

***Parupeneus moffitti*, a New Goatfish (Perciformes: Mullidae)
from the Mariana Islands**

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Abstract—The mullid fish *Parupeneus moffitti* is described from three adult specimens collected in the Mariana Islands from depths of 120 and 230 m. It is distinct in having 15 pectoral rays, 7-8 + 28-30 gill rakers, long barbels (1.15 in head length), last dorsal and anal soft rays distinctly longer than penultimate rays, and in color: red with a lighter red stripe on back below dorsal fins, bordered above and below by a row of indistinct small dark brown spots

Introduction

Three specimens of an unidentified goatfish (family Mullidae) were landed in the Mariana Islands in recent years at surprisingly deep water for species of this family. The first was taken in 1982 by handline from 210 m at the island of Anatahan by Robert B. Moffitt from the R/V "Townsend Cromwell" of the Honolulu Laboratory of the National Marine Fisheries Service. He noted its similarity to *Parupeneus cyclostomus* (Lacepède 1801), but decided it might be different; he took a color photograph of the fish and preserved it. The second specimen was caught in 1989, also by handlining, off Guam from an estimated depth of 120 m by Billy Wong. The junior author examined it when fresh and recognized it as a species of *Parupeneus* Bleeker (1876). He did not believe it was any of the eight species of the genus recorded from the Mariana Islands (Myers 1988), so he also took a color photograph of the fish. He preserved it and brought it to the Bishop Museum. The senior author, who has been working on a revision of *Parupeneus* with Paul Guézé, recognized the Guam specimen as representing an undescribed species. Moffitt then provided his specimen from Anatahan.

While this paper was in press, the junior author discovered a third specimen that had been collected by Edward San Nicolas from 230 m off Guam; data from this specimen were then added.

The purpose of the present paper is to describe this species from the three known specimens.

Materials and Methods

The holotype and one paratype of the new species is deposited in the Bishop Museum, Honolulu (BPBM), and the second paratype at the U.S. National Museum of Natural History, Washington, D.C. (USNM). The length recorded for these three specimens is standard length (SL), the straight-line distance from the front of the upper lip to the base of the caudal fin (end of hypural plate). Head length is measured from the same anterior point to the end of the opercular membrane, and snout length from the same point to the fleshy edge of the orbit. Body depth is the maximum depth (at the origin of the first dorsal fin), and body width the greatest width just posterior to the gill opening. Orbit diameter is the least fleshy diameter, and the interorbital space the least fleshy width. Cheek depth is measured from the lower fleshy edge of the orbit vertically to the ventral fleshy edge of preopercle. Caudal peduncle depth is the least depth, and caudal peduncle length the horizontal distance from the rear base of the anal fin to the caudal-fin base. Caudal concavity is the horizontal distance between verticals at tips of the longest and shortest caudal rays. Median fin spine and ray measurements are taken from the point where they emerge from the scaled part of the body (not to their extreme bases as one would see on a radiograph).

Lateral-line scales were counted from the upper end of the gill opening to the base of the caudal fin (hence the two pored scales posterior to the caudal-fin base are not included). Gill rakers were counted on the first gill arch and include all rudiments. The upper-limb count is given first; the raker at the angle is included in the lower-limb count.

In the description below, data in parentheses refer to the paratype (when different from holotype). Proportional measurements in the text are rounded to the nearest .05.

Parupeneus moffitti, n. sp.

Fig. 1, Table 1

HOLOTYPE: BPBM 34930, 235 mm SL, male, Mariana Islands, Guam, off the southwest side of Orote Peninsula (13°26'N; 144°38'E), hook and line with electric reel, about 120 m, Billy Wong, 27 August 1989.

PARATYPES: USNM 321084, 214 mm SL, male, Mariana Islands, Anatahan Island (16°20.0'N, 145°38.3'E), R/V "Townsend Cromwell" Cruise 82-02, Station 44, handline, 210 m, Robert B. Moffitt, 27 April 1982; BPBM 35051, 225 mm SL, Guam, NE coast, near Pagat, 230 m, hook and line, Edward San Nicolas, 20 October 1990.

DIAGNOSIS: A species of *Parupeneus* with 15 pectoral rays, 7-8 + 28-30 gill rakers, long barbels (1.15 in head), last dorsal and anal soft rays distinctly longer than penultimate rays; body varying from pale orange-red to deep red, the edges of the scales darker; a longitudinal lighter red streak along upper row of scales below dorsal fins, bordered above and below with a row of small brown spots.

Table 1. Proportional Measurements of Specimens of *Parupeneus moffitti* Expressed as a Percentage of the Standard Length

	Holotype	Paratypes	
	BPBM 34930	USNM 321084	BPBM 35051
Standard length (mm)	235	214	225
Body depth	27.9	29.3	27.2
Body width	15.8	15.4	14.2
Head length	33.8	34.1	32.4
Snout length	18.8	18.7	17.4
Orbit diameter	6.0	6.4	9.0
Interorbital width	9.7	9.7	9.0
Cheek depth	13.1	12.9	12.9
Upper jaw length	14.2	14.1	13.9
Barbel length	29.2	30.0	28.5
Caudal peduncle depth	10.0	10.0	10.1
Caudal peduncle length	24.8	24.7	23.7
Snout to origin of first dorsal fin	41.7	40.6	39.5
Snout to origin of second dorsal fin	64.0	63.3	61.8
Snout to origin of anal fin	63.4	64.3	65.0
Snout to origin of pelvic fins	33.5	35.9	32.1
Base of first dorsal fin	19.6	19.3	19.7
Base of second dorsal fin	16.6	16.7	16.4
Base of anal fin	12.9	13.2	13.5
First dorsal spine	3.1	2.4	3.0
Second dorsal spine	16.2	15.9	16.8
Longest dorsal spine	21.0	20.8	21.9
First ray of second dorsal fin	8.0	8.9	9.8
Longest dorsal soft ray	11.8	12.2	12.6
Eighth dorsal soft ray	8.5	8.8	9.1
Ninth dorsal soft ray	9.5	9.6	11.1
First anal soft ray	7.8	8.8	8.8
Longest anal soft ray	11.1	12.1	12.2
Sixth anal soft ray	9.8	9.8	10.2
Seventh anal soft ray	11.1	11.2	11.8
Caudal fin length	24.1	24.9	23.4
Caudal concavity	14.0	14.9	12.4
Pectoral fin length	23.3	23.2	24.1
Pelvic spine length	14.4	14.0	13.5
Pelvic fin length	22.5	22.9	23.1

DESCRIPTION: Dorsal rays VIII-9; anal rays I,7 (first dorsal and anal soft rays unbranched, the rest branched, the last to base); pectoral rays 15 (upper two unbranched); pelvic rays I,5; principal caudal rays 15 (upper and lower unbranched); dorsal and ventral procurrent caudal rays 9, the two most posterior segmented; lateral-line scales 28; scales above lateral line to origin of dorsal fin 2½; scales below lateral line to origin of anal fin 6½; circumpeduncular scales 14; median predorsal scales 12 (13), the most posterior notched for first dorsal



Figure 1. Holotype of *Parupeneus moffitti*, BPBM 34930, 235 mm SL, Guam (Robert F. Myers).

spine; median preventral scales 8; median interdorsal scales 3, the most posterior notched; diagonal rows of scales on cheek 3; a single row of scales on subopercle and interopercle; gill rakers 7 + 30 (8 + 28–30); pseudobranchial filaments 38 (33–34); branchiostegal rays 3; vertebrae 10 + 14; supraneural (predorsal) bones 2.

Body moderately elongate, the depth 3.6 (3.4–3.7) in SL; body width 1.75 (1.9) in depth; head length 2.95 (2.95–3.1) in SL; dorsal profile of head smoothly convex; snout length 1.8 (1.8–1.85) in head length; orbit diameter 5.6 (5.2–5.3) in head; interorbital space strongly convex, the width 3.5 (3.5–3.6) in head; cheek depth 2.6 (2.5–2.65) in head; barbels long, reaching or nearly reaching origin of pelvic fins, 1.15 in head; caudal peduncle depth 3.4 (3.2–3.4) in head; caudal peduncle length 1.35 in head.

Mouth terminal, slightly oblique, and small, the maxilla extending to within a half orbit diameter of a vertical at front of orbit, the upper jaw length 2.4 (2.3–2.4) in head; teeth conical, peg-like, well-spaced, in a single row in jaws, 29 upper jaw of holotype and 23 in lower; no teeth on vomer or palatines. Tongue fused to floor of mouth.

Nostrils very small, the posterior a short near-vertical slit directly in front of center of eye, the anterior nearly half distance to front of snout. Longest gill raker on first gill arch as long as longest gill filament, 1.7 in orbit diameter.

A single stout spine on opercle at level of lower edge of orbit; posterior free margin of preopercle extending to level of lower edge of orbit, the ventral margin reaching a vertical at posterior end of maxilla.

Scales very finely ctenoid; head scaled except chin and laterally and anterodorsally on snout; maxilla with two scales, the anterior one very small; fins naked except continuation of scales from body onto base of caudal fin and very small scales extending about two-thirds distance to posterior margin; a scaly

process nearly as long as orbit diameter laterally at base of each pelvic fin; two large scales midventrally between bases of pelvic fins. Lateral line following contour of back.

Origin of first dorsal fin above third lateral-line scale; dorsal spines slender and flexible; first dorsal spine very short, 11 (11–14) in head; third dorsal spine longest (though fourth nearly as long), 1.6 (1.5–1.65) in head; first ray of second dorsal fin 4.25 (3.8) in head; second dorsal soft ray longest, 2.85 (2.6–2.8) in head; anal spine very small, not detectable on holotype externally, about half pupil diameter in paratype; first anal soft ray 4.35 (3.7–3.9) in head; second anal soft ray longest, 3.05 (2.65–2.8) in head; last dorsal and anal soft rays distinctly longer than penultimate rays; caudal fin forked, its length 1.4 (1.35–1.4) in head, the caudal concavity 2.4 (2.3–2.6) in head; pectoral fins pointed, the fourth ray longest, 1.45 (1.35–1.45) in head; origin of pelvic fins below upper pectoral-fin base; pelvic fins reaching slightly posterior to pectorals, their length 1.5 (1.4–1.5) in head.

Color in alcohol pale yellowish brown with a brown spot posteriorly on each scale of scale row at base of dorsal fins and extending three scales posterior to insertion of second dorsal fin, these spots most evident on scales below interdorsal space and base of second fin; a faint brown spot on lower posterior part of scales in scale row above lateral line below interdorsal space and second dorsal fin (dark pigment along edges of these scales of the paratype, thus forming a zigzag line); fins pale except a narrow blackish margin on membrane between fifth and seventh spines, and three narrow dusky horizontal bands in anal fin of paratype (traces of these bands on anal fin of holotype).

Color of holotype when fresh: body pale orange-red dorsally, shading to pinkish white on sides and ventrally, the edges of the scales narrowly orange-red (darker dorsally); a longitudinal mottled pink streak on back below dorsal fins, broadest below second dorsal, bordered above and below with a dull yellowish band superimposed on the light orange-red coloration, the scale edges within these bands darker; a series of indistinct brown spots, one posteriorly on each scale of row of scales below base of dorsal fins and on three scales posterior to insertion of second dorsal fin; a few faint small dusky spots on lower posterior part of some scales in scale row above lateral line below dorsal fins; a small lavender spot edged in orange-red in center of each scale of caudal peduncle and base of caudal fin; head light red dorsally, becoming mottled pale orange-red on side and ventrally, with traces of oblique pale blue and yellow lines ventroposteriorly to eye; barbels pale pink; iris red with an irregular inner rim of yellow; first dorsal fin light orange-red, suffused with yellow, with concentrations of orange-red distally on membranes between third and eighth spines (the largest between fifth and sixth spines); margin of membranes between fourth and seventh dorsal spines narrowly dusky yellow; second dorsal fin orange-red on basal half, the outer half with alternating narrow irregular diagonal lines of yellow and pale blue edged with pale red; anal fin entirely banded like outer half of second dorsal, but lines lavender instead of pale blue; caudal fin orange-red on lobes, becoming translucent with light yellow rays in broad centroposterior part of fin; paired fins

translucent light red, more heavily pigmented on rays, with a broad concentration of this color laterally on pelvics and as a spot nearly as large as eye on base of pectorals.

Color of the paratype from a photograph taken soon after capture: head and body red overall, the scale edges darker red; a lighter red longitudinal band on back beginning below rear part of first dorsal fin and ending below rear of second dorsal fin, bordered above by a row of 14 small brown spots and below by nine spots, the latter mainly on lower scale edges; barbels red; iris red; first dorsal fin red, becoming slightly yellowish at tip; second dorsal fin red on basal two-thirds, yellow on outer third, with four red-edged pale blue lines diagonally crossing the yellow; anal fin yellow with four longitudinal pale blue lines edged in red proximally and purple distally; first two rays of anal fin largely red; caudal fin red, the membranes of outer third of fin yellow; pectoral fins with red rays and pale membranes; pelvic fins red.

REMARKS: This species of *Parupeneus* is name *moffitti* in honor of Robert B. Moffitt who collected and photographed the first specimen.

Parupeneus moffitti is most closely related to *P. chrysonemus* (Jordon & Evermann 1903), an endemic Hawaiian species. It differs from *chrysonemus* as follows: pectoral rays 15 (15–17 for *chrysonemus*, but strongly modal on 16; of 32 counted, only four have 15 pectoral rays, and these only on one side); lower-limb gill rakers 28–30 (25–27 for *chrysonemus*); last dorsal and anal rays notably longer (see Table 1) (subequal in *chrysonemus*); and shorter pelvic fins (1.4–1.5 in head, compared to 1.2–1.4 in *chrysonemus*). Also, *P. chrysonemus* is a smaller species. The largest of 32 specimens of *chrysonemus* from 28 lots measures 196 mm SL, and the second largest 172 mm; our three specimens of *moffitti* range in standard length from 214 to 235 mm.

It is in color that these two species of goatfish exhibit their close relationship. The details of coloration on the back, the small pale blue spots posteriorly on the body and caudal-fin base, and the wavy blue and yellow bands in the second dorsal and anal fins are almost the same on both species. The only obvious differences in color are the pale yellow barbels of *chrysonemus* and a dark spot behind the eye. There is also similarity in general morphology and the long barbels.

Parupeneus dubius (Temminck & Schlegel 1843) is another species that seems to be related to *P. moffitti*, in view of similarity in color. It is known, to date, from Japan, northwestern Australia, and Natal. It differs from *moffitti* in having 16 pectoral rays, 6–7 + 20–21 gill rakers, shorter barbels (1.35–1.45 in head), and deeper body (2.9–3.25 in SL).

Parupeneus moffitti also resembles *P. cyclostomus* in its general configuration and long barbels. The latter differs in usually having 16 pectoral rays, a total gill-raker count of 29–33 (36–38 for *moffitti*), and in color. The most distinctive feature of the color of *cyclostomus* is a broad yellow saddle-like spot on the caudal peduncle; it is apparent even on the yellow color phase by being brighter yellow.

Parupeneus moffitti is unusual for a goatfish in its occurrence in 120–230 m. Within the genus *Parupeneus*, only *P. chrysonemus*, *P. cyclostomus*, and *P. posteli* Fourmanoir & Guézé are known to range to depths as great as 200 m. *P. cyclostomus* is primarily a shallow-water fish. *P. chrysonemus* has been taken in as little as 20 m at Midway Atoll in the Northwestern Hawaiian Islands (the sea is cooler there than the main Hawaiian Islands where the species is found only at much greater depths). *P. posteli* is a small, large-eyed species known only from the island of Réunion in the Indian Ocean from the depth range of 150–250 m.

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