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Review of the fishes of the genus *Pempheris* (Perciformes: Pempheridae) of India, with description of a new species and a neotype for *P. mangula* Cuvier

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Abstract

The pempherid fishes, or sweepers, of the genus *Pempheris* are represented in the seas of India by the following five species: *P. flavicycla* Randall, Bogorodsky & Alpermann 2013; *P. malabarica* Cuvier in C. & V. 1831; *P. mangula* Cuvier 1829, for which a neotype is described; *P. sarayu*, new species; and *P. schwenkii* Bleeker 1855, a first record for India. Preliminary research has shown that *P. schwenkii* consists of a complex of species and/or subspecies. *Pempheris molucca* Cuvier in C. & V. 1831 is treated as a *nomen dubium*. A key is provided for the five species of the genus for India, and all are illustrated in color.

Key words: taxonomy, biogeography, sweepers, coral-reef fishes, *mangula*, *sarayu*, *flavicycla*, *malabarica*, *schwenkii*.

Introduction

Fishes of the genus *Pempheris*, popularly known as sweepers, have a very distinctive body shape: compressed, deepest below the anterior third of the total length, then strongly tapering posteriorly, mainly on the ventral side. They also are unusual in having an inner layer of small scales and an outer layer of much larger scales. The lateral-line scales are in the inner layer but not completely covered by the large scales. These fishes are also unique in having a short-based, pointed dorsal fin and a very long, low anal fin. Many are copper or bronze in color. Their short snout, strongly oblique mouth, protrusible upper jaw, and numerous long gill rakers are specializations for feeding on zooplankton. They shelter in the reef by day, often in aggregations. As their very large eyes suggest, they feed at night. Except for two species in the western Atlantic, all are from the Indo-Pacific region. Most

occur in tropical or subtropical localities, but a few are found in the temperate seas of Australia, New Zealand, and Japan. One has colonized the Mediterranean Sea via the Suez Canal (Golani *et al.* 2002), where a study has been made of its biology (Golani & Diamant 1991). Although well represented in museum collections, their classification remains imperfect; nowhere is this more apparent than in India.

Patrick Russell (1803: 10, fig.) published the first record of a species of *Pempheris* from India. He spent “several years” in residence at Vizagapatam (now Visakhapatnam) on the east coast, sampled the catches of fishermen, and had drawings made of 200 species by a native artist. His identifications were often the closest to species he knew from Europe, but not scientific names. His one species of *Pempheris* was identified as “The Sparus with a lunate tail; five dorsal spines; the body somewhat of a hatchet form; the fins squamous.” This was followed by the native name Mangula Kutti, fin-ray counts, and a 24-line description. The color was described as “generally reddish with an obscure mixture of gold.” One count he gave is of diagnostic importance: 42 anal soft rays. His drawing is reproduced here as Figure 1. He did not retain specimens.

Cuvier (1829: 195) described the new genus *Pempheris* in 5 lines and provided the scientific name *Pempheris mangula* for Russell’s fish in a footnote in volume 2 of his *Règne Animal*, with no description.

Cuvier in Cuvier and Valenciennes (1831) described *Pempheris oualensis* from the island of Oualan (now Kosrae) in the Caroline Islands in detail, followed by brief descriptions of seven other new species of *Pempheris*, one of which was *P. mangula*. His description of the latter was taken entirely from Russell; no specimen of this species was listed. The other new species include *P. vanicolensis* from Vanikoro Island in the Santa Cruz Islands, *P. nesogallica* from Mauritius, *P. malabarica* from the Malabar coast of India, *P. mexicana* from Acapulco, a locality error for the western Atlantic *P. schomburgkii* Müller & Troschel (R.D. Mooi, MS), and *P. molucca*, based on a fanciful painting in Renard (1718 to 1719 – see Pietsch 1995), reproduced here as Fig. 2. We regard Cuvier’s name *P. molucca* as a *nomen dubium*, and unavailable.

Day (1876: 175) reported two species of *Pempheris* in his *Fishes of India*: *P. mangula* Cuvier and *P. molucca* Cuvier in C. & V. His *P. mangula*, illustrated as Fig. 3 on his Plate 42 is, however, *P. malabarica* (corrected by him in 1888: 788). His *P. molucca* (Plate 42, fig. 2) is *P. mangula*. In his 1888 supplement to *Fishes of India*, he wrote to omit the synonyms for *P. molucca* and to call this species *P. russellii*. However, he overlooked *P. mangula* Cuvier 1829, so *P. russellii* is invalid as a synonym.

Before any definitive study can be made of the genus *Pempheris* of the Indian Ocean, it is imperative to determine what species Russell had when he described Mangula Kutti. Both authors have collected specimens

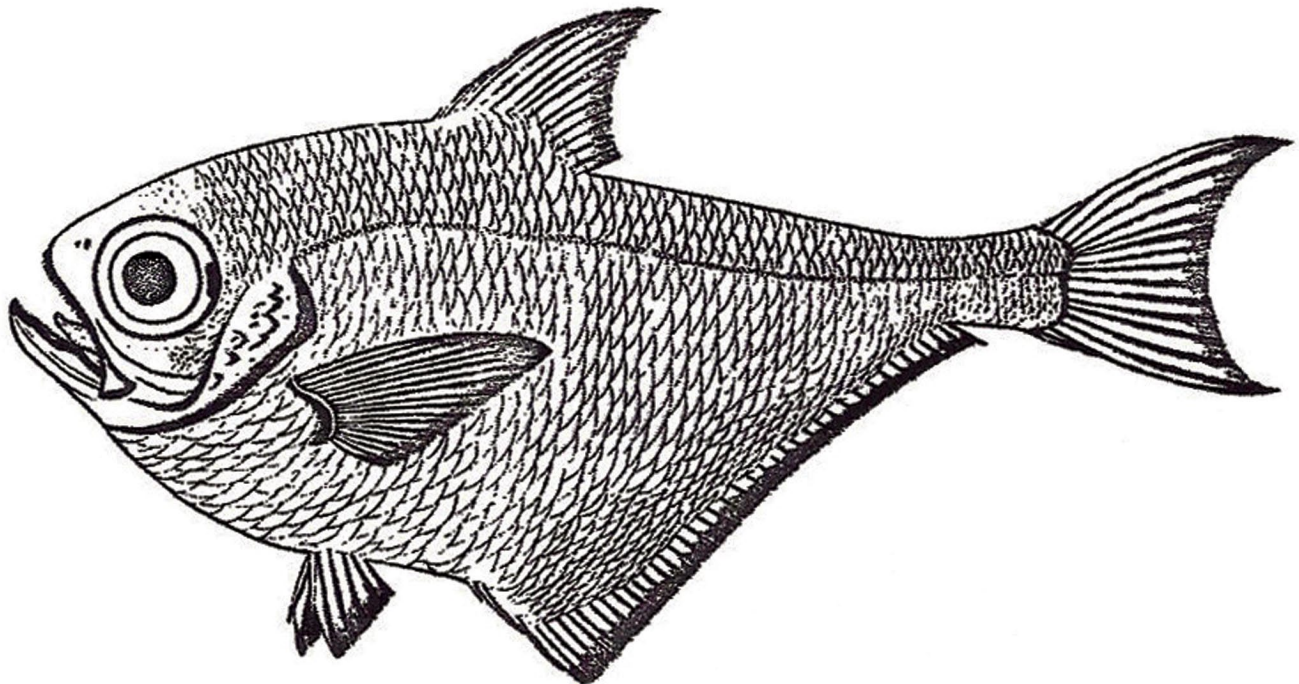


Figure 1. Drawing of *Mangula Kutti* (*Pempheris mangula*) from Visakhapatnam, India (from Plate CXIV in Russell, 1803).

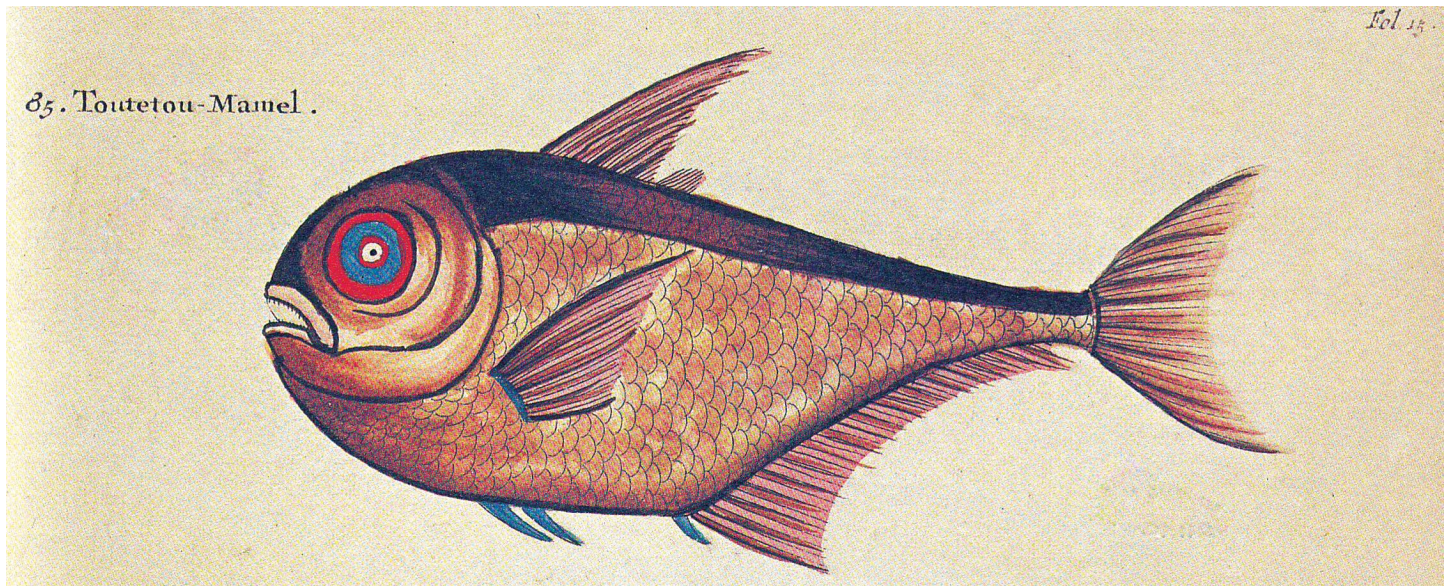


Figure 2. *Toutetou-Mamel* from Renard (1719: fig. 85), the basis for *Pempheris molucca* Cuvier in C. & V. 1831.

believed to be the true *Pempheris mangula* in the coastal waters of continental India, but none at or near the type locality of Visakhapatnam. The second author made a recent visit to this city, obtained specimens of *Pempheris* from fishermen that were caught from a rocky area outside the harbor, and selected one as the neotype. The species is still called Mangula Kutti, as it was in 1803.

A key and diagnoses are provided here for the species of *Pempheris* known from India (including Lakshadweep and the Andaman Islands). In addition, we describe a neotype of *Pempheris mangula*, describe a new species of *Pempheris*, and provide the first record of *P. schwenkii* Bleeker from India. Preliminary genetic studies and tabulation of meristic data indicate that *P. schwenkii* will probably be divided into several species or subspecies.

Materials and Methods

Specimens of the genus *Pempheris* of this study have been obtained on loan from or deposited in The Natural History Museum, London (BMNH); Bishop Museum, Honolulu (BPBM); California Academy of Sciences, San Francisco (CAS); Central Marine Fisheries Research Institute, Kochi (formerly Cochin), India (CMFRI); Muséum national d'Histoire naturelle, Paris (MNHN); South African Institute for Aquatic Biodiversity, Grahamstown, South Africa (SAIAB); Senckenberg Museum, Frankfurt (SMF); U.S. National Museum of Natural History, Washington, D.C. (USNM); Zoological Survey of India, Indian Museum, Kolkata (formerly Calcutta)(ZSI) and the Zoological Survey of India, Kozhikode (formerly Calicut) (ZSI/CLT).

Data in parentheses in the description of the new species refer to paratypes. Lengths of specimen are given as standard length (SL), measured from the base of the caudal fin (posterior end of hypural plate) to the median end of the upper lip; head length is measured from the same anterior point to the posterior end of the opercular flap, snout length from the same point to the nearest bony edge of the orbit, and upper-jaw length from the same anterior point to the posterior end of the maxilla; body depth is taken from the origin of the anal fin vertically to the base of the dorsal fin; body width is measured just posterior to the opercular flap; orbit diameter is the horizontal fleshy diameter, and interorbital width the least bony width; 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 base of caudal fin; predorsal, preanal, and prepelvic lengths are measured from the base of the anterior spine of these fins in a straight line to the median anterior point of the upper lip; lengths of spines and rays of median fins are measured to their extreme bases; caudal-fin length is measured horizontally from the base to a perpendicular at the end of the longest ray; 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 ray.

Counts of pectoral-fin rays contain the rudimentary upper ray. Lateral-line scale counts are made to the base of the caudal fin. Gill-raker counts include rudiments; only the total count is recorded. Proportional measurements are rounded to the nearest .05.

Key to the Species of *Pempheris* of India

- 1a. Lateral-line scales 65–75; scales above lateral line to base of first dorsal spine 6 or 7; tip of lower jaw often with a slight anteriorly-projecting knob.....*P. malabarica*
- 1b. Lateral-line scales 46–61; scales above lateral line to base of first dorsal spine 3 or 4; tip of lower jaw without an anteriorly-projecting knob.....2
- 2a. Lateral-line scales 46–55; pectoral-fin rays 16–18 (modally 17); a dark brown band along base of anal fin.....*P. schwenkii*
- 2b. Lateral-line scales 53–61; pectoral-fin rays 17–19 (modally 18, except *P. flavicycla* of Red Sea modally 17); base of anal fin without dark band.....3
- 3a. Anal fin with a complete black border, much broader anteriorly; inner half of iris bright yellow, outer half black; eye small for genus, orbit diameter 7.9–8.6 in SL; outer part of paired patch of small teeth anteriorly in lower jaw exposed when mouth fully closed (in specimens less than about 110 mm SL).....*P. flavicycla*
- 3b. Anal fin without a black border (there may be blackish pigment, especially anteriorly on outer part of anal fin, but not forming a solid black border); inner half of iris not bright yellow; orbit diameter 6.95–7.5 in SL (except in *P. mangula*, orbit diameter 7.3–8.4 in SL); no teeth exposed in lower jaw when mouth fully closed.4
- 4a. Body depth 2.2–2.25 in SL; prepelvic length 2.65–2.7 in SL; pectoral-fin length 3.5–3.65 in SL; a large black spot in axil of pectoral fin.....*P. mangula*
- 4b. Body depth 2.05 in SL; prepelvic length 2.55–2.65 in SL; pectoral-fin length 3.4–3.55 in SL; no black spot in axil of pectoral fin.....*P. sarayu*, n. sp.

TABLE 1

Anal-fin soft rays of specimens of *Pempheris* of India

	35	36	37	38	39	40	41	42	43	44	45	46	47	48
<i>P. flavicycla</i>				1	3	8	5	6	6	2				
<i>P. malabarica</i>								2	10	13	9	6		1
<i>P. mangula</i>				5	5	7	1							
<i>P. sarayu</i>					1									
<i>P. schwenkii</i>	2	4	8	12	15	11	6	3						

TABLE 2

Pectoral-fin rays of specimens of *Pempheris*
of India (both sides counted)

	16	17	18	19
<i>P. flavicycla</i>	4	25	29	4
<i>P. malabarica</i>		2	42	38
<i>P. mangula</i>		2	25	5
<i>P. sarayu</i>			1	1
<i>P. schwenkii</i>	7	77	38	

TABLE 3

Lateral-line scales of specimens of *Pempheris* of India

	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	
<i>P. flavicycla</i>						1	1	3	2	5	4	4	1	1																	
<i>P. malabarica</i>																				3	5	6	6	6	3	4	3	3	1	1	
<i>P. mangula</i>								3	4	5	2	1	1																		
<i>P. sarayu</i>										1																					
<i>P. schwenkii</i>	1	2	3	9	9	11	10	9	4	2																					

TABLE 4

Total gill-rakers of specimens of *Pempheris* of India

	24	25	26	27	28	29	30	31	32	33	34
<i>P. flavicycla</i>						1	4	8	3	2	
<i>P. malabarica</i>	2	9	17	10	3						
<i>P. mangula</i>				4	6	5	1				
<i>P. sarayu</i>								1			
<i>P. schwenkii</i>		2	8	8	10	6	2				

Pempheris flavicycla Randall, Bogorodsky & Alpermann 2013

Figures 3–5; Tables 1–4.

Pempheris mangula [non Cuvier] Rüppell 1836: 36 (Mohila, Red Sea); Klunzinger 1870: 469 (Quseir, Red Sea); Klunzinger 1884: 81 (Red Sea); Dor 1984: 165 (Red Sea).

Pempheris oualensis [non Cuvier] Jones & Kumaran 1980: 356, fig. 303 (Lakshadweep); Debelius 1999: 154, middle fig. (Seychelles).

Pempheris vanicolensis [non Cuvier] Talwar & Kacker 1984: 692 (Port Blair, Andaman Sea); Allen & Steene 1987: 55, pl. 36, nos. 5 & 6 (Jeddah, Red Sea and Mahé, Seychelles); Winterbottom *et al.* 1989: 41, fig. 224 (Chagos Archipelago; illustrated specimen lost); Randall & Anderson 1993: 29 (Republic of Maldives); Field & Field 1998: 138, upper fig. (Red Sea); Kuitert 1998: 119, upper figs. (Republic of Maldives); Lieske & Myers 2004: 124, middle fig. (Kenya and Red Sea); Imamura in Kimura *et al.* 2009: 177, 3 figs. (Andaman Sea); Taquet & Diringer 2012: 133, middle fig. (western Indian Ocean).

Pempheris flavicycla flavicycla Randall, Bogorodsky & Alpermann 2013: 4, figs. 3–5 (Oman and islands of Indian Ocean).

Pempheris flavicycla marisrubri Randall, Bogorodsky & Alpermann 2013: 9, figs. 7–9 (Red Sea and Gulf of Aden).

Diagnosis. Dorsal rays VI,9; anal rays III,38–44; pectoral rays 16–19 (16 only in Red Sea subspecies, where modally 17; modally 18 elsewhere in Indian Ocean); lateral-line scales 53–61; gill rakers 29–33; outer part of paired patch of small teeth anteriorly in lower jaw exposed when mouth fully closed (in specimens less than about 110 mm SL); body depth 2.3–2.55 in SL; head length 3.25–3.55 in SL; eye small for the genus, 7.9–8.6 in



Figure 3. *Pempheris flavicycla flavicycla*, holotype, BPBM 17633, female, 138 mm, Mafia Island, Tanzania (J.E. Randall).



Figure 4. *Pempheris flavicycla marisrubri*, Ras Mohammed, Red Sea (S.V. Bogorodsky).

SL; caudal fin slightly forked, the fin length 3.95–4.35 in SL; pectoral-fin length 3.55–3.8 in SL; bronze in life, grading to greenish dorsally on head and body; anal fin with a broad black border, about half the fin-ray length anteriorly, progressively narrower posteriorly; caudal fin with a broad blackish posterior margin, the upper and lower margins usually blackish; dorsal fin with a large apical black spot, often with a blackish anterior margin, sometimes dark on posterior margin; a transverse elliptical black spot of variable size at base of pectoral fins; iris black with a broad bright yellow inner ring. Largest specimen, the holotype, 138 mm SL.

Distribution. *Pempheris flavicycla* is presently known in Indian seas only from Lakshadweep (formerly Laccadive Archipelago), and the Andaman Islands. It is otherwise reported from the Red Sea, Oman, Kenya, Tanzania, Seychelles, Chagos Archipelago, Republic of Maldives, Sri Lanka, and the Similan Islands and island of Phuket, Thailand.

Remarks. As may be seen from the synonymy, *Pempheris flavicycla* has most often been misidentified as

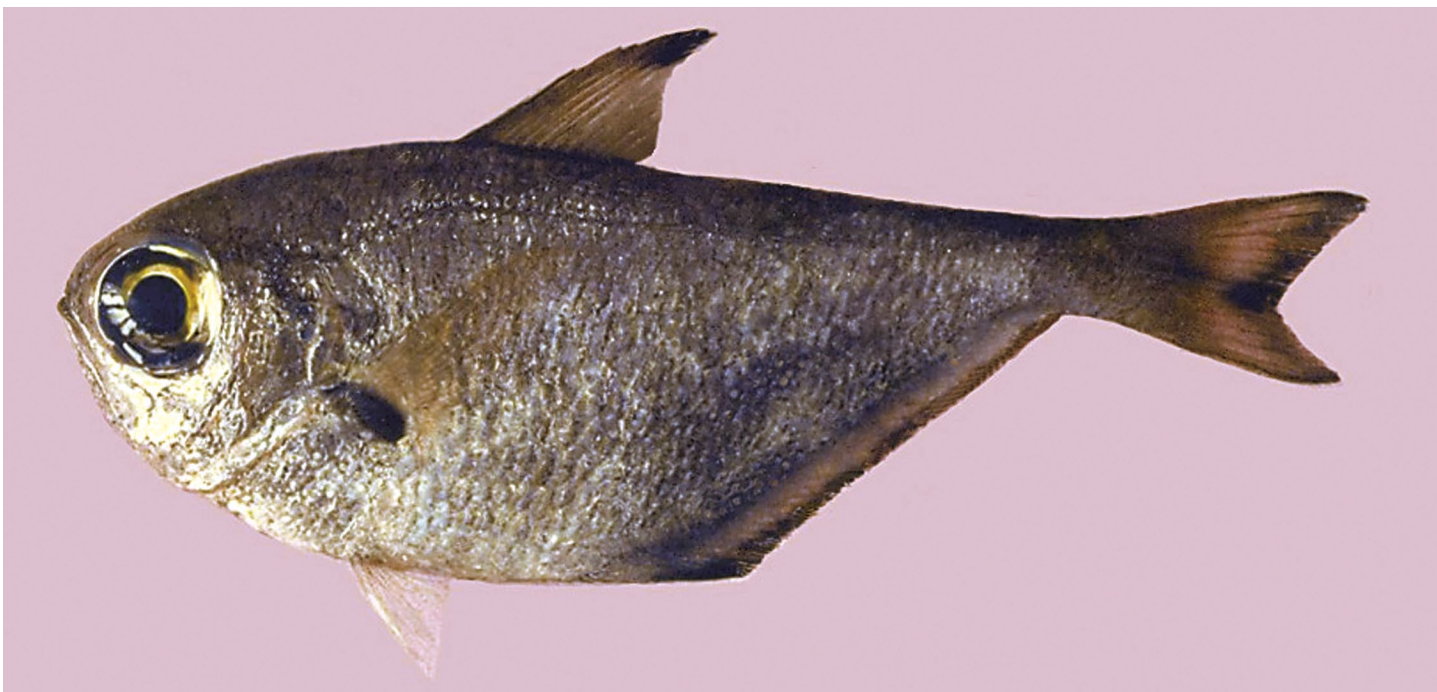


Figure 5. *Pempheris flavicycla flavicycla*, Andaman Islands (P.T. Rajan).

P. vanicolensis Cuvier in C. & V. 1831, type locality Vanikoro Island of the Santa Cruz Islands. Both species have a black border on the anal fin, and usually a broad black margin on the caudal fin. Randall *et al.* (2013) differentiated the two species by color (*P. flavicycla* has a bright yellow ring around the pupil of the eye and a black spot at the base of the pectoral fins), and both are well-separated by the counts of lateral-line scales and gill rakers (see Tables 3 and 4).

Pempheris flavicycla is typically found in clear-water, coral-reef areas. Although it may shelter in caves within the reef by day, it is often seen in small groups in the open, but close to refuge in the reef. Specimens examined have been collected from less than 10 m, but S.V. Bogorodsky (pers. comm.) observed the Red Sea subspecies at depths to 30 m. The species is not known from continental coasts exposed to open-ocean waves; the specimens collected from Tanzania and Kenya were obtained from reefs of offshore islands.

Material of *Pempheris flavicycla* examined: Red Sea, Sinai Peninsula, Ras Muhammed, USNM 402211, 205 mm; Gulf of Aqaba, USNM 402218, 4: 117–132 mm; Saudi Arabia, Rabigh, SMF 33630, 4: 104–119 mm; Al Lith, SMF 33631, 4: 65–81 mm. Gulf of Aden, Djibouti, CAS 235013, 120 mm. Oman, S. coast, Raha Bay, BPBM 36325, 72 mm. Tanzania, Mafia Island, BPBM 17633, 138 mm (holotype); USNM 410717, 118 mm. Republic of Maldives, North Malé Atoll, BPBM 36372, 7: 31–130 mm; SAIAB 189345, 129 mm; Kaafu Atoll, SAIAB 187538, 2: 116–117 mm. Sri Lanka, Trincomalee, ZSI/CLT 2465, 120 mm. Lakshadweep, CMFRI 26372, 40 mm. Comoro Islands, Anjouan, USNM 402278, 121 mm. Mauritius, USNM 19953, 11: 105–143 mm (bad condition); USNM 343806, 141 mm.

***Pempheris malabarica* Cuvier in Cuvier & Valenciennes 1831**

Figures 6–9; Tables 1–4.

Pempheris malabarica Cuvier in C. & V. 1831: 308 (Malabar coast of India); Bauchot 1963: 165 (list of two syntypes).

Pempheris mangula [non Cuvier] Day 1875: 175, pl. 42, fig. 3 (seas of India).

Pempheris molucca [non Cuvier] Talwar & Kacker 1984, 691, fig. 281 (Port Blair, Andaman Sea).

Pempheris sp. Randall 1995: 245 (Masirah Island, south coast of Oman).

Pempheris adusta [non Bleeker] Sarang *et al.* 2011: 22 (Ratnagiri, Maharashtra, India).



Figure 6. Syntype of *Pempheris malabarica*, MNHN A219 (R D. Mooi).



Figure 7. *Pempheris malabarica*, BPBM 27667, 113 mm SL, Kovalam, Kerala, India (J.E. Randall).

Diagnosis. Dorsal rays VI,9; anal rays III,42–48; pectoral rays 17–19; lateral-line scales 65–75; scales above lateral line to origin of dorsal fin 6 or 7; gill rakers 25–28; small teeth showing on lower jaw when mouth fully closed; tip of lower jaw often with an anteriorly-projecting knob; body depth 2.25–2.45 in SL; head length 3.05–



Figure 8. *Pempheris malabarica*, BPBM 36185, 128 mm, Masirah Island, Oman (J.E. Randall).

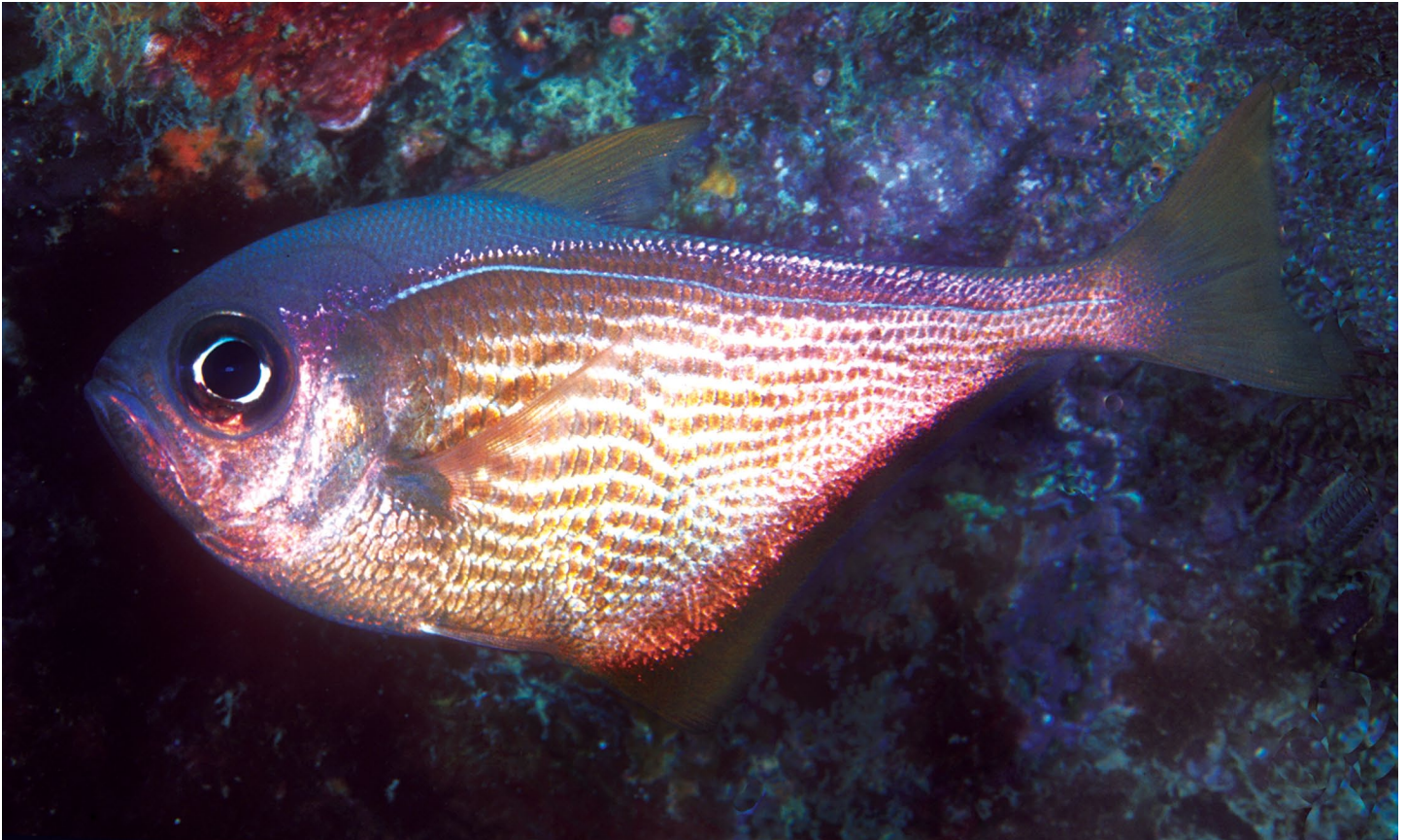


Figure 9. *Pempheris malabarica*, Sri Lanka (J.E. Randall).

3.4 in SL; eye small for the genus, the orbit diameter 7.9–9.1 in SL (in specimens 107–134 mm SL); caudal fin slightly forked, the fin length 3.95–4.35 in SL; paired fins short, the pectoral-fin length 3.45–4.25 in SL; pelvic-fin length 1.85–2.1 in head length. Color when fresh orangish to reddish copper, the scales rimmed with silvery white, very narrowly dorsally, broader on ventral half of body, resulting in a striped pattern; median fins orangish red, the dorsal indistinctly bordered by blackish, most evident at the tip; posterior margin of caudal fin slightly and narrowly blackish; margin of anal fin usually slightly blackish anteriorly; base of pectoral fin a little darker than adjacent chest, but not as a distinct spot. Largest specimen examined, BPBM 30046, 147 mm, from Lombok, Indonesia.

Distribution. Known from Oman, Sri Lanka (Fig. 9), India, and Indonesia. In addition, Dr. Randall D. Mooi (pers. comm.) has examined specimens from Thailand, Cambodia, and Singapore.

Remarks. *Pempheris malabarica* is the most distinct species of the genus in the Indian Ocean by virtue of its having the highest anal-fin ray and lateral-line scale counts, the lowest gill-raker counts, and in coloration. It is a common species in India. We were able to obtain many specimens from the bycatch of fishermen using trawls or gill nets. Sarang *et al.* (2011) reported the species (as *Pempheris adusta*) from trawling in 10–25 m off the west coast of India at Ratnagiri, Maharashtra. The first author was surprised to collect *P. malabarica* at the southern Indonesian island of Lombok.

Material of *Pempheris malabarica* examined. India: Maharashtra, Ratnagiri, ZSI/CLT 2488A: 10 lots. Kerala, Kollam, ZSI/CLT 2488B, 2 lots; Kovalam, BPBM 27667, 6: 46–113 mm. Tamil Nadu, Tuticorin, BPBM 20660, 112 mm; ZSI/CLT 2488C, 4 lots. Oman: Masirah Island, BPBM 36125, 138 mm; BPBM 36185, 128 mm. Indonesia: Lombok, BPBM 30046, 2: 138–147 mm.

Pempheris mangula Cuvier 1829

Figures 10, 11; Tables 1–4, 5.

Pempheris mangula Cuvier 1829: footnote, 195, after Russell 1803: 114 (Visakhapatnam, India); Cuvier in C. & V. 1831: 304 (after Russell 1803).

Pempheris molucca [non Cuvier] Day 1876: 175, pl. 42, fig. 3 (seas of India).

Neotype. ZSI/CLT 2489, mature female, 147 mm, India, Coromandel coast, Visakhapatnam, rocky area outside harbor, 15 m, from fishermen, gill net, K.K. Bineesh and P. Sarayu, June 7, 2012.

Paraneotypes. BPBM 41079, 5: 55–81 mm, India, Kerala, Kovalam, rocky point off Raja Hotel, about 300 m N of lighthouse, 0–7 m, rotenone, J.E. Randall and W.F. Smith-Vaniz, Feb. 10–11, 1980; ZSI/CLT 2490, 3: 116–130 mm, India, SE Coast, Tuticorin, bycatch of fishermen, coral reef, 5–20 m, K.K. Bineesh, March 18, 2010; ZSI/CLT 2491, 3: 136–141 mm, same data as neotype.

Diagnosis. Dorsal rays VI,9; anal rays III,38–41; pectoral rays 17–19; lateral-line scales 54–59; scales above lateral line to origin of dorsal fin 4; gill rakers 27–30; outer part of paired patches of small teeth anteriorly in lower jaw not exposed when mouth fully closed in specimens less than 110 mm SL; band of teeth at front of jaw crossed by three to five irregular rows of very small teeth; body depth 2.2–2.25 in SL; head length 3.25–3.45 in SL; eye diameter 7.3–8.4 in SL; caudal fin slightly forked, the fin length 3.45–3.75 in SL; pectoral-fin length 3.5–3.65 in SL; color of body of holotype when fresh: silvery with iridescence, the silvery reflections obscuring yellowish brown spots, one per scale, that consist of a narrow bar dorsally and grade to a round or oval spot ventrally; outer third of dorsal fin with a black spot and submarginal dark reddish zone; anal fin yellowish white, colored like body basally, with a dark reddish margin that is progressively broader and more blackish anteriorly; caudal fin mainly reddish, tinged with yellow, the outer fifth blackish, the upper and lower margins a little blackish; lateral line passing through middle of caudal fin blackish; a large black spot in axil of pectoral fin, and a narrow dark brown band across outer base of fin; iris mainly iridescent silver. Largest specimen, the neotype, 147 mm SL.

Description. Dorsal rays VI,9, the spines slender, the rays branched; anal rays III,40 (38–41), spines stout, rays slender; pectoral rays 17 (18 other side) 17–19 (rarely 17 or 19), the first rudimentary, the second unbranched,



Figure 10. Neotype of *Pempheris mangula*, ZSI/CLT 2489, 147 mm, Visakhapatnam, India (K.K. Bineesh).



Figure 11. Paraneotype of *Pempheris mangula*, ZSI/CLT 2491, 116 mm, Tuticorin, India (K.K. Bineesh).

remaining rays branched; principal caudal rays 17, the median 15 branched; upper and lower procurrent caudal rays 5 (4 or 5), the most posterior segmented; lateral-line scales to base of caudal fin 54 (54–59), continuing to end of fin; gill rakers 28 (27–30); branchiostegal rays 7; vertebrae 25.

Body moderately deep, the depth 2.4 (2.35–2.5) in SL, and compressed, the width 3.55 (3.05–3.4) in body depth; head length 3.4 (3.2–3.45) in SL; dorsal profile of head smoothly convex; snout short 4.75 (4.6–4.85) in head length; eye relatively small for the genus, 7.3–8.4 in SL; interorbital slightly convex, the width 3.75 (3.4–4.0) in head length; caudal-peduncle depth 3.3 (3.15–3.4) in head length; caudal-peduncle length 3.0 (3.05–3.5) in head length.

Mouth strongly oblique, forming an angle of about 60° to horizontal axis of head and body, the slender lower jaw slightly protruding when mouth fully closed; maxilla slender anteriorly, expanding posteriorly to a width about three-fourths pupil diameter, usually reaching to below center of eye, the posterior margin nearly straight, the lower corner broadly rounded, the upper corner slightly rounded; dorsoposterior edge of maxilla slipping under edge of suborbital when mouth fully closed; upper jaw with two to three rows of very small, well-separated, slender, sharply conical, recurved teeth, progressively smaller posteriorly, narrowing to a single row toward end of jaw; teeth of upper jaw fully exposed when mouth closed; lower jaw expanding to a slight knob at symphysis; teeth on each side of symphysis about half size of those of upper jaw, nodular to slender and sharply conical, progressively more recurved medially, in three to five rows, narrowing to a single row near end of jaw; vomer with an expanded V-shaped patch of villiform teeth in two to four irregular rows; palatines with a long narrow patch of very small nodular teeth in three to four irregular rows anteriorly, narrowing to one or two rows posteriorly. Tongue narrowly V-shaped with a slender rectangular tip, the upper surface smooth. Gill rakers long, the longest 1.5 times longer than longest gill filaments.

Gill opening extending dorsally to level of upper edge of orbit, and anteriorly to below anterior edge of orbit. Operculum ending posteriorly in a thin obtuse angle; margin of preopercle mostly scaled over, free at broadly rounded corner, with a flat, acute spine about one-third maximum width of maxilla, separated by a U-shaped notch from a flat, irregular, sharp ridge to ventroanterior end of margin. A distinct ridge midventrally on chest. Anterior and posterior nostrils in front of upper one-third of orbit, one-third distance to front of snout, the apertures vertically oval, separated by a septum nearly equal to nostril width; anterior nostril with a membranous flap on dorsal and posterior edge that covers anterior nostril when moved forward and nearly covers posterior nostril

when laid back. Scales thin, deciduous, and cycloid, except finely ctenoid ventrally on chest and dorsally on body posterior to dorsal fin, including top of caudal peduncle.

Origin of dorsal fin in vertical alignment with rear base of pectoral fin, the predorsal length 2.5 (2.5–2.6) in SL; first dorsal spine short, 4.4–5.15 in head length; fifth dorsal spine longest, 4.1 (4.05–5.4) in SL; first or second dorsal soft rays longest, 4.35 (3.65–3.85) in SL; origin of anal fin below middle of dorsal fin, the preanal length 2.05 (1.9–2.0) in SL; first anal spine 5.6–6.4 in head length; third anal spine 3.35 (2.35–5.6) in head length; longest anal soft ray 1.5 (1.5–1.6) in head length; caudal-fin length 3.75 (3.45–3.65) in SL; second branched pectoral ray usually longest, 3.65 (3.5–3.65) in SL; origin of pelvic fins below rear base of pectoral fins, the prepelvic length 2.75 (2.65–2.85) in SL; pelvic spine 2.2 (2.1–2.3) in head length; pelvic-fin length 1.65 (1.55–1.75) in head length.

Color of neotype in alcohol. Light yellowish brown with silvery reflections dorsally, the scales with a vertically elongate, yellowish brown spot, the spots becoming more oval ventrally; fins yellowish, the dorsal with a black spot on outer two-fifths of fin; outer fifth of caudal fin faintly blackish; lateral line in middle of caudal

TABLE 5

Proportional measurements of type specimens of *Pempheris mangula* as percentages of the standard length

	neotype		paraneotypes			
	ZSI/CLT	ZSI/CLT	ZSI/CLT	ZSI/CLT	ZSI/CLT	ZSI/CLT
	2490	2489	2489	2491	2491	2491
Standard length (mm)	147	116	118	136	138	141
Body depth	45.6	45.8	45.5	44.5	44.3	45.3
Body width	12.8	14.6	14.9	13.1	12.9	14.7
Head length	29.6	30.9	30.0	29.1	30.1	30.4
Snout length	6.4	6.4	6.8	6.5	6.5	6.3
Orbit diameter	11.9	13.8	13.5	12.6	12.4	12.1
Interorbital width	7.9	7.7	7.6	8.1	8.3	8.9
Caudal-peduncle depth	8.9	9.5	9.3	9.2	9.4	9.0
Caudal-peduncle length	9.8	9.5	8.6	9.5	8.8	9.1
Predorsal length	39.7	39.9	38.2	40.0	40.2	38.6
Preanal length	49.3	52.1	52.2	51.0	50.0	51.8
Prepelvic length	36.8	38.0	37.9	37.4	37.5	36.9
Base of dorsal fin	18.3	18.8	19.0	19.1	18.2	18.4
First dorsal spine	broken	6.1	6.8	6.5	6.3	5.9
Fifth dorsal spine	24.5	broken	24.6	24.1	21.8	18.5
Longest dorsal ray	23.0	27.3	broken	27.4	27.2	26.1
Base of anal fin	52.4	54.2	52.5	52.5	54.7	55.0
First anal spine	broken	4.3	4.7	5.2	5.4	5.3
Third anal spine	9.0	13.2	11.5	10.6	13.4	11.3
Longest anal ray	19.7	20.0	20.2	19.1	19.9	19.0
Caudal-fin length	26.8	27.3	28.1	28.5	29.0	28.8
Caudal concavity	9.0	9.6	10.6	9.5	9.4	8.4
Pectoral-fin length	27.5	28.8	28.4	27.5	28.4	28.0
Pelvic-spine length	13.5	13.9	14.3	14.4	14.5	14.3
Pelvic-fin length	17.0	16.9	15.6	17.0	16.4	16.8

fin blackish; about outer third of anal fin blackish anteriorly, narrowing posteriorly; paired fins pale yellowish, the pectorals with blackish axil and a narrow curved dusky band across outer base; iris mainly yellowish with blackish arc dorsally. Color when fresh as in Figure 10.

Distribution. Presently known from Visakhapatnam and Tuticorin on the east coast of India, and Kovalam in Kerala on the southwest coast.

Remarks. The gill net used by the fishermen to collect our specimens of *Pempheris mangula* at Visakhapatnam was set at about midnight and retrieved five or six hours later. We believe the silvery coloration of the holotype is mainly a postmortem change. The color in alcohol is now essentially the same as Fig. 11 of the paraneotype.

Day (1876: 175) used the name *Pempheris mangula* for what is here regarded as *P. malabarica* Cuvier in C. & V., as can be deduced from his counts of 42–46 anal soft rays (see Table 1) and his illustration (Plate 42, Fig. 2) with a lateral-line scale count of 65 (Table 3). Day's *Pempheris molucca* Cuvier is *P. rhomboidea* Kossman & Räuber, type locality, Red Sea.

Sequencing of the mtDNA barcode gene COI shows that *Pempheris mangula* is apparently very closely related to *P. rhomboidea*: there is only a 1.1% divergence between *P. mangula* from India (GenBank accession #KJ020189-KJ020195) and *P. rhomboidea* from the Red Sea (KJ020196-KJ020199)(Bineesh *et al.*, in prep.). The precise ranges of the three sibling species *P. mangula*, *P. rhomboidea*, and *P. sarayu* on the Indian subcontinent remain to be resolved.

Pempheris sarayu, n. sp.

Fig. 12; Tables 1–4, 6.

Holotype. BPBM 27666, 130 mm SL, India, Kerala, Kovalam, rocky point about 300 m N of lighthouse, off Raja Hotel, 0–7 m, rotenone, J.E. Randall and W.F. Smith-Vaniz, Feb. 10–11, 1980.

Diagnosis. Dorsal-fin rays VI,9; anal-fin rays III,39; pectoral-fin rays 18-19; lateral-line scales 55; gill rakers 9 + 22; body depth 2.05 in SL; head length 3.3 in SL; dorsal profile of head straight above eye, convex on nape; eye large, the orbit diameter 7.6 in SL; caudal fin slightly forked, the fin length 4.15 in SL; pectoral fins 3.65 in SL; origin of pelvic fins below middle of pectoral-fin base, the prepelvic length 2.55 in head length; pelvic fins short, 1.9 in head length, color in alcohol dull orange dorsally, brassy yellow on side and ventrally; fins orangish yellow, the distal third of dorsal fin with an oval black spot; no dark pigment at base or axil of pectoral fins; iris mainly yellowish; color when fresh silvery white, each scale with a vertically elongate copper-brown spot; dorsal fin with pale orangish gray membranes and orangish rays, a little darker at margin of fins; anal fin orangish, grading to whitish distally; caudal fin pinkish orange with a faint dusky posterior margin; pectoral fins light pinkish brown with a curving brown band at base; pelvic fins whitish; iris a mixture of dark yellowish brown and red.

Description. Dorsal-fin rays VI,9, the spines slender, the soft rays branched; anal-fin rays III,39, the spines stout, the soft rays branched; principal caudal rays 17, the median 15 branched; upper procurrent caudal rays 5, and lower procurrent caudal rays 4, the most posterior segmented; pectoral-fin rays 18 (other side 19), the first rudimentary, the second unbranched; pelvic-fin rays I,5, all soft rays branched; lateral-line scales to base of caudal fin 55, continuing to end of fin; gill rakers 31; branchiostegal rays 7; vertebrae 25.

Body deep for the genus, the depth 2.05 in SL, and compressed, the width 3.15 in body depth; head length 3.3 in SL; dorsal profile of head straight above eye, then convex to origin of dorsal fin; snout short 4.05 in head length; eye relatively large for the genus, 7.6 in SL; interorbital convex, the least width 3.6 in head length; caudal-peduncle depth 3.3 (3.15–3.4) in head length; caudal-peduncle length 2.0 in head length.

Mouth strongly oblique, forming an angle of about 65° to horizontal axis of head and body, the slender lower jaw slightly protruding when mouth fully closed; maxilla slender anteriorly, expanding posteriorly to a width equal to lens of eye, the upper and lower margins concave, the posterior edge rounded, reaching to below center of eye; upper corner of maxilla slightly rounded, lower corner broadly rounded, the dorsoposterior edge barely slipping under edge of suborbital when mouth fully closed; upper jaw with an irregular double row of tiny bluntly



Figure 12. Holotype of *Pempheris sarayu*, BPBM 27666, 130 mm, Kovalam, Kerala, India (J.E. Randall).

conical teeth anteriorly in jaw (except one sharply conical, recurved tooth at symphysis about twice as long as remaining teeth), narrowing to one row posteriorly; very small nodular teeth anteriorly in a narrow band in lower jaw in three to four irregular rows, separated at symphysis by a fleshy gap, narrowing to a single row posteriorly; upper teeth visible when mouth fully closed, but none of lower teeth may be seen when mouth closed; vomer with a V-shaped patch of villiform teeth in two irregular rows; palatines with a long narrow patch of very small nodular teeth in two irregular rows anteriorly, narrowing to one posteriorly. Tongue narrowly triangular, with a slender rectangular tip, the upper surface smooth. Gill rakers long, the longest 1.5 times longer than longest gill filaments.

Gill opening extending dorsally to level of upper edge of orbit, and anteriorly to below anterior edge of orbit. Operculum ending posteriorly in a thin membranous edge supported by ridges that end posteriorly in pointed exerted tips; margin of preopercle mostly scaled over, free at broadly rounded corner, with a triangular spine about one-fifth maximum width of maxilla, separated by a U-shaped notch from a flat, irregular, sharp ridge to ventroanterior end of margin. A distinct ridge midventrally on anterior two-thirds of chest, followed by a flat triangular area anterior to base of pelvic fins. Anterior and posterior nostrils vertically oval, in front of upper edge of pupil, separated by a septum narrower than nostril width; anterior nostril with a hemispherical posterior flap that does not extend into opening of posterior nostril when laid back.

Scales thin, deciduous, and cycloid, except finely ctenoid on chest and dorsally on body above lateral line.

Origin of dorsal fin in vertical alignment with rear base of pectoral fin, the predorsal length 2.65 in SL; first dorsal spine short, 3.8 in head length; sixth dorsal spine longest, 4.1 in SL; second dorsal soft ray longest, 4.0 in SL; origin of anal fin below middle of dorsal fin, the preanal length 2.0 in SL; first anal spine 7.8 in head length; third anal spine 2.0 in head length; longest anal soft ray 1.2 in head length; caudal fin length 4.15 in SL; second branched pectoral ray usually longest, 3.65 in SL; origin of pelvic fins below mid-base of pectoral fins, the prepelvic length 2.55 in SL; pelvic spine 2.2 (2.25) in head length; pelvic fins short, not reaching anus, the fin length 1.9 in head length.

Color in alcohol as given in Diagnosis; color when fresh as in Figure 12.

Etymology. This species is named *Pempheris sarayu* in honor of the second author's wife. The name is treated as a noun in apposition.

Distribution. Presently known from only one specimen collected at Kovalam, Kerala, India.

Remarks. Akhilesh Kallivalappil made a major effort to collect additional specimens of *Pempheris sarayu* at the exact locality at Kovalam where the first author collected the holotype in 1980, but he obtained only specimens of *P. mangula* and *P. malabarica*.

Pempheris sarayu seems most closely related to *P. rhomboidea*. The meristic data for *P. sarayu* are well within the range of counts for *P. rhomboidea* (see Tables 1–4). The two species share the relatively large eye, the same prepelvic length, a slightly forked caudal fin with a faint dusky posterior margin, black pigment of the dorsal fin confined to the distal end, and no black spot at the base of the pectoral fins. *Pempheris sarayu* differs from *P. rhomboidea* in having shorter pectoral fins (3.65 in SL, compared to 3.4–3.55 in *P. rhomboidea*), slightly greater body depth, and the dorsal surface of the tongue with very small, discrete papillae vs. transverse irregular rows of close-set, fleshy papillae. It is mainly copper-colored in life, compared to bronze in *P. rhomboidea*.

TABLE 6

Proportional measurements of the holotype of *Pempheris sarayu*
(BPBM 27666) as percentages of the standard length

Standard length (mm)	130
Body depth	48.5
Body width	15.4
Head length	30.5
Snout length	7.5
Orbit diameter	13.1
Interorbital width	8.5
Caudal-peduncle depth	15.1
Caudal-peduncle length	7.7
Predorsal length	37.6
Preanal length	50.3
Prepelvic length	39.1
Base of dorsal fin	19.3
First dorsal spine	8.1
Fifth dorsal spine	24.5
Longest dorsal ray	25.2
Base of anal fin	58.5
First anal spine	3.9
Third anal spine	15.4
Longest anal ray	25.3
Caudal-fin length	24.0
Pectoral-fin length	27.4
Pelvic-spine length	13.5
Pelvic-fin length	16.2

Pempheris schwenkii Bleeker 1855

Figures 13–15; Tables 1–4.

Pempheris schwenkii Bleeker 1855: 314 (type locality, Batu Islands, Sumatra); Smith & Heemstra 1986: 669 (Indo-West Pacific south to Natal).

Pempheris oualensis [non Cuvier] Smith 1953; 248, pl. 34 (East Africa south to Natal); Allen & Steene 1987: 55, pl. 36, fig. 7 (Mahé, Seychelles).

Diagnosis. Dorsal-fin rays VI,9; anal-fin rays III,35–42; pectoral-fin rays 16–18 (rarely 16; modally 17); lateral-line scales 46–55; scales deciduous (lateral-line scales less); gill rakers 25–30; body depth 2.35–2.45 in SL; head length 3.2–3.3 in SL; snout length 4.6–5.1 in head length; eye large, 7.2–7.7 in SL; caudal fin length 3.3–4.5 in SL, and moderately to strongly forked, the caudal concavity 2.3–2.55 in head length; pectoral fins 3.2–3.5 in SL; prepelvic length 2.45–2.6 in SL; pelvic fins 1.8–2.05 in head length; color variable, often silvery gray dorsally, with lavender iridescence, the sides silvery, the scales sometimes rimmed in copper; a black spot on about outer third of dorsal fin, the leading edge broadly blackish; anal fin with a broad blackish band along base; about outer fourth of caudal fin blackish, the upper and lower margins blackish but about half as broad; pectoral fins with a dark bluish gray band across base.

Distribution. Reported from the Red Sea, Kenya, and South Africa to Eastern Cape (Heemstra & Heemstra 2004: 326), Madagascar, Mauritius, St. Brandon's Shoals (Cargados Carajos), and Seychelles, east to the Batu Islands, Sumatra (type locality) and the Andaman Sea. Smith (1949: 247) first listed this species from South Africa as *Pempheris schwenkii*; however, he wrote, "An East Indian species once recorded from Natal (doubtful)." Smith



Figure 13. *Pempheris schwenkii*, BPBM 18771, 103 mm, Sri Lanka (J.E. Randall).



Figure 14. *Pempheris schwenkii*, BPBM 21599, 102 mm, La Digue, Seychelles (J.E. Randall).

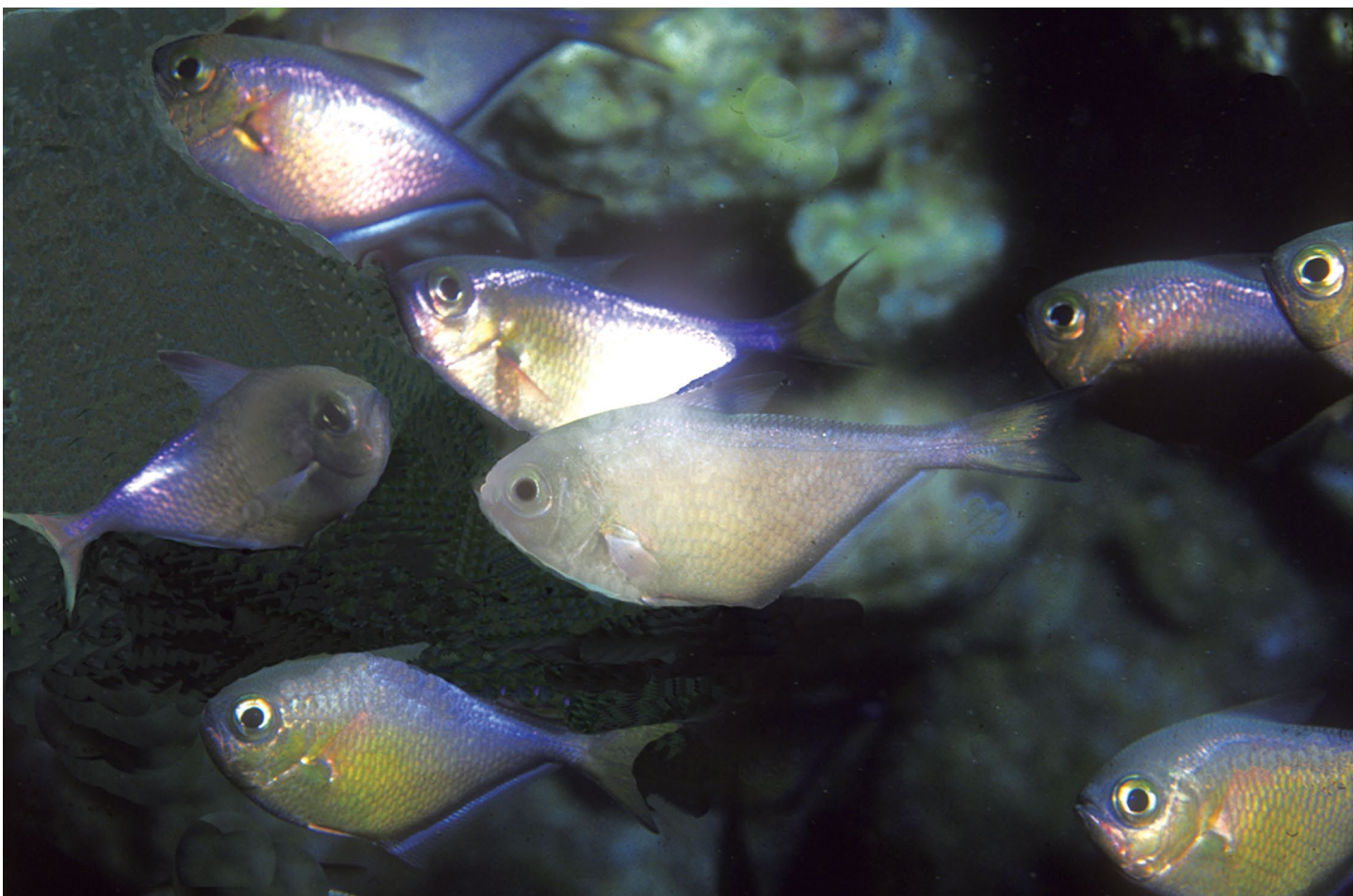


Figure 15. Aggregation of *Pempheris schwenkii*, south coast of Oman (J.E. Randall).

and Heemstra (1986: 559, pl. 84, fig. 216.4) provided the first positive record for South Africa. We report this species for the first time from India, based on specimens from the southeast coast at Tuticorin. The first author also collected it from Hikkaduwa and Trincomalee, Sri Lanka.

Remarks. The second author made a genetic comparison between specimens identified as *Pempheris schwenkii* from KwaZulu-Natal, South Africa and material provisionally identified as this species from Tuticorin, Tamil Nadu, India. The COI sequences of *P. schwenkii* from India (KJ020182–KJ020187) and South Africa (JF494129–JF494132, HQ561454) show a 10.1% divergence (Bineesh *et al.* in prep.).

The first author obtained a market specimen from the island of Lombok in southern Indonesia (BPBM 30020, 101 mm SL) that is colored like *P. schwenkii* and was first identified as this species. However, it has a small eye (orbit diameter 8.4 in SL, compared to 7.1–7.7 in nine specimens from the western Indian Ocean, 77–106 mm SL) and shorter pectoral fins, 3.7 in SL, compared to 3.2–3.6 in the same nine specimens.

Nine other specimens identified as *P. schwenkii* from the Red Sea have 51–55 lateral-line scales, compared to 46–53 for 32 specimens from other localities in the western Indian Ocean. Further study of *P. schwenkii* throughout its range is planned by us and colleagues in the expectation that it will prove to be a complex of subspecies or closely related species.

Pempheris schwenkii occurs in semi-stationery aggregations in caves or below overhangs in reefs by day (Figures 15, 16), feeding individually on zooplankton away from reef at night.

Material of *Pempheris schwenkii* examined. India, Tamil Nadu, Tuticorin, BPBM 41096, 101 mm; ZSI/CLT 2492, 5: 95–108 mm. Sri Lanka, Trincomalee, BPBM 18771, 5: 90–103 mm; Hikkaduwa, BPBM 27196, 2: 83–92 mm. Seychelles, La Digue, BPBM 21599, 9: 66–102 mm; BPBM 22980, 5: 63–88 mm; Mahé, BPBM 22937, 90 mm. Oman, south coast, Raha Bay, BPBM 35867, 96 mm; BPBM 36325, 72 mm. Red Sea, Saudi Arabia, Al Lith, SMF 33631, 2: 47–77 mm. South Africa, KwaZulu-Natal, SAIAB 80038, 3: 45–58 mm; SAIAB 189307, 2: 44–65 mm.



Figure 16. Aggregation of *Pempheris schwenkii*, Hurghada, Egypt, Red Sea (J.E. Randall).

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