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Grammatonotus bianchi, a new species of splendid perch (Percoidei: Callanthiidae) from Myanmar, northeastern Indian Ocean

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Abstract

A new splendid perch, *Grammatonotus bianchi* **sp. nov.** is described on the basis of two specimens (45.9–68.7 mm SL) collected at 184 m depth in the Andaman Sea off the coast of Myanmar during bottom surveys conducted by the R/V *Dr Fridtjof Nansen* in 2018. The new species can be distinguished from all congeners by its large head (37.7–38.6% SL), large orbit (14.4–15.3% SL), caudal-fin shape, and fresh coloration. A key to Indian Ocean species of *Grammatonotus* is provided.

Key words: Callanthiidae, *Grammatonotus bianchi* sp. nov., taxonomy, R/V *Dr. Fridtjof Nansen,* trawl surveys, Myanmar

Introduction

The family Callanthiidae contains 17 species in two genera, *Callanthias* Lowe 1839 and *Grammatonotus* Gilbert 1905 occurring in the eastern Atlantic (including the Mediterranean), Indian and Pacific Oceans (Nelson 2006; Anderson *et al*. 2015; 2018). All members of this family are small (<25 cm TL) brightly colored fishes usually found near the bottom over rocky areas and on reefs at depths of 4 to 660 m (Anderson 1999). They are popularly known as splendid perches (or groppos) for their magnificent colours and systematic position within the perciform order. Fishes in the callanthid family were formerly considered as a subfamily (Callanthiinae) of the family Serranidae, but were later placed in their own family on the bases of sharing a combination of characters unusual in percoid fishes: nasal organ with poorly developed lamellae, presence of modified scales with unique ornamentation along body midlaterally and lateral line running along base of dorsal fin to terminate near base of ultimate soft dorsal fin ray or continuing posteriorly on dorsolateral surface of caudal peduncle (Anderson 1999; Anderson *et al*. 2015; 2018). The genus *Grammatonotus* can be distinguished from *Callanthias* by the following combination of characters: one opercular spine; 9 (rarely 8 or 10) soft dorsal-fin rays; 9 soft anal-fin rays, 13 (7+6) branched caudal-fin rays; 14–23 tubed lateral-line scales; posteriormost dorsal procurrent caudal fin ray almost always articulating with fifth hypural and only occasionally with both posteriormost epural and fifth hypural; posteriormost ventral procurrent caudal fin ray almost always supported by haemal spine of penultimate vertebra and by parhypural; distance from posteriormost rib to first haemal spine 0.7–2.1 % SL; first caudal vertebra without parapophyses (Anderson *et al*. 2016; 2018). The genus is currently represented by 10 valid species (Anderson *et al*. 2018), nine of which have distributions primarily within the western and central Pacific Ocean: *Grammatonotus roseus* (Günther 1880), *G. laysanus* Gilbert 1905, *G. surugaensis* Katayama, Yamakawa & Suzuki 1980, *G. crosnieri* (Fourmanoir 1981), *G. macrophthalmus* Katayama, Yamamoto & Yamakawa 1982, *G. ambiortus* Prokofiev 2006, *G. brianne* Anderson, Greene & Rocha 2016, *G. pelipel* Anderson & Johnson 2017, and *G. xanthostigma* Anderson & Johnson 2017. A

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single species *G. lanceolatus* (Kotthaus 1976) was described from the northwestern Indian Ocean off Socotra Island. Additionally, in a review of *Grammatonotus* by Anderson *et al*. (2018), several putative species were mentioned, including two possible undescribed species from the southwestern Indian Ocean briefly described as *Grammatonotus* sp. due to the poor condition of specimens. The two species mentioned in Anderson *et al.* (2018) are herein referred to as *Grammatonotus* sp. 1 (Mascarenes) and *Grammatonotus* sp. 2 (Mozambique) for comparative purposes.

Recent surveys (2013, 2015 and 2018) by the EAF-Nansen Programme of FAO in cooperation with the Myanmar government using the Norwegian R/V *Dr Fridtjof Nansen* along the coast of Myanmar, resulted in the production of a FAO marine species identification guide intended for fishery purposes (Psomadakis *et al*. 2019). Included in the guide are 15 fish species new to science as well as a number (=51) of possibly undescribed fish species. Among them is *Grammatonotus* sp. which could not be morphologically associated with any known species. This species is herein described as a new species and a key to the known species of *Grammatonotus* from the Indian Ocean is provided.

Methods and abbreviations

Counts and measurements follow Hubbs & Lagler (1958) and *Anderson et al*. (2018). Measurements were taken from specimens preserved in 70% ethanol using a digital caliper to the nearest 0.1mm. Comparative meristic and morphometric data for the 10 valid species of *Grammatonotus* as well as for the two possible undescribed species from the southwestern Indian Ocean were obtained from Anderson *et al*. (2018). Data presented in the study as being from either 'literature' or 'this study' was merged into ranges herein (presented in Table 1 and 2). Scale descriptions follow Roberts (1993). Skeletal analysis was undertaken using radiographs (Fig. 3) obtained from an Inspex 20i Digital X-Ray Imaging System. Description of fresh coloration is based on color photographs taken upon collection of the specimens (Fig. 2), and preserved coloration is based on specimens stored in 70% ethanol. Map of collecting sites (Fig. 1) was generated using QGIS 2.14.2 Essen (QGIS Development Team, QGIS Geographic Information System, Open Source Geospatial Foundation Project; http://qgis.osgeo.org/) and Google Earth (http://www.google.co.uk/intl/en_uk/earth).

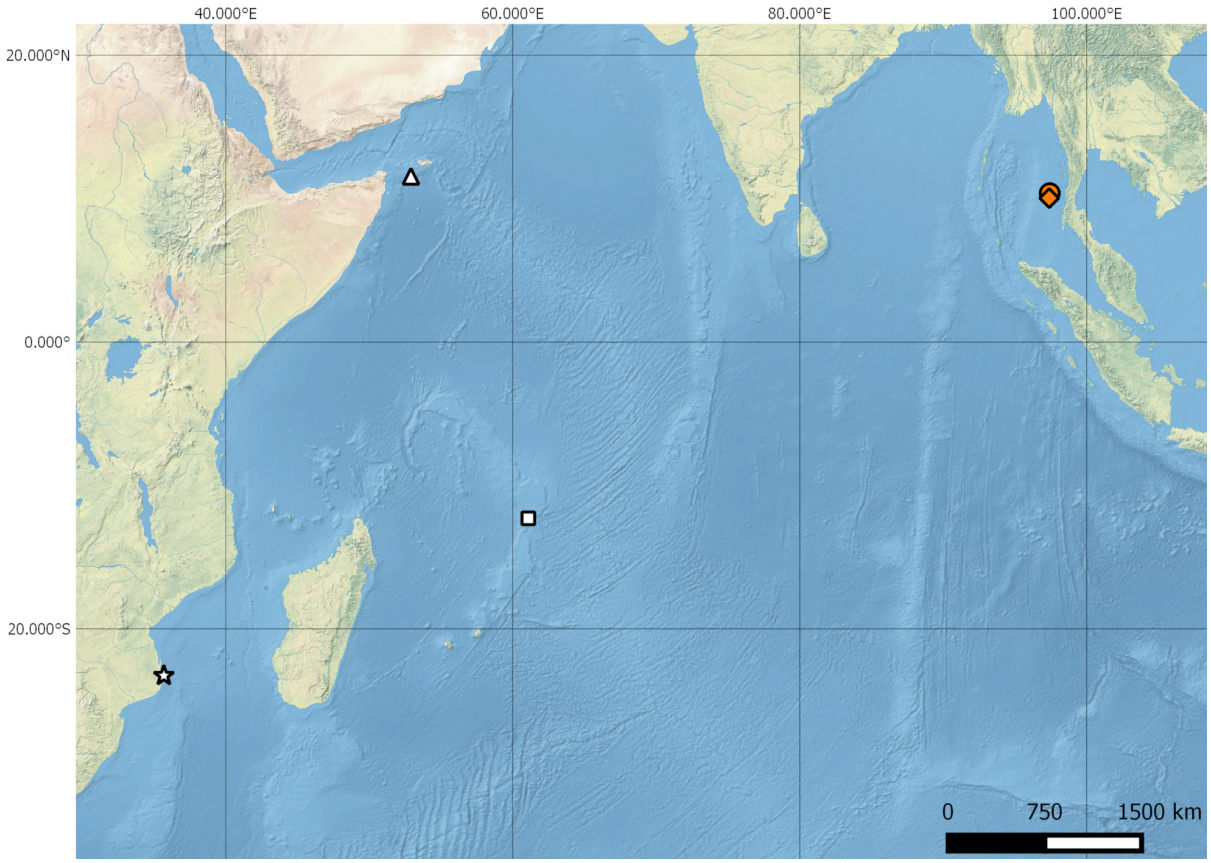

FIGURE 1. Localities of *Grammatonotus* spp. within the Indian Ocean. Orange markers represents *G. bianchi* **sp. nov.**; white triangle *G. lanceolatus*; white square *G.* sp.1 (Mascarenes); and white star *G.* sp. 2 (Mozambique).

Abbreviations: FAO (Food and Agriculture Organization of the United Nations), HL (head length), SAIAB (South African Institute for Aquatic Biodiversity, Makhanda (Grahamstown)), and SL (standard length).

***Grammatonotus bianchi* sp. nov.**

(English name: Bianchi's splendid perch; FAO name: Andaman splendid perch; Burmese name: Andaman Yaung Sone Ka Ka Tit)

(Figures 1–3; Tables 1–3)

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Grammatonotus sp.: Psomadakis *et al*. 2019: 399, Pl. XXIX, fig. 219 (Myanmar coast).

Holotype. SAIAB 208486, 68.7 mm SL, off Tanintharyi coast, Myanmar, Andaman Sea, Indian Ocean, 10°2'42.00"N and 97°22'45.00"E, R/V *Dr. Fridtjof Nansen*, bottom trawl, station 154, 184 m depth, 27 September 2018, collected by P.N. Psomadakis.

Paratype. SAIAB 208488, 45.9 mm SL, same collection data as holotype.

Photographic record (non-type). 121 mm TL, off Tanintharyi coast, Myanmar, Andaman Sea, Indian Ocean, 10°23'19.80"N and 97°24'48.60"E, R/V *Dr. Fridtjof Nansen*, bottom trawl, station 172, 182–184 m depth, 28 May 2015, specimen lost.

FIGURE 2. Fresh coloration of *Grammatonotus bianchi* **sp. nov.** shortly after collection: **(a)** Holotype, SAIAB 208486, 68.7 mm SL (photo by P.N. Psomadakis); **(b)** Specimen collected in 2015, 121 mm TL (photo by O. Alvheim) for which voucher is unavailable (specimen lost).

Diagnosis. A species of *Grammatonotus* distinguishable from its congeners by the following combination of characters: large head, its length 37.7–38.6% SL; postorbital head length 16.7–17% SL; large orbit, its diameter 14.4–15.3% SL; short caudal peduncle, its length 17.3–18.7% SL; caudal fin with upper and lower lobes produced; fresh coloration distinctive with unique bright yellow caudal fin covered by reddish spots and fuchsia or violet distal third (see Table 3, Fig. 2 and detailed color description below).

Description. Morphometric and meristic data are presented in Table 1 and 2. Holotype data is presented first, followed by paratype data (if different) in parentheses. Body somewhat compressed, moderately deep, its depth 2.9–3.1 in SL; body width 5.9–6.3 in SL. Dorsal profile convex from snout tip to origin of first dorsal-fin spine, thereafter gradually convex to end of dorsal-fin base. Ventral profile concave from tip of lower jaw to pelvic-fin origin, thereafter parallel to body axis until anal-fin origin. Anal-fin base slightly concave. Caudal peduncle with slightly concave dorsal and ventral profiles. Head large, its length 2.6–2.7 in SL. Orbit large, its diameter 2.5–2.6 in HL. Mouth terminal and oblique; moderately large with an upper jaw length 2.5–2.6 in HL; jaws subequal. Maxilla reaching posteriorly to middle of eye. Premaxilla protrusile. No supramaxilla. Interorbital convex. One opercular spine; distal margins of interopercle and subopercle smooth; margin of preopercle smooth.

TABLE 1. Frequency distribution for number of fin rays and gill rakers in species of *Grammatonotus*; data for all species other than *G. bianchi* **sp. nov.** (data in bold) taken from Anderson *et al.* (2018).

	Dorsal-fin rays			**Anal-fin rays**	**Pectoral-fin rays**			
	X,10	**XI,8**	**XI,9**	**III,9**	**18**	**19**	**20**	**21**
ambiortus			5	5			2	
***bianchi* sp. nov.**			**2**	**2**		**1**	**1**	
brianne			4	4	3	5		
crosnieri			9	9	2	15	1	
lanceolatus			3	3		3		
laysanus	1		16	18		2	31	2
macrophthalmus			10	10		3	7	
pelipel			3	3		2	3	
roseus			5	5		10		
sp. 1 (Mascarenes)			11	11				
sp. 2 (Mozambique)		1	1		1	1		
surugaensis			3	3	1	2		
xanthostigma			2	2		4		

	Total gill rakers on first arch									
	24	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**
ambiortus						1				
***bianchi* sp. nov.**		**1**	**1**							
brianne			1	2	1					
crosnieri			2	3	1	3				
lanceolatus		1	1	-	1					
laysanus					2	4	5	3	2	1
macrophthalmus			6	3	1	2	1	-	1	
pelipel					2					
roseus	1	1	-	1	2					
sp. 1 (Mascarenes)		-	-	-	-	-				
sp. 2 (Mozambique)				1	1					
surugaensis	2	1								
xanthostigma		1	-	-	2	1				

TABLE 2. Morphometric data (standard length in mm, other measurements expressed as % SL) of *Grammatonotus bianchi* **sp. nov.**, all 10 previously described species of *Grammatonotus* and *G.* sp.1 (Mascarenes) and *G.* sp.2 (Mozambique); B = broken; slight damage indicated by +.

	INDIAN OCEAN					CORAL TRIANGLE		
	***G. bianchi* sp. nov.**		***G. lanceolatus***	***G.* sp. 1**	***G.* sp. 2**	***G. brianne***	***G. crosnieri***	***G. roseus***
	Holotype	**Paratype**		**(Mascarenes)**	**(Mozambique)**			
Standard length (mm)	68.7	45.9	48.8–66.4	55.5–106	66.4–67.1	72.9–84.4	41.9–118	49.2–64.6
Depth of body	32	34.6	30.9–37.3	28.1–32.7	29.8–30.3	33.0–35.4	*30.5–39.2*	*35.4–37.2*
Predorsal-fin length	36.4	38.1	36.5–38.3	32.1–36.6	32.8–34.6	30.6–33.5	29.9–39.6	32.8–38.1
Head length	37.7	38.6	32.0–37.3	31.3–34.6	29.5–32.5	29.5–32.1	28.5–33.9	33.0–35.6
Length of snout	5.7	6.1	5.1–6.9	4.1–6.8	4.5–6.1	4.4–5.3	4.3–5.4	5.1–6.5
Diameter of orbit	14.4	15.3	11.3–12.3	10.9–14.6	9.4–11.0	9.7–11.1	11.0–14.9	13.2–14.6
Interorbital width	8	6.3	5.3	5.8–7.4	5.0–5.8	7.0–7.7	5.2–8.6	6.0–8.2
Postorbital length of head	16.7	17	15.8	12.8–15.6	13.1–13.4	12.4–14.2	10.8–15.0	13.4–14.2
Length of upper jaw	15.3	14.8	13.5–15.1	12.4–14.2	13.0–14.2	12.6–14.2	13.2–14.8	13.6–14.8
Pectoral-fin length	24.9	24.6	22.4–26.6	24.3–27.4	23.9–25.5	22.7–25.6	22.0–28.9	25.0–26.1
Pelvic-fin length	27.4	27	26.0–28.1	25.5–30.1	26.8–28.8	26.7–28.6	27.2–41.1+	24.8+–25.3
Length of caudal peduncle	17.3	18.7	21.3	21.0–24.9	20.9–23.2	23.8–24.6	21.9–27.0	21.1–23.1
Depth of caudal peduncle	14.7	15.5	12.9–17.0	12.1–15.9	10.6–13.0	14.4–16.2	14.1–17.7	14.8–16.2
Upper caudal-fin lobe length	B	B		~42.5–~55.1	31.4+		38.2–117+	
Lower caudal-fin lobe length	B	B		~38.6–~66.5	35.2+		31.5–108+	
Mid-caudal-fin ray length	33.6	29	38.9–41.9	~27.9–~46.3	~40.5–~41.9	58.6–82.2		
Longest caudal-fin ray								
Depressed anal-fin length	38.3	35.7	37.9	28.4–35.4	40.8–41.0	~39.2–42.2	33.4–70.1	36.5+–36.7+
Length of first anal spine	5.5	5.9		~2.4–4.4	3.9–4.4	2.8–3.4	6.2–10.3	4.5–6.5
Length of second anal spine	10.2	10		5.1–7.1	7.5–7.9	5.3–7.3	9.4–14.3	7.9–9.3
Length of third anal spine	12.1	13.5		6.1–8.7	9.3–9.7	7.5–9.2	11.1–15.3	9.6–11.4
Anal-fin base length	19.2	19.8	18.6	16.7–18.4	19.7–20.9	18.0–20.3	16.4–20.4	18.1–21.4
Penultimate dorsal-fin ray length	17.3	17.2		~14.8–~16.3	~18.2	19.8–22.7	16.7–19.6	
Ultimate dorsal-fin ray length	15.3	15.5		~11.0–13.9	~13.3	~16.0–19.0	12.8–16.8	14.2
Penultimate anal-fin ray length	18.8	17		~14.4–17.6	~16.8–17.3	18.2–21.5	16.6–21.5+	
Ultimate anal-fin ray length	14.6	12		12.4–13.6	~14.2–15.1	~13.7–18.0	12.6–15.4	

.....continued on the next page

TABLE 2. (Continued)

	OPEN PACIFIC OCEAN					
	G. ambiortus	***G. laysanus***	***G. macrophthalmus***	***G. pelipel***	***G. surugaensis***	***G. xanthostigma***
Standard length (mm)	31–120	22.9–137	95–119	28.1–49.3	74.3	60.2–61.0
Depth of body	30.0–34.3	27.5–35.1	27.9–33.3	34.2–34.3	35.7	29.6–31.1
Predorsal-fin length	33.3–38.7	30.7–36.8	30.5–35.9	35.7–37.7	31	33.2–33.9
Head length	33.9–37.5	28.9–34.9	28.3–34.6	31.0–34.0	31.2	29.8–30.2
Length of snout		4.3–8.0	4.6–7.2	4.3–5.3	5.1	4.7–4.9
Diameter of orbit		10.0–14.2	13.1–16.6	7.5–9.6	11.3	9.0–9.0
Interorbital width		5.0–7.8	7.8–9.7	5.9–6.8	6.7	5.6–5.7
Postorbital length of head		12.1–15.3	10.7–13.6	14.6–16.2	13.6	13.9–15.0
Length of upper jaw		11.6–15.1	11.6–14.1	12.8	13.2	12.3–12.8
Pectoral-fin length	19.4–24.6	21.2–26.8	18.9–23.7	27.4	~25	23.4–24.1
Pelvic-fin length		26.7–36.3	21.6–27.5	29.6	~26.9	26.6–27.6
Length of caudal peduncle	15.2–21.8	21.2–26.5	15.7–21.3	21.4–23.3	22.1	22.8–23.4
Depth of caudal peduncle	12.1–15.4	12.7–17.3	14.5–16.5	12.5–14.4	17.5	12.6–13.8
Upper caudal-fin lobe length		41.8–88.9+	74.4	29.5–41.4+	~37.3	
Lower caudal-fin lobe length		39.7+–81.1	72.6	29.5–46.7	36.1+	
Mid-caudal-fin ray length				26.3–28.5		55.6–59.3
Longest caudal-fin ray			54.1–84.7			
Depressed anal-fin length		30.3–44.5	32.6+–42.7	31.3–36.5	31.6	39.7–42.7
Length of first anal spine		4.6–7.4	5.2–6.0	5.7	6.1	3.7–3.8
Length of second anal spine		6.6–10.2	7.7–8.7	9.1	7.1+	6.7–7.2
Length of third anal spine		8.5–12.2	9.5–11.5	10.3	7.8	8.0–8.7
Anal-fin base length	16.7–21.5	17.0–21.4	19.7–21.7	19.3–19.9	15.2	18.6–20.7
Penultimate dorsal-fin ray length		15.6–27.5				18.9–~19.6
Ultimate dorsal-fin ray length		15.5–22.9				~14.6–15.6
Penultimate anal-fin ray length		~15.8–23.1				18
Ultimate anal-fin ray length		11.5–18.2				15.2

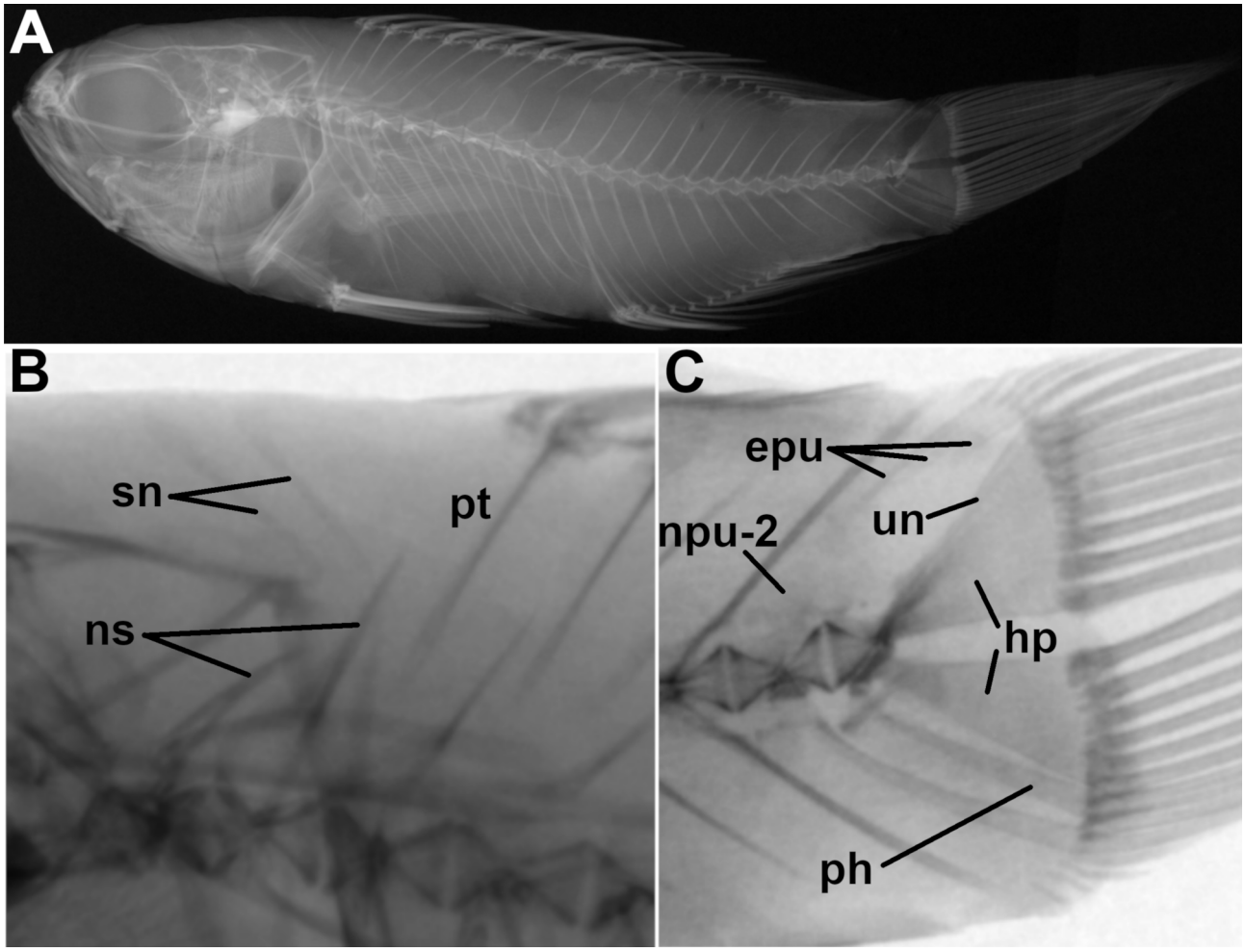

FIGURE 3. Radiograph of *Grammatonotus bianchi* **sp. nov.** Holotype, SAIAB 208486, 68.7 mm SL **(a–c)**; **a**: whole specimen in lateral view; **b**: close-up illustrating the configurations of supraneural bones (sn), anterior neural spines (ns), and anterior dorsal pterygiophore (pt); **c**: close-up of caudal skeleton where: (epu) epuralia, (hp) hypurals, (npu-2) neural process, (ph) parhypurale, (un) uroneurale (images by Mark Lisher & Nkosinathi Mazungula).

Dorsal fin not incised at junction of spinous and soft portions. Dorsal-fin rays XI, 9. Anal-fin rays III, 9. Pectoral-fin rays 20 (19). Pelvic-fin rays I, 5. Caudal fin rounded (somewhat pointed with median rays produced in lost specimen Fig. 2B) with filamentous rays on upper and lower lobes. Principal caudal-fin rays 15 (8+7); branched caudal-fin rays 13 (7+6); procurrent caudal-fin rays 6 dorsally and ventrally. Branchiostegal rays 6. Pseudobranchs with 14 (12) filaments. Gill rakers long and slender, 8 (7) + 18, total number on first gill arch 26 (25). Lateral line count not possible because most scales missing; nine tubed lateral line scales remaining on left side of holotype from below fourth dorsal-fin spine to second dorsal-fin ray; 9 tubed lateral line scales remaining on right side of paratype from below the seventh dorsal-fin spine to the fifth dorsal-fin ray where the lateral line terminates. Mid-lateral series scales ca. 24. Circum-caudal-peduncular scales ca.16.

Vertebrae 24 (10 precaudal + 14 caudal). Parapophyses absent from first caudal vertebra. Supraneurals 2. One trisegmental pterygiophore associated with dorsal fin, and one with anal fin. Pleural ribs 8 pairs on vertebrae 3 to 10. Hypural fusions 1 w/2; 3 w/4. Epurals 3. Epineurals at least 11 pairs.

Premaxilla with outer series of canine-like teeth with three to four slightly enlarged at anterior end of jaw; inner band of villiform to small conical teeth, band expanded near symphysis; no teeth at symphysis. Dentary with series of conical teeth substantially smaller in size (less than half) to those on the premaxilla; two enlarged into caniniform teeth about one third back on jaw; patch of villiform teeth next to symphysis; one exserted canine at anterior end of jaw; no teeth at symphysis. Vomer with few small conical teeth arranged in a chevron-shaped patch, patch without posterior prolongation. Palatine with band of villiform teeth. No teeth on tongue or pterygoids.

TABLE 3. Comparison of coloration and caudal-fin shape of *Grammatonotus bianchi* **sp. nov.** with congeneric species. Characters of *G. bianchi* **sp. nov.** outlined in first column, ✓ indicates the presence of these characters in congeneric species.

			INDIAN OCEAN			CORAL TRIANGLE				OPEN PACIFIC OCEAN				
	***G. bianchi* sp. nov.**	***G. lanceolatus***	***G.* sp. 1 (Mascarenes)**	***G.* sp. 2 (Mozambique)**	***G. brianne***	***G. crosnieri***	***G. roseus***	***G. ambiortus***	***G. laysanus***	***G. macrophthalmus***	***G. pelipel***	***G. suruganensis***	***G. xanthostigma***
Fresh coloration													
Body	Reddish orange dorsally											✓	
	Yellowish or pink on sides		✓	✓	✓								
	Whitish anteriorly on breast			✓	✓	✓						✓	
Head	Reddish orange dorsally												
	Whitish ventrally			✓	✓	✓						✓	
Upper jaw	Anterior tip yellowish												
	Reddish premaxilla ventral edge				✓	✓					✓	✓	
Lower jaw	Anterior half reddish												
	Posterior half whitish												
Pectoral fin	Semi-translucent												
	Uniformly pale orange					✓			✓		✓		
Dorsal fin	Bright yellow										✓	✓	✓
	Reddish spots basally												
	Spines with reddish tips		✓							✓	✓		
Pelvic fin	Mostly translucent												
	Outer rays fuchsia or violet distally		✓										
Anal fin	Pinkish basally												
	Bright yellow distally										✓		
Caudal fin	Bright yellow										✓	✓	✓
	Reddish spots												
	Distal third fuchsia or violet												
	Filamentous upper & lower lobe rays yellow												
Caudal-fin shape													
Upper & lower lobes produced									✓	✓	✓		
Central rays not produced*													
Posterior margin rounded**							✓		✓				

*Produced in lost specimen; **Somewhat pointed in lost specimen.

Scales peripheral ctenoid. Body with mid-lateral series of modified scales (see Anderson *et al.* 2018, Fig.1C–D). Most of head, including maxilla, dentary, dorsum of snout, and interorbital region with scales. Dorsal, anal, pectoral and pelvic fins without scales; modified scales (interpelvic process) overlapping pelvic-fin bases along midventral line.

Fresh coloration described from photos including the holotype (Fig. 2A), paratype and photographic record of one specimen (Fig. 2B) not retained. Dorsal part of body reddish orange, fading to yellowish or pink on the sides; lower part of head and body whitish anteriorly on breast, belly (partially) and opercular region, becoming yellowish or pale pink behind pelvic-fins bases to caudal-fin base; anterior tip of upper jaw yellowish with reddish premaxilla ventral edge, lower jaw anterior half reddish; iris of eye yellow centrally with red peripherally almost reaching pupil both dorsally and ventrally, bluish band over red dorsal part of iris; pectoral fin semi-translucent and uniformly pale orange; dorsal fin bright yellow with reddish spots basally on interspinous membranes, a centrally located row of reddish spots from the fourth dorsal-fin spine, and reddish tips on dorsal-fin spines; pelvic fin mostly translucent with outer rays fuchsia or violet distally; anal fin pinkish basally and bright yellow distally; caudal fin bright yellow with reddish spots, distal third fuchsia or violet, filamentous upper and lower lobe rays yellow.

Preserved coloration. Uniformly yellowish brown throughout, opercle semi-translucent.

Etymology. The species is named in honor of Dr. Gabriella Bianchi, in recognition of her remarkable contribution to advancing knowledge on the marine resources and ecosystems of developing countries throughout a long and productive career at FAO in the role of Senior Fisheries Officer and now as Research Coordinator of the EAF-Nansen Programme. Early in her career, Gabriella was a key person in the FAO FishFinder Programme (formerly SIDP) and contributed significantly to our knowledge of the world's marine biodiversity through the production of reference publications, including the FAO Species Identification Sheets for the Western Indian Ocean and for the Eastern Central Atlantic, as well as several FAO field species identification guides covering the fishery resources of many countries in Africa and Asia. The specific epithet is treated as a noun in apposition.

Distribution. *Grammatonotus bianchi* **sp. nov.** is currently known only from the type locality, off Myanmar's Tanintharyi coast, in the Andaman Sea (Fig. 1) at depths of 182–184 m.

Comparisons. *Grammatonotus bianchi* **sp. nov.** is distinguishable from all valid species of *Grammatonotus* by having a larger head, its length 37.7–38.6% SL [vs. 28.3–37.5% SL for all other congeners]; a larger postorbital head length 16.7–17.0% SL [vs. 10.7–16.2% SL]; a larger orbit diameter 14.4–15.3% SL [vs. 7.5–14.9% SL, except for *G. macrophthalmus*]; a shorter caudal peduncle length 17.3–18.7% SL [vs. 20.9–27% SL, except for *G. ambiortus* and *G. macrophthalmus*]; a unique fresh coloration with a bright yellow caudal fin covered by reddish spots and fuchsia or violet distal third (see Fig. 2, Table 3 and color description), and a rounded (semi-produced central rays in unretained specimen) caudal fin with produced upper and lower lobes (except for *G. laysanus*).

It can be further distinguished from the only other described species of *Grammatonotus* occurring in the Indian Ocean, *G. lanceolatus*, by having a larger interorbital width 6.3–8.0% SL [vs. 5.3% SL]; shorter mid-caudal-fin rays 29–33.6% SL [vs. 38.9–41.9% SL], and slightly longer anal-fin base, its length 19.2–19.8% SL [vs. 18.6% SL].

Grammatonotus bianchi **sp. nov.** can be easily further distinguished from the two putative undescribed species from the southwestern Indian Ocean, namely, *Grammatonotus* sp. 1 (Mascarenes) and *Grammatonotus* sp. 2 (Mozambique) sensu Anderson et al. (2018) by having a deeper body, its depth 32.0–34.6% SL [vs. 28.1–32.7 and 29.8–30.3% SL]; a longer upper jaw, its length 14.8–15.3% SL [vs. 12.4–14.2 and 13.0–14.2]; longer anal-fin spines, first spine length 5.5–5.9% SL [vs. 2.4–4.4 and 3.9–4.4 % SL], second spine length 10–10.2% SL [vs. 5.1–7.1 and 7.5–7.9], and third spine length 12.1–13.5% SL [vs. 6.1–8.7 and 9.3–9.7% SL].

When compared to the three Coral Triangle *Grammatonotus* species, *G. bianchi* **sp. nov.** can be further separated from *G. brianne* by a longer predorsal-fin length, 36.4–38.1% SL [vs. 30.6–33.5% SL]; a longer upper jaw length, 14.8–15.3% SL [vs. 12.6–14.2% SL]; substantially shorter mid-caudal-fin rays, length of 29–33.6% SL [vs. 58.6–82.2% SL]; longer anal-fin spines, with first spine length 5.5–5.9% SL [vs. 2.8–3.4% SL], second spine length 10.0–10.2% SL [vs. 5.3–7.3], and third spine length of 12.1–13.5% SL [vs. 7.5–9.2% SL]. From *G. crosnieri* by having a longer snout, its length 5.7–6.1% SL [vs. 4.3–5.4% SL]; shorter anal-fin spines, with first spine length 5.5–5.9% SL [vs. 6.2–10.3% SL], second spine length 10–10.2% SL [vs. 9.4–14.3% SL], and third spine length of 12.1–13.5% SL [vs. 11.1–15.3% SL]. From *G. roseus* by having a shallower body, its depth 32–34.6% SL [vs. 35.4–37.2% SL]; a shorter pectoral fin, its length 24.6–24.9% SL [vs. 25.0–26.1% SL]; a longer pelvic fin, its length 27–27.4% SL [vs. 24.8–25.7% SL].

When compared to the open Pacific Ocean species, *G. bianchi* **sp. nov.** can be further distinguished from *G.*

laysanus by having a longer predorsal-fin length, 36.4–38.1% SL [vs. 30.7–36.8% SL]. From *G. macrophthalmus* by a longer predorsal-fin length, 36.4–38.1% SL [vs. 30.5–35.9% SL]; a longer upper jaw, its length 14.8–15.3% SL [vs. 11.6–14.1% SL]; a longer pectoral fin, its length 24.6–24.9% SL [vs. 18.9–23.7% SL]; longer second and third anal-fin spines, their length 10–10.2 and 12.1–13.5% SL respectively [vs. 7.7–8.7 and 9.5–11.5% SL]. From *G. pelipel* by a larger interorbital width of 6.3–8% SL [vs. 5.9–6.8% SL]; a longer upper jaw, its length 14.8–15.3% SL [vs. 12.8% SL]; shorter pectoral and pelvic fins, their lengths 24.6–24.9 and 27–27.4% SL [vs. 27.4 and 29.6% SL]; a deeper caudal peduncle, its depth 14.7–15.5% SL [vs. 12.5–14.4% SL]; longer mid-caudal-fin ray length of 29–33.6% SL [vs. 26.3–28.5% SL]; longer third anal spine, its length 12.1–13.5% SL [vs. 10.3% SL]. From *G. surugaensis* by having a shallower body, its depth 32–34.6% SL [vs. 35.7% SL]; a longer predorsal-fin length of 36.4–38.1% SL [vs. 31% SL]; a longer length of upper jaw 14.8–15.3% SL [vs. 13.2% SL]; shallower caudal peduncle, its depth 14.7–15.5% SL [vs. 17.5% SL]; longer depressed anal-fin length of 35.7–38.3% SL [vs. 31.6% SL]; longer third anal-fin spine, its length 12.1–13.5% SL [vs. 7.8% SL]; and longer anal-fin base, its length 19.2–19.8% SL [vs. 15.2% SL]. From *G. xanthostigma* by a deeper body, its depth 32–34.6% SL [vs. 29.6–31.1% SL]; a longer predorsal length, 36.4–38.1% SL [vs. 33.2–33.9% SL]; a longer snout, its length of 5.7–6.1% SL [vs. 4.7–4.9% SL]; a larger interorbital width of 6.3–8% SL [vs. 5.6–5.7% SL]; a longer upper jaw, its length 14.8–15.3% SL [vs. 12.3–12.8% SL]; a deeper caudal peduncle, its depth 14.7–15.5% SL [vs. 12.6–13.8% SL]; substantially shorter mid-caudal-fin rays, their length 29–33.6% SL [vs. 55.6–59.3% SL]; shorter depressed anal fin, its length 35.7–38.3% SL [vs. 39.7–42.7% SL]; longer anal-fin spines, first spine length 5.5–5.9% SL [vs. 3.7–3.8% SL], second spine length 10–10.2% SL [vs. 6.7–7.2% SL], and third spine length of 12.1–13.5% SL [vs. 8.0–8.7% SL].

Key to Indian Ocean species of *Grammatonotus*

1a. Caudal fin with produced upper and lower lobes 2
1b. Caudal fin without produced upper and lower lobes 3
2a. Predorsal-fin length 36–38% SL. Body depth 32–35% SL. Head length 37–39% SL. Caudal peduncle length 17–19% SL. . . . . *G. bianchi* **sp. nov.** (Andaman Sea)
2b. Predorsal-fin length 32–37% SL. Body depth 28–33% SL. Head length 31–35% SL. Caudal peduncle length 21–25% SL. . . . . *Grammatonotus* sp.1 (Mascarene Plateau)
3a. Predorsal-fin length 36–38% SL. Body depth 31–37% SL. Head length 32–37% SL. Caudal peduncle depth 13–17% SL . . . . . *G. lanceolatus* (off Socotra Island)
3b. Predorsal-fin length 32–35% SL. Body depth 29–30% SL. Head length 29–33% SL. Caudal peduncle depth 10–13% SL . . . . . *Grammatonotus* sp. 2 (Mozambique)

Discussion

Grammatonotus bianchi **sp. nov.** appears to be most similar to *G. laysanus* from the Pacific Ocean in sharing a similar rounded caudal-fin shape with upper and lower caudal-fin lobes produced (Table 3). Furthermore, the two species share some color characters such as having yellow dorsal fins, and pectoral fin pale orange. Although *G. bianchi* **sp. nov.** and *G. laysanus* share some color characters, general caudal-fin shape, and meristic and morphometric characters, they are easily distinguished from one another as *G. bianchi* **sp. nov.** has a larger head, longer postorbital head length, larger orbit, and fewer gill rakers (see comparisons section above, and Tables 1 & 2 for details).

When comparing photographs (Fig. 2) of *G. bianchi* **sp. nov.** collected in 2015 and 2018, there seems to be slight intraspecific variation in the length of median caudal-fin rays and extent of the violet band distally on the caudal fin. The 2018 specimens display a reddish orange body dorsally, becoming yellowish on the sides, with the ventral half of head and pectoral-fin region of body whitish. Whereas, the 2015 specimen displays a body with dorsal portion reddish pink, becoming pink on the sides and the ventral half of head and pectoral-fin region of body whitish with a bluish grey tinge. These slight variations in both coloration and caudal-fin median rays could be due to sexual dimorphism, size, or in case of coloration the condition and time lapse between collection and photographing of the specimens. Both specimens of *G. bianchi* **sp. nov.** collected in 2018 (representing the holotype and paratype) with a rounded caudal fin are females, making it highly probable that the unretained specimen collected in 2015 with produced median caudal fin rays (Fig. 2B) may represent a male. It is recommended that further specimens be analysed when they become available to confirm that observed variation in color and caudal-fin shape are due to sexual dimorphism in *G. bianchi* **sp. nov.**

Comparative material examined

Grammatonotus sp. 1 (Mascarenes): SAIAB 84121 (11 specimens), 55.5–106 mm SL, Mascarene 14, Western Indian Ocean, 12°17.02'S, 61°04.75'E, 275–276 m depth, 24 October 2008, R/V *Dr. Fridtjof Nansen*, collected by Denis Tweddle & Oddgeir Alvheim.

Grammatonotus sp. 2 (Mozambique): SAIAB 82074 (2 specimens), 66.4–67.1 mm SL), PCH2007-M56, Western Indian Ocean, 23°15.2'S, 35°40.8'E, 151–156 m depth, 14 October 2007, R/V *Dr. Fridtjof Nansen*, collected by Phillip & Elaine Heemstra.

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