

Two new species of deepwater cardinalfish from the Indo-Pacific, with a definition of the *Epigonus pandionis* group (Perciformes: Epigonidae)

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Abstract Two new Indo-Pacific species of deepwater cardinalfish, *Epigonus lifouensis* and *E. tuberculatus* are described based on the specimens collected from the Loyalty Islands and Cocos-Keeling Islands, respectively. These species belong to the *Epigonus pandionis* group defined as lacking an opercular spine, having more than 43 pored lateral-line scales to the end of the hypural and dorsal-fin rays VII-I, 9–11. *Epigonus lifouensis* is distinguished from other members of the group by a combination of the following characters: ribs present on the last abdominal vertebra; tongue toothless; tubercle absent on inner symphysis of lower jaw; eye elliptical; total gill rakers 24–25; pectoral-fin rays 18–19; pyloric caeca 10–13; body depth 17.0–17.1 % SL; and posterior half of oral cavity and tongue black. *Epigonus tuberculatus* is distinguished from other members of the group by a combination of the following characters: ribs on the last abdominal vertebra reduced or absent; tongue toothless; tubercle present on inner symphysis of lower jaw; total gill rakers 21–22; pectoral-fin rays 19–20; pyloric caeca 8–10; orbital

diameter 14.5–15.4 % SL; and lower-jaw length 16.0–17.6 % SL. A key to the species and some comments on the group are provided based on examination of all members (nine species, including two new species) of the group.

Keywords Deepwater cardinal fish · *Epigonus* · New Caledonia · Australia

Introduction

Fishes of the genus *Epigonus* Rafinesque 1810 (deepwater cardinalfish) are distributed from temperate to tropical waters in the world (Mayer 1974; Okamoto 2012; Okamoto and Motomura 2012). In a recent taxonomic study of the genus *Epigonus*, Okamoto (2012) proposed four species groups: the *Epigonus constanciae* group (Okamoto 2012), the *Epigonus oligolepis* group (Okamoto and Motomura 2011), the *Epigonus telescopus* group (Abramov 1992), and an unnamed group (Okamoto 2012). In the last group, Okamoto (2012) indicated that the group consists of seven species, viz., *Epigonus denticulatus* Dieuzeide 1950; *Epigonus elongatus* Parin and Abramov 1986; *Epigonus cavaticus* Ida, Okamoto and Sakaue 2007; *Epigonus fragilis* (Jordan and Jordan 1922); *Epigonus marisrubri* Krupp, Zajonz and Khalaf 2009; *Epigonus pandionis* (Goode and Bean 1881); and *Epigonus parini* Abramov 1987, and is characterized by the following combination of characters: opercular spine absent, more than 43 pored lateral-line scales to end of hypural, and VII-I, 9–11 dorsal-fin rays.

During an investigation of material of the genus from the Indo-Pacific, two undescribed species having the above-mentioned characters collected from Lifou Island, the Loyalty Islands and the Cocos-Keeling Islands were

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found. Herein, these species are described as two new species, and the species group is defined as “the *Epigonus pandionis* group”. Also, a key to the species and some comments of the group are provided based on examination of all members of the group.

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 first caudal vertebra is defined as the first vertebra bearing a definite hemal spine. Measurements were made with calipers to the nearest 0.1 mm. The formula for the configuration of the supraneural bones, anterior neural spines, and anterior dorsal fin pterygiophores follows Ahlstrom et al. (1976). Counts of supraneurals, vertebrae, and ribs were taken from radiographs. The term “maxillary mustache-like process” is used for a process on the maxillary head (see Okamoto 2011: fig. 3). The number of pyloric caeca and sex were established by dissection of the abdomen on the right side. Standard length and head length are abbreviated as SL and HL, respectively. Institutional codes follow Sabaj Pérez (2012).

Epigonus lifouensis sp. nov.

(New English name: Loyalty Deepwater Cardinalfish)
(Figs. 1, 2a)

Holotype. MNHN 2000-0018, 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, beam trawl, 21 February 1989.

Paratype. MNHN 2003-1826, 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, Waren dredge, 23 February 1989.

Diagnosis. A species of *Epigonus* with the following combination of characters: opercular spine absent; ribs present on the last abdominal vertebra; tongue toothless; maxillary mustache-like process absent; tubercle absent on

inner symphysis of lower jaw; eye elliptical; total gill rakers 24–25; vertebrae 10 + 15; pored lateral-line scales 48–49 + 3–4; dorsal-fin rays VII–I, 10; pectoral-fin rays 18–19; pyloric caeca 10–13; body depth 17.0–17.1 % SL; and posterior half of oral cavity and tongue black.

Description. Counts and proportional measurements are given in Table 1. Data for the holotype are presented first, followed by data of paratype (if different) in parentheses. Body slender, laterally compressed, nape not humped, deepest at pectoral-fin base. Head large and thick. Maxillary mustache-like process absent. Snout short and round; two nostrils close-set without dermal flap, elliptical, posterior one slightly larger. Eye large, elliptical, diameter greater than postorbital length; bony rim of orbit slightly raised above dorsal profile; interorbital region flat. Mouth large, terminal, gape oblique; posterior margin of maxilla extending to below anterior margin of pupil; lower jaw not projecting when mouth closed; tubercle absent on inner symphysis of lower jaw. Teeth minute, two or three rows on anterior half of upper jaw, toothless at symphysis; one or two rows on all of lower jaw but in three rows at symphyseal part. Villiform teeth on vomer and palatines. Tongue toothless. Opercular spine absent; preopercle without spines, ventral and posterior margins smooth. Origin of first dorsal fin vertically above anterior portion of pelvic fin; first dorsal-fin spine minute; two supernumerary spines on first dorsal-fin pterygiophore. Spine of second dorsal fin weak and short. Gap between dorsal fins longer than snout length. Origin of anal fin vertically below posterior portion of second dorsal-fin base; first anal-fin spine minute; second spine long, length longer than length of first spine on first dorsal fin; two supernumerary spines on first anal-fin pterygiophore. Posterior tip of pectoral fin not reaching to vertical line from anus (tip broken). Pelvic fin short, posterior tip not reaching to anus. Caudal fin deeply forked. Anus located anteriorly vertically below second dorsal-fin origin. Ribs present on last abdominal vertebra. Supraneural bones 3; formula for configuration of supraneural bones, anterior neural spines, and anterior dorsal fin pterygiophores /0 + 0/0 + 2/1 + 1/1/. Scales deciduous, cycloid, covering the whole body except snout tip, anterior to rim of orbit, and surface of jaws; scales also present on bases of second dorsal, anal, and caudal fins; series of pored

Fig. 1 *Epigonus lifouensis* sp. nov., MNHN 2000-0018, holotype, 139.7 mm SL



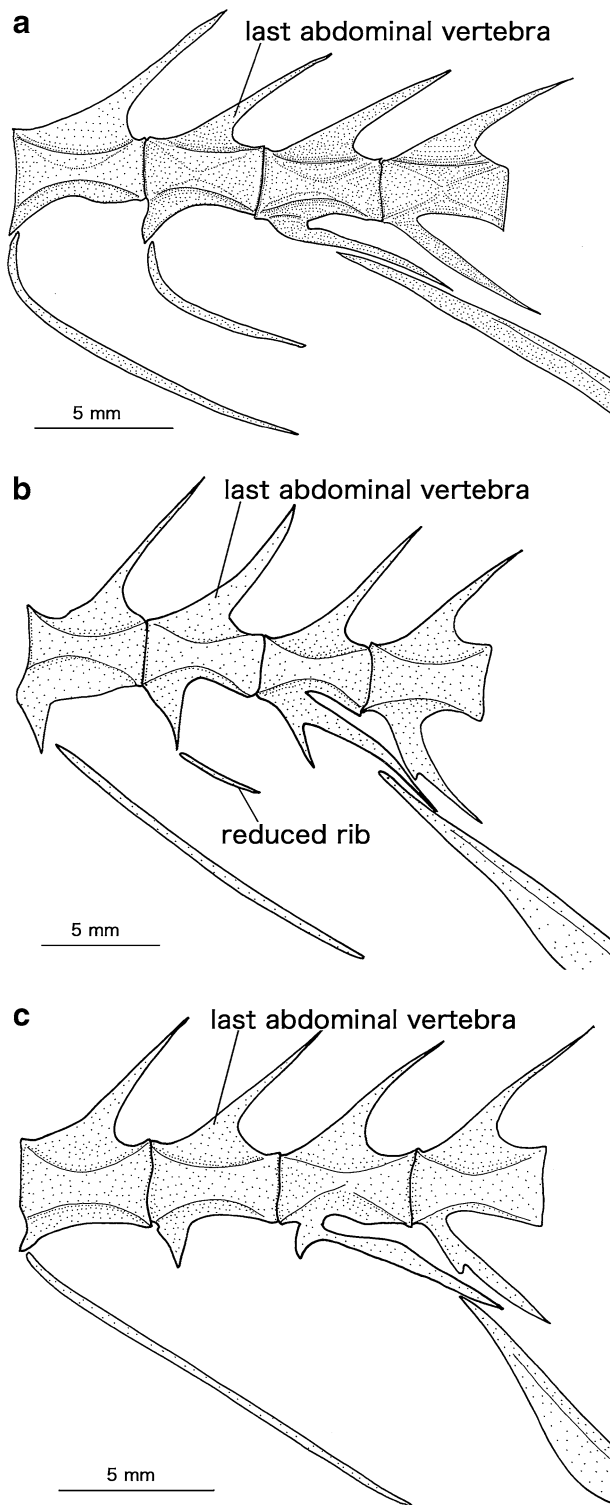


Fig. 2 Lateral view of vertebrae of abdominal region of **a** *Epigonus lifouensis* sp. nov., MNHN 2000-0018, holotype, 139.7 mm SL, **b** *Epigonus tuberculatus* sp. nov., CSIRO H 5677-08, holotype, 154.0 mm SL, and **c** *Epigonus tuberculatus* sp. nov., CSIRO H 5677-09, paratype, 132.3 mm SL

lateral-line scales complete, 4 (3) pored scales on caudal fin. No trace of luminous organ around belly or visceral organs.

Color in alcohol (Fig. 1). Body, head, and all fins uniformly light brown, except for the posterior half of oral cavity and tongue which are black. All fins with many melanophores on the soft rays and membranes.

Distribution. The holotype and paratype were collected from south of Lifou Island, Loyalty Islands, New Caledonia, at depths of 500–575 m (Fig. 3).

Etymology. The specific name *lifouensis* refers to the locality of the type specimens.

Comparison. *Epigonus lifouensis* belongs to a group of similar species in the *Epigonus pandionis* group (present study). *Epigonus lifouensis* is most similar to *E. elongatus*; however, *E. lifouensis* is distinguished from *E. elongatus* in having ribs on the last abdominal vertebra (Fig. 2a) (vs. lacking in *E. elongatus*), and higher gill rakers and pyloric caeca counts (24–25 and 10–13 vs. 21–22 and 7–9 in *E. elongatus*, respectively). *Epigonus cavaticus* and *E. fragilis* also have 24–27 total gill rakers but differ from *E. lifouensis* in having lower pectoral-fin ray and pyloric caeca counts (16–17 and 7–8 vs. 18–19 and 10–13 in *E. lifouensis*, respectively). Furthermore, *E. lifouensis* differs from *E. denticulatus*, *E. marisrubri*, *E. pandionis*, and *E. parini* in having fewer gill rakers (24–25 vs. 28–34 in *E. denticulatus*, 29–30 in *E. marisrubri*, 26–30 in *E. pandionis*, and 35–39 in *E. parini*), elliptic eye (vs. round), and black tongue and oral cavity (vs. tan or light brown). In addition to the above-mentioned differences, *E. marisrubri* has a tooth patch on the tongue (vs. absent in *E. lifouensis*), and *E. pandionis* has a greater body depth (24.0–28.6 % SL in *E. pandionis* vs. 17.0–17.1 % SL in *E. lifouensis*). *Epigonus lifouensis* is distinguished from the second new species in the present study, *E. tuberculatus* (Fig. 4), in having developed ribs on the last abdominal vertebra (vs. ribs absent or reduced on this vertebra in *E. tuberculatus*; Fig. 2b, c), lacking tubercle on inner symphysis of lower jaw (vs. having in *E. tuberculatus*; Fig. 5), and higher gill rakers count (24–25 vs. 21–22 in *E. tuberculatus*).

Remarks. *Epigonus lifouensis* had ribs on the last abdominal vertebra (Fig. 2a). Mochizuki and Shirakihara (1983) regarded the presence or absence of a pair of ribs on the last abdominal vertebra as an important diagnostic character in this genus. However, in reviewing *Epigonus*, Abramov (1992) proposed the taxonomy of the genus without the character. In the present study, it is clear that the condition of ribs on the last abdominal vertebra in the *E. pandionis* group is important based on examination of all members (Table 2).

Table 1 Counts and measurements of *Epigonus lifouensis* sp. nov. and *Epigonus tuberculatus* sp. nov.

	<i>Epigonus lifouensis</i>		<i>Epigonus tuberculatus</i>	
	Holotype MNHN 2000-0018	Paratype MNHN 2003-1826	Holotype CSIRO H 5677-08	Paratype CSIRO H 5677-09
Standard length (mm)	139.7	202.5	154.0	132.3
Counts				
Dorsal-fin rays	VII-I, 10	VII-I, 10	VII-I, 10	VII-I, 10
Anal-fin rays	II, 9	II, 9	II, 9	II, 9
Pectoral-fin rays	18	19	19	20
Pored lateral-line scales	48 + 3	49 + 4	46 + 4	48 + 3
Scales above lateral line	3	3	3	3
Scales below lateral line	9	9	9	9
Gill rakers	7 + 18 = 25	6 + 18 = 24	5 + 16 = 21	5 + 17 = 22
Pyloric caeca	13	10	8	10
Vertebrae	10 + 15	10 + 15	10 + 15	10 + 15
Measurements (% standard length)				
Head length	32.4	32.1	34.4	32.7
Head width	18.0	18.7	17.8	16.3
Head height	14.7	15.4	16.5	15.6
Body depth	17.0	17.1	18.8	17.8
Body width	16.0	18.0	17.8	16.8
Caudal-peduncle depth	7.1	6.6	7.7	7.9
Caudal-peduncle length	24.3	24.2	25.2	27.1
Orbital diameter	14.5	13.8	15.4	14.5
Interorbital width	8.4	7.8	8.4	9.1
Postorbital length	10.1	11.5	10.4	10.4
Upper-jaw length	14.4	14.1	13.9	12.7
Lower-jaw length	17.6	17.1	17.6	16.0
Snout length	8.2	8.4	10.8	7.5
Pre-1st dorsal-fin length	39.2	38.7	40.1	38.1
Pre-2nd dorsal-fin length	62.6	62.5	61.9	60.9
Prepectoral fin length	32.4	32.8	34.8	31.9
Prepelvic fin length	36.9	39.1	36.7	35.5
Preanus length	55.2	59.5	57.8	57.6
Preanal fin length	66.5	68.2	68.7	66.7
1st spine length on 1st dorsal fin	3.7	Broken	3.3	Broken
2nd spine length on 1st dorsal fin	Broken	Broken	8.8	Broken
3rd spine length on 1st dorsal fin	Broken	Broken	Broken	Broken
2nd dorsal-fin spine length	Broken	4.2	4.5	Broken
1st anal-fin spine length	1.9	2.9	1.4	2.2
2nd anal-fin spine length	Broken	4.1	4.4	5.3
Pelvic-fin spine length	Broken	7.7	7.5	Broken
1st dorsal-fin base	12.2	15.3	11.2	10.8
2nd dorsal-fin base	9.4	9.4	9.5	10.4
Anal-fin base	7.9	7.6	8.9	8.8
Pectoral-fin length	Broken	12.2	16.6	Broken
Pelvic-fin length	Broken	9.8	Broken	Broken

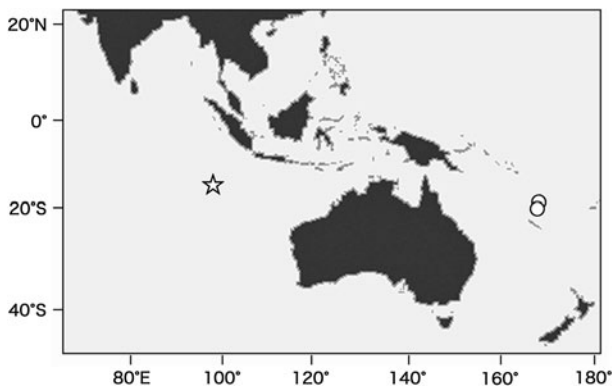


Fig. 3 Collection localities of *Epigonus lifouensis* sp. nov. (circles) and *E. tuberculatus* sp. nov. (star)

The holotype of *E. lifouensis* was a male with a fully ripe testis. The paratype was a female with a great number of eggs in several developmental stages. The most developed eggs were ca. 0.4 mm in diameter, and were round with a single oil globule.

***Epigonus tuberculatus* sp. nov.**

(New English name: Keeling Deepwater Cardinalfish)
(Figs. 2b, c, 4, 5)

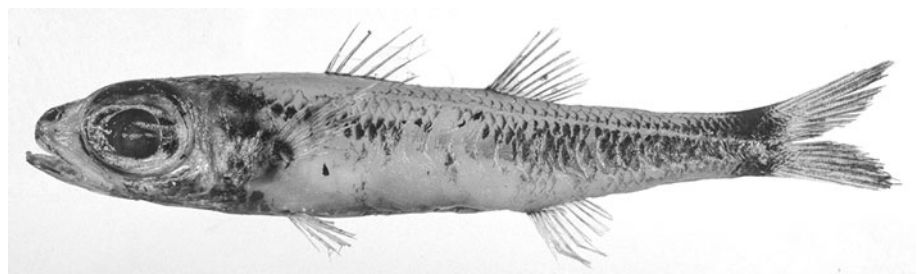
Holotype. CSIRO H 5677-08, 154.0 mm SL, female, 14°45'S, 95°24'E–14°45'S, 95°22'E, south of Cocos-Keeling Islands, Indian Ocean, 473–570 m depth, 11 April 2001, trawl, collected by M. Scott.

Paratype. CSIRO H 5677-09, 132.3 mm SL, female, same data as holotype.

Diagnosis. A species of *Epigonus* with the following combination of characters: opercular spine absent; ribs on the last abdominal vertebra reduced or absent; tongue toothless; maxillary mustache-like process absent; tubercle present on inner symphysis of lower jaw; total gill rakers 21–22; vertebrae 10 + 15; pored lateral-line scales 46–48 + 3–4; dorsal-fin rays VII–I, 10; pectoral-fin rays 19–20; pyloric caeca 8–10; orbital diameter 14.5–15.4 % SL; and lower-jaw length 16.0–17.6 % SL.

Description. Counts and proportional measurements are given in Table 1. Data for the holotype are presented first, followed by data of paratype (if different) in parentheses.

Fig. 4 *Epigonus tuberculatus* sp. nov., CSIRO H 5677-08, holotype, 154.0 mm SL (taken by T. Carter)



Body slender, laterally compressed, nape not humped, deepest at pectoral-fin base. Head large and thick. Maxillary mustache-like process absent. Snout short and round; two nostrils close-set without dermal flap, elliptical, posterior one slightly larger. Eye large, round, diameter greater than postorbital length; bony rim of orbit slightly raised above dorsal profile; interorbital region flat. Mouth large, terminal, gape oblique; posterior margin of maxilla extending to below anterior margin of pupil; lower jaw not projecting when mouth closed; developed tubercle present on inner symphysis of lower jaw (smaller tubercle). Teeth minute, in one or two rows on anterior portion of upper jaw, toothless at symphysis; one or two rows on all of lower jaw with a pair of small conical teeth at symphyseal part. Small conical teeth on vomer and palatines. Tongue toothless. Opercular spine absent, not forming median ridges; preopercle without spines, ventral and posterior margins smooth. Origin of first dorsal fin vertically above anterior portion of pelvic fin; first dorsal-fin spine minute; two supernumerary spines on first dorsal-fin pterygiophore. Spine of second dorsal fin short, slightly thicker than first dorsal-fin spines (broken). Gap between dorsal fins longer than snout length. Origin of anal fin vertically below posterior portion of second dorsal-fin base; first anal-fin spine minute; second spine short, length subequal to spine of second dorsal fin; two supernumerary spines on first anal-fin pterygiophore. Posterior tip of pectoral fin not reaching to vertical line from anus. Pelvic fin short, not reaching to anus. Caudal fin deeply forked. Anus located anteriorly vertically below second dorsal-fin origin. Reduced ribs present on last abdominal vertebra (ribs absent). Supraneural bones 3; formula for configuration of supraneural bones, anterior neural spines, and anterior dorsal fin pterygiophores /0 + 0/0 + 2/1 + 1/1/. Scales deciduous, weakly ctenoid, covering the whole body except snout tip, anterior to rim of orbit, and surface of jaws; scales also present on bases of second dorsal, anal, and caudal fins; series of pored lateral-line scales complete, 4 (3) pored scales on caudal fin. No trace of luminous organ around belly or visceral organs.

Color in alcohol (Fig. 4). Body, head, and caudal fin uniformly dark brown, except for the lips and oral cavity which are tan. All fins except caudal fin light brown, with many melanophores on the soft rays and membranes.

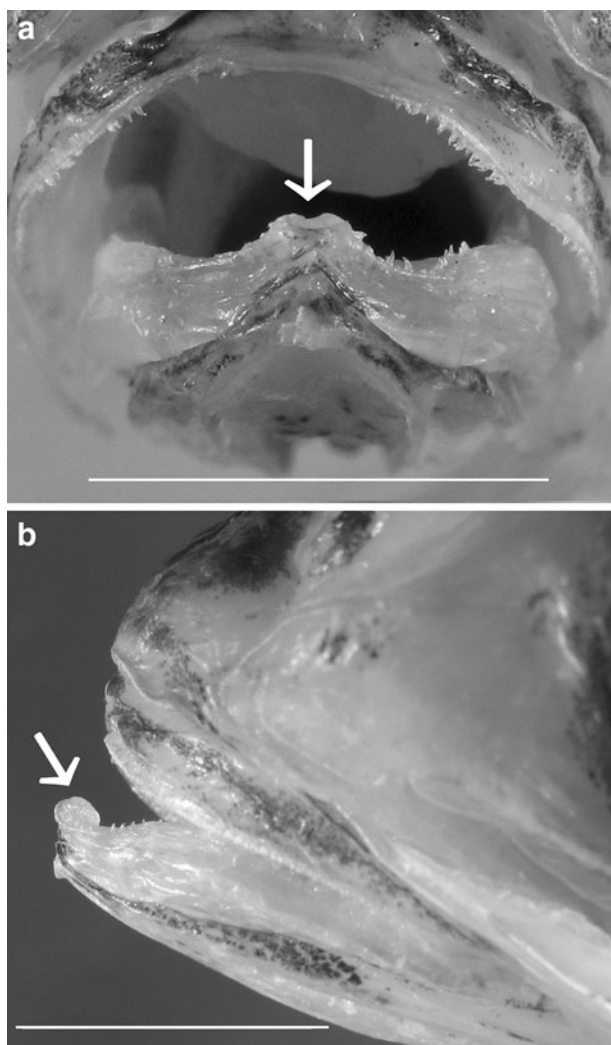


Fig. 5 Tip of mouth of *Epigonus tuberculatus* sp. nov., CSIRO H 5677-08, holotype, 154.0 mm SL. **a** Front view, **b** lateral view. Arrows show the tubercle of lower jaw. Bars 10 mm

Distribution. The holotype and paratype were collected from south of the Cocos-Keeling Islands, Indian Ocean, at a depth of 473–570 m (Fig. 3).

Etymology. The specific name *tuberculatus* is from the Latin *tuber* meaning swelling, in reference to the tubercle found on the inner symphysis of the lower jaw (Fig. 5).

Comparison. *Epigonus tuberculatus* belongs to a group of similar species in the *Epigonus pandionis* group (present study). The holotype of *Epigonus tuberculatus* has a tubercle on inner symphysis of lower jaw and can be distinguished from other members by that character. On the other hand, the smaller paratype of this species (132.3 mm SL) had an undeveloped tubercle compared with holotype (154.0 mm SL). Thus, there may be an ontogenetic change in this character. However, *E. tuberculatus* can be distinguished from *E. elongatus* by having a greater orbital diameter and lower-jaw length (14.5–15.4 % SL and

16.0–17.6 % SL vs. 12.1–13.6 % SL and 13.4–15.1 % SL in *E. elongatus*, respectively). Furthermore, *E. tuberculatus* differs from *E. denticulatus*, *E. marisrubri*, *E. parini*, and *E. pandionis* in having fewer gill rakers (21–22 vs. 28–34 in *E. denticulatus*, 29–30 in *E. marisrubri*, 35–39 in *E. parini*, and 26–30 in *E. pandionis*) and ribs absent or reduced on the last abdominal vertebra (Fig. 2b, c) (vs. developed ribs present in the latter species). In addition to the above-mentioned differences, *E. tuberculatus* is distinguished from *E. marisrubri* and *E. pandionis* in having a toothless tongue (vs. tooth patch present on tongue in *E. marisrubri*) and shallower body depth (17.8–18.8 % SL vs. 24.0–28.6 % SL in *E. pandionis*), respectively. The other two species of the group, *E. cavaticus* and *E. fragilis*, differ from *E. tuberculatus* in having developed ribs on the last abdominal vertebra and 16–17 pectoral-fin rays (vs. ribs absent or reduced on the last abdominal vertebra and 19–20 pectoral-fin rays in *E. tuberculatus*). The diagnostic characters between two new species in the present study are described in the “Comparison” of *E. lifouensis*.

Remarks. The ribs on the last abdominal vertebra are usually present in most species of the genus *Epigonus* including members of the *E. pandionis* group defined in the present study (21 species, Okamoto 2012; Okamoto et al. 2012). On the other hand, 10 species of the genus lack the ribs on the last abdominal vertebra (Okamoto and Fukui 2011; Okamoto and Motomura 2011; Okamoto et al. 2011). However, the holotype and paratype of *E. lifouensis* have the reduced ribs and lack ribs on the last abdominal vertebra, respectively (Fig. 2b, c). This condition is also found in *Epigonus marimonticolus* Parin and Abramov 1986 of the *E. constanciae* group (see Okamoto 2012).

The holotype and a paratype of *E. tuberculatus* were females with a great number of eggs at several developmental stages. The most developed eggs were ca. 0.5 mm in diameter, and were round with a single oil globule.

The *Epigonus pandionis* group

Included species. Nine species (Figs. 1, 4, 9): *Epigonus cavaticus*, *E. denticulatus*, *E. elongatus*, *E. fragilis*, *E. lifouensis*, *E. marisrubri*, *E. pandionis*, *E. parini*, and *E. tuberculatus*.

Diagnosis. Opercular spine absent; more than 43 pored lateral-line scales to end of hypural; and dorsal fin rays VII–I, 9–11.

Remarks. The *E. pandionis* group comprises nine species and is distinguished from the *E. constanciae* group (16 species; see Okamoto 2012) in lacking an opercular spine (vs. opercular spine present in the *E. constanciae* group). Furthermore, the *E. pandionis* group differs from the *E. telescopus* group (four species; see Okamoto et al. 2012)

Table 2 Comparison of the selected characters among nine species of the *Epigonus pandionis* group

Species	Tooth patch on tongue	Ribs on last AV	Gill rakers	Pyloric caeca	P1 rays	1st spine on D1	Sources
<i>E. cavaticus</i>	Absent	Present	24–27	7–8	16	Visible	Present study ($n = 4$); Ida et al. (2007)
<i>E. denticulatus</i>	Absent	Present	28–34	10–14	18–21	Visible	Present study ($n = 24$); Mayer (1974)
<i>E. elongatus</i>	Absent	Absent	22–23	7–9	18–20	Visible	Present study ($n = 3$); Parin and Abramov (1986)
<i>E. fragilis</i>	Absent	Present	25–26	7–8	16–17	Visible	Present study ($n = 5$); Mayer (1974)
<i>E. lifouensis</i>	Absent	Present	24–25	10–13	18–19	Visible	Present study ($n = 2$)
<i>E. marisrubri</i>	Present	Present	29–30	10	17–18	Visible	Present study ($n = 2$); Krupp et al. (2009)
<i>E. pandionis</i>	Absent	Present	26–30	10–13	17–19	Visible	Present study ($n = 44$); Mayer (1974)
<i>E. parini</i>	Absent	Present	35–39	8–11	18–20	Invisible	Present study ($n = 1$); Abramov (1987)
<i>E. tuberculatus</i>	Absent	Absent or reduced	21–22	8–10	19–20	Visible	Present study ($n = 2$)

AV abdominal vertebra, P1 pectoral fin, D1 first dorsal fin

in lacking an isolated spine between the first and second dorsal fins (vs. an isolated spine present in the *E. telescopus* group; see Okamoto et al. 2012). The remaining species group of the genus, viz., the *E. oligolepis* group (four species; see Okamoto and Motomura 2011), is characterized by a small number of pored lateral-line scales (33–40, mostly 35–38 in the *E. oligolepis* group vs. more than 43 pored lateral-line scales in the *E. pandionis* group).

Most species of the other three species groups of the genus *Epigonus* (the *E. constanciae* group, the *E. oligolepis* group, and the *E. telescopus* group) have been reported from continental slopes or seamounts, with records ranging from 200 m to depths exceeding 1,000 m (Mochizuki 1990; Gon 1985; Okamoto 2011, 2012; Okamoto and Motomura 2011, 2012). Similarly, six species of the *E. pandionis* group, including two new species, have been collected from deeper than 200 m depth (Mayer 1974; Mochizuki 1990; Abramov 1987, 1992; Mytilineou et al. 2005; Ruiz-Pico et al. 2012), viz. *E. denticulatus*, *E. elongatus*, *E. lifouensis* sp. nov., *E. pandionis*, *E. parini*, and *E. tuberculatus* sp. nov. On the other hand, of the remaining three species of the group, *E. cavaticus* was reported from a cave facing the drop off of the fringing reef of Palau at a depth of about 20 m (Ida et al. 2007). *Epigonus fragilis* is a species endemic to the Hawaiian Island, which usually occurs at a depth of 120–125 m (Mayer 1974). Recently, a single specimen of the species was collected by fishing at a depth of 3–4.5 m (BPBM 41101); this is the shallowest record for the genus. *Epigonus marisrubri* has been reported from a coral reef area at a depth of 52 m at the northern tip of the Gulf of Aqaba, Red Sea (Krupp et al. 2009). In addition, the first author found a single specimen of *E. marisrubri* collected from the Gulf of Aden at depths of 100–200 m in the research collection of the National Museum of Natural History, Smithsonian Institution (USNM 305950). The specimen represents the first record of the species from the

Gulf of Aden. Thus, these three species of the group inhabit the coastal reef area and continental shelf.

In the present study, it is clear that ribs on the last abdominal vertebrae are absent in *E. elongatus* (Fig. 6a). Also, the presence of ribs on the last abdominal vertebra of *E. marisrubri* and *E. parini* is reported for the first time in the present study (Fig. 6b, c). These characters are thus useful for distinguishing these species and other related species (see below). Selected characters of the nine species are compared in Table 2.

The presence or absence of a tooth patch on the tongue is an important diagnostic character in the genus (Gon 1985; Okamoto and Motomura 2012). Krupp et al. (2009) reported that *E. marisrubri* has a tooth patch on the tongue (Fig. 7), this is unique to *E. marisrubri* within the *E. pandionis* group. *Epigonus denticulatus* rarely present 1–4 min teeth on the tongue, but they are scattered and do not form a dense tooth patch. According to Okamoto and Motomura (2011) and Okamoto (2012), in other species groups of the genus, one species of the *E. constanciae* group and three species of the *E. oligolepis* group have the tooth patch on the tongue.

Abramov (1987) described that *E. parini* has six spines on the first dorsal fin, which is a unique character among the genus. However, it is clear that this species has seven spines on the first dorsal fin. Although the first spine is obscure because the spine is hidden under the skin of the first dorsal fin base (Fig. 8a), it can be distinguished in radiographs of the fish (Fig. 8b).

Key to the species of the *Epigonus pandionis* group

- 1a. First spine on first dorsal fin hidden under skin, six spines on first dorsal fin visible; second dorsal-fin rays I, 9; gill rakers 35–39 (east of New Zealand; Fig. 9g) *E. parini*

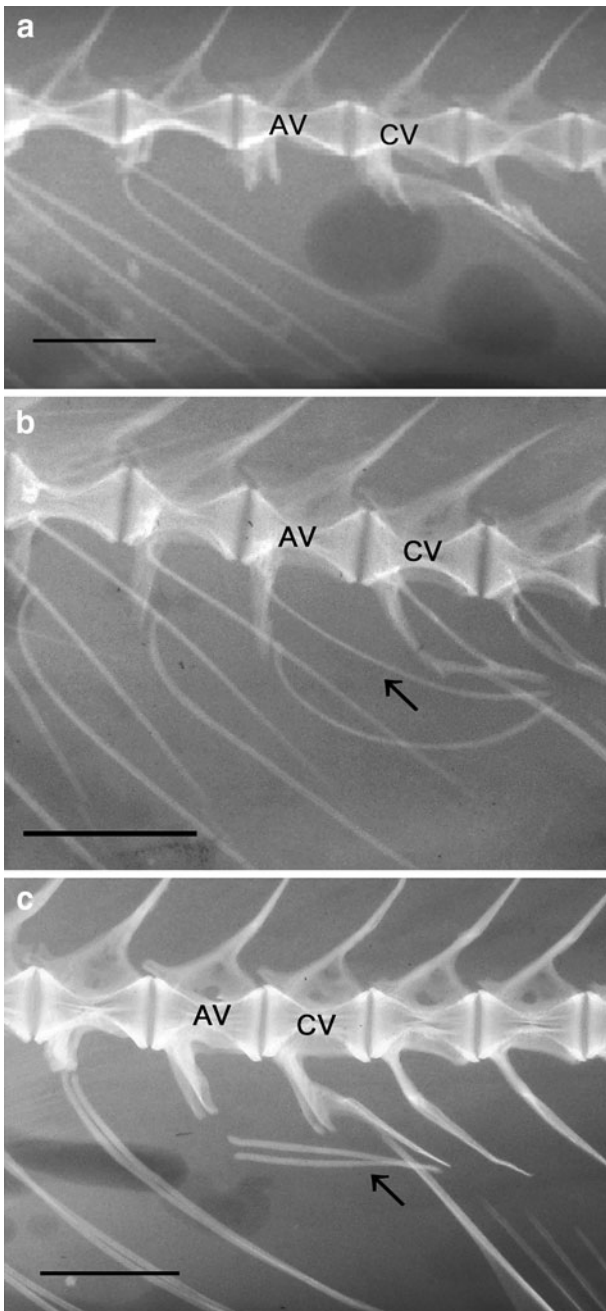


Fig. 6 X-ray photograph of abdomen of **a** *Epigonus elongatus*, ZIN 47138, holotype, 160.0 mm SL, **b** *E. marisrubri*, SMF 31636, paratype, 134.0 mm SL, and **c** *E. parini*, NSMT-P 41252, 168.0 mm SL. *Arrows* show the ribs on the last abdominal vertebra, bearing no ribs in **a**. AV abdominal vertebra, CV caudal vertebra. *Bars* 5 mm

1b. First spine on first dorsal fin not hidden under skin, seven spines on first dorsal fin visible; second dorsal-fin rays I, 10–11; gill rakers 21–34 2

2a. Tooth patch of 2–4 rows of dense teeth present on tongue (Gulf of Aqaba, Red Sea; Gulf of Aden; Figs. 7, 9e) *E. marisrubri*

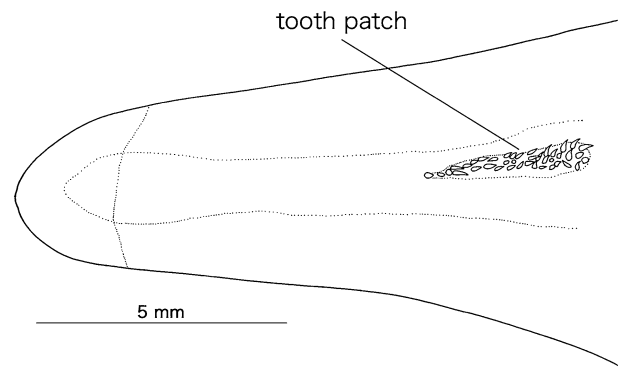


Fig. 7 Dorsal view of toothed tongue of *Epigonus marisrubri*, USNM 305950, 139.8 mm SL

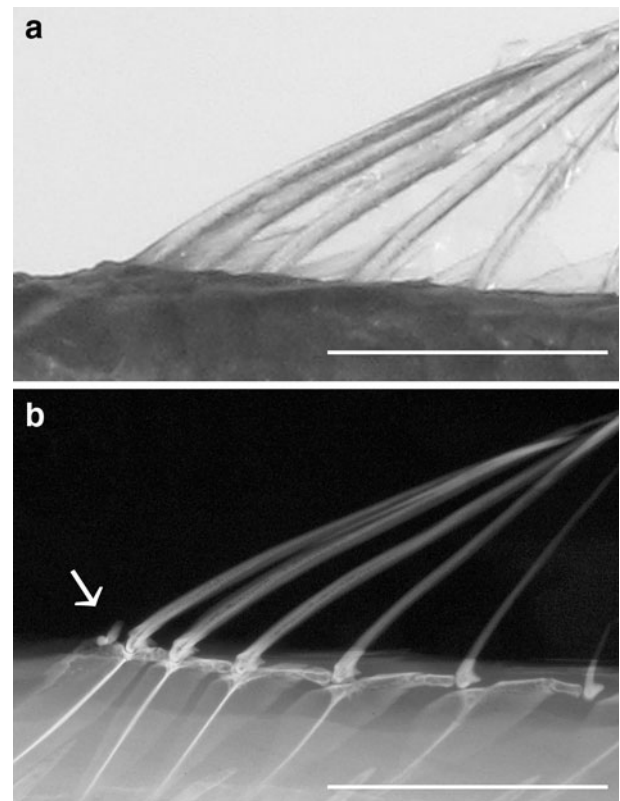


Fig. 8 Lateral view of anterior part of first dorsal fin of *Epigonus parini*, NSMT-P 41252, 168.0 mm SL. **a** Photograph and **b** X-ray photograph. *Arrow* shows the first spine. *Bars* 10 mm

2b. Tooth patch not on tongue (rarely present in *E. denticulatus*, but reduced, a small number of teeth patches of 1–4 teeth scattered on tongue). 3
 3a. Gill rakers 21–23; ribs on last abdominal vertebra reduced or absent (Figs. 2b, c, 6a) 4
 3b. Gill rakers 24–34; ribs present on last abdominal vertebra (Figs. 2a, 6b, c) 5
 4a. Tubercle present on inner symphysis of lower jaw (Fig. 5); orbital diameter 14.5–15.4 % SL; lower-jaw

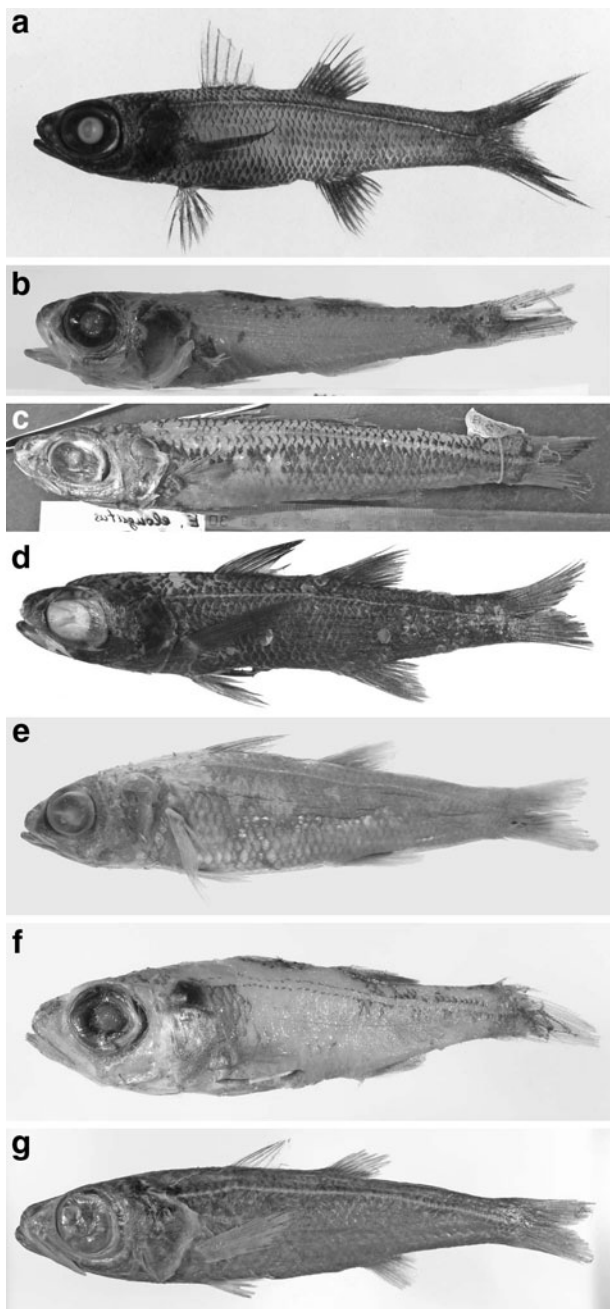


Fig. 9 Other seven species of the *Epigonus pandionis* group. **a** *Epigonus cavaticus*, NSMT-P 72637, holotype, 65.4 mm SL, **b** *E. denticulatus*, USNM 269827, 88.4 mm SL, **c** *E. elongatus*, ZIN 47138, holotype, 160.0 mm SL (photograph taken by M. Nazarkin), **d** *E. fragilis*, BPBM 41101, 111.0 mm SL, **e** *E. marisrubri*, SMF 31636, paratype, 134.0 mm SL, **f** *E. pandionis*, CAS 223178, 97.0 mm SL, **g** *E. parini*, NSMT-P 41252, 168.0 mm SL

length 16.0–17.6 % SL (Cocos-Keeling Islands, Indian Ocean; Fig. 4) *E. tuberculatus* sp. nov.

4b. Tubercle absent on inner symphysis of lower jaw; orbital diameter 12.1–13.6 % SL; lower-jaw length 13.4–15.1 % SL (western Indian Ocean; Fig. 9c) *E. elongatus*

5a. Pyloric caeca 7–8; pectoral-fin rays 16–17 6
 5b. Pyloric caeca 10–14; pectoral-fin rays 18–21 (rarely 17 in *E. pandionis*) 7

6a. Teeth on lower jaw minute; orbital diameter 44.4–47.5 % HL; upper jaw-length 40.2–42.5 % HL; adult not exceeding 100 mm SL (Palau, western North Pacific; Fig. 9a) *E. cavaticus*

6b. Teeth on lower jaw conical; orbital diameter 38.4–42.9 % HL; upper-jaw length 45.5–48.2 % HL; adult exceeding more than 150 mm SL (Hawaiian Islands; Fig. 9d) *E. fragilis*

7a. Gill rakers 24–25; eye elliptical; posterior half of oral cavity and tongue black (Loyalty Islands, New Caledonia; Fig. 1) *E. lifouensis* sp. nov.

7b. Gill rakers 26–34; eye round; posterior half of oral cavity and tongue tan or light brown 8

8a. Body moderately deep, body depth 22.4–29.6 % SL; caudal-peduncle length 22.0–26.3 % SL; gill rakers 26–30; 100–130 mm SL specimens with posterodorsally canted ring encircling the caudal peduncle (Atlantic; Fig. 9f) *E. pandionis*

8b. Body slender, body depth 15.8–23.6 % SL; caudal-peduncle length 25.9–33.1 % SL; gill rakers 28–34; 100–130 mm SL specimens without posterodorsally canted ring on caudal peduncle (Indo-Pacific; Atlantic; Mediterranean; Fig. 9b) *E. denticulatus*

Comparative materials. *Epigonus cavaticus*: NSMT-P 72637, holotype, 65.4 mm SL, southern fringing reef of Ngemelis Island, Palau, 20 m depth, 27 February 2003; NSMT-P 72638–72640, 3 paratypes, 66.6–69.5 mm SL, same data as holotype. *Epigonus denticulatus*: AMS I.21669-005, 2 specimens, 124.0–132.3 mm SL, 33°31'S, 152°04'E, New South Wales, Australia, 28 September 1977; AMS I.29540-002, 125.3 mm SL, 35°32'S, 150°46'E, New South Wales, Australia, 10 August 1977; CAS 223187, 2 specimens, 97.0–112.6 mm SL, 16°37'N, 11°18'E, off Angola, 590–608 m depth, 28 March 2005; FAKU-S 1114, 5 specimens, 109.1–132.8 mm SL, 21°16.8'N, 17°29.0'W, North Atlantic, 19 December 1971; FAKU 43989, 76.0 mm SL, 38°46.6'S, 168°46.6'E, New Zealand, 510 m depth, 27 November 1970; FAKU 44154, 148.4 mm SL, 38°40.6'S, 167°45.5'E, New Zealand, 655 m depth, 26 November 1970; FAKU 104596, 118.4 mm SL, 24°45.4'N, 16°33.6'W, North Atlantic, 740 m depth, 6 January 1972; FAKU 108973–108975, 3 specimens, 121.6–125.8 mm SL, 38°40.6'S, 167°45.5'E, New Zealand, 655 m depth, 26 November 1970; HUMZ 99934, 122.8 mm SL, 26°09'S, 06°21'E, eastern South Pacific, 246 m depth, 9 March 1983; HUMZ 99937, 119.2 mm SL, same data as HUMZ 99934; HUMZ 148540, 123.0 mm SL, 19°07'S, 11°26'E, off Namibia, 445 m depth, 7 September 1995; UF 177077, 2 specimens,

54.2–59.0 mm SL, 24°20'N, 83°14'W, Florida Keys, 23 April 2003; USNM 269827, 2 specimens, 84.3–88.4 mm SL, 11°24'N, 51°35'E, Somalia, western Indian Ocean, 75–175 m depth, 17 December 1964; USNM 272063, 112.2 m SL, east of Brush Island, New South Wales, Australia, 5 July 1976. *Epigonus elongatus*: ZIN 47138, holotype (photograph and radiograph), 160.0 mm SL, 11°00'S, 50°42'E, western Indian Ocean, 320 m depth, 9 April 1983; ZIN 47139, 2 paratypes (radiographs), 140.0–149.0 mm SL, same data as holotype. *Epigonus fragilis*: BPBM 21175, 107.0 mm SL, northwestern Hawaiian Islands, 30 June 1977; BPBM 24929, 2 specimens, 89.0–102.0 mm SL, Hawaiian Islands, 15 October 1975; BPBM 28853, 167.0 mm SL, Oahu, Hawaiian Islands, 12 March 1982; BPBM 37063, 170.0 mm SL, Oahu, Hawaiian Islands, 15 February 1993; BPBM 41101, 111.0 mm SL, Lighthouse area, Puna, Hawaiian Islands, 3–4.5 m depth; December 2010; USNM 207704, 66.9 mm SL, Hawaiian Islands, 3 November 1968. *Epigonus marisrubri*: SMF 31636, paratype, 134.0 mm SL, 29°27.3'N, 34°58.3'E, Gulf of Aqaba, 52 m depth, 2 May 1990; USNM 305950, 139.8 mm SL, 12°03'N, 50°54'E, Gulf of Aden, Indian Ocean, 100–200 m depth, 7 November 1989. *Epigonus pandionis*: CAS 223178, 97.0 mm SL, 11°15'S, 13°42'E, eastern Atlantic, 20–21 m depth (probably data an error), 4 April 2005; FAKU-S 1270, 100.0 mm SL, 17°13'N, 16°44'W, eastern North Atlantic, 11 December 1971; MCZ 144904, 11 specimens, 64.7–74.3 mm SL, 36°57'N, 74°37'W, western North Atlantic, 298 m depth, 7 September 1995; TCWC 7027.10, 5 specimens, 72.8–80.0 mm SL, 28°47'N, 86°04'W, Gulf of Mexico, 351–357 m depth, 14 May 1985; UF 221291, 4 specimens, 136.7–182.0 mm SL, 03°45'N, 08°03'E, Equatorial Guinea, western Atlantic, 409–485 m depth, 14 May 1965; UF 221434, 19 specimens, 51.2–61.3 mm SL, 03°49'N, 07°38'E, Equatorial Guinea, western Atlantic, 264–269 m depth, 14 May 1965; UF 222947, 3 specimens, 162.9–180.0 mm SL, Caribbean Sea, 373–434 m depth, 14 July 1966. *Epigonus parini*: NSMT-P 41252, 168.0 mm SL, 43°33'S, 161°26'E, Louisville Ridge, New Zealand, 623 m depth, 3 April 1985.

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