



The diversity of marine seaweeds from coastal zones of Saurashtra

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Abstract

Research on regional marine seaweed diversity is the first step of the phycological research or studies. There is various research works reported on marine algal diversity and distribution from different states in India. Marine seaweeds are exposed during inter tidal activity in coast. Gujarat has a longest coastal area among all the states in India. Purpose for this current study is that a numerous species of marine-seaweeds-reported from the selected zones of Saurashtra, Gujarat. The portion of marine-algae was recorded in the selected four sea coast zones i.e., Dwarka, Okha, Porbandar and Veraval. The study was carried out during April 2019 to December 2019. 21 species were recorded during this study period. Random sampling method was opted out for the study. The different species of Chlorophyceae, Phaeophyceae and Rhodophyceae observed and recorded.

Keywords: biodiversity, marine seaweeds, phycology, seasonal changes, chlorophyceae, pheophyceae, rhodophyceae

Introduction

India has a costal line of more than 7000 kilometres which supports a rich diversity of seaweeds (Oza and Zaidi 2001)^[17]. In Gujarat, both of the Gulfs such as Kutch and Khambhat are greatly diversified due to their various coastline habitats such as coastal processes, geomorphology and physiography. Specially in Gujarat, the coast of Saurashtra is a longest stretches of corallines, rocks, and limestone-substratum which are rich in quantities of algal diversity. These seaweeds are getting visible for the duration of low-tide period. Marine-seaweeds are huge benthic-algae and it is macro thallic and multicellular. These algae are separated from the most microscopic size of algae (Smith-1944)^[20]. They plays vital role as environmentally and economically noteworthy component in marine-ecosystem and make a remarkable support to marine primary-production (Mann KH, 1973^[16]. Williams and Smith, 2007)^[24]. These plants form are vital renewable-resources in the aquatic-environment (John, Peter Paul and Raja, 2011)^[9]. It was evaluated that around 90 percentage of the species of marine plants are algae and nearly 40 percentage of the universal photosynthesis which is contributed from seaweeds (Anderson, 1992). The total frameworks along the various coastline-states of India has been stated to be 6, 77,308 tonnes wet-weight (ww) including 1260 tonnes of drift seaweed (Krishnamurthy,1970)^[14].

Currently, there are many countries such as China, Chile, Indonesia, India, Japan, North Korea, Norway, South Korea, Philippines and USA working on intensive studies on seaweeds in the World. These countries lead to contribute nearly 95% of the world's viable seaweed volume (Khan and Satam,2003)^[12]. Around 90% of seaweed manufacturing comes from culture-based practices. According to FAO-Food and Agricultural Organization-2014 of the United Nation (UN) the average yearly growth rate of algae was 8.13% in amount and 6.84% in financial value in between 2003and2012. At the global level approximately 20,000 marine-seaweed species have been recorded and nearly 221 species of seaweeds are economically used (Khan-and - Satam,2003)^[12].

Seaweeds are primary producer and they are used as a human food, in farm as an animal feed, as a manure for land plants growth, as a bio-fertilizer, as a medicine, and as an economically important bioactive resources and phycocolloid-sources like Iodine all over the world (Levering *et al*,1969^[15], Chapman, 1970)^[4]. Many species of seaweeds such as a *Hydroclathrus*, *Gracilaria laurencia*, *Laminaria*, *Macrocystis*, *Undaria*, *Porphyra*, *Sargassum* and *Acanthophora* is consumed by the human as a curry, salad, vegetable, pickle, and soup (Chennubhotla *et al*, 1987)^[5]. Due to a chemical composition of seaweeds it is also popular in the industrial products. Some of marine seaweeds used in the industrial products i.e. gelling, stabilizing agent in food, in pharmaceutical companies, dairy, textile and paper industries (Kolanjinathan *et al*, 2014)^[13].

Recent seaweed status of Indian country shows 844 species distributed among 217 genera which include 434 Rhodophyceae species (Red algae), 191 Pheophyceae species (Brown algae) and 216 Chlorophyceae species (green algae) of seaweeds (Oza and Zaidi, 2001^[17], Venkatraman and Wafar, 2005). From this distribution 198 species which includes 109 species of red seaweeds, 62 species of green seaweeds and 54 species of brown seaweeds for Gujarat-and-Tamil-Nadu (B. Jha *et al*,2009)^[3]. Several research works of marine seaweeds have been stated in the various parts of Indian-coast. The coast of Tuticorin is recorded with total 86 species of seaweeds which includes 27 green algae, 27 brown algae and 32 red algae species (Canciyal *et al*, 2014)^[6]. The Manapad coast-area recorded 20 seaweeds-species (Doss and Rukshana, 2016)^[7]. The water lagoons, Chennai are recorded 25 species of seaweeds during the year 2014-2016 (Bhagyaraj and Kunchithapatham, 2016)^[2]. The total number of 73 seaweeds species recorded in west coast, Maharashtra during a year 2015-2016 (Waghmode, 2017)^[23]. 39 species of marine algae recorded in bet Dwarka during March 2019 (H. Kalsariya *et al*. 2020). Total 39 species of seaweeds

observed in Okha coast during the year 2016-2017 (Dave *et al.*, 2019^[8]) During September to November and December to February total 35 and 47 species of seaweeds reported respectively in veraval and sikka coast, Gujarat (Pathak *et al.*, 2020)^[18, 19]. Total 50 species of seaweeds were recorded from Veraval and Sikka coasts region of Gujarat. Among them 17 species of green, 14 species of brown and 19 species of red marine-seaweeds during September 2019 to February 2020 (6months) using belt transect method. (Pathak *et al.*, 2020)^[18, 19]. Totally 74 species were recorded among them 28 species-Chlorophyceae (green), 18 species-Phaeophyceae (brown) and 28 species of Rhodophyceae (red) in Vadakkadu and Olaikuda, Rameshwaram, southeast coast of India (Roy S. 2020)^[21]. In consequence of above mention status of seaweed distribution, the current study leads to define the seasonal distribution of marine seaweeds at four selected locations of Saurashtra region *viz.* Dwarka, Okha, Porbandar and Veraval coast, Gujarat.

Materials-and-Methods

Description of selected study location

Four coastal zones (approximately in 300 km distance) were selected from Saurashtra for the diversity study of marine seaweeds. The details of the coastal line areas given below: The Okha coast (22.4649°N, 69.0702°E) located at the mouth of Gulf of Kutch. Okha coast mostly covers the north and western part of Saurashtra. The Okha coast observed for a great variety of marine organisms such as seaweeds, gastropods and corals which is visible during low tide period. Dwarka (28.5823°N, 77.0500°E) is the first capital of Gujarat. It is located at the western end of the Saurashtra. The samples of seaweeds were collected near the bhadkeshwar mahadev temple from Dwarka. Porbandar (21.6417°N, 69.6293°E) is an ancient port city. Chowpati area selected for the collection of samples. Veraval coast (20.9159°N, 70.3629°E) is an inlet of the Arabian Sea and it is well-known intertidal zone in Gujarat State. Behind the lighthouse area selected for the seaweeds sample collection.

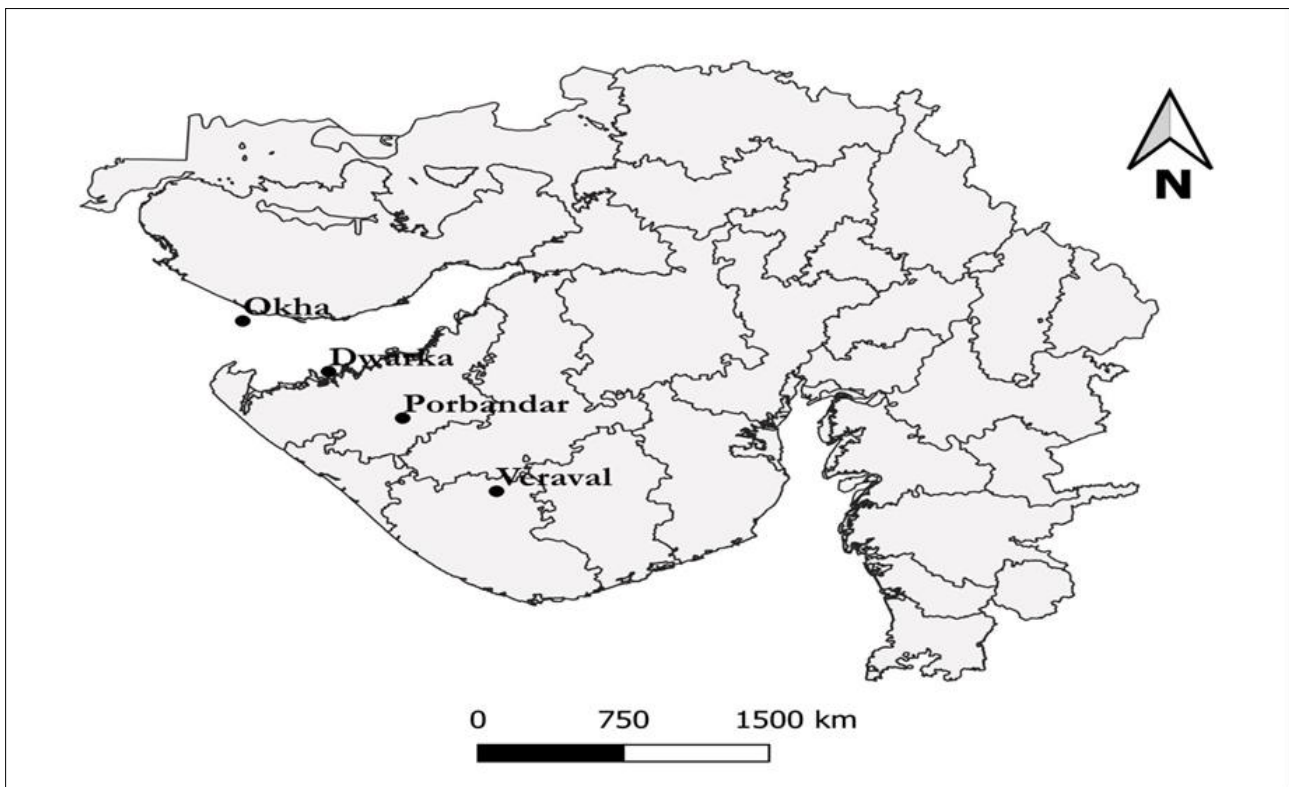


Fig 1 : GIS map of selected area in Saurashtra, Gujarat, India

Sampling Period and Sampling-Method

The work was initiated from April to December-2019. The random sampling method used for the collection of seaweeds from the selected sites. The entire specimen collected from the inter-tidal region. Collections of macro-algal specimens were carried out at four different sites from Saurashtra coast. All seaweeds specimens were collected from the inter-tidal region during summer to winter (April to December) in the year 2019. Collections were made during day time hours from their natural habitats. All the species

were identified using a standard reference material of B. Jha *et al.* 2009^[3].

Results

In the figure 1, figure 2 and figure 3 shows the species of Chlorophyceae, Pheophyceae and Rhodophyceae respectively. These species were recorded during study period (April to December 2019) from the Dwarka, Okha, Porbandar and Veraval.

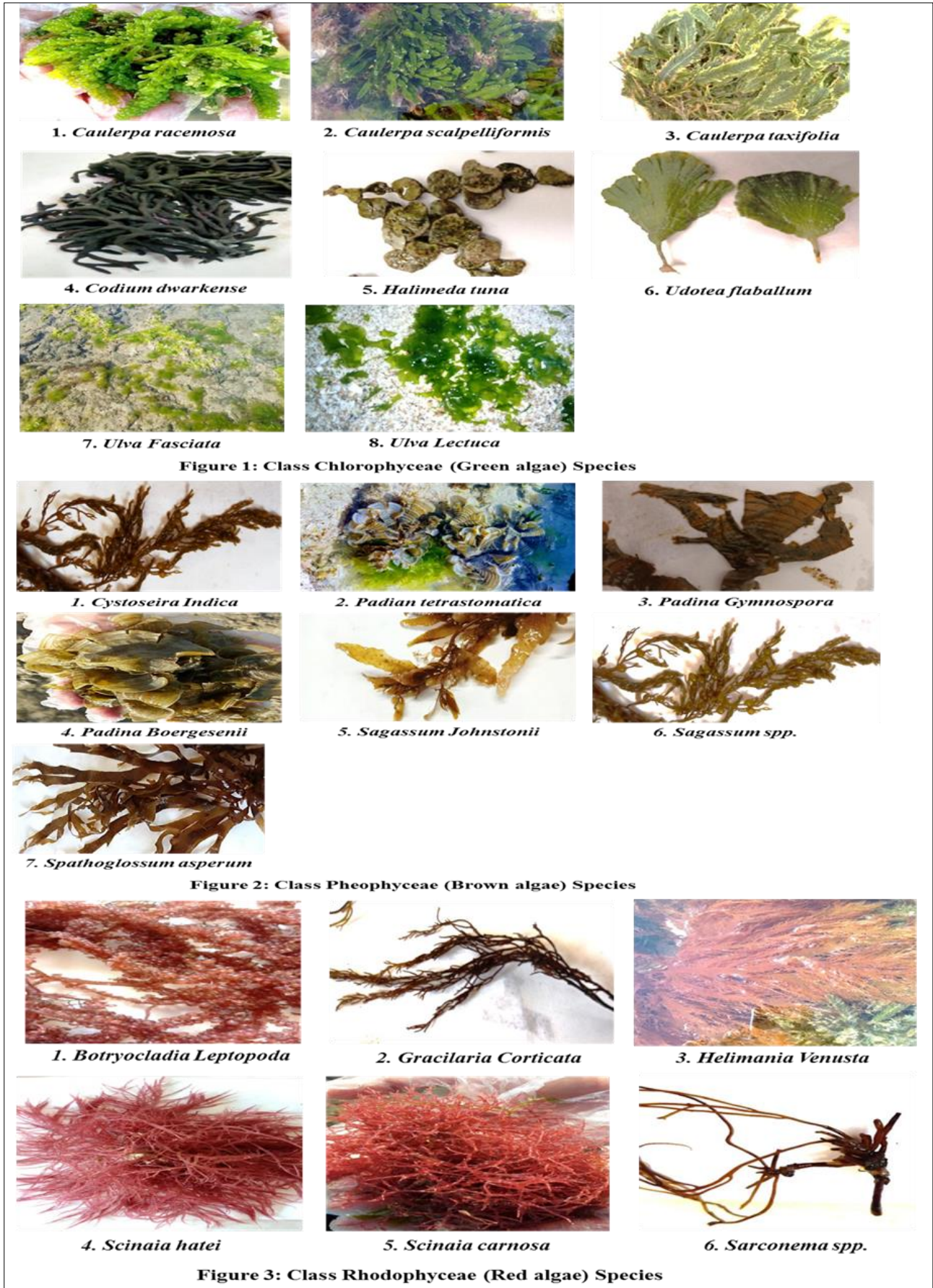


Fig 2

Table 1: Recorded species from Dwarka, Okha, Porbandar and Veraval

Species	Class	Order	Family	Dwarka		Okha		Porbandar		Veraval		
				Pre-Monsoon	Post-Monsoon	Pre-Monsoon	Post-Monsoon	Pre-Monsoon	Post-Monsoon	Pre-Monsoon	Post-Monsoon	
<i>Caulerpa-racemosa</i>	Chlorophyceae	Bryopsidales	Caulerpaceae	-	-	√	√	√	-	√	√	
<i>Caulerpa-scalpelliformis</i>				-	-	√	√	-	-	√	-	
<i>Caulerpa-taxifolia</i>				-	-	√	√	-	-	√	-	
<i>Codium-dwarkense</i>			Codiaceae	-	-	-	-	√	√	-	-	
<i>Halimeda tuna</i>			Halimedaceae	-	-	√	√	-	-	-	-	
<i>Udotea flabulum</i>			Udoteaceae	-	-	√	√	-	-	-	-	
<i>Ulva fasciata</i>		Ulvales	Ulvaceae	-	-	√	√	-	-	-	-	
<i>Ulva lactuca</i>				-	-	-	√	-	-	√	√	
<i>Cystoseira indica</i>	Phaeophyceae	Fucales	Cystoceiraceae	√	√	-	-	-	-	√	√	
<i>Padina tetrastrumatica</i>		Dictyotales	Dictyotaceae	-	-	√	√	-	-	-	-	
<i>Padina gymnospora</i>				-	-	√	√	-	-	-	-	
<i>Padina Børgesenii</i>				-	-	√	√	-	-	-	-	
<i>Sargassum johnstonii</i>		Fucales	Sargassaceae	√	-	-	-	-	-	√	-	
<i>Sargassum spp</i>				√	-	-	√	-	-	-	-	√
<i>Spatoglossum asperum</i>		Dictyotales	Dictyotaceae	-	-	√	√	√	-	-	-	
<i>Botryocladia leptopoda</i>		Rhodophyceae	Rhodymeniales	Rhodymeniaceae	-	-	√	√	√	√	-	-
<i>Gracilaria corticata</i>			Gracilariales	Gracilariaceae	-	-	√	√	√	-	-	-
<i>Halymenia venusta</i>			Cryptonemiales	Halymeniaceae	-	-	√	√	-	-	-	-
<i>Scinaia hatei</i>	Nemaliales		Galaxauraceae	-	-	√	√	√	√	-	-	
<i>Scinaia carnosa</i>			Scianiaceae	-	-	√	√	√	√	√	√	
<i>Sarconema filiforme</i>	Gigartinales		Solieriaceae	√	-	-	-	-	-	-	√	-

According to result recorded species are shown in the table1.Total 21 species were recorded throughout the study period, among these marine seaweeds species 8 species from Class chlorophyceae (green algae), 7 species from class pheophyceae (Brownalgae) and 6 species from class Rhodophyceae (red algae) were observed. During the study period it is observed that the Ulva spp. observed abundant in pre and post monsoon period followed by Padina spp., Sargassum spp. And Botryocladia spp.

Conclusion

As per the results, Okha>Porbandar>Veraval>Dwarka. Okha was found rich in seaweed diversity. In this study, the growth of seaweeds also depends on climatic conditions such as weather, season and coastal environment. This study also provides information of marine seaweeds and gives an idea about the presence of seaweed resources variety, planning for conservation of these natural resource and use as sustainable application in future aspect. These coastal regions of the seaweed flora will be benefiting us in the wide use of seaweeds which is economically important.

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