



Four new species of the frogmouth genus *Chaunax* (Lophiiformes: Chaunacidae) from Taiwan and the Philippines

HSUAN-CHING HO^{1,2,3,4,5*} & WEN-CHUN MA²

¹National Museum of Marine Biology and Aquarium, Pingtung, Taiwan

²Institute of Marine Biology, National Dong Hwa University, Pingtung, Taiwan

³Department and Graduate Institute of Aquaculture, National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan

⁴Institute of Marine Biology, National Taiwan Ocean University, Keelung, Taiwan

⁵Australian Museum, Sydney, Australia (Research Associate)

*Corresponding author: ogcoho@gmail.com; <https://orcid.org/0000-0003-1154-601X>

Abstract

Four new species of the genus *Chaunax* found in Taiwan and the Philippines are described. *Chaunax albatrossae* **sp. nov.** belongs to the *C. abei* species group and is distinct from its congeners in having a dark gray mouth cavity, a dark brown to black gill chamber and gill rakers and skin covered with only short, simple spinules. Three new species belong to the *C. fimbriatus* species group: *Chaunax erythraeus* **sp. nov.** is distinct in having a uniformly pinkish-red body and an entirely black gill chamber; *Chaunax obscurus* **sp. nov.** is distinct in having a dark gray mouth cavity and orange-red marbling on the dorsal surface that fades after fixation; and *Chaunax viridiretis* **sp. nov.** is distinguished by its green reticulate pattern with some small, bright-white patches on the dorsal surface. The diagnostic characters used to identify the chaunacids are summarized and a key to all *Chaunax* species found in Taiwan and adjacent waters is provided.

Key words: Biodiversity, systematics, taxonomy, anglerfish, deep-sea fish

Introduction

The anglerfish family Chaunacidae, known as frogmouths or coffinfishes, comprises two genera, *Chaunax* Lowe, 1846 with 25 currently valid species, and *Chaunacops* Garman, 1899 with 4 species. Collectively, they are distributed in all three major oceans and the Mediterranean Sea. Species of this family are characterized by a rounded to slightly cuboidal head, very loose and flaccid skin that is densely covered with minute, spinule-like scales, a short illicium with an esca comprising a dense cluster of short cirri, a naked, oval illicial trough associated with the illicium, small gill openings that are rounded and slightly tubular and situated above the inner side of the pectoral-fin base, and short second and third dorsal-fin spines that are embedded beneath the skin. Body size is usually less than 30 cm, with most under 20 cm SL (Caruso 1989a; Ho & McGrouther 2015).

Le Danois (1979) reviewed the family and recognized 9 valid species in a single genus, *Chaunax*, while also describing a new subspecies, *C. umbrinus flammeus* (= *C. flammeus*) from Madagascar. Le Danois (1984) described *Chaunax latipunctatus* from Sala y Gomez Ridge in the eastern Pacific Ocean (correct type locality provided in Ho & Shao 2010). Okamura & Oryuu (in Okamura & Kitajima 1984) described *Chaunax tosaensis* (a junior synonym of *C. penicillatus* McCulloch, 1915) from Japan.

Caruso (1989a) reviewed the Atlantic chaunacids, re-assigning *Chaunax coloratus* Garman, 1899 and *C. roseus* Barbour, 1941 to a new genus, *Bathychaunax*, and separated the remaining species of *Chaunax* into two species groups, the *C. pictus* group and the *C. fimbriatus* group. In the same publication he described a new species, *Chaunax suttkusi*, placing it in the latter species group. Later that year, Caruso (1989b) reviewed the genus *Bathychaunax*, described a new species *Bathychaunax melanostomus* and recorded *B. coloratus* from the eastern Indian Ocean. Caruso *et al.* (2006) demonstrated that *Chaunacops* Garman, 1899, a senior synonym of *Bathychaunax*, is the valid name of this genus.

Caruso (in Carpenter & Niem 1999) listed 2 genera and 8 species found in the western central Pacific: *Bathychaunax coloratus*, *B. melanostomus*, *C. abei* Le Danois, 1978, *C. breviradiatus* [misspelling of *C. breviradius* Le Danois, 1978], *C. endeavouris* Whitley, 1929, *C. fimbriatus* Hilgendorf, 1879, *C. penicillatus* and *C. tosaensis*. He also remarked (p. 2020) that “The taxonomic status of the Indo-Pacific members of the genus *Chaunax* is at present uncertain. At least 3 of the 6 nominal species that have been described from the area appear to be valid. *Chaunax tosaensis* appears to be a synonym of *C. penicillatus*; *C. abei*, *C. breviradius*, and *C. endeavouri* appear to represent at least 2 distinct species, 1 of which may be a synonym of *C. fimbriatus*.”

Caruso (in Randall & Lim 2000) listed 3 species in the South China Sea, *C. abei*, *C. fimbriatus* and *C. penicillatus*, and speculated that *C. abei* might be a synonym of *C. fimbriatus*. However, a more recent study (Ho & Last 2013) recognized *C. fimbriatus* as distinct from *C. abei*.

Subsequently, Ho & Shao (2010) described *C. nudiventer* from the tropical Pacific Ocean and provided new data for *C. latipunctatus*. Ho *et al.* (2013) described four new species of *Chaunax* from New Zealand and adjacent waters and Ho & Last (2013) described 2 new species from the Indian Ocean and provided taxonomic notes on the species groups and species. Ho *et al.* (2015) documented the chaunacids and described 2 new species from the eastern Indian Ocean side of Indonesia. Ho *et al.* (2016) described *C. multilepis* from southern India, and Ho & Ma (2016) reviewed *Chaunax* from the southern Africa, proposing names for 3 new species.

In the Indo-West Pacific, *Chaunax pictus* Lowe, 1846 was commonly recorded in publications treating the Indian Ocean fauna (Alcock 1889; Smith in Smith & Heemstra 1986; Kapoor *et al.* 2002), Australia (Russell & Houston 1989), New Zealand (Paulin *et al.* 1989) and Taiwan (Chen 1969; Shen 1984). However, this species is actually confined to the central Western Atlantic (Caruso 1989a), and records from elsewhere are misidentifications (Ho & Last 2013). In addition, descriptions of species found in southern Australia (Gomon & Ho in Gomon 2008), New Zealand (Ho in Roberts *et al.* 2015), southern Taiwan (Ho in Koeda & Ho 2019) and the Western Indian Ocean (Ho & Caruso, in Heemstra *et al.*, in press) were provided in various book chapters.

Although numerous chaunacid specimens have been deposited in fish collections around the world, most are not well sorted and identified. In this study, the authors examined large numbers of specimens collected from the Indo-West Pacific Ocean in worldwide collections, among which four species are herein recognized as new: *C. erythraeus* sp. nov., *C. obscurus* sp. nov. and *C. viridiretis* sp. nov. from northeastern Taiwan, and *C. albatrossae* sp. nov. from the Philippines. A diagnosis and description of each species, as well as a key to all species in Taiwan and adjacent waters, are provided. Characters used to distinguish chaunacid species are discussed.

Materials and methods

Measurements and counts were taken following Ho & Shao (2010). Counts of lateral-line neuromasts follow Caruso (1989a) with minor modifications (Fig. 1). Morphological terminology follows Caruso (1989a). Photographs of dermal spinules were taken by using an environmental scanning electron microscope (FEI Quanta 200).

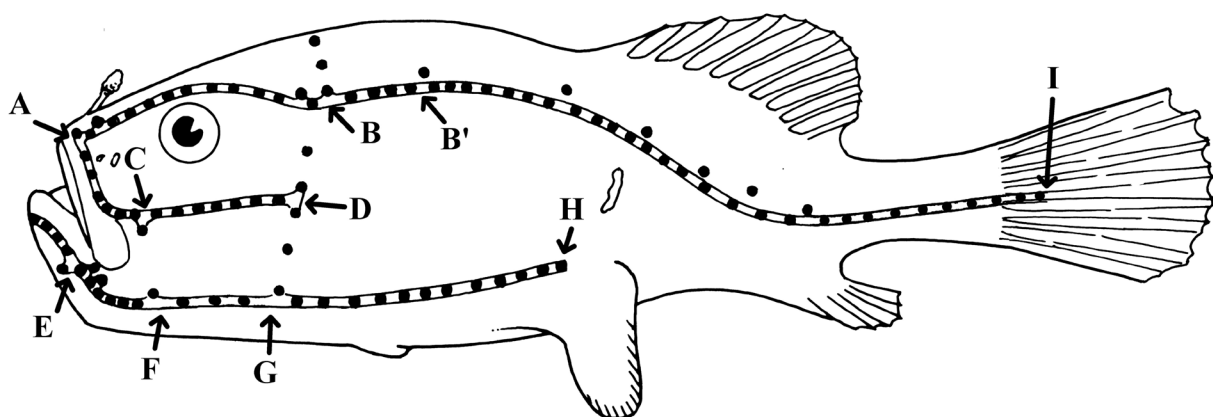


FIGURE 1. Diagram of sensory and lateral-line neuromasts. AB, supraorbital series; AC, premaxillary series; BB', anterior body series; BD, upper preopercular series; BI, body series, including those on caudal fin; CD, infraorbital series; DG, lower preopercular series; EF, mandibular series; FG, hyomandibular series; GH, pectoral series.

Specimens are deposited at the Biodiversity Research Center, Academia Sinica, Taipei, Taiwan (ASIZP), National Museum of Marine Biology and Aquarium, Pingtung, Taiwan (NMMB-P), Muséum national d'Histoire naturelle, Paris, France (MNHN), and Museum Support Center, National Museum of Natural History, Smithsonian Institution, Suitland, Maryland, USA (USNM). Distribution data of specimens examined from worldwide collections are included in order to give complete information on the geographic ranges of the species treated in this study.

Morphological data for comparison were obtained from Ho *et al.* (2013; 2015), Ho & Last (2013), Ho & Ma (2016) and/or from specimens examined by the authors.

Abbreviations. Body size: HL, head length; SL, standard length. Fins: A, anal-fin rays; C, caudal-fin rays; D, dorsal-fin elements; P, pectoral-fin rays. Lateral-line neuromast series (see Fig. 1 for the landmarks): AB, supraorbital series; AC, premaxillary series; BB', anterior body series; BD, upper preopercular series; BI, body series, including those on caudal fin; CD, infraorbital series; DG, lower preopercular series; EF, mandibular series; FG, hyomandibular series; GH, pectoral series. GRi to GRiv are gill rakers of first to fourth gill arches, respectively.

Ethics approval consent to participate. The materials examined were collected from local fish markets or on board research vessels. All fishes had been preserved and deposited in museum collections at different times before being studied. No living animal was used in the present study.

Results

Family Chaunacidae

Chaunax Lowe, 1846

Chaunax Lowe, 1846:81 (type species: *Chaunax pictus* Lowe, 1846; by monotypy).

Chaunax differs from the only confamilial genus *Chaunacops* in having more lateral-line neuromasts: BD 2–5 (vs. 1), GH 10–19 (vs. 2–4) and BI 26–50 (vs. 18–26); a well expanded lower part of the maxilla, much broader than the upper part (vs. uniformly narrow or with the lower part only slightly expanded); a narrower intersphenotic space (15.5–21.8% SL, vs. 21.8–24.7% SL); a shorter illicium (2.3–5.0% SL, vs. 7.0–7.4% SL); a shorter caudal fin (26.9–32.9% SL vs. 32.5–35.7% SL); mainly 12 dorsal-fin rays (vs. mainly 11) and 7 anal-fin rays (vs. mainly 6); and well-toothed palatines with the teeth in a long, narrow band (vs. only a few teeth at the anterior end) (Caruso, 1989a, b; Ho & McGrouther, 2015).

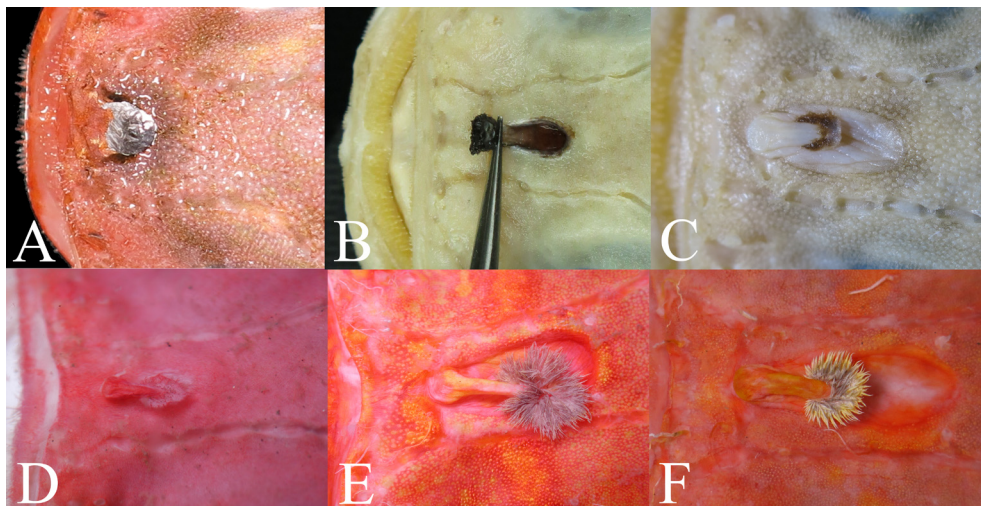


FIGURE 2. Dorsal views of heads showing illicium and illicial trough of *Chaunax* species. A. *C. penicillatus*, NMMB-P23379. B. *C. pictus*, MNHN 1981-1273, illicium held erect by forceps. C. *C. abei*, NMMB-P26756. D. *C. apus*, ASIZP 63182. E. *C. fimbriatus*, ASIZP 63257. F. *C. obscurus* sp. nov., NMMB-P71252. All specimens fresh except C preserved.

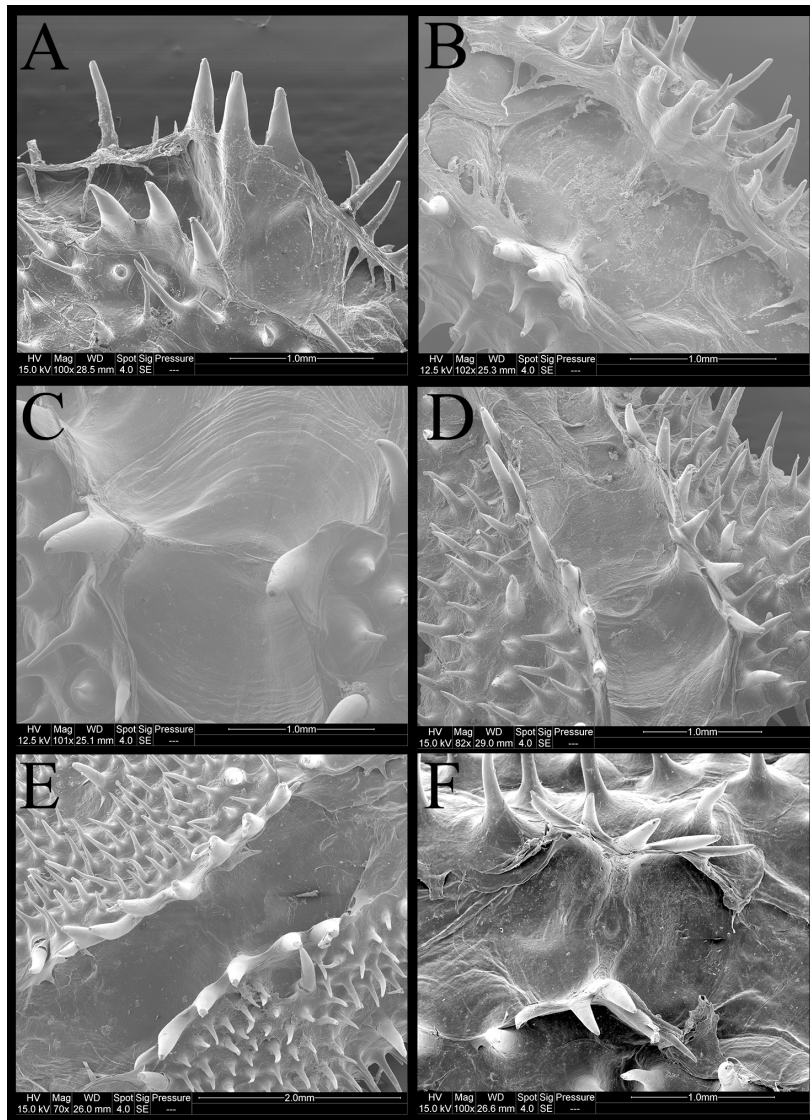


FIGURE 3. Scanning electron micrographs (SEM) showing neuromasts and their neighbor spines along the sensory canals. A–C. *C. abei* species group: *C. apus*, ASIZP 64564, 154 mm SL (A), *C. gomoni*, NSMT-P95092, 170 mm SL (B), and *C. russatus*, BSKU 44629, 221 mm SL (C). D–E. *C. fimbriatus* species group: *C. fimbriatus*, ASIZP 70143, 148 mm SL (D), *C. umbrinus*, and ASIZP 70334, 186 mm SL (E). F. *C. pictus* species group: *C. penicillatus*, ASIZP 58059, 126 mm SL.

Key to species of *Chaunax* in Taiwan and adjacent waters

- 1A. Illicial trough deep, concave and black; illicium very short, housed within illicial trough (Figs. 2A–B) (*C. pictus* group) *C. penicillatus*
- 1B. Illicial trough shallow, of same color as body; illicium stout to slender (Figs. 2C–F) 2
- 2A. No cirri on dorsal surface of head or above eyes; usually 1 or 3 pairs of spinules flanking lateral-line neuromasts (Figs. 3A–C); cirri along body margin flap-like (Fig. 4A) or filamentous 3 (*C. abei* group)
- 2B. Cirri present on dorsal surface of head and above eyes; 3–8 pairs of spinules flanking lateral-line neuromasts (Figs. 3D–E); cirri along body margin filamentous (Figs. 4B–C) 6 (*C. fimbriatus* group)
- 3A. Mouth cavity, gill chamber and gill rakers grayish to blackish *C. albatrossae* sp. nov.
- 3B. Mouth cavity, gill chamber and gill rakers pale or, rarely, grayish in small areas 4
- 4A. Coloration uniformly pink when fresh, without any discrete pattern, sometimes with deep red blotches; esca with pink or whitish cirri; dermal spinules slender and curved *C. apus*
- 4B. Dorsal surface spotted; esca with brown, green or gray cirri; dermal spinules stout and straight 5
- 5A. Spinules on dorsal surface all simple; dorsal surface of body densely covered with small spots *C. breviradius*
- 5B. Spinules on dorsal surface both bifurcate and simple; large green spots encircled by yellow or large yellow spots on dorsal surface of body *C. abei*
- 6A. Two large white patches on dorsal surface, one associated with underlying third dorsal-fin spine and one before dorsal-fin

- origin; filaments on body usually highly branched *C. fimbriatus*
- 6B. No large white patches on dorsal surface; filaments on body surface usually simple 7
- 7A. Body uniformly red when fresh; esca pink; entire fish turning creamy-white when preserved; BI 29–33; GH 10–11. *C. erythraeus* **sp. nov.**
- 7B. Irregular greenish or orange-red patterns on dorsal surface when fresh; esca green; gray to dark brown blotches and/or reticulates pattern on dorsal surface and esca gray to brown when preserved; BI 32–37; GH 11–13. 8
- 8A. Very fine greenish-yellow patches on dorsal surface when fresh, these turning brown and forming very fine, pale, reticulated pattern when preserved. *C. umbrinus*
- 8B. Large and irregular green reticulate patterns or yellow patches on dorsal surface when fresh, changing into dark brown reticulate patterns or fading when preserved 9
- 9A. Mouth cavity pale gray, not especially dark; bright white dots or patches on head and dorsal-fin origin when fresh; irregular green reticulate pattern on dorsal surface when fresh, changing to dark gray blotches with pale reticulate pattern when preserved. *C. viridiretis* **sp. nov.**
- 9B. Mouth cavity dark gray posteriorly; no bright white dots on head or dorsal-fin origin when fresh; dorsal surface with irregular yellow patches when fresh, but patches fading after preservation, forming pale blotches with light brown reticulate patterns. *C. obscurus* **sp. nov.**

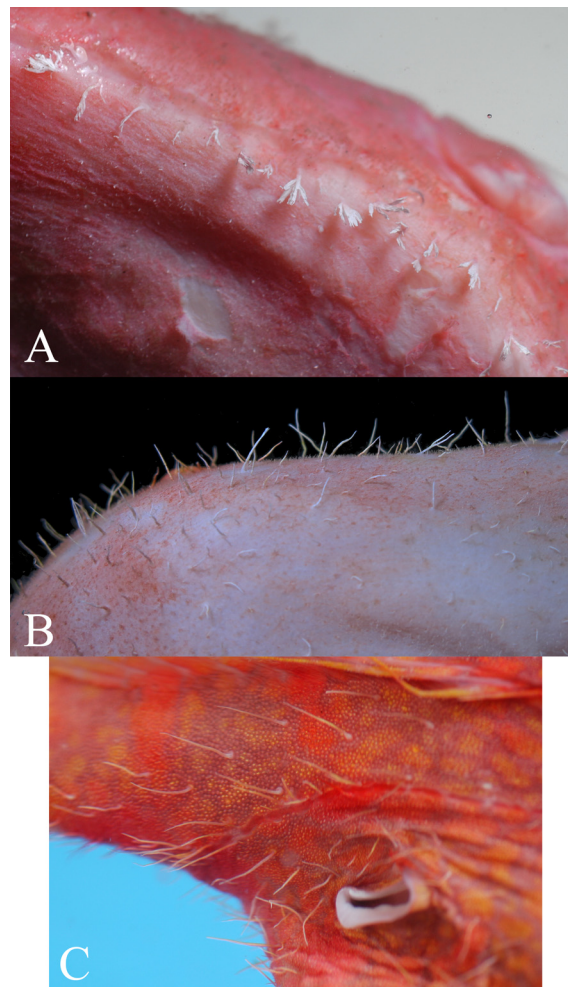


FIGURE 4. Two forms of cirri on body surface of *Chaunax* species. A. Flap-like cirri in *C. apus*, ASIZP 63182. B–C. Filamentous cirri in *C. fimbriatus*, NMMB-P34718, 211 mm SL, and *C. obscurus* **sp. nov.**, ASIZP 71252, 175 mm SL, respectively.

***Chaunax albatrossae* sp. nov.**

English name: Albatross frogmouth

Figs. 5, 6A; Tables 1–4

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Holotype. MNHN 2005-0517 (77.3 mm SL), ca. 13°38'N, 121°39'E, off Luzon Island, Philippines, 195–200 m, 1 Dec. 1973.

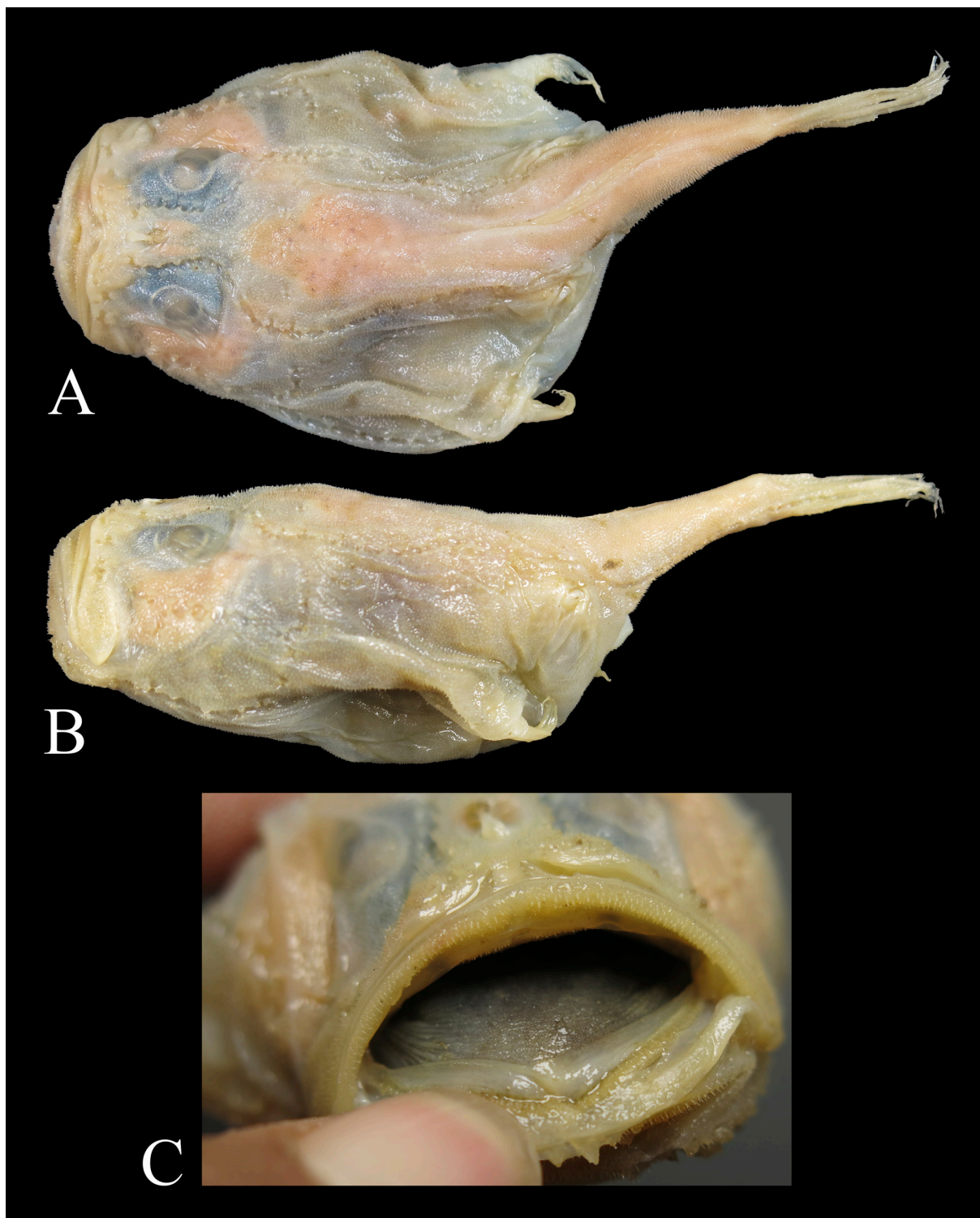


FIGURE 5. *Chaunax albatrossae* sp. nov., holotype, MNHN 2005-0517, 77.3 mm SL, preserved. A. Dorsal view. B. Lateral view. C. Mouth cavity.

Paratypes. Seven specimens, 59.3–137.7 mm SL, all from Philippines: MNHN 2005-0608 (2 specimens, 59.3–93.5 mm SL), 12°19'58.8"N, 121°42'0"E, Tablas Strait, between Mindoro and Tablas Island, 673–675 m, 4 Jun. 1985; MNHN 2005-0876 (3, 44.9–119.2), 12°10'4.8"N, 121°45'0"E, Tablas Strait, between Mindoro and Tablas Island, 700–702 m, 4 Jun. 1985; USNM 168872 (1, 113.7), 8°34'48"N, 124°1'22.8"E, Iligen Bay, off Mindanao Island, 8 Aug. 1909; USNM 168883 (1, 137.7), 10°0'0"N, 125°6'36"E, Sogod Bay, off Leyte Island, 3–1412 m, 31 Jul. 1909.

Etymology. This species is named after the vessel USFC *Albatross*, treated as feminine, in service with the United States Bureau of Fisheries in the late 1800s and early 1900s, which collected the first two specimens of the present species.

Diagnosis. A small species (reaching 137.7 mm SL) of the *C. abei* species group with dark gray mouth cavity and dark brown to black gill chamber and gill rakers; skin covered with short, simple spinules; lateral-line neuromasts BD 2–4 (mainly 3), GH 12–13, BI 28–33 (30–32); GRii 10–12 (11); eye large (9.6–12.0% SL); head relatively long (42.4–46.3% SL), pre-preopercular length 31.1–32.1% SL, predorsal length 51.1–53.0% SL, upper-jaw 25.0–26.2% SL; peritoneum black; body in preserved state uniformly creamy-white, including esca.

Description. Morphometric (expressed as % SL) and meristic data are given in Tables 1–4. Data for holotype provided below followed by ranges for paratypes in parentheses, when different.

D III, 12; P 12 (11–12, mainly 12); A 7; C 9. Lateral-line neuromasts: AB 11 (10–11); AC 8; BD 3 (2–4); CD 6 (5–7, mainly 5–6); DG 3; EF 6; FG 3; GH 12/13 (12–13); BB 6; BB' 4; BI 32/33 (28–33, mainly 30–32), including 2/3 (2–4) on caudal fin. Gill rakers: GRi 4 +12 (10–12)=16 (14–16); GRii 11 (10–12); GRiii 1+11 (10–11)=12 (11 or 12); GRiv 10 (9–10).

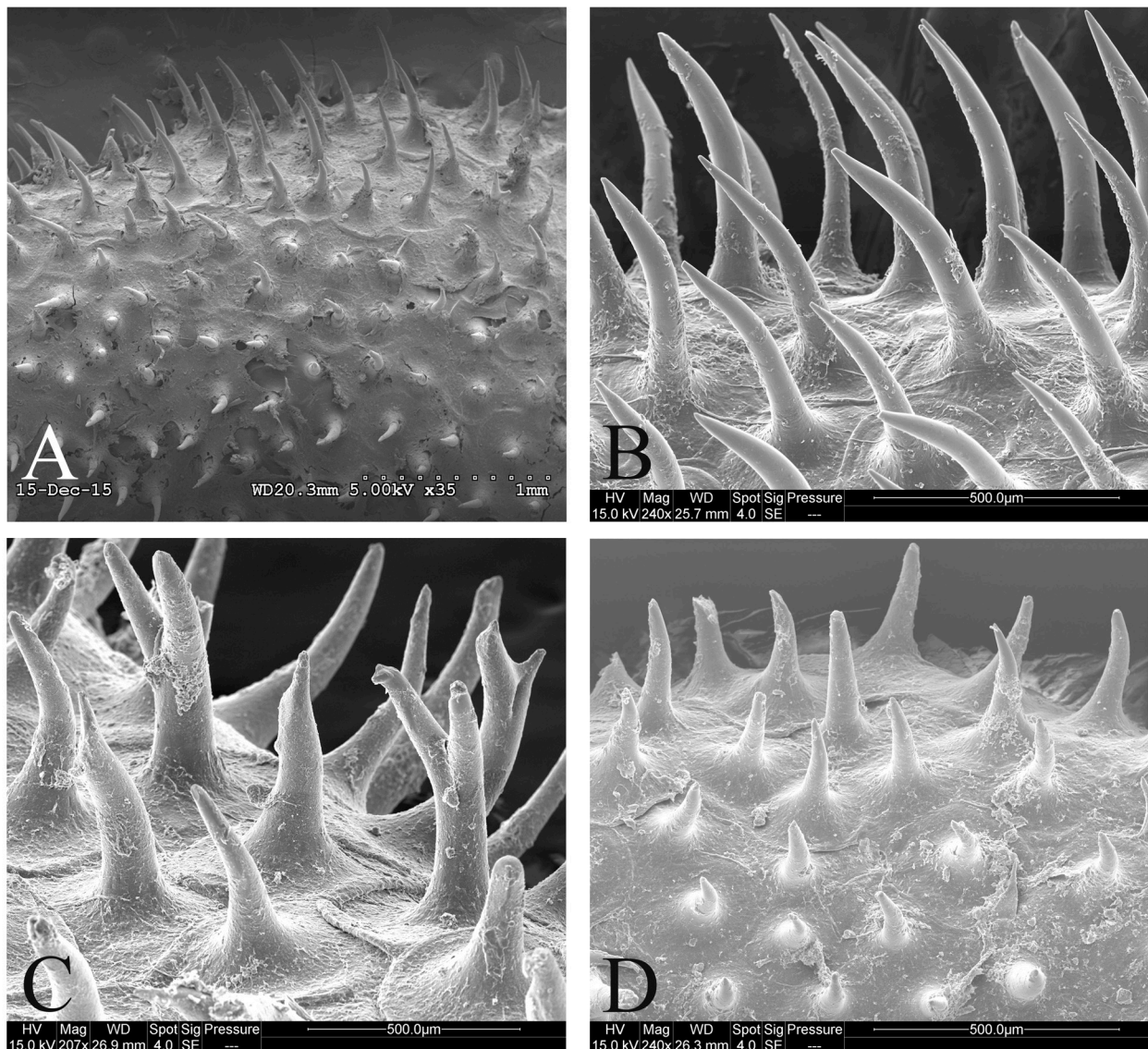


FIGURE 6. Dermal spinules of *Chaunax* species, SEM, all samples taken from skin above eye. A. *C. albatrossae* sp. nov., MNHN2005-0876, 119.2 mm SL. B. *C. apus*, ASIZP 64564, 154 mm SL. C. *C. abei*, ASIZP 70159, 137 mm. D. *C. breviradius*, ASIZP 70154, 76 mm SL.

TABLE 1. Frequency of pectoral-fin rays and lateral-line neuromasts (AB, AC, BD, CD, DG, EF, EG) of selected chaunacid species. Values are counted on both sides when available. *indicates the value of holotype.

	Pectora-fin rays						AB				AC				BD			
	n	10	11	12	13	14	n	10	11	12	n	7	8	9	n	2	3	4
<i>C. abei</i> group																		
<i>C. abei</i>	40			31	9*		56	5	48*	3	56	3	53*		56	53*	3	
<i>C. albatrossae</i> sp. nov.	16		5	11*			16	2	14*		16		16*		16	3	12*	1
<i>C. apus</i>	191		3	151	37		344	11	310*	23	342	3	338*	2	342	28	298*	16
<i>C. breviradius</i>	87			43	44*		95	3	92*		96		96*		96	92*	4	
<i>C. fimbriatus</i> group																		
<i>C. erythraeus</i> sp. nov.	6				6*		6	5*	1		6		6*		6	4*	2	
<i>C. fimbriatus</i>	34			2	17	5	36	2	33	1	36		36		36	14	21	2
<i>C. obscurus</i> sp. nov.	16				5*	11*	16	1	14*	1*	16	1	15*		16	16*		
<i>C. umbrinus</i>	7				3	4	9		7	2	10		10		10	9	1	
<i>C. viridiretis</i> sp. nov.	18					18	18		16*	2	18		18*		18	16*	2	
<i>C. pictus</i> group																		
<i>C. penicillatus</i>	84			41*	36	7	92	15	66*	11*	93	1	92*		93	83*	10*	
	CD						DG				EF				FG			
	n	4	5	6	7	8	n	3	4	5	n	5	6	7	n	2	3	4
<i>C. abei</i> group																		
<i>C. abei</i>	56		18	35*	3*		57	57*			57	48*	9		57		57*	
<i>C. albatrossae</i> sp. nov.	16		6	8*	2		16	16*			16		16*		16		16*	
<i>C. apus</i>	344	1	34*	267*	41	1	342	327	15*		343	12	317*	14	348	2	343*	3
<i>C. breviradius</i>	95		20	93*	2		96	96*			96		96*		96		96*	
<i>C. fimbriatus</i> group																		
<i>C. erythraeus</i> sp. nov.	6			5*	1		6	1	5*		6		6*		6		6*	
<i>C. fimbriatus</i>	36			5	22	9	36	5	28	3	36		35	1	36		35	1
<i>C. obscurus</i> sp. nov.	15			10*	4*	1	16	6	9*	1	14		14*	2	16	1	15*	
<i>C. umbrinus</i>	10			4	6		10	8	2		10	1	9		10		10	
<i>C. viridiretis</i> sp. nov.	18			11	7		18	3*	13*	2	17	1	14*	2	18		18*	
<i>C. pictus</i> group																		
<i>C. penicillatus</i>	94		2	48*	36	8	94	66*	24	4	94		93*	1	94		94*	

Head length 2.3 (2.2–2.4) in SL; head width 5.5 (5.3–5.7) in SL, 2.4 (2.3–2.4) in HL; predorsal length 1.9 (1.9–2.0) in SL; pre-gill-opening length 1.6 (1.5–1.7) in SL; pre-preopercular length 3.2 (3.1–3.2) in SL, 1.4 (1.3–1.5) in HL; upper jaw 3.9 (3.8–4.0) in SL, 1.7 (1.7–1.8) in HL; illicial length 12.0 (11.8–12.6) in HL; pre-illicial length 13.8 (13.4–14.5) in HL; illicial trough length 6.4 (5.5–7.1) in HL; eye diameter 4.5 (4.2–4.8) in HL; post-anus length (TL1) 3.1 (2.8–3.2) in SL, 1.4 (1.3–1.4) in HL; post-dorsal length (TL2) 5.1 (4.9–5.2) in SL, 2.2 (2.1–2.3) in HL; post-anal length (TL3) 5.7 (5.3–6.5) in SL, 2.5 (2.3–2.8) in HL; caudal-peduncle height 5.2 (5.0–5.4) in HL; caudal-fin length 3.4 (3.2–3.7) in SL, 1.5 (1.4–1.6) in HL.

Body slender but head globular, skull slightly elevated posteriorly. Skin thin, loose and flaccid, semi-transparent. Pectoral- and pelvic-fin rays with free tips. Caudal peduncle relatively long and slender, slightly depressed, tapering posteriorly.

Illicium short and stout, esca with large central tongue (*sensu* Le Danois, 1978) bearing many thin cirri. Illicial trough broadly rounded or oval, flat, relatively short and broad, subequal in length to diameter of eye pupil. Interorbital space flat and broad.

TABLE 2. Frequency of lateral-line neuromasts (BB, BB', GH, BI) of selected chaunacid species in present study. Values are counted on both sides when available. *indicates the value of holotype.

	BB				BB'					GH										
	n	5	6	7	n	3	4	5	6	n	9	10	11	12	13	14	15	16	17	18
<i>C. abei</i> group																				
<i>C. abei</i>	30		29*	1	57		57*			53		1	4	22	30*	6*				
<i>C. albatrossae</i> sp. nov.	8		8*		16		16*			16				9*	7*					
<i>C. apus</i>	287		287		219	10	205*	4		241				3	16*	59	63	48	38	14
<i>C. breviradius</i>	48	1	47		95	7	88*			93	6*	20*	46	19	-	1	1			
<i>C. fimbriatus</i> group																				
<i>C. erythraeus</i> sp. nov.	3		3*		6	2*	4			6		5*	1							
<i>C. fimbriatus</i>	18		18		36	6	29	1		36		3	16	14	3					
<i>C. obscurus</i> sp. nov.	8		6*		16		14*	1	1	16		3*	8*	5						
<i>C. umbrinus</i>	5	1	3	1	9		1	8		10			1	5	3	1				
<i>C. viridiretis</i> sp. nov.	9		9*		18		8*	10		18			6*	7*	5					
<i>C. pictus</i> group																				
<i>C. penicillatus</i>	30		30*		91		26	64*	1	90		10*	32*	36	10	2				
BI																				
	n	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	
<i>C. abei</i> group																				
<i>C. abei</i>	53					1	3	7	10	14	11*	4	3*							
<i>C. albatrossae</i> sp. nov.	16		1	1	5	6	2*	1*												
<i>C. apus</i>	179				1	1	-	1	5	10	17	34	20*	20	24	18	14	9	5	
<i>C. breviradius</i>	93	1	1	4	21*	26*	21	10	2	5	1									
<i>C. fimbriatus</i> group																				
<i>C. erythraeus</i> sp. nov.	6			2*	2*	-	1	1												
<i>C. fimbriatus</i>	34				2	3	5	2	14	3	3	2								
<i>C. obscurus</i> sp. nov.	15		1*	2	3*	2	2	1	1	1	2									
<i>C. umbrinus</i>	8									1	2	3	2							
<i>C. viridiretis</i> sp. nov.	18						2	4*	4	6	1	1								
<i>C. pictus</i> group																				
<i>C. penicillatus</i>	87				1	3	6	4	10	2	18	21*	7	12	2	-	1			

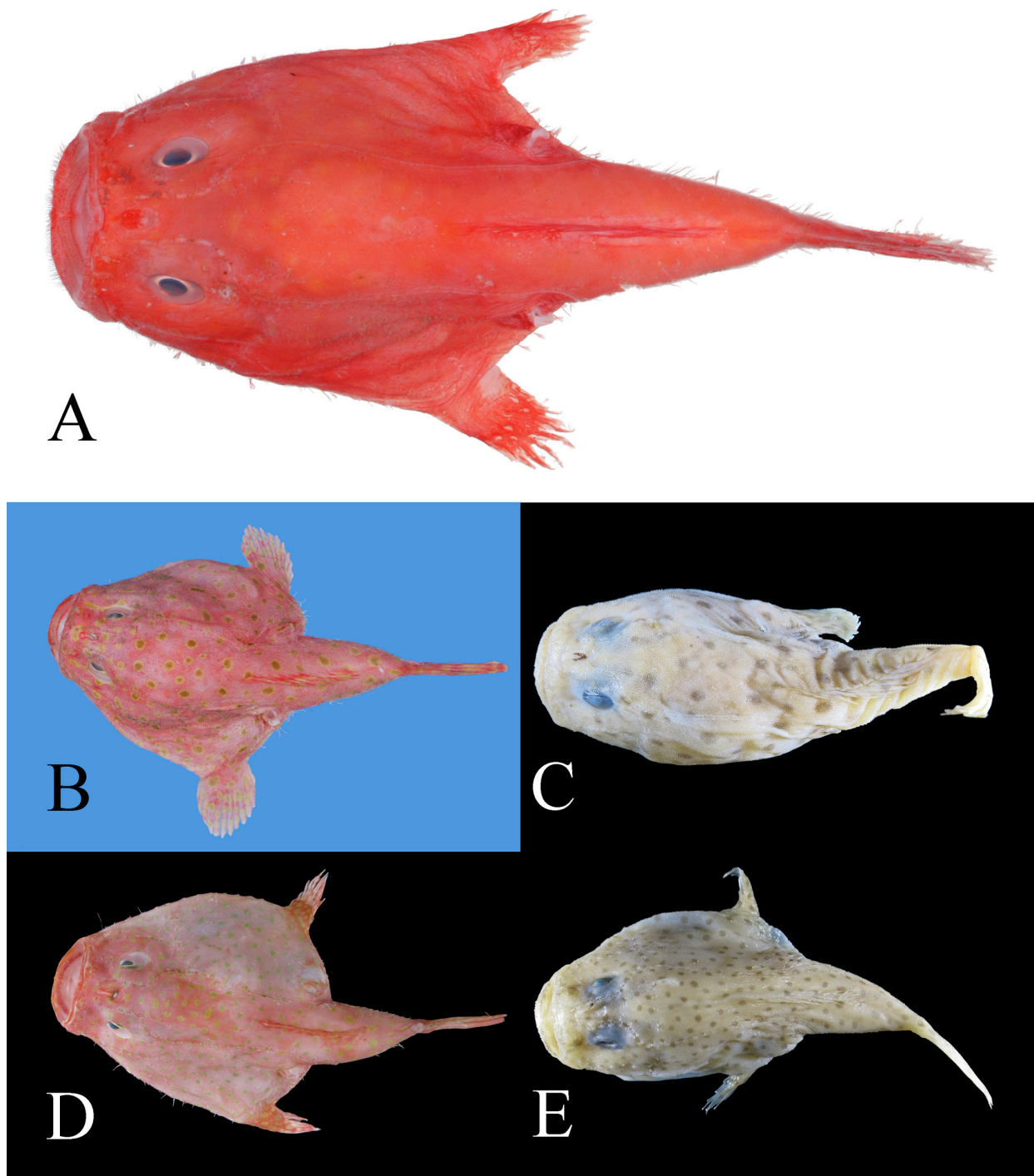


FIGURE 7. Three nominal species in the *Chaunax abei* species group. A. *C. apus*, ASIZP 63185, 185 mm SL, fresh. B. *C. abei*, ASIZP 63195, 130 mm SL, fresh. C. *C. abei*, NMMB-P16429, 196.2 mm SL, preserved. D. *C. breviradius*, NMMB-P22388, 87.6 mm SL, fresh. E. *C. breviradius*, NMMB-P22388, 83.8 mm SL, preserved.

Dermal spinules relatively short and thin, all straight and simple (Fig. 6A); 4 or 5 rows of spinules in front of illicial trough; no spinules on illicial trough or illicial base; 3 or 4 pairs of spinules flanking lateral-line neuromasts.

Teeth on both jaws slender, fang-like. Band of 6–7 irregular tooth rows on upper jaw, tooth length gradually increasing from outer to inner rows; 3–4 irregular rows of teeth on lower jaw, in same arrangement as on upper jaw. Teeth on vomer small, in approximately 3 irregular rows, separated into 2 patches by medial gap. Teeth on palatine small, in elongate patch close to outer end of corresponding vomerine patch.

TABLE 3. Gill raker counts of selected *Chaunax* species in present study, all counted on one side only.

	GRi								GRii					
	n	11	12	13	14	15	16	17	n	8	9	10	11	12
<i>C. abei</i> group														
<i>C. abei</i>	28		3	14	11*				28		24*	4		
<i>C. albatrossae</i> sp. nov.	8				2	2	4*		8			2	5*	1
<i>C. apus</i>	35	1	0	2	7	17	5	3	35	1	2	11	17	4
<i>C. breviradius</i>	40			6	18	16			40			27	13	
<i>C. fimbriatus</i> group														
<i>C. erythraeus</i> sp. nov.	3	1*	2						3	1*	2			
<i>C. fimbriatus</i>	18		4	9	5				18		14	4		
<i>C. obscurus</i> sp. nov.	8		1	3*	4				8	2	2*	4		
<i>C. umbrinus</i>	5			3	2				5	1	3	1		
<i>C. viridiretis</i> sp. nov.	9	1*	3	3	2				9	5*	4			
<i>C. pictus</i> group														
<i>C. penicillatus</i>	38	4	11	19	4				38	12	23	3		
	GRiii							GRiv						
	n	8	9	10	11	12	13	n	6	7	8	9	10	
<i>C. abei</i> group														
<i>C. abei</i>														
<i>C. albatrossae</i> sp. nov.	28		16	10*	2			28		7	21*			
<i>C. apus</i>	8				6	2*		8				7	1*	
<i>C. breviradius</i>	35			7	21	5	2	35		1	5	27	2	
<i>C. fimbriatus</i> group														
<i>C. erythraeus</i> sp. nov.	28	2*	13	13				28		19*	8	1		
<i>C. fimbriatus</i>	3	1*	1	1				3	1*	2				
<i>C. obscurus</i> sp. nov.	16		4	9	3			18		8	10			
<i>C. umbrinus</i>	8			4	4*			8		2	6*			
<i>C. viridiretis</i> sp. nov.	5		3	2				5		4	1			
<i>C. pictus</i> group														
<i>C. penicillatus</i>	9		7	2*				9		9*				
	38	4	21	13				38		29	9			

Cirri present on surfaces of both jaws and lateral sides of body, mainly associated with lateral-line canals; no cirri on dorsal surface of head, supraocular membranes or lower part of maxilla.

Coloration. Fresh coloration unknown but presumably uniformly pinkish, with or without colored spots or patches. Preserved specimens light brownish without marks or spots; esca creamy-white, most cirri pale or brownish distally, but some uniformly brown on anterior surface; tongue and mouth cavity blackish (some paratypes paler than others following long-term preservation); gill chamber mostly blackish, paler on ventral surface; gill arches uniformly blackish, except rakers and filaments pale; peritoneum black.

Size. Attaining 137.7 mm SL (USNM 168883); apparently a small species.

TABLE 4. Morphometric data of four species in *Chuanax abei* species group. HT=holotype.

	<i>C. abei</i>			<i>C. albatrossae</i> sp. nov.			<i>C. apus</i>			<i>C. breviradius</i>		
	HT	Types, non-types	HT	HT	Types	HT	HT	Non-types	HT	Types, non-types	HT	Types, non-types
		Mean (Range)	SD		Mean (Range)	SD		Mean (Range)	SD		Mean (Range)	SD
SL (mm)	81.1	92.0–187 (n=23)		77.3	59.3–119 (n=5)		83.0	104–256 (n=25)		108.6	51.5–137.6 (n=36)	
In % SL												
Head length	37.2	39.3 (36.9–41.8)	1.3	42.4	43.9 (42.4–46.3)	1.7	–	38.5 (36.6–40.1)	1.0	41.1	39.9 (36.1–43.6)	1.8
Head width	16.8	17.4 (16.0–20.1)	1.1	17.7	18.6 (17.6–20.4)	1.1	–	15.5 (13.3–17.3)	1.1	16.7	17.1 (15.2–19.4)	1.0
Pre-preopercular length	26.5	27.1 (25.1–28.8)	0.9	31.3	31.6 (31.1–32.1)	0.4	30.1	26.2 (24.2–28.8)	1.4	26.5	27.5 (25.7–30.2)	1.1
Pre-dorsal length	48.5	49.7 (45.0–53.4)	2.4	51.1	52.1 (51.1–53.0)	0.8	–	45.1 (43.3–48.3)	1.2	47.2	48.7 (44.6–53.5)	2.4
Pre-gill opening length	61.3	62.9 (60.4–64.6)	1.2	66.9	63.2 (59.5–66.9)	3.0	57.3	58.5 (56.5–60.0)	1.0	62.7	63.7 (59.1–67.8)	2.2
Illicial length	3.9	4.1 (3.3–4.9)	0.4	3.4	3.6 (3.2–3.9)	0.3	–	3.4 (2.7–4.1)	0.4	–	5.3 (4.0–6.3)	0.6
Illicial trough length	6.9	7.8 (6.8–9.3)	0.6	6.0	7.1 (6.0–7.9)	0.8	–	5.2 (4.3–7.1)	0.8	6.4	8.3 (6.4–9.9)	0.7
Pre-illicial trough	2.6	3.8 (3.1–4.6)	0.4	3.6	3.1 (2.4–3.6)	0.4	–	2.9 (1.4–4.1)	0.8	3.7	4.4 (3.2–5.5)	0.6
Eye diameter	7.8	8.3 (7.5–9.6)	0.6	10.2	10.3 (9.6–12.0)	1.0	8.8	8.0 (6.9–9.7)	0.8	7.7	8.0 (6.4–10.2)	0.9
Upper jaw length	19.4	20.4 (18.8–22.2)	0.9	25.0	25.4 (25.0–26.2)	0.5	21.2	20.4 (19.1–22.1)	0.9	21.5	21.2 (19.0–24.2)	1.1
Post-anus length (TL1)	31.2	30.7 (28.1–33.9)	1.7	32.1	32.7 (30.9–35.3)	1.7	32.4	34.4 (31.9–37.9)	1.7	30.9	30.6 (27.0–34.8)	1.6
Post-dorsal length (TL2)	18.0	18.1 (16.6–22.8)	1.5	20.3	19.8 (19.2–20.3)	0.5	20.4	19.7 (17.2–23.8)	1.8	17.2	17.1 (14.4–20.6)	1.5
Post-anal length (TL3)	15.0	16.0 (14.2–18.6)	1.3	18.8	17.6 (15.3–18.8)	1.3	18.0	16.8 (14.6–19.1)	1.4	14.3	15.5 (12.4–18.6)	1.6
Caudal peduncle depth	7.6	8.2 (6.7–9.3)	0.5	8.4	8.4 (8.1–8.9)	0.3	–	7.4 (7.0–7.8)	0.3	8.2	8.4 (7.7–9.2)	0.4
Caudal fin length	32.3	32.0 (29.1–36.3)	1.9	31.3	29.5 (27.2–31.3)	1.9	–	28.5 (25.7–31.9)	1.9	28.6	30.2 (25.4–35.3)	2.2

Distribution. Type series collected from central Philippines at depths of 195–702 m, excluding one specimen (USNM 168883) with imprecise depth record of 3–1412 m. This species apparently rare in collections, possibly reflecting either low population size or restricted distribution.

Remarks. This new species is quite unusual in having a dark mouth cavity and gill chamber, something that is rare in chaunacids. Four other chaunacid species, three of them newly described below in the *C. fimbriatus* species group, do possess this feature but can be easily separated from *C. albatrossae* by the cirri on the dorsal surface of their heads and other diagnostic characters given in their respective accounts. Another species *Chaunacops melanostomus*, which has a uniformly dark brown body, also has dark mouth cavity and gill chamber.

All the specimens comprising the type series of *C. albatrossae* were initially identified by us as *Chaunax apus* Lloyd, 1909 (Fig. 7A), a species that also occurs in the Philippines, because both species have a uniform, creamy-white color when preserved and they share similar proportions. But the new species differs from *C. apus* in having a dark gray or dark brown mouth cavity and gill chamber (vs. uniformly pale); relatively short and fine, uniformly straight dermal spinules (Fig. 6A; vs. slender and curved, Fig. 6B); GH 12–13 (vs. 12–19, mainly 14–16); and BI 28–33 (vs. 30–43, mainly 37–40).

Chaunax albatrossae is likely sympatric with *C. breviradius* but not with *C. abei*. It has a relatively larger eye diameter, longer head, longer pre-opercular, predorsal and pre-gill opening lengths and longer upper-jaw length than either *C. abei* (Figs. 7B, C) or *C. breviradius* (Figs. 7D, E) from the South China Sea (Table 4), as well as the other members of the *C. abei* species group in the Indo-West Pacific region besides *C. apus* (Ho, pers. data). Moreover, *C. albatrossae* has short, simple dermal spinules (Fig. 6A), different from the mixture of bifurcate and simple spinules in *C. abei* (Fig. 6C) but similar to those of *C. breviradius* (Fig. 6D).

Chaunax erythraeus sp. nov.

Red eyebrow frogmouth

Figs. 8, 9, 10A–D; Tables 1–3, 5

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Holotype. NMMB-P21097 (1, 225), ca. 24°30'N, 125°25.2'E, off Da-xi, Yilan, northeastern Taiwan, northwestern Pacific Ocean, bottom trawl, ca. 300 m, 17 Jun. 2013, purchased from fish market.

Paratypes. NMMB-P21098 (1, 203), 17 Jun. 2013; ASIZP 63219 (1, 224), 24 Apr. 2004; both collected from near the type locality.

Etymology. The specific name *erythraeus*, a Latin adjective meaning reddish, refers to the uniformly pinkish-red coloration, which is unique among the members of the *C. fimbriatus* species group.

Diagnosis. Body uniformly pinkish- or orange-red when fresh, mouth cavity light gray but darker in pharyngeal region, gill chamber entirely black. Tail short and stout (TL1=27.1–27.9% SL; TL2=13.5–16.1% SL; TL3=10.4–11.1% SL). GH 10 (rarely 11), BI 29–33, GRii 8–9, P 13.

Description. Morphometric (expressed as % SL) and meristic data are provided in Tables 1–3, 5. Following data provided first for holotype, followed in parentheses by range for paratypes, when different.

D III, 12; P 13; A 7; C 9. Lateral-line neuromasts: AB 10/10 (10–11); AC 8/8 (8); BB 6 (6); BB' 4 (4); BD 3/3 (2–3); CD 7/6 (6–7); DG 4/4 (3–4); EF 6/6 (6); FG 3/3 (3); GH 10/11 (10–11); BI 32/33 (29–33), including 3/4 (3–4) on caudal fin base. Gill rakers: GRi 3+9= 12 (3+8–9=11–12); GRii 9 (8–9); GRiii 1+9=10 (1+7–9=8–10); GRiv 7 (6–7)

Head length 2.4 (2.4–2.5) in SL; head width 5.2 (4.5–5.5) in SL, 2.2 (1.9–2.2) in HL; pre-preopercular length 3.5 (3.5) in SL, 1.4 (1.4) in HL; predorsal length 2.1 (2.0–2.1) in SL; pre-gill-opening length 1.7 (1.6–1.7) in SL; illicial length 13.6 (10.3–13.6) in HL, illicial trough length 6.7 (5.9–6.8) in HL; eye diameter 5.6 (5.0–5.6) in HL; upper jaw 4.7 (4.7–4.8) in SL, 1.9 (1.9–2.0) in HL; post-dorsal fin length 6.3 (6.2–7.4) in SL, 2.6 (2.5–3.0) in HL; post-anus length 3.6 (3.6–3.7) in SL, 1.5 (1.4–1.5) in HL; post-anal fin length 9.7 (9.0–9.3) in SL, 4.0 (3.7–4.0) in HL; caudal peduncle depth 4.4 (4.1–4.4) in HL; caudal fin length 3.5 (3.5–3.7) in SL, 1.5 (1.4–1.5) in HL.

Body robust, relatively deep and broad. Head globular with broad interorbital space; skull slightly elevated posteriorly. Trunk cylindrical. Skin relatively thin, loose and flaccid; tips of pectoral- and pelvic-fin rays well connected by membranes. Caudal peduncle relatively short and stout, slightly cylindrical, tapering posteriorly.

Illicium short and stout; esca with fat central tongue bearing many thin, pink cirri. Illicial trough relatively

shallow, oval, about 1.5 times longer than wide, slightly smaller than eye window. Second dorsal-fin spine close to illicium, third dorsal-fin spine situated at about midpoint of pre-dorsal distance, both spines embedded beneath skin.

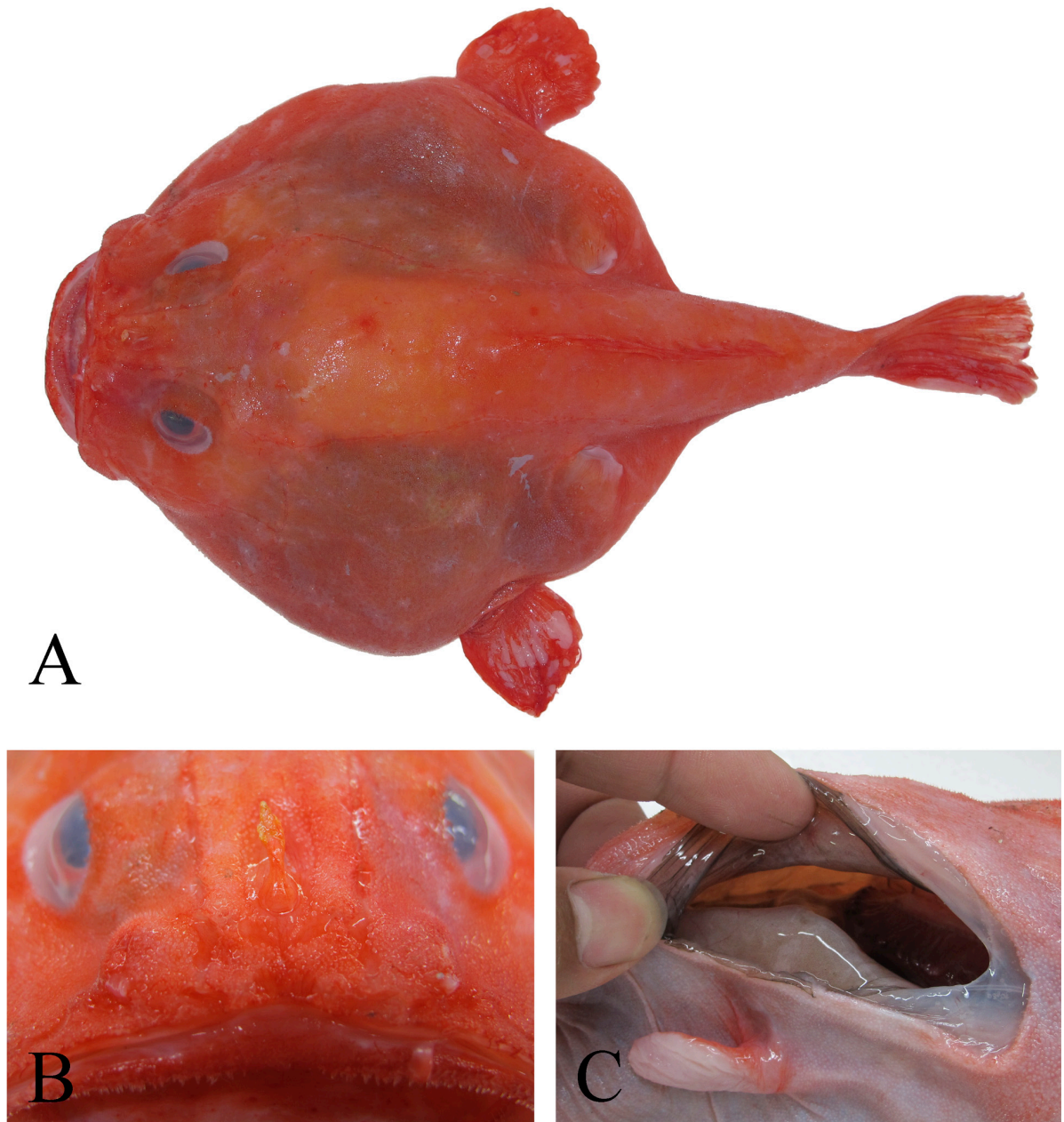


FIGURE 8. *Chaunax erythraeus* sp. nov., holotype, NMMB-P21097, 225 mm SL, fresh. A. Dorsal view. B. Anterior view of head. C. Interior of right gill chamber.

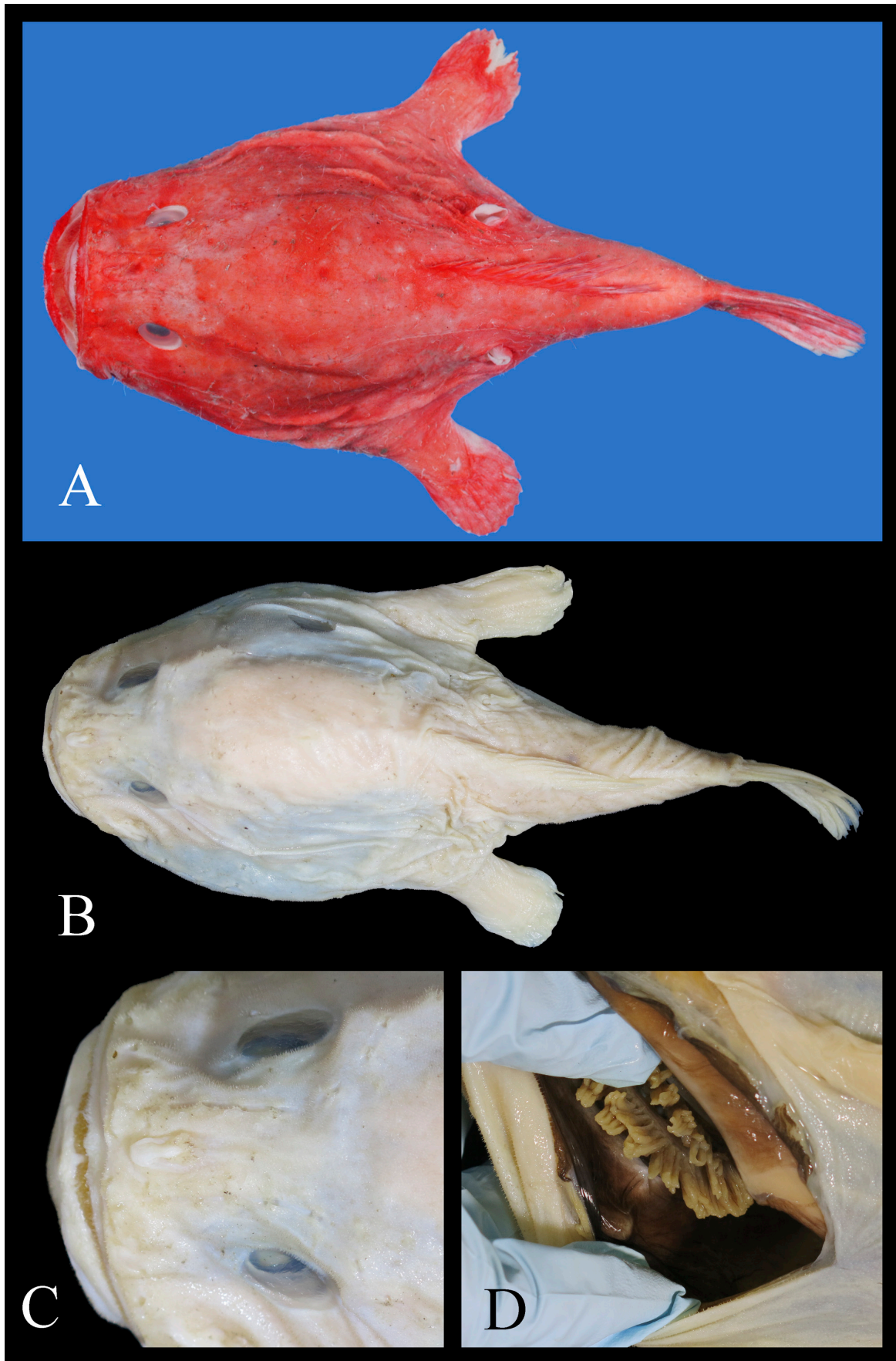


FIGURE 9. *Chaunax erythraeus* sp. nov., paratype, ASIZP 63219, 224 mm SL. A. Fresh condition, dorsal view. B–D. Preserved condition: B, dorsal view; C, dorsal view of head, D, interior of right gill chamber.

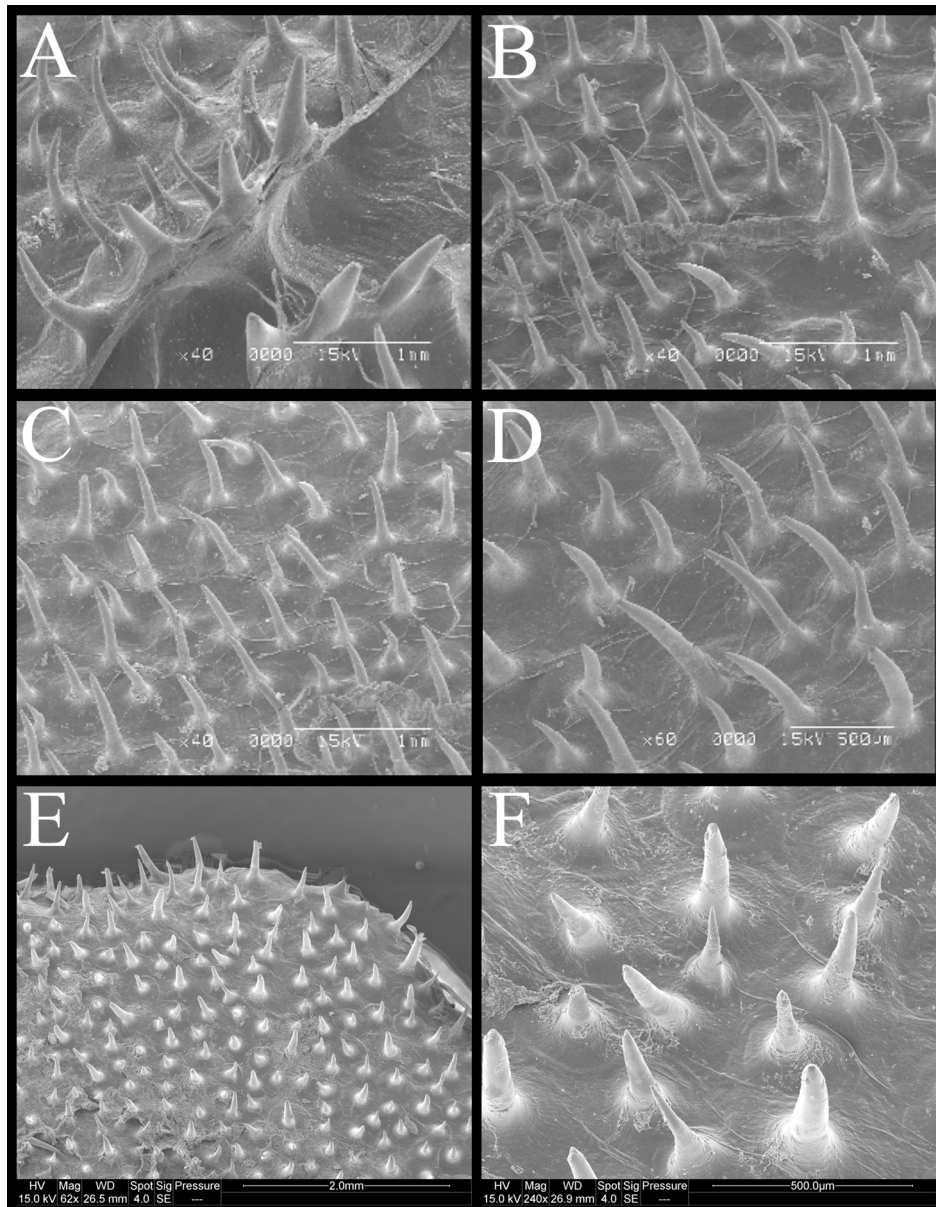


FIGURE 10. Dermal spinules of two species in *Chaunax fimbriatus* species group, SEM. A–D. *C. erythraeus*, NMMB-P21098, paratype, 203 mm SL. A. spinules beside neuromast. B. cirri on skin above eye (middle). C–D, skin above eye. E–F. *C. fimbriatus*, ASIZP 70143, 160 mm SL, skin on body.

Dermal spinules relatively thin and slender (Figs. 10A–D), mostly simple but those on body mixed with very sparse bifurcate spinules; interspaces of dermal spinules about equal to their length. In front of illicial trough, wide band of 4 rows of dermal spinules and more posterior narrow band of 1–2 rows separated by short naked area; 3–4 pairs of short spinules bridging successive neuromasts. Interspaces of lateral-line neuromasts much wider than width of neuromast.

Teeth relatively slender, fang-like. Broad band of about 8 irregular rows of teeth on upper jaw, those situated mesially slightly larger, posterior one-third of band tapering. Band of about 6 irregular rows of teeth on lower jaw; teeth similar in size to those in upper jaw, those of innermost row slight longer than others. Vomer with 2 bands of teeth separated by small gap, each band comprising about 4 irregular tooth rows. Each palatine with single band of about 4 rows of small teeth.

Cirri present on external surface of both jaws, membrane above eye, interorbital space, dorsal surfaces of head and body, lower part of premaxilla, lateral sides of body and caudal peduncle; those on dorsal surface of head sometimes branched.

TABLE 5. Morphometric data of five species in *Chaunax fimbriatus* group. HT=holotype

	<i>C. erythraeus</i> sp. nov.			<i>C. fimbriatus</i>			<i>C. obscurus</i> sp. nov.			<i>C. umbrinus</i>			<i>C. viridiretis</i> sp. nov.		
	HT	Types		HT	Non-types	SD	HT	Types		HT	Non-types	SD	HT	Types	
SL (mm)	225	203–225 (n=3)		254	98.6–227 (n=33)		254	133–254 (n=8)		196	66–286 (n=6)		196	148–203 (n=11)	
In % SL		Mean (Range) SD		Mean (Range) SD		Mean (Range) SD		Mean (Range) SD		Mean (Range) SD		Mean (Range) SD		Mean (Range) SD	
Head length	41.2	40.8 (39.7–41.3) 0.9	42.2 (39.4–44.3) 1.2	43.3	43.2 (41.1–45.1) 1.2	41.2 (38.1–43.9) 1.9	43.2	43.2 (41.1–45.1) 1.2	41.2 (38.1–43.9) 1.9	39.6	39.6 (37.0–41.8) 1.4	39.9 (37.0–41.8) 1.4	39.6	39.9 (37.0–41.8) 1.4	
Head width	19.2	19.7 (18.0–22.0) 2.1	19.9 (18.5–20.9) 0.6	20.5	20.3 (19.1–22.4) 1.0	18.6 (17.5–19.5) 0.8	20.3	20.3 (19.1–22.4) 1.0	18.6 (17.5–19.5) 0.8	17.7	18.3 (17.7–19.1) 0.5	18.3 (17.7–19.1) 0.5	17.7	18.3 (17.7–19.1) 0.5	
Pre-preopercular length	28.7	28.7 (28.6–28.8) 0.1	29.2 (26.5–33.2) 1.1	30.5	30.4 (28.0–31.8) 1.1	28.6 (26.1–30.7) 1.1	30.4	30.4 (28.0–31.8) 1.1	28.6 (26.1–30.7) 1.1	26.4	27.6 (22.7–29.9) 2.0	27.6 (22.7–29.9) 2.0	26.4	27.6 (22.7–29.9) 2.0	
Pre-dorsal length	48.5	48.8 (48.6–49.2) 0.3	50.1 (47.6–54.0) 1.5	47.4	51.2 (47.4–52.9) 2.0	49.3 (44.9–51.5) 1.7	51.2	47.4–52.9) 2.0	49.3 (44.9–51.5) 1.7	49.5	48.3 (46.4–51.4) 1.4	48.3 (46.4–51.4) 1.4	49.5	48.3 (46.4–51.4) 1.4	
Pre-gill opening length	60.2	61.4 (60.3–62.7) 1.2	64.7 (61.3–66.9) 1.4	64.4	63.9 (60.6–64.9) 1.4	63.5 (60.5–67.3) 1.7	63.9	60.6–64.9) 1.4	63.5 (60.5–67.3) 1.7	60.7	61.2 (58.1–64.8) 1.9	61.2 (58.1–64.8) 1.9	60.7	61.2 (58.1–64.8) 1.9	
Illicial length	3.0	3.5 (3.0–4.0) 0.5	5.3 (4.3–7.0) 0.5	3.8	4.5 (3.8–5.2) 0.5	4.1 (3.5–4.8) 0.3	4.5	3.8–5.2) 0.5	4.1 (3.5–4.8) 0.3	3.0	3.7 (3.0–4.4) 0.5	3.7 (3.0–4.4) 0.5	3.0	3.7 (3.0–4.4) 0.5	
Illicial trough length	6.2	6.3 (5.8–7.0) 0.6	8.0 (5.9–9.1) 0.6	8.4	7.8 (7.1–8.4) 0.4	7.0 (6.3–8.4) 0.7	7.8	7.1–8.4) 0.4	7.0 (6.3–8.4) 0.7	5.9	6.5 (5.9–7.6) 0.5	6.5 (5.9–7.6) 0.5	5.9	6.5 (5.9–7.6) 0.5	
Pre-illicial trough length	2.7	2.5 (2.3–2.7) 0.2	3.9 (2.5–5.2) 0.6	2.9	4.1 (2.9–5.0) 0.8	3.4 (2.7–4.3) 0.6	4.1	2.9–5.0) 0.8	3.4 (2.7–4.3) 0.6	2.9	2.8 (2.4–3.2) 0.3	2.8 (2.4–3.2) 0.3	2.9	2.8 (2.4–3.2) 0.3	
Eye diameter	7.3	7.6 (7.1–8.3) 0.6	7.9 (6.6–10.3) 0.9	6.9	8.3 (6.9–9.1) 0.7	7.5 (6.6–8.7) 0.8	8.3	6.9–9.1) 0.7	7.5 (6.6–8.7) 0.8	8.0	7.3 (6.1–8.1) 0.7	7.3 (6.1–8.1) 0.7	8.0	7.3 (6.1–8.1) 0.7	
Upper jaw length	21.2	21.1 (21.0–21.2) 0.1	22.1 (20.7–24.8) 0.7	23.0	22.4 (18.7–24.0) 1.7	20.5 (18.3–22.8) 1.4	22.4	18.7–24.0) 1.7	20.5 (18.3–22.8) 1.4	20.4	20.7 (19.7–21.9) 0.7	20.7 (19.7–21.9) 0.7	20.4	20.7 (19.7–21.9) 0.7	
Post-anus length (TL1)	27.9	27.6 (27.1–27.9) 0.4	28.3 (25.6–31.0) 1.3	27.7	27.9 (25.5–30.9) 1.7	27.9 (25.4–31.9) 2.2	27.9	25.5–30.9) 1.7	27.9 (25.4–31.9) 2.2	30.4	29.5 (26.2–32.7) 2.0	29.5 (26.2–32.7) 2.0	30.4	29.5 (26.2–32.7) 2.0	
Post-dorsal length (TL2)	15.9	15.2 (13.5–16.1) 1.4	17.7 (15.1–20.0) 1.1	16.0	15.9 (12.4–17.9) 1.7	16.3 (15.0–18.6) 0.9	15.9	12.4–17.9) 1.7	16.3 (15.0–18.6) 0.9	18.0	17.1 (14.5–18.9) 1.3	17.1 (14.5–18.9) 1.3	18.0	17.1 (14.5–18.9) 1.3	
Post-anal length (TL3)	10.4	10.7 (10.4–10.7) 0.4	13.8 (11.2–16.7) 1.2	10.7	12.4 (10.7–14.3) 1.4	12.7 (11.5–14.0) 0.8	12.4	10.7–14.3) 1.4	12.7 (11.5–14.0) 0.8	14.4	14.2 (12.0–16.7) 1.5	14.2 (12.0–16.7) 1.5	14.4	14.2 (12.0–16.7) 1.5	
Caudal peduncle length	9.3	9.6 (9.3–10.0) 0.4	10.2 (9.3–11.0) 0.4	8.9	9.5 (8.9–9.8) 0.3	9.2 (8.6–10.1) 0.6	9.5	8.9–9.8) 0.3	9.2 (8.6–10.1) 0.6	9.0	9.3 (8.8–9.8) 0.4	9.3 (8.8–9.8) 0.4	9.0	9.3 (8.8–9.8) 0.4	
Caudal fin length	28.2	28.1 (27.2–28.8) 0.8	28.9 (26.1–31.7) 1.4	27.2	29.7 (27.2–31.6) 1.8	27.7 (25.9–30.7) 1.8	29.7	27.2–31.6) 1.8	27.7 (25.9–30.7) 1.8	29.6	29.4 (27.1–31.2) 1.5	29.4 (27.1–31.2) 1.5	29.6	29.4 (27.1–31.2) 1.5	

Coloration. When fresh (Figs. 8, 9A), body surface uniformly pinkish-red with ventral side paler; cirri on esca pinkish with orange tips; cirri on body white to pink; gill chamber uniformly black (Fig. 9D); mouth cavity white anteriorly, gradually becoming gray posteriorly. After preservation, body surface uniformly creamy-white; illicium, esca and illicial trough pale; gill chamber uniformly black; gill arches light gray; and peritoneum black.

Distribution. Only known from three species in the type series collected from northeastern Taiwan at depths of around 300 m; apparently endemic to this region.

Remarks. *Chaunax erythraeus* sp. nov. is the only species among the ten species recognized in the *C. fimbriatus* species group with a uniformly pinkish- or orange-red coloration (uniformly creamy-white when preserved) and a uniformly black gill chamber (vs. a uniformly pale gill chamber or one with some black patches; Ho, pers. obs.).

Chaunax flammeus, known only from the holotype taken off northern Madagascar, also has a uniformly pale body color when preserved, but Le Danois (1979) stated that the fresh adult is yellow-pink with irregular marbling. In addition, *C. erythraeus* has a relatively short tail (TL1=27.1–27.9% SL, TL2=13.5–16.1% SL, TL3=10.4–11.1% SL) compared to that of *C. flammeus* (TL1=34.1% SL, TL2=18.5% SL, TL3=16.9% SL); and a black gill chamber (vs. uniformly pale).

Chaunax hollemani Ho & Ma 2016 also displays a uniformly creamy-white color when preserved, but its fresh coloration is still unknown. It differs from *C. erythraeus* in having different numbers of lateral-line neuromasts: DG 3 (vs. mainly 4), GH 11–14 (mainly 11; vs. 10–11, mainly 10), and BI 33–38 (vs. 29–33). It also has a relatively longer tail (TL1=28.9–31.8% SL, TL2=15.2–19.4% SL, TL3=13.7–15.9% SL), compared to those of *C. erythraeus* (TL1=27.1–27.9% SL, TL2=13.5–16.1% SL and TL3=10.4–10.7% SL).

The remaining 8 congeners in the *C. fimbriatus* species group have complex color patterns that easily allow their separation from *C. erythraeus*.

***Chaunax obscurus* sp. nov.**

Black-mouth frogmouth

Figs. 11, 12A–C, 13A–E, 14A; Tables 1–3, 5

urn:lsid:zoobank.org:act:F9C7A38E-63BD-4DEF-BD39-DB8A4CD405D9

Holotype. NMMB-P34690 (254), ca. 24°30'N, 125°25.2'E, off Daxi, Yilan, northeastern Taiwan, northwestern Pacific Ocean, bottom trawl, ca. 200–300 m, 25 Aug. 2020.

Paratypes. ASIZP 71252 (1, 175), off Daxi, Yilan, 7 Jul. 2004; NMMB-P34691 (1, 187), NMMB-P34692 (1, 180), NMMB-P34693 (1, 170), NMMB-P34694 (1, 164), NMMB-P34695 (1, 141), NMMB-P34696 (1, 133), all collected together with holotype.

Etymology. The specific name, a Latin adjective meaning dark, refers to the black mouth cavity and gill chamber.

Diagnosis. Species of *C. fimbriatus* group distinguished from other members of that group by its black mouth cavity and gill chamber; skin covered with simple spinules; relatively short caudal peduncle (TL1=25.5% SL, TL2=17.9% SL, TL3=13.5% SL); 3–5 spinules flanking neuromasts; fresh body coloration (orange-red with irregular small yellow patterns on dorsal surface, latter turning pale when preserved); yellowish green to brown esca; modal lateral-line neuromasts: BD 2, CD 6, DG 3 or 4, FG 3, GH 11 or 12; and P 13 or 14.

Description. Morphometric (expressed as % SL) and meristic data are provided in Tables 1–3, 5. Following data provided first for holotype, followed in parentheses by range for paratypes, when different.

D III, 12; P 13; A 7; C 9. Lateral-line neuromasts: AB 11/12 (10–12, mainly 11); AC 8/8 (7 or 8, mainly 8); BB 6; BB' 6 (4–6, mainly 6); BD 2/2 (2); CD 6/7 (6–8, mainly 6); DG 4/4 (3–5, mainly 4); EF 6/6 (5–7, mainly 6); FG 3/3 (2 or 3, mainly 3); GH 10/11 (10–12, mainly 11); BI 28/30 (28–36), including 0/2 (0–4) on caudal-fin base. Gill rakers: GRi 4+9=13 (3–4+8–10=12–14); GRii 9 (8–10); GRiii 1+10=11 (1+9–10=10–11), GRiv 8 (7 or 8).

Head length 2.3 (2.2–2.4) in SL; head width 4.9 (4.5–5.2) in SL, 2.1 (2.0–2.2) in HL; pre-preopercular length 3.3 (3.1–3.6) in SL, 1.4 (1.3–1.5) in HL; predorsal length 2.1 (1.9–2.1) in SL; pre-gill opening length 1.6 (1.5–1.7) in SL; illicial length 11.5 (8.6–11.5) in HL, illicial trough length 5.2 (5.3–6.0) in HL; eye diameter 6.3 (4.7–6.3) in HL; upper jaw 4.3 (4.2–5.4) in SL, 1.9 (1.8–2.3) in HL; post-dorsal fin length 6.3 (5.6–8.1) in SL, 2.7 (2.4–3.5) in HL; post-anus length 3.6 (3.2–3.9) in SL, 1.6 (1.4–1.7) in HL; post-anal fin length 9.4 (7.0–9.4) in SL, 4.1 (3.0–4.1) in HL; caudal peduncle depth 11.2 (10.2–11.2) in SL, 4.9 (4.4–4.9) in HL; caudal fin length 3.7 (3.2–3.7) in SL, 1.6 (1.3–1.6) in HL.

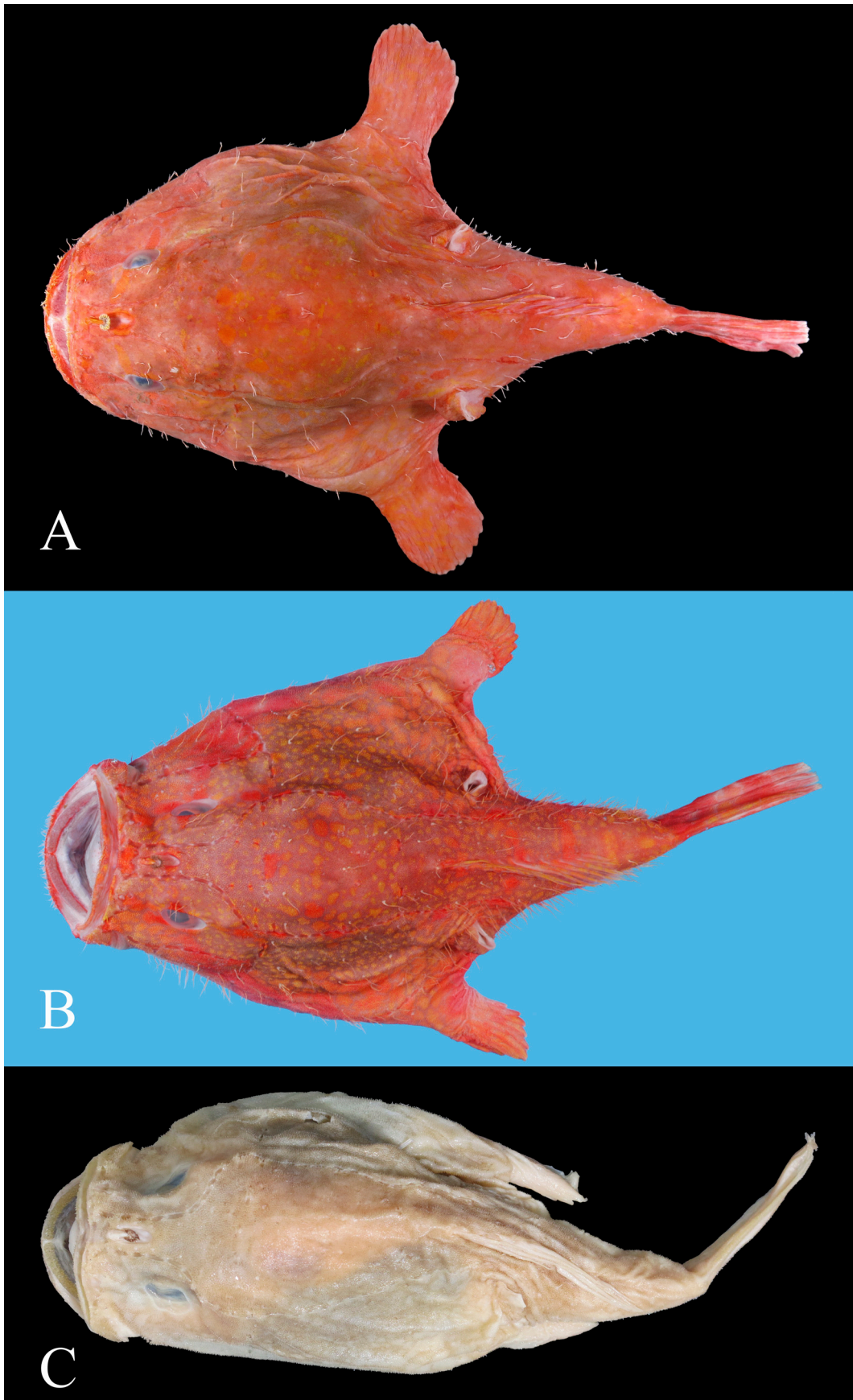


FIGURE 11. *Chaunax obscurus* sp. nov. A. Holotype, NMMB-P34690, 254 mm SL, fresh. B–C. Paratype, ASIZP 71252, 175 mm SL, fresh (B) and preserved (C).

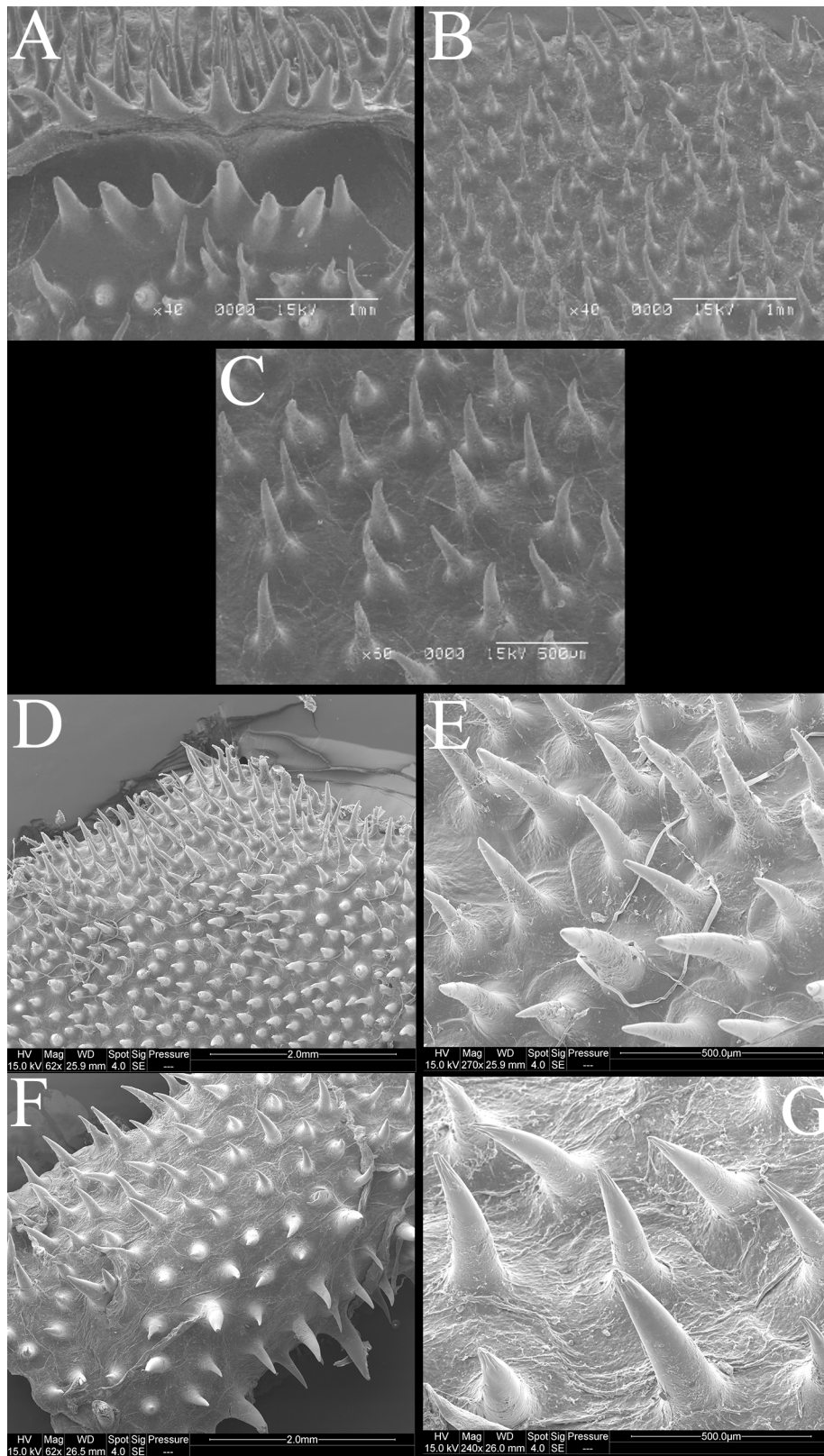


FIGURE 12. Dermal spinules of three other species in *Chaunax fimbriatus* species group, SEM. A–C. *C. obscurus* **sp. nov.**, NMMB-P34693, 170 mm SL: A, spinules beside neuromast; B–C, skin above eye. D–E. *C. umbrinus*, ASIZP 70334, 248 mm SL, skin above eye. F–G. *C. viridiretis* **sp. nov.**, ASIZP 64499, paratype, 165 mm SL, skin above eye.

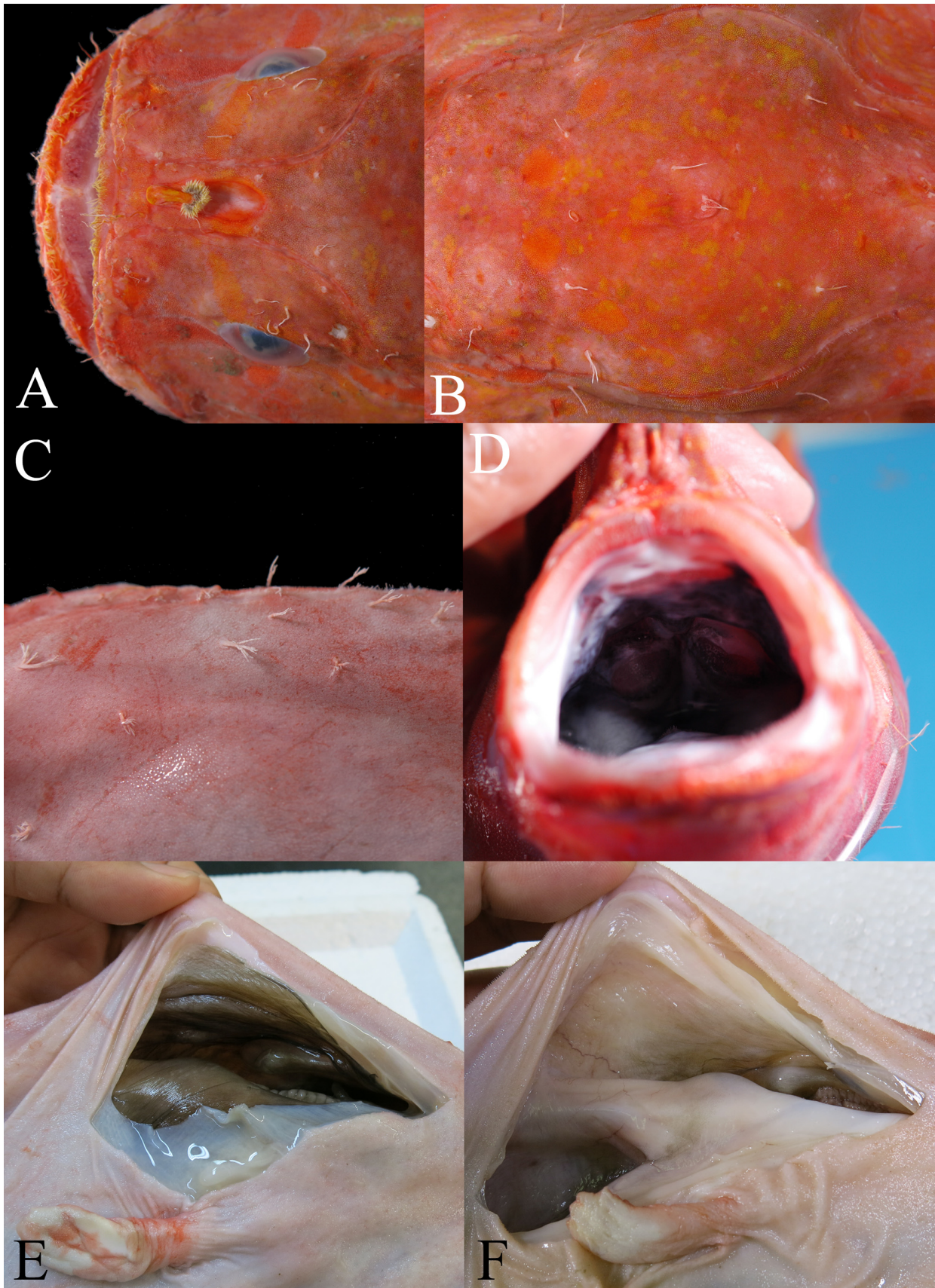


FIGURE 13. Details of two species in *Chaunax fimbriatus* species group. A–E. *C. obscurus* **sp. nov.** (A–C, E, holotype; D, paratype, ASIZP 71252): A, dorsal view of head; B, dorsal view of dorsum; C, ventral view of left side of head; D, mouth cavity; E, dark coloration within right gill chamber. F. *C. fimbriatus*, NMMB-P34718, 211 mm SL, pale coloration within right gill chamber.

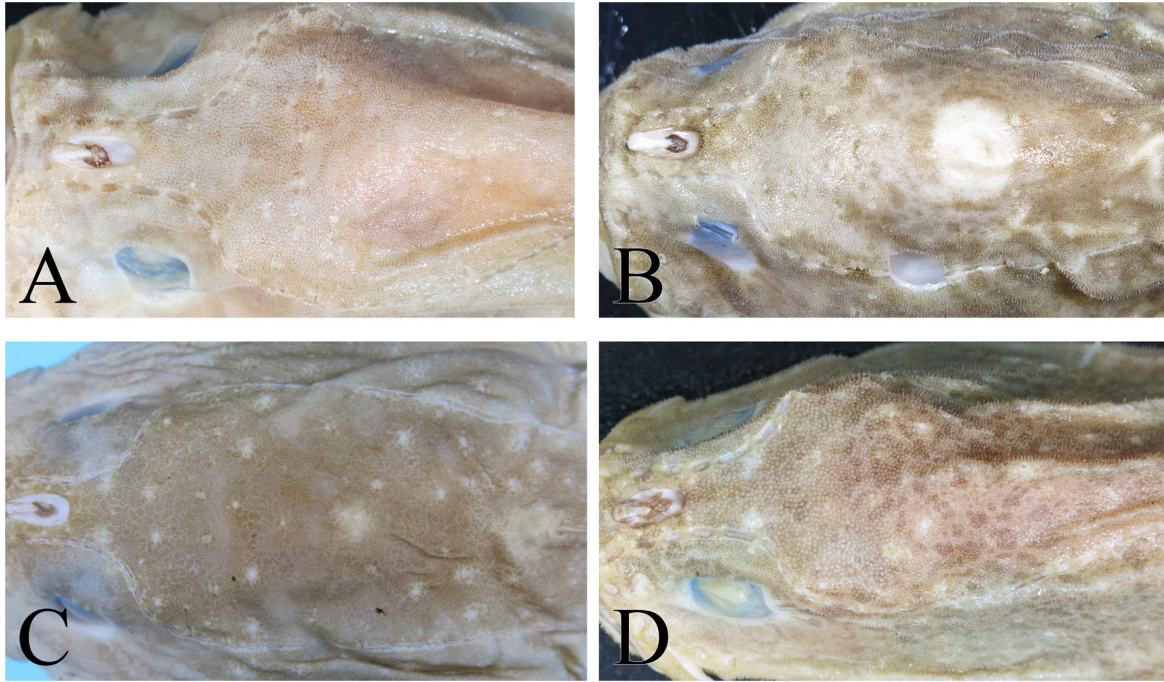


FIGURE 14. Preserved coloration on dorsal surface of four species in *Chaunax fimbriatus* species group. A. *C. fimbriatus*, NMMB-P13862, 115.7 mm SL. B. *C. obscurus* sp. nov., ASIZP 71252, 175 mm SL. C. *C. umbrinus*, NMMB-P23460, 216 mm SL. D. *C. viridiretis* sp. nov., ASIZP 64503, 196 mm SL. Not to scale.

Body robust, relatively deep. Head globular with broad interorbital space, skull slightly elevated posteriorly. Trunk cylindrical. Skin thick, loose and flaccid; tips of pectoral- and pelvic-fin rays well connected by thick skin. Caudal peduncle relatively short and stout, somewhat cylindrical, tapering posteriorly.

Illicium short and stout; esca with thick central tongue bearing many yellowish-green to brown cirri. Illicial trough slightly concave, oval, about twice as long as wide, its length about equal to eye diameter.

Dermal spinules relatively short and stout; interspaces slightly greater than spinule length. Broad band of about 14 (10–14) rows of dermal spinules in front of illicial trough; 3–5 pairs of short spinules flanking neuromasts; interspaces of lateral-line neuromasts much longer than width of neuromast.

Teeth relatively slender and fang-like; band of about 8 (6–8) irregular rows of teeth on upper jaw, those in middle portion slightly larger than rest, posterior one-third narrower than rest of band; band of 6 (5–6) irregular rows of teeth on lower jaw, teeth slightly larger than those on upper jaw with those in innermost row slightly longer than others. Vomer with 2 bands of teeth separated by small gap, with about 4 (3 or 4) irregular rows in each band. Each palatine with single band of small teeth.

Cirri present on external surface of both jaws, interorbital space, membranes above eye, dorsal surfaces of head and body, lower part of premaxilla, lateral body and caudal peduncle; most cirri relatively strong and branched.

Coloration. When fresh (Figs. 11A–B, 13A–E), body covered with many irregular, 3–8 mm wide yellow patches forming reticulate patterns on orange-red background, but ventral side paler. Cirri on esca yellowish-green to brown, those on body pale to orange red. In preserved state (Figs. 13C, 14A), markings faded to numerous irregular pale patches on light brown background and ventral side pale; cirri on esca deep brown, cirri on body pale; gill chamber black except for small pale region posteriorly, mouth cavity gray anteriorly but gradually becoming black posteriorly, gill arches gray, peritoneum black.

Distribution. Currently only known from type series collected off northeastern Taiwan at depths of around 300 m; likely an endemic species in this area.

Remarks. All of the present specimens of *Chaunax obscurus* sp. nov. were collected together with *C. fimbriatus* and *C. viridiretis* sp. nov. (described below) off northeastern Taiwan, but the first species was much less abundant than the other two. All three species are very similar to each other in coloration and morphology, but *C. obscurus* can be separated from *C. fimbriatus* by two distinct features, its lack of white patches dorsally (Figs. 11, vs. 15A)

and its mainly black gill chamber (Fig. 13E; vs. pale, Fig. 13F, or sometimes with small irregular black patches). The dorsal white patches of *C. fimbriatus* are clear and distinct in both fresh and preserved condition and its color patches remain gray or brown in preserved specimens (Fig. 14B), whereas they fade in preserved specimens of *C. obscurus* (Fig. 14A).

Chaunax umbrinus Gilbert, 1905, which inhabits the Hawaiian Islands and the Emperor Seamount chain (pers. data), is readily separable from *C. obscurus* by having very fine greenish-yellow patches on the dorsal surface (Fig. 15B), that turn brown when preserved to form a very fine pale reticulated pattern on a brownish background (Figs. 14C).

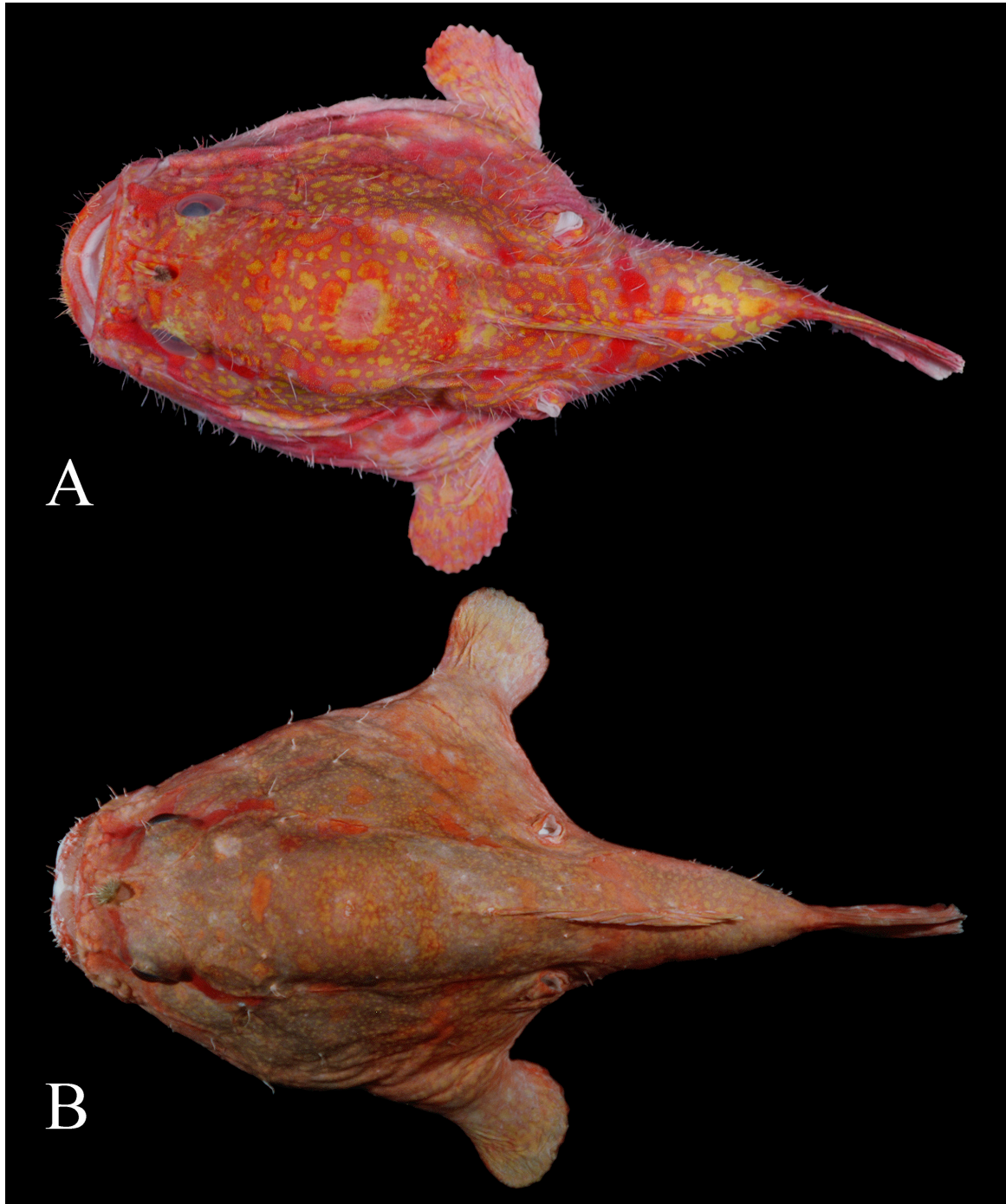


FIGURE 15. Fresh coloration of two species in *Chaunax fimbriatus* species group. A. *C. fimbriatus*, ASIZP 63257, 274 mm SL. B. *C. umbrinus*, ASIZP 70334, 248 mm SL, photo by J. E. Randall.

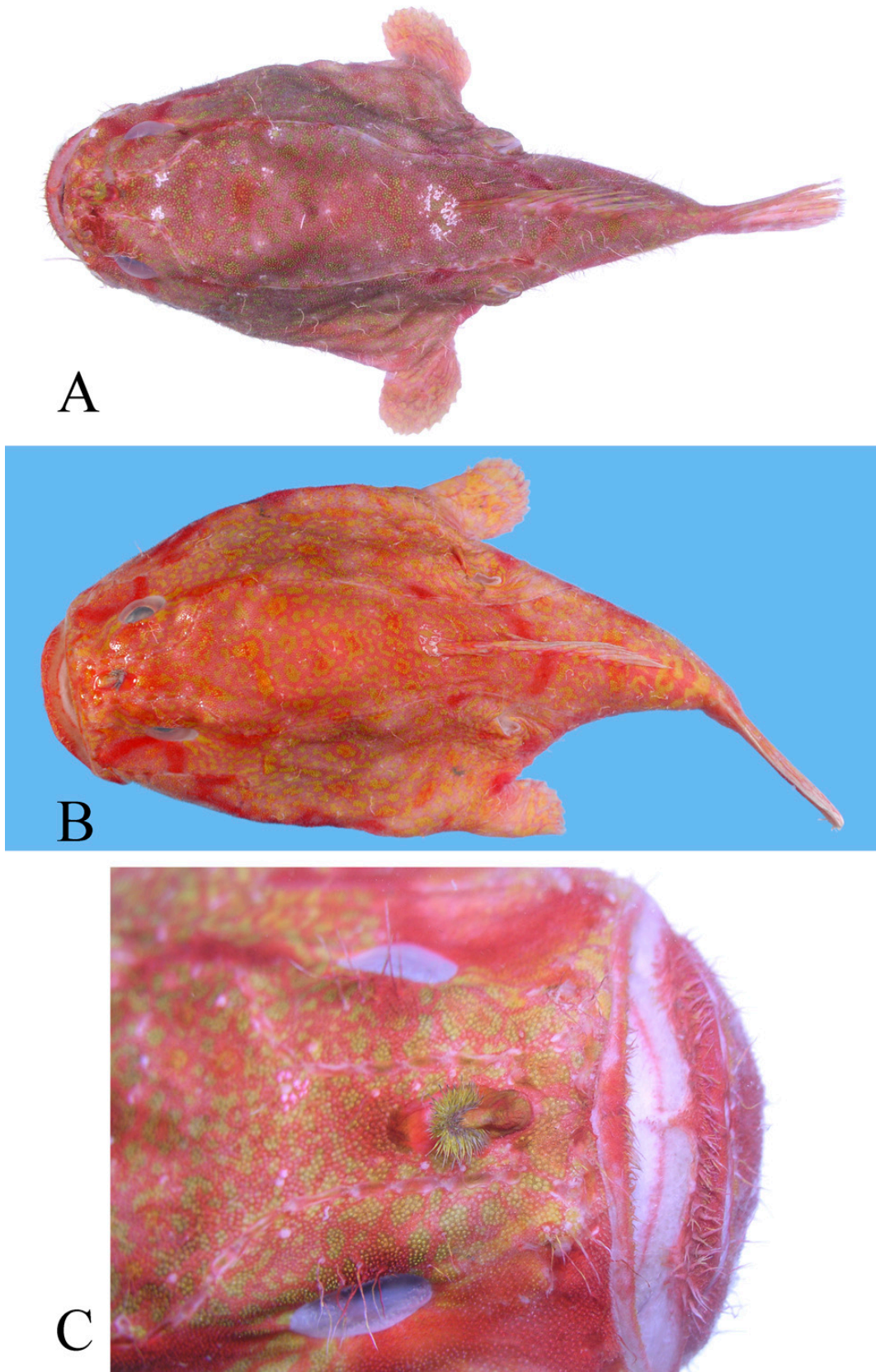


FIGURE 16. Fresh coloration of *Chaunax viridiretis* sp. nov. A. Holotype, ASIZP 64503, 196 mm SL. B. Paratype, USNM 395937, 203 mm SL. C. Paratype, ASIZP 64499, 192 mm SL, dorsal view of anterior part of head.

***Chaunax viridiretis* sp. nov.**

Green-net frogmouth

Figs. 14D, 16, 17; Tables 1–3, 5

urn:lsid:zoobank.org:act:85DEDE30-A621-4AED-86D8-C99844D9C38D

Holotype. ASIZP 64503 (196), ca. 24°58'N, 121°58'E, off Da-xi, Yilan, northeastern Taiwan, northwestern Pacific Ocean, ca. 300 m, 19 Jun. 2004, coll. H.-C. Ho, purchased from Da-xi fish market.

Paratypes. Nine specimens, 162–203 mm SL. ASIZP 64499 (2, 165–192), AMS I.44816-001 (ex. ASIZP 64499, 162), USNM 395937 (ex. ASIZP 64499, 2, 168–203), 13 Jun. 2004; ASIZP 64567 (3, 165–183), AMS I.44816-002 (ex. ASIZP 64567, 177), 7 Jul. 2004; ASIZP 64569 (2, 148–172), 7 Jul. 2004; ASIZP 65400 (1, 168), 7 Jul. 2004; NMMB-P23373 (1, 159), 7 Jul. 2004; NMMB-P23374 (1, 180), 7 Jul. 2004; all collected from near type locality.

Etymology. The specific name is a genitive noun phrase formed by combining the Latin adjective *viridis*, meaning green, and the genitive form *retis* of the Latin noun *rete*, meaning net, refers to the greenish irregular reticulate pattern on the body surface.



FIGURE 17. Preserved coloration of *Chaunax viridiretis* sp. nov.. A. Holotype, ASIZP 64503, 196 mm SL. B. Paratype, ASIZP 64499, 192 mm SL.

Diagnosis. Species in *C. fimbriatus* group displaying irregular green reticulate pattern on dorsal surface when fresh, with patches of small, bright white spots on interorbital space, head and origin of dorsal fin. Mouth cavity pale and gill chamber blackish. Ilicium short and stout; esca yellowish green. Slender cirri arising within interorbital

space and on lower part of maxilla and supraocular membranes. Spinules on dorsal surface relatively strong and stout, their interspaces being shorter than their lengths. BD 2–3, GH 11–13, BI 32–35; GRii 8–9; P 13–14 (mainly 14).

Description. Morphometric (expressed as % SL) and meristic data are provided in Tables 1–3, 5. Following data provided first for holotype, followed in parentheses by range for paratypes, when different.

D III, 12; P 13–14 (mainly 14); A 7; C 9. Lateral-line neuromasts: AB 11 (11–12); AC 8 (7–8); BB 6; BB' 4 (4–5); BD 2 (2–3); CD 6 (6–7); DG 4 (3–5); EF 6 (5–7); FG 3; GH 12 (11–13); BI 33/35 (32–37), including 2–4 on caudal-fin base. Gill rakers: GRi 3–5+8–10=11–14; GRii 8–9; GRiii 1+9=10 (1+8–9=9–10); GRiv 7.

Head length 2.5 (2.3–2.7) in SL; head width 5.4 (5.1–5.7) in SL, 2.2 (2.1–2.3) in HL; pre-preopercular length 3.5 (3.3–3.9) in SL, 1.4 (1.3–1.6) in HL; predorsal length 2.1 (1.9–2.1) in SL; pre-gill opening length 1.6 (1.5–1.7) in SL; illicial length 10.4 (8.3–13.2) in HL; illicial trough length 6.1 (5.2–6.8) in HL; pre-illicium length 13.5 (11.0–15.3) in HL; eye diameter 5.5 (4.9–6.6) in HL; upper jaw 4.7 (4.3–5.0) in SL, 1.9 (1.8–2.0) in HL; post-anus length (tail 1) 3.4 (3.2–3.7) in SL, 1.4 (1.3–1.5) in HL; post-dorsal length (tail 2) 5.9 (5.3–6.9) in SL, 2.4 (2.2–2.7) in HL; post-anal length 7.2 (6.3–8.2) in SL, 2.9 (2.5–3.3) in HL; caudal peduncle depth 4.3 (3.9–4.7) in HL; caudal fin length 3.4 (3.2–3.6) in SL, 1.4 (1.3–1.5) in HL.

Body rather robust. Interorbital space broad and skull slightly elevated posteriorly. Skin relatively thick, tips of pectoral- and pelvic-fin rays well-connected to each other by skin. Caudal peduncle somewhat cylindrical, short and stout, tapering posteriorly.

Illicium short and stout, esca with broad central tongue bearing many thin, greenish or yellowish cirri. Illicial trough relatively deep, oval, about 1.7 times longer than wide and shorter than eye window diameter.

Dermal spinules relatively short and stout (Figs. 12F–G), forming rough skin covering entire body except for eye windows, outer half of pectoral fins, entire anal fin and membranes of all fins; interspaces between dermal spinules slightly longer than spinule lengths. Wide transverse band of 7 or 8 rows of dermal spinules in front of illicial trough. Interspaces of lateral-line neuromasts slightly greater than the width of neuromasts; 3 or 4 pairs of short spinules flanking neuromasts.

Teeth relatively slender and fang-like. Band of 5–6 irregular rows of teeth on upper jaw, those on middle and in inner row slightly longer than others, posterior one-third of band narrowing; band of 3–4 irregular rows of teeth on lower jaw, these teeth slightly longer than those of upper jaw, with those in innermost row slightly longer than others. Vomer with two bands of teeth separated by small gap, with 3 irregular tooth-rows in each band. Each palatine with single band of small teeth.

Cirri on external surfaces of both jaws, interorbital space, supraocular membrane, dorsal surfaces of head and body, lower part of premaxilla, lateral sides of body and caudal peduncle; those on interorbital space and dorsal surface of head sometimes branched.

Coloration. When fresh, body reddish with irregular greenish reticulate pattern on dorsal surface and paler ventral surface; small bright-white spots in small patches on interorbital space, head and origin of dorsal fin; esca yellowish-green. When preserved, dorsal surface showing gray reticulate pattern, esca brownish. Mouth cavity pale anteriorly, grayish posteriorly; gill chamber and peritoneum black.

Distribution. Currently only known from the type series collected (according to the fishermen involved) by bottom trawl from a rocky bottom near the coast of northeastern Taiwan at depths of about 300 m. Likely an endemic species in this area, in light of the first author's more than 20 years of observations in many museum collections.

Remarks. *Chaunax viridiretis* **sp. nov.** shares similar body proportions and meristic values with *C. fimbriatus* and *C. obscurus*, which co-occur with it in northeastern Taiwan (Tables 1–3, 5). When fresh, *C. obscurus* has yellow patches on an orange-red background, which fade after preservation to form pale patches with light brown reticulations, whereas *C. viridiretis* has small, yellow-green patches on a reddish background, which turn dark gray after preservation and form a dark-brown marbled pattern with paler reticulations (Fig. 14A, vs. 14D). Furthermore, the mouth cavity of *C. obscurus* is gray anteriorly and black posteriorly (Fig. 13D), while that of *C. viridiretis* is mostly pale, with the pharyngeal region light gray. *Chaunax viridiretis* **sp. nov.** differs from *C. fimbriatus* in having fine greenish reticulation on dorsal surface and bright white patches on the interorbital space, head and origin of the dorsal fin (vs. a yellowish or reddish pattern with two bright-white patches on the dorsal surface); greenish cirri on the esca when fresh (vs. grayish to brownish cirri); relatively stout (vs. slender) spinules; BD mainly 2 (vs. 3); and CD mainly 6 (vs. 7).

Among non-sympatric species, *C. viridiretis* **sp. nov.** is similar to *C. umbrinus* in having a complicated reticulate color pattern, but can be distinguished by the pattern's greenish color and the bright white patches on the interorbital space, head and origin of the dorsal fin (vs. a fine yellowish or reddish pattern and no white patches); greenish cirri

on the esca (vs. brownish cirri); relatively stout (vs. relatively slender) spinules; and DG modally 4 (vs. modally 3), CD modally 6 (vs. modally 7) (Tables 1–4).

Discussion

Most chaunacid species share similar body proportions and coloration, especially members of the same species complex. The flabby body makes it difficult to take precise measurements, especially when specimens are not preserved properly (e.g., when they are twisted, bent or compressed). Although some diagnostic characters used to separate species are rather consistent, some, like coloration, show considerable individual variability in some species. The diagnostic features discussed below are mainly based on the species treated in the present study. Additional information for other chaunacids is also cited, based on previous publications and/or examination of comparative material.

Illicium. In members of the *C. pictus* species group, the illicium is usually short and stout. *Chaunax penicillatus* has an especially short illicial stem, which is almost embedded inside the esca. *Chaunax apus*, *C. erythraeus*, *C. obscurus*, *C. umbrinus* and *C. viridiretis* have a short and stout illicium. *Chaunax abei*, *C. albatrossae* and *C. breviradius* have a relatively thin illicium, and that of *C. fimbriatus* is distinctly slender than those of all the other congeners. In general, *Chaunacops* spp. have a slender illicium that is longer than that of most *Chaunax* species.

Esca. The shape of the esca is affected by preservation, but its coloration is quite consistent in both fresh and preserved material. Most species have a central tongue (*sensu* Le Danios, 1978) bearing small cirri, but some species in the *C. fimbriatus* species group lack a clear central tongue and consist entirely of small cirri.

Cirri on esca. The coloration of cirri in most species is quite consistent. Members of the *C. pictus* group have relatively stout cirri, these being black on the anterior side of the esca and bright white on the posterior side. *Chaunacops coloratus*, *Chaunax apus* and *C. erythraeus* have uniformly pink or red cirri on the esca, which turn entirely creamy-white when preserved. Most congeners have gray, brown or yellowish-green cirri when fresh that become gray or brown when preserved.

Illicial trough. All three members of the *C. pictus* species group have a black, deeply concave illicial trough, that houses the illicium and esca. The remaining species of *Chaunax* have a shallow, oval illicial trough, although those of *C. fimbriatus* and *Chaunacops* spp. are somewhat deeper and longer than those of other chaunacids.

Lateral-line neuromast complex. Chaunacid species have open lateral-line canals on the head and body, with many neuromasts exposed. Each neuromast is accompanied by a narrow, lunate scale and 1 to 8 small spinules on each side that form a complex. *Chaunacops* spp., *Chaunax mulleus* Ho, Roberts & Stewart, 2013 and *C. russatus* Ho, Roberts & Stewart (2013) have only 1 spinule on each side of the neuromasts, whereas the other species have 3 to 8 spinules. Species of the *C. abei* group usually have 3 to 5 spinules and those in the *C. fimbriatus* group usually have 5 to 8. The numbers of spinules vary and can be used to separate some, but not all species; however, it should be remembered that juveniles and other young individuals generally have fewer spinules than adults.

Numbers of lateral-line neuromasts. Caruso (1989a) proposed several categories of lateral-line neuromasts, which are reported slightly differently herein (see Fig. 1; Tables 1–2). *Chaunacops* spp. have 9 or 10 (mainly 9) neuromasts in the supraorbital series (AB) whereas *Chaunax* spp. have 10–12 (mainly 11, but up to 16 in *C. latipunctatus*). *Chaunacops* spp. have 5–7 (mainly 6 or 7) in the premaxillary series (AC) whereas *Chaunax* spp. have 7–9 (mainly 8). *Chaunacops* spp. have only 1 (rarely 0) in the upper preopercular series (BD) whereas *Chaunax* spp. have 2–5 (mainly 2 or 3). *Chaunacops* spp. have 4–7 (mainly 4 or 5) in the infraorbital series (CD) whereas most *Chaunax* spp. have 4–9 (mostly 6) and *C. fimbriatus* has mostly 7. *Chaunacops* has only 2 in the lower preopercular series (DG) whereas members of the *C. abei* species group have 2–5 (mainly 3), except for *C. multilepis* and *C. suttkusi*, which have mainly 4. Members of the *C. fimbriatus* species group have 3–5 (mainly 4 except mainly 3 in *C. penicillatus*). *Chaunacops* spp. have 3–5 neuromasts in the mandibular series (EF) whereas *Chaunax* spp. have 5–7 (mainly 6, rarely 8 or 9). *Chaunacops* spp. have 2–5 (mainly 3 or 4) in FG whereas *Chaunax* spp. have 2–6 (mainly 3), except that *C. latipunctatus*, *C. mulleus*, *C. russatus* and *C. suttkusi* mainly have 4. *Chaunacops* spp. have 2–4 (mainly 3) in the pectoral series (GH) whereas *Chaunax* spp. show great variability among species, ranging from 9 to 19, the latter being the count in *C. nudiventer*. *Chaunacops* spp. have 2–4 (mainly 3) in the anterior body series (BB') whereas *Chaunax* spp. have 3–6 (mainly 3 or 4), except for *C. umbrinus* and *C. penicillatus*, which mainly have 8, and *C. viridiretis*, which has 4 or 5. Finally, *Chaunacops* spp. have 17–26 in the

body series (BI), while *Chaunax* spp. show great variability among species, ranging from 27 to 50, the latter being the count in *C. nudiventer*.

Cirri on head and body. All members of the *C. fimbriatus* species group have cirri on the membranes overlying the eyes and on the dorsal surface of the head (Figs. 15A, 18C), whereas cirri are absent from these areas in members of the *C. abei* species group. *Chaunax penicillatus* has few to many cirri around the illicial trough but none on the membranes overlying the eyes. All members of *Chaunax* have cirri on the body surface, especially laterally along the lateral-line canals. Most members of the *C. abei* species group, such as *C. abei*, *C. apus* and *C. albatrossae*, have cirri that are broad, flap-like and bright white in color (Fig. 4A). In contrast, members of the *C. fimbriatus* species group and *C. breviradius* have cirri that are thin and filamentous, sometimes branched, and usually pale, but not bright white (Figs. 4B, C).

Gill rakers. Gill raker counts of different species mostly overlap (Table 3), but in some cases, their numbers can be diagnostic for helping to separate species. Species of the *C. abei* species group tend to have slightly more rakers, although the numbers are quite variable compared to those of species in the *C. fimbriatus* species group.

Pectoral-fin rays. Members of *C. abei* species group tend to have slightly fewer pectoral-fin rays (11–13, mainly 12, except for *C. breviradius* with mainly 12 or 13) than members of the *C. fimbriatus* species group (12–14, mainly 13 or 14). *Chaunax penicillatus* mainly has 12 or 13 fin rays (Table 2). We counted a single specimen of *Chaunacops coloratus* examined has 14 fin rays, but those from other localities have 11–12 (Ho and McGrouther, 2015).

Dermal spinules. The shapes and sizes of the dermal spinules differ among species in both *Chaunacops* and *Chaunax*. *Chaunacops coloratus* and *Cc. melanostomus* have very large, simple, widely-spaced spinules, each with a broad, rounded base, whereas the other species of *Chaunacops* and all *Chaunax* spp. have small, densely arranged spinules, either all simple or, uniquely in *Chaunax abei*, *C. endeavouri*, and *C. flavomaculatus*, a mixture of forked and simple spinules. Among these three species, the body spinules of *C. abei* and *C. flacomaculatus* are somewhat stouter than in the others. *Chaunax apus* has relatively densely arrayed, very slender and curved spinules (Fig. 6B), similar to those of *C. nudiventer*, *C. mulleus* and *C. russatus*. Most species in the *C. abei* species group have short, thin spinules with interspaces that are usually broader than the lengths of these spinules. Species of *C. fimbriatus* species group and *C. penicillatus* have rather stout spinules with interspaces that vary in breadth between species.

Coloration. Coloration is an important character for distinguishing chaunacids, especially members of the *C. fimbriatus* group. *Chaunacops coloratus* has a uniformly red coloration (bluish in small individuals) that turns creamy-white when preserved, and *Cc. melanostomus* has a dark brown to black body with a light brown tail, which is unique in the family. All *Chaunax* species have a pink, red or orange-red background color, usually marked with differently colored spots, patches or vermiculate patterns. Species of the *C. abei* species group are usually covered with more or less rounded green spots that turn brown or dark gray when preserved, although some, like *C. apus*, may be uniformly pink or red.

Species of the *C. fimbriatus* species group usually have a deep-red background coloration with irregular yellow, orange-yellow or green patches or vermiculate patterns, although some, like *C. erythraeus*, are uniformly pink or red. Color patches or patterns that are yellow when fresh, such as those in *C. obscurus*, fade when preserved, while orange-red or green patches or patterns, like those of *C. fimbriatus* or *C. viridiretis*, turn dark brown when preserved.

Caruso *et al.* (2007) described the fresh coloration of *C. suttkusi* as having yellow or yellow-green spots that fade rapidly when preserved, a situation that has never to our knowledge been found in other congeners.

Acknowledgements

This study was conducted by the first author since 2005 with a large support from Dr. Kwang-Tsao Shao (retired from Academia Sinica, Taipei, Taiwan). Various help was provided by many individuals who are sincerely acknowledged. We thank J. Paxton, M. McGrouther, A. Hey, S. Reader, K. Graham (AMS); P.-L. Lin, S.-P. Huang (ASIZP); H. Endo, N. Nakayama (BSKU); W. N. Eschmeyer, T. Iwamoto, D. Catania, M. Hoang, J. Fang (CAS); P. R. Last, A. Graham, W. T. White, J. Pogonoski (CSIRO); N. Nakabo, Y. Kai (FAKU); M. A. Rogers (FMNH); K. Amaoka, K. Nakaya, M. Yabe, H. Imamura, K. Kawai, F. Tashiro (HUMZ); K. E. Hartel, A. Williston (MCZ); C. D. Roberts, A. L. Stewart, C. D. Struthers (NMNZ); K. Matsuura, G. Shinohara, M. Nakae, T.P. Satoh (NMST); R.-R. Chen

(NMMB-P); M. F. Gomon, D. J. Bray (NMV); T. Munroe (NOAA), B. C. Russell, H. K. Larson, M. P. Hammer (NTM); P. C. Heemstra, E. Heemstra, W. Holleman, E. Anderson, R. Bills (SAIAB); and L. Parenti, R. Vari, D. G. Johnson, V. G. Springer, J.-K. Song, J. T. Williams, S. Raredon, D. G. Smith, S. Smith, D. Pitassy, J. Clayton, K. Murphy, L. Palmer (USNM) for various help in curatorial assistance and valuable discussions. We thank Z.-H. Chang and T.-L. Lin for assistance in taking SEM photos. The manuscript was read and improved by M. J. Grygier (National Museum of Marine Biology & Aquarium) and B. Mundy (formerly NOAA).

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Appendix 1. Comparative materials examined in this study.

***Chaunax abei*: Holotype:** MNHN 1977-0048 (81.3), 34°28'58.8»N, 136°54'38.4»E, Toba, Mie, Japan, 180 m, coll. T. Abe. **Paratype:** MNHN B-3112 (1, 90.9), same as holotype. **Non-types. Taiwan: Audi, Taipei, NE Taiwan:** ASIZP 61410 (2, 43.0–57.0), 15 Nov. 2000. **Da-xi, Yilan, NE Taiwan:** ASIZP 58973 (1, 63.0), 9 Oct. 1997; ASIZP 59922 (1, 97.0), 20 Mar. 1998; ASIZP 60906 (1, 50.0), 12 Aug. 2001; ASIZP 63195 (1, 130), 24 Apr. 2004; ASIZP 64498 (2, 158–182), 13 Jun. 2004; ASIZP 64563 (1, 93.0), 7 Jul. 2004; ASIZP 65401 (1, 164), 13 Jul. 2004; ASIZP 66370 (1, 69.0), 14 Mar. 2005; ASIZP 70140 (1, 116), 10 May 2005; ASIZP 70159 (1, 137), 8 Mar. 2006; ASIZP 70205 (3, 121–165), 7 Dec. 2006; NMMB-P01764 (1, 76.3), 9 Sep. 2003; NTUM 04211 (2, 104.5–122.3), 30 Jan. 1972; NTUM 05360 (1, 89.0), 13 Dec. 1970. **Nan-fang-ao, Yilan, NE Taiwan:** ASIZP 63220 (1, 95.0), ASIZP 63221 (1, 80.0), ASIZP 63222 (1, 57.0), 9 May 2004; ASIZP 64508 (3, 65.0–118), 12 Jun. 2004; ASIZP 64526 (1, 32.0), 19 Apr. 2004; ASIZP 64608 (9, 26.0–90.0), 7 Jul. 2004; ASIZP 70157 (4, 57.0–125), 8 Mar. 2005; NMMB-P11257 (1, 64.5), 5 Jul. 2011; NMMB-P16312 (4, 78.2–119.8), 16 Jul. 2010; NMMB-P16335 (6, 63.3–119.1), 20 Jul. 2010; NMMB-P16385 (1, 153), 10 Jul. 2010; NMMB-P16398 (1, 162), 16 Jul. 2010; NMMB-P16429 (1, 169.2), 16 Jul. 2010; NMMB-P16452 (1, 138.7), 10 Jul. 2010. **Dong-gang, Pingtung, SW Taiwan:** ASIZP 53904 (1, 80.0), 8 Mar. 1968; ASIZP 55225 (2, 75.0–103), 27 Feb. 1979; ASIZP 56114 (1, 114), no date; ASIZP 62210 (1, 70.0), 1 Mar. 2001; ASIZP 63737 (1, 87.0), 27 Aug. 2003; ASIZP 65129 (1, 48.0), 10 Mar. 2005; ASIZP 66368 (1, 93.0), 18 Jun. 2005; ASIZP 71250 (3, 57.0–68.0), 16 Nov. 2008; ASIZP 71251 (2, 52.0–74.0), 11 Nov. 2008; NMMB-P01122 (2, 71.0–79.6), 1 Dec. 1983; NMMB-P01285 (1, 28.5), no date; NMMB-P02715 (2, 43.3–55.5), 28 May 2002; NMMB-P05735 (1, 74.1), 21 Jul. 1979; NMMB-P05754 (1, 81.8), 13 Mar. 2003; NMMB-P05785 (1, 44.8), 13 Mar. 2003; NMMB-P06811 (2, 83.0–90.81), 20 Mar. 2009; NMMB-P07917 (1, 65.6), 11 Jun. 2004; NMMB-P07918 (1, 59.4), 11 Jun. 2004; NMMB-P08012 (1, 81.0), 18 Jun. 2004; NMMB-P08113 (1, 83.0), 16 Apr. 2004; NMMB-P08149 (1, 69.7), 11 Jun. 2004; NMMB-P08233 (1, 106.6), 16 Jun. 2004; NMMB-P09305 (3, 29.4–89.10), 27 Aug. 2008; NMMB-P09373 (2, 31.8–33.7), 8 Aug. 2008; NMMB-P11252 (3, 32.8–94.4), 18 May. 2008; NMMB-P11253 (8, 30.6–72.92), 27 May. 2008; NMMB-P11587 (12, 56.3–141.6), 23 Jan. 1960; NMMB-P13873 (1, 154.7), 28 Jan. 2011; NMMB-P14353 (1, 86.4), 8 Nov. 2001; NMMB-P14535 (1, 30.6), 28 Feb. 2002; NMMB-P17516 (1, 47), 26 Aug. 2012; NMMB-P17782 (1, 152.3), 9 Aug. 2012; NMMB-P17871 (2, 73.6–120.2), 25 Jan. 2012; NMMB-P22024 (1, 56.6), 31 Dec. 2013; NMMB-P22025 (1, 44.8), 25 Feb. 2014; NMMB-P22032 (1, 79.5), 7 Nov. 2013; NMMB-P22036 (1, 87.3), 27 Aug. 2013; NMMB-P22381 (1, 91.5), 22 Apr. 2015; NMMB-P22386 (2, 76.4–82.3), 11 Jun. 2013; NMMB-P23452 (1, 80.8), 29 Mar. 2964; NTUM 04212 (1, 123), 7 Jun. 1978; NTUM 05392 (1, 111), 11 Mar. 1975. **Fang-shan, Pingtung, SW Taiwan:** NMMB-P08238 (1, 71.3), 17 Jun. 2004. **Taiwan:** NMMB-P08646 (2, 54.6–59.2) no date; NMMB-P11584 (7, 68.2–108.6), 30 May 1983; NMMB-P23375 (1, 104.2), no date; NMMB-P22376 (1, 89.9), no date. **Japan:** NSMT-P 7701–14 and NSMT-P 8487–8 (10, 35–131); NSMT-P 7864–75 (12, 43–77); NSMT-P 10894 (1, 124), off Choshi City; NSMT-P 10895 (1, 119), off Choshi City; NSMT-P 10896 (1, 120), off Choshi City; NSMT-P 10897 (1, 91), off Choshi City; NSMT-P 10898 (1, 82), off Choshi City; NSMT-P 45980 (3, 75.0–107), Suruga Bay, 180–450 m; NSMT-P 45981 (5, 28.0–87.0), Suruga Bay, 200–540 m; NSMT-P 45982 (1, 60.0), Suruga Bay, 285–480 m; NSMT-P 45983 (1, 29.0), Suruga Bay, 320–560 m; NSMT-P 46522 (5, 30.0–74.0), Suruga Bay, 282–500 m; NSMT-P 46554 (3, 30.0–93.0), Suruga Bay, 175–400 m; NSMT-P 46597 (1, 90.0), Suruga Bay, 150–300 m; NSMT-P 46610 (1, 30), Suruga Bay, 135–350 m; NSMT-P 47145 (1, 111), off Hitachi, 150 m; NSMT-P 48270 (1, 111), Suruga Bay, 240–410 m; NSMT-P 48311 (1, 153), Suruga Bay, 205–423 m; NSMT-P 57338 (1, 27.0), Tosa Bay, 295–304 m; NSMT-P 57346 (1, 28.0), Tosa Bay, 295–304 m; NSMT-P 57355 (1, 100), Tosa Bay, 239–258 m; NSMT-P 57571 (1, 138), Tosa Bay, 295–304 m; NSMT-P 59820 (3, 31.0–48.0), Mimase; NSMT-P 59913 (4, 62.0–92.0), Mimase; NSMT-P 59915 (2, 31.0–35.0), Mimase; NSMT-P 60153 (1, 132), Mimase; NSMT-P 60186 (1, 27.0), Tosa Bay, 316–319 m; NSMT-P 63283 (1, 103), East China Sea, 130 m; NSMT-P 65632 (2, 55.0–83.0), East China Sea, 305 m; NSMT-P 66385 (1, 37.0), Suruga Bay, 145–160 m; NSMT-P 68085 (1, 120), Suruga Bay; NSMT-P 68086 (1, 85.0), Suruga Bay; NSMT-P 68810 (2, 30.0–34.0), Tosa Bay, 300 m; NSMT-P 73539 (1, 101), Onahama Bay; NSMT-P 73740 (3, 90.0–96.0), Onahama Bay; NSMT-P 73966 (1, 90.0), Onahama Bay; NSMT-P 74192 (1, 89.0); NSMT-P 75995 (1, 36.0), Mimase; NSMT-P 75998 (1, 119), Mimase; NSMT-P 76194 (1, 187), Mimase; NSMT-P 78200 (2, 36.0–40.0), Suruga Bay, 300–400 m; NSMT-P 79329 (1, 125), Pacific coast off Ibaraki Prefecture, 149–151 m; NSMT-P 92772 (1, 115), Mimase; USNM 50801 (9), Honshu, 115–183 m. 1 May 1900; USNM 148530 (2), Honshu, 128 m, 26 Oct. 1906; USNM 148531 (4), Honshu, 161 m, 26 Oct. 1906; USNM 148738 (1), Honshu, 161 m, 26 Oct. 1906; USNM 149585 (3), Honshu, 128 m, 26 Oct. 1906.

***Chaunax apus* Lloyd, 1909: Holotype:** ZSI 2404/1 (83.0 SL), Bay of Bengal, off Akyab coast, Myanmar, Investigator station 379, depth 530 fathoms [969 m]). **Non-types. Da-xi, Yilan, NE Taiwan:** ASIZP 61271 (1, 104.0), 14 Sep. 2001. ASIZP 63219 (1, 147.0), 300–400 m, 24 Apr. 2004. **East Taiwan:** ASIZP 69696 (2, 128.0–154.0), 502–613 m, 26 Aug. 2006. **Nan-fang-ao, Yi-lan, NE Taiwan:** AMS I.44817-001 (ex. ASIZP 63185, 1:168), 9 May 2004; ASIZP 63184 (1, 198.0), 280–310 m, 9 May 2004. ASIZP 63186 (1, 163.0), 280–310 m, 9 May 2004. ASIZP 63187 (no data), 280–310 m, 9 May 2004. ASIZP 64480 (1, 19.0), 22 May 2004. ASIZP 64493 (1, 226.0), 28 May 2004. ASIZP 64501 (2, 237.0–260.0), 13 Jun. 2004. ASIZP 65464 (1, 213.0), 7 Jul. 2004. NMMB-P23377 (1, 165.6), 19 Jun. 2004; USNM 359936 (ex. ASIZP 64564, 2, 128–154). **South China Sea:** ASIZP 66865 (2, 43.0–48.0), 514 m, 17 Aug. 2005. ASIZP 66880 (2, 30.0–47.0), 506 m, 17 Aug. 2005; ASIZP 66885 (1, 44.0), 513 m, 17 Aug. 2005; ASIZP 66935 (1, 213), 516 m, 17 Aug. 2005; NTUM 10483 (1, 70.4), 653–700 m, 12 Jan. 2014. **Japan:** BSKU 32500 (1, 131), Okinawa trough, 400–420 m. **Philippines:** ASIZP 67853 (1, 141), 422–431 m, 20 May 2007; ASIZP 68228 (1, 115), 418–456 m, 2 Jun. 2007; CAS 88651 (5, 35.0–130), Luzon, 435–451 m, 27 Sep. 1995; CAS 88681 (1, 115), Luzon, 363–385 m, 23 Sep. 1995; USNM 168254 (1, 141), Luzon, 454 m, 18 Jul. 1908; USNM 168525 (1, 98), Luzon, 518 m, 2 Feb. 1908; USNM 168872 (1, 115), Mindanao, 1280 m, 8 Aug. 1909; USNM 168885 (1, 141), Mindanao, 420 m, 5 Aug. 1909.

***Chaunax breviradius* Le Danois, 1978: Holotype.** MNHN 1977-0762 (111), 14°01'01.2"N, 120°20'00.0"E, off southwest Luzon, the Philippines, 182–200 m, 19 Mar. 1976. **Paratype.** All from the Philippines. MNHN 1977-0763 (1, 91) and MNHN 1977-0764 (1, 73), 14°02'N, 120°18'E, off southwest Luzon, 180–194 m, 19 Mar. 1976; MNHN 1977-0765 (3, 30–40), 13°49'01.2"N, 120°02'00.0"E, off southwest Luzon, 415–510 m, 25 Mar. 1976; MNHN 1977-1100 (1, 28), 14°N, 120°18'E, off southwest Luzon, 189–209 m, 22 Mar. 1976; MNHN 1977-1101 (1, 31), 14°N, 120°19.02'E, off southwest Luzon, 188–192 m, 22 Mar. 1976. **Non-types. Dong-gang, Pingtung, SW Taiwan:** ASIZP 65127 (1, 110), 10 Mar. 2005; ASIZP 65128 (1, 112), 10 Mar. 2005; ASIZP 70154 (1, 76.0), 10 Mar. 2005; NMMB-P01286 (1, 67.9); NMMB-P05736 (4, 113.9–144.4), 29 Mar. 1964; NMMB-P08364 (1, 63.3), 18 Mar. 2005; NMMB-P11254 (1, 71.1), 10 Dec. 2010; NMMB-P11255 (2, 62.8–73.05), 30 Oct. 2010; NMMB-P11256 (1, 69.4), 15 Dec. 2009; NMMB-P11578 (1, 46.0), 29 Mar. 1964; NMMB-P12251 (1, 83.9), 15 Dec. 2007; NMMB-P15703 (1, 83.5), 8 Nov. 2009; NMMB-P19265 (1, 66.0), 10 Nov. 2011; NMMB-P19323 (1, 60.6), 3 Nov. 2011; NMMB-P22029 (2, 73.2–97.3), 20 Feb. 2014; NMMB-P22374 (1, 65.8), 5 Jan. 2015; NMMB-P22375 (3, 56.7–69.8), 4 Dec. 2014; NMMB-P22378 (1, 51.5), 29 Oct. 2014; NMMB-P22388 (2, 83.8–87.6), 4 Jun. 2015; NMMB-P23383 (1, 102), 6 Oct. 2015; NMMB-P23449 (1, 126.8), 16 Jun. 2004; NMMB-P23453 (1, 85.2), 11 Jun. 2004. **Vietnam:** ASIZP uncat. (1, 116); ASIZP uncat. (1, 87.0); ASIZP uncat. (1, 60.0); ASIZP uncat. (1, 117); ASIZP uncat. (1, 78.0); ASIZP uncat. (1, 77.0); ASIZP uncat. (7, 61.0–82.0); ASIZP uncat. (4, 75.0–104). **Nha Trang, Vietnam:** NMMB-P13265 (1, 74.0), 16 Apr. 2009; NMMB-P13266 (1, 73.9), 16 Apr. 2009; NMMB-P13268 (1, 85.0), 18 Apr. 2009; NMMB-P13269 (1, 113.4), 18 Apr. 2009; NMMB-P13270 (7, 59.7–76.35), 18 Apr. 2009; NMMB-P13271 (1, 60.9), 15 Apr. 2009; NMMB-P13272 (4, 72.9–101.5), 18 Apr. 2009; NMMB-P13276 (1, 116.7), 18 Apr. 2009. **Philippines:** MNHN 2005-0482 (2, 97–110.2), 1 Jun. 1985; MNHN 2005-0500 (5, 30.7–61.9), 1 Jun. 1985; MNHN 2005-0555 (1, 47.3), 1 Jun. 1985; MNHN 2005-0940 (2, 110.1–113), 5 Jun. 1985; MNHN 2005-0949 (1, 87.9), 1 Jun. 1985; MNHN 2005-0986 (2, 97.7–137.6), 2 Jun. 1985; MNHN 2005-0997 (2, 31.3–91.8), 1 Jun. 1985; MNHN 2005-1282 (1, 92.9), 188–195 m, 2 Jun. 1985; MNHN 2005-1313 (2, 49.1–135.1), 2 Jun. 1985; MNHN 2005-1355 (6, 68.7–103.1mm), 178–185 m, 1 Jun. 1985. **South China Sea:** BSKU 17608 (1, 137), 265–286 m; BSKU 17178–208 (31, 31.0–80.0), 135–137 m, 10–11 Jul. 1972; NSMT-P 78823 (1, 200), Tonga Seamount Ridge, 449–460 m. **Indonesia:** HUMZ 191210 (1 :127), 180–210 m.

***Chaunax fimbriatus*: Non-types. Daxi, Yilan, Taiwan:** AMS 44816-003 (ASIZP 63237ex, 2, 94.0–141), 21 Mar. 2004; ASIZP 58060 (1, 142), 27 Mar. 1992; ASIZP 61489 (1, 188), 100 m, 17 Feb. 2000; ASIZP 63068 (1, 142), 210–340 m, 2 Apr. 2004; ASIZP 63237 (1, 90.0), 21 Mar. 2004; ASIZP 63257 (2, 185–274), 21 Mar. 2004; ASIZP 64492 (1, 176), 28 May 2004; ASIZP 64500 (2, 163–183), 13 Jun. 2004; ASIZP 64504 (3, 152–210), 19 Jun. 2004; ASIZP 64509 (2, 120–143), 12 Jun. 2004; ASIZP 64511 (3, 105–227), 12 Jun. 2004; ASIZP 64568 (6, 128–234), 7 Jul. 2004; ASIZP 64570 (2, 147–158), 7 Jul. 2004; ASIZP 64575 (3, 152–192), 13 Jul. 2004; ASIZP 65413 (1, 140), 7 Jul. 2004; ASIZP 65417 (1, 73.0), 24 Sep. 2004; ASIZP65488 (1, 124), 28 Mar. 2005; ASIZP 70138 (1, 147), 10 May 2005; ASIZP 70141 (1, 100), 10 May 2005; ASIZP 70142 (2, 152–190), 10 May 2005; ASIZP 70143 (3, 128–160), 10 May 2005; NMMB-P10852 (1, 240), 30 Jun. 2009; NMMB-P10967 (1), 6 Sep. 2010; NMMB-P13862 (1), 8 Dec. 2010. **Audi, Yilan, Taiwan:** ASIZP 61409 (1, 101), 200 m, 15 Nov. 2000. **Nan-fano-ao, Yilan, Taiwan:** ASIZP 65458 (1, 114), 11 Mar. 2005; ASIZP 65459 (1, 124), 11 Mar. 2005; ASIZP 65460 (1, 117), 11 Mar. 2005.

Cheng-gong, Taitung: FRIP 21703 (1, 193), Cheng-gong, Taitung, 9 May 2006. **Dong-gang, Pingtung, Taiwan:** NMMB-P02890 (1), 100 m, 8 Nov. 2001; NMMB-P16430 (1, 60.1), 28 Jan. 2012; NMMB-P22026 (1, 49.0), no date; NMMB-P26440 (1, 34.0), 20 Jun. 2017. **Japan:** NSMT-P 48296 (1, 30), Pacific coast of Ibaraki Prefecture, 412–421 m; NSMT-P 57309 (1, 31), Tosa bay. 526–539 m.

***Chaunax umbrinus*: Holotype.** USNM 51547 (holotype, juvenile, in poor condition). **Non-types. Hawaii Islands:** ASIZP 70334 (fromly BPBM 29274, 1, 248); BPBM 25094 (1, 101); BPBM 17344 (1, 286); BPBM 24205 (1, 66). **Emperor Seamount Chain:** FAKU 72571 (2, 180–200); FAKU 72572 (1, 172); NSMT-P 72898 (2, 233–241); NSMT-P 72863 (2, 190–211); NMMB-P23459 (1, 84.7), 340 m, 13 Apr. 2013; NMMB-P23460 (1, 216), 415 m, 17 May 2013; NMMB-P23461 (1, 81.9), 450 m, 31 Aug. 2013; NMMB-P23462 (1, 180), 349 m, 2 Oct. 2013.

***Chaunax penicillatus*: Holotype.** AMS E.5488 (83.0), southwest of Cape Everard, Victoria, Australia, depth 293–366 m. Holotype of *Chaunax tosaensis*: BSKU 36101 (275), Mimase fish market, Tosa Bay, ca. 200–300 m, 27 Nov. 1981. **Paratype.** AMS I.13605 (55.0), Australia. Plus several paratypes of *Chaunax tosaensis*. **Non-types. Daxi, Yilan, Taiwan:** ASIZP 58059 (1, 126), 19 Jan. 1990; ASIZP 63067 (1, 66.0), 210–340 m, 2 Apr. 2004; ASIZP 65412 (1, 164), 7 Jul. 2004; ASIZP 70139 (1, 71.0), 10 May 2005; NMMB-P23372 (2), 19 Jun. 2004. **Nan-fang-ao, Yilan, Taiwan:** ASIZP 63178 (1, 248), 9 May 2004; ASIZP 63179 (1, 208), 9 May 2004; ASIZP 63180 (1, 176), 9 May 2004; ASIZP 63181 (1, 182), 9 May 2004; ASIZP 63182 (1, 168), 9 May 2004; ASIZP 63183 (1, 152), 9 May 2004; ASIZP 64481 (2, 182–200), 22 May 2004; ASIZP 64502 (1, 140), 19 Jun. 2004; ASIZP 64525 (3, 38.0–50.0), 14 May 2004; ASIZP 64565 (1, 170), 7 Jul. 2004; ASIZP 64591 (2, 38.0–41.0), 28 Jun. 2004; ASIZP 64598 (3, 58.0–75.0), 7 Jul. 2004; ASIZP 65399 (1, 215), 13 Jun. 2004; ASIZP 65412 (1, 164), 7 Jul. 2004; ASIZP 70162 (7, 39.0–114), 8 Mar. 2005; ASIZP 64608 (1, 43.0), 7 Jul. 2004; NMMB-P10550 (1, 128), 16 Jul. 2010; NMMB-P15394 (4, 62.6–135), no date; NMMB-P16380 (1, 90.4), 16 Jul. 2010. **Dong-gang, Pingtung, Taiwan:** NMMB-P23365 (1, 39.0), 16 Mar. 2016; NMMB-P23379 (1, 93.5), 23 Oct. 2015; NMMB-P23585 (1, 70.0), 9 Aug. 2016; NMMB-P24225 (1), 20 Oct. 2003; NMMB-P30770 (1, 36.8), 8 Dec. 2018; NMMB-P31025 (1, 85.0), 12 Aug. 2018. **Taiwan:** NMMB-P11580 (1, 65), 30 May 1983; NMMB-P23372 (1, 159), 19 Jun. 2004; NMMB-P23372 (2, 158–173), 19 Jun. 2004. **South China Sea:** FRIP 3056 (1, 83.0). **Japan:** NSMT-P 30508 (2, 148–188), Mimase, Kochi; NSMT-P 46858 (1, 157), 325–600 m. **Philippines:** ASIZP 67862 (1, 34.0), 422–431 m; USNM 168253 (1, 210), Luzon, 340 m; CAS 88645 (2), 382–376 m; CAS 237348 (1, 32.8), 435–451 m, 13 Oct. 1995; MNHN 2005-1009 (1, 70.0 mm), 14°54'N, 121°3'E, 3 Jun. 1985. **Malasia:** USNM 168907 (1, 65.7), Sabah, 29 Sep. 1909. **New Caledonia:** MNHN 2002-0239 (1, 72.0 mm), 18°57'S, 163°12'E, 485m, 17 Sep. 1985; MNHN 2002-1281 (1, 235.0 mm), 24°55'1.2''S, 168°22'1.2''E, 500–510 m, 3 Sep. 1985; MNHN 2002-1649 (1, 166.0 mm), 24°55'1.2''S, 168°21'0''E, 500–610 m, 28 Oct. 1986; MNHN 2003-1507 (1, 201 mm), 24°54'0''S, 168°21'0''E, 540 m, 11 Aug. 1999; NTUM 10489 (1, 55.3 mm), 22 Oct. 2008. **Papua New Guinea:** NTUM 10391 (1, 32.5 mm), 21 Dec. 2012; NTUN 10396 (1, 32.6 mm), 19 Oct. 2008. **French Polynesia:** MNHN 2000-4573 (1, 125.6 mm), 7°55'58.8''S, 140°43'1.2''E, 420–430 m, 4 Sep. 1997; MNHN 2006-1462 (1, 94.7 mm), 24°54'S, 168°21'E, 540 m, 11 Aug. 1999. SIO 93-48 (1, 167); CAS 216055 (1, 125).

***Chaunax endeavouri*: Australia:** AMS E.5698 (1, 122.6), 41°07'S, 148°17'E, Bay of Fires, 100 m, 7 Nov. 1914; AMS E.5710 (1, 95.0), 37°48'S, 149°16'E, S of Cape Everard, 146 m, 20 Oct. 1914; AMS I.13016 (1, 88.3), 37°50'S, 149°16'E, S of Cape Everard, 164–274 m, 9 Apr. 1914; AMS I.15551-011 (1, 27.9), 26°30'S, 153°30'E, off Brisbane, 46–366 m, 1968; AMS I.15976-012 (3, 103.7–113.2), 32°50'S, 152°43'E, 55 miles E of Newcastle, 585 m, 7 May 1971; AMS I.16574-004 (2, 62.7–76.2), 33°S, 152°E, off Sydney, 274 m, Aug. 1972; AMS I.19082-001 (1, 126.1), 31°48'S, 153°12'E, NE of Crowdy Head, 366–376 m, 11 Sep. 1975; AMS I.19375 (1, 77.8), 35°30'S, 150°45'E, E of Ulladulla, 329 m, 10 Nov. 1976; AMS I.23900-001 (2, 130–152), 29°53'S, 153°41'E, E of Wooli, 400 m, 19 Apr. 1978; AMS I.25800-024 (1, 96.9), 18°00'S, 147°02'E, NE of Hinchinbrook Island, in Townsville Trough, 220–220 m, 8 Jan. 1986; AMS I.25805-007 (1, 88.8), 18°00'S, 147°04'E, N of Townsville, 260–264 m, 10 Jan. 1986; AMS I.25808-008 (3, 125.6–128.9), 17°59'S, 147°06'E, NE of Hinchinbrook Island, in Townsville Trough, 300–306 m, 11 Jan. 1986; AMS I.25809-006 (2, 104–123.5), 17°59'S, 147°06'E, NE of Hinchinbrook Island, in Townsville Trough, 300 m, 11 Jan. 1986; AMS I.26443-002 (3, 129.5–150), 35°29'S, 150°46'E, E of Brush Island, 238–283 m, 4 Dec. 1985; AMS I.29734-006 (1, 122.5), 28°02'S, 153°53'E, NE of Coolangatta, 229 m, 16 Aug. 1978; AMS I.37601-005 (1, 48.2), 22°00'S, 153°01'E, E of Swains Reef, 180 m, 11 Sep. 1995; AMS I.37972-003 (1, 192), 33°35'S, 151°58'E, off Broken Bay, 324–329 m, 26 Sep. 1996; AMS I.38088-015 (2, 95.2–103.1), 21°50'59''S, 153°01'23''E, E of Swain's Reef, 199 m, 10 Sep. 1995; AMS I.38089-003 (2, 45.5–49.2), 22°11'33''S, 153°11'43''E, E of Swain's Reef, 181 m, 9 Sep. 1995; AMS I.40453-009 (1, 37.2), 29°18'S, 153°48'E,

E of Yamba, 174–210 m, 21 Jul. 1999; AMS I.40492-006 (1, 70.5), 22°25'S, 153°20'23"E, E of Swains Reef, 181 m, 9 Sep. 1995; AMS I.43888-001 (1, 152.7), 35°21'S, 150°29'E, Ulladulla offshore, Jan. 1993; AMS I.45375-003 (1, 155), 32°05'S, 153°05'E, E of Crowdy Head, 357–366 m, 27 Jul. 1981; AMS IA.5445 (1, 107), 31°51'S, 152°45'E, off Crowdy Head, 55 m, 2 Sep. 1931; AMS IA.5805 (1, 102.9) and AMS IA.5806 (1, 72.6), 33°50'S, 151°20'E, E of Sydney, 201 m, 1933; AMS IB. 8270 (1, 132), 34°S, 151°E, 20 miles off Wollongong, 274 m, 30 Jul. 1968; AMS IB.4378 (1, 95.3), 32°55'S, 151°55'E, E of Newcastle, 183–293 m, 2 Jul. 1959; AMS IB.4594 (1, 43.1), 33°50'S, 151°30'E, off Sydney, 25 miles E of Manly, 219–229 m, 28 Jan. 1960.

Chaunax flammeus: MNHN 1977-0023; MNHN 1977-0047 (holotype).

Chaunax latipunctatus: listed in Ho & Shao (2010).

Chaunax suttkusi: USNM 157968 (1, 77.9 mm), 24°46'48"N, 80°10'12"W, Mexico, 457–475 m, 18 Jul. 1955. USNM 261610 (1, 112.4 mm), 27°25'12"N, 93°40'12"W, Florida, 732 m, 31 Jan. 1964. MNHN 1977-0039 (1, 136.2 mm), 39°31'1.2"N, 31°4'58.8"W, Portugal, 500–800 m, 25 Oct. 1971. MNHN 1988-0397 (2, 88.3–127 mm), 16°12'0"N, 16°49'58.8"W, Mauritania, 40 m, Mar. 1982. MNHN 1998-1288 (3, 194–245 mm), 47°0'0"N, 4°0'0"W, France, 1988. MNHN 2000-5362 (6, 41.5–114.4 mm), 21°28'1.2"N, 17°40'1.2"W, Mauritania, 600–605 m, 1973. MNHN 2001-0145 (5, 41.0–67.1 mm), 7°18'0"S, 12°4'58.8"E, Angola, 29 Aug. 2000. Plus about 150 lots, including paratype series, deposited in FMNH, USNM, CAS and MCZ.

Chaunacops coloratus: MCZ 28734 (1, 190), holotype.

Other specimens examined were listed in Ho & Shao (2010); Ho *et al.* (2013); Ho & Last (2013); Ho & McGrouther (2015); Ho *et al.* (2015); Ho *et al.* (2016); and Ho & Ma (2016).