

## New record of the Whitespot hawkfish from Kenting National Park and Orchid Island, Southern Taiwan

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### Abstract

The hawkfish species *Paracirrhites hemistictus* (Günther, 1874) was newly collected from Kenting National Park and Orchid Island, both in Southern Taiwan, and we have described three specimens of this new Taiwanese record. *Paracirrhites hemistictus* can be distinguished in having a grayish-brown body with many brown or black spots, as well as a white patch on the lateral line. The following characteristics were also documented: 48 pored lateral-line scales, 7+12 gill rakers, 10<sup>th</sup> dorsal fin spine distinctly longer than the 9<sup>th</sup>, large scales on cheeks forming 5–6 slating rows, a branch 2<sup>nd</sup> pectoral fin ray, and small scales on the snout anterior to the nostrils. Detailed descriptions and fresh color photos have been provided.

**Keywords:** Actinopteri, Centrarchiformes, Ichthyology, Pisces, Taxonomy

### Introduction

The hawkfish family Cirrhitidae comprises 12 genera and 35 species of carnivorous, often small, and colorful fish, which inhabit warm seas (Randall, 1963; Fricke et al., 2020). Members of this family are predominantly characterized as having 14 pectoral-fin rays, of which the lower 5–7 are unbranched and usually

enlarged with membranes deeply incised and cirri projecting posteriorly from the inter-spinous membranes near the tips of the dorsal-fin spines. Other characteristics include a fringe of cirri on the hind edge of the anterior nostril and gill membranes broadly joined with a free fold across the isthmus (Randall, 1963).

The genus *Paracirrhites* comprises

eight species characterized by cycloid scales, upper 1–2 and lower 7 pectoral fin rays unbranched, 11 dorsal-fin rays, non-serrated suprascapular, enlarged canine teeth at the front of the upper jaw and along the sides of the lower jaw; 5–6 rows of large scales on the cheeks, five rows of large scales above the lateral line, a single cirrus from the membrane near the tip of each dorsal fin spine, minimally incised membranes on the spinous portions of the dorsal fins, and truncated to rounded caudal fins (Randall, 1963).

In Taiwan, six genera of the family Cirrhitidae comprising 12 species have been documented (Shao, 2021), including three species of the genus *Paracirrhites*: *Paracirrhites arcatus* (Cuvier, 1829), *Paracirrhites forsteri* (Schneider, 1801) and *Paracirrhites hemistictus* (Günther, 1874); the latter is based on a photograph from an angler (no voucher specimen). Recently, three *P. hemistictus* were collected, two from Orchid Island and one from Kenting National Park (Hengchun); these represent the first specimen-based records of this species in Taiwan.

## Methods and materials

Methods for counts and proportional measurements followed Hubbs and Lagler (1958), and all measurements were made with digital calipers to the nearest 0.1 mm. Morphometric data were expressed as a percentage of the standard length (SL) and head length (HL). The cheek depth was

defined as the narrowest space between the lower margin of the eye and the lower margin of the premaxilla. Osteological characters were determined by digital X-ray photographs, and specimens were deposited at the Pisces Collection of the National Museum of Marine Biology and Aquarium, Pingtung, Taiwan (NMMB-P).

## Results

### Family Cirrhitidae

#### *Paracirrhites hemistictus* (Günther, 1874)

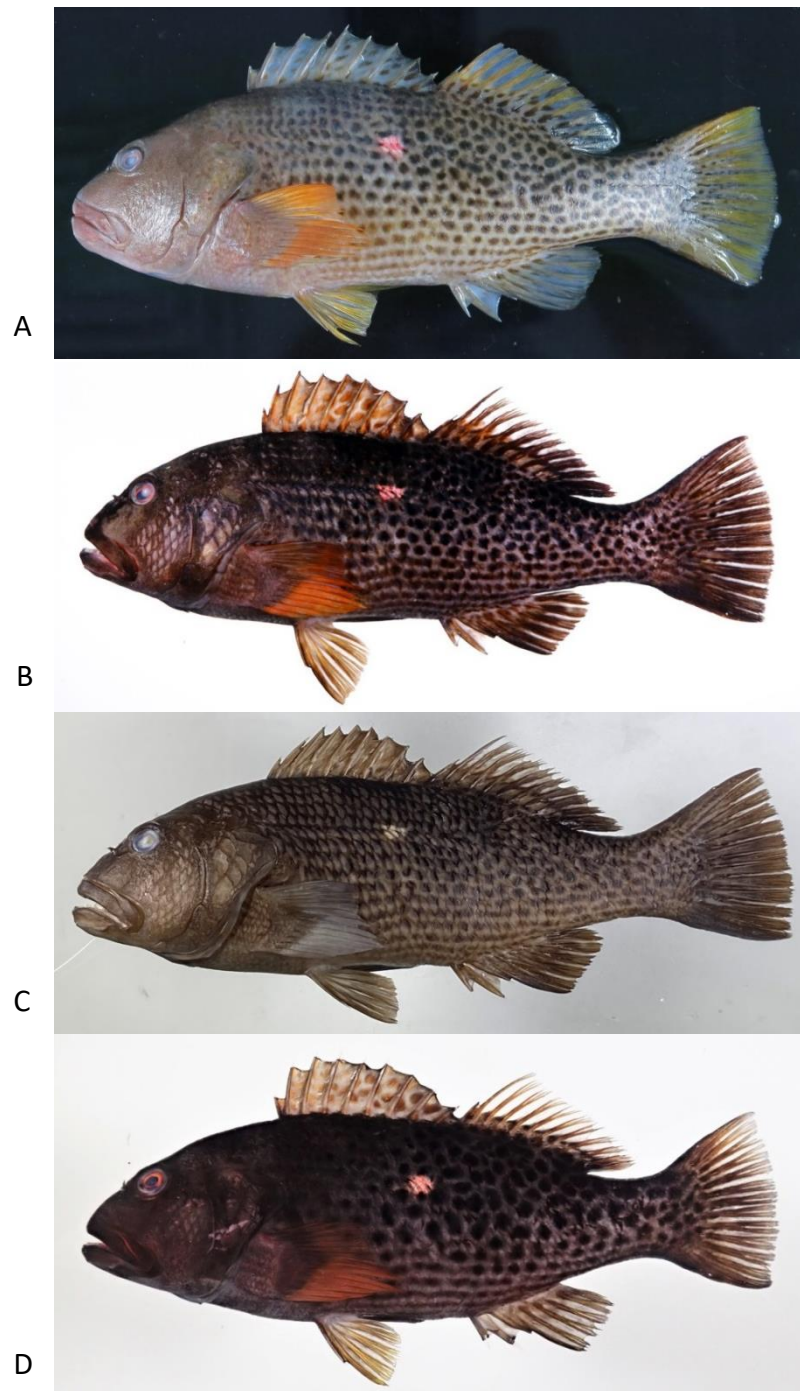
Whitespot hawkfish

Figs. 1A–D, 2A; Table 1

*Cirrhites hemistictus* Günther, 1874:69, pl. 50, fig. B (Type locality: Society Islands).

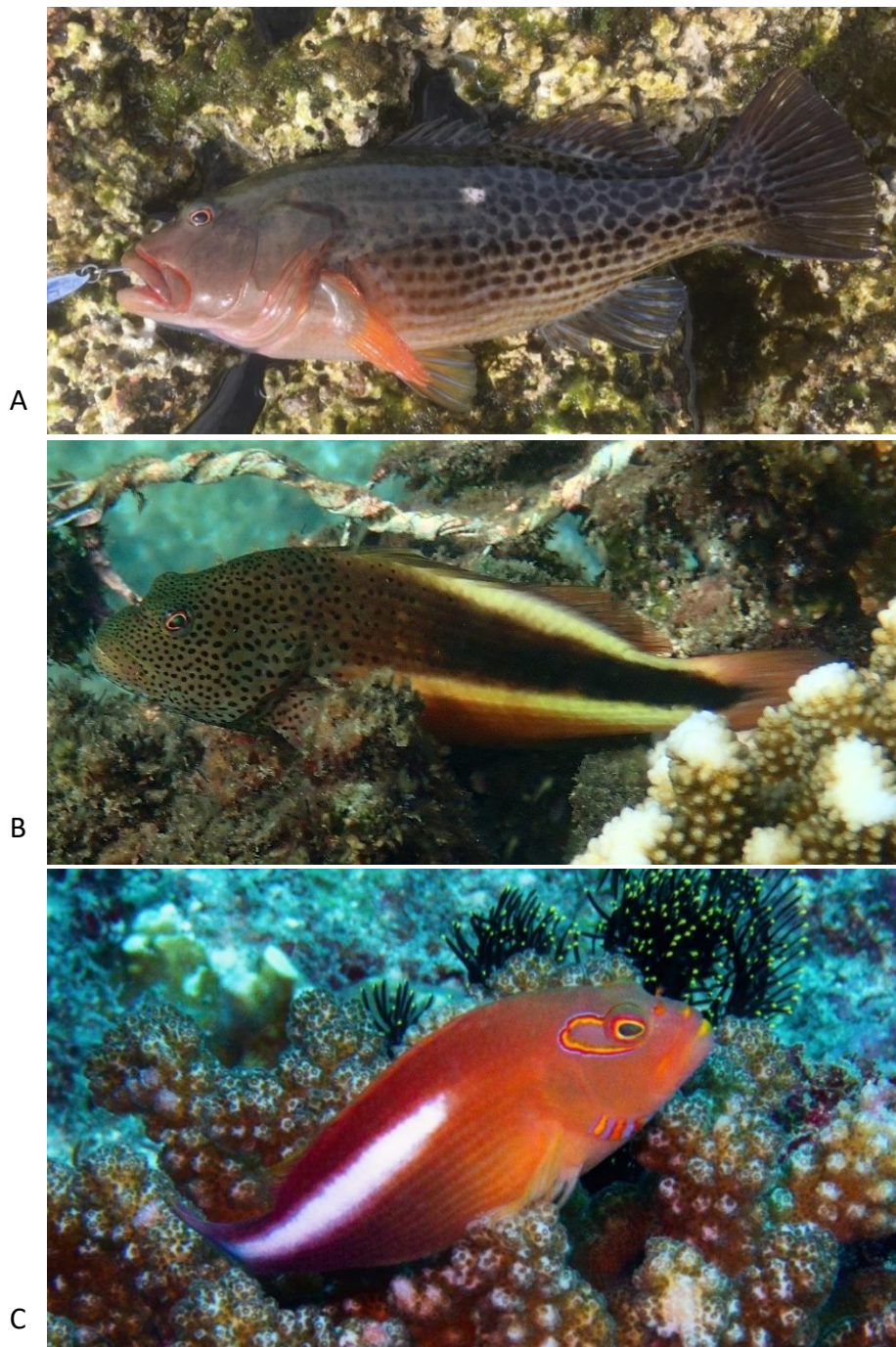
*Paracirrhites hemistictus* (Günther, 1874): Randall, 1963:409 (reviewed). Masuda et al. 1984:200 (Japan). Nakabo, 2000:911 (pictured key). Randall, 2001:3328 (list). Allen & Erdmann, 2012:317 (East Indies).

**Specimens examined.** NMMB-P34285, 183.4 mm SL, Orchid Island (Lan-yu), Taitung, southeastern Taiwan, 4 Jun. 2020, collected by angling off the shore. NMMB-P34355, 134.1 mm SL, ca. 22°01'N, 121°36'E, near “Elephant trunk rock” (Hsiang-bi-yan), Orchid Island, Taitung, 20 Jul. 2020, collected by angling off the shore by N.-W. Lai. NMMB-P35562, 198.7 mm SL, ca. 21°55'N



**Fig. 1.** *Paracirrhites hemistictus*. A. NMMB-P35562, 198.7 mm SL. B–C. Fresh (B) and preserved (C) samples of NMMB-P34285, 183.4 mm SL. D. NMMB-P34355, 134.1 mm SL.





**Fig. 2.** A. Individual (~20 cm) freshly caught on 29 June 2017 by Y.-J. Tsou. B. *Paracirrhites forsteri*, at 1 m depth at Houbihu, Southern Taiwan, 5 Jul. 2020, by C.-N. Tang. C. *Paracirrhites arcatus* at 12 m depth at Hsiao Liuchiou, Southern Taiwan, 12 Aug. 2021, by Y.-H. Yu.

**Tab. 1.** Morphometric and meristic data of three *Paracirrhites hemistictus* specimens collected from Taiwan.

SL (mm)	NMMB-P35562		NMMB-P34285		NMMB-P34355	
	198.7		183.4		134.1	
<b>Morphometrics</b>	%SL	%HL	%SL	%HL	%SL	%HL
HL	34.5		33.1		34.7	
Body depth (pelvic-fin base)	34.8	100.6	33.3	100.7	34.3	98.8
Body width (pectoral-fin base)	18.7	54.2	18.0	54.5	18.7	53.8
Snout length	11.3	32.8	12.1	36.6	12.2	35.2
Eye diameter	5.3	15.3	4.9	14.8	4.9	14.2
Bony interorbital width	5.5	16.0	5.7	17.3	6.3	18.1
Upper jaw	14.2	41.3	13.7	41.5	14.0	40.4
Cheek depth	7.0	20.3	7.3	21.9	7.6	21.9
Predorsal length	36.5	105.6	36.4	109.9	35.2	101.4
Prepectoral length	31.5	91.1	31.9	96.4	30.8	88.7
Prepelvic length	40.8	118.1	40.1	121.3	40.3	115.9
Preanal length	66.1	191.6	63.1	190.8	62.8	180.9
Pectoral-fin length (upper half)	16.3	47.1	16.4	49.6	16.1	46.4
Pectoral-fin length (lower half)	25.4	73.7	22.6	68.4	20.6	59.4
Pelvic-fin length	18.2	52.7	17.6	53.0	18.4	52.9
Pelvic-fin spine length	10.3	29.8	10.3	31.0	10.3	29.7
Dorsal-fin base length	52.7	152.7	53.0	160.1	54.4	156.5
1 <sup>st</sup> dorsal-fin spine length	4.8	14.0	4.7	14.2	4.0	11.6
5 <sup>th</sup> dorsal-fin spine length	11.0	32.0	11.1	33.4	11.1	31.9
10 <sup>th</sup> dorsal-fin spine length	7.5	21.6	8.2	24.7	6.8	19.6
1 <sup>st</sup> dorsal-fin ray length	13.8	40.0	13.9	42.0	13.1	37.7
1 <sup>st</sup> anal-fin spine length	7.3	21.2	5.7	17.3	6.5	18.8
2 <sup>nd</sup> anal-fin spine length	10.5	30.5	9.2	27.7	9.6	27.5
3 <sup>rd</sup> anal-fin spine length	9.8	28.5	8.8	26.7	9.1	26.1
Anal-fin base length	16.6	48.2	17.1	51.7	16.6	47.8
Longest anal-fin-ray length	17.4	50.5	16.7	50.4	17.1	49.3
Caudal-peduncular length	23.8	68.9	25.3	76.4	21.6	62.3
Caudal-peduncular depth	13.9	40.2	13.1	39.7	13.2	38.1
Caudal-fin length	18.7	54.2	19.7	59.5	20.1	58.0
<b>Meristics</b>						
Dorsal-fin elements	X, 11		X, 11		X, 11	
Pectoral-fin rays	1+6+7		1+6+7		1+6+7	
Pelvic-fin elements	I, 5		I, 5		I, 5	
Anal-fin elements	III, 6		III, 6		III, 6	
Lateral-line scales (LLS)	47+1		46+2		47+1	
White spots on LLS	16-18		14-16		16-17	
Transverse scale rows	6/11		5+1/11		5+1/11	
Circumpeduncular scales	24		24		24	
Preopercle serrae	11 (tiny)		18		31	
Predorsal scales	11		11		10	
Gill rakers	7+12		7+12		7+12	
Pseudobranchial filaments	26		27		23	
Total caudal fin rays	41		42		43	

120°42'E, off Bai-sa, Hengchun, Pingtung, southern Taiwan, 5–8 m, 2021.

**Description of Taiwanese specimens.**

Morphometric and meristic data are provided in Table 1.

Dorsal-fin elements X, 11; pectoral-fin rays 14; pelvic-fin elements I, 5; anal-fin elements III, 6; principle caudal-fin rays 8 (upper lobe) + 7 (lower lobe) = 15; procurrent rays 14–15 (upper)/12–13 (lower); total caudal-fin rays 41–43. Pored lateral-line scales 48, including 1 or 2 small scales on caudal-fin base. Five transverse scale rows between dorsal fin origin and lateral line (excluding a small row on the fin base) and eleven between lateral line and origin of anal fin. Predorsal scale rows 10–11. Circumpeduncular scale rows 24. Gill rakers on outer surface of first gill arch 7 (upper limb) + 12 (lower limb). Pseudobranches 23–27. Vertebrae: 10 precaudal + 16 caudal = 26. Vertebral formula 0/0/0+2/1+1/1/1/1/1/1 (predorsal and spinous dorsal fins only). Supraneurals 3.

Body fusiform, slightly compressed, deepest body depth and width (at pelvic fin base) 2.9–3.0 and 5.3–5.5 times in SL, respectively. Dorsal and ventral profiles slightly convex. Head moderately large (2.9–3.0 in SL); dorsal profile more pronounced than ventral; interorbital region slightly convex along head. Snout moderately long, blunt anteriorly, 2.7–3.0 in HL or 2.1–2.5 times the eye diameter.

Eyes small, 6.5–7.0 in HL. Interorbital space broad and flat, its bony width 5.8–6.3 in HL.

Mouth moderately small, terminal, its gape slightly oblique, forming a ca. 10° angle with the horizontal body axis; length of upper jaw 2.4–2.5 in HL; lower jaw slightly beyond the upper jaw anteriorly; posterior end of maxilla extending to a vertical through anterior half of the middle of the eye. Lips of both jaws thin but broad. First suborbital bone (lacrima) well developed, slightly overlapping with anterior portion of maxilla, its lower margin smooth; cheek depth 4.6–4.9 in HL (not including upper jaw). Two nostrils well in front of eye; anterior nostril rounded with a high rim and a flame-like flap posteriorly bearing many cirri, the flap reaching posterior margin of posterior nostril when appressed. Posterior nostril elliptical, with horizontal axis longer and slightly above the anterior nostril; simple without fleshy rim.

Opercle a large, triangular bony structure with a broad flap on its posterior margin, the flap extending to well beyond the pectoral-fin base posteriorly, about the same vertical of the dorsal-fin origin. Exposed margin along middle of preopercle with row of small to spiny serrae. Margins of subopercle and interopercle smooth. Lower portions of branchiostegal membranes fused together, forming a fold free from the isthmus.

Single dorsal fin with a long base,

deeply concaved in the middle, its spinous portion arched with its base slightly longer than that of the soft-rayed base. Dorsal-fin spines somewhat compressed; first spine short (7.1–8.6 in HL); fifth spine longest (3.0–3.1 in HL), spines gradually shorter except for the last spine (10<sup>th</sup>; also the leading spine of the posterior lobe, distinctly longer than the penultimate spine); length of 10<sup>th</sup> spine 4.0–5.1 in HL. First dorsal-fin ray longest, 2.4–2.7 in HL, gradually shorter posteriorly. Pectoral fin moderately large, somewhat square, its origin well below body axis and opercular flap; upper seven rays short and thin, uppermost ray simple and others branched, the longest ray 2.0–2.2 in HL; lower seven rays enlarged, thickly covered by skin, all simple, upper four rays long, the longest ray 1.4–1.7 in HL, gradually shorter ventrally. Origin of pelvic fin below middle of pectoral fin, about a vertical through base of 4<sup>th</sup> dorsal-fin spine, its tip not reaching anus when appressed. Anal fin moderately large with a short base, second spine 3.3–3.6 in HL, longer than the other two spines; first ray longest, 2.0 in HL, gradually shorter posteriorly. Caudal fin truncate, 1.7–1.8 in HL. Caudal peduncle short and deep: length 1.3–1.6 in HL and depth 2.5–2.6 in HL.

Villiform and/or canine teeth on jaws, vomer and palatine; no teeth at symphysis of upper jaw. Wide patch of villiform teeth at front of upper jaw followed by narrow band of villiform teeth along most of upper

jaw; outer margin of upper jaw with two canines in the front, the posterior large and strong, followed by a row of many small, stout teeth. Broad patch of villiform teeth at front of lower jaw; a row of canines on anterior half of the jaw, gradually enlarged posteriorly, the posterior 3–4 especially strong, followed by single row of small canines. Vomer with a wide triangular patch of small, villiform teeth, no backward prolongation on the patch. Palatine with a short row of 4–5 small, stout teeth on anterior portion. No teeth on pterygoids or tongue.

Seven gill rakers on the upper limb of the first gill arch and 12 on the lower limb, except for NMMB-P34285 has a few small, toothed rakers on anterior portion of the lower limb between the developed rakers. Pseudobranch present, with 23–27 filaments. Cycloid scales cover the entire body; those on opercle especially large, arranged in about 2–3 rows. Large scales on cheek arranged in 5–6 slanting rows. An irregular row of moderately small scales along spinous dorsal-fin base; about 2–3 rows of small scales along soft dorsal-fin base. Numerous small, cycloid scales (mostly embedded by skin) on snout, top of head, shoulder, exposed portion of maxilla, chin, cheek, operculum, and lower portion of the branchiostegal region. Small, cycloid scales on fin bases, extending to about basal 1/2 to 2/3 of the pectoral fin, basal half 1/2 to 4/5 of the inter-membranes of pelvic fin, basal 1/4 to



1/3 of the soft dorsal-fin base, and 4/5 of the caudal fin. Lateral line complete, lateral-line scales not enlarged, each with a simple sensory tubule at the dorsal-posterior corner. Parallel rows of scales above and below lateral line.

**Fresh coloration.** Grayish brown overall or grayish brown dorsally and paler ventrally, with a single large, bright, white spot along lateral line under the posterior portion of the spinous dorsal fin base (usually crossing about three scales) at about the 14<sup>th</sup>–18<sup>th</sup> lateral-line scales. Body covered with many large, irregular black spots on body; two dark or brown-orange stripes on ventral region; jaws, lips, branchiostegal region, and pectoral fin orange or orangish-red; spinous dorsal fin brown with orange-brown spots, soft dorsal fin brown; pelvic fin yellowish-orange with inter-membranes light blue or brown; anal fin brown with inter-membranes light blue; caudal fin dark brown with spots on its base.

**Preserved coloration.** Body dark brown, paler ventrally; numerous black spots on body and the basal portion of the soft dorsal fin, anal fin, and caudal fin. Spinous dorsal fin with pale vermiculate pattern.

**Distribution.** Widespread in the Eastern Indian Ocean and Western Pacific, including Christmas Island and Cocos Keeling Islands, east to Line Islands and Pitcairn Islands, and north to Ogasawara Islands (Japan). It appears to be a shallow-

water species; all specimens were collected and/or photographed in coral-rich areas <10 m.

**Remarks.** The coloration of *P. hemistictus* is distinct and can be easily distinguished from the other cirrhitid species found in Taiwan. Randall (1963) discussed the coloration of *P. hemistictus* and its junior synonym “*Paracirrhites polystictus*” and advised further investigation on these two color morphs. Thus far, all individuals examined by our group, either based on specimens or photographs, belong to the “*H. polystictus*” color form.

The number of serrae on the preopercle likely reduces as individuals grow; there were 31, 18, and 12 spiny serrae in the 134.1, 183.4 and 198.7 mm specimens, respectively. Although Randall (1963) defined the genus *Paracirrhites* to be without palatine teeth, we found a single row of 4–5 small, blunt teeth on the anterior portion of the palatine in all three specimens.

*Paracirrhites hemistictus* differs from *P. forsteri* (Fig. 2B) in coloration, as well as the fact that the 10<sup>th</sup> dorsal fin spine is distinctly longer than the 9<sup>th</sup>; large scales on cheek forming 5–6 slating rows (small scales on cheek do not separate into rows). *Paracirrhites hemistictus* differs from *P. arcatus* (Fig. 2C) in having second pectoral-fin ray branched (vs. simple in the latter), possessing small scales on the snout anterior to the nostrils (vs. no scales



on the snout in *P. arcatus*); and a different coloration.

**Comparative materials.** *Paracirrhites forsteri*: NMMB-P011424 (n=1; 151 mm SL), Hengchun market, Pingtung, Taiwan, 13 Mar. 2010. NMMB-P011425 (n=1; 120 mm SL), Hengchun market, Pingtung, Taiwan, 13 Mar. 2010. NMMB-P034354 (n=2; 92–108 mm SL), Hsiang-bi-yan, Orchid Island, Taitung, Southeastern Taiwan, 20 Jul. 2020. *Paracirrhites arcatus*: NMMB-P002360 (n=1; 105 mm SL), Houbihu, Hengchun, Pingtung, Taiwan, 4 Feb. 2002. NMMB-P008676 (n=1; 63 mm SL), Nanwan, Hengchun, Pingtung, Taiwan, by Y.-H. Yu, 23 Jun. 2005.

### Acknowledgements

We thank Mr. Yao-Jen Tsou, Mr. Yo Tasi, and Mr. Yuan-Huan Yu for providing photographs and specimens. This study was supported by the National Museum of Marine Biology and Aquarium, Taiwan.

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