

**DISTRIBUTIONAL RANGE EXPANSIONS  
OF THE CARDINALFISHES *GYMNAPOGON JANUS*  
AND *G. SAGITTARIUS* (GOBIIFORMES: APOGONIDAE),  
AND FRESH COLOR DESCRIPTION OF *G. JANUS***

***Siti Tafzilmeriam Sheikh Abdul Kadir*<sup>1,3\*</sup>, *Ying Giat Seah*<sup>2,3</sup>, *Reo Koreeda*<sup>4</sup>,  
*Mizuki Matsunuma*<sup>5\*</sup> and *Hiroyuki Motomura*<sup>6</sup>**

ABSTRACT

A single specimen of *Gymnapogon janus* Fraser, 2016, previously recorded only from the Philippines, was collected from the South China Sea off Kuantan, Pahang State (east coast of Peninsular Malaysia). This represents the first record of the species from Malaysian waters. In addition, three specimens of *Gymnapogon sagittarius* Yoshida, Kawai & Motomura, 2019, previously reported from Vietnam, Thailand, Indonesia, Papua New Guinea, and Malaysia (Terengganu State), and now collected off the southeastern coast of Johor State, Malaysia represent a new locality record of the species within Malaysian waters. The fresh coloration of *G. janus* is described in detail, the only previous color description of the species having been made from the preserved type specimens.

Keywords: Actinopterygii, distribution, morphology, South China Sea

INTRODUCTION

The apogonid genus *Gymnapogon* Regan, 1905, inhabiting sandy/muddy substrates in relatively deep water in the Indo-Pacific region (GON & GOLANI, 2002; FRASER, 2019; YOSHIDA ET AL., 2019), currently comprises the following eleven valid species (FRASER, 2019; YOSHIDA ET AL., 2019): *Gymnapogon africanus* Smith, 1954; *Gymnapogon annona* (Whitley, 1936); *Gymnapogon foraminosus* (Tanaka, 1915); *Gymnapogon janus* Fraser, 2016; *Gymnapogon japonicus* Regan, 1905; *Gymnapogon melanogaster* Gon & Golani, 2002, *Gymnapogon philippinus* (Herre, 1939), *Gymnapogon sagittarius* Yoshida, Kawai

---

<sup>1</sup> Mangrove Research Unit, Institute of Oceanography and Environment, Universiti Malaysia Terengganu, 21030 Kuala Nerus, Terengganu, Malaysia. E-mail: sititafzil@umt.edu.my

<sup>2</sup> Faculty of Fisheries and Aquaculture Sciences, Universiti Malaysia Terengganu, 21030 Kuala Nerus, Terengganu, Malaysia.

<sup>3</sup> South China Sea Repository and Reference Centre, Institute Oceanography and Environment, Universiti Malaysia Terengganu, 21030 Kuala Nerus, Terengganu, Malaysia.

<sup>4</sup> School of Marine Biosciences, Kitasato University, 1-15-1 Kitasato, Minami-ku, Sagamihara, Kanagawa 252-0373, Japan.

<sup>5</sup> Maizuru Fisheries Research Station, Field Science Education and Research Center, Kyoto University, Nagahama, Maizuru, Kyoto 625-0086, Japan. E-mail: k1139853@kadai.jp

<sup>6</sup> The Kagoshima University Museum, 1-21-30 Korimoto, Kagoshima 890-0065, Japan.

\*Corresponding authors.

Received 28 October 2025; accepted 10 December 2025.

& Motomura, 2019; *Gymnapogon urospilotus* Lachner, 1953; *Gymnapogon vanderbilti* (Fowler, 1938); and *Gymnapogon velum* Fraser, 2019.

During a marine fish fauna survey conducted on 20–24 September 2023, a single specimen of *G. janus* was collected from the South China Sea off Kuantan, Pahang State (east coast of Peninsular Malaysia) (ca. 03°48'N, 103°24'E). This is the first confirmed record of the species from Malaysian waters, and the only record of the species since the original description by FRASER (2016), based on two specimens from the Philippines.

In addition, three specimens of *G. sagittarius* were obtained at a local fish landing port at Pahang (Peninsular Malaysia), the specimens having been collected by bottom trawler off the southeast coast of Johor State (southern South China Sea). *Gymnapogon sagittarius* was originally described on the basis of type specimens from Ha Long Bay (Vietnam), the Andaman Sea (Thailand) and Terengganu State (Malaysia) (YOSHIDA *ET AL.*, 2019). Later, KUITER & KOZAWA (2019), GLOERFELT-TARP & KAILOLA (2022) and ALLEN & ERDMANN (2024) recorded the species from the Philippines, Indonesia and Papua New Guinea. Therefore, the present specimens from Johor represent a regional distributional range extension of the species in Malaysian waters, indicating that *G. sagittarius* is widely distributed along the South China Sea coast of Peninsular Malaysia.

## MATERIALS AND METHODS

Methods of counts and measurements followed FRASER (2016) and YOSHIDA *ET AL.* (2019). The measurements of the holotype of *Gymnapogon janus* in Table 1 were converted from millimeters (mm) into percentages of standard length (% SL) based on the measurements provided in FRASER (2016: table 1). All measurements were made to the nearest 0.1 mm with needle-point calipers under a dissecting microscope. Standard length is abbreviated as SL. Curatorial procedures for the newly collected specimens followed the protocols of MOTOMURA & ISHIKAWA (2013). Osteological characters of *G. janus*, including the number of branched caudal-fin rays, were observed from a radiograph of the specimen (KAUM–I. 190178). The examined specimens are deposited at UMTF (South China Sea Repository and Reference Centre, Universiti Malaysia Terengganu, Malaysia) and KAUM (The Kagoshima University Museum, Japan). The holotype and three paratypes of *G. sagittarius* deposited at KAUM [listed by YOSHIDA *ET AL.* (2019)] were examined for comparative purposes. The distribution map was generated using QGIS 3.10 (QGIS Development Team, 2021) with data from Natural Earth (free vector and raster map data at [naturalearthdata.com](http://naturalearthdata.com)).

## RESULTS AND DISCUSSION

### *Gymnapogon janus* Fraser, 2016

New standard Malay name: Sebekah Janus

(Fig. 1A; Table 1)

**Material examined:** KAUM–I. 190178, 40.5 mm SL, off Kuantan, Pahang State, Malaysia (ca. 03°48'N, 103°24'E), obtained at fish landing port at Kuantan (Kompleks LKIM Kuantan), bottom trawl, 24 Sept. 2023, UMT and KAUM Fish Team.

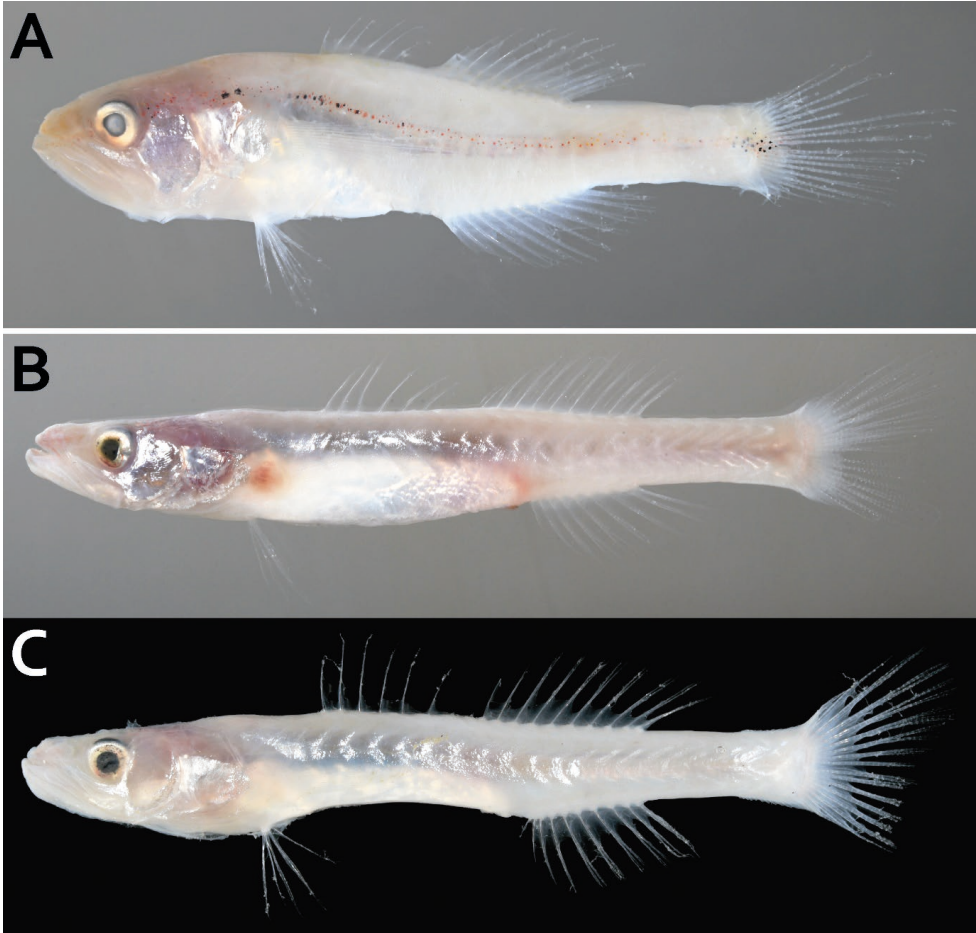


Figure 1. Fresh specimens of *Gymnapogon janus* (A) and *G. sagittarius* (B, C) from Malaysia. A: KAUM-I. 190178, 40.5 mm SL, off Kuantan, Pahang; B: KAUM-I. 212348, 56.3 mm SL, off southeast coast of Johor; C: KAUM-I. 211650, 48.1 mm SL, off southeast coast of Johor. Photos by KAUM.

**Identification.**— Counts and measurements of the specimen are given in Table 1 (all dorsal- and anal-fin rays damaged). The specimen (Fig. 1A) identification was based on the following diagnostic characters given by FRASER (2016) for *G. janus*: relatively oblong body; 10 dorsal-fin soft rays; 10 anal-fin soft rays; 14 pectoral-fin rays; caudal fin with  $8 + 7$  branched rays; and 2 rows of villiform vomerine teeth on each side.

Morphometric values for the Malaysian specimen (40.5 mm SL) differed slightly from those of the two type specimens (55.9 and 62.5 mm SL) of *G. janus* given by FRASER (2016) (Table 1). Such differences most likely represent ontogenetic proportional changes within the species, the small (Malaysian) specimen possessing a relatively larger head (including larger eyes, broader interorbital region, and longer upper jaw) and longer pectoral and pelvic fins.

Table 1. Counts and measurements (% of SL) of specimens of *Gymnapogon janus*.

|                        | This study        | Fraser (2016)* |          |
|------------------------|-------------------|----------------|----------|
|                        | KAUM–I.<br>190178 | Holotype       | Paratype |
| SL (mm)                | 40.5              | 62.5           | 55.9     |
| Counts                 |                   |                |          |
| Dorsal-fin rays        | VI-I, 10          | VI-I, 10       | VI-I, 10 |
| Anal-fin rays          | II, 10            | II, 9          | II, 10   |
| Pectoral-fin rays      | 14                | 14             | 14       |
| Pelvic-fin rays        | I, 5              | I, 5           | I, 5     |
| Total gill rakers      | 2 + 11            | 2 + 11         | 3 + 11   |
| Vertebrae              | 10 + 14           | 10 + 14        | 10 + 14  |
| Measurements (% of SL) |                   |                |          |
| Body depth             | 23.2              | 21.0           | 23.3     |
| Head length            | 40.7              | 37.4           | 36.9     |
| Eye diameter           | 8.9               | 5.4            | 6.6      |
| Snout length           | 8.9               | 8.6            | 8.2      |
| Interorbital width     | 8.1               | 7.4            | 7.3      |
| Upper jaw length       | 20.7              | 17.8           | 18.8     |
| Caudal peduncle depth  | 8.9               | 11.0           | 11.1     |
| Caudal peduncle length | 22.2              | 25.0           | 21.5     |
| Pectoral fin length    | 28.6              | 21.4           | damaged  |
| Pelvic fin length      | 17.8              | 15.7           | 13.8     |

\*measurements (% of SL) calculated from Fraser (2016: table 1)

Moreover, the following characteristic melanophore distribution of the present specimen (Fig. 1A) closely agreed with the type specimens of *G. janus* described and figured by Fraser (2016: fig. 1A): two minute melanophores vertically along posterior margin of orbit; two relatively large black dots horizontally along dorsal edge of opercle; black dots along anterior portion of lateral line; and black dots forming an oval cluster at midpoint of caudal-fin base. Although the black dots above the opercle and caudal-fin base in the holotype (62.5 mm SL) were smaller than in the present specimen (40.5 mm SL), such differences are also regarded here as intraspecific growth-related variations.

**Description of fresh coloration.**— The present specimen enabled a description of fresh coloration of *G. janus* to be recorded for the first time, the original description having been based solely on long term preserved specimens (see FRASER, 2016). In addition to the melanophore distribution (above), the following color features were noted: head and body uniformly creamy-white, without any distinct markings (Fig. 1A); suborbital, cheek, and opercular areas with silvery reflection; all fins semitranslucent white without markings; minute red melanophores densely scattered on snout, anterior portions of both jaws, and

dorsal surface of head; red dots distributed on postorbital area, just above silver cheek and opercular areas, forming broad band; and red dots densely distributed along entire lateral line (black dots restricted to anterior portion). In the subsequently preserved specimen, the red pigmentation was entirely lost.

**Distribution and habitat.**— The species has previously been known only from the two type specimens from the Philippines, the holotype of *G. janus* having been collected from the Visayan Sea, southeast of Sicozon Island, Iloilo Province (11.3667°N, 123.33°E). The latitude coordinate was erroneously stated as “west” in FRASER (2016). The present specimen represents the first record of the species from Malaysia (Fig. 2).

The holotype of *G. janus* was collected by otter trawl in depths of 0–38.4 m, and the paratype by using dynamite in a reef area of depth of 1–3 m. The present Malaysian specimen of *G. janus* was found in the mouth of a holocentrid fish, *Myripristis botche* Cuvier, 1829 (KAUM–I. 190163), which was obtained at a local fish market in Kuantan. This suggests that *G. janus* inhabits rocky or coral reef environments along the east coast of Peninsular Malaysia. However, it is also possible that the *G. janus* specimen was accidentally present in the mouth of *M. botche* when it was captured. All fins of the *G. janus* specimen were damaged, and DNA extraction from its muscle tissue was unsuccessful, likely due to degradation by digestive enzymes, suggesting that the specimen had been in the stomach of *M. botche* for some time.

### ***Gymnapogon sagittarius* Yoshida, Kawai & Motomura, 2019**

New standard Malay name: Sebekah Panah

(Fig. 1B, C; Table 2)

**Material examined:** KAUM–I. 211650, 48.1 mm SL, KAUM–I. 212348, 56.3 mm SL, UMTF 13298, 58.8 mm SL, off southeast coast of Johor State, Malaysia (ca. 01°34'N, 104°30'E; obtained at fish landing port at Endau, Johor State), bottom trawl, 23 Sept. 2024, UMT and KAUM Fish Team.

**Identification.**— Counts and measurements of the present specimens are provided in Table 2. Specimen identification (Fig. 1B, C) was based on the following diagnostic characters given by YOSHIDA *ET AL.* (2019) for *G. sagittarius*: dorsal-fin rays VI–I, 9; anal-fin rays II, 8; pectoral-fin rays 14–15; pelvic-fin rays I, 5; developed gill rakers 11 or 12; total gill rakers (including rudiments) 12 or 13; narrow body, its depth 14.1–14.3% of SL; eye diameter 5.6–5.8% of SL; interorbital width 4.1–4.4% of SL; pelvic fin length 13.9–14.6% of SL; a single large spine at angle of preopercle; a silver stripe on mid-lateral body; black pigmentation absent on caudal-fin base; and all fins semi-translucent, without any distinct markings or pigmentation. Although several characters, including the number of pectoral-fin rays, differed between the present specimens and the type series ( $n = 8$ ), they were considered minor intraspecific variations.

*Gymnapogon sagittarius* is most similar to *G. velum*, known only from two type specimens from Australia. Both species are characterized by an elongate, slender body and well separated first and second dorsal fins. However, the former species has 9 dorsal-fin rays and 8 anal-fin rays, compared with 12 or 13 and 13, respectively, in the latter (FRASER, 2019; YOSHIDA *ET AL.*, 2019).

Table 2. Counts and measurements (% of SL) of specimens of *Gymnapogon sagittarius*.

|                                                            | This study        |                   |               | Yoshida <i>et al.</i> (2019)      |
|------------------------------------------------------------|-------------------|-------------------|---------------|-----------------------------------|
|                                                            | KAUM-I.<br>211650 | KAUM-I.<br>212348 | UMTF<br>13298 | Type specimens<br>( <i>n</i> = 8) |
| SL (mm)                                                    | 48.1              | 56.3              | 58.8          | 33.9–63.5                         |
| Counts                                                     |                   |                   |               |                                   |
| Dorsal-fin rays                                            | VI-I, 9           | VI-I, 9           | VI-I, 9       | VI-I, 9                           |
| Anal-fin rays                                              | II, 8             | II, 8             | II, 8         | II, 8                             |
| Pectoral-fin rays                                          | 14                | 15                | 14            | 16–17                             |
| Pelvic-fin rays                                            | I, 5              | I, 5              | I, 5          | I, 5                              |
| Gill rakers including rudiments                            | 2 + 11            | 2 + 11            | 2 + 10        | 2–3 + 10–11 = 12–13               |
| Developed gill rakers                                      | 1 + 10            | 1 + 11            | 1 + 10        | 1 + 9–10 = 10–11                  |
| Measurements (% of SL)                                     |                   |                   |               |                                   |
| Body depth                                                 | 14.3              | 14.2              | 14.1          | 12.0–15.1                         |
| Body width                                                 | 8.3               | 7.8               | 7.1           | 6.7–8.8                           |
| Head length                                                | 38.9              | 38.4              | 37.8          | 33.1–37.2                         |
| Eye diameter                                               | 5.8               | 5.7               | 5.6           | 5.2–6.1                           |
| Snout length                                               | 9.4               | 8.9               | 8.2           | 7.1–8.1                           |
| Interorbital width                                         | 4.4               | 4.1               | 4.4           | 3.7–4.4                           |
| Upper jaw length                                           | 15.8              | 15.3              | 14.6          | 13.0–14.3                         |
| Caudal peduncle depth                                      | 8.1               | 8.3               | 7.3           | 6.8–6.9                           |
| Caudal peduncle length                                     | 20.4              | 22.6              | 23.5          | 19.6–21.4                         |
| Pre-dorsal-fin length                                      | 38.7              | 39.0              | 38.4          | 36.9–38.7                         |
| Dorsal-fin base length                                     | 42.6              | 42.0              | 42.1          | 39.7–43.3                         |
| 1 <sup>st</sup> dorsal-fin spine length                    | damaged           | 8.7               | 8.0           | 7.0–9.8                           |
| 2 <sup>nd</sup> dorsal-fin spine length                    | damaged           | 9.6               | 9.4           | 8.0–10.9                          |
| 3 <sup>rd</sup> dorsal-fin spine length                    | 10.6              | 10.1              | 11.6          | 10.0–11.5                         |
| 4 <sup>th</sup> dorsal-fin spine length                    | damaged           | 9.6               | 10.4          | 8.3–10.3                          |
| 1 <sup>st</sup> spine length of 2 <sup>nd</sup> dorsal fin | 6.0               | damaged           | damaged       | 4.7–7.1                           |
| Longest dorsal-fin soft ray length                         | 12.8              | 12.2              | 12.5          | 9.4–10.9                          |
| Pre-anal-fin length                                        | 65.4              | 62.6              | 61.6          | 61.8–65.4                         |
| Anal-fin base length                                       | 14.8              | 14.5              | 15.3          | 14.2–15.1                         |
| 1 <sup>st</sup> anal-fin spine length                      | 3.3               | 3.0               | 3.2           | 2.0–2.9                           |
| 2 <sup>nd</sup> anal-fin spine length                      | damaged           | 6.2               | damaged       | 3.8–5.6                           |
| Longest anal-fin soft ray length                           | damaged           | damaged           | damaged       | 9.6–11.9                          |
| Pectoral-fin base length                                   | 3.5               | 3.5               | 3.6           | 3.2–4.0                           |
| Pectoral fin length                                        | 19.1              | 19.4              | 20.1          | 17.4–19.8                         |
| Pre-pelvic-fin length                                      | 32.9              | 30.4              | 30.3          | 29.0–30.6                         |
| Pelvic-fin spine length                                    | damaged           | 10.5              | damaged       | 8.6–10.6                          |
| Longest pelvic-fin soft ray length                         | 13.9              | 14.6              | 14.6          | 12.0–15.6                         |



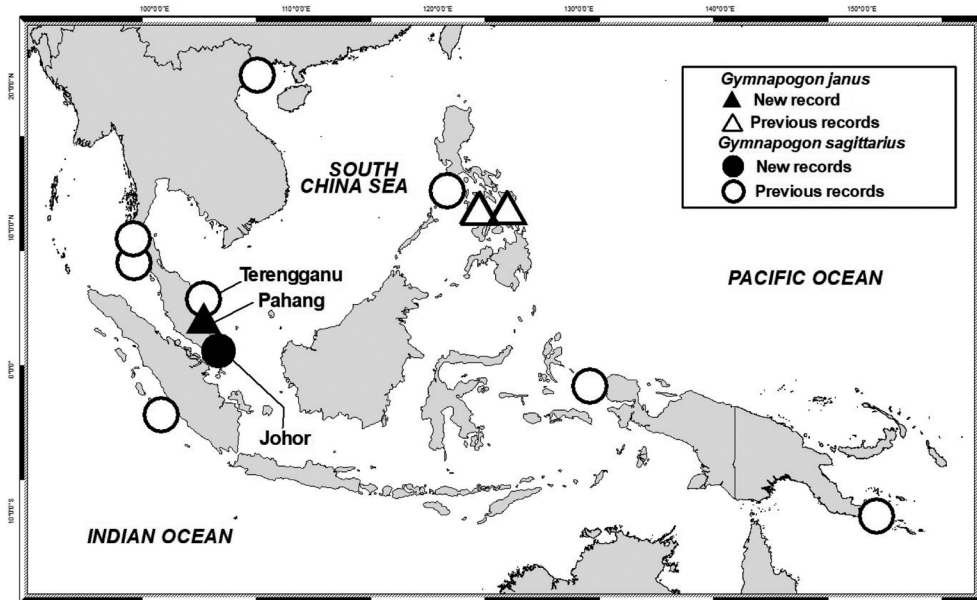


Figure 2. Distributional map of *Gymnapogon janus* (triangles) and *G. sagittarius* (circles). Black and white symbols indicate new and previous records, respectively. Previous records of *G. janus* based on Fraser (2016); those of *G. sagittarius* based on YOSHIDA ET AL. (2019), KUITER & KOZAWA (2019), GLOERFELT-TARP & KAILOLA (2022) and ALLEN & ERDMANN (2024).

**Distribution and habitat.**— *Gymnapogon sagittarius* has previously been recorded from the Andaman Sea coast of Thailand (Ranong and Phuket), northern Vietnam (Ha Long Bay), the South China Sea coast of Peninsular Malaysia (Terengganu State), the Philippines (Mindoro), Indonesia (West Sumatra, Raja Ampat Islands, and West Papua), and Papua New Guinea (Milne Bay) (YOSHIDA ET AL., 2019; KUITER & KOZAWA, 2019; GLOERFELT-TARP & KAILOLA, 2022; ALLEN & ERDMANN, 2024). Therefore, the present specimens collected off Johor State represent the first records of the species from that region, indicating that the species is widely distributed along the east coast of Peninsular Malaysia.

Although *G. sagittarius* has previously been known solely from a few trawled specimens (YOSHIDA ET AL., 2019; GLOERFELT-TARP & KAILOLA, 2022), KUITER & KOZAWA (2019) provided excellent underwater photographs of the species from Indonesia and Papua New Guinea. In addition, ALLEN & ERDMANN (2024) stated that the species inhabits burrows on soft mud bottoms in 10–35 m depth.

#### ACKNOWLEDGEMENTS

We thank H. Endo (Kochi University, Japan) for providing relevant literature; and G. Hardy (Ngunguru, New Zealand) for reading the manuscript and providing help with English. We also acknowledge the support and facilities provided by the Fisheries

Development Authority of Malaysia (LKIM), Fishermen Association, Universiti Malaysia Terengganu, South China Sea Repository and Reference Centre and International Islamic University Malaysia Kuantan. Specimen collection was done under the MyABS permit number 600206 together with research approvals from Kelantan State Economic Planning Unit, Terengganu State Economic Planning Unit, Pahang State Biodiversity Council and Johor state Economic Planning Division. This study was supported in part by Universiti Malaysia Terengganu (UMT) through a Strategic Research Grant (UMT/SRG/2023/55435); JSPS KAKENHI Grant Numbers 20H03311, 21H03651, 23K20304, and 24K02087 (HM), the JSPS Core-to-Core CREPSUM JPJSCCB20200009, and the “Establishment of Glocal Research and Education Network in the Amami Islands” project of Kagoshima University, adopted by the Ministry of Education, Culture, Sports, Science and Technology, Japan.

#### REFERENCES

- ALLEN, G. R., AND M. V. ERDMANN. 2024. *Reef Fishes of the East Indies. Second Edition. Volumes I–III*. Tropical Reef Research, Perth Australia. xii + 1466 pp.
- FRASER, T. H. 2016. A new species of cardinalfish (*Gymnapogon*, Gymnapogonini, Apogonidae, Percomorpha) from the Philippines. *Zootaxa* 4107: 431–438.
- FRASER, T. H. 2019. A new species of cardinalfish from Australia (Percomorpha: Apogonidae: *Gymnapogon*). *J. Ocean Sci. Found.* 32: 89–97.
- GLOERFELT-TARP, T., AND P. J. KAILOLA. 2022. *Trawled Fishes of Southern Indonesia and Northwestern Australia. Second Edition*. Australian Society for Fish Biology. vii + 422 pp. (Available from: <https://www.asfb.org.au/trawled-fishes-of-southern-indonesia-and-northwestern-australia>)
- GON, O., AND D. GOLANI. 2002. A new species of the cardinalfish genus *Gymnapogon* (Perciformes, Apogonidae) from the Red Sea. *Ichthyol. Res.* 49: 346–349.
- KUITER, R. H., AND T. KOZAWA. 2019. *Cardinalfishes of the World. New Edition*. Aquatic Photographics, Seaford and Anthias (Nexus), Okazaki. ii + 198 pp.
- MOTOMURA, H., AND S. ISHIKAWA (eds.). 2013. *Fish Collection Building and Procedures Manual. English Edition*. The Kagoshima University Museum, Kagoshima and the Research Institute for Humanity and Nature, Kyoto. 70 pp. (Available from: [http://www.museum.kagoshimau.ac.jp/staff/motomura/dl\\_en.html](http://www.museum.kagoshimau.ac.jp/staff/motomura/dl_en.html))
- QGIS DEVELOPMENT TEAM. 2021. *QGIS Geographic Information System. Open Source Geospatial Foundation Project*. Available from: <http://qgis.osgeo.org> (accessed on 2 December 2021)
- YOSHIDA, T., T. KAWAI, AND H. MOTOMURA. 2019. *Gymnapogon sagittarius*, a new species of cardinalfish (Perciformes: Apogonidae) from the South China Sea and Andaman Sea. *Ichthyol. Res.* 67: 92–97. <https://doi.org/10.1007/s10228-019-00706-9>