

Occurrence of *Baseodiscus quinquelineatus* (Quoy and Gaimard, 1833) (Pilidiophora: Heteronemertea) in Mindanao, Philippines

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The heteronemertean *Baseodiscus quinquelineatus* (Quoy and Gaimard, 1833) is identifiable by five black-or-brown longitudinal dorsal stripes and two same-colored ventral ones on a greyish or milky white body. This ribbon worm has a wide distribution in the Indo-West Pacific region. In the Philippines, the species was first reported from Gaspar Island, Marinduque in Luzon in the 19th century. In this article, we report the occurrence of this heteronemertean – identified by its external morphology – from the island of Mindanao in Carmen, Agusan del Norte. This is the first published record of *B. quinquelineatus* from Mindanao, making it the first ribbon worm species reported from this island.

Keywords: biogeography, distribution, first record, invertebrate, Lineidae, Nemertea

Members of the heteronemertean genus *Baseodiscus* Diesing, 1850 of the family Valenciniidae Hubrecht, 1879 can be identified by external morphology, mainly based on body color and markings (Kajihara *et al.* 2022). One of the ~ 60 congeners, *Baseodiscus quinquelineatus* (Quoy and Gaimard, 1833) is easily identifiable by having five brown-or-black longitudinal lines (hence “quinquelineatus” for having five lines/stripes) on the dorsal surface and two same-colored ones on the ventral surface. Individuals of this species can attain 6 m in length (Punnett 1900a). The entire body is grayish-white, the head is small and heart-shaped, and the posterior end of the body is obtuse (Gibson 1979; Kajihara *et al.* 2022; iNaturalist 2023). The most common combination of these lines/stripes is three on the dorsal side and two on the ventral side, which is observed in the nominal species *Borlasia quinquelineata* Quoy and Gaimard, 1833, *Eupolia trilineata* Staub, 1900, and *Taeniosoma*

aequale Stimpson, 1857. However, this combination of body lines/stripes varies in other nominal taxa; each of the stripes on both dorsal and ventral sides can be doubled (as in *Taeniosoma aequale*) or tripled (as in *Eupolia novemlineata* Bürger, 1893), or anteriorly tripled and posteriorly doubled (as in *Taeniosoma septemlineatum* Stimpson, 1857). Because of their external morphological features, these nominal species are considered conspecific with *B. quinquelineatus* (Quoy and Gaimard, 1833) (Gibson 1979; Kajihara *et al.* 2022).

Currently, *B. quinquelineatus* (Quoy and Gaimard, 1833) is widely distributed in the Indo-West Pacific: India (Venkataraman *et al.* 2012), Torres Straits (Punnett 1900a), Gulf of Thailand (Putchakarn 2009), Singapore (Bürger 1895; Punnett 1900b), Indonesia (Bürger 1893; Staub 1900), Philippines (Stimpson 1857), Japan (Stimpson 1857; Kajihara 2017; Kajihara *et al.* 2022), New Guinea (Quoy and Gaimard, 1833), Australia

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(Bürger 1895; Gibson 1979), Solomon Islands (Gibson and Sundberg 2002), New Caledonia (Punnett 1900c), and Hawaii (Gibson 1979).

In the Philippines, the first published record of *B. quinquelineatus* was made from Gaspar Island in Gasan, Marinduque Province in Luzon (Stimpson 1857). It was more than a century later when several nemerteans were collected during the Smithsonian Philippines Expedition in 1979 and 1989 and cataloged in the Smithsonian United States National Museum of Natural History (USNM). As of writing, a database search at the museum's website (<https://collections.nmnh.si.edu/>) for the collection in the Department of Invertebrate Zoology resulted in two records of *B. quinquelineatus*: USNM 80548, two fragments, Negros Island in Visayas, collector and collection date unknown, identified by R. Gibson in 1983; and USNM 80649, collected in Zamboanga del Norte in Mindanao by C. A. Child on 03 May 1979; so far as we are aware, no article has been published based on these specimens. Recently,

the species was reported from Sogod, Cebu based on an image made available by Poppe and Poppe (2009) at SeaLifeBase. In summary, *B. quinquelineatus* has been known from the Philippines by a single publication (Stimpson 1857) and a web article (Poppe and Poppe 2009); although unpublished museum specimen records based on material from Negros and Mindanao are present, no ribbon worm has previously been reported from the latter island in any scientific paper. Here, we report the occurrence of this heteronemertean in Carmen, Agusan del Norte in Mindanao, which represents the first published record for the species from this island, hence updating its known geographic distribution in the country (Figure 3).

A single specimen of *B. quinquelineatus* (Figure 1) was collected from a seagrass bed [dominated by *Cymodocea rotundata* Asch. and Schweinf., with some *Thalassia hemprichii* (Ehrenberg) Ascherson, 1871, *Halodule* sp., and *Halophila* sp. (Meñez *et al.* 1983)] (Figure 2B) in the littoral zone of Brgy. Vinapor, Carmen, Agusan del

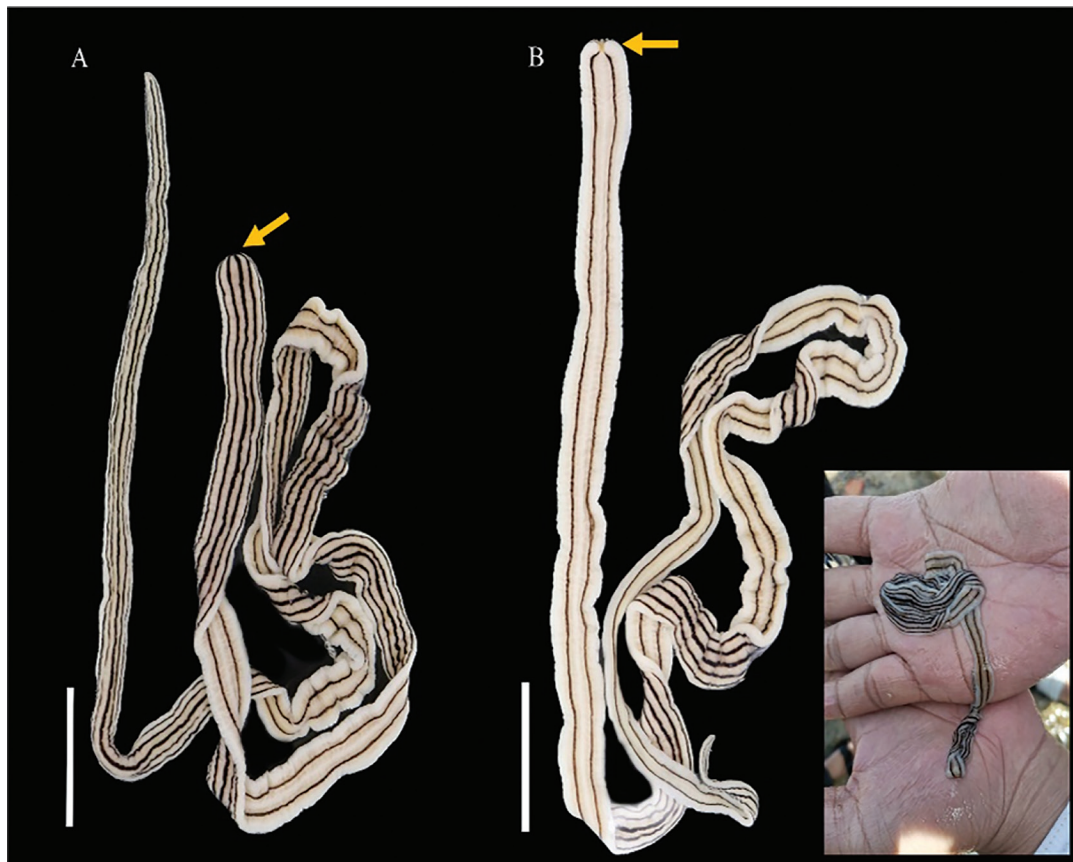


Figure 1. *Baseodiscus quinquelineatus* (Quoy and Gaimard, 1833) BIOCSU: 0001 from Carmen, Agusan del Norte showing most of the dorsal body [A] and most of the ventral side [B]. Arrow pointed at the decapitated anterior end of the worm. Inset is a photograph of the specimen taken on site after being extracted from its habitat. Scale bar: 2 cm. Photographs taken by Julius Anthony M. Leones and Shirlamaine Irina Calagui.



Figure 2. Collection site of *B. quinquelineatus* in Brgy. Vinapor, Carmen, Agusan del Norte [A] and the seagrass bed [B] from which the specimen was found and extracted. Photographs taken by Shirlamaine Irina Calagui and Israel Isaac Salo.

Norte (Figure 2A) (9.094°N, 125.211°E) on 13 May 2023. The specimen was broken anteriorly while being extracted from the seagrass bed, and the cut part was not recovered, rendering the specimen decapitated. After extraction, the live specimen was placed in a plastic bottle with seawater and brought to the Department of Biology, Caraga State University, and photographed using a Canon EOS 800D camera, and then the entire specimen was preserved in 99% ethanol.

The length of the decapitated specimen is approximately 40 cm, the anterior body diameter is 0.8 cm, and the posterior body diameter near its end is 0.4 cm, making the anterior wider than the posterior. The ground color is grayish-white on both dorsal and ventral sides; however, the ventral body is mostly pale brown in color, within which the two longitudinal stripes are embedded, with grayish-white coloration only on the margin (Figure 1). The dorsal surface presents five longitudinal continuous black stripes from the fragment's anterior to posterior

end (Figure 1A); two black longitudinal stripes are on the ventral surface (Figure 1B). Though the anterior end of the collected specimen was missing, its identification as *B. quinquelineatus* was still possible because it fits the external diagnostic characteristics for this species.

Ribbon-worm taxonomic studies are very limited in the Philippines, mainly due to the lack of researchers specializing in this taxon. Despite this limitation, ribbon worms have been reported from the country, mainly from the Luzon and Visayas regions, mainly by foreign researchers (Humes 1942; Collin and Arneson 1995; Gibson and Moore 1998; Kajihara 2007, 2020; Kajihara *et al.* 2007, 2011) but not from Mindanao. The *B. quinquelineatus* specimen reported herein was found during a faunal survey, specifically designed for intertidal ribbon worms in Panay and Mindanao. Further reports and species descriptions of potentially new species collected in this survey will be published separately in the future.

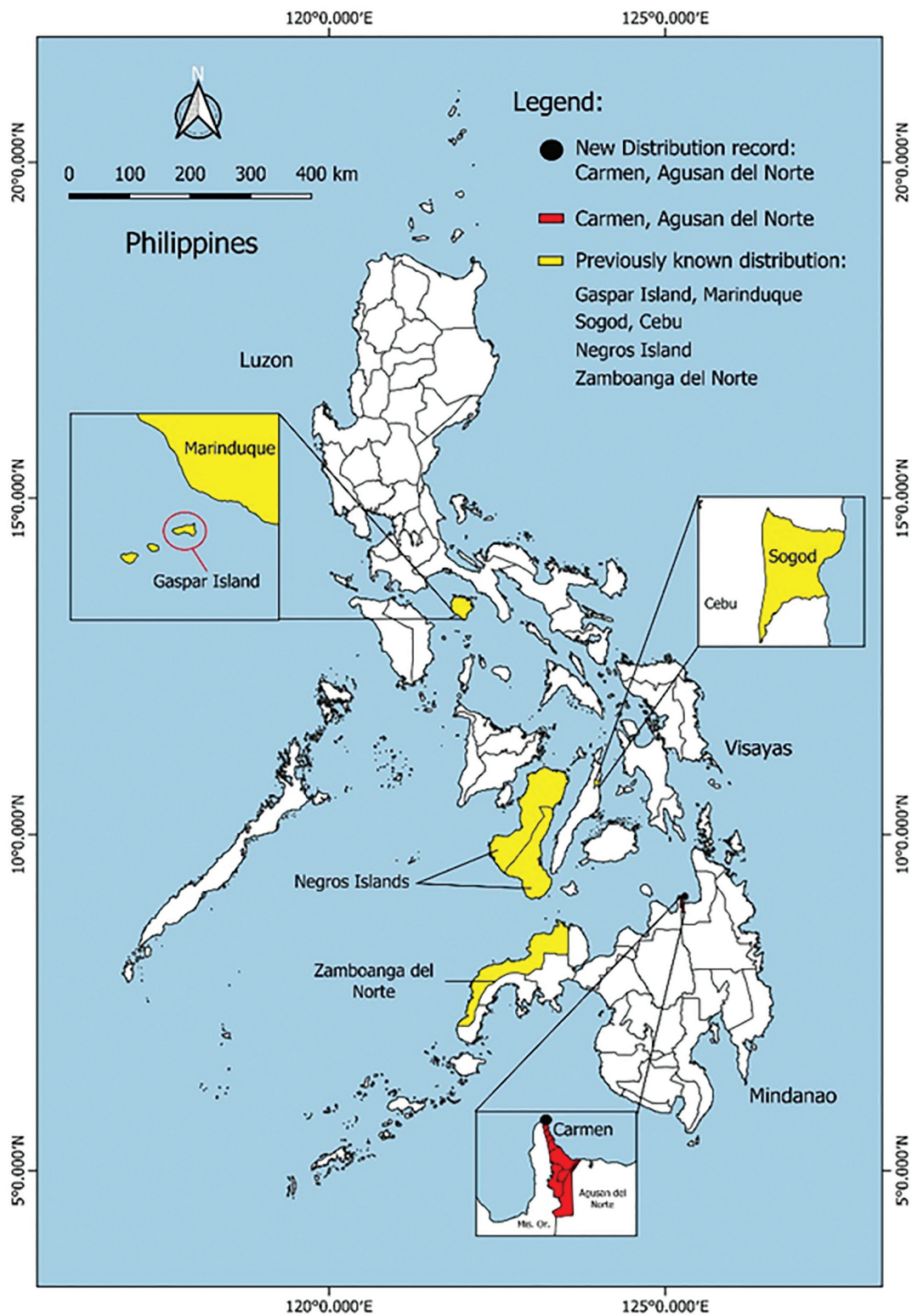


Figure 3. Updated distribution of *B. quinquelineatus* in the Philippines. Gaspar Island, Marinduque (Stimpson 1857); Negros Island (USMN 80548); Zamboanga del Norte (USMN 80649); Sogod, Cebu (Poppe and Poppe 2009) and Brgy. Vinapor, Carmen, Agusan del Norte (present study).

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REFERENCES

- ASCHERSON P. 1871. Die geographische Verbreitung der Seegräser. Petermanns Geographische Mitteilungen 17: 241–248.
- BÜRGER O. 1893. Südgeorgische und andere exotische Nemertinen. Zoologische Jahrbücher, Abteilung für Systematik, Ökologie und Biologie der Tiere 7: 207–240, pls. 8, 9.
- BÜRGER O. 1895. Beiträge zur Anatomie, Systematik und geographischen Verbreitung der Nemertinen. Zeitschrift für Wissenschaftliche Zoologie 61: 16–37, pls. 2–3.
- COLIN PL, ARNESON C. 1995. Tropical Pacific invertebrates: a field guide to the marine invertebrates occurring on tropical Pacific coral reefs, seagrass beds, and mangroves. Beverly Hills: Coral Reef Press. 684p.
- DIESING CM. 1850. Systema helminthum, Vol. 1. Vienna: W. Braumüller. 243p.
- GIBSON R. 1979. Nemerteans of the Great Barrier Reef 2. Anopla Heteronemertea (Baseodiscidae). Zoological Journal of the Linnean Society 66: 137–160.
- GIBSON R, MOORE J. 1998. Further observations on the genus *Geonemertes* with a description of a new species from the Philippine Islands. Hydrobiologia 365: 157–171.
- GIBSON R, SUNDBERG P. 2002. Some heteronemerteans (Nemertea) from the Solomon Islands. Journal of Natural History 36: 1785–1804.
- HUBRECHT AAW. 1879. The genera of European nemerteans critically revised, with description of several new species. Notes from the Leyden Museum 1: 193–232.
- HUMES AG. 1942. The morphology, taxonomy, and bionomics of the nemertean genus *Carcinonemertes*. Illinois Biological Monographs 18: 1–105.
- iNaturalist. 2023. *Baseodiscus quinquelineatus*. Retrieved on 07 Jul 2023 from https://www.inaturalist.org/observations?place_id=any&taxon_id=1074868
- KAJIHARA H. 2007. *Callinera emiliae* sp. nov. (Nemertea: Palaeonemertea) from Negros Island, the Philippines. Zootaxa 1454: 39–47.
- KAJIHARA H, OLYMPIA MY, GOMEZ-DELAN G, QUILANTANG MB, SHIMOMURAM, TANIYAMA S, ASAKAWA M. 2007. Preliminary report on the nemertean fauna (phylum Nemertea) in the Philippines. UPV Journal of Natural Sciences 12: 123–128.
- KAJIHARA H, OLYMPIA M, KOBAYASHI N, KATO H, CHEN HX, STRAND M, SUNDBERG P. 2011. Systematics and phylogeny of the hoplonemertean genus *Diplomma* (Nemertea) based on molecular and morphological evidence. Zoological Journal of the Linnean Society 161(4): 695–722.
- KAJIHARA H. 2017. Species diversity of Japanese ribbon worms (Nemertea). In: Species diversity of animals in Japan. Motokawa M, Kajihara H eds. Tokyo: Springer Japan. p. 419–444.
- KAJIHARA H. 2020. Three species of ribbon worms (Nemertea) from Cebu, the Philippines. Species Diversity 25(2): 251–273.
- KAJIHARA H, ABUKAWA S, CHERNYSHEV AV. 2022. Exploring the basal topology of the heteronemertean tree of life: establishment of a new family, along with turbotaxonomy of Valenciniidae (Nemertea: Pilidiorhina: Heteronemertea). Zoological Journal of the Linnean Society 196(1): 503–548.
- MEÑEZ EG, PHILIPPIPS RC, CALUMPONG HP. 1983. Seagrasses from the Philippines. Smithsonian Contributions to the Marine Sciences 21: 1–40.
- POPPE G, POPPE P. 2009. *Baseodiscus quinquelineatus*. Retrieved on 17 May 2023 from <https://www.sealifebase.se/photos/PicturesSummary.php?ID=88092&what=species>
- PUTCHAKARN S. 2009. Biodiversity of marine invertebrates dwelling in the coral reefs along the Gulf of Thailand. Retrieved on 17 May 2023 from https://www.jsps.go.jp/english/e-astrategy/date/07_asia-horcs_03_p2/session1/s1-15_Sumaitt.pdf

- PUNNETT RC. 1900a. On some nemerteans from Torres Straits. Proceedings of the General Meetings for Scientific Business of the Zoological Society of London 68: 825–831.
- PUNNETT RC. 1900b. On a collection of nemerteans from Singapore. Quarterly Journal of Microscopical Science 44: 111–139.
- PUNNETT RC. 1900c. On some South Pacific nemertines collected by Dr Willey. Zoological Results Based on Material from New Britain, New Guinea, Loyalty Islands and Elsewhere, Collected during the Years 1895, 1896, and 1897 by Arthur Willey 5: 569–584.
- QUOY JRC, GAIMARD JP. 1833. Voyage de découvertes de l’Astrolabe exécuté par ordre du Roi, pendant les années 1826–1827–1828–1829, sou le commandement de M.J. Dumont d’Urville, Zoologie, tome quatrième. Paris: Tastu. 285p.
- STAUB J. 1900. Neue Nemertinen aus Amboina. Denkschriften der Medicinisch-Naturwissenschaftlichen Gesellschaft zu Jena 8: 591–614 [75–98 in an alternative pagination].
- STIMPSON W. 1857. Prodromus descriptionis animalium evertibratorum, quae in Expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federata missa, Cadwaladaro Ringgold et Johanne Rodgers Ducibus, observavit et descripsit. Pars. II. Turbellarieorum nemertineorum, generum et specierum adhuc ineditarum descriptiones; adjunctis notis de generibus jam constitutis. Proceedings of the Academy of Natural Sciences of Philadelphia 9: 159–165.
- VENKATARAMAN K, RAGHUNATHAN C, RAGHURAMAN R, SREERAJ CR. 2012. Marine biodiversity in India. Kolkata: Zoological Survey of India. 64p.