

First record of hydrozoan genera *Eucheilota* McCrady, 1859 and *Mitrocomella* Haeckel, 1879 and species *Porpita porpita* (Linnaeus, 1758) and *Physalia physalis* (Linnaeus, 1758) in Bali, Indonesia

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Abstract

This report documents the first record of the genera *Eucheilota* and *Mitrocomella* and species *Porpita porpita* and *Physalia physalis* in Bali, Indonesia, based on observed occurrences in different times and sites. The coincidence of the annual stranding of *Physalia physalis* in the east Bali and south Java coasts during the monsoon periods in Indonesia suggests a link with the upwelling events in the areas. However, more work is needed to analyse this phenomenon and study the occurrences of other Hydromedusae due to the limited data on hydrozoans in Indonesian waters. Overall, this report provides primary data to contribute to the general understanding of the biodiversity of marine organisms in Indonesia.

Keywords

Eucheilota, *Mitrocomella*, *Porpita porpita*, *Physalia physalis*, Hydromedusae, Bali

Introduction

Class Hydrozoa (Phylum Cnidaria) encompasses two subclasses, Hydroidolina and Trachylinae. Hydroidolina contains the orders Anthoathecata, Leptothecata and Siphonophorae, with 118 families, whereas Trachylinae contains the orders Actinulida, Limnomedusae, Narcomedusae and Trachymedusae with a total of 28 families. Many hydrozoans have not been properly identified as species (Miglietta et al. 2008). Precise identification often requires observations of a live adult specimen and knowledge

of the complete life stage. However, the small size of the medusa makes it easy to escape from plankton net/collecting tools and the similar appearance of the juvenile medusa between species and genera renders identification challenging. Despite the vast diversity of this group, hydrozoan medusae (Hydromedusae) play an important role in shaping marine ecology through their feeding habit. They serve as a potential predator of fish eggs and larvae and as a competitor for other marine organisms that compete for similar prey with them, such as zooplanktivores (Purcell 2003, Marques et al. 2017). The ability to survive in various environmental conditions such as low ecological quality, raises their capacity to predate and compete. Therefore, it is necessary to identify the species and their roles in the marine ecosystem.

Most hydrozoan species reported are native to tropical and temperate seas in the Pacific, Atlantic and Indian Oceans. However, only species from the Mediterranean Sea are well studied (Boero et al. 2005, Zenetos et al. 2005, Gravili et al. 2013). According to the map of the world's study areas of jellyfish by Brotz et al. (2012), there is limited information on jellyfish in the seas around Southeast Asia, despite the high biodiversity in the region. Studies have reported that the diversity of jellyfish in Indonesian waters mainly consists of scyphozoans: *Crambione mastigophora* in Saleh Bay, Nusa Tenggara Island (Asrial et al. 2015), *Crambionella helmbiru* in southern waters of Central Java (Nishikawa et al. 2015), *Mastigias papua*, *Cassiopeia ornata* and *Aurelia aurita* in marine Lakes in Berau region, East Kalimantan, as well as Cubozoa (*Tripedalia cystophora*) (Cleary et al. 2016). Regarding hydrozoan diversity in Indonesia, order Filifera has been reported in Bali waters by Cairns and Hoeksema (1998) and the polyp of *Clytia linearis* in Kei Islands has been described by Schuchert (2003), but they are mainly in polyp forms.

The limited data on jellyfish diversity around Indonesian waters, particularly for Hydromedusae, is not only due to the inconspicuous presence of this organism, but also likely related to the developing Indonesian economy compared to other countries in the region, thus leading to neglect in understanding the local marine environment. This study reports the observations of four Hydromedusae, *Eucheilota* McCrady, 1859 from the Lovenellidae family, *Mitrocomella* Haeckel, 1879 from the Mitrocomidae family, *Porpita porpita* (Linnaeus, 1758) from the Porpitidae family and *Physalia physalis* (Linnaeus, 1758) from the Physaliidae family, in Bali waters. This report provides primary data to contribute to the species checklist of marine organisms in Indonesia.

Results

Four Hydromedusae were observed at different times and sites (Fig. 1). The observations of *Porpita porpita* and *Physalia physalis* were based on a beach stranding in Semawang Beach (115°15'49.02156"E, 8°42'29.11284"S) on 8 July 2020, whereas *Eucheilota* and *Mitrocomella* were collected using a beaker from a boat that was moving relatively slowly along Selini Beach on 3 April 2021 (114°39'25.67196"E, 8°8'25.40004"S). The specimens were collected, photographed and identified to the genera level for *Eucheilota* and *Mitrocomella* and species-level for *Physalia physalis* and *Porpita porpita*.

The specimen with medusa having a hemispherical shape has distinct black spots in the perradial bulbs and four radial canals could only be identified to the genus level as *Euceilota*, based on Bouillon et al. (2006) (Fig. 2 and Fig. 3). The specimen with a hemispherical medusa, four radial canals, gonads located in the middle of the radial canals, 16 marginal tentacles with basal bulbs and cirri between the tentacles was identified as *Mitrocomella*, based on Schuchert (2017) and Bouillon et al. (2006) (Fig. 4 and Fig. 5). The species that is bright blue (adult) or yellow (young), disc-shaped, upper surface nearly flat, free-floating, no sail, a single mouth beneath the float, tentacles on the margin of the disc was identified as *Porpita porpita* according to Schuchert (2010) (Fig. 6). Furthermore, *P. physalis* was identified following Totton (1960) as having a sail-shaped bluish-pinkish colour, free-floating and all zooids being submersible (Fig. 7). Both *Physalia physalis* and *Porpita porpita* have a pneumatophore structure that allows them to float on the sea surface and comprise hydroid colonies (zooids) with specialised functions (Fig. 8). There were 114 individuals of *Physalia physalis* and ten individuals of *Porpita porpita* collected, consisting of six blue and four yellow individuals. The collected *P. physalis* specimens measured 0.7-5.4 cm in length from the top of the crest to the tip of the longest tentacle (Fig. 9). Unlike the floating Hydromedusae, *Euceilota* and *Mitrocomella* actively swim on the sea surface using the muscle contractions of the bell. The author did not count the exact number of *Euceilota* and *Mitrocomella* as these organisms were spotted amongst ctenophores.

Discussion

According to the local people, *P. physalis* had been washed ashore since the end of June 2020, with each beach stranding event lasting approximately two weeks. Nevertheless, the observation conducted at the same site from June to August 2021 resulted in no stranded *Porpita porpita* and *Physalia physalis* being seen. In addition, similar findings were also reported by the beach guards along the southern coasts of the Special Region of Yogyakarta Province, which has annual stinging cases of the stranded *P. physalis*, except in 2021. The period of strandings of *P. physalis* in these areas is the same as in the east Bali coasts. The local media in Bali started reporting the massive stranding of *P. physalis* (Fig. 10) since 2005 and it has become an annual phenomenon on the east coasts of Bali during June-August; however, there were no scientific data provided prior to this study. As pleuston, these organisms are driven by wind and ocean currents (Pandya et al. 2013). Thus their presence can be suggested to have been carried from somewhere along with the wind direction. There is south-easterly winds from the Australian continent to the equator during these months that reaches maximum wind speeds in June–August (Chang 2004, Chang et al. 2005, Wheeler and McBride 2005). This is also likely why these species have not been observed (nor reported by the fishermen and local people) in the northern part of Bali island.

Mitrocomella is abundant in plankton communities and can even become the major species in gelatinous plankton communities in the Arctic (Stepanjants 1989), temperate (Lock et al. 1999, Buecher and Gibbons 2000, Widmer 2004, Dutto et al. 2019) and tropical

waters (Chunguang et al. 2018). As known in a few members of the genus, *Mitrocomella* can disperse in its life phases (medusae and hydroid), enabling it to occupy many marine environments. At the same time, the polyp of *Eucheilota* is highly tolerant to various environmental conditions, such as high salinity (Vannucci et al. 1970) and different temperatures (Altuna 2009). Thus, some of its members, including *E. menoni*, are invasive species in Atlantic and European waters (Altuna 2009). The observed medusa *Mitrocomella* in this study tend to be overlooked due to the white to transparent colour; in contrast, *Eucheilota* has noticeable medusae with four distinct black spots in the perradial bulbs. *Eucheilota* and *Mitrocomella* in Selini Beach in early April are presumably related to the relatively weak winds in these months due to the inter-monsoon periods in Indonesia (Chang 2004, Chang et al. 2005, Wheeler and McBride 2005), whereas other studies have revealed the appearances of these Hydromedusae during upwelling events (Pages et al. 1991; Miglietta et al. 2008). However, more investigation into the environmental effects that shape the dynamics of these Hydromedusae is needed. Despite the Hydromedusae in this report being native and common to tropical and subtropical seas in the Pacific, Atlantic and Indian seas (Bouillon and Barnett 1999, Zhang et al. 1999, Calder et al. 2003, Kirkendale and Calder 2003, Kubota and Tanase 2007, Calder 2010, Gul and Gravili 2014, Chunguang et al. 2018), data to indicate their presence in Bali waters, as well as in Indonesia waters, remain limited. Hence, to the best of the author's knowledge, this is the first scientific record of the observed occurrence of *Porpita porpita*, *Physalis physalis*, *Eucheilota* and *Mitrocomella* in Bali waters.

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Conflicts of interest

The author declares that there is no conflict of interest.

References

- Altuna A (2009) *Eucheilota menoni* Kramp, 1959 (Cnidaria: Hydrozoa: Lovenellidae), an Indo-Pacific species new to the Atlantic fauna from the bay of Biscay (north of Spain). *Aquatic Invasions* 4 (2): 353-356. <https://doi.org/10.3391/ai.2009.4.2.7>
- Asrial E, Prajitno A, Susilo E, Bintoro G (2015) Biology and blooms of the edible jellyfish (*Crambione mastigophora*) in the Saleh Bay, Indonesia. *Journal of Biodiversity and Environmental Sciences* 6 (6): 356-369.
- Boero F, Di Camillo C, Gravili C (2005) Phantom aliens in Mediterranean waters. *Aquatic Invasions MarBEF Newsletter* 3: 21-22.
- Bouillon J, Barnett T (1999) The marine fauna of New Zealand: Hydromedusae (Cnidaria: Hydrozoa). *NIWA Biodiversity Memoirs* 113: 1-136.
- Bouillon J, Gravili C, Pagès F, Gili JM, Boero F (2006) An introduction to Hydrozoa. *Muséum national d'Histoire naturelle* 591 p.
- Brotz L, Cheung WW, Kleisner K, Pakhomov E, Pauly D (2012) Increasing jellyfish populations: trends in large marine ecosystems. In: Purcell J, Mianzan H, Frost JR. (Eds.) *Jellyfish Blooms IV. Developments in Hydrobiology*, 220. Springer, Dordrecht, 3-20 pp. [ISBN 978-94-007-5316-7] https://doi.org/10.1007/978-94-007-5316-7_2
- Buecher E, Gibbons MJ (2000) Interannual variation in the composition of the assemblages of medusae and ctenophores in St. Ecosystem. *Scientia Marina* 64 (Suppl 1): 123-134. <https://doi.org/10.3989/scimar.2000.64s1123>
- Cairns SD, Hoeksema BW (1998) *Distichopora vervoorti*, a new shallow-water stylasterid coral (Cnidaria: Hydrozoa: Stylasteridae) from Bali, Indonesia. *Zoologische Verhandelingen* 323 (24): 311-318.
- Calder D, Mallinson J, Collins K, Hickman C (2003) Additions to the hydroids (Cnidaria) of the Galápagos, with a list of species reported from the islands. *Journal of Natural History* 37 (10): 1173-1218. <https://doi.org/10.1080/00222930110116039>
- Calder DR (2010) Some anthoathecate hydroids and limnopolyps (Cnidaria, Hydrozoa) from the Hawaiian archipelago. *Zootaxa* 2590 (1): 1-91. <https://doi.org/10.11646/zootaxa.2590.1.1>
- Chang CP (2004) *East Asian monsoon*. 2. World Scientific, Singapore, 572 pp. [ISBN 981-238-769-2] <https://doi.org/10.1142/5482>
- Chang CP, Wang Z, McBride J, Liu CH (2005) Annual cycle of Southeast Asia-maritime continent rainfall and the asymmetric monsoon transition. *Journal of Climate* 18 (2): 287-301. <https://doi.org/10.1175/JCLI-3257.1>
- Chunguang W, Zhenzu X, Donghui G, Jiaqi H, Mao L (2018) Taxonomic notes on Hydroidomedusae (Cnidaria) from the South China Sea V: Families Laodiceidae, Lovenellidae, Malagazziidae, and Mitrocomidae (Leptomedusae). *Acta Oceanologica Sinica* 37 (10): 104-111. <https://doi.org/10.1007/s13131-018-1309-y>
- Cleary DF, Becking LE, Polónia AR, Freitas RM, Gomes N (2016) Jellyfish-associated bacterial communities and bacterioplankton in Indonesian Marine lakes. *FEMS microbiology ecology* 92 (5): 1-14. <https://doi.org/10.1093/femsec/fiw064>
- Dutto MS, Chazarreta CJ, Rodríguez CS, Schiariti A, Diaz Briz LM, Genzano GN (2019) Macroscale abundance patterns of hydromedusae in the temperate Southwestern

Atlantic (27-56 S. PLOS One 14 (6): 0217628. <https://doi.org/10.1371/journal.pone.0229678>

- Gravili C, Di Camillo CG, Piraino S, Boero F (2013) Hydrozoan species richness in the Mediterranean Sea: past and present. *Marine Ecology* 34: 41-62. <https://doi.org/10.1111/maec.12023>
- Gul S, Gravili C (2014) On the occurrence of *Porpita porpita* (Cnidaria: Hydrozoa) at Pakistan coast (north Arabian Sea). *Marine Biodiversity Records* 7 <https://doi.org/10.1017/S1755267214000189>
- Kirkendale L, Calder DR (2003) Hydroids (Cnidaria: Hydrozoa) from Guam and the commonwealth of the Northern Marianas Islands (CNMI). *Micronesica* 35 (36): 159-188.
- Kubota S, Tanase H (2007) Exceptional winter strandings of *Porpita pacifica* (Chondrophora, Porpitiidae) in Tanabe Bay, Wakayama Prefecture, Japan. *Nanki Seibutu* 49: 41-42.
- Lock KO, Beyst BR, Mees J (1999) Circadian patterns in the tidal plankton of a sandy beach in Zeebrugge (Belgium). *Belgian Journal of Zoology* 129 (2): 339-352.
- Marques F, Angélico MM, Costa JL, Teodósio MA, Presado P, Teodósio MA, Presado P, Fernandes A, Chainho P, Domingos I (2017) Ecological aspects and potential impacts of the non-native hydromedusa *Blackfordia virginica* in a temperate estuary. *Estuarine, Coastal and Shelf Science* 197: 69-79. <https://doi.org/10.1016/j.ecss.2017.08.015>
- Miglietta MP, Rossi M, Collin R (2008) Hydromedusa blooms and upwelling events in the Bay of Panama, Tropical East Pacific. *Journal of Plankton Research* 30 (7): 783-793. <https://doi.org/10.1093/plankt/fbn038>
- Nishikawa J, Ohtsuka S, Mujiono N, Lindsay DJ, Miyamoto H, Nishida S (2015) A new species of the commercially harvested jellyfish *Crambionella* (Scyphozoa) from central Java, Indonesia with remarks on the fisheries. *Journal of the Marine Biological Association of the United Kingdom* 95 (3): 471-481. <https://doi.org/10.1017/S002531541400157X>[\[Opens in a new window\]](#)
- Pandya K, Parikh K, Dave C, Mankodi P (2013) Occurrence of hydrozoans from the Saurashtra Coast of Gujarat, India. *Research Journal of Marine Sciences* 1 (4): 1-3.
- Purcell JE (2003) Predation on zooplankton by large jellyfish, *Aurelia labiata*, *Cyanea capillata* and *Aequorea aequorea*, in Prince William Sound, Alaska. *Marine Ecology Progress Series* 246: 137-152. <https://doi.org/10.3354/meps246137>
- Schuchert P (2003) Hydroids (Cnidaria, Hydrozoa) of the Danish expedition to the Kei Islands. *Steenstrupia* 27 (2): 137-256.
- Schuchert P (2010) The European athecate hydroids and their medusae (Hydrozoa, Cnidaria): Capitata Part 2. *Revue Suisse de Zoologie* 117: 337-555. <https://doi.org/10.5962/bhl.part.117793>.
- Schuchert P (2017) Systematic notes on some leptomedusa species with a description of *Neotima galeai* n. spec. Hydrozoa, Cnidaria). *Rev. Suisse Zool* 124: 351-375.
- Stepanjants SD (1989) Hydrozoa of the Eurasian Arctic Seas. In: Herman Y (Ed.) *The Arctic Seas*. 1. Springer, Boston, MA, 397-430 pp. [ISBN 978-1-4613-0677-1]. https://doi.org/10.1007/978-1-4613-0677-1_16
- Totton AK (1960) Studies on *Physalia physalis* (L.). Part 1. Natural history and morphology. *Discovery Reports* 30: 301-368.
- Vannucci M, Santhakumari V, Dos Santos E (1970) The ecology of hydromedusae from the Cochin area. *Marine Biology* 7 (1): 49-58. <https://doi.org/10.1007/BF00346808>

- Wheeler M, McBride J (2005) Australian-Indonesian monsoon. In: Intraseasonal variability in the atmosphere-ocean climate system. Springer, Berlin, Heidelberg, 125-173 pp. [ISBN 978-3-540-27250-2] https://doi.org/10.1007/3-540-27250-X_5
- Widmer CL (2004) The hydroid and early medusa stages of *Mitrocoma cellularia* (Hydrozoa, Mitrocomidae. Marine Biology 145: 315-321. <https://doi.org/10.1007/s00227-004-1322-x>
- Zenetos A, Çinar M, Pancucci-Papadopoulou M, Harmelin J, Furnari G, Andaloro F, Bellou N, Streftaris N, Zibrowius H (2005) Annotated list of marine alien species in the Mediterranean with records of the worst invasive species. Mediterranean Marine Science 6 (2): 63-118. <https://doi.org/10.12681/mms.186>
- Zhang J, Xu Z, Wang Y, Chen Y (1999) Hydromedusae and Siphonophora in western waters of Taiwan Island during winter and spring. Journal of Oceanography in Taiwan Strait 18: 76-82.

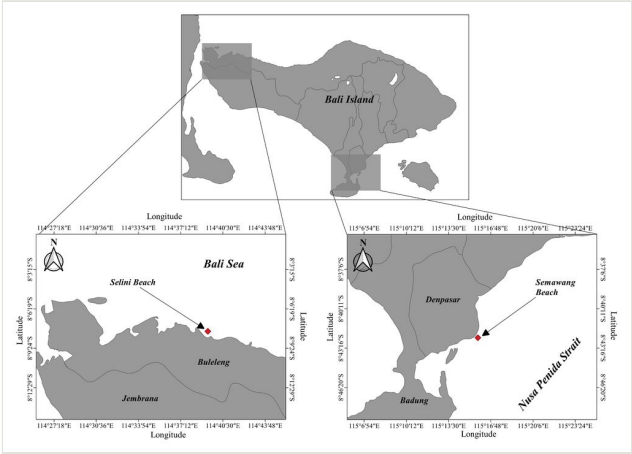


Figure 1.

Map showing the *Porpita porpita* and *Physalia physalis* (115°15'49.02156"E, 8°42'29.11284"S), *Eucheilota* and *Mitrocomella brownei* (114°39'25.67196"E, 8°8'25.40004"S).



Figure 2.

Eucheilota spotted on Selini Beach, Buleleng Regency, Bali Island. Lateral view of the medusae. Note the four periradial bulbs with a distinct black spot.

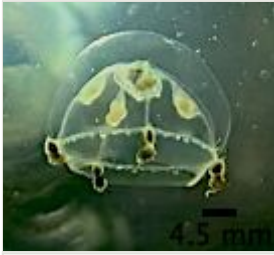


Figure 3.

Eucheilota spotted on Selini Beach, Buleleng Regency, Bali Island. Lateral view of the medusae.



Figure 4.

Mitrocomella spotted on Selini Beach, Buleleng Regency, Bali Island. Lateral view of the medusae.

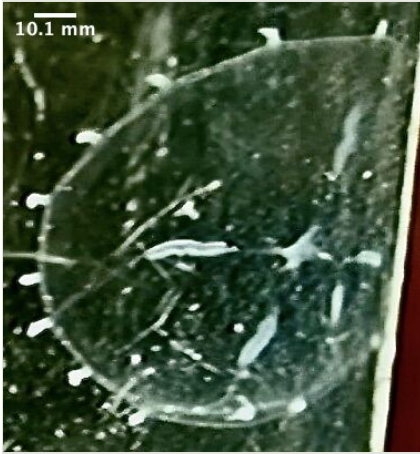


Figure 5.

Mitrocomella spotted on Selini Beach, Buleleng Regency, Bali Island. Ventral view of the medusae.



Figure 6.
Yellow individual of *Porpita porpita*.



Figure 7.

Physalia physalis washed ashore in Semawang Beach, Denpasar City, Bali Island. Note the lateral view with the pneumatophore (gas-filled float) and zooids attached to the ventral side.

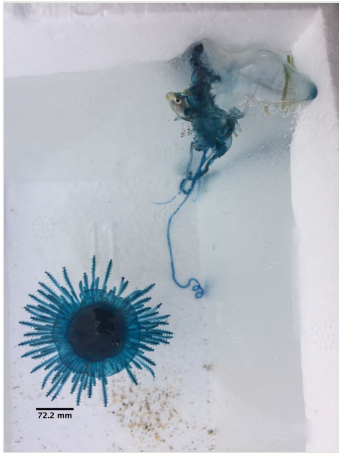


Figure 8.

Stranded *Physalia physalis* (top) and *Porpita porpita* (bottom) in Semawang Beach, Denpasar City, Bali Island.



Figure 9.

Counting and measuring individuals of the stranded *Physalia physalis* in the Semawang Beach, Denpasar City, Bali Island. The specimens' total lengths were 0.7-5.4 cm, measured from the top of the crest to the tip of the longest tentacle.

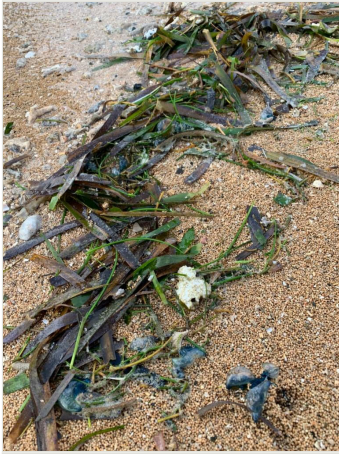


Figure 10.

The massive stranding of *Physalia physalis* amongst the seagrass along the strand-line of Semawang Beach, Denpasar City, Bali Island.