The First Record of Sona Sea Catfish *Pseudosciades sona* (Hamilton 1822) in Sabah, Malaysian Borneo, on the Basis of Morphological and Molecular Data

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Received 19 February 2024 | Reviewed 6 June 2024 | Accepted 30 September 2024 | Published 31 December 2024

DOI: 10.51200/bjomsa.v8i.4947

Abstract

The Sona Sea Catfish *Pseudosciades sona* is widely distributed across the Indo-West Pacific, including Malaysia. In this paper, we report the first record of the species from Sabah, based on morphological and molecular data. The single specimen of *Pseudosciades sona* was obtained during a field survey, from the fish market in Beluran, Sabah. The DNA of the specimen has been sequenced and data was published in elsewhere. The species is diagnosed by a combination of morphometric characteristics, including 10–12 pectoral-fin rays, long head (27.59%–31.85% of SL), long snout (28.89%–35.86% of HL), wide mouth (58.04%–65.72% of HL), eye diameter (12.90%–15.75% of HL), distance between below the eye to the bottom of the head (18.95%–24.57% of HL), distance between behind the eye and the margin of operculum (55.75%–60.32% of HL), bony interorbital width (53.67%–60.03% of HL), long bases of dorsal-fin (5.21%–6.18% of SL), anal-fin (13.12%–16.64% of SL), pectoral-fin (5.21%–6.18% of SL), and pelvic-fin (4.14%–5.34% of SL). This paper describes the morphological features of this species, with a brief discussion on catfish conservation and its significance as a fishery resource in Malaysia.

Keywords: Ariidae, *Pseudosciades sona*, new record, Sona Sea Catfish, Sabah

Introduction

The catfish order Siluriformes comprises 41 families, with 512 genera and 4267 species (Van der Laan et al., 2024). Catfishes are distributed circumglobally, in both tropical and temperate waters, and are recorded in marine, estuarine and freshwater ecosystems. Apparently, only 13 families under the suborder Siluroidei can be found in the Western Central Pacific (Van der Laan et al., 2024).

The families Ariidae, along with Bagridae and Siluridae are the three most important sea catfishes in the Western Central Pacific (Froese & Pauly, 2023). Of the three Ariidae subfamilies

which are Ariinae, Bagreinae and Galeichthyinae, only members of subfamily Ariinae have been recorded in Southeast Asia, while the latter two recorded in Africa and the Americas (Kailola, 2004; Acero & Betancur-R, 2007; Marceniuk & Menezes, 2007; Kulongowski, 2010; Matsunuma et al., 2011; Jalal et al., 2012; Marceniuk et al., 2012; Kottelat, 2013; White et al., 2013, Yoshida et al., 2013; Kimura et al., 2015; Abdurrahman et al., 2016; Marceniuk et al., 2017; Marceniuk et al., 2023). Ariidae is also the most commercially important catfish in Malaysia (DoFM, 2020).

Previous studies on catfishes in Malaysia listed 30 species of Ariidae (Roberts, 1989; Kailola, 1999; Kailola, 2004; Marceniuk & Menezes, 2007; Jalal et al., 2012; Kimura et al., 2015; Abdurahman et al., 2016). Based on the compiled list, all species have been recorded in Sabah except four species namely *Arius arenarius*, *Hemiarius stormii, H. sumatranus,* and *Pseudosciades sona*.

The presence of both *Arius arenarius* and *Hemiarius harmandi* in the country is questionable. *Arius arenarius* was reported from Penang by Kailola (2004). However, in that study, only part of the specimen was referred to. We note that *A. arenarius* is morphologically similar to *A. arius*, thus, with limited specimen used in that study, the presence of *A. arenarius* is likely a misidentification of *A. arius*. As for *H. harmandi* which was recorded from Baram River, Sarawak in 1901, the identification is questionable due to the systematic complexities of the species (Fricke et al., 2024). The 1901 Sarawak (=Baram, River, Borneo) record was originally listed as *Arius brevirostris* (Steindachner, 1901). The taxonomic status of *Arius brevirostris* which was treated as a synonym of *Arius harmandi* by Kailola (2004), but *A. brevirostris* is presently considered as *incertae sedis* (Fricke et al., 2024). In this report, we provide the morphometric and meristic data of *Pseudosciades sona* based on a single Sabah specimen. The specimen was barcoded using the COI gene (Nasihin-Seth et al., 2019). Additionally, we provide some notes on the status of catfish conservation and catfish as a fisheries resource in Malaysia.

Materials and Methods

Here we report the first record of Sona Sea Catfish based on a single specimen collected from Beluran fish market. Beluran is a remote coastal town located at the estuary of the Sapi River, on the northeast coast of Sabah, Malaysia (Figure 1). The specimen is from a larger collection of catfishes collected from a fish biodiversity survey from 2016–2017, where several of the catfish collections were sequenced for their DNA study (Nasihin-Seth et al., 2019). The fish survey included field sampling of fresh specimens purchased and collected from fish markets and fish landing sites throughout Malaysia. *Pseudossciades sona* specimens (vouchers no. ZRC 53351 (1-3), ZRC 50386 (3)) from Lee Kong Chian Natural History Museum (LKCNHM) in Singapore were also examined in this study.

Figure 1. Map of Malaysia. The red-dot shows the location of Beluran fish market (5°55'31.5"N 117°38'37.2"E), from where the single specimen of *Pseudosciades sona* was collected from.

Morphometric and meristic data from each specimen examined were taken following Ng (2003) and Kailola (2004). The morphometric data are: standard length (SL) which was measured from the tip of the snout to the base of the caudal fin, total length (TL) measured from the tip of the snout to the tip of the upper caudal-fin lobe, head length (HL), snout length (SnL), mouth width (MW), eye diameter (ED), distance between below the eye to the bottom of the head (EH), distance between behind the eye and the margin of operculum (EO), bony interorbital width (IO), body width (BW), dorsal-fin base (DL), anal-fin base (AL), pectoral-fin base (P1L), and pelvic-fin base (P2L). Meristics data include: dorsal- , anal- , pectoral- and caudal- fin ray counts, and gill-raker counts. The morphological data of two closely-related species, *Arius macronotacanthus* and *Osteogeneiosus militaris* were also taken for comparison (Table 1).

Identification keys to ariid catfish species were based on Ng (2003), Kailola (2004), Marceniuk and Menezes (2007), Betancur-R (2009), and Abdurahman et al. (2016). The specimen, along with other species of catfish specimens collected during the same survey, and examined in this study, were deposited at the marine collection of the Borneo Marine Research Institute (IPMB), Universiti Malaysia Sabah. As indicated in the introduction, molecular work on the single specimen of *Pseudosciades sona* was carried out in a separate work (Nasihin-Seth et al., 2019). The results of the DNA sequence (COI gene of the *Pseudosciades sona* specimen) was submitted to GenBank® (http://www.ncbi.nlm.nih.gov), with accession number MN094546, and to the BOLD Systems (https://www.boldsystems.org/) with identification number BCCM012-19 (Nasihin-Seth et al., 2019).

Table 1. Meristic and morphometric characters of *Pseudosciades sona* (IPMB-I 170816-08.03, ZRC 53351 (1–3), ZRC 50386 (3)), *Arius macronotacanthus* (IPMB-I 010716-17.05, IPMB-I 010716-17.06, IPMB-I 210916-04.01 – IPMB-I 210916-04.05) and *Osteogeneiosus militaris* (IPMB-I 010716-17.12, IPMB-I 150716-17.11, IPMB-I 120816-17.01, IPMB-I 120816-17.02, IPMB-I 120816-17.03, IPMB-I 120816-17.04, IPMB-I 250816-08.07, IPMB-I 151016-80.04, IPMB-I 151016-80.05, IPMB-I 151016-80.06), as well as *Hemiarius verrucosus* (n=7) and *Hemiarius stormii* (n=4) (Ng, 2003).

	Pseudosciades sona **n=5 (Present study)**	***Hemiarius stormii*** **n=4 (Ng, 2003)**	***Hemiarius verrucosus*** **n=7 (Ng, 2003)**	***Arius macronotacanthus*** **n=7 (Present study)**	***Osteogeneiosus militaris*** **n=10 (Present study)**
Total length, TL (mm)	218–301	-	-	167–218	189–349
Standard length, SL (mm)	179–237	147.3–281.5	98.7–267.5	132–188	152–292
Dorsal-fin rays	I, 7	-	I, 7	I, 7	I, 7
Anal-fin rays	15–18	-	9-10	17	18
Pectoral-fin rays	I, 10–12	-	11-12	I, 10	I, 10
Pelvic-fin rays	I, 5–6	-	I, 5	I, 5	I, 5
Gill raker	13	-	15-17	16	10–12
Caudal-fin rays	15–18	-	17	15	14
Head length (HL) / SL (%)	27.16–31.85	28.8–29.6	29.3–31.7	24.33–30.38	23.61–28.12
Snout length (SnL) / HL (%)	28.89–35.86	37.0–39.8	35.2–41.7	27.69–32.95	26.18–32.42
Mouth width (MW) / HL (%)	58.04–65.72	-		51.56–57.08	34.21–49.34
Eye diameter (ED) / HL (%)	12.90–15.75	9.7–11.8	10.6–14.0	18.26–25.54	13.32–18.31
Distance between below the eye to the bottom of the head (EH)/ HL (%)	18.95–24.57	-	-	14.34–20.94	7.32–13.73
Distance between behind the eye and the margin of operculum (EO) / HL (%)	55.75–60.32	-	-	49.39–53.23	50.44–62.75
Bony interorbital width (IO) / body width (HL) (%)	53.67–60.03	38.3–39.9	26.6–39.7	46.62–53.38	52.77–63.68
Dorsal-fin base (DL) / SL (%)	9.58–12.86	-	10.7–12.5	10.94–13.89	8.51–10.45
Anal-fin base (AL) / SL (%)	13.12–16.64	13.7–14.9	13.6–17.1	13.24–15.83	14.61–18.1
Pectoral-fin base (P1L) / SL (%)	5.21–6.18	-	-	2.98–5.38	3.80–5.17
Pelvic-fin base (P2L) / SL (%)	4.14–5.34	-	-	3.87–4.89	2.81–4.81

Pseudosciades sona (Hamilton 1822)

[English common name: Sona Sea Catfish]

[Malay common name: Duri Sona]

Pimelodus sona Hamilton, 1822: 172, 376 (type locality: India: estuaries of Bengal; types: NT; Hamilton's unpublished figure reproduced in Britz 2019:Pl. 94).

Bagrus trachipomus Valenciennes in Cuvier and Valenciennes, 1840a: 443 (type locality: India: Bengal; holotype: MNHN A.9346, Ferraris, 2007:55).

Hexanematichthys leptocassis Bleeker, 1861g: 65 (type locality: Malaysia: Penang; syntypes [350–360 mm TL]: not preserved) (Kailola, 2004).

Material examined

IPMB-I 170816-08.03, 237 mm SL, mature female, Beluran fish market, Sabah, Malaysia, 17 August 2016. DNA barcoded (Accession number in GenBank®: MN094546; Identification number in BOLD system: BCCM012-19).

Diagnosis

A species of the monospecific genus *Pseudosciades* with the following combination of characters: Finely granulated head shield, two pairs of palatal tooth patches with smaller, round vomerine (centre) tooth patch while the accessory (outer) tooth patch is bigger, containing conical teeth (Kailola, 1999; Marceniuk & Menezes, 2007). *Pseudosciades sona* (Figure 2) differs from other Ariidae species by having conical and sharp teeth in two palatal teeth patches on each side (the outer patch of palatal teeth is triangular with elongated towards out and much bigger than the inner and round patch) (Figure 3). Previously described as *Hemiarius* species, this characteristic differs from *H. stormii* and *H. verrucosus* that has strong, sharp, and conical teeth in 2 oval palatal teeth patches on each side. However, these 2 palatal teeth patches form a contiguous palatal teeth patch in larger fish (Kailola, 1999; Ng, 2003). These species also differ from *P. sona* by having shark-like snout (Ng, 2003).

The single specimen of *Pseudosciades sona* (IPMB-I 170816-08.03), was recorded with the following combination of morphological characters: dorsal-fin rays 7 with 1 serrated spine; anal-fin rays 16; pectoral-fin rays 12 with 1 spine; pelvic-fin rays 5, adipose fin with dark margins.

Figure 2. *Pseudosciades sona*, IPMB-I 170816-08.03, 237 mm SL, mature female, Beluran fish market, 17 August 2016 (not to scale).

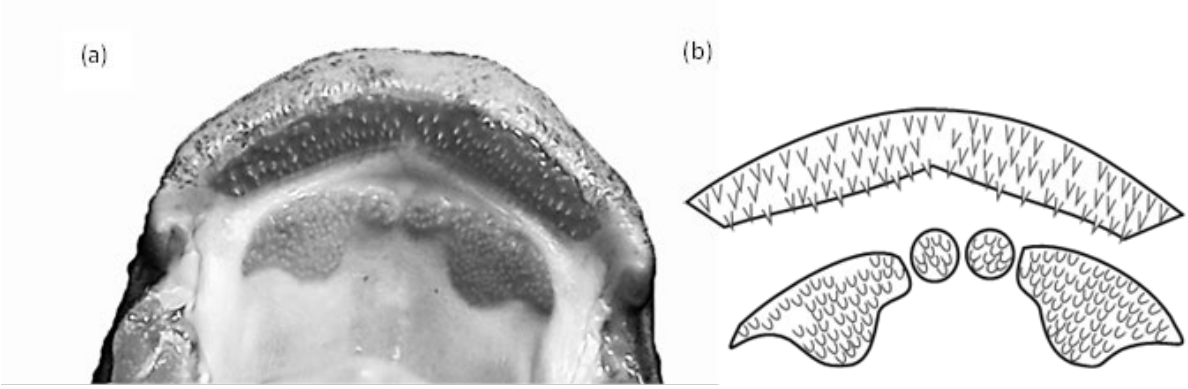

Figure 3. An image (a) and an illustration (b) of the palatal tooth patches of *Pseudosciades sona*, IPMB-I 170816-08.03, 237 mm SL, mature female, Beluran fish market, 17 August 2016 (not to scale).

Remarks

Members of Ariidae are characterized by a deeply forked caudal-fin, presence of an adipose fin, usually three pairs of barbels, a bony shield covering part of the dorsal surface of the head, and unique pattern of the tooth patches on the palate (Kailola, 2004; Marceniuk & Menezes, 2007). Previously, *P. sona* was placed under the genus *Hemiarius* that shares the diagnostic characters of a long adipose-fin base, almost long as the anal-fin base, presence of accessory tooth plates bearing small conical teeth that are transversely elongated and narrow, and two patches of palatal teeth for each side (Marceniuk & Menezes, 2007). Recent paper on the redescription of Ariidae genera has placed this species under a monotypic genus, *Pseudosciades*. This genus is characterised with having moderately long posterior branches of the mesethmoid (bone located at the front skull), apparent

epioccipital (part of back dorsal skull), and slightly concave anterior margin of the nuchal plate. *Pseudo* in Latin means false hence, this genus shares similar characteristics with species of genus *Sciades*. The diagnostic characteristics include a medial groove of neurocranium delimited mainly by frontal bones, anterior and median nuchal plates forming a shield-like structure, and nuchal plate overlapping parietosupraoccipital process (posterior part of skull) (Marceniuk et al., 2023).

The species was only previously recorded elsewhere in Malaysia, precisely from Penang in Peninsular Malaysia (Ng, 2003). Morphological data for *P. sona* remain limited to a few available publications on the species (Kailola, 1999, 2004; Marceniuk & Menezes, 2007; Marceniuk et al., 2023).

The COI gene of the single specimen of *P. sona* reported here (IPMB-I 170816-08.03) was carried out for BLAST in GenBank database in October 2024. Results of that study showed a high similarity (>95%) with the other seven *P. sona* COI sequences in the database. As the published morphological data of *P. sona* is limited, we compared our morphological data to two other closely-related species, *Arius macronotacanthus* and *Osteogeneiosus militaris* (Table 1), which we also recorded in Sabah. In *A. macronotacanthus*, the palatal teeth are conical but sharp, and distributed in a pair of somewhat triangular tooth patches (Figures 4 & 5), whereas in *O. militaris* (Figure 6), the teeth are also conical but sharp, and distributed in a pair of elongated tooth patch, separated by a circular groove anteriorly (Figures 6 & 7). Additionally, *P. sona* has 3 pairs of fleshy barbels (Figure 2), whereas *O. militaris* only has a pair of stiff barbel (Figure 6).

Figure 4. *Arius macronotacanthus* IPMB-I 210916-04.01, 168 mm SL, female, Kota Marudu fish market, 21 September 2016 (not to scale).

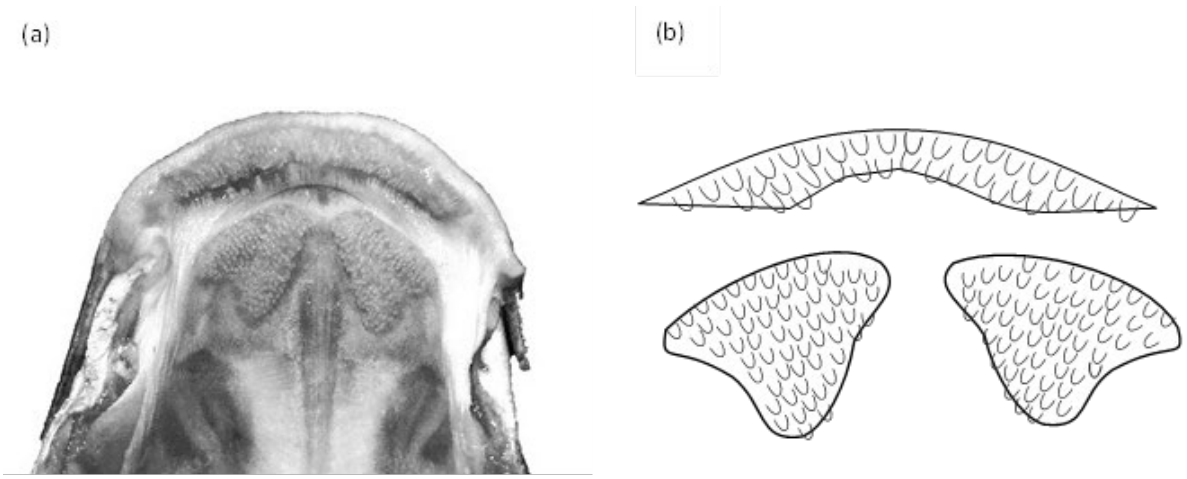

Figure 5. An image (a) and an illustration (b) of the palatal tooth patches of *Arius macronotacanthus* IPMB-I 210916-04.01, 168 mm SL, female, Kota Marudu fish market, 21 September 2016 (not to scale).

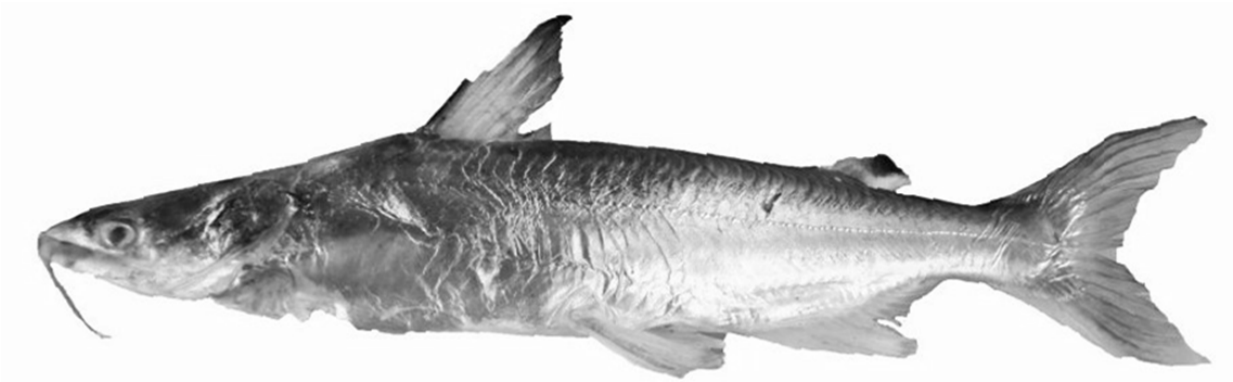

Figure 6. *Osteogeneiosus militaris* IPMB-I 250816-08.07, 261 mm SL, male, Beluran fish market, 25 August 2016 (not to scale).

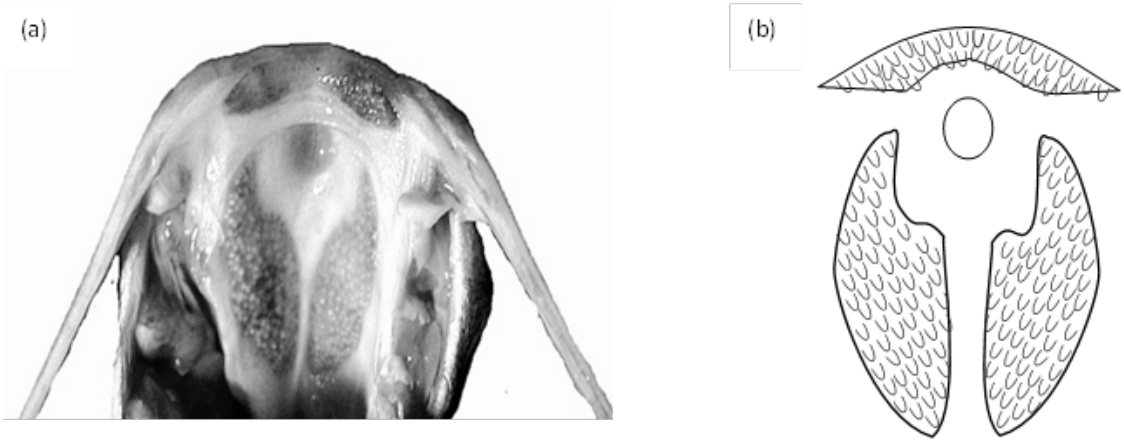

Figure 7. An image (a) and an illustration (b) of the palatal tooth patches of *Osteogeneiosus militaris* IPMB-I 250816-08.07, 261 mm SL, male, Beluran fish market, 25 August 2016 (not to scale).

Pseudosciades sona has longer head, HL (27.59%–31.85% of SL), snout length, SL (28.89%–35.86% of HL), and mouth width, MW (58.04%–65.72% of HL) with smaller eye diameter (12.90%–15.75% of HL) compared to *A. macronotacanthus* and *O. militaris.* The distance between below the eye to the bottom of the head, EH (18.95%–24.57% of HL) in *P. sona* is also longer compared to *A. macronotacanthus* (14.34%–20.94% of HL) and *O. militaris* (7.32%–13.73% of HL). Additionally, this species has longer pectoral-fin base, DL (5.21%–6.18% of SL) compared to *A. macronotacanthus* (2.98%–5.38% of SL) and *O. militaris* (3.80%–5.17% of SL).

The IUCN Red List (2024) currently lists the assessment status of 31 Ariidae species found distributed in the Western Central Pacific, but excluding *P. sona*. Most of the species are listed as least concern (LC) status, with one species listed for each of the following categories: critically endangered (CR), endangered (EN) and vulnerable (VU) species status.

In Malaysia and the Southeast Asian region, catfishes have long been referred to as a "poor man's fish", where because of "myths" surrounding the way these fishes obtain their food as scavengers, render the prices of this group of fishes as inherently lower (RM7-8 per kilograms) compared to other kinds of marine fishes of similar size (upwards of RM10 per kilograms) (based on survey and interview data of the present study). This relatively cheaper fish is nevertheless, a commercially important fisheries resource. As reported in the "Economics of Fisheries and Aquaculture in The Coral Triangle (CT)" (Asian Development Bank, 2014; Ahmad et al., 2016), sea catfishes are a particularly popular group of fish, and is one of the highly consumed fish in the CT countries. Moreover, in Malaysia, recent annual fisheries landing statistics indicates that marine catfishes are landed throughout the year, with 24,308 and 18,341 metric tonnes of ariids caught in 2019 and 2020, respectively (DoFM, 2019, 2020). As such, while Ariidae continue to be exploited as human food fish, and at the same time new species are continually being recorded (this study), thus, it is important to monitor the catfish species for sustainable fisheries resource management.

Comparative material examined

7 specimens *Arius macronotacanthus*: 2 specimens (IPMB-I 010716-17.05 180 mm SL; IPMB-I 010716-17.06, 188 mm SL), 1°50.97' N, 102° 51.33' E, Parit Besar fish landing site, Batu Pahat, Johor, 0-100 m depth, trawl, 1 July 2016; and 5 specimens (IPMB-I 210916-04.01, 168 mm SL; IPMB-I 210916-04.02, 162 mm SL; IPMB-I 210916-04.03, 143 mm SL; IPMB-I 210916-04.04, 142 mm SL; IPMB-I 210916-04.05, 132 mm SL), 6° 29.97' N, 116° 46.24' E, Kota Marudu market, trawl, 21 September 2016. 10 specimens *Osteogeneiosus militaris*: 2 specimens (IPMB-I 010716-17.12, 178 mm SL; IPMB-I 150716-17.11, 246 mm SL), 1° 51.10' N, 102° 51.30' E, Parit Besar fish landing site, Batu Pahat, Johor, 0-100 m depth, trawl, 15 July 2016; 4 specimens (IPMB-I 120816-17.01, 274 mm SL; IPMB-I 120816-17.02, 258 mm SL; IPMB-I 120816-17.03, 255 mm SL; IPMB-I 120816-17.04, 260 mm SL), 1° 50.47' N, 102° 52.94' E, Parit Haji Salam fish landing site, Batu Pahat, Johor, 0-100 m depth, trawl, 15 July 2016; 1 specimen (IPMB-I 250816-08.07), 5° 50.35' N, 118° 7.26' E, Sandakan wet market, Sabah, 0-100 m depth trawl; 3 specimens (IPMB-I 151016-80.04, IPMB-I 151016-80.05, IPMB-I 151016-80.06), 1° 40.70' N, 110° 25.56' E, Sungai Bako, Kuching, Sarawak, fish net; as well as *Hemiarius verrucosus* (n=7) and *Hemiarius stormii* (n=4) (Ng, 2003).

Acknowledgements

The authors express gratitude to Mr Kelvin Lim and supporting staffs of Lee Kong Chian Natural History Museum (LKCNHM) for granting access to catfish collection and for their hospitality during SNS' visit to the lab. This work form part of the PhD study of SNS. The study was funded by Universiti Malaysia Sabah UMS Great fund (Project Code: GUG0031-ST-P-1/2016) awarded to BMMM.

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