

**NEW DISTRIBUTION OF SPOTTED GARDEN EEL *Heteroconger guttatus*  
ALLEN, ERDMANN & MONGDONG, 2020 (ANGUILLIFORMES, CONGRIDAE,  
HETEROCONGRINAE) FROM SAPARUA ISLAND,  
THE MOLUCCAS, INDONESIA**

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## ABSTRACT

Two specimens of garden eel (384.3–398.0 mm total length) were collected from Saparua Island, the Moluccas, Indonesia, and identified as *Heteroconger guttatus* Allen, Erdmann & Mongdong, 2020. These specimens represent the westernmost record of this species, which was previously only known from its type locality in Venu Island, West Papua Province, Indonesia.

**Key words:** distribution, identification, meristics, morphometric, voucher specimens

## INTRODUCTIONS

The subfamily Heterocongrinae, or garden eels, comprises marine eels with distinctive ethological adaptations, living semi-buried and exposing only the head and anterior body above the sandy to muddy substrate in clear tropical waters at depths of 2–55 meters (Smith, 1989; Allen & Erdmann, 2009; Kakizaki et al., 2015; Ishikawa et al., 2022; Silva, 2024). This behavior enables them to swiftly retreat into their burrows, giving rise to a wave-like visual effect when the colony responds to external disturbance, serving as a form of defense mechanism (Allen & Erdmann, 2009).

The subfamily consists of two genera: *Gorgasia* with 14 species and *Heteroconger* with 23 species (Fricke et al., 2025). The latter is distinguished from the former by the following morphological characteristics: upper lip flange continuous, extending to the center of the snout tip; anterior nostril located on the flange, with an ethmoid pore above the flange; mouth short, smaller than eye diameter, sloping and not reaching the eye; mandible slightly protruding; jaws,

intermaxillae, and vomer with multiserial dentition; number of lateral-line pores proportional to vertebral count (Herre, 1923; Böhlke & Randall, 1981; Castle & Randall, 1999).

The majority of *Heteroconger* species are predominantly distributed in the Indo-Pacific region (Castle & Randall, 1999). At least 10 species have been recorded in Indonesian waters: *Heteroconger cobra* Böhlke & Randall, 1981, *Heteroconger enigmaticus* Castle & Randall, 1999, *Heteroconger hassi* Klausewitz & Eibl-Eibesfeldt, 1959, *Heteroconger mercyae* Allen & Erdmann, 2009, *Heteroconger perissodon* Böhlke & Randall, 1981, *Heteroconger fugax* Koeda, Fujii & Motomura, 2018, *Heteroconger polyzona* Bleeker, 1868, *Heteroconger taylori* Castle & Randall, 1995, *Heteroconger tricia* Castle & Randall, 1999, and *Heteroconger guttatus* Allen, Erdmann, & Mongdong, 2020 (Allen & Erdmann, 2024).

The distribution of the recently described *H. guttatus* is poorly known, as the species was previously only reported from the type locality in West Papua, eastern Indonesia (Allen et al., 2020). During an ichthyofaunal survey supported by the Faculty of Fisheries and Marine Science, Pattimura University, two specimens of *H. guttatus* were collected from the waters around Saparua Island in the Moluccas, Indonesia. These specimens are the first record of *H. guttatus* outside its type locality and thus extend the known distribution.

## MATERIALS AND METHODS

Preservation and curation of the two *Heteroconger guttatus* specimens, collected using a hand net at depths of 10–15 m in the Moluccas and subsequently deposited in the Museum Zoologicum Bogoriense (MZB, Cibinong), followed the protocols in Motomura and Ishikawa (2013). Identification and classification follow Allen et al. (2020). Methods of counting meristic traits and measuring morphometric traits follow Castle & Randall (1999) and Allen et al. (2020), while the terminology for head pores and vertebrae formula follow McCosker et al. (1989) and Allen et al. (2020). Total, snout–anus, and head lengths are abbreviated as TL, SAL and HL, respectively. The pores were observed using a stereo-microscope (Olympus S7X7). The vertebrae were counted from radiographs.

## RESULTS

Examination of two garden eel specimens collected from the coastal waters of Saparua Island, the Moluccas, Indonesia, revealed that both individuals are referable to *Heteroconger guttatus* Allen, Erdmann & Mongdong, 2020. A detailed morphological description, including measurements, counts, vertebral data, and coloration characteristics, is presented below,

confirming the taxonomic identity of the species and providing additional information on intraspecific variation.

***Heteroconger guttatus* Allen, Erdmann, & Mongdong, 2020**

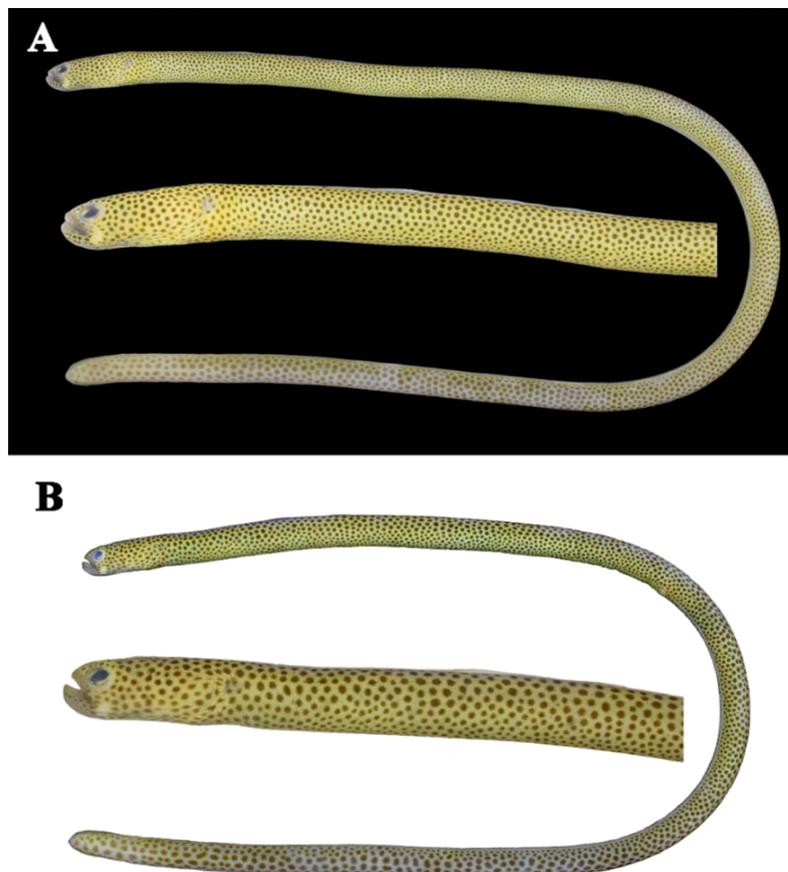
English common name: Spotted garden eel

New Indonesian name: Belut taman berbintik

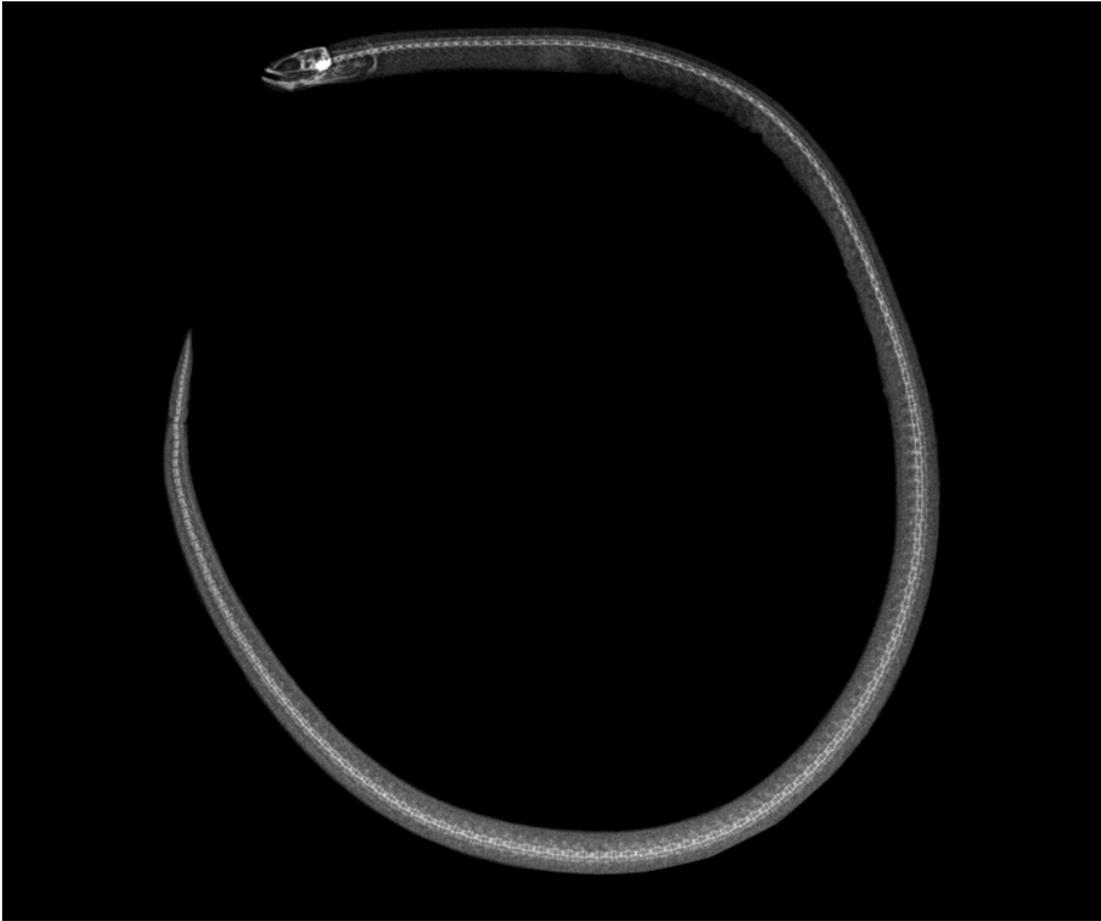
Figs. 1, 2, Table 1

**Material examined.** MZB (INA 842), 384.3 mm SL, MZB (INA 843), 398.0 mm SL, Saparua Island, Moluccas, Indonesia, 3°37'00"S, 128°37'32"E, 10–15 m depth, hand net, K. Wibowo, 10 Nov. 2023.

**Identification.** The morphological characters of specimens from Saparua Island (Figs. 1, 2) are in accordance with the diagnostic traits of *Heteroconger guttatus* as described by Allen et al. (2020). These include a slender body, with dorsal fin origin in front of the gill opening; the presence of pterygoid teeth; body depth at gill opening 38–39% HL; preanal lateral-line pores 63–64; preanal vertebrae 62–63; total vertebrae 169–172; body white to pale yellow, with a dense irregular pattern of small orange-brown to dark brown spots.



**Figure 1.** Fresh specimens of *Heteroconger guttatus* collected from Saparua Island, the Moluccas, Indonesia: (A) MZB (INA 842), 384.3 mm TL (B) MZB (INA 843), 398.0 mm TL.



**Figure 2.** Radiograph of *Heteroconger guttatus*, MZB (INA 843), 398.0 mm TL.

**Table 1.** Morphological measurements and meristic data of *Heteroconger guttatus*.

	This study n = 2	Allen et al. (2020) n = 42
Total length (mm)	384.3–398.0	188–442
Measurement (% TL)		
Snout-anus length	36.9–40.1	35.9–40.7
Measurement (% SAL)		
Predorsal length	9.7–9.8	8.9–12.7
Head length	13.7–14.6	10.3–15.7
Measurement (% HL)		
Snout length	12.1–12.3	10.9–19.1
Eye diameter	20.4–20.6	19.0–28.4

	This study n = 2	Allen et al. (2020) n = 42
Measurement (% HL)		
Fleshy interorbital	15.2–17.8	13.6–18.8
Mouth length	29.9–32.7	21.4–32.9
Gill opening	6.8–9.7	6.7–11.7
Branchial interspace	23.8–26.5	21.5–36.4
Pectoral fin length	7.6–7.9	5.5–8.7
Depth at gill opening	38.8–39.3	28.8–40.2
Depth at anus	35.5–36.5	26.8–37.7
Meristic counts		
Predorsal vertebrae	3–4	2–4
Preanal vertebrae	62–63	59–66
Total vertebrae	169–172	164–175
Lateral-line pores before pectoral fin	5–6	5–7
Lateral-line pores before anus	63–64	59–64
Total lateral-line pores	144–158	144–158
Dorsal fin rays before anus	159–179	158–179
Total dorsal fin rays	460–469	435–496
Anal fin rays	276–289	274–301
Pectoral fin rays	10–11	10–11
Supraorbital series	1+3	1+3
Infraorbital series	3+3	3+3
Preopercular-mandibular series	4+5	4+5
Supratemporal series	1+1	1+1

**Description.** Meristic counts and morphometric traits (expressed as ratios) are provided in Table 1. Vertebral formula 3–4 (predorsal)/62–63 (preanal)/169–172 (total vertebrae); lateral-line pores anterior to pectoral fin 5–6, anterior to anus 63–64, total 144–158; preanal dorsal fin rays 159–179, total 460–469; anal fin rays 276–289; pectoral fin rays 10–11; head pores (left side): supraorbital pores 1+3, infraorbital pores 3+3, preoperculomandibular pores 4+5, supratemporal pores 1+1.

Body elongated, slightly compressed anteriorly, increasingly compressed posteriorly; body depth greatest in pectoral fin region. Head slightly depressed, curved downwards at pectoral fin base. Anus at 35–40% TL from snout. Snout short, rounded; lower jaw projecting; lips well developed, upper lip confluent medially, covering anterior nostril and folded upwards and back over anterolateral face of snout; lower lip similarly folded downwards. Anterior nostril minute

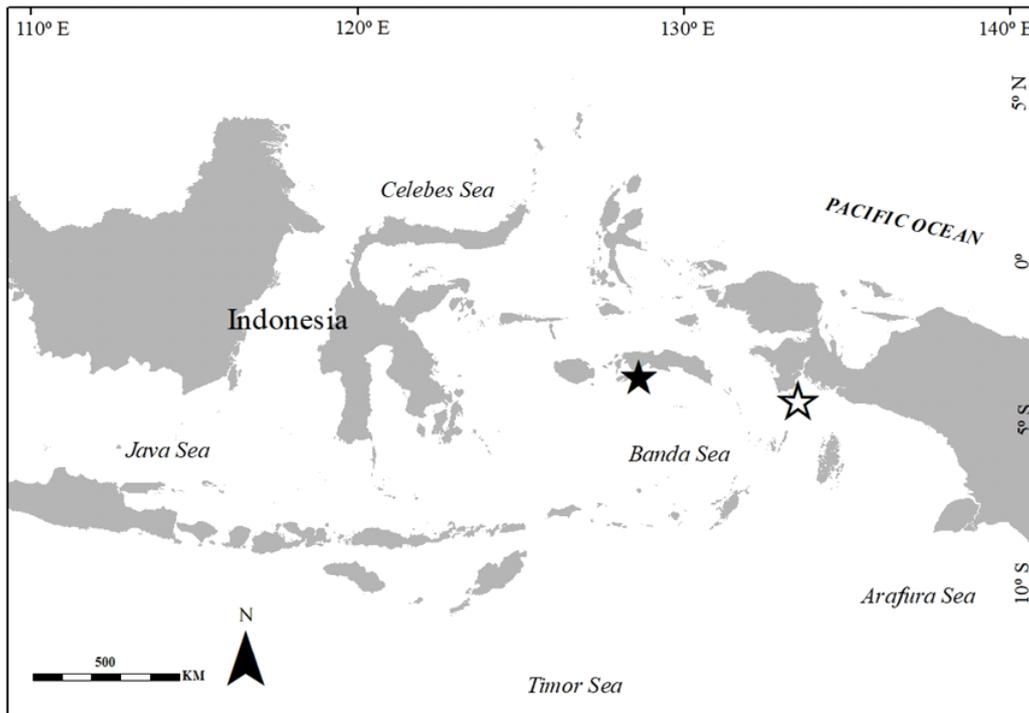
and tubular, near snout midline; posterior nostril opening simple and anterodorsal to orbit. Mouth oblique, posterior margin slanting downwards to below middle of pupil. Eye large, oval, slightly projecting dorsally above head profile. Throat folds moderately developed, extending to branchial opening. Gill opening oblique, anterior to pectoral fin base, ventral margin posterior to dorsal margin. Pectoral fin small, rounded. Dorsal fin low, origin anterior to gill opening; anal fin low. Caudal fin greatly reduced; bluntly pointed tail tip.

Head pores indistinct with rims slightly raised; lateral-line pores very small, becoming smaller posteriorly, making them difficult to count toward the posterior end of the body; total number of lateral-line pores fewer than number of vertebrae.

Jaws with numerous small teeth, slightly enlarged on pterygoid and posterior regions of vomer and maxillary. Maxillary with 5 rows of teeth anteriorly and one or two rows posteriorly. Dentary with 6 rows of teeth, regular at each side and irregular in middle. Anterior intermaxillary-vomer with 8 rows of teeth reduced to two rows posteriorly; length of intermaxillary-vomerine tooth patch approximately equal to length of maxillary patch. Pterygoid with biserial teeth.

**Fresh specimen coloration.** Head and body pale yellow with scattered small orange-brown to dark-brown spots in an irregular maze; body more densely spotted in dorsal and ventral than lateral regions; spots smaller ventrally. Dorsal and anal fins transparent. Iris pearly-white with a dark marginal band, broad and black dorsally, paler and faint ventrally. Lips well-developed, darker than body, grayish brown posteriorly. Small white blotch below eye extending downwards behind posterior margin of mouth.

**Distribution and habitat.** The specimens of *H. guttatus* were collected from clear waters off Saparua Island, the Moluccas, at depths of 10–15 m on a white sandy substrate extending seawards in front of a coastal mangrove belt. This record represents the westernmost occurrence of the species and extends its known distribution approximately 553 km west of the type locality in West Papua (Fig. 3).



**Figure 3.** Distribution records of *Heteroconger guttatus*; the white-filled star represents previous records (Allen et al., 2020) and the black-filled star represents the new record reported in this study.

## DISCUSSION

Although the morphological characters of the Moluccas specimens fully agree with the original description of *Heteroconger guttatus* (Allen et al., 2020), two characters cited in the generic diagnosis of *Heteroconger* (see Introduction), namely mouth length relative to eye diameter and the proportionality between lateral-line pores and vertebral counts, may appear variable. The statement “mouth short, smaller than eye diameter” should be interpreted as a generalized condition distinguishing *Heteroconger* from *Gorgasia*, rather than a strict metric applicable to all species. In several congeners, including *H. guttatus*, the oblique mouth may reach to below the anterior margin or middle of the pupil, with mouth length overlapping eye diameter (Castle & Randall, 1999; Allen et al., 2020). Likewise, the proportionality between vertebrae and lateral-line pores represents a general trend. In *H. guttatus*, total pore counts are consistently lower, partly due to the difficulty of observing minute posterior pores (Allen et al., 2020), a pattern also reported for *H. taylori* and *H. lentiginosus* (Castle & Randall, 1999). These variations appear to represent intrageneric variation within *Heteroconger*.

*Heteroconger guttatus* can be distinguished from other *Heteroconger* species by the combination of the color pattern and the number of vertebrae (Allen et al., 2020). The color pattern of *Heteroconger fugax* is similar to that of *H. guttatus*; however, the two species can be distinguished by the presence or absence of a prominent white blotch on the operculum, which

is a diagnostic characteristic of *H. fugax* (vs. no blotch in *H. guttatus*). In terms of meristic characters, there are clear differences between the two species; these include lacks pterygoid teeth (present in *H. guttatus*), the number of predorsal vertebrae (8 in *H. fugax* vs. 2–4 in *H. guttatus*), total number of vertebrae (197 vs. 169–172), number of dorsal fin rays (590 vs. 460–469), and number of anal fin rays (425 vs. 276–289) Furthermore, *Heteroconger fugax* lacks pterygoid teeth (vs. pterygoid teeth present in *H. guttatus*) (Koeda et al., 2018; Allen et al., 2020; this study).

Meanwhile, *Heteroconger tomberua* and *Heteroconger tricia* also have superficially similar color patterns, but they can be distinguished from *H. guttatus* by the size and number of spots on the side of the head. In *H. tomberua*, the spots tend to be large, close to pupil size, sparsely arranged, and number less than 15 (Castle & Randall, 1999) [vs. numerous smaller spots in *H. guttatus* (Allen et al., 2020; this study)]. In contrast, *H. tricia* has only one or two spots on the side of the head (Castle & Randall, 1999) [vs. multiple spots in *H. guttatus* (Allen et al., 2020; this study)]. *Heteroconger tomberua* and *H. tricia* also have a greater number of vertebrae than *H. guttatus* (188–210 vs 169–172), and are also characterized by a shorter mouth, with the posterior end of the mouth not extending beyond the anterior margin of the eye (Castle & Randall, 1999) [vs. posterior edge of mouth extending posteriorly to below and behind the anterior edge of the pupil (Allen et al. 2020; this study)]. Furthermore, *H. tomberua* and *H. tricia* lack pterygoid teeth (Castle & Randall, 1999), while these are present in *H. guttatus* (Allen et al., 2020; this study).

The vertebral counts of *Heteroconger guttatus* (164–175) fall within the overlapping range reported for *Heteroconger taylori* (169–172) and *H. hassi* (164–175) (Allen et al., 2020). The main diagnostic character for *H. taylori* is a body with comparatively large solid black spots which extend onto the dorsal fin [vs. body with scattered smaller brown to dark brown spots and only sparse markings on a transparent dorsal fin in *H. guttatus* (Allen et al., 2020; this study)]. In contrast, *H. hassi* is characterized by a denser spot pattern on the body, with three larger black patches, one in the area of the gill opening and pectoral fin, one in the mid-lateral body between the head and anus, and one around the anus [vs. lacking large black patches with only sparsely spaced scattered small brown spots in these regions in *H. guttatus* (Castle & Randall, 1999; Allen et al., 2020; Allen & Erdmann, 2024; this study)]. In addition, in *H. hassi* the dorsal fin origin is located above or slightly behind the gill opening [vs. dorsal fin origin distinctly anterior to the gill opening in *H. guttatus* (Castle & Randall, 1999; Allen et al., 2020; this study)].

At the type locality in West Papua, *H. guttatus* inhabits shallow sandy areas at depths of 13–25 m, with colonies occupying approximately 50–100 m<sup>2</sup> and consisting of about 50–100 individuals (Allen et al., 2020). The occurrence of *H. guttatus* at Saparua Island in depth and substrate conditions comparable to those reported from the type locality in West Papua suggests that the species may be more widely distributed across suitable sandy habitats in eastern Indonesia than previously recognized. The apparent rarity of *H. guttatus* may reflect sampling bias associated with its cryptic, burrow-dwelling behavior and limited survey effort in sandy habitats.

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