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## Four new fishes of the genus *Pempheris* (Perciformes: Pempheridae) from the western Indian Ocean

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### Abstract

Four new species of pempherid fishes (common name sweepers) of the genus *Pempheris* are described: *P. convexa* from the south coast of Oman and the Maldives, unique in the convex dorsal profile of the head, small eye, and silver-gray color, and the scales rimmed with yellowish brown; *P. cuprea* from northern Mozambique with a deep body, low counts of pectoral-fin rays and gill rakers, and copper coloration; *P. darvelli* from the Gulf of Oman, silvery with irregular broad brassy stripes and pink iridescence on head and dorsally on body; and *P. eatoni*, common on the coast of KwaZulu-Natal and Mozambique, often in tidal channels along rocky shores, and typically silvery gray with blue-green iridescence, each scale with a vertically elongate brown spot.

**Key words:** taxonomy, systematics, new species, sweepers, Oman, Mozambique, South Africa, Maldives.

## Introduction

The marine fishes of the family Pempheridae, popularly known as sweepers, consist of two genera, *Pempheris* Cuvier 1829 with 30 currently recognized species, and *Parapriacanthus* Steindachner 1870 with four. Fishes of the genus *Pempheris* are distinctive in having a compressed body that is deepest below the anterior third of the total length, then strongly tapering posteriorly, mainly on the ventral side. They also are unusual in having two layers of scales, an inner layer of strongly adherent small scales and an outer layer of scales that are deciduous. 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. Most are copper, bronze, or silvery in color. They shelter in the reef by day, often in aggregations. As their very large eyes suggest, they feed at night. Their short snout, strongly oblique mouth, protrusible upper jaw, and numerous long gill rakers are specializations for feeding on zooplankton. Two species are known from the western Atlantic, the rest from the tropical to warm temperate seas of the Pacific and Indian Oceans.

We describe here four new species of *Pempheris* in preparation for a review of the family for the series of multiple-author volumes on all the coastal fishes of the western Indian Ocean being prepared for publication by the South African Institute for Aquatic Biodiversity.

## Materials and Methods

The specimens of the genus *Pempheris* for this study have been obtained from or examined at the Bishop Museum, Honolulu (BPBM); California Academy of Sciences, San Francisco (CAS); Muséum national d'Histoire Naturelle, Paris (MNHN); South African Institute for Aquatic Biodiversity, Grahamstown, South Africa (SAIAB); and the U. S. National Museum of Natural History, Washington, D.C. (USNM).

Data in parentheses in the descriptions refer to paratypes. Lengths of specimens are given as standard length (SL), measured from the base of the caudal fin (posterior end of hypural plate) to the median anterior end of the upper lip; head length is measured from the same anterior point to the posterior end of the opercular flap, 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 bony 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; 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, and caudal concavity the horizontal distance between tips of the shortest and longest 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 ray.

Counts of the soft rays of the anal and pectoral fins, lateral-line scales, and gill-rakers for the new species of *Pempheris* of the Indian Ocean are given in Tables 1–4. Counts of pectoral-fin rays include the rudimentary upper ray; counts are recorded for the fins of both sides. The scales of *Pempheris* are in two layers, the outer layer larger and very deciduous. The lateral-line scales are in the more adherent inner layer; only the narrow middle zone of this row of scales remains exposed when the outer row of scales are intact. Lateral-line scale counts are made to the base of the caudal fin (the lateral line continues to the end of the fin in *Pempheris*). Scale counts based on the outer layer of scales are often not possible due to scale loss. This is especially true of counts of scales above and below the lateral line. Because the scales of the inner layer are smaller, and the size of scales in the outer layer becomes progressively smaller as they approach the fin origins, it is often difficult to decide when one layer stops and the other begins. Predorsal scales were not counted because they are not in regular rows anteriorly. Most of the scales on species of *Pempheris* are cycloid. Those ventrally on the chest are strongly ctenoid in all known species. Ctenoid scales are variably present on different species, which can be of taxonomic importance. If a scale is only partly ctenoid, it is considered ctenoid. Gill-raker counts include rudiments; only the total count is recorded in Table 4. Having only two type specimens of *P. cuprea* and *P. darvelli*, we counted lateral-line scales and gill rakers of both sides. Proportional measurements are rounded to the nearest .05.

TABLE 1

Anal-fin soft rays of specimens of new species of *Pempheris* of the western Indian Ocean

	38	39	40	41	42	43	44
<i>P. convexa</i>		1	2				
<i>P. cuprea</i>		1		1			
<i>P. darvelli</i>				1		1	
<i>P. eatoni</i>	3	11	15	10	6	2	1

TABLE 2

Pectoral-fin rays of specimens of new species of *Pempheris* of the western Indian Ocean (both sides counted)

	17	18	19
<i>P. convexa</i>	1	3	2
<i>P. cuprea</i>	4		
<i>P. darvelli</i>		4	
<i>P. eatoni</i>	16	29	3

TABLE 3

Lateral-line scales of specimens of new species of *Pempheris* of the western Indian Ocean

	52	53	54	55	56	57	58	59	60
<i>P. convexa</i>	1	1			1				
<i>P. cuprea</i>			1	1	1	1			
<i>P. darvelli</i>					1	2	1		
<i>P. eatoni</i>		1	4	7	9	10	7	7	3

TABLE 4

Total gill-rakers of specimens of new species of *Pempheris* of the western Indian Ocean

	26	27	28	29	30	31	32	33
<i>P. convexa</i>				1	1	1		
<i>P. cuprea</i>		1	1	2				
<i>P. darvelli</i>					1	1	2	
<i>P. eatoni</i>			1	8	16	13	9	1



**Figure 1.** *Pempheris convexa*, holotype, BPBM 36009, male, 114.5 mm SL Sawda Island, south coast of Oman (J.E. Randall).

***Pempheris convexa*, n. sp.**

Figures 1–2, Tables 1–5.

**Holotype.** BPBM 36009, male, 114.5 mm, Arabian Sea, Oman, south coast, Sawda Island, 17° 28' 28" N, 56° 36' 5" E, coral reef, 9 m, spear, J.E. Randall, Nov. 5, 1993.

**Paratypes.** BPBM 41078, 117 mm, Republic of Maldives, North Malé Atoll, Villingili Island, north side off dock, rock wall, 1–2 m, spear, J.E. Randall, March 8, 1979; USNM 410915, 118 mm, Arabian Sea, Oman, south coast, Raha Bay, west side, rocky point, tide pool, 0–1.5 m, rotenone, J.E. Randall and I. McLeish, Feb. 6, 1993.

**Diagnosis.** Dorsal rays VI,9 anal rays III,39 or 40; pectoral rays 17–19; lateral-line scales 52–56; scales ctenoid on side of chest, nape, and body below dorsal fin to the scale row above lateral line; caudal fin scaled on about basal fourth; gill rakers 29–31; body depth 2.0–2.1 in SL; head length 3.3–3.4 in SL; dorsal profile of head strongly convex; eye relatively small, orbit diameter 8.0–8.5 in SL; caudal-fin length 3.65–3.85 in SL, and moderately emarginate, the caudal concavity 3.65–4.1 in head length; pectoral-fin length 3.3–3.4 in SL. Largest specimen examined, 118 mm SL. Color in alcohol yellowish to orangish brown; dorsal fin with brownish yellow rays, translucent yellow membranes, and a large blackish spot distally on posterior spines and anterior soft rays;

TABLE 5

Proportional measurements of type specimens of  
*Pempheris convexa* n. sp. as percentages of the standard length

	holotype	paratypes	
	BPBM 36009	BPBM 41078	USNM 410915
Standard length (mm)	114.5	116	118
Body depth	49.5	48.4	47.7
Body width	16.1	14.9	14.6
Head length	30.6	29.3	29.5
Snout length	7.1	6.8	6.9
Orbit diameter	12.5	12.1	11.8
Interorbital width	8.8	8.6	8.6
Caudal-peduncle depth	9.8	9.2	9.7
Caudal-peduncle length	7.9	7.7	8.0
Predorsal length	38.4	39.5	39.3
Preanal length	55.2	54.3	55.0
Prepelvic length	41.2	40.2	39.7
Base of dorsal fin	20.5	18.5	18.6
First dorsal spine	6.1	5.4	5.9
Sixth dorsal spine	23.7	broken	broken
Longest dorsal ray	24.1	broken	broken
Base of anal fin	55.8	55.1	56.0
First anal spine	4.2	4.2	4.1
Third anal spine	12.2	12.1	12.0
Longest anal ray	19.5	18.7	19.3
Caudal-fin length	26.0	broken	27.5
Caudal concavity	7.5	–	8.1
Pectoral-fin length	30.5	29.4	29.6
Pelvic-spine length	14.1	13.0	12.8
Pelvic-fin length	17.5	17.6	broken

anal fin with basal fourth dark reddish brown, a broad brownish yellow zone, and a narrow whitish border, except fin anterior to about fifth soft ray darker brown; caudal fin brown on scaled basal part, brownish yellow distally; paired fins brownish yellow; iris dark bluish gray, the pupil brown. Color when fresh as in Fig. 1.

**Description.** Dorsal rays VI,9, the spines slender, the rays branched; anal rays III,39 (39 or 40); the spines stout, the rays slender; pectoral rays 19 (17–18), the first rudimentary, second unbranched, remaining rays branched; principal caudal rays 17, the median 15 branched; upper procurent caudal rays 5, the lower rays 3, the most posterior of each segmented distally; lateral-line scales 53 (52–56) to base of caudal fin, continuing to end of fin; gill rakers 30 (29–31); branchiostegal rays 7; vertebrae 25.

Body moderately deep, the depth 2.0 (2.0–2.1) in SL, and compressed, the width 3.1 (3.25) in body depth; head length 3.3 (3.4) in SL; dorsal profile of head smoothly convex; snout short 4.3 (4.3–4.55) in head length; eye relatively small, the orbit diameter 8.0 (8.25–8.5) in SL; interorbital strongly convex, the width 3.5 (3.4–3.45) in head length; caudal-peduncle depth 2.9 (2.95–3.2) in head length; caudal-peduncle length 3.9 (3.7–3.8) in head length.

Mouth 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 nearly equal to pupil diameter, reaching posteriorly to below pupil (on one side of holotype to below front of pupil; on other side nearly to posterior edge of pupil); upper and lower margins of maxilla inwardly curved, the posterior edge straight with only the lower corner rounded; width of posterior edge of maxilla nearly equal to pupil diameter; very small, sharp, incurved teeth in two irregular rows anteriorly in upper jaw, narrowing to a single row posteriorly; very small conical teeth on each side of nodular symphysis of lower jaw in four irregular rows, those of outer rows slightly recurved, those of inner rows strongly recurved; rows soon narrowing to two for most length of jaw, ending with a few teeth in a single row; all teeth of upper jaw exposed when mouth fully closed, but none of lower jaw; vomer with an expanded V-shaped patch of very small conical teeth in two irregular rows; palatines with a long narrow patch of very small, medially curved teeth in two irregular rows; tongue narrowly triangular, the upper surface with small papillae; gill rakers long, the longest gill filaments three-fourths length of longest gill raker.

Gill opening extending dorsally nearly to level of upper edge of pupil and anteriorly nearly to a vertical at anterior edge of orbit. Opercular membrane broadly rounded posteriorly, with a slight indentation for anterior end of pectoral-fin base; margin of preopercle narrowly free only ventrally, with two flat spines, the dorsoposterior one acutely triangular, 2 mm long in holotype, separated by 3 mm from asymmetrical ventroanterior spine, unique in having very small serrae (5 on holotype) on slightly rounded tip (spines hidden by scales when not lost); a slight ridge midventrally on anterior two-thirds of chest (where scales are strongly ctenoid and adherent).

Anterior and posterior nostrils adjacent on snout in front of dorsal edge of pupil, closer to margin of orbit than upper jaw; nasal apertures vertically oval, separated by a septum nearly equal to nostril width; a membranous flap on posterior edge of anterior nostril covers nostril when folded forward but just reaches edge of posterior nostril when laid back.

Scales very small and cycloid anteriorly on snout, progressively larger posteriorly, becoming ctenoid in mid-interorbital and on nape; scales of rest of body cycloid, except dorsally above lateral line, posterior to rear base of dorsal fin, and on chest where most strongly ctenoid; small ctenoid scales present on head, except for a large naked area on opercle with a fine honeycomb pattern; opercular flap with very small cycloid scales reaching nearly to margin.

Origin of dorsal fin in vertical alignment with rear base of pectoral fins, the predorsal length 2.6 (2.55) in SL; first dorsal spine short, 5.05 (5.0–5.45) in head length; sixth dorsal spine longest, 4.35 in SL; first or second dorsal soft rays longest, 3.8 (3.65–3.95) in SL; origin of anal fin below middle of dorsal fin, the preanal length 1.8 in SL; first anal spine 7.3 (7.0–7.2) in head length; third anal spine 2.5 (2.4–2.45) in head length; longest anal soft ray 1.55 in head length; caudal fin length 3.85 (3.65) in SL; caudal concavity 4.1 (3.65) in head length; second or third pectoral ray longest, 3.3 (3.4) in SL; origin of pelvic fins below rear base of pectoral fins, the prepelvic length 2.45 (2.5) in SL; pelvic spine 2.15 (2.25–2.3) in head length; pelvic-fin length 1.75 (1.65) in head length.

**Color of holotype in alcohol.** Body orangish brown, the outer edge of scales whitish; dorsal fin with brownish yellow rays, brown membranes, and a blackish spot on about outer third of last two spines and first five soft rays;



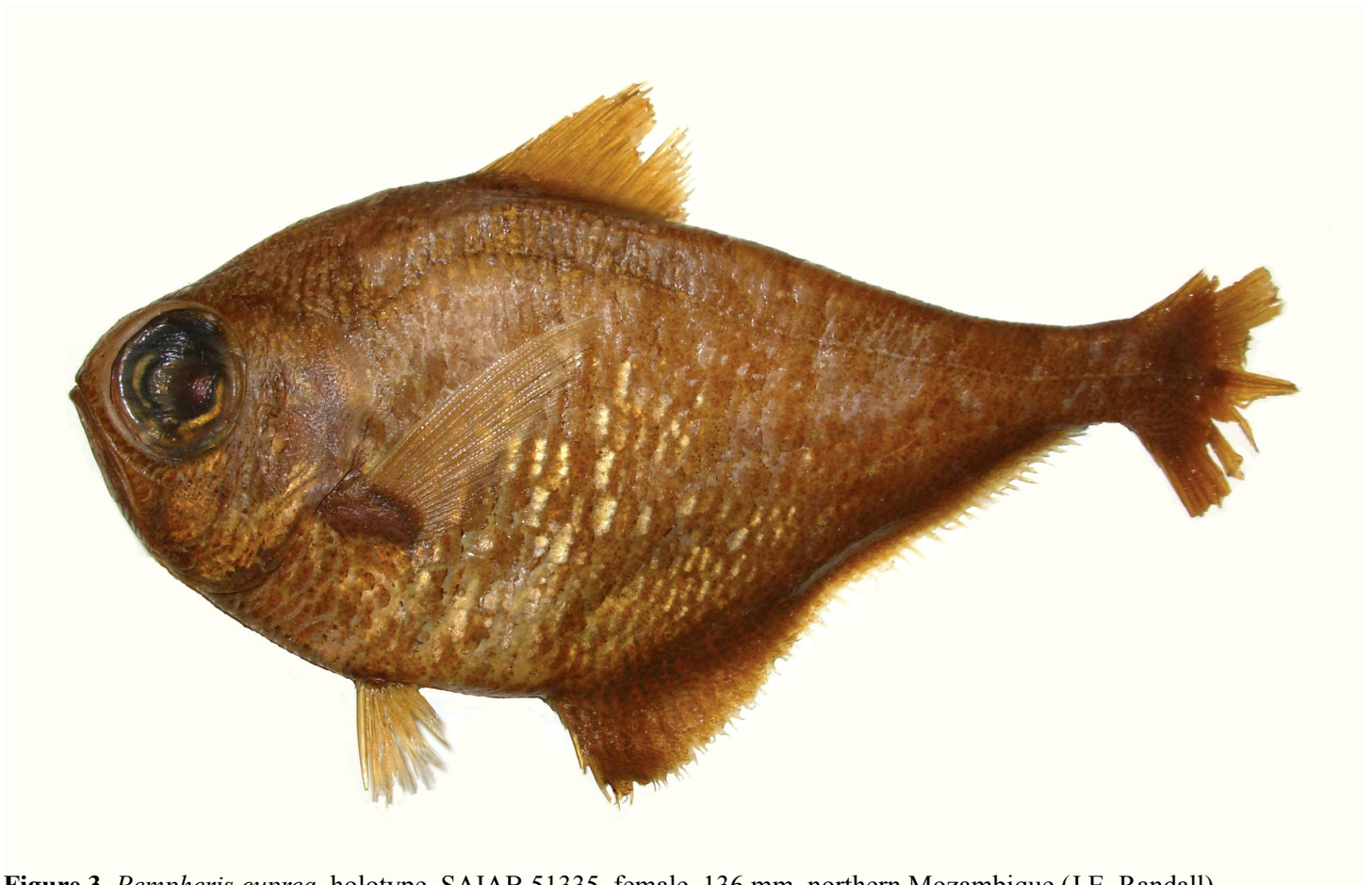
**Figure 2.** South coast of Oman, Raha Bay, west side (I. McLeish).

anal fin with a broad dark reddish brown band on base (and extending broadly onto adjacent body), a very broad light yellowish zone, and a narrow whitish margin, a dark brown anterior margin to soft portion of fin, expanding distally to cover first five rays and membranes; caudal fin brownish yellow, more brown on scaled basal portion, with a blackish margin on about distal fifth of fin; paired fins pale yellowish, pectoral fins with a dark brown band across base; iris dark bluish gray.

**Color of holotype when fresh.** Body light silvery gray, suffused with green dorsally on body; scales below lateral line with irregular light brown posterior margin; lateral line a broken dark brown line; front of snout, interorbital, and anterior nape dark brown with darker brown scale edges, becoming dark green with black edges in a narrowing band posteriorly on nape; then broader and still darker at base of dorsal fin, and narrowing posteriorly; dorsal fin brown with a large apical black spot, the membranes posterior to spot a little translucent distally; anal fin light brown, colored like body basally; scaled basal part of caudal fin brown, followed by a broad orange zone, and a blackish posterior margin; dorsal and ventral margins dark orange; paired fins with orange-red rays and translucent whitish membranes; pectoral fins with a bluish black band across base; iris a mixture of red, pale yellowish, brown, and blackish.

**Etymology.** This species name *convexa* is from Latin in reference to the strongly rounded dorsal profile of the head.

**Remarks.** The three type specimens of *Pempheris convexa* are from surprisingly different habitats; this might cast doubt on their being the same species. The holotype was collected from a coral reef at a depth of 9 m at Sawda Island, one of the Kuria Muria Islands off the south coast of Oman. The paratype from the Maldives was collected in 1–2 m from a rock wall in a small boat harbor of North Malé Atoll. The paratype from Raha Bay on the south coast of Oman was taken from a large surge channel fully exposed to the open sea (Fig. 2). The three specimens share the strongly convex dorsal profile of the head, nearly the same meristic and measurement data, and a high percentage of ctenoid scales. We know of no closely related species. Regrettably, all were collected before tissue samples were routinely taken from specimens for genetic study.



**Figure 3.** *Pempheris cuprea*, holotype, SAIAB 51335, female, 136 mm, northern Mozambique (J.E. Randall).

***Pempheris cuprea*, n. sp.**

Figure 3, Tables 1–4, 6.

**Holotype.** SAIAB 51335, 136 mm, female, northern Mozambique, Oct. 1973 (no further data).

**Paratype.** SAIAB 199988, 115 mm, female, same data as holotype.

**Diagnosis.** Dorsal rays VI,9 anal rays III,39 or 41; pectoral rays 17; lateral-line scales 54–57 (pored scales of both sides counted); scales on side of chest ctenoid; gill rakers 26–28 (rakers of both sides counted); body deep, the depth 2.1–2.15 in SL; head length 3.4–3.5 in SL; orbit diameter 7.4–7.55 in SL; jaws moderately oblique, forming an angle of about 65° to horizontal axis of body; pectoral-fin length 3.15 in SL. Color in alcohol bronze brown, many scales over pectoral region, abdomen, and above anterior part of anal fin with vertically elongate shiny copper-colored spot.

**Description.** Dorsal rays VI,9, the spines slender, the rays branched; anal rays III,41 (39); the spines stout, the rays slender; pectoral rays 17, the first rudimentary, second unbranched, remaining rays branched; principal caudal rays 17, the median 15 branched; upper procurrent caudal rays 6, lower procurrent caudal rays 4, the posterior 3 of each segmented distally; average lateral-line scale count of both sides 56 (55) to base of caudal fin,



continuing to end of fin; gill rakers 28 (26–28); branchiostegal rays 7; vertebrae 25.

Body moderately deep, the depth 2.1 (2.15) in SL, and compressed, the width 3.0 (3.05) in body depth; head length 3.5 (3.4) in SL; dorsal profile of head a slight sinusoidal curve; snout short 4.5 (4.0) in head length; orbit diameter 7.55 (7.4) in SL; interorbital strongly convex, the width 3.5 (3.4–3.45) in head length; caudal-peduncle depth 3.1 (3.0) in head length; caudal-peduncle length 3.35 (3.4) in head length.

Mouth moderately oblique, forming an angle of about 65° to horizontal axis of head and body; tip of slender lower jaw distinctly protruding when mouth fully closed; maxilla slender anteriorly, expanding posteriorly to a width three-fourths pupil diameter, reaching posteriorly to below middle of eye; upper and lower margins of maxilla inwardly curved, the posterior edge straight, with both corners rounded (the upper only slightly); width of posterior edge of maxilla nearly equal to pupil diameter; very small, sharp, recurved teeth in two irregular rows anteriorly in upper jaw, narrowing to a single row posteriorly; lower jaw with five to six irregular rows of very small teeth on each side of symphysis that appear to be nodular but are strongly recurved with very short points; rows soon narrowing to two for most length of jaw, ending posteriorly with a few teeth in a single row; all teeth of upper jaw exposed when mouth fully closed, but none of lower jaw; vomer with a V-shaped patch of very small recurved teeth in one to two irregular rows; palatines with a long narrow patch of very small, medially curved teeth in two irregular rows; tongue narrowly triangular, the upper surface densely covered with small papillae; gill rakers long, the longest at angle 1.2 times longer than longest gill filament.

Gill opening extending dorsally nearly to level of upper edge of orbit, and anteriorly slightly before a vertical at anterior edge of orbit. Opercular membrane broadly rounded posteriorly, just covering most anterior end of bony base of pectoralfin; ventroposterior margin of preopercle with two small flat spines (visible only when overlying layer of scales is lost), the uppermost narrowly pointed in direction of base of abdomen. Anterior and posterior nostrils vertically oval, adjacent on snout in front of dorsal edge of pupil; posterior nostril of holotype 1 mm in length, 2 mm from fleshy edge of orbit; anterior nostril with a fleshy rim and a membranous posterior flap that extends over internareal space when laid back.

Scales anteriorly on snout very small and cycloid, progressively larger posteriorly, becoming ctenoid in mid-interorbital space, on nape, and rest of head, including maxilla and in a narrow one-scale row on preorbital; scales on most of remaining body cycloid, except ctenoid on two scale rows below dorsal fin, continuing as five median dorsal rows posterior to rear base of dorsal fin, and on all of chest to base of pectoral fin, progressively more strongly ctenoid ventrally; caudal fin scaled on about basal fourth.

Origin of dorsal fin in vertical alignment with rear base of pectoral fins, the predorsal length 2.55 (2.65) in SL; first dorsal spine short, 5.5 (4.9) in head length; sixth dorsal spine longest, 7.55 (6.2) in SL; origin of anal fin below middle of dorsal fin, the preanal length 1.95 in SL; first anal spine 8.0 (8.35) in head length; third anal spine 2.9 (2.8) in head length; longest anal ray 1.85 in head length (broken in paratype); third pectoral ray longest, 3.15 in SL; origin of pelvic fins below rear base of pectoral fins, the prepelvic length 2.45 (2.5) in SL; pelvic spine 2.45 in head length; pelvic-fin length 1.7 in head length.

**Color in alcohol.** Body copper brown, many scales over pectoral region, abdomen, and above anterior part of anal fin with a bright metallic silver-to-copper vertically elongate spot; small metallic copper-colored scales on preopercle, subopercle, and ventroposteriorly on opercle; fins orangish brown; dorsal fin with an apical black spot (present in paratype and presumed present in holotype); anal fin with a broad, dark, orangish brown band at base; pectoral fins orangish brown, with a dark brown spot over entire base of fin; pelvic fins dusky yellowish brown; iris with what appears to be remnants of two encircling copper-colored rings.

**Etymology.** This species is named *cuprea* from the Latin for copper, in reference to its coloration.

**Remarks.** We were hesitant to describe this species from two damaged specimens, with no information on locality other than northern Mozambique, and no data on habitat, collectors, etc. However, the low counts of only 26–28 gill rakers (equaled only by the very diverse species of the *Pempheris schwenkii* complex), the low count of 17 pectoral rays, the steep angle of jaws, the protruding tip of the lower jaw, and the chest scales entirely ctenoid overcame our reluctance. We hope that anyone collecting fishes in Mozambique and farther north on the African coast will be alert to the need for more specimens and photographs of this species.

TABLE 6

Proportional measurements of type specimens of  
*Pempheris cuprea* n. sp. as percentages of the standard length

	holotype	paratype
	SAIAB 51335	SAIAB 199988
Standard length (mm)	136	116
Body depth	47.0	46.4
Body width	15.6	15.5
Head length	28.7	29.3
Snout length	7.4	6.9
Orbit diameter	13.2	13.6
Interorbital width	8.8	8.6
Caudal-peduncle depth	9.5	9.8
Caudal-peduncle length	8.8	8.7
Predorsal length	38.9	38.1
Preanal length	51.6	51.7
Prepelvic length	36.1	36.5
Base of dorsal fin	19.2	19.7
First dorsal spine	5.1	6.0
Sixth dorsal spine	18.0	18.8
Longest dorsal ray	broken	broken
Base of anal fin	55.9	56.4
First anal spine	3.7	3.5
Third anal spine	10.2	10.4
Longest anal ray	16.0	broken
Caudal-fin length	broken	broken
Caudal concavity	–	–
Pectoral-fin length	31.6	31.0
Pelvic-spine length	12.1	12.0
Pelvic-fin length	17.6	17.3



**Figure 4.** *Pempheris darvelli*, holotype, BPBM 41178, female, 117 mm, Jissah Island, Gulf of Oman (H.A. Randall).

***Pempheris darvelli*, n. sp.**

Figure 4–7, Tables 1–4, 7.

**Holotype.** BPBM 41178, mature female, 117 mm, Gulf of Oman, Jissah Island, 23° 33' 30.80" N, 58° 39' 8.64" E, clusters of large boulders separated by sand, 6–7 m, spear, Brian W. Darvell and Keith D. P. Wilson, Nov. 27, 2013.

**Paratypes.** USNM 427522, male, 97 mm, same data as holotype.

**Diagnosis.** Dorsal rays VI,9 anal rays III,41–43; pectoral rays 18 or 19; lateral-line scales 56–58; ctenoid scales on anteroventral 90% of chest; gill rakers 30–32; body depth 2.1 in SL; head length 3.0–3.05 in SL; orbit diameter 7.45–7.7 in SL; caudal-fin length 3.45–3.55 in SL, and moderately emarginate, the caudal concavity 3.55–3.7 in head length; pectoral-fin length 3.15–3.2 in SL. Color in alcohol dark maroon brown, the outer edge of scales broadly translucent gray; dorsal fin pale yellowish, the distal half of first six soft rays and adjacent membranes black (dark pigment covering outer half of longest rays and adjacent membranes); anal fin and adjacent base of body darker brown than body, becoming progressively more translucent yellow distally, with a small brown spot on each scale; anal ray tips translucent white; anterior five rays and membranes dark brown, the dark pigment also distally on the next five rays; caudal fin dusky yellowish, darker brown basally and broadly darker all around margin; pectoral fins yellowish gray with a large dark maroon brown spot covering entire base of fin; axil also dark maroon brown; pelvic fins pale dusky yellowish; color of adults in life as in Figs. 5 and 6. Largest specimen examined, the holotype, 117 mm SL.

**Description.** Dorsal rays VI,9, the spines slender, the rays branched; anal rays III,43 (41), the spines stout, all rays branched; pectoral rays 18 (18–19), the first rudimentary, the second unbranched, remaining rays branched; principal caudal rays 17, the median 15 branched; upper and lower procurrent caudal rays 5, the most posterior of

each segmented distally; lateral-line scales 58 (56–58) to base of caudal fin, the pored scales continuing to end of fin; gill rakers 31 (30–32); branchiostegal rays 7; vertebrae 25.

Body moderately deep, the depth 2.1 (2.1) in SL, and compressed, the width 3.35 (3.35) in body depth; head length 3.05 (3.0) in SL; dorsal profile of head a slight sinuous curve; snout short, 4.3 (4.6) in head length; orbit diameter 7.7 (7.45) in SL; interorbital convex, the width 3.95 (4.0) in head length; caudal-peduncle depth 3.65 (3.55) in head length; caudal-peduncle length 3.75 (3.95) in head length.

Mouth oblique, the upper jaw forming an angle of about 60° to horizontal axis of head and body; lower jaw of holotype protruding 0.5 mm when mouth fully closed (no lower teeth then visible); maxilla slender anteriorly, expanding posteriorly to a width equal to pupil diameter, and extending slightly posterior to a vertical at rear edge of pupil; upper and lower margins of maxilla inwardly curved, the posterior edge straight with acutely pointed upper corner and broadly rounded lower corner; width of posterior edge of maxilla 3 in orbit diameter; upper edge of maxilla barely slipping under the narrow preorbital when mouth closed; upper lip of holotype about 1.5 mm in height, soon narrowing along side of jaw to less than a mm, the median surface with small bristle-like papillae, becoming low papillae laterally on lip; lower lip densely papillose medially, the papillae progressively more sparse laterally; front of upper jaw with very small, sharp, strongly recurved teeth in two irregular rows, soon narrowing to a single row on side of jaw; tiny teeth on each side of symphysis of lower jaw in four or five, close-set, irregular rows, those of outer rows nodular, those of inner rows very strongly recurved with very short pointed tip; teeth narrowing posteriorly on jaw to a single row; vomer with low nodular teeth, mainly in a single row, forming a V-shape; small nodular teeth, mostly in a single row, on palatines; tongue nearly an equilateral triangle, the upper surface densely covered with small papillae; gill rakers long, the longest adjacent to angle one-half orbit diameter.

Gill opening extending dorsally nearly to level of upper edge of orbit and anteriorly a pupil diameter from a vertical at posterior margin of orbit; opercular membrane broadly rounded posteriorly; margin of preopercle narrowly free only ventrally, with two flat triangular spines separated by a distance equal to half height of maxilla (spines hidden by scales when not lost); a slight ridge midventrally on anterior two-thirds of chest (where scales are strongly ctenoid and adherent).

Anterior and posterior nostrils adjacent on snout in front of center of eye, separated by a nostril width, vertically oval, the length (1.5 mm in holotype) twice maximum width; posterior nostril of holotype 1.7 mm from fleshy edge of orbit; anterior nostril with a low fleshy rim and a membranous posterior flap that extends over internostril space when laid back.

Scales very small and cycloid anteriorly on snout, progressively larger posteriorly, becoming ctenoid in mid-interorbital space and rest of head (including maxilla, the single row of scales on preorbital, and all of operculum except for opercular membrane); scales of rest of body cycloid, except 5 ctenoid median dorsal rows posterior to rear base of dorsal fin, and on chest where the anteroventral scales are strongly ctenoid.

Origin of dorsal fin in vertical alignment with posterior edge of opercular membrane, the predorsal length 2.55 (2.55) in SL; first dorsal spine short, 4.95 (6.25) in head length; sixth dorsal spine longest, 4.4 (4.3) in SL; first or second dorsal soft rays longest, 3.8 (3.75) in SL; origin of anal fin below middle of dorsal fin, the preanal length 2.0 (2.0) in SL; first anal spine 7.8 (8.25) in head length; third anal spine 3.0 (3.05) in head length; longest anal soft ray 1.85 (1.7) in head length; caudal-fin length 3.55 (3.45) in SL; caudal concavity 3.7 (3.55) in head length; second or third pectoral ray longest, 3.15 (3.2) in SL; origin of pelvic fins below rear base of pectoral fins, the prepelvic length 2.55 (2.7) in SL; pelvic spine 2.15 (2.2) in head length; pelvic-fin length 1.8 (1.85) in head length.

**Color in alcohol** (as in Fig. 4). Described above in the Diagnosis.

**Color in life** (as in Figs. 5 and 6). Note the scales of the body below the lateral line with vertically oval metallic bronze to copper centers and silvery edges that give a striped pattern to the body, the many small silvery pink scales with brown edges above the lateral line and on the head, the band of small, olive green scales with dark brown edges from dorsally on the head to the base of the dorsal fin, the silvery white dot on each lateral-line scale, the pinkish brown scales ventrally on chest with silvery white edges; the black-tipped dorsal fin with a broad yellowish anterior margin, translucent membranes, and pink rays; anal fin with a broad, basal pinkish silver zone, a middle dark olive green zone, the anterior lobe with an added lighter olive green zone, and all of fin with an outer translucent zone, except anterior lobe distally blackish; caudal fin translucent with yellowish rays, dusky



**Figure 5.** *Pempheris darvelli*, Jissah Island, Gulf of Oman (B. Darvell).

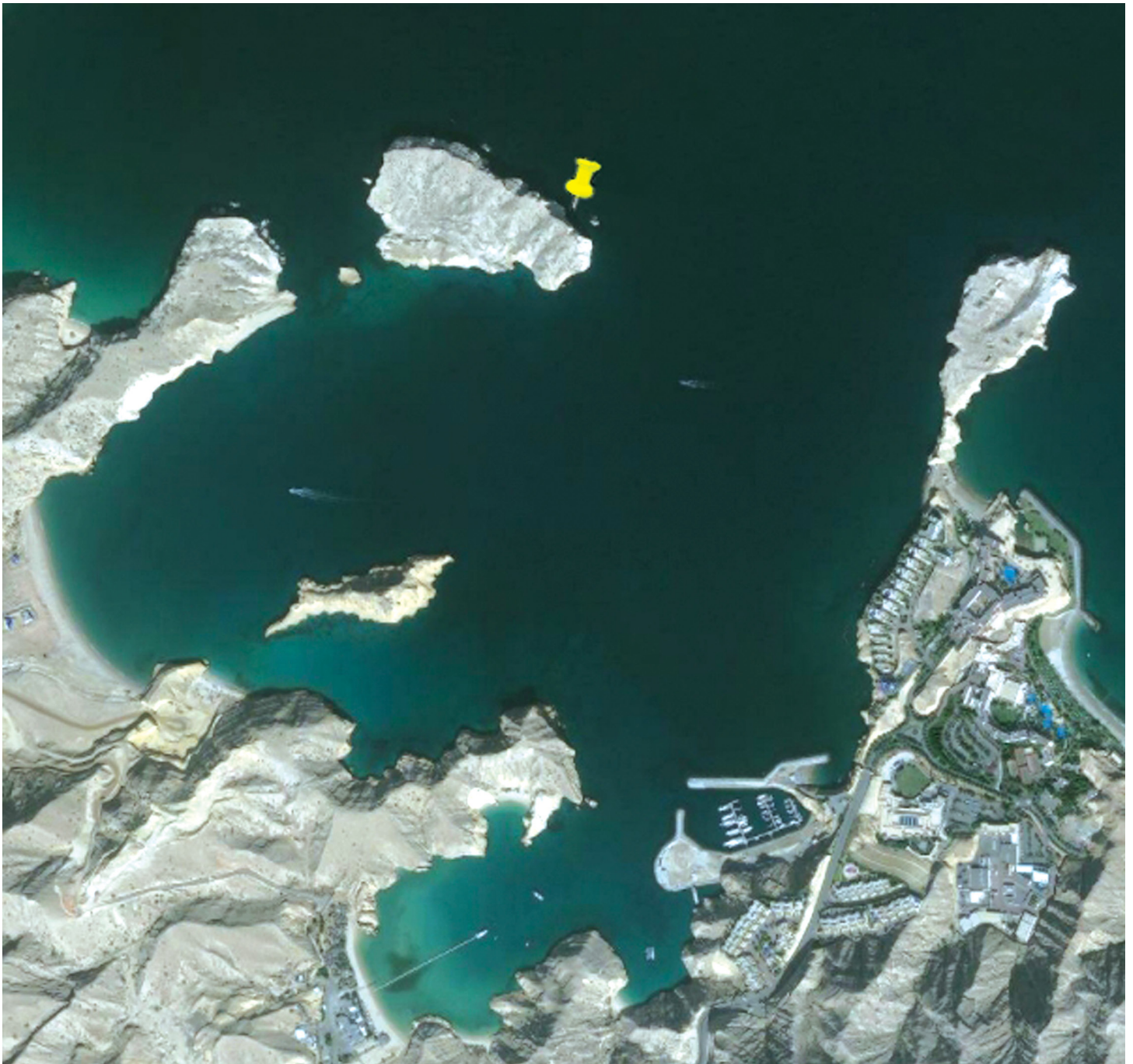


**Figure 6.** *Pempheris darvelli*, Jissah Island, Gulf of Oman (B. Darvell).

yellowish upper and lower margins, and a broad blackish border; pectoral fins translucent with pink rays and a large reddish brown basal spot; pelvic fins with whitish lateral edge.

**Etymology.** We are pleased to name this species in honor of Brian W. Darvell in appreciation of his fieldwork in Oman resulting in the specimens and photographs of this new species.

**Remarks.** At the first author's suggestion, Darvell made a trip to Oman, accompanied by diver-photographer Keith D. P. Wilson, with a mission to photograph and collect any of four probable undescribed species of *Pempheris* of which we have single specimens without any photographs and no data on color. They went on commercial dive boats that take scuba divers to view and photograph the Oman marine life. They were therefore restricted in the use of a spear to collect specimens. We are pleased that they succeeded in collecting three specimens of the species described above at Jissah Island (Fig. 7).

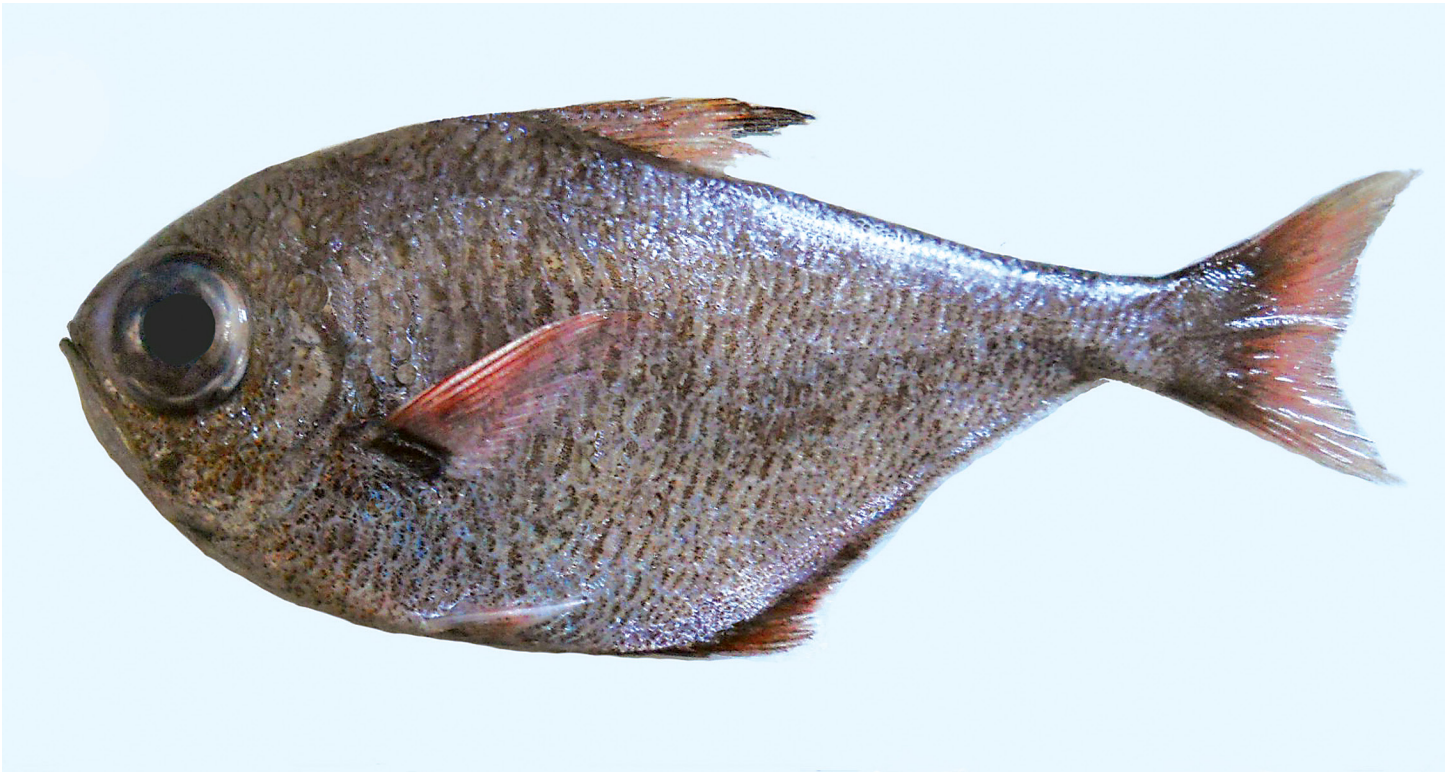


**Figure 7.** Yellow pin indicates the type locality of *Pempheris darvelli* at Jissah Island, Gulf of Oman (GoogleMaps).

TABLE 7

Proportional measurements of type specimens of  
*Pempheris darvelli* n. sp. as percentages of the standard length

	holotype	paratype
	BPBM	USNM
	41178	427522
Standard length (mm)	117	97
Body depth	47.1	47.5
Body width	14.0	14.1
Head length	32.7	33.0
Snout length	7.6	7.2
Orbit diameter	13.0	13.4
Interorbital width	8.3	8.3
Caudal-peduncle depth	9.0	9.3
Caudal-peduncle length	8.7	8.4
Predorsal length	39.0	39.7
Preanal length	50.4	49.8
Prepelvic length	39.1	37.2
Base of dorsal fin	18.8	17.9
First dorsal spine	6.6	5.3
Sixth dorsal spine	22.8	23.2
Longest dorsal ray	26.4	26.7
Base of anal fin	54.2	54.3
First anal spine	4.2	4.0
Third anal spine	10.8	10.3
Longest anal ray	17.7	19.3
Caudal-fin length	28.2	29.0
Caudal concavity	8.9	9.3
Pectoral-fin length	31.8	31.2
Pelvic-spine length	15.2	15.1
Pelvic-fin length	18.0	17.8



**Figure 10.** *Pempheris eatoni*, holotype, SAIAB 189160, female, 134 mm SL, Scottburgh, KwaZulu-Natal (outer layer of scales largely missing) (A.D. Connell).

### *Pempheris eatoni*, n. sp.

Figure 10–14, Tables 1–4, 8.

*Pempheris moluca* (error for *molucca*; non Cuvier) Smith 1949: 248 (occasional as far south as Durban).

*Pempheris adusta* (non Bleeker) Heemstra in Smith & Heemstra 1986: 669, pl. 85 (south to the Transkei).

*Pempheris onalensis* (error for *oualensis*; non Cuvier) van der Elst 1989: 233, fig. (Durban north to Mozambique).

**Holotype.** SAIAB 189160, gravid female, 134 mm SL, Republic of South Africa, KwaZulu-Natal, Scottburgh, 30° 17.719' S; 30° 45.251' E, intertidal channel linked to open sea, with rock overhangs, 1–2 m, cast net, Patrick Eaton (for Allan D. Connell), June 3, 2012.

**Paratypes.** SAIAB 16554, 128 mm, mature female, KwaZulu-Natal, Kosi Bay, 1905 (no other data); SAIAB 51229, 6: 27–67 mm, Mozambique, Pinda, 14.216° S, 40.766° E, Sept. 1, 1956; SAIAB 3874, 19: 71–127 mm, Mozambique, Ibo Island lighthouse, 12.333° S, 40.616° E, M.M. Smith *et al.*, Oct. 1, 1973 (includes former SAIAB 3968, 11 specimens, 116–127 mm SL, with same collection data); USNM 410914, 3: 72–87 mm and CAS 237379, 89 mm, same data as preceding; BPBM 41164, 97 mm, Mozambique, Ibo Island, fish depot, 12.340° S, 40.576° E, M.M. Smith *et al.*, Oct. 2, 1973 (formerly SAIAB 4226); SAIAB 51230, 17: 16–83 mm, KwaZulu-Natal, about 4 km north of Umhloti, 29.649° S, 31.133° E., large subtidal pool to 5 m depth, sheltered from surf by offshore reef, rotenone, M. Christensen & W. Holleman, June 30, 1977; SAIAB 8606, 100 mm, KwaZulu-Natal, Kosi Bay, Feb. 1, 1979 (no other data); BPBM 41177, 138 mm, mature female, same data as holotype; BPBM 41191, 2: 125–140 mm, same collection data as holotype, Oct. 1, 2014.



**Diagnosis.** Dorsal rays VI,9 or 10 (usually 9); anal rays III,38–44; pectoral rays 17–19; lateral-line scales 53–60; chest scales entirely ctenoid; caudal fin scaled on about basal fourth; gill rakers 28–33; body depth 2.2–2.35 in SL; head length 3.3–3.4 in SL; orbit diameter 7.15–7.7 in SL; longest dorsal ray 3.7–4.05 in SL; pectoral-fin length 3.3–3.55 in SL; color of holotype in alcohol gray-brown, the scale edges narrowly gray; dorsal fin brownish gray with an apical black spot; anal fin colored like body basally, with a broad blackish middle zone, the margin narrowly whitish; caudal fin yellowish gray; paired fins pale yellowish, the pectorals with a dark brown band across base; iris grayish blue; color of holotype when fresh as in Fig. 10; color in life as in Figs. 12–14. Largest specimen examined, 140 mm SL.

**Description.** Dorsal rays VI,9 (9 or 10, rarely 10), the spines slender, the rays branched; anal rays III,39 (38–44), the spines stout, all rays branched; pectoral rays 18 (17–19), the first rudimentary, the second unbranched, remaining rays branched; principal caudal rays 17, the median 15 branched; upper and lower procurrent caudal rays 5, the most posterior of each segmented distally; lateral-line scales 56 (53–60) to base of caudal fin, the pored scales continuing to end of fin; scales above lateral line to origin of dorsal fin 4 or 5; gill rakers 29 (28–33); branchiostegal rays 7; vertebrae 25.

Body moderately deep, the depth 2.2 (2.1–2.35) in SL, and compressed, the width 2.95 (2.7–3.15) in body depth; head length 3.4 (3.3–3.4) in SL; dorsal profile of head slightly convex, nearly flat on nape; snout short 4.0 (3.9–4.35) in head length; orbit diameter 7.45 (7.15–7.7) in SL; interorbital convex, the width 3.2 (3.15–3.4) in head length; caudal-peduncle length 3.65 (3.3–3.7) in head length.

Mouth strongly oblique, the upper jaw 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 nearly equal to pupil diameter, and extending posterior to below center of eye; upper and lower margins of maxilla inwardly curved, the posterior edge straight with slightly rounded corners; width of posterior edge of maxilla 3 in orbit diameter; upper edge of maxilla barely slipping under the narrow preorbital when mouth



**Figure 11.** *Pempheris eatoni*, paratype, SAIAB 3874, 90 mm SL, Ibo Island, Mozambique (S. O'Hara).

TABLE 8

Proportional measurements of type specimens of  
*Pempheris eatoni* n. sp. as percentages of the standard length

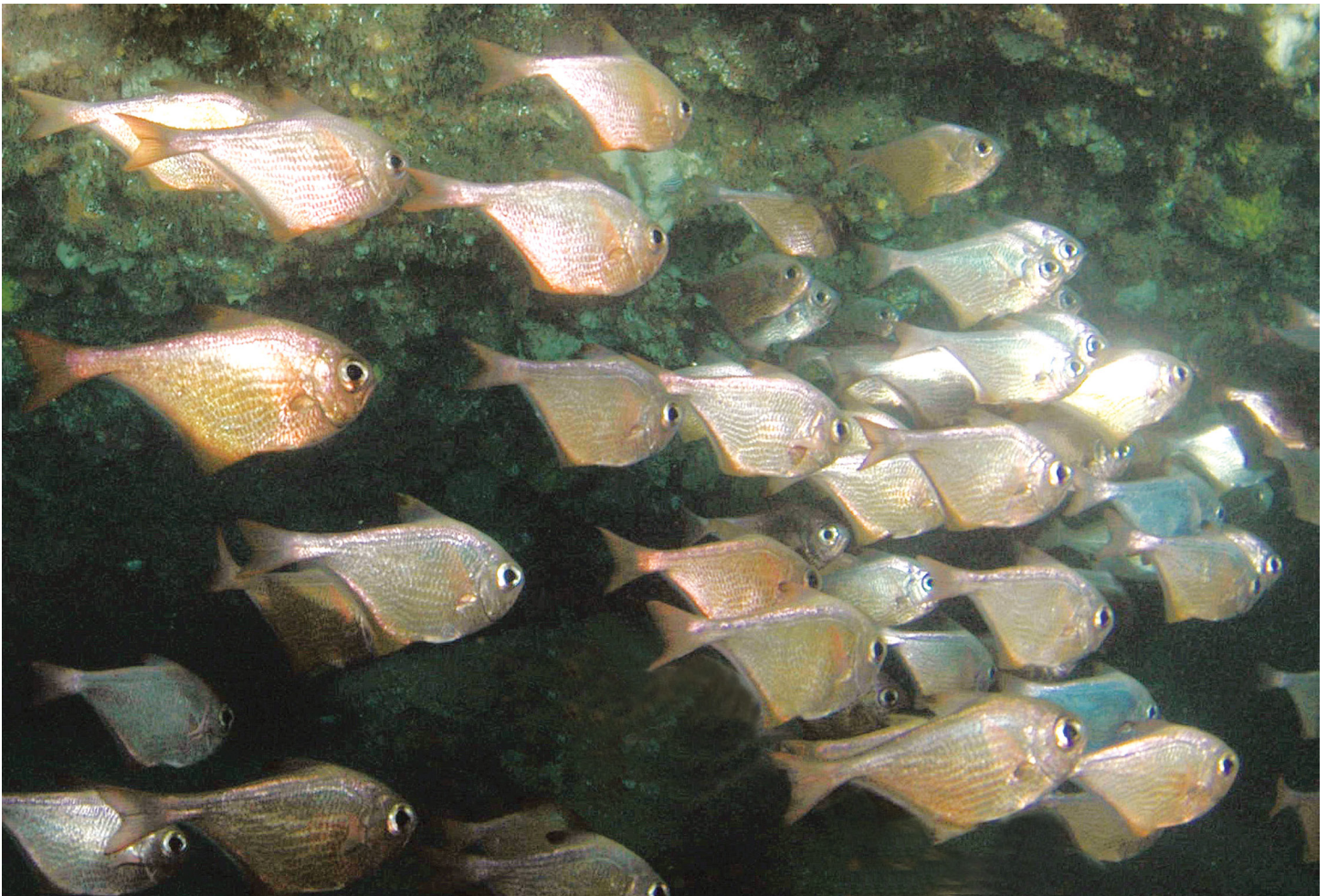
	holotype		paratypes					
	SAIAB 189160	SAIAB 3874	SAIAB 51230	USNM 410914	SAIAB 3874	BPBM 41164	SAIAB 16554	BPBM 41177
Standard length (mm)	134	72	81	86	96	97	128	138
Body depth	45.5	43.1	42.5	43.2	45.8	45.8	43.8	42.7
Body width	15.3	13.9	14.3	15.1	14.5	15.0	15.2	15.7
Head length	29.5	30.4	30.5	29.4	30.4	30.0	29.8	29.7
Snout length	7.4	7.0	7.4	7.1	7.8	7.7	7.4	7.5
Orbit diameter	13.4	14.0	13.6	13.9	13.2	13.1	13.2	13.1
Interorbital width	9.0	8.3	8.7	8.2	8.5	8.6	9.0	9.3
Caudal-peduncle depth	9.3	9.1	8.8	8.9	9.3	9.1	8.7	9.5
Caudal-peduncle length	8.1	9.0	8.3	8.5	9.1	8.3	8.4	8.2
Predorsal length	37.4	36.9	37.6	35.0	38.0	37.2	38.2	37.7
Preanal length	54.2	51.0	51.8	50.6	49.5	48.7	54.5	53.5
Prepelvic length	39.1	37.5	39.0	38.0	38.7	38.2	38.5	38.7
Base of dorsal fin	19.5	18.7	18.0	17.9	18.3	18.1	21.0	19.3
First dorsal spine	6.7	8.5	8.1	7.8	7.9	8.2	6.7	6.8
Sixth dorsal spine	21.6	24.2	broken	23.8	broken	24.3	21.9	21.0
Longest dorsal ray	26.0	27.1	25.8	24.8	24.6	25.3	25.4	26.9
Base of anal fin	53.2	54.1	53.9	54.6	54.1	54.0	53.6	55.7
First anal spine	4.9	4.2	4.5	3.9	4.8	4.2	4.7	5.5
Third anal spine	13.5	10.5	10.4	11.8	10.0	10.5	12.8	13.6
Longest anal ray	16.0	17.0	17.9	17.5	17.7	14.7	16.4	16.8
Caudal-fin length	23.7	26.5	28.4	27.1	28.2	27.2	23.4	broken
Caudal concavity	10.1	9.3	8.0	7.6	8.7	8.8	7.4	—
Pectoral-fin length	29.8	29.4	28.1	28.7	30.2	29.4	28.4	29.5
Pelvic-spine length	14.2	14.1	13.6	13.4	13.6	13.3	14.6	14.8
Pelvic-fin length	17.0	17.7	17.3	17.9	16.8	17.8	16.0	16.5



**Figure 12.** *Pempheris eatoni*, subadult, southern Mozambique (D. King).



**Figure 13.** *Pempheris eatoni*, adult, uShaka Marine World, Durban, KwaZulu-Natal (D. King).



**Figure 14.** *Pempheris eatoni*, aggregation, 12 m, reef off Durban, KwaZulu-Natal (D. King).

closed; a single row of small scales on preorbital; very small, sharp, strongly recurved teeth in two irregular rows anteriorly in upper jaw; teeth on each side of nodular symphysis of lower jaw in three to four irregular rows of tiny teeth, the outer one or two rows slightly recurved, the inner one or two rows strongly recurved teeth to side of lower jaw narrowing to a single row for most of jaw length (rarely with a tooth directly medial to another); all teeth of upper jaw exposed when mouth fully closed; none of lower jaw visible when mouth closed; vomer with an expanded V-shaped patch of very small teeth in three to four irregular rows, some only nodular, others sharp and recurved; palatines with a long narrow band of very small, medially curved teeth in two to three irregular rows anteriorly, the inner teeth larger and strongly medially curved, narrowing to a single row of very small nodular teeth posteriorly; tongue narrowly triangular with inwardly curved edges, the upper surface with small papillae; gill rakers long, the longest gill filaments two-thirds length of longest gill raker.

Gill opening extending dorsally to level of upper edge of orbit, and anteriorly to a vertical at anterior edge of orbit. Opercular membrane ending posteriorly in a obtuse angle; margin of preopercle free only ventrally, with two flat, acutely triangular spines (about 1.5 mm long in holotype) and separated by a gap of about 2 mm from tip of lower, asymmetrical, more rounded spine; a distinct ridge midventrally on anterior fourth of chest, the posterior fourth forming a flat triangular zone.

Anterior and posterior nostrils in front of dorsal edge of pupil, one-third distance to median front of upper lip, the apertures vertically oval, separated by a septum nearly equal to nostril width; anterior nostril with a membranous flap on posterior edge that reaches edge of posterior nostril when laid back.

Scales thin, deciduous, and cycloid, except ctenoid in posterior interorbital, on nape, below last few rays of dorsal fin, and strongly on five middle rows dorsally on body posterior to dorsal fin; scales also ctenoid on all of chest, progressively coarser ventrally; small scales extending well out on anal fin (probably nearly to margin if all were intact), and nearly half way to margin on caudal fin (most posteriorly on membranes).

Origin of dorsal fin in vertical alignment with origin of pelvic fins, the predorsal length 2.65 (2.65–2.7) in

SL; first dorsal spine short, 4.4 (3.6–4.4) in head length; sixth dorsal spine longest (very slender distally and easily broken, including two of paratypes measured), 4.1–4.2 in SL; first or second dorsal soft rays longest, 3.7 (3.7–4.05) in SL; origin of anal fin below middle of dorsal fin, the preanal length 1.95 (1.95–2.05) in SL; first anal spine 6.6 (6.35–7.55) in head length; third anal spine 2.2 (2.2–3.0) in head length; longest anal soft ray 1.85 (1.65–2.05) in head length; caudal fin length 4.3 (3.5–3.8) in SL; caudal concavity 2.9 (3.4–4.65) in head length; second or third branched pectoral ray usually longest, 3.5 (3.3–3.55) in SL; origin of pelvic fins below rear base of pectoral fins, the prepelvic length 2.5 (2.55–2.65) in SL; pelvic spine 2.1 (2.15–2.25) in head length; pelvic-fin length 1.75 (1.6–1.75) in head length.

**Color in alcohol.** The preserved appearance can be variable; some specimens like the holotype are brown, the scale edges shiny gray, the vertically elongate, elliptical scale centers light gray-brown, densely dotted with dark brown; median fins yellowish gray, the dorsal broadly tipped with black, the anal colored like body basally, with a broad blackish median zone, the margin pale yellowish; paired fins pale yellowish, the pectorals with a horizontally elongate rectangular dark brown spot basally on rays, not extending below onto fin base. Some specimens within the same lot show color variation. Those of SAIAB 3968, for example, are grayish orange-brown, many nearly uniform, others with vertically elongate bright silver to copper scale centers, especially over abdomen. Old specimens such as SAIAB 16554, collected in Kosi Bay in 1905, are nearly uniform pale orangish brown; even the distal black spot of the dorsal fin is almost completely faded.

**Color in life.** There is also much variation in the color in life. A subadult photographed by Dennis King (Fig. 12) in a tidal channel in Mozambique was light brown dorsally with some copper iridescence, grading to a broad zone containing lateral line with scale centers blue-green, the edges light gray-brown; rest of body progressively lighter brown ventrally, faintly suffused with light blue-green, except chest where scales are blue-green, the edges light brown; snout pinkish gray with blackish scale edges; interorbital and nape brown with some copper iridescence; operculum and cheek blue-green with silver reflections; iris light blue-green and silvery; dorsal fin with greenish yellow rays and translucent membranes, except for black on outer membranes of longest rays; anal fin blue-green on scaly basal three-fifths, the rays yellowish with translucent membranes on outer two-fifths; caudal fin greenish yellow with brown upper and lower margins, the lateral line in middle of fin dark gray.

Dennis King's underwater photograph (Fig. 14) of an aggregation of adults of *Pempheris eatoni* in 12 m shows color variation. A few fish to the right are mainly silvery blue-green, but most are silvery with scale centers reddish to yellowish brown, thus imparting a linear pattern. The large fish in the lower right corner has a nearly straight striped pattern. Most of the other fish have a variously wavy striped pattern. If one had only a single fish of this species for the color description, the pattern of its stripes might be described in the false expectation that other fish have the same pattern.

**Etymology.** This species is named *Pempheris eatoni* in honor of Patrick Eaton who collected the holotype and five other adult specimens for this study.

**Remarks.** *Pempheris eatoni* is presently known from Ibo in northern Mozambique, south at least to Durban. It is found along exposed rocky shores, often in small groups that shelter in caves or beneath ledges by day from depths as little as 1–2 m to at least 15 m. The photograph of Fig. 12 was taken in 2 m by Dennis King in “a tidal rock pool about 30 km north of Durban.” His photograph of Fig. 13 was taken at the uShaka Marine World in Durban, and his underwater photo of Fig. 14 in a large cave in 12 m off Durban.

Van der Elst (1981: 233) wrote that this species ventures out of shelter at night to feed on planktonic invertebrates and larval fishes. He reported an extensive spawning season, judging from seeing shoals of juveniles through most of the year. We have noted that the gonads of adult fish of the genus *Pempheris* that we have examined are nearly always mature regardless of the time of year. Van der Elst also wrote that this species swims slowly, when not stressed, propelling itself mainly by characteristic ‘sweeps’ of the pectoral fins (hence the common name sweeper).

The smallest fully mature specimen we found among the type material was a female, 116 mm SL, from the collection of SAIAB 3968 at Ibo, Mozambique.

Juvenile and subadult fishes have notably larger eyes, in general, than adults, but this is not true for species of *Pempheris*. Note in Table 8 how little the eye size of *P. eatoni* changes with growth, and compare the eye size of the adult holotype of this species (Fig. 10) and that of the subadults of Figs. 11 and 12. Species of *Pempheris*

retain the large eye of the juvenile because it is needed to feed on zooplankton at night.

Four other species of *Pempheris* are found within the range of *P. eatoni*: *P. nesogallica* Cuvier, type locality Mauritius, usually misidentified as *P. mangula* Cuvier [first correctly identified by Heemstra & Heemstra (2004: 327)], *P. cuprea*, and two undescribed species that have usually been misidentified as *P. schwenkii* Bleeker.

*Pempheris eatoni* seems to be most closely related to *P. nesogallica*. The two have the same relatively deep body, the same large eyes and broad interorbital space, the same angle of jaws with the lower jaw equally protruding when jaws are closed, dentition nearly the same (the dense band of very small teeth anteriorly in lower jaw a little broader and more strongly curved in *P. nesogallica*), and no obvious difference in the fins (the paired fins of both short for the genus). The two species share nearly the same meristics, differing slightly in gill-raker counts, 28–32 for *P. eatoni* and 30–34 for *P. nesogallica*. Both species have the scales of the chest fully ctenoid (if we may classify any scale with a margin partly ctenoid as fully so), and both have ctenoid scales on the nape; however, only *P. eatoni* has ctenoid scales on the back below the dorsal fin. In life color, the two species are readily distinguished (compare Fig. 15 of *P. nesogallica* with Figs. 12 and 13 of *P. eatoni*). *P. nesogallica* is green dorsally on the head and above the lateral line on the body, compared to copper or bronze on *P. eatoni*; the stripes below the lateral line, formed by the vertically elongate dark maroon-brown spot on each scale, are broader and darker; the iris of the eye is largely metallic dark brown, compared to mainly silvery to light golden in *P. eatoni*; and the spot at the base of the pectoral fins is larger and darker brown.

*Pempheris flavicycla* Randall, Satapoomin & Alpermann, similar in size and shape to *P. eatoni*, is widespread in the tropical and subtropical Indian Ocean and may be found as shallow as *P. eatoni*, but there is no record of it from the east coast of Africa (though it is known from islands near the coast). It clearly avoids shores exposed to open ocean storms. By contrast, *P. eatoni* is presently known only from the continental shores of KwaZulu Natal and Mozambique. During storms, it retreats to deeper water (Allan D. Connell, pers. comm.).



**Figure 15.** *Pempheris nesogallica*, Aliwal Shoal, KwaZulu-Natal (A. Diringer).

## Acknowledgments

We are most grateful to Dr. Allan D. Connell for his collections and photographs of *Pempheris* from KwaZulu-Natal; his cousin Patrick Eaton for the special effort to collect fish from the difficult exposed rocky shore of South Africa; Dennis King and Alain Diringer for superb underwater photographs of *Pempheris*; Ian McLeish for his photograph of the Raha Bay, Oman (the type locality for *P. convexa*), and Brian W. Darvell and Keith D. P. Wilson for their expedition to Oman at our request to photograph and collect *Pempheris*. Thanks are also due Roger Bills and Bufo Konqobe of the South African Institute for Aquatic Biodiversity, David Catania of the California Academy of Sciences, and Shirleen Smith of the U. S. National Museum of Natural History for the loan of specimens. We are also grateful to Arnold Y. Suzumoto and Loreen O'Hara of the Bishop Museum for curatorial assistance, and Helen A. Randall and Sean O'Hara for photographs. The manuscript was reviewed by Bruce Carlson and David W. Greenfield.

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