

Morphological Comparison of a Poorly Known Scorpionfish, *Parapterois macrura*, with a Related Species, *P. heterura* (Scorpaenidae: Pteroinae)

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Hiroyuki Motomura (2004) Morphological comparison of a poorly known scorpionfish, *Parapterois macrura*, with a related species, *P. heterura* (Scorpaenidae: Pteroinae). *Zoological Studies* 43(1): 1-7. The taxonomic status of a scorpionfish *Parapterois macrura* (Scorpaenidae: Pteroinae), originally described as *Pterois macrura* from the Malabar Coast off Calicut, west coast of India by Alcock (1896), has long been in doubt. Comparison of *P. macrura* collected from Indian waters with a related congener *P. heterura* (Bleeker, 1856), originally described from Ambon, Indonesia and subsequently collected from the southeast coast of Africa and western Pacific Ocean, revealed that the former was distinguished from *P. heterura* by the following characters: a scaleless interorbital space, lower counts of longitudinal scale series, greater head and snout lengths and head depth, a shorter tentacle on the posterior spine of the lacrimal, the upper margin of the orbit higher than or level with the base of the first dorsal spine (in lateral view) in adults and top of a bulge on the snout much lower than the ventralmost margin of the orbit (in lateral view) in adults. Morphological changes with growth for both species and populations in *P. heterura* are also discussed. <http://www.sinica.edu.tw/zool/zoolstud/43.1/1.pdf>

Key words: Comparison, Scorpaenidae, *Parapterois macrura*, *Parapterois heterura*.

The genus *Parapterois* Bleeker, 1876 (Scorpaenidae: Pteroinae), proposed as a new genus for *Pterois heterurus* Bleeker, 1856, originally described from Ambon, Indonesia, is characterized by high pectoral fin ray counts (18-21 vs. 12-17 in the related genus *Pterois* Oken), a low anal fin spine counts (2 vs. 3), some branched pectoral fin rays (vs. unbranched), and a truncated caudal fin with the upper and lower rays longest in large adults (vs. a rounded caudal fin without long rays) (Eschmeyer and Rama-Rao 1978, Eschmeyer 1986). Although *Parapterois* has long been considered a monotypic genus (Eschmeyer 1986, Ishida 1997), Mandrytsa (2001) treated a poorly known scorpionfish, *Pterois macrura* Alcock, 1896, originally described from the Malabar Coast off Calicut, west coast of India, as a second species of *Parapterois* and provided a key to the two species. With the exception of Mandrytsa (2001) and some type catalogs (Menon

and Yazdani 1968, Menon and Rama-Rao 1975), no reports of *Pterois* (= *Parapterois*) *macrura* have been published since Alcock's (1896) original description and subsequent report (Alcock 1898), although *Parapterois heterura* is well known. Thus, the taxonomic status and characters of *P. macrura* have remained obscure.

Examination of *Parapterois* specimens collected from India showed them to represent *P. macrura*, which could be distinguished from *P. heterura* on the basis of several morphological characters recognized in this study. The present paper includes confirmation of the validity of *P. macrura*, assessments of diagnostic characters of *P. heterura* and *P. macrura* proposed in the key by Mandrytsa (2001), descriptions of newly recognized diagnostic characters and morphological changes with growth for both species, and comments on populations in *P. heterura*.

MATERIALS AND METHODS

Specimen lengths are given as standard length (expressed as SL), measured from the anteriormost tip of the upper lip to the posterior end of the hypural plate. Head and snout lengths were measured from the anteriormost tip of the upper lip to the posterior end of the opercular flap and to the anterior margin of the eye, respectively. Head depth was taken obliquely from the uppermost margin of the orbit (frontal) to the posterior corner (near the preopercle) of the suborbital ridge (see Fig. 1). Pored lateral line scales could not be counted in this study because all of the specimens examined were in poor condition, owing to their having been caught by trawl nets. Scales in the longitudinal series, being nearly vertical to the oblique scale rows above the lateral line from the posterior point of the supracleithral spine base to the caudal fin base, were usually counted on the basis of deciduous scale traces. Gill raker counts included all rudiments.

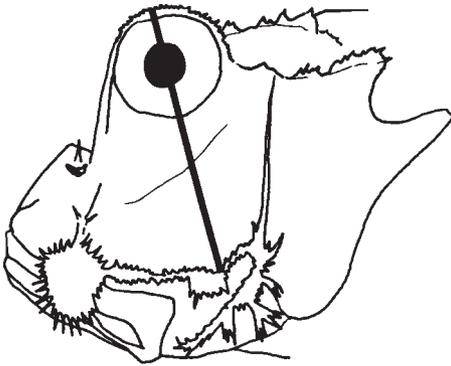


Fig. 1. Head of *Parapterois macrura* (MUFS 16910, 110 mm SL, off Malpe, Karnataka, west coast of India) in lateral view. Head depth is defined in this study as a straight line from the uppermost orbit margin to the suborbital ridge. Numerous scales and tiny spines are not illustrated.

Institutional codes follow Leviton et al. (1985), with additional institutional abbreviations as follows: Division of Fisheries Sciences, Faculty of Agriculture, Miyazaki University, Japan (MUFS); South African Institute for Aquatic Biodiversity, South Africa (SAIAB, formerly RUSI); and Raffles Museum of Biodiversity Research, Department of Biological Sciences, National University of Singapore (ZRC, formerly NMS). The following specimens of *Parapterois* species were examined during this study: *Parapterois heterura* from western Indian Ocean (14 specimens, 39-116 mm SL) - SAIAB 802 (holotype of *Pterois natalensis* von Bonde, 1923), 66 mm SL, Natal coast, South Africa (29°26'30''S, 31°25'40''E), 53 m, 30 July 1920; SAIAB 3023, 1 specimen, 79 mm SL, off Mozambique, May 1973, coll. by B. Andrews; SAIAB 48157, 4 specimens, 87-116 mm SL, off Mozambique (19°51'S, 36°18'E), bottom trawl, 66 m, 18 June 1994, coll. by R. W. Leslie; SAIAB 62730, 1 specimen, 64 mm SL, mouth of St. Lucia River, KwaZulu-Natal, South Africa (28°23'30''S, 32°26'10''E), 35 m, 22 Sept. 1999, coll. by S. Fennessy; SAM 11855 (syntypes of *Pterois nigripinnis* Gilchrist, 1904), 3 specimens, 39-51 mm SL, 4 km off mouth of Umhlanga River, Natal, South Africa, 40-48 m, 26 Mar. 1901, coll. by P. Faure; SAM 34263, 2 specimens, 87-112 mm SL, off Beira, Mozambique (19°51'S, 36°18'E), 66 m; SAM 34264, 2 specimens, 70-79 mm SL, off Beira, Mozambique (19°49'S, 36°05'E), 54 m. *Parapterois heterura* from western Pacific Ocean (12 specimens, 57-139 mm SL) - MUFS 16696, 1 specimen, 62 mm SL, off Meitsu, Nango, Miyazaki, Japan, 23 Nov. 1998, coll. by H. Motomura; MUFS 17718, 1 specimen, 67 mm SL, off Meitsu, Nango, Miyazaki, Japan, 5 June 1999, coll. by H. Motomura; MUFS 17730-17731, 2 specimens, 65-74 mm SL, off Meitsu, Nango, Miyazaki, Japan, 12 June 1999, coll. by H. Motomura; NSMT-P 34409,

Table 1. Frequency distribution of selected counts in *Parapterois* species

	Anal fin spines		Anal fin rays		Pectoral fin rays			Longitudinal scale series							
	2	7	8	18	19	20	43	44	45	46	47	48	49	50	51
<i>P. heterura</i>	21	20	1	2	11	10	-	-	1	3	3	3	3	1	1
<i>P. macrura</i>	11	11	-	-	7	4	1	1	2	2	1	1	1	-	-
	Upper gill rakers			Lower gill rakers				Total gill rakers							
	4	5	6	10	11	12	13	14	15	16	17	18	19		
<i>P. heterura</i>	1	23	2	2	10	8	5	1	2	10	7	6	1		
<i>P. macrura</i>	-	5	6	-	4	7	-	-	-	1	7	3	-		

1 specimen, 88 mm SL, Futo, Ito, Sagami Bay, Shizuoka, Japan, 2-3 m, 11 July 1991, coll. by M. Aizawa; NSMT-P 34604, 1 specimen, 89 mm SL, Tosa Bay, Kochi, Japan, bottom trawl, 30 m, 1 Oct. 1989, coll. by O. Okamura; NSMT-P 46604, 1 specimen, 57 mm SL, off Osezaki, Suruga Bay, Shizuoka, Japan, bottom trawl, 150-300 m, 26 Oct. 1994, coll. by H. Saito; NSMT-P 63542, 1 specimen, 86 mm SL, East China Sea (27°57-59'N, 125°56-59'E), bottom trawl, 117-118 m, 20 Oct. 2001, coll. by T. Saito and H. Namikawa; RMNH 5872 (holotype of *Pterois heterurus* Bleeker, 1856), 78 mm SL, Ambon, Maluku Is., Indonesia; URM-P 17403, 1 specimen, 139 mm SL, Chinen, Okinawa, Ryukyu Is., 30 Apr. 1986, coll. by T. Yoshino; URM-P 17420, 1 specimen, 114 mm SL, Chinen, Okinawa, Ryukyu Is., 5 May 1986, coll. by T. Yoshino; ZRC 728, 1 specimen, 96 mm SL, South China Sea (05°22-25'N, 107°36-47'E), 70-73 m, 11 June 1956, coll. by M. F. V. Manihine. *Parapterois macrura* (11 specimens, 77-111 mm SL) - MUFS 16908-16910, 3 specimens, 78-110 mm SL, off Malpe, Karnataka, west coast of India, bottom trawl, 80 m, 30 Mar. 2000, coll. by H. Motomura and Y. Iwatsuki; ZMH 5598, 7 specimens, 77-111 mm SL, off near Karwar, Karnataka, west coast of India (14°42'N, 73°54'E), bottom trawl, 75 m, 15 Feb. 1965, coll. by A. Kotthaus; ZMH 5599, 1 specimen, 81 mm SL, off near Cochin, west coast of

India (9°40'N, 75°38'E), bottom trawl, 138-210 m, 10 Feb. 1965, coll. by A. Kotthaus. Localities of specimens of both species examined during this study are indicated in figure 2.

RESULTS AND DISCUSSION

Validity of *Parapterois macrura*

Parapterois macrura was originally described as *Pterois macrurus* from the Malabar Coast off Calicut, west coast of India by Alcock (1896). Since the original description and a subsequent report (Alcock 1898), there have been no further references to that species, except in type catalogs (Menon and Yazdani 1968, Menon and Rama-Rao 1975), until Mandrytsa (2001) recognized both *P. heterura* (see Figs. 3A, 4A) and *P. macrura* (see Figs. 3B, 4B) as valid species of *Parapterois* and provided a key to the species. In his key, Mandrytsa (2001) briefly noted that *P. macrura* differed from *P. heterura* in having the upper margin of the orbit higher than the level of the first dorsal fin spine base (vs. slightly lower in the latter), the interorbital space without scales (vs. covered with scales), a tentacle on the lacrimal not reaching the posterior margin of the maxilla (vs. extending

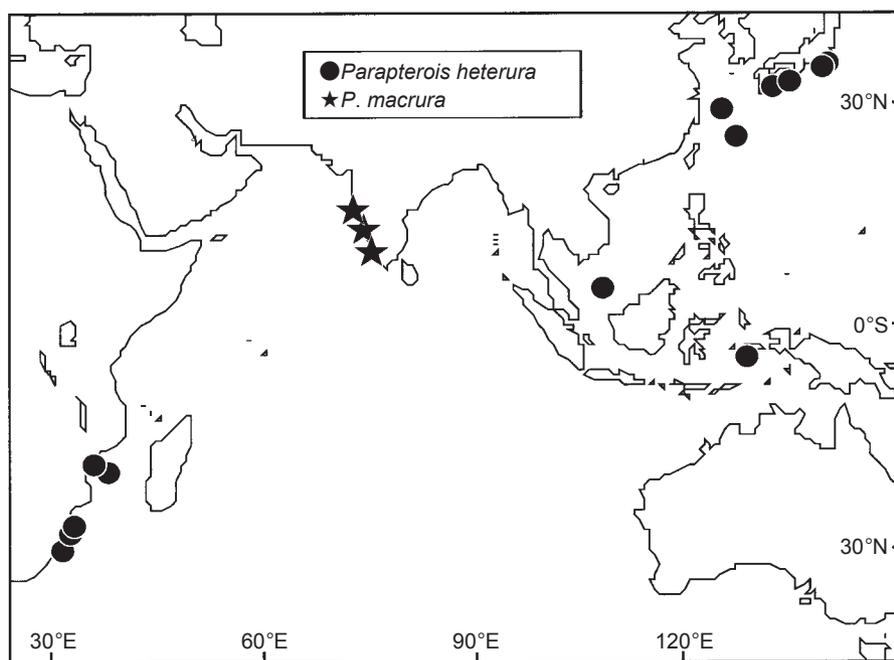


Fig. 2. Collection localities of specimens of *Parapterois* species examined in this study. Circles and stars indicate *P. heterura* and *P. macrura*, respectively.

beyond it), and a flap with small black spots present on the tip of the first dorsal fin spine (vs. flap absent).

A flap on the tip of the first dorsal fin spine was not apparent in Alcock's (1898) original figure of *Pterois macrura*, nor in examples of that species examined during this study (owing to their poor condition, as the dorsal fin spines and membranes of most were damaged). This character still needs confirmation. Furthermore, careful examination of the orbit/dorsal fin spine character and lacrimal tentacle length revealed that these were not always reliable for species' discrimination (see below).

Examination during this study of specimens (11 specimens, 77-111 mm SL) of *Parapterois* collected from the west coast of India (Fig. 2) showed them to lack scales on the midline of the narrow interorbital space. On the other hand, the interorbital space of all specimens (26 specimens, 39-139 mm SL) of *P. heterura*, collected from South Africa, Mozambique, Indonesia, South China Sea, East China Sea, and Japan (Fig. 2), was covered with scales. Accordingly, the Indian and other specimens of *Parapterois* could be readily distinguished from each other by this single character. *Parapterois heterura* (type locality: Ambon, Indonesia), including 6 known nominal species, viz. *Ebosia pavo* Schmidt, 1931 (Nagasaki, Japan), *E. starksi* Franz, 1910 (Kanagawa, Japan), *Pterois jordani* Regan, 1905 (Inland Sea, Japan), *P. natalensis* von Bonde, 1923 (Natal, South Africa), *P. nigripinnis* Gilchrist, 1904 (Natal, South Africa), and *P. tanabensis* Tanaka, 1918

(Wakayama, Japan), which have been treated as junior synonyms of *P. heterura* (see Eschmeyer and Rama-Rao 1978, Eschmeyer 1998), has at no time been reported from Indian waters, including the west coast of India. Although the type specimens of *P. macrura* (registered in the Zoological Survey of India, Calcutta) could not be examined during this study, both the type locality and Alcock's (1896) description of a scaleless interorbital space in that species, support the identification of the Indian west coast specimens examined here as *P. macrura* being a valid species.

Parapterois macrura is currently known only from the west coast of India (Alcock 1896; this study: Fig. 2), whereas *P. heterura* is widely distributed in scattered localities of the Indo-West Pacific, viz. east coast of South Africa, Mozambique, Indonesia (Ambon), South China Sea, Taiwan, East China Sea and southern Japan (Eschmeyer 1986, Poss 1999; this study: Fig. 2).

Comparisons

Meristic characters: Dorsal fin spines and rays, and anal fin spines of *Parapterois macrura* numbered the same (viz. XIII, 9, and II, respectively) as those of *P. heterura*, with no apparent variations. Although Eschmeyer (1986) described *P. heterura* as having 2 anal fin spines in adults and 3 in young, all of the specimens examined (39-139 mm SL) had 2 anal fin spines (Table 1). In fact, the number of anal fin spines is unlikely to change with growth in either *P. heterura* or *P. macrura*.

The numbers of anal and pectoral fin rays,

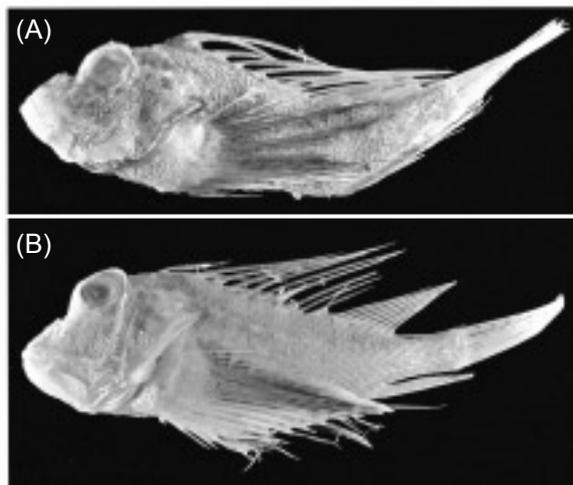


Fig. 3. Adults of *Parapterois heterura* (A) and *P. macrura* (B). (A) SAIAB 48157, 104 mm SL, off Mozambique; (B) ZMH 5598, 104 mm SL, off Karwar, west coast of India.

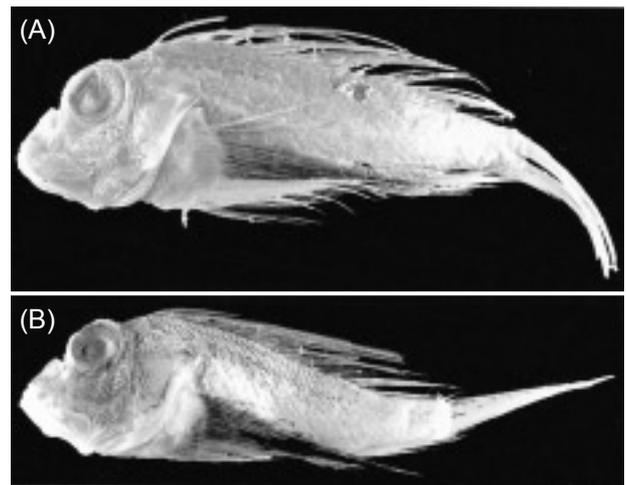


Fig. 4. Young of *Parapterois heterura* (A) and *P. macrura* (B). (A) ZRC 728, 96 mm SL, South China Sea; (B) MUFS 16909, 83 mm SL, off Malpe, west coast of India.

and total gill rakers also showed no significant differences between the 2 species (Table 1). However, the number [mean 45.9 (range 43-49)] of scales in the longitudinal series in *P. macrura* tended to be slightly greater than those [47.7 (45-51)] in *P. heterura* (Table 1). Furthermore, *P. heterura* had a strong modal count of 5 gill rakers on the upper limb, whereas *P. macrura* had equally 5 or 6 gill rakers on that element (Table 1).

Morphometric characters: *Parapterois macrura* is very similar to *P. heterura* in overall body appearance (see Figs. 3-4). *Parapterois macrura*, however, significantly differed from *P. heterura* in having greater head length [mean 42.4% of SL (range 39.7-44.1% of SL) vs. 38.2% (34.9-39.7%) in the latter; Fig. 5A], snout length [mean 15.8% of SL (range 12.9-19.1% of SL) vs. 12.6% (11.2-14.1%); Fig. 5B] and head depth [mean 23.0% of SL (range 21.0-25.1% of SL) vs. 19.0% (17.6-20.4%); Fig. 5C]. With the exception of those proportions, no other significant differences in proportional measurements were found between the 2

species.

Head morphology: *Parapterois* species have a tentacle on the posterior spine of the lacrimal. The tip of the tentacle in *P. macrura* usually failed to extend beyond the level of the posterior margin of the maxilla (see Fig. 1), although those in 2 smaller specimens (77-78 mm SL), which comprised 18.2% of the total number of specimens examined (11 specimens, 77-111 mm SL), did so slightly. Contrary to *P. macrura*, *P. heterura* had a long tentacle, usually extending beyond the level of the posterior margin of the maxilla, although those of 2 larger specimens (114-139 mm SL), which comprised 7.7% of the total number of specimens examined (26 specimens, 39-139 mm SL), failed to reach the posterior margin.

The upper margin of the orbit of larger *P. macrura* (7 specimens, 79-111 mm SL) was level with or higher than the base of the first dorsal fin spine (in lateral view), whereas that of smaller ones (4 specimens, 77-83 mm SL) was below the level of the first dorsal fin spine base (Fig. 6B). In *P. heterura*, the upper margin of the orbit was considerably below the level of the first dorsal fin spine base (in lateral view) throughout life (Fig. 6A). Therefore, although larger *P. macrura* could be readily distinguished from *P. heterura* by the orbit/dorsal fin spine character, smaller examples of the 2 species were difficult to distinguish from each other solely by that character. Accordingly, the 2

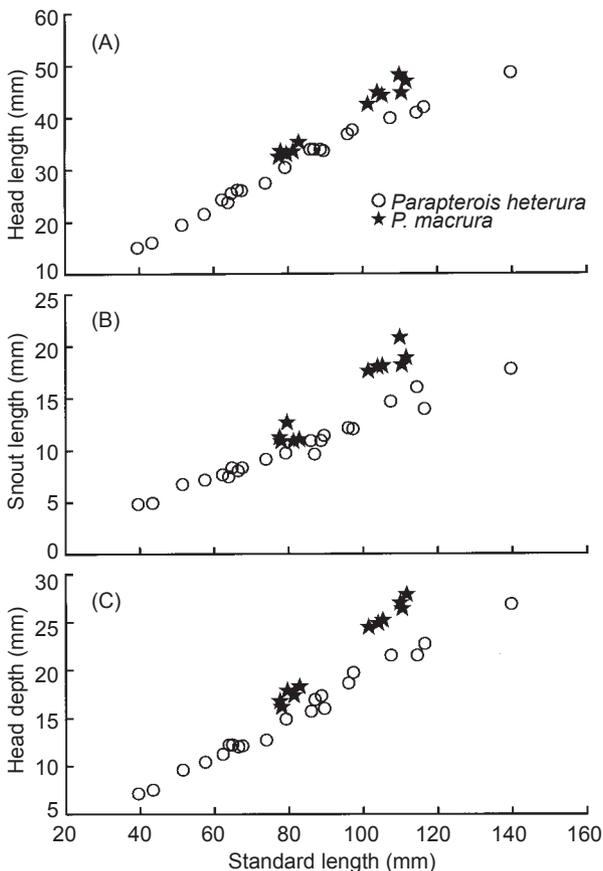


Fig. 5. Relationships of head length (A), snout length (B) and head depth (C) to standard length in *Parapterois heterura* (circles) and *P. macrura* (stars).

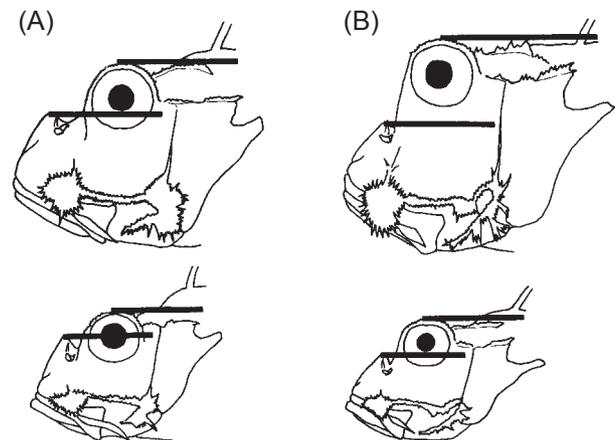


Fig. 6. Heads of *Parapterois heterura* (A) and *P. macrura* (B) in lateral view. Upper and lower drawings indicate larger and smaller specimens of each species, respectively. Horizontal lines indicate levels of the uppermost margin of the orbit and top of a bulge on the snout. (A, upper), URM-P 17403, 139 mm SL; (A, lower), MUFS 17718, 67 mm SL; (B, upper), MUFS 16910, 110 mm SL; (B, lower), MUFS 16908, 78 mm SL. Numerous scales and tiny spines are not illustrated.

above-mentioned characters are not always reliable for species' discrimination, although Mandrytsa (2001) used them as species' diagnostic characters.

The top of a bulge on the snout of larger *P. macrura* (6 specimens, 101-111 mm SL) was considerably below the level of the ventralmost margin of the orbit (in lateral view), whereas that of smaller specimens (5 specimens, 77-83 mm SL) was located between the levels of the ventralmost margins of the pupil and orbit (Fig. 6B). The top of a similar bulge on the snout level with the middle of the pupil was found in all specimens examined of *P. heterura*, except for 2 larger specimens (114-139 mm SL) in which the top of the bulge was located between the levels of the ventralmost margins of the pupil and orbit (Fig. 6A).

Change of nasal spines with growth: Examination of different life stages of *P. heterura* and *P. macrura* showed that the number of nasal spines in both species increased to 2 or more with growth. In *P. macrura*, young (77-79 mm SL) and adults (81-114 mm SL) had a single and 3 nasal spines on one side, respectively, 3 other adults (110 mm SL, 105 mm SL and 104 mm SL) having 5, 6 and 7 nasal spines on one side, respectively. On the other hand, *P. heterura* young (39-97 mm SL) and adults (87-139 mm SL) had a single and 2 nasal spines on one side, respectively, with the exception of a single adult (116 mm SL) which had 3 nasal spines on one side.

Populations of *P. heterura*: A pit between the posterior nostrils of all *P. macrura* specimens examined was not covered by scales. Although *P. heterura* collected from the western Indian Ocean, viz. South Africa and Mozambique, had a naked pit as in *P. macrura*, *P. heterura* collected from the western Pacific Ocean, viz. South China Sea, East China Sea, and Japan, had a scaly pit. Additional differences between western Indian and western Pacific Ocean populations of *P. heterura* were not found during this study. The 2 populations might be different species. Future studies, including molecular analyses, will help elucidate the taxonomic status of these 2 populations.

Key to species and populations of *Parapterois*

1a. Scales absent on midline of interorbital space throughout life; longitudinal scale series 43-49 (mean 45.9); head length 39.7-44.1% (42.4%) of SL; snout length 12.9-19.1% (15.8%) of SL; head depth 21.0-25.1% (23.0%) of SL; tip of tentacle on posterior spine of lacrimal not extending beyond level of posterior margin of maxilla

(sometimes extending slightly beyond in young); upper margin of orbit higher than or level with base of first dorsal spine (in lateral view) in adults, lower than in young; top of bulge on snout well below ventralmost margin of orbit (in lateral view) in adults, located between levels of ventralmost margins of pupil and orbit in young

- *P. macrura* (west coast of India)
- 1b. Scales present on midline of interorbital space throughout life; longitudinal scale series 45-51 (mean 47.7); head length 34.9-39.7% (38.2%) of SL; snout length 11.2-14.1% (12.6%) of SL; head depth 17.6-20.4% (19.0%) of SL; tip of tentacle on posterior spine of lacrimal usually extending beyond level of posterior margin of maxilla (sometimes not reaching it in adults); upper margin of orbit well below level of first dorsal spine base (in lateral view); top of bulge on snout usually level with midline of pupil (in lateral view), sometimes located between levels of ventralmost margins of pupil and orbit in adults
- 2a. Pit between posterior nostrils covered with scales
- *P. heterura* (western Pacific population)
- 2b. Pit between posterior nostrils naked
- *P. heterura* (southeast African coast population)

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