



Redescription of *Tetragonurus pacificus* (Teleostei: Stromateoidei: Tetragonuridae), based on specimens collected from Taiwan and Tarawa Atoll

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Abstract

The rare squaretail *Tetragonurus pacificus* Abe 1953 was described on the basis of a single poor-condition specimen obtained from the stomach of a yellowfin tuna collected from west of the Solomon Islands. A fresh specimen of *T. pacificus* was recently collected from southwestern Taiwan and its morphology and the fresh coloration are herein described in detail. In addition, a juvenile specimen collected from the southern Pacific Ocean was found in the museum collection. The species is characterized by dorsal-fin spines 10–11; longitudinal scale rows along body axis 72–80; and predorsal scales 17–20. The present specimen collected from off southwestern Taiwan represents the northernmost record of the species from the Pacific Ocean.

Keywords: squaretail, Taxonomy, Pisces, new record, distribution

Introduction

The family Tetragonuridae (squaretails) is a small group of mesopelagic or epipelagic oceanic fishes comprises a single genus and 3 valid (4 nominal) species, *Tetragonurus atlanticus* Lowe 1839, *Tetragonurus cuvieri* Risso 1810, and *Tetragonurus pacificus* Abe 1953 (Last 2001; Parin & Piotrovsky 2004; Fricke *et al.* 2019). Members of the family Tetragonuridae is characterized by an elongated body, presence of pelvic fins in adults, two dorsal fins, teeth on the vomer and palatines, five or six branchiostegal rays, heavy adherent keeled scales, and four hypural and two epural bones on hypural plate (Haedrich 1967).

Tetragonurus pacificus was described by Abe (1953) from a single specimen obtained from the stomach of a yellowfin tuna, collected from west of the Solomon Islands. Due to the poor condition of the holotype, the original description of the species lacked some important morphological characters. For 50 years following the original description, juveniles only were recorded from the Indian, and central and eastern Pacific oceans (Grey, 1955; Ahlstrom *et al.* 1976), with no additional information on adult specimens. Although Parin & Piotrovsky (2004) reported 9 adult specimens (140–204 mm SL) from the Indian Ocean, with listing some meristic and morphometric characters of the specimens, they did not provide a detailed description.

During a survey on ichthyofaunal of southwestern Taiwan, a tetragonurid specimen was collected by mid-water trawl from off southwestern Taiwan (as bycatch of the Sakura shrimp *Lucensosergia lucens*). The specimen was identified as *T. pacificus* by comparing directly with the holotype of the species. In addition, a younger specimen collected from the southern Pacific Ocean was also found in the same collection of the holotype. A redescription of the species is provided on the basis of the holotype and two newly found specimens.

Methods and materials

Methods for taking counts and measurements followed Abe (1953). Fin rays and vertebrae were counted from the radiographs. Measurements were made to the nearest 0.1 mm with a needle-point caliper. Standard length is abbreviated as SL. Morphological descriptions are based on the specimens listed below. Data of *T. atlanticus* and *T. cuvieri* are those provided in Parin & Piotrovsky (2004). Collection abbreviations: Pisces Collection, National Museum of Marine Biology & Aquarium, Pingtung (NMMB-P) and Department of Zoology, University Museum, University of Tokyo (ZUMT).

Taxonomy

Tetragonurus pacificus Abe 1953

Figures 1–2; table 1

Tetragonurus pacificus Abe 1953: 45, figs. 5–6 (west of Solomon Islands); Grey 1955: 14, fig. 7; Headrich 1967: 98; Ahlstrom 1976: 333, fig. 14; Headrich 1986: 851; Last 2001: 3785; Parin & Piotrovsky 2004: S56.

Material examined. NMMB-P29945, 96.2 mm SL, off Dong-gang (ca. 22°39'N, 120°24'E), Pingtung, Taiwan, South China Sea, 5 July 2018, mid-water trawl, obtained at fish-landing ground at Dong-gang, collected by K. Koeda and A. Teramura; ZUMT 47823, 122.5 mm SL, west of Solomon Islands (ca. 6°36'S, 152°29'E), obtained from stomach of yellowfin tuna, 30 December 1952, collected by research vessel “Fusa-maru”; ZUMT 48781, 48.4 mm SL, southwest of Tarawa (Kiribati) (ca. 3°18'S, 171°12'E), 30 March 1956.

Diagnosis. A species of *Tetragonurus* with 40 vertebrae; 10–11 spines on first dorsal fin; 72–80 longitudinal scale rows along body axis; and following combination of characters: anal fin with 1 spine and 10–11 soft rays; predorsal scales 17–20; head length 26.1–28.6% SL; orbit diameter 7.3–8.9% SL; and longest pectoral-fin ray length 14.3–15.5% SL.

Description. Counts and measurements are given in Table 1.

Body elongate, compressed; caudal peduncle long, shallow, its length ca. 5 times its depth, square shape in cross section. Snout blunt. Dorsal surface of head weakly keeled. Eye rounded, its diameter slightly shorter than snout. Dorsal surface of interorbital space slightly convex. Posterior nostril slit-like, located midway between uppermost point of eye and snout tip; anterior nostril oblong, located midway between posterior nostril and snout tip. Mouth moderately large, slightly oblique; posterior margin of maxilla reaching a vertical through middle of orbit. Lower jaw completely covered by upper jaw; anterior tip of upper jaw projecting anteriorly beyond lower jaw when mouth open. Teeth on upper jaw conical, uniserial. Teeth on lower jaw large, flattened with curved tips, adhering to each other, gradually taller posteriorly (arranged V-shaped in profile when viewed anteriorly). Palatines and vomer with tiny inwardly directed conical teeth. Posteroventral corner of preopercle with serrations.

Lateral line indistinct, from uppermost point of gill opening, weakly arched following dorsal outline of body and reaching caudal peduncle, but not caudal-fin base. Posterior part of caudal peduncle with two prominent longitudinal keels, their length equal to caudal peduncle depth. Body and head fully scaled by strongly adherent scales, except for lips; scales on body facing posteroventrally, each with a prominent longitudinal ridge.

Origin of first dorsal fin slightly posterior to pectoral-fin bases; second or third dorsal-fin spine longest, spine length thereafter gradually shorter posteriorly; base of last dorsal-fin spine closer to base of first dorsal-fin soft ray (unbranched) than penultimate dorsal-fin spine. Second dorsal fin taller than first; base of second dorsal fin shorter than first. Third dorsal-fin ray longest in second dorsal fin. Origin of anal fin posterior to origin of second dorsal fin; end of anal-fin base posterior to end of dorsal-fin base. Pectoral fins pointed, posterior tip reaching a vertical through base of fifth dorsal-fin spine. Origin of pelvic fin at above same vertical beneath middle of pectoral-fin base. Caudal fin forked, both lobes pointed.

Color when fresh. Body blackish-grey with greenish reflection on lateral body axis and yellowish reflection on ventral region. Head black with silver to gold reflection on cheek and operculum; dorsal surface of head, snout and lower jaw solid black. Dorsal, anal, pelvic, and caudal fins blackish-grey, membranes paler; pectoral fin black.

Color when preserved. Body blackish-brown anteriorly, light brown posteriorly. Head black. All fins blackish-brown.

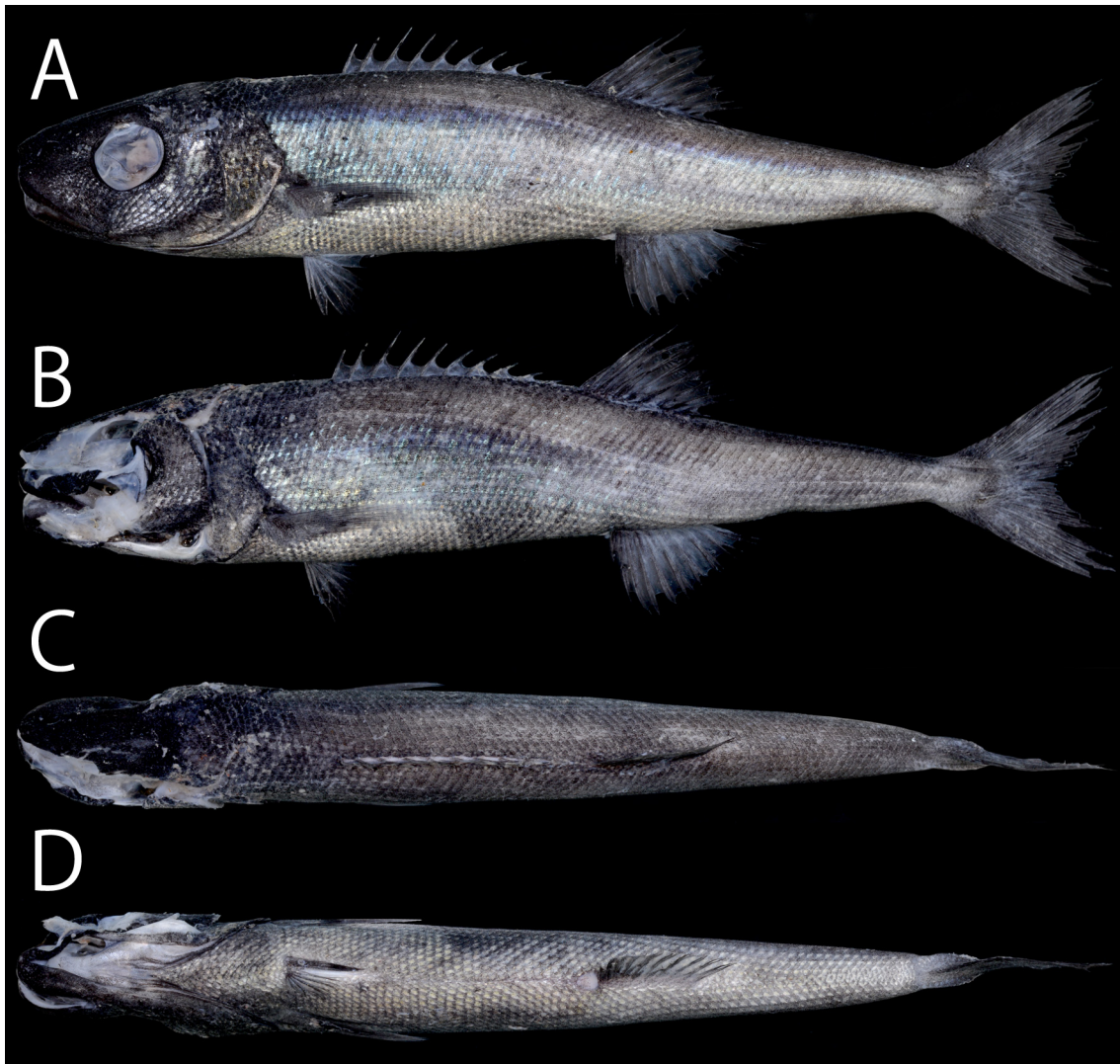


FIGURE 1. Fresh specimen of *Tetragonurus pacificus* from Taiwan. NMMB-P29945, 96.2 mm SL. A: right view (photograph reversed the direction to left); B: left view; C: dorsal view; D: ventral view.

TABLE 1. Meristic and morphometric data of specimens of *Tetragonurus pacificus*.

	ZUMT 47823	NMMB-P29945	ZUMT 48781
	Holotype	Non-type	Non-type
	W of Solomon Is.	Taiwan	SW of Tarawa
Standard length (mm; SL)	122.5	96.2	48.4
Counts			
Dorsal-fin rays	X, 12	XI, 11	X, 13
Anal-fin rays	I, 10	I, 10	I, 11
Pectoral-fin rays	16	16	16
Pelvic-fin rays	I, 5	I, 5	I, 5
Principal caudal-fin rays	damaged	9 + 8	9 + 8
Second caudal-fin rays (procurrent rays)	damaged	11 + 12	damaged + 10

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TABLE 1. (Continued)

	ZUMT 47823	NMMB-P29945	ZUMT 48781
	Holotype	Non-type	Non-type
	W of Solomon Is.	Taiwan	SW of Tarawa
Branchiostegal rays	6	6	N/A
Pseudobranch rays	damaged	18	14
Gill rakers	7 + 14 (6 + 13)**	8 + 11	6 + 11
Longitudinal scale rows	78	72	80*
Predorsal scales	20	17	20
Scales below first dorsal-fin origin	damaged	4	4
Scales below second dorsal-fin origin	5 1/2	5	6
Scales above anal-fin origin	9 1/2	9	10
Scales between dorsal fins	23	22	22
Teeth on upper jaw	29	20	19
Teeth on lower jaw	39	29	23
Vertebrae	N/A	16 + 24=40	N/A
Measurements (%SL)			
Head length	26.1	28.6	27.7
Body depth	14.7	19.2	20.7
Body width	12.7	11.9	9.3
Orbit diameter	7.3	7.9*	8.3
Snout length	7.8	8.6*	5.8
Interorbital width	6.4	7.0	5.6
Preorbital depth	3.7	4.8*	5.6
Longest pectoral-fin ray	14.3	15.5	damaged
First dorsal-fin spine length	damaged	3.9	2.5
Second dorsal-fin spine length	damaged	5.1	4.8
Third dorsal-fin spine length	damaged	6.5	5.2
Fourth dorsal-fin spine length	damaged	5.6	damaged
First anal-fin spine length	damaged	0.4	2.7
Caudal peduncle depth	damaged	4.9	5.6
Caudal peduncle length	damaged	25.1	27.3

*counted/measured on right side. **counts of right side in parentheses

Distribution. *Tetragonurus pacificus* is currently known from scattered localities in subtropical region of Indo-Pacific as follows: Sumatra to the Seychelles, in the West Australian Basin, and above the Equator Seamount, in the Indian Ocean (Grey, 1955; Parin & Piotrovsky 2004), and west of the Solomon Islands in the Western Pacific Ocean (Abe 1953), north of Samoa and the Hawaiian Islands in the central Pacific Ocean (Grey, 1955; Ahlstrom *et al.* 1976), and from a mid-oceanic station (3°47'N, 118°30'W) in the eastern Pacific Ocean (Ahlstrom *et al.* 1976); and the two additional specimens represent new records of Taiwan and Tarawa (Kiribati).

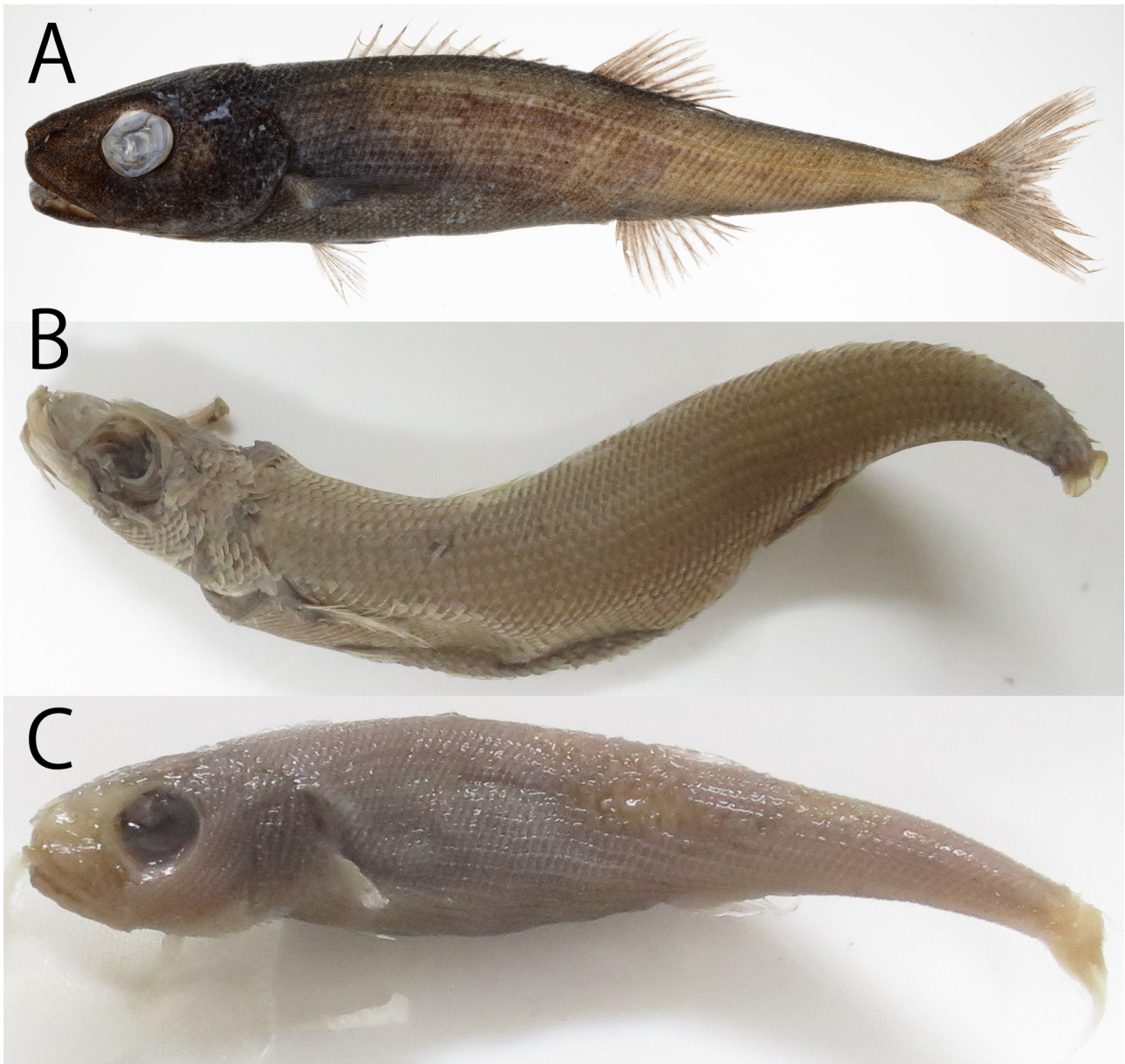


FIGURE 2. Preserved specimens of *Tetragonurus pacificus*. A: NMMB-P29945, 96.2 mm SL, Taiwan (photograph direction reversed); B: ZUMT 47823, 122.5 mm SL, holotype, west of the Solomon Islands; C: ZUMT 48781, 48.4 mm SL, juvenile, southwest of Tarawa (Kiribati).

Remarks. The two new specimens agree well with most morphological features of the holotype of *T. pacificus* (Fig. 2), except for the counts of teeth on both jaws and gill rakers varied in the three specimens (Table 1), such variations may infer the ontogenetic change. In addition, some of the morphometric features are also different among the three specimens, although these differences may reflect ontogenetic growth, individual variations, and/or condition of the specimens (Fig. 2).

Tetragonurus pacificus is unique from the two congeners, *T. atlanticus* and *T. cuvieri*, in having fewer counts in following meristic characters: 40 (39–43 in Parin & Piotrovsky 2004) vertebrae (vs. 44–51 in *T. atlanticus* and 52–58 in *T. cuvieri*, respectively), 10–11 (9–12) first dorsal-fin spines (vs. 13–17 and 16–21, respectively), and 72–80 longitudinal scale rows along body axis (vs. 93–95 and 97–114, respectively). Although the two congeners, are distributed circumglobally, mainly in the subtropical zone, both species are also known from the high latitude region of Pacific Ocean, e.g. off Hokkaido, northern Japan (Nakabo & Doiuchi 2013). On the other hand, *T. pacificus* is only known from the subtropical zone in the Indian and Pacific oceans. The Taiwanese specimen represents

the northernmost distributional record (ca. 5,000 km northwestward range extension in the western Pacific Ocean) for the species.

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