

Obliquogobius bathyalis, a new species of deep-living gobies (Teleostei: Gobiidae) from New Caledonia, southwestern Pacific Ocean

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Abstract

A new species of deep-water goby, *Obliquogobius bathyalis* n. sp. from New Caledonia, is described on the basis of three specimens collected with trawls at 264–350 m depth. The new species is characterised by the following characters: second dorsal-fin rays I, 8; anal-fin rays I,8 or I,9; head length 29.4–36.7% of SL; eye diameter 41.5–52.35 of head length; longitudinal scale rows 24–26; transverse scale rows 9–10; no predorsal scales; no scales on lateral surface of nape; postorbital pore G absent (from anterior oculoscapular canal); gill opening wide; caudal fin asymmetrical dorsoventrally, rays of upper half much longer than those of lower half, giving obliquely pointed appearance; four or five vertical dark bars on lower side of body; first dorsal fin distally with large black blotch; caudal fin distally dark; distinct dark spot on centre of caudal-fin base present. The new species is compared with other species in the genus. A revised key to the species of *Obliquogobius* is presented.

Keywords: Gobies, New species, Identification key, New Caledonia, Geographical distribution.

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Citation: Fricke, R. 2022. *Obliquogobius bathyalis*, a new species of deep-living gobies (Teleostei: Gobiidae) from New Caledonia, southwestern Pacific Ocean. FishTaxa 24: 1-9.

Introduction

Gobies of the family Gobiidae are the largest group of fishes, living in freshwater, transitional water and marine habitats of tropical and temperate climate zones. Currently, a total of 1,965 species in 257 genera are known in the family (Fricke et al. 2022a). In the ocean, most species live in shallow water, but a few species of the genus *Obliquogobius* Koumans 1941 are known to occur in deep water below 100 m, down to depths of 496 m (Goren 1992). Recently, gobiid fishes were arranged in the order Gobiiformes (Nelson et al. 2016, based on Betancur-R et al. 2013; Thacker 2009). Within the Gobiidae, five valid subfamilies are recognised, Sicydiinae, Gobionellinae, Oxudercinae, Amblyopinae and Gobiinae (Larson and Murdy 2001; Fricke et al. 2022a). The Gobiinae contains 1,273 species in 150 genera (Fricke et al. 2022a).

The genus *Obliquogobius* was originally described by Koumans (1941: 219), based on *Gobius cometes* Alcock 1890. Without being aware of this name, Herre (1945: 402) named a new genus *Orissagobius* for the same species, which is now a junior synonym of *Obliquogobius*. Shibukawa and Aonuma (2007) redefined the genus, as having the following combination of characters: VI+I,8–10 dorsal-fin rays; I,8–10 anal-fin rays; 20–24 pectoral-fin rays; 22–26 longitudinal scale rows; midline of pre-dorsal fin region naked; gill opening relatively wide, anteroventral point extending to (or beyond) vertical through preopercular margin; outermost teeth on both jaws slender, larger than inner row teeth; enlarged, stout canine-like teeth absent; head sensory papillae well developed, usually modified into bulbous or short barbel-like fleshy flaps; reduced longitudinal pattern of sensory papillae rows on cheek; head sensory canal pores moderately developed, comprising snout pore (B'), single anterior (C) and posterior (D) interorbital pores, four postorbital pores (E, F, G, and H'; absent in some species), and three preopercular pores (M', N, and O'); 10 + 16 = 26 vertebrae; P-V 3/II II I I 0/9. The genus currently includes the following 7 species: *O. cirrifer* Shibukawa & Aonuma 1997 (Shibukawa & Aonuma 1997: 143) from the Ryukyu Islands; *O. cometes* (Alcock 1890) (Alcock 1890: 208 as *Gobius cometes*) from the Indo-West Pacific between India, the Philippines and Japan; *O. eptactis* Fujiwara, Psomadakis, Swe &

Motomura 2021 (Fujiwara et al. 2021: 542) from Myanmar; *O. fulvostriatus* Chen, Jaafar & Shao 2012 (Chen et al. 2012: 270) from the Ryukyu Islands; *O. megalops* Shibukawa & Aonuma 1997 (Shibukawa & Aonuma 1997: 146) from the Ryukyu Islands; *O. turkayi* Goren 1992 (Goren 1992: 267) from the central Red Sea; *O. yamadai* Shibukawa & Aonuma 1997 (Shibukawa and Aonuma 1997: 147) from the Philippines and Japan. In the course of a study of the fishes of New Caledonia, three specimens of a previously undescribed species of *Obliquogobius* was discovered. The new species is described in the present paper.

Materials and Methods

The type material of the new species is deposited in the following collections: Muséum National d'Histoire Naturelle, Paris, France (MNHN); National Taiwan University, University Museum, Taipei, Taiwan (NTUM); Staatliches Museum für Naturkunde in Stuttgart, Germany (SMNS). Comparative materials are listed below. Abbreviations of museum collections (see below) follow Fricke and Eschmeyer (2022a).

Methods follow Winterbottom and Burrige (1993) and Shibukawa and Aonuma (2007); fin-ray counts follow Fricke (1983). The starting point for length measurements is the middle of the upper jaw. The standard length (measured from the tip of the upper jaw to the middle of the urohyal/caudal fin base) is abbreviated SL, the head length HL. Generic classification and nomenclature follow Fricke et al. (2022b). Reference and journal citations follow Fricke and Eschmeyer (2022b). The map was composed using QGIS 3.6. The key to species is updated, based on the key presented by Shibukawa et al. (2007).

Results

Systematic ichthyology

The present paper follows the classifications provided by Nelson (2016) and Laan et al. (2014):

Superclass Gnathostomata

Subclass Neopterygii

Division Teleostei

Order Gobiiformes

Family Gobiidae Cuvier 1816

Genus *Obliquogobius* Koumans 1941

Obliquogobius bathyalis new species

(Figs. 1-2)

Common name: New Caledonian deep-water goby

Holotype: MNHN 2022-0161, 32.5 mm SL, southwestern Pacific Ocean, New Caledonia Grande Terre Group, slope east of Canal de la Havannah, 22°13'S 167°07'E, 264-273 m depth, Wei-Jen Chen and R/V Alis, Cruise EXBODI, St. CP3788, trawl, 3 Sept. 2011.

Paratypes: NTUM 10670, 1 specimen, 30.0 mm SL, same data as the holotype. SMNS 27306, 29.9 mm SL, southwestern Pacific Ocean, New Caledonia, Chesterfield Islands, southeast of northern lagoon, 19°29'06"S 158°37'37"E, 350 m depth, Bertrand Richer de Forges and R/V Coriolis, Cruise CHALCAL1, St. CP5, trawl, 16 July 1984, 16:15-17:07 h NCT.

Diagnosis: A species of *Obliquogobius* distinguished from other members of the genus by the following combination of characters: second dorsal-fin rays I, 8; anal-fin rays I, 8 or I,9; head length 29.4-36.7% of SL; eye diameter 41.5-52.35 of head length; longitudinal scale rows 24-26; transverse scale rows 9-10; no predorsal scales; no scales on lateral surface of nape; postorbital pore G absent (from anterior oculoscapular canal); gill opening wide; caudal fin asymmetrical dorsoventrally, rays of upper half much longer than those of lower half,

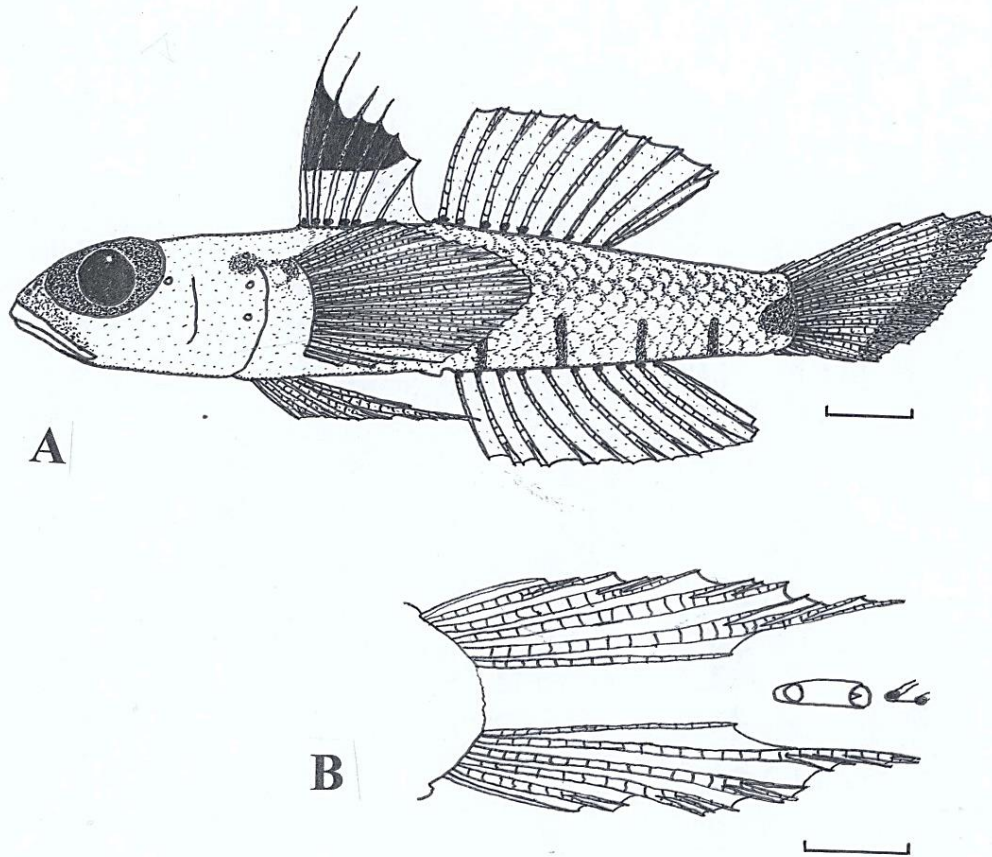


Figure 1. *Obliquogobius bathyalis* n. sp., MNHN 2022-0161, holotype, 32.5 mm SL, southwestern Pacific Ocean, New Caledonia Grande Terre Group, slope east of Canal de la Havannah. Cephalic sensory system. **A.** Dorsal view. **B.** lateral view.

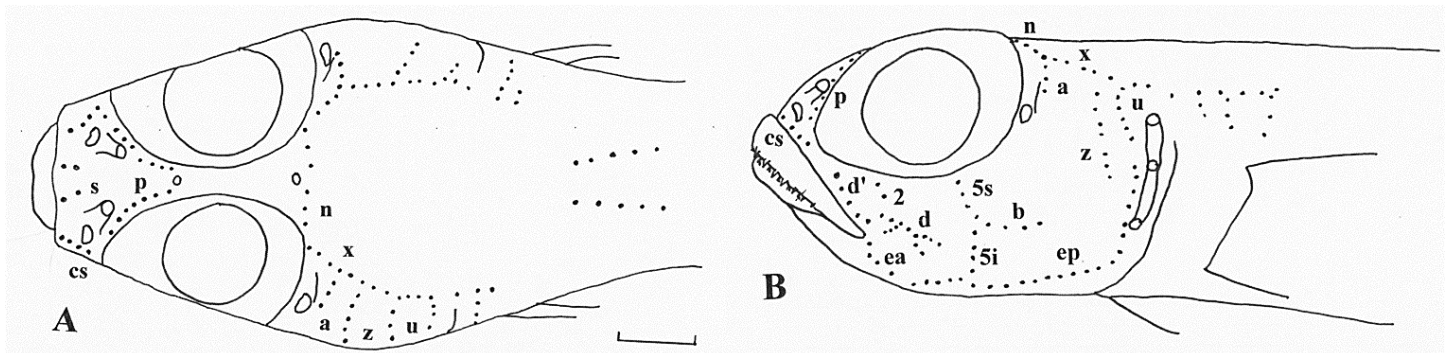


Figure 2. *Obliquogobius bathyalis* n. sp., MNHN 2022-0161, holotype, 32.5 mm SL, southwestern Pacific Ocean, New Caledonia Grande Terre Group, slope east of Canal de la Havannah. **A.** Lateral view. Scale indicates 5 mm. **B.** Pelvic fins. Scale indicates 3 mm.

giving obliquely pointed appearance; four or five vertical dark bars on lower side of body; first dorsal fin distally with large black blotch; caudal fin distally dark; distinct dark spot on centre of caudal-fin base present.

Description: D VI + I,8 (VI + I,8); A I,9 (I,8; I,9); P1 iii-iv,14-15,iv-v (total 22-23) [iii-iv,13-16,iv-v (total 21-24)]; P2 I,5 (I,5); C (iii),ii,12,ii,(iii) [(iii-v),ii,13-14,ii,(iii-v)]. Measurements of the holotype and paratypes are given in Table 1.

Gill rakers (including rudiments) 5+8 (4-5 + 7-8). Longitudinal scale rows ca. 26 (ca. 24-25). Median predorsal scales 0 (0). Transverse scales 9 (10). Scales dorsally at pectoral-fin base 2 (1-2). Scales on pelvic-fin base near spine 3 (2-3). Belly scales beginning opposite tip of pelvic-fin spine. Vertebrae 9 + 17 (9 + 17).

Table 1. Counts and measurements of *Obliquogobius bathyalis* n. sp.

Catalogue number	MNHN 2022-0161	NTUM 10670	SMNS 27306
Type status	Holotype	Paratype	Paratype
Counts:			
D1/D2	VI/i,8	VI/i,8	VI/i,8
A	i,9	i,8	i,9
P1 left/P1 right	iii,15,iv/iv,14,v	iv,14,iv/iii,13,v	iii,15,v/iii,16,v
C	(iii)ii,12,ii,(iii)	(iii)ii,13,ii,(iii)	(v)ii,14,ii,(v)
Longitudinal scale rows	ca. 26	ca. 25	24
Predorsal scale rows	0	0	0
Transverse scale rows	9	10	10
Scales on P1 base	2 (dorsally)	?	1 (dorsally)
Scales on P2 base	3 (near spine)	?	2 (near spine)
Gill rakers		5 + 8	
Vertebrae	9 + 17	9 + 17	9 + 17
Measurements:			
Total length	40.5	37.6	36.3
Standard length (SL)	32.5	30.0	29.9
Caudal-fin length	8.0	7.6	6.4
Predorsal(1) length	11.9	11.8	10.2
Predorsal(2) length	17.5	16.4	15.7
Preanal length	18.0	16.8	17.9
Prepelvic length	10.2	9.8	8.7
Prepectoral length	11.7	10.4	10.1
Head length	10.6	10.1	8.8
Head width	6.9	5.4	5.5
Body depth	5.8	5.9	5.5
Body width	4.8	3.8	4.1
Orbit diameter	4.4	4.2	4.6
Preorbital length	1.8	1.8	1.7
Interorbital distance	0.6	0.4	0.5
Caudal-peduncle length	5.2	5.1	8.2
Caudal-peduncle depth	3.3	2.9	2.7
Maxillary length	3.9	3.7	3.7
Urogenital papilla length	--	--	0.8
First spine/second spine D1	9.1/ 7.2	9.0/ 8.1	4.8 / 6.1
Third spine/fourth spine D1	5.9/ 5.6	7.1/ 5.5	5.7/5.2
Fifth spine/sixth spine D1	4.0/ 3.1	4.2/ 3.1	3.8/3.1
First ray/fifth ray D2	5.1/ 5.6	5.1/	broken/5.4
Last ray D2	4.9	4.9	broken
First/fifth/last ray A	3.7/ 5.9/ 4.4	3.8/ 5.1/broken	2.7/4.5/broken
Pectoral-fin length	9.3	6.7+	8.1
Spine length P2/Pelvic-fin length	2.6/ 9.5	2.5/ 7.6	2.9/7.8
D1 base length	5.7	5.4	5.4
D2 base length	7.3	7.0	7.1
A base length	8.7	8.4	7.1
P1 base length	3.7	3.3	
P2 base length	1.2	1.0	
Distance between pelvic-fin bases	0.9	1.2	

Body slender, compressed, width significantly less than depth. Head subcylindrical, depressed anteriorly. No raised cutaneous ridges on head and nape. Snout short (much shorter than eye diameter), rounded, and slightly inflated. Eye large, located dorsolaterally. Interorbital region very narrow (its width much narrower than pupil diameter), flattened. Anterior and posterior nostrils close to each other; former located midway between eye and upper jaw, with membranous tube; latter located before anterior margin of eye, small, circular. Mouth terminal,

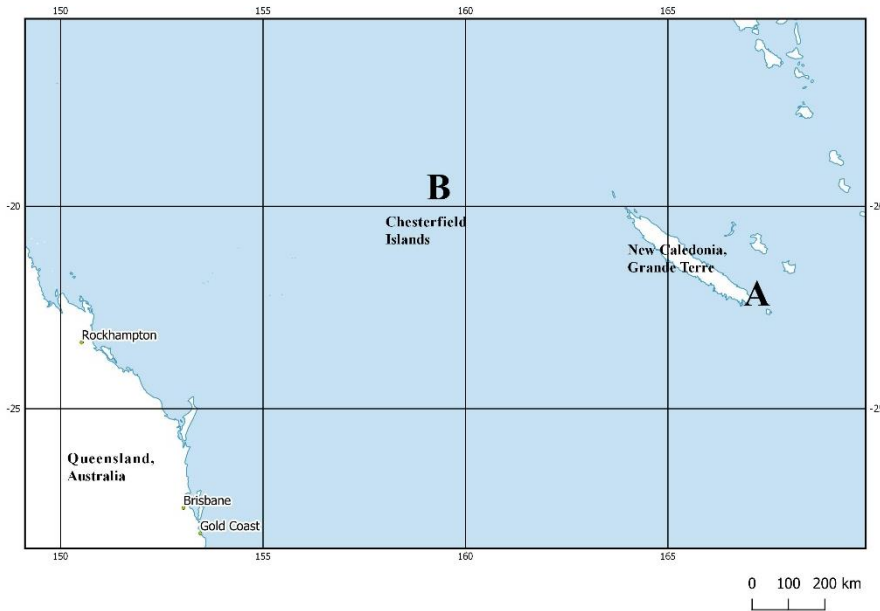


Figure 3. Distribution of *Obliquogobius bathyalis* n. sp. in New Caledonia, southwestern Pacific. **A.** Holotype, MNHN 2022-0161, **B.** Chesterfield Islands paratype (SMNS 27306).

inclined obliquely upwards anteriorly, forming angle of ca. 35° with body axis. Anterior margin of tongue slightly emarginate, free from floor of mouth. Lower jaw subequal to upper jaw, its posterior tip reaching to vertical before middle of pupil. Upper-jaw tip before vertical through lower-jaw tip. Upper jaw with a row of 13 large, pointed, conical teeth on each side; lower jaw with 2 rows of teeth, outer row with 6 teeth on each side, lower with 8 teeth on each side; vomerine and palatine teeth absent. Gill membranes attached anteriorly to isthmus. Preopercular margin nearly straight, upper margin on level of mid-pupil; opercular margin rounded, upper end on level of upper third of pupil.

The cephalic sensory system of the holotype is illustrated in Figure 2. Head sensory canals pores moderately developed, comprising snout pore (B'), single anterior (C), and posterior (D) interorbital pores, one postorbital pore (G) and three preopercular pores (M', N, and O'). Sensory papillae on head moderately developed; reduced longitudinal pattern of sensory-papillae rows on cheek, all rows uniserial or comprising a single papilla; sensory-papillae row a with 3 well-spaced papillae; row b with 5 papillae; rows c and cp absent; row d with 7-10 papillae, bifurcated.

Body covered with deciduous ctenoid scales; belly scales reaching forward to opposite tip of pelvic-fin spine. Prepelvic-fin region with 3 (2) cycloid scales near base of pelvic-fin spine; 2 (1) scales dorsally on pectoral-fin base. Entire head region otherwise naked. Scales on cheek and pectoral-fin base not found.

All dorsal- and anal-fin spines slender, flexible. First dorsal fin triangular, 1st spine longest, first to fourth spines with filamentous tips; dorsal-fin origin located posterior to vertical through pectoral-fin base. Second dorsal and anal fins relatively long, origin of latter on level of vertical through first soft ray of second dorsal fin, last rays well separated from caudal-fin base. Pectoral fin long, middle rays longest, tips reaching to above origin of 4th anal-fin membrane; all rays connected by membrane, 3-4 (3-4) uppermost and 4-5 (4-5) lowermost rays unbranched. Pelvic fins fused medially with a little connecting membrane (between innermost rays); posterior tip reaching below 2nd anal-fin ray when appressed; pelvic-fin origin well before ventral end of pectoral-fin base; first to fourth segmented pelvic-fin rays branched. Caudal fin long, longer than caudal-peduncle length; asymmetrical, upper rays longer than lower rays.

Colour in preservative: Head and body sand yellow, eyes dark gray. Snout and region before upper end of pectoral-fin base dusky. Sides of body with 4 (4-5) short vertical bars above anal-fin base. Caudal-fin base with a large, rounded dark gray spot. Dorsal- and anal-fin spines and rays basally with small gray spots.

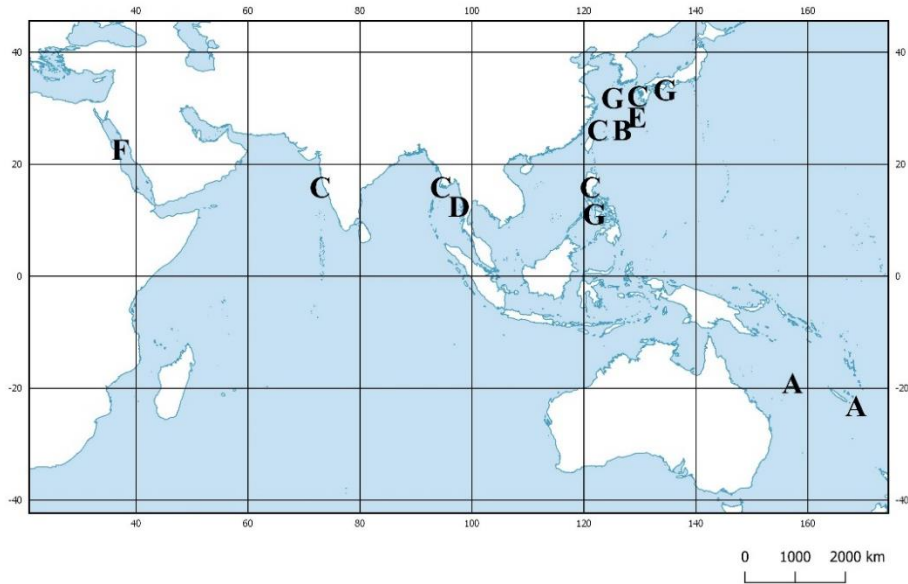


Table 2. Comparison of the species of *Obliquogobius*. Differences to *O. bathyalis* n.sp. are printed in bold face.

Figure 4. Distribution of the species of the genus *Obliquogobius* in the Indo-West Pacific. **A.** *Obliquogobius bathyalis* n. sp., **B.** *O. cirrifer*, *O. fulvostratus*, **C.** *O. cometes*, **D.** *O. eptactis*, **E.** *O. megalops*, **F.** *O. turkayi*.

	<i>O. bathyalis</i> n.sp	<i>O. cirrifer</i>	<i>O. cometes</i>	<i>O. eptactis</i>	<i>O.</i> <i>fulvostratus</i>	<i>O. megalops</i>	<i>O. turkayi</i>	<i>O. yamadai</i>
D2	I,8	I,8	I,9-10	I,9-10	I,9	I,8	I,9	I,9-10
A	I,8-9	I,9	I,8-10	I,9	I,10	I,9	I,9	I,9-10
P1 (total)	21-24	21	23	21-22	21	23	21-22	21-23
Vertebrae	10 + 16	10 + 16	10 + 16	10 + 16	10 + 16	10 + 16	10 + 16	10 + 16
Gill opening	wide	wide	wide	narrow	wide	wide	wide	narrow
Longitudinal scale rows	24-26	22	23-24	24	22	24	24-25	22-24
Transverse scale rows	9-10	7	8	7	7	7	7	6-8
Predorsal scales	0	0	4	0	0	0	0	0
Scales on lateral nape surface	absent	absent	present	present	absent	absent	present	present
Postorbital pore G	absent	absent	present	present	absent	absent	absent	present
Caudal fin	asymmetrical	asymmetrical	asymmetrical	asymmetrical	asymmetrical	asymmetrical	symmetrical	asymmetrical
Body colouration (bars)	4-5 dark bars	without bars	7 yellow bars	7 yellow bars	without bars	without bars	without bars	5-6 yellow bars
First dorsal fin margin	black	melanophores	pale	pale	melanophores	black	black	black
Black blotch on centre of C base	present	absent	absent	absent	absent	present	present	present
D2 colouration (preserved)	basal dark spots	pale	striped	pale	pale	pale	2 rows of spots	pale
C colouration (preserved)	distally dark	distally dark	striped	pale	upper third dusky	pale	upper and lower rays dark	pale
Head length (% in SL)	29.4-36.7	30.1	36.1-41.5	32.9-34.4	30.1	33.2	33.5-34.0	28.3-33.5
Eye diameter (% of head length)	41.5-52.3	45.2	25.9-28.7	33.5-36.8	45.2	42.6	38.0-39.0	32.7-37.3
Distribution	New Caledonia	Ryukyu Islands	Indo-West Pacific	Myanmar	Ryukyu Islands	Ryukyu Islands	Red Sea	Philippines to Japan
Depth range (m)	235-350	141-165	179-187	181-184	141-165	290	434-496	99-143

First dorsal fin distally with a large black blotch. Distal margin of caudal fin gray, other fins translucent.

Distribution: This species is only known from the Chesterfield Islands (Coral Sea, New Caledonia), and the island slope east of the southern tip of Grande Terre (New Caledonia) (Figs. 3, 4). The holotype and paratypes were collected at depths of 264-350 m.

Etymology: The new species is named after the upper bathyal depths (below 200 m) where it occurs. It is the masculine form of an adjective.

Comparisons: *Obliquogobius bathyalis* n. sp. is compared with the other species of the genus in Tab. 2; it differs in having second dorsal fin rays I,8 (versus I,9-10 in *O. cometes*, *O. eptactis*, *O. fulvostriatus*, *O. turkayi* and *O. yamadai*); anal-fin rays I,8-9 (versus I,10 in *O. fulvostriatus*), gill opening wide (versus narrow in *O. eptactis* and *O. yamadai*); longitudinal scale rows 24-26 (versus 22 in *O. cirrifer* and *O. fulvostriatus*); 9-10 transverse scale rows (versus 6-8 in all other species); no predorsal scales (versus 4 in *O. cometes*); scales on lateral nape surface absent (versus present in *O. cometes*, *O. eptactis*, *O. turkayi*, *O. yamadai*); postorbital G absent (versus present in *O. cometes*, *O. eptactis* and *O. yamadai*); body colouration with 4-5 dark bars (versus without bars in *O. cirrifer*, *O. fulvostriatus*, *O. megalops*, *O. turkayi*; 7 yellow bars in *O. cometes* and *O. eptactis*; 5-6 yellow bars in *O. yamadai*); first dorsal fin margin black (versus pale in *O. cometes* and *O. eptactis*); dark blotch on centre of caudal-fin base present (versus absent in *O. cirrifer*, *O. cometes*, *O. eptactis*, *O. fulvostriatus*); second dorsal fin pale, with small basal dark spots (versus without small basal dark spots in all other species); caudal fin distally dark (versus striped in *O. cometes*; pale in *O. eptactis*, *O. megalops*, *O. yamadai*).

Key to species of the genus *Obliquogobius*

- 1a. Second dorsal fin with I, 9–10 rays; lateral side of nape scaled; pore G of anterior oculoscapular canal present2
- 1b. Second dorsal fin with I, 8 rays; nape naked; pore G of anterior oculoscapular canal absent6
- 2a. Head length 36.1–41.5% of SL; eye diameter 25.9–28.7% of head length; second dorsal and caudal fins with distinct, black barred pattern (Central Indian Ocean and Gulf of Aden)*O. cometes*
- 2b. Head length 34.4% or less of SL; eye diameter 31.6% or more of head length; black barred pattern on second dorsal and caudal fins absent3
- 3a. Cheek and pectoral-fin base naked4
- 3b. Cheek and pectoral-fin base with cycloid scales; caudal fin asymmetrical dorsoventrally (i.e., upper half of fin longer than lower half)*O. yamadai*
- 4a. Caudal fin asymmetrical dorsoventrally5
- 4b. Caudal fin symmetrical dorsoventrally (central Red Sea)*O. turkayi*
- 5a. Second dorsal-fin rays I,10; gill opening wide; scales on lateral nape surface absent; postorbital pore G absent (Ryukyu Islands)*O. fulvostriatus*
- 5b. Second dorsal-fin rays I, 9; gill opening narrow; scales on lateral nape surface present; postorbital pore G present (Myanmar)*O. eptactis*
- 6a. Gill opening relatively narrow, extending a little beyond a vertical line through posterior margin of preopercle (not reaching anteriorly to a vertical line through eye); pelvic fins united medially, with well-developed connecting membrane (between innermost rays) and frenum; first spine of first dorsal fin greatly elongate and filamentous in male; some small black spots (obviously smaller than pupil) on first dorsal fin; some black spots at dorsal margin of caudal fin, in addition to blackened posterior margin (off Okinawa-jima Island, Ryukyu Islands, Japan)*O. cirrifer*
- 6b. Gill opening wide, extending anteriorly beyond a vertical line through posterior margin of eye; pelvic fins almost separated, with rudimentary low connecting membrane (between innermost rays) and no frenum; no elongate spines in first dorsal fin (although the condition in male of *O. megalops* unknown); distinct, large black spot (larger than pupil) on first dorsal fin; caudal fin without distinct black markings7
- 7a. Four or 5 narrow dusky vertical lines on body; second dorsal fin with basal dark spots; caudal fin distally dark (New Caledonia)*O. bathyalis* n. sp.

7b. No distinct dusky vertical lines on body; second dorsal fin pale, without basal dark spots; caudal fin pale (off Amami-oshima Island, Ryukyu Islands, Japan)*O. megalops*

Discussion

This is an interesting finding of a species of deep-water goby New Caledonia. The type locality is situated on the island slope off the southeast coast of Grande Terre (New Caledonia); apparently the species is widespread on island slopes of the region, as a paratype was found at the Chesterfield Islands. The three available specimens were caught using bottom trawls. Deep-water gobies living on soft habitats of island slopes at depths below 200 metres are difficult to collect; the available habitat is not extensive, and the fishes are small, so only occasionally remain in the meshes of the net.

Within the genus *Obliquogobius*, the new species is most similar to *O. cirrifer* and *O. megalops* from northwestern Pacific. It is mainly distinguished from those species by details of colouration.

Further exploration of deep island slopes in the southwestern Pacific will certainly reveal additional species of this genus.

Acknowledgements

I would like to thank the following persons for providing access to the material, catalogue numbers and information: Z. Gabsi, P. Pruvost (MNHN), J.-N. Chen and W.-J. Chen (NTUM). Christiane Zeitler (SMNS) provided Micro-CTs of the type material. My gratitude goes to the crews of the R/V *Alis* and participants of the oceanographic cruise (campaign: EXBODI; PIs, Sarah Samadi and Laure Corbari) involved in organizing the survey and the capture of the samples. The campaign EXBODI was supported by UMS Flotte Océanographique Française.

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