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Descriptions of Two New Species of the Genus *Pempheris* (Pisces: Pempheridídae) from Australia, with a Provisional Key to Australian Species

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ABSTRACT. *Pempheris ornata* n.sp. is described from 34 specimens collected at sites along the southern Australian coast, from Rottnest Island in Western Australia east to Rapid Bay, South Australia. The scales of this species are cycloid, deciduous, and large, the last characteristic resulting in uniquely low counts of 32–39 lateral-line scales. It is also immediately separable from other *Pempheris* by: 6–7 yellow-orange or golden-brown stripes on anterior body, reducing to three stripes on caudal peduncle (stripes dark brown in preserved specimens); body cream-coloured or transparent; dark linear light organ visible through body wall between pelvic- and anal-fin origins, with a slight bifurcation around anus; segmented anal-fin rays 27–30; 14–17 circumpeduncular scales. *Pempheris ypsilychnus* n.sp. is found from Shark Bay in Western Australia, along the north coast to Cape York, and south to Moreton Bay in Queensland. It is described on the basis of 63 specimens and is distinguished from congeners by the following combination of characters: scales ctenoid and adherent; pelvic axillary scale present; dark Y-shaped light organ visible through body wall between pelvic- and anal-fin origins, with wide bifurcation around anus; gill-raker counts on first arch 6–8 + 19–22 = 25–30 (usually 26–27); lateral-line scales 62–74 (usually 63–69). Although the exact membership of the genus is questionable at this time, a provisional key to the Australian species of *Pempheris* is provided.

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Fig. 1. Holotype of *Pempheris ornata* n.sp., AMS I.33831-001, 71.4 mm SL, Rapid Bay, South Australia, freshly caught. Photo by R.H. Kuiter.

Fig. 2. *Pempheris ornata* at the type locality of Rapid Bay, South Australia. Photo by R.H. Kuiter.

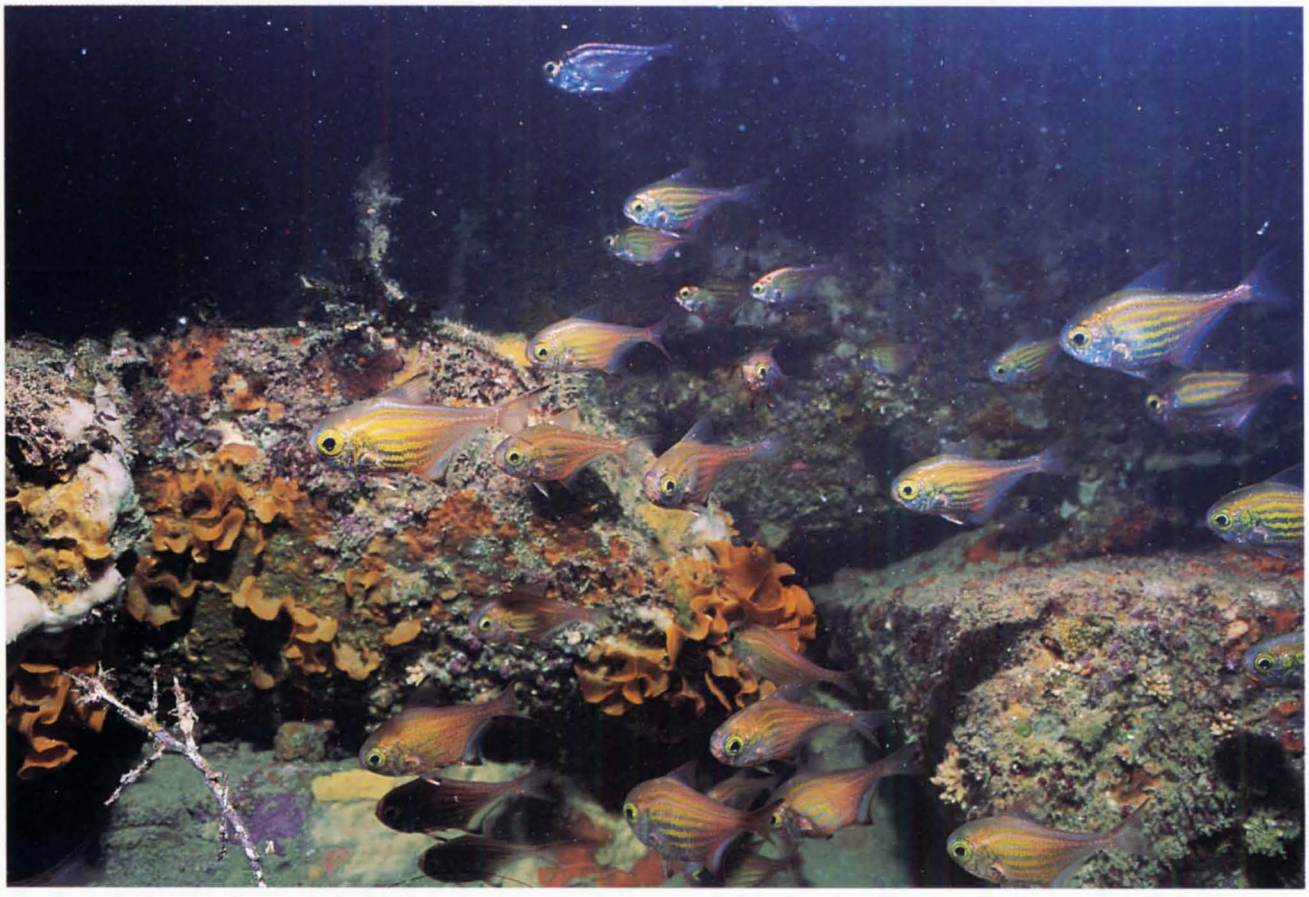

Fig. 3. A school of *Pempheris ornata* at the type locality of Rapid Bay, South Australia. Photo by R.H. Kuiter.

Introduction

Fishes of the family Pempheridae, commonly known as bullseyes or sweepers, are found on rocky and coral reefs of the tropical and temperate Indo-Pacific and western Atlantic Oceans to depths of 100 m. Since Tominaga (1965), the family has been restricted to include two genera of small to medium-sized fishes (usually < 200 mm SL) characterised by strongly compressed bodies, a single short dorsal fin, large eyes, and the lateral line extending well onto the caudal fin: *Pempheris* Cuvier, 1829 with over 30 nominal species (of which fewer than 20 are valid), and *Parapriacanthus* Steindachner, 1870 with 8 nominal species (of which about four are valid). Although there is clear support that the members of the two genera collectively form a monophyletic group (Tominaga, 1968), the monophyly of each individual genus has yet to be rigorously tested. Preliminary study of osteology, myology and internal organ morphology by the senior author suggests that neither genus, as currently conceived, is monophyletic.

Evidence was presented by Tominaga (1986) that the Glaucosomatidae, a family of medium-sized to large fishes in one genus (*Glaucosoma*), is closely related to the Pempheridae. This was supported by Johnson (1993: 19), who proposed that the two families should be included as subfamilies under the Pempheridae. However, this taxonomic change is unnecessary if the two groups are each monophyletic—they can be considered sister families.

Australia boasts the highest diversity of these related taxa, and a number of the species are endemic to its coastlines. Records are known for all four species of *Glaucosoma* (of which *G. hebraicum, G. magnificum, G. scapulare* are endemic), three of the probable four species of *Parapriacanthus* (*P. elongatus* endemic), and almost half of the valid members of *Pempheris* (of which *P. affinis, P. compressa, P. klunzingeri, P. multiradiata* are endemic; New Zealand reports of *P. compressa* appear to be erroneous [e.g., Griffin, 1928; Paulin *et al.*, 1989]). While examining material for a systematic revision of the family Pempheridae, the senior author

"rediscovered" what appeared to be two new Australian endemic species of *Pempheris* that had been originally described in an unpublished thesis by the junior author some 15 years earlier (Jubb, 1977). This paper describes the two new species, which are here assigned to the genus *Pempheris* pending a systematic revision of the Pempheridídae. These two new species raise the number of Australian endemic *Pempheris* to six. A provisional key to the Australian *Pempheris* is provided.

Methods and Materials

Specimen sizes are reported as standard length (SL) in mm, measured from the tip of the snout to the middle of the posterior edge of the hypural plates. All morphometric measurements are presented as percentages of SL, with holotype values presented first, followed, in parentheses, by mean and range values of remaining specimens. Head depth was measured at the vertical of the posterior margin of the eye. Predorsal, prepelvic and preanal lengths were measured from the tip of the snout to the origin of the relevant fin. Body depth was measured at the vertical from the dorsal origin to the ventral belly. Peduncle depth was the horizontal distance measured from the anal-fin insertion (base of last segmented ray). All other measurements follow Hubbs & Lagler (1949) or are self-explanatory.

Counts are presented with the holotype value(s) first, followed, in parentheses, by the mode, range, and frequency comments for the remaining specimens. Calculation of mode and determination of range for number of lateral-line scales and gill rakers includes counts of both sides. Gill-raker counts are provided as upper + lower limb counts of outer elements (including rudiments) of the first arch. Caudal-fin ray counts are separated into number of principal caudal rays (branched rays + 1 unbranched ray above and below) and procurrent rays (remaining unbranched elements anterior to the principal rays). Procurrent ray number is provided as upper and lower counts, with unsegmented and then segmented elements separated by a comma. Predorsal scale counts were made to the vertical from the anterior margin of the pupil. All other counts follow Hubbs & Lagler (1949). Cheek scale row number was often difficult to determine, either because scales are missing (*Pempheris ornata*) or because scales are crowded and do not form obvious rows (*P. ypsilychnus*).

Counts and measurements are based on all specimens listed as material examined, except in cases where damage (particularly for fin-ray measurements) precluded their use. Statistical comparisons were performed using SAS Ver. 6 (SAS Institute Inc., SAS Campus Dr., Cary, NC, USA, 27513).

Material is deposited in the following institutions: AMS—Australian Museum, Sydney; BMNH—The Natural History Museum, London; CSIRO—CSIRO Marine Laboratories, Hobart; MPM—Milwaukee Public Museum, Milwaukee; NMV—Museum of Victoria, Melbourne; NTM—Northern Territory Museum, Darwin; ROM—Royal Ontario Museum, Toronto; SMNS—Staatliches Museum für Naturkunde in Stuttgart, Stuttgart; WAM—Western Australian Museum, Perth; USNM—National Museum of Natural History, Washington, D.C.

Pempheris ornata n.sp.

Figs 1–4a, 5–6; Table 1

Pempheris sp.—Hutchins & Thompson, 1983: 40, fig. 183 (brief description, colour illustration).—Allen, 1985: fig. 229 (colour photograph).—Hutchins & Swainston, 1986: 66, fig. 336 (brief description, colour illustration).—Gomon, 1994: 608, fig. 536 (description, colour photograph).—Hutchins, 1994: 49, as *P.* sp. 3 (Western Australian distribution).

Material examined. HOLOTYPE, AMS I.33831-001, 71.4 mm, South Australia, Rapid Bay (35°31'09"S 138°11'05"E), 9.1 m, R.H. Kuiter, 21 March 1995.

PARATYPES, 19 specimens, 52.7–75.5 mm, all collected with the holotype. AMS I.33831-002, 63.2 mm; BMNH 1995.7.17: 1, 54.8 mm; MPM 31496, 2: 66.6–67.9 mm; NMV A15835, 4: 53.2–75.5 mm; NTM S.14104-001, 53.6 mm; ROM 69303, 68.2 mm; USNM 337545, 2: 51.1–75.1; WAM P.30996-001, 2: 52.7–66.0.

Other material: 20 specimens, 31.3–67.7 mm. AMS I.20221-002, 58.5 mm, Western Australia, Recherche Arch., Mondrain Island (34°08'S 122°14'E), 30 m, B.C. Russell, 21 March 1978; AMS I.20186-001, 2: 51.4–52.3 mm, South Australia, Kangaroo Island, Penneshaw (35°44'S 137°58'E), 9 m, B. Russell and R. Kuiter, 12 March 1978; AMS I.20247-013, 3: 31.1–35.0 mm, Western Australia, Rottnest Island, Kingston Reefs (31°59'S 115°33'E), 8 m, B. C. Russell, 12 April 1978; WAM P.27916-001, 2: 56.6–58.4 mm, Western Australia, Recherche Arch., Mondrain Island (34°08'S 122°14'E), 30 m, B. Russell, 21 March 1978; WAM P.28300-014, 11: 50.7–67.7 mm, Western Australia, east side of Lucky Bay (34°08'S 122°15'E), 11–12 m, J.B. Hutchins *et al.*, 16 April 1984.

Diagnosis. *Pempheris ornata* is unique among the Pempheridídae in having: 6–7 yellow-orange or golden-brown stripes on anterior part of body, reducing to three stripes on caudal peduncle (stripes become dark brown in preserved specimens), body cream-coloured or transparent; 32–39 lateral-line scales. Other features which, in combination, help to distinguish it from other members of the family are: all scales cycloid and deciduous; circumpeduncular scales 14–17; segmented anal-fin rays 27–30; dark, linear light organ visible through body wall between pelvic- and anal-fin origins with a slight bifurcation around the anus; anterior light organ an upwardly-curving mass of finger-like projections communicating posteriorly with pyloric caeca.

Description. Dorsal-fin rays V,11 (V,11; IV–V,10–12, only once IV, rarely 10 or 12); anal-fin rays III,28

(III,28; III,27–30); pectoral-fin rays 16 (16; 15–17, extremes uncommon); pelvic-fin rays I,5; principal caudal-fin rays 9+8; upper procurrent rays 6,1 (6,1; 5–8,1–2); lower procurrent rays 4,1 (4,1; 3–5,1–2); lateral-line scales 35 left, 36 right (35; 32–39, rarely the extremes); scale rows above lateral line 4; scale rows below lateral line 7 (7; 6–8); cheek scale rows 4–6 (based on only 6 specimens); predorsal scales 28 (28; 25–33); circumpeduncular scales 15 (15; 14–17, rarely the extremes); gill rakers 7+22 (7+21; 7–8 + 21–24, rarely 24); total gill rakers 29 (28–30 almost equally common; 28–32, once 32).

As percentage of SL: head length 32.2 (32.0; 30.6–33.7); head depth 32.7 (33.1; 29.8–36.8); snout length 7.3 (7.0; 6.0–8.0); eye diameter 14.2 (14.5; 13.6–15.7); interorbital width 8.7 (8.2; 6.8–9.3); upper jaw length 18.9 (18.6; 17.2–20.0); predorsal length 42.0 (38.8; 34.6–42.9); prepelvic length 37.4 (39.9; 34.5–45.7); preanal length 57.0 (58.4; 54.9–64.3); pelvic-fin origin to anal-fin origin 22.8 (21.7; 19.6–25.3); body depth 44.4 (40.9; 34.4–46.3); pectoral-fin length 30.1 (29.8; 27.2–32.5); pelvic-fin length 21.0 (21.0; 19.6–22.4); dorsal-fin base 24.6 (22.8; 20.6–25.1); longest dorsal-fin ray 26.7 (25.2; 22.9–28.8); anal-fin base 43.7 (42.1; 38.8–45.6); longest anal-fin ray 18.9 (19.4; 14.9–22.2); caudal-peduncle length 13.0 (12.8; 9.6–14.8); caudal-peduncle depth 9.0 (10.0; 8.9–11.5); dorsal-fin origin to pelvic-fin origin 44.3 (41.0; 36.0–46.2); dorsal-fin origin to anal-fin origin 46.9 (44.2; 37.3–50.2); dorsal-fin origin to anal-fin insertion 58.1 (56.5; 53.3–59.1).

Caudal fin forked. All scales cycloid and deciduous, with flank scales large. Gular scaled. Pelvic axillary scale absent. Prepelvic area (breast) unkeeled, flat and broad.

Anterior light organ an upwardly curving mass of small finger-like projections communicating posteriorly with pyloric caeca (Fig. 4a). Posterior light organ linear with slight bifurcation around anus (not visible in view of Fig. 4a, 5).

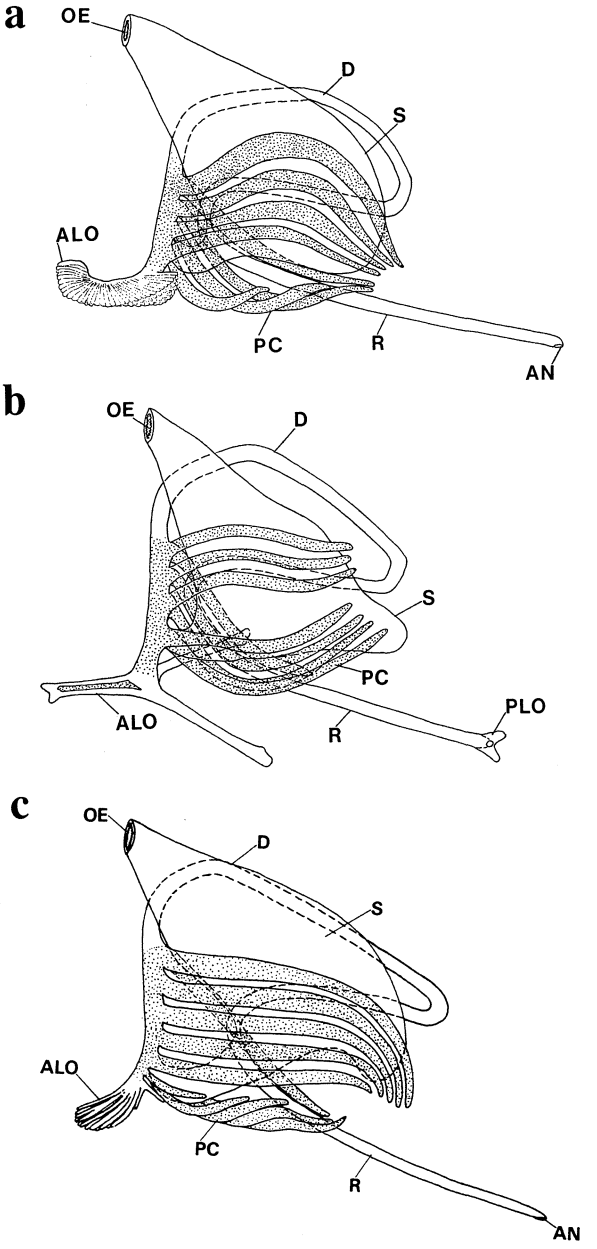

Fig. 4. Light organs of three species of *Pempheris*, left lateral aspect. (a) *P. ornata*. (b) *P. ypsilychnus*. (c) *P. klunzingeri*. ALO, anterior light organ; AN, anus; D, duodenum; OE, oesophagus; PC, pyloric caecum; PLO, posterior light organ; R, rectum. (RNJ).

Coloration. Holotype when freshly dead (Fig. 1): background colour on cheek, opercle, and body below lateral line iridescent silver; dorsal head, nape, and body above lateral line greyish to reddish; medial dark stripe along predorsal scales to dorsal-fin origin; dark stripe at level of dorsal part of eye extending to opercular opening, then merging with the upper-most body stripe; margins of jaws dark; lower part of cheek dark; iris yellowish; body below dorsal fin with 7 golden-brown stripes, with middle stripes brightest by having fewest darker chromatophores; number of body stripes decreasing posteriorly to three on caudal peduncle, ending at base of caudal-fin rays; stripes become increasingly reddish posteriorly; all fins with pinkish to reddish cast; dorsal fin pinkish hyaline, with dark anterior edge and dark distal tips on last two spines and first three segmented rays; anal fin quite red basally and on first few segmented rays, remainder pinkish hyaline with black tips on all but last 5 segmented rays, black covering 1/3 length of first 3 rays and about 1/4 length of remaining rays; pectoral fin pinkish hyaline; pelvic fin reddish hyaline, with distal 1/4 of first two segmented rays black; caudal fin reddish hyaline, with black tips on outermost branched rays. Colours from photographs of live individuals very similar to those of holotype, except for the following (Figs. 2,3; Allen, 1985: fig. 229; Gomon, 1994: fig. 536; unpublished photos by R. Kuiter): body background pale or cream-coloured, the posterior body and caudal peduncle sometimes transparent; stripe behind eye bright yellow or golden-brown; iris bright yellow; lower part of cheek with scattered yellow

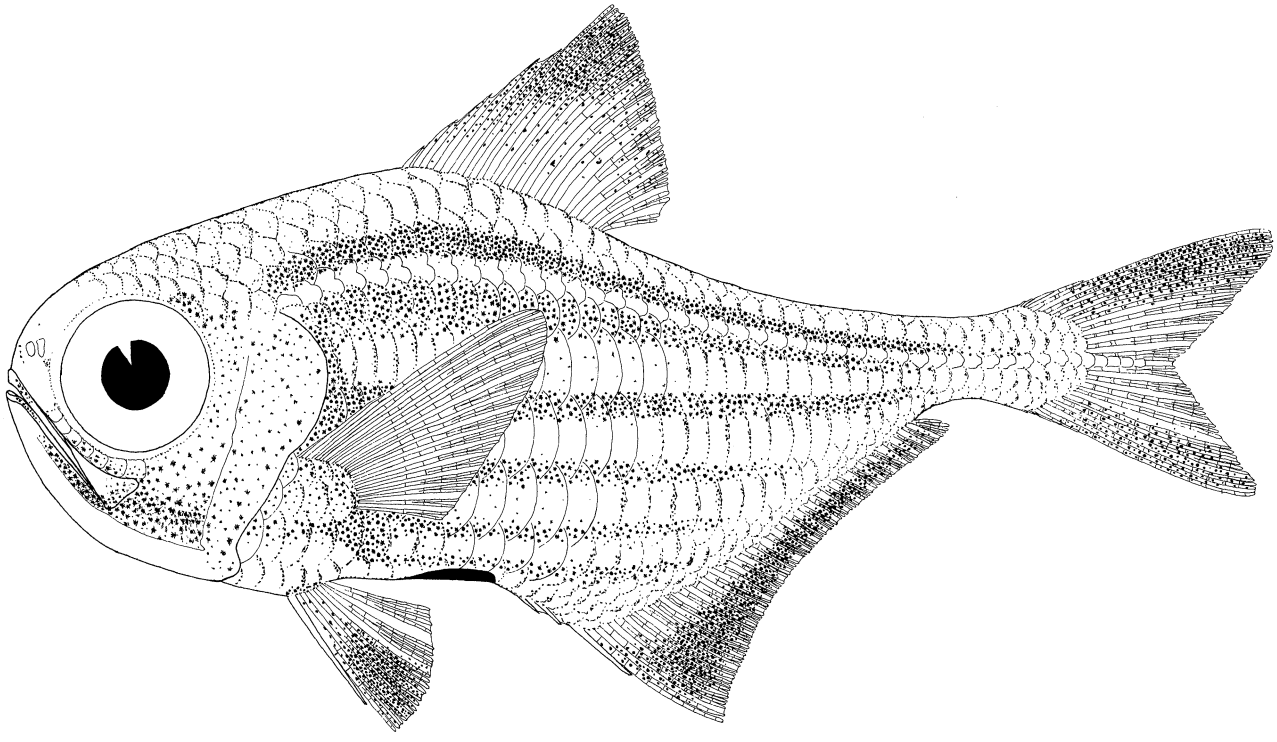

Fig. 5. Line drawing of *Pempheris ornata* n.sp., AMS. I.20221-002, 58.5 mm SL, Mondrain Island, Recherche Archipelago, Western Australia. (RNJ).

chromatophores; body stripes much brighter yellow; fins usually less reddish with less obvious black tips.

In 70% ethanol: cheek, opercle, and area below pectoral fin and sometimes lower part of abdomen silvery; dorsal part of head and nape dusky; remainder of body straw-coloured; stripes present as series of dark chromatophores, sometimes only 6 (rather than 7) from ventral abdomen to dorsal-fin base; fins yellowish with similar pattern of dark tips as described above, although black coloration variable in extent; black, silver-margined, linear light organ associated with rectum visible through body wall (Fig. 5), becoming slightly bifurcate around anus.

Comparisons. The only species with vaguely similar coloration to *P. ornata* are *P. multiradiata* and colour forms of what is presently referred to as *P. oualensis*. In these two species the longitudinal stripes are brown or reddish-brown (vs. orange or yellow) and more numerous (8 or more on the body vs. 6–7). Within the genus, *P. ornata* has uniquely low counts of lateral-line scales (32–39) and anal-fin rays (27–30). *P. multisquamata* has the lowest lateral-line scale counts among remaining *Pempheris* species (42–49). Only *P. analis* and the new species *P. ypsilychnus* overlap the uppermost portion of the anal-fin ray count (30–36); both of these species have ctenoid (vs. cycloid scales), lateral-line scale counts of well over 60, and are without any longitudinal striping.

Distribution. Specimen localities are limited to areas along the southwest and south coast of Australia, from Rottnest Island (near Perth) to Rapid Bay (just south of Adelaide) (Fig. 6). The species also has been reported north to Dongara (= Port Denison), Western Australia (Hutchins & Swainston, 1986; Hutchins, 1994).

Table 1. Total number of gill rakers on the first arch of specimens of *Pempheris ornata* n.sp. from western (Rottnest Island, Recherche Arch.) and eastern (Kangaroo Island, Rapid Bay) localities.

No. of Gill Rakers	28	29	30	31	32
Western localities	2	4	5	5	1
Eastern localities	8	5	4	–	–

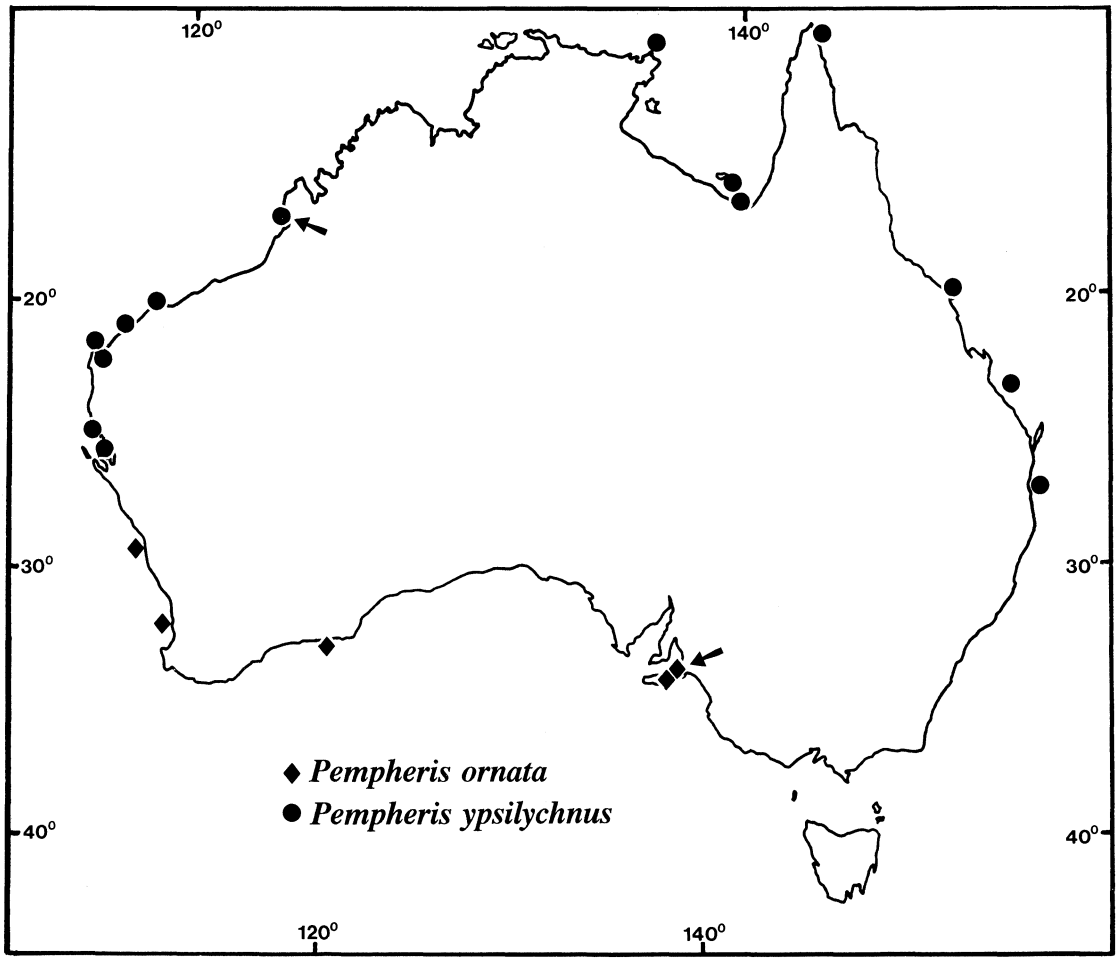

Fig. 6. Distributions of the two new species of *Pempheris*. Arrows indicate holotype localities.

Biology. The species is reported as sometimes congregating beneath piers and near jetties and not often sighted during the day (Gomon, 1994). The deepest recorded collecting site is 30 m. This is the smallest member of the genus *Pempheris*, not known to exceed much more than 75 mm SL. The smallest gravid female measured 56 mm SL. The only geographic difference in meristics noted was a slightly lower total number of gill rakers on the first arch for the easternmost collections (Kangaroo Island, Rapid Bay) compared to western collections (Rottnest Island, Recherche Arch.) (modes of 28 vs. 30–31) (Table 1). However, more specimens are needed to establish whether or not these differences are significant.

Etymology. The specific name comes from the Latin *ornamentum*, meaning ornamented or ornate, in reference to the spectacular coloration of this species compared to its congeners. It is to be treated as a noun in apposition.

Pempheris ypsilychnus n.sp.

Figs 4b, 6–8; Tables 2–3

Pempheris analis (non Waite, 1910).—Tominaga, 1963: 276, 278, tab. 4 (description of posterior light organ, meristics, distribution).—Tominaga, 1968: 72, 74–78, 80, 82, 86, tabs. 3–5 (descriptions of osteology, meristics, posterior light organ, and possible affinities).

Pempheris klunzingeri (non McCulloch, 1911).—Haneda *et al.*, 1966: 537, figs. 3,4 (description of light organ structure, drawings of anatomy).

Pempheris sp. 1.—Hutchins, 1994: 49 (Western Australian distribution).

Material examined. HOLOTYPE: WAM P.28059-019, 74.1 mm, Western Australia, Broome (17°59'S 122°11'E), 1 m, N.L. Sarti, 28 March 1982.

PARATYPES: 18 specimens, 51.5–117.7 mm. AMS I.15557-187, 7: 51.5–80.0 mm, Queensland, Gulf of Carpentaria (17°24'S 140°09'E), 10 m, CSIRO Prawn Survey, 27 November 1963; CSIRO C3443, 117.7 mm, Queensland, Gulf of Carpentaria (16°56.7'S 140°08.8'E), 18 m, Rama

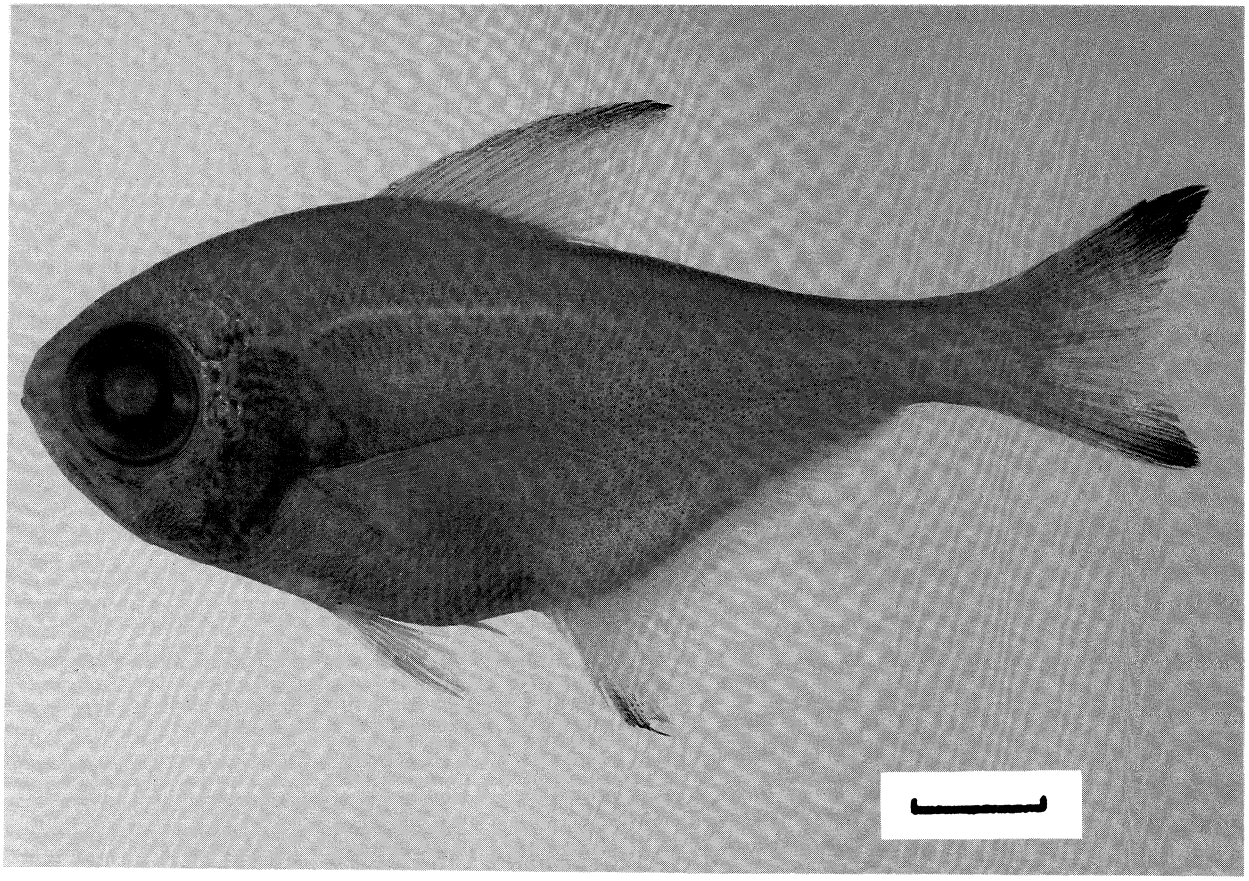

Fig. 7. Holotype of *Pempheris ypsilychnus* n.sp., WAM P28059-019, 74.1 mm SL, Broome, Western Australia, preserved in ethanol. Scale bar is 10 mm.

stn 147, 11 September 1963; MPM 31024, 4: 60.9–78.9 mm, from AMS I.15557-187; NTM S.13277-001, 88.5 mm, Queensland, east of Cape York Peninsula (11°21.4'S 142°58.2'E), 22 m, R. Williams, 1 December 1991; SMNS 14293, 2: 58.0–68.3 mm, Western Australia, Exmouth Gulf, 6–12 km south of Exmouth (22°00'00"S 114°08'30"E to 22°02'20"S 114°08'30"E), 11–14 m, R. Fricke and F/V "Denison", 2–3 September 1992; USNM 337546, 63.7 mm, from MPM 31024; WAM P.28059-023, 66.7 mm, collected with holotype; WAM P.28416-019, 91.2 mm, Western Australia, Gantheaume Pt. (17°58'S 122°10'E), 2–5 m, N. Sarti and A. Williams, 13 September 1982.

Other material: 44 specimens, 56.5–120.6 mm. AMS IA.1780-81, 2: 91.5–92.4 mm, Queensland, Port Denison (20°03'S 148°15'E), E.H. Rainford, 1924; AMS IB.7208, 65.0 mm, Queensland, Gulf of Carpentaria; AMS I.20769-045, 110.1 mm, Cape York, Halfway Island, NNW face (11°23'S 142°57'E), 4–9 m, AMS Australian Institute of Marine Science, 18 February 1979; AMS I.15482-005, 64.3 mm, Queensland, Heron Island (23°27'S 151°57'E), H. Choat, 16 June 1965; AMS I.15557-289, 8: 56.5–67.8 mm, Queensland, Gulf of Carpentaria (17°24'S 140°09'E), 10 m, CSIRO Prawn Survey, 27 November 1963; CSIRO C2640, 99.6 mm, Western Australia, Dampier Archipelago (20°35'S 116°35'E), Vessel Lancelin, 1954; CSIRO C2786, 95.2 mm, Western Australia, Exmouth Gulf? (22°S 114°20'E), Vessel Lancelin; CSIRO C2787, 98.2 mm, as CSIRO C2786; CSIRO A3230, 110.7 mm, Queensland, Gulf of Carpentaria, SE of Mornington Island (16°42.2'S 139°29.5'E), 12.6 m, Rama stn 336, 11 November 1963; CSIRO A3231, 77.6 mm, as CSIRO A3230; CSIRO A3232, 72.5 mm, as CSIRO A3230; NTM S.13236-001, 84.0 mm, Northern Territory, south of Sphinx Head, Marchinbar Island (11°16'S 136°41'E), 18–21 m, H. Larson, 16 November 1990; WAM P.4317, 2: 77.3–81.5 mm, Western Australia, Dampier Archipelago (20°33'S 116°32'E), P. Barrett-Lennard, December 1957; WAM P.4687, 67.4 mm, Western Australia, Exmouth Gulf (22°05'S 114°15'E), 13 m (7 fthms), R. McKay, 13 September 1958; WAM P.13415, 72.8 mm, Western Australia, Dampier Archipelago (20°33'S 116°32'E), 1954; WAM P.13416-13421, 6: 113.8–120.6 mm, Western Australia, Shark Bay (25°21'S 113°44'E), F. Barrett-Lennard, September 1960; WAM P.13422, 68.2 mm, Western Australia, Exmouth Gulf (22°05'S 114°15'E), R.J. McKay, 13 September 1958; WAM P.13458, 58.9 mm, Western Australia, Exmouth Gulf (22°05'S 114°15'E), R. McKay, 1958; WAM P.22950, 103.8 mm, Western Australia, Kendrew Island, Museum Bay (20°29'S 116°32'E), B. Hutchins, 19 February 1973; WAM P.23659-001, 95.4 mm, Western Australia, Carnarvon (24°53'S 113°40'E), 24 m (dredging at 13 fthms), D. Heald, 19 July 1972; WAM P.25113-001, 95.3 mm, Western Australia, Dampier Archipelago, Kendrew Island (20°28'S 116°32'E), G.R. Allen, 6 November 1974; WAM P.25369-024, 6: 58.8–80.8 mm, Western Australia, North West Cape, Outer Reef, off

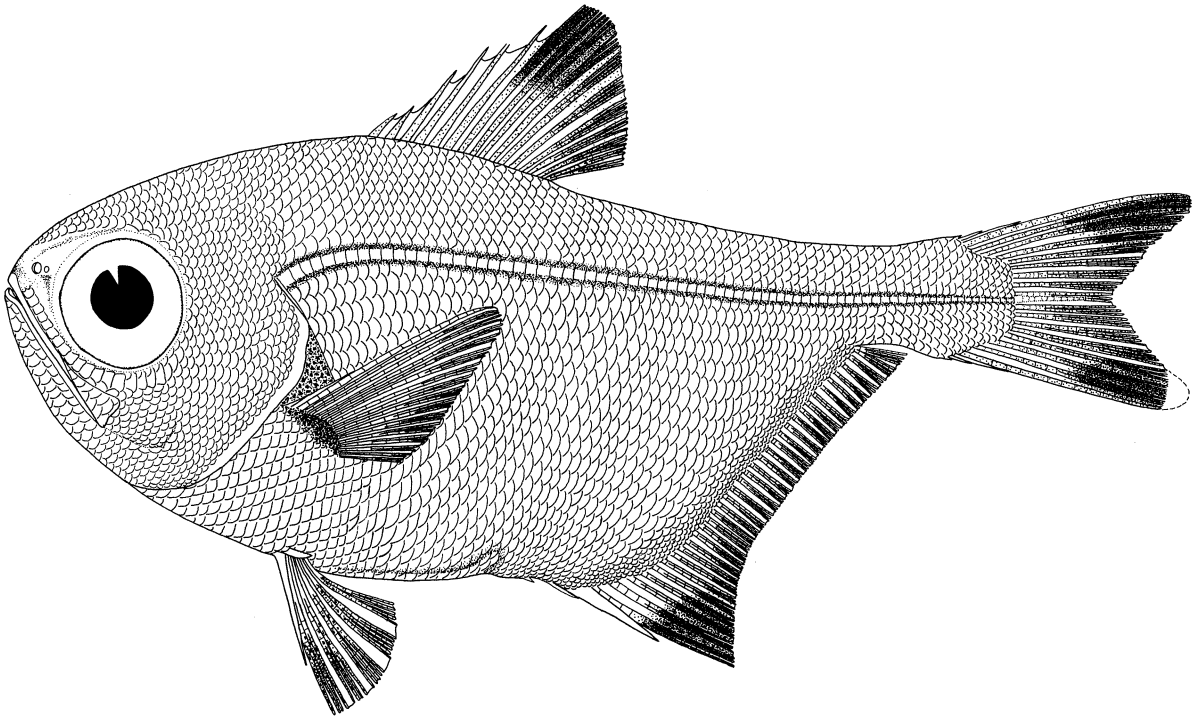

Fig. 8. Line drawing of *Pempheris ypsilychnus* n.sp., WAM P.13416, 113.8 mm SL, Shark Bay, Western Australia. (RNJ).

Tantabiddy Ck. (21°55'S 113°57'E), 8–10 m, G.R. Allen, 27 June 1975; WAM P.25508-017, 85.7 mm, Western Australia, Exmouth Gulf (21°57'S 114°12'E), B. Hutchins, 6–7 December 1975; WAM P.25508-051, 70.2 mm, Western Australia, Exmouth Gulf, 4 km from Exmouth (21°57'S 114°12'E), B. Hutchins, 6–7 December 1975; WAM P.26043-001, 92.7 mm, Western Australia, Shark Bay (25°25'S 113°25'E), P. Barrett-Lennard, 1960.

Diagnosis. *Pempheris ypsilychnus* is distinguished from all other members of the Pempheridídae by the following combination of characters: all scales ctenoid and adherent; pelvic axillary scale present; lateral-line scales 62–74 (usually 63–69); gill raker counts on first arch 6–8 + 19–22 = 25–30 (usually 26–27); dark, Y-shaped light organ visible through body wall between pelvic- and anal-fin origins, with its bifurcation around anus (Fig. 8).

Description. Dorsal-fin rays VI,10 (VI,10; V–VI,9–11, V only once, rarely 11); anal-fin rays III,33 (III,34; III,30–36, once 30); pectoral-fin rays 17 (17; 16–18); pelvic-fin rays I,5; principal caudal-fin rays 9+8; upper procurrent rays 6,2 (6,2; 5–8,1–2); lower procurrent rays 3,2 (3,2; 3–5,1–2); lateral-line scales 64 (68; 62–74, rarely more than 70); scale rows above lateral line 9 (10; 9–11); scale rows below lateral line 18 (18; 17–21); cheek scale rows 7 (6–9, extremes less common); predorsal scales 39 (39; 35–45, usually 37–43); circumpeduncular scales 22 (24; 22–26, usually 23–24); gill rakers 6+21 (7+20; 6–8, rarely 8 + 19–22); total gill rakers 27 (27; 25–30, most frequently 26–27, once 30).

As percentage of SL: head length 35.2 (34.5; 31.8–39.4); head depth 33.7 (34.0; 30.0–39.7); snout length 7.7 (7.0; 5.8–8.1); eye diameter 14.8 (15.1; 13.2–16.5); interorbital width 8.9 (8.0; 6.5–9.3); upper jaw length 19.0 (19.0; 17.3–20.5); predorsal length 41.0 (40.0; 36.1–44.7); prepelvic length 38.1 (38.7; 33.8–49.3); preanal length 57.8 (59.9; 54.0–66.1); pelvic-fin origin to anal-fin origin 22.5 (24.5; 19.8–29.6); body depth 43.8 (41.9; 37.1–46.0); pectoral-fin length 28.2 (27.9; 24.1–31.7); pelvic-fin length 19.2 (19.6; 17.4–21.8); dorsal-fin base 20.6 (20.3; 18.1–23.0); longest dorsal-fin ray 24.8 (24.3; 20.7–26.8); anal-fin base 43.1 (43.2; 40.5–46.0); longest anal-fin ray 19.8 (18.7; 15.0–21.7); caudal-peduncle length 12.0 (10.7; 9.0–13.0); caudal-peduncle depth 10.8 (10.5; 9.2–11.3); dorsal-fin origin to pelvic-fin origin 42.8 (41.5; 36.3–44.9); dorsal-fin origin to anal-fin origin 45.9 (45.3; 39.6–51.1); dorsal-fin origin to anal-fin insertion 57.9 (57.2; 43.9–60.9).

Caudal fin forked. All scales ctenoid and adherent. Gular scaled. Pelvic axillary scale present. Prepelvic area (breast) unkeeled, flat and broad.

Anterior and posterior light organs Y-shaped (Fig. 4b, 8). Anterior organ communicates with pyloric caeca, forward extension consisting of two ducts that unite anteriorly. Anterior organ underlain by pigmented tissue and layer of translucent muscle. Posterior organ

communicates directly with the rectum (Haneda *et al.*, 1966: 537), underlain by a layer of pigmented tissue.

Coloration. Live colour unknown. Holotype preserved in 70% ethanol (Fig. 7): dorsal part of head, nape, and body yellowish or straw and speckled with tiny dark brown chromatophores; cheek and particularly opercular area darker; preventral area anterior to pelvic-fin bases pale yellow and without chromatophores; dentaries without chromatophores, permitting dark bar on gular to show through; lower part of cheek dark; dark, Y-shaped light organ visible through body wall between pelvic- and anal-fin origins, with wide bifurcation around the anus, silvery margins along length of linear portion; iris black; lateral-line scales without chromatophores making lateral line obvious on lightly speckled body; dorsal fin hyaline, with, at most, distal 1/4 of spines and first three segmented rays dark; anal fin hyaline, with distal 1/4 of first two segmented rays dark; pectoral and pelvic fins hyaline; medial caudal-fin rays hyaline and speckled with tiny chromatophores, with bases yellow, three outermost branched rays and adjacent unbranched rays with black tips that gradually fade proximally. Colours of other preserved specimens very similar, differing in the following: variation in amount of black on tips of fins from none to 1/3 their length; occasionally silvery flanks; sometimes few or no chromatophores speckling body, sometimes more chromatophores, especially on ventral part of head; Y-shaped light organ often with silver margins over entire length; iris sometimes coppery.

Comparisons. In Australia, this species is most likely to be confused with *P. analis, P. compressa*, and *P. klunzingeri*. Among these ctenoid-scaled *Pempheris* species, only *P. ypsilychnus* bears a pelvic axillary scale and has a Y-shaped posterior light organ visible through the body wall (Fig. 8). It is the only member of the genus with a Y-shaped anterior light organ (Fig. 4b). Total gill raker counts for *P. ypsilychnus* are considerably lower than other ctenoid-scaled members of the genus (25–30 vs. 31–38). *P. klunzingeri* has the most similar body shape, but has five dorsal spines (vs. six) and a longer anal fin (anal-fin base:SL ratio 0.47–0.55, mean 0.51 vs. 0.41–0.46, mean 0.43) due to a higher number of segmented anal-fin rays (35–41 vs. 30–36); it also tends to have higher lateral-line scale counts (66–80, usually >70 vs. 62–74, usually 63–69) and the anterior light organ is restricted to a mop-like mass of tissue communicating with the pyloric caeca (Fig. 4c). *P. analis* tends to be deeper bodied (dorsal origin to pelvic origin:SL ratio 0.41–0.46, mean 0.44 vs. 0.36–0.45, mean 0.42) with a longer anal-fin base (anal-fin base:SL ratio 0.43–0.49, mean 0.46 vs. 0.41–0.46, mean 0.43); additionally, it has no anterior light organ. *P. compressa* generally has higher numbers of segmented anal-fin rays (34–40 vs. 30–36) and, hence, a longer anal-fin base (anal-fin base:SL ratio 0.52–0.58, mean 0.54 vs. 0.41–0.46, mean 0.43); it has no anterior light organ.

Distribution. Specimens have been collected at a number of sites in northern Australia, from the central west coast of Western Australia to the southern Great Barrier Reef (Fig. 6). The southernmost record on the east coast, Moreton Bay near Brisbane, was reported by Haneda *et al.* (1966: 537) as *Pempheris klunzingeri* (a misidentification).

Biology. Little is known about this species. The largest known maximum size is 120.6 mm SL, and capture depths range from 1 m to 24 m. Haneda *et al.* (1966: 537) studied specimens obtained in a shrimp trawl, and described the anterior light organ as V-shaped, apparently overlooking the anterior portion of this structure (Fig. 4b). Body depth (measured as dorsal-fin origin to pelvic-fin origin) varies geographically. Specimens from western localities (Shark Bay to Broome) have deeper bodies than those from eastern localities (Gulf of Carpentaria to Port Denison) (0.40–0.45, mean 0.43 vs. 0.36–0.42, mean 0.40; means significantly different, T=6.79, DF=60, $p<0.001$). Eastern specimens tend to have higher lateral-line scale counts and more segmented anal-fin rays than western specimens (Tables 2, 3); the higher anal-fin ray counts are particularly noticeable among Gulf of Carpentaria examples (Table 3).

Etymology. The specific name is a combination of *ypsilon*, the Greek letter Y, and *lychnos*, Greek for lamp or light. This combination alludes to the Y-shaped posterior organ that is visible through the body wall and characteristic of this species, reported to be luminescent (Haneda *et al.*, 1966). The epithet is to be treated as a noun in apposition.

Discussion. The relationships of these two new species cannot be determined at present. Preliminary results from a systematic revision of the family Pempheridae by the senior author, as well as the character distributions

Table 2. Number of lateral-line scales (left side) of specimens of *Pempheris ypsilychnus* n.sp. from western (Shark Bay to Broome) and eastern (Gulf of Carpentaria to Port Denison) localities.

No. Lateral-line scales	62	63	64	65	66	67	68	69	70	71	72	73	74
Western localities	2	1	6	6	7	6	2	1	1	–	–	–	–
Eastern localities	–	2	3	2	3	2	9	6	1	–	1	–	1

Table 3. Number of segmented anal-fin rays of specimens of *Pempheris ypsilychnus* n.sp. from western (Shark Bay to Broome) and eastern (Gulf of Carpentaria, Cape York and Great Barrier Reef) localities.

No. of anal-fin rays	30	31	32	33	34	35	36
Western localities	1	3	7	10	7	3	1
Cape York, GBR	–	2	2	1	1	–	–
Gulf of Carpentaria	–	–	1	1	8	10	4

described by Tominaga (1968) and Jubb (1977), provide reason to doubt the monophyly of the two included genera, *Parapriacanthus* and *Pempheris*. The two new species exhibit the external features that traditionally have been used to characterise *Pempheris* (deep body, anal fin in scaly sheath, lateral-line scales extending to posterior margin of caudal fin), but share a number of internal features with the members of *Parapriacanthus* (cleithrum morphology, Y-shaped anterior light organ in *Pempheris ypsilychnus*). Their placement in *Pempheris* should, therefore, be regarded as provisional.

Below is a key to the Australian species of *Pempheris*. In Australian waters, *Pempheris* can be distinguished from *Parapriacanthus* by: anal fin in scaled sheath (vs. no scaly sheath), 27 or more segmented anal-fin rays (vs. 27 or fewer), lateral-line extending to distal tips of medial caudal-fin rays (vs. to middle of medial caudal-fin rays), deeper body (head length about equal to body depth vs. head length generally greater than body depth). The key is provisional in two respects. First, the membership of *Pempheris*, as noted, is subject to change until the genus can be diagnosed by synapomorphies. Second, the identification of species of cycloid-scaled *Pempheris*, excepting perhaps *P. schwenkii*, is questionable pending completion of a worldwide revision. Colour patterns noted below are those of adults. Distributions are taken from examined specimens and records in Hutchins (1994) and Hutchins & Swainston (1986). The authorship of *P. compressa* to White (1790) follows the recommendation of Paxton *et al.* (1989: 12).

Provisional Key to Australian *Pempheris*

1. Scales on flank cycloid and deciduous; lateral-line scales smaller than (and partly or mostly concealed by) surrounding scales, sensory tubes longer than wide or wider than long; prepelvic area narrow and keeled or broad and unkeeled 2

—— Scales on flank ctenoid and adherent; lateral-line scales equal in size or slightly larger than (and not concealed by) surrounding scales, sensory tubes wider than long; prepelvic area broad and unkeeled 6

2. Dorsal fin V, 10–13; pelvic axillary scale absent; prepelvic area broad and unkeeled; lateral-line sensory tubes wider than long; anterior light organ present as mass of finger-like projections (Fig. 4c) 3

—— Dorsal fin VI, 8–10; pelvic axillary scale present; prepelvic area narrow and keeled; lateral-line sensory tubes longer than wide; anterior light organ absent 5

3. Body with series of 6 or more longitudinal stripes; lateral-line scales 32–49; segmented anal-fin rays 27–39 4

—— Body without longitudinal stripes; lateral-line scales 55–63; segmented anal-fin rays 37–43 (Australian endemic: Hervey Bay Qld. south to Montague Island, NSW) ..... *affinis* McCulloch, 1911

4. Body with 6–7 yellow or orange longitudinal stripes; lateral-line scales 32–39; segmented anal-fin rays 27–30; total gill rakers on first arch 28–32; posterior light organ linear with slight bifurcation around anus (Australian endemic: Dongara WA south and east to Rapid Bay SA; Fig. 5) ..... *ornata* n.sp.

—— Body with 8 or more copper or brown longitudinal stripes; lateral-line scales 42–49; segmented anal-fin rays 32–39; total gill rakers on first arch 33–37; posterior light organ absent (Australian endemic: Jurien Bay WA south, through SA, Vic., Tas., north to Terrigal NSW) ..... *multiradiata* Klunzinger, 1880

5. Lateral-line scales 44–51; scales above lateral line 3–4; scales below lateral line 9–13; deep purplish dorsally, almost black posterior to dorsal fin, shading to silvery flanks with pinkish or lavender iridescence; leading edge of dorsal fin dark; scaled base of anal fin dark with remainder of fin pale or lightly pigmented; caudal fin dusky or yellow (widespread Indo-Pacific; in Australia, Rottnest Island, WA north, NT?, south to Capricorn Grp. Qld.) ..... *schwenkii* Bleeker, 1855

—— Lateral-line scales 52–71; scales above lateral line 5–7; scales below lateral line 12–16; body generally coppery or silvery iridescent, sometimes with longitudinal stripes on body; leading edge of dorsal fin dark with black distal tips to anterior segmented rays; anal fin with or without dark base, remainder of fin dusky (or mostly dusky) except for pale distal margin; pectoral fin usually with distinctly dark base or spot (widespread Indo-Pacific; in Australia, Rottnest Island, WA north through NT?, south to Qld and Lord Howe Island, NSW) ..... *oualensis* Cuvier, 1831

6. Posterior light organ Y-shaped and visible through body wall; pelvic axillary scale present; total gill rakers on first arch 25–30; segmented anal-fin rays 30–36; anterior light organ Y-shaped (Fig. 4b) (Australian endemic: Shark Bay WA north through NT and south to Heron Island, Qld.; Fig. 5) ..... *ypsilychnus* n.sp.

—— Posterior light organ absent; pelvic axillary scale absent; total gill rakers on first arch 31–38; segmented anal-fin rays 30–41; anterior light organ absent or a clump of finger-like projections (Fig. 4c) 7

7. Dorsal spines V (first segmented ray branched); segmented anal-fin rays 36–41; in life, an orange bar behind head to pectoral base; anterior light organ present as a mass of finger-like projections (Fig. 4c) (Australian endemic: Shark Bay WA south and east to Kangaroo Island, SA) ..... *klunzingeri* McCulloch, 1911

—— Dorsal spines VI (rarely V, if so, first segmented ray unbranched); segmented anal-fin rays 30–40; no orange bar behind head; anterior light organ absent 8

8. Segmented anal-fin rays 34–40; body depth:SL ratio as measured from dorsal-fin origin to pelvic-fin origin 0.46–0.51, mean 0.49; anal-fin base:SL ratio 0.52–0.58, mean 0.54; dorsal fin with a dark leading edge, distal tips of only first or second ray dark; anal fin generally dark, without conspicuously darker tips to anterior rays (Australian endemic: Byron Bay NSW south to Gabo Island, SA) ..... *compressa* (White, 1790)

—— Segmented anal-fin rays 30–36; body depth:SL ratio as measured from dorsal-fin origin to pelvic-fin origin 0.41–0.46, mean 0.44; anal-fin base:SL ratio 0.43–0.49, mean 0.46; dorsal fin with or without dark leading edge, distal third of first to fifth ray dark; tips of anterior anal-fin rays distinctly darker than other rays, other rays pale or pigmented (Jurien Bay WA north, through NT?, south to Broughton Island, NSW, east to Lord Howe Island; also Kermadec Island and North Island, New Zealand) ..... *analis* Waite, 1910.

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