

Parupeneus fraserorum, a new species of goatfish (Perciformes: Mullidae) from South Africa and Madagascar

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ABSTRACT. *Parupeneus fraserorum* is described as a new species of mullid fish from three specimens collected off the coast of KwaZulu-Natal, South Africa in 39–57 m. Five additional specimens taken by trawl in 81 m off southeastern Madagascar are listed as non-type material. This species is most similar to *P. chrysopleuron*, known from Japan to Western Australia, which differs in having an asymmetrical maxilla, a higher and more pointed first dorsal fin, and larger size (223 mm SL, compared to 166.5 mm)

KEYWORDS: Mullidae, *Parupeneus*, new species, South Africa, Madagascar

INTRODUCTION

The goatfish family Mullidae consists of six genera: *Mulloidichthys* Whitley, *Mullus* Linnaeus, *Parupeneus* Bleeker, *Pseudupeneus* Bleeker, *Upeneus* Cuvier, and *Upeneichthys* Bleeker. *Mulloidichthys* is the only genus represented by species in all tropical and subtropical seas. The species of *Upeneus* are found in all except the eastern Pacific. *Mullus* is confined to the Atlantic, and *Pseudupeneus* to the Atlantic and eastern Pacific. *Upeneichthys* is represented by three species in southern Australia and New Zealand. The species of *Parupeneus* are known only from the Indo-Pacific region. The genus is differentiated primarily by dentition. The teeth in the jaws are bluntly conical and well spaced in a single row, and there are no teeth on the vomer or palatines. All the species of *Parupeneus* share the following meristic data: dorsal fins VIII + 9; anal-fin rays 7; principal caudal-fin rays 15; pelvic-fin rays 1,5; and lateral-line scales 27 or 28. The variation in the lateral-line scale count is attributed to the decision of the observer where to end the scale count at the base of the caudal fin (two or three pored scales are on the caudal-fin base).

Randall (2004) revised *Parupeneus*, recognizing 27 species. What appeared to a 28th species of the genus was known at that time from an underwater photograph taken in about 30 m off the coast of KwaZulu-Natal, South Africa, but no specimens were collected until 2008. We describe this species here from three specimens collected in 39–57 m off KwaZulu-Natal. We also record five non-type specimens taken by trawl off southeastern Madagascar in the depth range of 39–81 m.

MATERIALS AND METHODS

Specimens of the new species are deposited in the Bernice P. Bishop Museum, Honolulu (BPBM) and the South African Institute for Aquatic Biodiversity, Grahamstown (SAIAB).

Lengths of specimens are given as standard length (SL), measured from the front of the upper lip to the base of the caudal fin (posterior end of the hypural plate); head length (HL) is measured from the same anterior point to the posterior end of the opercular flap; body depth is taken vertically from the base of first dorsal spine where it emerges from the body (not the internal base); body width is the maximum width just posterior to the gill opening; orbit diameter is the greatest fleshy diameter, and interorbital width the least fleshy width; cheek depth is measured from the lower fleshy edge of the orbit vertically to the ventral margin of the preopercle; upper-jaw length is taken from the front of the upper lip to the posterior end of the maxilla; depth of maxilla is the maximum fleshy vertical depth; barbel length is the maximum straight length of the longest barbel; caudal-peduncle depth is the least depth, and caudal-peduncle length the horizontal distance between verticals at the rear base of the anal fin and the caudal-fin base; lengths of fin spines and rays of the dorsal and anal fins are measured from where they emerge from the body; caudal-fin length is the horizontal distance from the base of the fin to a vertical at the tip of the longest ray; caudal concavity is the horizontal distance between verticals at the tips of the longest and shortest rays; pectoral-fin length is the length of the longest ray; pelvic-fin length is measured from the base of the pelvic spine to the tip of the longest soft ray. Lateral-line scale counts do not include the 2

or 3 pored scales on the caudal-fin base; pectoral-ray counts include the upper rudimentary ray; gill-raker counts were made on the first gill arch of the right side. They include all rudiments; the raker at the angle is contained in the count of the lower-limb gill rakers.

In the description of the new species, data in

parentheses refer to paratypes. The data in the table of measurements of the new species are given as percentages of the standard length. Proportional measurements in the text of the diagnosis and description are rounded to the nearest 0.05. Counts of pectoral-fin rays were made on both sides.



Fig. 1. Holotype of *Parupeneus fraserorum*, SAIAB 81385, 166.5 mm SL, KwaZulu-Natal. (Photo by Dennis R. King).

***Parupeneus fraserorum* sp. nov.**

Fig. 1 – 6, Table 1

Holotype. SAIAB 81385, 154.5 mm, South Africa, KwaZulu-Natal, reef off Pumula (near Hibberdene), 30°40.03'S, 30°35.40'E, reef, 57 m, hook and line, M.D. Fraser, 2 September 2008.

Paratypes. BPBM 40931, 166.5 mm, and SAIAB 81386, 151 mm, South Africa, KwaZulu-Natal, reef off Pumula (near Hibberdene), 30°38.110'S, 30°33.630'E, 39 m, spear, M.D. Fraser, 31 August 2008.

Non-types. SAIAB 82829, 92–118 mm, Madagascar, 25°8.95'S, 47°6.92'E, 81 m, trawl, R/V Dr. Fridtjof Nansen Station 12, 7 September 2008.

DIAGNOSIS. Pectoral-fin rays 16 or 17; gill rakers 6 + 21 or 22; body depth 2.8–2.9 in SL; head length 2.8–2.9 in SL; snout length 1.8–1.85 in HL; posterior margin of maxilla symmetrically convex; barbels 1.3–1.35 in HL; third dorsal spine longest, 1.8–2.0 in HL; longest dorsal ray 3.15–3.3 in HL; penultimate dorsal-fin ray only slightly shorter than last ray; pectoral-fin length 1.2–1.25 in HL; pelvic-fin length 1.35–1.5 in HL. Colour in life: an orange-yellow stripe following lateral line; body above stripe pale brown; body below stripe white with light blue iridescence centrally in each scale, posteriorly becoming a smaller, more defined spot; edges of scales narrowly dark; a dark brown spot about half pupil

diameter in height at upper end of gill opening; faint oblique blue lines anterior and posterior to eye; wavy blue lines in second dorsal and anal fins; iridescent blue longitudinal streaks in caudal fin; a light red bar at base of pectoral fins; barbels white.

DESCRIPTION. Dorsal fins VIII + 9; anal fin I, 7; pectoral-fin rays 16 (16 or 17), the upper two and lowermost unbranched; pelvic fin I, 5; principal caudal-fin rays 15, the middle 13 branched; upper and lower procurrent caudal-fin rays 9, the posterior two segmented; lateral-line scales 27 (plus 3 on caudal-fin base); scales above lateral line to origin of first dorsal fin 2; scales below lateral line to origin of anal fin 5; circumpeduncular scales 14; median predorsal scales 13; median prepelvic scales 7; gill rakers 6 + 22 (6 + 21); branchiostegal rays 3; vertebrae 10 + 14.

Body depth 2.85 (2.8–2.9) in SL; body width 1.95 (1.9–2.05) in body depth; head length 2.9 (2.8–2.85) in SL; snout length 1.8 (1.8–1.85) in HL; orbit diameter 4.55 (4.35–4.45) in HL; interorbital space convex, the width 3.25 (3.45–3.5) in HL; cheek depth 2.15 (2.2–2.25) in HL; barbels reaching beyond posterior margin of preopercle, their length 1.35 (1.3–1.35) in HL (barbels of holotype had dried before preservation, so their length should be greater than given in Table 1); caudal-peduncle depth 3.0 (2.9–3.1) in HL; caudal-peduncle length 1.6 (1.65–1.77) in HL.

Table 1. Proportional measurements of type specimens of *Parupeneus fraserorum* as percentages of SL.

	Holotype	Paratypes	
	SAIAB 81385	SAIAB 81386	BPBM 40931
Standard length (mm)	154.5	151.0	166.5
Sex	male	female	female
Body depth	34.9	35.5	34.6
Body width	17.8	17.4	18.0
Head length	34.2	35.1	35.8
Snout length	19.2	19.3	19.4
Orbit diameter	7.5	8.1	7.8
Interorbital width	10.1	9.6	10.2
Cheek depth	15.9	15.7	16.1
Upper-jaw length	13.4	13.1	13.5
Depth of maxilla	6.7	6.3	6.8
Barbel length	25.8	27.5	26.9
Caudal-peduncle depth	11.4	12.0	11.6
Caudal-peduncle length	21.5	21.1	20.9
Pre-dorsal length	42.3	damaged	43.8
Pre-anal length	63.0	65.4	64.0
Pre-pelvic length	32.8	31.7	32.9
First dorsal-fin spine	4.4	4.3	3.6
Second dorsal-fin spine	16.9	17.1	16.3
Third dorsal-fin spine	19.2	18.5	17.8
Fourth dorsal-fin spine	18.7	18.3	17.4
First dorsal-fin ray	10.1	10.0	broken
Second dorsal-fin ray	10.9	10.7	10.8
Eighth dorsal-fin ray	10.4	10.5	10.3
Ninth dorsal-fin ray	10.0	10.8	10.8
Anal-fin spine	2.8	1.9	2.3
Seventh anal-fin ray	12.6	13.6	11.4
Caudal-fin length	25.4	25.5	broken
Caudal concavity	14.2	14.0	–
Pectoral-fin length	28.3	29.2	28.8
Pelvic-fin spine length	16.5	16.9	aberrant
Pelvic fin length	24.8	25.6	24.0

Mouth ventral, and slightly oblique, the gape forming an angle of about 15° to horizontal axis of head and body; mouth small, the upper-jaw length 2.55 (2.65–2.7) in HL; posterior edge of maxilla symmetrically convex; maximum depth of maxilla 5.1 (5.25–5.55) in HL; jaws of holotype with 12 or 13 bluntly conical, unevenly spaced teeth on each side, the anterior teeth slightly incurved (median anterior teeth of upper jaw aberrantly short and rounded); posterior two teeth in upper jaw slightly forward-curving; no teeth on vomer or palatines; tongue fused to floor of mouth.

Posterior nostril a short vertical slit at front edge of orbit before middle of eye; anterior nostril a small aperture with a low posterior rim on line from posterior nostril to front of upper lip, slightly closer to front of upper lip than posterior nostril. Longest gill raker about 1.2 in length of longest gill filament.

Opercle with a single spine at level of lower edge of orbit, its tip ending at edge of opercular membrane; free edge of preopercle extending dorsally to level of lower edge of orbit, the ventral margin ending a pupil diameter short of maxilla.

Scales finely ctenoid; scales dorsally on head extending forward an orbit diameter from front of upper lip; three oblique rows of scales on cheek to edge of preopercle; two near-vertical rows of scales on opercle, and one on subopercle and interopercle; two scales on expanded posterior part of maxilla, the anterior scale about one-third size of posterior and overlapping base of posterior scale; fins naked except for base of caudal fin with three rows of scales like those of body, followed by series of small, slender scales between rays about halfway along fin; slender pelvic axillary scale about 40% length of pelvic spine; a midventral scaly process of two rounded scales at base of pelvic fins, the first broadly overlapping the second; sensory canals on lateral-line scales with three to seven branches.

Origin of dorsal fin above base of third lateral-line scale, the predorsal length 2.35 (2.3) in SL; first dorsal spine very short, 7.8 (8.2–9.9) in HL; second dorsal spine 2.0 (2.05–2.2) in HL; third dorsal spine 1.8 (1.9–2.0) in HL; fourth dorsal spine 1.85 (1.9–2.05) in HL; first dorsal soft ray 3.4 (3.4–4.25) in HL; second dorsal soft ray 3.15 (3.25–3.3) in HL; eighth dorsal soft ray slightly shorter than ninth ray; ninth dorsal soft ray 3.15 (3.25–3.3) in HL; origin of anal fin below base of second dorsal soft ray, the preanal length 1.6 (1.55) in SL; anal spine very small, 12.2 (15.5–18.5) in HL; seventh anal soft ray longest, 2.7 (2.6–3.1) in HL; caudal-fin length 1.35 (1.4) in HL; caudal fin strongly forked, the caudal concavity 2.4 (2.5) in HL; pectoral fins long, 1.2 (1.2–1.25) in HL; pelvic fins long, but not reaching anus, 1.2 (1.2–1.25) in HL; pelvic spine 1.4 (1.35–1.5) in HL.

Colour of holotype in alcohol: body pale tan above lateral line, near-white ventrally (specimen in preservative only two months; will be more brown with age); a vertically oval blackish spot on membrane above opercular spine, its height equal to pupil diameter; fin membranes translucent, the rays pale yellowish; barbels

whitish. Colour of holotype when fresh as in Plate 1A.

Colour in life from underwater photographs: an orange-yellow stripe on body following lateral line, its width less than scale height; body above stripe pale brown, with narrow darker brown scale edges, the darker scale edges extending into stripe; body below stripe white with light blue iridescence centrally in each scale, becoming a smaller, more defined spot on each scale posteriorly and on caudal-fin base; an oval dark brown to deep red spot a pupil diameter in height on membrane above opercular spine; three oblique blue lines extending anterior to eye and less distinctly posterior to eye; fins translucent pale orangish to reddish grey, the second dorsal with five narrow, wavy, pale blue stripes, the lower two posterior in fin; caudal fin with blue lines paralleling rays, some broken into dashes, the uppermost iridescent; anal fin with four narrow pale blue stripes; a light red bar at base of

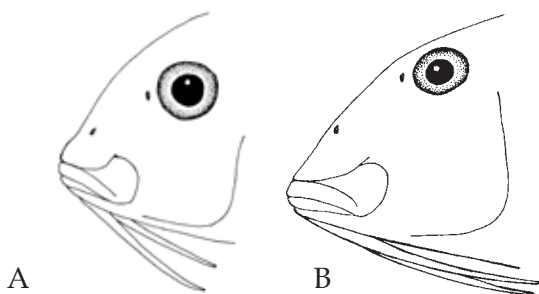


Fig. 2. Shape of maxillae of *Parupeneus fraserorum* (A) and *P. chrysopleuron* (B). (Drawn by E. Heemstra).

pectoral fins; barbels white.

The underwater photograph of Plate 1D was taken of a fish actively feeding during the day. Goatfishes of this genus have been observed to quickly assume a disruptive red colour pattern while feeding. We believe this is also the nocturnal colour pattern.

ETYMOLOGY. We are pleased to name this species collectively for Michael D. Fraser and Valda J. Fraser, he for collecting the type specimens, and she for her underwater photograph of Plate 1D, our first awareness of the species.

REMARKS. *Parupeneus fraserorum* appears to be most closely related to *P. chrysopleuron* Temminck & Schlegel, type locality Japan, known otherwise only from Taiwan, Arafura Sea, and the Northwest Shelf of Australia. Both have the same general morphology, the broad orange-yellow stripe along the lateral line, and the oblique pale blue lines anterior and posterior to the eye. They differ in colour principally by the dark spot above the opercular spine and the blue streaks of the caudal fin of *P. fraserorum*. The only slight meristic difference is the count of 16 or 17 pectoral rays for *P. fraserorum* vs. 15 or 16 for *P. chrysopleuron*. The most significant morphological differences are the symmetrically

rounded maxilla of *P. fraserorum* [sharing this character with *P. heptacanthus* (Lacepède) and *P. janssenii* (Bleeker) – Fig. 2] and the higher and more pointed first dorsal fin of *P. chrysopleuron* (longest dorsal spine 1.5–1.75 in HL, compared to 1.8–2.25 in HL for *P. fraserorum*). In addition, *P. chrysopleuron* appears to attain larger size. The three type specimens are fully mature, the largest 166.5 mm SL. The second author has not seen any individuals larger than 180 mm SL. Three of eleven specimens of *P. chrysopleuron* examined by the first author are over 200 mm SL, the largest 223 mm.

At the present time, *Parupeneus fraserorum* is known only from KwaZulu-Natal, South Africa and southeastern Madagascar from depths of 27–81 m. It was first observed off the KwaZulu-Natal coast between Scottburgh (30°17'S) and Pumula (30°38'S). In January, 2009, the second author photographed it on a barge intentionally sunk six weeks earlier as an artificial reef in 27 m at 28°9.771'S, 32° 34.042'E (2 km south of Cape Vidal).

Specimens from Madagascar were collected from six trawling stations from the R/V *Dr. Fridtjof Nansen* in September and October, 2008 in 40–81 m. Five specimens from Station 12, the deepest collection, were deposited at the South African Institute for Aquatic Biodiversity (listed above as nontypes).

The two paratypes from KwaZulu-Natal were collected from a group of four or five individuals in an area about 25 x 25 m. The species is generally found over sand bottom near the edge of low-profile reefs, usually singly, but occasionally in loose pairs.

ACKNOWLEDGEMENTS

We thank Michael Fraser for collecting the KwaZulu-Natal specimens of *Parupeneus fraserorum*, Valda Fraser for her underwater photograph, and Jessica Escobar-Porras and the scientific crew of the R/V *Dr. Fridtjof Nansen* Station for the specimens and photographs from Madagascar. Simon A. Chater of the South African Association for Marine Biological Research assisted in the preservation of specimens, and Loreen R. O'Hara of the Bishop Museum took x-rays. Special thanks are due Elaine Heemstra of the South African Institute for Aquatic Biodiversity for calling our attention to the specimens of *P. fraserorum* from Madagascar and arranging for the loan of specimens and photographs. Mark McGrouther of the Australian Museum provided a photograph of the head of *P. chrysopleuron* so that Elaine Heemstra could draw Fig. 1. The manuscript was reviewed by Philip C. Heemstra and Helen A. Randall.

LITERATURE CITED

- RANDALL, J. E. 2004. Revision of the goatfish genus *Parupeneus* (Perciformes: Mullidae), with descriptions of two new species. *Indo-Pacific Fishes* 36: 1–64.



Fig. 3. *Parupeneus fraserorum*, KwaZulu-Natal. (Photo by Dennis R. King).

Fig. 4. *Parupeneus fraserorum*, KwaZulu-Natal. (Photo by Dennis R. King).



Fig. 5. *Parupeneus fraserorum* actively feeding, KwaZulu-Natal. (Photo by Valda J. Fraser).

Fig. 6. *Parupeneus fraserorum*, SAIAB 82829, 117 mm SL, Madagascar. (Photo by Jessica Escobar-Porras).

