Short Research Article

First Record of Sea Anemone *Anthopleura handi* Dunn, 1978 (Actiniaria: Actinidae) from coast across the Indian Mainland

ABSTRACT

Anthopleura handi Dunn, 1978 was previously recorded from Andaman Islands. Here we report *Anthopleura handi* Dunn, 1978 for the first time from coast across the Indian mainland. The sea anemone specimen was collected from intertidal sandy area of Talasari Beach (21°36'11"N, 87°24'27"E), Balasore, Odisha. This paper also reports the species for the first time from eastern coast of Indian Mainland as well as from Odisha state with its diagnostic characters. In India there are total thirteen species of genus *Anthopleura* have been reported without proper taxonomic study. Thus this paper also deals with a comparative analysis of various sea anemone species of genus *Anthopleura* reported from Indian water.

Keywords

First record, Sea anemone, Actiniaria, Anthopleura, Indian mainland

1. INTRODUCTION

Ocean comprises over 90 percent of the habitable space on the Earth and contains some 250,000 known species, with many more remaining to be discovered. At present, there are about 238,165 accepted marine faunal species described in the World Register of Marine Species database (WoRMS, 2023), yet this is only a fraction of all species living in the ocean, with new discoveries being made every year. India is one of the major mega-biodiverse countries which is home to a variety of species-rich ecosystems with an enormous 8,118 km, spread across the mainland and the islands of Andaman and Nicobar and Lakshadweep (Gopalakrishnan et al., 2012). The marine ecosystem is home to a huge amount of marine faunal groups, although the sea anemone, order Actiniaria, Hertwig, 1882, are possibly one of the most understudied marine faunal groups. They are one of the notable benthic inhabitants whose occurrence have been reported across the all depths and latitudes (Ammons and Daly, 2008; Schories et al., 2011; Gonzalez- Munoz et al., 2016). Actiniarians, popularly called as 'SeaAnemones', belongs to the phylum Cnidaria form a vital group of intertidal invertebrate differentiated by their habit, habitat and excellent colouration. The actiniarian, sea anemones are gathered under the class Anthozoa that contains about 1107 described species occurring across the world (Fautin, 2008). This benthic faunal group is biologically very much vital for their close associations with various macrobenthic fauna such as clown fishes, shrimps and hermit crabs (Bach and Herrnkind, 1980; Fautin and Allen, 1992). In a generalized view, sea anemones are cylindrical in shape; having three distinguished body part oral disc, column and pedal disc. The lower part of body bears pedal disc which provide site for firm attachment with solid substratum

Commented [I1]: Include the reference source.

especially rock, wooden structure and dead coral. The upper end having mouth and the hollow tentacles arising from the oral disc surround it. The tentacle number varies species to species and arranged in a specific number of cycle which is the distinguished characters for species identification. The cylindrical column of the sea anemones is tapered towards the pedal disc bearing end and the oral disc is generally greater in diameter. Sea anemones of India have had scant attention in comparison with other members of Anthozoa (especially scleractinian corals and octocorals).

Commented [l2]: Customize with journal templates, need to tap a space at the beginning of a paragraph

` The initiating works about sea anemones in Indian water were mainly focused on the occurrence and carried out by (Stoliczka, 1869; Annandale, 1907, 1915; Carlgren, 1925, 1949; Menon, 1927; Panikkar, 1936, 1937, 1938). Later further study was conducted by multiple authors and everyone contributed to the science at their individual level. Revised checklist on the diversity of sea anemone of Indian water, prepared by Anushma et.al. (2022) reports a total of 92 species of Actiniarians under 22 families and 54 genera from Indian water. With special reference to genus Anthopleura there are total 13 species are reported so far from Indian water.

Present author came across a single specimen of genus Anthopleura, collected from Talasari Beach Beach of Odisha; which is identified as *Anthopleura handi* Dunn, 1978. Previously the species was reported from Andaman Island, Bay of Bengal by (Raghunathan et.al. 2014). So far there is no any report of this species from coast across the Indian mainland; therefore, this paper reports the occurrence of Anthopleura *handi* Dunn, 1978 for the first time from coast across Indian mainland. Previously there was a scarcity of literature regarding details taxonomic description of various species of genus *anthopleura* in Indian water. Here for the first time, we have added a comparative analysis of various sea anemone species of genus *anthopleura* reported from Indian water.

2. MATERIALS AND MATHODS

The specimen (n=1) was encountered while surveying across Talasari Beach (21°36'11"N, 87°24'27"E**),** Balasore, Odisha. It was observed that the column region of specimen was embedded inside the intertidal sandy area with tentacle exposed outside. After collection specimen it was preserved in 70% alcohol and brought to the laboratory for further stages of taxonomic work. Photography and the detailed morphometric analysis of the specimen was conducted. Photographs of specimens were taken in both live and preserved condition. Photograph of distinguishable characters of preserved specimens were taken under stereomicroscope, LEICA EZ4HD. Specimen was identified up to species level following the relevant literature (Dunn, 1978, Fautin et. al., 2008). Preserved specimens are deposited in the National Zoological Collections of General Non- chordate Section, Zoological Survey of India, Kolkata, India.

UNDER PEER REVIEW

Fig. 1. (A) Sample collection site with latitude and longitude; **Fig. 1. (B)** Distribution of *Anthopleura handi* Dunn, 1978 throughout India.

UNDER PEER REVIEW

3. RESULTS

Taxonomic account of the species is given hereunder based on the collected specimen.

Phylum: **Cnidaria** Hatschek, 1888

Class: **Anthozoa** Ehrenberg, 1834

Order: **Actiniaria** Hertwig, 1882

Family: **Actinidae** Rafinesque, 1815

Genus: **Anthopleura** Duchassaing de fonbressin and Michelotti, 1860

Material examined: One example (Total length 19.28 mm, Total diameter 14 mm), Reg. No. ZSI/GNC/P4781/1, Collected by Santanu Mitra, collected on 02.11.2023 from Talsari Beach, Balasore, Odisha, India.

4. DIAGNOISTIC CHARACTERS

Specimen distinctly longer than broad (Length/diameter = 1.37) in preserved condition **(Fig.3)**. Column brownish yellow with gravels attached, 14 mm in diameter; oral disc grey; tentacles to 2-4 mm long in preserved specimen, with light bars across them **(Fig. 2D)**; column with closely packed adhesive verrucae of 0.62-0.78 mm arrayed in a longitudinal manner **(Fig. 2B)**; gravels are attached with verrucae**(Fig. 2B)**; acrorhagus located at the distal end of each column of verrucae. Oral disc bearing lipless slit like mouth, slightly smaller than the pedal disc **(Fig. 3 A, B)**. Tentacles equal in appearance, greyish yellow in colour in preserved condition, tapered bluntly at tip, approximately 60 in number, arranged irregularly **(Fig. 2A), (Fig. 3 A, B)**;

Mesenterial insertions visible through pedal disc as dark lines **(Fig. 2C).** Pedal disc roughly circular, adhesive and well organized **(Fig.4)**.

Habitat: Specimens were attached to rocky substances or oyster shells on intertidal sandy flats, including the high inter-tidal regions, where the anemones inhabit sand around the base of rocks. It was found that when the base of specimen is attached to solid object or buried in sediment and oral disc was at or above surface of substratum.

Colour in life: Tentacles transparent with dark brownish horizontal stripes interrupted by narrow white cross bar at irregular interval throughout its entire length; column overall grey-brown with brownish - purple verrucae. Oral disc light greyish in colouration **(Fig. 3 A, B)**. Acrorhagi showing same colouration as column but some with white- tipped.

Distribution (Within India): Talsari, Odisha (Present record), Andaman Island, Bay of Bengal (Raghunathan et al. 2014)

Distribution (Outside India): Malaysia; Singapore; Philippines; northern and eastern Australia. Type locality: Jeram Beach, Strait of Malacca, Selangor, Penin - sular Malaysia.

Remarks: Previously reported from Andaman Island (Raghunathan et.al. 2014) but the occurrence of *Anthopleura handi* Dunn, 1978 from Odisha is a new distributional record to Indian mainland.

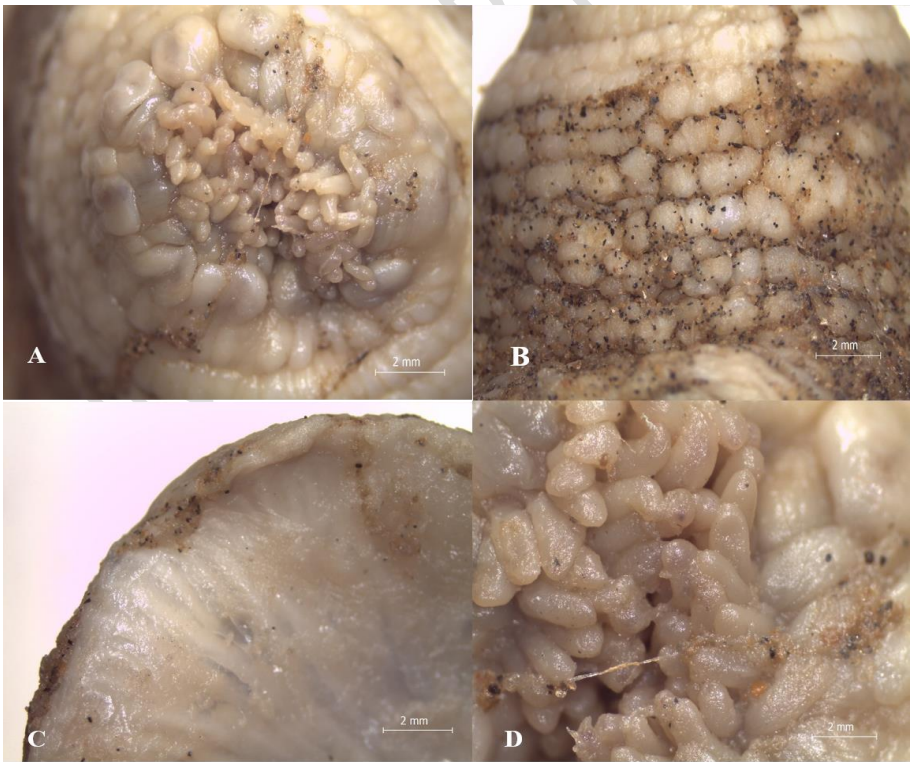

Fig. 2. **(A)** Oral end showing arrangement of tentacles around mouth, **(B)** Distribution of verrucae across the column, **(C)** Portion of pedal disc, **(D)** Tentacles.

Fig. 3 (A), (B). Overall view of *Anthopleura handi* Dunn, 1978, (ZSI RegNo. ZSI /GNC/P4781/1) in living condition.

Commented [l3]: Make fig 4. Must be proportional like the size of Fig 3.

Fig.4. *Anthopleura handi* Dunn, 1978 in preserved condition.

5. DISCUSSION

Genus *Anthopleura* Duchassaing de Fonbressin & Michelotti, 1860 is represented by 102 species worldwide. Among them only thirteen species have been reported from Indian water. *Anthopleura handi* Dunn, 1978 was described on the basis of 200 specimen originally. The

present specimen collected by Santanu Mitra from Talsari Beach, Balasore, Odisha is almost similar with the originally described specimen by Dunn, 1978. Original description mentioning the column may be drab grey, grey-brown, grey-green or tan in color but in case of present specimen column is grey-brown in colour. Original description also stating tentacle number ranges from ranges 45 to 61 whereas present specimen accounts for approximately 60 tentacles. A comparative analysis of all the species of genus *Anthopleura* reported from Indian water is given below;

List 1 : Comparative analysis of all the species of genus *Anthopleura* reported from Indian water

Sl No.	**Species Name**	**Tentacle**	**Distinguished Character (needed if any)**
1	*Anthopleura anneae* (Carlgren, 1940)	160 tentacles (Den Hartog and Vennam, 1993)	No
2	*Anthopleura asiatica* (Uchida and Muramatsu 1958)	48 tentacles with greyish brown colouration (Uchida T. & Muramatsu S. (1958)	oral disc greyish brown in colouration (Uchida T. & Muramatsu S. (1958)
3	*Anthopleura buddiemieri* (Fautin 2005)	100 tentacles Bijukumar et al. (2015)	No
4	*Anthopleura dixoniana* (Haddon and Shackleton 1893)	60 tentacles (Fautin et.al., 2009)	Verruace greenish, brownish or orangish in colouration; Oral disc brown with green and yellow spot around the mouth (Fautin et.al., 2009).
5	*Anthopleura elegantissima* (Brandt 1835)	24 tentacles (Fautin and Hand 2007)	No
6	*Anthopleura handi* Dunn 1978	60 tentacles (Dunn, 1978)	Oral disc greyish in colouration, column with closely packed adhesive verrucae of 0.62-0.78mm arrayed in a longitudinal manner throughout whole length (Dunn, 1978)
7	*Anthopleura nigrescens* (Verril 1928)	48-90 tentacles (Acuna et. al., 2022)	Oral disc dark gray-brown to black in colouration (Acuna et. al., 2022)

UNDER PEER REVIEW

8	*Anthopleura panikkarii* (Parulekar 1968)	96 tentacles(Parulekar, 1968)	No
9	*Anthopleura sola* (Pearse and Francis 2000)	Tentacle brownish with yellow band (Govenar, K. 2021)	Oral disc green pigmentation (Govenar, K. 2021).
10	*Anthopleura thalia* (Gosse, 1854)	30-60 tentacle; Tentacle greyish green to brownish yellow in colouration, slightly darker distally than proximally (Daly and Picton 2012).	Verrucae are more prominent distally than proximally; Some specimens with red pigment overlying oral disc; red colouration especially concentrated near bases of tentacles and over the site of mesenterial insertions (Daly and Picton 2012).
11	*Anthopleura waridi* (Carlgren, 1900)	Tentacles dark olive green to brown, tapered; arranged in up to five cycles (Gul, 2017).	No

Interestingly *Anthopleura handi* Dunn, 1978 can be distinguished from A. *anneae,* A. *asiatica*, A. *buddiemieri,* A. *elegantissima*, A. *panikkarii,* A. *sola,* A. *thalia* and A. *waridi* on the basis of either number of tentacle or colour of tentacle but show some sort of similarity with A. *dixoniana* and A. *nigrescens* on the basis of tentacle number. In A. *handi* oral disc grey in colour whereas in A. *dixoniana* oral disc brown with green and yellow spot around the mouth (Fautin et.al., 2009) and in A. *nigrescens* oral disc dark gray-brown to black in colouration (Acuna et. al., 2022).

Interestingly the specimen was collected from Odisha, eastern coast of India and previously recorded from Andaman Islands (Raghunathan et.al. 2014). Thus this finding has a great significance in geographical point of view as it is recorded for the first time from Indian mainland.

6. CONCLUSION

India shares a coastline of nearly 8,118 km km that is exceptionally varied and dynamic and shows diverse rock-based, sediment-based and coral-dependent coastland landforms (Gopalakrishnan et al., 2012). In worldwide level there are about 1107 described sea anemone species have been recorded (Fautin, 2008) but in Indian water there are only 92 (Anushma et.al.

UNDER PEER REVIEW

2022). Data showing there is a huge lack of study on sea anemone in India. Sea anemone has a very unique importance in marine biodiversity as it acts as 'bioindicator'. Sea anemone shows mutualistic association with hermit crabs, mollusc, polychaetes and barnacle (Balakrishnan et. al., 2019, Antoniadou et. al., 2013). Thus on conservation purposes it has a significant value as it is associated with such a wide variety of macrofaunal invertebrate group. Previously the current species was reported from island biogeographic region but now it has been recorded from coastal biogeographic region and thus this finding shows a great value on geographical basis.

Commented [l4]: Fix spacing

REFERENCES

1. WoRMSEditorial Board World Register of Marine Species, 2024. http://www.marinespecies.org at VLIZ Accessed January, 2024.

2. Gopalakrishnan A., Divya P.R., Basheer V.S., Raja Swaminathan, T., Kathirvelpandian, A. Bineesh, K.K., Kumar, R.G. and Jena J. K. 2012. Macro flora and fauna of the Gulf of Mannar - a checklist. National Bureau of Fish Genetics Resources. Lucknow, UP, India, 127 pp.

3. Ammons, A.W. and Daly, M. 2008. Distribution, habitat use and ecology of deep water Anemones (Actiniaria) in the Gulf of Mexico. Deep Sea Research Part II, *Topical Studies in Oceanograph*y, 55(24): 2657-266**.** DOI**:**10.1016/j.dsr2.2008.07.015.

4. Schories, D., Reise, K., Sanamyan, K., Sanamyan, N., Clasing, E., and Reise, A. 2011. Actinian dominated intertidal mudflats: A new case of an extraordinary rare phenomenon from Southern Chile. *Journal of Sea Research*, 65, 304-314.

5. González-Muñoz, R., Simões, N., Guerra-Castro, E.J., Hernández-Ortíz, C., Carrasquel, G., Mendez, E., Lira, C., Rada, M., Hernández, I., Pauls, S. M., Croquer, A. and Cruz-Motta, J. J. 2016. Sea anemones (Cnidaria: Actiniaria, Corallimorpharia, Ceriantharia, Zoanthidea) from marine shallow-water environments in Venezuela: New records and an updated inventory. *Marine Biodiversity Records*, 9: 18. DOI 10.1186/s41200-016-0016-7.

6. Fautin, Daphne & Wallace, Carden & Crowther, Andrea. (2008). Fautin, D. G., Wallace, C. C. and Crowther, A. L. (2008) Revision of the sea anemone fauna of Moreton Bay, S.E. Queensland. Memoirs of the Queensland Museum 54: 35-64.. Memoirs of the Queensland Museum. 54.

7. Bach, C. E., & Herrnkind, W. F. (1980). Effects of Predation Pressure On the Mutualistic Interaction Between the Hermit Crab, Pagurus Pollicaris Say, 1817, and the Sea Anemone, Calliactis Tricolor (Lesueur, 1817). *Crustaceana*, *38*(1), 104-108. https://doi.org/10.1163/156854080X00508

UNDER PEER REVIEW

8. Fautin, D.G. and G.R. Allen, 1992. Field guide to anemonefishes and their host sea anemones. Western Australian Museum, Francis Street, Perth.

9. Annandale, N. 1907. The fauna of brackish ponds at Port Canning, Lower Bengal. P.1. *Records of Indian Museum*, 1(4): 45-74.
10. Stoliczka, F. 1869. On the anatomy of Sagartia schilleriana and Membranipora bengalensis, a new coral and a bryozoan living in brackish water at Port Canning. Journal of Asiatic Society of Bengal, 38: 28–63.
11. Annandale, N. 1915. Fauna of Chilka Lake. The Coelenterates etc. Memoirs of Indian Museum, 5: 65-114.
12. Carlgren, O. 1925. A revision of the Actiniaria of the Chilka Lake. *Arkiv för Zoology*, 17A: 1-21.
13. Carlgren, O. 1949. A survey of the Ptychodactaria Corallimorpharia and Actiniaria. *Kungl. Svenska vetenskapsakademiens handlingar* 1: 1-121.
14. Menon, K.R. 1927. Subclass Zoantharia (except Scleractiniae). *Bulletin of Madras Govt. Museum (Natural History Section)*, 1(1): 31-40.
15. Panikkar, N.K. 1936. The structure, bionomics and systematic position of two new brackish water Actiniaria from Madras. *Proceedings of the Zoological Society of London.* 106: 39-52.
16. Panikkar, N. K., and Aiyar, R. G. 1937. The brackish water fauna of Madras. *Proceedings Section B Indian Academy of Science*, Bangalore. 6 (5): 284-337.
17. Panikkar, N.K., 1938. Studies on Peachia from Madras. *Proceedings Indian Academy of Science*, Bangalore. 7(4): 182–205.
18. Anushma, K., M. P. Prabhakaran, and K. P. Deepa. "A Revised Checklist of Sea Anemones (Order: Actiniaria) from the Exclusive Economic Zone (EEZ) of India." Journal of Aquatic Biology & Fisheries 10.1 (2022): 15-26.
19. Raghunathan, C. & Raghuraman, R. & Choudhury, Smitanjali & Venkataraman, Krishnamoorthy. (2014). DIVERSITY AND DISTRIBUTION OF SEA ANEMONES IN INDIA WITH SPECIAL REFERENCE TO ANDAMAN AND NICOBAR ISLANDS. Records of the Zoological Survey of India. 114. 269-294.
20. Dunn, D.F., 1978. *Anthopleura handi* n. sp. (Coelenterata, Actiniaria), an internally brooding, intertidal sea anemone from Malaysia. *Wasmann Journal of Biology*, **35**: 54-64.
21. Fautin, D. G., Wallace, C. C. and Crowther, A. L. (2008) Revision of the sea anemone fauna of Moreton Bay, S.E. Queensland. Memoirs of the Queensland Museum 54: 35-64.. Memoirs of the Queensland Museum. 54.
22. Den Hartog, J.C. and Vennam, J. 1993. Some Actiniaria (Cnidaria: Anthozoa) from the West Coast of India. *Zoologische Mededelingen, Leiden.* 67: 601–637
23. Uchida, T., & Muramatsu, S. (1958). Notes on Some Japanese Sea-anemones (With 5 Text-figures). *北海道大學理學部紀要*, *14*(1), 111-119.
24. Kumar, Biju & kv, Dhaneesh & Geethu, M. (2015). FIRST RECORD OF THE SEA ANEMONE *ANTHOPLEURA BUDDEMEIERI* FAUTIN (CNIDARIA: ACTINIARIA: ACTINIIDAE) FROM THE INDIAN COAST. Journal of Aquatic Biology & Fisheries. 3. 111-114.
25. Fautin, D. G., Tan, S. H., & Tan, R. (2009). Sea anemones (Cnidaria: Actiniaria) of Singapore: abundant and well-known shallow-water species. Raffles Bulletin of Zoology, 121-143.

26. FAUTIN, D. G., and C. HAND. 2007. Anthozoa, p. 173-184. In: The Light and Smith Manual: intertidal invertebrates from central California to Oregon. J. T. Carlton (ed.). University of California Press, Berkeley.
27. Acuña, Fabián & González-Muñoz, Ricardo & Garese, Agustín & Díaz-Ferguson, Edgardo. (2022). First records of *Anthopleura nigrescens* (Verrill, 1928) and Telmatactis panamensis (Verrill, 1869) (Cnidaria, Anthozoa, Actiniaria) from Parque Nacional Coiba, Pacific coast of Panama. Check List. 18. 1141-1146. 10.15560/18.5.1141.
28. Parulekar, A. H. (1968). On a new species of sea anemone from Maharashtra, India. Journal of the Bombay Natural History Society, 65(3): 590-595 page(s): 590-595.
29. Govenar, K. (2021). Evidence of Photoenhancement by Green Fluorescent Proteins in Low Light Conditions: A Potential Factor of Habitat Distribution for the Sea Anemone *Anthopleura sola*. *UC San Diego*. ProQuest ID: Govenar_ucsd_0033M_20222. Merritt ID: ark:/13030/m56j0m8s. Retrieved from https://escholarship.org/uc/item/0ws0d0fs.
30. Daly, Marymegan & Picton, Bernard. (2012). Description of the Sea Anemone *Anthopleura Thallia* (Gosse 1854). Biology & Environment Proceedings of the Royal Irish Academy. 112B. 1-6. 10.3318/BIOE.2012.10.
31. Gul, Shahnawaz. (2017). FIRST RECORDS OF SEA ANEMONES (CNIDARIA: ACTINIARIA) FROM THE COAST OF PAKISTAN (NORTHERN ARABIAN SEA). Int. J. Biol. Biotech.. 14. 247-252.
32. Balakrishnan, Dr. Srinivasan & Santhanam, Perumal & Tudu, Prasad & Yogesh Kumar, J S & Mohapatra, Anil. (2019). Mutualistic interactions of polychaete, barnacles, mollusca and sea anemone with hermit crab. Indian Journal of Geo-Marine Sciences. 48. 286-287.
33. Antoniadou, C., Vafeiadou, A. M., & Chintiroglou, C. (2013). Symbiosis of sea anemones and hermit crabs in temperate seas. *Symbiosis: Evolution, Biology and Ecological Effects. NOVA Science, New York, 95118*.

Commented [I5]: Fix spasing distance and reference writing according to UPJOZ journal template

UNDER PEER REVIEW