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Callionymidae of New Caledonia, with Remarks on Related Species and Descriptions of 10 New Species from New Caledonia, Australia, New Guinea, and Hawaii (Teleostei)

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With 35 figures and 2 tables

Summary

The Callionymidae of New Caledonia (including Chesterfield Islands, Grande Terre, and Loyalty Islands) is revised. A total of 21 species is recorded from the archipelago, including 6 new records: *Callionymus brevianalis* Fricke, 1983; *C. corallinus* Gilbert, 1905; *C. enneactis* Bleeker, 1879; *C. keeleyi* Fowler, 1941; *C. moretonensis* Johnson, 1971; *C. pleurostictus* Fricke, 1982; *C. rivatoni* Fricke, 1993; *C. scaber* McCulloch, 1926 (new record); *C. tethys* Fricke, 1993; *Diplogrammus goramensis* (Bleeker, 1858); *Synchiropus circularis* Fricke, 1984; *S. morrisoni* Schultz in Schultz et alii, 1960; *S. novaecaledoniae* Fricke, 1993; *S. ocellatus* (Pallas, 1770); *S. orstom* **n.sp.**; *S. rameus* (McCulloch, 1926); *S. richeri* **n.sp.**; *S. sechellensis* Regan, 1908 (new record); *S. signipinnis* **n.sp.**; *S. splendidus* (Herre, 1927); *S. springeri* Fricke, 1983 (new record). References to, and museum materials of the species are listed; distributions in New Caledonia are analyzed. A key to New Caledonian Callionymidae is presented. *Callionymus scaber* McCulloch, 1926 is redescribed. A **neotype** is designated for *Callionymus ocellatus* Pallas, 1770. Several new records of callionymid fish species from other areas are included in the paper.

In addition, *Callionymus afilum* **n.sp.**, *C. bifilum* **n.sp.**, *C. kailolae* **n.sp.**, *Synchiropus grandoculis* **n.sp.**, and *S. paxtoni* **n.sp.** from Australia, *Callionymus zythros* **n.sp.** from Papua New Guinea, and *Synchiropus hawaiiensis* **n.sp.** from the Hawaii Ridge, are described. *Callionymus leucobranchialis* Fowler, 1941 is redescribed on the basis of 3 specimens from northern Australia. A checklist of the callionymid fishes of Australia is presented, including 42 species (with 11 new records).

Zusammenfassung

Die Arten der Familie Callionymidae aus Neukaledonien werden revidiert. Das Untersuchungsgebiet umfasst die Iles Chesterfield, Grande Terre und die Iles Loyautés. Aus Neukaledonien sind insgesamt 21 Arten der Familie bekannt (einschließlich 6 Neufunde): *Callionymus brevianalis* Fricke, 1983; *C. corallinus* Gilbert, 1905; *C. enneactis* Bleeker, 1879; *C. keeleyi* Fowler, 1941; *C. moretonensis* Johnson, 1971; *C. pleurostictus* Fricke, 1982; *C. ri-*

vatoni Fricke, 1993; *C. scaber* McCulloch, 1926 (neuer Fundort); *C. tethys* Fricke, 1993; *Diplogrammus goramensis* (Bleeker, 1858); *Synchiropus circularis* Fricke, 1984; *S. morrisoni* Schultz in Schultz et alii, 1960; *S. novaecaledoniae* Fricke, 1993; *S. ocellatus* (Pallas, 1770); *S. orstom* **n.sp.**; *S. rameus* (McCulloch, 1926); *S. richeri* **n.sp.**; *S. sechellensis* Regan, 1908 (neuer Fundort); *S. signipinnis* **n.sp.**; *S. plendidus* (Herre, 1927); *S. springeri* Fricke, 1983 (neuer Fundort). Neukaledonische Literaturzitate und Museumsmaterial aus dem Untersuchungsgebiet werden aufgelistet; außerdem wird die Verbreitung der Arten in Neukaledonien untersucht. Die Arbeit enthält einen Bestimmungsschlüssel der Callionymidae Neukaledoniens. *Callionymus scaber* McCulloch, 1926 wird wiederbeschrieben; für *Callionymus ocellatus* Pallas, 1770 wird ein **Neotypus** festgelegt. Für mehrere Arten werden neue Fundorte aus anderen Gebieten beschrieben.

Zusätzlich werden *Callionymus afilum* **n.sp.**, *C. bifilum* **n.sp.**, *C. kailolae* **n.sp.**, *Synchiropus grandoculis* **n.sp.** und *S. paxtoni* **n.sp.** aus Australien, *Callionymus zythros* **n.sp.** aus Papua-Neuguinea sowie *Synchiropus hawaiiensis* **n.sp.** vom Hawaii-Rücken erstbeschrieben. *Callionymus leucobranchialis* Fowler, 1941 wird aufgrund von 3 Exemplaren aus Nordaustralien wiederbeschrieben. In einer Checkliste der Callionymidae Australiens werden 42 Arten aufgeführt (darunter 11 Neufunde).

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1. Introduction

The French overseas territory of New Caledonia comprises three major groups of islands, the Iles Chesterfield in the west, the main island "Grande Terre" with a few small islands towards the north and south, and the Iles Loyauté in the east. The archipelago is zoogeographically relatively isolated from other island groups of Melanesia and from Australia; the islands do not only have a unique land fauna, but also a high degree of endemism in their marine fauna. This suggests the presence of a former barrier, but also a long geographical isolation with the survival of relict forms and a high percentage of subsequent speciation (FRICKE, 1997).

The dragonets of the family Callionymidae are a group of benthic marine fishes, found in warm and temperate seas from the very shallows to depths of at least 800 m. Most species live on soft, sandy or muddy substrates. The two largest genera, *Callionymus* and *Synchiropus,* are distributed nearly circumtropical. The Indo-Pacific species of the family have been revised by FRICKE (1983), who distinguished a total of 82 species of *Callionymus* and 27 species of *Synchiropus.*

The family Callionymidae was not known from New Caledonia until FOURMANOIR & RIVATON (1979: 417–418) presented a record of a single callionymid fish found at New Caledonia, *Callionymus japonicus*. This record was apparently based on the species *Callionymus rivatoni* which was described by FRICKE (1993). FRICKE (1981a) recorded *Callionymus moretonensis,* FRICKE (1981b) *Synchiropus ocellatus* from New Caledonia. FRICKE (1983) described 2 species *(Callionymus enneactis, Synchiropus rameus)* from New Caledonia, FRICKE & BROWNELL (1993) recorded *Callionymus corallinus* on the basis of a single specimen. FRICKE (1993) revised the Callionymidae of New Caledonia for the first time, recording a total of 13 species including three new species *(Callionymus rivatoni, C. tethys, Synchiropus novaecaledoniae).* KULBICKI et alii (1994) recorded *Synchiropus circularis* Fricke, 1984 and *S. morrisoni* Schultz in Schultz et alii, 1960 from the Chesterfield Bank. This brings the total number of callionymid fishes hitherto known from New Caledonia up to 15.

Recent investigations of the New Caledonian ichthyofauna, mostly by I.R.D. Nouméa (M. KULBICKI, B. RICHER DE FORGES, J. RIVATON) and by foreign collectors (J. E. RANDALL, BPBM, Honolulu; R. WINTERBOTTOM, Toronto, Canada; also the author of the present paper) resulted in a large quantity of additional material. Six additional species are recorded from New Caledonia in the present paper, including three new species (Tab. 1). In addition, closely related species from Australia, New Guinea, and Hawaii are described. A revised checklist of Australian Callionymidae (Tab. 2) is presented.

2. Methods, materials and acknowledgements

Methods

Methods follow FRICKE (1983). The standard length (measured from the middle of the upper lip to the posterior margin of the hypural plate) is abbreviated as *SL.*

Tab. 1. Checklist of New Caledonian Callionymidae. New records are printed in **bold face.**

Species	First record from New Caledonia
Callionymus brevianalis Fricke, 1983	Fricke, 1993
Callionymus corallinus Gilbert, 1905	Fricke & Zaiser Brownell, 1993
Callionymus enneactis Bleeker, 1879	Fricke, 1983
Callionymus keeleyi Fowler, 1941	Fricke, 1993
Callionymus moretonensis Johnson, 1971	Fricke, 1981a
Callionymus pleurostictus Fricke, 1982	Fricke, 1993
Callionymus rivatoni Fricke, 1993	Fricke, 1993
Callionymus scaber McCulloch, 1926	**present paper**
Callionymus tethys Fricke, 1993	Fricke, 1993
Diplogrammus goramensis (Bleeker, 1858)	Rivaton et alii, 1989
Synchiropus circularis Fricke, 1984	Kulbicki et alii, 1994
Synchiropus morrisoni Schultz in Schultz et alii, 1960	Kulbicki et alii, 1994
Synchiropus novaecaledoniae Fricke, 1993	Fricke, 1993
***Synchiropus orstom* n.sp.**	**present paper**
Synchiropus ocellatus (Pallas, 1770)	Fricke, 1981b
Synchiropus rameus (McCulloch, 1926)	Fricke, 1983
***Synchiropus richeri* n.sp.**	**present paper**
Synchiropus sechellensis Regan, 1908	**present paper**
***Synchiropus signipinnis* n.sp.**	**present paper**
Synchiropus splendidus (Herre, 1927)	Whitley, 1961
Synchiropus springeri Fricke, 1983	**present paper**

Tab. 2. Checklist of Australian Callionymidae (new records are printed in **bold face**). – States and areas: *ACT* Australian Commonwealth Territory (Jervis Bay); – *CI* Christmas Island; – *CK* Cocos Keeling Islands; – *CS* Coral Sea; – *LHI* Lord Howe Island; – *NI* Norfolk Island; – *NT* Northern Territory; – *NSW* New South Wales; – *QLD* Queensland; – *SA* South Australia; – *VIC* Victoria; – *TAS* Tasmania; – *WA* Western Australia.

Species	CAAB Code[1)]	Australian States	Reference/ description
Anaora tentaculata Gray, 1834	37 427045	**WA**[2)]	present paper
***Callionymus afilum* n.sp.**	37 427008	**WA, NT, QLD**	present paper
Callionymus annulatus Weber; 1913	37 427016	QLD	Fricke, 1983
Callionymus australis Fricke, 1983	37 427013	WA	Fricke, 1983
Callionymus belcheri belcheri Richardson, 1844	37 427011	WA, NT, QLD	Fricke, 1983
***Callionymus bifilum* n.sp.**	37 427038	**WA, NT**	present paper
Callionymus brevianalis Fricke, 1983	37 427039	**QLD**	Fricke, 1990
Callionymus calcaratus Macleay, 1881	37 427015	WA, SA, VIC, NSW, ACT, LH, NI	Fricke, 1983
Callionymus corallinus Gilbert, 1905		QLD[3)]	Fricke, 1983

Tab. 2, continued.

Callionymus delicatulus Smith, 1963	37 427037	WA	Fricke, 1983
Callionymus draconis Nakabo 1977	37 427017	WA	Nakabo et alii, 1992
Callionymus enneactis Bleeker, 1879	37 427018	WA, NT, QLD	Fricke, 1983
Callionymus filamentosus Valenciennes in Cuvier & Valenciennes, 1837	37 427040	**WA**[4)]	Fricke, 1983
Callionymus goodladi (Whitley, 1944)	37 427006	WA	Fricke, 1983
Callionymus grossi Ogilby, 1910	37 427007	WA, NT, QLD	Fricke, 1983
***Callionymus kailolae* n.sp.**	37 427041	**WA**	present paper
Callionymus keeleyi Fowler, 1941	37 427046	NT	Russell & Houston, 1989
Callionymus leucobranchialis Fowler, 1941		**WA, QLD**[5)]	present paper
Callionymus limiceps Ogilby, 1908	37 427012	QLD, NSW	Fricke, 1983
Callionymus macdonaldi Ogilby, 1911	37 427023	NT, QLD, NSW	Fricke, 1983
Callionymus meridionalis Suwardji, 1965	37 427019	WA, NT, QLD	Fricke, 1983
Callionymus moretonensis Johnson, 1971	37 427003	**NT**[6)], QLD, **NSW**	Fricke, 1983
Callionymus pleurostictus Fricke, 1982	37 427021	NT, **QLD**	Fricke, 1983
Callionymus russelli Johnson, 1976	37 427022	NT, QLD, NSW	Fricke, 1983
Callionymus scaber McCulloch, 1926	37 427036	QLD, **NSW,** LHI	present paper
Callionymus sphinx Fricke & Heckele, 1984	37 427024	NT	Fricke & Heckele, 1984
Callionymus sublaevis McCulloch, 1926	37 427010	WA, NT, QLD	Fricke, 1983
Dactylopus dactylopus (Bennett in Cuvier & Valenciennes, 1837)	37 427005	WA, NT, QLD, NSW	Fricke, 1983
Diplogrammus goramensis (Bleeker, 1858)	37 427026	CK, WA, QLD, NI	Fricke, 1983
Diplogrammus xenicus (Jordan & Thompson, 1914)	37 427027	WA	Fricke, 1983
Synchiropus australis (Nakabo & McKay, 1989)	37 427029	QLD, **NSW**[7)]	Nakabo & McKay, 1989
Synchiropus calauropomus (Richardson, 1844)	37 427001	QLD, NSW, ACT, VIC, TAS, SA, WA	Fricke, 1983
Synchiropus claudiae Fricke, 1990	37 427042	**QLD**[8)]	Fricke, 1990
***Synchiropus grandoculis* n.sp.**	37 427043	**WA**	present paper

Tab. 2, continued.

Synchiropus morrisoni Schultz in Schultz et alii,1960	37 427031	WA, QLD	Fricke, 1983
Synchiropus occidentalis Fricke, 1983	37 427033	WA	Fricke, 1983
Synchiropus ocellatus (Pallas, 1770)	37 427032	WA, QLD, NSW	Fricke, 1983
Synchiropus papilio (Günther, 1864)	37 427014	WA, SA, VIC, TAS, **ACT**[9], NSW, **QLD**[9]	Fricke, 1983
***Synchiropus paxtoni* n.sp.**	37 427044	**WA**	present paper
Synchiropus phasis (Günther, 1880)	37 427002	WA, SA, VIC, TAS, NSW	Fricke, 1981b
Synchiropus rameus (McCulloch, 1926)	37 427009	WA, NT, QLD, **NSW**[10]	Fricke, 1983
Synchiropus splendidus (Herre, 1927)	37 427034	WA, QLD	Fricke, 1983

(Footnotes, Tab. 2)

1) Codes for Australian Aquatic Biota; see Yearsley, Last & Morris (1997). Additional codes were provided by G. Yearsley (personal communication, 3 May 2000).

2) **New record** from WA based on NTM S.12309-011 (1 specimen, 39.7 mm SL; Western Australia, Timor Sea, east of West Island, Ashmore Reef, 12°15'S 123°00'E, 0–0.5 m depth; H. Larson; 17 Sep. 1987). Another **new record** of *Anaora tentaculata* from Papua New Guinea; based on NTM S.13680-024 (2 specimens, 17.2–22.0 mm SL; Madang, 05°09'S 145°48'E, 0–1.5 m depth; H. Larson; 18 Aug. 1992).

3) **New record** from Australia, based on NTM S.13595-010 (1 specimen, 13.5 mm SL; reef S of Triangle Reef, 10°34.48'S 143°55.28'E, 14–15 m depth; H. Larson et alii; 16 Jan. 1993.

4) **New record** from Australia, based on CSIRO 4203 (1 specimen; Western Australia, off Port Hedland, 19°41.4'S 118°08.1'E, 52 m depth; C.S.I.R.O.; 1983).

5) **New record** from Australia; see redescription above (5.5.).

6) **New record** from Northern Territory based on SMNS 12172 and SMNS 12173 (specimens listed above in description of *C. moretonensis,* 4.5.).

7) **New record** from New South Wales, based on AMS I.37472-001 (1 male, 88.4 mm SL; New South Wales, off Newcastle, 62–70 m depth, 32°54'S 151°59'E – 32°53'S 152°00'E; FRV "Kapala"; 29 Mar. 1995). – Two additional specimens collected east of Dunk Island, Queensland: NTM S.11770-005 (1 specimen, 118.9 mm SL; 256–260 m depth; H. Larson; 16 Jan. 1985); – NTM S.11756-013 (1 specimen, 130.3 mm SL; 298–300 m depth; H. Larson and party; 11 Jan. 1986).

8) **New record** from Australia, based on Queensland specimens (ANSP 170860, 1 specimen, 11.6 mm SL; Endeavour Reef, off W tip of S edge of E half of reef, 15°45'S 145°42'E; J. C. Tyler & C. L. Smith; 6 Jan. 1969. – ANSP uncat., 1 specimen, 12.7 mm SL; Endeavour Reef, 1/2 mile E of Cook wreck site at S edge of W portion of E half of reef, 15°45'S 145°42'E, 14–20 m depth; J. C. Tyler & C. L. Smith; 11 Jan. 1969. – ANSP uncat., 1 specimen, 10.2 mm SL; Endeavour Reef, 3/4 mile NW of Cook wreck site, 15°45'S 145°42'E, 2–5 m depth; J. C. Tyler & C. L. Smith; 16 Jan. 1969. – NTM S.11898-012, 1 female, 29.7 mm SL; Lizard Island, 14°40'S 145°28'E, 3 m depth; H. Larson & B. Goldman; 15 Feb. 1977).

9) **New record** from Queensland, based on AMS I.20990-056 (3 specimens; Yonge Reef, 14°51'S 145°16'E, 6–12 m depth D. F. Hoese; 2 Dec. 1978).
New record from A.C.T., based on SMNS 14779 (5 specimens; Jervis Bay, at Bristol Point, 35°08'20''S 150°44'40''E, 0–3 m depth; R. Fricke & T. Trnski; 12 May 1993).

10) **New record** from New South Wales, based on AMS I.26312-010 (1 female, 63 mm SL; NE of Yamba, 29°25'S 153°30'E – 29°18'S 153°30'E, 49–54 m depth; FRV "Kapala"; 22 May 1986).

Materials

For the present study, fish specimens deposited in the following institutions were examined:

AMS The Australian Museum, Sydney, Australia;
ANSP The Academy of Natural Sciences of Philadelphia, U.S.A.;
BMNH Natural History Museum, London, Great Britain [formerly British Museum (Natural History)];
BPBM Bernice P. Bishop Museum, Honolulu, U.S.A.;
BSKU Department of Biology, Faculty of Science, Kochi University, Japan;
BSMP Philippine Bureau of Sciences, Manila, Philippines;
CAS California Academy of Sciences, San Francisco, U.S.A.;
CSIRO Commonwealth Scientific and Industrial Research Organization, Division of Fisheries Research, Hobart, Tasmania, Australia;
FAKU Faculty of Agriculture, Kyoto University, Kyoto, Japan;
HUMZ Hokkaido University, Museum of Zoology, Hakodate, Japan;
KFRS Kanudi Fisheries Research Station, Port Moresby, Papua New Guinea;
MNHN Museum National d'Histoire Naturelle, Paris, France;
NMNZ Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand (formerly Dominion Museum, then National Museum of New Zealand);
NSMT-P National Science Museum (Natural History), Tokyo, Japan;
NTM Northern Territory Museum of Arts and Sciences, Darwin, Northern Territory, Australia;
QM Queensland Museum, Brisbane;
RMNH Nationaal Naturhistorisch Museum (formerly Rijksmuseum van Natuurlijke Historie), Leiden, The Netherlands;
ROM Royal Ontario Museum, Toronto, Canada;
RUSI J. L. B. Smith Institute of Ichthyology, Rhodes University, Grahamstown, South Africa;
SMNS Staatliches Museum für Naturkunde, Stuttgart, Germany;
USNM National Museum of Natural History, Smithsonian Institution, Washington D.C., U.S.A.;
WAM Western Australian Museum, Perth, Australia;
ZIM Zoologisches Institut und Zoologisches Museum, Universität Hamburg, Germany;
ZISP Zoological Institute, Academy of Sciences, St. Petersburg, Russia (formerly ZIL);
ZMB Zoologisches Museum der Humboldt-Universität, Berlin, Germany;
ZSI Zoological Survey of India, Calcutta, India.

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Queensland, Australia) kindly donated callionymid fish specimens which were used in the present study. R. Yin (La Jolla, California, U.S.A.) sent an underwater photo of *Synchiropus circularis* from Sabah, Malaysia. G. Yearsley (Hobart, Tasmania, Australia) kindly provided CAAB codes for the additional Australian callionymid taxa. C. Petrinos (Athens, Greece) sent a photo of *Synchiropus morrisoni* for identification that represents a new record of the species for Indonesia.

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3. Key to New Caledonian species of Callionymidae

1a Operculum with a free flap of skin; sides of body with a ventrolateral fold of skin below the lateral line . . . . . ***Diplogrammus goramensis*** (Bleeker, 1858)
1b Operculum without a free flap of skin; sides of body without a ventrolateral fold of skin below the lateral line **2**

2a Soft dorsal fin rays branched; preopercular spine without an antrorse spine at its base (except *Synchiropus rameus* and *S. sechellensis,* which have the first dorsal fin very high but without filaments, first spine more than 2.5 times in first ray of second dorsal fin) (genus *Synchiropus*) **3**
2b Soft dorsal fin rays unbranched except the last which is divided at its base; preopercular spine base with an antrorse spine at its base; if first dorsal fin not filamentous, less than 2 times longer than first spine of second dorsal fin . . . . . (genus *Callionymus*) **13**

3a Preopercular spine base with an antrorse spine **4**
3b Preopercular spine base without an antrorse spine **5**

4a Main tip of preopercular spine upcurved, dorsal margin with 2 large curved points . . . . . ***Synchiropus sechellensis*** Regan, 1908
4b Main tip of preopercular spine straight, dorsal margin with 4–11 small antrorse serrae . . . . . ***Synchiropus rameus*** (McCulloch, 1926)

5a Dorsal margin of preopercular spine with 2–5 curved points (additional to the main tip) **6**
5b Dorsal margin of preopercular spine with 1 curved point (additional to the main tip) . **9**

6a Pectoral fin with 28-35 rays . . . . . ***Synchiropus splendidus*** (Herre, 1927)
6b Pectoral fin with 18–25 rays **7**

7a Dorsal margin of preopercular spine with 2 curved points (additional to the main tip) . **8**
7b Dorsal margin of preopercular spine with 3–4 curved points (additional to the main tip) . . . . . ***Synchiropus springeri*** Fricke, 1983

8a Sides of body with large, circular, light blotches which are surrounded by a dark line . . . . . ***Synchiropus circularis*** Fricke, 1984
8b Body colouration not as described in **6a**; usually reddish, with starry pattern on the sides consisting of median dark and ventral white spots . . . . . ***Synchiropus morrisoni*** Schultz in Schultz et alii, 1960

9a Main tip of preopercular spine straight **10**
9b Main tip of preopercular spine upcurved **11**

10a Eye large, its diameter 1.9–2.0 in head; first dorsal fin in male with 1 filament; first dorsal fin pale in male . . . . . ***Synchiropus signipinnis*** **n.sp.**
10b Eye medium, its diameter 2.1–2.8 in head; first dorsal fin in male with 3 filaments; first dorsal fin striped in male . . . . . ***Synchiropus novaecaledoniae*** Fricke, 1993

11a Body brown, sides with starry blotches; D_1 brown in male, with 4 ocelli . . . . . ***Synchiropus ocellatus*** (Pallas, 1770)
11b Body pale or reddish; colouration of D_1 different from **11a,** fin at most with a single dark blotch or ocellus **12**

12a Eye large, diameter 1.7–2.1 in head; first dorsal fin without filament; caudal fin in male with median filaments . . . . . ***Synchiropus richeri*** **n.sp.**
12b Eye medium, diameter 2.1–2.5 in head; first dorsal fin with filament; caudal fin without median filaments . . . . . ***Synchiropus orstom*** **n.sp.**

13a Main tip of preopercular spine straight, dorsal margin with small antrorse serrae **14**
13b Main tip of preopercular spine upcurved, dorsal margin with 1 or more large curved points **21**

14a D_2 total 9 rays; A total 8 rays **15**
14b D_2 total 7–8 rays; A total 6–7 rays **20**

15a D_1 with 1 to 4 filaments, urogenital papilla visible **16**
15b D_1 without filaments, urogenital papilla not visible **18**

16a D_1 with 4 filaments . . . . . ***Callionymus scaber*** McCulloch, 1926, male
16b D_1 with 1 or 3 filaments **17**

17a D_1 with 1 filament (1st spine); first dorsal fin mottled with dark, no lines, with an ocellus surrounding the distal part of the third spine; thorax with a faint brown spot, but without surrounding lines . . . . . ***Callionymus rivatoni*** Fricke, 1993, male
17b D_1 with 3 filaments (1st to 3rd spines); D_1 with narrow oblique dark lines, 2nd membrane distally with a small dark spot close to 2nd spine, no ocellus; thorax with a dark spot surrounded by lines extending on the membrane between pelvic and pectoral fins . . . . . ***Callionymus tethys*** Fricke, 1993, male

18a Caudal fin length 1.6–2.2 in SL **19**
18b Caudal fin length 2.4–3.6 in SL . . . . . ***Callionymus tethys*** Fricke, 1993, female

19a Ventral margin of preopercular spine concave, dorsal margin with 7–12 small antrorse serrae; distal half of anal fin blackish . . . . . ***Callionymus scaber*** McCulloch, 1926, female
19b Ventral margin of preopercular spine straight, dorsal margin with 4–7 small antrorse serrae; distal one-fifth of anal fin blackish . . . . . ***Callionymus rivatoni*** Fricke, 1993, female

20a D_2 vi,1; A v,1; 2–4 small antrorse serrae on the dorsal margin of the preopercular spine . . . . . ***Callionymus brevianalis*** Fricke, 1983
20b D_2 vii,1; A vi,1; 7–14 small antrorse serrae on the dorsal margin of the preopercular spine . . . . . ***Callionymus pleurostictus*** Fricke, 1982

21a Dorsal margin of preopercular spine with a small antrorse barb and 1–2 large curved points; first dorsal fin with a large ocellus on second and third membranes . . . . . ***Callionymus moretonensis*** Johnson, 1971
21b Dorsal margin of preopercular spine without an antrorse barb; dorsal fin without a large ocellus **22**

22a D_2 vii,1; A vi,1; cheeks with 2 vertical ocellate black streaks . . . . . ***Callionymus enneactis*** Bleeker, 1879
22b D_2 viii,1; A vii,1; cheeks without vertical ocellate streaks **23**

23a First dorsal fin with two long filaments; caudal fin elongate; body depth 7–10 in SL . . . . . ***Callionymus keeleyi*** Fowler, 1941
23b First dorsal fin high in males; low in females, without filaments; caudal fin distally rounded; body depth 4.5–6.0 in SL . . . . . ***Callionymus corallinus*** Gilbert, 1905.

4. New Caledonian Callionymidae

4.1. *Callionymus brevianalis* Fricke 1983

CAAB Code (Australia): 37 427039

Callionymus (Calliurichthys) brevianalis Fricke, 1983: 323–328, fig. 98 (West Irian Jaya, Hawaii Island, 00°49'48''S 130°56'48''E, 0–6 m depth; holotype: USNM 243038). – Fricke, 1990: 9–13, fig. 5 (Papua New Guinea, Port Moresby, Motupore Island, 6–7 m depth).

Callionymus brevianalis: Fricke, 1993: 364 (New Caledonia).

Pseudocalliurichthys brevianalis: Nakabo, Senou & Aizawa, 1998: 454–455 (in comparison with *P. ikedai*).

Material

Total: 19 specimens (including 3 specimens listed by Fricke, 1983, 1990).

Material from the study area. **Coral Sea, Chesterfield Bank:** MNHN 1993-0118, 1 specimen; 20°36'54''S 162°51'12''E, R/V "Vauban", St. DW.856; 12 Jan. 1987. – SMNS 12521, 1 specimen; same data as MNHN 1993-0118.

New Caledonia, Récifs de Entrecasteaux: SMNS 12522, 1 specimen; 18°05'12''S 162°55'E, 39 m depth; R/V "Vauban", St. DW.440b; 27 Feb. 1985. – SMNS 12524, 1 specimen; 18°03'36''S 162°55'36''E, 36–37 m depth; R/V "Vauban", St. DW.441; 27 Feb. 1985. – SMNS 12527, 1 specimen; 18°30'12''S 163°09'48''E, 35–36 m depth; R/V "Vauban", St. DW.454; 28 Feb. 1985. – SMNS 21309, 2 specimens, 15.4–16.8 mm SL; 18°23'48''S 163°06'36''E, 41–42 m depth; R/V "Vauban", St. 460; 1 Mar. 1985.

New Caledonia, Grande Terre: SMNS 12523, 1 specimen; 20 km W Nouméa, 22°17'12''S 166°17'06''E, 25 m depth; R/V "Vauban", St. DW.42; 24 May 1984. – SMNS 12525, 1 specimen; Baie de Saint-Vincent, 55 km WNW Nouméa, 21°57'24''S 165°59'54''E, 0–1 m depth; M. Kulbicki, R/V "Alis"; 26 Mar. 1990. – SMNS 12526, 1 specimen; 20 km NE Pam, 20°14'16''S 164°23'06''E, 35–40 m depth; R/V "Vauban", St. DW.900, 14 Jan. 1987. – SMNS 21323, 1 specimen, 20.8 mm SL; 22°27'36''S 166°24'54''E, 15 m depth; B. Richer de Forges, R/V "Vauban", Cruise LAGON, St. 64; 20 Aug. 1984. – SMNS 22119, 1 specimen; SW coast, Province Sud, SE side of baie de Pritzbue, at Bouraké, rocks N of boat landing, 21°57'32''S 165°59'20''E, 0–2.5 m depth; R. Fricke; 23 May 2000.

Comparison material. **Australia, Queensland:** ANSP uncat., 1 specimen, 15.2 mm SL; Endeavour Reef, 1/2 mile E of Cook wreck site at S edge of W portion of E half of reef, 15°45'S 145°42'E , 14–20 m depth; J. C. Tyler & C. L. Smith; 11 Jan. 1969.

Vanuatu: AMS I.37929-050, 3 specimens, 10.1–16.1 mm SL; Ureparapara Island, Lorup Bay, near top of island, 13°32.26'S 167°20.30'E; M. McGrouther et alii; 21 May 1997.

Distribution

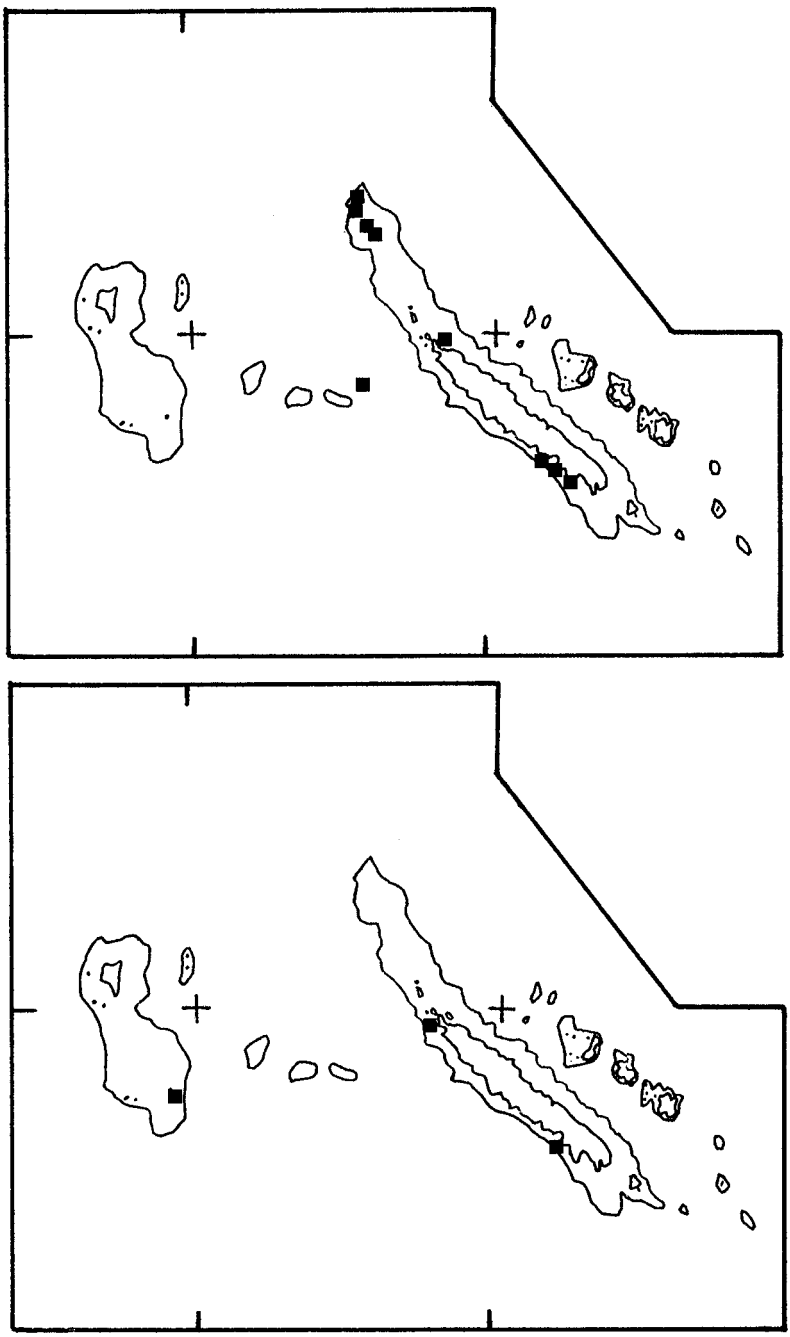
New Caledonia (Grande Terre) and Chesterfield Bank (Fig. 1). The species was collected at depths of 1–40 m. Outside the area around New Guinea and Queensland/Australia (new record), east to Vanuatu (new record).

4.2. *Callionymus corallinus* Gilbert, 1905

Callionymus corallinus Gilbert, 1905: 649–650, fig. 251 (Avau Channel between Maui and Lanai Islands, Hawaiian Islands; 32–37 fms/58–68 m; holotype: USNM 51581). – Jordan & Seale, 1906: 415 (Hawaii; on GILBERT). – Fowler, 1928: 423 (on GILBERT). – Fowler, 1938: 299 (on GILBERT). – Fricke, 1993: 364 (New Caledonia). – Randall, Earle, Pyle, Parrish & Hayes, 1993: 385, fig. 74 (Midway Atoll).

Callionymus (Callionymus) corallinus: Fricke, 1983: 742–745, fig. A1 (Oahu, Makua, Hawaiian Islands, 27 m depth). – Fricke & Zaiser Brownell, 1993: 7–9, fig. 3 (Izu Islands, Japan; Hawaiian Islands; New Caledonia; 12–58 m depth; 30 specimens examined).

Synchiropus (Synchiropus) kiyoae (part): Fricke & Zaiser, 1983: 122 (Hachijo-jima, Japan).



Figs 1–2. Geographical distribution of *Callionymus* species in New Caledonian waters. – 1. *C. brevianalis (above);* – 2. *C. corallinus (below).*

Paradiplogrammus corallinus: Nakabo, 1991a: 249–253, figs. 1–3 (Hachijo-jima, Japan; Hawaiian Islands).
Synchiropus corallinus: Randall, 1996: 151, 2 colour photos [Hawai'i and Japan, in 39–400 feet (12–122 m)]. – Randall, 1999: 196–198, pl. 1 E, F (Hawaiian Islands).

Material

Total: 34 specimens (including 30 specimens listed by Fricke, 1983; Fricke & Zaiser Brownell, 1993).

Coral Sea, Chesterfield Bank: SMNS 21301, 1 specimen, 22.4 mm SL; southeastern Chesterfield Bank, 21°49'42''S 159°30'18''E, 50 m depth; R/V "Vauban", Cruise GOLLONA, St. 1205; 22 Oct. 1985.
New Caledonia, Grande Terre: SMNS 12270, 1 female, 20.8 mm SL – 40 km SSE Nouméa, 22°31'S 166°29.7'E, 22 m; R/V "Vauban", St. DW.83; 21 Aug. 1984. – SMNS 21244, 1 male, 30.8 mm SL; northwestern lagoon, southwest of Koumac, 20°18'18''S 164°32'15''E, 26 m depth; B. Richer de Forges, R/V "Vauban", St. 892; 14 Jan. 1987.

Comparison material (additional to that listed by Fricke & Zaiser Brownell, 1993).
Australia, Queensland: NTM S.13595-010, 1 specimen, 13.5 mm SL; reef S of Triangle Reef, 10°34.48'S 143°55.28'E, 14–15 m depth; H. Larson et alii; 16 Jan. 1993.
Hawaiian Islands: SMNS 19596, 1 specimen; off Aina Haina, Oahu Island, 21°16'30''N 157°45'30''W, 25 m depth; J. E. Randall; 12 Sep. 1967.
Tonga: USNM 337958, 1 specimen; Ha'apai Group, Uoleva Island on W side, 19°50'07''S 174°25'19''W, 18–23 m depth; J. T. Williams et alii; 9 Nov. 1993.

Distribution

Coral Sea (Chesterfield Bank, new record); New Caledonia (Grande Terre) (Fig. 2). Outside the area, western and central Pacific, southeast to Tonga (new record); Midway Atoll and Hawaiian Islands; Izu Islands/Japan; Saipan/Northern Marianas. New records from Australia (Queensland) and Mariana Islands. The species found at depths of 12–58 m.

Habitat

Miyake-jima, Japan: On a substrate of mixed volcanic and coral sand, broken shells, and rubble, with low relief and no algal cover (rarely on pure sand); 15–16 m depth (rarely at 12–18 m). Hawaii: On coral rubble; 25–58 m depth. New Caledonia: On coral rubble; 22–50 m depth.

Remarks

The taxonomic position of this species is not clear, as it shows characters intermediate between *Callionymus* and *Synchiropus.* The record from Saipan is based on a photograph by R. F. Myers (Guam) taken at 15 m depth at Hiro Kimura in August 2000.

4.3. *Callionymus enneactis* Bleeker, 1879

CAAB Code (Australia): 37 427018

Callionymus enneactis Bleeker, 1879: 95–97 (Singapura/Singapore; holotype: RMNH 4814). – Blaber, Milton & Rawlinson, 1991: 7 (Vona Vona, Solomon Islands). – Randall, Allen & Steene, 1997: 524 (New Caledonia; etc.). – Yearsley, Last & Morris, 1997: Appendix D (CAAB Code).
Callionymus (Callionymus) enneactis: Fricke, 1983: 122–137, figs. 33–34 (Singapore, Gulf of Thailand, Hong Kong, Taiwan, Japan, Western Indonesia, Philippines, Palau Islands, Yap Islands, Eastern Indonesia, Papua New Guinea, Bismarck Archipelago, Trobriand Islands, Western Australia, Northern Australia, Eastern Australia, Solomon Islands, New Caledonia; tide pools to 15 m depth). – Fricke, 1993: 365 (Loyalty Islands).

Paradiplogrammus sp.: RIVATON, FOURMANOIR, BOURRET & KULBICKI, 1989: 30 (Nouvelle-Calédonie/New Caledonia, in checklist).
Paradiplogrammus enneactis: NAKABO, 1993: 992, fig. (Japan; with pictorial key).
Paradiplogrammus parvus: NAKBO, 1993: 992, fig. (Japan; with pictorial key).
Callionymus parvus: YEARSLEY, LAST & MORRIS, 1997: Appendix D (CAAB Code).

Material

Total: 704 specimens (including 596 specimens listed by FRICKE 1983).

New Caledonia, Grande Terre: NMNZ P.29628, 1 male (25.5 mm SL) and 2 females (19.6–20.8 mm SL); Baie Gadji, Toro Bay, Nouméa , 22°11'S 166°23'E, 0–2 m depth; C. D. ROBERTS & C. D. PAULIN; 10 Oct. 1992. – SMNS 21286, 1 specimen, 21.8 mm SL; Sêche Croissant Reef, 22°20'20''S 166°22'30''E, 2 m depth, sargassum and sand; M. KULBICKI; 1 Aug. 1996. – SMNS 21295, 2 specimens, 18.9–29.3 mm SL; Sainte-Marie, 22°18'25''S 166°27'40''E, 3 m depth, coral and sand; M. KULBICKI, St. ROT.1; 18 Mar. 1999. – SMNS 21296, 13 specimens, 15.6–21.4 mm SL; Grande Rade, 22°14'08''S 166°23'57''E, 3 m depth, coral and sand; M. KULBICKI; 23 Mar. 1999. – SMNS 21298, 17 specimens, 16.4–23.5 mm SL; Grande Rade, 22°14'04''S 166°24'01''E, 2 m depth, coral and sand; M. KULBICKI; 2 Apr. 1999. – SMNS 22120, 9 specimens; SW coast, Province Sud, SE side of baie de Pritzbue, at Bouraké, rocks N of boat landing, 21°57'32''S 165°59'20''E, 0–2.5 m depth; R. FRICKE; 23 May 2000.

Loyalty Islands: MNHN 1980-0146; 1 male, 21.2 mm SL, P. FOURMANOIR, 1980.

Comparison material. **Philippines:** ROM 53499, 1 specimen, 22.4 mm SL; Visayas, Negros Oriental Province, Mangrove Point on spit of land at Banlas Point on S tip of Daco Island, just E of Bais, 9°33'54''N 123°09'54''E, 0–0.5 m depth; R. WINTERBOTTOM et alii; 21 May 1987.

Indonesia: SMNS 15179, 2 specimens, 11.4–12.3 mm SL; Ambon Bay, north shore, near the village of Poka, Ambon Island, Maluku, 3°39'S 138°11'30''E, 1.5 m depth; S. MOSS; Mar. 1994. – SMNS 15903, 11 specimens, 16.1–22.1 mm SL; Tasik Ria Beach, 19 km SW Manado, North Sulawesi Province, Celebes Sea, 1°19'N 124°38'E, 0.3–0.9 m depth, sand and seagrass; R. FRICKE & G. R. ALLEN; 24 Nov. 1994. – SMNS 15036, 8 specimens, 12.4–21.4 mm SL; NW corner of Lembeh Island, small coves on Lembeh Strait side, 9 km NE Bitung, 60 km E Manado, North Sulawesi Province, Celebes Sea, 1°40'N 125°20'E, 2.0–5.0 m depth, sand and silt bottom with seagrass; R. STEENE; 25 Nov. 1994. – SMNS 15946, 4 specimens, 20.7–28.5 mm SL; same data as SMNS 15903, 0–2.5 m depth; R. FRICKE; 26 Nov. 1994.

Papua New Guinea: SMNS 8541, 4 specimens, 13.5–18.2 mm SL; Motupore Island, Port Moresby, 6 m depth; P. COLIN; 3 Nov. 1986. – SMNS 8548, 5 specimens, 14.3–20.5 mm SL; Motupore Island, Papua New Guinea; P. COLIN; 23 Feb. 1987. – SMNS 8553, 1 male, 16.4 mm SL, south of Soloatu Island, Port Moresby, 22 m depth; P. COLIN; 7 Nov. 1986. – SMNS 11564, 2 specimens, 23.0–28.8 mm SL; Motupore Island, Bootless Bay, 15 km W Port Moresby, Central Province, 9°30'S 147°10'E, 1.2 m depth at high tide (would be exposed at low tide), sand with seagrass; J. T. MOYER; 2 Jan. 1986. – SMNS 11566, 3 specimens, 13.2–15.8 mm SL – same data as SMNS 11564, 5 m depth; J. T. MOYER; 10 Jan. 1996. – SMNS 11567, 1 specimen, 24.8 mm SL; same data as SMNS 11564, 1 m depth; J. T. MOYER; 13 Jan. 1986. – SMNS 11568, 3 specimens, 9.8–11.8 mm SL; same data as SMNS 11564, 5 m depth; J. T. MOYER; 13 Jan. 1986.

Western Australia: SMNS 14189, 2 specimens, 19.5–44.4 mm SL; Nanga Bay, at Nanga Homestead, Henry Freycinet Harbour, Shark Bay, 50 km SSE Denham, Peron Peninsula, Shire of Shark Bay, 26°18'S 113°48'E, 0.5–1.4 m depth at low tide, sand with seagrass; R. FRICKE; 22 Aug. 1992. – SMNS 14195, 2 specimens, 31.7–36.0 mm SL; same data as SMNS 14189, 0.1–1.5 m depth; R. ERICKE; 23 Aug. 1992. – SMNS 18378, 5 specimens, 24.1–32.5 mm SL; Entrance Point, 7 km SW Broome, 18°00'39''S 122°12'26''E, 0–2.5 m depth, sand bottom; R. FRICKE; 24 Aug. 1996. – SMNS 18422, 1 specimen, 15.2 mm SL; 1 km ENE Gantheaume Point, 7 km WSW Broome, 17°58'35''S 122°11'05''E, 0–1.5 m depth, sand bottom; R. FRICKE; 25 Aug. 1996. – SMNS 18446, 5 specimens, 16.1–30.1 mm SL; same data as SMNS 18378, 0–1 m depth; R. FRICKE; 26 Aug. 1996.

Australia, Queensland: AMS I.21529-041, 3 specimens; Lizard Island, N point, 14°39'S 145°27'E, 3–9 m depth; D. HOESE & H. LARSON; 29 Jan. 1975.

Distribution

New Caledonia (Grande Terre; new record); Loyalty Islands (Fig. 3). Outside the area, the species is found between Japan, Singapore, Western Australia, Yap Islands and the Solomon Islands, from the intertidal zone to 15 m depth.

4.4. *Callionymus keeleyi* Fowler, 1941

CAAB Code (Australia): 37 427046

Callionymus keeleyi Fowler, 1941: 14–16, fig. 9 (Cebu, Philippines; holotype: USNM 99425).
Callionymus (Callionymus) keeleyi: Fricke, 1983: 174–177, fig. 51 (Philippines; Indonesia, Kai Islands; Papua New Guinea; 16–59 m depth, sand bottoms). – Fricke, 1993: 368 (New Caledonia).
?Repomucenus virgis (non Jordan & Fowler, 1903): Rivaton, Fourmanoir, Bourret & Kulbicki, 1989: 31 (Nouvelle-Calédonie/New Caledonia, in checklist). – Kulbicki & Wantiez, 1990: 124 (St. Vincent Bay, New Caledonia).

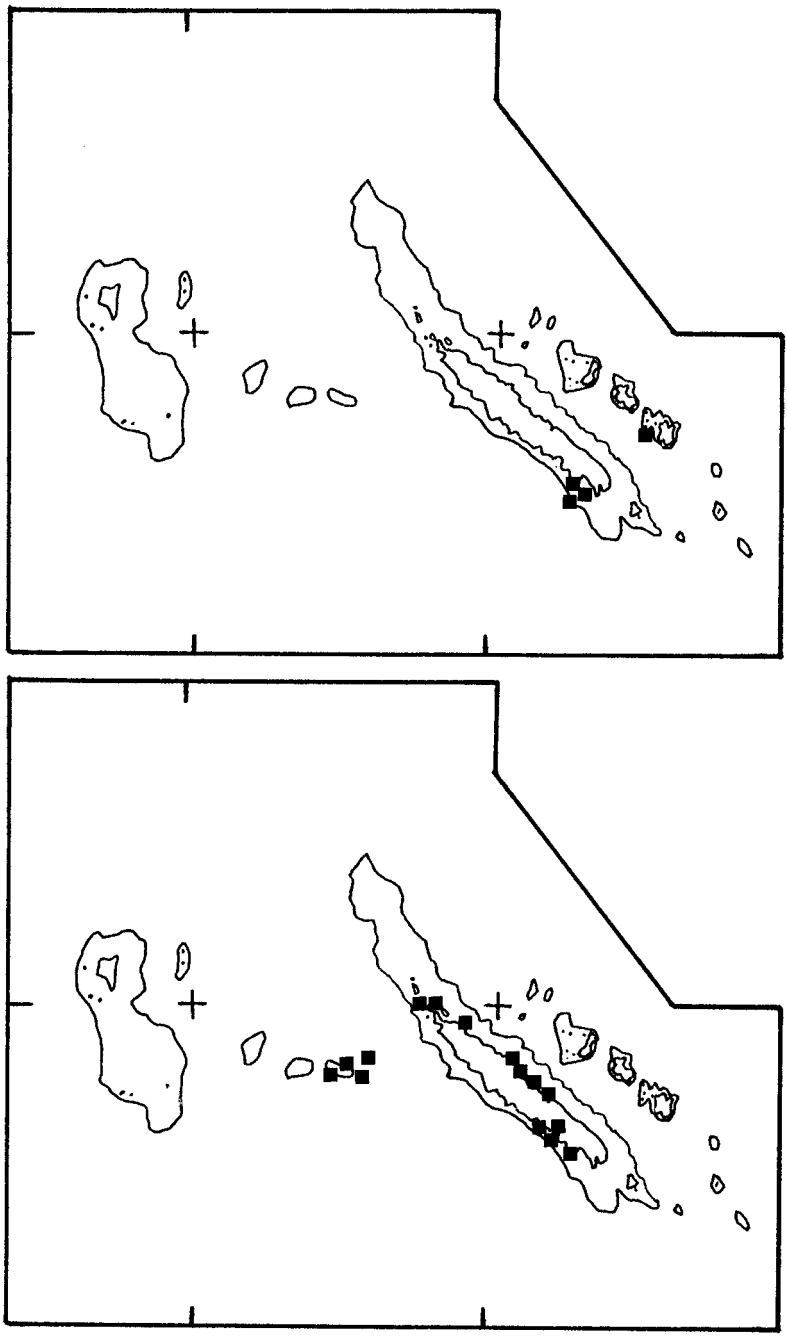
Material

Total: 52 specimens (including 7 specimens listed by Fricke, 1983).

Coral Sea, Chesterfield Bank: SMNS 11622, 3 specimens; 20°38'30''S 162°26'E, 24–27 m depth; R/V "Vauban", St. DW.873; 13 Jan. 1987. – SMNS 11626, 1 specimen; 20°37'36''S 162°53'12''E, 28 m depth; R/V "Vauban", St. DW.847; 11 Jan. 1987. – SMNS 11627, 1 specimen; 20°41'42''S 162°41'30''E, 22–27 m depth; R/V "Vauban", St. DW.860; 13 Jan. 1987. – SMNS 11904, 1 specimen; 20°35'S 162°30'E, 30–70 m depth; R/V "Vauban", St. DW.876; 13 Jan. 1987.

New Caledonia, islands north of Grande Terre: SMNS 11616, 1 specimen; Ile Art, 19°57'18''S 163°52'48''E, 25–26 m depth; R/V "Alis", St. CP.1068; 24 Oct. 1989. – SMNS 11618, 2 specimens; reef 15 km WNW Ile Yandé, 19°59'06''S 163°52'30''E, 24–30 m depth; R/V "Alis", St. CP.1069; 24 Oct. 1989. – SMNS 11902, 2 specimens; 10 km SE Ile Art, 19°55'48''S 163°53'E, 27–28 m depth; R/V "Alis", St. CP.1067; 24 Oct. 1989.

New Caledonia, Grande Terre: MNHN 1993-0121, 2 specimens; Baie de Saint-Vincent Nord, 21°58'30''S 166°01'E, 15 m depth; M. Kulbicki; 22 Sep. 1989. – MNHN 1993-0122, 2 specimens; Baie de Saint-Vincent, 21°57'24''S 165°59'54''E, 2 m depth; M. Kulbicki, R/V "Alis"; 22 Mar. 1990. – SMNS 9887, 3 specimens; same data as MNHN 1993-0121. – SMNS 11619, 3 specimens, Baie de Saint-Vincent, 22°04'S 166°04'E, R/V "Alis", St. 2; 28 June 1989. – SMNS 11620, 1 specimen; 10 km E Houaillou, 21°16'S 165°47'18''E, 46 m depth; R/V "Vauban", St. DW.752; 7 Jan. 1987. – SMNS 11621, 1 specimen; 5 km E Houaillou, 21°14'54''S 165°48'24''E, 53 m depth; R/V "Vauban", St. DW.753; 7 Jan. 1987. – SMNS 11623, 1 specimen; 5 km E Houaillou, 21°18'30''S 165°46'12"E, 30 m depth, R/V "Vauban", St. DW.751; 7 Jan. 1987. – SMNS 11624, 1 specimen; 5 km E Houaillou, 21°20'S 165°47'36''E, 28 m depth, R/V "Vauban", St. DW.750; 7 Jan. 1987. – SMNS 11625, 1 specimen; Baie de Saint-Vincent, 21°58'S 166°01'E, 10 m depth; R/V "Alis", St. 27; 2 Mar. 1989. – SMNS 11903, 2 specimens; same data as MNHN 1993-0122. – SMNS 11905, 1 specimen; 21°54'06''S 165°26'54''E, 28–32 m depth; R/V "Vauban", St. DW.815; 10 Jan. 1987. – SMNS 12529, 1 specimen; Baie de Saint-Vincent, 22°05'30''S 166°05'E, 17 m depth; M. Kulbicki, R/V "Alis"; 30 Mar. 1989. – SMNS 17847, 7 specimens, 40.3–57.0 mm SL; Baie de Saint-Vincent, 22°01'S 166°05'E; M. Kulbicki; 7 Dec. 1984. – SMNS 17849, 1 specimen, 49.8 mm SL; Baie de Saint-Vincent, 21°58'S 166°01'E, 5–12 m depth; M. Kulbicki, R/V "Vauban", St. 17; 23 Apr. 1986. – SMNS 17850, 2 specimens, 61.4–66.8 mm SL; northern Baie de Saint-Vincent, 21°58'30''S 166°01'00''E, 10 m depth; O.R.S.T.O.M., Nouméa, St. 1; 21 Nov. 1989. – SMNS 17852, 2 specimens, 33.4–46.4 mm SL; northeastern lagoon, 15 km WNW Ouégoa, 20°14'18''S 164°15'24''E, 12–14 m depth; O.R.S.T.O.M., Nouméa, St. CP.1060; 5 May 1988. – SMNS 17853, 1 specimen, 51.7 mm SL; northern Baie de Saint-Vincent, 21°57'30''S 166°01'30''E, 6 m depth; M. Kulbicki, R/V "Alis"; 28 Apr. 1989. – SMNS 21312, 1 specimen, 38.8 mm SL; 21°58'06''S 166°02'12''E, 12 m depth; B. Richer de Forges, R/V "Vauban", St. 195; 20 Sep. 1984. – SMNS 21318, 1 specimen, 28.7 mm SL; 22°18'24''S 166°32'54''E, 24 m depth; R/V "Vauban", St. 30; 23 May 1984.



Figs 3–4. Geographical distribution of *Callionymus* species in New Caledonian waters. – 3. *C. enneactis (above);* – 4. *C. keeleyi (below).*

Distribution

Coral Sea (Chesterfield Bank; new record); New Caledonia (Grande Terre; islands north of Grande Terre) (Fig. 4). The species was found at depths of 2–70 m. Outside the area, the species is known from the Philippines, eastern Indonesia, Papua New Guinea and Australia (Northern Territory).

4.5. *Callionymus moretonensis* Johnson, 1971

CAAB Code (Australia): 37 427003

Callionymus kaianus moretonensis Johnson, 1971: 108–113, figs. 1–2 (7 miles east of Cape Moreton, South Queensland, Australia, 68–72 fms depth; holotype: AMS I.15608-001).

Callionymus moretonensis: Fricke, 1981a: 359–360, fig. 7 (part: Queensland, New Ireland, New Caledonia; 150 m depth). – Fricke, 1983: 223–226, fig. 65 (Queensland; 84–150 m). – Fricke, 1993: 368 (New Caledonia). – Yearsley, Last & Morris, 1997: Appendix D (CAAB Code).

?Bathycallionymus formosanus: Rivaton, 1989: 145 (Iles Chesterfield). – Rivaton, Fourmanoir, Bourret & Kulbicki, 1989: 30 (Nouvelle-Calédonie/New Caledonia, in checklist).

?Bathycallionymus moretonensis: Rivaton, Fourmanoir, Bourret & Kulbicki, 1989: 30 (Nouvelle-Calédonie/New Caledonia, in checklist).

?Callionymus mortonensis: Blaber, Milton & Rawlinson, 1991: 7 (Vona Vona, Solomon Islands).

Material

Total: 21 specimens (including 11 specimens listed by Fricke, 1981a, 1983).

New Caledonia, Grande Terre: SMNS 12047, 1 specimen; Canal de la Havannah, 22°22'S 167°01'E, 150 m depth; P. Fourmanoir; Nov. 1979.

Comparison material (additional to specimens listed by Fricke, 1981a, 1983). **Australia, Northern Territory:** SMNS 12173, 8 specimens; Arafura Sea, 305 km NNE to N Cape Stewart, 9°21'S 135°15'E, 80 m depth; R. Williams, F/V "Clipper Bird"; 12 Nov. 1990. – SMNS 12172, 5 specimens; Arafura Sea, 220 km NE De Courcy Head, 9°40'S 133°59'E, 98 m depth; R. Williams, F/V "Clipper Bird"; 8 Nov. 1990.

Australia, New South Wales: AMS I.24783-992, 1 specimen; NE of North Solitary Island, 29°50'S 153°39'E – 29°44'S 153°41'E, 165 m depth; FRV "Kapala"; 11 Oct. 1978. – AMS I.30409-003, 2 specimens; E of Wooli, 29°50'S 153°38'E – 29°48'S 153°39'E, 153 m depth; FRV "Kapala"; 1 Aug. 1978. – AMS I.31480-001, 5 specimens; off Long Reef, 33°42'S 151°31'E – 33°41'S 151°32'E, 120–123 m depth; FRV "Kapala"; 18 Oct. 1990. – AMS I.33675-004, 1 specimen; off Crowdy Head, 31°52'S 152°49'E – 31°58'S 152°54'E, 84–94 m depth; FRV "Kapala"; 4 Dec. 1991. – SMNS 14791, 13 specimens; off Newcastle, 33°02'S 152°05'E, 113–117 m depth; FRV "Kapala", St. K931007; 5 May 1993.

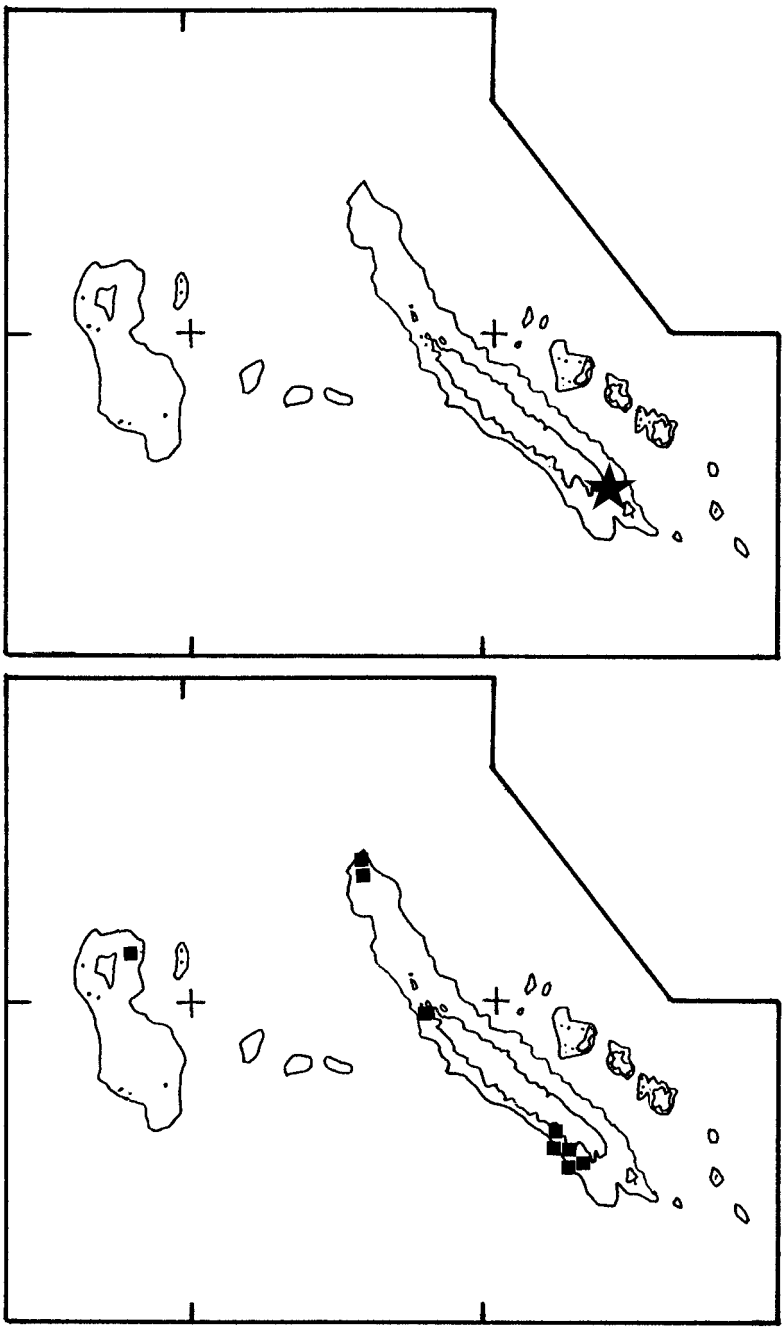
Distribution

New Caledonia (Grande Terre) (Fig. 5). Otherwise, *Callionymus moretonensis* is distributed in the Arafura Sea/Northern Territory (new record), southern Queensland and northern New South Wales (new record), Australia, south to 33°42'S. Possibly also Chesterfield and Solomon Islands. The species lives at depths of 84–165 m.

Remarks

Fricke (1998) found in the New Caledonian specimen (SMNS 12047) characters intermediate between *Callionymus futuna* Fricke, 1998 from Futuna Island, and *Callionymus moretonensis* from northeastern Australia. More New Caledonian material is necessary to finally judge about its taxonomic status.

Some northwestern Australian specimens previously assigned to this species



Figs 5–6. Geographical distribution of *Callionymus* species in New Caledonian waters. – 5. *C. moretonensis (above);* – 6. *C. pleurostictus (below).*

turned out to belong to *Callionymus bifilum* n.sp. (description see below, 5.2.), and *Callionymus kailolae* n.sp. (description see below, 5.4.).

4.6. *Callionymus pleurostictus* Fricke, 1982

CAAB Code (Australia): 37 427021

Callionymus (Calliurichthys) pleurostictus Fricke, 1982a: 138–141, figs. 7–8 (Bay of Nhatrang, Vietnam; Gulf of Thailand; holotype: CAS 46723). – Fricke, 1983: 428–433, figs. 126–127 (Ambon, Indonesia; Northern Australia; 1–22 m depth). – Fricke, 1989: 53 (near Rabaul, New Britain; Guadalcanal, Solomon Islands; 0–35 m depth).

Pseudocalliurichthys sp.: Rivaton, Fourmanoir, Bourret & Kulbicki, 1989: 30 (Nouvelle-Calédonie/New Caledonia, in checklist).

Callionymus pleurostictus: Fricke, 1993: 368–369 (New Caledonia). – Yearsley, Last & Morris, 1997: Appendix D (CAAB Code).

Pseudocalliurichthys pleurostictus: Nakabo, 1993: 993, fig. (Japan; with pictorial key).

Pseudocalliurichthys sp.: Kulbicki, Randall & Rivaton, 1994: 33 (Chesterfield Islands, 40–74 m depth).

Material

Total: 172 specimens (including 51 specimens listed by Fricke, 1982a, 1983, 1989).

New Caledonia, Récifs d'Entrecasteaux: SMNS 21302, 3 specimens, 20.0–43.1 mm SL; 18°26'42''S 163°09'42''E, 40 m depth; R/V "Vauban", St. 468; 1 Mar. 1985. – SMNS 21308, 1 specimen, 25.3 mm SL; 18°23'48''S 163°06'36''E, 41–42 m depth; R/V "Vauban", St. 460; 1 Mar. 1985.

New Caledonia, Grande Terre: NMNZ uncat., 1 male, 31.0 mm SL; Baie de la Dumbéa, off Nouméa Harbour entrance, 22°14'S 166°22'E, 20–25 m depth; C. D. Roberts, C. D. Paulin & M. Kulbicki, M/V "Romance"; 11 Oct. 1992. – ROM 65535, 1 male (23.6 mm SL) and 2 females (18.3–21.2 mm SL); Passe de la Dumbéa, a little west of Recif Laregnère, 22°19'50''S 166°16'50''E, 19.8–22.9 m depth; R. Winterbottom et alii; 5 Sep. 1991. – ROM 65536, 6 males (20.1–29.3 mm SL) and 7 females (14.2–20.0 mm SL); Baie de la Dumbéa, fringing reef on NW arm just E of beach, 22°12'15''S 166°21'30''E, 1.8–6.1 m depth; R. Winterbottom et alii; 2 Sep. 1991. – ROM 65537, 1 female, 17.1 mm SL; 300 m N of Sêche Croissant Reef, 22°19'30''S 166°21'00''E, 7.6–10.7 m depth; R. Winterbottom et alii; 9 Sep. 1991. – SMNS 12528, 1 specimen; Baie de Saint-Vincent, 21°59'12''S 165°58'18''E; R/V "Alis", St. 7; 23 Mar. 1990. – SMNS 17848, 1 male, 37.8 mm SL; northwestern lagoon, 5 km SW of Poum, 20°18'06''N 163°57'06''E, 21 m depth; B. Richer de Forges, St. DW.989; 30 Apr. 1988. – SMNS 21243, 2 males, 26.6–27.8 mm SL; ca. 8 km west of Nouméa, 22°27'36''S 166°24'54''E, 15 m depth; B. Richer de Forges, R/V "Vauban", St. 64; 20 Aug. 1984. – SMNS 21294, 4 specimens, 26.4–39.5 mm SL; Grande Rade, 22°14'04''S 166°24'01''E, 2 m depth, coral and sand; M. Kulbicki; 2 Apr. 1999. – SMNS 21297, 3 specimens, 21.4–25.2 mm SL; Grande Rade, 22°14'04''S 166°24'01''E, 2 m depth, coral and sand; M. Kulbicki; 2 Apr. 1999. – SMNS 21319, 1 specimen, 27.9 mm SL; 22°14'42''S 166°11'06''E, 10 m depth; B. Richer de Forges, R/V "Vauban", Cruise LAGON, St. 51; 25 May 1984. – SMNS 21324, 1 specimen, 23.2 mm SL; 22°20'54''S 166°22'12''E, 15 m depth; B. Richer de Forges, R/V "Vauban", St. 3; 21 May 1984.

Comparison material (additional to specimens listed by Fricke, 1982a, 1983, 1989).

Indonesia. Irian Jaya: ANSP 128766, 1 female, 22.9 mm SL; reef at Rani Isle, 5 miles S of Sowek, Soepiori Island; National Science Foundation; 4 Mar. 1956.

Australia, Queensland: AMS I.20781-010, 4 specimens; Lizard Island, 14°41'S 145°28'E; D. F. Hoese et alii; 5 Dec. 1978. – AMS I.20982-055, 1 specimen; Lizard Island, 14°41'S 145°27'E, 5–6 m depth; J. R. Paxton et alii; 28 Nov. 1978. – AMS I.22613, 1 specimen; Escape Reef; AMS-WAM Party; 1981. – AMS I.25109-067, 1 specimen; Osprey Reef, 13°58'S 146°41'E, 1–3 m depth; AMS Sunbird Party; 7 Nov. 1984. – ANSP 170854, 6 specimens, 16.0–22.2 mm SL; Endeavour Reef, off W tip of S edge of E half of reef, 15°45'S 145°42'E, 10–16 m depth; J. C. Tyler & C. L. Smith; 6 Jan. 1969. – ANSP 170856, 19 specimens, 7.9–22.9 mm SL; Endeavour Reef, 1/2 mile E of Cook wreck site at S edge of W portion of E half of reef, 15°45'S 145°42'E, 14–20 m depth; J. C. Tyler & C. L. Smith, 11 Jan. 1969. –

ANSP 170859, 20 specimens, 9.1–31.0 mm SL; Endeavour Reef, ca. 1/4 mile N of Cook wreck site, white sand around isolated 3 m high coral knoll, 13–18 m depth, 15°45'S 145°42'E; J. C. Tyler & C. L. Smith; 14 Jan. 1969. – ANSP 170861, 5 specimens, 19.3–32.9 mm SL; Big Hope Island, middle of E end of island, 15°45'S 145°42'E, 10 m depth; J. C. Tyler & C. L. Smith; 18 Jan. 1969. – ANSP 170862, 2 subadults, 13.3 mm SL; northern Escape Reef, middle of W edge of reef, 15°45'S 145°42'E, 25–28 m depth; J. C. Tyler & C. L. Smith; 23 Jan. 1969. – ANSP 170863, 14 specimens, 17.8–37.0 mm SL; Endeavour Reef, W end of E half of reef, S side, 15°45'S 145°42'E, 13–15 m depth, J. C. Tyler & C. L. Smith; 15 Jan. 1969. – ANSP 170865, 4 specimens, 18.5–30.3 mm SL; Endeavour Reef, middle of W edge of western half, 15°45'S 145°42'E, 8–12 m depth; J. C. Tyler & C. L. Smith; 4 Jan. 1969. – ANSP uncat. (ex 170858), 8 specimens, 13.2–18.7 mm SL; Endeavour Reef, 3/4 mile NW of Cook wreck site, 15°45'S 145°42'E, 2–5 m depth; J. C. Tyler & C. L. Smith; 16 Jan. 1969. – ANSP uncat. (ex 170864), 1 male, 28.4 mm SL, Little Hope Island, middle of N end of island, 15°45'S 145°42'E, 2–5 m depth; J. C. Tyler, C. L. Smith & A. C. Gill; 17 Jan. 1969. – ROM uncat., 1 male, 20.0 mm SL; N side of Falrey Island, Lizard Island, on patch reef, 3 m depth; R. Winterbottom & C. Bordan; 27 June 1994.

Distribution

Chesterfield Islands (new record); New Caledonia (Récifs d'Entrecasteaux, new record; Grande Terre) (Fig. 6). Outside the area, the species is widespread in the eastern Indo-Australian Archipelago and the islands of the central Southwest Pacific; Irian Jaya/Indonesia (new record); Queensland/Australia (new record). It is found at depths of 0–42 m.

4.7. *Callionymus rivatoni* Fricke, 1993

? Callionymus japonicus (non Houttuyn, 1782): Fourmanoir & Rivaton, 1979: 417–418 (Sud de Nouvelle-Calédonie, 22°20'S 167°10'30''E, 180 m depth).

Callionymus gardineri rivatoni Fricke, 1993: 365–368, fig. 1 (New Caledonia: Grande Terre; holotype: MNHN 1993-0120).

Repomucenus huguenini (non Bleeker, 1859): Rivaton, 1989: 145 (Iles Chesterfield). – Rivaton, Fourmanoir, Bourret & Kulbicki, 1989: 31 (Nouvelle-Calédonie/New Caledonia, in checklist). – Kulbicki & Wantiez, 1990: 124 (St. Vincent Bay, New Caledonia). – Kulbicki, Randall & Rivaton, 1994: 33 (Chesterfield Islands, 70–80 m depth).

Material

Total: 41 specimens.

Holotype. **New Caledonia, Grande Terre:** MNHN 1993-0120, male, 54.8 mm SL; S Baie de Saint-Vincent, 22°05'S 166°10'E, 15 m depth; 22 Aug. 1989.

Paratypes. **New Caledonia, Grande Terre:** MNHN 1993-0119, 1 female, 37.4 mm SL; E Ile des Pins, 22°38'12''S 167°34'48''E, 105–110 m depth; R/V "Alis", St. DW.81; 9 Sep. 1989. –SMNS 12271, 1 male, 35.0 mm SL; NE Ile Pott, 19°37'18''S 163°52'24''E, 37–38 m depth; R/V "Alis", St. CP.1116; 26 Oct. 1989. – SMNS 12272, 1 female, 33.5 mm SL; 80 km SE Nouméa, 22°31'48''S 167°07'30''E, 67–71 m depth; R/V "Vauban", St. DW.375; 21 Jan. 1985.

Other material. **Coral Sea, Chesterfield Islands:** SMNS 21228, 2 males, 59.4–68.6 mm SL; southeast of Ile de Sabre, 20°31'30''S 161°06'27''E, 88 m depth; B. Richer de Forges, R/V "Coriolis", St. CHALCAL CP.2; 15 July 1984. – SMNS 21238, 1 male, 27.6 mm SL; northeastern lagoon, 19°24'54''S 158°48'45''E, 55 m depth; B. Richer de Forges, Cruise CORAIL 2, St. 32; 23 July 1988. – SMNS 21239, 1 male, 34.1 mm SL; northeastern lagoon, 19°49'05''S 158°24'51''E, 42 m depth; B. Richer de Forges, Cruise CORAIL 2, St. 155; 1 Aug. 1988. – SMNS 21246, 1 male, 46.9 mm SL; northeastern lagoon, 19°41'29''S 158°18'47''E, 58 m depth; B. Richer de Forges, Cruise CORAIL 2, St. 164; 2 Aug. 1988. – SMNS 21284, 2 specimens, 92.8–116.7 mm SL; northeastern lagoon, 19°17'54''S 158°35'30''E, 68 m depth; B. Richer de Forges, R/V "Coriolis", St. CHALCAL CP.7; 18 July 1984.

Coral Sea, Chesterfield Bank: SMNS 21236, 1 female, 26.7 mm SL; 40 km ENE of Iles de Sable, 19°37'18''S 161°32'24''E, 37–38 m depth; B. Richer de Forges, R/V "Alis", St.

DW.1116; 26 Oct. 1989. – SMNS 21237, 1 male, 26.5 mm SL; 50 km SE of Iles de Sable, 20°30'50''S 161°05'13''E, 80 m depth; B. Richer de Forges, R/V "Coriolis", Cruise CHALCAL, St. CP.3; 15 July 1984. – SMNS 21240, 1 female, 39.6 mm SL; 40 km SE of Chesterfield Islands lagoon, 20°46'15''S 158°41'38''E, 70 m depth; B. Richer de Forges, Cruise CHALCAL, St. D.48; 23 July 1984. – SMNS 21266, 5 specimens, 47.3–70.2 mm SL; 20°27'21''S 161°04'42''E, 75 m depth; B. Richer de Forges, Cruise CORAIL 2, St. CP.24; 22 July 1988. – SMNS 21283, 5 specimens, 50.2–103.7 mm SL; 21°24'54''S 159°09'18''E, 60 m depth; B. Richer de Forges, R/V "Coriolis", Cruise CHALCAL 1, St. CP.15; 25 July 1984.
New Caledonia, Récifs d'Entrecasteaux: SMNS 21303, 1 specimen, 17.5 mm SL; 18°26'42''S 163°09'42''E, 40 m depth; R/V "Vauban", St. 468; 1 Mar. 1985. – SMNS 21317, 1 specimen, 26.2 mm SL; 18°22'06''S 163°05'00''E – R/V "Vauban", St. 165; 1 Mar. 1985.
New Caledonia, islands north of Grande Terre: SMNS 21285, 3 specimens, 68.3–130.1 mm SL; Bélep Island, 19°36'24''S 163°50'00''E, 35 m depth; M. Kulbicki, R/V "Vauban", Cruise BELEP, St. 34; 7 July 1986.
New Caledonia, Grande Terre: SMNS 17863, 1 male, 128.3 mm SL; northwestern lagoon, 20 km west of Poum, 20°12'30''S 163°54'36''E; O.R.S.T.O.M., Nouméa; 2 May 1988. – SMNS 21226, 1 male (68.2 mm SL) and 1 female (23.5 mm SL); northwestern lagoon, west of Poum, 20°15'06''S 163°54'52''E, 35–36 m depth; B. Richer de Forges, St. DW.995; 2 May 1988. – SMNS 21247, 2 males, 38.5–45.8 mm SL; southeastern lagoon, 20 km north of Yaté, 21°57'54''S 166°52'30''E, 47–48 m depth; B. Richer de Forges, St. 0626; 6 Aug. 1986. – SMNS 21252, 1 male, 29.3 mm SL; southeastern lagoon, east of Goro, 22°17'00''S 167°06'00''E, 50 m depth; B. Richer de Forges; 5 Aug. 1986. – SMNS 21277, 1 male, 71.3 mm SL; 22°37'00''S 166°52'42''E, 50 m depth; O.R.S.T.O.M., Nouméa, St. 315; 27 Nov. 1984. – SMNS 21290, 1 specimen, 13.1 mm SL; northwestern lagoon, 20°37'06''S 164°13'06''E, 15 m depth; B. Richer de Forges, St. DW.942; 28 Apr. 1988. – SMNS 21314, 1 specimen, 22.3 mm SL; 22°16'36''S 166°12'12''E, 12 m depth; B. Richer de Forges, R/V "Vauban", Cruise LAGON, St. 50; 25 May 1984.
New Caledonia, Récifs du Sud: SMNS 21316, 1 specimen, 27.0 mm SL; 22°54'18''S 166°53'00''E, 29 m depth; R/V "Vauban", St. 547; 15 Sep. 1985.
New Caledonia, Ile des Pins: SMNS 21305, 1 specimen, 22.7 mm SL; 22°33'30''S 167°14'12''E, 64 m depth; R/V "Vauban", St. 400; 23 Jan. 1985.

Distribution

Coral Sea (Chesterfield Islands; Chesterfield Bank; new record), New Caledonia (Récifs d'Entrecasteaux, new record; Grande Terre; Récifs du Sud; Ile des Pins, new record) (Fig. 7). The species is endemic to the area. It lives on sandy bottoms at depths of 12–110 m.

Remarks

This species was originally described by Fricke (1993) as a subspecies of *Callionymus gardineri* Regan, 1908. Recently, additional materials were detected. Comparison of the three subspecies results in upgrading *Callionymus rivatoni* to the species level. Other species of the *Callionymus-japonicus* species-group are listed below ("Remarks" section of 5.3., *C. japonicus*).

4.8. *Callionymus scaber* McCulloch, 1926 (Fig. 8)

CAAB Code (Australia): 37 427036

Callionymus affinis Ogilby, 1910: 134–135 (Cape Moreton/Queensland; permanently invalid, homonym of *Callionymus affinis* Regan, 1908).

Callionymus, Calliurichthys, japonicus (non Houttuyn, 1782): McCulloch, 1926: 8 (Lord Howe Island).

Callionymus, Calliurichthys, japonicus var. *scaber* McCulloch, 1926: 197 (Lord Howe Island; syntypes: AMS I.3122, 1 specimen; AMS I.4079, 1 specimen; AMS I.5133, 1 specimen, AMS I.9282, 1 specimen).

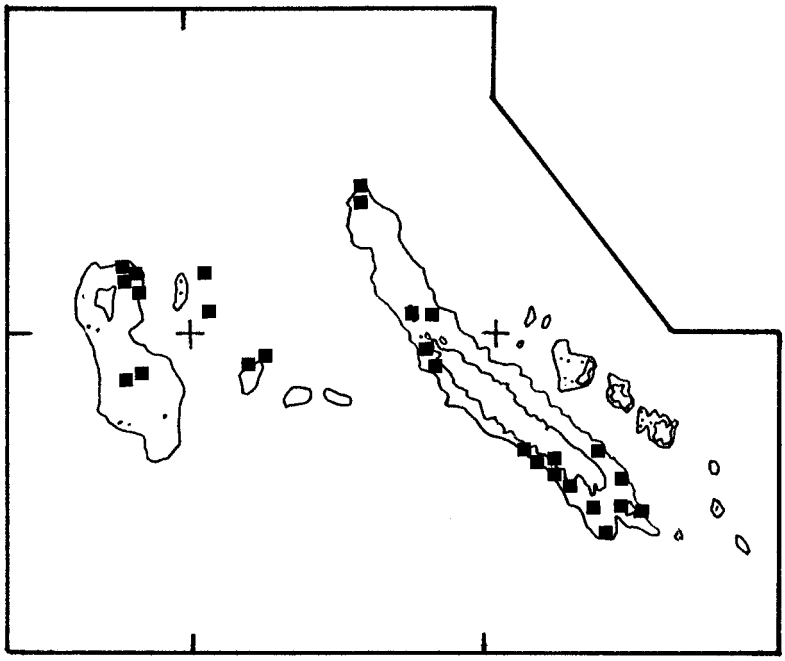


Fig. 7. Geographical distribution of *Callionymus rivatoni* in New Caledonian waters.

Callionymus (Calliurichthys) japonicus scaber: Fricke, 1983: 392–393 (Lord Howe Island; southern Queensland).
Calliurichthys japonicus: Rivaton, Fourmanoir, Bourret & Kulbicki, 1989: 30 (Nouvelle-Calédonie/New Caledonia, in checklist). – Kulbicki, Randall & Rivaton, 1994: 33 (Chesterfield Islands).
Callionymus scaber: Yearsley, Last & Morris, 1997: Appendix D (CAAB Code).

Material

Total: 20 specimens.

Material from the study area. **Coral Sea, Chesterfield Islands:** SMNS 21224, 1 female, 69.5 mm SL; northeastern lagoon, 19°17'54''S 158°35'30''E 68 m depth; B. Richer de Forges, R/V "Coriolis", St. CHALCAL CP.7; 18 July 1984. – SMNS 21230, 1 male, 72.6 mm SL; northeastern lagoon, 19°28'03''S 158°24'23''E, 54 m depth; B. Richer de Forges, Cruise CORAIL 2, St. 125; 29 July 1988. – SMNS 21241, 1 female, 47.7 mm SL; northeastern lagoon, 19°24'58''S 158°21'35''E, 56 m depth; B. Richer de Forges, Cruise CORAIL 2, St. 120; 29 July 1988. – SMNS 21248, 1 female, 56.5 mm SL; 30 km NNE Caye de l'Observatoire, 21°13'30''S 158°50'12''E, 66 m depth; B. Richer de Forges; 24 July 1984.

Comparison material. **Australia, New South Wales:** AMS I.26229-002, 2 specimens, 151.6–197.0 mm SL; SE of Evans Head, off Iluka; FRV "Kapala"; 24 May 1988. – AMS I.26312-007, 9 specimens; NE of Yamba, 29°25'S 153°30'E, 49–54 m depth; FRV "Kapala"; 22 May 1986. – AMS I.26828-005, 1 specimen; NE of Tweed Heads, 28°06'S 153°48'E–28°11'S 153°48'E, 112–115 m depth; FRV "Kapala"; 3 June 1978. – AMS I.32120-007, 1 male, 156.7 mm SL, and 1 female, 139.2 mm SL; off Clarence River, 29°20'S 153°34'E – 29°25'S 153°37'E, 67–73 m depth; K. Graham, FRV "Kapala"; 2 May 1990. – AMS I.34028-001, 1 male, 180.7 mm SL, and 1 female, 136.4 mm SL; off Brunswick, 28°22'S 153°39'E – 28°27'S 153°41'E, 47–57 m depth; K. Graham, FRV "Kapala"; 25 May 1991.
Australia, Lord Howe Island: AMS IA.3633, 1 female, 66.2 mm SL; 31°31'S 159°05'E – R. E. Baxter.

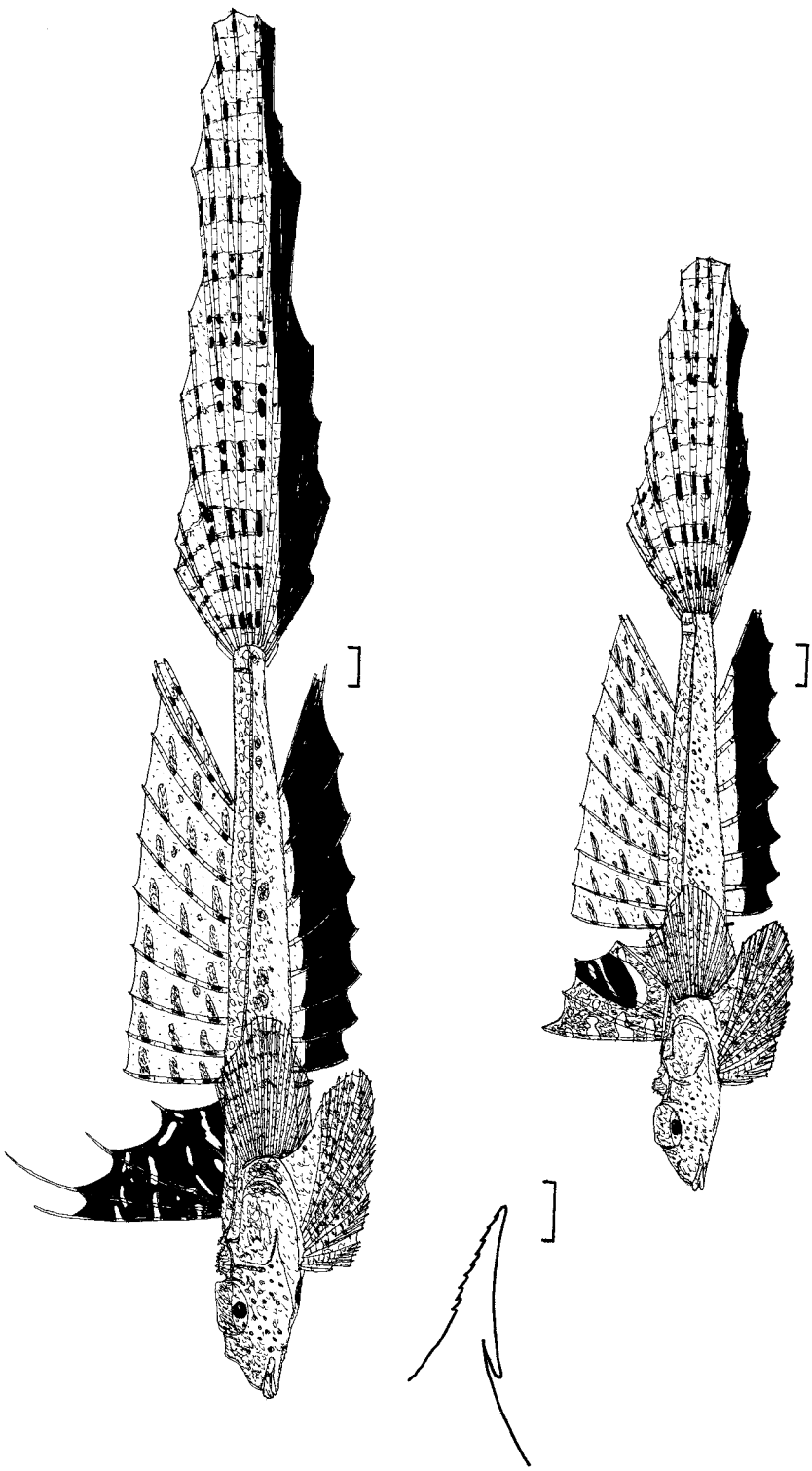


Fig. 8. *Callionymus scaber* McCulloch, 1926; AMS I.26229-002, Australia, New South Wales, southeast of Evans Head. Specimen 1, male, 197.0 mm SL. – *Above*, lateral view (scale: 10 mm); *centre*, left preopercular spine (scale: 3 mm). – Specimen 2, female, 151.6 mm SL; *below*, lateral view (scale: 10 mm).

Diagnosis

A *Callionymus* of the *Callionymus-japonicus* species-group of the subgenus *Callionymus* with a total of 9 rays in the second dorsal fin, 8 rays in the anal fin, 18–20 pectoral fin rays, 7–12 small antrorse serrae dorsally on the preopercular spine (additional to the main tip) and an antrorse spine at the base; with a high first dorsal fin in males bearing filaments on all four spines, the first dorsal fin in the male black, with oblique white streaks; with the throat plain dark brown in females; and in males with the distal five-sixths of the anal fin black, in females with the distal two-thirds of the anal fin black.

Description

D_1 IV; D_2 viii,1; A vii,1; P_1 ii,14–16,i-ii (total 18–20); P_2 I,5; C (i),i,7,ii,(i).

Body elongate and depressed. Head slightly depressed, 4.9–5.0 in SL. Eye 2.7–3.1 in head. Preorbital length 2.4–2.7 in head. Interorbital distance 17.8–20.7 in head. Occipital region with 2 rough protuberances on each side, and a rough postorbital area. Maxillary length 2.7–3.6 in head. Preopercular spine with a straight main tip, a smooth base, a strong antrorse spine at its base, and 7–12 small serrae on the dorsal margin (Fig. 8, centre). Preopercular spine length 3.1–4.4 in head. Preopercular spine formula 1 $\frac{7–12}{}$ 1. Body depth 9.8–11.4 in SL. Body width 5.0–5.9 in SL. Urogenital papilla in the male 9.6–12.6 in head, in the female 15.9–31.8 in head. Caudal peduncle length 5.4–7.0 in SL. Caudal peduncle depth 23.7–26.3 in SL. Maximum observed SL 197.0 mm (male), 151.6 mm (female).

First dorsal fin relatively high in the male, all spines with short filaments, first spine 3.9–4.1 in SL, 2nd spine 3.3–4.4 in SL, 3rd spine 5.0–5.5 in SL, 4th spine 7.8–8.5 in SL; in the female lower, spines without filaments, 1st spine 4.7–5.0 in SL, 2nd spine 5.2–5.3 in SL, 3rd spine 5.4–6.2 in SL, 4th spine 6.8–8.8 in SL. Predorsal (1) length 4.0–4.3 in SL. Second dorsal fin rays unbranched, the last divided at its base. First ray of second dorsal fin in the male 4.9–7.3 in SL, last ray 4.2–4.8 in SL; in the female, 1st ray 5.8–6.2 in SL, last ray 4.6–5.3 in SL. Predorsal (2) length 2.2–2.4 in SL. Anal fin beginning on a vertical through about 2nd ray of second dorsal fin. Anal fin rays unbranched, the last divided at its base. First anal fin ray in the male 9.8–12.6 in SL, last ray 5.5–5.9 in SL; 1st ray in the female 9.9–12.3 in SL, last ray 5.6–6.4 in SL. Preanal fin length 2.1–2.3 in SL. Pectoral fin reaching to about 2nd anal fin membrane when laid back. Pectoral fin length 4.6–5.4 in SL. Prepectoral fin length 3.0–3.2 in SL. Pelvic fin reaching to 1st anal fin membrane when laid back. Pelvic fin spine 14.2–22.9 in SL; pelvic fin length 3.2–3.8 in SL. Prepelvic fin length 4.8–5.9 in SL. Caudal fin with the median 4 rays extremely elongate; caudal fin length in the male 1.2–1.4 in SL, in the female 1.6–1.7 in SL.

Colour in alcohol: Body dorsally light grey to greyish brown, with rounded whitish and brownish spots; sides of body in males each with a row of brown blotches, arranged in groups of 2–3, below the lateral line. Head grayish brown, with small dark brown spots below the eyes. Throat in the male dark brown, with a central heart-shaped black blotch; plain dark brown in the female.

First dorsal fin in the male black, with oblique white streaks; in the female greyish brown, with a large black ocellus distally surrounding the third spine. Second dorsal fin with 3 blackish spots on each ray, and with 3 horizontal grey streaks on each membrane. Males with distal five-sixths of anal fin black, females with distal two-thirds of anal fin black. Lower one-third of caudal fin black, upper two-thirds with

about 12 double vertical rows of dark brown spots. Pectoral fin pale, upper half with vertical rows of small blackish spots. Pelvic fin mottled with dark brownish grey.

Sexual dimorphism: Males have a higher first dorsal fin than females, with the spines filamentous, and with whitish oblique stripes on a black background (with an ocellus distally around third spine in females), a longer snout, a longer caudal fin, and a longer urogenital papilla.

Distribution

Coral Sea, Chesterfield Islands (new record) (Fig. 9). Outside the area, Lord Howe Island, southeastern Queensland and New South Wales/Australia (new record), at depths of 47–115 m (Fig. 24).

Relationships

This species is closely related to *Callionymus japonicus* Houttuyn, 1782 (Houttuyn, 1782: 312–314, Japan; Fricke, 1983: 380–392, figs 114–115, part: northern half of distribution range, *C. japonicus japonicus*), and *Callionymus afilum* n.sp. which is described below. *Callionymus scaber* differs in the shape, colouration, and presence of 4 filaments in the male's first dorsal fin, and in the broader black area on the anal and caudal fin in both sexes; also in the larger size of the black blotch on the thorax of the male, and the brown area on the thorax of the female.

Remarks

This species was treated by authors as a subspecies of *Callionymus japonicus.* Comparison with New Caledonian and northern Australian materials, however, revealed that *C. japonicus* (discussed below, 5.3.), *C. afilum* (described below, 5.1.) and *C. scaber* are separate, though closely related species.

4.9. *Callionymus tethys* Fricke, 1993

Callionymus tethys Fricke, 1993: 369–371, fig. 2 (New Caledonia; Loyalty Islands; holotype: MNHN 1993-0136).

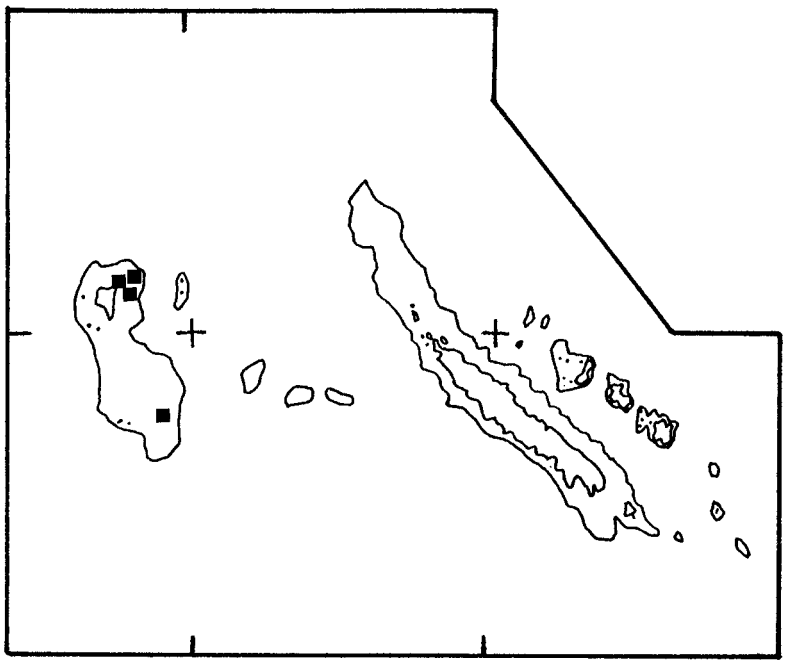
Material

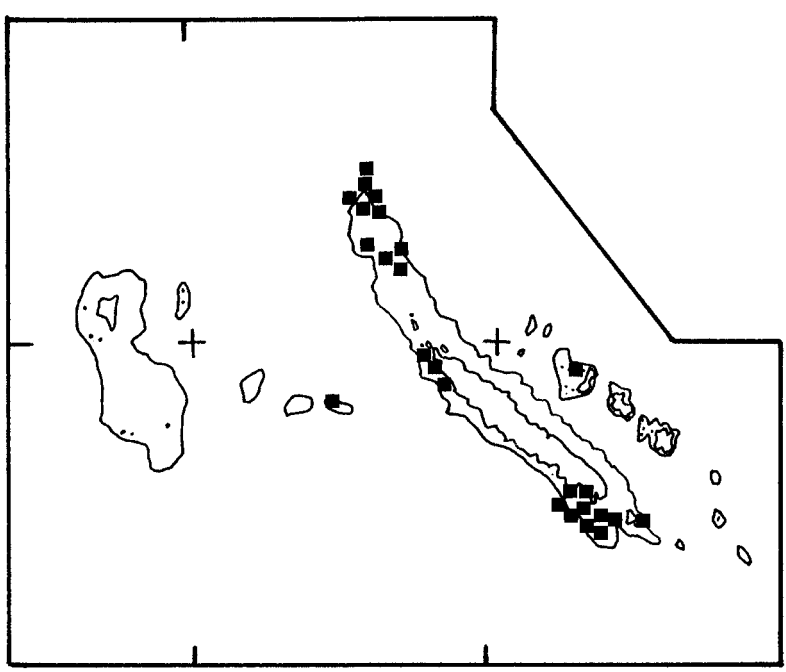
Total: 32 specimens.

Type material. Holotype. **New Caledonia, Grande Terre:** MNHN 1993-0136, male, 86.14 mm SL; 38 km SSE Nouméa, 22°37'54''S 166°41'06''E, 35 m depth; R/V "Vauban", St. DW.230; 22 Oct. 1984.

Paratypes. **Coral Sea, Chesterfield Bank:** SMNS 12267, 2 males, 44.2–60.2 mm SL; 20°38'12''S 162°44'12''E, 23–24 m depth; R/V "Vauban", St. DW.865; 13 Jan. 1987.

Paratypes. **New Caledonia, reefs north of Grande Terre:** MNHN 1993-0128, 1 female, 25.2 mm SL; Grand Passage, NW of New Caledonia, 18°20'18''S 163°05'30''E, 35–36 m depth; R/V "Vauban", St. DW.447; 28 Feb. 1985. – MNHN 1993-0129, 1 female, 22.4 mm SL; Grand Passage, NW of New Caledonia, 18°28'30''S 163°10'24''E, 38–39 m depth; R/V "Vauban", St. DW.469; 1 Mar. 1987. – MNHN 1993-0130, 1 female, 21.4 mm SL; Grand Passage, NW of New Caledonia, 19°06'24''S 163°13'18''E, 42–43 m depth; R/V "Vauban", St. DW.541; 6 Mar. 1985. – MNHN 1993-0134, 1 female, 22.2 mm SL; Grand Passage, NW of New Caledonia, 19°33'00''S 163°46'00''E, 40–41 m depth; R/V "Alis", St. DW.1126; 27 Oct. 1989. – MNHN 1993-0135, 1 female, 36.0 mm SL; Grand Passage, NW of New Caledonia, 19°18'30''S 163°10'42''E, 47 m depth; R/V "Alis", St. DW.1169; 30 Oct. 1989. – MNHN 1993-0000, 1 female, 15.9 mm SL; Grand Passage, NW of New Caledonia, 18°19'00''S 163°04'00''E, 36 m depth; R/V "Vauban", St. DW.446; 28 Feb. 1985. – SMNS 12269, 4 males, 16.3–28.0 mm SL; Grand Passage, NW of New Caledonia, 19°27'18''S 163°16'18''E, 48 m depth; R/V "Alis", St. DW.1182; 31 Oct. 1989.





Figs 9–10. Geographical distribution of *Callionymus* species in New Caledonian waters. – 9. *C. scaber (above);* – 10. *C. tethys (below).*

Paratypes. **New Caledonia, Grande Terre:** MNHN 1993-0124, 1 female, 25.4 mm SL; 20 km S Nouméa, 22°24'00''S 166°19'42''E, 13–14 m depth; R/V "Vauban", St. DW.7; 21 May 1984. – MNHN 1993-0125, 1 male, 42.8 mm SL; 35 km SSE Nouméa, 22°36'06''S 166°34'24''E, 22 m depth; R/V "Vauban", St. DW.158; 24 Aug. 1984. – MNHN 1993-0126, 1 female, 43.0 mm SL; 40 km SSE Noumea, 22°31'30''S 166°29'42''E, 22 m depth; R/V "Vauban", St. DW.83; 21 Aug. 1984. – MNHN 1993-0127, 1 female, 29.7 mm SL; 30 km S Nouméa, 22°20'42''S 166°20'48''E, 10 m depth; R/V "Vauban", St. DW.258; 7 Nov. 1984. – MNHN 1993-0131, 1 female, 30.2 mm SL; 20 km W Ile des Pins, 22°50'12''S 167°01'00''E, 52–53 m depth; R/V "Vauban", St. DW.570; 17 July 1985. – MNHN 1993-0132, 1 male, 51.8 mm SL; NW New Caledonia, 20°18'18''S 164°32'06''E, 22–26 m depth; R/V "Vauban", St. DW.892; 14 Jan. 1987. – SMNS 12266, 1 female, 36.0 mm SL; Cap Baye, 21°01'36''S 165°34'42''E, 32–33 m depth; R/V "Vauban", St. DW.788; 9 Jan. 1987. – SMNS 12268, 1 female, 43.2 mm SL; 20 km SW Nouméa, 22°18'30''S 166°13'48''E, 10 m depth, R/V "Vauban", St. DW.42; 25 May 1984.

Paratypes. **Loyalty Islands:** MNHN 1993-0133, 1 male, 49.2 mm SL; Ile Beautemps-Beaupré, 20°13.4'S 166°19.7'E, 30–32 m depth; R/V "Vauban", St. DW.902; 14 Jan. 1987.

Other material. **New Caledonia, island north of Grande Terre:** SMNS 21289, 1 specimen; 18°56'24''S 162°32'42''E, 32–33 m depth; R/V "Vauban", St. 486; 2 Mar. 1985.

New Caledonia, Grande Terre: SMNS 21225, 1 male, 69.9 mm SL; northwestern lagoon, west of Koumac, 20°38'54''S 164°13'18''E, 10–15 m depth; B. Richer de Forges, St. DW.941; 27 Apr. 1988. – SMNS 21229, 1 male, 66.1 mm SL; northwestern lagoon, west of Koumac, 20°37'00''S 164°11'06''E, 15 m depth; B. Richer de Forges, St. DW.943; 28 Apr. 1988. – SMNS 21234, 1 female, 25.3 mm SL; northwestern lagoon, WNW of Koumac, 20°19'00''S 163°55'18''E, 22–23 m depth; B. Richer de Forges, St. DW.990; 30 Apr. 1988. – SMNS 21235, 1 female, 27.0 mm SL; northwestern lagoon, west of Koumac, 20°34'36''S 164°09'48''E, 15–16 m depth, B. Richer de Forges, St. DW.945; 28 Apr. 1988. – SMNS 21249, 1 female, 28.5 mm SL; northwestern lagoon, WNW of Koumac, 20°39'30''S 164°15'24''E, 50–55 m depth; B. Richer de Forges, 27 Apr. 1988. – SMNS 21269, 2 specimens, 48.8–88.1 mm SL; 22°21'54''S 166°14'30''E, 19 m depth; R/V "Vauban", St.39; 24 May 1984. – SMNS 21272, 1 specimen, 52.3 mm SL; 22°44'48''S 166°51'36''E, 36–40 m depth; R/V "Vauban", St. 346; 29 Nov. 1984.

New Caledonia, Ile des Pins: SMNS 21313, 1 specimen, 48.1 mm SL; 22°40'48''S 167°20'24''E, 40 m depth; R/V "Vauban", St. 411; 24 Jan. 1985.

Distribution

Chesterfield Bank; New Caledonia (islands north of Grande Terre, new record; Grande Terre; Ile des Pins, new record); Loyalty Islands (Ouvéa) (Fig. 10). This species is endemic to the area. It was found at depths of 10–55 m.

4.10. *Diplogrammus goramensis* (Bleeker, 1858)

CAAB Code (Australia): 37 427026

Callionymus goramensis Bleeker, 1858: 214 (Goram Archipelago, Indonesia; syntypes: RMNH 4812, 2 specimens).

Diplogrammus goramensis: Hoese et alii, 1976: 48 (Norfolk Island). – Wass, 1984: 26 (Samoa). – Rivaton, Fourmanoir, Bourret & Kulbicki, 1989: 30 (Nouvelle-Calédonie/New Caledonia, in checklist). – Zug, Springer, Williams & Johnson, 1989: 7 (Rotuma). – Nakabo, Iwata & Ikeda, 1992: 103–105, fig. 1 (Ishigaki Is. and Okinawa Is., Okinawa Prefecture, Japan). – Francis, 1993: 166 (Australia; Norfolk Island). – Nakabo, 1993: 986, fig. (Japan; with pictorial key). – Allen & Smith-Vaniz, 1994: 16 (Cocos-Keeling Islands). – Kulbicki, Randall & Rivaton, 1994: 33 (Chesterfield Islands, 23 m depth). – Yearsley, Last & Morris, 1997: Appendix D (CAAB Code).

Diplogrammus (Diplogrammus) goramensis: Fricke, 1983: 493–504, fig. 148 (Vietnam, China, Philippines, Eastern Indonesia, Papua New Guinea, Australia/Queensland, Palau Islands, Caroline Islands, Kapingamarangi Atoll, Mariana Islands, Marshall Islands, Fiji Islands, American Samoa, Cook Islands; 5–34 m depth). – Fricke, 1993: 371 (expected to occur at New Caledonia),

Material

Total: 322 specimens (including 288 specimens listed by FRICKE, 1983).

Coral Sea, Chesterfield Islands: SMNS 21231, 1 female, 37.7 mm SL; northeastern lagoon, 19°41'28''S 158°15'37''E, 23 m depth; B. RICHER DE FORGES, Cruise CORAIL 2, St. 163; 2 Aug. 1988.

New Caledonia, Grande Terre: SMNS 21242, 2 males, 22.9–24.0 mm SL; Passe de Saint-Vincent, 60 km WNW of Nouméa, 22°02'06''S 165°57'00''E, 4 m depth; M. KULBICKI, R/V "Alis", St. 4; 21 Mar. 1990. – SMNS 21292, 2 specimens, 25.4–38.0 mm SL; Tiaré area, 22°10'40''S 166°15'50''E, 4 m depth, seagrass and sand; M. KULBICKI, 11 July 1996.

Loyalty Islands: MNHN 1980-0123, 1 specimen; P. FOURMANOIR; 1973. – SMNS 21287, 1 specimen, 27.3 mm SL; Ouvéa Atoll, Ile Angeu, 20°26'54''S 166°24'00''E, 3 m depth; J. T. WILLIAMS, R/V "Alis", St. JTW 91-18; 19 Nov. 1991. – USNM 319872, 1 specimen; Ouvéa Atoll, southern section of lagoon, off Gee Islet on lagoon side, 20°39'30''S 166°23'00''E, 18 m depth; J. T. WILLIAMS, P. TIRARD & J.-L. MENOU; 14 Nov. 1991. – USNM 319873, 10 specimens; same data as SMNS 21287.

Comparison material. **Cocos Keeling Islands:** ANSP 149657, 1 specimen, 16.7 mm SL; West Island, ocean side, cove on N end, 12°08'22''S 96°49'00''E, 0.5–1.0 m depth; W. F. SMITH-VANIZ et alii; 1974. – ANSP 149658, 2 specimens, 32.6–41.5 mm SL; Direction Island, tidal channel and adjacent sandy area at S end of island, 12°05'35''S 96°53'10''E, 1.5–5.0 m depth; W. F. SMITH-VANIZ & P. L. COLIN; 31 Mar. 1974.

Solomon Islands: AMS I.39030-106, 1 specimen; Santa Cruz Islands, Duff Islands, Lakao Island, Temomoa Point, 09°47'54''S 165°05'18''E, 0–10 m depth; M. MCGROUTHER et alii; 24 Sep. 1998. – USNM 357264, 1 specimen; Santa Cruz Islands, Duff Island, Lakao at NW end at Temomoa Point, 09°47'54''S 165°05'18''E, 0–10 m depth; J. T. WILLIAMS et alii; 24 Sep. 1998.

Vanuatu: AMS I.37928-009, 3 specimens, 20.8–33.6 mm SL; Banks Group, Rowa Island, leeward side of reef, NW side, 13°38'S 167°30'E, 1–7 m depth; M. MCGROUTHER et alii; 20 May 1997.

Kiribati, Gilbert Islands: AMS I.18027-002, 1 female, 20 mm SL; Betio Island, Tarawa; D. F. HOESE; 1 Nov. 1973. – AMS I.18038-014, 1 specimen; off Ribona Island, Abaiang Atoll; D. F. HOESE & B. GOLDMAN; 5 Nov. 1973.

Tonga: USNM 334459, 1 specimen; E'ua Island, reef just S of Ohonua Harbour, 21°20'15''S 174°58'14''W , 18–26 m depth; J. T. WILLIAMS et alii; 2 Nov. 1993. – USNM 338555, 6 specimens; Vava'u Group, Vava'u Island, W of Vaipuua, a point NW of Mount Talau, 18°38'23''S 173°59'54''W, 0–1.3 m depth; J. T. WILLIAMS et alii; 16 Nov. 1993.

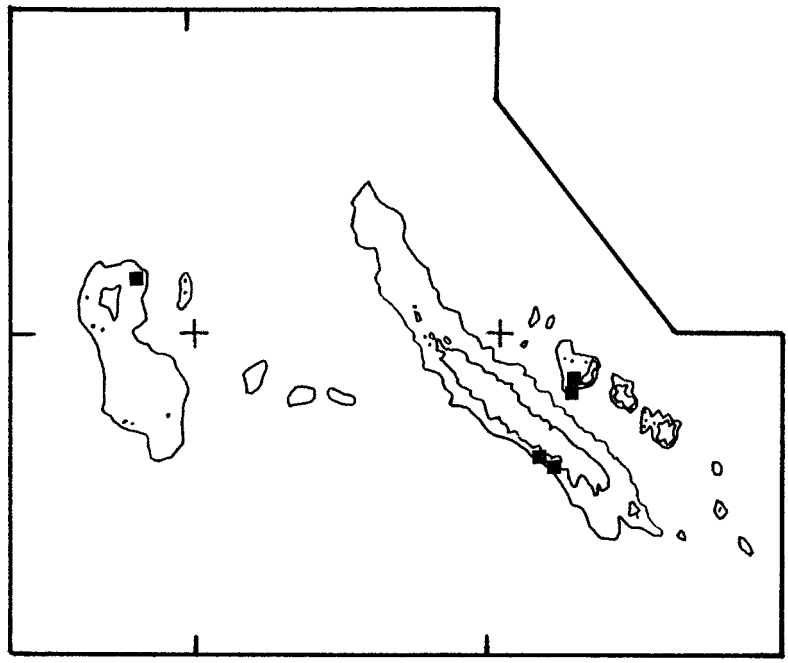
Distribution

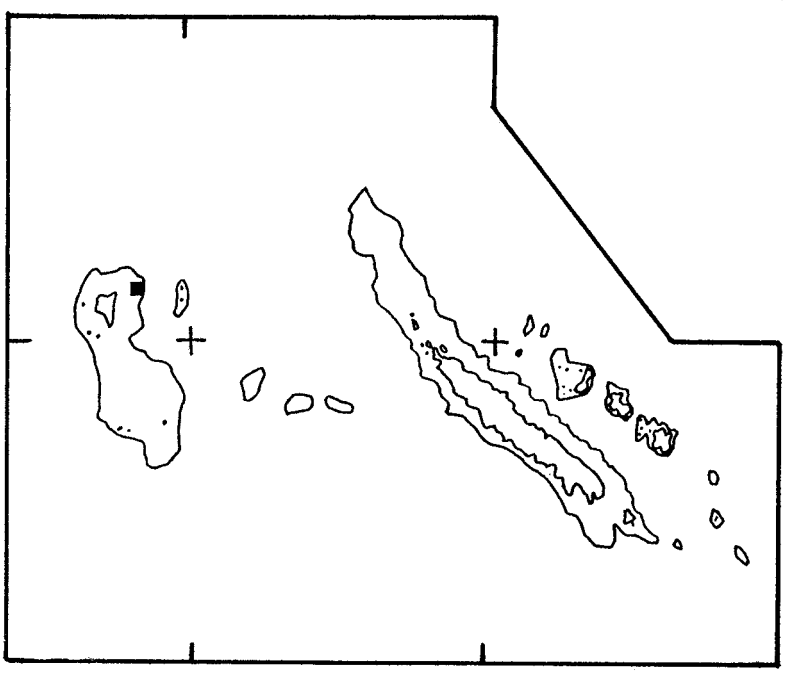
Coral Sea (Chesterfield Islands); New Caledonia (Grande Terre; new record); Loyalty Islands (new record) (Fig. 11). Outside the area, the species is distributed from the Cocos Keeling Islands in the west, Vietnam, China and the Philippines in the north to Australia in the south, Marshall Islands, Solomon Islands (new record), Vanuatu (new record) and Kiribati/Gilbert Islands (new record) in the east, Tonga (new record) and Cook Islands in the southeast; the species is living in lagoons and on sand patches around coral reefs at depths of 0–34 m. Rotuma.

4.11. *Synchiropus circularis* Fricke, 1984

Synchiropus (Synchiropus) circularis Fricke, 1984: 68–71, fig. 1 (Beach Cave Cove, northwest of Tinian Town, Tinian, Marianas Islands, 14°59.7'N 145°36.2'E; holotype: USNM 267390, ex University of Guam 5130).

Synchiropus circularis: KULBICKI, RANDALL & RIVATON, 1994: 33 (Chesterfield Islands, 5 m depth). – RANDALL, ALLEN & STEENE, 1997: 524, photo (Chesterfield Bank, 3.0–7.5 m depth, reef). – MYERS, 1999: 232 (Philippines, Marianas, and Chesterfield Banks).





Figs 11–12. Geographical distribution of callionymid fish species in New Caledonian waters. – 11. *Diplogrammus goramensis (above);* – 12. *Synchiropus circularis (below).*

Material

Total: 7 specimens (including 5 specimens listed by FRICKE, 1984).

Comparison material. **Philippines:** ROM 53502, 1 male, 30.1 mm SL, and 1 female, 44.8 mm SL; Visayas, Sumilon Island, Cebu Strait, 9°26'07''N 123°23'04''E, 3.7–7.6 m depth; D. JOHNSON et alii; 21 May 1987.

Distribution

Coral Sea (Chesterfield Islands) (Fig. 12). Outside the area, Malaysia (Sabah), Philippines and Mariana Islands. New record for Malaysia.

Remarks

Record from Malaysia based on underwater photo of mating specimens from Sabah by R. YIN (La Jolla, U.S.A.), taken in October, 1999.

4.12. *Synchiropus morrisoni* Schultz in Schultz et alii, 1960

Synchiropus morrisoni Schultz in Schultz et alii, 1960: 409–410, fig. 132 (Bikini Atoll; holotype: USNM 141126). – FRICKE, 1981b: 98–102, figs 30–31 (revision; Caroline Islands and American Samoa). – FRICKE, 1983: 630–635, figs 195–196 (revision; western and central Pacific). – KULBICKI, RANDALL & RIVATON, 1994: 33 (Chesterfield Islands, 8 m depth, based on photography).

Distribution

Chesterfield Islands (Fig. 13). Outside the area, Western Australia, southern Japan, Ryukyu Islands and northern Sulawesi/Indonesia to Marshall Islands and American Samoa. New record from Lembeh Strait, northern Sulawesi, Indonesia, based on color photo by C. PETRINOS (Athens, Greece) (C. PETRINOS, personal communication, May 2000).

4.13. *Synchiropus novaecaledoniae* Fricke, 1993

Synchiropus novaecaledoniae Fricke, 1993: 372–374, fig. 3 (New Caledonia; holotype: MNHN 1993-0140).

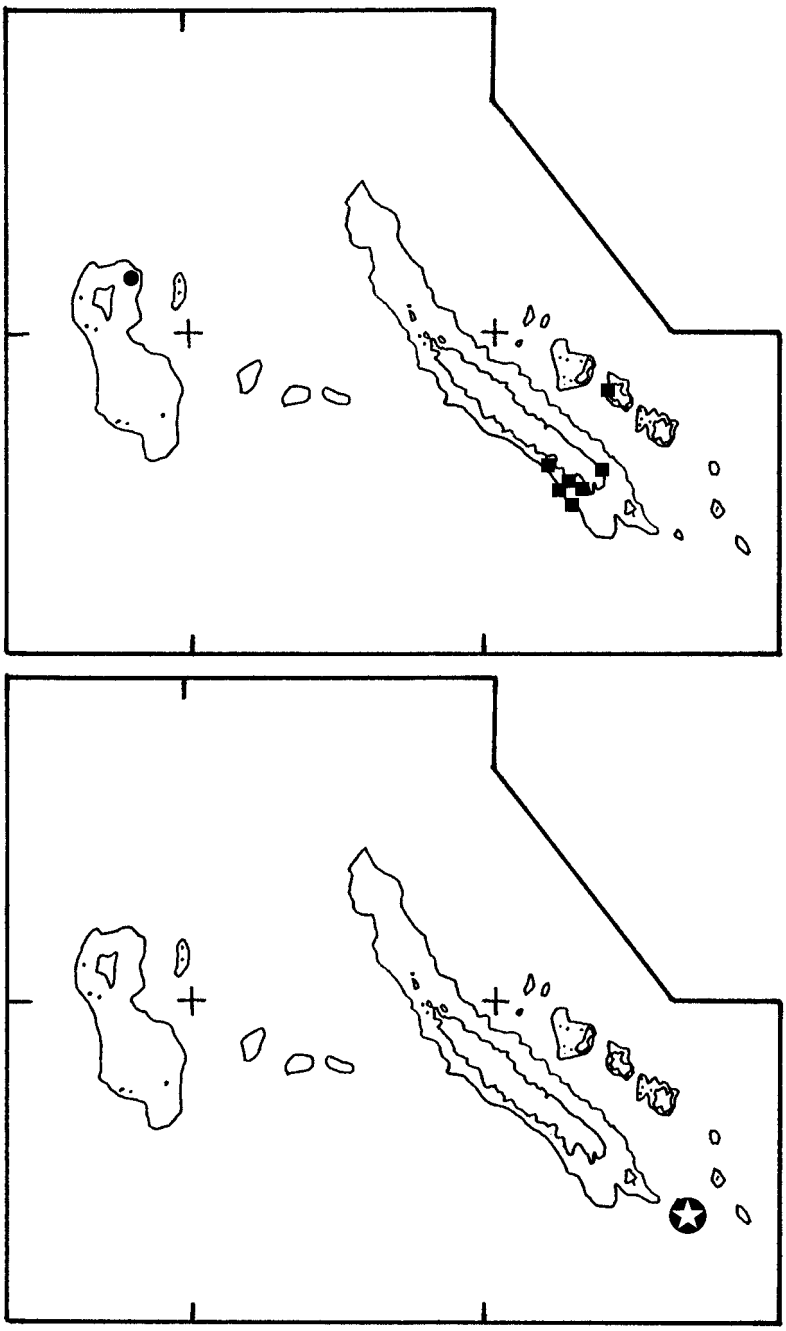
Material

Total: 18 specimens.

Holotype. **New Caledonia, Norfolk Ridge, West Jumeau Seamount:** MNHN 1993-0140, male, 68.9 mm SL; 23°40.1'S 167°59.7'E, 246 m depth; R/V "Vauban", St. DW.14; 22 May 1987.

Paratypes. **New Caledonia, Norfolk Ridge, West Jumeau Seamount:** MNHN 1993-0138, 1 female, 45.2 mm SL; same data as the holotype. – MNHN 1993-0139, 1 female, 27.8 mm SL; 23°41.4'S 168°00.6'E, 230–240 m depth; R/V "Alis", St. DW.73; 7 Sep. 1989. – SMNS 12540, 2 females, 33.7–ca. 35 mm SL (second specimen head only); 23°41.2'S 168°00.5'E, 240–280 m depth; R/V "Alis", St. DW.76; 7 Sep. 1989.
New Caledonia, Norfolk Ridge, unnamed seamount: SMNS 12539, 1 female, 33.1 mm SL; 23°21.2'S 168°04.9'E, 225–270 m depth; R/V "Alis", St. DW.101; 14 Sep. 1989.

Other material. **New Caledonia, Norfolk Ridge, West Jumeau Seamount:** NMNZ P.29044, 2 males, 52.3–57.7 mm SL; 23°41.30'S 168°00.57'E – 23°40.52'S 168°00.52'E, 230–250 m depth; R/V "Alis", Cruise BERYX 11; 20 Oct. 1992. – NMNZ P.29110, 1 female, 49.4 mm SL; 23°41.48'S 168°00.65'E – 23°41.70'S 168°00.22'E, 240–300 m depth; R/V "Alis", Cruise BERYX 11; 20 Oct. 1992. – NMNZ P.29144, 1 female, 55.8 mm SL; 23°42.00'S 168°01.25'E – 23°42.90'S 168°01.25'E, 300–350 m depth; R/V "Alis", Cruise BERYX 11; 20 Oct. 1992. – SMNS 11613, 2 specimens; 23°40'36''S 168°01'06''E; R/V "Alis", St. DW.70;



Figs 13–14. Geographical distribution of *Synchiropus* species in New Caledonian waters. – 13. *S. morrisoni* (circles) and *S. ocellatus* (squares) *(above);* – 14. *S. novaecaledoniae (below).*

7 Sep. 1989. – SMNS 21265, 5 specimens, 50.3–64.1 mm SL; 23°41'40''S 168°00'42''E, 260 m depth; B. RICHER DE FORGES, R/V "Alis", Cruise BATHUS 3, St. 804; 27 Dec. 1993. – SMNS 21275, 2 specimens, 54.0–65.2 mm SL; 23°40'16.2''S 168°00'57''E, 280 m depth; LE HODEY, R/V "Alis", Cruise BERYX 11, St. CP.45; 20 Oct. 1992. – SMNS 21288, 1 specimen, 45.7 mm SL; 23°39'04.2''S 167°59'04.2''E, 280 m depth; R/V "Vauban", St. DW.20 SMIB-3; 23 May 1987.

Distribution

New Caledonia, Norfolk Ridge (West Jumeau Seamount) (Fig. 14). The species is found at depths of 225–350 m on the submarine ridge southeast of the Ile des Pins. It is endemic to the area.

Remarks

In addition to the original description, the life colouration of the species was documented (based on colour photographs by C. D. ROBERTS of NMNZ specimens): Head and body rose grey, with brown spots, blotches and streaks.

Male: First dorsal fin basally dark brown, distally yellow. Second dorsal fin with vertical yellow streaks, distal margin yellow. Caudal fin with vertical rows of yellow spots. Caudal fin base with two large yellow blotches. Other fins translucent or whitish.

Female: Body with yellowish spots. First dorsal fin anteriorly bluish white, posteriorly greyish, third membrane with a black ocellus. Second dorsal fin with oblique stripes of yellowish brown.

4.14. *Synchiropus ocellatus* (Pallas, 1770) (Fig. 15)

CAAB Code (Australia): 37 427032

Callionymus ocellatus Pallas, 1770: 25–28, pl. 4, figs. 1–3 (Amboina/Ambon Island, Moluccas/Maluku, Indonesia; neotype: SMNS 21263, as designated below).

Synchiropus (Synchiropus) ocellatus: FRICKE, 1981b: 90–97, figs. 28–29 (Okinawa, Vietnam, Indonesia, Philippines, Palau, Yap, New Guinea, Australia/Queensland, New Caledonia, Fiji, Tonga). – FRICKE, 1983: 635–642, fig. 197 (Japan/Izu Islands, Ryukyu Islands, Philippines, Caroline Islands/Ponape, Indonesia, New Guinea, New Britain, Queensland, Fiji, Marquesas Islands, Pitcairn).

Neosynchiropus ocellatus: NAKABO, 1991b: 2–5 (early juveniles; Okinawa and Izu, Japan). – NAKABO, 1993: 990, fig. (Japan; with pictorial key).

Synchiropus ocellatus: RIVATON, FOURMANOIR, BOURRET & KULBICKI, 1989: 31 (Nouvelle-Calédonie/New Caledonia, in checklist). – FRICKE, 1993: 374 (New Caledonia). – ALLEN, 1996: 111 (Scott Reef, north-western Australia). – YEARSLEY, LAST & MORRIS, 1997: Appendix D (CAAB Code).

Material

Total: 178 specimens (including 158 specimens listed by FRICKE, 1981b, 1983).

Material from the study area. **New Caledonia, Grande Terre:** AMS IB.7082, 1 male, 68.2 mm SL; R. CATALA; 30 Dec. 1963. – NMNZ P.29600, 1 male (44.7 mm SL) and 1 female (44.2 mm SL); Goeland Cay, 6 nautical miles off Nouméa, 22°23'S 166°23'E, 2–3 m depth; C. D. ROBERTS & M. KULBICKI; 27 Oct. 1992. – NMNZ P.29479, 1 male, 48.3 mm SL; same data as NMNZ P.29600. – SMNS 18313, 4 specimens, 23.2–40.8 mm SL; southeastern coast, Touaourou, 6 km SE of Yaté, 22°10'36''S 166°57'51''E, 0–0.6 m depth, lagoon area at low tide; R. FRICKE; 26 July 1996. – SMNS 21245, 1 female, 16.9 mm SL; Passe de Saint-Vincent, 60 km WNW of Nouméa, 22°02'06''S 164°57'00''E, 4 m depth; M. KULBICKI, R/V "Alis", St. 4; 21 Mar. 1990. – SMNS 21264, 2 specimens, 44.7–52.7 mm SL; Grande Rade, Baie de Numbo, 22°18'51''S 166°27'29''E, 6 m depth, coral and sand; M. KULBICKI; 1 Apr. 1999. – SMNS 21299, 1 specimen, 18.3 mm SL; Récif Abore 1, 22°23'50''S 166°18'10''E, 5 m depth, coral and

sand; M. Kulbicki; 5 Aug. 1996. – SMNS 22090, 1 specimen; NE coast, Province Nord, 4 km NW Tao, 25 km NW Hienghène, 20°31'49''S 164°47'01''E, 0.2–3.5 m depth; R. Fricke; 13 May 2000.
Loyalty Islands: SMNS 21675, 1 specimen; Baie du Santal, 2 km NNE Peng, 8 km S Xepenehé, Lifou Island, 20°51'46''S 167°09'35''E, coralline rocks, 2 m depth; R. Fricke; 18 July 1999. – SMNS 22117, 1 specimen; same data as SMNS 21675; 20 May 2000.

Comparison material. **Solomon Islands:** AMS I.39010-137, 1 specimen; Santa Cruz Islands, Reef and Lomlom Islands, Nialo Point, east side of Forrest Pass, 10°16'00''S 166°18'30''E, 0–35 m depth; M. McGrouther et alii; 18 Sep. 1998.
Vanuatu: AMS I.37308-033, 1 male; Erromango Island, 0–3 m depth; M. McGrouther et alii; 26 May 1996. – AMS I.37332-028, 1 female; Namuka Islands, south of Epi Island, 16°49.63'S 168°22.35'E, 0–2 m depth; J. T. Williams et alii; 11 June 1996. – USNM 343884, 1 female, 21.9 mm SL; Shepherd Islands, Namuka Island, W side of island along rocky and sandy shore, 16°49'37''S 168°22'15''E, 0–2 m depth; J. T. Williams et alii, M/V "Lewia"; 11 June 1996. – USNM 343885, 1 subadult, 8.9 mm SL, Shepherd Islands, Tongoa Island, Judy Reef at NW tip of island, 16°52'30''S 168°31'30''E, 1–6 m depth; J. T. Williams et alii, M/V "Lewia"; 9 June 1996. – USNM 343886, 1 male, 49.4 mm SL; Erromango Island, Dillon's Bay, tide pool on SW side of bay along Williams Point, 18°49'39''S 169°00'23''E, 0–1 m depth; J. T. Williams, M/V "Lewia"; 25–26 May 1996. – USNM 343906, 1 female, 20.5 mm SL; Erromango Island, Port Narevin, SE edge of harbor, rocky shore through a surge channel through reef to sand, 0–6 m depth; J. T. Williams et alii, M/V "Lewia"; 28 May 1996.

Distribution

New Caledonia (Grande Terre); Loyalty Islands (Lifou; new record) (Fig. 13). Outside the area, the species is widespread in the western and central Pacific, between Vietnam, Indonesia, Japan, northern Australia, Marquesas Islands and Pitcairn; it is found from the intertidal zone to depths of at least 30 m. New record from Solomon Islands.

Remarks

This species was previously only recorded from New Caledonia on the basis of a single specimen (AMS IB.7082), with no precise locality stated.

Pallas (1770: 25–28, pl. 4, figs 1–3) described and illustrated his *Callionymus ocellatus* on the basis of two specimens, a male and a female. Though the illustration is of a relatively high quality, it is impossible to identify the description and illustration to the species level, as important characters are not mentioned or shown; Pallas's species may have either been based on *Synchiropus bartelsi* Fricke, 1981, *S. moyeri* Zaiser & Fricke, 1985, *S. ocellatus,* or *S. stellatus* Smith, 1963. No type material could be detected (Eschmeyer, 1998: 1223; own research, see Fricke, 1982b: 77). Type material of this species was not found in collections housing Pallas materials, neither in the ZISP, St Petersburg nor in the ZMB, Berlin. The original illustration was probably directly taken from specimens which were then discarded and never reached a museum collection. In order to stabilize the present taxonomic status and usage of the name (in the sense of Fricke, 1983: 635–642, fig. 197, including diagnosis), I hereby designate the following specimen as the neotype of *Callionymus ocellatus* Pallas, 1770 (which well agrees with the description and the male specimen illustrated by Pallas, 1770: pl. 4, fig. 1; as no good specimen from the former type locality Ambon is available, I am choosing a specimen in good condition from Cebu Island in the southern Philippines which originates from a locality that seems close enough):

Neotype. SMNS 21263, male, 72.8 mm SL, 94.3 mm TL; Philippines: Santa Rosa, Lapu Lapu City, Cebu Island, 10°19'S 123°57'E; Tropical Fish Exporter; Mar. 1980.

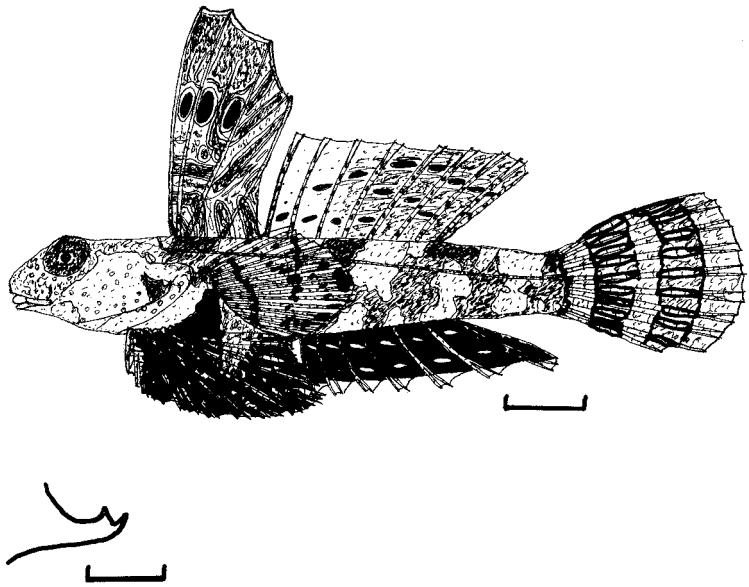


Fig. 15. *Synchiropus ocellatus* (Pallas, 1770); Philippines, Cebu Island, Lapu Lapu City, SMNS 21263, neotype, male, 72.8 mm SL. – *Above,* lateral view (scale: 10 mm); – *below,* left preopercular spine (scale: 2 mm).

Description of neotype: D_1 IV; D_2 8; A i,6; P_1 ii,16–17,i (total 19–20); P_2 I,5; C (ii),i,7,ii,(ii).

Body elongate and depressed. Head slightly depressed, 3.8 in SL. Eye 2.8 in head. Preorbital length 3.2 in head. Interorbital distance 7.6 in head. Maxillary length 3.6 in head. Preopercular spine length 6.3 in head. Preopercular spine formula – $\frac{1}{-}$ 1. Body depth 5.3 in SL. Body width 4.2 in SL. Urogenital papilla 18.3 in head. Caudal peduncle length 5.1 in SL. Caudal peduncle depth 9.8 in SL.

First dorsal fin high, all spines elongate, without filaments; first spine 2.4 in SL, 2nd spine 2.4, 3rd spine 2.6, 4th spine 3.6. Predorsal (1) length 3.25 in SL. Second dorsal fin rays branched, the last divided at its base. First ray of second dorsal fin 5.1 in SL, 5th ray 4.4, last ray 4.6. Predorsal (2) length 2.2 in SL. Anal fin beginning on a vertical through 2nd membrane of second dorsal fin. Anal fin rays branched except for the first, the last divided at its base. First anal fin ray 9.7 in SL, 5th ray 5.3, last ray 4.9. Preanal fin length 1.9 in SL. Pectoral fin reaching to 3rd anal fin membrane when laid back. Pectoral fin length 4.1 in SL. Prepectoral fin length 2.7 in SL. Pelvic fin reaching to 2nd anal fin membrane when laid back. Pelvic fin spine 12.6 in SL; pelvic fin length 2.8. Prepelvic fin length 4.6 in SL. Caudal fin distally convex; caudal fin length 3.2 in SL.

Colouration as described by FRICKE (1983: 641); the first dorsal fin has three ocelli (Fig. 15).

4.15. *Synchiropus orstom* **n.sp.** (Fig. 16)

Synchiropus (Synchiropus) altivelis (non Temminck & Schlegel, 1845): FRICKE, 1993: 371–372 (part: New Caledonia).

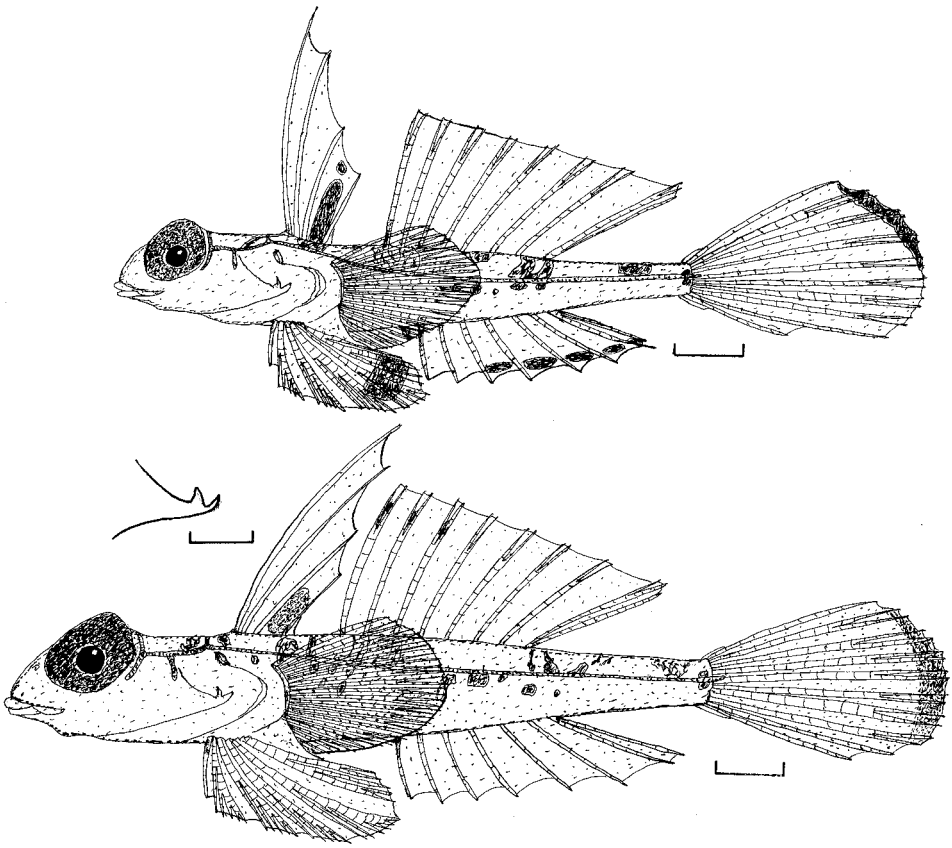


Fig. 16. *Synchiropus orstom,* n.sp.; New Caledonia, East Jumeau Seamount, 402 m depth; MNHN 1999–1254, holotype, male, 85.2 mm SL. – *Above,* lateral view (scale: 10 mm); – *centre,* left preopercular spine (scale: 3 mm); – SMNS 21276, female, 104.3 mm SL; *below,* lateral view (scale: 10 mm).

Material

Total: 6 specimens.

Holotype. **New Caledonia, Norfolk Ridge, East Jumeau Seamont:** MNHN 1999-1254, male, 85.2 mm SL; 23°45'52.2''S 168°16'57''E, 402 m depth; C. Debitus, R/V "Alis", Cruise SMIB.8, St. DW.179; 30 Jan. 1993.

Paratypes. **New Caledonia, Norfolk Ridge, Aztèque Seamount:** SMNS 11612, 1 male, 105.5 mm SL; 23°37'30''S 167°42'06''E, 460 m depth; R/V "Alis", St. Aztèque 7; 14 Feb. 1990. **New Caledonia, Norfolk Ridge, East Jumeau Semount:** SMNS 21276, 1 female, 104.3 mm SL; same data as the holotype.

Other material. **New Caledonia, Norfolk Ridge, East Jumeau Seamount:** NMNZ P.29340, 1 male (99.4 mm SL) and 1 female (96.6 mm SL); 23°44.50'S 168°16.70'E – 23°45.30'S 168°16.80'E, 390–400 m depth; R/V "Alis", Cruise BERYX 11; 21 Oct. 1992. – NMNZ P.29373, 1 male, 110.9 mm SL; 23°44.80'S 168°16.85'E – 23°40.50'S 168°15.52'E, 390–420 m depth; R/V "Alis", Cruise BERYX 11; 21 Oct. 1992.

Etymology

The new species is named after the O.R.S.T.O.M. (Office de la Recherche Scientifique et Technique Outre-Mer; now named I.R.D., Institut de Recherche pour le Développement) ap-

preciating the great effort in exploring the New Caledonian marine biodiversity. Most of the New Caledonian callionymid fish material was obtained during research cruises of the Centre de Nouméa of that institution. In the species name, the acronym is used as a noun in apposition.

Diagnosis

A *Synchiropus* of the *Synchiropus-altivelis* species-group of the subgenus *Synchiropus* with 8 rays in the second dorsal fin, 7 anal fin rays, 20–22 pectoral fin rays; a preopercular spine with a thin, short, upcurved main tip and with a strong, vertical, curved point on its dorsal margin; eye of a medium size, eye diameter 2.1–2.5 in head; first dorsal fin higher than second dorsal fin in both sexes, first spine in the male with a short filament; second dorsal fin distally straight in both sexes, first ray not elongate in the male; anal fin relatively low; caudal fin elongate, without filaments; the first dorsal fin with an elongate dark blotch basally on the third membrane; the anal fin distally spotted in the male, pale in the female; the caudal fin distally dark; the pelvic fin distally dark grey in the male.

Description

D_1 IV (IV); D_2 8 (8); A vi,1 (vi,1); P_1 i,17–18,ii, total 20–21 (i,17–19,ii, total 20–22); P_2 I,5 (I,5); C (i),i,7,ii,(i) ((i),i,7,ii,(i)).

Body elongate and slightly depressed. Head slightly depressed, 3.6 (3.3–3.7) in SL. Eye 2.5 (2.1–2.4) in head. Preorbital length 4.7 (4.3–4.4) in head. Interorbital distance 14.4 (15.5–28.4) in head. Maxillary length 3.6 (3.7) in head. Occipital region with two low bony protuberances. Preopercular spine with a thin, short, upcurved main tip; with a strong, vertical, curved point on its dorsal margin; a smooth ventral margin; and lacking an antrorse spine at its base (Fig. 16, centre). Preopercular spine length 5.5 (4.7–6.0) in head. Preopercular spine formula – $\frac{1}{-}$ 1 (– $\frac{1}{-}$ 1). Lateral lines of the opposite sides of the body interconnected by a commissure across the predorsal region. Body depth 6.7 (6.1–6.2) in SL. Body width 5.6 (5.1–5.4) in SL. Urogenital papilla in the male 14.8 (12.2) in head, in the female not visible. Caudal peduncle length 4.2 (4.5–5.2) in SL. Caudal peduncle depth 17.0 (16.8–18.6) in SL.

First dorsal fin high in both sexes, the first spine in the male with a short filament; length of first spine in the male 2.5 (3.4) in SL, 2nd spine 2.9 (3.9), 3rd spine 5.0 (6.0), 4th spine 7.3 (8.8); 1st spine in the female 2.6 in SL, 2nd spine 3.2, 3rd spine 5.0, 4th spine 9.2. Predorsal (1) length 3.3 (3.0–3.1). Second dorsal fin rays branched, the last divided at its base. First ray of second dorsal fin in the male 4.0 (3.7) in SL, 5th ray 6.4 (6.2), last ray 3.6 (3.8); 1st ray in the female 4.2 in SL, 5th ray 5.2, last ray 4.8. Predorsal (2) length 2.2 (2.1). Anal fin beginning on a vertical through 2nd or 3rd membrane of second dorsal fin. Anal fin rays unbranched, the last divided at its base. First anal fin ray in the male 10.2 (10.8), 5th ray 6.4 (6.5), last ray 5.2 (4.6); 1st ray in the female 11.7 in SL, 5th ray 5.9, last ray 5.8. Preanal fin length 1.9 (1.8). Pectoral fin reaching to 2nd or 3rd anal fin membrane when laid back. Pectoral fin length 4.2 (4.0–4.4) in SL. Prepectoral fin length 2.6 (2.5–2.6). Pelvic fin reaching to 1st anal fin membrane when laid back. Pelvic fin spine 12.9 (11.5) in SL; pelvic fin length 3.3 (3.2–3.4) in SL. Prepelvic fin length 3.6 (3.4–3.8). Caudal fin distally slightly elongate, longer in males than in females, lacking filaments in both sexes; caudal fin length in the male 2.4 (2.5) in SL, in the female 3.0 in SL.

Colour in alcohol. Head and body pale, back and sides of body with irregular brown spots and saddles. Eye dark grey. First dorsal fin pale, third membrane in the

male with an elongate blackish blotch on the basal three-fourths and a small distal black spot; in the female with a grey blotch on the basal half. Second dorsal pale; anterior rays in the female with a distal grey spot each. Anal fin pale, 3rd to last membranes in the male with distal dark grey blotches. Caudal fin pale; in the male upper distal margin dark grey, in the female whole distal margin greyish. Pelvic fins pale, in the male with a distal grey blotch. Pectoral fin translucent.

Sexual dimorphism. Males have a higher first dorsal fin than females, a longer caudal fin, a longer urogenital papilla, and a slightly different colouration of the first and second dorsal, anal, caudal and pelvic fins.

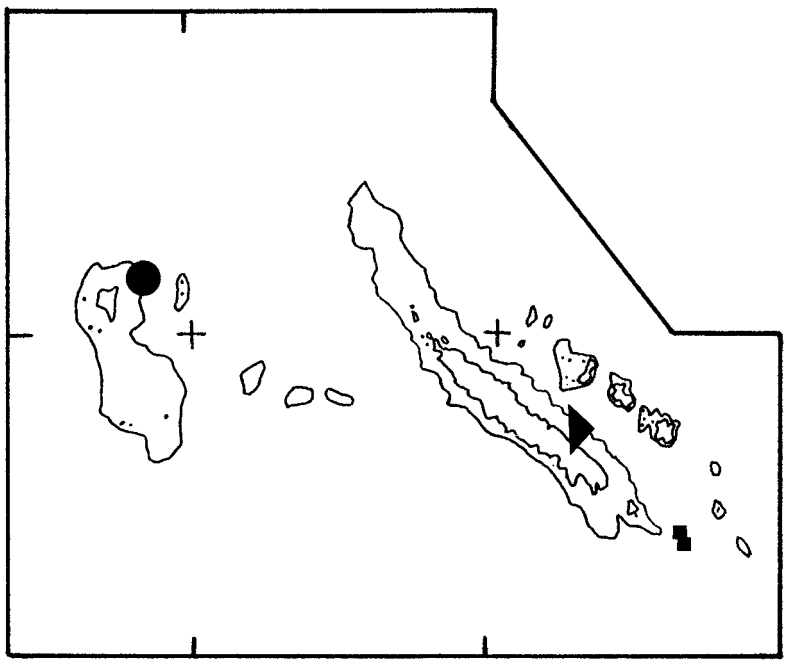
Distribution

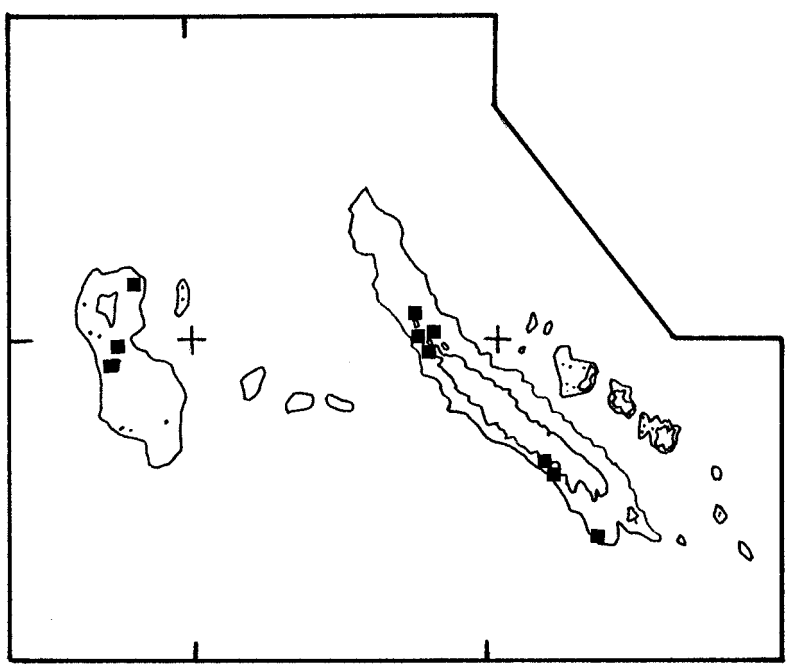
The new species is known only from the East Jumeau and Aztèque seamounts, situated on the Norfolk Ridge, ESE of Grande Terre, New Caledonia (Fig. 17); it was collected at depths of 390–460 m.

Relationships

Synchiropus orstom **n.sp.** is a member of the *Synchiropus-altivelis* species-group (other species of the group see description of *S. altivelis,* 5.7.). It is distinguished from other species with a medium-sized eye (eye diameter 2.3–3.0 in head length) by the short, upcurved main tip of its preopercular spine (long in *S. hawaiiensis, S. monacanthus, S. novaecaledoniae, S. paxtoni;* straight in *S. grinnelli, S. hawaiiensis, S. kanmuensis, S. kinmeiensis, S. novaecaledoniae*), the vertical dorsal point on the preopercular spine (recurved in *S. australis, S. hawaiiensis, S. masudai, S. paxtoni*), the first dorsal fin in higher than the second dorsal fin in both sexes (same height as second dorsal fin in *S. delandi;* lower in the male in *S. hawaiiensis,* lower in both sexes in *S. kinmeiensis,* lower in the female in *S. masudai*), first spine of second dorsal fin elongate in males (not elongate in *S. australis, S. grinnelli, S. monacanthus*), single filament in male's first dorsal fin (no filament in *S. monacanthus* and *S. richeri,* 3 filaments in *S. novaecaledoniae*), the high second dorsal fin (low in *S. grinnelli* and *S. kanmuensis*), the second dorsal fin distally convex in both sexes (distally straight in male *S. australis, S. grinnelli, S. kanmuensis, S. novaecaledoniae;* distally straight in females of all other species except *S. paxtoni*), the lacking caudal fin filaments (filaments present in *S. australis,* male *S. grinnelli, S. kamoharai,* male *S. kanmuensis, S. kinmeiensis, S. masudai, S. paxtoni,* and *S. richeri*), third membrane of first dorsal fin in males with a dark blotch (pale in *S. delandi, S. kanmuensis, S. masudai;* striped in *S. kamoharai, S. monacanthus, S. novaecaledoniae*), third membrane of first dorsal fin in females with a dark blotch (pale in *S. kanmuensis, S. masudai, S. paxtoni;* striped in *S. kamoharai;* basally dark in *S. monacanthus*), anal fin in the male distally spotted (pale in *S. hawaiiensis, S. kamoharai, S. kanmuensis, S. kinmeiensis, S. masudai, S. novaecaledoniae, S. paxtoni, S. richeri*), anal fin in the female pale (distally spotted in *S. hawaiiensis, S. kamoharai*), caudal fin distally dark (pale in male *S. hawaiiensis, S. kamoharai, S. kanmuensis, S. novaecaledoniae, S. paxtoni, S. richeri*), and the pale pelvic fins (distally dark in *S. australis, S. delandi, S. grinnelli, S. masudai,* male *S. monacanthus;* with two rows of dark spots in *S. hawaiiensis*).

Synchiropus richeri also differs from *S. orstom* in having a higher second dorsal fin and a lower first dorsal fin; *S. signipinnis* differs in having a lower first dorsal fin in females with is distally dark, lacking a basal dark blotch on third membrane, a short-





Figs 17–18. Geographical distribution of *Synchiropus* species in New Caledonian waters. – 17. *S. orstom* (squares), *S. richeri* (triangle) and *S. signipinnis* (circle) *(above);* – 18. *S. rameus (below).*

er caudal fin, a longer main tip of the preopercular spine, a pale first dorsal fin, anal fin, caudal and pelvic fin in the male.

Remarks

This species was regarded by Fricke (1993) as belonging to *S. altivelis.* When subsequently additional material became available, East Jumeau and Aztèque seamount specimens were found to be consistently different from NW Pacific material of *S. altivelis.*

4.16. *Synchiropus rameus* (McCulloch, 1926)

CAAB Code (Australia): 37 427009

Callionymus, Calliurichthys, rameus McCulloch, 1926: 201–203, pl. 53 (Cape Capricorn, Queensland, Australia; holotype: AMS E.6504, not found according to Eschmeyer, 1998: 1423).

Synchiropus (Orbonymus) rameus: Fricke, 1981b: 144–148, fig. 45 (Western Australia, northern Australia). – Fricke, 1983: 684–687, fig. 212 (New Caledonia, Western Australia, Gulf of Carpentaria/Queensland; 23–75 m). – Sainsbury, Kailola & Leyland, 1985: 346 (Northwest Shelf and Kimberley region, northwestern Australia).

Orbonymus rameus: Rivaton, 1989: 145 (Iles Chesterfield).

Synchiropus rameus: Kulbicki & Wantiez, 1990: 124 (St. Vincent Bay, New Caledonia). – Fricke, 1993: 374 (New Caledonia). – Rivaton, Fourmanoir, Bourret & Kulbicki, 1989: 31 (Nouvelle-Calédonie/New Caledonia, in checklist). – Kulbicki, Randall & Rivaton, 1994: 33 (Chesterfield Islands, 91 m depth). – Yearsley, Last & Morris, 1997: Appendix D (CAAB Code).

Material

Total: 34 specimens (including 6 specimens listed by Fricke, 1981b, 1983).

Material from the study area. **Coral Sea, Chesterfield Islands:** SMNS 21270, 2 specimens, 60.5–62.7 mm SL; 19°17'54''S 158°34'15''E, 65–68 m depth; B. Richer de Forges, R/V "Coriolis", Cruise CHALCAL, St. CP.7; 18 July 1984. – SMNS 21279, 7 specimens, 45.1–74.0 mm SL; 20°35'18''S 158°47'24''E, 67 m depth; B. Richer de Forges, R/V "Coriolis", Cruise CHALCAL 1, St. CP.12; 23 July 1984. – SMNS 21280, 1 specimen, 70.9 mm SL; 20°50'57.6''S 158°36'37.2''E, 70 m depth; B. Richer de Forges, R/V "Coriolis", Cruise CHALCAL 1, St. CP.13; 23 July 1984.

New Caledonia, islands north of Grande Terre: SMNS 11615, 1 specimen; Ile Art, S shore, 19°57'18''S 163°52'48''E, 25–26 m depth; R/V "Alis", St. CP.1068; 24 Oct. 1989. – SMNS 11617, 1 specimen; reef 15 km WNW Ile Yandé, 19°59'06''S 163°52'30''E, 24–30 m depth; R/V "Alis", St. CP.1069; 24 Oct. 1989. – SMNS 11906, 1 specimen; 35 km ESE Ile Art, 19°50'48''S 164°00'E, 28 m depth; R/V "Alis", St. DW.1073; 24 Oct. 1989. – SMNS 11907, 1 specimen; 5 km W Ile Pott, 19°35'18''S 163°24'36''E, 48 m depth; R/V "Alis", St. DW.1192; 1 Nov. 1989.

New Caledonia Grande Terre: MNHN 1980-0947, 1 female, 64.0 mm SL; M.-L. Bauchot & L. A. Maugé; 1980. – MNHN 1993-0141, 1 specimen; Baie de Saint-Vincent Sud, 22°05'05''S 166°05'E, 15 m depth, M. Kulbicki; 20 Nov. 1989. – SMNS 9888, 1 specimen; same data as MNHN 1993-0141. – SMNS 11908, 1 specimen; S part of Baie de Saint-Vincent, 22°06'12''S 166°05'48''E, 17 m depth; R/V "Vauban", St. DW.175; 18 Sep. 1984. – SMNS 17846, 2 specimens, 89.9–92.0 mm SL; northwestern lagoon, 30 km WNW of Poum, 20°04'18''S 163°32'12''E, 27 m depth; O.R.S.T.O.M., Nouméa, St. 1023; 3 Apr. 1988. – SMNS 21311, 1 specimen, 34.7 mm SL; 22°04'30''S 166°03'24''E, 12 m depth; B. Richer de Forges, R/V "Vauban", Cruise LAGON, St. 177; 18 Sep. 1984. – SMNS 21282, 5 specimens, 73.9–93.7 mm SL; Baie de Saint-Vincent, 22°05'12''S 166°04'42''E, 13 m depth; M. Kulbicki, 20 Aug. 1985.

New Caledonia, Récif du Sud, S of Grande Terre: SMNS 11614, 1 specimen; 22°45'S 166°45'48''E, 46 m depth; R/V "Vauban", St. DW.310; 27 Nov. 1984.

Comparison material. **Australia, Queensland:** AMS E.6504, holotype, male, 143.7 mm SL; 21 km SE of Cape Capricorn, 23°37'S 151°22'E, 24 m depth; FIS "Endeavour"; 29 July 1910.

Australia, New South Wales: AMS I.26312-010, 1 female, 63 mm SL; NE of Yamba, 29°25'S 153°30'E – 29°18'S 153°30'E, 49–54 m depth; FRV "Kapala"; 22 May 1986.

Distribution

Coral Sea (Chesterfield Islands); New Caledonia (Grande Terre, including islands in the north and Récif du Sud) (Fig. 18). The species was found at depths of 15–48 m. Outside the area, it occurs around the northern half of Australia, south to New South Wales at 29°25'S, at depths of 23–75 m.

4.17. *Synchiropus richeri* **n.sp.** (Fig. 19)

Material

Total: 5 specimens.

Holotype. **New Caledonia, Grande Terre:** MNHN 1999-1253, male, 87.2 mm SL; E slope, 30 km E Thio, 21°43'03''S 166°38'34.2''E, 565 m depth; B. Richer de Forges, R/V "Alis", Cruise BATHUS 1, St. 708; 19 Mar. 1993.

Paratypes. **New Caledonia, Grande Terre:** SMNS 21281, 3 males, 81.0–84.2 mm SL, and 1 female, 80.8 mm SL; same data as the holotype.

Etymology

The new species is named in honour of Bertrand Richer de Forges (IRD, Nouméa, Nouvelle-Calédonie), appreciating his efforts in collecting the type material of the new species, and many other New Caledonian callionymid fishes.

Diagnosis

A *Synchiropus* of the *Synchiropus-altivelis* species-group of the subgenus *Synchiropus* with 8 rays in the second dorsal fin, 7 anal fin rays, 20–22 pectoral fin rays, a short upcurved main tip and a strong curved dorsal point on the preopercular spine, the first dorsal fin not much higher than the first ray of the second dorsal fin; the second dorsal fin in the male slightly elongate; the caudal fin in the male with the median rays filamentous; the eye very large, eye diameter 1.7–2.1 in head; the first dorsal fin pale, with a basal dark grey blotch on the third membrane in both sexes; the body pale, with the postorbital area and the anterior back covered with small brown blotches.

Description

D_1 IV (IV); D_2 8 (8); A vi,1 (vi,1); P_1 ii,18,ii, total 22 (i–ii,16–19,i–ii, total 20–22); P_2 I,5 (I,5); C (ii),i,7,ii,(ii) ((ii),i,7,ii,(ii)).

Body elongate and slightly depressed. Head slightly depressed, 3.1 (3.1–3.5) in SL. Eye 2.1 (1.7–2.0) in head. Preorbital length 5.4 (4.7–6.6) in head. Interorbital distance 21.6 (15.8–29.9) in head. Maxillary length 4.0 (2.6–3.9) in head. Occipital region with two very low bony protuberances. Preopercular spine with a short, stout, nearly vertically upcurved main tip, a strong, vertical point on its dorsal margin, a smooth ventral margin, and a smooth base (Fig. 19, centre). Preopercular spine length 5.7 (4.2–6.7) in head. Preopercular spine formula $-\frac{1}{-}1$ ($-\frac{1}{-}1$). Body depth 6.1 (5.9–6.3) in SL. Body width 5.8 (5.5–6.1) in SL. Lateral lines of the opposite sides of the body interconnected by a commissure across the predorsal area. Urogenital papilla in the male 12.2 (16.8–18.0) in head, in the female 27.0 in head. Caudal peduncle length 4.2 (4.3–4.5) in SL. Caudal peduncle depth 18.6 (18.3–19.7) in SL.

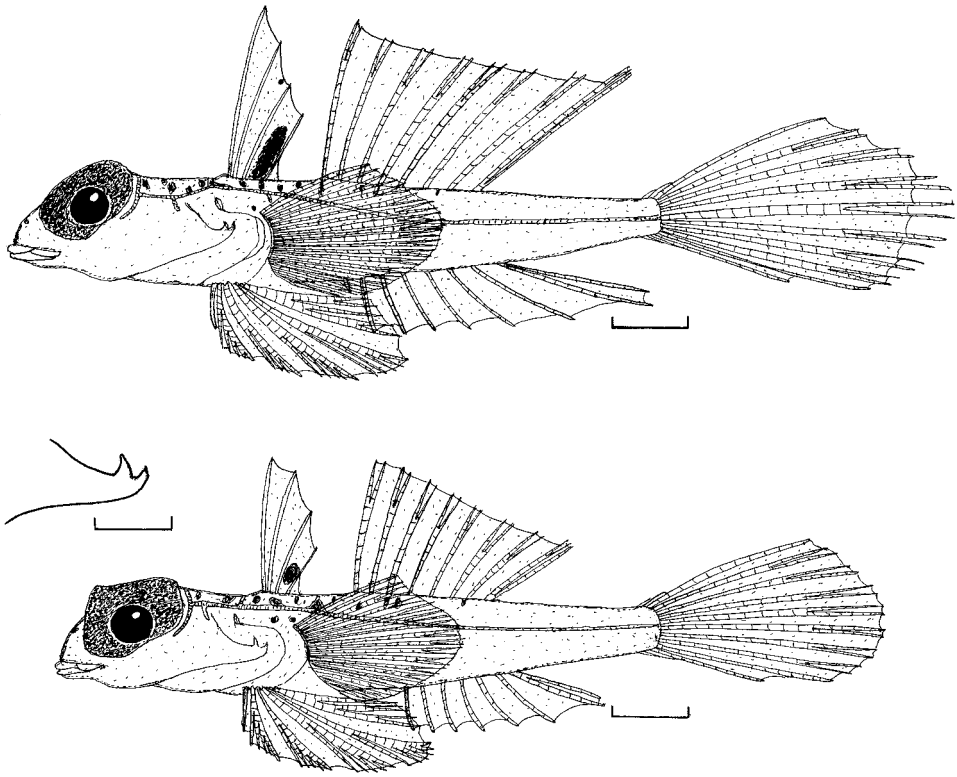


Fig. 19. *Synchiropus richeri* n.sp.; New Caledonia, Grande Terre, eastern slope, 30 km E Thio, 565 m depth; MNHN 1999–1253, holotype, male, 87.2 mm SL. – *Above,* lateral view (scale: 10 mm); – *centre,* left preopercular spine (scale: 3 mm). – SMNS 21281, specimen 1, paratype, female, 80.8 mm SL; *below,* lateral view (scale: 10 mm).

First dorsal fin not much higher than first ray of second dorsal spine in both sexes, without filaments; first spine in the male 3.7 (3.6–4.9) in SL, 2nd spine 4.5 (4.8–5.0), 3rd spine 6.3 (5.8–6.4), 4th spine 8.9 (9.0–9.5); 1st spine in the female 4.4 in SL, 2nd spine 5.0, 3rd spine 6.6, 4th spine 11.8. Predorsal (1) length 2.9 (2.8–3.0) in SL. Second dorsal fin rays branched, the last divided at its base. Second dorsal fin slightly concave in the male, first ray slightly elongate, its length 4.1 (3.8–4.0) in SL; 5th ray 4.1 (4.2–4.3), last ray slightly elongate, 3.4 (3.5–3.8); second dorsal fin in the female distally mostly straight, 1st ray 4.4 in SL, 5th ray 5.4, last ray 5.4. Predorsal (2) length 2.0 (2.0–2.1) in SL. Anal fin beginning on a vertical through 3rd membrane of second dorsal fin. Anal fin rays unbranched, the last divided at its base. First anal fin ray in the male 12.8 (11.2–14.2) in SL, 5th ray 7.6 (5.8–7.1), last ray 4.1 (3.8–4.7); 1st ray in the female 13.5 in SL, 5th ray 7.7, last ray 6.4. Preanal fin length 1.8 (1.7–1.8) in SL. Pectoral fin reaching to 3rd or 4th anal fin membrane when laid back. Pectoral fin length 3.8 (3.8–3.9). Prepectoral fin length 2.5 (2.4–2.5) in SL. Pelvic fin reaching to 2nd anal fin membrane when laid back. Pelvic fin spine 14.8 (12.4–14.8) in SL; pelvic fin length 3.2 (3.1–3.4) in SL. Prepelvic fin length 3.2 (3.1–3.6) in SL.

Caudal fin distally elongate in the male, median rays bearing short filaments; in the female slightly shorter, without filaments; caudal fin length in the male 2.2 (2.1–2.4) in SL, in the female 2.6 in SL.

Colour in alcohol. Head and body pale whitish, eye dark grey dorsally, silvery laterally. Postorbital area and anterior back with small brown blotches, forming double saddles below the anterior section of the second dorsal fin base. First dorsal fin in the male with a small distal black spot on the second membrane, and in both sexes with a larger dark grey bloch basally on the third membrane. Other fins pale or translucent.

Sexual dimorphism. Males have slightly higher first and second dorsal fins than females, a longer caudal fin with median filaments, and a longer urogenital papilla.

Distribution

The new species is known only from the type locality on the eastern slope of Grande Terre/New Caledonia, 30 km east of Thio (Fig. 17); it was collected at a depth of 565 m.

Relationships

Synchiropus richeri, n.sp. is a member of the *Synchiropus-altivelis* species-group of the subgenus *Synchiropus (Synchiropus)* (names and references of other species of the group see below at description of *S. altivelis,* 5.7.). The new species is distinguished from other species of the subgroup with very large eyes (eye diameter 1.7–2.2 in head) by the short and upcurved main tip of its preopercular spine (longer and straight in *S. novaecaledoniae, S. signipinnis*), the first dorsal fin which is as high as the second dorsal fin in both sexes (lower in both sexes of *S. grandoculis;* higher in *S. novaecaledoniae, S. orstom,* male *S. monacanthus* and male *S. signipinnis*), lacking filaments in the first dorsal fin in both sexes (3 filaments in male *S. novaecaledoniae;* 1 filament present in male *S. signipinnis* and both sexes of *S. orstom*), second dorsal fin relatively high in males (low in *S. grandoculis*), second dorsal fin distally concave in the male (straight in *S. novaecaledoniae, S. signipinnis*), caudal fin bearing median filaments in males (without filaments in male *S. monacanthus, S. novaecaledoniae, S. orstom, S. signipinnis*), first dorsal fin with a black blotch on third membrane in both sexes (pale in *S. grandoculis;* striped in male *S. monacanthus* and *S. novaecaledoniae;* pale in male *S. signipinnis),* anal fin pale (distally dark in male *S. monacanthus,* distally spotted in male *S. orstom*), caudal fin pale (distally dark in male *S. monacanthus,* both sexes of *S. orstom,* and female *S. signipinnis*), and pale pelvic fins (distally dark in male *S. monacanthus*).

4.18. *Synchiropus sechellensis* Regan, 1908

Synchiropus sechellensis Regan, 1908: 249, pl. 30, fig. 1 (Seychelles, 37 fms depth; syntypes: BMNH 1908.3.23.265–266, 2 specimens). – Randall & Anderson, 1993: 38 (Maldive Islands). – Goren & Dor, 1994: 62 (Red Sea).

Synchiropus (Synchiropus) sechellensis: Fricke, 1981b: 84–87, fig. 27 (Gulf of Suez, Red Sea; Seychelles) – Fricke, 1983: 663–668, figs 205–206 (Red Sea to Somalia, Gulf of Aden, and Seychelles).

Material

Total: 28 specimens (including 22 specimens listed by Fricke, 1981b, 1983).

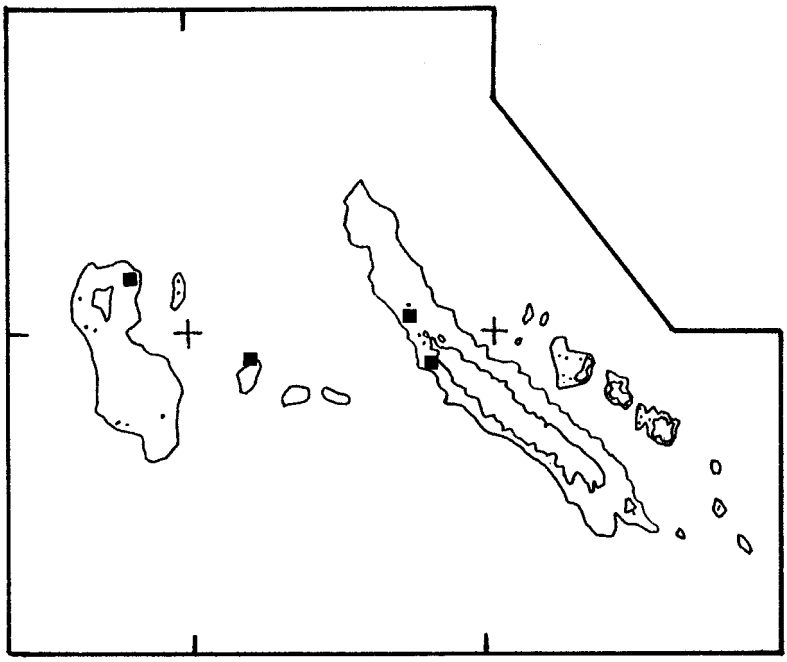


Fig. 20. Geographical distribution of *Synchiropus sechellensis* in New Caledonian waters.

Coral Sea, Chesterfield Islands: SMNS 21251, 1 female, 31.0 mm SL; northeastern lagoon, 19°12'00''S 158°53'36''E, 59 m depth; B. Richer de Forges; 25 July 1988.
Coral Sea, Chesterfield Bank: SMNS 21267, 1 male, 35.3 mm SL; 20°27'21''S 161°04'42''E, 75 m depth; B. Richer de Forges, Cruise CORAIL 2, St. CP.24; 22 July 1988.
New Caledonia, islands north of Grande Terre: SMNS 21300, 1 specimen, 21.2 mm SL; Bélep Island, 19°57'00''S 163°44'54''E, 34 m depth; R/V "Alis", Cruise NORD, St. DW.1181; 31 Oct. 1989.
New Caledonia, Grande Terre: SMNS 21250, 1 female, 25.9 mm SL; northwestern lagoon, WNW of Koumac, 20°39'30''S 164°15'24''E, 50–55 m depth; B. Richer de Forges; 27 Apr. 1988.

Comparison material. **Maldives:** BPBM 32708, 2 specimens, 36.1–39.4 mm SL; South Male Atoll, Embudu Island, N side, outside reef, cave in drop-off, 35 m depth; J. E. Randall et alii; 18 Mar. 1988.

Distribution

Coral Sea (Chesterfield Islands, new record; Chesterfield Bank, new record), New Caledonia (Grande Terre, new record) (Fig. 20). Outside the area, Maldives, northwestern Indian Ocean and Red Sea. The species was collected at depths of 34–75 m.

Remarks

This is an unusual finding of a species otherwise distributed in the northwestern Indian Ocean and Red Sea, indicating a widely disjunct distribution range.

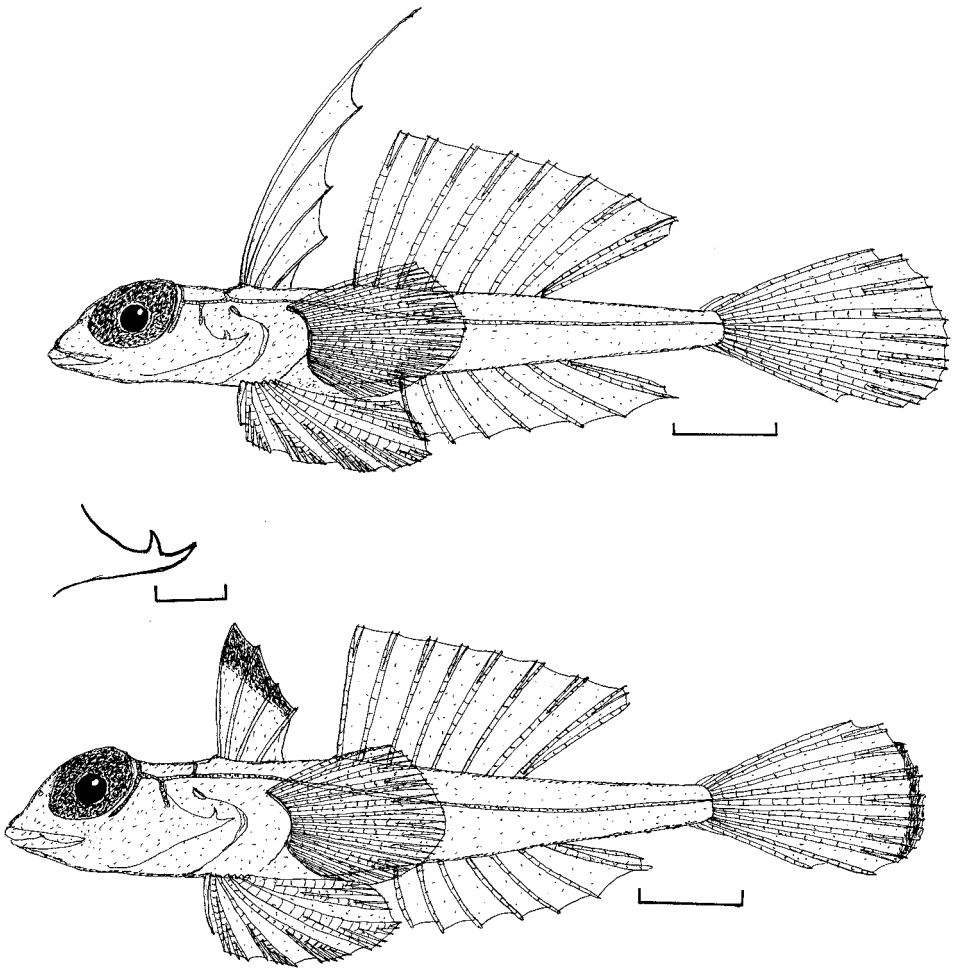


Fig. 21. *Synchiropus signipinnis* n.sp.; Chesterfield Islands, 348 m depth; MNHN 1999–1252, holotype, male, 64.8 mm SL. – *Above,* lateral view (scale: 10 mm); – *centre,* left preopercular spine (scale: 2 mm). – SMNS 21271, paratype, female, 68.6 mm SL; *below,* lateral view (scale: 10 mm).

4.19. *Synchiropus signipinnis* **n.sp.** (Fig. 21)

Foetorepus altivelis (non Temminck & Schlegel, 1845): Rivaton, 1989: 155 (Iles Chesterfield). – Rivaton, Fourmanoir, Bourret & Kulbicki, 1989: 30 (Nouvelle-Calédonie/New Caledonia, in checklist). – Kulbicki, Randall & Rivaton, 1994: 33 (Chesterfield Islands, 348 m depth).

Paradiplogrammus sp.: Kulbicki, Randall & Rivaton, 1994: 33 (Chesterfield Islands, 348 m depth).

Material

Total: 2 specimens.

Holotype. **Coral Sea, Chesterfield Islands:** MNHN 1999-1252, male, 64.8 mm SL; 19°43'48''S 158°35'15''E, 348 m depth; B. Richer de Forges, R/V "Coriolis", Cruise CHALCAL, St. CP.8; 19 July 1984.

Paratype. **Coral Sea, Chesterfield Islands:** SMNS 21271, 1 female, 68.6 mm SL, same data as the holotype.

Etymology

Signum (Latin) means sign; *pinnis* (Latin) means fin. The name refers to the high dorsal fin of the male which is elevated for flagging in the holotype.

Diagnosis

A *Synchiropus* of the *Synchiropus-altivelis* species-group of the subgenus *Synchiropus* with 8 rays in the second dorsal fin, 7 anal fin rays, 19–22 pectoral fin rays; a preopercular spine with a long, slightly upcurved main tip and with a strong, vertical, curved point on its dorsal margin; eye large, eye diameter 1.9–2.0 in head; first dorsal fin higher than second dorsal fin in the male, slightly lower in the female, first spine in the male with a short filament; second dorsal fin distally straight in both sexes, first ray not elongate in the male; anal fin relatively low; caudal fin elongate, without filaments; the first dorsal fin plain pale in both sexes; the anal fin pale in both sexes; the caudal fin pale in the male, distally dark in the female; the pelvic fin pale in both sexes.

Description

D_1 IV (IV); D_2 8 (8); A vi,1 (vi,1); P_1 i,18–19,i, total 20–21 (i,17–19,i, total 19–21); P_2 I,5 (I,5); C (ii),i,7,ii,(ii) ((ii),i,7,ii,(ii)).

Body elongate and slightly depressed. Head slightly depressed, its length 3.8 (3.8) in SL. Eye 2.0 (1.9) in head. Preorbital length 5.9 (3.8) in head. Interorbital distance 15.4 (18.9) in head. Maxillary length 3.2 (2.2) in head. Occipital region with two low, smooth bony protuberances. Preopercular spine with a long, slightly upcurved main tip, a vertical, curved point on its dorsal margin, a smooth ventral margin, and a smooth base (Fig. 21, centre). Preopercular spine length 4.7 (4.2) in head. Preopercular spine formula $-\frac{1}{-}1$ ($-\frac{1}{-}1$). Lateral lines of the opposite sides of the body interconnected by a commissure across the predorsal region. Body depth 6.8 (6.4) in SL. Body width 5.6 (5.2) in SL. Urogenital papilla in the male holotype 14.2 in head, in the female 25.7. Caudal peduncle length 4.3 (4.1) in SL. Caudal peduncle depth 18.0 (17.2) in SL.

First dorsal fin high in the male, first spine longest, bearing a filament; length of first spine 2.0 in SL, 2nd spine 3.1, 3rd spine 5.3, 4th spine 9.7; in the female lower, first spine only slightly longer than first ray of second dorsal fin; length of 1st spine 5.0 in SL, 2nd spine 5.8, 3rd spine 8.3, 4th spine 11.2. Predorsal (1) length 3.5 (3.3) in SL. Second dorsal fin rays branched, the last divided at its base. Second dorsal fin in the male high, distally nearly straight, first ray not produced. First ray of second dorsal fin in the male holotype 4.0 in SL, 5th ray 4.7, last ray 4.2; second dorsal fin in the female lower, 1st ray 5.2 in SL, 5th ray 6.1, last ray 5.1. Predorsal(2) length 2.2 (2.1) in SL. Anal fin beginning on a vertical through third membrane of second dorsal fin. Anal fin rays unbranched, the last divided at its base. First anal fin ray in the male holotype 10.8 in SL, 5th ray 6.5, last ray 5.7; 1st ray in the female 10.7 in SL, 5th ray 8.5, last ray 7.1. Preanal fin length 1.9 (1.8) in SL. Pectoral fin reaching to base of third anal fin membrane when laid back. Pectoral fin length 4.3 (4.5) in SL. Prepectoral fin length 2.6 (2.5) in SL. Pelvic fin reaching to first or second anal fin membrane when laid back. Pelvic fin spine 14.4 (12.0) in SL; pelvic fin length 3.3 (3.5) in SL. Prepelvic fin length 3.6 (3.5) in SL. Caudal fin distally convex in both sexes, without filaments; caudal fin length in the male holotype 3.0 in SL, in the female 3.4 in SL.

Colour in alcohol. Head and body plain pale in both sexes, eye dark grey. All fins pale in the male; first dorsal fin with a distal dark grey area in the female, caudal fin mid-distally grey, other fins pale.

Sexual dimorphism. Males differ from females in the higher first dorsal fin, the higher second dorsal fin, the slightly longer caudal fin, the longer urogenital papilla, and the different colouration of the first dorsal and caudal fins.

Distribution

The new species is only known from the type locality, slope of the Chesterfield Islands (Fig. 17); it was collected at a depth of 348 m.

Relationships

Synchiropus signipinnis n.sp. is a member of the *Synchiropus-altivelis* species-group of the subgenus *Synchiropus (Synchiropus)* (members of the group, and references, see below, description of *S. altivelis,* 5.7.). It is distinguished from other species of the subgroup with very large eyes (eye diameter 1.7–2.2 in head length) by its straight main tip of the preopercular spine (upcurved in *S. grandoculis, S. orstom, S. richeri*), the first dorsal fin much higher than the second dorsal fin in males (as high as second dorsal fin in *S. richeri,* lower in *S. grandoculis*), the first dorsal fin slightly lower than the second dorsal fin in females (higher in *S. novaecaledoniae* and *S. orstom*), the first spine of the first dorsal fin bearing a filament in males (without filaments in *S. grandoculis* and *S. richeri;* the first two spines extended but without filaments in *S. monacanthus*), the first spine of the first dorsal fin in females without a filament (with a filament in *S. orstom* and *S. paxtoni*), the second dorsal fin distally straight in males (concave in *S. orstom* and *S. richeri*), the caudal fin without median filaments in males (with median filaments in *S. grandoculis* and *S. richeri*), the first dorsal fin pale in males (with a black spot on the third membrane in *S. orstom, S. paxtoni, S. richeri;* striped in *S. monacanthus, S. novaecaledoniae*), the first dorsal fin distally dark but without a dark blotch on the third membrane in females (plain pale in *S. grandoculis, S. paxtoni;* with a black blotch in *S. novaecaledoniae, S. orstom, S. richeri;* basally dark in *S. monacanthus*), and the anal fin plain pale (distally dark in male *S. monacanthus;* distally spotted in male *S. orstom*).

4.20. *Synchiropus splendidus* (Herre, 1927)

CAAB Code (Australia): 37 427034

Callionymus splendidus Herre, 1927: 416–417, pl. 2 (Bungau, Philippines, 2 fms depth; holotype: was BSMP uncat., destroyed during WWII).

Synchiropus splendidus: Whitley, 1961: 65 (New Caledonia/Nouméa region, Grande Terre). – Schroeder, 1980: 187 (Sulu Sea, Philippines). – Blaber, Milton & Rawlinson, 1991: 7 (Vona Vona, Solomon Islands). – Allen & Swainston, 1993: 94 (New Guinea; shallow reefs in sheltered areas). – Fricke, 1993: 374–375 (New Caledonia). – Yearsley, Last & Morris, 1997: Appendix D (CAAB Code).

Synchiropus (Synchiropus) splendidus: Fricke, 1981b: 127–132, fig. 40 (Kapingamarangi Atoll, Caroline Islands, Palau Islands, Indonesia, New Guinea, Australia). – Fricke, 1983: 668–672, fig. 207 (Philippines; Papua New Guinea).

Pterosynchiropus splendidus: Rivaton, Fourmanoir, Bourret & Kulbicki, 1989: 31 (Nouvelle-Calédonie/New Caledonia, in checklist). – Nakabo, 1993: 988, fig. (Japan; with pictorial key).

Material

Total: 188 specimens (including 179 specimens listed by Fricke, 1981b, 1983).

New Caledonia (Grande Terre): SMNS 21274, 3 specimens, 29.7–44.6 mm SL; Bancs Nord, 22°23'10''S 166°30'50''E, 8 m depth, sand and coral bottom; M. Kulbicki, St. 8–4; 5 Sep. 1985. – SMNS 21291, 2 specimens, 31.4–32.6 mm SL; Kouaré area, 22°46'40''S 166°48'40''E, 10 m depth, sand and coral; M. Kulbicki, R/V "Vauban", St. Kouaré No. 11; 20 June 1986. – SMNS 21293, 3 specimens, 13.3–21.8 mm SL; Sêche Croissant Reef, 22°20'20''S 166°22'30''E, 2 m depth, sargassum and sand; M. Kulbicki; 1 Aug. 1996.

Distribution

New Caledonia (Grande Terre) (Fig. 22). Outside the area, between the Ryukyu Islands, Western Australia, Queensland/Australia, and Papua New Guinea; the species is found at depths of 0–18 m.

Remarks

This species was recorded from New Caledonia by Fricke (1993) on the basis of a specimen in the Aquarium Nouméa, which had been collected in New Caledonia (but the precise locality was not known).

4.21. *Synchiropus springeri* Fricke, 1983

Synchiropus springeri Fricke, 1983: 673–677, fig. 208 (Fiji, S side of channel at NE end of Malolo Island barrier reef, 17°45'S 177°04'W, 0–20 m depth; holotype: USNM 235725).

Synchiropus postulus (non Smith, 1963): Rivaton, Fourmanoir, Bourret & Kulbicki, 1989: 31 (Nouvelle-Calédonie/New Caledonia, in checklist).

Material

Total: 18 specimens (including 3 specimens listed by Fricke, 1983).

Material from the study area. **New Caledonia (Grande Terre):** SMNS 21233, 1 female, 14.0 mm SL; Passe de Saint-Vincent, 22°02'06''S 164°57'00''E; M. Kulbicki, R/V "Alis", St. 9; 26 Mar. 1990.

Loyalty Islands: USNM 319876, 2 specimens, 19.1–22.7 mm SL; Ouvéa Atoll, S end of lagoon on steep rocky shore, 20°42'48''S 166°24'00''E, 0–5 m depth; J. T. Williams; 13 Nov. 1991.

Other material. **Solomon Islands:** AMS I.39010-091, 1 male, 20.7 mm SL; Santa Cruz Islands, Reef and Lomlon Island, Nialo Point, E side, 10°16'00''S 166°18'56''E, 0–35 m depth; M. McGrouther et alii; 18 Sep. 1998.

Vanuatu: AMS I.37928-032, 7 specimens, 10.7–13.7 mm SL; Banks Group, Rowa Island, leeward side of reef, NW side, 13°38'S 167°30'E, 1–7 m depth; M. McGrouther et alii; 20 May 1997. – ?BPBM 16113, 1 female, 14.7 mm SL, paratype of *Synchiropus claudiae* Fricke, 1990; Savo, SW side, 9°08'S 159°48'E, rocks shore in 0–1 m depth: J. E. Randall et alii; 18 July 1973.

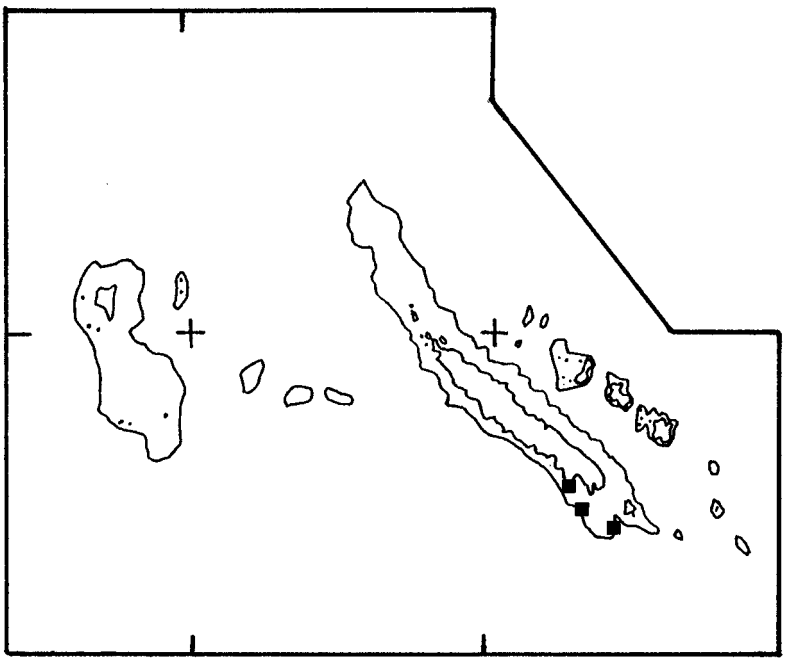
Rotuma: USNM 284372, 3 specimens, 5.4–16.3 mm SL; E side, just N of Afnaha Island, 12°30'S 177°05'E, 0–14 m depth; V. G. Springer et alii; 21 May 1986.

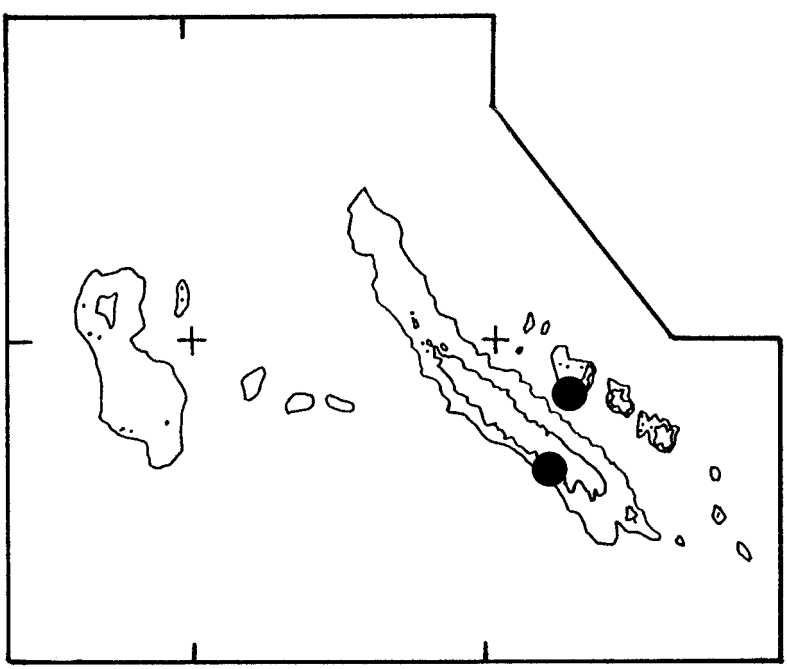
Distribution

New Caledonia (Grande Terre) (new record): Loyalty Islands (Ouvéa) (new record) (Fig. 23). Outside the area, Solomon Islands (new record) and Vanuatu (new record) to Fiji and Rotuma (new record).

Remarks

The finding of a male of *Synchiropus springeri* from the Solomon Islands (AMS I.39010-091) suggests that the female paratype of *S. claudiae* Fricke, 1990 (Fricke,





Figs 22–23. Geographical distribution of *Synchiropus* species in New Caledonian waters. – 22. *S. splendidus (above);* – 23. *S. springeri (below).*

1990: 2, part, Solomon Islands only) from Savo, Solomon Islands (BPBM 16113) might belong to *S. springeri.* The females of the two species are difficult to distinguish.

The closely related species *Synchiropus laddi* Schultz in Schultz et alii, 1960 lives on the Pacific Plate, from Palawan through the Marshall Islands east to Tonga (new record; based on USNM 334467, 6 specimens from E'ua) and Tuamotu Archipelago. Another closely related species, *Synchiropus kiyoae* Fricke & Zaiser, 1983, is known from southern Japan and the northern Philippines (new record, based on USNM 298203 and USNM 298209, total 5 specimens, from Batanes).

5. Related Indo-west Pacific species of Callionymidae

5.1. *Callionymus afilum* **n.sp.** (Fig. 24)

CAAB Code (Australia): 37 427008

Callionymus japonicus var. *japonicus* (non Houttuyn, 1782): Kailola, 1971: 129 (Yule Island, Gulf Province, Papua New Guinea).

Callionymus japonicus japonicus (non Houttuyn, 1782): Fricke, 1983: 380–392 (part: northern Australia; Papua New Guinea). – Sainsbury, Kailola & Leyland, 1985: 346 (Northwest Shelf to Arafura Sea, northwestern and northern Australia).

Material

Total: 19 specimens.

Type material, Holotype. **Australia Northern Territory, Arafura Sea:** AMS I.21943-004, male, 146.8 mm SL; R/V "Soela"; 18 Nov. 1980.

Paratypes. **Western Australia:** CSIRO H.745-02, 1 male, 177.8 mm SL; N of Cape Lambert, 20°11'S 117°14'E, 36 m depth; R/V "Soela"; 10 Oct. 1986. – CSIRO H.1466-01, 1 male, 169.2 mm SL; NW of Port Hedland, 19°35'S 117°49'E, 59 m depth; P. Last & R/V "Soela"; 22 Sep. 1988. – CSIRO H.1479-01, 1 male, 112.5 mm SL; N of Dampier Archipelago, 20°11'S 116°47'E, 43 m depth; P. Last & R/V "Soela"; 24 Sep. 1988. – CSIRO H.4643-02, 1 male, 195.1 mm SL; NW of Port Hedland, 19°46'S 118°07'E, 44 m depth; R. Daley; 26 Aug. 1997.

Paratypes. **Australia, Northern Territory, Arafura Sea:** AMS I.21943-021, 1 female, 133.2 mm SL; same data as the holotype. – AMS I.21842-028, 4 females, 99.0–112.7 mm SL; R/V "Soela"; 1980. – SMNS 21375, 1 male (142.3 mm SL) and 1 female (126.1 mm SL); same data as the holotype.

Paratype. **Australia, northern Queensland:** CSIRO 754, 1 female, 133.1 mm SL; near York Island, Torres Strait; 24 Apr. 1979.

Paratypes. **Papua New Guinea:** KFRS F.01705, 1 male, 174.3 mm SL; Bramble Cay; 9 July 1967. – KFRS F.02709, 1 male, 106.2 mm SL; northwest of Yule Island; 10 Nov. 1969.

Other material. **Western Australia:** CSIRO 2143, 1 female, 97.0 mm SL; northeastern Monte Bello Island, 20°03'S 115°57'E, 80 m depth; 2 Dec. 1979. – CSIRO B.2079, 1 male, 40.0 mm SL; NW of Dampier Archipelago, 19°54'S 116°02'E, 78 m depth; R/V "Soela"; 3 Dec. 1979. – CSIRO B.2080, 1 female, 48.3 mm SL; NE of Barrow Island, 20°16'S 115°47'E, 57 m depth; P. Kailola & R/V "Soela"; 5 Dec. 1979. – WAM P.26197-024, 1 male, 111.8 mm SL; 40 km NE of Legendre Island, Dampier Archipelago, 20°05'S 117°05'E, 44 m depth; B. Hutchins; 17 Apr. 1978.

Etymology

Afilum (Latin) means without filaments. The name refers to the first dorsal fin of males, which is lacking filaments in the new species, while the closely related species *C. japonicus* and *C. scaber* possess filaments.

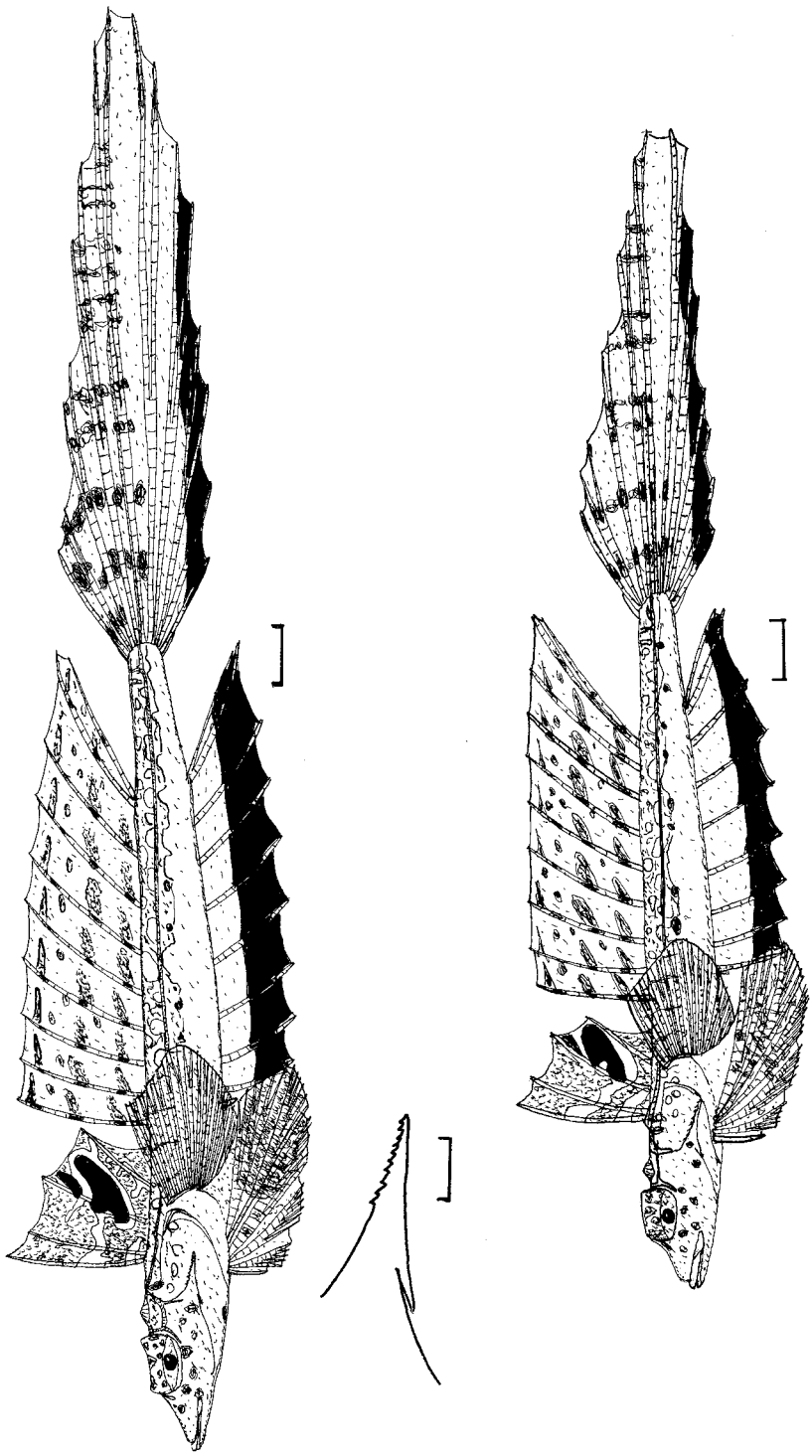


Fig. 24. *Callionymus afilum* n.sp.; AMS I.21943-004, Arafura Sea, Northern Territory, Australia, holotype, male, 146.8 mm SL. – *Above*, lateral view (scale: 10 mm); – *centre*, left preopercular spine (scale: 3 mm). – SMNS 21375, Arafura Sea, Northern Territory, Australia, specimen 2, female, 126.1 mm SL; *below*, lateral view (scale: 10 mm).

Diagnosis

A *Callionymus* of the *C.-japonicus* species-group of the subgenus *Calliurichthys* with a total of 9 rays in the second dorsal fin, 8 rays in the anal fin, 18–20 pectoral fin rays, 7–10 small antrorse serrae dorsally on the preopercular spine (additional to the main tip) and an antrorse spine at the base, with a relatively low first dorsal fin in males not bearing filaments; with the first dorsal fin brownish in males, bearing a large black ocellus distally on the third membrane with basal branches reaching to the posterior part of the second membrane; with the throat plain white in females; and in males with the distal half of the anal fin black, in females with the distal one-third black.

Description

D_1 IV; D_2 viii,1; A vii,1; P_1 i-ii,15–16,i-ii (total 18–20); P_2 I,5; C (i),i,7,ii,(i).

Body elongate and slightly depressed. Head slightly depressed, its length 5.1 (4.7–5.4) in SL. Eye 2.8 (2.4–2.7) in head. Preorbital length in the male 2.8 (2.5) in head, in the female 2.8–3.0 in head. Interorbital distance 41 (21–25) in head. Maxillary length 3.0 (2.3–3.0) in head. Occipital region with two smooth bony protuberances (one behind each eye). Preopercular spine with a staight main tip, a smooth ventral margin, a strong antrorse spine at its base, and 7–10 small serrae on its dorsal margin (Fig. 24, centre). Preopercular spine length 3.0 (2.5–3.1) in head. Preopercular spine formula 1 $\frac{7–10}{–}$ 1. Body depth 10.7 (9.7–10.7) in SL. Body width 6.4 (5.6–6.2) in SL. Urogenital papilla length in the male 7.8 (11.4) in head, in the female 35 or more in head or not visible. Caudal peduncle length 6.3 (6.1–6.6) in SL. Caudal peduncle depth 23.7 (20.0–21.5) in SL. Maximum observed SL 195.1 mm (male), 133.2 mm (female).

First dorsal fin relatively low in both sexes, first spine slightly longer than first ray of second dorsal fin, spines without filaments; length of first spine in the male 5.8 (6.1) in SL, 2nd spine 6.9 (6.1) in SL, 3rd spine 6.9 (6.7) in SL, 4th spine 9.5 (7.7) in SL; length of 1st spine in the female 4.8–5.7 in SL, 2nd spine 5.5–6.1 in SL, 3rd spine 5.8–6.1 in SL, 4th spine 8.4–8.6 in SL. Predorsal (1) length 4.3 (4.0–4.3) in SL. Second dorsal fin rays unbranched except for the last which is divided at its base. First ray of second dorsal fin in the male 5.9 (5.7) in SL, last ray 4.9 (6.0) in SL; in the female, 1st ray 5.6–5.8 in SL, last ray 4.4–5.0 in SL. Predorsal (2) length 2.5 (2.3–2.5) in SL. Anal fin beginning on a vertical through 2nd ray of second dorsal fin. Anal fin rays unbranched, the last divided at its base. First anal fin ray in the male 10.8 (11.0) in SL, last ray 5.8 (6.1) in SL, 1st ray in the female 9.2–12.4 in SL, last ray 6.0–7.2 in SL. Preanal fin length 2.3 (2.1–2.2) in SL. Pectoral fin reaching to 2nd anal fin membrane when laid back. Pectoral fin length 5.7 (5.0–6.1) in SL. Prepectoral fin length 3.3 (3.1–3.3) in SL. Pelvic fin reaching to 1st or 2nd anal fin membrane when laid back. Pelvic fin spine 21.6 (13.4–25.0) in SL; pelvic fin length 3.8 (3.4–3.8) in SL. Prepelvic fin length 4.6 (4.8–5.6) in SL. Caudal fin distally elongate, with the median 4–6 rays longer than head; caudal fin length in the male 1.3 (1.2) in SL, in the female 1.5–1.6 in SL.

Colour in alcohol: Head and body brownish, ventral sides of body whitish. Thorax in the male white, with a small heart-shaped black blotch, but without lines; in the female plain white. Eye and cheeks with few large dark brown blotches. Dorsal sides of head and body with whitish spots; sides of body below the lateral line with a row of small dark brown spots which are arranged in pairs.

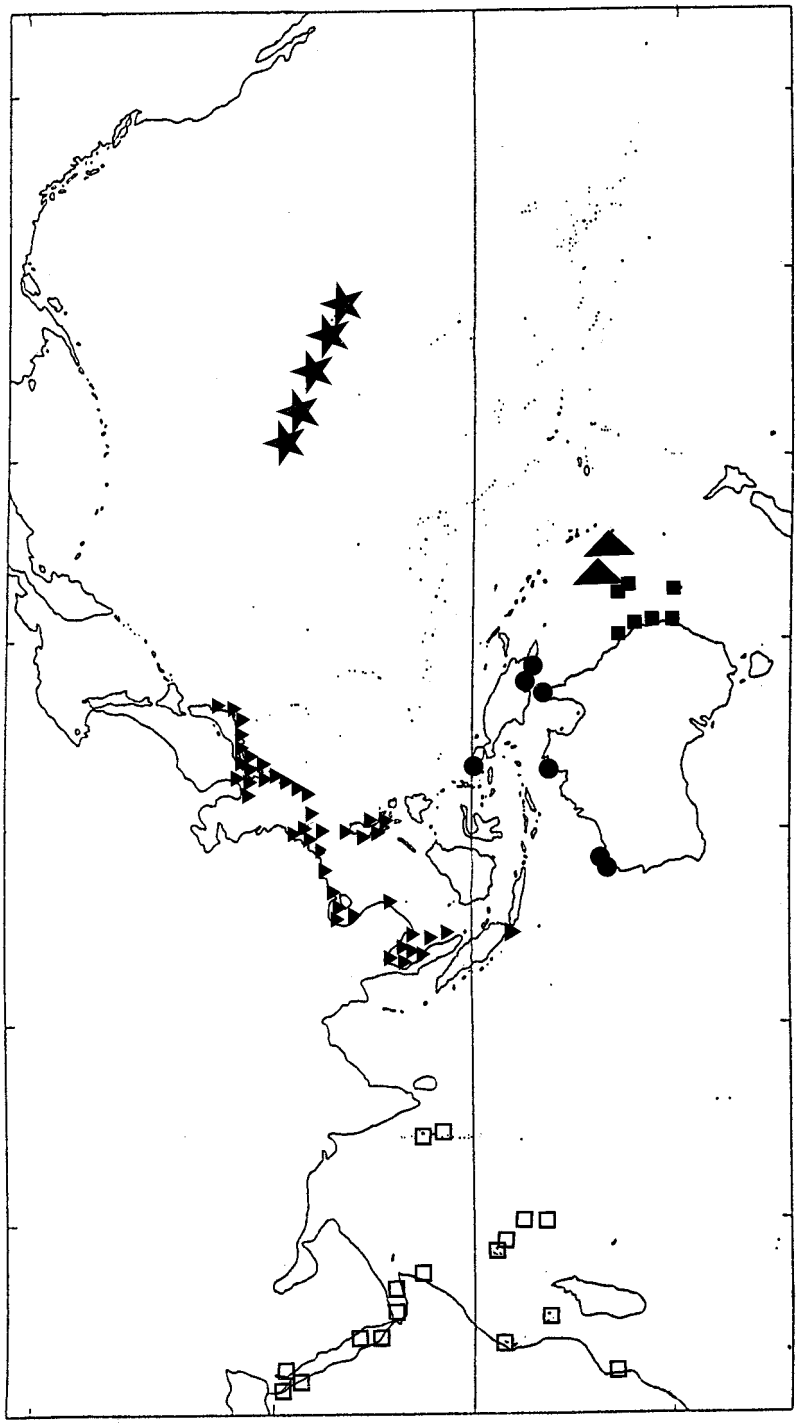


Fig. 25. Geographical distribution of the *Callionymus-japonicus* species-group. – Circles, *C. aflum* n.sp. – Black stars, *C. decoratus*. – Open squares, *C. gardineri*. – Small black triangles, *C. japonicus*. – Large black triangles, *C. rivatoni*. – Black squares, *C. scaber*.

First dorsal fin brownish, in both sexes with a large black ocellus distally on the third membrane with basal branches reaching to the posterior part of the second membrane; above the ocellus on the third membrane with a small distal dark blotch. First and second membranes with a basal and a median wavy white line. Second dorsal fin with 3–4 brown spots on each ray, and each membrane with horizontal brown streaks and a few brown spots in between. Anal fin basally whitish; distal half (in the male) or distal one-third (in the female) black. Lower margin of caudal fin black; upper half with 5–6 pairs of vertical rows of brown spots. Pectoral fin translucent, with a few faint vertical lines in its upper half. Pelvic fin whitish or light brown, distally with a brownish area or with numerous small brown spots and blotches.

Sexual dimorphism: There is little sexual dichromatism, except for the small brown blotch on the thorax which is present in males but absent in females. Females have a shorter caudal fin, a much shorter urogenital papilla, and a slightly shorter snout than males.

Distribution

Australia (Western Australia south to 20°16'S; Northern Territory; Queensland at Torres Strait); Papua New Guinea (Fig. 25). The species was found at depths of 36–80 m.

Relationships

This new species is closely related to *Callionymus japonicus* and *C. scaber;* it differs from both species in the absence of filaments from the first dorsal fin of the male, and in the male's first dorsal fin colouration (distally with large brown blotches in *C. japonicus;* plain black, with oblique whitish lines in *C. scaber*). From *Callionymus scaber,* the new species also differs in having smooth and much lower bony protuberances in the occipital region, and a narrower distal black zone on the anal fin in both sexes (*C. scaber,* male: fin nearly plain black; female: distal two-thirds black).

5.2. *Callionymus bifilum* **n.sp.** (Fig. 26)

CAAB Code (Australia): 37 427038

Callionymus moretonensis (non Johnson, 1971): Gloerfelt-Tarp & Kailola, 1984: 265, 1 fig. (13°18'S 128°21'E, Joseph Bonaparte Gulf, Western Australia). – Sainsbury, Kailoila & Leyland, 1985: 270–271, colour photo of CSIRO CA.3532 (Timor Sea, Australia).

Material

Total: 3 specimens.

Holotype. **Western Australia:** CSIRO CA.3532, 1 male, 86.6 mm SL; Timor Sea, Joseph Bonaparte Gulf, 13°18'S 128°21'E, 84–87 m depth; P. Kailola & R/V "Soela"; 30 June 1980.

Other material. **Western Australia:** BMNH 1892.1.14.26–27, 2 specimens; Holothuria Bank; Walker; before 1892.

Etymology

Bi means two, *filum* means filament. The name refers to the two long caudal fin filaments of the male.

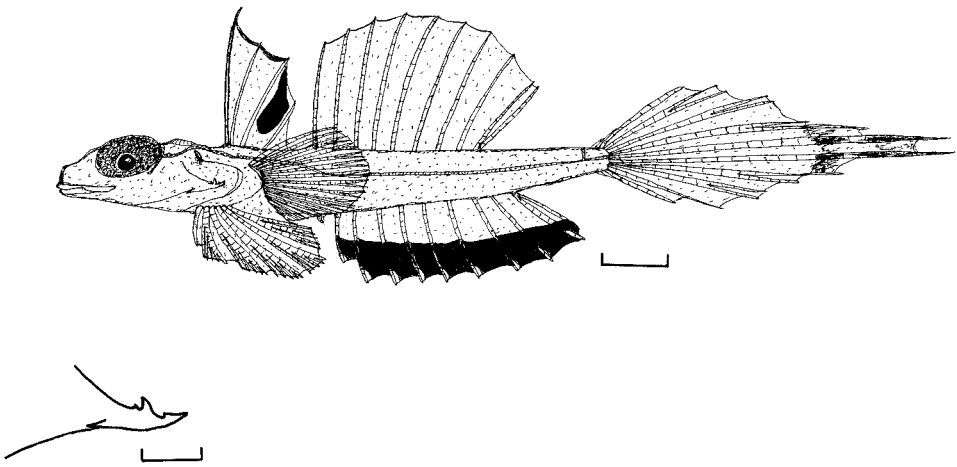


Fig. 26. *Callionymus bifilum* n.sp.; CSIRO CA.3532, Western Australia, Joseph Bonaparte Gulf, holotype, male, 86.6 mm SL. – *Above,* lateral view (scale: 10 mm); – *below,* left preopercular spine (scale: 3 mm).

Diagnosis

A *Callionymus* of the *Callionymus-kaianus*-group of the subgenus *Callionymus* with a high first dorsal fin, the first spine elongate, with a short filament in males; with the second dorsal fin distally convex in males; the caudal fin distally convex, with two long filaments; the preopercular spine with an upcurved main tip, a small antrorse barb, a large curved spine on the dorsal margin, and an antrorse spine at the base; the first dorsal fin with a large black blotch restricted to the distal section af the third membrane; the anal fin with a subdistal black streak on the 1st to 7th membranes; and the sides of the body pale.

Description

D_1 IV (IV); D_2 viii,1 (viii,1); A viii,1 (viii,1); P_1 ii,16–17,ii (total 20–21) (i,16–18,ii-iii; total 20–21); P_2 I,5 (I,5); C (ii),i,3,ii,2,ii,(ii) ((i-ii),i,3–4,i-ii,2–3,ii,(i-ii)).

Body elongate and depressed. Head depressed, its length 4.0 (3.5–3.6) in SL. Eye 2.3 (2.1–2.2) in head. Preorbital length 3.2 (3.1–3.6) in head. Interorbital distance 36 (19–23) in head. Occipital region smooth, with two low bony protuberances. Maxillary length 2.4 (2.9–3.0) in head. Preopercular spine with a slightly upcurved main tip, a small antrorse and one or two large curved points on its dorsal margin, and a strong antrorse spine at its base (Fig. 26, below); its length 4.1 (3.2–3.5) in head. Preopercular spine formula $1 \frac{3}{=} 1$ ($1 \frac{3}{=} 1$). Lateral line reaching from eye to end of upper unbranched caudal fin ray, with a few short branches below the first dorsal fin; the lines of the opposite sides are interconnected by a commissure each across the predorsal area and across the dorsal side of the caudal peduncle. Urogenital papilla 10.5 (10.1–15.1) in head. Body depth 9.2 (7.0–7.8) in SL. Body width 5.7 (4.1–4.8) in SL. Caudal peduncle length 5.9 (5.8–6.5) in SL. Caudal peduncle depth 25 (24–25) in SL.

First dorsal fin high in the male, first spine elongate, with a short filament, its length 4.1 (5.1–5.4) in SL; second spine 5.0 in SL, third spine 5.6, fourth spine 9.3.

Predorsal (1) length 3.3 (3.1) in SL. Second dorsal fin distally straight in the male; its rays unbranched, the last divided at its base. First ray of second dorsal fin 5.3 (5.8–5.9) in SL, 5th ray 3.4 in SL, last ray 6.4 in SL. Predorsal(2) length 2.2 (2.1) in SL. Anal fin beginning on a vertical through 2nd ray of second dorsal fin. Anal fin rays unbranched, the last divided at its base. First anal fin ray 11.2 (11.0–12.2) in SL, last ray 6.8 in SL. Preanal fin length 2.0 (1.9) in SL. Pectoral fin reaching to base of 2nd anal fin membrane when laid back. Pectoral fin length 5.4 (5.2–5.6) in SL. Prepectoral fin length 2.7 in SL. Pelvic fin reaching to base of 1st anal fin membrane when laid back. Pelvic fin spine 14.4 in SL. Pelvic fin length 4.3 (4.0) in SL. Prepelvic fin length 4.2 in SL. Caudal fin distally convex, with the two median rays unbranched, but not filamentous; caudal fin length 1.7 (2.4–3.0) in SL.

Colour in life (according to Gloerfelt-Tarp & Kailola, 1984; P. Kailola, personal communication). Head and body brown, with yellow blotches; belly lighter, creamy white. First dorsal fin with a large distal black blotch on the third membrane. Second dorsal fin yellowish brown, distally with dark spots, basally with vertical white stripes. Anal fin with large, distal, dark grey blotches, forming a distal dark band. Pectoral fin translucent. Caudal fin with yellow blotches.

Colour in alcohol. Head and body pale whitish. Eye dark grey. First dorsal fin membranes translucent, distal margins of 1st and 2nd membranes blackish, 3rd membrane with a large kidney-shaped black blotch in its distal two-thirds. Second dorsal fin, pectoral and pelvic fins translucent. Caudal fin pale, distally with two vertical dark grey cross-bands. Distal half of anal fin black, leaving the tips of the fin rays white.

Distribution

Australia (Western Australia, Holothuria Bank to Joseph Bonaparte Gulf) (Fig. 27). Endemic to the area. The holotype was collected at a depth of 84 m.

Relationships

This new species is a member of the *Callionymus-kaianus* species-group of the subgenus *Callionymus (Callionymus).* Within the group, it belongs to a subgroup with a high second dorsal and anal fin (in males). The following species are closely related: *Callionymus altipinnis* Fricke, 1981 (Fricke, 1981a: 373–375, fig. 18, Hong Kong) from China; *C futuna* Fricke, 1998 (Fricke, 1998: 3–6, fig. 1, Futuna Island shelf, 14°13'30''S 178°10'18''W, 224–252 m depth; holotype: MNHN 1995-0521); *C. guentheri* Fricke, 1981 (Fricke, 1981a: 370–373, figs 15–17, west of Zamboanga, Philippines, 07°03'N 121°48'E, 150 m depth; south coast of Luzon to north coast of Mindanao, Philippines, 100–503 m depth, mud bottoms) from the Philippines; *C. semeiophor* Fricke, 1983 (Fricke, 1983: 745–750, fig. A 2, Saleh Bay, northern Sumbawa, Indonesia, 50–150 m depth; holotype: NTM S.10764-001) from Indonesia; *C. sokonumeri* Kamohara, 1936 (Kamohara, 1936: 448, fig. 2 on p. 447, Mimase Market, Province Tosa, Shikoku, Japan, 80 fms/146 m depth) from Japan. The new species differs from *C. altipinnis* in much shorter dorsal fin filament, the longer caudal fin in the male, the lower second dorsal fin, and a different colouration of the body and the anal fin; from *C. futuna* in the much shorter first dorsal fin filament, the distally convex second dorsal fin in the male, and the colouration of the first and second dorsal, anal and caudal fins and of the sides of the body; from the closely related *C. guentheri* in its higher first dorsal fin in the male (the first spine being longer

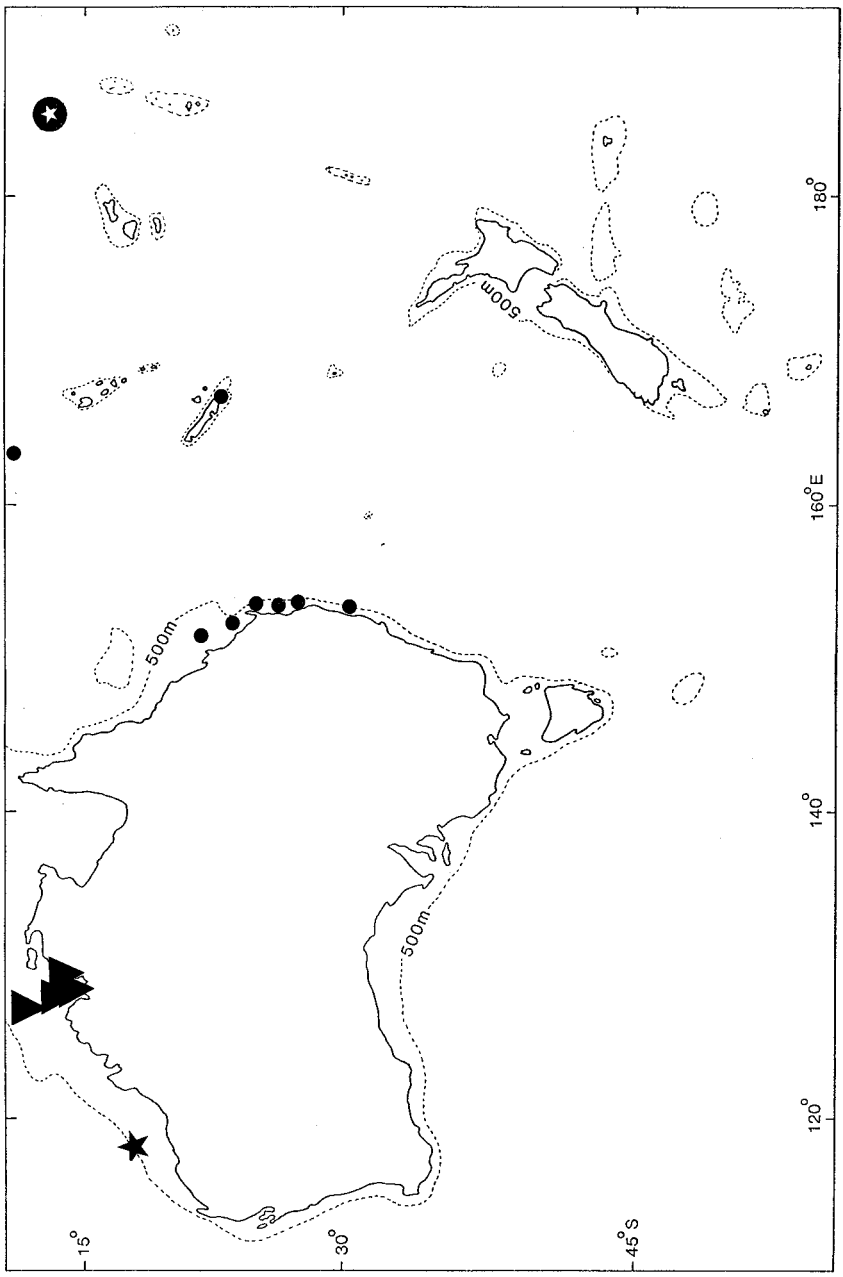


Fig. 27. Geographical distribution of species of the *Callionymus-kaianus* species-group around Australia and in the Southwest Pacific. – Black triangles, *C. bifilum* n.sp. – White star surrounded by black, *C. futuna*. – Black star, *C. kailolae* n.sp. – Black circles, *C. moretonensis*.

than the first ray of the second dorsal fin), the lower second dorsal fin in the male, the different caudal fin shape and much longer caudal fin in the male (*C. bifilum:* caudal fin length 1.7 in SL; *C. guentheri:* 2.2–3.0 in SL), and a different colouration of the first and second dorsal fin, caudal fin, pelvic fin, and body; from *C. semeiophor* in the lower first dorsal and shorter caudal fins in the male, the different caudal fin shape, and the different colouration of the first and second dorsal fin and the body; and from *C. sokonumeri* in the different shape of the first dorsal fin, the much longer caudal fin, the lower anal fin in the male, the different shape of the preopercular spine (main tip narrower; larger dorsal points not equal in length), and the different colouration of the first and second dorsal, anal, caudal and pelvic fins, head and sides of the body. The new species is distinguished from *C. kailolae* n.sp. (see below, 5.4.) by the second dorsal fin which is distally convex in males, the lower anal fin, the much longer caudal fin with the median two rays extremely elongate in the male, the lower first dorsal fin, and the different colouration of the body.

Callionymus bifilum n.sp. differs from *C. moretonensis* in having the black blotch on the first dorsal fin exclusively on the third membrane (extending to the second spine in *C. moretonensis*), a large and a small curved point dorsally on the preopercular spine (two nearly equally sized points in *C. moretonensis*), the distal half of the anal fin black (*C. moretonensis:* distal margin black only), a higher first dorsal fin, and a different colouration of the second dorsal and caudal fins.

Remarks

This species was treated by Fricke (1981a: 359–360, part) as *Callionymus moretonensis* Johnson, 1971, which is now restricted to the northeastern coast of Australia (Arafura Sea, southern Queensland, northern New South Wales) and New Caledonia, possibly extending to Bismarck Archipelago and Solomon Islands. Both species are members of the *Callionymus-kaianus* species-group; distributions of species of the group in Australia and the Southwest Pacific are shown in Fig. 27.

5.3. *Callionymus japonicus* Houttuyn, 1782

Material

Total: 143 specimens (including 142 specimens listed by Fricke, 1983).

Indonesia: SMNS 8538, 1 male, 155.1 mm SL; south of Java, 8°33'00''S 114°31'30''E; T. Gloerfelt-Tarp; 18 May 1983.

Diagnosis

A *Callionymus* of the *Callionymus-japonicus* species-group of the subgenus *Calliurichthys* with a total of 9 rays in the second dorsal fin, 8 rays in the anal fin, 18–20 pectoral fin rays, 7–12 small antrorse serrae dorsally on the preopercular spine (additional to the main tip) and an antrorse spine at the base, with a relatively low first dorsal fin in males bearing filaments on the first and second spines only; with the first dorsal fin pale in males, with a large black ocellus distally on the third membrane with basal branches reaching to the posterior part of the second membrane; with the throat plain white in females; and in males with the distal half of the anal fin black, in females with the distal one-third black.

Distribution

Southern half of Japan, South Korea and eastern China south to Philippines, South China Sea and southern Java (Fig. 25). The species is known from depths of 59–128 m.

Relationships

Callionymus japonicus is closely related to *C. afilum* and *C. scaber;* it is compared with these two species above (5.1., p. 48; 4.8., p. 20).

Remarks

The discovery of additional species has resulted in splitting the former *Callionymus-japonicus* species-group (9 second dorsal fin rays, 8 anal fin rays, preopercular spine with a strong main tip, a strong antrorse spine at its base, and small serrae on its dorsal margin) into four new groups:

(1) Species with all median caudal fin rays extremely elongate in the male: *Callionymus-japonicus* species-group *(C. afilum, C. decoratus, C. gardineri, C. japonicus, C. rivatoni, C. scaber),* distribution see Fig. 25;

(2) species with the median 2–4 caudal fin ray branches extremely elongate in the male: *Callionymus-persicus* species-group (*C. aagilis, C. izuensis, C. luridus, C. neptunius, C. persicus, C. sereti, C. superbus, C. tethys, C. zythros* n.sp.), distribution of species see Fig. 31;

(3) species with the caudal fin moderately elongate in the male: *Callionymus-margaretae* species-group *(C. australis, C. margaretae);*

(4) species with a barely elongate caudal fin in the male: *Callionymus-scabriceps* species-group *(C. scabriceps).*

The Australian CAAB Code previously assigned to this species has been transfered to *Callionymus afilum* n.sp. (CAAB 37 427008) (G. Yearsley, personal communication, 3 May 2000), as *C. japonicus* does not occur in Australia.

5.4. *Callionymus kailolae* **n.sp.** (Fig. 28)

Northwestern ocellated dragonet (Australia)
CAAB Code (Australia): 37 427041

Material

Total: 1 specimen.

Holotype. **Western Australia:** AMS I.22807-021, male, 125.6 mm SL; 175 km N of Port Hedland, 18°32'S 118°17'E, 200–204 m depth; J. R. Paxton & R/V "Soela"; 2 Apr. 1982.

Etymology

This new species is named in honour of Patricia Kailola, Newnham, Tasmania, Australia, who published a photo of the new species, in appreciation of her interest in callionymid fish research.

Diagnosis

A *Callionymus* of the *kaianus*-group of the subgenus *Callionymus* with a high first dorsal fin, the first spine elongate but not filamentous in males; with the second dorsal fin distally straight in males; the caudal fin distally convex, without filaments; the preopercular spine with an upcurved main tip, a small antrorse barb, a larger and

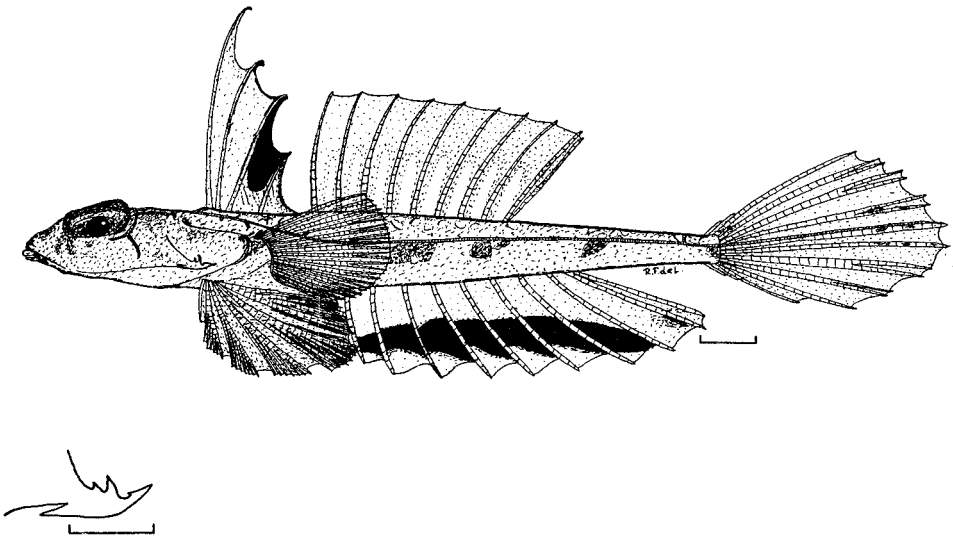


Fig. 28. *Callionymus kailolae* n.sp.; AMS I.22807-021, holotype, male, 125.6 mm SL; Western Australia, 18°32'S 118°17'E, 200–204 m depth. – *Above,* lateral view (scale: 10 mm); – *below,* left preopercular spine (scale: 5 mm).

a smaller curved spine on the dorsal margin, and an antrorse spine at the base; the first dorsal fin with a large black blotch restricted to the distal section of the third membrane; the second dorsal fin with basal vertical white streaks; the anal fin with a subdistal black streak on the 1st to 7th membranes; and the sides of the body with a row of single dark blotches below the lateral line.

Description

D_1 IV; D_2 viii,1; A viii,1; P_1 ii,16–17,ii, total 20–21; P_2 I,5; C (ii),i,3,ii,2,ii,(ii).

Body elongate and depressed. Head depressed, 4.4 in SL. Eye 2.3 in head. Preorbital length 3.8 in head. Interorbital distance 33 in head. Occipital region small, with two low bony protuberances. Maxillary length 6.7 in head. Preopercular spine with a slightly upcurved main tip, a small antrorse and two large curved points on its dorsal margin, and a strong antrorse spine at its base (Fig. 28 B); its length 4.2 in head. Preopercular spine formula $1 \frac{3}{-} 1$. Lateral line reaching from eye to end of upper unbranched caudal fin ray, with a few short branches below the first dorsal fin; the lines of the opposite sides are interconnected by a commissure each across the predorsal area and across the dorsal side of the caudal peduncle. Urogenital papilla 8.6 in head. Body depth 9.5 in SL. Body width 6.4 in SL. Caudal peduncle length 4.6 in SL. Caudal peduncle depth 28 in SL.

First dorsal fin high in the male, first spine elongate, not bearing a filament, its length 3.3 in SL; second spine 4.6 in SL, third spine 5.3, fourth spine 10.2. Predorsal (1) length 3.8 in SL. Second dorsal fin distally straight in the male; its rays unbranched, the last divided at its base. First ray of second dorsal fin 5.6 in SL, last ray 6.0 in SL. Predorsal (2) length 2.4 in SL. Anal fin beginning on a vertical through 2nd ray of second dorsal fin. Anal fin rays unbranched, the last divided at its base. First anal fin ray 9.0 in SL, last ray 4.7 in SL. Preanal fin length 2.2 in SL. Pectoral fin

reaching to base of 2nd anal fin membrane when laid back. Pectoral fin length 5.8 in SL. Prepectoral fin length 2.9 in SL. Pelvic fin reaching to base of 1st anal fin membrane when laid back. Pelvic fin spine 16.9 in SL. Pelvic fin length 4.1 in SL. Prepelvic fin length 3.9 in SL. Caudal fin distally convex, with the two median rays unbranched, but not filamentous; caudal fin length 3.1 in SL.

Colour in life (according to Gloerfelt-Tarp & Kailola, 1984; Kailola, personal communication). Head and body brown, with yellow blotches; belly lighter, creamy white. First dorsal fin with a large distal black blotch on the third membrane. Second dorsal fin yellowish brown, distally with dark spots, basally with vertical white stripes. Anal fin with large, distal, dark grey blotches, forming a distal dark band. Pectoral fin translucent. Caudal fin with yellow blotches.

Colour in alcohol. Head and body brownish, ventrally lighter. Eye dark grey. Sides of body with a row of dark grey blotches below the lateral line. First dorsal fin whitish, with a distal black blotch on the third membrane. Second dorsal fin with vertical white stripes in its basal half. Anal fin with a subdistal black band from 1st to 7th membranes. Caudal, pectoral and pelvic fins pale or translucent.

Distribution

Australia (Western Australia: north of Port Hedland) (Fig. 27). Endemic to the area. Known from soft bottoms (mud) at depths of 200–204 m.

Relationships

This new species is a member of the *Callionymus-kaianus* species-group of the subgenus *Calionymus (Callionymus).* Within the species group, it is related to species with a distally straight second dorsal fin in the male, and lacking caudal fin filaments: *C. bleekeri* Fricke, 1983 (Fricke, 1983: 91–95, fig. 23, Java, Indonesia; holotype: RMNH 4872); *C. carebares* Alcock 1890 (Alcock, 1890: 209, off Madras coast, 98–102 fms depth, syntypes: BMNH 1890.11.28.18–24, 7 specimens; MNHN 1890-0335-0340, 6 specimens; ZSI F.12740–12741, 2 specimens; ZSI 12742 and 12858, 15 specimens. Fricke, 1983: 105–108, fig. 27, revision) from the Gulf of Aden to the Gulf of Bengal; *C. kotthausi* Fricke, 1981 (Fricke, 1981a: 363–364, fig. 10, Cochin, India; holotype: ZIM 5535; Fricke, 1983: 177–180, fig. 52, revision) from India; *C. ochiaii* Fricke, 1981 (Fricke, 1981a: 366–368, fig. 13, Shubishi, Kagoshima Prefecture, Japan, holotype: FAKU 23261; Fricke, 1983: 230–233, figs 67–68, revision) from southern Japan; *C. regani* Nakabo, 1979 (Nakabo, 1979: 231–234, fig. 1, tab. 1, Saya de Malha Bank, 126–191 m depth, holotype: HUMZ 72408; Fricke, 1983: 250–253, fig. 74, revision) from the Saya de Malha Bank, western Indian Ocean; *C. whiteheadi* Fricke, 1981 (Fricke, 1981a: 360–361, fig. 8, off Bali, Indonesia, 08°50'S 114°14'E, 110–220 m depth, holotype: BMNH 1980.6.20.1; Fricke, 1983: 297–300, fig. 89, revision) from western Indonesia. The new species is distinguished from *C. bleekeri* in the lacking filament of the male's first dorsal fin, the higher anal fin, the different shape of the preopercular spine, and the different colouration of the second dorsal fin, the anal fin and the caudal fin; from *C. carebares* in the higher first dorsal fin, the different shape of the preopercular spine, and the colouration of the vertical fins; from *C. kotthausi* in the higher first dorsal fin, the higher anal fin, the different shape of the preopercular spine, and the different colouration of the first dorsal fin and the body; from *C. ochiaii* in the lacking filament but higher membranes of the male's first dorsal fin, the more symmetrical cau-

dal fin of the male, the shorter main tip of the preopercular spine, and the different colouration of the second dorsal, anal and caudal fins of the male; from *C. regani* in the higher first dorsal fin of the male, the first spine being more elongate, the higher anal fin, and the different colouration of the male's first dorsal fin and the anal fin; and from *C. whiteheadi* in the higher first dorsal fin of the male, the higher anal fin, and the different colouration of the first dorsal, anal and caudal fins.

Callionymus kailolae n.sp. differs from *C. moretonensis* Johnson, 1971 in the lacking filaments in the first dorsal and caudal fin, the higher anal fin, and in the colouration of the first dorsal, anal and caudal fins. It was above compared with the co-occurring *C. bifilum* n.sp. (description see 5. 2.).

5.5. *Callionymus leucobranchialis* Fowler, 1941 (Fig. 29)

Whitegill dragonet

Callionymus leucobranchialis Fowler, 1941: 19–22, fig. 12 (part: San Fernando Point Light, Luzon, Philippines, 16°30'36''N 120°11'06''E, 45 fms depth; holotype: USNM 99393). – Fricke, 1983: 181–182 (on Fowler).

Material

Total: 3 specimens.

Australia, Queensland: NTM S.14279-007, 1 male, 38.1 mm SL; W of Weipa, Gulf of Carpentaria, 12°12.7'S 140°30.4'E, 61 m depth; P. Alderslade; 4 Dec. 1990.

Western Australia: CSIRO H.1084-1 and H.1084-2, 2 males, 65.8–77.7 mm SL; S of Rowley Shoals, 18°37'S 118°20'E, 137 m depth; R/V "Soela"; 25 Sep. 1987.

Diagnosis

A *Callionymus* of the *Callionymus-caeruleonotatus* species-group of the subgenus *Callionymus* with 9 rays each in the second dorsal and anal fins; 3–5 curved points dorsally on the preopercular spine; the first dorsal fin extremely high in the male, all spines filamentous, the second spine longest; the gill membranes white; the anal fin plain whitish in the male; the pelvic fins whitish, distally dark grey.

Description

D_1 IV; D_2 viii,1; A viii,1; P_1 i,15–17,i (total 17–19); P_2 I,5; C(ii),i,7,ii,(ii).

Body elongate and depressed. Head depressed, 4.1–4.7 in SL. Eye 2.2 in head. Preorbital length 2.9–3.2 in head. Interorbital distance 20.8–29.4 in head. Maxillary length 2.7–2.8 in head. Preopercular spine length 2.9–3.4 in head. Preopercular spine formula $1 \frac{3-5}{-} 1$. Body depth 11.3–12.5 in SL. Body width 5.6–5.8 in SL. Urogenital papilla in the male 9.5–11.8 in head. Caudal peduncle length 5.6–7.0 in SL. Caudal peduncle depth 21.9–24.3 in SL.

First dorsal fin extremely high in the male, all spines filamentous, the second longest; first spine 1.4 in SL, 2nd spine 1.2, 3rd spine 2.6–2.7, 4th spine 3.5–3.9. Predorsal (1) length 3.1–3.7 in SL. Second dorsal fin rays unbranched, the last divided at its base. First ray of second dorsal fin in the male 6.4–7.1 in SL, 5th ray 5.3–6.2, last ray 3.7. Predorsal (2) length 2.0–2.3 in SL. Anal fin beginning on a vertical through 2nd ray of second dorsal fin. Anal fin rays unbranched, the last divided at its base. First anal fin ray in the male 11.4–13.2 in SL, 5th ray 7.6–9.6, last ray 5.6–6.2. Preanal fin length 1.9–2.1 in SL. Pectoral fin reaching to base of 3rd anal fin membrane when laid back. Pectoral fin length 4.7–4.8 in SL. Prepectoral fin length 2.5–2.8 in SL.

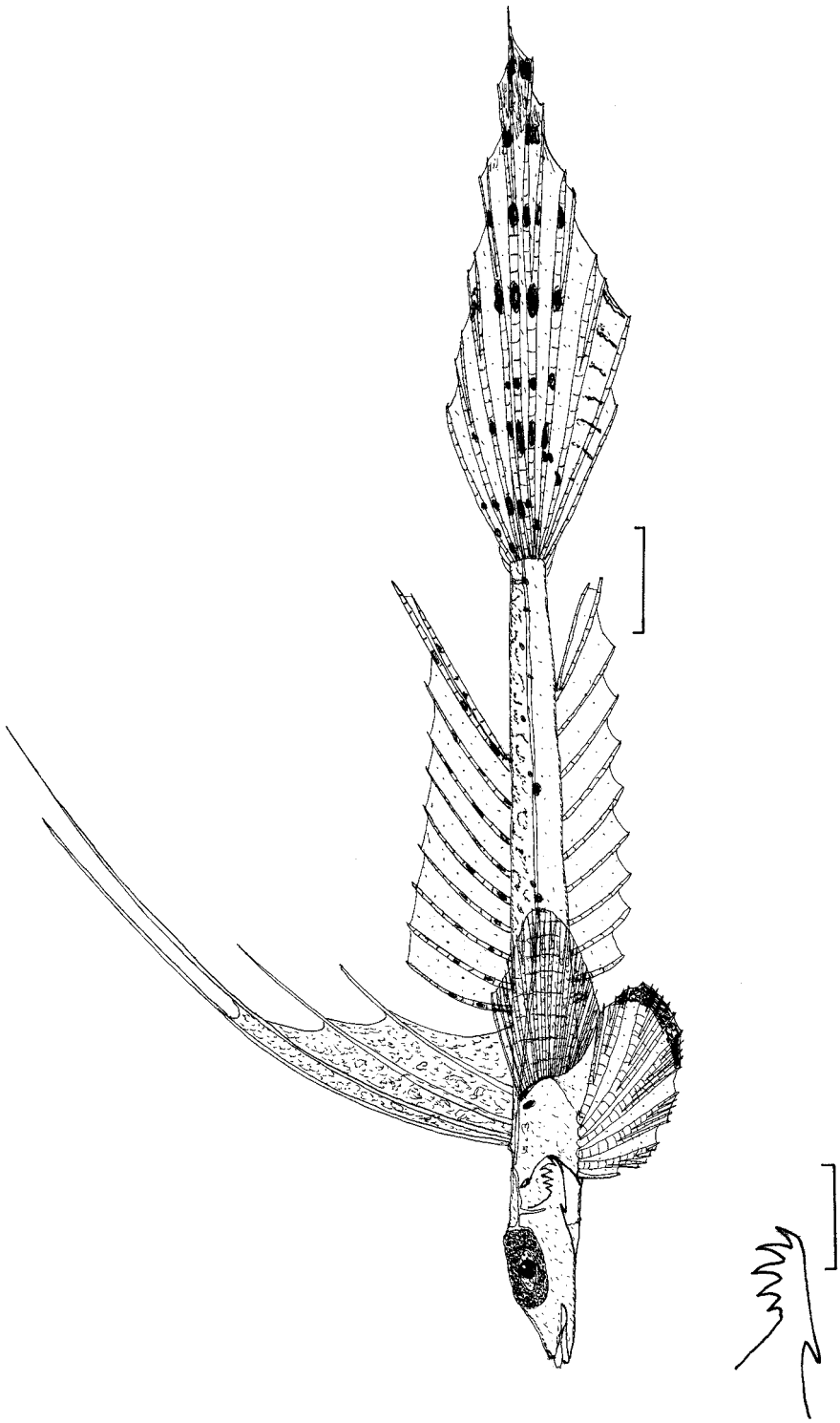


Fig. 29. *Callionymus leucobranchialis* Fowler, 1941; CSIRO H.1084-1, male, 77.7 mm SL; Western Australia, 18°37'S 118°20'E, 137 m depth. – *Above*, lateral view (scale: 10 mm); – *below*, left preopercular spine (scale: 5 mm).

Pelvic fin reaching to base of 1st anal fin membrane when laid back. Pelvic fin spine 16.0–18.1 in SL; pelvic fin length 3.5–3.8 in SL. Prepelvic fin length 3.9–4.7 in SL. Caudal fin extended, without filaments (except for the occasional presence of a short median filament); caudal fin length 1.4.

Colour in alcohol. Head and body yellowish brown, back with irregular brownish circles and half circles, lower half of body yellowish white. Sides of body with a row of small dark brown blotches below the lateral line. Eye dark grey, iris silvery. Gill membranes white. Two small black spots at dorsal end of pectoral fin base.

First dorsal membranes dusky, with whitish marbling. Second dorsal fin translucent, rays with small brownish spots. Anal fin whitish. Caudal fin with about 7 vertical rows of dark blotches; lower two membranes with narrow oblique brownish streaks. Distal part of caudal fin dark grey. Pelvic fin whitish, distally dark grey. Pectoral fin with vertical rows of small brown spots.

Distribution

Australia (Western Australia: south of Rowley Shoals; Queensland: Gulf of Carpentaria). New record from Australia. Outside the area, Philippines (Luzon). The species has been collected at depths of 61–137 m.

Relationships

This species is closely related to *Callionymus caeruleonotatus* Gilbert, 1905 (Gilbert, 1905: 648–649, pl. 89, Hawaiian Islands; Fricke, 1983: 95–99, fig. 34, revision, Hawaiian Islands); that species is distinguished in having a total of 8 anal fin rays, a lower first dorsal fin without filaments, the anal fin distally blackish in males, and two horizontal rows of dark spots on the cheeks.

Remarks

This species was previously known only from the holotype from the Philippines. The unexpected rediscovery of the species, and range extension to northern Australia, makes a redescription necessary that is presented here.

5.6. *Callionymus zythros* **n.sp.** (Fig. 30)

Material

Total: 1 specimen.

Holotype. **Papua New Guinea:** BPBM 38532, male, 46.2 mm SL; Madang Province, Wongat Island, lagoon side, silty slope, 20–27 m depth; J. E. Randall; 6 Nov. 1987.

Diagnosis

A *Callionymus* of the *Callionymus-persicus* species-group of the subgenus *Calliurichthys* with 9 rays in the second dorsal fin, 8 rays in the anal fin, 19–20 pectoral fin rays, 5–6 small dorsal serrae on the preopercular spine, the median two caudal fin rays extremely elongate, the first dorsal fin in the male with the second spine longest, but dorsal spines without filaments; the thorax with faint lines in the male; the first dorsal fin in the male on the 1st and 2nd membranes with 8 oblique brown lines, and on the 3rd and 4th membranes with brown blotches and lines; anterior distal portions of 2nd and 3rd membranes each with a short black line following the outer margin of the membrane.

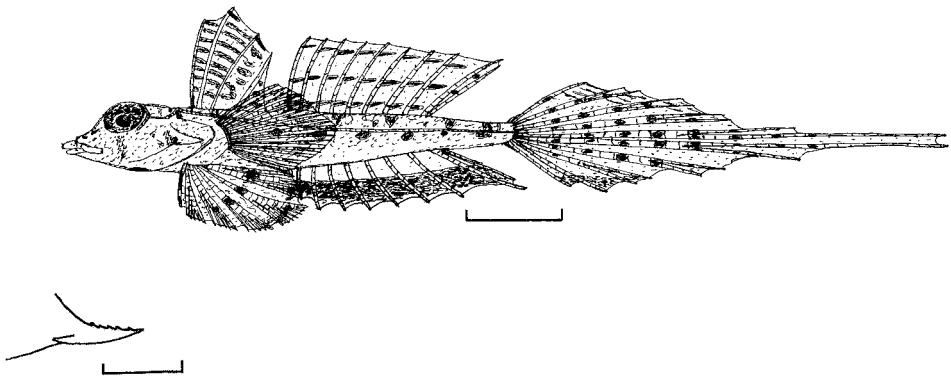


Fig. 30. *Callionymus zythros* n.sp.; BPBM 32532, holotype, male, 46.2 mm SL; Papua New Guinea, Wongat Island, 20–27 m depth. – *Above,* lateral view (scale: 10 mm); – *below,* left preopercular spine (scale: 3 mm).

Description

D_1 IV; D_2 viii,1; A vii,1; P_1 ii,16–17,i (total 19–20); P_2 I,5; C (ii),i,7,ii,(ii).

Body elongate and slightly depressed. Head slightly depressed, 4.2 in SL. Eye 2.5 in head. Preorbital length 2.8 in head. Interorbital distance 9.5 in head. Maxillary length 2.5 in head. Occipital region with a low, rough bony ridge on each side. Preopercular spine with a straight main tip, a smooth ventral margin, a strong antrorse point at its base, and 5–6 small antrorse dorsal serrae (Fig. 30, below). Preopercular spine length 3.2 in head. Preopercular spine formula $1 \frac{5-6}{-} 1$. Lateral line interconnected by a commissure each across the interorbital and the occiptal region, and by two commissures dorsally across the caudal peduncle. Body depth 7.4 in SL. Body width 6.2 in SL. Urogenital papilla in the male 16 in head. Caudal peduncle length 5.6 in SL. Caudal peduncle depth 19.2 in SL.

First dorsal fin higher than second dorsal fin in the male, but spines not filamentous; second spine longest; first spine 4.7 in SL, 2nd spine 4.1, 3rd spine 4.8, 4th spine 6.3. Predorsal (1) length 3.7 in SL. Second dorsal fin rays unbranched, the last divided to its base. Second dorsal fin distally straight, the last ray slightly elongate. First ray of second dorsal fin in the male 5.9 in SL, last ray 4.8. Predorsal (2) length 2.0 in SL. Anal fin beginning on a vertical through 2nd ray of second dorsal fin. Anal fin rays unbranched, the last divided to its base. First anal fin ray in the ale 15.9 in SL, last ray 4.9. Preanal fin length 2.0 in SL. Pectoral fin reaching to base of 3rd anal fin membrane when laid back. Pectoral fin length 4.2 in SL. Prepectoral fin length 2.8 in SL. Pelvic fin reaching to base of 1st anal fin membrane when laid back. Pelvic fin spine 10.5 in SL; pelvic fin length 3.4 in SL. Prepelvic fin length 4.2 in SL. Median two rays of caudal fin in the male distally extremely elongate; caudal fin length in the male 1.0 in SL.

Colour in life (based on photograph taken from the holotype by J. E. Randall). Head and body light brown, belly white. Eye brown. Sides of head and body covered with large grey blotches; sides of body also with small reddish brown spots. Thorax with faint lines reaching to membrane connecting pectoral fin with pelvic fin. First dorsal fin yellowish, with oblique dark brown lines. Second dorsal fin with three horizontal rows of greyish brown spots, and with white spots on the rays in

between. Distal half of anal fin blackish, leaving tips of fin rays and distal section of membranes whitish. Lower margin of caudal fin blackish; central part with 8 vertical rows of brown spots, dorsal part with 3 oblique greyish brown lines. Pelvic fin with a median and a distal row of blackish blotches. Pectoral fin translucent.

Colour in alcohol. Head and body yellowish, belly white. Eyes dark grey. Suborbital region with a faint vertical brown streak; base of preopercular spine with 2–3 brown spots. Thorax with a heart-shaped dark brown blotch, but without lines. Sides of body with a row of 6 brown blotches below the lateral line; back with about 6 faint brown saddles. First dorsal fin on the 1st and 2nd membranes with 8 oblique brown lines, and on the 3rd and 4th membranes with brown blotches and lines; anterior distal portions of 2nd and 3rd membranes each with a short black line following the outer margin of the membrane. Second dorsal fin translucent; each membrane with 3 horizontal brown streaks. Distal half of anal fin brown, leaving tips of fin rays and distal section of membranes whitish. Lower margin of caudal fin brown; central part with 8 vertical rows of brown spots. Pelvic fin with a median and a distal row of brown blotches. Pectoral fin translucent.

Distribution

The new species is known only from the type locality, Wongat Island, Madang Province, Papua New Guinea (Fig. 31); the holotype was collected at a depth of 20–27 m.

Relationships

Callionymus zythros n.sp. is a member of the *Callionymus-persicus* species-group, which is characterized by 9 dorsal rays, 8 anal rays, the median 2–4 caudal fin branches extremely elongate, and a preopercular spine with a strong main tip, a strong antrorse spine at its base, and small serrae on its dorsal margin; other members of the group are *Callionymus aagilis* Fricke, 1999 (Fricke, 1999: 491–493, fig. 9, Réunion; holotype: MNHN 1966-0833); *C. izuensis* Fricke & Zaiser Brownell, 1993 (Fricke & Zaiser Brownell, 1993: 4, fig. 2, Igaya Bay, Miyake-jima, Izu Islands, Japan; holotype: NSMT-P 35099); *C. luridus* Fricke, 1981 (Fricke, 1981c: 390–393, figs 2–3, tab. 2, Macclesfield Bank, South China Sea, holotype: BMNH 1894.4.24.7; Fricke, 1983: 394–398, fig. 116, Macclesfield Bank, 69.5–80.5 m depth); *C. neptunius* (Seale, 1910) (Seale, 1910: 539–540, Balayan Bay, Philippines, holotype destroyed in WW II; Fricke, 1983: 411–416, fig. 121, revision); *C. persicus* Regan, 1906 (Regan, 1906: 325–326, pl. 3, fig. 1, Persian Gulf, Mekran Coast, Muscat, syntypes: BMNH; Fricke, 1983: 416–423, figs 122–124, revision); *C. sereti* Fricke, 1998 (Fricke, 1998: 6–9, fig. 2, Futuna Island Shelf; holotype: MNHN 1995-0523); *C. superbus* Fricke, 1983 (Fricke, 1983: 442–448, fig. 131, Indonesia; holotype: RMNH 6219); *C. tethys* Fricke, 1993 (Fricke, 1993: 369–371, fig. 2, New Caledonia; holotype: MNHN 1993-0136). The new species differs from all species of the group except *C. izuensis* and *C. persicus* in the absence of filaments in the male's first dorsal fin, and in having 8 oblique brown lines on the 1st and second membranes of the first dorsal fin. From the most closely related species *C. persicus,* the new species differs in having less distinct lines on the thorax, in the broader dark band on the male's anal fin, in having only the median 2 caudal fin branches elongate (4 branches elongate in *C. persicus),* and the different colour pattern of the first dorsal fin. From *C. izuensis, C. neptunius, C. superbus* and *C. thethys,* the new species differs in having less distinct lines

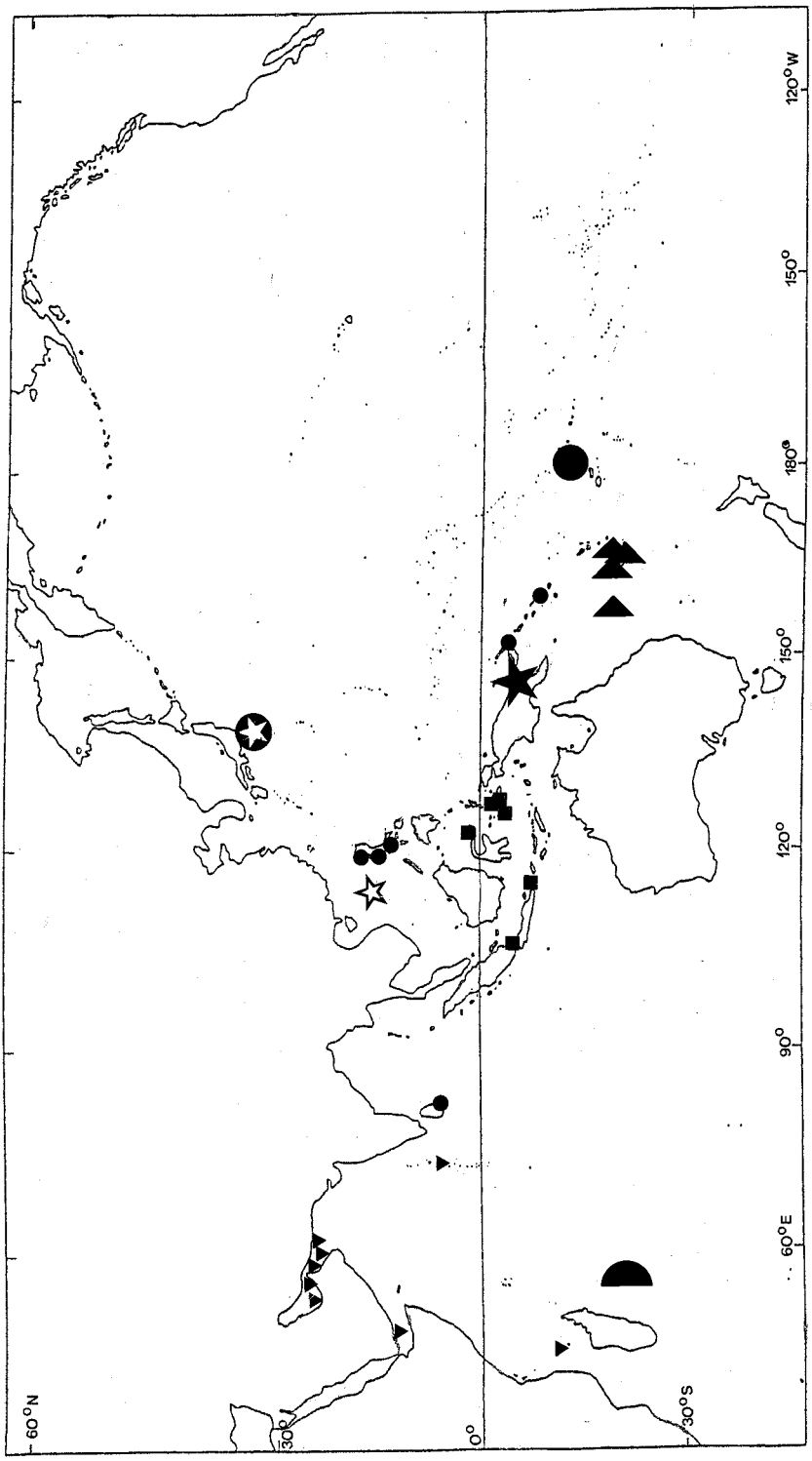


Fig. 31. Geographical distribution of the *Callionymus-persicus* species-group. – Black half circle, *Callionymus aagilis*. – White star surrounded by black, *C. izuensis*. – White star, *C. luridus*. – Small black circles, *C. neptunius*. – Small black triangles, *C. persicus*. – Large black circle, *C. sereti*. – Small black squares, *C. superbus*. – Large black triangles, *C. tethys*. – Black star, *C. zythros* n.sp.

on the thorax. From *C. izuensis,* it also differs in the number of brown lines on the first dorsal fin (only 5 lines in the lower half of the 1st and 2nd membranes in *C. izuensis*).

Remarks

The discovery of additional species has resulted in splitting the former *Callionymus-japonicus* species-group (9 second dorsal fin rays, 8 anal fin rays, preopercular spine with a strong main tip, a strong antrorse spine at its base, and small serrae on its dorsal margin) into four new groups (see remarks on 5.3. *C. japonicus*). Species with the median 2–4 caudal fin ray branches extremely elongate in the male form the *Callionymus-persicus* species-group (distribution see Fig. 31; species: *C. aagilis, C. izuensis, C. luridus, C. neptunius, C. persicus, C. sereti, C. superbus, C. tethys, C. zythros* n.sp.).

5.7. *Synchiropus altivelis* (Temminck & Schlegel, 1845)

Callionymus altivelis Temminck & Schlegel, 1845: 155–156, pl. 79, fig. 1 (Ohomura, near Nagasaki, Japan; lectotype: RMNH D.1012, dry specimen, as designated by Boeseman, 1947: 134).
Synchiropus (Synchiropus) altivelis: Fricke, 1981b: 55–60 (part: Japan, South China Sea, Java/Indonesia, Philippines). – Fricke, 1983: 576–583 (part: Japan, Taiwan, Philippines).
Foetorepus altivelis: Nakabo, 1993: 987, fig. (Japan; with pictorial key).

Material

Total: 53 specimens (as listed by Fricke, 1981b, 1983; specimens from Japan, Taiwan, Philippines, South China Sea, and Indonesia).

Diagnosis

A *Synchiropus* of the *Synchiropus-altivelis* species-group of the subgenus *Synchiropus* with 8 rays in the second dorsal fin, 7 anal fin rays; a preopercular spine with a long, straight main tip and with a strong, recurved point on its dorsal margin; eye small, eye diameter 3.0–3.3 in head; first dorsal fin higher than second dorsal fin in both sexes, first spine in the male with a long filament; second dorsal fin distally straight in the female, distally concave in the male, first ray elongate in the male; anal fin relatively low in the female, larger in the male; caudal fin elongate in the male, with numerous long filaments; caudal fin shorter in the female, without filaments; first dorsal fin pale in the male, with a dark blotch on the third membrane in the female; the anal fin pale in the male, distally spotted in the female; the caudal fin pale in both sexes; the pelvic fin pale in both sexes.

Distribution

Southern Japan to western Indonesia (Java) and the Philippines, at depths of 71–566 m (Fig. 32).

Remarks

The publication date of the original description of *Callionymus altivelis* Temminck & Schlegel is 1845 (according to Sherborn & Kentink, 1895).

Populations from the Hawaiian Islands described by Fricke (1981b, 1983) under the name *S. altivelis* were found to belong to a separate species, *S. hawaiiensis* n.sp.

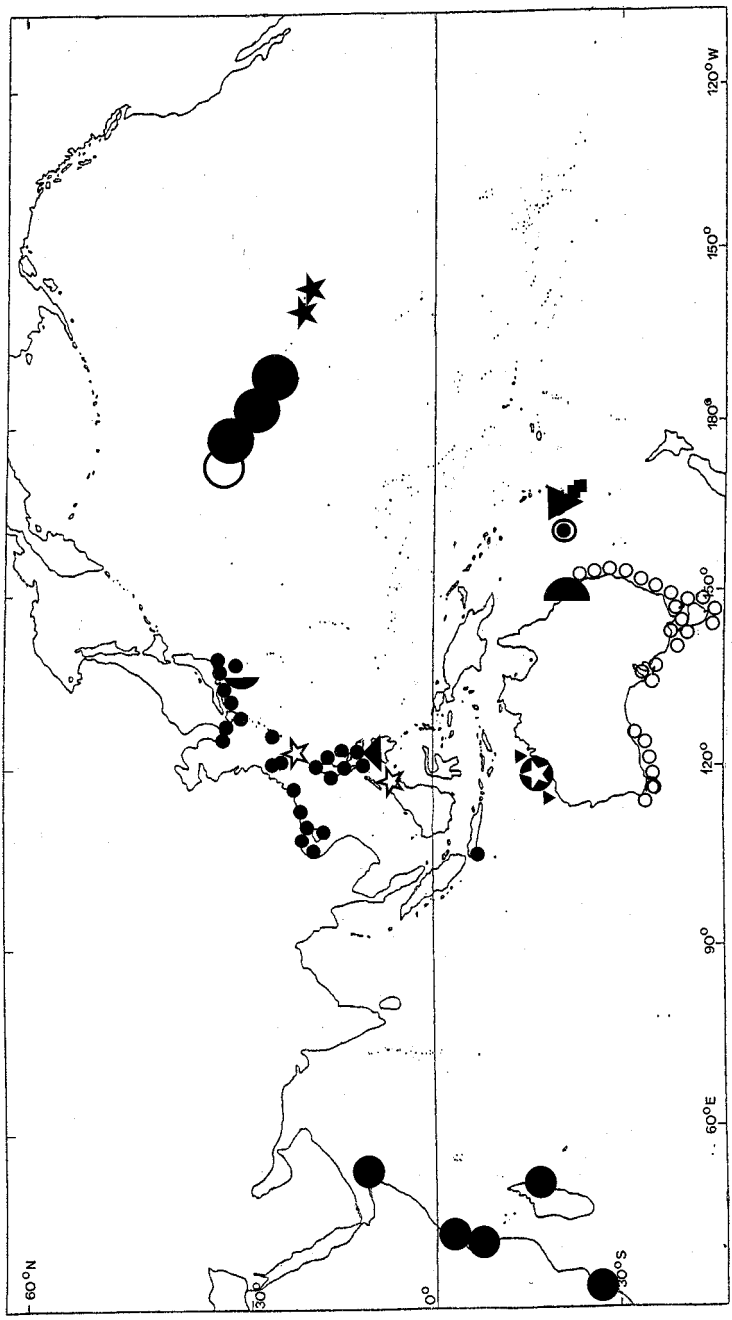


Fig. 32. Geographical distribution of the *Synchiropus-altivelis* species-group. – Circles: Small black circles, *S. altivelis*. – Small open circles, *S. calauropomus*. – Large open circle, *S. kammuensis*. – Large black circles, *S. kimmeiensis*. – Medium black circles, *S. monacanthus*. – Small black circle surrounded by white circle, *S. signipinnis* n.sp. – Half circles: Large black half circle, *S. australis*. – Small black half circle, *S. kamoharai* and *S. masudai*. – Stars: White stars, *S. delandi*. – Black stars, *S. hawaiiensis* n.sp. – White star surrounded by black, *S. paxtoni* n.sp. – Triangles: Small black triangle, *S. grandoculis* n.sp. – Medium black triangle, *S. grimnelli*. – Large black triangle, *S. richeri* n.sp. – Squares: Small black squares, *S. noviaecaledoniae* and *S. orstom* n.sp.

(as described below, 5.9.). The Hancock Seamount material mentioned by Fricke (1981b, 1983) belongs to *S. kinmeiensis* Nakabo, Yamamoto & Chen, 1983. The northern population of *S. altivelis* is restricted to an area between Japan, the Philippines, and western Indonesia.

Specimens from seamounts SE of New Caledonia, previously assigned to *S. altivelis,* were found to belong to a separate species, *S. orstom* n.sp. (description see above, 4.15.).

The *Synchiropus-altivelis* species-group was formerly regarded as consisting of five species only (Fricke, 1983; *S. altivelis, S. calauropomus, S. delandi, S. grinnelli, S. monacanthus*). Subsequently, several additional species were described. Now, the species-group is expanded to comprise the following 17 species (distributions see Fig. 32):

(1) *S. altivelis* (Temminck & Schlegel, 1845); southern Japan to Gulf of Tonkin, western Indonesia, and Philippines.

(2) *S. australis* Nakabo & McKay, 1989 (Nakabo & McKay, 1989: 563–565, figs 1–2, off Queensland, 23°59'S 152°59'E, 380 m depth; holotype: QM I.21255); Queensland and New South Wales, Australia.

(3) *S. calauropomus* (Richardson, 1844) (Richardson, 1844: 10–11, pl. 7, figs 4–5, Australia, holotype: BMNH 1855.9.19.183, as *Callionymus calauropomus;* Fricke, 1981b: 68–72, figs 19–20, revision, southern half of Australia; Fricke, 1983: 587–592, figs 178–179, southern half of Australia); southern Australia.

(4) *S. delandi* Fowler, 1943 (Fowler, 1943: 81–82, fig. 20, Mabul Island, northeastern Borneo, 04°12'10''N 118°38'05''E, 260 fms/475 m depth, holotype: USNM 99524; Fricke, 1983: 592–595, fig. 180); Borneo to Taiwan.

(5) *S. grandoculis* n.sp. (description see below, 5.8.); Western Australia.

(6) *S. grinnelli* Fowler, 1941 (Fowler, 1941: 24–26, fig. 15, San Bernardino Light, Philippines, 12°55'26''N 124°22'12''E, 195 fms/357 m depth, holotype: USNM 99436; Fricke, 1983: 595–599, figs 181–182); Philippines.

(7) *S. hawaiiensis* n.sp. (description see below, 5.9.); Hawaiian Islands.

(8) *S. kamoharai* Nakabo, 1983 (Nakabo, 1983: 210–211, fig. 5, Kochi Province, Japan, holotype: BSKU 7452); southern Japan.

(9) *S. kanmuensis* Nakabo, Yamamoto & Chen, 1983 (Nakabo, Yamamoto & Chen, 1983: 351–353, fig.3, Kanmu Seamount, Emperor Seamounts, 32°00'N 172°50'E, 355–498 m depth, holotype: FAKU 50671); Kanmu Seamount, north central Pacific.

(10) *S. kinmeiensis* Nakabo, Yamamoto & Chen, 1983 (Nakabo, Yamamoto & Chen, 1983: 349–351, figs 1–2, Kanmu and Kinmei Seamounts, Emperor Seamounts, 350–375 m depth, holotype: HUMZ 68699); Kanmu, Kinmei and Hancock Seamounts (new record, based on BPBM 24808), north central Pacific.

(11) *S. masudai* Nakabo, 1987 (Nakabo, 1987: 335–340, figs 1, 2, 3A, Kochi Prefecture, Japan, holotype: FAKU 52494); southern Japan.

(12) *S. monacanthus* Smith, 1935 (Smith, 1935: 187–189, Port Alfred, South Africa, holotype: RUSI 135; Fricke, 1983: 627–630, figs 193–194); South Africa to Somalia, also Madagascar (new record, based on MNHN 1988-1476-1477, 2 specimens).

(13) *S. novaecaledomiae* Fricke, 1993 (see above, 4.13.); West Jumeau Seamount, SE of Grande Terre, New Caledonia.

(14) *S. orstom* n.sp. (see above, 4.15.); East Jumeau and Aztèque Seamounts, SE of Grande Terre, New Caledonia.
(15) *S. paxtoni,* n.sp. (see below, 5.10.); Western Australia.
(16) *S. richeri* n.sp. (see above, 4.17.); Grande Terre, New Caledonia.
(17) *S. signipinnis* n.sp. (see above, 4.19.); Chesterfield Islands.

5.8. *Synchiropus grandoculis* **n.sp.** (Fig. 33)

CAAB Code (Australia): 37 427043

Material

Total: 3 specimens.

Holotype. **Western Australia:** WAM P.20418-001, male, 128.5 mm SL; 70 km SE Rowley Shoals, 18°01'S 118°25'E, 351–353 m depth; N. Sinclair & P. Berry; 24 Aug. 1983.
Paratypes. **Western Australia:** NTM S.12728-041, 135.4 mm SL; SE of Rowley Shoals, 18°01'S 118°23'E, 420 m depth; D. Evans; 6 Feb. 1990. – SMNS 12822, 2 specimens, 117.6–135.6 mm SL; same data as the holotype.

Etymology

Grandis (Latin) means large; *oculus* (Latin) means eye (form *oculis*). The name refers to the unusually large eyes of the new species.

Diagnosis

A *Synchiropus* of the *Synchiropus-altivelis* species-group of the subgenus *Synchiropus* with 8 rays in the second dorsal fin, 7 anal fin rays, 19–21 pectoral fin rays, a preopercular spine with a short, upcurved main tip and a strong curved dorsal point; the first dorsal fin plain pale in both sexes, lower than the first ray of the second dorsal fin; the first ray of the second dorsal fin slightly elongate in the male; the median caudal fin rays blackish and with short filaments in the male; the eye large, its diameter 1.9–2.2 in head; and the preorbital region 3.6–5.9 in head.

Description

D_1 IV (IV); D_2 8 (8); A vi,1 (vi,1); P_1 i,18–19,i, total 20–21 (i,17–19,i; total 19–21); P_2 I,5 (I,5); C (ii),i,7,ii,(ii) ((iii),i,7,ii,(iii)).

Body elongate and slightly depressed. Head slightly depressed, 3.8 (3.8–3.9) in SL. Eye extremely large; eye diameter 2.2 (1.9–2.0) in head. Preorbital length 3.6 (4.4–5.9) in head. Interorbital distance 8.2 (9.8–10.1) in head. Maxillary length 3.4 (3.2–3.4) in head. Preopercular spine with a short, upcurved main tip, a vertical, curved dorsal point, a smooth ventral margin and base (Fig. 33, below). Preopercular spine length 4.1 (3.8–4.0) in head. Preopercular spine formula – $\frac{1}{-}$ 1. Body depth 6.1 (5.5–5.9) in SL. Body width 5.4 (5.0–5.5) in SL. Urogenital papilla in the male 29 (34) in head, in the female 38. Caudal peduncle length 4.1 (4.2–4.4) in SL. Caudal peduncle depth 17.9 (16.0–17.4) in SL.

First dorsal fin relatively low in the male, first spine 4.5 (5.0) in SL, 2nd spine 5.4 (5.9), 3rd spine 7.6 (7.9), 4th spine 11.4 (13.8); in the female, 1st spine 6.6 in SL, 2nd spine 7.6, 3rd spine 9.4, 4th spine 12.2. Predorsal (1) length 3.1 (3.0–3.2) in SL. Second dorsal fin rays branched, the last divided at its base. First ray of second dorsal fin in the male 4.8 (4.9) in SL, last ray 5.5 (5.6); in the female, 1st ray 5.2 in SL, last ray 5.8 in SL. Predorsal (2) length 2.1 (2.1–2.2) in SL. Anal fin beginning on a vertical through 3rd or 4th membrane of second dorsal fin. Anal fin rays unbranched, the

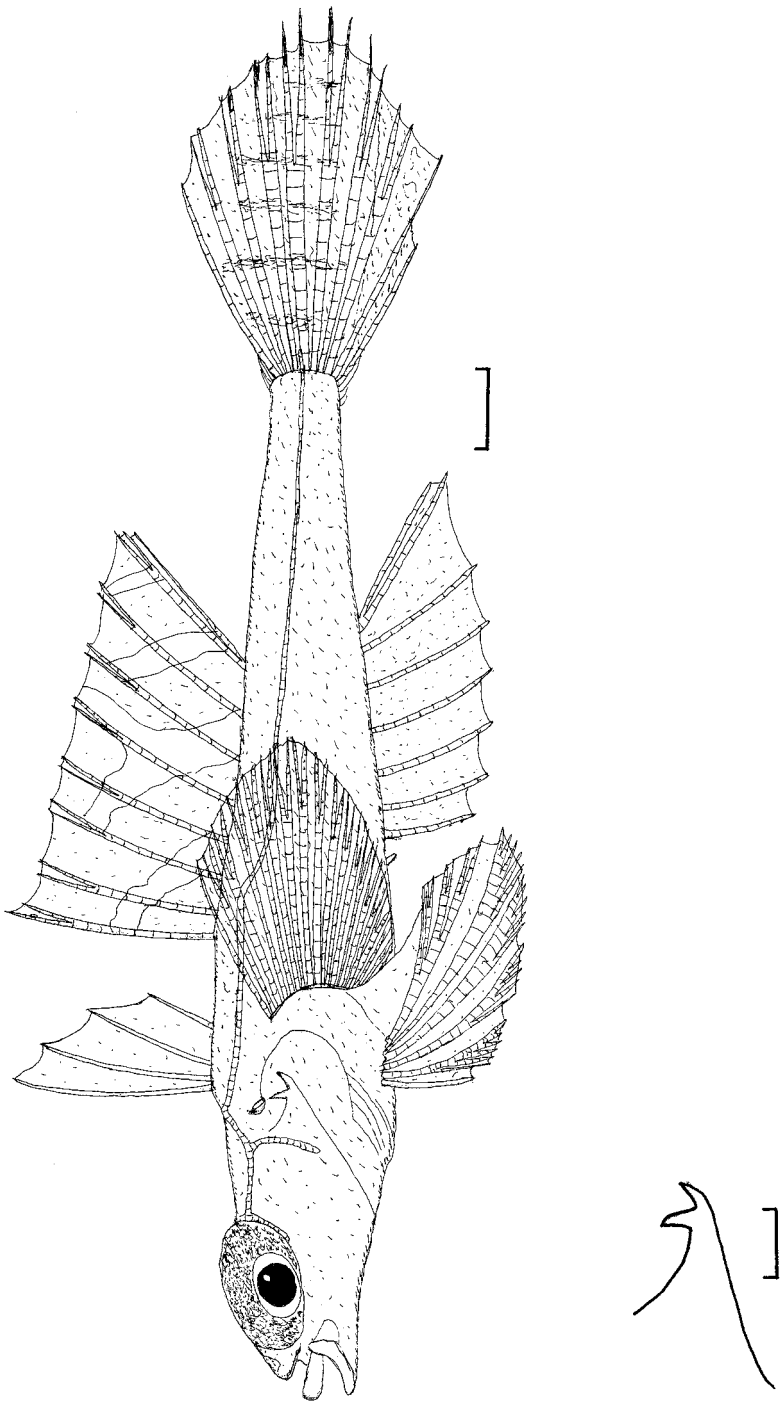


Fig. 33. *Synchiropus grandoculis* n.sp.; Western Australia, 70 km SE of Rowley Shoals; SMNS 12822, paratype, specimen 1, male, 135.6 mm SL. – *Above*, lateral view (scale: 10 mm); – *below*, left preopercular spine (scale: 3 mm).

last divided at its base. First anal fin ray 11.6 (11.6) in SL, last ray 6.5 (6.2–7.0). Preanal fin length 1.8 (1.8) in SL. Pectoral fin reaching to 3rd anal fin membrane when laid back. Pectoral fin length 4.1 (4.0–4.1) in SL. Prepectoral fin length 2.6 (2.4–2.5) in SL. Pelvic fin reaching to 1st or 2nd anal fin membrane when laid back. Pelvic fin spine 11.8 (12.1–13.4) in SL; pelvic fin length 3.7 (3.7–3.8) in SL. Prepelvic fin length 3.5 (3.1–3.2) in SL. Caudal fin distally convex, the median three rays with short filaments in the male; caudal fin length in the male 2.7 (2.9) in SL, in the female 2.8 in SL.

Colour in life (male specimen; according to field note by N. Sinclair, Perth, Western Australia). Head and body pale. A yellow bar each dorsally across preorbital and interorbital region; two yellow blotches dorsally on snout. Sides of body with horizontal yellow stripes, and some yellow spots below. First dorsal fin with white spines and orange yellow membranes. Second dorsal fin pink-orange, with 4 oblique white bars. Anal fin rays white, membranes red. Caudal fin with a red lower margin; with about 6 vertical yellow bars, and white spots in between; tips of median fin rays blackish. Pelvic fins white, with yellow mottling. Pectoral fin translucent.

Colour in alcohol. The yellow, orange and red colours fade away. Specimens have the head, body, and fins plain whitish; the eye dark grey, and the tips of the caudal fin blackish.

Sexual dimorphism. Not much developed. Males differ from females in the slightly higher first dorsal fin, in the slightly elongate first ray of the second dorsal fin, in the longer caudal fin, the longer urogenital papilla, and a brighter life colouration.

Distribution

This new species is known only from the type locality, the continental slope west of Broome, Western Australia (Fig. 32); it was collected at depths of 351–420 m.

Relationships

Synchiropus grandoculis n.sp. is a member of the *Synchiropus-altivelis* species-group (species see description of *S. altivelis,* 5.7.). The new species is compared with *S. orstom* n.sp. (4.15.), *S. richeri* n.sp. (4.17.) and *S. signipinnis* n.sp. (4.19.) in the "Relationships" sections of these species. It is distinguished from *S. novaecaledoniae* and *S. monacanthus* in having a short, upcurved main tip of the preopercular spine (long and straight in the other two species), the first dorsal fin lower than the second dorsal fin in both sexes (higher in *S. novaecaledoniae* and male *S. monacanthus;* as high as second dorsal fin in female *S. monacanthus*), the caudal fin bearing median filaments in males (extended but without filaments in the other two species), the first dorsal fin pale in males (striped in the other species), pale in females (basally dark in *S. monacanthus;* with a black blotch in *S. novaecaledoniae*), the anal fin pale (distally dark in male *S. monacanthus;* with stripes and spots in *S. novaecaledoniae*), and the pelvic fin pale (distally dark in male *S. monacanthus).*

5.9. *Synchiropus hawaiiensis* **n.sp.** (Fig. 34)

Synchiropus (Synchiropus) altivelis (non Temminck & Schlegel, 1845): Fricke, 1981b: 55–60, figs 15–16 (part: Hawaiian Islands). – Fricke, 1983: 576–583, figs 173–174 (part: Hawaiian Islands).

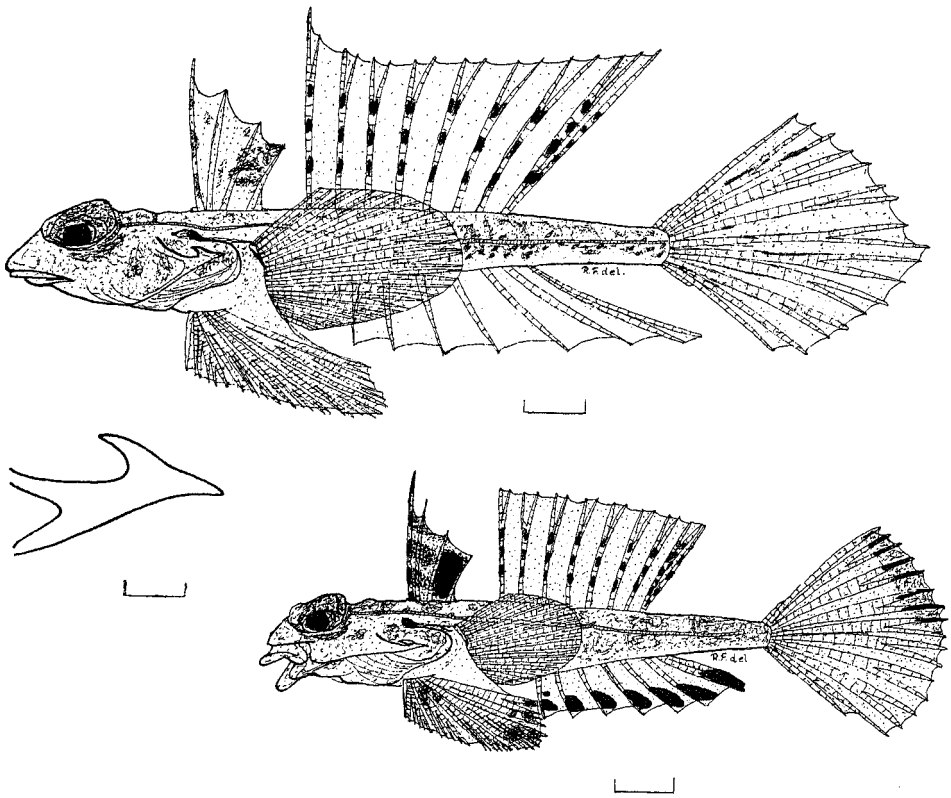


Fig. 34. *Synchiropus hawaiiensis* n.sp.; Hawaiian Islands; BPBM 23874, paratypes. – *Above,* specimen 1, male, 116.3 mm SL: lateral view (scale: 10 mm); – *centre,* left preopercular spine (scale: 2 mm); – *below,* specimen 2, female, 87.8 mm SL: lateral view (scale: 10 mm). (From Fricke, 1981b: figs 15–16.)

Synchiropus kinmeiensis (non Nakabo, Yamamoto & Chen, 1983): Randall, 1999: 198–200, fig. 6 (part: Hawaiian Islands).

Material

Total: 88 specimens.

Holotype. **Hawaiian Islands:** USNM 314624, male, 110.3 mm SL; 20°38'18''N 156°40'36'' – 20°41'06''N 156°41'18''W, 292–296 m depth; R/V "Townsend Cromwell", Cruise 33, St. TC 33-36; 9 Nov. 1967.

Paratypes. **Hawaiian Islands:** BPBM 9840, 1 specimen, 102 mm SL; Pailolo Channel, between Maui and Molokai Islands, 219 m depth; L. Hensler & R/V "Machias", Cruise 3; Feb. 1970. – BPBM 24219, 9 specimens, 90–128 mm SL; Pailolo Channel, between Maui and Molokai Islands, 21°02'N 156°44'W, 229–238 m depth; R/V "Townsend Cromwell", Cruise 40, St. 56; 18 Nov. 1968. – BPBM 24244, 16 specimens, 75–131 mm SL; Pailolo Channel, between Maui and Molokai Islands, 21°02'N 156°45'W, 234 m depth; R/V "Townsend Cromwell", Cruise 40, St. 62; 19 Nov. 1968. – BPBM 24358, 14 specimens, 83–116 mm SL; North Maui, 21°04'N 156°30'W, 274–318 m depth, R/V "Townsend Cromwell", Cruise 40, St. 92; 25 Nov. 1968. – SMNS 21816, 10 specimens, 73.9–121.6 mm SL; same data as BPBM 24244. – SMNS 21817, 4 specimens, 104.8–112.3 mm SL; same data as BPBM 24358. – SMNS 21929, 4 specimens, 81.5–115.6 mm SL, 21°03'01''N 156°45'04''W – 21°07'00''N 156°50'03''W, 229 m depth; R/V "Townsend Cromwell", Cruise 40, St. TC 40-63; 19 Nov. 1968. – USNM 314596, 2 specimens, 84.3–98.2 mm SL; 20°57'25''N 156°47'06''W –

21°04'00''N 156°44'06''W, 216–232 m depth; R/V "Townsend Cromwell", Cruise 36, St. TC 36-11; 28 Apr. 1968. – USNM 314598, 1 female, 82.6 mm SL; 21°01'42''N 156°43'06''W – 20°58'48''N 156°45'06''W, 185–232 m depth; R/V "Townsend Cromwell", Cruise 35, St. TC 35-4; 28 Mar. 1968. – USNM 314609, 2 specimens, 60.8–86.2 mm SL; Pailolo Channel; R/V "Townsend Cromwell"; Jan. 1970. – USNM 314610, 2 specimens, 68.8–101.4 mm SL; 21°00'36''N 156°44'12"W – 20°57'54''N 156°47'24''W, 220–221 m depth; R/V "Townsend Cromwell", Cruise 36, St. TC 36-12; 25 Apr. 1968. – USNM 314611, 3 specimens, 65.9–111.0 mm SL; 21°01'12''N 156°44'06''W – 20°57'54''N 156°47'54''W, 227–234 m depth; R/V "Townsend Cromwell", Cruise 36, St. TC 36-8; 27 Apr. 1968. – USNM 314612, 4 specimens, 75.5–120.5 mm SL; same data as SMNS 21929. – USNM 314613, 4 specimens, 75.6–128.3 mm SL; 21°03'06''N 156°45'00''W – 21°01'00''N 156°50'54''W, 212–236 m depth; R/V "Townsend Cromwell", Cruise 40, St. TC 40-69; 20 Nov. 1968. – USNM 314616, 2 males, 109.8–114.4 mm SL; 21°01'12''N 156°44'06''W – 20°57'12''N 156°47'06''W, 0–210 m depth; R/V "Townsend Cromwell", Cruise 40, St. TC 40-47; 16 Nov. 1968. – USNM 315443, 5 specimens, 73.6–113.0 mm SL; 21°01'42''N 156°43'30''W – 20°57'30''N 156°47'42''W, 219–229 m depth; R/V "Townsend Cromwell", Cruise 40, St. TC 40-53; 17 Nov. 1968. – USNM 315445, 4 specimens, 81.2–125.7 mm SL; 21°04'00''N 156°43'48''W – 20°57'18''N 156°47'18''W, 218 m depth; R/V "Townsend Cromwell", Cruise 40, St. TC 40-49; 17 Nov. 1968.

Etymology

The name of the new species refers to the type locality, Hawaiian Islands, to which it is apparently endemic.

Diagnosis

A *Synchiropus* of the *Synchiropus-altivelis* species-group of the subgenus *Synchiropus* with 8 rays in the second dorsal fin, 7 anal fin rays, 17–22 pectoral fin rays; a preopercular spine with a long, straight main tip and a strong, recurved point on its dorsal margin; eye medium sized, eye diameter 2.4–2.9 in head; first dorsal fin in the male lower, in the female higher than second dorsal fin, without filaments; second dorsal fin distally straight in the female, distally concave in the male, first ray elongate in the male; anal fin relatively low in the female, larger in the male; caudal fin elongate in the male, shorter in the female, without filaments; first dorsal fin with a blackish blotch on the third membrane in both sexes, in the female also with dark stripes on the anterior membranes; the anal fin pale in the male, distally spotted in the female; the caudal fin pale in the male, dorsally dark in the female; the pelvic fin with two rows of dark spots.

Description

D_1 IV (IV); D_2 8 (8); A vi,1 (vi,1); P_1 i,18–19,ii, total 21–22 (o-ii,15–20,ii, total 17–22); P_2 I,5 (I,5); C (ii),i,7,ii,(ii) ((i-ii),i,7,ii,(i-ii)).

Body elongate and slightly depressed. Head length 3.8 (3.3–3.7) in SL. Eye 2.5 (2.4–2.9) in head. Preorbital length 3.4 (3.2–4.1) in head. Interorbital distance 6.4 (8.3–21.1) in head. Occipital region with two low, round bony protuberances. Maxillary length 3.0 (3.1–3.7) in head. Preopercular spine with a long, straight main tip, a smooth base, a smooth ventral margin, and an extremely recurved dorsal point (Fig. 34, centre). Preopercular spine formula – $\underline{1}$ 1 (– $\underline{1}$ 1). Lateral lines of the opposite sides of the body interconnected by a commissure across the predorsal region. Body depth 7.1 (4.8–7.1) in SL. Body width 6.2 (4.0–5.3) in SL. Urogenital papilla in the male 24.0 (9.4–16.4) in head, in the female more than 44 in head or not visible. Caudal peduncle length 4.0 (4.1–4.8) in SL. Caudal peduncle depth 16.7 (17.6–18.7) in SL. Maximum observed SL 130.8 mm (male), 114.2 mm (female).

First dorsal fin relatively low in the male, first spine occasionally with a short filament but always shorter than first ray of second dorsal fin; length of first spine 5.3 (4.3–5.1) in SL, 2nd spine 5.4 (4.8–5.4), 3rd spine 6.4 (5.9–6.5), 4th spine 8.4 (7.0–8.6); in the female higher than first ray of second dorsal fin, first spine always with a filament; length of 1st spine 3.2–4.6 in SL. Predorsal (1) length 3.6 (3.5–3.7) in SL. Second dorsal fin rays branched, the last divided at its base. Second dorsal fin distally convex in the male, straight in the female. First ray of second dorsal fin in the male elongate, its length 3.4 (3.4–3.9) in SL, 5th ray 3.6 (3.5–4.3), last ray 3.3 (3.2–4.0); 1st ray in the female 4.4–4.7 in SL. Predorsal (2) length 2.3 (2.1–2.2) in SL. Anal fin beginning on a vertical through 2nd membrane of second dorsal fin. Anal fin rays unbranched, the last divided at its base. First anal fin ray in the male 9.4 (9.5–11.7), 5th ray 5.9 (5.9–6.5), last ray 4.1 (4.0–6.7); 1st ray in the female 9.2–11.3 in SL. Preanal fin length 1.9 (1.8–2.0) in SL. Pectoral fin reaching to 3rd–4th anal fin membrane when laid back. Pectoral fin length 3.4 (3.5–4.7) in SL. Prepectoral fin length 2.7 in SL. Pelvic fin reaching to 1st–2nd anal fin membrane when laid back. Pelvic fin spine 12.7 (11.2–14.0) in SL; pelvic fin length 3.0 (2.9–3.7). Prepelvic fin length 3.6 (3.4–3.7) in SL. Caudal fin distally elongate in the male, the median rays occasionally with a few short filaments; shorter in the female, distally rounded; caudal fin length in the male 2.3 (1.9–2.6) in SL, in the female 2.8–3.6 in SL.

Colour in alcohol. Head and body brown, sides of body spotted with dark brown. Eye dark grey. First dorsal fin in the male light, first spine with darker spots, third membrane with a distal dusky area occasionally reaching on distal part of second membrane. Second dorsal fin rays spotted with dark grey. Anal, caudal, pectoral and pelvic fins pale. First dorsal fin in the female with a large black blotch on the third membrane, and dark brown stripes on the anterior membranes. Second dorsal rays spotted with grey. Anal fin pale, or distally with black blotches. Upper distal section of caudal fin dark grey. Pectoral fins translucent; pelvic fin with two groups of brown spots.

Sexual dimorphism. Males have a higher second dorsal (especially 1st ray) and anal fin, a longer caudal fin, a shorter first spine of the first dorsal fin, a longer urogenital papilla, and a different colouration of the first dorsal fin.

Distribution

The new species is known only from Pailolo Channel, Hawaiian Islands (between the islands of Maui and Molokai) (Fig. 32). It was collected at depths of 185–318 m.

Relationships

Synchiropus hawaiiensis n.sp. is a member of the *Synchiropus-altivelis* species-group (other species see above in description of *S. altivelis,* 5.7.). It is distinguished from other species with medium-sized eyes (eye diameter 2.3–3.0 in head) by the long and downcurved main tip of the preopercular spine (short and upcurved in *S. australis, S. delandi, S. kamoharai, S. masudai, S. orstom*), the recurved dorsal point on the preopercular spine (vertical in *S. kamoharai, S. monacanthus, S. orstom*), the male's first dorsal fin lower than the second dorsal fin (higher in *S. australis, S. grinnelli, S. kamoharai, S. kanmuensis, S. masudai, S. monacanthus, S. novaecaledoniae, S. orstom, S. paxtoni*), the female's first dorsal fin higher than the second dorsal fin (lower in *S. kinmeiensis, S. masudai*), the second dorsal fin high in males (low in *S. grinnelli, S. kanmuensis*), the male's second dorsal fin distally concave (straight in *S.*

australis, S. grinnelli, S. kanmuensis, S. novaecaledoniae), the female's second dorsal fin distally straight (convex in *S. orstom, S. paxtoni*), the male's caudal fin extended, but without filaments (longer, and with median filaments in *S. australis, S. kamoharai, S. kanmuensis, S. kinmeiensis, S. masudai, S. paxtoni*), the female's caudal fin without filaments (with median filaments in *S. kamoharai*), the male's first dorsal fin with a dark blotch on third membrane (pale in *S. delandi, S. kanmuensis, S. masudai;* striped in *S. kamoharai, S. monacanthus, S. novaecaledoniae*), the male's anal fin pale (distally dark in *S. grinnelli, S. monacanthus, S. orstom*), and the female's anal fin with distal dark spots (pale in *S. kanmuensis, S. kinmeiensis, S. masudai, S. monacanthus, S. novaecaledoniae, S. orstom, S. paxtoni*).

Remarks

This new species was originally described by FRICKE (1981b, 1983) as part of *Synchiropus altivelis* (non Temminck & Schlegel, 1845). When subsequently additional material of the *Synchiropus-altivelis* species-group became available, the Hawaiian Islands specimens were found to belong to a separate, new species.

RANDALL (1999: 198–200) treated Hawaiian specimens as *S. kinmeiensis;* they were found to differ from that species in having a lower first dorsal fin of the female, and the female's anal fin bearing dark spots; the caudal fin of a male specimen of *S. hawaiiensis* was illustrated by RANDALL (1999: fig. 6) as having filaments, but this is apparently an artifact, as fragments of membranes were found on the median caudal rays of males.

5.10. *Synchiropus paxtoni* **n.sp.** (Fig. 35)

CAAB Code (Australia): 37 427044

Material

Total: 6 specimens.

Holotype: **Western Australia:** AMS I.22828-011, male, 113.1 mm SL; 190 km NW of Port Hedland, 19°01'S 117°21'E, 200–202 m depth; J. R. PAXTON, R/V "Soela"; 14 Apr. 1982.

Paratype: **Western Australia:** AMS I.22828-000, 1 female, 129.8 mm SL; same data as the holotype. – CSIRO H.3193-01, 1 female, 119.9 mm SL; NW of Port Hedland, 18°27'S 117°34'E, 460 m depth; CSIRO party; 3 Feb. 1992.

Other material. **Western Australia:** AMS I.24449-006, 1 specimen, NW Shelf, 18°53'S 116°10'E; R/V "Soela"; 1984.

Australia, Northern Territory: NTM S.12453-001, 1 male, 106.8 mm SL; Arafura Sea, N of Bathurst Island, 9°46'S 130°01'E, 279 m depth; M. SACHSE; 16 July 1988. – NTM S.12454-001, 1 specimen, 94.8 mm SL; same area as NTM S.12453-001, 9°46'S 130°00'E, 275 m depth; M. SACHSE; 4 July 1988.

Etymology

This new species is named in honour of JOHN PAXTON (AMS, Sydney), who collected the holotype and one paratype on board of R/V "Soela".

Diagnosis

A *Synchiropus* of the *Synchiropus-altivelis* species-group of the subgenus *Synchiropus* with 8 rays in the second dorsal fin, 7 anal fin rays, 19–22 pectoral fin rays; a preopercular spine with a long, upcurved main tip and a strong, recurved point on its dorsal margin; eye medium sized, eye diameter 2.7–3.0 in head; first dorsal fin in the male higher than, in the female as high as second dorsal fin, first spine with a filament

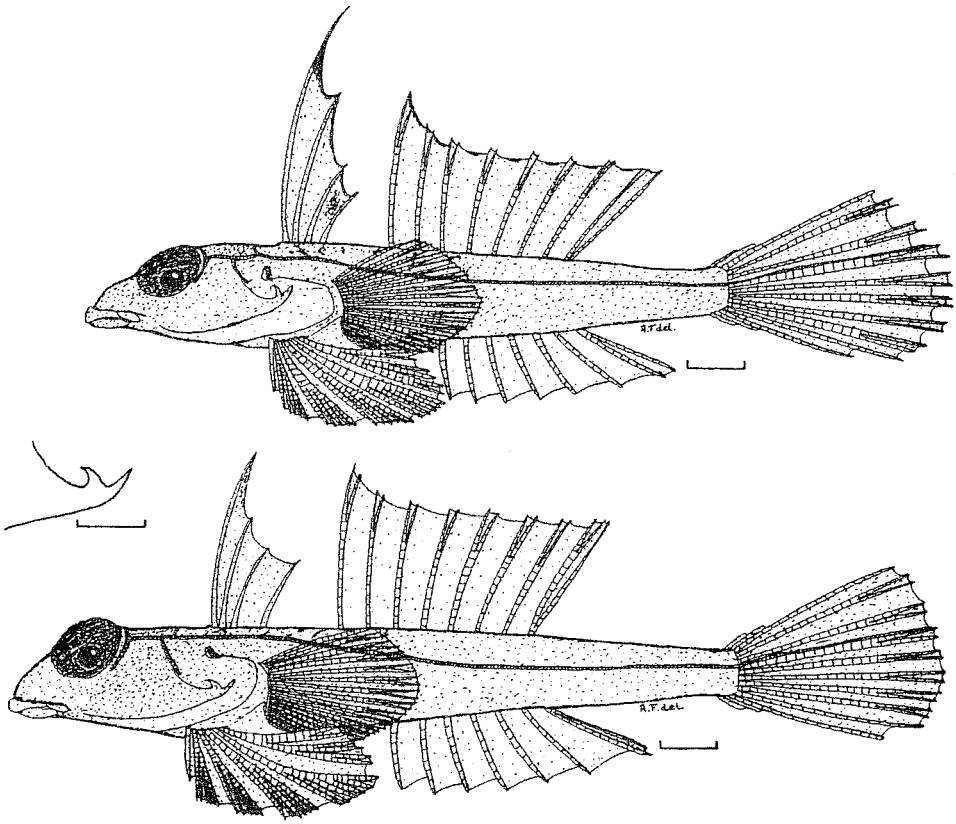


Fig. 35. *Synchiropus paxtoni* n.sp.; Western Australia; AMS I.22828-011, holotype, male, 113.1 mm SL. – *Above,* lateral view (scale: 10 mm); – *centre,* left preopercular spine (scale: 4 mm). – AMS I.22828-000, paratype, 1 female, 129.8 mm SL; – *below,* lateral view (scale: 10 mm).

in both sexes; second dorsal fin distally concave in both sexes, first ray elongate; anal fin relatively low in both sexes; caudal fin elongate in the male, with a few short median filaments, shorter in the female, without filaments; first dorsal fin pale in the male, with a dark spot on the third membrane in the female; the anal, caudal and pelvic fins pale in both sexes.

Description

D_1 IV (IV); D_2 8 (8); A vi,1 (vi,1); P_1 i,17–18,ii, total 20–21 (i,16–19,ii; total 19–22); P_2 I,5 (I,5); C (ii),i,7,ii,(ii) ((ii),i,7,ii,(ii)).

Body elongate and slightly depressed. Head slightly depressed, 3.7 (3.7) in SL. Eye 2.7 (2.7–3.0) in head. Preorbital length 3.2 (3.8–4.1) in head. Interorbital distance 15.6 (11.6–11.8) in head. Maxillary length 3.3 (3.2–3.3) in head. Preopercular spine with a long, upcurved main tip, a strong, recurved dorsal point, a smooth ventral margin and base (Fig. 35, centre). Preopercular spine length 5.6 (4.4–6.1) in head. Preopercular spine formula – $\frac{1}{-}$ 1. Body depth 6.5 (6.5–7.1) in SL. Body width 4.9 (4.6–5.4) in SL. Urogenital papilla in the male 16 (33) in head, in the female 54 in

head. Caudal peduncle length 4.2 (4.2–4.4) in SL. Caudal peduncle depth 15.6 (14.9–16.9) in SL.

First dorsal fin distally concave in both sexes, high in the male, the first spine filamentous; length of first spine 2.6 (3.0) in SL, 2nd spine 4.0 (4.2), 3rd spine 7.2 (7.0), 4th spine 10.0 (9.9); lower in the female, 1st spine 4.0 in SL, 2nd spine 6.3, 3rd spine 8.5, 4th spine 9.3. Predorsal (1) length 3.2 (3.4–3.5) in SL. Second dorsal fin rays branched, the last divided at its base. First ray of second dorsal fin 4.1 (4.1–4.4) in SL, last ray 4.9 (5.2–5.3) in SL. Predorsal (2) length 2.1 (2.2) in SL. Anal fin beginning on a vertical through 3rd ray of second dorsal fin. Anal fin rays unbranched, the last divided at its base. First anal fin ray 10.2 (10.7–12.2) in SL, last ray 6.2 (6.3–6.6) in SL. Preanal fin length 1.8 (1.8–1.9) in SL. Pectoral fin reaching to base of 1st–2nd anal fin membrane when laid back. Pectoral fin length 4.6 (4.7–4.9) in SL. Prepectoral fin length 2.6 (2.7–2.8) in SL. Pelvic fin reaching to 1st anal fin membrane when laid back. Pelvic fin spine 12.9 (14.2–17.3) in SL; pelvic fin length 3.4 (3.6–3.7) in SL. Prepelvic fin length 3.6 (3.7–4.0) in SL. Caudal fin distally convex, the male with short filaments on the median rays; caudal fin length 3.0 (3.2–3.5) in SL.

Colour in alcohol. Head and body pale, eye dark grey. Back with a few small dark brown spots below base of first dorsal fin. First and second dorsal fins in the male distally with a narrow dark margin, first dorsal fin in the male also with a faint dark blotch distally on the third membrane. Other fins colourless.

Sexual dimorphism. Males have a higher first dorsal fin than females, a longer urogenital papilla, and a different colouration of the first and second dorsal fins.

Distribution

This new species is known from the outer continental shelf off Port Hedland, Western Australia (Fig. 32), and from the Arafura Sea, Northern Territory; the species was collected at depths of 200–460 m.

Relationships

Synchiropus paxtoni n.sp. is a member of the *Synchiropus-altivelis* species-group (species see description of *S. altivelis,* 5.7.). It is closely related to *S. australis* from southern Queensland, but differs in the lower first dorsal fin in males, the distally concave second dorsal fin in both sexes, the lacking black colouration in the male's caudal and anal fins, and the longer preorbital. *Synchiropus paxtoni* n.sp. differs from other species with a medium-sized eye (eye diameter 2.3–3.0 in head) by the long, upcurved main tip of its preopercular spine (short and upcurved in *S. australis, S. delandi, S. kamoharai, S. masudai, S. orstom;* short and straight in *S. grinnelli;* long and straight in *S. kanmuensis, S. kinmeiensis, S. novaecaledoniae;* long and downcurved in *S. hawaiiensis*), a recurved dorsal point on the preopercular spine (vertical in *S. kamoharai, S. monacanthus, S. orstom*), the male's first dorsal fin higher than the second dorsal fin (lower in *S. hawaiiensis, S. kinmeiensis*), the male's second dorsal fin distally concave (straight in *S. australis, S. grinnelli, S. kanmuensis, S. novaecaledoniae*), the female's second dorsal fin distally concave (straight in all other species except *S. orstom*), the male's caudal fin with few median filaments (without filaments in *S. delandi, S. hawaiiensis, S. monacanthus, S. novaecaledoniae*), the female's caudal fin without filaments (with median filaments in *S. kamoharai*), the male's first dorsal fin with a dark blotch on the third membrane (pale in *S. delandi, S. kanmuensis, S. masudai;* striped in *S. kamoharai, S. monacanthus*), the female's first dorsal fin pale

(with a dark blotch on third membrane in *S. grinnelli, S. hawaiiensis, S. novaecaledoniae, S. orstom;* striped in *S. kamoharai;* basally dark in *S. monacanthus*), and with the anal fin pale in both sexes (distally spotted or blackish on *S. australis, S. delandi, S. grinnelli,* female *S. hawaiiensis, S. kinmeiensis,* male *S. monacanthus,* male *S. orstom*).

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