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# *Epigonus okamotoi* (Perciformes: Epigonidae), a junior synonym of *E. draco*, with new distributional records for *E. atherinoides* and *E. lifouensis* in the West Pacific

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## Abstract

*Epigonus okamotoi* Fricke, 2017 was originally described on the basis of a single specimen collected from New Britain, Papua New Guinea during one of the exploratory cruises (campaign: MADEEP) in 2014 organized under the *Tropical Deep-Sea Benthos* program. However, there are no clear differences in the meristic and morphometric characters between the holotype of the new species and specimens of *E. draco* Okamoto, 2015, including two additional specimens of the species found in the ichthyological collections in the NTUM. The genetic distance (*p*-distance) between the two "species" at the *COI* locus was negligible. Accordingly, the holotype of *E. okamotoi* is considered to be a specimen of *E. draco*, and the former nominal species is reduced to a junior synonym of *E. draco*. In addition, we rediagnose and report new distributional records for *E. atherinoides* (Gilbert, 1905) and *E. lifouensis* Okamoto & Motomura, 2013 in the West Pacific.

**Key words:** Teleostei, deepwater cardinalfish, western Pacific, synonymy, molecular taxonomy, Tropical Deep-Sea Benthos

## Introduction

*Epigonus okamotoi* Fricke 2017 was originally described from a single specimen collected in New Britain, Papua New Guinea during one of the exploratory cruises (campaign: MADEEP) in 2014 organized under the *Tropical Deep-Sea Benthos* program (*TDSB*). This newly described species appears to belong to the "*E. constanciae* group" (*sensu* Okamoto 2012) by having a pungent opercular spine and more than 40 pored lateral-line scales (Fricke 2017). According to the original description, although this species is similar to *Epigonus atherinoides* (Gilbert 1905) and *Epigonus draco* Okamoto 2016, it can be distinguished from these species in some meristic and morphometric characters (Fricke 2017). However, re-examination of the type specimen of *E. okamotoi* revealed that the original description did not accurately report several important diagnostic characters. We compared the type specimen of *E. okamotoi* with type specimens and other specimens of *E. draco* with morphological and molecular data. In addition to the re-examination of the holotype of *E. okamotoi*, we report new distributional records of *E. atherinoides* and *Epigonus lifouensis* Okamoto & Motomura 2013 in the western Pacific based on the specimens collected through the *TDSB* program and the cooperation project between Taiwan and France entitled "Taiwan France Marine Diversity Exploration and Evolution of Deep-sea Fauna".

## Materials and methods

Meristic and morphometric methods followed Mayer (1974) and Okamoto (2011). The number of missing lateral-

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line scales was estimated by counting scale pockets. The number of pored lateral-line scales on the caudal fin is represented as "+ *n*". The first caudal vertebra is defined as the first vertebra bearing a distinct hemal spine. Measurements were made with calipers to the nearest 0.1 mm. Counts of supraneurals, vertebrae, and ribs were taken from radiographs. The term "maxillary mustache-like process" is used for a lateral process on the maxillary head (see Okamoto 2012: fig. 2). The number of pyloric caeca and sex were determined by dissection of the right side of the abdomen. Standard length is abbreviated as SL. Institutional abbreviations for the depositories of the material examined are: CAS (California Academy of Sciences, San Francisco), MNHN (Muséum National d'Histoire Naturelle, Paris), NSMT (National Museum of Nature and Science, Tsukuba), and NTUM (National Taiwan University, University Museums, Taipei).

Small pieces of muscle-tissue were excised from the specimens, preserved in 95% ethanol, and stored at −20◦C in the Marine Biodiversity and Phylogenomics Laboratory at the Institute of Oceanography, National Taiwan University, Taipei. Genomic DNA was extracted using an automated DNA-extractor (LabTurbo 48 Compact System with LGD 480–220 kits: Taigene Bioscience Corporation, Taipei) following the manufacturer's protocol. The standard barcoding marker of a mitochondrial cytochrome c oxidase I (*COI*) gene was used to provide the molecular data for the sequence comparison among the specimens examined. PAUP* (Swofford 2002) was used to compute pairwise *p*-distances of the sequences to evaluate the genetic divergences between species and within species. Protocols for *COI* gene amplification and sequencing follow those outlined in Ward *et al*. (2005) and in Lo *et al*. (2017). The sequences obtained were deposited in GenBank (http://www.ncbi.nlm.nih. gov/) as a genetic reference for future DNA-identification and research on deepwater cardinalfishes.

## Results and discussion

### *Epigonus draco* Okamoto 2015

English name: Dragon Deepwater Cardinalfish
(Fig.1; Table 1)

*Epigonus draco* Okamoto, 2015: 121, fig. 1 (original description, type locality: Solomon Islands [07°43′34″S, 158°29′24″E; 08°41′16″S, 157°41′27″E], western South Pacific [collected during the SALOMON 2 Expedition under the TDSB]); Okamoto 2016: 184, fig. 6 (photograph and notes, Society Islands).

*Epigonus ctenolepis* (not of Mochizuki & Shirakihara, 1983): Iwamoto & McCosker 2014: 291, fig. 122 (color photograph and notes, between Luzon and Mindoro, Philippines).

*Epigonus okamotoi* Fricke, 2017: 117, fig. 1–4 (original description, type locality: Solomon Sea, Papua New Guinea, West New Britain Province, off southwestern New Britain, Ainto Bay [06°06′04.7988″S, 149°12′12.5136″E; 06°07′38.3376″S, 149°12′06.4152″E], western South Pacific [collected during the MADEEP Expedition under the TDSB]).

**Material examined.** 12 specimens, 87.1–160.1 mm SL. Papua New Guinea: NTUM 11869 (tissue voucher: PNG2315), 105.2 mm SL, 06°07′S, 149°13′E, 570 m depth, St. CP4332, 6 May 2014, R/V Alis, MADEEP Expedition; NTUM 12701 (tissue voucher: PNG2250), holotype of *E. okamotoi*, 158.8 mm SL, 06°06′04.7988″S, 149°12′12.5136″E; 06°07′38.3376″S, 149°12′06.4152″E, 315–624 m depth, St. CP4330, 6 May 2014, R/V Alis, MADEEP Expedition; NTUM 13035 (tissue voucher: PNG0963), 103.7 mm SL, 05°25′S, 145°56′E, 500–870 m depth, St. CP4021, 13 December 2012, R/V ALIS, PAPUA NIUGINI Expedition. Philippines: CAS 235796, paratype, 160.1 mm SL, 13°36′7″N, 120°23′2″E, between Luzon and Mindoro, 541–636 m depth, 1 June 2011. Society Islands: MNHN 2014-0217, 104.7 mm SL, 16°41′11″S, 151°25′30″W, Raiatea island, 638–700 m depth, St. CP3438, 16 October 2009, R/V ALIS, TARASOC Expedition; MNHN 2014-0871, 87.1 mm SL, 16°46′31″S, 151°22′41″W, Raiatea island, 573–611 m depth, St. CP3458, 18 October 2009, R/V Alis, TARASOC Expedition. Solomon Islands: MNHN 2006-0589, holotype, 127.4 mm SL, 07°43′34″S, 158°29′24″E, 391–623 m depth, St. CP2206, 25 October 2004, R/V Alis, SALOMON 2 Expedition; MNHN 2006-0684, paratype, 88.8 mm SL, same data as holotype; MNHN 2006-0063, 2 paratypes, 110.0–145.0 mm SL, 08°41′16″S, 157°41′27″E, 786 m depth, St. CP2277, 5 November 2004, R/V Alis, SALOMON 2 Expedition. Vanuatu: MNHN 2012-0836, paratype, 128.1 mm SL, 15°41′31″S, 167°01′19″E, west of Malo Island, 481 m depth, St. AT9, 17 September 2006, R/V Alis, SANTO 06 Expedition.

**Diagnosis.** A species of *Epigonus* with the following combination of characters: dorsal-fin rays VII–I, 10;

pectoral-fin rays 19–20; total gill rakers 22–23; pyloric caeca 7–10; pored lateral-line scales 47–49 + 3–4; scales below lateral line 9; vertebrae 10 + 15; opercular spine present; maxillary mustache-like processes absent; ribs absent on last abdominal vertebra; uppermost margin of pectoral-fin base lower than horizontal line through center of eye; proximal radial of first anal-fin pterygiophore slender; and mouth cavity black.

**Distribution.** Known from the Philippines (Iwamoto & McCosker 2014), Papua New Guinea (Fricke 2017; this study), Solomon Islands, Vanuatu (Okamoto 2015), and Society Islands (Okamoto 2016), at depths of 391–870 m (Fig. 2).


**FIGURE 1.** *Epigonus draco*. A, holotype of *E. okamotoi* (NTUM 12701, 158.8 mm SL, preserved specimen, Papua New Guinea); B, holotype of *E. draco* (MNHN 2006-0589, 127.4 mm SL, preserved specimen, Solomon Islands); C, *E. draco* (NTUM 11869, 105.2 mm SL, fresh specimen, Papua New Guinea).

**Synonymy.** Fricke (2017) referred *E. okamotoi* to the *E. constanciae* group (*sensu* Okamoto 2012) based on the presence of a pungent opercular spine. According to Okamoto (2016), this species group comprises 19 species besides *E. okamotoi*: *E. affinis* Parin & Abramov 1986; *E. atherinoides* (Gilbert 1905); *E. chilensis* Okamoto 2012; *E. constanciae* (Giglioli 1880); *E. crassicaudus* de Buen 1959; *E. ctenolepis* Mochizuki & Shirakihara 1983; *E. draco* Okamoto 2015; *E. elegans* Parin & Abramov 1986; *E. heracleus* Parin & Abramov 1986; *E. lenimen* (Whitley 1935); *E. machaera* Okamoto 2012; *E. marimonticolus* Parin & Abramov 1986; *E. mayeri* Okamoto 2011; *E. megalops* (Smith & Radcliffe *in* Radcliffe 1912); *E. occidentalis* Goode & Bean 1896; *E. pectinifer* Mayer 1974; *E. robustus* (Barnard 1927); *E. thai* Prokofiev & Bussarawit *in* Parin *et al*. 2012; and *E. waltersensis* Parin &

Abramov 1986. Fricke (2017) stated that *E. okamotoi* is distinguishable from similar species of this group in having a combination of the following characters: dorsal-fin rays VII–I, 9; pectoral-fin rays 15; gill rakers 22; pyloric caeca 4; pored lateral-line scales 47 + 4; scales below lateral line 8; vertebrae 10 + 15; opercular spine present; maxillary mustache-like process absent; ribs absent on last abdominal vertebra; upper margin of pectoral-fin base on level of upper margin of pupil; proximal radial of first anal-fin pterygiophore slender; mouth cavity light grey. However, re-examination of the holotype of *E. okamotoi* revealed that the holotype has dorsal-fin ray VII–I, 10, pectoral-fin rays 20, and scales below lateral line 9. Additionally, the position of the upper margin of pectoral-fin base of the holotype of *E. okamotoi* in fresh condition is lower than a horizontal line through the center of eye (Fricke 2017: fig. 3). The position of the pectoral fin of species of *Epigonus* slightly change after fixation owing to the shrinkage of the body. These characters and other meristic characters except for pyloric caeca (not confirmed to avoid damaging the specimen) of the holotype of *E. okamotoi* correspond to that of *E. draco*. Fricke (2017) noted that *E. okamotoi* differs from *E. draco* in the orbital diameter, postorbital length, snout length, preanus length, preanal-fin length, and length of third spine of first dorsal-fin. However, there are no clear differences in the morphometric characters between this holotype and the examined specimens of *E. draco*, including two additional specimens of the species from Papua New Guinea (Table 1). Further comparison of DNA sequences at the *COI* locus for the samples from *E. draco* and *E. "okamotoi"* demonstrated that the genetic distance (*p*-distance) between the two "species" was negligible (0 – 0.00156) (Table 2). The *p*-distances between *E. draco* and *E. atherinoides*, both of the *E. constanciae* species group, was substantially higher at 0.09390 and 0.09546 (Table 2). Therefore, the holotype of *E. okamotoi* is considered to be a specimen of *E. draco*, and the former nominal species is reduced to a junior synonym of *E. draco*.

**Remarks.** We found additional specimens of *E. draco*, collected in Papua New Guinea, at the National Taiwan University Museums (NTUM). These specimens represent the first record of this species from this locality. *Epigonus draco* is distributed on continental slopes in the western and central tropical Pacific, at depths greater than 315 m.

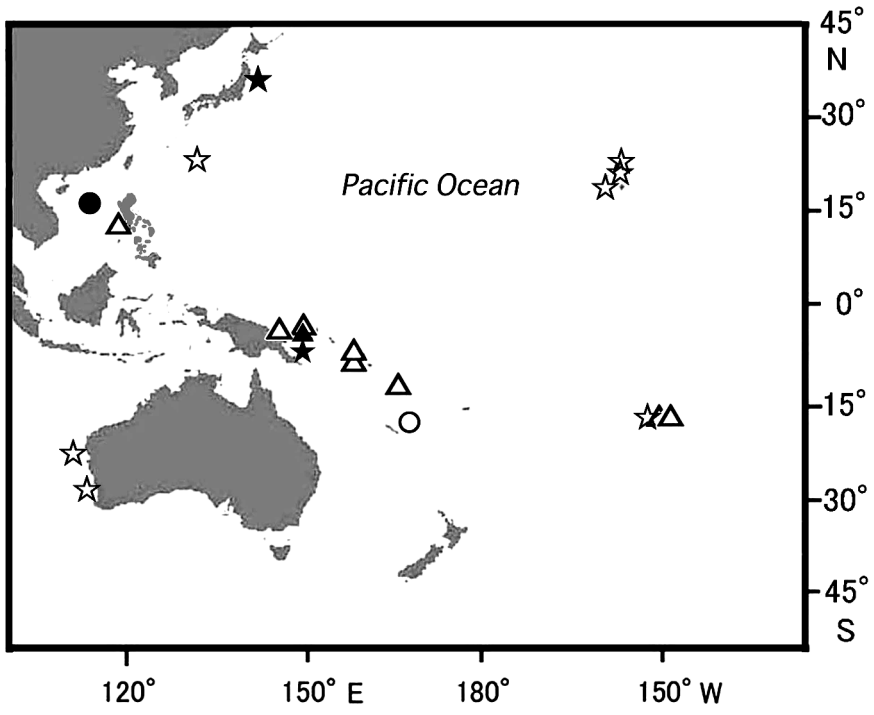


**FIGURE 2.** Distributional records of *Epigonus draco* (open triangles = previous studies and additional specimens in present study; solid triangle = type locality of *E. okamotoi*), *E. atherinoides* (open stars = previous studies; solid stars = present study), and *E. lifouensis* (open circle = type locality; solid circle = present study) in western Pacific Ocean.

**TABLE 1.** Selected counts and measurements of specimens of *Epigonus draco*, including the holotype of *E. okamotoi*, and *E. atherinoides* and *E. lifouensis* from western Pacific Ocean.

| | *E. okamotoi* | *E. draco* | | *E. atherinoides* | | *E. lifouensis* |
|---|---|---|---|---|---|---|
| | NTUM 12701 Holotype | MNHN 2006-0589 Holotype | Other specimens *n*=11 | NSMT-P 102607 *n*=1 | NTUM 11045 *n*=1 | NTUM 13374 *n*=1 |
| Standard length (mm) | 158.8 | 127.4 | 87.1–160.1 | 69.5 | 111.4 | 175.0 |
| Counts | | | | | | |
| Dorsal-fin rays | VII-I, 10 | VII-I, 10 | VII-I, 10 | VII-I, 10 | VII-I, 10 | VII-I, 10 |
| Anal-fin rays | II, 9 | II, 9 | II, 9 | II, 9 | II, 9 | II, 9 |
| Pectoral-fin rays | 20 | 20 | 19–20 | 20 | 20 | 19 |
| Pored lateral-line scales | 47 + 5 | 49 + 4 | 46–49 + 3–5 | unknown | 48 + 5 | 47 + 5 |
| Scales above lateral line | 3 | 3 | 3 | unknown | 3 | 2 |
| Scales below lateral line | 9 | 9 | 9 | unknown | 8 | 9 |
| Gill rakers | 6 + 17 = 23 | 6 + 17 = 23 | 5–6 + 16–17 = 22–23 | 5 + 15 = 20 | 6 + 16 = 22 | 6 + 18 =24 |
| Vertebrae | 10 + 15 | 10 + 15 | 10 + 15 | 10 + 15 | 10 + 15 | 10 + 15 |
| Measurements (% standard length) | | | | | | |
| Head length | 31.2 | 32.4 | 31.2–34.7 | 28.2 | 31.2 | 34.2 |
| Head width | 17.1 | 16.8 | 14.4–18.6 | 11.8 | 15.7 | 18.7 |
| Head height | 14.2 | 13.1 | 12.9–15.9 | 13.5 | 12.0 | 15.4 |
| Body depth | 16.6 | 17.2 | 14.9–18.3 | 15.7 | 14.3 | 16.2 |
| Body width | 14.7 | 15.3 | 10.8–18.6 | 9.6 | 13.8 | 17.8 |
| Caudal-peduncle depth | 8.2 | 8.8 | 7.9–9.1 | 7.3 | 5.6 | 7.5 |
| Caudal-peduncle length | 24.2 | 24.2 | 22.7–26.1 | 29.4 | 26.4 | 22.6 |
| Orbital diameter | 14.4 | 14.0 | 13.4–17.6 | 10.8 | 13.7 | 14.6 |
| Interorbital width | 8.0 | 7.3 | 6.9–8.4 | 7.3 | 6.7 | 8.8 |
| Postorbital length | 9.6 | 10.9 | 9.5–12.2 | 11.1 | 8.5 | 11.1 |

……continued on the next page

**TABLE 1.** (Continued)

| | *E. okamotoi* | *E. draco* | | *E. atherinoides* | | *E. lifouensis* |
|---|---|---|---|---|---|---|
| | NTUM 12701 Holotype | MNHN 2006-0589 Holotype | Other specimens *n*=11 | NSMT-P 102607 *n*=1 | NTUM 11045 *n*=1 | NTUM 13374 *n*=1 |
| Upper-jaw length | 10.6 | 10.4 | 10.6–12.9 | 10.8 | 10.7 | 13.0 |
| Lower-jaw length | 14.2 | 14.9 | 12.6–15.3 | 14.1 | 13.6 | 16.8 |
| Snout length | 6.7 | 7.7 | 6.7–9.5 | 6.5 | 6.8 | 8.3 |
| Pre-1st dorsal-fin length | 37.5 | 36.3 | 36.8–39.6 | 32.9 | 36.4 | 40.4 |
| Pre-2nd dorsal-fin length | 59.1 | 60.8 | 59.9–64.7 | 57.4 | 62.8 | 62.6 |
| Pre-pectoral-fin length | 33.7 | 32.4 | 33.3–36.7 | 27.8 | 33.1 | 35.1 |
| Pre-pelvic-fin length | 35.6 | 35.7 | 35.9–38.2 | 30.9 | 34.0 | 38.7 |
| Pre-anus length | 54.0 | 55.4 | 54.8–57.8 | 56.7 | 58.4 | 59.5 |
| Pre-anal-fin length | 67.3 | 66.8 | 65.7–69.0 | 65.6 | 67.8 | 70.3 |
| 1st spine length on 1st dorsal fin | 2.1 | 3.0 | 1.9–3.0 | 2.0 | 1.9 | 5.9 |
| 2nd spine length on 1st dorsal fin | Tip broken | 12.6 | 12.1–13.7 | Tip broken | Tip broken | Tip broken |
| 3rd spine length on 1st dorsal fin | 14.8 | Tip broken | 13.9–17.3 | Tip broken | Tip broken | Tip broken |
| 2nd dorsal-fin spine length | 5.9 | Tip broken | 5.7–6.7 | Tip broken | 4.1 | 4.9 |
| 1st anal-fin spine length | 1.4 | 2.4 | 1.2–2.6 | 1.7 | 0.8 | 2.2 |
| 2nd anal-fin spine length | 6.5 | 6.5 | 5.4–7.2 | 6.6 | 4.9 | 4.9 |
| Pelvic-fin spine length | 9.3 | 10.6 | 9.3–11.6 | Tip broken | 8.0 | 8.6 |
| 1st dorsal-fin base | 10.5 | 12.1 | 9.8–12.9 | 9.4 | 11.5 | 10.8 |
| 2nd dorsal-fin base | 9.6 | 10.2 | 8.3–10.8 | 9.6 | 8.9 | 9.6 |
| Anal-fin base | 8.4 | 8.8 | 8.5–10.0 | 10.9 | 8.4 | 8.1 |
| Pectoral-fin length | 11.6 | 12.9 | 10.7–15.3 | Tip broken | Tip broken | 14.1 |
| Pelvic-fin length | 12.6 | 14.3 | 13.2–16.6 | Tip broken | 12.8 | Tip broken |

**TABLE 2.** Pairwise genetic distances (*p*-distance) at the *COI* locus of species *Epigonus* examined in this study.

| Sample No. | Species | Tissue no. | Genbank no. | Sample 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|
| 1 | *E. draco* | PNG2315 | MG725237 | - | | | |
| 2 | *E. draco* | PNG963 | MG725238 | 0.00156 | - | | |
| 3 | *E. "okamotoi"* | PNG2250 | MG725239 | 0 | 0.00156 | - | |
| 4 | *E. atherinoides* | PNG2351 | MG725240 | 0.09390 | 0.09546 | 0.09390 | - |

***Epigonus atherinoides* (Gilbert 1905)**
English name: Slender Deepwater Cardinalfish
Japanese name: Hira-yasemutsu
(Fig. 3; Table 1)

*Hynnodus atherinoides* Gilbert, 1905: 618, pl. 79 (original description, type locality: Pailolo Channel [21°15′59″N, 157°52′12″W], south coast of Oahu, Hawaiian Islands); Jordan & Jordan 1922: 44 (list and note, Hawaiian Islands); Fowler & Bean 1930: 121 (description, Hawaiian Islands); Tinker 1944 (note, Hawaiian Islands).

*Epigonus occidentalis* (not of Goode & Bean, 1896): Mayer 1974: 170 (in part); Gon 1985: 222 (key to the Hawaiian species of *Epigonus*); Borets 1986: 6 (list, Colahan Seamount, Hawaiian Seamounts); Williams *et al*. 1996: 153 (list, Western Australia); Hutchins 2001: 32 (list, Western Australia); Hoese *et al*. 2006: 1114 (based on Williams *et al*. 1996, Western Australia).

*Epigonus atherinoides*: Mochizuki 1982: 226 (description, Kyushu-Palau Ridge); Mochizuki & Shirakihara 1983: 202, fig. 2 (description, Hawaiian Islands, Kyushu-Palau Ridge); Mochizuki 1984: 146, pl. 133-Q (color photograph and notes); Parin & Abramov 1986: 176 (description, Nazca and Sala y Gomez Ridges); Parin 1991: 679 (list, Nazca and Sala y Gomez Ridges); Abramov 1992: 95 (notes and key); Hayashi 1993: 682 (key); Chave & Mundy 1994: 397 (list, Hawaiian Archipelago); Mochizuki 1997: 306 (color photograph and notes); Chave & Malahoff 1998: 102 (list, Hawaiian Islands); Gon 1999: 2613 (key and notes); Hayashi 2000: 780 (key); Hayashi 2002: 780 (key); Mundy 2005: 357 (list and notes, Hawaiian Islands); Randall 2007: 217 (notes, Hawaiian Islands); Okamoto & Fukui 2011: 391 (key); Okamoto 2012: 252 (key); Hayashi 2013: 865 (key); Okamoto 2016: 182 (photograph and description, Hawaiian Islands, Kyushu-Palau Ridge, Australia, Society Islands, Nazca and Sala y Gomez Ridges).

**Material examined.** 2 specimens. Japan: NSMT-P 102607, 69.5 mm SL, 36°55.51′N, 141°24.91′E; 36°54.01′N, 141°24.15′E, off Fukushima Prefecture, northeastern Japan, 276–279 m depth, 26 October 2006. Papua New Guinea: NTUM 11045 (tissue voucher: PNG2351), 111.4 mm SL, 06°08′S, 149°10′E, 430–620 m depth, St. CP4334, 6 May 2014, R/V Alis, MADEEP Expedition.


**FIGURE 3.** *Epigonus atherinoides*. A, NSMT-P 102607, 69.5 mm SL, preserved specimen, northeastern Japan; B, NTUM 11045, 111.4 mm SL, fresh specimen, Papua New Guinea.

**Diagnosis.** A species of *Epigonus* with the following combination of characters: dorsal-fin rays VII–I, 10 or rarely VII–I, 9; pectoral-fin rays 20–22; total gill rakers 20–23; vertebrae 10 + 15; pyloric caeca 11–15; pored lateral-line scales 46–50 + 3–5; scales below lateral line 7–8; opercular spine pungent; maxillary mustache-like processes blunt; ribs on last abdominal vertebra absent or rarely present but reduced; upper margin of pectoral-fin base subequal to level of horizontal line through center of eye; proximal radial of first anal-fin pterygiophore broad; cycloid scales on lateral sides of body; head length 28.2–32.7% SL; upper-jaw length 10.2–11.9% SL; caudal-peduncle depth 6.4–8.2% SL.

**Distribution.** Known from the northeastern Japan (present study), Kyushu-Palau Ridge (Mochizuki 1982), Hawaiian Islands (Gilbert 1905), western Australia (Okamoto 2016), Society Islands (Okamoto 2016), Papua New Guinea (present study), and Nazca and Sala y Gomez Ridges (Parin 1991), at depths of 276–755 m (Fig. 2).

**Remarks.** The Japanese specimen is a juvenile with dense pigmentation on the posterior half of the lateral side of the body. *Epigonus megalops* (Smith & Radcliffe in Radcliffe, 1912) had been regarded as a junior synonym of *E. atherinoides*; however, the former was recognized as a valid species by Okamoto (2016).

### *Epigonus lifouensis* Okamoto & Motomura 2013

English name: Loyalty Deepwater Cardinalfish
(Fig. 4; Table 1)

*Epigonus lifouensis* Okamoto & Motomura, 2013: 302, fig. 1 (original description, type locality: 21°40′59″S, 167°31′59″E, south of Lifou Island, Loyalty Islands, New Caledonia, western Pacific [collected during the MUSORSTOM 6 Expedition under the TDSB]).

**Material examined.** 1 specimen. South China Sea: NTUM 13374, 175.0 mm SL, 16°03′N, 113°54′E, seamount nearby the Macclesfield Bank, South China Sea, 356–410 m depth, St. CP4151, 27 July 2015, R/V OR1, ZhongSha 2015 Expedition.

**Diagnosis.** A species of *Epigonus* with the following combination of characters: dorsal-fin rays VII–I, 10; pectoral-fin rays 18–19; total gill rakers 24–25; vertebrae 10 + 15; pyloric caeca 9–13; pored lateral-line scales 47–49 + 3–5; opercular spine absent; maxillary mustache-like processes absent; ribs on last abdominal vertebra present; tongue toothless; tubercle absent on inner symphysis of lower jaw; eye elliptical; body depth 16.2–17.1% SL; and posterior half of oral cavity and tongue black.

**Distribution.** Known from New Caledonia (Okamoto & Motomura 2013) and South China Sea (present study), at depths of 356–575 m (Fig. 2).

**Remarks.** *Epigonus lifouensis* was originally described on the basis of two specimens collected from the south of Lifou Island, Loyalty Islands, New Caledonia, at depths of 500–575 m and recognized as a member of the *E. pandionis* group (Okamoto & Motomura 2013). The present specimen represents the first record of the species from the South China Sea, Taiwan. Deepwater cardinalfishes of Taiwan are represented by two species including the first record of *E. lifouensis* here reported and *E. denticulatus* Dieuzeide, 1950. Although Gon (2000) listed *E. macrops* (Brauer 1906) in the checklist of the fishes of the South China Sea, it may be a misidentification (see Okamoto & Nakayama 2016). It should be noted that the specimens available to date were collected at a ridge nearby remote islands or a seamount rather than on the continental slope, suggesting a particular habitat of the species.

**FIGURE 4.** *Epigonus lifouensis*, NTUM 13374, 175.0 mm SL, fresh specimen, South China Sea.

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## References

Abramov, A.A. (1992) Species composition and distribution of *Epigonus* (Epigonidae) in the world ocean. *Journal of Ichthyology*, 32, 94–108.

Borets, L.A. (1986) Ichthyofauna of the northwestern and Hawaiian submarine ranges. *Journal of Ichthyology*, 26 (3), 1–13.

Chave, E.H. & Malahoff, A. (1998) *In Deeper Waters. Photographic Studies of Hawaiian Deep-sea Habitats and Life-forms*. University of Hawai'i Press, Hawai, viii + 128 pp.

Chave, E.H. & Mundy, B.C. (1994) Deep-sea benthic fish of the Hawaiian Archipelago, Cross Seamounts, and Johnston Atoll. *Pacific Science*, 48, 367–409.

Fowler, H.W. & Bean, B.A. (1930) The fishes of the families Amiidae, Chandidae, Duleidae, and Serranidae, obtained by United States Bureau of Fishes Steamer "Albatross" in 1907 to 1910, chiefly in the Philippine Islands and adjacent seas. *Bulletin of the United States National Museum*, 100 (10), i–x, 1–334.

Fricke, R. (2017) *Epigonus okamotoi*, a new species of deepwater cardinalfish from New Britain, Papua New Guinea, Solomon Sea, western Pacific Ocean (Teleostei: Epigonidae). *FishTaxa*, 2, 116–122.

Gilbert, C.H. (1905) The deep-sea fishes of the Hawaiian Islands. Aquatic Resources of the Hawaiian Islands. *Bulletin of the United States Fish Commission*, 23, 577–713, pls. 66–101.

Gon, O. (1985) Two new species of the deep-sea cardinalfish genus *Epigonus* (Perciformes, Apogonidae) from the Hawaiian Islands, with a key to the Hawaiian species. *Pacific Science*, 39, 221–229.

Gon, O. (1999) Epigonidae. *In*: Carpenter, K.E. & Niem, V.H. (Eds.), *FAO Species Identification Guide for Fishery Purposes. The Living Marine Resources of the Western Central Pacific. Vol. 4. Bony Fishes Part 2. Mugilidae to Carangidae*. FAO, Rome, pp. 2611–2613.

Gon, O. (2000) Epigonidae. *In*: Randall, J.E. & Lim, K.K.P. (Eds.), A checklist of the fishes of the South China Sea. *The Raffles Bulletin of Zoology*, 8 (Supplement), pp. 569–667 + 614.

Goode, G.B. & Bean, T.H. (1896) Oceanic ichthyology, a treatise on the deep-sea and pelagic fishes of the world, based chiefly upon the collections made by the steamers Blake, Albatross, and Fish Hawk in the northwestern Atlantic, with an atlas containing 417 figures. *Special Bulletin of the United States National Museum*, 2, 1–553.

Hayashi, M. (1993) Epigonidae. *In*: Nakabo, T. (Ed.), *Fishes of Japan with Pictorial Keys to the Species*. Tokai University Press, Tokyo, pp. 682–683 + 1317. [in Japanese]

Hayashi, M. (2000) Epigonidae. *In*: Nakabo, T. (Ed.), *Fishes of Japan with Pictorial Keys to the Species. Second Edition*. Tokai University Press, Tokyo, pp. 780–781, 1553. [in Japanese]

Hayashi, M. (2002) Epigonidae. *In*: Nakabo, T. (Ed.), *Fishes of Japan with Pictorial Keys to the Species. English Edition*. Tokai University Press, Tokyo, pp. 780–781, 1545.

Hayashi, M. (2013) Epigonidae. *In*: Nakabo, T. (Ed.), *Fishes of Japan with Pictorial Keys to the Species. 3rd Edition*. Tokai University Press, Hadano, pp. 865–866, 1986. [in Japanese]

Hoese, D.F., Bray, D.J., Allen, G.R. & Cross, N.J. (2006) Epigonidae. Deepsea cardinalfishes, deepwater cardinalfishes. *In*: Hoese, D.F., Bray, D.J., Paxton, J.R. & Allen, G.R. (Eds.), *Zoological Catalogue of Australia. Vol. 35. Fishes. Parts 1–3*. CSIRO Publishing and the Australian Biological Resources Study, Collingwood, pp. 1113–1115.

Hutchins, J.B. (2001) Checklist of the fishes of Western Australia. *Records of the Western Australian Museum*, 63 (Supplement), 9–50.
https://doi.org/10.18195/issn.0313-122x.63.2001.009-050

Iwamoto, T. & McCosker, J.E. (2014) Deep-water fishes of the 2011 Hearst Philippines Biodiversity Expedition of the California Academy of Sciences. *In*: Williams, G.C. & Gosliner, T.M. (Eds.), *The Coral Triangle: the 2011 Hearst Philippine Biodiversity Expedition*. California Academy of Sciences, San Francisco, pp. 263–332.

Jordan, D.S. & Jordan, E.K. (1922) A list of the fishes of Hawaii, with notes and descriptions of new species. *Memoirs of the Carnegie Museum*, 10 (1), 1–92, 1–4 pls.

Lo, P.-C., Liu, S.-H., Mohd Nor, S.A. & Chen, W.-J. (2017) Molecular exploration of hidden diversity in the Indo-West Pacific sciaenid clade. *PLoS ONE*, 12 (4), e0176623.

https://doi.org/10.1371/journal.pone.0176623
Mayer, G.F. (1974) A revision of the cardinalfish genus *Epigonus* (Perciformes, Apogonidae), with descriptions of two new species. *Bulletin of the Museum of Comparative Zoology*, 146, 147–203.
Mochizuki, K. (1982) Apogonidae. *In*: Okamura, O., Amaoka, K. & Mitani, F. (Eds.), *Fishes of the Kyushu-Palau Ridge and Tosa Bay*. Japan Fisheries Resource Conservation Association, Tokyo, pp. 226–227 + 376–377.
Mochizuki, K. (1984) Genus *Epigonus*. *In*: Masuda, H., Amaoka, K., Araga, C., Uyeno, T. & Yoshino, T. (Eds.), *The Fishes of the Japanese Archipelago*. Tokai University Press, Tokyo, pp. 146, pl. 133.
Mochizuki, K. (1997) Epigonidae. *In*: Okamura, O. & Amaoka, K. (Eds.), *Sea Fishes of Japan*. Yama-kei, Tokyo, pp. 306–307. [in Japanese]
Mochizuki, K. & Shirakihara, K. (1983) A new and rare apogonid species of the genus *Epigonus* from Japan. *Japanese Journal of Ichthyology*, 30, 199–207.
Mundy, B.C. (2005) Checklist of the fishes of the Hawaiian Archipelago. *Bishop Museum Bulletin in Zoology*, 6, 1–704.
Okamoto, M. (2011) A new species of deepwater cardinalfish, *Epigonus mayeri*, from the eastern Central Atlantic, and redescription of *Epigonus heracleus* Parin and Abramov 1986 (Perciformes: Epigonidae). *Ichthyological Research*, 58, 101–108.
https://doi.org/10.1007/s10228-010-0195-x
Okamoto, M. (2012) Two new species of the genus *Epigonus* (Perciformes: Epigonidae) from the South Pacific, with a definition of the *Epigonus constanciae* group. *Ichthyological Research*, 59, 252–254.
https://doi.org/10.1007/s10228-012-0284-0
Okamoto, M. (2015) *Epigonus draco*, a new species of deepwater cardinalfish (Perciformes: Epigonidae) from the western Pacific. *Species Diversity*, 20, 121–127.
https://doi.org/10.12782/sd.20.2.121
Okamoto, M. (2016) Validity of *Epigonus megalops* (Perciformes: Epigonidae), redescription of *E. atherinoides*, and first record of *E. draco* from the central South Pacific. *Species Diversity*, 21, 177–186.
https://doi.org/10.12782/sd.21.2.177
Okamoto, M. & Fukui, A. (2011) Redescription of a rare deepwater cardinalfish, *Epigonus ctenolepis* Mochizuki and Shirakihara 1983, and comparison with related species (Perciformes: Epigonidae). *Ichthyological Research*, 58, 388–392.
https://doi.org/10.1007/s10228-011-0243-1
Okamoto, M. & Motomura, H. (2013) Two new species of deepwater cardinalfish from the Indo-Pacific, with a definition of the *Epigonus pandionis* group (Perciformes: Epigonidae). *Ichthyological Research*, 60, 301–311.
https://doi.org/10.1007/s10228-013-0352-0
Okamoto, M. & Nakayama, N. (2016) First records of the luminous deepwater cardinalfish (Perciformes: Epigonidae), *Epigonus macrops* (Brauer, 1906), from the southeastern Atlantic and Timor Sea. *Species Diversity*, 21, 79–83.
https://doi.org/10.12782/sd.21.1.079
Parin, N.V. (1991) Fish fauna of the Nazca and Sala y Gomez Submarine Ridges, the easternmost outpost of the Indo-West Pacific zoogeographic region. *Bulletin of Marine Science*, 49, 671–683.
Parin, N.V. & Abramov, A.A. (1986) Materials for a revision of the genus *Epigonus* Rafinesque (Perciformes, Epigonidae): species from the submarine ridges of the southern East Pacific and preliminary review of the "*Epigonus robustus* species-group". *Trudy Instituta Okeanologii im. P. P. Shirshova*, 121, 173–194. [in Russian]
Randall, J.E. (2007) *Reef and Shore Fishes of the Hawaiian Islands*. Sea Grant College Program, University of Hawai'i, Honolulu, xiv + 546 pp.
Swofford, D.L. (2002) *PAUP*, Phylogenetic analysis using parsimony (*and other methods). Version 4*. Sinauer Associates, Sunderland, MA. [software]
Tinker, S.W. (1944) *Fishes of Hawaii. A Handbook of the Fishes Found Among the Islands of the Central Pacific Ocean*. Tong Publishing Company, Honolulu, 404 pp.
Ward, R.D., Zemlak, T.S., Innes, B.H., Last, P.R. & Hebert, P.D.N. (2005) Barcoding Australia's fish species. *Philosophical Transactions of the Royal Society of London*, Series B, 360, 1847–1857.
https://doi.org/10.1098/rstb.2005.1716
Williams, A., Last, P.R., Gomon, M.F. & Paxton, J.R. (1996) Species composition and checklist of the demersal ichthyofauna of the continental slope off Western Australia (20–35°S). *Records of the Western Australian Museum*, 18, 135–155.