Cottages, Bali. – CMK 8929, 2; Bali. – ZMA 120.462, 1; Flores. – CMK 11291, 3; Halmahera. – CMK 7356, 1; Java. – USNM 264972, 13; Moluccas. – ZRC 32867-71, 5; Pulau Bintan, Riau Archipelago. – WAM P.29961-003, 1; Sibena. – CMK 6170, 7 (some are *Pandaka*); Pare Pare, Sulawesi. – RMNH 26976, 1 (identification tentative). – CMK 11407, 1; Salo Pongkeru, Sulawesi. – ZRC 45759, 2; Lake Mahalona, Sulawesi. – CMK 6133, 2; Sulawesi, road from Sengkang to Palopo. – ZRC uncat., 2; Nias, Sumatra. – RMNH 14344, 1; NTM S. 14511-010, 15; NTM S. 14511-014, 9; Sekongkang River, Sumbawa. – RMNH 15079, 2; RMNH 15080, 1; no data. TIMOR LESTE: NTM S.15777-008, 1; Vero River, Lautem Province.

PHILIPPINES: AMS I.21924-001, 1; Batangas Province. – FMNH 47590, 14; ZMH 19313, 16; Lake Bombon. – AMS I.23027-004, 2; Mactan Island, Cebu. – CMK 9854, 3; Ambacan River, Leyte; CMK 9910, 6; CMK 9867, 10; Ambacan River, Leyte. – CMK 10049, 5; Lagu Lagu Creek, Leyte. – CMK 9817, 1; Baybay, Leyte. – CAS 26374, 1185; FMNH 47570, 75; Lake Bombon, Luzon. – NTM S.16706-001, 6; NTM S.16706-001, 6; Lake Taal, Luzon. – CAS 50727, 10; Olo Creek, Luzon. – USNM 120206, 38; Luzon. – CAS 38630, 1; Baras River, Rizal Province. – CAS 38635, 21; Lake Mainit, Surigao Prov-

ince. – CAS 38628, 3; Coron. – USNM 342066, 1; USNM 139211, 1; Cabugao River, Catanduanes Island. – ZRC 46848, 1; Bohol, Inambacan River. – CAS 29973, 27; Lake Naujan. – CAS 26378, 1; Concepcion. GUAM: CAS 67308, 4; Apra Harbour.

REPUBLIC OF PALAU: CAS 67588, 5; CAS 76077, 9; CAS 76071, 1; CAS 76061, 19; CAS 76069, 1; CAS 76079, 96; Babeldaob, Palau. – CAS 76064, 4; Balbelthuap, Palau. – CAS 76073, 2; CAS 76067, 5; CAS 76066, 2; CAS 76068, 1; CAS 76062, 12; Palau. – CAS 76074, 1; CAS 76060, 14; Koror. – CAS 76072, 2; Arakabesan Island, Palau. – CAS 76075, 2; Tibdal Stream, Koror. – AMS I.27163-001, 1; Merab Ra Chol Stream, Palau. – AMS I.39656-004, 7; Ngarameskang, Palau. – CAS 76070, 11; Arakitaoch Stream, Palau. – CAS 76161, 2; Arakitaoch Stream, Babeldaob. – CAS 76065, 8; Arakabesan Island, Palau. – CAS 96217, 1; Ngardok Lake, Palau. FEDERATED STATES OF MICRONESIA: NTM S.13492-001, 1; Utwe River, Kosrae. – NTM unreg., 3; Pohnpei. WEST PAPUA: AMS I.34141-004, 1; Supiori Island. – WAM P.31458-014, 11; Wapoga River tributary. – WAM P.31463-009, 2; Warman Stream, Raja Ampat Islands. – NTM S.14850-001, 2; Otokwa River. – NTM S.14849-001, 1; lower Kamora River. – WAM P.31033-008, 1; Yapen Island. PAPUA NEW GUINEA: WAM P.32353-011, 1; Mebulibuli River, Fergusson Island, D'Entrecasteaux Islands. – WAM P.30977-018, 33; WAM P.30976-002, 7; WAM P.30975-005, 3; WAM P.30966-006, 1; Kikori River. – USNM 217271, 73; Lower Fly River. – USNM 297245, 2; Cape Ward Hunt. – ZMUC uncat., 1; Manus Island, Bismarck Archipelago. – AMS I.17103-014, 1; Port Moresby. – AMS I.39584-001, 1; Morobe Province. – AMS I.16671-068, 1; Sek Island, Madang. – NTM S.13689-008, 1; Biges River, Madang. – NTM S.13678-001, 78; lake by Kokong village, Madang. – NTM S.13663-004, 1; Nagada River, near Madang. – WAM P.28969-005, 2; W of Rabaul. – WAM P.28150-005, 2; S of Cassowary Island, lower Fly River. – AMNH 48589, 1; Finschafen. – USNM 11493, 13; Manus Island. – USNM 217272, 10; lower Fly River. – ZMH 19343, 1; ZMH 19314, 1; "Neue Pommern" (New Britain).

AUSTRALIA: Queensland: AMS I.22056-004, 130+; Bailey Creek, Cape Tribulation. – QM I.30465, 9; Stewart Creek, Daintree River. – NTM S.14195-004, 5; Bloomfield River. – NTM unreg., 2; Albert River. – QM I.30468, 16; Bamboo Creek, Mossman. – AMS I.22067-002, 4; Mulgrave River. – AMS I.23296-003, 3; Pascoe River. – QM I.28269, 10; Innisfail, Johnstone River. – NTM S.14198-001, 3; Alice River. – AMS I.22045-009, 21; QM I.30476, 4; Daintree River. – QM I.17908, 10; Chinaman Creek, Earlville. – QM I.17907, 1; Wright Creek, Cairns. – NTM S.14196-002, 1; Cape Tribulation. – AMS I.21419-008, 8; Cairns Harbour. – QM I.31194, 11; Saltwater Creek, Rothwell. – NTM S.14192-001, 1; Stewart River. – QM I.17909, 1; Moody's Creek, Cairns. – QM I.31280, 1; Moreton Bay. – AMS I.23259-001, 28; Rockhampton. – AMS I.22908-001, 6; Lake Manchester, Brisbane. – QM I.27018, 5; Boggy Creek, Brisbane River. – QM I.21152,

1; Albert River. – AMS I.22041-015, 3; Mowbray River. – QM I.23434, 4; Brisbane River. – AMS I.34643-001, 1; Johnstone Passage. – WAM P.28818-001, 1; Moreton Bay. – AMS I.17989-015, 1; Mackenzie River, Leura. – QM I.17910, 2; Brisbane River. – QM I.21853, 3; Holloway's Beach. – QM I.29979, 2; Liverpool Creek. – AMS I.22041-014, 280+; Mowbray River. – AMS I.23293-003, 2; Pascoe River. – NTM S.14199-001, 1; Tully River. – QM I.17906, 1; Stuart Creek, Townsville. – QM I.17905, 1; Freshwater Creek, Cairns. – QM I.25240, 12; Boggy Creek, Brisbane. – NTM S.14200-002, 2; Tully River. – QM I.21268, 2; Kennedy River. – QM I.27030, 1; Moreton Bay. – NTM S.14187-001, 1; NTM S.14188-003, 1; Daintree River. – AMS I.17236-001, 1; Lake Wabby, Fraser Island. – QM I.21428, 1; Lake Wabby. – Fraser Island. – NTM S.13125-001, 8; Topwhiphandle Lagoon, Normanby River. – QM I.23434, 4; Colleges Crossing, Brisbane River. – QM I.33605, 1; Maroochy River. – AMS I.22043-001, 3; Daintree River. – AMS I.21258-006, 43; Cape Tribulation. – NTM S.16058-001, 1; Bamboo Creek, Daintree River.

SOLOMON ISLANDS: NTM unreg., 1; Eravo River, Tetepare. – NTM unreg., 14; Lake Bangatu, Tetepare. – LACM W65-32, 12; LACM W65-32, 3; Guadalcanal. – USNM 341230, 5; Puk Puk Island. TROBRIANDS: USNM 341225, 1; Trobriand Islands. FIJI: USNM 341231, 3; Kumbana Creek, Viti Levu. – USNM 261774, 17; Naikorokoro Creek, Viti Levu. VANUATU: MNHN 2004-0168, 3; Saravaka River, Santo. NEW CALEDONIA: AMNH 96929 (MNHN 1992-437), 19; AMNH 96828, 5; MNHN 1992-438, 3; MNHN 2000-1267, 9; MNHN 1992-425, 6; MNHN 1992-426, 2; MNHN 1992-431, 6; La Foa River. – MNHN 1992-434, 1; MNHN 1992-430, 2; MNHN 1992-429, 3; MNHN 1992-1342, 3; MNHN 1992-433, 15; MNHN 1990-710, 1; MNHN 1992-435, 2; MNHN 1992-432, 3; MNHN 2000-1291, 8; AMNH 96830, 14; AMNH 96831, 15; MNHN 1992-437, 19.

**Diagnosis.** A *Redigobius* with dusky scale margins forming network pattern; side of body variably marked with series of dark brown blotches or bars (partly internal), one blackish, slightly oblique, narrow bar on side of body, second blackish narrow bar present on lower half of body; four distinct dark brown to blackish spots along mid-ventral line at anal fin; second dorsal rays 1,6-8, usually 1,7; anal rays 1,6-8, usually 1,6; pectoral rays 14-18, usually 16; longitudinal scales 21-27; TRB 6½ to 8½, modally 8; predorsal scales 5-8. Two dark bars on side of body in combination with four dark spots along mid-ventral line of anal fin and caudal peduncle usually diagnostic for this variable species. Widespread in a range of freshwater to estuarine habitats from the Seychelles to New Caledonia and Japan.

**Description.** Based on 111 specimens, 12-40 mm SL.

First dorsal VI; second dorsal I,6-I,8 (usually I,7); anal I,6-8 (usually I,6); pectoral rays 14-18 (usually 16); segmented caudal rays usually 17; caudal ray pattern 8/7 to 10/8 (usually 9/8); branched caudal rays 6/5 to 8/6 (usually 7/6); procurent caudal rays 6/6 to 8/7; longitudinal scale count 21-27 (mean 23); TRB 7-9 (mean 8); predorsal scale count 5-8 (mean 7); circumpeduncular scales 10-13 (mean 12). Gill rakers on outer face of first arch 1+7 to 3+6, with equal modes of 2+7 (in 6) and 3+6 (in 6). Pterygiophore formula 3-12210 (8). Vertebrae 11+15 (8). Neural spines of first three vertebrae narrow to stout, pointed (in 7); slight flange present (in 2), tip bifid in one of these specimens. One (1) or two (7) epurals. Two (1) or three (7) anal pterygiophores before haemal spine of first caudal vertebra.

Body compressed; body depth at anal origin 19.5-26.9 % SL (mean 23.1 %); body width at anus 8.5-15.4 % SL (mean 12.3 %) (Table 6). Head somewhat compressed, deeper than wide, but not greatly so, length 27.0-36.7 % SL (mean 30.7 %). Head depth at posterior preopercular margin 59.7-77.0 % HL (mean 68.3 %); cheeks may be inflated in large males (about 30 mm SL upward). Head width at posterior preopercular margin 46.8-73.0 % HL (mean 63.0 %). Large males (about 35 mm SL) become more slender-bodied and large-headed in appearance. Mouth terminal, slightly oblique, forming an angle of about 25-30° with body axis; jaws generally reaching well past rear of eye in adult males, nearly to lower corner of preopercle, and to below mid-eye in females. Lips smooth; lower lip free at sides, fused across front; adult males with lips broad across front and narrow along side of jaw. Upper jaw 30.0-76.3 % HL (mean 36.4 % in females, 51.1 % in males). Eye lateral, high on head, top usually forming part of dorsal profile, 22.9-35.4 % HL (mean 29.5 %). Snout rounded to pointed, 20.3-31.6 % HL (mean 25.4 %). Interorbital narrow, flat, 6.3-23.9 % HL (mean 12.4 %). Caudal peduncle compressed, length 14.4-30.9 % SL (mean 27.3 %). Caudal peduncle depth 8.8-15.4 % SL (mean 13.1 %).

First dorsal fin pointed; first to third spines longest. First dorsal spine longest in males, sometimes filamentous, usually joined by membrane to shorter or subequal second spine, 15.5-44.3 % SL (mean 30.9 %), in females, 15.7-28.1 % (mean 21.3 %). Second or third dorsal spines longest in

females. Second dorsal spine length 14.3-33.0 % SL (mean 18.9 %). Third dorsal spine length 14.3-20.0 % SL (mean 17.3 %). Second dorsal and anal fins short-based, pointed posteriorly, posterior-most rays longest, in adult males rays may reach caudal fin when depressed, posterior rays falling well short of caudal fin base in adult females. Pectoral fin rounded to slightly pointed, central rays longest, 22.4-31.2 % SL (mean 27.3 %); rays branched but for uppermost. Pelvic fins rounded, reaching to anus (just short of anus in smaller specimens) and to anal fin spine in some males, 22.7-30.2 % SL (mean 26.4 %); fins longer). Caudal fin rounded posteriorly, 26.2-34.2 % SL (mean 29.1 %).

No mental frenum, chin smooth. Anterior nasal opening in short tube, placed just behind upper lip, tube may be oriented forward. Posterior nasal opening oval, placed close to front centre margin of eye. Gill opening restricted, extending forward to just under opercle. Inner edge of shoulder girdle smooth or with low fleshy flange; few specimens with rudimentary lobes or fleshy bumps. Gill rakers on outer face of first arch very short and stubby, longest rakers near angle of arch; rakers on inner face of first arch very small, pointed; inner rakers on other arches similar to first arch inner rakers but slightly longer. Tongue tip blunt to rounded; few specimens with tongue folded longitudinally and tip pointed. Upper jaw with 2-3 rows of small curved sharp teeth across front and 1 row along side; teeth absent from posterior quarter to third of jaw in both sexes; in large males, outermost teeth enlarged and stout, especially at angle of jaw. Lower jaw with 3-4 rows of small sharp teeth, outermost row largest and stoutest; anteriormost teeth largest in adult males, posteriormost teeth may be largest in adult females; posterior half to two-thirds of lower jaw without teeth in large males.

Predorsal scales cycloid, scaled up to close behind eyes. Operculum with three to five large cycloid scales; some specimens with only upper part of opercle scaled. Cheek naked. Pectoral base covered with small cycloid scales. Prepelvic area covered with small cycloid scales. Belly scales ctenoid or cycloid, usually ctenoid in larger specimens. Ctenoid scales on side of body.

Head pores and sensory papillae pattern basically as for *R. balteatus* (Fig. 3); three preopercular pores present.

**Coloration of preserved material.** Head and body whitish yellow, variably speckled with brown to dark brown, scale margins outlined with dark brown, forming reticulate pattern (Fig. 5). Side of body with series of five dark brown blotches, short bars or small X-shaped marks along mid-lateral line, posteriormost blotch smallest, on middle of caudal peduncle. Anteriormost lateral dark blotch or bar (below first dorsal fin) darkest and contiguous with dark brown to blackish, slightly oblique, narrow bar on side of body, extending ventrally to mid-line of belly; bar not meeting its counterpart from opposite side. Second dark brown to blackish narrow bar present (below gap between dorsal fins) on lower half of body, bar joining its counterpart just behind anus. Six short evenly spaced brown saddles crossing dorsum (often indistinct), anteriormost saddle just above rear of preopercle, posteriormost just before procurrent rays of caudal fin; each saddle either alternating with, or just above, the row of five dark brown blotches along mid-side of body. Along mid-ventral line, four distinct dark brown to blackish spots (in life, connected to internal bars of brown pigment and reaching to mid-lateral line of body), spots commencing over second to third anal fin rays and evenly spaced posteriorly to just before ventral procurrent rays of caudal fin. Base of caudal fin with two short dark brown blotches or horizontal bars, arranged one above the other on either side of middle of fin

base, touching a small brown central blotch or square of brown pigment on mid-base itself. Pectoral fin base light brown, with two distinct dark brown blotches, upper small and rounded, placed over bases of third to seventh fin rays, lower blotch larger, elongate and slightly oblique, running from middle of gill opening to postero-ventral corner of fin base; brown to dark brown blotch may be present just above fin base. Breast and belly yellowish white to faintly mottled brown. Peritoneum pale, speckled with brown dorsally.

Side of head with two broad dark brown lines from eye to jaw, first from anterior part of eye to anterior half of jaw, second from ventral edge of eye to rictus in small-jawed specimens (females and small males) and to mid-jaw in long-jawed males; two to three similar dark brown lines from nape crossing preopercle and opercle, forming oblique to curved bands of light and dark lines, which may be broken up so as to be vermiculate or spotted, especially in adult males. Rear edge of eye with dark brown margin (contiguous with second brown line from eye to jaw) angled posteriorly to form sharp corner at upper rear edge. Interorbital with variable brown marbling or short lines over top of eye. In some specimens, sensory pores on dorsal surface of head made conspicuous with dark brown to dark grey pigment. Lips brownish or banded by dark lines on head. Chin and anterior part of underside of head brownish

Table 6. Morphometrics of *Redigobius bikolanus*.

	males (n=52)		females (n=59)	
	range	mean	range	mean
<b>Percentage of standard length</b>				
Head length	28.8-36.7	32.3	27.0-34.2	29.6
Body depth	19.5-26.9	23.2	19.6-26.5	23.1
Body width	9.2-15.4	12.5	8.5-14.9	12.1
Length of caudal peduncle	24.2-30.9	27.3	23.1-30.9	27.3
Depth of caudal peduncle	11.6-15.4	13.6	10.7-15.8	13.0
Length of pectoral fin	24.3-31.2	27.9	22.4-30.0	26.9
Length of pelvic fin	22.7-29.8	26.4	22.7-30.2	26.3
Length of caudal fin	26.8-34.2	30.1	26.2-30.8	28.5
Longest D1 spine	15.5-44.3	30.9	15.7-28.1	21.3
<b>Percentage of head length</b>				
Head depth	59.7-76.6	68.1	58.8-77.0	68.5
Head width	46.8-70.7	61.7	51.1-73.0	64.1
Snout length	20.3-31.6	25.7	20.5-29.9	25.3
Eye width	22.9-32.7	28.4	25.0-35.4	30.2
Jaw length	32.7-76.3	52.8	30.0-52.6	37.3
Interorbital width	6.3-19.8	13.0	6.5-23.9	12.1



to dusky, some specimens with one or two dark brown lines over branchiostegal membrane (continuation of dark lines from side of head).

First dorsal fin transparent with round to oval black spot posteriorly, close to fin base, and two dusky to blackish horizontal stripes, ventralmost running anteriorly from black spot and ending in small dark brown to blackish spot on anterior face of first spine, upper stripe narrower anteriorly, may be denser posteriorly, running along middle to upper third of fin and ending in similar blackish spot on first spine; remainder of first spine dusky to pale and banded with black, its membrane usually pale; stripes and black spots vary in size and density; round black spot at rear of fin may have several blackish stripes and small spots extending up and back from it, following curve of fin spines to trailing edge of fin. Second dorsal fin transparent with four to five oblique narrow lines formed by series of elongate brownish spots, submarginal region usually unpigmented and fin margin faintly dusky to brownish; two dark brown spots just above fin base, one on anterior quarter of base and one at mid-point of fin. Caudal fin transparent with three to six rows of fine dark spots and speckling; rows of spots may be somewhat oblique or coalesced into irregular lines. Anal fin plain brown to translucent, with dark brown streaks extending along membranes from mid-ventral dark blotches. Pectoral fin transparent, fin rays sometimes brown-speckled. Pelvic fins transparent with dark brown streaks along fin membrane between third and fifth rays, fin margins and frenum faintly speckled with brown or unpigmented.

In some specimens from Fraser Island, Queensland, there are three mid-ventral spots on the caudal peduncle (initially it was thought that such specimens represented a separate species). For example, three out of seven specimens from Bool Creek (QM I.31118) have the third spot absent or fused with the second spot, making it appear longer than usual).

**Coloration of fresh material.** This species has been illustrated in colour in a number of books, such as Kottelat et al. (1993), Allen et al. (2000; 2002), Hayashi & Shiratori (2003), Kawanabe & Mizuno (1989), Leggett & Merrick (1987) and Senou et al. (2004).

Live colour pattern similar to that of preserved specimens. Head and body creamy white to pale grey, with dark brown to blackish markings on

side of body; four to six (usually five) blackish bars visible internally, joining dark spots on mid-ventral line of caudal peduncle to the six dark mid-lateral spots (Fig. 6). Side of head with whitish to pale gold speckles, spots or vermiculate blotches overlying background colour. Iris pale gold to brownish, may have upper half darker than lower half, pupil ringed with narrow margin of bright gold to red-gold. First dorsal fin transparent to translucent pale yellow to orange-red, with dark brown to black markings. Second dorsal fin transparent to translucent pale yellow or orange with dark brown to blackish markings. Anal fin transparent to translucent brownish or purplish brown, usually with transparent margin, or streaked with dull red and blackish along fin rays. Caudal fin variable, transparent with brownish to pale gold speckles, to banded with reddish and pale yellow. Pectoral fin usually transparent, may have golden speckles along lower part of fin rays. Pelvic fins dusky to reddish brown to charcoal grey; reddish pigment may be present along central membrane of fins and on frenum.

**Comparisons.** *Redigobius bikolanus* is variable in colour pattern and not easy to simply differentiate from some of its congeners. The two dark bars on the side of the body, in combination with the four dark spots along the mid-ventral line of the anal fin and caudal peduncle, are generally fairly diagnostic for this species. It is most similar in appearance to *R. nanus* (see Comparisons under that species), *R. oyensi* and *R. tambujon*.

*Redigobius bikolanus* can be distinguished from *R. oyensi* in that it usually has a second dorsal fin-ray count of 1,7 (versus usually 1,6 in *R. oyensi*), having the first spine of the first dorsal fin spine usually the longest, never the fourth (versus fourth spine nearly always longest) and not having a distinct mark above the pectoral fin base (versus a blackish W- or V-shaped blotch above the pectoral fin base).

It can be separated from *R. tambujon* by its first dorsal fin pattern, with a round to oval black spot posteriorly, close to the fin base, and two blackish horizontal stripes along the fin (*R. tambujon* usually has a large black blotch at the rear of the fin and two diffuse to dense dark stripes, one stripe close to the fin base and other submarginal to nearly central on fin); its five dark brown lateral blotches and two oblique bars (*R. tambujon* has a series of dark brown X- or chevron-shaped marks along the side of the body, which may form



Fig. 5. *Redigobius bikolanus*, ROM 74853, female, 21.8 mm SL, freshly dead; Caroline Islands: Palau. Photograph by Rick Winterbottom.

a broad dark brown band), difference in lip and jaw shape in adult males, with lips wide anteriorly, becoming evenly narrower below the eye (in male *R. tambujon* the upper lip is wide anteriorly, but narrowing quickly in a distinct curve below the eye, giving a characteristic shape to the jaws) and a pectoral ray count of 14-17, usually 16-17 (versus in 15-18, usually 17, in *R. tambujon*).

**Distribution.** *Redigobius bikolanus* is a widespread Indo-west Pacific species, found from Comores to Fiji. In Australia, this species has been recorded from Shark Bay to Brisbane (Allen et al., 2002; Hoese & Larson, 2006).

**Ecology.** This species is found in fresh and brackish waters, in small streams and mangroves. Jackson (in Fowler, 1944) noted that this species was found in fresh waters of the New Hebrides, with pipefish, and that the gobies darted rapidly about. Merrick & Schmida (1984) report this species as being locally abundant next to "weed banks" in Australia. Ng et al. (1999) described specimens from Pulau Tioman, Malaysia, as obtained from "among submerged bank vegetation and from under rocks near the banks of fast-flowing freshwater streams".

Rayner et al. (2008, 2009) discussed changes in community structure and dietary habits of fishes in the seasonally flooding Mulgrave River, Queensland, finding that *R. bikolanus* formed a significant part of a gobioid-dominant fish assemblage during the dry season (when flows were lower).

**Remarks.** Bleeker (1878) described *Stigmatogobius isognathus* from a single specimen from Singapore, 48 mm TL. The possible holotype is RMNH 4551, a 40 mm SL female *Redigobius* species (caudal fin

7.5 mm long; D. Hoese, in litt.). When I examined the specimen, in 1988, it was in a jar with a 32 mm SL female apparently of the same species. However, Martien van Oijen (pers. comm., 17 Dec 2009) considers that RMNH 4551 may not be the holotype, for several reasons (e.g. *Stigmatogobius isognathus* was not mentioned in Bleeker's auction catalogue). The status of this species name (and some other Bleeker gobiid types) needs further research (in progress).

Koumans (1931) used the name *Pseudogobius* as a "museum name" of Bleeker's, in synonymy with *Stigmatogobius* and placed *Gobius isognathus* Bleeker (museum name), among others, in *Stigmatogobius*. He also stated that "*Pseudogobius isognathus* of Blkr. is not synonymous with *Gobius isognathus* Blkr. from Madagascar, which belongs to *Awaous*, perhaps it is identical with *Stigmatogobius isognathus* Blkr.". Koumans (1932) further stated that the type of *Stigmatogobius isognathus* Bleeker was "apparently lost" without giving any further information as to why he thought so, and he presented a description of *S. isognathus* based on "two specimens of Bleeker's collection, Rijks Mus. Nat. Historie Leiden number 4551", with lengths of 40 and 32 mm, but states that they were from Batavia in estuaries, not Singapore.

Herre (1927) described *Vaimosa bikolana* from six syntypes (BSM 13232, 23-26 mm SL), since destroyed in WWII. The type locality is a creek at Barrio Puru, Legaspi, near Albay Gulf, Luzon. Close locations are Lake Buhí, and Sorsogon, both places from which other *Redigobius* species have been described. Lake Buhí is the type locality for *Gobius dispar* and *G. sternbergi* (a synonym of *Redigobius dispar*). Herre's description and illustration of *V. bikolana* (1927: 151, pl. 11, fig. 2) are clearly that of the present species, although the oblique black bar on the side of the abdomen is not mentioned nor illustrated (marking shown in his drawing of the conspecific *Vaimosa montalbani* (Herre 1936b: pl. 1, fig. 3).

*Parvigoobius immeritus* Whitley, 1930, a replacement name for *Gobius flavescens* De Vis, was considered by Larson (2001) to be a synonym of *Redigobius bikolanus*, based on the descriptions provided by McCulloch and Ogilby (1919) and Whitley (1930, 1931). It was not until 2008 that the two syntypes (AMS I.434) were examined to confirm that they are truly *Redigobius* and not *Pseudogobius*.

In his description of *Vaimosa horiae*, Herre (1936a) described a male 29 mm long and a female



Fig. 6. *Redigobius bikolanus*, aquarium kept; Singapore; a, male; and b, female. Photographs by Heok Hui Tan.

27.5 mm long as “types”, referring to the others as paratypes but did not designate a holotype. He also stated that the species was “described from the types and ten paratypes, 21-29 mm in length”. In fact, all are syntypes. Two specimens are in CAS-SU 29070; one (29 mm SL) is *Redigobius tambujon*, while the other (26 mm SL) is *R. bikolanus*. Among the nine syntypes in CAS-SU 29071, one is *Redigobius tambujon*, seven are *R. bikolanus* and one is *Mugilogobius chulae*. See lectotype designation under *R. tambujon*.

*Vaimosa osgoodi* Herre, 1935a, was based on a holotype (14 mm long), an ‘allotype’ (16 mm long)

and 33 other specimens (10-16 mm in length); the holotype is *R. bikolanus*. Among the 29 remaining paratypes in CAS-SU 24464, six specimens are *Redigobius bikolanus*, with the largest separated in the jar, and the remainder are a species of *Pandaka*.

The holotype and 56 paratypes of *Vaimosa montalbani* Herre, 1936a, are in CAS-SU 30967. The holotype and three other specimens (18-20 mm SL) in the same vial are *Redigobius bikolanus*. Another vial contains a *Mugilogobius* and three eleotrids (probably *Hypseleotris*), the remainder of specimens in the bottle are *R. bikolanus*.

There are some regional differences in colour and body form (e.g. CMK 9817 "small black" form from Leyte, Philippines, noted by Maurice Kottelat; males with enlarged mouth and gravid females at 12 mm SL from Tetepare, Solomon Islands), but these all fit within *R. bikolanus*. The males from a sample from the Seychelles all had the second or third (not first) dorsal fin spine longest or subequal. A genetic and morphological study covering all habitat types and geographic localities may help to clarify if there are cryptic species within *R. bikolanus*.

Allen (1989) first refers to the Fraser Island form as being different in having three instead of four mid-ventral line dark spots. This is the fish referred to as *Stigmatogobius* by Bayly et al. (1975). Most Fraser Island specimens examined for this study had four spots.

*Redigobius chryosoma* (Bleeker, 1875)  
(Fig. 7)

*Lophogobius chryosoma* Bleeker, 1875b: 114-116 (type locality: Bandjermasin, Borneo and Amboina).

*Gobius (Acentrogobius) leptochilus*: Weber, 1911: 41-42, fig. 10.

*Cyprinogobius chryosoma*: Koumans, 1937: 12-13.

*Redigobius chryosoma* – Inger & Chin, 1962: 184-185, fig. 97; Allen, 1989: 152, pl. 52; Erfteimeijer et al., 1989: 125 (Bintuni River); Allen, 1991: 192, fig. 37; Kottelat et al., 1993: 151; Séret, 1997: 374; Larson & Williams, 1997: 370; Allen et al., 2000: 129; Larson & Murdy, 2001: 3601; Allen et al., 2002: 284; Hoese & Larson, 2006: 1681.

*Redigobius chryosomus*: Larson, 2001: 207, fig. 206.

**Material examined.** INDONESIA: RMNH 4489, 4 syntypes of *Lophogobius chryosoma*, 35.5-37 mm SL; Banjarmasin, Borneo [= Kalimantan]. MALAYSIA: ZRC 19698-19704, 7, 24-34 mm SL; Malacca; M. Dali, 12 Feb 1966. – FMNH 51670, 3, 21-28 mm SL; tributary of Little Kretam River, just above *Nyssa* belt, Kinabatangan River, East Coast Residency, North Borneo [= Sabah]; R. F. Inger, 12 May 1950. BRUNEI: NTM S.14804-002, 5, 8-30 mm SL; Sungei Birau, tributary of Sungei Tutong, Tutong District; H. Larson & party, 25 Aug 1997. PAPUA NEW GUINEA: WAMP.30977-017, 27, 27-34 mm SL; Veiru village, about 5 km up Waimake Creek, Kikori River; G. Allen, 5 Mar 1995. AUSTRALIA: AMS I.22044-003, 5, 14-29 mm SL; backwater creek 8 miles

from mouth of Daintree River; D. Hoese & party, 14 Sep 1980. – AMSI.24692-012, 19, 14.5-23.5 mm SL; Leaders Creek, 500 m downstream from crossing, Darwin, Northern Territory; D. Hoese & party, 14 Sep 1984. – AMS I.24683-003, 139, 15.5-26 mm SL; 100 m upstream from Bynoe road bridge, Blackmore River, Northern Territory; D. Hoese & party, 8 Sep 1984.

**Material examined but no data taken.** WEST PAPUA: NTM S.14850-003, 1; Lower Otokwa River. – NTM S.14845-001, 2; Ajkwa River. – NTM S.15101-003, 1; East Minajewi River. – NTM S.14829-004, 5; Lower Mawati River. PAPUA NEW GUINEA: Kanudi Fisheries Laboratory, Port Moresby FO 1878, 3; Oriomo River, western District. – Kanudi Fisheries Laboratory, Port Moresby FO 3868, 1; Maribob Creek, Aroa River. – Kanudi Fisheries Laboratory, Port Moresby FO 1878, 2; Oriomo Station, Daru. AUSTRALIA: AMSI.22034-005, 5; Ingham, Queensland. – AMS I.22052-003, 11; Daintree River, Queensland. – NTM S.14289-003, 1; Leaders Creek, Darwin, Northern Territory. – NTM S.11816-005, 1; Leaders Creek. – NTM S.14404-005, 34; Maxwell Creek, Melville Island, Northern Territory. – NTM S.14388-004, 49; NTMS.14390-004, 64; "14 km creek", Melville Island, Northern Territory. – NTM S.16045-005, 1; Tumbling Water, Blackmore River, Northern Territory. – NTM S.10691-001, 2; Berry Springs, Northern Territory. – NTM S.10862-003, 2; Blackmore River, Northern Territory.

**Diagnosis.** A short-bodied *Redigobius* easily distinguished from all others by its distinctive pale grey coloration; dark brown to blackish bar under eye and dense black spot at rear of red and orange first dorsal fin; five short transverse papillae rows under eye; ctenoid nape scales; nearly always having a second dorsal and anal fin ray count of I,6; pectoral rays usually 17; longitudinal scales 22-25; TRB 7½-9; predorsal scales 5-7, reaching close up behind eyes. Known from brackish to freshwater rivers and streams from Malaysia to northern Australia.

**Description.** Based on 32 specimens, 16.5-35 mm SL. An asterisk indicates the counts of a 35.5 mm SL female syntype of *Lophogobius chryosoma* (only specimen from which data was taken).

First dorsal VI\*; second dorsal always I,6\*; anal always 1,6\*; pectoral rays 15-18 (usually 17\*); segmented caudal rays always 17\*, caudal ray pattern 9/8; branched caudal rays 6/6(2), 7/6(22), 7/7(5), 8/6(1); procurrent caudal rays 5/5(3), 6/5(1); longitudinal scale count 22-25\* (mean 23); TRB 7½-9 (mean 8\*); predorsal scale count 5-7\* (mean 6); circumpeduncular scales 12-13 (mean 12). Gill rakers on outer face of first arch 2+8(2), 3+7(1), 3+8(5), 3+9(1). Pterygiophore formula

3-12210 (in 4). Vertebrae 11+14(1), 12+14(3). Neural spine of first three vertebrae slender and pointed (2), third spine in one specimen with irregular flange. Two epurals (4). Four anal pterygiophores before haemal spine of first caudal vertebra (4).

Head and body compressed, body width at anus 10.5-16.2 % SL (mean 13.4 %) (Table 7). Head short, deeper than wide, length 26.6-34.5 % SL (mean 30.6 %). Body depth at anal origin 26.2-33.4 % SL (mean 29.4 %). Head depth at posterior preopercular margin 71.8-91.4 % HL (mean 80.7 %); head width at posterior preopercular margin 58.1-73.1 % HL (mean 65.2 %). Mouth terminal, oblique, forming an angle of 20-30° with body axis; jaws generally reaching to below anterior half of eye in both sexes; jaws only slightly longer in males. Upper jaw 29.8-32.6 % HL (mean 32.0 % in females, 34.8 % in males). Eye large, lateral, high on head, top forming part of dorsal profile in adults, 31.4-40.6 % HL (mean 35.1 %). Snout bluntly rounded, 21.1-30.2 % HL (mean 26.3 %). Interorbital moderate, flat to slightly rounded, 13.3-23.5 % HL (mean 18.2 %). Caudal peduncle compressed, relatively short, length 27.9-32.1 % SL (mean 30.3 %). Caudal peduncle depth 14.0-17.1 % SL (mean 15.3 %).

First dorsal fin pointed, no spines elongate or filamentous, second and third spines longest (usually third) or subequal; spines slightly longer in males than females; spines just reaching first

few elements of second dorsal fin when depressed. Second dorsal spine length 15.5-27.3 % SL (mean 19.2 %). Third dorsal spine length 15.2-21.3 % SL (mean 17.4 %). Second dorsal and anal fins tall, short-based, posteriormost rays longest, rays usually not reaching caudal fin when depressed, except in large males. Pectoral fin slightly pointed, central rays longest, 25.6-33.3 % SL (mean 29.5 %); rays all branched but for upper and lowermost rays. Pelvic fins slender, narrow and oval, reaching to anus or anal fin origin, 16.6-30.3 % SL (mean 27.3 %). Caudal fin rounded, 27.1-38.5 % SL (mean 31.5 %).

No mental frenum, chin smooth to somewhat fleshy. Anterior nasal opening small, in very short tube, oriented forward and placed behind upper lip. Posterior nasal opening relatively large, irregular oval, placed very close to front centre margin of eye. Gill opening usually extending forward to just under opercle. Inner edge of shoulder girdle with bony or fleshy low flange that may angle outward from body; flange may be bumpy or irregular, some specimens with small knobs present. Gill rakers on outer face of first arch small, slender, longest rakers near angle of arch; rakers reducing in size anteriorly; rakers may be lightly pigmented. Tongue tip blunt. In male, upper jaw teeth in 2-3 rows at front, 1 at side, teeth small, sharp and evenly sized; outer row teeth largest and stoutest; lower jaw teeth in about 4 rows across front of jaw, size and shape

Table 7. Morphometrics of *Redigobius chryosoma*.

	syntype	males (n=13)		females (n=19)	
		range	mean	range	mean
<b>Percentage of standard length</b>					
Head length	26.6	28.8-34.5	30.7	26.6-33.7	30.6
Body depth	29.4	26.2-32.3	29.2	26.7-33.4	29.5
Body width	-	10.5-16.2	13.1	11.9-15.4	13.6
Length of caudal peduncle	28.9	27.9-32.1	29.9	28.4-32.1	30.5
Depth of caudal peduncle	16.0	14.1-17.1	15.4	14.0-16.6	15.3
Length of pectoral fin	-	26.6-33.3	30.0	25.6-32.6	29.2
Length of pelvic fin	-	26.4-30.3	28.3	16.6-30.2	26.7
Length of caudal fin	-	29.0-38.5	32.2	27.1-34.2	30.9
Longest D1 spine	-	15.2-27.3	21.1	15.5-20.7	17.7
<b>Percentage of head length</b>					
Head depth	79.6	76.4-91.4	82.9	71.8-86.7	79.2
Head width	58.1	59.6-73.1	66.1	58.1-71.4	64.7
Snout length	26.9	21.1-30.2	26.4	21.4-29.0	26.2
Eye width	35.5	31.4-40.4	34.8	31.8-40.6	35.4
Jaw length	33.3	30.9-37.6	34.1	29.8-33.8	32.0
Interorbital width	14.0	15.8-23.5	18.7	13.3-22.7	17.8



Fig. 7. *Redigobius chrysosoma*, captive specimen; Australia: Queensland, Mowbray River. Photograph by Gunther Schmida.

similar to those of upper jaw; no teeth particularly large or curved. In female, teeth very similar to male but generally smaller and outer row teeth not as stout.

Predorsal scales ctenoid at side, midline cycloid. Operculum scales large, cycloid. Cheek naked. Pectoral base covered with cycloid scales. Prepelvic area usually with cycloid scales; ctenoid scales often at sides; occasionally entire area with ctenoid scales. Belly scales ctenoid. Ctenoid scales on side of body.

Head pores and sensory papillae pattern as in Figure 8; only species of genus with transverse papilla rows under eye.

**Coloration of preserved material.** Head and body yellowish white to light brown, paler ventrally; scale margins, especially along dorsum and mid-side of body, unevenly edged with brown, forming irregular and somewhat diffuse reticulate pattern. In some specimens, a pattern of staggered irregular brown blotches present along dorsum and side of body, blotches may form a broken line along mid-side of body, ending on caudal fin base. Thin black line, partly internal, along mid-ventral line of caudal peduncle, commencing at rear of anal fin and ending on ventral edge of caudal fin (contiguous with narrow black edge

of fin). Opercle with diffuse dark brown line running obliquely back to meet diffuse to dark brown blotch above pectoral fin base; opercular line and pectoral base blotch may be so diffuse so as to be almost indistinguishable (in specimens from Brunei, opercular mark formed into large sickle-shaped brown blotch covering most of opercle). Dark brown line, broadest dorsally, running from eye to end of jaws or to below end of jaws; line may be broken-up. Snout and top of head darker than side of head; may be one or two indistinct brown blotches or short lines behind upper part of eye. Pectoral fin base dusky to brownish, darker dorsally, may form brown blotch or spot. Underside of head and breast plain dark brown to brownish grey in adult males. Lips plain dusky to whitish with faint dusky spotting. Iris silvery, with distinctive dark brown to blackish curved blotch on dorsal to anterodorsal part of eye; dark area usually just contacting pupil, giving eye a slightly hooded look.

First dorsal fin transparent, with dark brown pigment mostly along upper part of membrane between first three spines, and distinct dense black oval spot on rear half of fin, spot mostly on proximal half of fin; scattered brownish pigment along base of fin. Second dorsal fin transparent to faintly dusky, with four or five rows of dark

brown oval spots and streaks; spots most distinct on basal half of fin and becoming more irregular and diffuse posteriorly; fin margin generally plain dusky. Caudal fin dusky to brownish with two dark brown square blotches or spots, one on either side of centre of fin base, and three or four vertically aligned rows of oval brown spots crossing fin, spots darkest toward base of fin, fading posteriorly (rear quarter of fin relatively plain); upper and lower margins of fin with narrow black edge, fading posteriorly; in some specimens, especially small females, fin spots diffuse and not clearly discernible. Anal fin plain dark greyish brown to brown. Pectoral fin transparent, base with scattered dark brown speckling, especially dorsally; edges of rays thinly margined with brown. Pelvic fins whitish to translucent, with dusky to brownish centre or fin entirely dusky but for translucent margins; frenum always unpigmented.

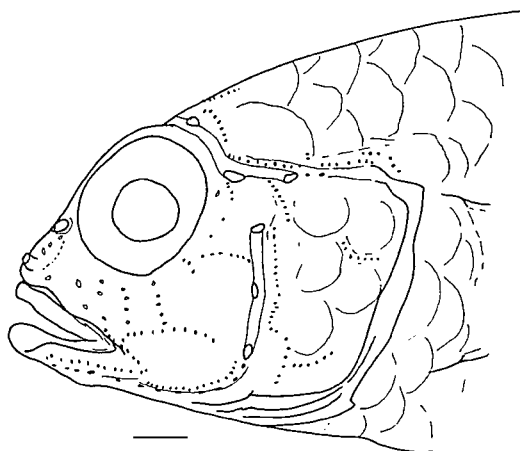


Fig. 8. *Redigobius chryosoma*, AMS I.24683-003, male, 24.5 mm SL; headpores and papillae pattern. Scale bar: 1 mm.

**Coloration of live fish.** From photographs of live or freshly dead fish by Neil Armstrong, Nonn Pativong & Rick Winterbottom; and personal observation of captive fish (Fig. 7). Peritoneum showing through abdominal wall as pale pinkish to silvery white.

Head and body pale yellowish grey to pale pearly grey, with scale margins outlined or spotted with soft grey to dark yellowish grey and indistinct diffuse grey blotches and speckles along side of body. Dorsum with three or four indistinct dark grey saddles or bars, most pronounced on nape and below each dorsal fin. Broad dusky grey somewhat oblique bar across opercle, usually showing faint golden speckles, and narrow V-shaped dark yellowish grey to black under eye, crossing cheek and ending on underside of head just behind jaws; dark bar running through eye to top of orbit, becoming more diffuse on iris but still visible. Iris golden brown to pale silvery; anterodorsal part of eye dark golden-brown.

First dorsal fin translucent to deep yellow, with broad black oblique line crossing first three dorsal spines, and large round black spot mostly on rear half of fin, red pigment present anterior to round black spot and also around anterior black line and along base of fin. Second dorsal fin transparent to reddish with rows of pale golden brown spots, fin margin broadly pale golden brown. Caudal fin translucent with two grey-brown spots at base and vertical rows of indistinct grey-brown spots and streaks. Anal fin transpar-

ent, becoming golden brown posteriorly. Pectoral fin transparent to slightly yellowish. Pelvic fins whitish to pinkish grey.

**Comparisons.** Easily distinguished from all other *Redigobius* by its distinctive pale coloration and dense black spot in the first dorsal fin, the transverse papillae rows under the eye, ctenoid nape scales and in nearly always having a second dorsal and anal fin ray count of I,6.

**Distribution.** Known from northern Australia (Wyndham, WA, to Gladstone, Queensland), Papua New Guinea, Malaysia, Brunei and Indonesia. The species has been reported from New Caledonia (Séret, 1997) but specimens were not examined for this study.

**Ecology.** *Redigobius chryosoma* occurs in shallow tidal freshwater streams, upper reaches of mangroves and in rivers. Specimens from Brunei were living in dense *Nypa* mangroves, where the fresh water (1 ppt) was clear dark brown. Inger & Chin (1962) got their Sabah specimens from a small, clear, freshwater forest stream. This species hovers above the substrate, and has become favoured by aquarium-keepers by its behaviour and distinctive colouring (Hansen, in Monks, 2006).

**Remarks.** Weber's (1911) figure 10 is clearly that of *R. chryosoma*, not *R. leptochilus*.

*Redigobius dewaali* (Weber, 1897)

(Figs. 9-10)

*Gobius dewaali* Weber, 1897: 145-146 (type locality: Umgeni River and Illovo River, Natal, South Africa); Gilchrist & Thompson, 1917: 402; Barnard, 1927: 815; Smith, 1949: 334; Nijssen et al., 1993: 232.

*Gobius dewaalii*: Boulenger, 1916: 26-27.

*Gobius maxillaris* Davies, 1948: 375-376, fig. (type locality: Knysna River, South Africa); Smith, 1949: 333, 1961: 333.

*Stigmatogobius dewaali*: Smith, 1960: 305, 1975: 69.

*Gobius* (*Stigmatogobius*) *dewaali*: Matthes, 1964: 181.

*Mugilogobius pongolensis* Kok & Blaber, 1977: 163-166, figs 1-2 (type locality: Nsimbu River, Pongolo River floodplain, Zululand, South Africa).

*Redigobius dewaali*: Hoese & Winterbottom, 1979: 5; Hoese, 1986: 803; Skelton, 1993a: 18, 27, 1993b: 366-367; Kyle, 1993: 48; Larson, 2001: 207; Strydom & Neira, 2006: 240-249.

*Redigobius pongolensis*: Hoese & Winterbottom, 1979: 5.

*Redigobius dewaalii*: Maugé, 1986: 382; Whitfield, 1998: 126-127.

**Material examined.** SOUTH AFRICA: ZMA 103.238, lectotype of *Gobius dewaali*, 28 mm SL; Umgeni River, Natal; M. Weber, 1894. – RUSI 807, holotype of *Mugilogobius pongolensis*, 26 mm SL; Nsimbu Pan, Pongolo River floodplain, Kwa-Zulu Natal; H. Kok, 30 Aug 1974. – RUSI 812, 1 paratype of *Mugilogobius pongolensis*, 22.5 mm SL; Nsimbu Pan, Pongolo River floodplain, Kwa-Zulu Natal; H. Kok, 27 Sep 1974. – RUSI 809, paratype of *Mugilogobius pongolensis*, 22.5 mm SL; Nsimbu Pan, Pongolo River floodplain, Kwa-Zulu Natal; H. Kok, 22 Oct 1974. – AMS I.27101-001, 4, 23-26.5 mm SL; Potter's Channel backwaters, St Lucia system, Kwa-Zulu Natal; H. Kok, 11 Sep 1976. – AMS I.27219-001, 1, 29 mm SL; Nkazana Stream, St Lucia system; H. Kok, Feb 1976. – SAM 24173, 3, 24.5-32 mm SL; E shore S lake, St Lucia system, Kwa-Zulu Natal; M. L. Wapenaar, Jun 1964. – SAM 24154, 2, 22.5-25.5 mm SL; St Lucia; M. L. Wapenaar, Jun 1964. – AMS I.27220-001, 25, 12-56 mm SL; Nhololo Dam, Pongolo River system; H. Kok, 17 Jul 1977. – RUSI 53041, 27, 19-26 mm SL; Tete, Phongolo River system, Kwa-Zulu Natal; G. Merron, 13 Apr 1995. – RUSI 37550, 11, 24-28 mm SL; Upper Kariega River, Eastern Cape; A. Whitfield & L. T. Morshuizen, Nov 1991. MOZAMBIQUE: NTM unreg., 2, 22-23 mm SL; southeast bay of Lake Piti, Maputo; R. Bills, 2001.

**Material examined but no data taken.** SOUTH AFRICA: ZMA 103.272, 1; ZMA 103.239, 5; paralectotypes of *Gobius dewaali*. – RUSI 810, 1; RUSI 813, 1; RUSI 815, 1; RUSI 816, 1; RUSI 817, 1 paratype of *Mugilogobius*

*pongolensis*; Pongolo River floodplain. – AMS I.23389-001, 2; St Lucia. – SAM 22036, 1; Little Brak estuary. – AMS I.37732-001, 5; Phongolo floodplain. – AMS I.23389-001, 2; St Lucia Lake system. – NTMS.12391-001, 1; Eastern Cape. – NTMS.15439-007, 22; Kosi Bay Lakes. – USNM 143281, 2; Inyoni, N of Durban.

**Diagnosis.** A *Redigobius* with brownish head and body and five to seven dark vertical to oblique bars along side; curved oblique dark stripes on pale head; reddish unpaired fins; compressed head and body; second dorsal rays 1,6-8, modally 1,7; anal rays 1,5-7, modally 1,6; pectoral rays 16-19; longitudinal scales 23-26; TRB 8-11; predorsal scales 8-11; modally circumpeduncular scales 13; second to fourth spine of first dorsal fin longest; first dorsal fin rounded with no elongate spines. Found in estuaries, rivers and freshwater lakes, in South Africa, Mozambique and Madagascar.

**Description.** Based on 31 specimens, 22-32 mm SL. An asterisk indicates the counts of the lectotype (Fig. 9).

First dorsal VI\*; second dorsal 1,6-1,8\* (nearly always 1,7); anal 1,5-7\* (usually 1,6); pectoral rays 16-19 (usually 17\*-18); segmented caudal rays 17\* (16 in 1), caudal ray pattern 9/8; branched caudal rays 6/6 (1), 6/7 (1), 7/6\* (21), 7/7 (5); longitudinal scale count 23-26 (mean 24, 25 in lectotype); TRB 8-11 (mean 10, 9 in lectotype); predorsal scale count 8-11 (mean 10\*); circumpeduncular scales 12-14 (mean 13.2). Gill rakers on outer face of first arch 1+5 (1), 2+6 (2), 2+7 (2), 3+6 (1). Vertebrae 12+14 (1), 12+15 (2). Neural spines of second and third vertebrae slender, pointed (2). Two epurals (2). Four (2) anal pterygiophores before haemal spine of first caudal vertebra.

Body compressed, may be less so anteriorly, body width at anus 8.9-32.9 % SL (mean 14.2 %) (Table 8). Head compressed, deeper than wide, length 27.6-33.1 % SL (mean 30.2 %). Depth at posterior preopercular margin 66.7-81.6 % HL (mean 73.1 %). Width at posterior preopercular margin 47.1-72.5 % HL (mean 61.6 %). Mouth subterminal, oblique to slightly oblique, forming an angle of about 20-25° with body axis; jaws generally reaching to below rear part of eye or to behind eye in males and to below mid-eye in females (behind eye in male lectotype). Lips smooth, lower lip free at sides, narrowly fused across front. Upper jaw 31.7-68.7 % HL (mean 34.6 % in females, 58.2 % in males). Eye lateral, high on head, top usually forming part of dorsal



profile, 23.9-35.8 % HL (mean 30.8 %). Snout flattened to slightly pointed, 20.6-31.6 % HL (mean 27.0 %). Interorbital narrow, flat, 9.1-21.7 % HL (mean 15.8 %). Body depth at anal origin 20.9-26.3 % SL (mean 24.1 %). Caudal peduncle compressed, length 25.2-31.1 % SL (mean 28.2 %). Caudal peduncle depth 12.4-15.2 % SL (mean 13.7 %).

First dorsal fin rounded, moderately low, second or third spines longest or subequal; spines not much longer in males than in females; spines barely reaching second dorsal fin origin when depressed. First dorsal spine length 14.0-14.7 % SL (mean 14.4 %). Second dorsal spine length 13.8-14.8 % SL (mean 14.3 %). Third dorsal spine length 12.9-18.2 % SL (mean 14.8 %). Fourth dorsal spine length 12.9-15.8 % SL (mean 14.7 %). Second dorsal and anal fins short-based, moderate in height, fin rays all about equal in height, rays falling well short of caudal fin base when depressed. Pectoral fin oval to rounded, central rays longest, 22.9-28.7 % SL (mean 25.6 %); rays all branched but for lower and uppermost rays. Pelvic fins oval, reaching to anus or to first anal fin ray, 24.2-28.0 % SL (mean 26.2 %). Caudal fin short, truncate to rounded, 26.1-32.0 % SL (mean 23.8 %).

No mental frenum, chin area reduced. Anterior nasal opening short, tubular, placed just behind upper lip, oriented down and forward. Posterior nasal opening narrow, oval, placed very

close to front centre margin of eye. Gill opening restricted to pectoral fin base or extending forward to just under opercle. Inner edge of shoulder girdle occasionally smooth, usually with bony or fleshy edge and one or two fleshy knobs or short flanges. Gill rakers on outer face of first arch reduced, rakers very short fleshy knobs, longest rakers near angle of arch. Tongue tip blunt to rounded. Teeth in upper jaw in 1-2 rows laterally, 2-5 rows across front of jaw, teeth at side of jaw small, sharp and evenly sized; outermost teeth across front of jaw large, stout, curved and sharp. Teeth in lower jaw similar to those in upper jaw but 2-4 rows present across front of jaw, teeth stout and sharp. In adult males with enlarged jaws, teeth at side of jaw mostly absent and front teeth enlarged and stoutly curved.

Predorsal scales mostly ctenoid, may be cycloid scales anteriorly; scales present up to behind eyes. Operculum scales ctenoid. Cheek naked. Pectoral base covered with cycloid scales. Prepelvic area covered with small cycloid scales. Belly scales usually ctenoid. Ctenoid scales on side of body.

Genital papilla in males a fleshy flattened oval, with pointed tip, whitish to dusky with whitish tip; in females papilla short, fleshy and rounded with pointed tip, may have faint ventral groove, unpigmented or with light dusting of melanophores.

Head pores and sensory papillae pattern as in Figure 11.

Table 8. Morphometrics of *Redigobius dewaali*.

	males (n=16)		females (n=15)	
	range	mean	range	mean
<b>Percentage of standard length</b>				
Head length	27.9-33.1	31.1	27.6-30.2	29.0
Body depth	20.9-25.8	24.0	23.1-26.3	24.1
Body width	11.2-30.0	14.3	8.9-32.9	13.7
Length of caudal peduncle	25.2-31.8	27.9	26.8-30.4	28.6
Depth of caudal peduncle	12.4-15.3	13.9	12.9-13.9	13.4
Length of pectoral fin	23.2-28.7	25.7	22.9-27.5	25.1
Length of pelvic fin	24.2-28.0	26.3	24.5-27.9	26.1
Length of caudal fin	26.8-32.0	29.7	26.1-29.2	27.6
Longest D1 spine	14.5-18.2	15.7	12.9-14.7	14.0
<b>Percentage of head length</b>				
Head depth	68.5-81.6	75.5	66.7-77.4	70.5
Head width	47.1-72.5	61.1	55.9-65.2	61.4
Snout length	22.1-31.6	27.7	20.6-29.5	26.0
Eye width	23.9-35.8	29.1	30.4-34.9	32.3
Jaw length	43.3-68.7	58.2	31.7-43.8	34.6
Interorbital width	10.6-20.2	16.1	9.1-21.7	14.7



Fig. 9. *Redigobius dewaali*, ZMA 103.238, male, 28 mm SL; lectotype of *Gobius dewaali*; Natal: Umgeni River. Photograph by Doug Hoese.



Fig. 10. *Redigobius dewaali*, a, freshly dead male and b, female; Madagascar. Photographs by Roger Bills.

**Coloration of preserved material.** Head and body whitish to pale yellowish brown, with scale margins on upper three-quarters of body broadly to narrowly outlined with brown, giving diffuse brownish appearance; five to seven vertical to somewhat oblique dark brown bars of variable height along mid-side of body, one or more bars may be replaced by brown blotch; dusky blotch above pectoral fin base. Two dark brown blotch-

es on base of caudal fin, placed above and below midline, sometimes coalescing with posteriormost dark brown blotch on body, forming Y-shape. Abdomen and underside of head plain yellowish white to faintly dusky; branchiostegal membranes may be dark in large males. Ventral midline of caudal peduncle with four large blackish to dark brown spots (partly internal); in some specimens these spots hardly visible. Side of head with three

or five slightly obliquely curved brown stripes, running from eye and upper part of preopercle back toward pectoral fin base; brown stripes may be partly broken-up and are variable in shape. Dark brown blotch from front of eye extending onto anterior half of lips and onto chin; snout, lips and chin plain brown in adult males.

First dorsal fin transparent to translucent, with three diffuse brown stripes, uppermost along fin margin, and large rounded black blotch on posterior part of fin, between third to sixth (or fourth to fifth) spines. Second dorsal fin transparent to translucent with three diffuse dusky brownish stripes, uppermost below transparent fin margin; may be scattered brown speckling and blotches along base of fin. Caudal fin translucent, lightly speckled with brown; plain brown in large males, with indistinct speckling near base. Anal fin transparent with broad blackish to brown vertical bar running from first midventral black blotch to fin margin (falling short in females); similar bar from second midventral black blotch extending to tips of posteriormost fin rays; in large males entire fin may be plain brown. Pectoral fin transparent to faintly speckled with brown, fin rays narrowly edged with brown. Pelvic fins translucent to dusky or plain brown, more heavily pigmented in centre of disk.

**Coloration of fresh material.** Based on colour slides by Roger Bills (Fig. 10). Pattern as in preserved material. Head and body light golden brown to fawn with scale margins outlined in brown forming reticulate pattern; bars and blotches along side of body dark brown; in male, area between lateral dark bars on posterior half of body with some indistinct speckling of iridescent green and golden green. Mid-ventral blotches along caudal peduncle diffuse blackish to black. Oblique stripes on head warm brown; in male, head markings almost purplish brown, also lips, chin and underside of head; underside of head whitish in female. Belly whitish in both sexes, but dusky anteriorly in male; pale orange eggs showing through abdominal wall in ripe female. Eye dark golden-brown.

First dorsal fin pink to light reddish with three broad brown bands and dense black spot posteriorly (may be blue or surrounded by blue when live); lower two bands may coalesce into single broad diffuse band. Second dorsal fin pale pink, darker basally, with two brown bands and dusky grey band just lower narrow pinkish margin. Anal

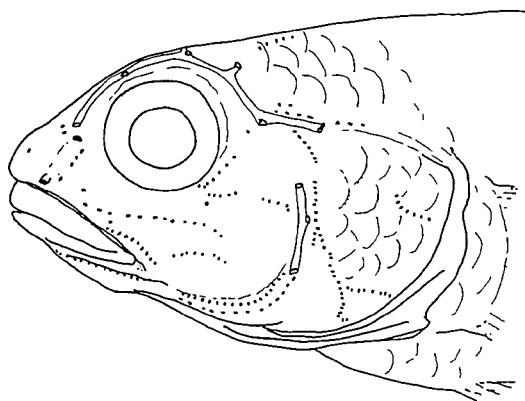


Fig. 11. *Redigobius dewaali*, AMS I.27101-001, female, 26.5 mm SL; headpores and papillae pattern.

fin faintly pink to dusty pinkish grey with blackish vertical bars. Caudal fin transparent with pale brownish to fawn fin rays, speckled with brown basally. Pectoral fin transparent with pale fawn to brownish fin rays. Pelvic fins transparent to whitish; in male, dusky patch in centre of disk.

A colour illustration in Skelton (1993b) shows the golden-brown body with blackish bars, blotches and dorsal saddles; the black spot in the first dorsal fin is narrowly outlined in red, the second dorsal fin margin is red, the anal fin has two broad reddish bands and the caudal fin is plain translucent.

**Comparisons.** This species somewhat resembles *R. bikolanus* in body colour pattern, differing from it in having five to seven dark vertical to oblique bars along the side of the body (versus one or two bars on anterior half of body), a low rounded first dorsal fin with no elongate spines (versus triangular to pointed first dorsal fin, often with first spine elongate) and stripes on head curving obliquely back (versus oblique stripes angled forward). Sometimes the anteriormost body band is darker than others, and the four dark spots along the ventral midline of the caudal peduncle are conspicuous and black, resembling the markings seen in *R. bikolanus*.

**Distribution.** Known from southern Africa (from the Kariega River northwards to the Limpopo); Madagascar (R. Bills, pers. comm.) and Mozambique.

**Ecology.** This species is found in warm temperate estuaries, rivers and freshwater lakes, where

it inhabits clear shallow areas with aquatic vegetation, feeding on small crustaceans and insect larvae (Skelton 1993). Kyle (1993) described *R. dewaali* attempting to migrate upstream, gathering in large shoals of several thousand fish, below the Pongolo River barrage in Ndumu Game Reserve, Kwa-Zulu. Many fishes were observed feeding on the *Redigobius*, and one tigerfish (*Hydrocynus vittatus*) had over 35 of them in its gut. Strydom & Neira (2006) described the larval stages of this species and discovered that they were only found in permanently open estuaries.

*Redigobius dewaali* has been described as rare by Skelton (1993), as its preferred estuaries are threatened by riverine habitat deterioration.

**Remarks.** The lectotype ("lectoholotype") of *Gobius dewaali* was selected by Matthes (1964); he stated that a 21 mm specimen, ZMA 103238, Umgeni River, was to be lectotype as the holotype (41 mm TL) was missing. Weber (1897) did not designate nor illustrate a holotype; possibly Matthes assumed that the largest specimen mentioned by Weber ("4.1 cm lang") was the holotype (when Weber's specimens were actually syntypes). Among the paralectotypes, the 11 specimens in ZMA 103.240 are *Pandaka*.

*Gobius maxillaris* Davies, 1948, is a primary homonym of *Gobius maxillaris* Macleay, 1878 (a junior synonym of *Mahidolia mystacina*). The type specimens (holotype and four paratypes) may be at BMNH (not researched).

Kok & Blaber (1977) called this fish 'blue-spot goby', while Skelton (1993) gives the South African common name of 'checked goby' to this fish.

### *Redigobius dispar* (Peters, 1868)

(Figs. 12-13)

*Gobius dispar* Peters, 1868: 264 (type locality: Lake Buhi & Lake Batu, Kolabos and Lebmanan brooks, Luzon, Philippines).

*Gobius sternbergi* Smith, 1902: 169, fig. (type locality: Lake Buhi, Philippines); Koumans 1940: 128-129.

? *Gnatholepis sternbergi*: Seale & Bean, 1907: 248 (Zamboanga, Mindanao).

*Gnatholepis* (?) *sternbergi*: Jordan & Richardson, 1910: 47.

(*Gobius*) *dispar*: Jordan & Richardson, 1910: 51 [as species incertae sedis].

*Redigobius sternbergi*: Herre, 1927: 98-99.

*Vainosa dispar*: Herre, 1927: 142-145.

*Cyprinogobius dispar*: Koumans, 1937: 13.

*Pseudogobius dispar*: Aurich, 1938: 164 (Bato Lake).

*Redigobius dispar*: Koumans, 1940: 185, 1953: 104-105; Kottelat et al., 1993: 151; Larson, 2001: 207, figs 205, 207, 209.

? *Redigobius dispar*: Koumans, 1940: 137.

**Material examined.** PHILIPPINES: ZMB 6702, lectotype of *Gobius dispar*, male, 42 mm SL; ZMB 33908, 6 paralectotypes, 35.5-38 mm SL; ZMB 6703, 4 paralectotypes, 30-36 mm SL; Luzon; Jagor. – ZMB 6700, 11 paralectotypes of *Gobius dispar*, 40-41 mm SL; Lake Batu, Luzon; Jagor. – ZMB 6705, 8 paralectotypes of *Gobius dispar*, 31-34 mm SL; Kalabos stream, Luzon; Jagor. – USNM 50536, 1 syntype of *Gobius sternbergi*, 24 mm SL; Luzon. – ZMH 743, 2; Lake Bato; Woltereck, 1932. – USNM 263330, 29, 14.5-32 mm SL; AMS I.24411-001, 2; Lake Buhi, Camarines Sur Province, Bicol region, Luzon; T. Roberts, 27 Apr 1976. – AMS I.25050-001, 2; Lake Buhi/Dunae; B. Grindelberger, 1980.

**Material examined but no data taken.** USNM 341238, 647; Lake Buhi, Camarines Sur Province, Luzon. – AMS I.25017-001, 1; Lake Buhi, Luzon.

**Diagnosis.** A compressed-bodied *Redigobius* with row of X-shaped dark blotches along mid-side of body; distinct blackish W-shaped shoulder blotch present and pale spots on side of head; nasal pores absent; lateral canal and pore over preopercle usually absent; second dorsal and anal fin rays modally 1,7; pectoral rays 15-20, modally 18; longitudinal scales 23-31; TRB 8-11; predorsal scales 9-14; circumpeduncular scales 12. Known only from freshwater lakes and streams in Luzon, Philippines.

**Description.** Based on 27 specimens, 19.5-42 mm SL. An asterisk indicates the counts of the lectotype of *Gobius dispar* (Fig. 12).

First dorsal VI\*; second dorsal 1,7\*-1,8 (modally 1,7); anal 1,6-8 (modally 1,7\*); pectoral rays 15-20\* (modally 18); segmented caudal rays 16-17\* (nearly always 17), caudal ray pattern usually 9/8\*; branched caudal rays 7/6 (in 4), 7/7 (17), 8/7\* (4); procurvent caudal rays 7/6 (1), 7/7 (1); longitudinal scale count 23-31 (mean 26; 25 in lectotype); TRB 8-11 (mean 9\*); predorsal scale count 9-14 (mean 11, 12 in lectotype); circumpeduncular scales 11-15 (mean 12.7; 12 in lectotype). Gill rakers on outer face of first arch 2+5(1), 2+7(1), 3+6(1). Vertebrae 11+15(15), 11+16(3), 12+14(1). Neural spines of first three slender,



**Fig. 12.** *Redigobius dispar*, ZMB 6702, male, 42 mm SL; lectotype of *Gobius dispar*; Philippines: Luzon. Photograph by Rex Williams.

second or third spines often blunt-tipped. Two epurals (17), fused in one. Two (in 2), three (15) or four (2) anal pterygiophores before haemal spine of first caudal vertebra.

Body compressed, somewhat less so anteriorly; body width at anus 8.2-14.7 % SL (mean 11.2 %) (Table 9). Head compressed, deeper than wide, length 27.8-35.8 % SL (mean 32.6 %). Head depth at posterior preopercular margin 58.7-83.6 % HL (mean 70.6 %); width at posterior preopercular margin 44.4-58.3 % HL (mean 52.8 %); head appearing enlarged in some males. Mouth large, terminal, oblique, forming an angle of about 30° with body axis; jaws reaching well behind eye in adult males and to below mid-eye to posterior margin of eye in adult females. Lips smooth;

lower lip free at sides, fused across front. Upper jaw 32.1-71.8 % HL (mean 36.7 % in females, 59.7 % in males). Eye lateral, high on head, not forming part of dorsal profile, 17.8-31.9 % HL (mean 25.3 %). Snout rounded to slightly pointed, 19.4-29.0 % HL (mean 24.1 %). Interorbital moderately wide and flat, 12.5-25.5 % HL (mean 20.3 %). Body depth at anal origin 20.4-25.3 % SL (mean 22.5 %). Caudal peduncle compressed, length 24.4-30.7 % SL (mean 27.1 %). Caudal peduncle depth 11.0-13.8 % SL (mean 12.1 %).

First dorsal fin low, rounded to slightly triangular, without elongate spines, first three spines about equal; tips just reaching second dorsal fin rays when depressed. Third dorsal spine length 12.8-15.9 % SL (mean 14.1 %). Fourth dorsal spine

**Table 9.** Morphometrics of *Redigobius dispar*.

	lectotype	males (n=15)		females (n=12)	
		range	mean	range	mean
<b>Percentage of standard length</b>					
Head length	33.6	31.1-35.8	33.5	27.8-33.9	31.5
Body depth	23.3	20.3-24.7	22.2	20.4-25.3	22.7
Body width	10.0	8.2-14.7	10.6	10.0-14.4	11.8
Length of caudal peduncle	25.7	24.5-29.7	27.2	24.4-30.3	27.1
Depth of caudal peduncle	11.9	11.3-13.8	12.1	11.0-13.3	12.1
Length of pectoral fin	25.0	23.1-28.0	24.8	21.7-24.8	23.2
Length of pelvic fin	20.7	19.8-23.1	21.6	18.6-23.8	21.7
Length of caudal fin	25.0	25.0-30.3	27.3	23.1-28.7	25.7
Longest D1 spine	14.3	13.2-15.9	14.9	12.6-14.8	13.6
<b>Percentage of head length</b>					
Head depth	72.3	61.8-83.6	74.3	58.7-78.0	66.8
Head width	47.5	44.4-63.1	52.4	50.0-58.3	54.0
Snout length	24.8	23.6-29.0	25.6	19.4-24.1	22.6
Eye width	19.9	17.8-28.1	22.9	23.0-31.9	27.4
Jaw length	64.5	38.2-71.8	59.7	32.1-39.8	36.7
Interorbital width	16.3	16.3-25.5	21.4	12.5-22.7	18.8



Fig. 13. *Redigobius dispar*, AMS I.24411-001, 31.5 mm SL, male; Philippines: Luzon: Lake Buhi. Photograph by Rex Williams.

length 12.6-15.9 % SL (mean 14.4 %). Second dorsal and anal fins short-based, anterior and posterior rays subequal, rays falling well short of caudal fin when depressed; second dorsal fin slightly pointed anteriorly; anal fin somewhat rounded anteriorly. Pectoral fin oval, central rays longest, 21.7-28.0 % SL (mean 24.1 %); rays all branched but for upper and lowermost ray. Pelvic fins rounded to oval, reaching to anus or nearly so, 18.6-23.8 % SL (mean 21.6 %). Caudal fin rounded to slightly truncate, 23.1-30.3 % SL (mean 26.4 %).

No mental frenum, chin smooth. Anterior nasal opening with low rim or very short tube, placed just behind upper lip. Posterior nasal opening oval, placed close to front centre margin of eye. Gill opening extending forward to under opercle. Inner edge of shoulder girdle smooth, five specimens observed with small fleshy knob or thin flange present. Gill rakers on outer face of first arch very short rudimentary knobs, largest near angle of arch. Tongue tip blunt to rounded. Teeth in upper jaw in 1-4 rows across front of jaw, 1-2 rows along side; teeth small and sharp and evenly sized; largest teeth across front of jaw, may be widely spaced and enlarged in adult males. Teeth in lower jaw similar to those in upper jaw but outer teeth across front of jaw smaller than those in upper jaw.

Predorsal scales cycloid. Operculum with cycloid scales, may be few present only on upper half. Cheek naked. Pectoral base with small cycloid scales. Prepelvic area covered with small cycloid scales. Belly usually with cycloid scales, may have ctenoid scales anteriorly or patch in centre. Ctenoid scales on side of body.

Head pores as in Figure 1. No nasal pores. Lateral canal and pore over preopercle usually absent, present in 10 specimens (plus one with a

short detached canal on left side only). Usually three preopercular pores, two in six specimens. Sensory papillae pattern as in Figure 1.

**Coloration of preserved material.** Head and body pale yellowish brown to whitish brown, with upper two-thirds of body dusky brown and series of about 10-12 distinct dark brown to blackish X-shaped marks and/or short vertical bars along mid-side of body, anteriormost bar darkest, may be black, dense dark brown to black narrow W-shaped blotch just above pectoral fin base; indistinct brownish saddles and cross-hatching on dorsum (Fig. 13). Base of caudal fin with small central brown blotch, may be faint or intense; similar small blotches may be present above and below central blotch, but placed mostly on fin itself.

Head brownish dorsally, side of head light brownish with indistinct brown-edged whitish bar from eye to middle of jaw (may appear as two short brown bars) and small scattered whitish spots over cheek and opercle, whitish spots more distinct, numerous and rounded in ZMB specimens (possibly due to preservation techniques). Distinct dark brown spot at upper rear edge of eye, placed over postorbital pore; may be a second paler brown spot anterior to this. Upper rear corner of opercle with dark brown irregular blotch, contiguous with W-shaped shoulder spot above pectoral base. Underside of head usually plain brownish, may be scattered small whitish spots and short vermiculate markings in adult males.

First dorsal fin transparent with two brown bands, one basal, one central, fin margin transparent; brown bands may be broken up into rows of spots or blotches or with rounded whitish to transparent spots enclosed within central dark band; entire fin may be dusky brown with broad



Fig. 14. *Redigobius lekutu*, NTM S.16756-001, female, 34 mm SL; holotype; Fiji: Vanua Levu, Lekutu River.

transparent margin. Second dorsal fin transparent with three or four diffuse brownish bands, outermost on fin margin; bands usually irregular or blotchy; in large males fin dark brown with bands coalescing and indistinct. Caudal fin transparent to light brown, spotted with brown near base or with faint rows of brown spots crossing fin. Anal fin plain dusky brown. Pectoral fin transparent to faintly dusky. Pelvic fin dusky brownish, including frenum, contrasting with pale belly.

**Coloration of fresh material.** No information available.

**Comparisons.** This species is unique within *Redigobius* in lacking nasal pores, and the oculo-scapular canal over the opercle is often absent. It is similar to *R. leptochilus* and *R. tambujon* in body form and coloration.

**Distribution.** Apparently endemic to several freshwater lakes of Luzon, Philippines (Bato and Buhi Lakes) and at least two streams. The single specimen from Mindanao reported by Seale & Bean (1907) is probably another species.

The "probably" *Redigobius dispar* specimens from the old harbour canal of Batavia (Jakarta), held at University of Michigan collection and mentioned by Koumans (1940; 1953) may belong to another species (they have not been examined for this work).

**Ecology.** Known from fresh water lakes of Camarines Sur Province. Many specimens examined for this study had been heavily parasitised by copepods.

**Remarks.** As *Redigobius dispar* is the senior synonym of the type species of the genus *Redigobius* (*Gobius sternbergi*), I designate a 42 mm SL male from ZMB 6702 as lectotype of *Gobius dispar* Peters, to preserve stability. The remaining six paralectotypes (35.5-38 mm SL) are now in ZMB 33908. There are several paralectotypes that have not been examined (BMNH 1868.7.10.12-15, 4, 33-44 mm SL), while probable syntypes are in ZMB 6737-6738 (H. Paepke (pers. comm. 1988) said there was "controversy" over the types).

The description of *Gobius sternbergi* Smith, 1902, the type species of the genus *Redigobius*, was based on six specimens (USNM 50536). Presently there are only three specimens in USNM 50536, 17.5-24 mm SL, all female.

***Redigobius lekutu*, new species**  
(Figs. 14-15)

*Redigobius* n. sp.: Jenkins, 2003: 16 (unpaginated).

**Holotype.** NTM S.16756-001, female, 34 mm SL; Fiji: Vanua Levu: upper Lekutu River near Kavula River; A. Jenkins & party, 9 Feb 2003.

**Paratypes.** All from Fiji: Vanua Levi: NTM S.16756-002, 56, 7.5-23.5 mm SL; same data as holotype. – AMS I.44806-001, 2, 23.5-26 mm SL; QM I.38424, 2, 24-24 mm SL; Station 4, Navuturerega Creek, Dreketi River; D. Boseto & party, 17 Aug 2006. – WAM P.33080-001, 4, 22-30 mm SL; Navuturerega Creek, Dreketi River, Station 4; D. Boseto & party, 15 Aug 2006. – NTM S.16764-001,

14, 9-21.5 mm SL; Station 1, Nasuva Creek, upper Dreketi River; A. Jenkins & party, 9 Aug 2006. – NTM S.16765-001, 40, 10-31.5 mm SL; site 60, upper Lekutu River; A. Jenkins & party, Sep 2003.

**Additional material (non-type).** NTM S.16766-001, 1; Batiri River, Dreketi River. – NTM S.16767-001, 11; Mba River, near Koro.

**Diagnosis.** A slender-bodied *Redigobius* distinguished by a mid-lateral dark band formed by seven to eight brown blotches and series of narrow vertical dark brown bars along mid-side; VII first dorsal fin spines; first dorsal fin low, rounded; second dorsal and anal rays usually I,7; pectoral rays 15-17, usually 15; longitudinal scales 26-29; TRB 8-9; predorsal scales 7-10; usually 12 circumpeduncular scales. Known only from two river systems in Vanua Levu, Fiji.

**Description.** Based on 26 specimens, 14-34 mm SL. An asterisk indicates the counts of the holotype (Fig. 14).

First dorsal VI (in 2), VII\* (24); second dorsal I,6-I,8\* (usually I,7); anal I,6-8 (usually I,7\*); pectoral rays 15-17\* (usually 15); segmented caudal rays usually 17\* (16 in 2), caudal ray pattern 9/8\* (23) or 9/7(2); branched caudal rays 6/5 (1), 7/5(1), 7/6(9), 7/7(7), 8/7(7) (8/7 in holotype); longitudinal scale count 26-29 (mean 27, 28 in holotype); TRB 8-9 (usually 8\*); predorsal scale

count 7-10 (mean 9\*); circumpeduncular scales 12-13 (mean 12.1; holotype 12). Gill rakers on outer face of first arch 0+4(1), 1+5(1), 2+5(1), 2+6(2). Pterygiophore formula 3-12211(2), 3-11211(1), 3-13111(1). Vertebrae 13+15(5), 13+16(2), 14+15(1). Two epurals (5). Three (1) or four (4) anal pterygiophores before haemal spine of first caudal vertebra.

Head and body slender, compressed; body width at anus 9.2-23.6 % SL (mean 11.8 %). Body depth at anal-fin origin 15.9-22.1 % SL (mean 19.4 %) (Table 10). Head deeper than wide, length 25.0-32.9 % SL (mean 28.2 %). Head depth at posterior preopercular margin 55.9-71.7 % HL (mean 63.9 %). Head width at posterior preopercular margin 53.7-66.7 % HL (mean 59.7 %). Mouth terminal, slightly oblique, forming an angle of about 20° with body axis; jaws generally reaching to below mid-eye in both sexes; jaws reaching to below posterior margin of eye in single large male specimen (31.5 mm SL) available for study. Lips usually smooth; lower lip free at sides, fused across front. Upper jaw 30.4-52.6 % HL (mean 34.9 % in females, 37.1 % in males). Eye lateral, high on head, top usually forming part of dorsal profile, 22.1-33.3 % HL (mean 29.1 %). Snout rounded, 20.0-29.5 % HL (mean 24.0 %). Interorbital narrow, 7.1-12.5 % HL (mean 9.4 %). Caudal peduncle compressed, length 21.7-28.9 % SL (mean 25.7 %). Caudal peduncle depth 10.0-13.1 % SL (mean 11.8 %).

Table 10. Morphometrics of *Redigobius lekutu*.

	holotype	males (n=12)		females (n=14)	
		range	mean	range	mean
<b>Percentage of standard length</b>					
Head length	27.6	27.2-32.9	29.4	25.0-31.0	27.4
Body depth	20.3	18.4-20.8	19.6	15.9-22.1	19.3
Body width	10.3	9.8-13.1	11.9	9.2-23.6	11.8
Length of caudal peduncle	25.0	23.8-28.9	27.4	21.7-27.1	24.6
Depth of caudal peduncle	11.5	11.9-13.1	12.4	10.0-12.7	11.4
Length of pectoral fin	27.4	21.6-26.9	24.6	17.5-27.4	24.1
Length of pelvic fin	20.6	21.0-25.3	23.1	3.0-23.9	19.7
Length of caudal fin	27.6	25.8-30.2	27.8	22.3-27.7	25.5
Longest D1 spine	15.3	12.4-19.4	14.8	11.0-15.3	13.1
<b>Percentage of head length</b>					
Head depth	69.1	58.9-67.2	63.4	55.9-71.7	64.2
Head width	63.8	55.4-62.3	58.4	53.7-66.7	60.5
Snout length	24.5	21.7-29.5	24.3	20.0-25.4	23.8
Eye width	27.7	22.1-32.7	28.5	26.7-33.3	29.5
Jaw length	34.0	30.4-52.6	37.1	32.3-38.7	34.9
Interorbital width	8.5	7.1-11.1	9.4	8.3-12.5	9.4



First dorsal fin relatively low, rounded, third and fourth spines longest or subequal; spines not much longer in males than females; spines not reaching second dorsal fin origin when depressed, except in adult male. First dorsal spine always shorter than next three. Third dorsal spine length 11.0-15.3 % SL (mean 13.0 %). Fourth dorsal spine length 11.0-19.4 % SL (mean 13.8 %). Second dorsal and anal fins taller than first dorsal fin, posteriormost rays not much longer than rays in middle of fin, falling well short of caudal fin origin when depressed, except in adult male, in which posteriormost dorsal and anal fin rays longer and reaching to caudal fin when depressed. Pectoral fin oval, central rays longest, 17.5-27.4 % SL (mean 24.3 %); rays branched but for upper and lowermost. Pelvic fins short, rounded to oval, reaching about two-thirds of distance to anus, 18.3-25.3 % SL (mean 21.0 %). Caudal fin rounded, 22.3-30.2 % SL (mean 26.5 %).

No mental frenum, chin smooth. Anterior nasal opening in very short tube, placed behind upper lip. Posterior nasal opening oval to round, placed close to front centre margin of eye. Gill opening restricted to pectoral fin base or extending forward to just under opercle. Inner edge of shoulder girdle always smooth. Gill rakers on outer face of first arch rudimentary low stubby nubs. Tongue large, tip rounded to slightly pointed. In males, lower jaw with about 4 rows of sharp stout curved teeth crowded at front, largest teeth in innermost row and largest teeth posteriorly; side of jaw with single row of low sharp teeth. Upper jaw teeth similar, but teeth at front larger, more curved and conspicuous. Teeth in females arranged similarly but all teeth small and evenly sized (front row teeth not larger than those at side), not particularly curved.

Predorsal scales cycloid. Operculum scales cycloid; may be naked or only partly scaled in some specimens. Cheek naked. Pectoral base naked. Prepelvic area with small cycloid scales; ctenoid scales present toward side of body. Belly scales cycloid. Ctenoid scales on side of body.

Male genital papilla flattened, slender and pointed to slightly rounded at tip. Female genital papilla enlarged and bulbous, with large opening. One female (WAM P.33080-001) with anus surrounded by fleshy rim and small fingerlike lobes; fleshy rim joined to genital papilla.

Head pores and sensory papillae pattern as shown in Figure 16.

**Coloration of preserved material.** Head and body brown to pale brown or pale yellowish, always lighter ventrally, with scale margins usually broadly outlined with brown on dorsal half of body and nape, centre of scale pale. Side of body with mid-lateral broad dark brown band extending from just above pectoral fin base to caudal fin base; band on body may be formed partly by a row of short vertical dark brown bars, especially toward posterior half of body; lower half of body usually plain whitish to pale yellowish. Pectoral fin base brown dorsally, paler ventrally, with dark brown to blackish blotch on upper part of base; blotch may be reduced or occupy most of upper half of fin base. Breast pale to dusky brown with scale margins narrowly outlined with light to dark brown, in both sexes. Belly pale yellowish. Base of male genital papilla blackish; papilla itself pale to dusky. Female genital papilla pale with narrow ring of dark pigment around opening.

Head light brown to brown, including underside and branchiostegal membrane, darkest dorsally; diffuse oblique brown to light brown line running from below eye back along top of opercle and ending at diffuse dark blotch at upper rear corner of opercle; short oblique brown bar from front of eye reaching to edge of upper lip (bar may be diffuse or nearly indistinguishable from background colour). Lips plain brown to brownish grey.

First dorsal fin mostly translucent to dusky grey, lighter in smaller specimens, with transparent band running just above base of fin; fin ray bases with dark grey spots and/or vertical streaks; may be diffuse blackish area (not forming distinct spot or blotch) at rear of fin just above transparent band. Second dorsal fin transparent to pale dusky, with three to four irregular slightly oblique dark brown lines or rows of spots, lowermost row just above fin base; fin margin plain dusky; in adult male, fin plain brown with indistinct brown lines and rows of brown spots. Anal fin plain brown to dark brown; in adult male, fin edged with grey to dark grey. Caudal fin translucent to dusky greyish brown, with about five vertical dark grey to brown narrow lines or bars (intensity variable) crossing fin, anteriormost bar right on hypural crease; indistinct dark brow streaks may follow fin rays; vertical lines/bars indistinct in some specimens (such as adult male). Pectoral fin faintly speckled to dusky brown. Pelvic fins



Fig. 15. *Redigobius lekutu*, aquarium kept. Fiji: Vanua Levu. Photograph by Aaron Jenkins.

dusky to dark brown; may be more intense pigment following fin rays.

**Coloration of fresh material.** Based on two colour photographs; one of captive adult male by John Pogonoski (see Jenkins 2003: 16) and one of captive female, by Aaron Jenkins (Fig. 15).

Head and body yellowish to greyish orange, head greyish brown in males; scale margins outlined in brown to dark brown on upper half of body, scales on lower part edged in orange-brown to orange, fading ventrally. Mid-lateral dark band along body formed by seven to eight brown blotches and a somewhat indistinct series of narrow vertical dark brown bars along mid-side. Head and body paler ventrally, yellowish to white. Pectoral fin base brownish (markings not discernible in photographs). Iris red-brown to gold.

First dorsal fin pale greyish orange with red-brown lines and streaks, distal third of fin greyer than rest. Second dorsal fin with proximal two-thirds pale greyish orange with red-brown lines; in male, distal third transparent with narrow dusky grey margin. Caudal fin transparent to faintly yellowish, barred with dark brown (plain dusky in adult male). Anal and pelvic fins plain dusky grey. Pectoral fin transparent with yellowish to dusky grey fin rays.

**Comparisons.** *Redigobius lekutu* differs from all other *Redigobius* species by the first dorsal fin nearly always having VII spines. It most closely resembles *R. tambujon* in basic form and pattern, but the two species differ in that *R. lekutu* has a low pectoral fin ray count of 15-16 (versus 17-18 in *R. tambujon*), anal rays usually 1,7 (usually 1,6 in *R. tambujon*), its fourth D1 spine is usually

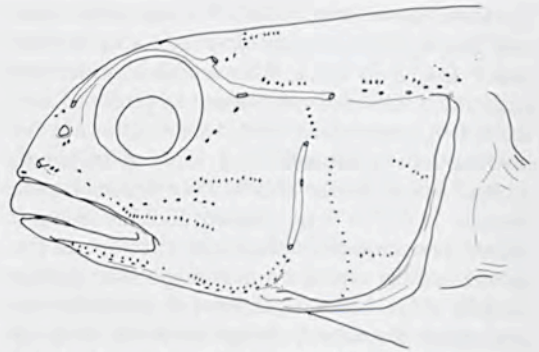


Fig. 16. *Redigobius lekutu*, WAM P.33080-001, male, 30 mm SL; headpores and papillae pattern.

longest (versus first spine usually longest) and the first dorsal fin has stripes but no dense black spot (black spot present in *R. tambujon*). The differences in colour pattern are especially noticeable when alive.

*Redigobius lekutu* differs from the other Fiji endemic *Redigobius*, *R. leveri*, by its anal-fin rays usually 1,7 (always 1,6 in *R. leveri*), its first dorsal fin with stripes but no black spot (oval black spot present in *R. leveri*) and the side of the body has a dark band formed by seven to eight brown blotches and narrow vertical dark brown bars (side with narrow dark vertical bars and squares and a ventral row of round spots in *R. leveri*).

**Distribution.** Restricted to the Lekutu and Dreketi River systems on the island of Vanua Levu, Fiji.

**Etymology.** Named *lekutu* for the Fijian river system in which this endemic species was first obtained. A noun in apposition.

**Ecology.** Known only from freshwater habitats. Jenkins (2003) first reported on the species and provided habitat data and site photographs. The species is known only from the Lekutu and Dreketi River systems, in lowland (below 150 m elevation) freshwater creeks and rivers. The habitat of the Lekutu River, where the species was first collected, was clear darkly stained water over rough fused rock and conglomerate substrate which formed pools and riffles. The fish was observed to form mid-water schools or sit on the substrate (Jenkins 2003).



Fig. 17. *Redigobius leveri*, aquarium kept; Fiji: Viti Levu: Wailoku, Vago Creek; a, male; b, female. Photographs by Paddy Ryan.

*Redigobius leveri* (Fowler, 1943)  
(Figs. 17-18)

*Vaimosa leveri* Fowler, 1943: 1, pl. 1, figs 1-3 (type locality: Waivivesi [lapsus for Nainivesi], Fiji), 1944: 182.

*Mugilogobius leveri*: Fowler, 1949: 136.

*Gobius leveri*: Ryan, 1980: 65.

*Redigobius leveri*: Hoese, in Bohlke, 1984: 107; Larson, 2001: 232; Jenkins, 2003: 15 [unpaginated].

**Material examined.** FIJI. ANSP 70196, holotype of *Vaimosa leveri*, 20 mm SL; ANSP 70197, 1 paratype, 19 mm SL; on steep rocks near waterfall, Waivivesi [= Wainivesi, tributary of Rewa River, Viti Levu]; R. A.

Lever, 30 Mar 1941. – NTM S.16753-001, 6, 23.5–44.5 mm SL; Savura Creek, Viti Levu; A. Jenkins, D. Boseto & S. Malo, 31 Jan 2003. – NTM S.16755-001, 2, 32.5–36.5 mm SL; just above dam after bridge on Savura Creek, Viti Levu; A. Jenkins & D. Boseto, 25 Jul 2002. – WAM P.33079-001, 1, 41.5 mm SL; below the falls, Savura Creek, Viti Levu; A. Jenkins & D. Boseto, 31 Jan 2003. – QM I.38423, 1, 24.5 mm SL; Tavoro Creek, Tavenui; A. Jenkins & D. Boseto, 22 Oct 2002. – AMS I.44805-001, 1, 21.5 mm SL; Tavoro Creek, Tavenui; A. Jenkins & D. Boseto, 21 Oct 2002.

**Material examined but no data taken.** NTM S.16754-001, 1; Savura Creek, Viti Levu.

**Diagnosis.** A slender-bodied *Redigobius* with side of body with short vertical dark bars; evenly

spaced rows of orange to brown spots (which may form lines) above and below row of vertical dark bars; blue to black W-shaped spot above pectoral fin base and several oblique dark brown lines crossing side of head; first dorsal fin pointed, reddish with dense black oval spot posteriorly; second dorsal rays and anal rays always I,6; pectoral rays 16-17; longitudinal scales 23-25; TRB 7-8½; predorsal scales 6-8; 12 circumpeduncular scales. Known only from freshwater rivers and creeks in Fiji.

**Description.** Based on 12 specimens, 20-44.5 mm SL. An asterisk indicates the counts of the holotype.

First dorsal VI\*; second dorsal fin rays always I,6\*; anal fin rays always I,6\*; pectoral fin rays 16-17\*; segmented caudal rays 16-17\*, caudal ray pattern 9/8\*; branched caudal rays 7/6(10) or 7/7(1); procurrent rays 9/9 to 11/10; longitudinal scale count 23-25\* (mean 24); TRB 7-8½ (mean 8\*); predorsal scale count 6-8\* (mean 8); circumpeduncular scales always 12\*. Gill rakers on outer face of first arch 1+5(1), 1+6(1), 2+6(1). Pterygiophore formula 3-12210(7), 3-13110(1), 3-13210(1). Vertebrae 11+15(1), 11+16(1), 12+14(7). Neural spines of second and third vertebrae slender, pointed (9). Two epurals (in 9). Three (in 3) or four (in 6) anal pterygiophores before haemal spine of first caudal vertebra.

Body slender, compressed, body width at anus

11.0-14.2 % SL (mean 12.4 %) (Table 11). Body depth at anal origin 18.8-22.1 % SL (mean 20.7 %). Head compressed, deeper than wide, length 25.8-29.8 % SL (mean 27.8 %); cheeks may be somewhat inflated in males. Head depth at posterior preopercular margin 64.1-76.9 % HL (mean 72.1 %), width at posterior preopercular margin 57.1-66.7 % HL (mean 61.6 %). Mouth terminal, slightly oblique, forming an angle of about 15° with body axis; jaws generally reaching to below rear half of eye in males and to below front half of eye in females. Lips smooth; lower lip free at sides, narrowly fused across front. Upper jaw 29.9-51.0 % HL (mean 32.7 % in females, 44.4 % in males). Eye lateral, high on head, top may form part of dorsal profile, 22.5-29.9 % HL (mean 26.4 %). Snout rounded to slightly pointed, 23.5-29.7 % HL (mean 26.2 %). Interorbital moderate, 6.9-17.6 % HL (mean 9.9 %). Caudal peduncle compressed, length 24.8-28.9 % SL (mean 26.7 %). Caudal peduncle depth 11.4-15.4 % SL (mean 13.6 %).

First dorsal fin pointed, third and fourth spines longest or subequal and may be elongate (usually third spine longest); fin always taller in males than females; in females, spines barely reaching second dorsal origin when depressed; in males, spines reaching to second dorsal fin origin or to past posterior insertion of fin. First dorsal spine always shorter than next three. Third dorsal spine nearly always longest, length 16.4-36.4 % SL

Table 11. Morphometrics of *Redigobius leverii*.

	males (n=6)		females (n=6)	
	range	mean	range	mean
<b>Percentage of standard length</b>				
Head length	27.9-29.8	28.6	25.8-29.8	27.0
Body depth	18.8-22.1	20.6	19.4-21.9	20.9
Body width	11.3-13.4	12.1	11.0-14.2	12.7
Length of caudal peduncle	24.8-28.4	26.9	24.8-28.9	26.4
Depth of caudal peduncle	11.4-15.4	13.5	13.2-14.2	13.9
Length of pectoral fin	27.9-29.3	28.5	27.4-29.8	28.7
Length of pelvic fin	19.5-23.7	22.1	21.5-24.9	22.9
Length of caudal fin	28.4-33.5	30.9	26.9-28.6	27.9
Longest D1 spine	17.6-36.4	29.8	16.4-21.6	18.2
<b>Percentage of head length</b>				
Head depth	64.1-76.9	71.7	65.7-75.9	72.6
Head width	57.1-66.7	61.3	58.6-63.6	61.9
Snout length	25.0-29.7	27.1	23.5-26.4	25.1
Eye width	22.5-29.6	26.2	24.3-29.9	26.6
Jaw length	37.5-51.0	44.4	29.9-34.8	32.7
Interorbital width	7.0-17.6	10.8	6.9-11.3	8.9

(mean 25.2 %). Fourth dorsal spine longest in one specimen, length 18.1 % SL. Second dorsal and anal fins tall, short-based, posteriormost rays longest, rays not reaching caudal fin when depressed even in males with elongate first dorsal fin spines. Pectoral fin oval to rounded, central rays longest, 27.4-29.8 % SL (mean 28.6 %); rays all branched but for lower and uppermost rays. Pelvic fins short, rounded to oval, reaching two-thirds of distance to anus, 19.5-24.9 % SL (mean 22.5 %); frenum and skin around pelvic spines thick and fleshy. Caudal fin rounded, 26.9-33.5 % SL (mean 29.5 %).

No mental frenum, chin smooth. Anterior nasal opening in very short tube, placed behind upper lip. Posterior nasal opening round, with very low rim, placed close to front centre margin of eye. Gill opening restricted to pectoral fin base. Inner edge of shoulder girdle smooth, small knob present in one specimen. Gill rakers on outer face of first arch low, rounded and rudimentary. Tongue short and reduced, tip blunt to rounded; entire tongue absent in several specimens. Jaws narrow and usually elongate, bluntly rounded anteriorly. In males, lower jaw teeth curved and sharp, in 1 row at side and 2-3 rows across front, teeth on innermost row larger, stouter, curving inward, with largest 2-3 teeth at outer curve of side of jaw. Upper jaw teeth similar, in 3-5 rows but outermost row (not innermost) teeth at front of jaw largest and stoutest; 3-4 teeth, at 'corner' of jaw before single row of teeth at side, may be enlarged and strongly curved. In females, teeth small, sharp and evenly sized, in 1-2 rows along side of jaws and 3-4 rows across front; largest and more curved teeth across front of upper jaw.

Predorsal scales cycloid. Operculum scales ctenoid, sometimes cycloid. Cheek naked. Pectoral base covered with cycloid scales. Prepelvic area covered with small cycloid scales. Belly scales cycloid, may have patch of ctenoid scales near anus or in centre. Ctenoid scales on side of body.

Head pores as for *R. balteatus* (Fig. 3). Sensory papillae pattern similar to that of *R. dispar* and *R. dewaali* (Figs. 1, 11).

**Coloration of preserved material.** Head and body pale yellowish white to pale greyish, always lighter ventrally, with scale margins thinly outlined with light brown, usually on dorsal half of body and nape, centre of each scale slightly darker than remainder. Side of body with about

five faint dusky horizontal lines extending from region of pectoral fin base to before caudal fin base; mid-side of body with a row of short vertical dusky grey bars, most prominent on posterior half of body; overall impression is that of a pale fish having a faint chequered pattern interspersed with faint grey lines. Dark grey to blackish irregular W-shaped mark above and partly behind pectoral fin base (partly concealed by pectoral fin). Pectoral fin base pale grey with one or two curved dark grey to brownish lines (similar to lines on head) around fin base, forming pale-centred ocellus.

Side of head with four thin dark brown slightly curved to irregular lines running obliquely backward: first (uppermost) from middle of jaw running through eye and extending onto nape, second line from above rear corner of jaw running across cheek and along top of opercle, third line from rictus crossing lower part of cheek and curving up on to upper rear corner of opercle and fourth line running from below jaws along lower edge of preopercle and ending on rear edge of opercle. Similar lines along branchiostegal rays, but these lines may be broken-up into spots or vermiculate markings, or indistinct. Dorsal part of eye covered with dark brown blotch, which may be indistinguishable from dark colour of nape. Snout, lips and chin plain dusky or with short dark lines and spots; oblique dark lines running from head may be distinct on lips or obscure. Underside of head and breast plain dusky or pale, speckled with dark grey spots in one large female.

First dorsal fin transparent to whitish with oval to irregular dense black spot dorsoposteriorly; membrane between first to third spines brown or heavily speckled with brown; first spine may have three to five brown spots along its leading edge; area directly anterior and ventral to black blotch unpigmented; basal part of fin marbled or spotted with brown. Second dorsal fin transparent with four to seven irregular vermiculate dark brown lines, which may be broken up into staggered rows of brown spots; outer edge of fin dusky. Anal fin plain dusky, darker proximally; in adult males, anal fin paler posteriorly and with two or three brown spots running along length of posteriormost two fin rays. Caudal fin plain dusky to translucent, with indistinct brownish speckles and streaks toward base, which may form vertical bar; darker brown streaks following fin rays; in some specimens, about five irregular



Fig. 18. *Redigobius leveri*, male, aquarium kept; Fiji: Viti Levu: Nausori River. Photograph by Aaron Jenkins.

vertical dark grey to brownish lines crossing fin and very distinct dark brown streaks following fin rays; dorsal edge of fin with series of short oblique dark lines (an extension of lines on second dorsal fin). Pectoral fin translucent to dusky, with two indistinct oblique to curved brownish lines crossing bases of rays; lines may form irregular rows of brownish spots. Pelvic fins pale or dusky to brown; frenum unpigmented.

Figure 2 of Fowler's original description (1943) shows the large dark spots along the lower part of the caudal peduncle (which would have been purplish in life); these spots are not usually visible in preserved material.

**Coloration of live material.** Based on colour photographs by Aaron Jenkins & Paddy Ryan (Figs. 17-18). Head and body soft pearly grey to greyish orange, centre of scales an iridescent pale greenish-gold to pale golden, giving chequered or spotted look to fish; with greyish red or reddish brown irregular lines and spots; lines on head always darker and more intense. Four purplish grey internal blotches running along lower edge of caudal peduncle from above anal fin to just before caudal fin, interspersed with four similar-sized blotches of yellowish white. W-shaped spot by pectoral fin base black, dark grey or bright iridescent blue partly outlined and overlaid with melanophores. Two evenly spaced rows of round to oval orange spots along lower part of body and series of indistinct narrow vertical dusky bars

along mid-side of body. Head and body paler ventrally and with white abdominal region. Pectoral fin base more yellowish than surrounding area, with red-brown blotch dorsally (not always developed) and curved red-brown line following shape of fin base. Iris silvery to pale gold, with grey to pinkish grey area dorsally, may cover dorsal half of eye; uppermost greyish-red line on head running through iris but less distinct than line on skin of head itself.

On first dorsal fin, large bright orange to yellow blotch immediately anterior to dense black spot on fin, if anterior blotch yellow then usually edged dorsally with orange; distal half of fin mostly transparent. Second dorsal and caudal fins transparent to faintly yellowish, spotted and barred with purplish brown to dark brown. Anal and pelvic fins transparent to bluish white, with purplish to purplish brown streaks running beside fin rays. Pectoral fin translucent to faintly yellowish, with whitish margin.

**Comparisons.** *Redigobius leveri* most resembles *R. oyensi* and *R. tambujon* in body shape, but can be distinguished from them by differences in colour pattern and other features, especially when alive (it is also restricted to Fiji, where the two other species do not occur).

*Redigobius leveri* can be separated from *R. tambujon* by always having a second dorsal ray count of 1,6 (versus nearly always 1,7) and having shorter jaws in adult males, reaching to rear of

eye (versus well behind eye) and in colour pattern: the side of the body with narrow dark interconnecting lines and narrow vertical bars and a ventral row of round spots in *R. leveri* (versus body with reticulate pattern and dark band along mid-side and no spots along lower part of body).

*Redigobius leveri* and *R. oyensi* are more similar in body form and jaw size and can be distinguished by pectoral ray count (nearly always 16 in *R. leveri* versus 16-18, usually 17, in *R. oyensi*) and colour pattern: body with narrow dark interconnecting lines and squares, narrow vertical bars and a ventral row of round spots in *R. leveri* (versus body with mid-lateral row of dusky to brownish paired blotches or indistinct rows of short vertical lines, anteriormost blotch usually forming a grey to black W, V or U shape above the pectoral fin base in *R. oyensi*).

**Distribution.** As far as is known, *R. leveri* is restricted to the island of Viti Levu, Fiji.

**Ecology.** The habitats where *R. leveri* occurs are shallow (less than 1 m) creeks with gravel, rubble, boulder and sand substrates, with rapids and pools.

**Remarks.** Fowler's (1943) figure of the holotype of *Vainosa leveri* shows a dark blotch on the anterior part of the first dorsal fin and his description states that this black blotch is on the anterior part of the fin. However, my examination of the holotype showed that the black blotch is on the posterior part of the fin, as in all the known specimens.

This species is represented on the 13 May 2002 series of Fijian stamps, as *Redigobius* sp. (48 cents) and appears to be the only species of the genus featured on a stamp (Miller & Miller 1999).

***Redigobius macrostoma* (Günther, 1861)**  
(Figs. 19-20)

*Gobius macrostoma* Günther, 1861: 44 (Australia) (secondary homonym of *Gobiopsis macrostomus* Steindachner, 1861).

*Gobius microphthalmus* Günther, 1861: 550 (replacement name for *Gobius macrostoma* Günther, 1861).

*Gillichthys australis* Ogilby, 1894: 367 (type locality: New South Wales, Australia).

*(Gobius) australis*: McCulloch, 1917: 187-188, pl.31 fig. 3.

*Cyprinogobius microphthalmus*: Koumans, 1937: 13.  
*Redigobius macrostomus*: Bell et al., 1984: 37, 42 (Botany Bay); Johnson, 1999: 749 (Moreton Bay); Larson, 2001: 208, fig. 207; Larson & Murdy, 2001: 3601; Allen et al., 2002: 284; Hoese & Larson 2006: 1681.

*Redigobius macrostoma*: Kuitert, 1993: 357, 1996: 346-347; Hoese & Larson, 1994: 805-806, 2006: 1681, 2008: 770; Larson & Hoese, 1996: 223-225; Johnson 1999: 749; Larson 2001: 208; Hammer, 2006: 191 (West lakes, Port River, Gulf St Vincent, South Australia).

**Material examined.** AUSTRALIA: BMNH 1953.12.31.6, holotype of *Gobius macrostoma*, male, 33 mm SL; Gould coll. - SAMA F.10137, 10, 20-35.5 mm SL; West Lakes, Adelaide, South Australia; M. Hammer & party, 24 Dec 2003. - AMS I.21443-002, 15, 19-26 mm SL; Tambo River at Red Cliffs, Victoria; T. Berra & party, 18 Oct 1979. - AMS I.16954-018, 10, 18.5-30 mm SL; Cowan Creek, Hawkesbury River, New South Wales; J. Paxton & H. Recher, 22 Nov 1972. - AMS I.19341-001, 24, 18-33 mm SL; Clarence River, New South Wales; J. Glaister, 11 Oct 1976. - AMS I.20056-012, 13, 14-32 mm SL; Wallaga Lake, Montreal Bay, NSW; I. Briggs & party, 18 Oct 1974. - AMS I.18241-016, 12, 20.5-29.5 mm SL; Oakes Bay, Port Hacking, NSW; AMS, NSW Fisheries, CSIRO, 14 Nov 1974. - NTM S.16391-001, 61, 15-30 mm SL; Botany Bay, NSW; D. Farrell, 9 Feb 1979. - NTM S.16452-001, 1, 25.5 mm SL; Lower Albert River, Queensland; M. Kennard, 7 Jul 1995. - AMS I.19578-009, 60, 12-26 mm SL; QM I.13396, 63, 11-26.5 mm SL; Toorbul, Moreton Bay, Queensland; CSIRO Prawn Survey, V. Wadley, 1 Oct 1974.

**Material examined but no data taken.** AUSTRALIA: AMS I.16954-018, 10; Cowan Creek, Hawkesbury River, NSW. - AMS I.26706-001, 2; Merimbula, NSW. - AMS I.20049-006, 13; Tuross River entrance, New South Wales. - AMS I.20032-007, 97; Weedy Island, Tuross River, NSW. - MNHN 1987-164, 4; Towra Point, NSW. - AMS I.20048-002, 25; Brou River, NSW. - AMS I.28552-006, 13; Currumbene Creek, Jervis Bay, NSW. - AMS I.41858-013, 3; AMS I.41858-039, 11; Iluka marina, Clarence River, NSW. - AMS I.41289-010, 1; Iluka, Clarence River, NSW. - NTM S.16451-001, 7; West Lakes, Adelaide, South Australia. - QM I.26684, 6; Aldershots, Moreton Bay, Queensland. - AMS IA.4149, 1; Brisbane River, Chelmer, Queensland. - QM I.8757, 2; Southport, Queensland.

**Diagnosis.** A *Redigobius* species with highly compressed head and body; body grey to pale brown, mottled and chequered with dark brown dorsally and about eight oblique narrow dark

brown to purplish brown bars along side; large black blotch on first dorsal fin; mouth greatly enlarged in mature males; first spine of dorsal fin always longest; second dorsal rays I,7-8, usually I,7; anal rays I,5-7, usually I,6; pectoral rays 15-18; lateral scales 25-29; TRB 9-12; predorsal scales 12-16, reaching close up behind eyes. Known only from south-eastern Australia, in brackish to fresh water habitats, including seagrass beds.

**Description.** Based on 43 specimens, 21-35.5 mm SL. An asterisk indicates the counts of the holotype of *Gobius macrostoma*.

First dorsal VI\* (V in one); second dorsal I,7-1,8 (nearly always I,7\*); anal I,5-7 (usually I,6\*); pectoral rays 15-18 (modally 16\*); segmented caudal rays always 17\*, caudal ray pattern 9/8; branched caudal rays 7/5 to 8/6 (usually 7/6); procurrent caudal rays 6/6 to 7/7; longitudinal scale count 25-29 (mean 27\*); TRB 9-12\* (mean 10); predorsal scale count 12-16\* (mean 14); circumpeduncular scales 11-12 (mean 12). Gill rakers on outer face of first arch 1+6(1), 1+7(2), 2+5(1), 2+6(6), 2+7(1). Pterygiophore formula 3-12210(12). Vertebrae 11+15(12). Neural spines of second and third vertebrae slender, pointed (11), first spine with bifid tip (1). Two epurals (in 12). Three anal pterygiophores before haemal spine of first caudal vertebra (in 12).

Body greatly compressed; body width at anus 5.6-12.5 % SL (mean 9.8 %) (Table 12). Head narrow, compressed, deeper than wide, length 26.8-35.3 % SL (mean 30.7 %). Head depth at posterior preopercular margin 64.7-83.7 % HL (mean 73.4 %). Width at posterior preopercular margin 30.7-60.0 % HL (mean 47.4 %). Body depth at anal origin 21.3-31.2 % SL (mean 25.5 %); body may be quite deep in mature males. Mouth subterminal, oblique, forming an angle of about 25-30° with body axis; jaws reaching well past in adult males (nearly to preopercular edge) and to below mid-eye in females (well posterior of eye in male holotype). Lips smooth; lower lip free at sides, fused across front. Upper jaw 29.4-71.5 % HL (mean 33.1 % in females, 48.8 % in males); jaws very narrow in mature males. Eye small, lateral, high on head and close to snout tip, top of eye may form part of dorsal profile, 20.3-33.3 % HL (mean 26.2 %). Snout short, slightly pointed to rounded, 16.2-25.2 % HL (mean 21.9 %); snout tending to be more pointed in females; in large males, fleshy rounded snout tip may slightly overhang upper lip. Interorbital broad, flat, 8.6-

16.7 % HL (mean 12.5 %). Caudal peduncle compressed, length 24.3-29.3 % SL (mean 26.9 %). Caudal peduncle depth 11.4-16.3 % SL (mean 13.3 %).

First dorsal fin triangular, pointed anteriorly, tips of first to third spines free; spines reaching first few rays of second dorsal fin when depressed. First dorsal spine always longer than next three, length 19.5-34.9 % SL (mean 27.4 %); spine averaging slightly longer in males (28.5 % in SL) than in females (26.1 %). Second dorsal and anal fins moderate in height, almost square in shape with anterior and posterior fin rays almost equal in height, posteriormost rays usually not reaching caudal fin when depressed; in mature males, these fins just reach caudal fin rays. Pectoral fin oval, with central fin rays longest, 25.1-30.9 % SL (mean 27.7 %); rays branched but for upper and lowermost. Pelvic fins moderately large, rounded to oval, reaching to anus, 22.3-29.2 % SL (mean 26.0 %). Caudal fin short, rounded, 25.9-30.5 % SL (mean 28.0 %).

No mental frenum, chin smooth, large adults with slight bump or swelling on chin. Anterior nasal opening tubular, placed just behind upper lip, tube short, oriented down and forward. Posterior nasal opening oval, placed close to front centre margin of eye. Gill opening usually extending forward to under opercle or just forward of pectoral fin base. Inner edge of shoulder girdle usually with smooth edge; 15 (of 43) specimens with one or two small fleshy to flattened knobs on edge of cleithrum. Gill rakers on outer face of first arch short fleshy stubs, without spines, rakers longest near angle of arch. Tongue long, tip rounded to blunt. In males, upper jaw teeth with about 4-5 rows of small sharp teeth in dense band across front of jaw, outer row teeth larger, stouter and curved, single row of stout sharp teeth along side of jaw; in females, upper jaw teeth similar but 1-2 rows of teeth present along side of jaw. Males with enlarged jaws with 1 very stout enlarged tooth at either side of front of jaw; teeth may be absent from posterior quarter of jaw. Lower jaw with 4-5 rows of small sharp teeth in dense band across front, narrowing abruptly to 1-2 along side of jaw. Males with enlarged jaws with several inner and outer row teeth enlarged, stout and curved (usually at either side of front of jaw), dense band of smaller teeth may be somewhat scattered at tip of jaw.

Predorsal scales small, cycloid; scaled right up to above rear part of eye; ctenoid scales may



be present along side above opercle. Operculum scales usually all ctenoid, or ctenoid dorsally and cycloid scales on ventral half. Cheek naked. Pectoral base covered with cycloid scales. Prepelvic area covered with small cycloid scales. Belly scales ctenoid. Ctenoid scales on side of body.

Head pores present, with three preopercular pores; sensory papillae pattern similar to that of *R. dispar* (Fig. 1).

**Coloration of fresh material.** Based on colour photographs by Mark Abell, Doug Hoese & Rudie Kuitert (Figs. 19-20).

Head and body pale grey to golden brown (body can appear translucent when alive), with dark brown blotches, bars and mottling; side of head nearly always pale grey on side. Dorsum crossed by about seven dark brown saddles or square blotches, commencing on nape above opercle, anteriormost three usually larger than others; size and shape of saddles variable. On side, below dorsal saddles, a broad irregular broken dark brown line running from above pectoral fin base to below second dorsal fin; line may be partly or wholly replaced by series of dark brown blotches, spots or vermiculate lines. Just above mid-line of body, a series of 8-10 broad V- or W-shaped dark brown blotches (bases of Vs and Ws at mid-side of body); 7-8 broad, posteriorly oblique, dark brown to dull violet brown bars extending from base of these blotches; bars

most distinct above anal fin. Abdominal region and pectoral fin base dull yellow to pale golden brown; may be paler in females. Peritoneum light brown on side, paler ventrally.

Preopercle, jaws and chin pale grey; opercle and breast pale yellow to yellowish grey. Two broad dark brown oblique lines extending from rear of eye, lower line horizontally to posteroventrally crossing cheek to varying extent, upper line short, ending approximately at rear edge of preopercle or coalescing with irregular dark brown markings on nape. Two short dark brown bars running anteroventrally from eye to anterior half of jaw. Two diffuse brown short horizontal lines crossing cheek above jaw, not always present. Four to seven short narrow dark brown lines or vermiculate squiggles extending anterodorsally from eye onto snout and nape. Opercle yellowish brown to yellowish grey with diffuse oblique brown bar or blotch on upper quarter. Lips plain pale grey, to brownish anteriorly; diffuse brown bars may be present as continuation of markings from eye and snout. Underside of head plain grey to yellowish grey. Iris golden brown with narrow pale gold rim around pupil.

First dorsal fin dull yellow to pale yellowish, with three dark brown oblique broad lines crossing fin, coalescing at black to dark brown blotch at rear of fin; oblique lines may be partly fused together or form series of dark brown spots linked

Table 12. Morphometrics of *Redigobius macrostoma*.

	holotype	males (n=21)		females (n=22)	
		range	mean	range	mean
<b>Percentage of standard length</b>					
Head length	31.8	29.5-35.3	32.2	26.8-31.6	29.0
Body depth	31.2	21.3-31.2	25.4	22.8-29.3	25.6
Body width	-	5.6-12.5	9.8	7.3-11.7	9.9
Length of caudal peduncle	27.6	24.3-29.1	26.9	24.4-29.3	27.0
Depth of caudal peduncle	14.2	12.3-16.3	13.7	11.4-14.1	13.0
Length of pectoral fin	27.6	25.1-30.9	27.9	25.6-29.2	27.4
Length of pelvic fin	25.2	22.3-28.2	25.7	24.7-29.2	26.4
Length of caudal fin	27.3	25.9-30.5	28.1	26.1-30.0	27.9
Longest D1 spine	-	23.1-34.9	28.5	19.5-31.4	26.1
<b>Percentage of head length</b>					
Head depth	81.0	66.2-83.7	75.0	64.7-77.5	71.7
Head width	41.9	30.7-51.3	43.1	46.4-60.0	51.9
Snout length	16.2	16.2-25.2	21.7	19.0-24.7	22.0
Eye width	22.9	20.3-29.8	24.8	23.9-33.3	27.6
Jaw length	45.7	32.3-71.5	48.8	29.4-38.1	33.1
Interorbital width	8.6	8.6-16.7	12.3	10.3-16.1	12.8



Fig. 19. *Redigobius macrostoma*, aquarium kept; Australia: New South Wales: Wallaga Lake. Photograph by Rudie Kuitert.



Fig. 20. *Redigobius macrostoma*, living female (left) and male (right); Australia: New South Wales: Wallaga Lake. Photograph by Rudie Kuitert.

by more diffuse brown lines; black spot at rear of fin may have iridescent blue in centre; fin spines dark, especially first three; membrane between first three spines and around black spot deeper yellow to red. Second dorsal fin translucent pale

yellow to purplish brown, with three to five dark brown to purplish brown lines or rows of rounded to elongate-oblique spots along fin, lines (or rows of spots) may be scattered, diffuse and indistinct or dark and conspicuous; fin margin

broadly dusky to translucent. Anal fin varying from translucent pale grey to dark brown to purplish brown, fin rays always darker and often more reddish brown than membrane; anteroventral margin narrowly edged with white. Caudal fin translucent, pale yellowish grey to dull purplish brown, banded with about six rows of small dark brown spots or irregular lines (which may be partly broken up into series of spots). Two dusky grey to dark brown oblique oval spots on caudal fin base, partly coalescing with spots on fin and markings on mid-side of body. Pectoral fin plain translucent pale yellowish to transparent, lower part of fin may be narrowly edged with white; fin base with dark brown spots, short bars and mottling. Pelvic fins pale grey to brown to nearly transparent, entire fin, including frenum margin, usually narrowly edged with white.

**Coloration of preserved material.** Colour pattern essentially as for fresh (live) specimens (Fig. 20), with head and body light brown to yellowish white to whitish, with light brown to dark brown markings; dorsal saddles, lateral blotches and oblique body bars usually appearing slightly more conspicuous than when alive, due to paler background colour.

**Comparisons.** *Redigobius macrostoma* is a distinctive species, endemic to southern Australia and unlikely to be confused with any other species of the genus due to its highly compressed head and body, high predorsal scale count and obliquely banded body coloration.

**Distribution.** Endemic to the south-east coast of Australia, from the Port River, South Australia, the Glenleg River, western Victoria, and around the coast as far north as the Noosa River in southern Queensland; also north-eastern Tasmania (Hoese & Larson, 1994; Larson & Hoese, 1996; Hammer, 2006).

**Ecology.** This species is commonly found on soft substrates (e.g. sand and seagrasses, muddy habitats) in estuaries and brackish coastal lakes as well as on rocky reefs and man-made structures (pylons). It also occurs in lower reaches of rivers, and occasionally in pure fresh water. Hammer (2006) first reported *R. macrostoma* from South Australia (Port River), where they appeared abundant among mussel shells attached to verti-

cal (artificial) surfaces and rocks. He was uncertain whether the species' occurrence in South Australia was natural (being previously overlooked) or ship-assisted via ballast water.

Bell et al. (1984) studied this species (and 46 other fish species) in a temperate mangrove creek at Botany Bay, south of Sydney on the east coast of Australia. *Redigobius macrostoma* formed 2.9 % of the fish community, and were permanent residents, with juveniles and adults present year-round, tending to be more abundant during summer.

Hoese & Larson (1994) indicate that the mouth only becomes enlarged in mature males, and that only a few males with enlarged mouths may be found at any particular time of year. In some preserved lots, all the specimens are males with enlarged mouths, while in other lots the males are of similar size, but all have small mouths only slightly larger than the females.

This species lives well in aquaria and will adapt to taking dried fish food (Larson & Hoese, 1996).

**Remarks.** Günther (1861: 44) described *Gobius macrostoma* (from a single specimen), but in the addenda to the same work (p. 550) he stated that his name was a homonym of *Gobiopsis macrostomus* Steindachner, 1861, as he considered *Gobiopsis* to belong to the genus *Gobius*. Therefore he replaced his *Gobius macrostoma* with *Gobius microphthalmus*. Under the International Code of Zoological Nomenclature, *macrostoma* Günther and *macrostomus* Steindachner are not homonyms. They have been sometimes treated as the same adjective with a feminine or masculine ending. This is not correct, the name is a combination of two words and the second word (-stomus or -stoma) is a noun, and therefore invariable; the fact that one of the names has been originally latinized with a feminine or masculine ending respectively, is irrelevant. Thus the two names differ by at least one letter and this is sufficient to prevent homonymy (Code, art. 57.6). Steindachner's *Gobiopsis macrostomus* is a valid species of *Gobiopsis* (Lachner & McKinney, 1978).

Specimens from South Australia and Victoria may have slightly higher lateral scale counts (27-29 and 28-29 respectively) than those from New South Wales (25-28, 29 in one specimen) and Queensland (26-28).

*Redigobius nanus*, new species  
(Figs. 21-23)

**Holotype.** AMS I.25498-002, male, 22.5 mm SL; mangroves, Shark Bay, Western Australia; D. Hoese & D. Rennis, 8 Sep 1985.

**Paratypes.** WESTERN AUSTRALIA: AMS I.25498-032, 58, 10-29 mm SL; same data as holotype. – AMS I.25538-007, 325, 7-19 mm SL; 7.5 km from road, Parry Creek, Wyndham; D. Hoese & D. Rennis, 28 Sep 1985. NORTHERN TERRITORY: NTM S.12992-011, 5, 16-19.5 mm SL; creek arm opposite Spot On Marina, Ludmilla Creek, Darwin; H. Larson, R. Williams & P. Miller, 4 Dec 1989. – NTM S.14735-002, 1, 17.5 mm SL; spawning ponds, Middle Point barramundi farm, Adelaide River; H. Sakurai, 23 Nov 1996. QUEENSLAND: QM I.31022, 8, 14-21.5 mm SL; Cabbage Tree Creek, upstream of boat harbour, Shorncliffe; J. Johnson, 16 Jan 1998. – AMS I.31627-004, 7, 14-25 mm SL; Boggy Creek, Brisbane River mouth, 20 Jun 1991. NEW GUINEA: WAM P.27786-020, 3, 13.5-17 mm SL; small mangrove creek at Oro Bay, Northern Province; G. Allen, 11 Sep 1982. – WAM P.30980-006, 57, 10.5-19 mm SL; about 1.5 km S of Kopi Chevron Camp on Kikori road, tributary creek of Kikori River; G. Allen, 7 Mar 1995.

**Additional material (non types).** NORTHERN TERRITORY: NTM S.10020-015, 12; NTM S.10989-005, 2; NTM S.10414-020, 1; Ludmilla Creek, Darwin. – NTM S.14390-003, 1; Melville Island. – NTM S.10469-016, 3; Channel Island, Darwin Harbour. – NTM S.11242-0107, 1; Woods Inlet, Darwin Harbour. QUEENSLAND: QM I.31191, 7; Cabbage Tree Creek, Shorncliffe. – AMS I.21258-006, 43; S of Cape Tribulation.

**Diagnosis.** A small *Redigobius*, less than 30 mm SL when adult; body with indistinct lateral dark speckling and dorsal saddles; scale margins narrowly outlined with dark brown; living fish with bright pale blue flecks and spots over brown markings on head, body and fins; first dorsal fin pointed, first spine elongate and pale-coloured in males; first or second spine longest in females but never elongate; second dorsal rays usually 1,7; anal rays usually 1,6; pectoral rays usually 16-17; longitudinal scales 20-25; TRB 7-10; predorsal scales 6-10; 12 circumpeduncular scales. Found in estuarine waters of northern Australia and southern New Guinea.

**Description.** Based on 38 specimens, 13.5-27 mm SL. An asterisk indicates counts of the holotype (Fig. 21).

First dorsal VI\* (37); second dorsal 1,6-1,8 (nearly always 1,7\*); anal 1,5-7 (usually 1,6\*); pectoral rays 15-18 (usually 16\*-17); segmented caudal rays 16-17, nearly always 17\*, caudal ray pattern nearly always 9/8\*; branched caudal rays ranging from 6/5 to 8/7, strongly modally 7/6 (8/6 in holotype); procurrent rays 6/6 to 8/7 (in 11, mode 8/7); longitudinal scale count 20-25 (mean 23\*); TRB 7-10 (mean 8\*); predorsal scale count 6-10\* (mean 8, 9 in holotype); circumpeduncular scales 12-13 (mean 12.1; holotype 12). Gill rakers on outer face of first arch 1+5(1), 1+6(1), 2+5(1), 2+6(2), 2+7(3), 3+7(4). Pterygiophore formula 3-12210(15). Vertebrae 11+15(14), 11+16(1). Neural spines of second and third vertebrae slender, pointed (15). Two epurals (in 15). Three anal pterygiophores before haemal spine of first caudal vertebra (in 15).

Body narrow, compressed, body width at anus 8.2-13.8 % SL (mean 10.8 %) (Table 13). Head deeper than wide, length 28.3-35.2 % SL (mean 31.4 %); head depth at posterior preopercular margin 55.6-80.0 % HL (mean 66.6 %); head width at posterior preopercular margin 55.5-72.8 % HL (mean 64.3 %). Mouth terminal, oblique, forming an angle of about 30° with body axis; jaws generally reaching past rear margin of eye in adult males and to below mid-eye in females. Upper jaw 32.0-76.1 % HL (mean 37.5 % in females, 56.0 % in males). Eye lateral, high on head, top usually forming part of dorsal profile, 25.0-36.0 % HL (mean 29.7 %). Snout short and flat to slightly pointed, 16.4-26.0 % HL (mean 21.7 %). Interorbital rather narrow, flat, 6.8-14.7 % HL (mean 10.4 %). Body depth at anal origin 16.0-24.8 % SL (mean 21.9 %). Caudal peduncle compressed, length 22.6-31.3 % SL (mean 27.0 %). Caudal peduncle depth 10.6-14.8 % SL (mean 13.1 %).

First dorsal fin pointed, with first dorsal fin spine elongate in males, fin slightly rounded to pointed in females. First dorsal spine nearly always longer than next, 15.0-38.0 % SL (mean 24.2 %); in males, mean spine length 29.6 %, 17.5 % in females. Holotype (and several others) with first and second spines elongate, but first always slightly longer than second spine; first spine reaching back to above rear insertion of second dorsal fin. Second dorsal spine length 13.5-19.1 % SL (mean 16.1 %); second spine may be longer than first in females. Third dorsal spine longest



Fig. 21. *Redigobius nanus*, holotype, AMS I.25498-002, male, 22.5 mm SL. Australia: Western Australia: Shark Bay. Right side, reversed. Photograph by Caroline Camilleri.

in one (male) specimen, length 14.4 % in SL. Second dorsal and anal fins short-based, anterior and posteriormost rays almost equal in length, dorsal fin rays not usually reaching caudal fin base when depressed. Pectoral fin oval, central rays longest, 22.2-28.5 % SL (mean 25.6 %); rays all branched but for upper and lowermost rays. Pelvic fins rounded to oval, reaching half to anus in both sexes, 21.8-27.9 % SL (mean 25.3 %). Caudal fin rectangular to rounded, 23.3-31.6 % SL (mean 27.4 %).

No mental frenum, chin may be flat, usually slightly inflated. Anterior nasal opening in tube, placed just behind upper lip, tube relatively short, oriented upward or forward. Posterior nasal opening oval, with low rim, very close to anterior-

most part of eye. Gill opening extending forward to under opercle. Inner edge of shoulder girdle with low thin bony to somewhat fleshy flange or small fleshy knob, occasionally edge smooth. Gill rakers on outer face of first arch very short rudimentary, without spines, longest rakers near angle of arch. Tongue tip blunt. Teeth in upper jaw in 1-2 rows laterally, 2-3 rows across front of jaw; teeth in females small, sharp and evenly sized; in males, teeth at side of jaw similar to females but those across front of jaw enlarged, stout, curved and sharp. Teeth in lower jaw similar to those in upper jaw; females with 3-4 rows of small sharp teeth present across front of jaw; males with teeth at side of jaw in single row or partly absent, teeth across front enlarged, stout

Table 13. Morphometrics of *Redigobius nanus*.

	holotype	males (n=20)		females (n=18)	
		range	mean	range	mean
<b>Percentage of standard length</b>					
Head length	31.6	28.4-35.2	31.6	28.3-33.3	31.3
Body depth	21.3	20.0-24.8	21.8	16.0-23.7	22.0
Body width	8.9	8.2-13.2	10.6	9.4-13.8	11.0
Length of caudal peduncle	24.9	22.6-30.5	26.9	23.2-31.3	27.2
Depth of caudal peduncle	12.9	12.6-14.8	13.5	10.6-13.8	12.7
Length of pectoral fin	24.9	22.2-28.5	25.9	22.3-28.0	25.1
Length of pelvic fin	24.4	21.8-27.9	25.0	23.1-27.4	25.6
Length of caudal fin	28.0	23.3-30.2	27.6	25.0-31.6	27.2
Longest D1 spine	37.8	19.1-38.0	29.6	13.5-19.6	17.5
<b>Percentage of head length</b>					
Head depth	76.1	59.6-80.0	67.1	55.6-71.7	65.9
Head width	57.7	57.1-72.8	63.4	54.5-72.5	65.3
Snout length	21.1	20.0-24.3	22.1	16.4-26.0	21.2
Eye width	29.6	25.0-34.0	28.8	25.5-36.0	30.7
Jaw length	76.1	41.5-76.1	56.0	32.0-43.8	37.5
Interorbital width	11.3	8.6-14.7	11.1	6.8-12.5	9.8



Fig. 22. *Redigobius nanus*, male, aquarium kept; Indonesia: Irian Jaya: Timika. Photograph by Gerry Allen.

and curved, especially 2-3 teeth at curve of jaw).

Ctenoid scales on side of body, reaching forward to above pectoral fin base. Predorsal scales cycloid, reaching to close behind eyes. Operculum scales small, cycloid, present at least on dorsal half; some specimens with few large cycloid scales covering most of operculum. Cheek naked. Pectoral base covered with small cycloid scales. Prepelvic area covered with small cycloid scales. Belly scales usually ctenoid, mid-line may include cycloid scales.

Male genital papilla small, short and flattened, tip rounded to (usually) pointed; occasionally elongate; a few specimens with papilla much broader at base than tip. Female genital papilla short, broad and somewhat bulbous; in larger specimens, ventral groove or fold may be present. Some specimens with no visible papilla.

Head pores and sensory papillae pattern as shown in Figure 24.

**Coloration of preserved material.** Head and body whitish yellow to pale brown, variably speckled with darker brown, scale margins thinly outlined with dark brown, forming reticulate pattern (Fig. 21). No clearly distinct markings displayed on body (other than network formed by scale markings); six to eight short evenly spaced brown saddles crossing dorsum (often indistinct), anteriormost saddle just above rear of

preopercle, posteriormost just crossing procurent rays of caudal fin; saddles coalescing with two faint staggered rows of roughly square brown blotches along mid-side of body, may form indistinct bars. In many specimens, not all these markings are discernible. Most distinctive body markings present along mid-ventral line, four dark brown spots (in life, connected to internal bars of brown pigment and reaching to mid-lateral line of body) commencing at (and including) genital papilla and evenly spaced posteriorly to just before ventral procurent rays of caudal fin; anteriormost dark spot often absent, ventral spots often indiscernible. Breast and belly pale to dark brown; abdominal region may have scattered distinct dark brown 'fly-specks'. No distinct dark bar on rear part of abdomen just above genital papilla.

Side of head variably mottled and speckled with dark brown, or may be plain light brown; two to three narrow dark brown lines running from anterior edge of eye to middle of jaw, area enclosed by dark lines paler than rest of head. In some specimens, cheek and opercle obliquely banded by light and dark lines, which may be vermiculate or marbled (but not conspicuously so), especially on opercle. Dusky brown blotch usually present above rear part of opercle. Chin and underside of head dark brown in males. Lips plain brownish. Pectoral fin base plain brown, forming two distinct longitudinal brown blotch-



Fig. 23. *Redigobius nanus*, female, aquarium kept; Australia: Northern Territory: Darwin, Leaders Creek. Photograph by David Wilson.

es in some specimens. Sensory pores around dorsal part of eye may be pigmented with dark brown, especially postorbital pore area, which may be much darker than others.

First dorsal fin transparent with oval black spot posteriorly, close to fin base, and two dusky to brown horizontal stripes, ventralmost running anteriorly from black spot and ending in small dark brown to blackish spot on anterior face of first spine, uppermost brown stripe narrower, running along upper third of fin and ending in similar blackish spot on first spine; remainder of first spine translucent to slightly dusky, its membrane usually pale, may be third blackish spot (not present on all specimens) on outer face of spine above brown stripe; stripes and black spot vary in size and density. Second dorsal fin transparent with four to five oblique narrow lines formed by series of elongate brownish spots, submarginal region unpigmented and fin margin greyish to grey-brown; three dark brown blotches evenly spaced along fin base (coinciding with brown saddles crossing dorsum). Caudal fin transparent with distinct pattern across base of fin of three staggered dark brown blotches, which may coalesce to form an irregular broad vertical bar, or with central blotch indistinct and only two dark blotches visible at either side of fin mid-base; rest of fin banded with rows of fine dark spots and speckling; rows of spots may be somewhat

oblique or coalesced into irregular rows. Anal fin plain dusky to dark brown. Pectoral fin transparent with brown-speckled fin rays. Pelvic fins transparent with dark brown speckling present on most of fin, margins and frenum unpigmented; central part of pelvic disk unpigmented.

**Coloration of live material.** Based on photographs of captive specimens from the Northern Territory and Papua New Guinea by Dave Wilson and Gerry Allen (Figs. 22-23).

Live fish similar in colour pattern to preserved specimens, but head and body translucent blue-grey to pale golden brown, with narrow brown

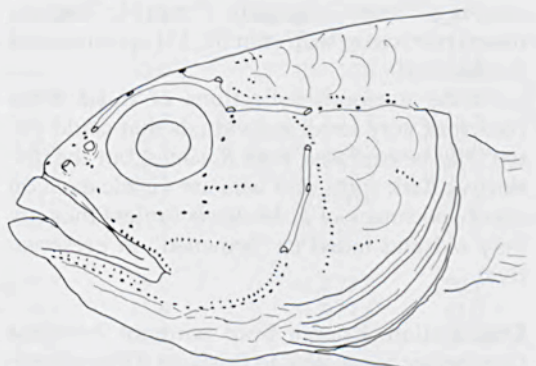


Fig. 24. *Redigobius nanus*, AMS I.25498-002, 25.5 mm SL, female paratype; headpores and papillae pattern.

scale margins, rest of each scale pale pinkish brown to pale blue to blue-grey and scattered blue to blue-white speckles. Dark bars and mottling on side of body appearing partly subcutaneous in living fish, apart from dark brown saddles on dorsum and dark brown bars along posterior half of body. Iris pale gold to pinkish gold, finely speckled with brown.

Dorsal fins transparent to translucent pinkish to pale blue, with brown spots and elongate blotches; dark spot on posterior part of first dorsal fin indistinct, overlaid with iridescent blue spot; tip of first dorsal fin plain pinkish to yellowish (only leading edge of elongate spine brown). Caudal fin transparent to faintly pinkish, with pale golden to pale blue speckling interspersed with dark brown spots and rows of spots at fin base. Anal fin translucent pinkish brown, with pale gold to iridescent blue blotch or streak at posteriormost part of fin and similarly coloured blotch or streak just behind mid-base of fin, close to body; fin margin translucent.

**Comparisons.** This species looks like a very small, relatively plain-coloured *R. bikolanus*, but can be separated from this species in lacking the one to two oblique blackish to dark brown bars along the abdomen (nearly always discernible in *R. bikolanus*), in having a relatively plain mottled body when preserved (versus 5-6 blackish bars and spots present along mid-side of body and along ventral part of caudal peduncle), by having a different first dorsal fin pattern (*R. nanus* with fin marbled and horizontally banded, with elongate part of first dorsal fin spine pale to white versus *R. bikolanus* with oblique black stripe on upper third of fin coalescing with black posterior spot, and dark first dorsal fin spine) and in only reaching 27 mm SL (usually 17 mm SL; 38 specimens) (versus up to 37 mm SL; 111 specimens of *R. bikolanus*).

Some museum collections of *R. bikolanus* consist of very small individuals that could potentially be confused with *R. nanus*, but the distinctive dark spots and bars are visible even on small specimens of *R. bikolanus* (unless they are very old and faded or "browned" in preservative).

**Distribution.** Known from northern Australia (Kimberley coast, WA, to Brisbane, Queensland) and southern New Guinea (Timika, West Papua, to Kikori River, Papua New Guinea).

**Etymology.** Named *nanus* (Latin for dwarf, masculine), with regard to its small size when adult compared to other species of the genus; an adjective.

**Ecology.** Specimens were usually collected in association with mangroves, among rock and mangroves or in muddy or sandy-muddy estuarine habitats.

### *Redigobius oyensi* (de Beaufort, 1913)

(Figs. 25-27)

*Gobius oyensi* de Beaufort, 1913: 137, fig. 4 (type locality: Buru and Ceram); Nijssen et al., 1993: 233.

*Lophogobius wera* Popta, 1922: 27 (type locality: Wera River, Sumbawa, Sunda Archipelago, Indonesia).

*Stigmatogobius oyensi*: Koumans, 1953: 122, fig. 28.  
*Redigobius leptochilus*: Larson, 2001: 208.

**Material examined.** PHILIPPINES: USNM 126396, 2 paratypes of *Illana cacabet*, 19-22 mm SL; Rio Grande, Mindanao. – USNM 99596, 1, 31 mm SL; Iwahig River, Puerto Princesa, Palawan; Albatross, 4 Apr 1909. – FMNH 50948, 12, 23.5-37 mm SL; Lapulapu River, Lapulapu, Iwahig, Palawan; Werner, 4 Mar 1947. – CAS 33166, 144, 18-35 mm SL; Comon River, Bohol. INDONESIA: ZMA 113.263, lectotype of *Gobius oyensi*, 44 mm SL male, upper course of Toebah River, western Ceram; L. de Beaufort, 27 Feb 1910. – ZMA 110.110, paralectotype of *Gobius oyensi*, 1, 27 mm SL; Jer (river) Toilela, near Tapa, Babber; F. A. H. W. der Marez Oyens. – SMF 6551, holotype of *Lophogobius wera*, male, 40 mm SL; Wera River, Sumbawa; J. Elbert, 12 Dec 1909. – NTM S.14155-002, 2, 32-34.5 mm SL; Sejong River, SW Sumbawa; K. Martin, 2 Jan 1995. – NTM S.14151-001, 1, 39.5 mm SL; Sejong River, SW Sumbawa; K. Martin, 31 Mar 1995. – NTM S.14144-001, 2, 29.5-33.5 mm SL; Sekongkang River, SW Sumbawa; K. Martin, 27 Mar 1995. – NTM S.14524-005, 2, 23.5-30 mm SL; Kanyola River, S Sumbawa; K. Martin, 29 Apr 1997. – NTM S.14154-001, 1, 26 mm SL; Tongoloka River, S Sumbawa; K. Martin, 1 Apr 1995. – CMK 9664, 1, 24.5 mm SL; 2 km NE of Singaraja, Bali; C. Appleby, 21 Jun 1992. – RMNH 11835, 2, 34-35 mm SL; Wae Memi Haroekoe near Ambon; F. Kopstein, Dec 1923.

REPUBLIC OF PALAU: CAS 76161, 2, 23.5-25.5 mm SL; Arakitaoch Stream, Babeldaob Island, Palau; Sumang & Marbou, 27 Nov 1956. – CAS 53262, 1, 27 mm SL; S of Ngatbong River, Babeldaob Island, Palau; Brittan & party, 15 Aug 1956. WEST PAPUA: WAMP.31463-006, 2, 38-43 mm SL; Warmon Stream, Batanta Island, Raja Ampat Islands; G. Allen & S. Renyaan, 29 Apr 1998. – WAMP.31461-006, 1, 36 mm SL; pool at base of water-



fall, Warmon Stream, Batanta Island, Raja Ampat Islands; G. Allen & S. Renyaan, 27 Apr 1998. PAPUA NEW GUINEA: WAM P.32353-011, 15, 21.5-31.5 mm SL; Mebulibuli River, Fergusson Island, D'Entrecasteaux Islands, G. R. Allen, 24 Aug 2002.

**Material examined but no data taken.** INDONESIA: NTM S.14148-005, 1; Liangse River, Sumbawa. – NTM S.14152-005, 11; Sejong River, Sumbawa. – NTM S.15383-001, 1; Sing Sing Waterfall, Bali. PAPUA NEW GUINEA: WAM P.29834-002, 2; Wewak. – AMSI.40375-001, 1; Kimbe Bay.

**Diagnosis.** A slender *Redigobius* with body brownish above and pale below; scale margins on dorsal two-thirds of body outlined in dark brown, forming reticulate pattern; five dark brown vertical blotches in line along side of body and distinctive U- or W-shaped black mark above pectoral fin base; large dense black spot present on rear of first dorsal fin; head may be enlarged and fleshy in adult males; body compressed; dorsal fin tall, with spines prolonged, fourth spine usually elongate in males; second dorsal fin rays 1,5-8, usually 1,7; anal fin rays 1,5-7, usually 1,6; pectoral fin rays 16-19; longitudinal scales 23-26, TRB 7-9; predorsal scales 6-11, reaching to close behind eyes. Known from freshwater habitats in Indonesia to Micronesia and Papua New Guinea.

**Description.** Based on 33 specimens, 19-44 mm SL. An asterisk indicates the counts of the lectotype of *Gobius oyensi*.

First dorsal VI\*; second dorsal 1,5-1,8 (usually 1,6\*); anal 1,5-7 (usually 1,6\*); pectoral rays 16-19 (usually 17, 18 in lectotype); segmented caudal rays usually 17\*, caudal ray pattern usually 9/8; branched caudal rays 6/6 to 8/7 (modally 7/6); procurent rays 8/8 to 12/11; longitudinal scale count 23\*-26 (mean 24); TRB 7-9 (mean 8\*); predorsal scale count 6-11 (mean 8; 7 in lectotype); circumpeduncular scales 12-13 (mean 12). Gill rakers on outer face of first arch 1+6(1), 1+7(1), 1+8(1), 2+4(1), 2+6(2), 2+7(3), 3+7(1), 3+8(1). Pterygiophore formula 3-12210(12), 3-112200(1). Vertebrae 11+16(3), 12+14(8), 12+15(1), 12+16(1). Neural spines of second and third vertebrae slender, pointed, or tips slightly broadened (in 2). Two epurals (in 13). Three (in 3) or four (in 10) anal pterygiophores before haemal spine of first caudal vertebra.

Body slender, compressed (slightly less so anteriorly); body width at anus 10.6-13.7 % SL (mean 11.7 %) (Table 14). Head rounded to slightly pointed in profile, deeper than wide, but not greatly so, length 25.4-30.6 % SL (mean 28.7 %); in large males, head may be enlarged and fleshy. Head depth at posterior preopercular margin 56.8-78.7 % HL (mean 66.8 %); head width at posterior preopercular margin 50.0-65.2 % HL (mean 60.6 %). Mouth terminal, slightly oblique, forming an angle of about 30-35° with body axis; jaws not greatly enlarged in males, reaching to below rear margin of eye in adult males and to below front half of eye in females. Lips smooth,

Table 14. Morphometrics of *Redigobius oyensi*.

	holotype	males (n=19)		females (n=15)	
		range	mean	range	mean
<b>Percentage of standard length</b>					
Head length	29.3	27.6-30.6	29.4	25.4-29.0	27.5
Body depth	25.0	18.3-25.0	21.7	19.6-24.3	21.2
Body width	14.1	10.6-14.1	12.0	10.7-18.0	12.4
Length of caudal peduncle	28.4	24.4-30.4	27.4	24.6-30.3	27.0
Depth of caudal peduncle	15.2	13.5-15.6	14.3	12.2-14.7	13.3
Length of pectoral fin	28.6	26.0-30.4	27.9	24.3-28.6	27.0
Length of pelvic fin	27.5	22.3-27.8	25.1	21.3-26.9	24.2
Length of caudal fin	30.2	26.9-34.6	30.6	24.8-30.0	27.3
Longest D1 spine	39.3	19.7-47.0	33.8	13.7-22.0	17.8
<b>Percentage of head length</b>					
Head depth	90.7	56.8-90.7	69.5	62.4-77.5	70.1
Head width	69.0	50.0-70.5	61.8	51.5-71.6	64.0
Snout length	28.7	22.7-29.3	26.2	22.5-30.1	26.2
Eye width	27.1	21.9-31.7	27.8	26.8-37.8	30.0
Jaw length	55.8	34.2-56.3	44.5	30.3-34.7	33.1
Interorbital width	10.1	8.4-16.4	11.4	7.4-13.9	10.1



Fig. 25. *Redigobius oyensi*, NTM S.14155-002, 35 mm SL; Indonesia: Sumbawa: Sejorang River. Photograph by Rex Williams.

fleshy and wide in adult males; lower lip free at sides, fused across front. Upper jaw 30.3-52.6 % HL (mean 33.1 % in females, 40.3 % in males). Eye rather small, lateral, high on head, top of eye usually forming part of dorsal profile, 25.3-37.8 % HL (mean 29.8 %). Snout flat, slightly pointed, 22.5-29.3 % HL (mean 26.0 %). Interorbital narrow, flat, 7.7-14.7 % HL (mean 10.6 %). Body depth at anal origin 18.3-24.3 % SL (mean 20.6 %). Caudal peduncle compressed, length 26.3-30.4 % SL (mean 27.8 %). Caudal peduncle depth 12.2-15.2 % SL (mean 13.6 %).

First dorsal fin tall and narrow, fourth spine nearly always longest, may be greatly elongate in males; spines longer in males than females; spines in females barely reaching second dorsal fin origin when depressed. Third dorsal spine (may be longer than fourth in females) length 13.7-32.2 % SL (mean 18.6 %). Fourth dorsal spine (nearly always longest in males) length 15.6-47.0 % SL (mean 30.5 %); if elongate, spine may reach back past second dorsal fin insertion, nearly to caudal fin base. Second dorsal and anal fins short-based, tall, posteriormost rays prolonged; in males, rays reaching caudal fin when depressed; in females, second dorsal fin rays falling well short of caudal fin. Pectoral fin slender, rounded, central rays longest, 24.3-30.4 % SL (mean 27.5 %); rays all branched except uppermost. Pelvic fins short, rounded, reaching two-thirds distance to anus, 22.2-27.8 % SL (mean 25.2 %). Caudal fin posterior margin rounded, 25.4-34.6 % SL (mean 29.9 %).

No mental frenum, chin usually smooth; fleshy and somewhat rounded in several specimens. Anterior nasal opening in very small short tube, placed behind upper lip. Posterior nasal opening larger, oval to rounded, placed close to anterior-

most part of eye. Gill opening mostly restricted to pectoral fin base, in some specimens extending forward to just under opercle. Inner edge of shoulder girdle smooth, occasionally with one or two small fleshy lobes or flaps. Gill rakers on outer face of first arch very short and stubby, longest rakers on upper half of arch; rakers on inner face of first arch similar, stubby. Tongue tip blunt to rounded. Lower jaw teeth in males curved and sharp, in 1 row at side and 3-4 rows across front, teeth on innermost row larger, stouter, curving inward, with largest 1-3 teeth at outer curve of side of jaw; upper jaw teeth similar, in 3-5 rows but outermost, not innermost, row of teeth at front of jaw largest and stoutest; 2-4 teeth just anterior to 1-2 rows of teeth at side may be enlarged and strongly curved. In females, teeth small, sharp and evenly sized, in 1-2 rows along side of jaws and 2-3 across front; largest and more curved teeth across front of upper jaw.

Predorsal scales cycloid; scaled up to behind eyes (RMNH 11835, two specimens from Ambon, with ctenoid predorsal scales present up to above rear margin of preopercle). Operculum with large scales, usually ctenoid. Cheek naked. Pectoral base covered with thin cycloid scales. Prepelvic area covered with small cycloid scales. Belly scales usually cycloid, may be partly ctenoid (often near anus). Ctenoid scales present on side of body.

Head pores and sensory papillae pattern similar to that in *R. dispar* (Fig. 1).

**Coloration of preserved material.** Head and body pale yellowish white to whitish, always paler ventrally, with scale margins on dorsal two-thirds of body and on nape broadly outlined with brown, giving light brown reticulate appearance (Fig. 25). Side of body with about five pairs of



Fig. 26. *Redigobius oyensi*, male, aquarium kept; New Guinea: Milne Bay. Photograph by Gerry Allen.

vertical dark brown to brown blotches along mid-side, posteriormost four blotches most prominent; especially last two blotches on caudal peduncle; no blotch on mid-base of caudal fin (only small brown spot usually visible). Specimens from Fergusson Island (New Guinea) with very conspicuous dark brown blotches along side, including one on caudal fin base; blotches along caudal peduncle being largest and densest; additionally, dusky brownish saddles crossing dorsum and extending down to interspaces between brown blotches. Dark brown to black U- or W-shaped mark above and partly behind upper part of pectoral fin base (may be partly concealed by fin). Pectoral fin base pale brownish with unpigmented area (a blotch or broad streak) crossing centre.

Side of head relatively plain, pale brownish with two or three darker brown slightly curved lines running obliquely: first uppermost from middle of jaw below nasal openings to eye and extending onto nape, second line running from above rictus along lower edge of eye (pale or unpigmented area on preorbital usually present between these two lines), third line (not always discernible) from behind rictus crossing lower part of cheek and curving up onto anterior corner of opercle. Lines on side of head may be diffuse and difficult to distinguish from background pigmentation. Branchiostegal ray membranes and underside of head plain brownish or mottled whitish. Brown irregular line or blotch just posterodorsal to eye, may be indistinguishable from dark colour of nape. Snout, lips and chin plain dusky to pale brownish.

First dorsal fin transparent to pale brownish with large oval to rounded dense black spot at



Fig. 27. *Redigobius oyensi*, female, aquarium kept; New Guinea: Milne Bay. Photograph by Gerry Allen.

rear, covering membrane from third to fourth spine; occasionally, spot not greatly developed, but discernible; membrane between first to third spines heavily speckled with brown; basal part of fin may be spotted with darker brown. Second dorsal fin transparent with four to seven irregular vermiculate dark brown lines, often broken up into staggered rows of elongate spots; fin margin dusky to dark grey. Anal fin plain dusky to grey-brown, darker proximally; adult males with several elongate brown spots running length of posteriormost few fin rays. Caudal fin plain dusky to translucent, with few indistinct brownish speckles and short streaks near base, which may form about five vertical bars, with darker brown streaks following fin rays. Pectoral fin translucent to dusky; large adults with a few indistinct oblique to curved rows of brownish spots crossing fin rays. Pelvic fins pale or dusky to brown; frenum pale, unpigmented.

**Coloration of fresh material.** Based on photographs by Gerry Allen of a captive male and two females from New Guinea, and photograph by Gerhard Ott of a captive female from Bali (Figs. 26-27).

Head and body translucent greyish brown, underside of head and belly pinkish white to cream, nape and side of body covered with dull orange to brownish orange spots tending to form longitudinal rows (spots darker dorsally, brightest spots on ventral half of body) and pale blue to greenish blue iridescent spots scattered along mid-side of body and dorsal half of body (wherever orange spots not present), five evenly spaced dusky grey-brown short saddles crossing dorsum (anteriormost saddle crossing nape at level of

preopercle, posteriormost shortest, just anterior to caudal fin base) and five irregular vertically oriented dark brown to blackish blotches along mid-side of body. On side of body just above and slightly behind uppermost part of pectoral fin base, a distinct W or V shaped black blotch present, iridescent bright blue pigment may be superimposed on blotch.

Opercle with one or two oblique streaks or broken rows of dull orange spots (contiguous with upper body spots and rows), often interspersed with blue to pale green iridescent spots. Cheek below eye and snout area may be similarly marked, or be relatively plain greyish brown with indistinct brown spots, short brown streaks and blue-green speckling around eye and over snout. Iris pale golden with brownish flecks and fine speckling, with narrow red-gold rim around pupil.

First dorsal fin with basal third transparent, remainder of fin orange and yellow, deepest colour closest to fin spines; large dense black blotch on posterior part of fin (shape and extent of blotch variable); distal margin of fin and spine tips translucent dusky grey. Second dorsal fin translucent with dusky grey margin and two to three rows of dark brown elongate spots, uppermost row at middle of fin, lowermost close to base, rows of spots often interspersed with irregular rows of pale gold spots. Anal fin (visible only in photo of adult male) translucent dusky brown, fading to greyish distally, with pale blue fin rays. Caudal fin transparent with vertical rows of indistinct brownish speckles and dusky brown to blackish blotch on mid-base of fin, with small square brown to blackish blotch above and below midbase blotch (may form a chunky V); dull orange to reddish brown and pale blue spots and blotches variably scattered near fin base. Pectoral and pelvic fins transparent with dusky to pale gold fin rays.

**Comparisons.** This species is similar in body shape and basic colour pattern to *R. tambujon* and *R. leveri* but can be distinguished from *R. leveri* (a Fiji endemic) by lacking rows of narrow oblique dark lines on the side of the head, having dark lateral blotches (versus a regular pattern of grid-like lines and spots) and by the fourth first dorsal spine nearly always being longest (third spine in *R. leveri*).

*Redigobius oyensi* is distinguished from *R. tambujon* in that it has the fourth dorsal spine usu-

ally longest (versus first spine in *R. tambujon*), a second dorsal ray count usually of I,6 (versus usually I,7) and by having the W or V shaped blotch above the pectoral fin base darker than the rest (versus this blotch not darker than the others in *R. tambujon*).

**Distribution.** Philippines, Indonesia, Micronesia, Papua New Guinea.

**Ecology.** The most detailed habitat information available is for the Mebulibuli River near old Basima village on Fergusson Island, D'Entrecasteaux Island Group, New Guinea, where this species was found with *Redigobius bikolanus* and *Stenogobius hoesei* (Gerry Allen, in litt.). About 1.5 km upstream of the village the river flowed through a series of rapids alternating with rocky pools and shallow broad sections with gravel and cobble substrate, flowing more slowly over gravel and mud downstream of the village, eventually flowing through disturbed forest, village gardens and then to mangroves and the sea. The holotype of *Lophogobius wera* came from freshwater, 40-50 metres above sea level, from the Wera River, Sumbawa.

**Remarks.** De Beaufort's original description of *Gobius oyensi* was based on the larger of two specimens (ZMA 113.263, 44 mm SL from Ceram; ZMA 110.110, 27 mm SL from Buru), with one additional specimen from Babber that he did not use in the description (ZMA 108.049, 20.5 mm SL). ZMA 113.263 is the specimen illustrated in de Beaufort (1913: fig. 4). ZMA 108.049 is *R. bikolanus*. Therefore, as de Beaufort had two species among his three syntypes (*Redigobius bikolanus* and *R. oyensi*) and to fix the name for the species, I designate ZMA 113.263 as lectotype for *Gobius oyensi* de Beaufort, 1913, to avoid possible confusion.

De Beaufort (1913) describes three transverse bands on the belly, with the last one through the anus – a pattern dimly discernible on a few preserved specimens. His Figure 4 shows two dusky bars across the abdomen; these markings are not visible in the preserved specimen (ZMA 113.263); he also states that the smaller fish only shows "vestiges" of the colour pattern. These "belly bands" can be clearly seen on nearly all specimens of *R. bikolanus* but not on any of the type specimens of *A. leptochilus*, *G. oyensi* or *L. wera*.

*Acentrogobius leptochilus* Bleeker was earlier

considered to be the correct name for this species (Larson 2001). However, as more material was examined, it was realised that the male holotype of *A. leptochilus* could not belong with *R. oyensi* as the second and third first dorsal fin spines were longest but none were elongate (the fourth dorsal fin spine is always elongate in male *R. oyensi*), and the distinctive lateral blotches and blackish U- or W-shaped mark above the pectoral fin base were not mentioned by Bleeker (1875b), nor visible on the holotype. *Acentrogobius leptochilus* is a junior synonym of *Redigobius tambujon* (Bleeker, 1854).

***Redigobius penango* Popta, 1922**  
(Fig. 28)

*Pseudogobius penango* Popta, 1922: 36 (type locality: Rumbia and Penango, Great Sunda Island, Celebes).

*Stigmatogobius penango*: Koumans, 1932: 3, 13, 1953: 110, 124-125.

*Pseudogobiopsis* (possibly *P. penango*) (in part): Larson & Kottelat, 1992: 233.

*Pseudogobiopsis penango*: Kottelat et al., 1993: 150, pl. 70.

*Redigobius penango*: Larson, 2001: 135, 208.

**Material examined.** INDONESIA, SULAWESI: SMF 6579, lectotype of *Pseudogobius penango*, 29.5 mm SL; Mengkoka, Penango [= Pehanggo] village; J. Elbert, Oct 1909. – SMF 6580-1, 2 paralectotypes of *Pseudogobius penango*, 26-30 mm SL; Rumbia; J. Elbert, 1909. – RMNH 10666, 1, 29.5 mm SL; Rumbia; J. Elbert, Sunda Expedition 1909-1910. – Ex NMBA 1847-52, 1 paralectotype of *Gobius latifrons*, 19.5 mm SL; Lake Matanna and Kalaena River. – CMK 6143, 53, 12.5-39.5 mm SL; on road from Palopo to Rantepao, Tandung stream, Kabupaten Luwu; M. Kottelat & A. Kottelat-Kloetzi, 12 Jun 1988. – CMK 6444, 8, 15-30 mm SL; Sungei Torak, 19 km on road from Enrekang to Pare Pare; M. Kottelat & A. Werner, 9 Mar 1989. – CMK 11395, 8, 13-34.5 mm SL; un-named tributary entering Salo Larona from the south about 300 m down-river of bridge on road to power plant; M. Kottelat, 12 Feb 1995. – RMNH 12076, 2, 41-42 mm SL; unspecified locality.

**Diagnosis.** A robust *Redigobius* with rounded head; scales on body cycloid, sometimes few weakly ctenoid scales on caudal peduncle present; body light greyish with scale margins outlined in dark grey to brown, forming reticulate pattern; dorsal and caudal fins finely barred; second dorsal rays I,7-8, usually I,7; anal rays I,6-7, usually

I,6; pectoral rays 14-18; longitudinal scales 22-26; TRB 7-10; predorsal scales 8-14; anteriormost scale sometimes enlarged. Known only from freshwater habitats in Sulawesi, Indonesia.

**Description.** Based on 30 specimens, 19.5-42 mm SL. An asterisk indicates the counts of the lectotype.

First dorsal VI\*; second dorsal I,7-I,8 (modally I,7; fin destroyed in lectotype); anal I,6-7 (modally I,6\*); pectoral rays 14-18 (mean 15; 17 on right, 16 on left, in lectotype); segmented caudal rays 16-17\* (modally 17), caudal ray pattern 7/5 to 8/7; branched caudal rays 12-15 (mean 14, 13 in lectotype); procurvent caudal rays 6/6 to 8/7 (modally 7/7); longitudinal scale count 22-26\* (mean 24); TRB 7-10 (mean 8,9 in lectotype); predorsal scale count 8-14 (mean 11, 12 in lectotype); circumpeduncular scales always 12\*. Gill rakers on outer face of first arch 1+2 to 2+6. Pterygiophore formula 3-12210 (8). Vertebrae 10+16(1), 11+15(9), 11+16(1). Neural spine of second vertebra bifid and expanded at tip (1) or narrow (1). Two epurals (13). Two (10) or three (1) anal pterygiophores before haemal spine of first caudal vertebra. Scapula unossified. Palatine not contacting quadrate. Pterygoid broad at base, two-thirds length of palatine. Quadrate forked. Metapterygoid rectangular, without process reaching to quadrate (Fig. 29). Preopercle with narrow groove along rear edge. No ossified gill-rakers.

Body robust, compressed posteriorly, more rounded anteriorly; body nearly triangular in cross-section; body width at anus 10-16.7 % SL (mean 13.6 %) (Table 15). Body depth at anal fin origin 18.2-25.2 % SL (mean 19.8 %). Head rounded, wider than deep, length 27.8-34.5 % SL (mean 30.5 %). Head depth at posterior preopercular margin 51.4-64.7 % HL (mean 57.5 %). Head width at posterior preopercular margin 65.1-85.0 % HL (mean 75.9 %). Mouth terminal, slightly oblique, forming an angle of about 20° with body axis; jaws reaching to below centre of eye in males and to below front half of eye in females (as in lectotype). Lips thick, fleshy and smooth; lower lip free at sides, narrowly fused across front. Jaws slightly longer in males than females, but not greatly enlarged, 32.4-56.3 % HL, mean 38.8 % (mean 36.9 % in females, 41.9 % in males). Eye dorsolateral, top usually forming part of dorsal profile, 21.5-31.7 % HL (mean 25.1 %). Snout short, flattened to rounded, 25.0-35.2 % HL (mean



Fig. 28. *Redigobius penango*, CMK 6143; Indonesia: Sulawesi: Tanjung River; a, female, 38.5 mm SL; b, male, 39.5 mm SL. Photographs by Maurice Kottelat.

29.8%). Interorbital broad, flat, 11.9-24.2% HL (mean 16.1%). Caudal peduncle compressed, length 23.1-28.3% SL (mean 25.4%). Caudal peduncle depth 10.7-14.4% SL (mean 13.4%).

First dorsal fin low, rounded, tips of second to fourth spines occasionally free, third or fourth spines longest or subequal; spines slightly longer in males than females; in males, spines just reaching second dorsal origin when depressed; in females, depressed spines falling short of second

dorsal fin origin. First dorsal spine always shorter than next three. Second dorsal spine longest in one female, length 16.4% SL. Third dorsal spine length in males 12.2-15.5% SL (mean 13.8%); length in females 10.9-16.4% (mean 12.4%). Fourth dorsal spine length in males 12.5-19.2% SL (mean 15.2%); length in females 11.1-13.3% (mean 12.1%). Second dorsal fin somewhat taller than first dorsal; anal fin low, about equal in height to first dorsal, posteriormost rays longest, rays usually fall well short of caudal fin when depressed; in large males, anal rays just reach caudal fin base. Pectoral fin broad, rounded, central rays longest, 21.0-27.4% SL (mean 25.2%); rays usually all branched. Pelvic fins rounded, with thick fleshy frenum; edge of frenum concave; in large specimens, frenum and fin base rugose and thickened; fin reaching halfway to two-thirds of distance to anus, 17.9-23.6% SL (mean 20.9%). Caudal fin oval to truncate posteriorly, usually rounded, 23.0-32.2% SL (mean 28.0%).

Chin usually fleshy anterior to mental f row of papillae, may form low frenum. Anterior nasal opening tubular, placed just behind edge of pre-orbital, tube short, oriented forward. Posterior

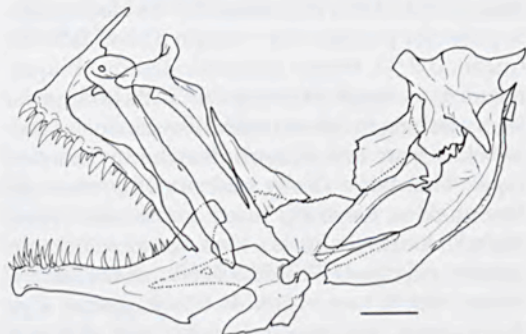


Fig. 29. *Redigobius penango*, ex CMK 6143, male, 37 mm SL; jaws and suspensorium. Scale bar: 1 mm.

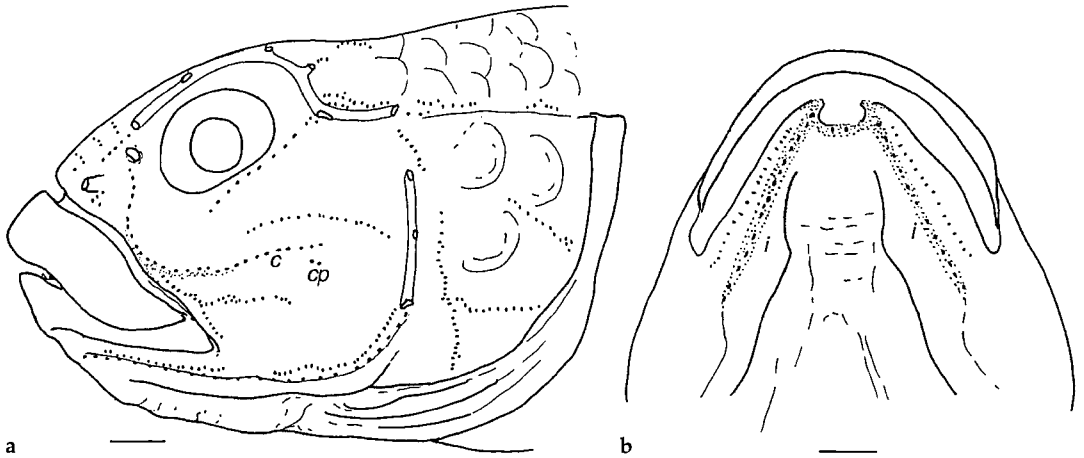


Fig. 30. *Redigobius penango*, CMK 6143, male, 39.5 mm SL; headpores and papillae pattern. a, lateral view; b, underside of head showing mandibular frenum, fine stipple indicating low groove surrounding papilla row i. Scale bar: 1 mm.

nasal opening oval, placed halfway between anterior nasal opening and front centre margin of eye. Gill opening extending forward to just under opercle. Inner edge of pectoral girdle convex, smooth. Gill rakers on outer face of first two arches reduced to rounded rudiments, longest rakers near angle of arch; rakers on inner face of first arch rudimentary; outer and inner rakers on other arches short, twice the length of first arch inner rakers. Tongue large, tip usually blunt, concave to almost bilobed in some specimens. Outer teeth in upper jaw largest, pointed and curved, behind this row are 3-4 rows of small sharp teeth; 2-3 rows at side of jaw. Lower jaw with 5-6 rows of small, curved pointed teeth across front, no teeth particularly enlarged; only 1-2 rows of teeth at side of jaw. Teeth in females smaller than in males.

Predorsal scales moderate, about even in size, reaching forward to close behind eyes. Operculum with one to four large cycloid scales on upper half; rarely naked. Cheek always naked. Pectoral base covered with large cycloid scales. Prepelvic area covered with cycloid scales. Belly scales cycloid. Body scales cycloid anteriorly, sometimes all body scales cycloid; posterior body scales weakly ctenoid, extend in narrow wedge anteriorly to behind pectoral fin; ctenoid scales may be present on caudal peduncle only.

Head pores present, as in Figure 30. Sensory papillae pattern longitudinal; all small and evenly sized; cheek row *c* long, *cp* row short and may join with row *c*; at least three *s* rows on snout.

**Coloration of preserved material.** Head and body brownish to light brownish yellow, paler ventrally; scale margins on upper two-thirds of body and nape outlined with brown, forming distinctive reticulate pattern; scales on lower third of body plain dusky to pale (Fig. 28). Scales on nape darker than those on side of body; dark outlines remain visible. Pectoral base plain brownish; Larona specimens (CMK 11395) with dorsal part of base darkest. Interorbital, top of snout and lips plain dark brownish to greyish brown.

Side of head pale brownish, usually with two or three diffuse broad dark brown streaks or blotches extending from lower edge and rear of eye backward across cheek, ending near rear edge of preopercle; dark brown blotch or short diffuse streak sometimes present at front edge of eye, running below nasal openings to upper jaw. Opercle relatively plain light brownish, scale margins rarely outlined in brown as in body scales. Underside of head pale yellowish white to pale greyish brown, with diffuse greyish brown line from anterior edge of opercle running ventrally across branchiostegal membranes and meeting its counterpart at isthmus (lines may become quite diffuse or absent at isthmus); anteriorly, similar diffuse greyish brown line beginning just behind rictus and extending right around chin close behind lips; these markings often more distinct in small specimens.

First dorsal fin with proximal half pale to dark grey, with two dark grey streaks crossing centre of fin, or a single broad dark grey to blackish

nearly central band; elongate black spot at rear of fin, sometimes occupying most of central to lower portion of fin; fin margin plain whitish, translucent or dark grey. Second dorsal fin translucent to grey, with about six rows of undulating narrow dark brown to dark grey lines; lines coalescing in some specimens and forming vermiculate pattern; fin margin dusky to white. Anal and pelvic fins plain whitish to dark grey. Pectoral fins whitish to light grey. Caudal fin translucent whitish with 7-10 vertical rows of short elongate brown to dark grey spots on upper  $\frac{3}{4}$  of fin, often coalescing into vertical irregular lines; lower  $\frac{1}{4}$  of fin plain hyaline; rear margin of fin plain whitish. Peritoneum very dark brown dorsally, sides and ventrally pale.

**Coloration of fresh material.** A colour slide by Maurice Kottelat of fresh specimens (CMK 6143; Fig. 28) shows little difference from preserved material. Head and body dull yellowish ventrally, yellowish grey dorsally, with dark greyish brown scale margins and blotchy streaks on cheek. Margin of anal fin and ventral margin of caudal fin dark grey.

**Comparisons.** This species can readily be distinguished from other *Redigobius* by having mostly cycloid scales on the side of the body (narrow wedge of ctenoid scales along mid-side, or ctenoid scales only on side of caudal peduncle), as all

other *Redigobius* have ctenoid scales on the body and in its distinctive reticulate, relatively plain colour pattern (versus variously patterned with blotches, lines and spots on the body in other *Redigobius*).

**Distribution.** Specimens are known only from six localities in south and south-east Sulawesi, Indonesia.

**Ecology.** Apparently restricted to freshwater streams in Sulawesi. The sample from Tandung (CMK 6143) was collected from a very steep-gradient stream, with shallow but swift water among large rocks, under forest cover. No other fish species was present. The sample from Larona (CMK 11395) was obtained from a sheltered stretch of the river (under forest cover) which in this area had a very strong and fast flow over rapids, upstream of a high waterfall. The sample from Torak (CMK 6444) was from a small stream with moderate flow in an open area. A specimen from Tandung River had the gut filled with insect larvae and very small cockroaches.

**Remarks.** Popta apparently used mainly one specimen when writing her description of this species, although she did state that she had four examples, one from Penango (SMF 6579) and three from Rumbia (SMF 6580-6581, 2; RMNH 10666, 1). She gave a lateral scale count of 26 in

**Table 15.** Morphometrics of *Redigobius penango*.

	lectotype	males (n=12)		females (n=18)	
		range	mean	range	mean
<b>Percentage of standard length</b>					
Head length	26.6	29.7-32.9	31.0	27.8-34.5	30.1
Body depth	29.4	18.9-20.3	19.6	18.2-22.2	20.0
Body width	-	12.6-14.3	13.3	10.7-16.7	13.9
Length of caudal peduncle	28.9	24.5-28.3	26.2	23.1-26.7	24.9
Depth of caudal peduncle	16.0	12.8-14.4	13.7	10.7-14.3	13.2
Length of pectoral fin	-	23.7-27.4	25.9	21.0-26.7	24.7
Length of pelvic fin	16.6	20.0-23.0	21.4	17.9-23.6	20.5
Length of caudal fin	-	27.5-29.4	28.6	23.0-32.3	27.6
Longest D1 spine	-	12.5-19.2	15.2	11.1-16.4	12.4
<b>Percentage of head length</b>					
Head depth	79.6	51.4-62.5	56.8	52.4-64.7	57.9
Head width	58.1	67.6-85.0	75.7	65.1-84.0	76.0
Snout length	26.9	27.9-35.2	30.3	25.0-33.3	29.4
Eye width	35.5	21.5-27.0	24.2	22.0-31.7	25.7
Jaw length	33.3	35.6-56.3	41.9	32.4-44.5	36.9
Interorbital width	14.0	12.4-24.2	16.9	11.9-22.7	15.6



the description. The specimen SMF 6579 has this count, while SMF 6580 and RMNH 10666 have 23 lateral scales (a scale count for the specimen SMF 6581, 26 mm SL, in poor condition, was not recorded), therefore SMF 6579 is likely to be the specimen mostly referred to by Popta. In 1988, a label was observed in the jar with this specimen stating that it was 'lectotype' but the author of this note is unknown and no lectotype designation has been published. For these reasons, and as the specimen is in reasonable though not good condition (has been somewhat squashed and dorsal fins damaged), and to prevent confusion with other taxa, SMF 6579 is designated here as lectotype for *Pseudogobius penango*.

A 19.5 mm SL paralectotype of *Gobius latifrons* (ex NMBA 1847-52) is actually a specimen of *R. penango*, as Larson & Kottelat (1992) and Larson (2001) pointed out.

*Redigobius penango* has a somewhat equivocal position in relation to other species of the genus. It differs in that it has a low mandibular frenum, the pelvic frenum and underside of head is fleshy and/or rugose, all the sensory papillae on the head are small and evenly sized, with variation in the *c* and *cp* rows, and in its relative plain reticulate colour pattern. In general appearance it resembles the Asian freshwater gobionelline *Rhinogobius* in its thick fleshy lips, rugose underside of head and thick frenum. The Philippine endemic freshwater species *Tukugobius carpenteri* also superficially resembles *R. penango*.

***Redigobius tambujon* (Bleeker, 1854)**  
(Figs. 31-33)

*Gobius tambujon* Bleeker, 1854: 319 (type locality: Perdana, River Panimbang, Batavia, River Tjiliwong, Java); Günther, 1861: 32; Weber, 1908: 259; Fowler, 1928: 403.

*Acentrogobius leptochilus* Bleeker, 1875b: 131 (type locality: Amboina).

*Acentrogobius leptochillus* [sic]: Koumans, 1953: 76-77.

*Glossogobius tambujon*: Jordan & Seale, 1908: 542.

*Gobius romeri* Weber, 1911: 39, fig. 8 (type locality: Panua Bori River near Sungai Manumbai, Wokam & Matora River near Sungai Manumbai, Wokam, Aru Is., Indonesia); Fowler, 1928: 403 (in part); Nijssen et al., 1993: 233.

*Gobius reticularis* Weber, 1911: 39, fig. 7 (type locality: Walde near Wokamar, Wokam; Matora

River near Sungai Manumbai, Wokam; near Papakula, Kobror; near Seltutti, Kobroor, Aru Island, Indonesia); de Beaufort, 1913: 140; Fowler, 1928: 405; Nijssen et al., 1993: 233.

*Vaimosa macrognathos* Herre, 1927: 145, pl. 10 fig. 2 (type locality: Lake Taal, Batangas Province, Philippines); Koumans, 1940: 185.

*Vaimosa sapanga* Herre, 1927b: 152, pl. 11 fig. 3 (type locality: Sapanga Creek, Angat, Bulacan Province, Luzon, Philippines).

*Stigmatogobius tambujon*: Koumans, 1932: 10-11.

*Vaimosa koumansii* Mukerji, 1935: 268-270, pl. 6 figs 3-4 (type locality: hill stream, Austen Straits, North Andaman).

*Pseudogobiopsis romeri*: Koumans, 1935: 132-133, 1941: 244.

*Vaimosa horiae* Herre, 1936a: 280 (type locality: Bab-el-Thuap, Pelew Group) (in part).

*Vaimosa cardonensis* Herre, 1940: 358, pl. 2 (type locality: Cardona, north coast of Laguna de Bay, Luzon); Böhlke, 1953: 118.

*Stigmatogobius sapanga*: Koumans, 1940: 185.

*Stigmatogobius tambujon*: Fowler, 1949: 140 (Lake Charanku, Saipan).

*Stigmatogobius romeri*: Koumans, 1953: 113, 115 (in part); Inger & Chin, 1962: 187; Ryan, 1980: 66.

*Redigobius sapangus*: Bright & June, 1981: 109 (Ngerksong reservoir, Palau).

?*Redigobius horiae*: Bright & June, 1981: 109 (Palau).

*Redigobius romeri*: Allen, 1991: 192-193, fig. 38, pl. 15, no. 15 (in part); Séret, 1997: 374.

*Redigobius romeri*: Kottelat et al., 1993: 152; Larson, 2001: 208-209; Larson & Murdy, 2001: 3601.

*Redigobius tambujon*: Kottelat et al., 1993: 152.

*Vaimosa macrognatha*: Larson 2001: 208.

**Material examined.** INDIA: ZRC 46962, 2, 26-36.5 mm SL; Rutland Island, off South Andaman, Andaman Islands; P. Biswas, Mar 2001. PHILIPPINES: CAS 32980, holotype of *Vaimosa cardonensis*, male, 21.5 mm SL; BMNH 1938.12.3.208-212, 6 paratypes, 17-20.5 mm SL; Cardona, Laguna de Bay north shore; A. W. Herre, Aug 1936. - FMNH 50948, 12, 23.5-37 mm SL; Lapulapu River, Iwahig, Palawan; Werner, 4 Mar 1947. - USNM 316135, 4, 15-27 mm SL; Casatagan River, Zambales Province, Luzon; T. Roberts, 14 Mar 1976. - CAS 66127, 10, 31-39.5 mm SL; Mindoro; L. R. Rivas, Apr-May 1963. REPUBLIC OF PALAU: CAS 29070, lectotype of *Vaimosa horiae*, male, 29.5 mm SL; freshwater, Babeldaob, Palau; Y. Hori, 14 Oct 1933. - CAS 76087, 21, 22.5-40 mm SL (3 C&S); Arakitaoch Stream, Babeldaob Island, Palau; Sumang & Marbou, 27 Nov 1956. - AMSI.25037-001, 1, 34 mm SL; Ngardis; G. Bright, 9 Jul 1977.

INDONESIA: RMNH 4458, lectotype of *Gobius*



Fig. 31. *Redigobius tambujon*, CMK 11334, female, 38 mm SL; Indonesia: Halmahera. Photograph by Rex Williams.

*tambujon*, 27 mm SL; [Ciliwong River], Batavia, Java. – RMNH 4663, holotype of *Acentrogobius leptochilus*, male, 38.5 mm SL; Amboina; P. Bleeker. – SMF 6703, lectotype of *Gobius roemeri*, male, 34 mm SL; Sungai Manumbai, Panura Boribei River, Wokam, Aru Islands; H. Merton, 14 Mar 1908. – SMF 6701, paralectotype of *Gobius reticularis*, female, 15 mm SL; near Papagule, Kobroor, Aru Islands; H. Merton, 30 Apr 1908. – ZMA 112.661, lectotype of *Gobius reticularis*, female, 17 mm SL; forest creek near Wokamar, Aru Islands; H. Merton, 17 Apr 1908. – SMF 6702, paralectotype of *Gobius reticularis*, 13 mm SL; freshwater near Seltutti, Kobroor, Aru Islands; H. Merton, 30 Apr 1908. – CMK 11356, 7, 19.5–31.5 mm SL; Halmahera; D. Robb, Aug 1994. – WAM P.31467-004, 2, 28–36 mm SL; E side Majalabit Bay, Waigeo Island, Raja Ampat islands, West Papua; G. Allen & S. Renyaan, 2 May 1998. – WAMP.31463-010, 1, 24 mm SL; Warmon Stream, Batanta Island, Raja Ampat Islands, West Papua; G. Allen & S. Renyaan, 29 Apr 1998. – WAMP.31461-006, 2, 24–36 mm SL; Warmon Stream, Batanta Island, Raja Ampat Islands, West Papua; G. Allen & S. Renyaan, 27 Apr 1998.

**Material examined but no data taken.** INDIA: RMNH 16994, 1; near Weli Village, Middle Andaman, Andaman Islands. PHILIPPINES: CAS 3166, 145+; Comon River, Bohol. – NTM unreg., 12; CAS 55265, 1; Palawan. – CAS 26384, 2; CAS 26380, 2; Subic Bay, Zambales Province. – CAS 26379, 2; Karig Malan River, Culion. – CAS 26382, 5; Baldat, Culion. – CAS SU 61626, 1; Tarogin River, Mindoro Oriental. – CAS 55265, 1; NE of Puerto Princesa, Palawan. – USNM 99537, 1; Amilao River, Iloilo. – USNM 263429, 6; Tabios River, Bataan, Luzon. – FMNH 50948, 12; Lapulapu River, Iwahig, Palawan. REPUBLIC OF PALAU: AMS I.24826-001, 10 (2 C&S); Imengelnal Stream, Babeldaob. – CAS 76080, 6; CAS 76086, 2; CAS 76085, 23; Babeldaob. – AMS L.39657-003, 7; Ngardoch River. – CAS 76082, 1; CAS 76083, 7; CAS 76081, 3; Arakitaoch Stream, Babeldaob. – CAS 76084, 9; Iklong Stream, Aalsemith River, Babeldaob. – AMS I.27216, 3; Metengalakumer River, Babeldaob. – CAS 53265, 1; Koror.

INDONESIA: CMK 7267, 1; Tanjung Mayong, Padang Island, Riau, Sumatra. – CMK 11334, 6; Halma-

hera. – USNM 266391, 1; Halmahera, Jailolo District. – WAMP.31466-005, 2; Waigeo Island, West Papua. PAPAUA NEW GUINEA: NTM S.13675-010, 1; Nagada River, Madang. – WAM P.28184-001, 2; S of Kavieng. SOLOMON ISLANDS: USNM 341221, 1; USNM 123449, 1; Florida Island [both lots possibly this species]. NO DATA: RMNH 10668, 1.

**Diagnosis.** A slender *Redigobius* with compressed head and body; greatly enlarged jaws in adult males with lips distinctively broadened anteriorly and narrowed below eye; body with scale margins outlined forming reticulate pattern; dark band along mid-side of body; head with 4–6 curved oblique dark bands crossing cheek and small dark mark behind upper rear part of eye (most conspicuous in males, resembling raised eyebrow); variably sized black blotch on posterior part of first dorsal fin; second dorsal rays 1,6–8, modally 1,7; anal rays 1,6–7, modally 1,6; pectoral rays 15–18; longitudinal scales 22–25; TRB 7–8½; predorsal scales 6–9. Known from swift freshwater rivers and streams from the Andaman Islands to Palau and New Guinea.

**Description.** Based on 42 specimens, 15–43.5 mm SL. An asterisk indicates the counts of the lectotype of *Gobius tambujon*.

First dorsal VI\*; second dorsal I,6–I,8 (usually 1,7\*); anal I,6–7 (usually 1,6\*); pectoral rays 15–18 (usually 17; 16 in syntype); segmented caudal rays 16–17\*; caudal ray pattern 9/8\*; branched caudal rays 6/5 (1), 7/6 (26), 7/7 (5), 7/8 (1), 8/6 (2); procurrent rays 6/6 (1); longitudinal scale count 22–25 (mean 24, 23 in syntype); TRB 7–9 (mean 8\*); predorsal scale count 6–9 (mean 8, 7 in syntype); circumpeduncular scales 11–13 (mean 12\*). Gill rakers on outer face of first arch 1+6 (1), 2+6 (1), 2+7 (4), 3+6 (3), 3+7 (1). Pterygiophore formula 3-12210 (9), 2-12220 (1). Vertebrae 10+16 (1),



**Fig. 32.** *Redigobius tambujon*, aquarium kept. Indonesia: Irian Jaya: Gam River; **a**, male and **b**, female. Photographs by Gerry Allen.

11+14(1), 11+15(9), 12+14(1). Neural spines of first three vertebrae narrow and pointed (10). Two epurals (10). Three (11) anal pterygiophores before haemal spine of first caudal vertebra.

Body and head slender, compressed (more so posteriorly); body width at anus 8.3-17.6 % SL (mean 12.2 %) (Table 16). Body depth at anal origin 14.3-30.0 % SL (mean 20.6 %). Head deeper than wide, length 20.5-43.5 % SL (mean 31.0 %); cheeks may be fleshy and bulbous in large males. Head depth at posterior preopercular margin 54.9-71.0 % HL (mean 61.4 %). Head width at posterior preopercular margin 45.5-66.0 % HL (mean 56.4 %). Mouth terminal, slightly oblique, forming an angle of about 20-25° with body axis; jaws slender, generally reaching past eye in males and to below front half of eye in females (to below mid-eye in large females). Lips smooth, lower lip free at sides, fused across front; in males, lip broader anteriorly, narrowing considerably in

steep curve below anterior edge of eye, giving characteristic shape to mouth. Chin may be flat or slightly inflated. Upper jaw length 15.7-75.0 % HL (mean 33.3 % in females, 61.1 % in males). Eye lateral, high on head, top usually forming part of dorsal profile, 19.6-33.0 % HL (mean 27.5 %). Snout flattened, pointed, 16.3-37.0 % HL (mean 24.6 %). Interorbital narrow to slightly concave, 7.1-16.4 % HL (mean 10.7 %). Caudal peduncle compressed, length 20.8-45.9 % SL (mean 27.8 %). Caudal peduncle depth 9.6-19.4 % SL (mean 13.1 %).

First dorsal fin rounded to pointed in males, depending on whether first spine longest or not; fin rounded in females, tip of first spine may be free, third and fourth spines may be subequal; spines slightly longer in males than females; spines reaching first few elements of second dorsal fin when depressed; fin just reaching first dorsal fin spine in females. First dorsal spine

usually longer than next three and may be elongate, 11.9-32.5 % SL (mean 23.0 %) mean length in SL in females 20.0 % and 25.2 % in males. Second dorsal spine never longest in males, in females length 11.9-14.3 % SL (mean 13.4 %). Third dorsal spine longest in only one specimen each among males and females. Second dorsal and anal fins short-based, moderate in height, pointed anteriorly and posteriorly, posteriormost rays in large males only just reaching caudal fin when depressed and posteriormost rays clearly longer than anterior rays. Pectoral fin slender, oval, central rays longest, 15.1-41.2 % SL (mean 26.4 %); rays all branched but for uppermost. Pelvic fins oval, reaching to anus in males, just falling short in females, 15.8-34.7 % SL (mean 24.0 %). Caudal fin rounded posteriorly, 19.7-34.6 % SL (mean 29.0 %).

Anterior nasal opening in short tube, placed behind upper lip, generally oriented forward. Posterior nasal opening oval, placed close to front centre margin of eye. Gill opening extending forward to under opercle. Inner edge of shoulder girdle smooth. Gill rakers on outer face of first arch very short, rounded and stubby, unspined, longest rakers near angle of arch. Tongue tip blunt to rounded. Jaws narrow, bluntly rounded anteriorly. In males, lower jaw teeth curved and sharp, in 1 row at side and 3 rows across front, teeth on innermost row larger, stouter, curving inward, with largest 1-3 teeth at outer curve of side of jaw

(just before single side row of teeth commences). Upper jaw teeth similar, in 3-5 rows but outermost, not innermost, row of teeth at front of jaw largest and stoutest; 2-4 teeth (at curve of jaw just before 1-2 rows of teeth at side) may be enlarged and strongly curved. In females, teeth small, sharp and evenly sized, in 1-2 rows along side of jaws and 3-4 rows across front; largest and more curved teeth across front of upper jaw; no teeth enlarged.

Ctenoid scales on side of body. Predorsal scales cycloid, close up to behind eyes. Operculum with few (3-5; may be quite large) cycloid scales. Cheek naked. Pectoral base covered with cycloid scales. Prepelvic area covered with small cycloid scales. Belly scales cycloid; some specimens with a few weakly ctenoid scales near pelvic fin base.

Head pores and sensory papillae pattern similar to that of *R. dispar* (Fig. 1).

**Coloration of preserved material.** Head and body pale brown to whitish, paler ventrally, especially on abdominal region (Fig. 31). Scales with broad brown margins, giving reticulate pattern, although brown colour may cover most of scales in small specimens, becoming overall brown and less reticulate in appearance. Mid-side of body with series of dark brown X- or chevron-shaped marks which may coalesce to form broad dark brown band along body, commencing just above

Table 16. Morphometrics of *Redigobius tambujon*.

	syntype RMNH 4458	males (n=22)		females (n=18)	
		range	mean	range	mean
<b>Percentage of standard length</b>					
Head length	31.5	26.8-35.0	32.4	20.5-43.5	29.3
Body depth	20.0	18.3-23.4	20.2	14.3-30.0	21.1
Body width	-	8.3-13.8	11.7	9.9-17.6	12.7
Length of caudal peduncle	27.8	23.8-34.2	27.1	20.8-45.9	28.7
Depth of caudal peduncle	12.6	11.6-14.9	13.2	9.6-19.4	13.0
Length of pectoral fin	-	15.1-29.8	25.8	18.7-41.2	27.2
Length of pelvic fin	18.5	15.8-27.7	23.4	17.7-34.7	24.9
Length of caudal fin	-	26.3-34.6	30.1	19.7-30.3	27.6
Longest D1 spine	-	23.3-32.5	25.2	11.9-24.4	20.0
<b>Percentage of head length</b>					
Head depth	63.5	55.4-71.0	61.8	54.9-68.0	60.8
Head width	56.5	45.5-63.6	54.8	51.4-66.0	58.4
Snout length	24.7	21.4-37.0	26.1	16.3-25.6	22.8
Eye width	29.4	19.6-30.0	25.5	26.6-33.0	29.9
Jaw length	50.6	36.0-75.0	61.1	15.7-38.5	33.3
Interorbital width	7.1	7.1-16.4	10.9	8.1-15.3	10.6

pectoral fin base. Pectoral fin base pale brown, sometimes with dark brown blotch or horizontal bar crossing uppermost part and extending onto bases of uppermost few rays. Breast and belly plain.

Side of head with four to seven forwardly oblique brown bands, tending to coalesce and become reticulate in large adults; anteriormost brown band from front of eye, extending just below nasal openings, crossing lips and joining on chin, nearly always visible. In adult males, one or two brown bands below eye may turn ventrally then posteriorly to run along edge of upper jaw. Many specimens with dense dark brown triangular blotch at upper rear edge of eye, sometimes difficult to discern among the brown mottling of interorbital region; dark blotch almost linear in some specimens. Top of snout and interorbital reticulated with dark brown. Underside of head plain, usually with dark brown band behind chin; in heavily-marked specimens, oblique brown bands crossing cheek ending in dark brown blotches on either side of isthmus.

First dorsal fin translucent to dusky, crossed by two diffuse to dense brownish stripes, one stripe close to fin base and other band submarginal to nearly central in position; usually large dense black blotch on rear of fin, size and extent of blotch somewhat variable (and absent altogether in some specimens from Mindoro, Philippines, e. g. CAS/SU 61627); some specimens with black spot closer toward centre of fin and not touching rear margin of fin. Second dorsal fin translucent to pale dusky with narrow brown to blackish marginal stripe and three to five brown stripes along fin, which may be broken up into series of elongate spots and dashes or coalesced into reticulate pattern; usually three brown stripes discernible in arrangement. Anal fin plain dusky to dark grey with narrow whitish to transparent margin. Caudal fin translucent to dusky with pair of dark brown blotches at base (at end of mid-lateral dark brown band or series of X-shaped marks) and five to seven narrow, oblique brown stripes or irregular rows of brown spots; stripes may break up ventrally, merging into series of brown lines following fin rays. Pectoral fin transparent with rays narrowly edged with brown. Pelvic fins translucent to dusky; if pigmented, then fins darkest dorsally, may be more intense along membrane between fourth and fifth rays.

**Coloration of fresh material.** Based on colour photographs by Gerry Allen and Rick Winterbottom. Colour pattern not too dissimilar to preserved material. Head and body translucent greyish brown to greyish yellow with dull yellow to pale gold spots scattered over upper half of body and predorsal region (Figs. 32-33). Scales on body with curved to vertical diffuse bar or blotch, giving indistinct reticulate to mottled pattern. Four evenly-spaced internal dark greyish broad bars extending from vertebral column to mid-ventral line; dark bars commencing above first few anal fin rays and may be slightly oblique. Mid-side of body with row of dark greyish brown to dark grey blotches, which may be indistinct. Caudal fin base with one or two blackish to dark grey spots. Pectoral fin base with iridescent white, pale blue or pale gold patch or vertical bar, usually extending onto bases of central fin rays. Head pale greyish brown to greyish yellow with brown to dull reddish brown oblique broad stripes. Iris brown with narrow pale gold rim around pupil.

First dorsal fin transparent with large black blotch on upper rear part of fin and reddish orange stripe along distal margin of fin (may be also narrowly edged in black above reddish orange stripe in some specimens); lower half of fin with pale dusky and pale orange patches, separated from upper half by narrow dark brown to blackish line extending forward from black blotch at rear of fin. Second dorsal fin transparent with pale brownish band along distal margin and about five oblique rows of brown spots which become more elongate and oblique toward posterior of fin; in between rows of brown spots, indistinct pale iridescent whitish blue spots present, which may form line below marginal brown stripe. Anal fin translucent with dusky to iridescent blue running parallel to fin rays or covering fin rays. Caudal fin translucent with irregular alternating rows of pale brown and pale gold or iridescent pale blue spots; brown spots most prominent on basal half of fin, fading posteriorly. Pectoral fin translucent, fin rays may be pale brown basally; iridescent white, pale blue or pale gold patch from fin base extending onto bases of central fin rays. Pelvic fin membrane transparent, fin rays greyish to pale iridescent blue.



Fig. 33. *Redigobius tambujon*, male, aquarium kept; New Guinea: Milne Bay. Photograph by Gerry Allen.

**Comparisons.** *Redigobius tambujon* is most similar in appearance (body form, meristics and colouring) to *R. oyensi*, *R. lekutu* and *R. leverii*; these relatively slender species may form a species-group. See these species' accounts for comparison with *R. tambujon*.

**Distribution.** Known from the Andaman Islands, Philippines, Micronesia (Palau), Indonesia (Riau, Sumatra, Java, Aru Islands, Halmahera, West Papua), and New Guinea (Madang, Kavieng). Séret (1997) reported the species from New Caledonia but no specimens were examined for this study. The specimen listed above in "Material examined" from the Solomon Islands is a small (19.5 mm SL) slender male, lacking colour pattern, that may possibly be *R. tambujon*.

**Ecology.** Most collections of this species have been from fresh water (only occasionally in estuarine habitats). It is usually found in swift flowing streams, often described as "cascades" or a "cascade zone", above or below waterfalls, with solid rock, boulder and gravel substrate. A few sites were described as having mud and sand present, and one was from a mangrove only 50 m from the shoreline.

A specimen from Palau contained insect remains and a few nematodes in its gut.

**Remarks.** The remaining type specimen of *Gobius tambujon* Bleeker (RMNH 4458) is not in the best condition but is slender, with long jaws and head, and has 18 pectoral fin rays; its sex is uncertain, but its morphology and meristic values agrees with recent specimens. Bleeker's description was based on three specimens 25-35 mm (TL), from Panimbang River, Perdana (just west of Batavia [Jakarta]), and the Tjiliwong [Ciliwong] River,

Batavia, but the whereabouts of the two other specimens are unknown. He also compared his new species with *Gobius poecilosoma* (a *Pseudogobius*) and *G. hoevenii* (a *Hemigobius*). As the whereabouts and identity of the other syntypes are unknown and to stabilise the name, the 27 mm SL specimen RMNH 4458 is here designated as lectotype for *Gobius tambujon* Bleeker.

Bleeker's *Acentrogobius leptochilus* was originally considered to be the correct name for *R. oyensi* (Larson, 2001) and not *R. tambujon*. However, as more material was examined, it was realised that the male holotype of *A. leptochilus* could not belong with *R. oyensi*, but was *R. tambujon*, as the second and third first dorsal fin spines were longest but none elongate (fourth dorsal fin spine always elongate in male *R. oyensi*), and the distinctive lateral blotches and blackish U or W shaped mark above the pectoral fin base were not mentioned by Bleeker (1875b). No colour pattern remains on the specimen other than the black blotch on the rear of the first dorsal fin.

The specimens from the Botanical Garden in Bogor (Java) identified as *Glossogobius tambujon* by Jordan & Seale (1908) have not been examined; assigning this citation to *R. tambujon* is based only on the short description they gave (indeed, they may not have had this species at all).

The male syntype specimen (SMF 6703) of the fish described as *Gobius roemeri* Weber, 1911, looks just like the lectotype of *R. tambujon*; the fish has 18 pectoral fin rays and Weber's Figure 8 shows the distinctive shape and colour pattern of this species. A label in the jar containing SMF 6703 says that it is a 'lectotype', but no such designation appears to have been published. The second specimen mentioned in Weber's description is in ZMA 110.976 (Nijssen et al., 1993). The females of this species were described as *G. reticularis* in the same paper, and illustrated (Weber, 1911: fig. 7). The specimen SMF 6702 (a syntype of *G. reticularis*) may possibly be a different species of *Redigobius* (but its condition prevented further identification). Another label saying 'lectotype' is in the jar containing SMF 6701, a 15 mm SL female *G. reticularis* (damaged, with lower half of its head missing). To prevent further uncertainty as to the name and status of these specimens and to provide stability, I designate SMF 6703 as lectotype of *Gobius roemeri* Weber and ZMA 112.661 as lectotype of *Gobius reticularis* Weber.

The 13 types of *Vaimosa macrognathos* Herre, 1927, were destroyed in WWII. Koumans (1940)

designated a lectotype (but we will never know which specimen it was). The name is synonymised here based on information in Herre's original description and illustration (Herre, 1927: 145-146, pl. 10 fig. 2).

The 21 syntypes of *Vaimosa sapanga* Herre, 1927, were destroyed in WWII. *Vaimosa sapanga* is treated here as a synonym of *R. tambujon* based on Herre's original description and figure (Herre, 1927: 152, pl. 11 fig. 3), which closely match characters of *R. tambujon*.

The syntypes of *Vaimosa horiae* Herre, 1936, in CAS 29070 and 29071 include *R. bikolanus* (eight specimens), *R. tambujon* (two) and *Mugilogobius chuluae* (one). The largest specimen (29.5 mm SL in CAS 29070), which seems to be the one on which most of Herre's description is based on, is an adult male with the typical colour pattern of *R. tambujon*. Because there are several species present among the type specimens and to stabilise the name, the 29.5 mm SL male in CAS 29070 is here designated as lectotype of *Vaimosa horiae* Herre (the 26.5 mm SL specimen also in CAS 29070 is *R. bikolanus*).

The holotype of *Vaimosa koumansii* Mukerji, 1935, from the Andamans, was reported as lost according to the ZSI type register (R. P. Barman, ZSI, in litt., 19 August 1991). From the original description, and the fish shown in Mukerji's Plate 6, which looks very like *R. tambujon*, I have synonymised *V. koumansii* with *R. tambujon*. The species was stated to come from a freshwater hill stream with rocks, so the habitat is appropriate, plus specimens from the Andamans lodged at RMNH and ZRC show that the species does occur there.

The male holotype and seven paratypes of *Vaimosa cardonensis* Herre, 1940, are all *Redigobius tambujon*.



Fig. 34. *Gobius vergeri*, holotype; Madagascar: Samborano River. From Bleeker (1875a: pl. 19 fig. 1).

### Nomina dubia and species not yet assigned

A list of nominal species of *Redigobius* and their valid names is provided (Table 1). However, there are a number of names which could possibly apply to species of *Redigobius*, and are briefly discussed below.

*Stigmatogobius amblyrhynchus* Bleeker, 1878: 207 (Java).

Bleeker's description was based on six specimens (38-45 mm TL), which are apparently lost (Koumans, 1953). The syntypes, held at RMNH, were not found during a search in 1988. From the original description this seems to have been a species of *Redigobius*. Kottelat et al. (1993: xxxvi) listed this species (as *Redigobius amblyrhynchus*) as a "species to watch", because it had not been recorded since the original description.

*Gobius magniloquus* Day, 1876: 296 (Madras, India).

A possible syntype (ZSIC 159), is either lost or destroyed. It was reported as lost according to the ZSI type register (R. P. Barman, ZSI, in litt., August 1991). From Day's original description, the species could belong to *Redigobius*, *Pseudogobius*, or *Mugilogobius*.



Fig. 35. *Redigobius* sp., AMNH 233641, 33 mm SL; Madagascar: Mahovouva River.

*Stigmatogobius micrognathus* Rao, 1971: 50, figs. 3a, 3c (Godavari Estuary, India).

The holotype is at the Zoology Museum, Andhra University, Waltair, and it has not been possible to examine it. The species could be a *Redigobius* or a *Pseudogobius*, based on the original description.

*Vaimosa microstomia* Seale, 1910: 538 (Malabon, Rizal Province, Luzon, Philippines).

The holotype, BSM 827 (33 mm SL, 45 mm TL) was destroyed in WWII. Koumans (1940) provided catalog number and SL of the holotype, but no other details. He regarded it as identical with *Pseudogobius javanicus*. From the original description, the species could also have been a *Redigobius*.

*Vaimosa rivalis* Herre, 1927: 149, pl. 11 fig. 1 (Talakop Creek, at foot of Mount Isarog, Calabanga, Camarines Sur Province, Philippines).

The syntypes, BSM 13061 (16 specimens) and BSM 13602 (8 specimens), were destroyed in WWII. Koumans (1940) provided the BSM catalogue number of the types. This species could be *Redigobius* or *Eugnathogobius*, based on the original description.

*Vaimosa tessellata* Herre, 1927: 153-154, pl. 12 fig. 1 (Titunod River, a mountain torrent at Kolambuan, Lanao Province, Mindanao).

The syntypes were listed by Koumans as being catalogued as BSM 12999, 5 (24-47 mm TL), destroyed in WWII (Koumans 1940: 185). Koumans (1940) regarded it as a synonym of *Pseudogobius javanicus*. From the original description, this species appeared to have been a *Redigobius* or a species of *Pseudogobius*. Herre (1927) did not mention the dark mid-ventral spots on the caudal peduncle for this species, which he described and illustrated for *Vaimosa bikolana* in the same paper.

*Gobius vergeri* Bleeker, 1867: 420 (Samberano River, Madagascar).

The holotype of *Gobius vergeri* was probably originally lodged at RMNH, but was not found during searches in 1976 and 1988 and is considered to be lost. Larson (2001) thought that it was a *Redigobius* (based on the original description and the colour figure in Bleeker (1875a: 58, pl. 19 fig. 1; reproduced in Sauvage, 1891: 354, pl. 39 fig. 4). Bleeker's figure looks somewhat like a male

*Redigobius*, with a large mouth reaching back past the eye (Fig. 34). Additionally, he stated that the type of *Gobius vergeri* had about 14 predorsal scales and resembled *Gobius tambujon* (*Redigobius tambujon*) and *G. poicilosoma* (*Pseudogobius poicilosoma*), adding to my suspicion that it may have been a *Redigobius*.

A single 33 mm SL female specimen of *Redigobius* resembling a slender *R. bikolanus* is known from Madagascar (AMNH 233641; Mahovoua River, outside Antarambe; P. V. Loiselle & Tsilavana, 24 Sept 2003; Fig. 35). This specimen, which is in poor condition, resembles *R. bikolanus* in meristics and other aspects (including pattern at caudal fin base) but is very slender (body depth 17 % SL compared to 19.5-26.9 % in *R. bikolanus*) and has 10 predorsal scales, a high count which somewhat agrees with Bleeker's count of 14. A similar high count is found in its neighbour *R. dewaali*, which does not resemble this specimen (compare Figs. 11 and 35). Additional specimens from Madagascar need to be examined.

## Discussion

There seem to be several species-groups within the genus *Redigobius*. *Redigobius chrysosoma* is the most easily recognisable species, differing from the others by having short transverse papilla rows under the eye, ctenoid scales on the side of the nape, nearly always having a second dorsal and anal fin ray count of 1,6 and a distinctive pale pearly grey live colour. It was tempting to place it in *Cyprinogobius*, the genus erected for it by Koumans (1937), but no significant osteological or other features appeared to warrant this.

Larson (2001) placed *Redigobius* at the base of her morphological trees showing relationships among genera of the subfamily Gobionellinae and considered the genus to be basal to that group. Three species of *Redigobius* were shown to be close to *Pseudogobioptis* in Larson (2009). Six species of *Redigobius* (*R. balteatus*, *R. bikolanus*, *R. chrysosoma*, *R. nanus*, *R. macrostoma*, *R. tambujon*) have been analysed for the cytochrome oxidase I (COI) gene for the Fish Barcode of Life Program (www.fishbol.org) and two other projects looking at several genes of a number of genera and species of gobionellines (Bertozzi et al., in prep.; Larson & McMahon, in prep.). The results so far are in general agreement with previous work.



## Acknowledgements

My many thanks to people at the following institutions who loaned me specimens, often for quite a while, especially Gerry Allen, Conservation International; His Majesty Emperor Akihito, BLIP; Genie Böhlke, late of ANSP; Dave Catania, CAS; Barry Chernoff, FMNH; Guy Duhamel, MNHN; Bill Eschmeyer, CAS; Karsten Hartel, MCZ; Doug Hoese, AMS; Butch Hulley, SAM; J.-C. Hureau, formerly of MNHN; Susan Jewett, formerly of USNM; Jeff Johnson, QM; Maurice Kottelat, Switzerland; Friedhelm Krupp, SMF; Kelvin Lim, ZRC; Mark McGrouther, AMS; Katsusuke Meguro, BLIP; Oliver Crimmen, BMNH; Sue Morrison, WAM; Barbara Brown, AMNH; Han Nijssen, ZMA; Peter Ng, ZRC; Martien van Oijen, RMNH; Hans-Joachim Paepke, formerly of ZMB; Brad Pusey, Griffith University, Brisbane; Bill Smith-Vaniz, formerly of ANSP; Heok Hui Tan, ZRC; Chavalit Vidthayanon, NIFI; Horst Wilkens, formerly of ZMH; and Rick Winterbottom, ROM.

Many thanks to all who helped provide fresh specimens, information, and/or photographs: Mark Abell, ANGFA; Mark Adams, SAMA; Neil Armstrong, ANGFA; Roger Bills, SAIAB; David Boseto, University of the South Pacific, Fiji; Caroline Camilleri, Office of the Supervising Scientist, Darwin; I-Shiung Chen, National Ocean University, Taipei; Phil Heemstra, SAIAB; Hans Horsthemke, Witten; Aaron Jenkins, Wetlands International, Fiji; Gerhard Ott, Flensburg; N. Oseko, Japan; Nonn Pativong, Bangkok; Christine Pöllabauer, New Caledonia; Paddy Ryan, Ryan Photographic, Colorado; Ukkrit Satapoomin, Biological Research Centre, Phuket; Toshiuki Suzuki, Amagasakikita Senior High School, Hyogo, Japan; Dave Wilson, Aquagreen, Darwin. My final thanks to Rex Williams, NTM, for black and white and X-ray photography, and much-appreciated assistance.

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Received 6 April 2009  
 Revised 27 January 2010  
 Accepted 21 March 2010