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Revision of southern African species of the anglerfish genus *Chaunax* (Lophiiformes: Chaunacidae), with descriptions of three new species

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Abstract

Species of the anglerfish genus *Chaunax* occurring off southern Africa are reviewed and nine species are recognized: *C. africanus*, *C. apus*, *C. flammeus*, *C. penicillatus*, *C. russatus*, *C. suttkusi*, and three newly described species. *Chaunax atimovatae* **sp. nov.** is distinguished by having numerous tiny melanophores on the skin and a mixture of bifurcate and simple spinules on its dorsal surface, scattered rounded green spots circled by yellow on its dorsal surface, 9 or 10 rakers on the second gill arch, and 2 neuromasts in the upper preopercular, 11–14 in the pectoral, 31–37 in the lateral-line proper. *Chaunax heemstraorum* **sp. nov.** is distinguished by a combination of all dermal spinules simple, large green spots on the dorsal surface, 10–12 rakers on the second gill arch; and 3 neuromasts in the upper preopercular, 13–18 in the pectoral, 37–42 in the lateral-line proper, and usually 5 on the caudal-fin base. *Chaunax hollemani* **sp. nov.** is distinguished by cirri on top of the head, head width 16.0–18.5% SL, pre-preopercle length 26.8–28.5% SL, 9 rakers on the second gill arch, and 2 neuromasts in the upper preopercular, 11–14 in the pectoral, and 33–38 in the lateral-line proper. A key to species found in the study region is provided.

Key words: Pisces, taxonomy, anglerfish, Chaunacidae, *Chaunax*, new species

Introduction

The chaunacid anglerfish genus *Chaunax* is a group of medium-sized demersal fishes inhabiting sandy to rocky bottoms in the warm waters of all major oceans and the Mediterranean Sea. The genus currently comprises 22 valid species, of which 10 species were described recently (Ho & Shao, 2010, Ho *et al.*, 2013, Ho & Last, 2013, Ho *et al.*, 2015, Ho *et al.*, 2016).

During visits to several major fish collections around the world, including the South Africa Institute of Aquatic Biodiversity (SAIAB), Muséum national d'Histoire naturelle (MNHN), the California Academy of Sciences (CAS) and the National Museum of Natural History, Smithsonian Institution (USNM), the authors examined all *Chaunax* specimens collected from around southern Africa. In total nine species were recognized, including four undescribed species. One has been described recently as *Chaunax africanus* Ho & Last, 2013. In this study, we formally describe the other three new species and provide brief synopses for the six valid nominal species. A revised key to all species found in southern Africa is also provided.

Methods and materials

Standard length (SL), measured from the symphysis of upper jaw to the end of the hypural plate, is used throughout. Methods for taking measurements and counts follow Ho *et al.* (2013) and Ho & Last (2013). Abbreviations of institutions follow Fricke & Eschmeyer (2016).

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Taxonomy

Family Chaunacidae

Chaunax Lowe, 1846

***Chaunax atimovatae* sp. nov.**
New English name: Southern frogmouth
Figures 1A–C, 2; Tables 1–3.

Holotype. SAIAB 81724 (149), 26°10.2'S, 33°17.6'E, off Mozambique, 505–509 m, 30 Sep. 2007.

Paratypes. 13 specimens, 104–211 mm SL. AMS I.28137-006 (2, 108–111), 22°19' 06"S, 43°06' 06"E, NW Tulear, Madagascar, 330–335 m, 2 Dec. 1988. MNHN 1977-0030 (1, 119), 22°17'10"S, 43°4'1"E, Madagascar, 450 m, 29 Nov. 1973. MNHN 1977-0036 (1, 105), 12°40'59"S, 48°16'1"E, Madagascar, 314 m, Apr. 1971. SAIAB 3306 (1, 118), KwaZulu-Natal, South Africa, 238 m, 10 Jan. 1973. SAIAB 11484 (1, 139), off Natal, KwaZulu-Natal, South Africa, 146 m, 11 Jan. 1973. SAIAB 34164 (1, 211), Maputo, southern Mozambique, Dec. 1987. SAIAB 74601 (3, 104–131), 18°2.1'S, 37°37.2'E, Beira, northern Mozambique, 162–200 m, 12 Aug. 2002. SAIAB 81904 (1, 106), 25°5.5'S, 35°18.4'E, off Mozambique, 347–353 m, 7 Oct. 2007. USNM 307534 (2, 122–162), 22°19'51"S, 43°06'06"E, northern Tulear, Madagascar, 330–335 m, Vityaz, cr. 17, st. 2644, 2 Dec. 1988.

Non-types (*indicates specimens with meristic data taken). **Madagascar**: MNHN 1977-0023 (2, 69.6–82.1), 25°28'59"S, 46°46'1"E, 350–360 m, 30 May 1973. MNHN 1977-0027 (1, 72.8), 23°36'0"S, 43°31'5"E, 395–410 m, 26 Feb. 1973. MNHN 1977-0029 (3, 43.1–111), 22°18'0"S, 43°4'8"E, 400 m, 27 Nov. 1973. MNHN 1977-0033 (2, 35.9–67.8), 18°55'01"S, 43°55'59"E, 250 m, 24 Nov. 1973. MNHN 1994-0312 (1, 107), 20°57' 0"S, 55°13'59"E, Réunion Island, 450–580 m, 1 Sep. 1982. MNHN 1994-0314 (1, 76.4), 20°49' 59"S, 55°34'59"E, Réunion Island, 605–620 m, 4 Sep. 1982. MNHN 1994-0315 (2, 67.0–131), 20°57'0"S, 55°13'59"E, 300–410 m, 9 Sep. 1982. MNHN 2013-1225 (2, 56.7–83.8), 22°14'6"S, 43°4'5"E, 470–475 m, 2 Dec. 1973. MNHN 2014-1107 (1, 123), 15° 35'8.4"S, 45°41'55.8"E, 197–217 m, 10 Jul. 2009. MNHN 2014-1169 (5, 39.1–71.1), 15°34'45"S, 45°42'30"E, 227–283 m, 10 Jul. 2009. MNHN 2014-1211 (1, 87.6), 15°33'37.2"S, 45°42'5.4"E, 350–580 m, 11 Jul. 2009. MNHN 2014-1264 (2, 31.3–35.2), 14°29'3"S, 47°26'50.4"E, 257–251 m, 6 Jul. 2009. MNHN 2014-1602 (1, 68.5), MNHN 2014-1628 (1, 37.7), 12°30'16.8"S, 48°23'12"E, 301–298 m, 27 Jun. 2009. MNHN 2014-1664 (5, 68.8–101), 15° 34'12.612"S, 45°43'10.812"E, 287–450 m, 10 Jul. 2009. MNHN 2014-1699 (1, 39.5), 14°51'56.4"S, 46°56'34.2"E, 236–297 m, 13 Jul. 2009. MNHN 2014-1719 (1, 95.5), 13°23'31.2"S, 47°58'4.2"E, 3 Jul. 2009. MNHN 2014-1756 (2, 52.6–79.7), 14°29'39.6"S, 47°26'27"E, 379–332 m, 14 Jul. 2009. MNHN 2014-1764 (1, 87.8), 12°32'7.8"S, 48°12'27"E, 485–468 m, 27 Jun. 2009. MNHN 2014-1781 (4, 38.7–105), MNHN 2014-1815 (1, 95.4), MNHN 2014-1838 (2, 33.5–60.1), MNHN 2014-1840 (1, 40.9), 14°49'53.4"S, 46°59'9"E, 446–340 m, 7 Jul. 2009. MNHN 2014-1846 (1, 110), 12°46'18"S, 48°12'48.6"E, 355–380 m, 2 Jul. 2009. MNHN 2014-1855 (3, 31.3–32.7), 14°30'10.8"S, 47°26'35.4"E, 325–274 m, 6 Jul. 2009. MNHN 2014-1878 (2, 22.0–22.9), 14°48'12"S, 46°59'9"E, 620–637 m, 7 Jul. 2009. MNHN 2014-1900 (1, 69.3), 15°25'4.8"S, 46°0'16.2"E, 313–274 m, 12 Jul. 2009. MNHN 2014-1962 (2, 38.0–40.0), 12°31'18.6"S, 48°19'33"E, 346–376 m, 27 Jun. 2009. MNHN 2014-2169 (1, 79.2), 12°43'15.6"S, 48°13'1.8"E, 442–491 m, 29 Jun. 2009. SAIAB 189524 (3, 31.5–45.2), 25°28'S, 44°25'E, Sud-Est Pointe Barrow, 203–210 m, 10 May 2010, coll. M. Lee & S. Ribes. SAIAB 189525 (1, 31.5), 25°03'S, 43°59'E, Sud-Ouest Pointe Barrow, 300–309 m, 11 May 2010, coll. M. Lee & S. Ribes. *USNM 307546 (2, 60.0–100), 22°19'30"S, 43°03'12"E, northern Tulear, 450–500 m, Vityaz, Cr. 17, st. 2645, 2 Dec. 1988. **South Africa**: *SAIAB 4709 (1, 76.0), 34°02'S, 25°42'E, Algoa Bay, Eastern Cape, 27 May 1970. *SAIAB 4710 (1, 150), 32°09'S, 29°00'E, Xora River mouth, Eastern Cape, Aug. 1947. *SAIAB 16533 (1, 77.0), 29°13'S, 31°29'E, Tugela River mouth, KwaZulu-Natal, 1920. *SAIAB 49355 (1, 84.0), 35°1.3'S, 19°44'E, off west coast, 145 m, 5 Jul. 1986. **Mozambique**: *SAIAB 28513 (1 of 3, 104), S of Maputo, Dec. 1987. **No data**: *SAIAB 4713 (1 of 5, 125).

Diagnosis. A species of the *Chaunax abei* species group with the following combination of characters: mixture of bifurcate and simple spinules on dorsal surface; when fresh, dorsal surface with green spots surrounded by yellow, mostly inter-connected; when preserved, dorsal surface with brown spots loosely arranged; 9 or 10 gill rakers on second gill arch; and usually 12 or 13 neuromasts in pectoral series and 34–36 in lateral-line proper.

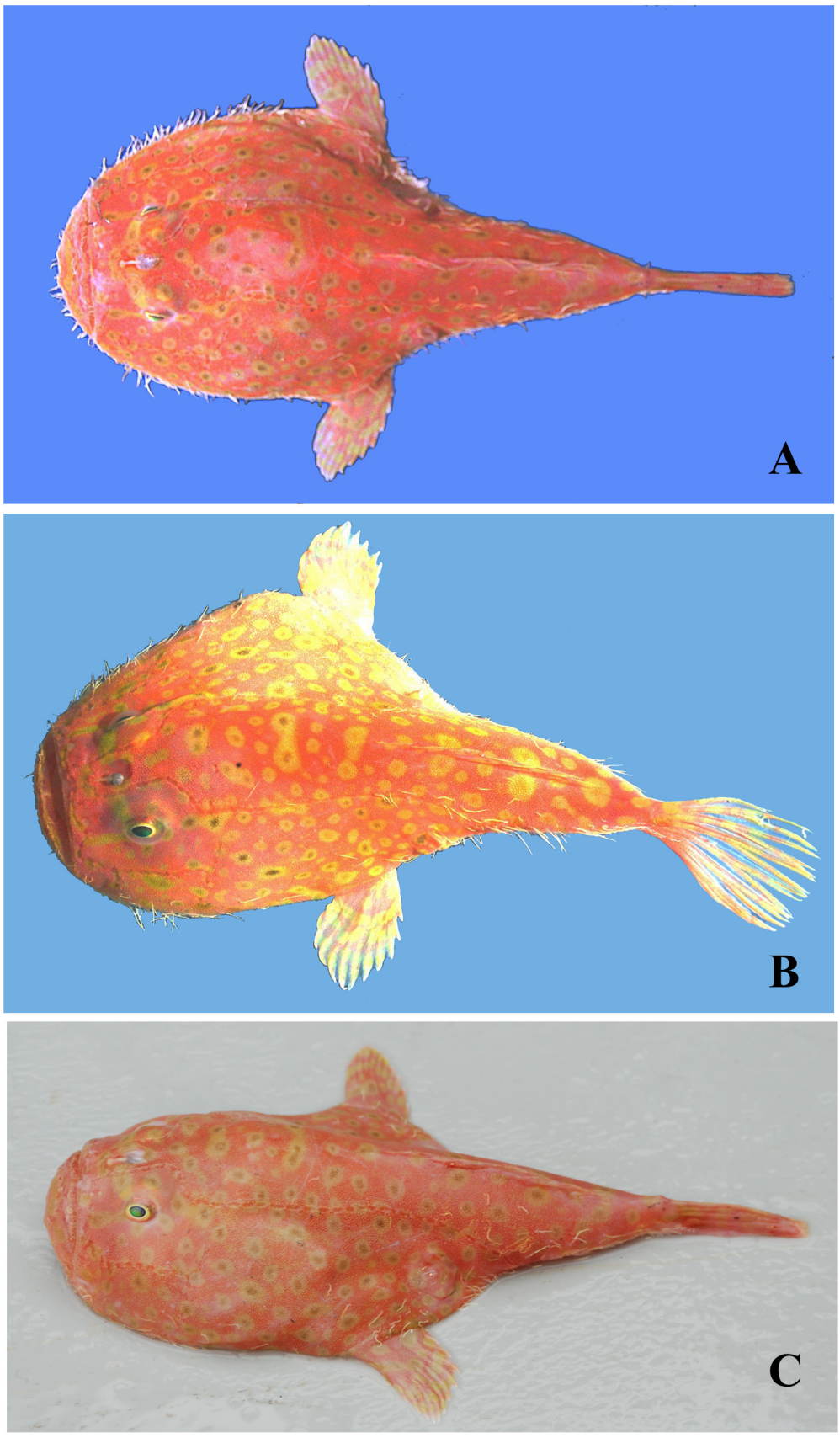

FIGURE 1. *Chaunax atimovatae* **sp. nov.** A. SAIAB 81724, holotype, 149 mm SL. B. SAIAB 81904, paratype, 106 mm SL. C. Uncatalogued specimen, ca. 21 cm in total, off Maputo, southern Mozambique.

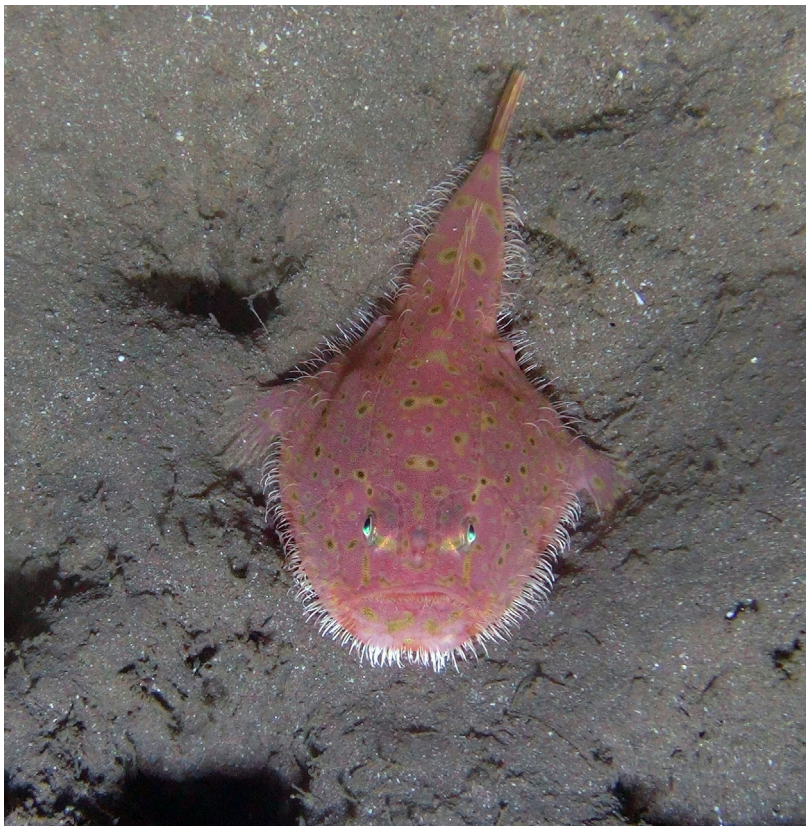

FIGURE 2. Underwater photograph of *Chaunax atimovatae* sp. nov., 29°40.616'S, 31°31.223'E, 220 m.

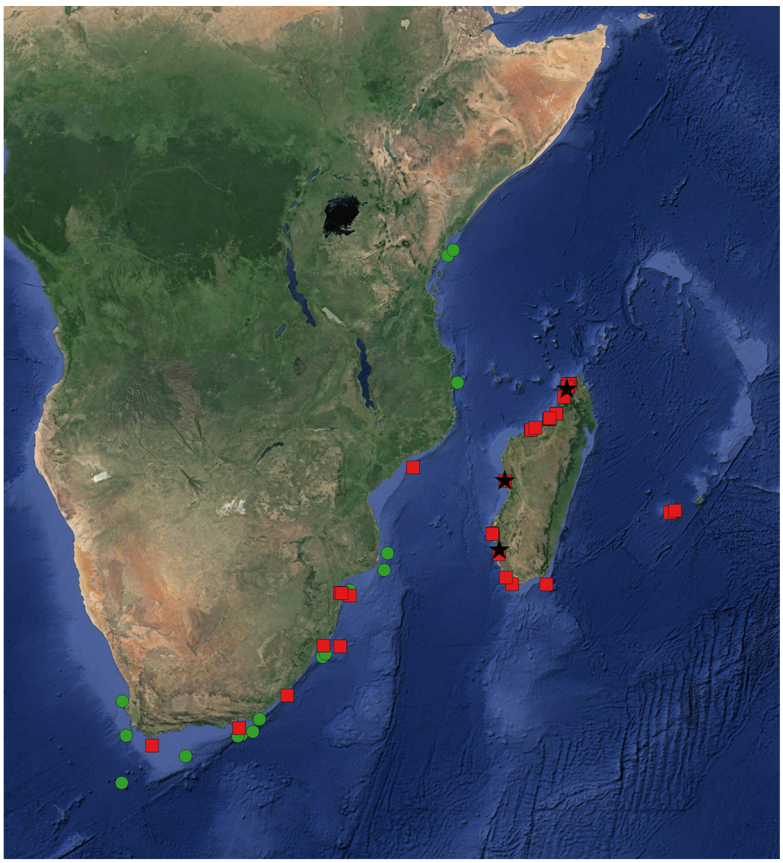

FIGURE 3. Distribution map of *Chaunax atimovatae* **sp. nov.** (red squares),*Chaunax heemstraorum* **sp. nov.** (green circles) and *Chaunax hollemani* **sp. nov.** (black star).

TABLE 1. Morphometric data of three new *Chaunax* species described in present study. H=holotype.

	Chaunax atimovatae **sp. nov.**			*Chaunex heemstraorum* **sp. nov.**			*Chaunax hollemani* **sp. nov.**		
	H	Types		H	All types		H	All types	
SL (mm)	149	104.0–216.0 (n=13)		163	95.1–163.0 (n=9)		194.5	114.9–178.7 (n=5)	
% SL		Mean (Range)	SD		Mean (Range)	SD		Mean (Range)	SD
Head length	39.6	40.6 (38.1–42.7)	1.2	39.3	40.4 (38.8–43.2)	1.8	40.3	39.7 (39.1–40.5)	0.6
Head width	17.4	17.2 (16.1–19.5)	0.9	15	16.0 (15.0–16.9)	0.8	17.2	17.2 (16.0–18.5)	0.9
Pre-preopercular length	26.8	27.5 (26.0–29.4)	1	26.1	27.5 (25.6–30.2)	1.8	27.1	27.5 (26.8–28.5)	0.7
Eye diameter	6	7.3 (6.0–8.5)	0.7	8.9	9.2 (8.5–10.9)	1	7.6	7.7 (7.3–8.4)	0.4
Illiical length	4.7	4.8 (4.3–5.7)	0.4	3.7	2.8 (2.5–3.7)	0.5	4.6	4.9 (4.2–5.6)	0.5
Illicial trough length	7.4	7.5 (6.2–9.2)	0.8	6.1	5.5 (4.7–6.7)	0.8	7.4	7.5 (7.1–7.9)	0.4
Pre-illicial trough length	5.4	5.0 (3.8–6.9)	0.9	5.8	5.7 (4.7–6.0)	0.6	3.8	3.4 (2.2–3.9)	0.7
Upper jaw length	19.5	20.3 (19.4–21.6)	0.9	18.4	19.2 (18.4–20.3)	0.8	21.7	21.6 (20.8–23.0)	0.9
Pre-dorsal length	51	50.5 (45.8–53.2)	2.5	46.6	48.4 (46.6–50.0)	1.3	46.9	48.0 (46.0–50.0)	1.6
Pre-gill opening length	66.4	64.1 (61.2–67.4)	2.1	60.1	57.8 (52.9–60.4)	3.3	62.9	62.1 (60.7–63.9)	1.5
Tail length 1	30.9	31.2 (27.3–33.9)	2	34.4	36.3 (34.4–38.8)	2	16.0	17.7 (15.2–19.4)	2.0
Tail length 2	16.1	17.2 (14.6–20.9)	1.7	19.6	19.3 (17.9–21.5)	1.4	28.9	30.3 (28.9–31.8)	1.2
Tail length 3	15.4	14.5 (13.2–16.0)	1	17.8	18.5 (17.0–20.8)	1.5	14.5	14.9 (13.7–15.9)	0.9
Caudal-peduncle depth	8.1	8.1 (7.7–8.6)	0.3	8	7.7 (7.4–8.1)	0.3	8.4	8.7 (8.4–9.0)	0.2
Caudal-fin length	28.2	30.2 (28.0–32.1)	1.5	30.7	29.5 (28.5–30.7)	0.9	27.8	29.9 (27.8–31.5)	1.4

Description. Morphometric and meristic data are provided in Tables 1–3; data for holotype is provided below followed by range for types in parentheses.

Dorsal-fin rays III, 12; pectoral-fin rays 13 (13, rarely 12); anal-fin rays 7; caudal-fin rays 9. Head length 2.5 (2.3–2.6) in SL; head width 5.7 (5.6–6.2) in SL and 2.3 (2.3–2.5) in HL; pre-dorsal length 1.9 (1.9–2.2) in SL; pre-gill opening length 1.5 (1.5–1.6) in SL; pre-preopercular length 3.7 (3.5–3.9) in SL and 1.5 (1.4–1.6) in HL; upper jaw 5.1 (4.6–5.0) in SL and 2.0 (1.9–2.1) in HL; illicial length 8.4 (7.0–9.4) in HL; eye diameter 6.6 (5.2–6.6) in HL; post-dorsal-fin length 6.2 (5.4–6.4) in SL and 2.5 (2.0–2.8) in HL; post-anus length 3.2 (3.0–3.7) in SL and 1.3 (1.1–1.5) in HL; post-anal-fin length 6.5 (6.5–7.6) in SL and 2.6 (2.6–3.1) in HL; caudal-peduncle depth 4.9 (4.8–5.3) in HL; caudal-fin length 3.5 (3.1–3.6) in SL and 1.4 (1.3–1.5) in HL.

Head globular, skull elevated posteriorly; trunk and tail robust, weakly compressed, tapering posteriorly; ventral surface of belly flattened; skin thick, loose and flaccid; caudal peduncle short, slightly depressed. Eyes rounded, directed laterally, covered by dermal membrane, broadly connected to adjacent skin, forming clear window; interspace between eyes broad, convex.

Illicium relatively slender, its length less than eye diameter; esca depressed, forming a large central plate bearing many dark brown cirri; second dorsal-fin spine close to illicium, embedded under skin and not detectable externally; third dorsal-fin spine situated at about midpoint of pre-dorsal distance, embedded beneath skin. Illicial trough oval, slightly concave, uniformly narrow, its length about twice its width. Origin of soft dorsal fin slightly behind middle of body; pectoral fin emerging laterally near middle of body, slightly anterior to vertical through gill opening; pelvic fin on breast, well anterior to pectoral fin; anus situated about three-fourths of way along body; anal-fin origin about four-fifths of way along body, tip nearly reaching caudal-fin base when depressed.

Both nostrils anterior to eye; anterior nostril surrounded by fleshy membrane, its rim taller posteriorly than anteriorly; posterior nostril a circular depression; mouth wide, superior, its opening nearly vertical; lower jaw robust, protruding slightly in front of upper jaw; maxilla tapering, narrow dorsally, broadly expanded ventrally; blunt spine on symphysis of lower jaw.

Broad transparent membrane on first gill arch; first ceratobranchial well-connected to opercular wall, and first epibranchial entirely free of it; gill filaments present on second to fourth gill arches, two rows of gill filaments on second and third gill arches, single row of gill filaments on fourth gill arch; filaments on inner rows of third and fourth gill arches about two-thirds length of filaments on other arches; inner surface of fourth gill arch completely connected to body. Single row of 14 (12–15) rakers on 1st gill arch, 3 (3–4) on upper limb and 11 (8–11) on lower limb, 10 (9 or 10) rakers on outer row of 2nd arch, 9 (9 or 10) rakers on outer row of 3rd arch, and single row of 8 (7 or 8) rakers on 4th arch.

Interspaces of lateral-line neuromast complex slightly longer than width of complex; 3 (2–4, usually 3) pairs of short spines bridging each neuromast. Lateral-line neuromast counts: supraorbital (AB) 11 (11 or 12); premaxillary (AC) 8; upper preopercular (BD) 2; infraorbital (CD) 7 (6 or 7); lower preopercular (DG) 3; mandibular (EF) 6 (5 or 6); hyomandibular (FG) 3; pectoral (GH) 14 (11–14); anterior lateral-line proper (BB') 4 (4 or 5); supratemporal (BB) 6; and lateral-line proper (BI) 35 (32–37), including 3 (2 or 3) on caudal-fin base.

Dorsal surface covered by simple, stout spinules, except for eye window, lips, distal fifth of dorsal surface and entire ventral surface of pectoral fin, distal half of dorsal surface and entire ventral surface of pelvic fin, entire anal fin and its base, membranes of dorsal fin, anus, and caudal-fin rays. Broad band of 4–9 rows of spinules in front of illicial trough (3 or 4 rows in specimens smaller than 100 mm SL). Ventral surface covered by slightly shorter, firm spinules. Jaws and body margin along lateral line densely covered with simple, stout cirri; cirri absent from head, jaws and ventral surface.

Coloration. When fresh, background of dorsal surface reddish gray dorsally and pale ventrally; small irregular green spots surrounded by yellow, mostly inter-connected on dorsal surface; bright white flap-like cirri along margins of body and jaws. When preserved, dorsal surface covered by small irregular gray spots on uniformly grayish background; pale ventrally. Cirri on esca dark brown. Gill chamber, buccal cavity and gill rakers pale; peritoneum black with small pale patches.

Size. The largest known specimen has a length of 211 mm SL.

Distribution. Known from the Western Indian Ocean off Madagascar, Mozambique and South Africa, westernmost record appears to be on the southern coast of South Africa (Fig. 3), collected at depths 145–637 m.

Etymology. The specific name is from a field trip of the "Atimo Vatae" (Madagascan for "deep south"), a trawler from Fort Dauphin, from which many Madagascan specimens were collected, including those in the type series.

TABLE 2. Distribution of gill-rakers counts of *Chaunax* species recognized from the study area. Star indicates the value of holotype.

Rakers of 1st gill arch	n	11	12	13	14	15	16	17	18	19	20
C. apus	5				1	3	2				
C. atimovatae	14		1	8	4*	1					
C. flammeus	1		1								
C. heemstraorum	31				4	20	7*				
C. hollemani	5			1*	3	1					
C. penicillatus	5	1	3	1							
C. russatus	2										2
C. suttkusi	7					1	3	3			
Rakers of 2nd gill arch	n	8	9	10	11	12	13	14	15		
C. apus	6				5	1					
C. atimovatae	14		6	8*							
C. flammeus	1		1								
C. heemstraorum	31			3	22*	6					
C. hollemani	5		5*								
C. penicillatus	5	2	3								
C. russatus	2								2		
C. suttkusi	7				2	4	1				
Rakers of 3rd gill arch	n	8	9	10	11	12	13	14			
C. apus	6				5	1					
C. atimovatae	14		10*	4							
C. flammeus	1		1								
C. heemstraorum	31			21	10*						
C. hollemani	5		1	4*							
C. penicillatus	5	2	3								
C. russatus	2							2			
C. suttkusi	7				2	4	0	1			
Rakers of 4th gill arch	n	7	8	9	10	11	12	?	?	?	?
C. apus	6			4	2						
C. atimovatae	14	3	11*								
C. flammeus	1		1								
C. heemstraorum	31		10	20*	1						
C. hollemani	5	1	4*								
C. penicillatus	5	5									
C. russatus	2						2				
C. suttkusi	7			1	5	1					

Remarks. *Chaunax atimovatae* **sp. nov.** is most similar to *Chaunax abei* from the northwestern Pacific region in having bifurcated spinules mixed with simple ones on its dorsal surface, but these bifurcated spinules are much less numerous and quite scattered. The background of body of *C. atimovatae* **sp. nov.** is grayish with numerous tiny black melanophores (visible under magnification) whereas that of *C. abei* is pale and lacks this pigmentation. The new species is also similar to *C. breviradius* from the South China Sea region in having a similar coloration when fresh; it differs from *C. breviradius* in having bifurcated spinules mixed with simple ones on dorsal surface (vs. simple spinules only), and relatively more neuromasts in the lateral-line proper (BI) (usually 34–36 vs. 30–32).

***Chaunax heemstraorum* sp. nov.**
New English name: Heemstras' frogmouth
Figures 4A–C; Tables 1–3

Holotype. SAIAB 82029 (163 mm SL), 24°35.3'S, 35°38.7'E, off Mozambique, 770–774 m, 12 Oct. 2007.

Paratypes. 8 specimens, 95.1–128 mm SL. MNHN 1977-0031 (1, 111), 22°16'8.4"S, 43°7'8.4"E, Madagascar, 195–200 m, 1 Dec. 1973. SAIAB 13737 (5, 95.1–126), 3°26'S, 40°23'E, off Malindi, Kenya, 484 m, 11 Dec. 1980. SAIAB 30332 (1 of 82, 128), 29°53'S, 31°25'E, off Durban, KwaZulu-Natal, South Africa, 410 m, 26 Aug. 1986. SAIAB 49351 (1, 124), 34°27'S, 17°57.1'E, off West coast, South Africa, 333 m, 12 Jan. 1986.

Non-types (*indicates specimens with meristic data taken). **Madagascar**: MNHN 1977-0023 (2, 69.6–82.1), 25°28'58.8"S, 46°46'1.2"E, 350–360 m, 30 May 1973. MNHN 2014-1581 (1, 68.4), 12°52'28.8"S, 48°07'42"E, 558–592 m, 25 Jun. 2009. MNHN 2014-1883 (1, 31.9), 12°47'56.4"S, 48°11'16.8"E, 430–488 m, 2 Jul. 2009. **South Africa**: *SAIAB 3182 (3, 33.2–62.4), KwaZulu-Natal, 552 m, Jun. 1973. SAIAB 4706 (2, 33.1–38.0), 33°33'S, 27°06'E, Great Fish Point, Eastern Cape, no date. SAIAB 28306 (1, 33.2), 34°29'S, 25°36.6'E, off South Coast, 438 m, 22 May 1988. SAIAB 28510 (1, 34.1), 35°36.4'S, 22°2.0'E, off South coast, 172 m, 28 Sep. 1987. *SAIAB 30332 (81 of 82, 37.1–83.4), 29°53'S, 31°25'E, off Durban, KwaZulu-Natal, 410 m, 26 Aug. 1986. SAIAB 34821 (1, 37.2), 34°30'S, 25°36'E, South coast, KwaZulu-Natal, 1985. SAIAB 35516 (1, 37.6), 34°13.8'S, 26°38.2'E, off Eastern Cape, 102 m, 3 Jun. 1990.*SAIAB 49353 (1, 55.1), 37°05'S, 17°39'E, off West coast, 230 m, 9 Jul. 1986. *SAIAB 49356 (1, 89.1), 34°24'S, 25°52'E, off South coast, 199 m, Oct. 1986. SAIAB 87668 (3, 84.0–91.1), 29°42.3'S, 31°37.0'E, Tugela Deep, KwaZulu-Natal, 320 m, 5 May 2005. **Kenya**: *SAIAB 14054 (6, 98.1–103), 3°49'S, 40°00'E, off Mombasa, Kenya, 455 m, 11 Dec. 1980. SAIAB 14094 (1, 39.0), 3°26'S, 40°43'E, off Kilifi, Kenya, 770 m, 11 Dec. 1980. **Mozambique**: *SAIAB 28513 (2 of 3), S of Maputo, Dec. 12. SAIAB 189801 (1, 96.4), 26°10.2'S, 33°17.6'E, 505–509 m, 30 Sep. 2007. SAIAB 81820 (1, 68.1), 25°51.6'S, 33°17.1'E, 509–511 m, 3 Oct. 2007. SAIAB 82062 (2, 38.2–41.5), 23°32.3'S, 35°52.2'E, 539–553 m, 14 Oct. 2007.*SAIAB 98898 (1, 67.0), 12°25.6'S, 40°40.6'E, 408 m, 23 Nov. 2007. **No data**: *SAIAB 4711 (4, 99.2–121). SAIAB 4713 (4 of 5).

Diagnosis. A species of the *C. abei* species group with relatively slender body, a smaller head and slender tail. It can be distinguished from congeners by following combination characters: large green spots on dorsal surface; usually 3 neuromasts on upper preopercular series, 15–16 in pectoral series, 35–38 in lateral-line proper and 5 on caudal-fin base; 10–12 rakers on second gill arch; and 13 pectoral-fin rays.

Description. Morphometric and meristic data are provided in Tables 1–3.

Dorsal-fin rays III, 12; pectoral-fin rays 13 (13 or 14, modally 13); anal-fin rays 7; caudal-fin rays 9. Head length 2.5 (2.3–2.6) in SL; head width 6.7 (5.9–6.7) in SL, 2.6 (2.4–2.6) in HL; pre-dorsal length 2.1 (2.0–2.1) in SL; pre-gill opening length 1.7 (1.7–1.9) in SL; pre-preopercular length 3.8 (3.3–3.9) in SL, 1.5 (1.4–1.5) in HL; upper jaw 5.4 (4.9–5.4) in SL, 2.1 (2.0–2.1) in HL; illicial length 10.7 (10.7–16.6) in HL; eye diameter 4.4 (4.0–4.6) in HL; post-dorsal-fin length 5.1 (4.7–5.6) in SL, 2.0 (1.8–2.3) in HL; post-anus length 2.9 (2.6–2.9) in SL, 1.1 (1.0–1.3) in HL; post-anal-fin length 5.6 (4.8–5.9) in SL, 2.2 (2.0–2.3) in HL; caudal-peduncle depth 4.9 (4.9–5.9) in HL; caudal-fin length 3.3 (3.3–3.5) in SL, 1.3 (1.3–1.4) in HL.

Head globular, skull elevated above rest of body posteriorly; trunk and tail robust, weakly compressed, tapering posteriorly to caudal-fin base; ventral surface of belly flattened; skin thick, loose and flaccid; interspace between eyes broad, convex; caudal peduncle short. Eyes rounded, directed laterally; covered by dermal membrane, broadly connected to adjacent skin, forming clear window.

Illicium relatively slender, its length less than eye diameter; esca depressed, forming large central plate bearing many dark brown cirri; second dorsal-fin spine close to illicium, embedded under skin and not detectable externally; third dorsal-fin spine situated at about midpoint of predorsal distance, embedded beneath skin. Illicial trough oval-shaped, slightly concave, uniformly narrow, its length about twice its width. Origin of soft dorsal fin slightly behind midpoint of body; pectoral fin emerging laterally near midpoint of body, slightly anterior to vertical through gill opening; pelvic fin on breast, well anterior to pectoral fin; anus situated just in advance of posterior fourth of body; anal-fin origin at posterior fifth of body, its tip nearly reaching caudal-fin base when depressed.

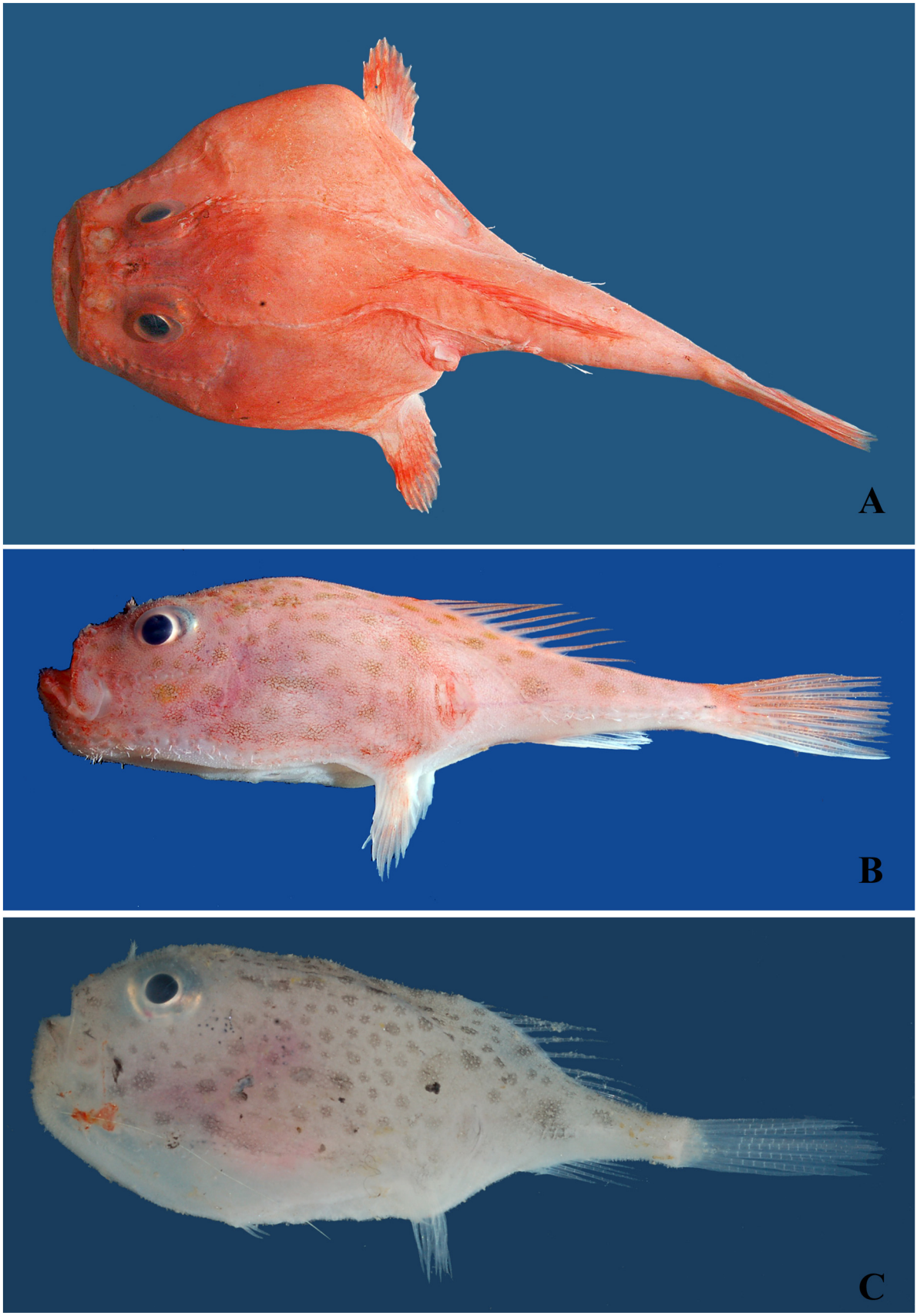

FIGURE 4. *Chaunax heemstraorum* **sp. nov.** A. SAIAB 82029, holotype, 163 mm SL. B. SAAIB 81820, non-type, 68.1 mm SL. C. SAIAB 82062, non-type, juvenile, 41.5 mm SL.

Nostrils anterior to eye; anterior nostril surrounded by fleshy membrane, its rim taller posteriorly than anteriorly; posterior nostril a circular depression; mouth wide, superior, its opening nearly vertical; lower jaw robust, protruding slightly in front of upper jaw; maxilla tapering, narrow dorsally, broadly expanded ventrally; blunt symphysial spine on symphysis of lower jaw.

Broad transparent membrane on first gill arch; first ceratobranchial well-connected to opercular wall, and first epibranchial entirely free of it; gill filaments present on second to fourth gill arches, two rows of gill filaments in second and third gill arches, single row of gill filaments on fourth gill arch; filaments on inner rows of third and fourth gill arches about two-thirds length of filaments on other arches; inner surface of fourth gill arch completely connected to body. Single row of 16 (14–16) rakers on 1st gill arch, 5 (4 or 5) on upper limb and 11 (10–12) on lower limb, 11 (10–12) rakers on outer row of 2nd arch, 11 (10–11) rakers on outer row of 3rd arch, and single row of 9 (8 or 9) rakers on 4th arch.

Interspaces of lateral-line neuromast complex slightly longer than its width; 3 (rarely 3–5, modally 3) pairs of short spines bridging each neuromast. Lateral-line neuromast counts: supraorbital (AB) 11 (10–12, modally 11); premaxillary (AC) 8; upper preopercular (BD) 3 (2–4, modally 3); infraorbital (CD) 6 (5–7, modally 6); lower preopercular (DG) 3 (3 or 4, modally 3); mandibular (EF) 6 (5 or 6); hyomandibular (FG) 3; pectoral (GH) 18 (13–18, mainly 15 or 16); anterior lateral-line proper (BB') 4 (3 or 4, modally 4); supratemporal (BB) 6; and lateral-line proper (BI) 38 (38–42), including 5 (3–6, modally 5) on caudal-fin base.

Dorsal surface covered by simple, stout spinules, except for eye window, lips, distal fifth of dorsal surface and entire ventral surface of pectoral fin, distal half of dorsal surface and entire ventral surface of pelvic fin, entire anal fin and its base, membranes of dorsal fin, anus, and caudal-fin rays. Single row of spinules in front of illicial trough (naked medially in some smaller specimens). Ventral surface covered by slightly shorter, firm spinules. Jaws and body margin along lateral line densely covered with simple, stout cirri; cirri absent from head, jaws and ventral surface.

Coloration. When fresh holotype (Fig. 4A) with uniformly reddish color, other non-type and juveniles (Fig. 4B–C) with dorsal surface covered with medium-sized irregular green spots on reddish background; pale ventrally. When preserved, dorsal surface with irregular gray spots on uniformly pale background or spots faded; pale ventrally. Cirri on esca dark brown. Gill chamber, buccal cavity and gill rakers pale; peritoneum black.

Size. The largest known specimen has a length of 163.0 mm SL. This is most likely a small species compared to other congeners.

Distribution. Known from the southern Africa, off South Africa (including the western coast), Mozambique and Kenya (Fig. 3). Bathymetric range 102–774 m.

Etymology. We are pleased to name this species after Dr. Philip and Elaine Heemstra, who offered great hospitality and assistance when the first author worked in the SAIAB fish collection.

Remarks. *Chaunax heemstraorum* **sp. nov.** is most similar to *C. nudiventer* in having large spots on its dorsal surface, slender dermal spinules and a relatively slender body. It differs from *C. nudiventer* in having its ventral surface covered by spinules (vs. a large naked area on ventral surface), modally 13 pectoral-fin rays (vs. modally 14), modally 3 neuromasts in BD (vs. modally 4 or 5), lacking melanophores on its ventral surface in smaller specimens (vs. densely covered by tiny melanophores in specimens smaller than 100 mm SL) and relatively few neuromasts on lateral-line proper (37–42 vs. 39–50).

It is also similar to *Chaunax latipunctatus* from the southeastern Pacific but differs in having a relatively short upper jaw (18.4–20.3% SL vs. 20.8–27.5% SL), relatively long post-anal length (17.0–20.8% SL vs. 13.0–16.7% SL), modally 13 pectoral fin rays (vs. modally 14), modally 11 neuromasts on supraorbital (vs. modally 12), modally 6 (vs. 7 or 8) on infraorbital; modally 3 (vs. 4 or 5) on hyomandibular.

Chaunax heemstraorum **sp. nov.** can be easily distinguished from *C. atimovatae* by its coloration, relatively large eye (8.5–10.9% vs. 6.0–8.5%), relatively long post-anal length (Tail length 1, 34.4–38.8% SL vs. 27.3–33.9% SL) and post-anal length (Tail length 3, 17.0–20.8% vs. 13.2–16.0% SL); modally 3 neuromasts in the upper preopercular (vs. 2), 13–18 in the pectoral (vs. 11–14) and 37–42 in the lateral-line proper (vs. 31–37).

Ho & Shao (2010:60) mentioned that two unidentified specimens similar to *C. nudiventer* were collected from the western Indian Ocean. Although these two specimens are most likely conspecifics with *C. heemstraorum* **sp. nov.**, they have only 11–12 neuromasts in the pectoral series and 34–36 in the lateral-line proper, fewer than those of *C. heemstraorum* **sp. nov.** Their identity is still doubtful at present.

Chaunax heemstraorum **sp. nov.** is one of two *Chaunax* species occurring on both sides of southern Africa, e.g. southeastern Atlantic and southwestern Indian oceans; on the west coast of South Africa, it has been found to north of 32°29'S. Another species occurring in the southeastern Atlantic is *C. suttkusi*, which is restricted to the Angolan region, north of about 11°45'S. These species appear not to occur sympatrically.

TABLE 3. Distributions of meristic data of *Chaunax* species recognized from the study area. Values are counted on both sides when paired. See text for abbreviations.

	Pectoral-fin rays						**AB**				**AC**	**CD**		
	n	10	11	12	13	14	**n**	10	11	12	8	5	6	7
C. apus	**32**		1	12	19		**37**		35	2	38	9	25	4
C. atimovatae	**34**			2	32*		**38**		37*	1	38*		20	18*
C. flammeus	**2**				2		**2**		2		2		2	
C. heemstraorum	**70**				68*	2	**86**	2	80*	4	86*	6	68*	12
C. hollemani	**10**			6*	4		**10**		10*		10*		10*	
C. penicillatus	**10**			4	6		**10**	6	4		10		8	2
C. russatus	**10**			6	4		**10**		6	4	8	2	8	
C. suttkusi	**16**	1	2	11	2		**16**		16		16		12	4

	BD				**DG**		**EF**				**FG**		
	n	2	3	4	3	4	6	7	8		3	4	5
C. apus	**38**	3	35		38		34	4			37	1	
C. atimovatae	**38**	38*			38*		37*	1			38*		
C. flammeus	**2**	2				2	2				2		
C. heemstraorum	**86**	7	76*	3	82*	4	84*	2			86*		
C. hollemani	**10**	10*			10*		10*				10*		
C. penicillatus	**10**	10			10		10				10		
C. russatus	**10**	10			10		8	2			8	2	
C. suttkusi	**16**	2	14		5	11	14	1	1		2	8	6

……continued on the next page

TABLE 3. (Continued)

		GH									**BB'**			**BB**	
	n	10	11	12	13	14	15	16	17	18	3	4	5	**n**	6
C. apus	**36**					19	12	3	2		2	32	1	**19**	19
C. atimovatae	**38**		6	18	10	4*						37*	1	**19**	19*
C. flammeus	**2**	2											2	**1**	1
C. heemstraorum	**86**				1	16	32	25	6	6*	2	84*		**43**	43*
C. hollemani	**10**		1	5*	1	3						8*	2	**5**	5*
C. penicillatus	**10**	2	8									8	2	**5**	5
C. russatus	**10**	3	4	1	2							10		**5**	5
C. suttkusi	**16**				4	2	8	2			2	14		**8**	8

		BI													
	n	30	31	32	33	34	35	36	37	38	39	40	41	42	43
C. apus	**38**					1	4	7	3	5	7	6	2		3
C. atimovatae	**30**		4	2	4	10	8*	6	4						
C. flammeus	**2**		2												
C. heemstraorum	**64**								2	22*	14	20	14	14	
C. hollemani	**4**				3*	3*	0	2	1	1					
C. penicillatus	**10**		2	2	2	2	2								
C. russatus	**10**				4	2		4							
C. suttkusi	**16**	2	6	4	0	2	2								

***Chaunax hollemani* sp. nov.**
New English name: Holleman's frogmouth
Figures 5A–C; Tables 1–3

Holotype. MNHN 1977-0034 (1, 195), 18° 54'S, 43°55'1.2"E, 280–320 m, 24 Nov. 1973.

Paratypes. 4 specimens, 115-179 mm SL. MNHN 1977-0028 (2, 115–158), 23°19'58.8"S, 43°31'1.2"E, 350 m, Mar. 1969. MNHN 1977-0038 (2, 121–179), 12°52'1.2"S, 48°10'1.2"E, 428 m, Mar. 1971.

Diagnosis. A member of the *C. fimbriatus*-species group with following combination of characters: uniformly creamy white when preserved; pre-preopercle length 26.8–28.5% SL, head width 16.0–18.5% SL, post-anus length 28.9–31.8% SL; peritoneal membrane uniformly brown; 2 neuromasts in upper preopercular series, 11–14 in pectoral series, 33–38 in lateral-line proper; 9 rakers on second gill arch; and 12 or 13 pectoral-fin rays.

Description. Morphometric and meristic data are given in Tables 1–3; following data summary is provided for holotype and range in all types (if different) in parentheses. Dorsal-fin rays III, 12 (12 or 13, 1 with 13); pectoral-fin rays 12 (12 or 13); anal-fin rays 7; caudal-fin rays 9. Head length 2.5 (2.5–2.6) in SL; head width 5.8 (5.4–6.2) in SL, 2.3 (2.2–2.5) in HL; pre-dorsal length 2.1 (2.0–2.2) in SL; pre-gill opening length 1.6 (1.6) in SL; pre-preopercular length 3.7 (3.5–3.7) in SL, 1.5 (1.4–1.5) in HL; upper jaw 4.6 (4.3–4.8) in SL, 1.9 (1.8–1.9) in HL; illicial length 8.8 (7.2–9.4) in HL; eye diameter 5.3 (4.7–5.4) in HL; post-dorsal-fin length 6.3 (5.1–6.6) in SL, 2.5 (2.0–2.7) in HL; post-anus length 3.5 (3.1–3.5) in SL, 1.4 (1.2–1.4) in HL; post-anal-fin length 6.9 (6.3–7.3) in SL, 2.8 (2.5–2.9) in HL; caudal peduncle depth 4.8 (4.4–4.8) in HL; caudal-fin length 3.6 (3.2–3.6) in SL, 1.5 (1.2–1.5) in HL.

Head globular, skull elevated above rest of body posteriorly; trunk and tail robust, weakly compressed, tapering posteriorly to caudal-fin base; ventral surface of belly flattened; skin thick, loose and flaccid; interspace between eyes broad, flat; caudal peduncle short. Eyes oval, directed laterally to dorsolaterally; covered by dermal membrane, broadly connected to adjacent skin, forming clear window.

Illicium long, length subequal to eye diameter; esca depressed, forming large central plate bearing many thin brown cirri; second dorsal-fin spine close to illicium, embedded under skin and not detectable externally; third dorsal-fin spine situated at about midpoint of pre-dorsal distance, embedded beneath skin. Illicial trough long oval, narrow anteriorly and much broader posteriorly, slightly concave, its length about 1.5 times its width. Origin of soft dorsal fin slightly behind midpoint of body; pectoral fin emerging laterally near midpoint of body, slightly anterior to vertical through gill opening; pelvic fin on breast, well anterior to pectoral fin; anus situated at posterior fourth of body; anal-fin origin at posterior fifth of body, its tip well short of caudal-fin base when depressed.

Nostrils anterior to eye; anterior nostril surrounded by fleshy membrane, its rim taller posteriorly than anteriorly; posterior nostril a circular depression; mouth wide, superior, its opening nearly vertical; lower jaw robust, protruding slightly in front of upper jaw; maxilla tapering, narrow dorsally, broadly expanded ventrally; blunt symphysial spine on symphysis of lower jaw. Upper jaw with band of 6 rows of teeth and lower jaw with 5 rows, gradually narrowing posteriorly.

Narrow membrane on first gill arch; first ceratobranchial well-connected to opercular wall and first epibranchial entirely free of it; gill filaments present on second to fourth gill arches, two rows of gill filaments in second and third gill arches, single row of gill filaments on fourth gill arch; filaments on inner rows of third and fourth gill arches about two-thirds length of filaments on other arches; inner surface of fourth gill arch completely connected to body. Single row of 13 (13–15) rakers on 1st gill arch, 4 (4 or 5) on upper limb and 9 (9 or 10) on lower limb, 9 rakers on outer row of 2nd arch, 10 (9 or 10) rakers on outer row of 3rd arch, and single row of 8 (7 or 8) rakers on 4th arch.

Interspaces of lateral-line neuromast complex about equal to or slightly wider than width of neuromast; 3–6 (usually 3 or 4) pairs of short spines bridging each neuromast. Lateral-line neuromast counts: supraorbital (AB) 11; premaxillary (AC) 8; upper preopercular (BD) 2; infraorbital (CD) 6; lower preopercular (DG) 3; mandibular (EF) 6; hyomandibular (FG) 3; pectoral (GH) 12 (11–14, usually 12); anterior lateral-line proper (BB') 4 (4 or 5, usually 4); supratemporal (BB) 6; and lateral-line proper (BI) 33 or 34 (33–38), including 2 or 3 (usually 2) on caudal fin.

Dorsal surface covered by a few taller and stronger bifurcate spinules mixed with many simple, smaller spinules, except for eye window, lips, distal fifth of dorsal surface and entire ventral surface of pectoral fin, distal half of dorsal surface and entire ventral surface of pelvic fin, entire anal fin and its base, membranes of dorsal fin, anus, and caudal-fin rays. Broad band of 12 (10–14) rows of spinules in front of illicial trough. Ventral surface covered by shorter simple spinules. Jaws and body margin along lateral line densely covered with simple, stout cirri; entire dorsal surface covered by scattered simple cirri, relatively dense on supraocular membrane and lower

portion of maxilla; cirri on dorsal surface and supraocular membrane accompanied by strong spinule, taller than those adjacent. Cirri absent from ventral surface.

Coloration. Fresh color unknown, presumably pinkish or reddish. When preserved, uniformly creamy white to light brown. Gill chamber pale, with large grayish patch on inner opercular wall; gill arches, buccal cavity, peritoneal membrane and external lining of stomach pale.

Size. Reaches at least 195 mm SL.

Distribution. Known from the western Indian Ocean off Madagascar (Fig. 3) at depths 280–428 m.

Etymology. The new species is named after Wouter Holleman, Research Associate at the South Africa Institute of Aquatic Biodiversity, in recognition of his contributions in fish taxonomy.

FIGURE 5. *Chaunax hollemani* **sp. nov.** A–B. MNHN 1977-34, holotype, 195 mm SL. B. 1977-0038, 1 of 2, paratype, 179 mm SL.

TABLE 4. Morphmetric data of six *Chaunax* species occurring in southern Africa based on specimens from the study area.

	C. penicillatus	***C. apus***	***C. russatus***	***C. suttkusi***	***C. flammeus***
SL (mm)	96–186 (n=5)	106–234 (n=4)	114–171 (n=9)	107–160 (n=3)	95.7 (n=1)
% SL	Mean (Range)	Mean (Range)	Mean (Range)	Mean (Range)	
Head length	40.7 (37.2–42.0)	38.9 (37.3–40.6)	41.2 (40.4–42.1)	42.4 (41.1–43.8)	43.4
Head width	21.8 (21.1–22.9)	15.4 (14.0–16.7)	21.5 (20.2–22.8)	17.6 (17.4–17.8)	20.7
Pre-preoercular length	28.2 (26.1–20.7)	25.9(25.0–27.4)	28.7 (27.5–29.8)	28.7 (28.0–29.1)	30.7
Eye diameter	6.7 (6.2–7.3)	8.0 (6.3–9.0)	8.8 (7.9–9.6)	8.0 (7.4–8.4)	10.4
Illiical length	1.8 (1.6–2.2)	3.1 (2.8–3.4)	3.6 (3.1–4.1)	3.6 (3.3–3.7)	5.2
Illicial trough length	4.6 (3.9–5.5)	5.7 (4.5–6.3)	7.5 (7.5–7.6)	5.9 (5.6–6.1)	10.4
Pre-illicial trough length	4.5 (4.2–4.8)	4.9 (4.1–5.6)	3.3 (2.6–3.9)	5.4 (4.7–6.3)	1.8
Upper jaw length	22.0 (20.0–23.0)	19.6 (18.7–21.3)	20.8 (19.6–21.9)	22.2 (21.5–22.8)	27.2
Pre-dorsal length	48.5 (44.4–53.8)	46.4 (44.4–48.1)	47.6 (47.4–47.8)	47.6 (45.8–48.9)	50.6
Pre-gill opening length	62.5 (59.4–65.1)	59.0 (57.5–61.3)	61.8 (59.6–64.0)	62.6 (61.7–63.7)	62.0
Tail length 1	27.9 (25.9–30.0)	34.7 (33.1–38.7)	33.9 (32.7–35.1)	34.1 (33.3–34.6)	34.1
Tail length 2	16.4 (15.0–17.7)	19.2 (17.3–20.2)	18.0 (15.8–20.2)	19.1 (18.7–19.4)	18.5
Tail length 3	14.2 (13.9–14.6)	16.2 (13.4–18.0)	15.6 (14.6–16.7)	16.2 (14.8–16.9	16.9
Caudal peduncle depth	8.3 (7.5–8.6)	7.7 (7.1–8.1)	7.8 (7.3–8.2)	8.5 (8.1–9.5)	10.0
Caudal fin length	30.0 (27.8–32.6)	29.5 (26.5–28.9)	27.6 (26.3–28.9)	28.8 (27.4–30.8)	32.9

Chaunax africanus Ho & Last, 2013

Tables 2–3

Chaunax africanus Ho & Last, 2013:442, figs. 4A–C, 5A–C (type locality: North of Beira, 18°02.1'S, 37°37.2'E, Mozambique, western Indian Ocean, 162–200 m).

Material examined. Two specimens listed in Ho & Last (2013).

Diagnosis. A species of *C. fimbriatus* species group with cirri on supraocular membrane; 3 or 4 pairs of spinules bridging each neuromast; pale cirri with brown tips on esca; GRii=8 or 9; and lateral-line neuromasts: BD=2, GH=10–12, BI= 31–32. Body covered by variable-sized, irregular brownish patches and a complex white reticulate pattern; eye surrounded by prominent radiating brownish markings; 2 or 3 pairs of narrow brownish bars at dorsal-fin base; pale reticulate markings frequently double-lined; pattern extending forward to front of lower jaw, and over pectoral and caudal fins.

Remarks. Only two specimens of this species examined. The species might be endemic to a small area off Mozambique, SE Africa, at depths 162–200 m.

Chaunax apus Lloyd, 1909

Tables 2–4

Chaunax apus Lloyd, 1909:169 (type locality: Bay of Bengal, off Akyab coast, Myanmar, Investigator station 379, 530 fathoms [969 m]). Caruso, 1989:160; Ho & Last, 2013:444; Ho *et al*., 2015:307.

Material examined. Madagascar: MNHN 1977-0030 (1 of 2, 119), 22°17'9.6"S, 43°4'1.2"E, 450 m, 29 Nov. 1973. MNHN 1977-0031 (1, 110.7), 22°16'8.4"S, 43°7'8.4"E, 195–200 m, 1 Dec. 1973. MNHN 1977-0040 (2, 194–195), 22°13'4.8"S, 43°1'58.8"E, 670–710 m, 2 Dec. 1973. MNHN 1977-0045 (3,66.5–117.2), 12°44'6"S, 48°10'4.8"E, 563–570 m, 5 Mar. 1971. SAIAB 31339 (1, 88.7), 12°28'S, 48°09'E, off Nosy-Be, 700–710 m, 12 Nov. 1988. **South Africa**: SAIAB 2727 (1, 142), 33°03'S, 18°00'E, off Saldanha Bay, Western Cape, 16 Oct. 1972. SAIAB 4712 (1, 152), off Durban, KwaZulu-Natal, Sep. 1967. SAIAB 10637 (1, 85.0), 27°44.4'S, 32°42.8'E, NE of Cape Vidal, 400–450 m, 26 May 1975. SAIAB 44919 (1, 111), West of Saldanha Bay, Western Cape, 440 m, 10 Sep. 1994. **Kenya**: SAIAB 13789 (1, 96.1), 4°22'S, 39°42'E, off Shimoni, 380 m, 9 Dec. 1980. SAIAB 14043 (2, 106–234), 4°17'S, 40°07'E, off Mombasa, 687–750 m, 10 Dec. 1980. SAIAB 14071 (1, 67.2), 3°04'S, 40°25'E, off Malindi, 280 m, 17 Dec. 1980. **Mozambique**: SAIAB 82130 (1, 253), 21°52'S, 35°48.6'E, 742–758 m, 17 Oct. 2007.

Diagnosis. A species of *C. abei*-species group with uniform pinkish color when fresh, creamy white when preserved; dermal spinules slender and curved; escal cirri colorless or with light brown tips; gill rakers on second gill arch; GR ii=11 or 12; and lateral-line neuromasts: BD=3, GH=13–17, BI=33–38, 3–5 (usually 5) on caudal-fin base.

Distribution. This species is most likely widespread in Indo-west Pacific and appear to be abundant (unpub. data). Specimens were collected from a broad range in western Indian Ocean at depths 195–969 m.

Remarks. Ho & Last (2013) discussed the validity of this species, being the first species described in the *C. abei*-species group, and is considered a valid species.

Although this seems to be a common species found in Indo-west Pacific Ocean, we have observed several geographic populations in different regions. This species is thus currently recognized as a probable species complex, but more investigation is needed. It can be separated from two New Zealand species, *C. russatus* and *C. mulleus*, by mainly having 3 spines on each side of neuromast (vs. 1); 12 rakers on second gill arch (vs. 14 or 15); and pale gill arch and gill chamber (vs. grayish).

Chaunax flammeus Le Danois, 1979

Tables 2–4

Chaunax umbrinus flammeus Le Danois, 1979:17, figs. 6–8 (type locality: North of Madagascar, 12°49'1.2"S, 48°4'58.8"E, 760–810 m).

Chaunax flammeus Le Danois, 1979: Ho & Last, 2013:444.

Material examined. MNHN 1977-0047 (95.7), holotype, 12°49'1.2"S, 48°4'58.8"E, 760–810 m, 14 Sep. 1977.

Diagnosis. A species in the *C. fimbriatus* species group with cirri on supraocular membrane; uniformly creamy white when preserved; GRii=9; and lateral-line neuromasts: BD=2, GH=10, BI= 31. Color when fresh pinkish with yellow markings (Le Danios, 1979).

Distribution. Known only from the holotype collected from the western Indian Ocean off northern Madagascar at depth 760–810 m.

Remarks. Le Danios (1979) described the species from only one specimen. There are, however, many specimens collected in the same time as the holotype and were later identified as *C. flammeus*. Examination on these specimens revealed at least four species, *C. atimovatae*, *C. heemstraorum*, *C. apus* and *C. hollemani*. In his drawing Le Danios (1979) clearly showed cirri on top of the head, an important character which places the species to the *C. fimbriatus* species group, and is thus the third species that can be ascribed to the group (subsequent to *C. fimbriatus* and *C. umbrinus*) (Ho & Last, 2013).

It is should be noted that with large number of specimens collected around Madagascar was examined by us, none could be ascribed to *C. flammeus* which may suggest that the species has a relatively narrow distribution in the deep water of northern Madagascar.

Chaunax penicillatus McCulloch, 1915

Tables 2–4

Chaunax penicillatus McCulloch, 1915:167, pl. 33, fig. 2 (type locality: 60 km SW of Cape Everard, Victoria, Australia, depth 293–366 m).

Material examined. MNHN 1977-0024 (1), Madagascar, 25°08'9.6"S, 47°21'3.6"E, 255 m, 3 Mar. 1973. SAIAB 13740 (1, 158), 3°26'S, 40°23'E, off Malindi, Kenya, 484 m, 11 Dec. 1980. SAIAB 13782 (1, 100), 4°38'S, 39°46'E, off Shimoni, Kenya, 350 m, 18 Dec. 1980. SAIAB 13788 (1, 96.0), 4°22'S, 39°42'E, off Shimoni, Kenya,380 m, 9 Dec. 1980. SAIAB 14078 (1, 180), 2°59'S, 40°34'E,off Ras Ngomeni, Kenya,301 m, 12 Dec. 1980. SAIAB 21604 (1, 186), no data.

Diagnosis. A species of *C. pictus*-species group with a deep illicial trough; a short illicium stem that largely embedded in esca; cirri on esca black anteriorly and bright white posteriorly; GRii=8 or 9; and lateral-line neuromasts: BD=2, GH=10–13, BI=31–35. Body orange to reddish with irregular yellowish vermicular or spotty patterns; sometimes large blackish patches on dorsal surface.

Distribution. This is a widespread species through Indo-west Pacific Ocean, from Japan to New Zealand and from South Africa to French Polynesia. Specimens from southern Africa were collected at depths 255–484 m.

Chaunax russatus Ho, Roberts & Stewart, 2013

Tables 2–4

Chaunax russatus Ho, Roberts & Stewart, 2013:105, figs. 11A–B, 12A–B (type locality: Kaikoura Canyon, 43°0.09'S, 173°53.85'E, New Zealand area, 821–1030 m).

Materials examined. CSIROH.5345-02 (1, 120), 36°35'S, 52°05'E, southwestern Indian Ocean, 835–1110 m, 29 Oct. 1999. CSIRO H.5849-01 (1, 120), 38°27'S, 47°42'E, South-West Indian Ridge, 656–962 m, 14 Mar. 2001. SAIAB 7271 (1, 171), 30°32'S, 30°32'E, KwaZulu-Natal, 625–900 m, 10 May 1977. SAIAB 86432 (1, 114), 28°20.2'S, 45°15.2'E, S of Madagascar, 739–759 m, 2 Sep. 2008.

Diagnosis. A species in *C. abei*-species group with 1 pair of spines bridging the lateral-line neuromasts; illicial trough wider than the pupil; gill chamber and gill arches grayish; GRii=14 or 15; and lateral-line neuromasts: BD=2, GH=10–13, BI=32–39. Body uniformly reddish when fresh, sometimes with irregular grayish marks.

Distribution. Known from southern hemisphere off New Zealand, Australia, Mozambique and South Africa. Specimens from southern Africa were collected at depths of 625–1110 m.

Remarks. Ho & Last (2013) reported that this is a trans-Indian Ocean distribution species. This species is widespread in the southern hemisphere off South Africa, Australia (both sides) and New Zealand. It also represents the deepest record of *Chaunax* in southern Africa.

Chaunax suttkusi Caruso, 1989

Tables 2–4

Chaunax suttkusi Caruso, 1989:160 (type locality: off Venezuela, Caribbean Sea, 11°40'N, 62°33'W, 585–622 m).

Material examined. All collected from Angola, western Africa: CAS 222317 (1), 7°28'S, 12°18'E, 418–427 m, 19 Apr. 2005. CAS 222332 (1), 11°57'S, 13°23'E, 470–475 m, 2 Apr. 2005. CAS 222328 (2), 11°32'S, 13°21'E, 361–364 m, 3 Apr. 2005. MNHN 2001-0145 (5, 41.0–67.1), 7°18'0.0"S, 12°04'58.8"E, Angola, 29 Aug. 2000. SAIAB 64325 (1), 12°05'S, 13°25'E, 444 m, 6 Mar. 2001. SAIAB 64377 (3), 9°38'S, 12°42'E, 432–486 m, 11 Mar. 2001. SAIAB 64421 (23), 10°7'S, 12°53'E, 374–378 m, 9 Mar. 2001. SAIAB 65888 (1), 11°45'S, 13°23'E, 349–356 m, 5 Mar. 2002. SAIAB 65997 (3), 10°48'S, 13°20'E, 331–336 m, 7 Mar. 2002. SAIAB 66009 (15), 9°06'S, 12°41'E, 438–404 m, 13 Mar. 2002.

Other materials. MNHN 1987-1006 (1, 91.6), 15°03'N, 17°21'W, Senegal, 330 m, May 1979. MNHN 1987-1545 (1, 105), 15°36'N, 17°06'W, Senegal, 400 m, May 1979. MNHN 1988-0397 (2, 88.3–127), 16°12'N, 16°50'W, Mauritania, 400 m, Mar. 1982. MNHN 2000-5362 (6, 41.5–114), 21°28'1.2"N, 17°40'1.2"W, Mauritania, 600–650 m, 1973.

Diagnosis. A species of *C. abei*-group with mainly dermal spinules very stout and strong; cirri on esca brown to black; GRii=11–13; and lateral-line neuromasts: FG=4, DG=4, GH=13–16, BI=30–35. Body pinkish, sometimes with green or yellow spots when fresh and uniformly creamy white when preserved.

Distribution. Widespread in Atlantic Ocean and Mediterranean Sea. Specimens examined in present study were collected from depths 331–622 m.

Remarks. Most specimens examined here were collected from Angola, western Africa. Caruso (1989) reported this species collected from about 11°45'S and further north in the eastern Atlantic Ocean, all our materials were collected within this range.

Discussion

Ho & Last (2013) summarized the *Chaunax* species in Indian Ocean. In this work three new species of the genus are added. Of all nine species, one species belongs to the *C. pictus* species group, three belong to the *C. fimbriatus* species group and five belong to the *C. abei* species group. In total, there are 25 nominal species in *Chaunax* at present. At least 5 new species from the Indo-Pacific ocean are currently being described (Ho, unpubl. data).

Although coloration is a good character to separate species, several Indian species seem to have pinkish or reddish color, sometimes with yellow marks, when fresh, and become uniformly creamy white when preserved. *Chaunax penicillatus* is orange-red in color with yellow patterns when fresh, sometimes with irregular blackish blotches on the dorsal surface, and is usually uniformly creamy white in preservation. *Chaunax apus* has a uniformly pinkish color that fades totally in preservation. *Chaunax africanus* has a complicate reticulate pattern in preservation, which presumably is similar when fresh/live. Ho *et al.* (2013) recorded the fresh color of *C. russatus* as uniformly reddish or sometimes with blackish marks on dorsal surface, and creamy white, or sometimes with blackish smoky marks on the dorsal surface. Caruso (1989a) recorded *C. suttkusi* as uniformly pinkish in color, sometimes with yellowish or greenish spots; however, all these spots faded after preservation. Both *C. heemstrorum* and *C. atimovatae* have greenish spots on dorsal surface and these spots had been retained in preservation in most specimens examined. Finally, the fresh color *C. flammeus* and *C. hollemani* are still unknown, but probably uniformly reddish or orange-red when fresh. Both are uniformly creamy white or light brown color in preservative.

Two species, *C. suttkusi* and *C. heemstrorum* are found on the eastern coast of Atlantic Ocean off western Africa. These two species are evidently not sympatric, with a gap between Angola and the east coast of South Africa. *Chaunax heemstrorum* is the only *Chaunax* sp. to occur in both eastern Atlantic and western Indian oceans.

Chaunax penicillatus and *C. apus* are both widely distributed in the Indo-west Pacific. *Chaunax russatus* is the only species distributed across the Indian Ocean and extended to southwestern Pacific Ocean. *Chaunax africanus*, *C. flammeus* and *C. hollemani* may have a relatively narrow distributions, and are only known from a few specimens from certain localities. *Chaunax atimovatae* has a relatively broad distribution in the western Indian Ocean, and is also the most common species along the coast of southern Africa (Fig. 3).

The bathymetric ranges varies among the species, *C. africanus* appears to be a relatively shallow species (162–200 m) and *C. flammeus* and *C. russatus* appear to be deep water species (760–810 m and 625–1110 m, respectively). Specimens of *C. hollemani* and *C. penicillatus* were collected in less than 500 meters, whereas the other species have slightly broader ranges, from 102 to 969 meters. The distribution range of each species may increase when more specimens become available. However, there is likely a barrier at around 500 meter depth for some *Chaunax* species.

Comparative materials. *Chaunax nudiventer* and *C. latipunctata*: listed in Ho & Shao (2010) and Ho *et al.* (2013). *Chaunax abei* and *C. breviradius*: list in Ho *et al.*(2015).

Key to species of *Chaunax* in southern Africa

1A. Illicial trough, black, deep and concave . . . . . *Chaunax penicillatus*
1B. Illicial trough flat, color as body ground color 2
2A. Filaments present on supraocular membrane; usually 3 or more spinules on each side of neuromast 3
2B. No filament on supraocular membrane; usually 1 to 3 spinules on each side of neuromast 5
3A. Complicate reticulate pattern present when preserved. . . . . *Chaunax africanus*
3B. Color pattern absent when preserved. 4
4A. Head width 16.0–18.5% SL, pre-preopercle length 26.8–28.5% SL; neuromasts: DG=3, GH=11–14, BI=33–38 . . . . . *Chaunax hollemani* **sp. nov.**
4B. Head width 20.7%SL, pre-preopercle length 30.7%SL; DG=4, GH=10, BI=31. . . . . *Chaunax flammeus*
5A. Gill chamber and gill arches grayish; 14–15 rakers on second gill arch. . . . . *Chaunax russatus*
5B. Gill chamber and gill arches pale; 13 or less rakers on second gill arch 6
6A. Neuromasts: FG=4; DG=4 . . . . . *Chaunax suttkusi*
6B. Neuromasts: FG=3; DG=3 7
7A. Dermal spinules slender and curved; body uniformly pinkish when fresh, creamy white when preserved . . . . . *Chaunax apus*
7B. Dermal spines stout and straight; green spots on pinkish body when fresh 8
8A. When fresh, small green spots circled by yellow color on dorsal surface; scattered bifurcate spinules on body. . . . . *Chaunax atimovatae* **sp. nov.**
8B. When fresh, large green spots on dorsal surface; simple spinules on body . . . . . *Chaunax heemstraorum* **sp. nov.**

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