

New records of Opisthobranchs (Mollusca: Gastropoda) from Gulf of Mannar, India

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An extensive survey was carried out to explore the Opisthobranchs and associated faunal community in and around the Gulf of Mannar Marine Biosphere Reserve (GoMBR), South-east coast of India, resulted eight species (*Aplysia juliana*, *Goniobranchus annulatus*, *Goniobranchus cavae*, *Goniobranchus collingwoodi*, *Goniobranchus conchylitatus*, *Dendrodoris albobrunea*, *Elysia nealae*, and *Thecacera pacifica*) which are new records to Indian coastal waters and GoMBR respectively. The detailed description, distribution and morphological characters are presented in this manuscript.

[Keywords: Opisthobranchs; Nudibranchs; Molluscs; Gulf of Mannar; South-east coast India.]

Introduction

Gulf of Mannar Marine Biosphere Reserve (GoMBR) is a shallow bay, located in the south-eastern tip of India and the west coast of Sri Lanka, in the Indian Ocean. The Gulf of Mannar consists of 21 islands and has an aggregate 10,500 km² area (Lat. 80°47'N and Long. 78°12' E). These islands possess a very interesting heterogeneous group of fauna and flora. Opisthobranchs are fascinating molluscs, diversifying not only in colours, but also in their specificity of feeding habitat. They found mostly in marine, from intertidal pools down to the greatest depths^{1,2}. It can be located on top of sponges, algae, bryozoans, hydroids, black corals, hard and soft corals^{3,4}.

Studies on the Indian Opisthobranchia taxonomy initiated during 1880s and in the Gulf of Mannar, Ceylon coast by Kelaart^{5,6}. Farran⁷ reported Ceylonese Nudibranch in the Gulf of Mannar in the Indian Territory. A total 19 species of opisthobranchs were reported by Gravely⁸, and Satyamurti⁹ recorded 30 species from the Krusadai Island, Gulf of Mannar. Later on, 29 species were added, of which 12 new species were reported from Mandapam group of islands, Gulf of Mannar coast^{10,24}. Recently, 20 species of opisthobranchs including 14 new records from Thoothukudi and Vembar group of islands in GoMBR were reported by Kumar *et al.*¹.

Materials and Methods

The present study was carried out in Gulf of Mannar Marine Biosphere Reserve, South-east coast of India

(Fig. 1) during 2017 to 2018 with the help of SCUBA diving gears in different sub-tidal regions. Opisthobranchs were observed, photographed and collected for further morphological identification. The collected specimens were fixed initially in mixture of 5 % formaldehyde and seawater. Before placing in the fixative solution, the animals were narcotized with a solution consisting of 72 g L⁻¹ of MgCl₂. The formaldehyde fixed specimens were transferred to 95 % ethanol for long term preservation. Identified specimens were deposited in the National Zoological Collections of Zoological Survey of India, Marine Aquarium Regional Centre, Digha, West Bengal. The species were identified based on morphological characters provided²⁵⁻²⁷ and available in <http://www.seaslugforum.net/>; <http://www.nudipixel.net/>²⁸.

Results

The systematic and distribution details of eight species of opisthobranchs which are new distribution records to Gulf of Mannar and Indian coastal waters, belonging 5 genera, 5 family and 2 orders are given in Figure 2. A total 66 species were reported under these five genera (*Aplysia*, *Goniobranchus*, *Dendrodoris*, *Elysia*, *Thecacera*) around Indian coast. Among them 33 species were reported from Andaman and Nicobar Islands, 30 species reported from west coast of India, 23 species reported from east coast of India, 16 species reported from Lakshadweep Islands, 13

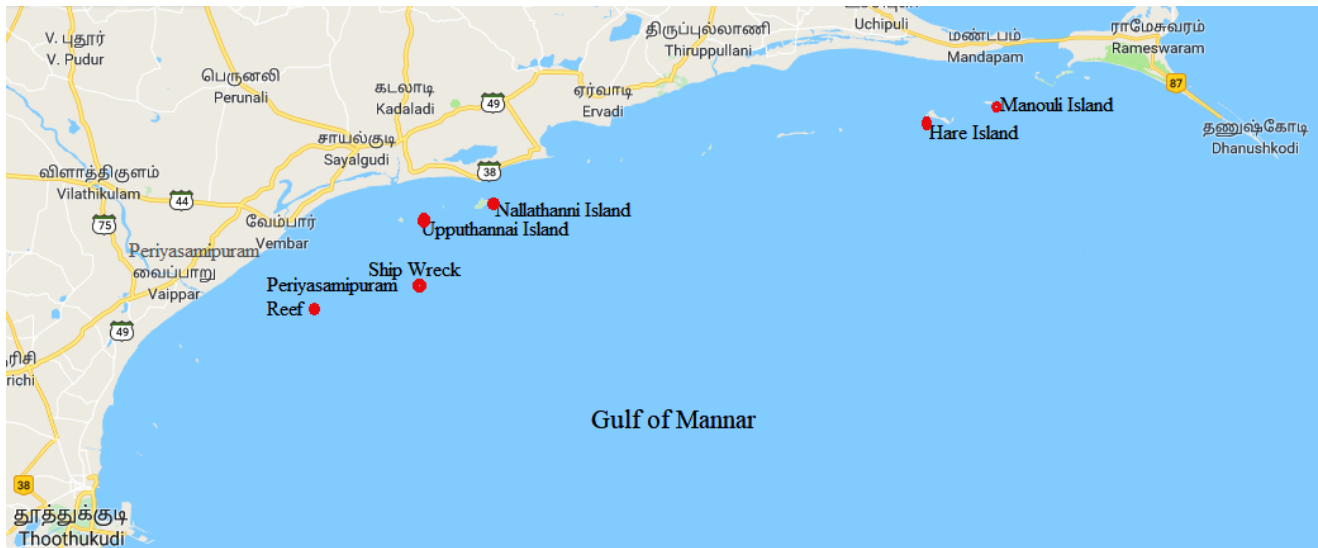


Fig. 1 — Map showing the localities of newly recorded species in Gulf of Mannar coast.

species from Gulf of Mannar coast and 9 species reported from Gulf of Kachchh (Table 1).

Taxonomic Account

Phylum: Mollusca

Class: Gastropoda

Subclass: Heterobranchia

Order: Anaspiidea

Family: Aplysiidae

Genus: *Aplysia*

1. *Aplysia juliana* Quoy & Gaimard, 1832

1837 *Aplysia rangiana* d'Orbigny

1860 *Syphonota bipes* Pease

1869 *Aplysia sandvichensis* G.B. Sowerby I

1875 *Aplysia brunnea* Hutton

1882 *Aplysia hamiltoni* Kirk

1905 *Aplysia sibogae* Bergh

1908 *Aplysia woodi* Bergh

1929 *Tethys capensis* O'Donoghue

1951 *Aplysia (Metaplysia) badistes* Pilsbry

1957 *Aplysia juliana* var. *quoyana* Engel & Eales

Location: Manouli Island (Lat. 09°10'52.2N; Long 79°08'44.8E), 8 m depth.

Reg. no: ZSI/MARC 5263

Description: Commonly known as walking sea hare. The colour of the animal is very often brown with paler spots, but it can be various other shades.

Size: Length is 28 mm

Micro habitat: Seaweed algae

Distribution: Indonesia, Australia, New Zealand, North Atlantic Ocean, South Africa, Caribbean sea, Cuba, Gulf of Mexico, Venezuela.

Remark: New record to India.

Taxonomic References: Quoy, J.R. & Gaimard, J.P.²⁹.

Order: Nudibranchia

Suborder: Doridina

Family: Chromodorididae

Genus: *Goniobranchus*

2. *Goniobranchus annulatus* (Eliot, 1904)

1904 *Chromodoris annulata* Eliot

1904 *Glossodoris annulata* Eliot

Location: Vembar (Lat. 09°02'16.1N; Long 78°22'45.4E), 9 m depth, Ship wreck

Reg. no: ZSI/MARC G5269

Description: White colour with yellow spots and blue or black ring. Small yellow or orange spots observed on the mantle. The blue rings are visible around the gills and two rhinophors. The mantle and foot is bordered with a blue line.

Size: 36 mm

Micro habitat: Shallow to sub-tidal near the reef crest, up to 15m depth

Distribution: Zanzibar, Red Sea, East Coast of South Africa to Thailand, Mediterranean Sea, Persian Gulf and Oman Sea.

Distribution in India: Goa, Andaman and Nicobar Islands.

Remark: New record to Gulf of Mannar coast, India. *Taxonomic Reference:* Eliot³⁰.

3. *Goniobranchus cavae* (Eliot, 1904)

1904 *Chromodoris cavae* Eliot

1904 *Glossodoris cavae* (Eliot)

Location: Vembar (Lat. 09°02'16.1N; Long 78°22'45.4E), 9 m depth, Ship wreck,



Fig. 2 — A-*Aplysia juliana*, B-*Goniobranchus annulatus*, C-*Goniobranchus cavae*, D-*Goniobranchus collingwoodi*, E-*Goniobranchus conchylitatus*, F-*Dendrodoris albobrunnea*, G-*Elysia nealae*, H-*Thecacera pacifica*.

Reg. no: ZSI/MARC G5270

Description: White mantle marked by a yellow tinge in irregular on the mantle and side of the foot. The dark blue or black spots located on dorsal surface

of the mantle and the foot. The tip of the rhinophores and gills are blue in colour.

Size: 38 mm

Micro habitat: Shallow and artificial reef ecosystem

Table 1— Distribution of genera *Goniobranchus*, *Elysia*, *Dendrodoris*, *Aplysia* and *Thecacera* reported from India — (Contd.)

S.No	Name of the species	AN	LK	WC	EC	GOK	GOM
1	<i>Goniobranchus albopunctatus</i>	*	-	-	-	-	-
2	<i>Goniobranchus alius</i>	-	*	-	-	-	-
3	<i>Goniobranchus annulatus</i>	*	-	*	-	-	**
4	<i>Goniobranchus aureopurpureus</i>	*	-	-	-	-	-
5	<i>Goniobranchus bombayana</i>	-	-	*	-	*	-
6	<i>Goniobranchus cavae</i>	-	-	-	-	-	**
7	<i>Goniobranchus coi</i>	*	-	-	-	-	-
8	<i>Goniobranchus collingwoodi</i>	*	-	-	-	-	**
9	<i>Goniobranchus conchyliatus</i>	*	-	*	-	-	**
10	<i>Goniobranchus decorus</i>	*	*	-	-	-	-
11	<i>Goniobranchus cf. setoensis</i>	-	*	-	-	-	-
12	<i>Goniobranchus fidelis</i>	*	*	-	*	*	*
13	<i>Goniobranchus geminus</i>	*	-	*	*	-	*
14	<i>Goniobranchus gleniei</i>	*	*	-	*	-	-
15	<i>Goniobranchus geometricus</i>	*	-	-	-	-	-
16	<i>Goniobranchus hintuanensis</i>	*	-	-	-	-	-
17	<i>Goniobranchus kuniei</i>	*	-	-	-	-	-
18	<i>Goniobranchus naiki</i>	-	-	*	*	-	-
19	<i>Goniobranchus preciosus</i>	*	-	*	-	-	-
20	<i>Goniobranchus reticulatus</i>	*	-	-	-	-	-
21	<i>Goniobranchus roboi</i>	*	-	-	-	-	-
22	<i>Goniobranchus setoensis</i>	-	*	-	-	-	-
23	<i>Goniobranchus sinensis</i>	*	-	-	-	-	-
24	<i>Goniobranchus tennentanus</i>	-	-	*	-	-	-
25	<i>Goniobranchus tinctorius</i>	*	-	*	-	-	-
26	<i>Goniobranchus trimarginatus</i>	-	-	*	*	-	*
27	<i>Elysia abei</i>	*	-	-	-	-	-
28	<i>Elysia bangtawaensis</i>	*	-	*	-	-	-
29	<i>Elysia bengalensis</i>	-	-	*	*	-	-
30	<i>Elysia chilkenis</i>	-	-	-	*	-	-
31	<i>Elysia expansa</i>	-	-	*	*	-	-
32	<i>Elysia grandifolia</i>	-	-	*	*	*	*
33	<i>Elysia cf hirasei</i>	-	-	*	-	-	-
34	<i>Elysia leucolegnote</i>	*	-	-	-	-	-
35	<i>Elysia nealae</i>	-	-	-	-	-	**
36	<i>Elysia obtuse</i>	-	-	*	-	*	-
37	<i>Elysia ornate</i>	*	*	*	*	-	*
38	<i>Elysia punctata</i>	-	-	-	*	-	-
39	<i>Elysia pusilla</i>	*	-	*	-	-	-
40	<i>Elysia rufescens</i>	-	*	-	-	-	-
41	<i>Elysia tomentosa</i>	-	*	*	-	*	-
42	<i>Elysia thompsoni</i>	-	-	*	-	*	-
43	<i>Dendrodoris albobrunnea</i>	-	-	-	-	-	**
44	<i>Dendrodoris atromaculata</i>	-	-	-	*	-	-
45	<i>Dendrodoris coronate</i>	-	*	-	-	-	-
46	<i>Dendrodoris fumata</i>	*	-	*	*	*	-
47	<i>Dendrodoris goani</i>	-	-	*	-	-	-
48	<i>Dendrodoris guttata</i>	*	-	-	-	-	-
49	<i>Dendrodoris grisea</i>	-	-	-	*	-	-
50	<i>Dendrodoris fumata</i>	*	-	*	*	-	-
51	<i>Dendrodoris fusca</i>	-	-	-	*	-	-
52	<i>Dendrodoris krusensternii</i>	*	-	*	*	-	-
53	<i>Dendrodoris nigra</i>	*	*	*	*	*	-
54	<i>Dendrodoris punctata</i>	-	-	-	*	-	-
55	<i>Dendrodoris pustulosa</i>	-	-	-	*	-	-
56	<i>Dendrodoris tuberculosa</i>	*	*	-	*	-	-
57	<i>Aplysia cornigera</i>	-	*	*	*	-	-

(Contd.)

Table 1— Distribution of genera *Goniobranchus*, *Elysia*, *Dendrodoris*, *Aplysia* and *Thecacera* reported from India

Name of the species	AN	LK	WC	EC	GOK	GOM	
58 <i>Aplysia dactylomela</i>		*	*	*	-	*	-
59 <i>Aplysia juliana</i>		-	-	-	-	-	**
60 <i>Aplysia fasciata</i>		-	-	*	-	-	-
61 <i>Aplysia lineolata</i>		-	-	-	*	-	-
62 <i>Aplysia oculifera</i>		*	*	*	-	-	-
63 <i>Aplysia parvula</i>		*	*	*	-	-	-
64 <i>Thecacera pacifica</i>		-	-	-	-	-	**
65 <i>Thecacera pennigera</i>		-	-	*	-	-	-
66 <i>Thecacera picta</i>		*	-	-	-	-	-
Total		33	16	30	23	9	13

Indicates the presence & absents

** New records

Distribution: East Africa; Tanzania.

Remarks: New record to India.

Taxonomic Reference: Eliot³⁰.

4. *Goniobranchus collingwoodi* (Rudman, 1987)

1987 *Chromodoris collingwoodi* Rudman,

Location: Nallathanni Island (Lat. 09°06'11.9N; Long 78°34'08.0E), 6 m depth

Reg. no: ZSI/MARC G5264

Description: The mantle is creamy white in colour with yellow colour spots present around the boarder of the mantle and orange or red colour small dots visible in between rhinophore and gills. The violet or blue coloured margin of the mantle and black rings are on the rhinophore.

Size: 18 mm

Micro habitat: Dead reef with algae

Distribution: Indo-Pacific.

Distribution in India: Andaman and Nicobar Islands.

Remarks: New record to Gulf of Mannar coast, India.

Taxonomic References: Rudman³¹.

5. *Goniobranchus conchylitatus* (Yonow, 1984)

1984 *Chromodoris conchylitata*

Location: Periyasampuram (Lat. 09°01'06.0N; Long 78°21'41.6E), 5 m depth

Reg. no: ZSI/MARC G5265

Description: It is characterised by the dark blackish lines, usually diagonal and the yellowish patches between. The background colour of the body has a creamy white, the rhinophores are orange or red colour and the gills triangular in cross section are edged with the same colour. White colour spots around the edge of the mantle.

Size: 21 mm

Micro habitat: Reef ecosystem

Distribution: Indo-Pacific.

Distribution in India: Goa, Andaman and Nicobar Islands.

Remarks: New record to Gulf of Mannar coast, India.

Taxonomic References: Gosliner *et al.*²⁷; Johnson & Gosliner³².

Family: Dendrodorididae

Genus: *Dendrodoris*

6. *Dendrodoris albobrunnea* Allan, 1933

Location: Hare Island (Lat. 09°08'45.5N; Long 79°05'44.2E), 8 mm depth.

Reg. no: ZSI/MARC G5267

Description: Dark translucent brown with white spots scattered all over the dorsal surface and the sides. On the ventral surface the background colour is much more translucent and the brown spots larger. The species has distinctive tentacular corners on the anterior parapodia.

Size: 41 mm

Micro habitat: Reef ecosystem

Distribution: Australia.

Remarks: New records to India.

Taxonomic Reference: Allan³³.

Family: Plakobranchidae

Genus: *Elysia*

7. *Elysia nealae* Ostergaard, 1955

Location: Nallathanni Island (Lat. 09°06'11.9N; Long 78°34'08.0E), 6 m depth

Reg. no: ZSI/MARC G5268

Description: It is green in colour with black and white spots scattered all over the animal. The rhinophores has white and black spots and dark brown shade on the tip.

Size: 28 mm

Micro habitat: Dead reef with algae

Distribution: Hawaii

Remarks: New record to India.

Taxonomic Reference: Ostergaard³⁴.

Family: Facelinidae

Genus: *Pteraeolidia*

7. *Thecacera pacifica* (Bergh, 1884)

1884 *Ohola pacifica* Bergh

1958 *Thecacera inhacae* MacNae

Location: Upputhanni Island (Lat. 09°01'51.6N; Long 78°33'19.5E), 19 m depth

Reg. no: ZSI/MARC G5272

Description: It is bright orange colour pattern and the tentacles have a purple or black band on below the blue colour tip region. The rhinophores and gills are also orange with purple colour on the top.

Size: 24 mm

Micro habitat: Reef ecosystem

Distribution: African coast, Indonesia, Vanuatu.

Remark: New record to India.

Taxonomic Reference: Bergh³⁵; Macnae³⁶.

Discussion

In India, a total of 311 species were reported belonging to 141 genera, 53 families and 7 orders, among them 131 species belonging to 66 genera were reported from Andaman and Nicobar Islands, 102 species belonging to 67 genera from Tamil Nadu coast, 72 species belonging to 48 genera from Lakshadweep Islands, 54 species belonging to 39 genera from Gujarat coast (west coast) and 40 species reported along Andhra Pradesh coast (East coast)³⁷.

The present study recorded eight species (*Aplysia juliana*, *Goniobranchus annulatus*, *G. cavae*, *G. collingwoodi*, *G. conchyliatus*, *Dendrodoris albobrunea*, *Elysia nealae* and *Thecacera pacifica*) from Gulf of Mannar, south-east coast which is new distribution record to Gulf of Mannar Marine Biosphere Reserve, India. A total of 26 species reported along the Indian coast under the genus *Goniobranchus* (*Goniobranchus albopunctatus*, *G. alius*, *G. annulatus*, *G. aureopurpureus*, *G. bombayana*, *G. cavae*, *G. coi*, *G. collingwoodi*, *G. conchyliatus*, *G. decorus*, *G. cf. setoensis*, *G. fidelis*, *G. geminus*, *G. gleniei*, *G. geometricus*, *G. hintuanensis*, *G. kuniei*, *G. naiki*, *G. preciosus*, *G. reticulatus*, *G. roboi*, *G. setoensis*, *G. sinensis*, *G. tennentanus*, *G. tinctorius*, *G. trimarginatus*), followed by 16 species in the genus of *Elysia* (*Elysia abei*, *E. bangtawaensis*, *E. bengalensis*, *E. punctata*, *E. bangtawaensis*, *E. chilkensis*,

E. expansa, *E. grandifolia*, *E. cf. hirasei*, *E. leucolegnote*, *E. nealae*, *E. obtuse*, *E. ornate*, *E. punctata*, *E. pusilla*, *E. rufescens*, *E. tomentosa*, *E. thompsoni*), 14 species belong to the genus of *Dendrodoris* (*Dendrodoris albobrunea*, *D. atromaculata*, *D. coronate*, *D. fumata*, *D. goani*, *D. guttata*, *D. grisea*, *D. fumata*, *D. fusca*, *D. krusensternii*, *D. nigra*, *D. punctata*, *D. pustulosa*, *D. tuberculosa*), 10 species reported under the genus of *Aplysia* (*Aplysia cornigera*, *A. dactylomela*, *A. juliana*, *A. fasciata*, *A. lineolata*, *A. oculifera*, *A. parvula*) and three species reported in the genus of *Thecacera* (*Thecacera pacifica*, *T. pennigera*, *T. picta*) by different researchers from India^{38,44,9,22,45,24,46,50,4,51,59, 60}.

Conclusion

Opisthobranchs are one of the least studied group under Phylum Mollusca and more investigation on the distribution, species richness, species diversity, ecology and taxonomy is needed to assess the status. The present study added eight species of Opisthobranchs with the existing list of Gulf of Mannar coast, India and further extensive study will be explore more number of Opisthobranchs species from India.

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