First Records of Two Deepwater Cardinalfishes (Perciformes: Epigonidae), *Epigonus lifouensis* and *E. pectinifer*, from Indonesia, Eastern Indian Ocean

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Twelve specimens (131.5–180.7 mm in standard length: SL) of *Epigonus lifouensis* Okamoto and Motomura, 2013 (Perciformes: Epigonidae) were collected from off Sumatra, Indonesia. Also, a single specimen (67.1 mm SL) of *E. pectinifer* Mayer, 1974 was collected off Java, Indonesia. These Indonesian specimens represent the first records of both species from the eastern Indian Ocean.

Key Words: Teleostei, deepwater fish, new record, Indo-Pacific, Java, Sumatra.

Introduction

Inada and Wudianto (2006) reported 301 species of fishes with crustaceans (36 species) and cephalopods (18 species) from deep waters (100–200 m depths) off Java and Sumatra, Indonesia, in the eastern Indian Ocean as “a photo album”. The project was implemented by the Overseas Fishery Co-operation Foundation of Japan and the Ministry of Marine Affairs and Fisheries of the Government of Indonesia during 2004 and 2005 using R/V Baruna Jaya IV for a stock assessment and feasibility study for a fishery in the area. From this project, numerous fish specimens were deposited at the Faculty of Fisheries, Hokkaido University, Hakodate, Japan and some new species were described based on these specimens (e.g., Anderson and Satria 2007; Last and White 2013; Ho *et al.* 2016). I examined the resulting specimens of the genus *Epigonus* Rafinesque, 1810 (Perciformes: Epigonidae) and found 12 specimens of *Epigonus lifouensis* Okamoto and Motomura, 2013 and a single specimen of *Epigonus pectinifer* Mayer, 1974. These Indonesian specimens represent the first records of the two species from the eastern Indian Ocean.

Materials and Methods

Meristic and morphometric methods followed Mayer (1974) and Okamoto (2011). Missing lateral-line scales were estimated by counting scale pockets. The number of pored lateral-line scales on the caudal fin is represented as “+*n*”. The term “maxillary mustache-like process” is used for a lateral process on the maxillary head (see Mayer 1974; Okamoto 2012). The definition of the first caudal vertebra follows Okamoto and Motomura (2011). Counts of supra-

neurals, vertebrae, and ribs were taken from radiographs. The sex and number of pyloric caeca were determined by dissection of the right side of the abdomen. Standard length is abbreviated as SL. The specimens examined in the present study are deposited in the Commonwealth Scientific and Industrial Research Organisation, Division of Marine and Atmospheric Research, Hobart (CSIRO); Fish Collection of Kyoto University, Maizuru Fisheries Research Station, Kyoto (FAKU); Hokkaido University Museum, Hakodate (HUMZ); Kanagawa Prefectural Museum of Natural History, Odawara (KPM); Muséum National d'Histoire Naturelle, Paris (MNHN); National Taiwan University, University Museums, Taipei (NTUM); and South African Institute for Aquatic Biodiversity, Grahamstown (SAIAB).

Epigonus lifouensis Okamoto and Motomura, 2013
(Fig. 1; Table 1)

Epigonus denticulatus (not of Dieuzeide): Inada and Wudianto 2006: 32 (photograph, off Sumatra, Indonesia).

Epigonus lifouensis Okamoto and 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); Okamoto *et al.* 2018: (South China Sea, Taiwan).

Material examined. HUMZ 190770 (137.4 mm SL, male)–190771 (131.5 mm SL, male), 05°29'11"N, 94°01'47"E–05°27'49"N, 94°01'52"E, off Sumatra, Indonesia, 347–361 m depth, 13 October 2004; HUMZ 191536–191545, 10 specimens, 05°46'52"N, 102°41'25"E–05°46'02"N, 102°39'53"E, off Sumatra, Indonesia, 546–639 m depth, 26 September 2004; (HUMZ 191536, 170.1 mm SL, male; HUMZ 191537, 151.7 mm SL, male; HUMZ 191538, 162.8 mm SL, female; HUMZ 191539, 150.4 mm SL, male; HUMZ 191540, 143.2 mm SL,

Fig. 1. *Epigonus lifouensis*, HUMZ 191539, 150.4 mm SL, from off Sumatra, Indonesia.

Table 1. Counts and measurements of *Epigonus lifouensis* and *E. pectinifer* from Indonesia in this study.

	<i>E. lifouensis</i> <i>n</i> =12 HUMZ 190770–190771 HUMZ 191536–191545	<i>E. pectinifer</i> <i>n</i> =1 HUMZ 190275
Standard length (mm)	137.4–180.7	67.1
Counts		
Dorsal-fin rays	VII-I, 10	VII-I, 9
Anal-fin rays	II, 9	II, 9
Pectoral-fin rays	18	17
Pored lateral-line scales	47–49+4–5	47+4
Scales above lateral line	2	3
Scales below lateral line	9	Missing scales
Gill rakers	7–8+19–21=26–28	8+21=29
Pyloric caeca	10–11	Damaged
Vertebrae	10+15	10+15
Measurements (% standard length)		
Head length	33.3–35.7	36.5
Head width	16.5–18.3	16.2
Head height	14.8–17.0	17.3
Body depth	17.0–20.1	23.8
Body width	13.7–17.0	13.6
Caudal-peduncle depth	8.0–9.4	10.0
Caudal-peduncle length	22.4–25.3	28.6
Orbital diameter	13.1–15.8	15.1
Interorbital width	8.2–9.6	9.4
Postorbital length	11.6–13.5	13.6
Upper-jaw length	13.2–14.8	15.1
Lower-jaw length	16.7–17.9	15.6
Snout length	7.4–9.0	8.9
Pre-1st dorsal-fin length	37.8–40.8	35.9
Pre-2nd dorsal-fin length	59.1–62.3	58.7
Pre-pectoral-fin length	33.2–36.2	35.0
Pre-pelvic-fin length	34.2–37.8	36.8
Pre-anus length	57.9–63.8	58.7
Pre-anal-fin length	68.7–72.0	67.5
1st spine length on 1st dorsal-fin	4.2–6.3	2.1
2nd spine length on 1st dorsal-fin	12.2–12.3	14.0
3rd spine length on 1st dorsal-fin	15.0–15.6	16.2
2nd dorsal-fin spine length	5.0–6.0	15.5
1st anal-fin spine length	1.5–2.6	3.6
2nd anal-fin spine length	4.5–6.3	15.5
Pelvic-fin spine length	6.3–9.9	14.9
1st dorsal-fin base	10.6–12.2	11.6
2nd dorsal-fin base	8.8–10.3	10.1
Anal-fin base	7.4–9.2	10.0
Pectoral-fin length	14.6–17.5	Tip broken
Pelvic-fin length	11.7–13.4	Tip broken

male; HUMZ 191541, 153.8 mm SL, male; HUMZ 191542, 180.7 mm SL, female; HUMZ 191543, 172.3 mm SL, male; HUMZ 191544, 156.7 mm SL, male; HUMZ 191545, 163.1 mm SL, male).

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 24–28; vertebrae 10+15; pyloric caeca 10–13; pored lateral-line scales 47–49+4–5; body depth 17.0–20.1% SL; opercular spine absent; maxillary mustache-like processes absent; tongue toothless; ribs present on last abdominal vertebra; tubercle absent on inner symphysis of lower jaw; eye elliptical; and posterior half of oral cavity and tongue black.

Distribution. Known from New Caledonia (Okamoto and Motomura 2013), South China Sea (Okamoto *et al.* 2018), and Indonesia (present study; Fig. 2), at depths of 347–639 m.

Remarks. In the faunal study of demersal fishes in Indonesia (Inada and Wudianto 2006), the present specimens from off Sumatra were identified as “*Epigonus denticulatus* Dieuzeide 1950”. However, I re-examined the specimens and identified them as *E. lifouensis* in the present study (Fig. 1). *Epigonus lifouensis* can be distinguished from *E. denticulatus* by having fewer gill rakers (24–28 vs. 28–34 in *E. denticulatus*) and a black tongue and oral cavity (vs. tan; Dieuzeide 1950; Mochizuki 1982, 1990; Abramov 1992; Okamoto and Gon 2018). In the eastern Indian Ocean, *E. denticulatus* has been reported from the south of the Great Australian Bight (Abramov 1992; Kamyshcheva 1985), but not from the north eastern Indian Ocean, to date.

Epigonus lifouensis was originally described based on two specimens from the south of Lifou Island, Loyalty Islands, New Caledonia (Okamoto and Motomura 2013). Later, a single specimen of the species was collected from a seamount nearby the Macclesfield Bank, South China Sea (Okamoto *et al.* 2018). The present specimens represent the first record of the species from the eastern Indian Ocean

(Fig. 2).

Epigonus lifouensis belongs to the *E. pandionis* group of Okamoto and Motomura (2013) defined as lacking an opercular spine, more than 45 pored lateral-line scales to the end of the hypural and dorsal-fin rays VII-I, 10. The species group comprises 9 species, including *E. lifouensis*: *E. cavaticus* Ida *et al.*, 2007; *E. denticulatus* Dieuzeide, 1950; *E. elongatus* Parin and Abramov, 1986; *E. fragilis* (Jordan and Jordan, 1922); *E. marisrubri* Krupp *et al.*, 2009; *E. pandionis* (Goode and Bean, 1881); *E. parini* Abramov, 1987; and *E. tuberculatus* Okamoto and Motomura, 2013.

Characters of the present Indonesian specimens agree with the characteristics of the two types and another specimen from the western Pacific of *E. lifouensis* reported in previous studies, with the exception of the gill rakers for which the Indonesian specimens had 26–28 (vs. 24–25 in Okamoto and Motomura 2013; Okamoto *et al.* 2018). Although the gill raker counts of *E. lifouensis* reported in previous studies are based on a small number of the specimens (total 3 specimens), I regard the difference as an intraspecific variation in the populations between the western Pacific and eastern Indian Oceans, with no overlap.

Epigonus pectinifer Mayer, 1974 (Fig. 3; Table 1)

Epigonus pectinifer Mayer, 1974: 186, fig. 19 (original description; type locality: 12°01'N, 61°53.5'W, Caribbean west of Grenada, 378–450 m depth; holotype: USNM 207725); Mochizuki and Shirakihara 1983: 205, fig. 5b (list and photograph, Japan); Mochizuki 1984: 146, pl. 133-O (brief description and photograph, Japan); Machida 1985: 482 (description and photograph, Okinawa Trough, Japan); Parin and Abramov 1986: 186 (description, Caribbean Sea, New Zealand, central North Pacific); Abramov 1992: 99 (key); Hayashi 1993: 683 (key, Japan); Mochizuki 1997: 306 (brief description and photograph, Japan); Shinohara and Matsuura 1997: 303 (list, Suruga Bay, Japan); Hayashi 2000: 781 (key, Japan); Shinohara *et al.* 2001: 324 (Tosa Bay, Japan); Hayashi 2002: 781 (key, Japan); Moore *et al.* 2003: 225, fig. 39 (record, near Norfolk, Baltimore, and Hudson canyons, off the New England region); Gon 2003: 1393 (key, western central Atlantic); Shinohara *et al.* 2005: 432 (list, Ryukyu Islands, Japan); Mundy 2005: 359 (list, Emperor Seamounts); McEachran and Feckhelm 2005: 242 (Gulf of Mexico); Okamoto and Fukui 2011: 391 (key); Okamoto 2012: 252 (key); Hayashi 2013: 865 (key, Japan); Stewart and Gon 2015: 1219 (key, New Zealand); Okamoto and Gon 2018: 280, fig. 16 (south west Indian Ocean).

Epigonus robustus (not of Barnard): Kuroda 1951: 331 (list, Suruga Bay, Japan); Kamohara 1964: 39 (list, Tosa Bay, Japan).

Material examined. HUMZ 190275, 67.1 mm SL, sex indeterminate, 08°10'3"S, 109°49'3"E–08°09'4"S, 109°48'8"E, off Java, Indonesia, 280–285 m depth, 13 September 2004.

Diagnosis. A species of *Epigonus* with the following combination of characters: dorsal-fin rays VII-I, 9; pectoral-

Fig. 2. Distributional records of *Epigonus lifouensis* (stars) and *E. pectinifer* (circle) in the eastern Indian Ocean.

Fig. 3. *Epigonus pectinifer*, HUMZ 190275, 67.1 mm SL, from off Java, Indonesia.

fin rays 15–18; total gill rakers 26–30; vertebrae 10+15; pyloric caeca 5–7; pored lateral-line scales 45–51+3–5; pungent opercular spine present; pointed maxillary mustache-like processes present; ribs on last abdominal vertebra present; slender tooth patch present on posterior half of tongue; pectoral fin not reaching a vertical line from anus.

Distribution. Known from the south western Indian Ocean (Okamoto and Gon 2018); Indonesia (present study); western North Atlantic (Moore *et al.* 2003); Gulf of Mexico (Mayer 1974; McEachran and Fechhelm 2005); Caribbean Sea (Mayer 1974); Tasman Sea, Australia and New Zealand (Parin and Abramov 1986; Abramov 1992; Okamoto 2012; Stewart and Gon 2015); Emperor Seamounts (Parin and Abramov 1986; Abramov 1992; Mundy 2005); and Japan (Machida 1985; Hayashi 2013), at 99–750 m depth.

Remarks. In a recent taxonomic study of the genus *Epigonus* in the western Indian Ocean, *E. pectinifer* has been reported from the study area for the first time (Okamoto and Gon 2018). Also, this species has been known from the western North Atlantic, western Pacific, and the Emperor Seamounts (Mayer 1974; Abramov 1992; Mundy 2005). The present specimen from Indonesia represents the first record of *E. pectinifer* from the eastern Indian Ocean (Fig. 2).

Epigonus pectinifer belongs to the *E. constanciae* group of Okamoto (2012) due to having a pungent opercular spine. The species group comprises 21 species (Okamoto 2015, 2016), including *E. pectinifer*: *E. affinis* Parin and Abramov, 1986; *E. atherinoides* (Gilbert, 1905); *E. bispinosus* Okamoto and Gon, 2018; *E. chilensis* Okamoto, 2012; *E. constanciae* (Giglioli, 1880); *E. crassicaudus* de Buen, 1959; *E. ctenolepis* Mochizuki and Shirakihara, 1983; *E. draco* Okamoto, 2015; *E. elegans* Parin and Abramov, 1986; *E. heracleus* Parin and Abramov, 1986; *E. idai* Okamoto and Gon, 2018; *E. lenimen* (Whitley, 1935); *E. machaera* Okamoto, 2012; *E. marimonticolus* Parin and Abramov, 1986; *E. mayeri* Okamoto, 2011; *E. megalops* (Smith and Radcliffe in Radcliffe, 1912); *E. occidentalis* Goode and Bean, 1896; *E. robustus* (Barnard, 1927); *E. thai* Prokofiev and Bussarawit in Parin *et al.*, 2012; and *E. waltersensis* Parin and Abramov, 1986. Of these, *E. pectinifer* is similar to *E. constanciae* in having a lingual tooth patch and a sharp-pointed maxillary mustache-like process;

however, the former is distinguished from the latter in lacking a tubercle on the outer symphysis of lower jaw and having a pair of ribs on the last abdominal vertebra (vs. a small tubercle present on the outer symphysis of lower jaw and ribs absent on the last abdominal vertebra in *E. constanciae*). Although *E. mayeri* also has a sharp-pointed maxillary mustache-like process and a pair of ribs on the last abdominal vertebra, it differs from *E. pectinifer* in having a longer pectoral fin (22.2–23.0% SL vs. 17.4–20.9% SL, and reaching to vertical line from anus vs. not reaching vertical line from anus in *E. pectinifer*), a larger orbital diameter (16.4–17.0% SL vs. 12.1–15.4% SL in *E. pectinifer*), a longer lower jaw (16.7–17.0% SL vs. 12.1–15.6% SL in *E. pectinifer*), and lacking a lingual tooth patch (vs. present in *E. pectinifer*).

In the check list of the species composition of the demersal ichthyofauna on the continental slope off Western Australia, eastern Indian Ocean by Williams *et al.* (1996), they listed three species of *Epigonus*: *E. macrops* (Brauer, 1906), *E. occidentalis*, and *E. robustus*. However, I re-examined the specimens originally identified as *E. occidentalis* by Williams *et al.* (1996) and re-identified them as *E. atherinoides* (CSIRO H 2557-13, CSIRO H 2603-01, CSIRO H 2603-02; see Okamoto 2016). Deepwater cardinalfishes of the eastern Indian Ocean are represented by 10 species (Abramov 1992; Williams *et al.* 1996; Okamoto and Aungtonya 2013; Okamoto and Motomura 2013; Okamoto 2016), including the first records of *E. lifouensis* and *E. pectinifer* here reported; the other 8 species are *E. atherinoides*, *E. denticulatus*, *E. lenimen*, *E. macrops*, *E. robustus*, *E. telescopus* (Risso, 1810), *E. thai*, and *E. tuberculatus*.

Comparative material. *Epigonus atherinoides*: CSIRO H 2557-13, 3 specimens, 106.7–138.3 mm SL, 23°41'6"S, 112°35'5"E–23°42'9"S, 112°35'9"E, west of Cape Farquhar, Western Australia, 612–620 m depth, 26 January 1991; CSIRO H 2603-01, 122.2 mm SL, 31°16'2"S, 114°50'2"E–31°16'8"S, 114°50'3"E, southwest of Ledge Point, Western Australia, 613–614 m depth, 9 February 1991; CSIRO H 2603-02, 96.3 mm SL, same data as CSIRO H 2603-01. *Epigonus denticulatus*: FAKU 144807, 50.7 mm SL, off Ibaraki Prefecture, Japan, 18 November 2016; KPM-NI 24857, 96.5 mm SL, off Heda, Suruga Bay, Shizuoka

Prefecture, Japan, 29 November 2009; KPM-NI 41603, 112.2 mm SL, 34°48'25"N, 138°30'36"E, Suruga Bay, Shizuoka Prefecture, Japan, 1 November 2016; KPM-NI 42646, 85.5 mm SL, 34°18'38"N, 137°23'10"E, Enshu-nada Sea, Shizuoka Prefecture, Japan, 329–385 m depth, 9 December 2016. *Epigonus lifouensis*: MNHN 2000-0018, holotype, 139.7 mm SL, male, 21°40'59"S, 167°31'59"E, south of Lifou Island, Loyalty Islands, New Caledonia, western South Pacific, 575 m depth, 21 February 1989; MNHN 2003-1826, paratype, 202.5 mm SL, female, 21°23'31"S, 167°46'10"E, south of Lifou Island, Loyalty Islands, New Caledonia, western South Pacific, 500 m depth, 23 February 1989; NTUM 13374, 175.0 mm SL, 16°03'N, 113°54'E, seamount nearby the Macclesfield Bank, South China Sea, 356–410 m depth, 27 July 2015. *Epigonus pectinifer*: KPM-NI 40138, 106.5 mm SL, off Heda, Suruga Bay, Shizuoka Prefecture, Japan, 9 May 2015; KPM-NI 41541, 80.2 mm SL, off Heda, Suruga Bay, Shizuoka Prefecture, Japan, 20 November 2016; SAIAB 86380, 3 specimens, 138.4–152.6 mm SL, 11°02'32"S, 50°35'29"E, off northern Madagascar, western Indian Ocean, 331–339 m depth, 27 September 2008; SAIAB 98893, 7 specimens, 50.8–64.7 mm SL, 12°41'43"S, 40°40'10"E, Comoro Is., western Indian Ocean, 292 m depth, 23 November 2007; SAIAB 193895, 4 specimens, 80.0–82.3 mm SL, 12°48'51"S, 40°45'69"E, off northern Mozambique, western Indian Ocean, 420–536 m depth, 15 February 1992.

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