



## Seaweeds diversity study of selected Beyt dwarka coast in Gujarat, India

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### Abstract

The Coast of Beyt Dwarka, (22°28'N and 69°05'E) located at the mouth of "Gulf of Kachchh" on the part of Saurashtra in Gujarat state. The site has a great diversity of marine algae in the area of the intertidal zone. The present study mainly focused on seaweed occurrence, distribution and diversity along the selected Beyt Dwarka coast. The seaweed diversity study performed in the month of March-2019. Collection of samples was done during low tide conditions. In outcome, a variety of seaweed species were collected along with their holdfast or rhizoid. Of the total collected 39 species of marine algae, green algae revealed maximum number of five species, followed by 26 red algae species and 8 brown algae species. The different classes and phylum found in different proportions and densities. Among all, red algae (Rhodophyta) found in abundance following Brown algae (Phaeophyta) and green algae (Chlorophyta).

**Keywords:** beyt dwarka, chlorophytes, phaeophytes, rhodophytes, seaweed diversity

### 1. Introduction

Marine algae, similarly known as seaweed microscopic photosynthetic organisms which group are and either seawater <sup>[1]</sup>. This marine resource is an autotroph, mostly found in ocean, lagoons, estuaries etc <sup>[2]</sup>. Seaweeds have complex differentiates thallus. These algae found attached to the bottom on solid substrates such as rocks, pebbles, shells, dead corals and plants <sup>[3]</sup>. It is mainly found in the intertidal region due to the richness of nutrients <sup>[4]</sup>. Marine algae subdivided into mainly three different types: brown algae (Phaeophyta), red algae (Rhodophyta) and green algae (chlorophyte). On the basis of their pigments that present in it <sup>[5, 6]</sup>.

Seaweed has great importance, rich in vitamins, minerals, proteins, carbohydrates, amino acids, lipids etc <sup>[7]</sup>. It is used as a food, animal feeds, fertilities and as raw materials in industrial production of industrial phycocolloids on nutritional food and aquaculture <sup>[8]</sup>. Due to the richness of bioactive constituents, it revealed many applications such as antioxidant, anticancer, antimalarial, pharmacological and cosmeceutical, activities <sup>[9]</sup>. Significant antimicrobial, antioxidant properties and good chemical composition of seaweeds *Sargassumlatifolium* collected from Saudi Arabia (the Red Sea and Arabian Gulf) Nadine M.S. Moubayed *et al.*(2016) <sup>[10]</sup> Julio Cesar Fernandes Peres *et al.* (2012) evaluated the antifungal activity of seaweed extracts. They suggested that the terpenes, neophytadiene, cartilagineol, obtusolelatol; and the ester ethyl hexadecanoate presence in the *L. dendroidea* extract that responsible for antifungal activity <sup>[11]</sup>. M. Kausalya\* and G.M. NarasimhaRao also reported the presence of active constituents responsible for antimicrobial activity of marine algae <sup>[12]</sup>. A good amount of an Antibacterial Activity of Some Marine Algae from the South East Coast of India reported by R. Seenivasan *et al.* They showed that the 80% Ethanolic, Methanolic, and acetone extract of green algae has the ability to inhibit the

growth of the Gram-positive and Gram-negative bacteria <sup>[13]</sup>. Yolanda Freile-Peleguin and Juan Luis Morales exhibited stolon of Caulerpa's potential antibacterial activity in marine algae from the coast of Yucatan, Mexico Yolanda <sup>[14]</sup>. Seaweeds screened from Mandapam Coastal waters screened for its antimicrobial activity by Sasikala C and Ge etha Ramani D (2017). They showed the importance of secondary metabolites for this activity <sup>[15]</sup>. Carmen Rizzo *et al.* (2017) exploited potential Antibacterial Activity of Marine Macroalgae against Pathogens Relevant Human Health benefits. They indicated polysaccharides represent a novel source for its antibacterial activity <sup>[16]</sup>. Besides its importance, India has a huge coastline of more than 7000 km which possesses a large diversity of marine seaweeds <sup>[17]</sup>. This seaweed is highly diversified and a variety of seaweed and a different proportion of diversities <sup>[18, 19]</sup>. In India, the Gujarat state covers a total coastline of 1600 km, which is the longest among all the states of the country, and it covers almost 21.9% of the Indian coastline of India. It has two identification. 1 Gulf of Khambhat 2. Gulf of kutch. The main objective of the study is to check the diversity of marine algae at Beyt Dwarka coast, Gujarat, India.

### 2. Materials and methods

#### 2.1 Site selection for study

Algal diversity study was carried out from the site that is located at Lat Ref: North Long Ref: East, Coordinates: 22° 28' 32.69" N, 69° 8' 38.14" E Altitude: 54 (Below Sea Level) The site location depicted in figure 1. Beyt Dwarka is an occupied island at the mouth of the Gulf of Kutch arranged 3 km off the shore of Okha, Gujarat, India. The island is estimated northwest to southeast in 13 km (8 mi) with a normal 4 km (2 mi) in the east-west bearing. It is a portion of sand and stone arranged 30 km (19 mi) north of the town of Dwarka The primary ocean extension of Gujarat is proposed among Okha and Beyt Dwarka.

## 2.2 Collection and Identification of Marine algae

Samples of the marine algae were collected in the month of March-2019(3/3/2019, around between 3 PM to 5 PM), Beyt Dwarka, Devbhumi Dwaraka District, Gujarat, 361350, India during low tide conditions.

During collection time, atmospheric condition is as follow: Temperature, (High/Low):- 30<sup>0</sup> C/18<sup>0</sup>C, Precipitation:- 0%, Humidity:- 55%, Wind:- 14 km/h.

The collected algal sample was washed with distilled water to remove impurities and macroscopic epiphytes and then placed on absorbent paper to remove excess water and stored at a low temperature until analyses. All samples collected in polythene bags and then stored in their natural color by using a formulation of Cupric sulphate (0.5gm) + Water (38ml) + Glacial acetic acid (4 ml) + 4% Formalin (8ml) + 95% Ethyl alcohol (50ml). The collected species were identified in the Department of Fisheries, Junagadh Agricultural University at Okha, Gujarat.

## 3. Results and Discussion

The 39 specimens of benthic algae under 3 phylum from four investigation. Table no. 01 revealed a distribution of all the 39 species from 3 phylum belonging to Chlorophyta,

Rhodophyta and Ochrophyta. Here occurrence of particular alga studied in Beyt dwarka is indicated.

Among collected algal species, total number of green algae, red algae and brown algae are 5, 26 and 8 respectively. Out of total five green algae, four algal species belong to Ulvophyceae class whereas 1 belong to Chlorophyceae class. All the collected red algae and brown algae belong to Florideophyceae and Phaeophyceae class. Graphical representation of collected algae in different phylum exhibited in figure no. 2. Distribution of collected algal species in different family expressed in figure no. 3. Fig. no. 4 to 7 showed images of seaweeds that found in abundance.

## 4. Conclusion

The seaweed diversity of beyt Dwarka consists of four major classes major classes Ulvophyceae, Chlorophyceae, Florideophyceae and Phaeophyceae. The occurrence and distribution of red algae is relatively greater than brown and green algae. Diversity of seaweeds vary in size and composition and contain a large variety of species. Marine algal species are widely distributed in different sea sites based on their adaptability.

## 5. Tables and Figures

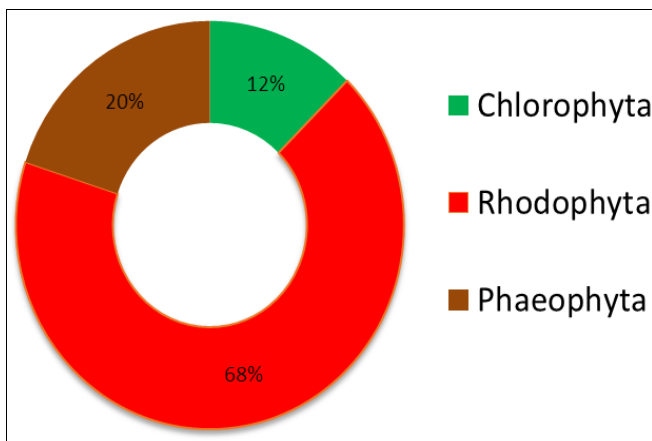
**Table 1:** Different seaweeds (Green, Red & Brown algae) with its Phylum, Class and its Family

Green algae (Chlorophyta)		Phylum	Class	Family
1	<i>Caulerpa racemosa</i>	Chlorophyta	Ulvophyceae	Caulerpaceae
2	<i>Caulerpaveravalensis</i> Thivy&Chauhan	Chlorophyta	Ulvophyceae	Caulerpaceae
3	<i>Caulerpa stercularoides</i>	Chlorophyta.	Ulvophyceae	Caulerpaceae
4	<i>Caulerpa scalpelliformis</i>	Chlorophyta	Ulvophyceae	Chlorophyceae
5	<i>Ulva reticulate</i>	Chlorophyta.	Chlorophyceae	Ulvaceae
Red algae (Rhodophyta)				
1	<i>Scinaia fascicularis</i>	Rhodophyta	Florideophyceae	Scinaiaceae
2	<i>Hypner valentiae</i> Montage	Rhodophyta	Florideophyceae	Cystocloniaceae
3	<i>Halymenia venusta</i>	Rhodophyta	Florideophyceae	Halymeniaceae
4	<i>Gracilaria foliifera</i>	Rhodophyta	Florideophyceae	Gracilariaceae
5	<i>Platysiphonia delicate</i>	Rhodophyta	Florideophyceae	Sarcomeniaceae
6	<i>Chondria dasyphylla</i> C. Agardh	Rhodophyta	Florideophyceae	Rhodomelaceae
7	<i>Botryocladia leptopoda</i> kylin	Rhodophyta	Florideophyceae	Rhodymeniaceae
8	<i>Potryocladia leptopoda</i> kylin	Rhodophyta	Florideophyceae	Rhodymeniaceae
9	<i>Gracillaria veravalensis</i>	Rhodophyta	Florideophyceae	Gracilariaceae
10	<i>Laurencia papillosa</i>	Rhodophyta	Florideophyceae	Rhodomelaceae
11	<i>Dermonema virens</i>	Rhodophyta	Florideophyceae	Liagoraceae
12	<i>Polysiphonia marina</i>	Rhodophyta	Florideophyceae	Rhodomelaceae
13	<i>Sarcomema mulleri</i> De Toni	Rhodophyta	Florideophyceae	Solieriaceae
14	<i>Hypner valentia</i> Montage	Rhodophyta	Florideophyceae	Cystocloniaceae
15	<i>Spyridia hypnoides</i>	Rhodophyta	Florideophyceae	Spyridiaceae
16	<i>Gracillaria textori</i>	Rhodophyta	Florideophyceae	Gracilariaceae
17	<i>Halimonia porphyroformis</i>	Rhodophyta	Florideophyceae	Halymeniaceae
18	<i>Acanthophora spicifera</i>	Rhodophyta	Florideophyceae	Rhodomelaceae
19	<i>Gracillaria dura</i>	Rhodophyta	Florideophyceae	Gracilariaceae
20	<i>Gracillaria corticata</i>	Rhodophyta	Florideophyceae	Gracilariaceae
21	<i>Sebdenia polydactyla</i>	Rhodophyta	Florideophyceae	Sebdeniaceae
22	<i>Hypnea sp.</i>	Rhodophyta	Florideophyceae	Cystocloniaceae
23	<i>Cylarthrum muelleri</i>	Rhodophyta	Florideophyceae	Rhodymeniaceae
24	<i>Heterosiphonia muelleri</i>	Rhodophyta	Florideophyceae	Dasyaceae
25	<i>Hypnea musciformis</i>	Rhodophyta	Florideophyceae	Florideophyceae
26	<i>Laurencia claviformis</i> Borgesen	Rhodophyta	Florideophyceae	Rhodomelaceae
Brown algae (Phaeophyta)				
1	<i>Padina tetrastomatica</i>	Ochrophyta	Phaeophyceae	Dictyotaceae
2	<i>Sargassum johnstonii</i>	Ochrophyta	Phaeophyceae	Sargassaceae
3	<i>Dictyopteris acrostichoides</i> Bornet	Ochrophyta	Phaeophyceae	Dictyotaceae
4	<i>Spatoglossum asperum</i> J. Agardh	Ochrophyta	Phaeophyceae	Dictyotaceae
5	<i>Sargassum tenerimum</i>	Ochrophyta	Phaeophyceae	Sargassaceae

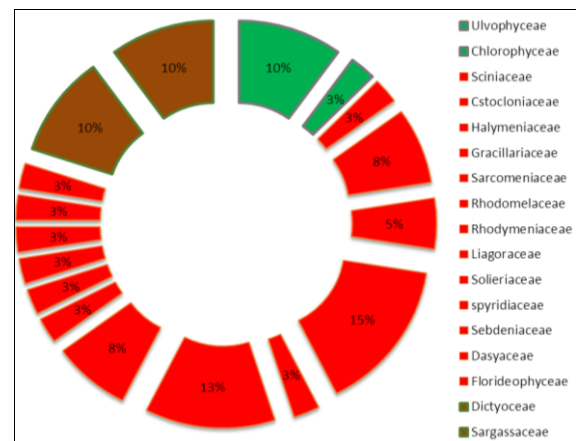
6	<i>Dictyopterus australis</i>	Ochrophyta	Phaeophyceae	Dictyotaceae
7	<i>Sargassum cinctum</i>	Ochrophyta	Phaeophyceae	Sargassaceae
8	<i>Turbinaria sp.</i>	Ochrophyta	Phaeophyceae	Sargassaceae



**Fig 1:** Location of algal collection site



**Fig 2:** Distribution of collected Chlorophyta, Rhodophyta and Phaeophyta phylum



**Fig 3:** Occurrence of different seaweed classes among collected different phylum

**Green Algae****Fig 4:** *Caulerpa racemosa***Fig 5:** *Ulva reticulata***Brown Algae****Fig 6:** *Padina tetrastomatica***Fig 7:** *Starveana anastomos***4. Acknowledgment**

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**5. References**

1. Ambhore JS, Whankatte VR. Biodiversity of marine algae along the Raigad coast of Konkan, Maharashtra. *Eur J Exp biology*. 2016; 6(4):69–76.
2. Kurve P, Kurve N Kumar, Oak G. Diversity and Abundance of Marine Macroalgae along Borli Coast: a Zone under the Western Ghats, Maharashtra, India. *Ambient Sci*. 2015; 2(1):1–8.
3. Pawar PR. Distribution Pattern & Species Diversity of Seaweeds at Uran (Navi Mumbai), West Coast of India. *Int J Pure Appl Zool* [Internet]. 2017; 5(1):25–32. Available from: <http://www.ijpaz.com>
4. Kumar RR. Comparative Study of Marine Microalgal Abundance and Diversity along Coastal Region of Raigad District, Maharashtra. *Int J Pure Appl Biosci*. 2017; 5(4):433–40.
5. Dave TH, Vaghela DT, Chudasama BG. Status, distribution, and diversity of some macroalgae along the intertidal coast of Okha, Gulf of Kachchh, Gujarat in India. ~ 327 ~ *J Entomol Zool Stud*. 2019; 7(3):327–31.
6. Muth AF, Congdon VM. Seaweeds and Seagrasses [Internet]. 3rd ed. *Encyclopedia of Ocean Sciences*. Elsevier Inc, 2019, 765–774p. Available from: <http://dx.doi.org/10.1016/B978-0-12-409548-9.11265-5>
7. Sushanto Gouda, Gitanjali Hubli, K Pramanik. Study on Algal Biodiversity in and around Rourkela, Odisha, India. 2015; 06(02):94–8.
8. Nirmal Kumar JI, Barot M, Kumar RN. Distribution and biochemical constituents of different seaweeds collected from Okha coast, Gujarat, India. *Indian J Geo-Marine Sci*. 2017; 46(2):349–57.
9. Raja A, CV and AA. Biological importance of Marine Algae- An overview. *Int J Curr Microbiol App Sci*. 2013; 2(5):222–7.

10. Venkataraman K, Wafar M. Coastal and marine biodiversity of India. *Indian J Mar Sci.* 2005; 34(1):57–75.
11. Peres JCF, de Carvalho LR, Gonçalez E, Berian LOS, Felicio JD. Avaliação de atividade antifúngica de extratos de macroalgas marinhas. *Cienc e Agrotecnologia.* 2012; 36(3):294–9.
12. Kausalya M, Narasimha Rao GM. *J Algal Biomass Utiln.* 2015; 6(1):78-87.
13. Seenivasan R, Indu H, Archana G, Geetha S. The Antibacterial Activity of Some Marine Algae from South East Coast of India. *J Pharm Res [Internet].* 2010; 3(8):1907–12. Available from: [http://idosi.org/aejaes/jaes9\(5\)/4.p](http://idosi.org/aejaes/jaes9(5)/4.p)
14. Freile-Pelegín Y, Morales JL. Antibacterial activity in marine algae from the coast of Yucatan, Mexico. *Bot Mar.* 2004; 47(2):140-6.
15. Sasikala C, Geetha Ramani D. Comparative study on antimicrobial activity of seaweeds. *Asian J Pharm Clin Res.* 2017; 10(12):384-6.
16. Rizzo C, Novese G, Morabito M, Faggio C, Pagano M, Spanò A, *et al.* Potential antibacterial activity of marine macroalgae against pathogens relevant for aquaculture and human health. *J Pure Appl Microbiol.* 2017; 11(4):1695-706.
17. Moubayed NMS, Al Houry HJ, Al Khulaifi MM, Al Farraj DA. Antimicrobial, antioxidant properties and chemical composition of seaweeds collected from Saudi Arabia (the Red Sea and Arabian Gulf). *Saudi J Biol Sci [Internet].* 2017; 24(1):162-9. Available from: <http://dx.doi.org/10.1016/j.sjbs.2016.05.018>
18. Satheesh S, Wesley S. Diversity and distribution of seaweeds in the Kudankulam coastal waters, south-eastern coast of India. *Biodivers J.* 2012; 3(1):79-84.
19. Rath J, Adhikary SP. Marine Macro-algae of Orissa, East Coast of India. *Algae.* 2006; 21(1):49-59.