Zootaxa 3717 (1): 085–095
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://dx.doi.org/10.11646/zootaxa.3717.1.7
http://zoobank.org/urn:lsid:zoobank.org:pub:0FB04DC9-E9D5-4848-8356-CEDDBD59E249

A new goatfish of the genus *Upeneus* (Mullidae) from Angoche, northern Mozambique

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Abstract

A new goatfish, *Upeneus saiab* **n. sp.** (Mullidae), is described from six specimens collected off Angoche, northern Mozambique, during a research cruise of the RV *Dr. F. Nansen* in August 2009. *Upeneus saiab* **n. sp.** differs from all congeneric species in the following combination of characteristics: seven dorsal-fin spines, 29 total gill rakers, body depth at anal-fin origin 17–19% SL, and pectoral-fin length 20–21% SL. Detailed comparisons with the eight other species of the *japonicus* group are made and a key for Western Indian Ocean species is provided. A new record of *Upeneus pori* for KwaZulu-Natal, South Africa, is reported based on *in situ* photographs. The need for further exploration of the rather long and ecologically diverse Mozambican coast and adjacent areas of southeastern Africa for the occurrence of yet undescribed or unreported goatfish species is emphasized.

Key words: *Upeneus saiab*, new species, *Upeneus pori*, new record, *japonicus* species group, coastal habitats

Introduction

Over its entire range of ca 2 750 km in length, the Mozambican coast is ecologically fragmented and diverse as a result of changing coastline, shelf width and bottom structure, and local incidences of upwelling, river runoffs, estuaries, islands, banks, coral reefs, mangrove forests, and seagrass beds (e.g., Lutjeharms 2006; ASCLME 2012; http://earthtrends.wri.org/). As a consequence the different habitats may be populated by rather different assemblages composed of organisms which occur in one habitat but are not necessarily encountered in others. Hence an essential prerequisite for studies aiming at preparing species inventories for such a long and diverse coastline is to collect representative samples from all kinds of habitats and examine those samples in detail taxonomically. In the tropical, biodiversity-rich setting of the Mozambican coast the need for such exploration applies even to relatively well-sampled and common groups of fishes such as the goatfishes (Mullidae).

Goatfishes occur in a variety of tropical and temperate coastal habitats and have significance as fishery resources and ecological indicators (Uiblein 2007). In Mozambique, goatfishes are an important component of demersal fish assemblages and artisanal fisheries. During bottom trawl surveys with the RV *Dr. Fridtjof Nansen* of the Sofala Bank, central Mozambique, in 1982 and 1990, goatfishes were found to be common on the entire shelf (Sætersdal et al. 1999). In a study of the artisanal fisheries management in the Nampula province, northern Mozambique, Lopes & Gervasio (2003) found goatfishes of the genus *Upeneus* to be of high importance as a fishery resource. In 2007, bottom trawling with RV *Dr. F. Nansen* at a number of stations along the entire coast of Mozambique resulted in collection of a large number of goatfishes (Uiblein & Heemstra 2010), allowing detailed taxonomic studies. Based on these samples and comparative material, regional reviews of the three goatfish genera *Mulloidichthys*, *Parupeneus*, and *Upeneus* for the Western Indian Ocean have been published (Randall & Heemstra 2009, Uiblein & Heemstra 2010, Uiblein 2011). The material collected off the Mozambican coast contributed to the description of four species new to science (*Parupeneus minys* Randall & Heemstra, 2009, *P. nansen* Randall & Heemstra, 2009, *Upeneus margarethae* Uiblein & Heemstra, 2010, *U. suahelicus* Uiblein & Heemstra, 2010) and several new records for this area.

Accepted by W. Holleman: 5 Aug. 2013; published: 26 Sept. 2013

During a more recent cruise with RV *Dr. F. Nansen* in August 2009, at a bottom trawl station off Angoche, Nampula province (northern Mozambique), several goatfishes were caught which could not be identified to species on board. One fresh specimen was photographed and brought back to the fish collection at the South African Institute of Aquatic Biodiversity (SAIAB), together with additional six specimens from the same trawl station. Detailed examination showed that one of the seven specimens is *U. guttatus* (Day, 1868), while the other six represent an undescribed species.

Based on the six specimens collected off Angoche and the examination of a large set of morphometric, meristic and colour characters, *Upeneus saiab* **n. sp.** is here described and compared with all species of the *japonicus* group, which is characterized by seven dorsal-fin spines, 21–32 total gill rakers, 12–15 pectoral-fin rays, and bars on upper caudal-fin lobe of fresh fish in all species (Uiblein & Heemstra 2010, 2011, Yamashita *et al*. 2011). Apart from *U. saiab* **n. sp.**, the following species also belong to this group: *Upeneus asymmetricus* Lachner, 1954 (Philippines), *U. australiae* Kim & Nakaya, 2002 (Australia, New Caledonia), *U. francisi* Randall & Guézé, 1992 (New Zealand, Norfolk Island), *U. guttatus* (Indo-West Pacific), *U. itoui* Yamashita, Golani & Motomura, 2011 (Japan), *U. japonicus* (Houttuyn, 1782) (West Pacific), *U. pori* Ben-Tuvia & Golani, 1989 (Western Indian Ocean, Eastern Mediterranean), and *U. seychellensis* Uiblein & Heemstra, 2011 (Seychelles Bank).

A key is provided for the Western Indian Ocean (WIO) species of the *japonicus* group. The results are briefly discussed with regard to the need for further exploration the coastal habitats of Mozambique and the SE African coast for the possible occurrence of yet undescribed or unreported goatfish species, and the importance of these data for the monitoring and management of fisheries resources.

Material and methods

A total of 40 morphometric and 12 meristic characters were compared, using 99 specimens of the nine species belonging to the *japonicus* group (Table 1). The number of lateral-line scales could not always be determined as specimens were not in good condition, hence the number of specimens is also shown in Table 1. A number of colour characters were also compared, based on photographs of fresh and preserved fish, including colour of body and barbels, the presence and colour of a mid-lateral body stripe, and caudal-fin colour patterns.

Methods for measuring and counting as well as descriptions of colour based on fresh and preserved fish follow Uiblein and Heemstra (2010, 2011). In all comparisons and preparation of the identification key, attention was paid to the most diagnostic characters, taking sample size and intraspecific variation into consideration. Measurements are given as % SL and are summarised in Table 1, with counts (*n*) for the species. Drawings of the caudal-fin colour patterns in preserved specimens of the WIO species of the *japonicus* group were prepared to facilitate identification of material encountered in scientific collections.

The type specimens were collected on behalf of SAIAB as an invited participant on the cruise.

Institutional codes followed Sabaj Pérez (2012).

Taxonomy

Genus *Upeneus* Cuvier, 1829

***Upeneus saiab* n. sp.**
SAIAB goatfish
(Figs. 1–2; Table 1)

Holotype. SAIAB 188298 (102 mm SL), Mozambique, Angoche, Nampula province, 16˚2.75' S 40˚20.26' E, FAO/ASCLME/SWIOFP survey 2009, RV *Dr. Fridtjof Nansen*, station 29, 29-40 m, bottom trawl, 14/Aug/2009.

Paratypes . SAIAB 188299 (5: 70–88 mm SL), Mozambique, Angoche, Nampula province, same locality and collection data as for holotype.

Diagnosis. Dorsal fins VII + 9; pectoral fins 14–15; gill rakers 8–9 + 20–21 = 29; lateral-line scales 29–30; body depth at first dorsal-fin origin 21–24; body depth at anus 17–19; caudal-peduncle depth 8.7–9.2; maximum head depth 18–20; head depth through eye 15–17; interorbital length 7.0–8.2; head length 29–30; postorbital

distance 12–13; orbit length 6.8–7.5; upper jaw length 9.5–12; barbel length 19–22; interdorsal distance 14–16; caudal-fin length 27–29; anal-fin height 14–16; pelvic-fin length 20–21; pectoral-fin length 20–21; first dorsal-fin height 19–22; second dorsal-fin height 14–16; upper lobe of caudal fin with 5 red oblique bars including one on tip; lower caudal-fin lobe covered mostly with red pigmentation ending in a black tip; barbels white; body and postorbital region ventrally white and dorsally ochre, bordered at mid body by a faint lateral pale ochre stripe from behind eye to caudal base, head ochre from snout to cheek and ventrally white; preserved fish pale brown, bars on upper caudal-fin lobe and the lower lobe pigmented tip only weakly retained.

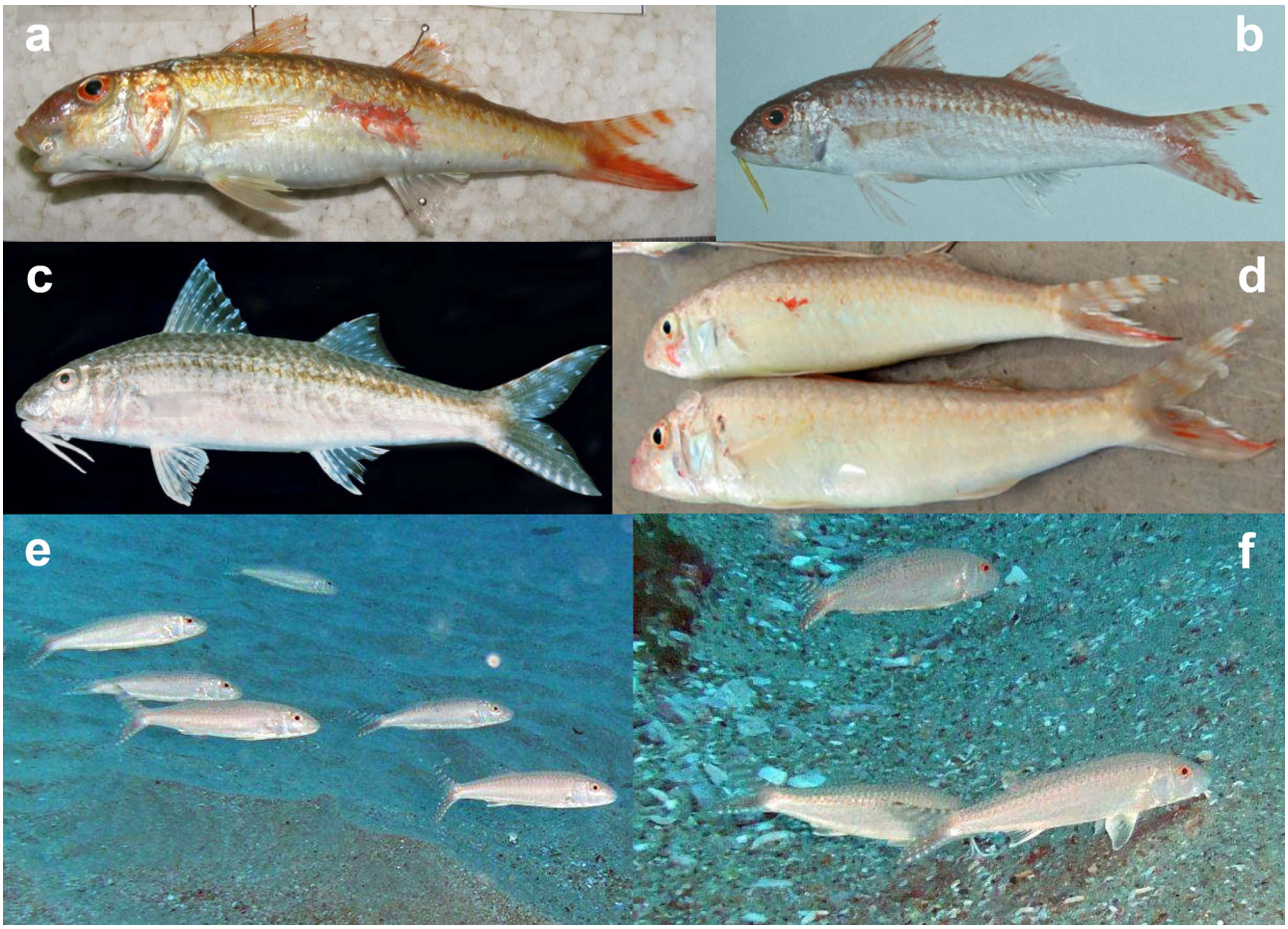

FIGURE 1. The four western Indian Ocean species of the *japonicus* group. (a) *Upeneus saiab* **n. sp.**, holotype, SAIAB 188298, 10.2 cm SL, northern Mozambique (M. Lisher); (b) *U. guttatus,* SAIAB 13947, 10 cm SL, Kenya (P.C. Heemstra); (c) *U. pori,* 114 mm, Red Sea, Egypt (J.E. Randall); (d) *U. seychellensis,* holotype, SAIAB 96980, 11.5 cm SL and (below) paratype, SAIAB 84280, 10.2 cm SL, Seychelles Bank (O. Alvheim); (e) and (f) *U. pori*, *in situ* photographs, north of Ribbon Reef, Sodwana Bay, KwaZulu Natal, South Africa (C. van Jaarsveld)

Description. Morphometric data as ratios of SL for holotype, data for paratypes in brackets: body moderately deep, its depth at first dorsal-fin origin 4.2 [4.5–4.9]; body depth at anal-fin origin 5.5 [5.2–6.1]; head depth through eye 5.8 [6.2–6.6]; head length 3.4 [3.3–3.4], larger than maximum depth of body and caudal-fin length (3.6 [3.4–3.7]); snout length 9.0 [9.4–10], shorter than postorbital length (8.0 [7.6–8.0]); postorbital distance 8.0 [7.6–8.0]; first dorsal-fin height 4.9 [4.6–5.2]; second dorsal-fin height 6.9 [6.1–6.8]; barbel length 4.6 [4.9–5.3]; pectoral-fin length 4.8 [4.7–5.0], subequal to pelvic-fin length (4.8 [4.7–4.9]); orbit length 15 [13–15], smaller than caudal-peduncle depth (11 [11]).

Fresh colour (Fig. 1): ventral half of body and postorbital region of head white and dorsal half ochre, bordered by a faint pale-ochre lateral stripe at mid body from behind eye to caudal base; head from tip of snout to cheek dorsally ochre and ventrally white; barbels white; caudal fin with 5 oblique red bars on upper lobe including one at lobe tip, all of similar width and narrower than hyaline interspaces between them; no clear bar pattern can be recognized on lower-caudal fin lobe which is mostly covered with red pigmentation, except for pale to pale-brown nuances at dorsal margin and anterior ventral third of lobe being partly pale overlain with red patches, becoming

increasingly red distally and being bordered by red pigmentation dorsally and ventrally; lower caudal-fin lobe ends in a dark tip; first dorsal fin hyaline, covered with irregular patches of red pigmentation that become larger towards anterior fin base, fin tip without pigmentation; second dorsal fin hyaline with three red bands, one at base, one at mid of fin and one broader distal one below the unpigmented fin tip; paired fins hyaline; anal fin hyaline, rays proximally white.

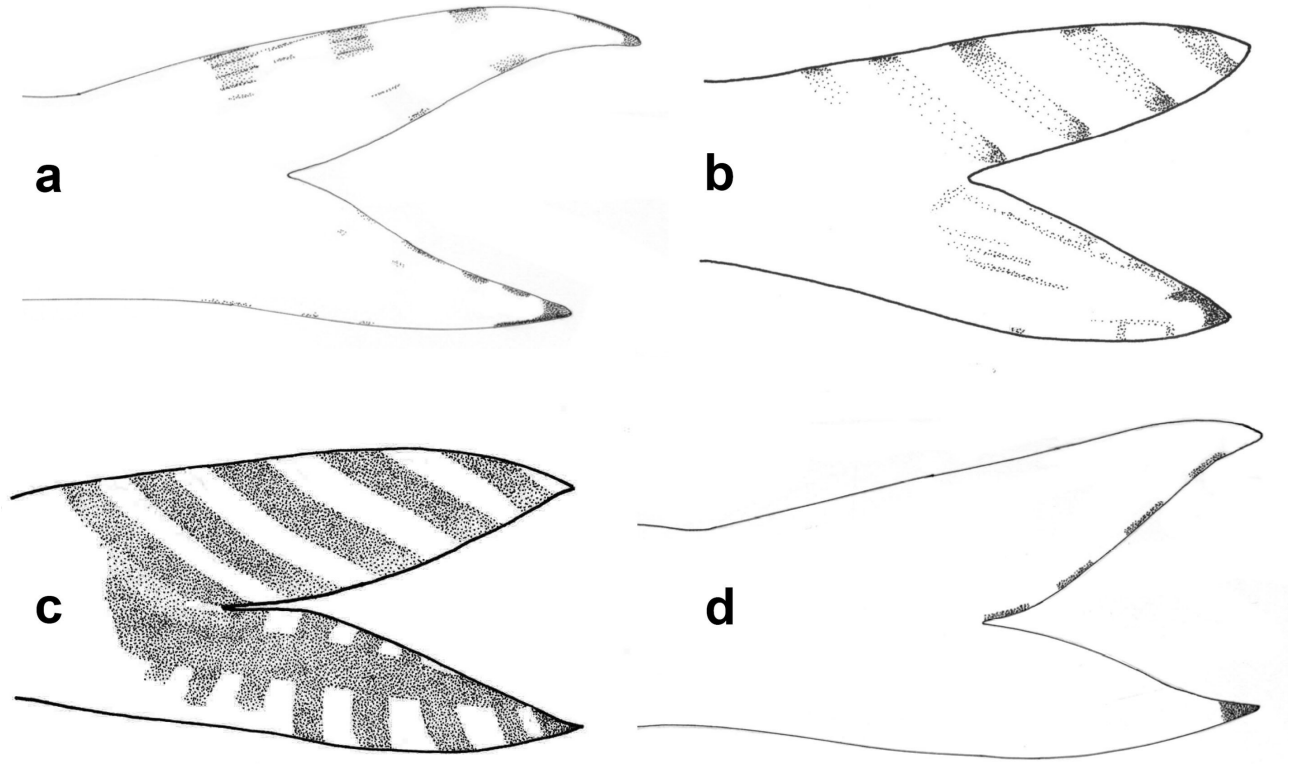

FIGURE 2. Drawings of caudal-fin colour patterns in preserved fish of the four Western Indian Ocean species of the *japonicus* group. (a) *U. saiab* **n. sp.**, holotype, SAIAB 188298, 10.2 cm SL, northern Mozambique; (b) *U. guttatus*, SAIAB 82714, 9.4 cm SL, Mozambique; (c) *U. pori*, MNHN 1992-977, 9.7 cm SL, Madagascar; (d) *U. seychellensis,* holotype, SAIAB 96980, 11.5 cm SL, Seychelles Bank (all drawings by E. Heemstra).

Preserved colour (Fig. 2). Head and body uniformly pale brown, becoming darker on dorsal half; head with dark patches above snout tip; opercle partly transparent; fin pigmentation mostly lost, remains of bars on upper caudal-fin lobe, a few nuances of pigmentation along both margins of posterior lower lobe, dark lower-lobe fin tip faintly retained.

Distribution. Currently only known from types collected off Angoche, northern Mozambique, Western Indian Ocean, at 29–40 m depth.

Etymology. The name "*saiab*" is used as a noun in apposition and is given to honor the importance and invaluable contributions of the South African Institute of Aquatic Biodiversity (SAIAB) as the primary scientific collection for taxonomic and systematic studies of the fish fauna of the Western Indian Ocean.

Comparisons and Remarks. *Upeneus saiab* **n. sp.** differs from all congeneric species in the following combination of characteristics (Table 1): seven dorsal-fin spines, 29 total gill rakers (20–21 rakers on lower limb), body depth at anal-fin origin 17–19% SL, and pectoral-fin length 20–21% SL.

It differs from the three WIO species of the *japonicus* group as follows (Table 1A, Figs. 1–2): from *U. guttatus* in shallower body depth at anal-fin origin, shallower caudal peduncle, longer postorbital distance, longer barbels, more pectoral-fin rays, more gill rakers, and presence of lateral body stripe in fresh fish; from *U. pori* it differs in shallower body depth at anal-fin origin, longer head, longer and wider barbels, lower anal fin, more gill rakers, and absence of oblique bars on lower caudal-fin lobe in both fresh and preserved fish; and from *U. seychellensis* it differs in shallower caudal peduncle, shorter snout, wider barbels, longer second dorsal-fin base, longer anal-fin base, larger pectoral-fin width, more gill rakers, and barbels white vs pale reddish in fresh fish.

TABLE 1A. Morphometric and meristic characters in *Upeneus saiab* n. sp. and three other species of the *japonicas* group occurring in the Western Indian Ocean; the most important distinctions from the new species are emphasized in bold.

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	Upeneus saiab **n. sp.** All types					*U. guttatus* Indian Ocean				*U. pori* Red Sea to Madagascar				*U. seychellensis* Seychelles-Bank			
	HT	Min	Mean	Max	*n*	Min	Mean	Max	*n*	Min	Mean	Max	*n*	Min	Mean	Max	*n*
SL (mm)	102	70	83,6	102	6	77	102,2	146	46	66	96,1	110	7	96	104,2	115	3
Body depth at first dorsal-fin origin	24	21	22,0	24	6	22	23,4	26	39	21	23,0	24	7	20	21,2	22	3
Body depth at anal-fin origin	18	17	18,4	19	6	**19**	**20,2**	**22**	39	**20**	**20,5**	**22**	7	18	18,2	19	3
Half body depth (from lateral line downwards) at first dorsal fin origin	19	16	17,6	19	5	17	19,3	21	33	18	19,3	21	7	17	18,1	19	3
Half body depth (from lateral line downwards) at anal fin origin	14	13	14,2	15	6	**15**	**15,8**	**18**	33	14	15,4	16	7	14	14,2	15	3
Caudal-peduncle depth	9,0	8,7	8,9	9,2	6	**9,3**	**10,0**	**11**	39	9,1	9,5	9,8	7	**9,2**	**9,4**	**9,6**	3
Caudal-peduncle width	3,8	3,0	3,6	3,9	6	3,2	4,0	5,1	39	3,5	3,8	4,2	7	3,6	3,8	4,1	3
Maximum head depth	20	18	19,5	20	6	18	20,1	22	39	18	19,3	20	7	18	19,1	20	3
Head depth across a vertical midline through eye	17	15	16,0	17	6	15	16,2	18	39	15	15,5	16	7	15	15,7	17	3
Suborbital depth	11	8,4	9,5	11	6	8,6	9,6	12	39	8,9	9,4	9,9	7	9,2	9,8	10	3
Interorbital length	8,0	7,0	7,6	8,2	6	7,2	7,8	8,4	39	7,4	7,9	8,4	7	6,7	7,1	7,7	3
Head length	29	29	29,6	30	6	26	27,4	30	39	**26**	**27,4**	**29**	7	27	28,3	30	3
Snout length	11	10	10,4	11	6	9,8	10,8	13	39	11	11,2	12	7	**11**	**11,7**	**12**	3
Postorbital length	12	12	12,7	13	6	**9,7**	**11,1**	**12**	39	11	11,6	12	7	12	11,8	12	3
Orbit length	6,9	6,8	7,1	7,5	6	6,2	7,2	8,8	39	5,9	6,8	7,8	7	6,0	6,3	6,5	3
Orbit depth	6,3	6,2	6,6	7,0	6	5,2	6,2	7,6	39	5,1	6,1	7,7	7	5,5	5,7	6,2	3
Upper-jaw length	12	9,5	10,5	12	6	9,6	10,8	12	39	10	10,7	12	7	11	11,0	11	3
Lower-jaw length	11	8,9	9,7	11	6	8,7	10,1	11	39	9,7	10,2	11	7	10	10,5	11	3
Snout width	8,5	7,5	8,0	8,5	6	7,7	8,9	11	36	8,0	8,5	10	7	7,3	8,2	9,2	3
Barbel length	22	19	19,9	22	6	**16**	**17,4**	**19**	38	**16**	**17,3**	**19**	7	17	18,7	22	3
Maximum barbel width	1,0	0,9	0,9	1,0	6	0,7	0,8	1,1	39	**0,6**	**0,7**	**0,9**	7	**0,7**	**0,8**	**0,8**	3
First pre-dorsal length	37	37	37,4	38	6	33	35,8	38	39	34	36,0	37	7	37	38,0	39	3
Second pre-dorsal length	66	64	65,4	68	6	60	63,6	68	39	63	64,6	67	7	63	64,0	65	3
Interdorsal distance	15	14	14,9	16	6	13	15,5	17	39	13	14,6	16	6	12	14,1	16	3
Caudal-peduncle length	23	22	23,0	24	6	22	23,7	26	39	22	22,9	24	7	24	23,9	24	3
Pre-anal length	67	65	66,1	67	6	60	64,3	68	39	60	63,9	67	7	65	66,6	68	3
Pre-pelvic length	34	32	33,3	35	6	28	31,2	34	39	28	30,6	32	7	30	31,7	33	3
Pre-pectoral length	33	31	31,7	33	6	27	29,3	33	39	28	29,3	30	7	28	29,9	32	3
Second dorsal-fin depth (second dorsal-fin origin to anal-fin origin)	19	17	18,4	19	6	**19**	**20,8**	**23**	39	**20**	**21,0**	**22**	7	18	18,7	19	3
Pelvic-fin depth (first dorsal-fin origin to pelvic-fin origin)	23	20	21,4	23	6	22	23,3	26	39	22	23,3	25	7	21	21,7	23	3
Pectoral-fin depth (first dorsal-fin origin to dorsal origin of pectoral fin)	16	14	14,7	16	6	15	16,4	19	39	16	16,4	17	7	16	16,6	17	3
Length of first dorsal-fin base	16	14	15,2	16	6	13	14,8	17	39	14	15,1	16	6	14	13,8	14	3
Length of second dorsal-fin base	13	13	13,9	15	6	12	13,4	15	39	13	13,6	15	7	**12**	**12,5**	**13**	3
Caudal-fin length (dorsal caudal-fin origin to upper caudal-lobe tip)	28	27	27,9	29	6	27	28,8	30	36	27	27,9	29	6	28	29,1	30	3

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TABLE 1A. (Continued)

	Upeneus saiab **n. sp.** All types					*U. guttatus* Indian Ocean				*U. pori* Red Sea to Madagascar				*U. seychellensis* Seychelles-Bank			
	HT	Min	Mean	Max	*n*	Min	Mean	Max	*n*	Min	Mean	Max	*n*	Min	Mean	Max	*n*
Length of anal-fin base	11	11	11,7	13	6	9,5	11,5	14	39	10	11,9	13	7	**9,6**	**10,0**	**10**	3
Anal-fin height	14	14	15,2	16	6	15	16,3	19	38	**16**	**16,2**	**17**	7	14	14,8	15	3
Pelvic-fin length	21	20	20,9	21	6	19	20,8	22	39	20	21,1	23	7	20	20,6	21	3
Pectoral-fin length	21	20	20,7	21	6	19	20,6	22	38	20	20,8	22	7	21	21,1	21	3
Pectoral-fin width (width of pectoral-fin base)	4,9	4,4	4,6	5,0	6	3,5	4,2	5,0	39	4,4	4,7	5,7	7	**3,9**	**4,0**	**4,2**	3
First dorsal-fin height	21	19	20,6	22	6	20	22,0	24	34	20	21,0	22	6	19	19,8	20	3
Second dorsal-fin height	14	14	15,5	16	6	14	16,0	18	37	15	15,8	16	6	16	16,0	17	3
Pectoral-fin rays	15	14	14,8	15	6	**12**	**13,2**	**14**	46	14	14,0	14	7	14	14,7	15	3
Rudimentary gill rakers on upper limb	1	1	2,2	3	6	2	3,5	5	46	0	1,1	2	7	**4**	**4,3**	**5**	3
Developed gill rakers on upper limb	7	5	6,0	7	6	**2**	**3,0**	**5**	46	5	6,3	7	7	**2**	**2,7**	**3**	3
Developed gill rakers on lower limb	17	15	16,5	17	6	**11**	**12,6**	**14**	46	14	15,9	18	7	**13**	**13,0**	**13**	3
Rudimentary gill rakers on lower limb	4	3	4,3	6	6	3	4,6	6	46	2	3,0	5	7	5	5,3	6	3
Total gill rakers on upper limb	8	8	8,2	9	6	**6**	**6,5**	**8**	46	**7**	**7,4**	**8**	7	**7**	**7,0**	**7**	3
Total gill rakers on lower limb	21	20	20,8	21	6	**16**	**17,2**	**18**	46	**18**	**18,9**	**20**	7	**18**	**18,3**	**19**	3
Total gill rakers	29	29	29,0	29	6	**23**	**23,7**	**25**	46	**26**	**26,3**	**27**	7	**25**	**25,3**	**26**	3
Scales along lateral line to caudal-fin base	30	29	29,3	30	4	28	29,6	31	30	29	29,1	30	7	29	29,7	31	3

TABLE 1B. Morphometric and meristic characters in four species of the *japonicus* group occurring in the Eastern Indian Ocean and/or Western Pacific; the most important distinctions from *Upeneus saiab* n. sp. are emphasized in bold.

	U. asymmetricus Philippines				*U. australiae* Australia				*U. francisi* Norfolk Island	*U. itoui* Japan				*U. japonicus* Malaysia to Japan			
	Min	Mean	Max	*n*	Min	Mean	Max	*n*	*n*=1	Min	Mean	Max	*n*	Min	Mean	Max	*n*
SL (mm)	74	82,1	100	4	73	104,2	128	23	78	87	102,7	118	2	104	112,2	120	7
Body depth at first dorsal-fin origin	22	23,4	24	4	**23**	**24,1**	**27**	23	24	22	21,7	22	2	23	23,8	25	7
Body depth at anal-fin origin	**20**	**20,8**	**22**	4	**20**	**21,3**	**23**	23	19	**20**	**20,3**	**21**	2	**19**	**20,3**	**22**	7
Half body depth (from lateral line downwards) at first dorsal fin origin	**19**	**19,5**	**20**	4	**18**	**19,8**	**22**	21	18	18	18,2	18	2	**19**	**20,0**	**21**	6
Half body depth (from lateral line downwards) at anal fin origin	14	15,1	16	4	**15**	**16,4**	**18**	20	15	16	15,7	16	2	**15**	**16,0**	**17**	7
Caudal-peduncle depth	8,8	9,3	9,9	4	**9,9**	**10,6**	**12**	23	**9.9**	**9,4**	**9,5**	**9,6**	2	8,7	9,6	10	7
Caudal-peduncle width	3,7	4,1	4,8	4	3,2	4,0	5,1	23	**2.3**	**4,4**	**4,5**	**4,5**	2	3,1	3,6	4,3	7
Maximum head depth	20	20,1	20	4	**20**	**21,0**	**23**	23	20	18	18,3	18	2	18	19,8	21	7
Head depth across a vertical midline through eye	15	15,7	16	4	15	16,5	18	23	**18**	**13**	**13,8**	**14**	2	15	15,8	16	7
Suborbital depth	9,4	9,7	10	4	9,0	10,3	12	23	8.4	9,0	9,1	9,2	2	8,2	9,3	10	7
Interorbital length	**8,0**	**8,6**	**9,0**	4	7,3	8,2	9,6	23	7.6	6,7	7,4	8,1	2	7,2	7,7	8,5	7
Head length	**27**	**27,7**	**29**	4	27	28,6	30	23	**31**	**27**	**27,5**	**28**	2	**27**	**27,8**	**29**	7
Snout length	9,9	10,2	11	4	9,9	11,7	13	23	10	**12**	**11,7**	**12**	2	11	11,1	12	7
Postorbital length	11	11,5	13	4	11	11,5	13	23	13	11	11,3	12	2	**10**	**11,0**	**12**	7
Orbit length	7,0	7,4	7,7	4	6,0	6,8	8,0	23	8.2	5,7	6,0	6,4	2	6,8	7,2	8,0	7

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TABLE 1B. (Continued)

	U. asymmetricus				*U. australiae*				*U. francisi*	*U. itoui*				*U. japonicus*			
	Philippines				Australia				Norfolk Island	Japan				Malaysia to Japan			
	Min	Mean	Max	*n*	Min	Mean	Max	*n*	*n*=1	Min	Mean	Max	*n*	Min	Mean	Max	*n*
Orbit depth	5,6	6,0	6,5	4	5,0	5,8	6,7	23	6.7	5,0	5,4	5,8	2	5,2	6,1	7,2	7
Upper-jaw length	9,6	10,2	11	4	9,3	10,8	12	23	12	10	10,4	11	2	9,7	10,3	11	7
Lower-jaw length	9,1	9,6	10	4	9,0	10,1	11	22	11	9,8	9,8	9,9	2	9,3	9,7	9,9	7
Snout width	8,1	8,8	9,3	4	7,9	8,9	10	20	7.0	7,6	7,7	7,8	2	7,1	8,3	9,2	7
Barbel length	**18**	**18,6**	**19**	4	**16**	**18,0**	**20**	23	**18**	**17**	**17,1**	**17**	2	18	20,2	22	7
Maximum barbel width	0,8	0,9	1,0	4	0,8	0,9	1,1	23	**0.8**	**0,8**	**0,8**	**0,8**	2	**0,6**	**0,7**	**0,8**	7
First pre-dorsal length	37	37,3	38	4	33	36,2	39	23	38	35	35,3	36	2	34	35,7	38	7
Second pre-dorsal length	64	64,9	66	4	61	63,5	66	23	66	61	61,5	62	2	63	64,3	66	7
Interdorsal distance	14	15,5	16	4	13	14,9	16	23	15	14	14,6	15	2	15	16,5	18	7
Caudal-peduncle length	22	22,6	24	4	22	24,1	26	23	23	24	24,4	25	2	22	23,5	25	7
Pre-anal length	63	64,7	68	4	60	63,3	67	23	66	63	63,3	63	2	61	63,8	67	7
Pre-pelvic length	32	33,1	34	4	30	32,7	35	23	33	31	31,4	32	2	30	31,5	35	7
Pre-pectoral length	30	30,2	31	4	29	30,2	32	23	33	29	29,5	30	2	29	30,6	33	7
Second dorsal-fin depth (second dorsal-fin origin to anal-fin origin)	**19**	**20,9**	**22**	4	**20**	**21,9**	**24**	23	**20**	**20**	**20,9**	**22**	2	**19**	**20,7**	**22**	7
Pelvic-fin depth (first dorsal-fin origin to pelvic-fin origin)	22	23,1	24	4	**22**	**24,2**	**27**	23	**24**	21	21,5	22	2	22	23,5	25	7
Pectoral-fin depth (first dorsal-fin origin to dorsal origin of pectoral fin)	15	15,8	17	4	**16**	**17,0**	**20**	23	16	15	14,9	15	2	14	16,0	18	7
Length of first dorsal-fin base	13	14,1	15	4	13	15,3	17	23	14	14	14,5	15	2	14	14,9	17	7
Length of second dorsal-fin base	13	13,4	14	4	12	13,5	15	23	**11**	14	14,1	14	2	13	14,2	15	7
Caudal-fin length (dorsal caudal-fin origin to upper caudal-lobe tip)	27	27,2	27	4	27	29,1	31	20	28	28	28,2	28	2	**25**	**25,9**	**27**	6
Length of anal-fin base	10	10,9	12	4	10	11,5	13	23	12	11	10,9	11	2	11	11,7	13	7
Anal-fin height	15	15,5	16	2	15	16,2	18	20	16	**16**	**16,4**	**17**	2	15	16,2	18	6
Pelvic-fin length	20	20,3	21	4	20	20,9	23	23	**24**	**18**	**18,8**	**19**	2	19	20,2	22	7
Pectoral-fin length	19	20,4	21	3	19	20,7	22	22	**25**	**19**	**19,7**	**20**	2	**22**	**23,2**	**24**	7
Pectoral-fin width (width of pectoral-fin base)	4,1	4,8	5,1	4	4,2	4,8	5,9	23	4.2	**3,8**	**3,9**	**4,1**	2	3,7	4,3	4,8	7
First dorsal-fin height	20	20,3	20	3	18	20,8	23	21	21	19	19,7	20	2	20	21,3	22	7
Second dorsal-fin height	15	15,6	16	2	15	16,1	18	21	16	**16**	**16,8**	**17**	2	15	16,8	18	5
Pectoral-fin rays	**13**	**13,0**	**13**	4	13	14,1	15	23	14	**13**	**13,5**	**14**	2	13	13,9	15	7
Rudimentary gill rakers on upper limb	1	2,5	4	4	1	2,6	4	23	1	1	2,0	3	2	2	3,3	5	7
Developed gill rakers on upper limb	3	4,5	6	4	**2**	**3,7**	**6**	23	8	**4**	**4,5**	**5**	2	**3**	**3,7**	**4**	7
Developed gill rakers on lower limb	15	16,3	17	4	**11**	**12,7**	**14**	23	**23**	13	13,0	13	2	**12**	**13,3**	**16**	7
Rudimentary gill rakers on lower limb	2	3,8	5	4	3	4,2	6	23	0	3	3,5	4	2	4	5,9	7	7
Total gill rakers on upper limb	**7**	**7,0**	**7**	4	**5**	**6,3**	**7**	23	9	**6**	**6,5**	**7**	2	**6**	**7,0**	**8**	7
Total gill rakers on lower limb	19	20,0	21	4	**16**	**16,9**	**18**	23	**23**	**16**	**16,5**	**17**	2	**18**	**19,1**	**20**	7
Total gill rakers	**26**	**27,0**	**28**	4	**22**	**23,2**	**24**	23	**32**	**22**	**23,0**	**24**	2	**25**	**26,1**	**28**	7
Scales along lateral line to caudal-fin base	28	28,3	29	4	27	28,8	30	13	**28**	29	29,5	30	2	29	29,5	30	4

Upeneus saiab **n. sp.** differs from non-WIO species of the *japonicus* group as follows (Table 1B): from *U. asymmetricus* in shallower body, narrower interorbital distance, longer head, longer barbels, more pectoral-fin rays, more total gill rakers, and absence of oblique bars on lower caudal-fin lobe; from *U. australiae* it differs in shallower caudal-peduncle, shallower maximal head depth, longer barbels, higher number of gill rakers, and absence of oblique bars on lower-caudal fin lobe; from *U. francisi* it differs in shallower and wider caudal peduncle, shallower head through eye, shorter head, longer and wider barbels, longer second dorsal-fin basis, shorter paired fins, less gill rakers, more lateral-line scales, and no lateral body stripe in fresh fish; from *U. itoui* it differs in shallower body, shallower, narrower, and shorter caudal-peduncle, deeper head through eye, shorter snout, longer and wider barbels, lower anal fin, shorter paired fins, wider pectoral fins, lower second dorsal fin, more gill rakers, and no oblique bars on lower-caudal-fin lobe; and it differs from *U. japonicus* in shallower body, longer head, longer postorbital length, wider barbels, longer caudal fin, shorter pectoral fins, more gill rakers, and presence of lateral body stripe and barbels white vs yellow in fresh fish.

Upeneus saiab **n. sp.** is distinct from all congeneric species in the combination of meristic, morphometric and colour characters. There is weak resemblance only with *U. pori* and *U. asymmetricus* in morphology and with *U. seychellensis* in colour. Similarly to the latter, *U. saiab* **n. sp.** lacks oblique bars on the lower caudal-fin lobe (Figs. 1a, d; 2a, d). The pale-brown nuances along the margins of the lower caudal-fin lobe in *U. saiab* might be interpreted as remains of reduced bars, but there is no evidence of the presence of any bars overlain by the red pigmentation of that lobe as found, for example, in *U. margarethae* (see also Uiblein & Heemstra 2010).

Comparisons of *in situ* photographs of *U. pori* from Elat, Gulf of Aqaba, Red Sea, published in the original description of this species (Ben-Tuvia & Golani 1989) with photographs from Sodwana Bay, KwaZulu-Natal, South Africa (Figure 1e, f) confirms its presence in South Africa. In both photographs (Figs. 1e, f) the typical caudal-fin pattern of this species becomes apparent, with 5–8 oblique bars along the ventral side of the lower fin lobe, followed by a solid brown space at the inner lobe region, and 3–5 bars along the dorsal lobe margin (Figs. 1c, 2c). Therefore, the distributional range of this species can now be regarded as reaching from the Red Sea to the eastern Mediterranean (as a Lessepsian migrant) in the north and to Madagascar and South Africa in the south.

This study contributes to enhanced identification of the recently described *U. itoui* which, in the original description, was only compared in detail with *U. pori* (Yamashita *et al*. 2011). The most important diagnostic finding is that *U. itoui* has a shallower head across a vertical midline through eye compared to all other species of the *japonicus* group (Table 1), a character not studied by Yamashita *et al*. (2011).

Two specimens of *U.* cf. *japonicus* identified by Motomura *et al.* (2012) from the southeastern Malayan Peninsula (Kuala Terrengganu, Malaysia), kindly provided by Hiroyuki Motomura (KAUM) for comparisons, were found to overlap in all characters with *U. japonicus* from the Eastern South China Sea and Japan. Hence, the present study extends the species range for *U. japonicus* to the western part of the South China Sea.

A single specimen from Vietnam (ZMUC P49483) assigned to *U. australiae* by Uiblein & Heemstra (2010) was here re-assigned to *Upeneus* sp.1 due to the caudal-fin colour patterns differing from *U. australiae*, requiring further taxonomic studies. Hence, there is currently no evidence of the distributional range of *U. australiae* extending beyond the waters surrounding tropical and subtropical Australia and New Caledonia (Randall & Kulbicki 2006).

Key to WIO species of *japonicus* group

This key was prepared using primarily the data of this study supported by counts by Yamashita *et al.* (2011) for *Upeneus pori*.

1a. Pectoral-fin rays 12–14; total gill rakers 23–25; first dorsal-fin height 4.1–5.1 times in SL; body red dorsally, preserved fish pale brown, not darker dorsally (Indo-Pacific) . . . . . *U. guttatus*

1b. Pectoral-fin rays 14(15); total gill rakers 25–29; first dorsal-fin height 4.5–5.3 times in SL; body grey, reddish-brown or red dorsally, preserved fish darker dorsally or pale brown 2

2a. Total gill rakers 29; caudal-peduncle depth 11 times in SL; snout length 9.0–10.0 times in SL, shorter than postorbital length (7.6–8.0) (Angoche, Mozambique) . . . . . *U. saiab* **n. sp.**

2b. Total gill rakers 25–27(28); caudal-peduncle depth 10–11 times in SL; snout length 8.2–9.5 times in SL, subequal to postorbital length (8.2–9.2) 3

3a. Anal-fin base length 7.5–9.8 and anal-fin height 5.8–6.4 times in SL; body depth at anal fin origin 4.6–5.1 times in SL; lower

caudal-fin lobe with 5–9 grey or reddish brown bars along ventral margin; preserved fish darker dorsally (Red Sea to Oman, Madagascar, South Africa, Eastern Mediterranean) . . . . . *U. pori*

3b. Anal-fin base length 9.7–10 and anal-fin height 6.5–7.0 times in SL; body depth at anal fin origin 5.4–5.5 times in SL, lower caudal-fin lobe with a red stripe and no bars in fresh fish; preserved fish pale brown (Seychelles Bank). . . . . *U. seychellensis*

Discussion

The current study clearly shows that there is continued need for exploration of the Mozambican coast and adjacent areas of southeastern Africa for not yet described or recorded goatfish species. Only five still valid species were listed in the FAO guide for Mozambique published more than 20 years ago (Fisher *et al.* 1990): *Upeneus moluccensis* Bleeker, 1855, *U. sulphureus* Cuvier, 1829, *U. tragula* Richardson, 1846, *U. vittatus* (Forsskål, 1775) and *U. taeniopterus* Cuvier, 1829, the latter however as a misidentification (Uiblein & Heemstra 2010). This species number has since doubled with *U. guttatus* added by Randall *et al.* (1993) to replace *U. bensasi* (Temminck & Schlegel, 1843) (a junior synonym of *U. japonicus*), three species (*U. margarethae*, *U. mascareinsis* Fourmanoir & Guéze, 1967, *U. suahelicus*) added by Uiblein & Heemstra (2010), and *U. saiab* **n. sp.** of this study.

The type locality off Angoche is characterized by a local upwelling (Lutjeharms 2006) and may provide specific habitat conditions that favor the formation of a distinct fish assemblage. However, given the long coastline, its many different habitats, and the obvious need to further explore those in more detail, it appears rather premature to speculate about the possible isolated occurrence of *U. saiab* **n. sp.** in that area. Moreover, the occurrence of the six type specimens together with a *U. guttatus* in a selected subsample from a single trawl station gives reason to assume that confusion with the latter, superficially similar species might have happened in the past, when no representative material was collected for post-cruise taxonomic studies.

With continued fish-taxonomically supported exploration of the Mozambican coast at least one additional *Upeneus* species can be expected to be encountered: *Upeneus pori*, originally described from the Red Sea and Mediterranean (Ben-Tuvia & Golani 1989) has recently been recorded from Madagascar by Uiblein & Heemstra (2010) and now also from KwaZulu-Natal, South Africa, based on *in situ* photographs. Also, regarding the other two goatfish genera *Mulloidichthys* and *Parupeneus*, at least two species can be expected to occur in Mozambique: *Mulloidichthys ayliffe* Uiblein, 2011 which is currently known from KwaZulu-Natal, Tanzania, Kenya, Oman, Seychelles, Sri Lanka and the Andaman Islands, and *Parupeneus fraserorum* Randall & King, 2009 which is known at present from KwaZulu-Natal and Madagascar.

With enhanced knowledge on their diversity and distribution and support from the most-updated identification keys and diagnostic information (Randall & Heemstra 2009, Randall & King 2009, Uiblein 2011, Uiblein & Heemstra 2011, the present study, Uiblein & Randall, in preparation), goatfishes can be increasingly used in ecosystem-related monitoring and management (see review by Uiblein 2007). This applies also in particular to areas along the Mozambican and SE African coast, where local, artisanal fisheries target goatfishes, but also to areas where species of this group are a common bycatch of larger, commercial fisheries.

Comparative material examined

Upeneus australiae (*n* = 23): AMS I.20778-021, 106 mm SL, Australia, Queensland, Lizard Island area: Decapolis reef, 14°50'S, 145°17'E, 12–14 m; AMS I.26833-001, 118–121 mm SL, Australia, Western Australia, Cockburn Sound, Fremantle, 32°11'S, 115°43'E; AMS I.20753-004, 73 mm, Australia, Queensland, Lizard Island, 14°36'S, 145°14'E, 14–15 m; WAM 32328-001, 3 spms, 90–103 mm SL, Australia, Western Australia, Shark Bay, Whaleback Hill, 24°40.772'S, 113°25.508'E, 14 m; AMS I.34397-134, 100 mm SL, Australia, Queensland, South Arm channel, Port Clinton, adjacent to West Flat, 22°34'08"S, 150°44'34"E, 10–11 m; WAM 25396, 88 mm SL, Australia, Western Australia, Rowley Shoals,17°26'S, 121°54'E, 28 m; NMV 24604, 88 mm SL, Australia, Queensland, Deception Bay, 27°12'S, 153°02'E; CSIRO 7365-01, 113 mm SL, Australia, Queensland, Torres Strait, N of Princess Charlotte Bay 14°08'S, 143°53'E, 18 m; CSIRO H4056-01, 105 mm SL, Australia, NW of Port Hedland, 19°46'S, 118°13'E, 35–37 m; furthermore, seven of the eight specimens (ZMUC P49483 excluded, see Remarks section) listed in Uiblein & Heemstra (2010) and additional four specimens listed in Uiblein & Heemstra (2011)

Upeneus guttatus (*n* = 46): MNHN 1967-553, 77 mm SL, Egypt, Gulf of Suez; SAIAB 188305, 92 mm,

Mozambique, Angoche, Nampula Province 16°2.75'S, 40°20.26'E, 29–40 m (same collecting data as types of *U. saiab* **n. sp.**); furthermore, the 27 specimens listed in Uiblein & Heemstra (2010) and additional 17 specimens in Uiblein & Heemstra (2011)

Upeneus itoui (*n* = 2): KAUM 13595, 118 mm SL, Japan, Kagoshima, off east of Sakinoyama, 31°25.44'N, 130°11.49'E, 27 m; KAUM 10984, 87 mm SL, Japan, Kagoshima, same locality.

Upeneus japonicus (*n* = 7): RMNH 4683, lectotype, 120 mm SL, Pacific, Japan; KAUM 41736, 119 mm, Malaysia (W. Pacific), Kuala Terrengganu, off Cendering, 5°16'N, 103°11'E, 70–90 m; KAUM 41737, 109 mm SL, Malaysia (W. Pacific), Kuala Terrengganu, same locality. In addition, the four specimens listed in Uiblein & Heemstra (2010)

Upeneus pori (*n* = 7): CAS 66225, PT, 107 mm SL, Red Sea, Israel, Eilat**;** MNHN 1989-0537, PT, 102 mm, Red Sea, Israel, Eilat; in addition, the five specimens listed in Uiblein & Heemstra (2010)

The single *U. francisi* and the four *U. asymmetricus* specimens listed in Uiblein & Heemstra (2010) and the three *U. seychellensis* listed in Uiblein & Heemstra (2011) are also included.

Acknowledgements

We thank the following colleagues for hospitality and assistance during collection visits, for the loan of specimens, or for providing other collection-related favors: Roger Bills, Bafo Konobe, Elaine and Phil Heemstra, Alan Whitfield (SAIAB), Mark McGrouther and Amanda Hay (AMS), Dave Catania and Mysi Hoang (CAS), Alastair Graham (CSIRO), Hiroyuki Motomura (KAUM), Romain Causse and Patrice Pruvost (MNHN), Dianne Bray (NMV), Ronald de Ruiter (RMNH), Sue Morrison (WAM), and Marcus Krag, Peter Møller, and Jørgen Nielsen (ZMUC). For providing photographs of fresh fish or drawings we thank Oddgeir Alvheim, Elaine Heemstra, Phil Heemstra, Christo van Jaarsveld, and Jack Randall. The first author (FU) thanks the South African Institute for Aquatic Biodiversity and the Nansen Programme of the Center for Development Cooperation in Fisheries at the Institute of Marine Research (IMR), Bergen, for travel support. The second author (ML) thanks the crew of RV *Dr. Fridtjof Nansen*. This is a contribution to the *Agulhas and Somali Current Large Marine Ecosystems* Project (*ASCLME*).

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