ALL INDIA CO-ORDINATED PROJECT
ON
TAXONOMY OF MOLLUSCA

ANNUAL REPORT

(December 2016 – May 2018)

GUJARAT STATE

BOMBAY NATURAL HISTORY SOCIETY

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1. Introduction

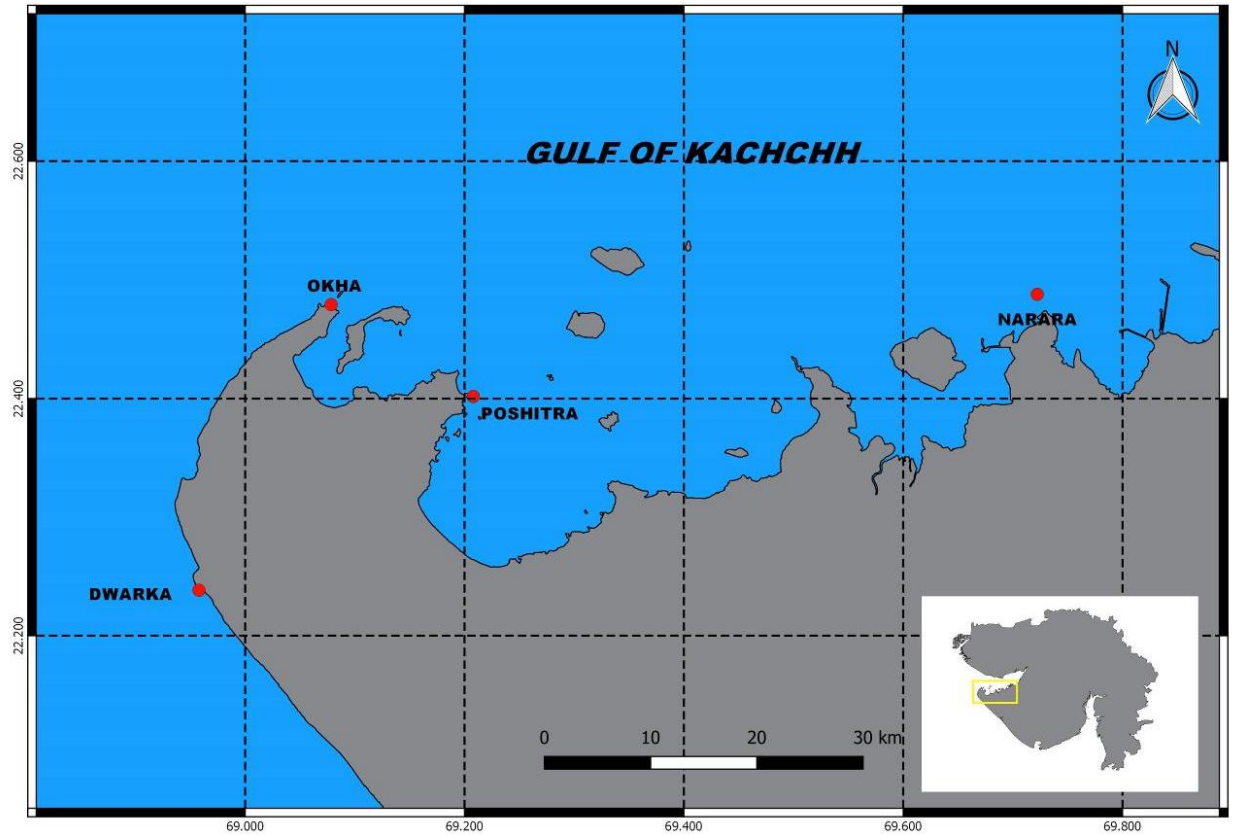
Gujarat has a long coastline of about 1650 km, which is mainly due to the presence of two gulfs *viz*. the Gulf of Khambhat (GoKh) and Gulf of Kachchh (GoK). The coastline has diverse habitats such as rocky, sandy, mangroves, coral reefs etc. The southern shore of the GoK in the western India, notified as Marine National Park and Sanctuary (MNP & S), harbours most of these major habitats. The reef areas of the GoK are rich in flora and fauna; Narara, Dwarka, Poshitra, Shivrajpur, Paga, Boria, Chank and Okha are some of these pristine areas of the GoK and its surrounding environs.

1. Objectives of the Project

1. Prepare the marine molluscan species inventory of Gujarat state.
2. Identify potential habitats for conservation of mollusca.
3. Identify threats to the molluscan diversity.
4. Capacity-building programmes for grassroots level staff.

2. Study Area

During the period from December 2016 to December 2017, we covered total four reefs of Gulf of Kachchh, *viz*. Narara, Dwarka, Poshitra and Okha.

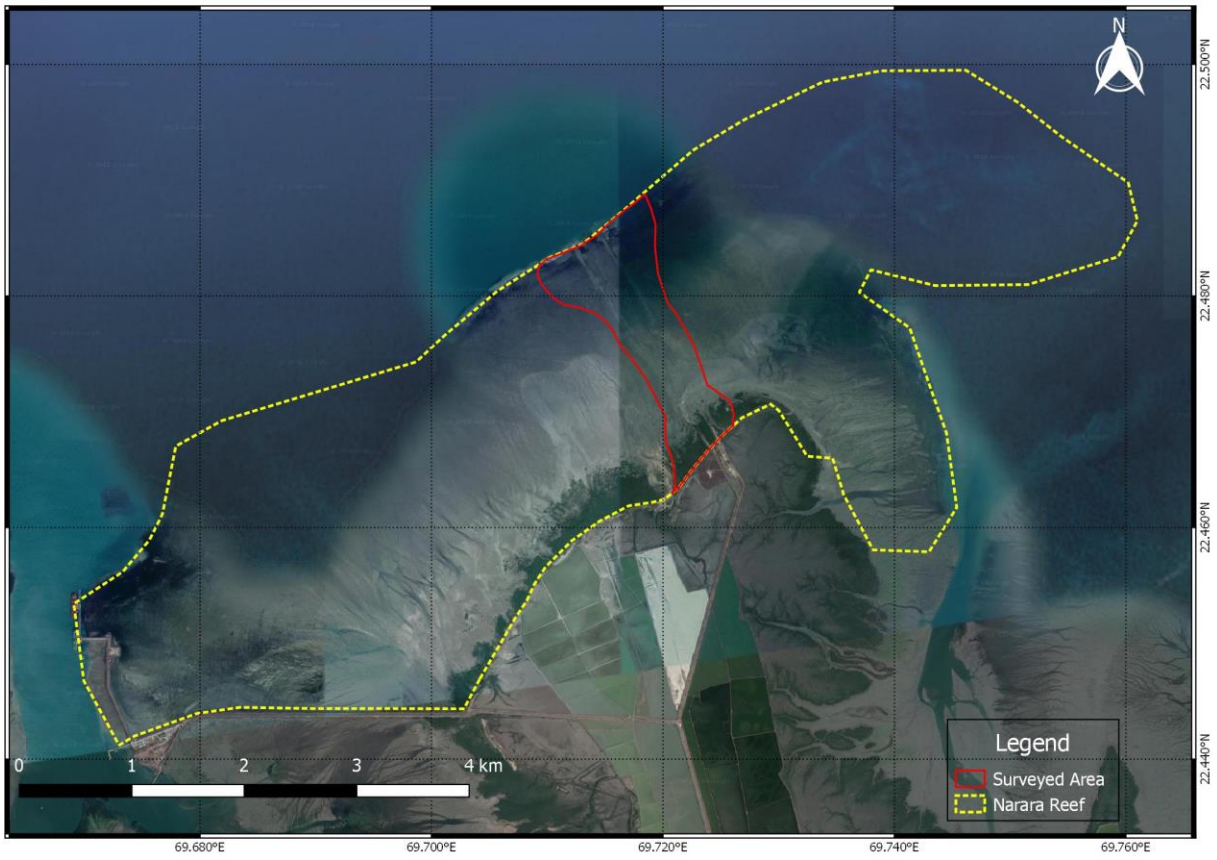


Map 1. Study Sites

2.1. Narara

Location: 22º25.8' and 69º42.1'

Photo 1. Habitat at Narara



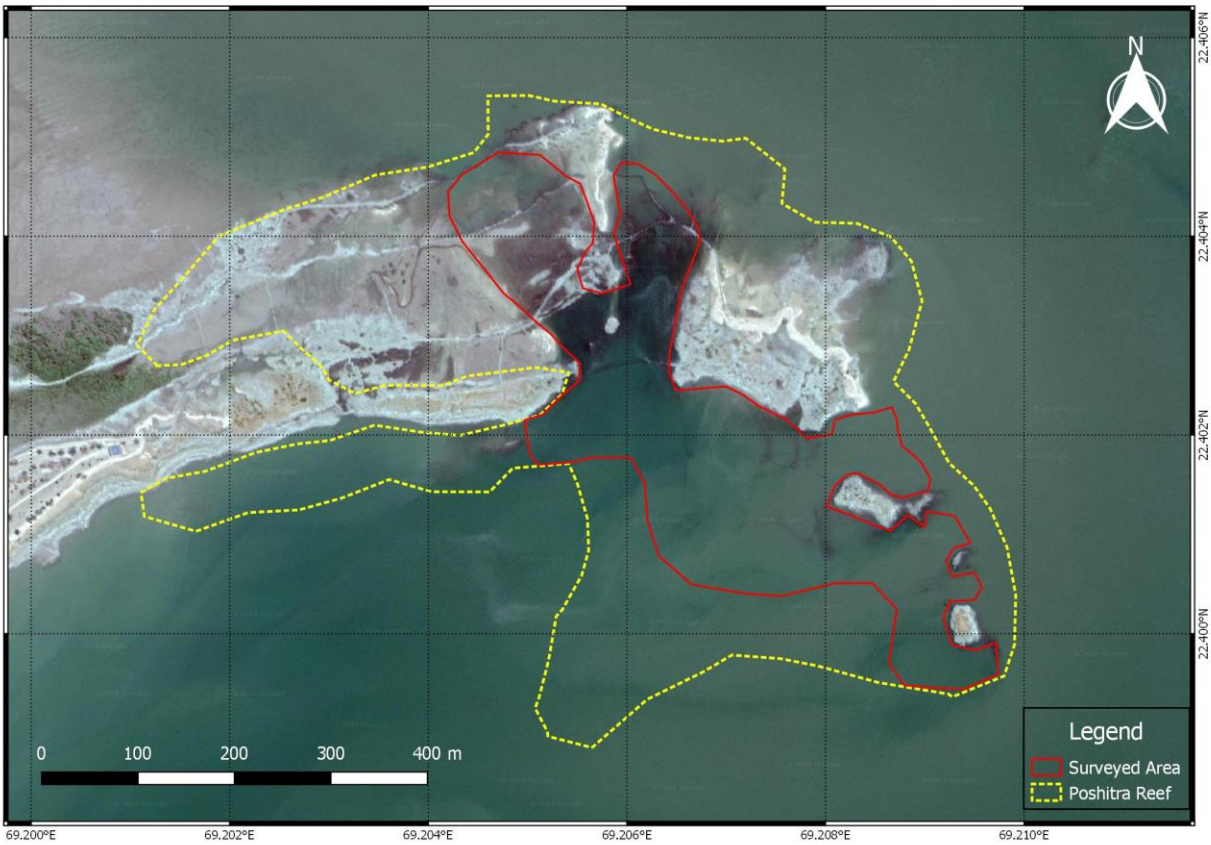
Major Habitat: Predominantly sand dominated with silt, scattered rocks. Live coral patches are present only near the reef edge. The habitat is highly degraded due to large-scale industrial establishments adjoining the region. Scars of large-scale coral mining of the past are still clearly visible despite its total ban in the late 1970s.

Biodiversity of Reef: Narara reef is one of the largest coral reefs of the area and is degrading rapidly. Besides some coral patches, the reef area in Narara supports diverse forms of encrusting invertebrate fauna. Densities of some of the faunal species are interestingly very high as compared to other reef areas in the MPA, for example sponge-associated nudibranchs. One can easily find varieties of crabs, sea anemone, star fish, octopus and puffer fish.

2.2. Poshitra Reef

Location: 22º22.0' and 69º11.1' E

Photo 2. Habitat at Poshitra Reef



Major Habitat: Sandy and rocky with several live coral patches

General Features: Poshitra reef is located at the tip of Poshitra Bay. The reef is very undulating with some huge rock formations in between. The main features of the area are beautiful and diverse coral reefs. Poshitra has many adjoining reefs such as Boria, Mangunda, Asab no Dhaliyo etc. All these reefs are very rich in terms of diversity.

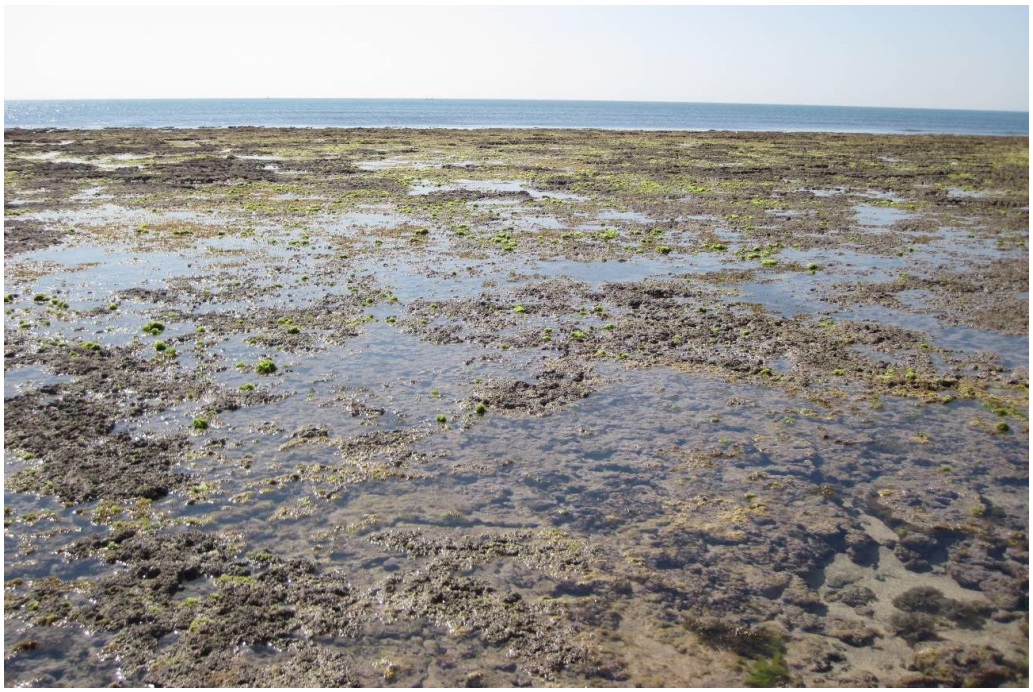
Biodiversity of Reef: Some of the finest coral reefs are found in and around Poshitra area. Soft corals like gorgonia and sea pen are also found in the area. Plate corals like Montipora were dominant in the recent past. Diversity of crabs is higher in the area. Nudibranchs like *Joruna* is found to be dominant in the area. *Sakuraeolis gujaratica* is point endemic to this particular reef.

2.3. Okha Reef

Location: 22°28'43.77"N and 69° 3'59.34"E

Major Habitat: Rocky with sandy Patches

Photo 3. Habitat at Okha



Biodiversity at Reef: Okha has degraded reef, which is mostly covered with the dead corals. Some live coral colonies towards the reef edges as well as reef-associated flora and fauna inhabits the area. The reef vegetation in the area is abundant as far as the recent survey and previous literatures are concerned.

2.4. Dwarka Reef

Location: 22°14'25.17"N and 68°57'23.51"E

Major Habitat: Rocky with sandy patches

Photo 2.6. Habitat at Dwarka Reef

General Features: Dwarka, The reef faces the Arabian Sea. The shore is dominated by rocky substratum with tidal pools. The exposure of intertidal zone at Dwarka is about 100 meters.

Biodiversity at Reef: The shore is also covered with various types of algae, hydroids, zooanthus colonies apart from some patches of the coral (*Favites sp.*). Apart from this, Rock Skipper (Blenniidae sp.), Wolf Crab, Neptune Crab, Brittle Star, Sea Anemone, Chiton, Polycheta worm, Flatworms etc. have also been spotted.

% of Sampled Area during Survey

No	Reef	Total Reef Area (KM^2) Approx.	Surveyed Area (KM^2)	% of Sample Area
1	Narara	25.9	1.62	6.25
2	Poshitra	0.35	0.11	31.42
3	Okha	0.28	0.17	60.71
4	Dwarka	0.10	0.03	30.00

4. Methodology

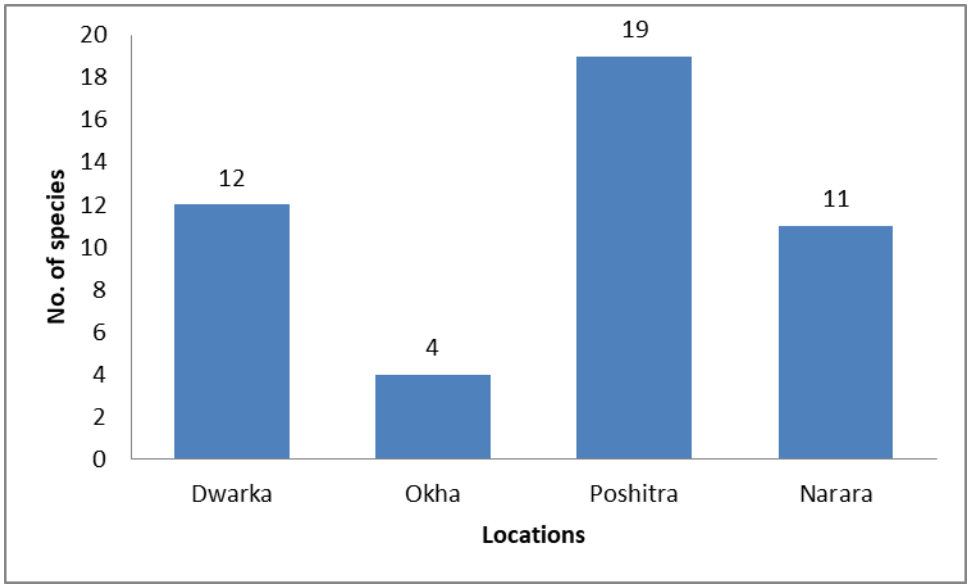
Potential areas were searched for direct sighting. Data such as geo-coordinates, micro habitat, associated fauna etc. were recorded. Selected specimens having taxonomic ambiguities were preserved in Ethanol (99%) and/or 4% formalin after relaxing them in Menthol solution prepared in sea water. All the specimens were then duly labeled with scientific name, date, place, name of collector, GPS coordinates and the medium of preservation, and deposited in the collections of BNHS. Sampling was carried out and on monthly basis excluding monsoon season. Nomenclature was verified on World Register for Marine Species (WoRMS, *www.marinespecies.org*).

5. Result and Discussion

5.1. Occurrence of ophistobranch fauna at all locations

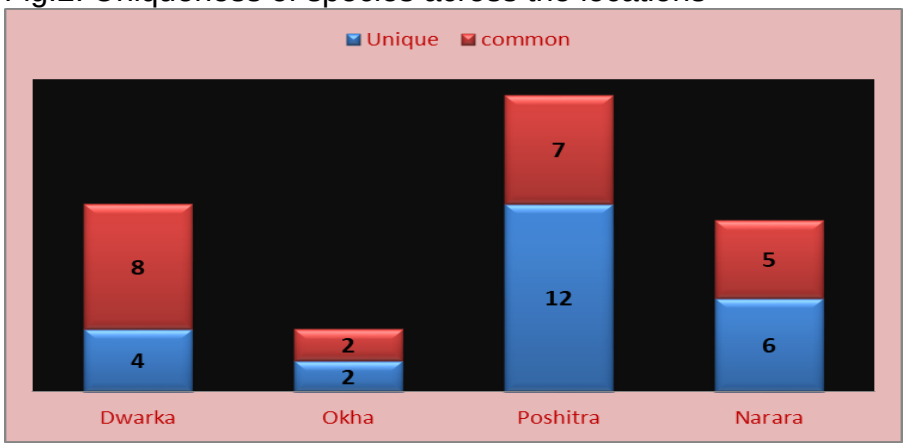
During the survey period, a total of 32 opisthobranch species were recorded (Table 1). Maximum diversity was observed at Poshitra with 19 species (Fig. 1) belonging to 11 families, followed by Dwarka reef with 12 species belonging to 8 families. Narara reef was recorded with 11 species belonging to 8 families, whereas Okha reef had the lowest diversity of ophistobranch fauna with only 4 species belonging to 4 familes.

Fig .1 Graph showing the number of ophistobranchs at each location



Of the 32 species recorded, 24 species were considered as specialist species i.e. restricted / reported from a single survey site. The remaining 8 species were recorded from more than one site. Poshitra recorded the maximum number of unique species i.e. 12 (Fig. 2), followed by Dwarka, which recorded 8 unique species. This indicates the requirement of a critical habitat and specific environment for specialist species. The survival of such specialist species purely depends on the preservation of these crucial habitats.

Fig.2. Uniqueness of species across the locations



5.2. Seasonal Occurrence

The opisthobranch diversity is purely season dependent. The diversity showed two different peaks i.e. winter peak (November-December) and post-winter peak (February-March) (Fig. 3).

Fig.3. Graph showing month-wise occurrence

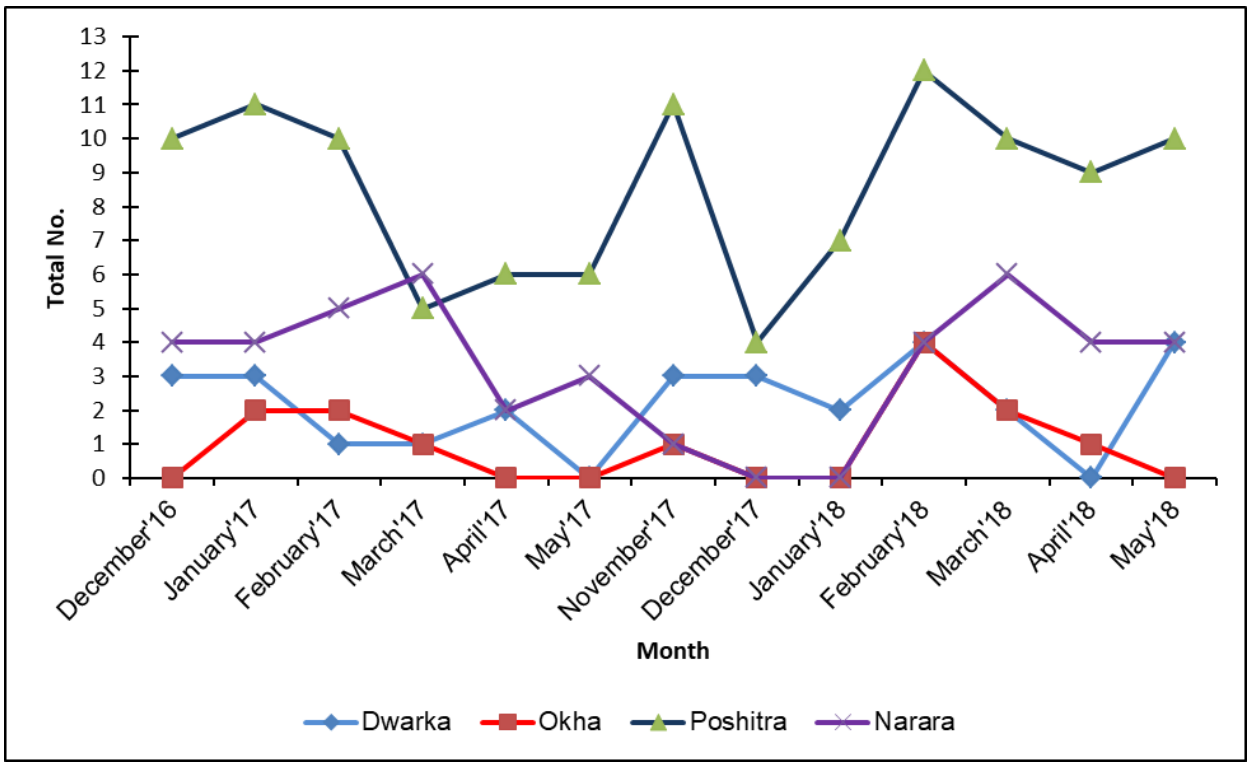


Table.1: List of ophistobranch fauna during the study period

Family		Scientific Name	Dwarka	Okha	Poshitra	Narara	Reference (previous records)
Haminoediae	1	*Haminoea ovalis*	-	√	-	-	Apte et al. 2010
	2	*Haminoea sp.*	-	-	-	√	Apte and Desai 2017
Plakobranchidae	3	*Elysia expansa*	√	√	√	√	Apte and Desai 2017
	4	*Elysia ornata*	√	-	√	-	Apte 2009
	5	*Elysia thompsoni*	√	-	√	-	Apte et al. 2010
Aplysiidae	6	*Aplysia dactylomela*	√	√	-	√	Apte et al. 2010
Pleurobranchidae	7	*Berthellina citrina*	-	-	-	√	Apte et al., 2010
Polyceridae	8	*Thecacera sp*	-	-	√	-	Apte and Desai 2017
	9	*Gymnodoris alba*	-	-	√	-	Apte et al., 2010
Discodoridiidae	10	*Peltodoris murrea*	-	-	-	√	Apte et al., 2010
	11	*Atagema rugosa*	-	-	-	√	Apte et al. 2010
	12	*Jorunna funebris*	-	-	√	√	Apte et al. 2010
Chromodoridiidae	13	*Glossodoris pallida*	√	-	√	√	Apte and Desai 2017
	14	*Hypselodoris carnea*	√	-	-	-	Apte and Desai 2017
	15	*Hypselodoris infucata*	-	-	-	√	Apte et al. 2010
	16	*Thorunna furtiva*	√	-	-	-	Apte & Desai 2017
Dendrodoridiidae	17	*Dendrodoris nigra*	-	-	-	√	Patel et al. 2010
Discodoridiidae	18	*Taringa sublutea*	-	√	-	-	Prasade et al.2015
Arminidae	19	*Dermatobranchus fortunatus*	√	-	-	√	Apte et al. 2010
Proctonotidae	20	*Janolus toyamensis*	-	-	√	-	Apte and Desai 2017
Tethydidae	21	*Melibe viridis*	-	-	√	-	Parasharya et al. 2014
Dotidae	22	*Doto sp*	-	-	√	-	Apte et al. 2017
Flabellinidae	23	*Flabellina bicolor*	√	-	√	-	Apte et al. 2010
Cuthonidae	24	*Trinchesia yamasui*	-	-	√	-	Apte et al. 2010
Facelinidae	25	*Facelina lineata*	-	-	√	-	Apte and Desai 2017
	26	*Phidiana militaris*	-	-	√	-	Apte et al. 2010
	27	*Noumeaella isa*	-	-	√	-	Apte and Desai 2017
	28	*Phyllodesmium cf. serratum*	√	-	√	-	Apte and Desai 2017

	29	*Sakuraeolis gujaratica*	-	-	√	-	Apte et al. 2010
	30	*Cratena sp*	-	-	√	-	Apte and Desai 2017
	31	*Pteraeolida semperi*	√	-	-	-	Apte and Desai 2017
Bornellidae	32	*Bornella stelifera*	-	-	√	-	Apte et al. 2010
		Total	12	4	19	11	

6. Anthropogenic Pressure

The state of Gujarat faces a rapid pace of human development. With a coastline of 1650 km, the state government is planning many Special Economic Zones on the coastal regions. This development also includes development of ports and harbours. This kind of developmental activities will increase pressure on the marine biodiversity on a large scale. Dredging of the ocean floor to construct jetties and the ship traffic may harm the marine ecosystem. Unregulated handling of coal on jetties like Sikka creates heavy carbon pollution in the area. Non-scientific interventions like bunds at Poshitra will be highly detrimental to live coral cover and must be removed.

During the study period we carried out on site observations of various threats to marine biodiversity in general. Following are the observations.

6.1. Handling the marine biodiversity

Fig. 5. Marine biodiversity being handled by guides (images as posted on social media) (Links
1:https://www.facebook.com/ojasisjetpur/photos/pcb.1842--3746-19684/1842--121935327-/?type=3
2:https://www.facebook.com/nararajamnagar/photos/a.315388275318422.1-73741835.3-6-52216252-28/315388251985-91/?type=3&theater

3:https://www.facebook.com/photo.php?fbid=1-74776559228521&set=a.1-7476-5-5896793.1-7374187-.1-----885611613&type=3&theater
4:https://www.facebook.com/photo.php?fbid=1-1555316-6173337&set=pcb.1-1555316-7-63337&type=3&theater)

This practice of handling some common marine biodiversity was observed specially at Narara and Poshitra where local guides handle the living organisms such as octopus, puffer fish and crabs to demonstrate to tourists. This activity also encourages tourists to handle marine creatures by themselves for photography. To tackle this situation, BNHS has chalked out education and awareness programmes for guides and nature educators.

Photo documentation

 *Sakuraeolis gujaratica*	 *Cratena sp*
 *Dendrodoris fumata*	 *Noumealla isa*
 *Cuthona yamasui*	 *Phidiana militaris*
 *Jorunna funebris*	 *Elysia ornata*

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