

# Description of three new species of dwarf *Glossogobius* from New Guinea and northern Australia

by

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**Abstract.** – The current paper describes three, highly distinctive, new species of *Glossogobius* from southern New Guinea and northern Australia. The species differ from other species of *Glossogobius* in the combination of small size (maximum size to 50 mm SL), strong sexual dimorphism in mouth and fin sizes and reductions of nape scales and head pores in two of the species. The new taxa are known from small rivers and streams at elevations of less than 100 m.

**Résumé.** – Description de trois nouvelles espèces de *Glossogobius* de Nouvelle Guinée et du nord de l'Australie.

Cet article décrit trois nouvelles espèces de *Glossogobius* du sud de la Papouasie-Nouvelle-Guinée et du nord de l'Australie. Ces espèces diffèrent des autres espèces de *Glossogobius* par une combinaison de caractères incluant une petite taille (taille maximale de 50 mm LS), un fort dimorphisme sexuel de la bouche et de la taille des nageoires, un nombre réduit d'écailles sur la nuque et des pores de la tête. Elles sont connues de petites rivières et de ruisseaux à des altitudes inférieures à 100 m.

## Key words

Gobiidae  
*Glossogobius*  
Australia-Papua New Guinea  
Freshwater  
New species

The predominately freshwater genus *Glossogobius*, which is confined to the Indo-Pacific region eastward to the Caroline Islands is estimated to contain at least 50 species (Hoese and

Allen, 1990). Only one species, *Glossogobius circumspetus* (Macleay, 1883), is restricted to estuarine environments in channels and mangroves. Species occur in a variety of habitats, from mangrove environments, rivers, small creeks and lakes. Some species are widely distributed, but others confined to small geographic areas, particularly diverse in Australia and New Guinea (Hoese and Allen, 2009, 2015). The species live on sand or sandy gravel bottoms and are not known to bury in sand, as we have observed for both species of the related *Psammogobius*. The genus is unusual exhibiting a wide range of sizes. *Glossogobius giuris* (Hamilton, 1822) from Africa has been reported to reach a total length of 50 cm (Eccles, 1992). We describe here three species that are amongst the smallest in the genus, maturing at around 20–30 mm SL and a maximum size of around 50 mm SL. Previously only three other diminutive species have been described, including *Glossogobius muscorum* Hoese & Allen, 2009, from New Guinea (to 60 mm SL), *G. bellendenensis* Hoese & Allen, 2009, from north-eastern Australia (to

53 mm SL) and *G. minutus* Geevarghese & John, 1983, from India (to 49 mm SL).

The material upon which the descriptions are based was collected by the authors and various other workers and aquarists from north-eastern Australia and southern New Guinea (Indonesia and Papua New Guinea). Samples were taken from peat bogs and small streams with sand and gravel substrates. Although the species described here appear to be allopatric, too little sampling has been carried out in southern New Guinea, and it is likely that the species are more widely distributed.

## MATERIAL AND METHODS

Institution abbreviations follow Sabaj Pérez (2014). Terminology for papillae (Fig. 1) follows Hoese (1983), Wongrat and Miller (1991) and Akihito and Meguro (1975). Head pore terminology and counts and measurements follow methods outlined in Hoese and Allen (1990, 2012). In describing each papilla line the first letter of the abbreviation indicates the orientation of the line on the head (L, along the axis; T, at right angles to the axis of the body and O, oblique); the second letter refers to the orientation of the

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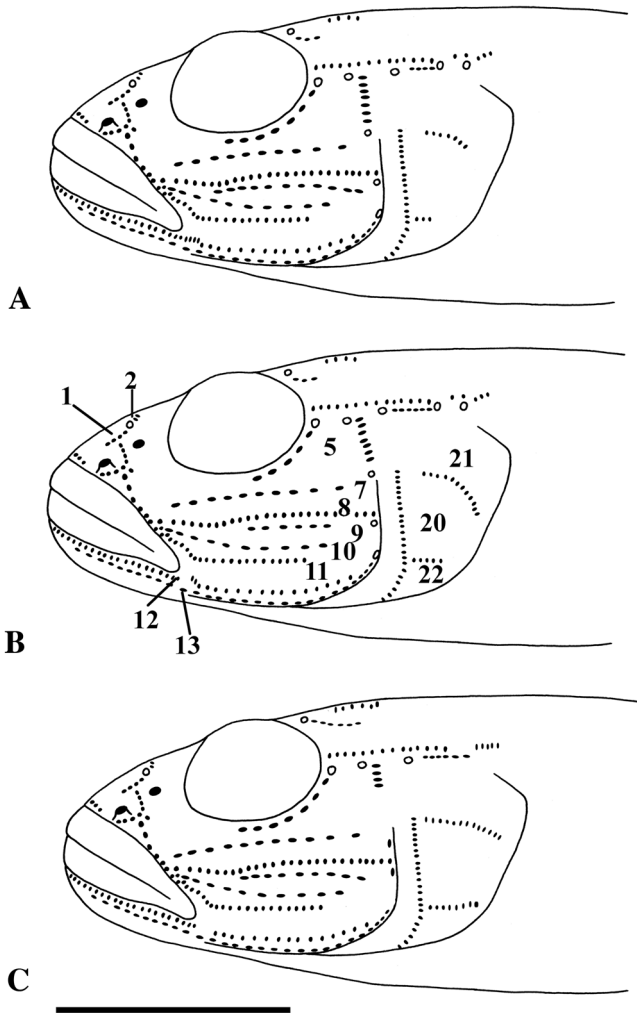


Figure 1. – Sensory papillae in three dwarf species of *Glossogobius*, composite drawing, based largely on holotypes. **A:** *G. gnomus*; **B:** *G. nanus*; **C:** *G. pumilus*. Numbers indicate papilla lines after Akihito and Meguro (1975) and in descriptions here. Scale bar = 5 mm.

papillae in relation to the axis of the line – L, along the axis and T, transverse at right angles to the axis of the line. Various abbreviations for the head pores have been used by various authors. The scheme in figure 1 is based on position of the pores and does not assume homologies. Sanzo (1911) labelled the pores with Greek letters, which are still used in European literature, but these have not been in general usage for species of *Glossogobius*. More recently workers have used capital letters to designate pores or abbreviations reflecting the position of the pores. Three systems, other than the one devised by Sanzo have typically been used. The system used here (Fig. 2) is a modification of Hoese and Lubbock (1982). The pores in *Glossogobius* include the posterior nasal pore (PNP) adjacent to the posterior nostril (B' of Akihito and Meguro, 1975 and NA, nasal of Lachner and McKinney, 1974); anterior interorbital pore (AIO)

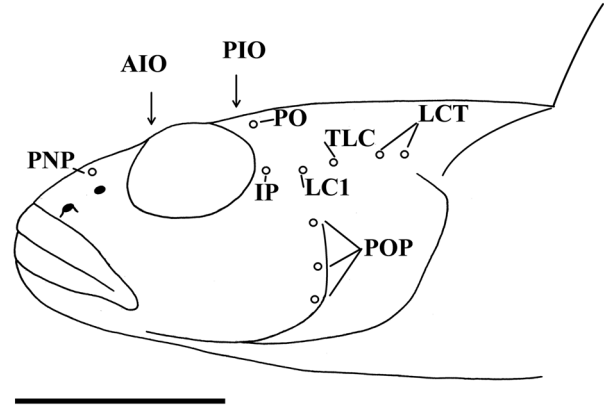


Figure 2. – Generalised drawing of head showing terminology used for sensory pore in dwarf species of *Glossogobius*. See Methods for explanation of abbreviations. Scale bar = 5 mm.

above front of eye (C of Akihito and Meguro and AITO of Lachner and McKinney); posterior interorbital pore (PIO) above rear of eye (D of Akihito and Meguro and PITO of Lachner and McKinney); postorbital pore (PO) above dorso-posterior margin of eye (E of Akihito and Meguro and SOT, supraotic of Lachner and McKinney); infraorbital pore (IP) immediately behind eye (F of Akihito and Meguro and AOT, anterior otic of Lachner and McKinney); lateral canal pore (LC1) above preoperculum (G of Akihito and Meguro, POT, posterior otic of Lachner and McKinney); terminal lateral canal pore (TLC) above or near posterior preopercular margin (H' of Akihito and Meguro and IT, intertemporal of Lachner and McKinney); lateral canal tube (LCT) segment above operculum with pore at each end (K' and L' or Akihito and Meguro and AT, anterior temporal and PT, posterior temporal of Lachner and McKinney); preopercular pores (POP) usually 3 along posterior preopercular margin (M', N and O' of Akihito and Meguro and POP1, POP2 and POP3 of Lachner and McKinney). The predorsal scale count is the number of rows crossing the midline before the first dorsal fin. The longitudinal scale count is the number of transverse rows of scales on the body, taken from the upper pectoral insertion of the end of the caudal peduncle. The transverse scale count is taken of the first row behind the anal spine upward and backward to the second dorsal origin. It should be noted that the transverse count is difficult to count accurately because of crowding of scales near the base of the anal fin. In some specimens the posterior belly scales reach almost to the anal fin origin and any small scale in the region was not included in the count. Because of the frequent occurrence of one scale in the region an extra scale was often included in the initial count, but later excluded based on position of that scale. The small scale below the base of the second dorsal fin is counted as a half scale. Counts of the holotypes are indicated by an asterisk. The specimens examined were small and delicate and counts for the holotypes are not included for gill rak-

ers because of the risk of damaging the specimens. Vertebral count was not available for the holotype of *Glossogobius nanus* because of logistic problems with x-ray machines. It was not considered essential when 50 of 52 other Australian specimens all had the same count. In material examined lists, the number of specimens is given following the registration number, followed by the size range in mm Standard Length (SL) in parentheses. Because of damage to fins and loss of scales, data were taken from specimens in the best condition. Measurements were taken only from adult specimens 24 mm SL and above.

Comparative material is listed in Hoese and Allen (1990, 2009, 2012, 2015). In addition, paratypes of an extralimital dwarf species, *Glossogobius minutus*, USNM 232954, 6(29-45), from the southwest coast of India were examined.

### *Glossogobius*

*Glossogobius* Gill, 1860: 46 (type species: *Gobius platycephalus* Richardson, 1846: 204, 318, China, by monotypy).

The genus has been defined and postulated to be related to *Psammogobius* and *Bathygobius* (Hoese and Allen, 2009; Hoese et al., 2015). Molecular studies support the relationship of those genera (Agorreta et al., 2013). The genus is characterised by a distinctive longitudinal papilla pattern, 26-29 (rarely 25) vertebrae and a bilobed tongue. The present paper brings the total number of recognised and described species to approximately 38. One of the species described

here is different from all other known *Glossogobius* in normally having only 26 vertebrae.

The species described here are dwarf species, maturing at about 20 to 30 mm SL and reaching a maximum size of less than 50 mm SL, making them the smallest in the genus along with *Glossogobius bellendenensis* and *G. muscorum*. Only one other species of similar size has been described, *Glossogobius minutus*, from India with a maximum size known of about 50 mm SL. That species lacks scales in the predorsal region, the pectoral fin base and prepelvic area, similar to the species described here but that species differs in having 1,8 anal-fin rays, 18-19 pectoral-fin rays and males with the first one or two dorsal spines filamentous. The dwarf species described here share the following features, which separates them from other species in the genus: mental fraenum indistinct usually with a rounded or truncate posterior margin, rarely with very short lateral lobes fused to the chin (Fig. 3); cheek slightly bulbous, without scales; interorbital narrow, much less than eye diameter; interorbital head pores not paired; predorsal area scaled, naked or with a few scale rows extending to above or just before the posterior preopercular margin (Fig. 4); operculum without scales dorsally; pectoral base naked; prepelvic area usually naked, rarely with a few scattered scales; belly with a large naked patch on midline behind pelvic fin insertion; gill rakers on inner face of first arch and other arches denticulate; typically with two more dorsal rays than anal rays, low pectoral fin count of 13-16, vertebrae 11+15-16 = 26 or 27 and small maximum size of less than 50 mm SL; papilla line 5 very short, extending from below middle of eye to infraorbital pore; a prominent black spot surrounding sixth dorsal spine near base in adults (faint in juveniles). These three species appears to be confined to streams in the Cape York Region of Queensland, and Arnhem Land region of Northern Territory, Australia and southern New Guinea.

Relationships of this group of species are unclear, but the presence of short lateral lobes of the mental fraenum in some large specimens, suggest they may belong to the *Glossogobius celebius* complex. However, the small mouth and

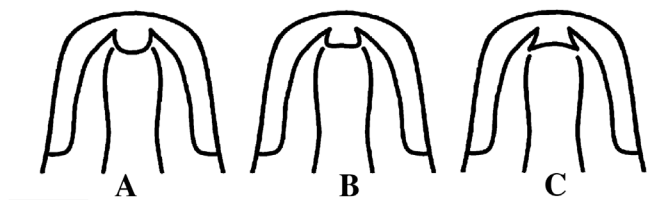


Figure 3. – Diagrammatic sketch of mental fraenum. A: Rounded fraenum; B: Truncate fraenum; C: Broad fraenum with short lateral lobes. Scale bar = 5 mm.

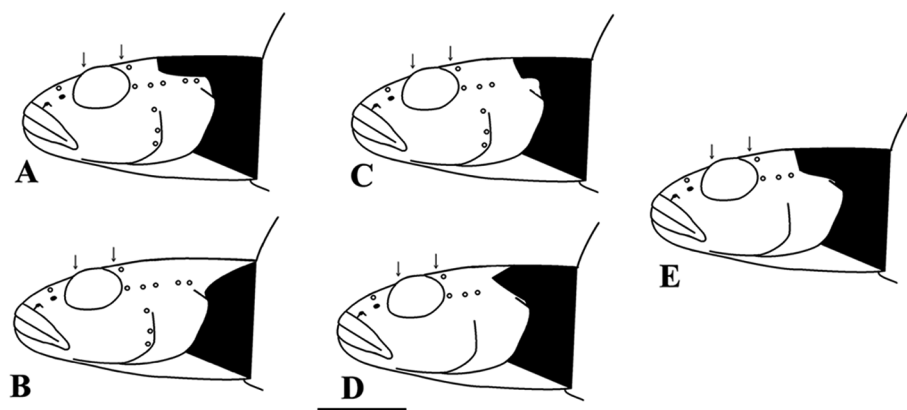


Figure 4. – Dark area indicating anterior extent of predorsal and prepelvic scales and head pores in various populations and species of dwarf *Glossogobius*. A: *Glossogobius gnomus*; B: *G. nanus*, Australia; C: *G. nanus*, Fly River; D: *G. pumilus*, Bensbach River; E: *G. pumilus*, Timika region. Scale bar = 5 mm.

indistinct mental fraenum is also characteristic of the *Glossogobius giuris* group. Two other small species (*Glossogobius torrentis* Hoese & Allen, 1990 and *G. coatesi* Hoese & Allen, 1990) are known from the Sepik and surrounding rivers of northern Papua New Guinea. These species reach a maximum size of 70–100 mm SL and differ from the species treated here in having a prominent curved mental fraenum with distinct lateral lobes, and fully developed papilla lines 5, 7 and 9. Small individuals are often overlooked and assumed to be juveniles. Consequently, it is likely that other dwarf species may exist in other parts of the Indo-Pacific.

The dwarf species treated here were found in some localities with *Glossogobius concavifrons* and juveniles of that species can be hard to separate from the species treated here. These dwarf species are distinctive from *G. concavifrons* in usually having 26 or 27 vertebrae (versus usually 28), larger, but few predorsal scales not reaching near the eye in 0–14 rows on the midline (versus reaching to near eye usually with 14–20 scales on the midline), a depressed nape region (versus rounded and elevated); second dorsal rays of I,7–10, rarely I,10 (versus I,9–13, rarely I,9), pectoral rays 13–16, rarely 16 (versus 16–19, rarely 16), longitudinal scale count of 24–28 (versus 29–33). The dwarf species can also be confused with *Glossogobius muscorum* and *G. bellendenensis*, which have reduced predorsal scales, similar to the condition in the dwarf species and also reach a similar maximum size (61 mm SL in *G. bellendenensis* and 44 mm SL for *G. muscorum* versus 43 mm SL maximum in species described here). The dwarf species described here differ in having fewer vertebrae (26–27 versus usually 28); lower second dorsal rays (I,7–10, rarely 10 versus I,10–11); fewer pectoral fin rays (usually 14–15 versus 16–17) and reduced mental fraenum (usually truncate to a rounded knob versus elevated with distinct lateral lobes).

### *Glossogobius gnomus*, new species

(Figs 1A, 4A, 5, 6, 12; Tabs I–V)

#### Material examined

*Holotype*. – MZB 23335, 31.2 mm SL male, small creek at extreme eastern end of Etna Bay, West Papua Province, Indonesia, 03°57.01'S, 134°58.64'E, rock, sand and mud, G. Allen and K. Hortle, 30 Apr. 1997.

*Paratypes*. – AMS I.47260-001, 4(29–31); MZB 23336, 4(25–30) and WAM P.31302-010, 23(18–33), taken with holotype. MZB 23638, 6(19–34), AMS I.47263-001, 3(19–34) and WAM P. 34655-001, 2(32–32) Prov. Maluku, Kab. Kepulauan Aru, Kec. Aru Selatan, Desa Jelja, P. Trangan: S. Gartanin. (= southern Trangan Island, Aru Islands), G. Allen and R. Hadiaty, 4 Dec. 2016.

#### Diagnosis

Mouth small, reaching to below a point between anterior margin of pupil and anterior margin of eye; mental fraenum with short lateral lobes attached to the chin; predorsal partly scaled, midline scaled forward to above or just behind posterior opercular margin; cheek and operculum naked; pectoral-fin base and prepelvic area naked; pelvic disc slightly thickened and oval, longer than wide, with most branching of first ray after middle of ray; first dorsal fin with black spot posteriorly, surrounding area near base of sixth dorsal spine, surrounded by large white area; second dorsal-fin rays usually I, 8; anal-fin rays usually I, 7; pectoral-fin rays 15–16; longitudinal scale count 24–28; predorsal scale count 8–14; transverse scale count (TRB) usually 7.5; vertebrae usually 11+16 = 27, preoperculum with 3 pores in adult, lateral canal tube above operculum present (LCT); lateral canal pore between infraorbital pore (LC1) and terminal lateral canal pore (TLC) present.

#### Description

Counts based on 36 specimens, measurements on 24 specimens 24–32.5 mm SL. First dorsal spines 6(30\*); second dorsal rays I,8–9, usually I,8; anal rays I,6–7, usually I,7; pectoral rays 15–16; longitudinal scale count 24(1), 25(7), 26(12\*), 27(8), 28(2); predorsal scale count 8–14; transverse scale count (TRB) 7/5(26\*), 8.5(4); gill rakers on outer face of first arch 1+1+5(1), 1+1+6(3), 2+1+7(1), = 7–10; lower gill rakers on outer face of second arch 0+6(4), 0+7(2) = 6–7; segmented caudal rays 9/8(30\*); branched caudal rays 7/6(5), 7/7(1), 8/7(24\*). Other meristics shown in tables I–V.

Head slightly depressed, length 26.4–31.9% SL; cheeks bulbous in adults over 22 mm SL, slightly bulbous in juveniles, head width at posterior preopercular margin 18.8–21.3% SL; depth at posterior preopercular margin 14.7–17.5% SL. Snout rounded in dorsal view; concave in side, with distinct notch formed from ascending processes premaxilla just before eye; 7.4–9.6% SL. Eye slightly longer than snout in juveniles and subequal to snout in adults above 20 mm SL, 6.9–8.0% SL in adults. Small bump between nostrils below anterior nostril present, but very low. Anterior nostril at end of short tube, slightly less than one nostril diameter above upper lip. Posterior nostril pore without elevated rim, about 1–2 nostril diameters from eye and 1–1.5 from anterior nostril. Preoperculum short, distance from end of eye to upper posterior preopercular margin slightly less than snout length. Postorbital moderate, subequal to distance from tip of snout to a point above end of pupil to just behind end of eye. Gill opening reaching to below a point just behind posterior preopercular margin. Jaws forming an angle of 30–40° with body axis; upper margin of upper jaw in line with or just below lower margin of eye, upper jaw length 12.6–14.4% SL in adult males and 9.7–11.9% SL in adult females. Teeth in upper jaw: outer row of teeth conical,

slightly enlarged teeth extending full length of premaxilla; an inner row of smaller conical teeth developed anteriorly only and a third innermost row of small depressible teeth anteriorly. Teeth in lower jaw: teeth in outer row conical, slightly enlarged and close-set confined to anterior half of dentary; a second inner rows of slightly smaller teeth extending the full length of the dentary coming larger posteriorly; an innermost row of posteriorly directed depressible teeth anteriorly on inner face of dentary. Tongue tip distinctly bilobed. Gill rakers on outer face of first arch triangular, very short, much less than filament length. Rakers on inner face of first arch and other arches shorter than rakers on outer face of first arch and denticulate. Body covered mostly with large ctenoid scales, anteriormost one or two rows cycloid; midline of belly naked or with a few cycloid scales before anus and a large naked patch behind pelvic fin insertion and a few rows of cycloid scales extending forward to below pectoral

fin insertion ventrally. First dorsal fin low and rounded in both sexes, lower than body depth at anal fin origin, fourth to sixth spines reaching to about the same point just before to just beyond origin of second dorsal fin when depressed; dorsal origin above a point just behind pelvic fin insertion. Second dorsal fin slightly higher than first dorsal fin, but lower than body depth at anal fin origin. Anal fin slightly lower than second dorsal fin, posterior most rays slightly elongate in mature males, reaching about half way to caudal fin when depressed, reaching less than half way to caudal fin in mature females. Pectoral fin with rounded to pointed margin, reaching to above a point between anus and just behind anal fin origin, (24.3-31.9% SL). Pelvic fin thick and rounded, reaching to or just beyond anus in males (21.7-23.4% SL) and usually well short of anus in females, reaching anus only in females over 30 mm SL (17.4-21.7% SL), fifth ray with few short branches and about 8-12 terminal tips, second ray with most sequential branches behind middle of ray.



Figure 5. – Preserved holotype of *Glossogobius gnomus*, MZB 23335, 31.2 mm SL.



Figure 6. – Live individuals of *Glossogobius gnomus*. A: Etna Bay, Photo G. Allen; B: Aru Islands, Photo R. Hadiaty.

#### Head pores

Posterior nasal pore just medial and slightly above posterior nostril; anterior interorbital pore above front of eye; posterior interorbital pore above posterior margin of pupil; postorbital pore behind upper margin of eye; infraorbital pore below postorbital and behind middle of eye; lateral canal pore above preoperculum present; terminal lateral canal pore above posterior just behind posterior preopercular margin of operculum (smallest specimen examined 19 mm SL); short tube above operculum, with pore at each end usually present, rarely as on open groove on one side and a tube on other side of head; 3 preopercular pores, upper in line with lower margin of eye in adults widely separated from lower 2 (Figs 2, 4A).

#### Papillae

Line 1 (before nasal pore) present and very short, not reaching snout tip. Line 2 extending from behind nasal pore arching upwards and backwards to near line on opposite side of head. Line 5 (suborbital) short, extending from below front half of eye to infraorbital pore. Line 6 (suborbital branch) absent. Line 7 (LL cheek row) extending from below front of eye and not in contact with papillae behind jaws, extending posteriorly to just beyond eye. Line 8 (LT cheek row = row *b*) extending

from jaws to end of preoperculum. Line 9 (LL cheek row) short extending from below front half middle of eye arching upward then downward to near posterior preopercular margin. Line 10 (LL cheek row) extending from jaws to just beyond end of eye and not reaching preopercular margin. Line 11 (LT row *d*) extending to below posterior end of eye. Line 12 (Outer POP-mandibular) continuous from chin to near lower preopercular pore, usually without a gap of no papillae behind posterior tip of jaws. Line 13 (Inner POP-mandibular) continuous from chin to lower preopercular pore. Line 20 (Opercular VT) composed of single row of papillae extending from just behind upper preopercular pore to lower margin of operculum. Line 21 (Upper OT) separate from Line 20 short and sloping downward posteriorly, ending well before posterior opercular margin. Line 22 (Lower OT) short, almost horizontal and composed of few papillae, usually only 3 or 4. Other papillae shown in figure 1A.

### Coloration

Head and body brown. Head with small scattered dark brown or black spots; a broad dark stripe from anteroventral margin of eye to middle of upper lip, extending onto lips followed posteriorly by a broad light brown or white stripe extending from eye to over posterior third of lips, followed by a one or two brown to black spots, upper spot curving downward and in some specimens, horizontally posteriorly, in some specimens forming an irregular bar connection to posterior tip of jaws; a small dark brown to black spot or elongate bar, smaller than pupil diameter almost in contact with posteroventral margin of eye; rest of cheek variable in coloration, sometimes with scattered dark brown to black mottling; chin and isthmus brown, slightly darker than sides of head in males, light brown in females, with the scattered small black spots, rest of ventral surface of head lighter in females; mental fraenum the same colour as surrounding chin area; lips dark brown except for white at posterior tip. Body dark brown from midside dorsally and pale brown ventrally; a series of 6-8 elongate dark brown to black spots on midside, often faint and indistinct in most specimens, mature males with distinct thin dark vertical bars crossing through centres of spots; posterior end of caudal peduncle with an irregularly shaped spot dark brown or black spot, followed posteriorly by and often connected to a dark vertical bar on base of caudal fin. First dorsal fin with a gray to black horizontal stripe basally ending just before a large ocellated black spot surrounding the sixth dorsal spine in both sexes, more prominent in larger specimens; a second stripe dorsally just below distal margin of fin, rest of fin light brown to white; second dorsal fin with two rows of irregularly shaped black spots and a broad black submarginal stripe near tip of fin, rest of fin light brown to whitish. Upper pectoral fin base with a short brown bar or small spot extending onto base of pectoral rays and a fainter and small spot ventrally on pec-

toral fin base not extending onto rays; pectoral fins brown to gray without spots. Caudal fin with rays covered with brown spots forming wavy bands (usually 5-7) on dorsal two-thirds of fin, ventral third of fin gray to light brown, without spots; spots sparse dorsally, a large black median spot on dorsal midline of caudal peduncle followed by a white spot at base of caudal fin, followed by a small dark spot on caudal fin. Anal fin whitish in juveniles and females, dark brown in mature males. Pelvic fins whitish in females and juveniles and dark brown in mature males.

In life, the species has a similar colour pattern, but is generally darker. There are traces of yellow near the tips of the dorsal fins (Fig. 6).

### Distribution

The species is known only from a single locality situated at less than 100 m elevation in West Papua Province (western New Guinea) and Aru Islands, Indonesia. The general habitat consists of a small (about 2-4 m wide and up to 2 m deep) stream near the coast, slowly flowing through closed-canopy rainforest. The stream was very clear with rock, sand, mud, and tree debris on the bottom. The stream was inhabited by 11 other species, including a plotsid catfish, anguillid eel, syngnathid pipefish, four species of gobiids (including *Glossogobius illimis* Hoese & Allen, 2012), three eleotrids, and a melanotaeniid rainbowfish (the locally endemic *Melanotaenia etnaensis* Allen *et al.*, 2016). Specimens from Aru Islands were collected from a moderately-fast flowing stream, with substrate consisted of white sand, leaf litter and fallen trunk; in the middle of a forest; canopy coverage 90-95%.

### Similarity to other species

The species is similar to the other species described in this paper and to *Glossogobius bellendenensis* and *G. muscorum*. It is most similar to *G. muscorum* in general head, pelvic fin and mental fraenum shapes. It differs from *G. muscorum* in having 11+16 vertebrae (versus 11+17): usually having second dorsal fin rays I,8 (versus I,9-10) and anal fin

Table I. – Dorsal ray counts of three dwarf species of *Glossogobius* from Australia and New Guinea. An asterisk indicates count of holotypes.

Species/population	I,7	I,8	I,9	I,10
<i>G. gnomus</i>				
Etna Bay	–	25*	5	–
Aru Islands		5	6	
<i>G. nanus</i>				
Australia	6	45*	3	–
Fly River	–	2	1	–
<i>G. pumilus</i>				
Bensbach River	–	3	24*	3
Timika area	–	9	21	–

Table II. – Anal ray counts of three dwarf species of *Glossogobius* from Australia and New Guinea.

Species/population	I,5	I,6	I,7	I,8
<i>G. gnomus</i>				
Etna Bay	–	5	24*	–
Aru Islands	–	1	10	–
<i>G. nanus</i>				
Australia	5	40*	9	–
Fly River	–	2	1	–
<i>G. pumilus</i>				
Bensbach River	–	1	24*	5
Timika area	–	3	27	–

Table III. – Pectoral ray counts of three dwarf species of *Glossogobius* from Australia and New Guinea.

Species/population	13	14	15	16
<i>G. gnomus</i>				
Etna Bay	–	–	25*	5
Aru Islands	–	–	6	5
<i>G. nanus</i>				
Australia	–	32	26*	–
Fly River	–	2	1	–
<i>G. pumilus</i>				
Bensbach River	5	25*	2	–
Timika area	–	15	12	3

Table IV. – Predorsal scale counts of three dwarf species of *Glossogobius* from Australia and New Guinea.

Species/population	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>G. gnomus</i>															
Etna Bay	–	–	–	–	–	–	–	–	4	6	8*	6	5	2	–
Aru Islands	–	–	–	–	–	–	–	–	–	3	4	1	3	–	–
<i>G. nanus</i>															
Australia	45*	5	2	–	–	–	–	–	–	–	–	–	–	–	–
Fly River	–	–	–	–	–	–	1	1	1	–	–	–	–	–	–
<i>G. pumilus</i>															
Bensbach River	1	1	–	3*	3	8	4	6	4	–	–	–	–	–	–
Timika area	–	–	–	1	3	12	4	4	7	2	–	–	–	–	–

Table V. – Vertebral counts of three dwarf species of *Glossogobius* from Australia and New Guinea.

Species/population	11+14	11+15	11+16	12+15	12+16
<i>G. gnomus</i>					
Etna Bay	–	–	13*	–	–
Aru Islands	–	2	8	–	–
<i>G. nanus</i>					
Australia	1	50	1	–	–
Fly River	1	1	1	–	–
<i>G. pumilus</i>					
Bensbach River	–	–	17*	3	–
Timika area	–	–	4	1	1

rays I,7 (versus I,8); a reduced sensory papilla line 5 starting below front quarter of eye (versus starting before eye); papilla line 7 not reaching lips (versus reaching lip) and a large ocellated spot surrounding the sixth dorsal spine (versus three small black spots along base of fin). It differs from *G. bellendenensis* in these same features, except that *G. bellendenensis* has 12+16 vertebrae. It differs from *G. nanus*, n. sp. and *G. pumilus*, n. sp. in having a slightly thickened rounded pelvic disc, with heavily branched first ray (versus thin and elongate, with fewer branches). It differs from *G. nanus* in vertebral counts (11+15 in *G. nanus*), anal ray counts (usually I,6 in *G. nanus*). It differs from *G. pumilus* in usually having I,8 second dorsal rays (I,9 in *G. pumilus*) and in having well developed preopercular pores and a tubular

canal above the operculum in adults (versus these absent at all sizes).

**Variation**

The species shows considerable sexual dimorphism in length of jaws, pelvic fin and coloration. Males have a larger mouth and longer pelvic fin than females. Mature males also have dark pelvic and anal fins, which are translucent to white in females.

Specimens from the Aru Islands differ slightly in being more variable in dorsal ray counts.

**Etymology**

From the New Latin, *gnomus* = diminutive fabled being or dwarf, alluding to the small size of this species, a noun in apposition.

***Glossogobius nanus*, new species**  
(Figs 7, 8, 1B, 4B, 4C, 12; Tabs I-V)

*Glossogobius* sp. – Allen & Hoese, 1980: 58 (Jardine and Archer rivers, Cape York, Queensland).

*Glossogobius* sp. 2. – Allen, 1991: 183, pl. 15, fig. 1 (in part, Papua New Guinea).

*Glossogobius* sp. 3. – Allen *et al.*, 2002: 271 (Cape York, Queensland).

Figure 7. – Freshly collected holotype of *Glossogobius nanus*, QM I.40670, 37.5 mm SL. Photo M. Hammer.



Figure 8. – Live individual from type locality of *Glossogobius nanus*. Photo M. Hammer.



#### Material examined

*Holotype*. – QM I.40670, 37.5 mm SL male, Myall Creek, Weipa, Queensland, M. Hammer.

*Paratypes*. – **Cape York, Queensland, Australia:** AMS I.21240-001, 13(10-26), Packsaddle Creek, 11°08'S, 142°23'E, Aug. 1979, D. Hoese and G. Allen; AMS I.21241-001, 17(11-22), Packsaddle Creek, 11°08'S, 142°23'E, Aug. 1979, D. Hoese and G. Allen; AMS I.21238-001, 15(11-20), Jardine River, 11°08'S, 142°25'E, Aug. 1979, D. Hoese and G. Allen; QM I.17949, 5(18-32) Jardine River, 13-15 Aug. 1980, R. Leggett; QM I.21787, 6(15-25), Jardine River, 27 Aug.-5 Sep. 1985, R. Leggett; QM I.26727, 1(29), 30 km south of Bamaga, 11°09'S, 142°21'E, 1 Aug. 1988, S.H. Midgley; WAM P.26718-004, 2(18-25), Packsaddle Creek, Jardine River system, 11°08'S 142°23'E, 30 Aug. 1979, G. Allen and D. Hoese; AMS I.21237-002, 6(14-26), Creek just south of Jardine, Cape York, 11°09'S, 142°22'E, 28 Aug. 1979, D. Hoese and G. Allen; AMS I.21237-029, 6(14-22), creek just south of Jardine River, 11°09'S, 142°22'E, 28 Aug. 1979, D. Hoese and G. Allen; WAM P.26381-018, 2(17-20), creek 1 km south of Jardine River, 11°10'S, 142°22'E, 21 Sep. 1978, G. Allen and R. Steene; AMS I.21248-009, 6(22-29), McDonnell Creek, Jackson River System, 11°37'S, 142°28'E, 1 Sep. 1979, D. Hoese; AMS I.21249-003, 1(27), Cockatoo Creek, Jackson River System, 11°38'S, 142°28'E, 2 Sep. 1979, D. Hoese and G. Allen; QM I.28190, 10(27-29), Cockatoo Creek, 11°32'S, 142°47'E, Aug. 1988, S.H. Midgley; QM I.39558, 3(18-22.5), Bromley Road Crossing, Olive River, 12°14.01'S, 142°52.65'E, 12 Oct. 1992; AMS I.21250-004, 2(19-29), Palm Creek, Wenlock River system, 12°04'S, 142°33'E, 2 Sep. 1979, D. Hoese and G. Allen; QM I.39550, 3(16-21), Snake Creek, Olive River system, 12°17.63'S, 142°51.48'E 21, Nov. 1992; AMS

I.23275-004, 76(14-22), Schramm Creek, Wenlock River system, 12°23'S, 142°36'E, 8 Oct. 1982, D. Hoese and D. Rennis; AMS I.23283-005, 15(11-31), Bellvue Creek, Embley River system, 12°42'S, 141°59'E, 12 Oct. 1982, D. Hoese and D. Rennis; AMS I.23263-006, 21(15-25), east of Weipa, 12°47'S, 142°19'E, 4 Oct. 1982, D. Hoese and D. Rennis; AMS I.47250-001, 2(41-43), captive bred from Jardine River, R. Leggett.

*Non-type material*. – **Cape York, Queensland, Australia:** QM I.26719, 10(27-30), Cockatoo Creek, 11°32'S, 142°27'E, Aug. 1988, S.H. Midgley; QM I.28173, 2(19-20), Olive River, Bromley Crossing, Bromley Station, 12°14'S, 142°52'E, 12 Oct. 1992, B. Herbert; AMS I.21233-001, 43(13-21), Creek 60 km N of Coen, 13°26'S, 142°56'E, 27 Aug. 1979, D. Hoese; AMS I.21249-001, 9(11-21), Cockatoo Creek, Jackson River System, 11°38'S, 142°28'E, 2 Sep. 1979, D. Hoese and G. Allen; AMS I.23275-[EX 004], 7(14-22), cleared and stained, Schramm Creek, Wenlock River system, 12°23'S, 142°36'E, D. Hoese and D. Rennis; AMS I.23273-002, 1(18), Ducie, River, 12°07'S, 142°16'E, 8 Oct. 1982, D. Hoese and D. Rennis; AMS I.23274-004, 20(14-20), Ducie River, 12°15'S, 142°30'E, 8 Oct. 1982, D. Hoese and D. Rennis; AMS I.23276-002, 6(13-20), Arthur Creek, Wenlock River system, 12°44'S, 142°30'E, 8 Oct. 1982, D. Hoese and D. Rennis.

**Northern Territory, Australia:** NTM S.15888-019, 1 (half taken for DNA), Cato River, 12°22'31"S, 136°22'46"E, 7 Jul. 2004, H. Larson.

**Papua New Guinea:** WAM P.27796-003, 2(25-26), Small creek 32 km N of Kiunga on Tabubil Road, Fly River system, 5°55'S, 141°17'E, 6 Sep. 1982, G. Allen and J. Paska; WAM P.27808, 1(29), tributary of Fly River at Kiunga, 21 Sep. 1982, G. Allen and J. Paska.



## Diagnosis

Mouth small, reaching to below a point between anterior margin of pupil and anterior margin of eye; mental fraenum indistinct in most specimens, developed as a low rounded to truncate fold in well preserved specimens; predorsal area largely naked to about half scaled, sides scaled forward to above posterior opercular margin, midline naked to about half scaled; cheek and operculum naked; pectoral-fin base and prepelvic area naked; first dorsal fin with black spot posteriorly surrounding area near base of sixth dorsal spine; second dorsal rays usually I,8; anal rays usually I,6; pectoral rays 14-16; longitudinal scale count 24-26; predorsal scale count 0-2 in Australian specimens, 5-7 in Fly River specimens; transverse scale count (TRB) 7.5; vertebrae usually 11+15 = 26; pelvic disc thin and elongate, width much less than length; preoperculum with 2-3 pores in adult, often absent in juveniles below 19 mm SL, lateral canal tube above operculum usually absent in Australian specimens, but present in specimens above 40 mm SL from Australia; lateral canal pore between infraorbital pore and terminal lateral canal pore present or absent.

## Description

Counts based mainly on 55 specimens, measurements taken on 30 specimens above 24 mm SL, with 345 specimens examined. First dorsal spines 6(55\*); second dorsal rays I,7-9, usually I,8; anal rays I,5-7, usually I,6; pectoral rays 14-15; predorsal scale count 0-2; longitudinal scale count 24(16), 25(14\*), 26(6); transverse scale count (TRB) 6.5(3), 7.5(25\*), 8.5(2); gill rakers on outer face of first arch 2+0-1+5-7 = 8-9; lower gill rakers on outer face of second arch 0+6-7; segmented caudal rays 9/8(30\*); branched caudal rays 6/6(2), 6/7(1), 7/6 (13\*), 7/7(6), 8/7(10). Other meristics shown in tables I-V.

Head slightly depressed, length 26.5-31.8% SL; cheeks slightly bulbous, head width at posterior preopercular margin 17.5-21.5% SL; depth at posterior preopercular margin 15.9-18.5% SL. Snout rounded in dorsal view; concave in side view in juveniles, convex in adults, with distinct notch formed from ascending process of premaxilla just before eye; 7.2-9.3% SL. Eye slightly longer than snout in juveniles and subequal to snout in adults above 20 mm SL, 6.5-9.1% SL. Small bump between nostrils below anterior nostril present, but very low. Anterior nostril at end of short tube, about one nostril diameter above upper lip. Posterior nostril pore without elevated rim, about one nostril diameter, from eye and 1-1.5 diameters from anterior nostril. Preoperculum short, distance from end of eye to upper posterior preopercular margin slightly less than snout length. Postorbital moderate, subequal to distance from tip of snout to a point above end of pupil to just behind end of eye. Gill opening reaching to below a point just behind posterior preopercular margin. Jaws forming an angle of 30-45° with body axis;

upper margin of upper jaw in line with middle to lower margin of pupil, upper jaw length 11-12.5% SL in adult males and 9.1-11% SL in adult females. Teeth in upper jaw: outer row of teeth conical, slightly enlarged, teeth extending full length of premaxilla; an inner row of slightly smaller conical teeth. Teeth in lower jaw: teeth in outer row conical, slightly enlarged and close-set confined to anterior half of dentary; a second inner row of slightly smaller teeth extending full length of dentary; an innermost row of posteriorly directed depressible teeth anteriorly on inner face of dentary. Tongue tip distinctly bilobed. Gill rakers on outer face of first arch triangular, very short, much less than filament length. Rakers on inner face of first arch and other arches shorter than rakers on outer face of first arch and denticulate. Body covered mostly with large ctenoid scales, anteriormost one or two rows cycloid; midline of belly naked or with a few cycloid scales before anus and a large naked patch behind pelvic fin insertion and a few rows of cycloid scales extending forward to below pectoral fin insertion ventrally. First dorsal fin low and rounded in both sexes, lower than body depth at anal fin origin, fourth to sixth spines reaching to about the same point just before to just beyond origin of second dorsal fin when depressed; dorsal origin above a point just behind pelvic fin insertion. Second dorsal fin of slightly higher than first dorsal fin, but lower than body depth at anal fin origin. Anal fin slightly lower than second dorsal fin, posterior most rays elongate in mature males, reaching about half way to caudal fin when depressed, reaching less than half way to caudal fin in mature females. Pectoral fin with rounded to pointed margin, reaching to above or just behind anal fin origin, 29.3-31.7% SL in mature males and 23.6-29.6% SL in mature females. Pelvic fin thin and oval, reaching to or just beyond anus, but usually not to anal fin origin, fifth ray with few branches and about 8-12 terminal tips, second ray with most sequential branching beginning before middle of ray.

## Head pores

Pores variable: posterior nasal pore just medial and slightly above posterior nostril; anterior interorbital pore above front of eye; posterior interorbital pore above posterior margin of pupil; postorbital pore behind upper margin of eye; infraorbital pore below postorbital and behind middle of eye; lateral canal pore above preoperculum present or absent; terminal lateral canal pore above posterior preoperculum in juveniles and just behind posterior preopercular margin of operculum in adults above 20 mm SL; short tube above operculum, with pore at each end usually absent, present in specimens over 40 mm SL and developed as an open trench in some specimens 25-35 mm SL; 3 preopercular pores in adults, 0-2 in juveniles below 17 mm SL, upper in line with lower margin of eye in adults widely separated from lower 2 (Figs 2, 4B, 4C).

### Papillae

Line 1 (before nasal pore) present and very short, not reaching snout tip. Line 2 extending from behind nasal pore arching upwards and backwards to opposite side of head. Line 5 (suborbital) very short, extending from below middle of eye to infraorbital pore. Line 6 (suborbital branch) absent. Line 7 (LL cheek row) extending from below front of eye and not in contact with papillae behind jaws, extending posteriorly to just beyond eye. Line 8 (LT cheek row = row *b*) extending from jaws to end of preoperculum. Line 9 (LL cheek row) short extending from below middle of eye to just beyond end of eye. Line 10 (LL cheek row) extending from jaws to just beyond end of eye and not reaching preopercular margin. Line 11 (LT row *d*) extending to below posterior end of eye. Line 12 (Outer POP-mandibular) continuous from chin to near lower preopercular pore, but with a gap of no papillae or continuous with a slight arch behind posterior tip of jaws. Line 13 (Inner POP-mandibular) continuous from chin to lower preopercular pore. Line 20 (Opercular VT) composed of single row of papillae extending from just behind upper preopercular pore to lower margin of operculum. Line 21 (Upper OT) separate from Line 20 and curving downward posteriorly, but not reaching posterior opercular margin. Line 22 (Lower OT) short, almost horizontal and usually composed of 4-8 papillae. Other papillae shown in figure 1B.

### Coloration

Highly variable. Head and body brown. Head with small scattered dark brown or black spots; a broad dark brown or black stripe from anteroventral margin of eye to above middle of upper lip, extending onto lips followed posteriorly by a broad white stripe extending from eye to over posterior third of lips, followed by a thin dark brown to black stripe from posterior margin of eye to over posterior tips of jaws; a small dark brown to black spot, smaller than pupil diameter almost in contact with posteroventral margin of eye; rest of cheek with scattered dark brown to black mottling or small spots; chin and isthmus light brown in juveniles, chin and prepelvic area with scattered small black spots in adult females and dark brown with dense melanophores on whole ventral surface of head in males over 28 mm SL; mental fraenum usually dark brown in adults; lips dark brown except for white area at posterior region. Body light to dark brown, usually darker on dorsal half of body. Body with a series of small brown or black spots, often paired, on midside, each with a thin dark brown or black vertical line extending ventrally and often dorsally; first spot or pair of spots below middle of first dorsal fin, second below second dorsal fin origin, third to fifth pair below second dorsal fin, fifth sometimes behind fin, sixth on middle of caudal peduncle, a midside black spot at posterior end of caudal peduncle, expanding into a short vertical bar on caudal fin

base (bar on caudal fin base sometimes separate from caudal peduncle spot). Pectoral-fin base with a short brown bar or small spot extending onto base of pectoral rays, a smaller and fainter brown to black spot near lower margin of base of fin, not extending onto rays; pectoral fins brown without spots. First dorsal fin light brown in juveniles, adults with a thin black stripe near base of fin ending just before ocellated black spot surrounding sixth spine; spot surrounding sixth spine reaching to posterior end of first dorsal fin membrane, spot often faint in females; in some specimens a second broad dark stripe below dorsal margin of fin. Second dorsal fin with black spots forming two rows one ventrally and one near middle of fin, distal margin of fin dark brown or gray. Caudal fin with central rays covered with brown spots forming wavy bands (usually 4-6) on dorsal two-thirds of fin, ventral gray to dark brown; spots fading dorsally with upper fifth of fin dark gray to brown; uppermost caudal ray with three small black spots near base of fin, with a lighter area between spots. Anal fin whitish basally, pale in juveniles, and distal one-quarter to one-third dark brown in adults. Pelvic fins gray to dark brown, heavily pigmented in adult males, lighter brown in females, with dense melanophores in females over 30 mm SL.

Freshly collected specimens are similar in coloration, but with the dorsal margin of the dorsal fins yellowish-orange (Fig. 7). In life the coloration is variable, but typically pale, with the body having a faint orange tinge and the black spot on the first dorsal fin often diffuse in life (Fig. 8), but dark black in large males (Fig. 7), with white margin in some specimens. The distal margins of the dorsal fins are yellowish-orange as in freshly collected specimens. Specimens collected from rivers with dark sand and gravel more strongly pigmented and generally darker than specimens found from lighter sand environments.

### Distribution

The species is known only from Australia (the Cape York Peninsula in Queensland and Arnhem Land in the Northern Territory) and the Fly River, Papua New Guinea. Australian material was collected from clear streams with considerable fine gravel on the bottom in elevations of a few metres to around 100 m.

### Remarks

The species has been bred and raised in captivity by R. Leggett who found that the eggs were attached in loose clusters to solid objects on the substrate (Leggett, 1990).

### Similarity to other species

The species is similar to the other species described in this paper and to *G. bellendenensis* and *G. muscorum*. It differs from all of these species in normally having 26 vertebrae (versus 27 or 28). It also differs from *G. bellendenensis*

and *G. muscorum* in having a reduced line 5 of the cheek sensory papillae, a reduced mental fraenum and an anal ray count of typically (I,6 versus usually I,8). The other two species described here differ in usually having an anal ray count of I,7. It also differs from *Glossogobius pumilus* n. sp. in having preopercular head pore. It also differs from *Glossogobius gnomus* n. sp. in having a thin elongate pelvic disc (versus thick and rounded).

### Variation

Specimens from the Fly River differ from Australian specimens in having a few scales on the midline of the predorsal just before the first dorsal-fin origin. Vertebral counts for the three specimens were 25, 26 and 27. For Australian material only 1 of 52 specimens had 25 vertebrae and one 27. Other features agree with Australian material and tentatively we regard the material as conspecific, but it is possible that they are a mixture of *G. nanus* and *G. gnomus*. Geographical variation in predorsal scales is known for *Glossogobius belendenensis*. The specimens were collected in streams over 900 km inland at elevations of around 50 m.

Considerable variation was noted relating to size and sex. In large mature males the head becomes more rounded, with the cheeks more bulbous and the posterior rays of the second dorsal and anal fin become more elongate. Measurements also suggest longer pectoral and caudal fins in males, but too few large males were available to test for significance of the differences. Head pores vary considerably with size. Usually specimens below 15 mm SL only have a short canal extending from near the posterior nostrils through the interorbital area to the end of the eye. With growth the lateral canal extends posteriorly eventually reaching just beyond the posterior preopercular margin. As a result, the lateral canal has only a terminal pore in juveniles, but a second pore is usually developed in specimens larger than 25 mm SL just before the posterior preopercular margin. Also the preopercular pores develop last often with no or only two pores in juveniles. Juveniles also have only a small diffuse spot surrounding the sixth dorsal spine and the spot only becomes a dark ocellated black spot in specimens around 25 mm SL and above.

### Remarks

NTM S. 15888-019 is the only known specimen known from the Northern Territory and lacks predorsal scales. It has been cut in half of DNA analysis, precluding vertebral or anal ray counts.

### Etymology

From the Latin noun, *nanus* = dwarf, alluding to the small size of this species.

### *Glossogobius pumilus*, new species (Figs 1C, 4D, E, 9, 10, 11, 12; Tabs I-V)

*Glossogobius* sp. 2. – Allen *et al.*, 2000 (in part, Timika Region, New Guinea).

### Material examined

*Holotype*. – WAM P.27823-011, 32 mm SL male, 17 km upstream of Bensbach lodge, 8°53'S, 141°12'E, 1 Oct. 1982, G. Allen and J. Paska.

*Paratypes*. – **Papua New Guinea**: AMS I.27507-001, 31 (21-32) and WAM P.27823-001, 109(13-35), taken with holotype; WAM P.27817-006, 2(31-32), 5 km upstream of Bensbach lodge, 8°51'S, 141°13'E, 29 Sep. 1982, G. Allen and J. Paska; **Papua, Indonesia**: WAM P.31296-003, 11(25-40) and MZB 23337, 2(29-32), south of Timika, E side of Portsite road, approximate km 24, 22 Apr. 1997, 04°37.47'S, 136°57'E, G. Allen and Party; WAM P.31756-002, 22(15-29) and AMS I.47250-001, 6(21-27), south of Timika, 04°41'S, 136°54.31'E, 7 Aug. 2000, G. Allen and K. Hortle.

### Diagnosis

Mouth small, reaching to below a point between anterior margin of pupil and anterior margin of eye; mental fraenum a small rounded protrusion or triangular, without distinct lateral lobes; predorsal partly scaled, midline scaled forward in adult to above a point between middle of operculum and just behind posterior preopercular margin; cheek and operculum naked; pectoral-fin base and prepelvic area naked; pelvic disc thin and oval, longer than wide and reaching to anus in adults; first dorsal fin with black spot posteriorly surrounding area near base of sixth dorsal spine; second dorsal rays usually I,9; anal rays usually I,7; pectoral rays 13-16; longitudinal scale count 24-27; predorsal scale count 0-9; transverse scale count (TRB) usually 7.5; vertebrae usually 11+16 = 27, preoperculum without pores, no lateral canal tube above operculum; lateral canal pore between infraorbital pore present in adults and terminal lateral canal pore present.

### Description

Counts based on 59 specimens, measurements taken on 24 specimens 24-41 mm SL. First dorsal spines 6(40\*); second dorsal rays I,8-10, usually I,9; anal rays I,6-7, usually I,7; pectoral rays 13-16, usually 14; longitudinal scale count 24(5), 25(11), 26(14), 27(5\*), 28(1); predorsal scale count 0-9; transverse scale count (TRB) 7/5(28), 8.5(9\*); gill rakers on outer face of first arch 1+0+5(1), 1+1+5(2), 1+1+6(3), 2+1+7(1) = 6-9; gill rakers on outer face of second arch 0+6(6), 0+7(1) = 6-7; segmented caudal rays 8/7(1), 9/8(29\*); branched caudal rays 7/6(5), 7/7(8\*), 8/7(19). Other meristics shown in tables I-V.

Figure 9. – Preserved holotype of *Glossogobius pumilus*, WAM P.27823-011, 32 mm SL male.



Figure 10. – Freshly collected paratype of *Glossogobius pumilus*, WAM P.27823-011, 33 mm SL male from Bensbach River. Photo G. Allen



Figure 11. – Live individual from Timika area of *Glossogobius pumilus*. Photo G. Allen.



Head slightly depressed, length 29.2-33.5% SL; cheeks bulbous in adults over 22 mm SL, slightly bulbous in juveniles, head width at posterior preopercular margin 16.4-20.3% SL; depth at posterior preopercular margin 14.3-17.9% SL. Snout rounded in dorsal view; convex or concave in side view, with distinct notch formed from ascending process of premaxilla just before eye in some specimens; 7.1-11.5% SL. Eye slightly longer than snout in juveniles and subequal to snout in adults above 20 mm SL, 6.3-8.5% SL in adults. Small bump between nostrils below anterior nostril present, but very low. Anterior nostril at end of short tube, slightly less than one nostril diameter above upper lip. Posterior nostril a pore without elevated rim, about 1.5-3 nostril diameters, from eye and 1.5-2 nostril diameters from anterior nostril. Preoperculum short, distance from end of eye to upper posterior preopercular margin slightly less than snout length. Postorbital moderate, subequal to distance from tip of snout to a point above end of pupil to just behind end of eye. Gill opening reaching to below a point just behind posterior preopercular margin. Jaws forming an angle of 37-47° with body

axis; upper margin of upper jaw in line with or just below lower margin of eye, posterior end below anterior margin of eye in females and immature males and below anterior half of pupil in mature males, upper jaw length 12.2-15.6% SL in adult males and 10.4-12.2% SL in adult females. Teeth in upper jaw: outer row of teeth conical, slightly enlarged teeth extending full length of premaxilla; an inner row of smaller conical teeth; an innermost row of enlarged depressible conical teeth anteriorly on premaxilla. Teeth in lower jaw: teeth in outer row conical, slightly enlarged and close-set confined to anterior half of dentary; a second inner row of slightly smaller teeth extending the full length of the dentary becoming larger posteriorly; an innermost row of posteriorly directed, curved depressible teeth anteriorly on inner face of dentary. Tongue tip distinctly bilobed. Gill rakers on outer face of first arch triangular, very short, much less than filament length. Rakers on inner face of first arch and other arches shorter than rakers on outer face of first arch and denticulate. Body covered mostly with large ctenoid scales, cycloid before a line from pectoral fin insertion to below first dorsal fin; belly usually with a few

cycloid scales before anus and a large naked patch behind pelvic fin insertion and a few rows of cycloid scales extending forward to below pectoral fin insertion ventrally. First dorsal fin low and rounded in both sexes, lower than body depth at anal fin origin, fourth to sixth spines reach to about the same point just before to just before origin of second dorsal fin when depressed; first dorsal fin origin above a point just behind pelvic fin insertion. Second dorsal fin slightly higher than first dorsal fin, but lower than body depth at anal fin origin; posterior rays reach just over half way to upper caudal fin base in mature females and to base of upper caudal fin in mature males. Anal fin slightly lower than second dorsal fin, posterior most rays very elongate in mature males, reaching to lower rays of caudal fin when depressed, reaching over half way to caudal fin in mature females. Pectoral fin with rounded margin, reaching to above a point between anus and behind anal fin origin, 23.3-31.2% SL. Pelvic fin thin and elongate, reaching to or just beyond anus in males (21.2-28.5% SL) and to or just anterior to anus in females (19.7-23.9% SL), fifth ray with few long branches and about 8-12 terminal tips.

#### Head pores

Posterior nasal pore just medial and slightly above posterior nostril; anterior interorbital pore above a point between anterior margin of pupil to half way to anterior margin of eye; posterior interorbital pore above posterior margin of pupil; postorbital pore behind upper margin of eye; infraorbital pore below postorbital and behind middle of eye; lateral canal pore above preoperculum present just before posterior preopercular margin; terminal lateral canal pore above a point just behind posterior preopercular margin of opercu-

lum (smallest specimen examined 19 mm SL); no short tube above operculum; no preopercular pores (Figs 2, 4D, 4E).

#### Papillae

Line 1 (before nasal pore) present and very short, not reaching snout tip. Line 2 extending from behind nasal pore arching upwards and backwards to opposite side of head. Line 5 (suborbital) short, extending from below front half of eye to infraorbital pore. Line 6 (suborbital branch) absent. Line 7 (LL cheek row) extending from below front of eye and usually continuous with papillae behind jaws, extending posteriorly to just beyond eye. Line 8 (LT cheek row = row *b*) extending from jaws to end of preoperculum. Line 9 (LL cheek row) short extending from below front half middle of eye arching upward then downward to just behind eye. Line 10 (LL cheek row) extending from jaws to just beyond end of eye and not reaching preopercular margin. Line 11 (LT row *d*) extending to below posterior end of eye. Line 12 (Outer POP-mandibular) continuous from chin to near lower preopercular pore, usually with a gap of no papillae behind posterior tip of jaws. Line 13 (Inner POP-mandibular) continuous from chin to lower preopercular pore. Line 20 (Opercular VT) composed of single row of papillae extending from just behind upper preopercular pore to lower margin of operculum. Line 21 (Upper OT) separate from Line 20 sloping downward posteriorly, ending close to posterior opercular margin. Line 22 (Lower OT) almost horizontal and composed of 6-10 papillae reaching to near end of operculum. Other papillae shown in figure 1C.

#### Coloration

Head and body brown. Head with scattered dark brown or black small spots and with larger mottling in adults; a broad dark stripe from anteroventral margin of eye to behind middle of upper lip, extending onto lips followed posteriorly by a broad white stripe extending from eye to over posterior third of lips, followed by a thin dark brown to black stripe from posterior margin of eye to behind posterior tips of jaws, becoming broader ventrally and often broken into two or three round spots; a small dark brown to black spot, smaller than pupil diameter almost in contact with posteroventral margin of eye; rest of cheek with large scattered dark brown to black mottling; chin and isthmus dark brown in mature males, chin dark brown with rest of ventral surface of head lighter in mature females; mental fraenum dark brown, sometimes only at sides of fraenum; lips dark brown except white at posterior tip, bar from anteroventral margin of eye bars crossing lips, but lips often dark and band not distinct on lips. Body brown, with an irregular shaped dark brown stripe

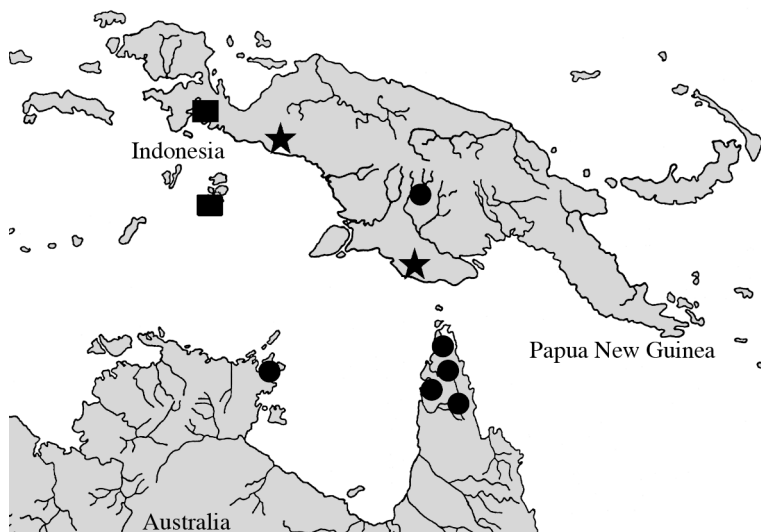


Figure 12. – Map showing known locations of dwarf species of *Glossogobius* from Australia and New Guinea, each symbol may represent multiple samples for *G. nanus* and *G. pumilus*; solid circle: *G. nanus*; square: *G. gnomus*; star: *G. pumilus*.

dorsally on midside breaking up into irregularly shaped dark brown spots on caudal peduncle (Fig. 11). A series of 8 elongate spots on midside of body, with X-shaped extensions dorsally and ventrally, each covering 1-2 scales in a longitudinal direction along midside; first spot below anterior quarter of first dorsal fin; second below posterior quarter of first dorsal fin, sometimes connected to first spot, third spot below a point between first and second dorsal fin; fourth and fifth spots below second dorsal fin; sixth and seventh spot on caudal peduncle; eighth spot triangular at posterior end of caudal peduncle, without dorsal or ventral extensions and apex pointing anteriorly. First dorsal fin with a thin black stripe near base, connecting to an ocellated black spot surrounding middle of sixth dorsal spine, spot fainter in females and immature males. Second dorsal fin with black spots forming 2 rows ventrally, distal margin of fin dark brown. Pectoral fin base with a round to oval spot, smaller than pupil diameter dorsally and in some specimens a second smaller spot near ventral base, fin translucent without spots. Caudal fin with upper rays covered with brown spots forming wavy bands (usually 4–6) on dorsal two-thirds of fin, ventral third gray to dark brown; a large black median spot on dorsal midline of caudal peduncle followed by a white spot at base of caudal fin, followed by a small dark spot on caudal fin. Anal fin whitish to translucent in young and gray in adults of both sexes. Pelvic fins translucent in young, gray to dark brown in adults of both sexes.

In freshly collected individuals from Bensbach River (Fig. 10), the overall coloration is similar to that described for preserved material, except as follows: distal tips of two dorsal and caudal fins orange and anal fin and ventral quarter of caudal fin gray with an orange tinge and the pectoral fins white. A live individual from the Timika region is similar in coloration, except that the pectoral fin is translucent (Fig. 11).

### Distribution

The species is known only from three localities, the Bensbach River in Papua New Guinea and the Timika Region in Papua, Indonesia. The species appears common in lowland clear to turbid streams (less than 50 m elevation) and also occurs in peat swamp habitat in the Timika region. It belongs to a relatively diverse fish species assemblage at the type locality, consisting of 16 species that also includes clupeids, plotosids (2 species), atherinids, melanotaeniids (2 species), ambassids, apogonids (2 species), terapontids, toxotids, eleotrids (3 species), and soleiids.

### Variation

Although the general coloration is similar in specimens from the two localities, specimens from the Timika region are generally darker than those from the Bensbach River. Pectoral ray counts for the two populations overlap, but dif-

fer significantly ( $p < 0.001$ ), with a mean for the Bensbach samples of 13.9 and 14.6 for the Timika population. Because pectoral ray counts can vary geographically in other gobioid fishes (Hoese and Allen, 1990), we tentatively regard the populations as conspecific. Although the midlateral spots appear different in the two populations in the specimens illustrated here, the width of the midside spots varies from covering one to three scales in both populations.

The species is also sexually dimorphic, with males having a larger mouth, longer pelvic fin and longer posterior rays of the second dorsal and anal fins. In addition some large males develop a steep and rounded snout and broad cheeks as shown for the holotype and paratype in figures 9 and 10 and are presumed to be breeding males. Similar head shape changes were also found in *Glossogobius nanus*.

### Similarity to other species

The species is the only species from New Guinea, which lacks preopercular pores and the tubular canal above the operculum. Species from the Malili Lakes in Sulawesi lack preopercular pores and those differ in having a very different papilla pattern (Hoese *et al.*, 2015). The blind *Glossogobius ankaranensis* Banister, 1994 from Madagascar lacks all head pores. *Glossogobius pumilus* is similar to the other species described in this paper and to *Glossogobius bellendenensis* and *G. muscorum*. In characters other than the absence of preopercular pores, the species differs from *G. muscorum* in having 11+16 vertebrae (versus 11+17), usually having second dorsal fin rays I,8 (versus I,9), anal fin rays I,7 (versus I,8); a reduced sensory papilla line 5 starting below front quarter of eye (versus starting before eye); papilla line 7 not reaching lips (versus reaching lip) and a large ocellated spot surrounding sixth dorsal spine (versus three small black spots along base of fin). It differs from *G. bellendenensis* in these same features, except that *G. bellendenensis* has 12+16 vertebrae and only one or two spots on the first dorsal fin. It also differs from *G. nanus* n. sp. and *G. gnomus* n. sp. in usually having second dorsal rays of I,9 (versus I,8). It also differs from *G. nanus* in vertebral counts (11+15 in *G. nanus*) and anal ray counts (usually I,6 in *G. nanus*).

### Etymology

From the Latin *pumilus* = a dwarf, a noun in apposition, alluding to the small size of this species.

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