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## *Lubricogobius nanus*, a new species of goby (Pisces: Gobiidae) from eastern Papua New Guinea

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### Abstract

A new species of goby, *Lubricogobius nanus*, is described from near Alotau, Milne Bay Province, Papua New Guinea on the basis of four adult specimens, 9.5–10.9 mm SL. Diagnostic features include 10–11 segmented dorsal-fin rays, 8–9 segmented anal-fin rays, the presence of both anterior and posterior nostrils, a low fleshy keel mid-dorsally and mid-ventrally on the caudal peduncle, a mid-lateral row of widely-spaced sensory papillae on the side of the body, approximately 15 scattered sensory papillae on the middle portion of the caudal fin, body depth 3.2–3.4 in SL, mainly brown coloration with yellow fins, and an exceptionally small size (<11 mm SL). Photographs and comparative morphological data are presented for the other four members of the genus, including *L. dinah*, *L. exiguus*, *L. ornatus*, and *L. tre*.

**Key words:** taxonomy, ichthyology, mud-slope fishes, Indo-Pacific, western Pacific Ocean.

### Introduction

The gobiid genus *Lubricogobius* contains small (<about 35 mm SL), relatively brightly colored fishes that inhabit coral reefs and adjacent habitats in the western Pacific Ocean and northwestern Australia. The genus, which is apparently most similar to *Gobiodon*, is characterised by an absence of scales and sensory pores, pelvic fins united by a well-developed frenum, relatively elongate shape (depth 2.9–3.4 in SL), a gill opening that is not restricted to the pectoral-fin base, and general yellowish coloration. The genus was reviewed by Randall & Senou (2001), who recognized three species including *L. dinah* Randall & Senou 2001, *L. exiguus* Tanaka 1915, and *L.*

*ornatus* Fourmanoir 1966. Randall & Senou (2001) allocated a fourth species, *L. pumilis* Larson & Hoese 1980 from Somalia, to the monotypic genus *Larsonella* Randall & Senou 2001, based on its scaled caudal peduncle, lack of a pelvic frenum, more slender body shape, depressed head shape, narrower gill opening, and pattern of cephalic sensory papillae that includes transverse rows radiating below the eye. Additionally, *Lubricogobius tre* Prokofiev 2007 was described on the basis of a single trawl specimen from Vietnam.

The present paper describes a new species of *Lubricogobius* that was collected near the town of Alotau in Milne Bay Province of eastern Papua New Guinea during December 2014 and August 2015. The author had a rare opportunity to investigate a habitat that is frequently overlooked by divers due to poor visibility and impoverished faunal diversity. A series of 34 scuba dives, involving 53 hours underwater, facilitated a detailed survey of a sloping, mud-bottom habitat, extending along 200 m of shoreline adjacent to a shipyard to depths of about 18 m. The first impression of this site, which occupies approximately 8,000 m<sup>2</sup>, was a featureless bottom with very few fishes, but closer inspection revealed numerous burrows occupied by a variety of fishes and invertebrates. The gobiid fauna was particularly rich and included several new discoveries belonging to the genera *Acentrogobius*, *Cryptocentrus*, *Tomiyamichthys*, and *Trimma* (Allen 2015a, b & c).

## Materials and Methods

Lengths are given as standard length (SL), measured from the median anterior point of the upper lip to the base of the caudal fin (posterior end of the hypural plate); body depth is measured at both the origin of the pelvic fins and the origin of the anal fin, and body width at the origin of the pectoral fins; head length (HL) is taken from the upper lip to the posterior end of the opercular membrane, and head width over the posterior margin of the preopercle; orbit diameter is the greatest fleshy diameter; interorbital width is the least bony width; snout length is measured from the median anterior point of the upper lip to the nearest fleshy edge of the orbit; upper-jaw length from the same anterior point to the posterior end of the maxilla; caudal-peduncle depth is the least depth, and caudal-peduncle length the horizontal distance between verticals at the rear base of the anal fin and the caudal-fin base; lengths of spines and rays are measured to their extreme bases; caudal and pectoral-fin lengths are the length of the longest ray; pelvic-fin length is measured from the base of the pelvic spine to the tip of the longest pelvic soft ray. Gill rakers were counted on the first gill arch, those on the upper limb listed first; rudiments are included in the counts.

Morphometric data presented as percentages of the standard length are included in Table 1. The range of counts and measurements for paratypes is indicated in parentheses if different from the holotype. Type specimens are deposited at the Western Australian Museum, Perth (WAM).

## *Lubricogobius nanus* Allen, n. sp.

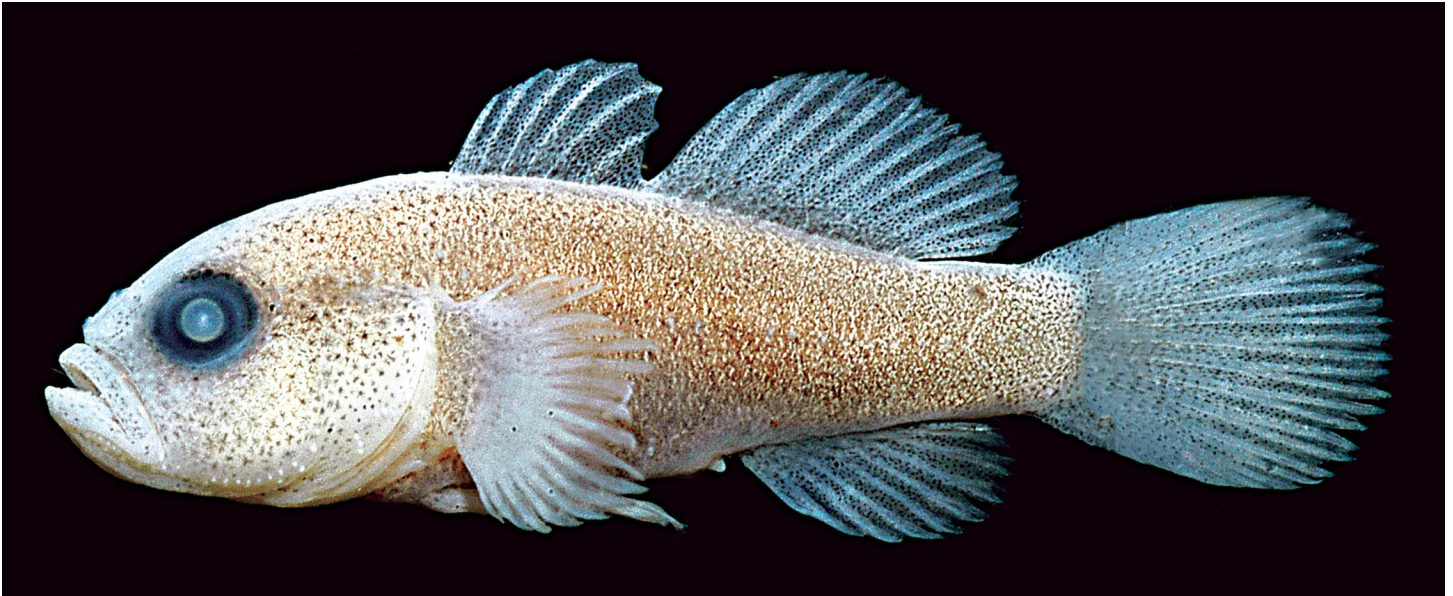
### Tiny Goby

Figures 1–7 & 9A, Table 1.

**Holotype.** WAM P.34428–001, male, 9.7 mm SL, Alotau, Papua New Guinea, 4.8 km west of main wharf, 10° 18.256' S, 150° 24.768' E, 14.5 m, clove oil and hand net, G.R. Allen, Aug. 24, 2015.

**Paratypes.** WAM P.34319–006, 2 specimens, 10.8 mm SL female & 10.9 mm SL male, same data as holotype except collected Dec. 10, 2014; WAM P.34428–002, male, 9.5 mm SL, collected with holotype.

**Diagnosis.** Dorsal-fin rays VI-I,10–11; anal-fin rays I,8–9; pectoral-fin rays 19; anterior nostrils present; scales absent; pelvic disc with conspicuous frenum; mid-lateral row of widely-spaced sensory papillae on side of body and approximately 15 scattered sensory papillae on middle portion of caudal fin; body depth 3.0–3.4 in



**Figure 1.** *Lubricogobius nanus*, preserved holotype, WAM P.34428-001, male, 9.7 mm SL, Alotau, Papua New Guinea (G.R. Allen).

SL; head length 2.7–2.9 in SL; head compressed, its width 1.1–1.4 in head depth; caudal fin rounded, shorter than head, in SL; color in life generally brown except head and fins yellowish with dense covering of tiny brown chromatophores, those of pectoral and pelvic fins mainly confined to basal half of fin; iris yellow.

**Description.** Dorsal-fin rays VI-I,10 (two paratypes with 11); anal-fin rays I,8 (one paratype with 9); all dorsal and anal-fin soft rays branched except first anal ray unbranched in one paratype, last dorsal and anal-fin soft rays branched to base; pectoral-fin rays 19 (both sides counted), all rays branched except uppermost and lowermost one or two; pelvic-fin rays I,5; branched caudal-fin rays 13; segmented caudal-fin rays 15; upper and lower unsegmented caudal-fin rays 6 and 6 respectively; gill rakers 4 + 12, including rudiments.

Greatest body depth 3.4 (3.0–3.3) in SL; depth at origin of anal fin 5.2 (3.7–4.4) in SL; body compressed, width 2.3 (2.0–2.1) in body depth; HL 2.8 (2.7–2.9) in SL; head compressed, width at posterior preopercular margin 1.4 (1.1–1.2) in depth at preopercular margin; snout short, 4.8 (4.5–4.9) in HL; eye moderately large, fleshy orbit diameter 3.2 (3.0–3.3) in HL; interorbital space narrow, least bony width 5.0 (5.4–7.1) in HL; caudal-peduncle depth 2.7 (2.4–2.6) in HL; caudal-peduncle length 1.8 (1.8–2.1) in HL; dorsal and ventral edges of caudal peduncle with low, fleshy keel.



**Figure 2.** *Lubricogobius nanus*, preserved paratype (WAM P.34428-002), male, 9.5 mm SL, slanted towards camera and illuminated to show sensory papillae (white spots) on middle of sides and on middle portion of caudal fin, Alotau, Papua New Guinea (G.R. Allen).

TABLE 1

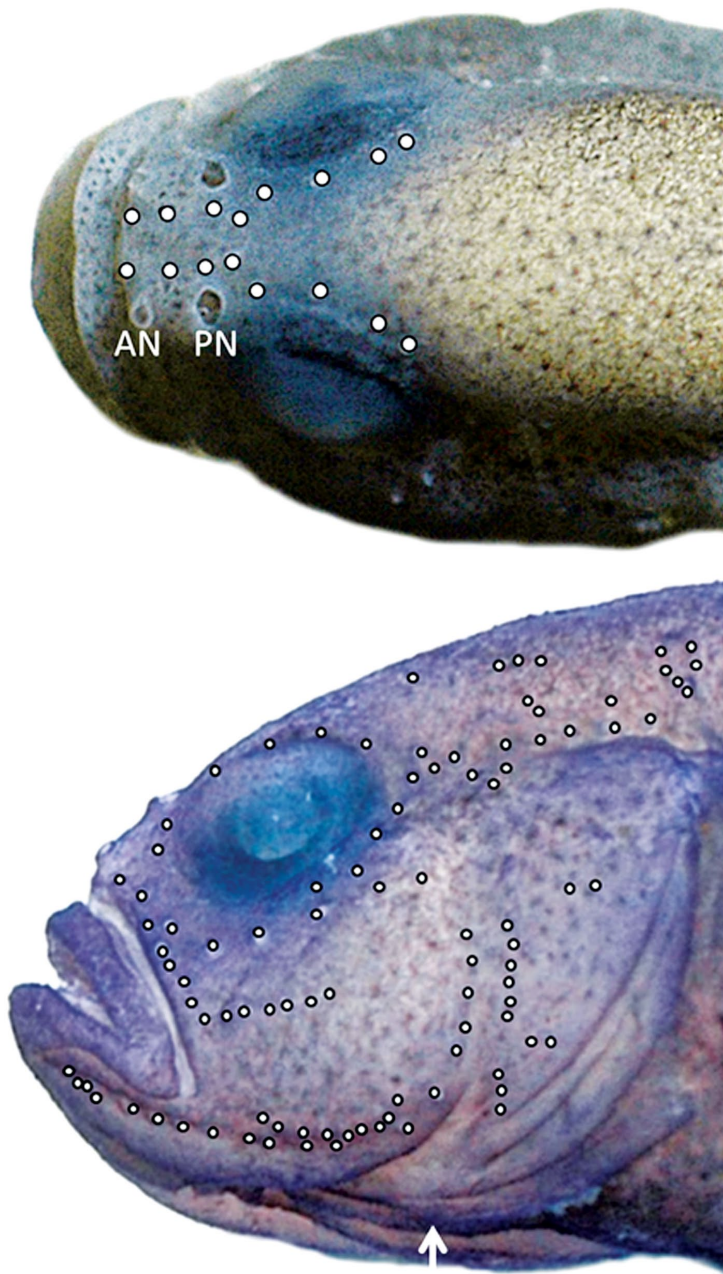
Proportional measurements (as percentage of SL) for  
type specimens of *Lubricogobius nanus*.

Asterisk (\*) indicates damaged fin.

	holotype	paratypes		
	WAM P. 34428-001	WAM P. 34319-006	WAM P. 34319-006	WAM P. 34428-002
Sex	male	male	female	male
Standard length (mm)	9.7	10.9	10.8	9.5
Greatest body depth	29.2	30.9	33.0	30.4
Depth at anal-fin origin	19.2	24.6	26.8	22.6
Body width	12.9	15.5	15.7	15.3
Head length	36.0	34.4	36.2	37.4
Head depth	27.5	28.7	27.5	28.2
Head width	20.1	23.9	24.5	23.4
Snout length	7.5	7.6	7.8	7.7
Orbit diameter	11.4	10.6	12.2	11.2
Interorbital width	7.2	6.4	6.2	5.3
Upper-jaw length	13.2	14.2	13.9	14.4
Caudal-peduncle depth	13.1	14.4	15.2	14.4
Caudal-peduncle length	19.6	19.4	20.6	17.7
Predorsal length	41.0	40.6	44.4	42.4
Preanal length	65.2	65.9	72.7	67.1
Prepelvic length	38.4	36.8	39.3	37.5
First dorsal spine	10.8	9.4	8.8	10.3
Longest dorsal spine	17.8	16.5	17.4	16.8
Spine of second dorsal fin	14.2	15.1	17.3	15.4
Longest dorsal soft ray	21.8	19.6	22.0	20.4
Anal spine	8.9	8.7	10.1	10.2
Longest anal soft ray	19.5	17.9	19.7	17.7
Caudal fin length	32.6	31.2	27.3	30.2
Pectoral fin length	32.0	28.2	30.2	30.4
Pelvic fin length	28.4	29.6	15.9*	28.7

Mouth moderately large and strongly oblique with lower jaw projecting, gape forming angle of about  $58^\circ$  to horizontal axis of head and body; maxilla ending on vertical at or slightly posterior to anterior edge of pupil, upper jaw length 2.7 (2.4–2.6) in HL. Upper jaw with outer row of slender, recurved, well-spaced canine teeth and inner band of 2–3 irregular rows of small conical teeth anteriorly in jaw, narrowing to single row posteriorly; front of lower jaw with outer row of 5–6 slender incurved canines on each side and two inner rows of small conical teeth, narrowing to single row on side of jaw except where interrupted by two large, recurved canines on each side. Tongue truncate anteriorly with broadly rounded corners. Gill opening ending below posterior border of preopercle.

Head and body naked; head, body, and fins covered with coat of finely granular mucus. Anterior nostrils present; posterior nostrils large, with fleshy rim, in anterior interorbital space at edge of orbit. No open sensory pores on head. Mid-lateral row of widely-spaced sensory papillae on side of body and approximately 15 scattered sensory papillae on middle portion of caudal fin (Fig. 2); pattern of cephalic sensory papillae as illustrated in Fig. 3.

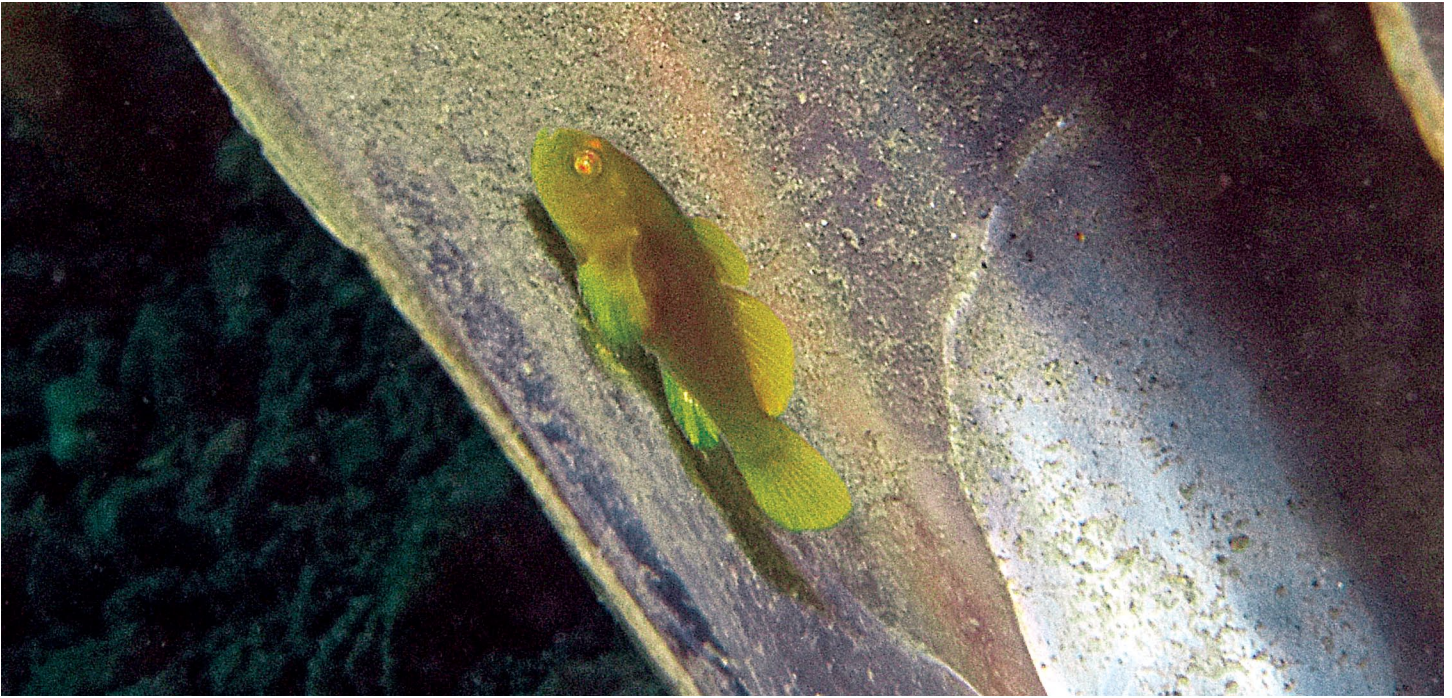


**Figure 3.** *Lubricogobius nanus*, preserved paratype (WAM P.34319–006), 10.8 mm SL, pattern of cephalic sensory papillae (shown by black-edged white spots; anterior and posterior nostrils indicated on dorsal view of head by AN and PN respectively. The white arrow on lower head indicates anterior extent of gill opening (G.R. Allen).

Origin of first dorsal fin about level with base of pectoral fins, predorsal length 2.4 (2.3–2.5) in SL; no filamentous dorsal-fin spines; first dorsal-fin spine 3.3 (3.6–4.1) in HL; fourth dorsal-fin spine longest, 2.0 (2.1–2.2) in HL; last interspinous membrane of first dorsal fin joined to spine of second dorsal fin near its base; spine of second dorsal fin 2.5 (2.1–2.4) in HL; fourth to seventh dorsal-fin soft rays longest and subequal, 1.7 (1.6–1.8) in HL; origin of anal fin below base of third dorsal soft ray, preanal length 1.5 (1.4–1.5) in SL; anal-fin spine 4.1 (3.6–3.9) in HL; fifth anal-fin soft ray longest, 1.8 (1.8–2.1) in HL; caudal fin rounded, 3.1 (3.2–3.7) in SL; pectoral fins reaching to about level of anus, middle rays longest, 3.1 (3.3–3.6) in SL; prepelvic length 2.6 (2.5–2.7) in SL; pelvic fins joined to form pointed disc, nearly reaching anus 3.5 (3.4–3.5, except 6.3 in damaged paratype) in SL; pelvic frenum well developed.

**Color in life.** (Figs. 4–5, 7 & 9A) Body generally medium brown; head and fins yellowish with dense covering of tiny brown chromatophores, those of pectoral and pelvic fins mainly confined to basal half of fin; iris yellow. A presumed female (not collected; Fig. 7, left) differed in having the entire head and body dark brown with tan to slightly yellowish fins.

**Color in alcohol.** (Figs. 1–2) Pale brown or tan, frequently with profuse covering of tiny, stellate melanophores; fins generally translucent with numerous pepper-like melanophores on inter-radial membranes.



**Figure 4.** *Lubricogobius nanus*, holotype, WAM P.34428-001, male, 9.7 mm SL, underwater photograph of fish sheltering in dead bivalve shell, Alotau, Papua New Guinea (G.R. Allen).

**Distribution and habitat.** The new species is currently known only from the type specimens, which were collected near Alotau, a small town in Milne Bay Province of Papua New Guinea (Fig. 6). All of the type specimens were obtained within 100 m of each other on an approximately 20° mud slope. Two of the specimens were collected together from the inside of a dead bivalve (Figs. 4 & 7) and the other two specimens were found on either filamentous algae or sponge that covered bottom debris, including a piece of wood (Fig. 5) and a cement block. A fifth uncollected specimen was also observed and photographed in the same dead bivalve mentioned above. The depth of capture ranged from 8–13 m.

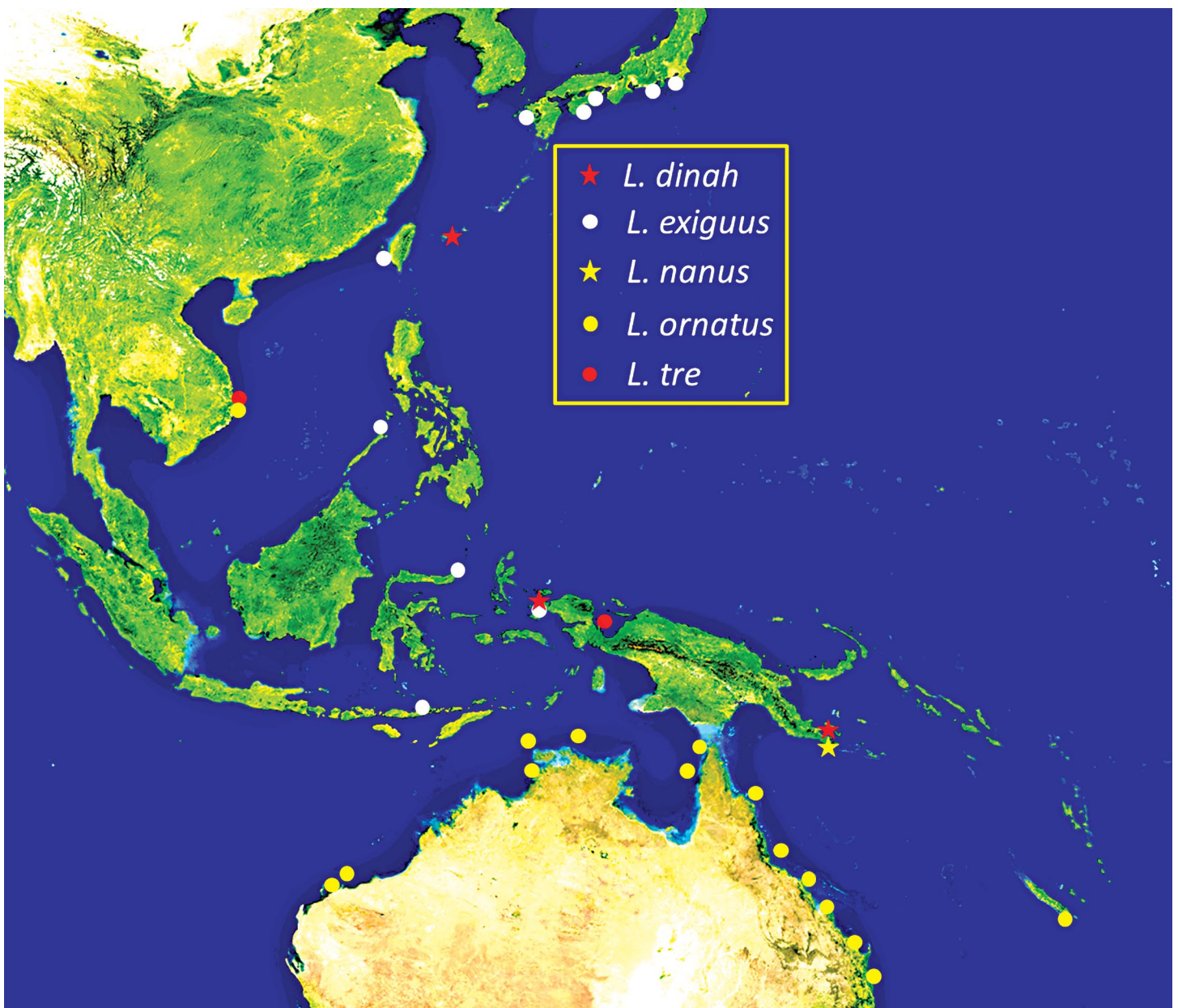
**Etymology.** This species is named *nanus* (Latin: dwarf) with reference to its small size, which is the most diminutive in the genus.



**Figure 5.** *Lubricogobius nanus*, paratype, WAM P.34319-006, male, 10.9 mm SL, underwater photograph, Alotau, Papua New Guinea (G.R. Allen).

**Comparisons.** The new species appears to be the smallest member of the genus with a maximum known size of approximately 11 mm SL in comparison to maximum sizes of 16.3 mm SL for *L. dinah* and 25.0–33.7 mm SL for the other species. Although only four tiny specimens of *L. nanus* are known, all have fully developed genital papillae. In addition, the male holotype was part of a nesting pair (with an uncollected presumed female) observed within the confines of a dead bivalve shell (Fig. 7).

The new species is possibly a close relative of *Lubricogobius tre*, described by Prokofiev (2009) on the basis of a single specimen, 25 mm SL, trawled in 15–20 m depth at Nha Trang Bay, Vietnam (12° 12'46" N, 109° 14'76" E). Both species have a unique segmented anal-fin ray count of 8–9 (other *Lubricogobius* with 5–7 rays), 10–11 segmented dorsal-fin rays, and 19 pectoral-fin rays. However, *L. tre* differs from *L. nanus* in having much shorter pelvic fins (16.0% SL versus 35.3–38.4% SL for the three type specimens of *L. nanus* with undamaged fins). It further differs in coloration, being predominately pinkish yellow with bright red-orange median fins rather than mainly brown with yellow fins in *L. nanus*. A drawing of the dorsal head papillae that accompanied the original description of *L. tre* shows a lack of sensory papillae in front of the posterior nostrils and only a single interorbital papilla adjacent to the dorsal rim of the eye, in marked contrast to *L. nanus*, which has four paired papillae on the dorsal snout and four conspicuous papillae on either side of the interorbital adjacent to the eye



**Figure 6.** Distribution of species of *Lubricogobius* based on museum specimens and underwater photographs, including questionable record of *L. tre* from Cenderawasih Bay, West Papua.



**Figure 7.** *Lubricogobius nanus*, underwater photograph of pair sheltering in dead bivalve shell, with 9.7 mm SL male holotype (right) resting on a clutch of eggs and darker uncollected presumed female, about 9 mm SL (left), Alotau, Papua New Guinea (G.R. Allen).

(Fig. 3). However, the papillae of *L. tre* may have been abraded off when the specimen was collected by trawling. A possible underwater photographic record (Fig. 8) of *L. tre* was obtained at Cenderawasih Bay, West Papua, Indonesia, which appears to have similar fin-ray counts except for an apparently anomalous count of seven spines in the first dorsal fin. Unfortunately no specimens were collected.

The new species has a mid-lateral row of sensory papillae along the side of the body and approximately 15 scattered sensory papillae on the middle portion of the caudal fin (Fig. 2), both features that have not been reported previously for the genus, but are likely present in other species, since they are easily missed unless specimens are properly illuminated and/or stained with cyanine blue.



**Figure 8.** *Lubricogobius* sp., possibly *L. tre*, approximately 20 mm SL, Cenderawasih Bay, West Papua Province, Indonesia (G.R. Allen).





**Figure 9.** Comparison of color patterns for species of *Lubricogobius*: (A) *L. nanus*, 10.9 mm SL (WAM P.34319–006), Alotau, Papua New Guinea (G.R. Allen); (B) *L. dinah*, approximately 15 mm SL, D’Entrecasteaux Islands, Papua New Guinea (J.E. Randall).

The remaining three members of the genus are clearly distinguished from *L. nanus* on the basis of color pattern (Figs. 9 & 10). *L. dinah* (Fig. 9B) differs in having an orange coloration except for a strongly contrasted white zone that encompasses the dorsal portion of the head and body. This species is also unique among species of the genus in lacking anterior nostril openings. Both *L. exiguus* and *L. ornatus* are generally yellow (Fig. 10), but the latter species differs in having pale blue lines radiating from the eye and across the opercle and pectoral-fin base. The two species also differ from *L. nanus* in having 5–7 segmented anal-fin rays (versus 8 or 9), and *L. exiguus* is further distinguished in having 16–18 (modally 17) pectoral-fin rays (versus 19).

The five species of *Lubricogobius* are sparsely represented in museum collections and are known on the basis of underwater photographs from relatively few locations (Fig. 6). Most observations involve *L. exiguus* (incorrectly identified as *L. ornatus* by Allen & Erdmann 2012), which is regularly encountered in the temperate waters of Japan and at Lembeh Strait near the northern tip of Sulawesi in Indonesia. It was particularly common at the last-mentioned locality during July 2014, with approximately 10–20 individuals seen during each hour-long scuba dive. It was often seen in pairs, usually hiding amongst or within sponges, abandoned mollusk shells, and discarded soft drink and beer bottles. Remarkably, a visit to the same sites 11 months later, in June 2015, failed to find a single individual during one week of diving. Therefore, it appears likely that this species has a short life



**Figure 10.** Comparison of color patterns for species of *Lubricogobius*: (C) *L. ornatus*, approximately 12 mm SL, New Caledonia (J.E. Randall); and (D) *L. exiguus*, approximately 20 mm SL, Lembeh Strait, North Sulawesi Province, Indonesia (G.R. Allen).

cycle and is susceptible to rapid swings in population numbers, perhaps similar to the situation in certain *Eviota* gobies, which have a lifespan lasting only a few months, including a 3-week pelagic larval stage (Depczynski & Bellwood 2005).

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Rob Vanderloos, owner of Milne Bay Charters, and his staff provided an excellent opportunity for the author to collect and photograph fishes aboard MV *Chertan* during December 2014 and August 2015. Julius Violaris generously provided unlimited access to the seafront adjacent to the Alotau headquarters of Nawae Construction Company. The initial visit was capably assisted by Roger Steen of Cairns, Australia. Thanks are also due Mark Allen, Glenn Moore, and Sue Morrison (WAM) for curatorial assistance. The manuscript was reviewed by Luke Tornabene and Rick Winterbottom.

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