

## MARINE MACROALGAE OF GUJARAT: DIVERSITY, ECOLOGY & PROSPECTS

\*Nikita Hadula<sup>1</sup>, Maulik Gadani<sup>1</sup> and Goral Jani<sup>2</sup>

<sup>1</sup>Department of Botany, St. Xavier's College (Autonomous), Ahmedabad, Gujarat

<sup>2</sup>Department of Botany, Government Arts & Science College, Bavla, Ahmedabad, Gujarat

\*Author for Correspondence: [hadulanikita@gmail.com](mailto:hadulanikita@gmail.com)

### ABSTRACT

Marine macroalgae constitute a vital component of coastal ecosystems, contributing significantly to primary productivity, habitat complexity and biogeochemical cycling. The Gujarat coast, located along the northwestern part of India with ~1,600 km of coastline, represents one of the most dynamic and ecologically diverse marine regions, encompassing unique habitats such as coral reefs, rocky intertidal zones, mudflats and estuarine systems supporting a rich assemblage of marine macroalgae (seaweeds). Despite numerous localized studies, a comprehensive synthesis of macroalgal diversity and ecological attributes along this coastline remains limited. The present review aims to consolidate existing knowledge on the diversity, distribution and ecological significance of marine macroalgae along the Gujarat coast, with particular emphasis on major regions including the Gulf of Kachchh, Gulf of Khambhat and adjoining open coastal areas. Gujarat's coast harbors nearly 198 macroalgal species distributed among three major groups: Chlorophyta (green algae), Phaeophyceae (brown algae) and Rhodophyta (red algae), with several ecologically and economically important genera such as *Ulva*, *Caulerpa*, *Sargassum*, *Padina*, *Gracilaria* and *Gelidium*. This review further evaluates anthropogenic threats, economic uses, and prospects for sustainable utilization and conservation. It helps in identifying key research gaps (systematics, seasonality, deep-water flora), and recommend future research priorities and policy actions to integrate seaweed resources into coastal livelihoods and conservation planning.

**Keywords:** Marine Algae, Biodiversity, Gujarat Coast, Seaweed

### INTRODUCTION

Earth has 71% of marine water and harbour a huge quantity of marine plant (Subba Rao, 2012). The southwest coast of India that is Gujarat is situated on north-western part of peninsular India (20 1 to 24 7 N and 68 4 to 74 4 E) which is a unique marine habitat infested with diverse macroalgae species. (GEC, 2012). Marine macroalgae, commonly referred to as seaweeds, are multicellular photosynthetic organisms that form an essential component of coastal and marine ecosystems. They play a crucial role in maintaining ecological balance by contributing to primary productivity, oxygen generation and nutrient cycling, while also serving as habitat and food sources for a wide range of marine organisms (Shalaby, 2011; Dhargalkar & Kavlekar, 2001). Macroalgae are broadly classified into three major groups based on their pigmentation and biochemical characteristics: Chlorophyta (green algae), Phaeophyceae (brown algae) and Rhodophyta (red algae).

India possesses an extensive coastline of over 7,500 km, supporting a rich diversity of marine flora. Among the various coastal states, Gujarat stands out due to its unique geomorphological and oceanographic features, including extensive intertidal zones, high tidal amplitude and the presence of coral reef ecosystems. Gujarat coastline extends for approximately 1,600 km (Ayyappan *et al.*, 2006), which is the longest among all the littoral states of the country and is 21.9% of the Indian coastline of 7517 km. Gujarat coast is having two gulf of Kachchh and gulf of Khambhat. Both of gulf are highly diversified due to their varied coastal featured including Physiological, geomorphology and coastal processes. (GEER, 2004).

India's western coast, particularly Gujarat, is notable for seaweed richness owing to diverse habitats (rocky shores, islands, estuaries, intertidal flats) and a long coastline. The region is characterized by a semi-arid climate, high salinity variations and one of the highest tidal amplitudes in the country, creating diverse ecological niches for marine organisms, including macroalgae.

The Gujarat coastline encompasses ecologically significant regions such as the Gulf of Kachchh, known for its coral reef-associated biodiversity, and the Gulf of Khambhat, characterized by high turbidity and strong tidal currents. The coastline has varied topography, geomorphology, coastal processes and river discharges into the Arabian sea and has been broadly segmented into five regions viz. the Rann of Kachchh, the Saurashtra coast, Gulf of Kachchh and the Gulf of Khambhat and the South Gujarat coast. Among these regions, the Gulf of Kachchh, extending over 1000km, is a wealthy coastline with the Marine National Park and Marine Sanctuary that includes 42 islands, rocky intertidal regions and mangrove forests supporting rich seaweed diversity. The Gulf of Khambhat is a delta region with several major rivers flowing into the sea, including the Narmada, Tapi and Mahi Sabarmati rivers. The intertidal region comprises mud and sand flats with minimal seaweed diversity. (Ganesan *et al.*, 2019).

Seaweeds are evolutionary primitive eukaryotic, marine multicellular benthic photosynthetic plant that lack true differentiation (i.e., no true root, stem and leaves) (Petsut *et al.*, 2012). But they have pseudo root known as holdfasts or rhizoids. They do photosynthesis through their thallus (Dawson, 1966). Marine macroalgae that possessing chlorophyll and capable of photosynthesis. Seaweed can reproduce sexually as well as asexually. Seaweeds are found in coastal region between high tide to low tide i.e. intertidal region and in the sun-tidal region up to a depth where photosynthetic light is available. They constitute one of the important living resources found mostly on a mudflat and rocky coastal wetland, coral reefs and lagoons, estuaries, attached to the bottom on solid substrates such as rock in the intertidal zones, washed up on beaches floating on the oceanic surface, and also in giant underwater forests, dead coral, pebbles, shells and plants (Sahayaraj *et al.*, 2014). Light, exposure, temperature, depth, tides, shore characteristic and the plant pigments unite to create a distinct environment that determines the distribution and variation among seaweeds (Dhargalkar & Kavlekar, 2004). Most of Green algae contain chlorophyll a and b and store food as starch in their plastids. The green colour of the chlorophyta is derived from amount of chlorophyll a and b is presents (Guiry, 2000-2019). Most of the Genus was identified based on the visualized characters observed by using the character like colour, size and growth form (filamentous, sheet-like, leafy, branching) thallus structure, texture (soft, slimy, leathery, rigid). Attachment/substrates (rock, shells, other algae), reproductive structure (conceptacles, receptacles, or reproductive blades), ecological habitat, seasonality, morphological features (presence of air bladders/pneumatocysts, branching patterns, leaf shape and margin characteristics), etc. (Oza & Zaidi, 2001).

Several studies have reported the occurrence of diverse macroalgal species along different parts of the Gujarat coast. However, most of these investigations are region-specific and lack a comprehensive synthesis that integrates taxonomic diversity, ecological patterns and applied significance. In recent years, there has been increasing interest in macroalgae due to their potential applications in biotechnology, pharmaceuticals, agriculture and environmental management. In this context, the present review aims to provide a consolidated account of marine macroalgae along the Gujarat coast, focusing on their diversity, distribution, ecological roles and future prospects. The study also highlights existing research gaps and emphasizes the need for systematic and interdisciplinary approaches for the sustainable utilization and conservation of macroalgal resources.

## **METHODOLOGY, SOURCES & APPROACH**

The present review is based on a comprehensive review of published literature on marine macroalgae of the Gujarat coast. Relevant research articles, review papers, books and reports were collected from various scientific databases, including Google Scholar, Scopus, Web of Science and institutional repositories. The

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literature survey primarily covered studies till recent advancements in macroalgal taxonomy, ecology and applied research. It synthesizes regional taxonomic checklists and monographs, published field surveys from the Gulf of Kachchh and Saurashtra, national overviews of Indian seaweed resources, technical reports on seaweed farming/valorisation, and recent peer-reviewed studies. Emphasis was placed on primary floristic accounts and recent regional surveys to report species counts and distribution patterns. The collected information was systematically analyzed and categorized into major themes such as taxonomic diversity, distribution patterns, ecological significance etc. The synthesized data were then organized to provide a comprehensive and coherent understanding of macroalgal diversity and its ecological and applied significance along the Gujarat coast.

### **DIVERSITY & TAXONOMIC COMPOSITION**

The present compilation reveals that the Gujarat coast harbours a rich and diverse macroalgal flora comprising approximately 213 species, distributed across three major divisions: Chlorophyta, Phaeophyceae and Rhodophyta (Pramanick *et al.*, 2014). Among these, Rhodophyta (red algae) dominate the flora, contributing the largest share with more than half of the recorded species (~104 species across 62 genera), followed by Chlorophyta (~58 species from 23 genera) and Phaeophyceae (~51 species from 16 genera) (Table-1).

The predominance of Rhodophyta indicates a mature and stable marine ecosystem, as red algae are typically more diverse in tropical and subtropical coastal environments. Similar trends have been reported from other Indian coastal regions, suggesting that Gujarat supports a typical tropical macroalgal assemblage with high red algal diversity.

At the genus level, several taxa such as *Ulva*, *Caulerpa*, *Sargassum*, *Gracilaria*, *Hypnea* and *Padina* were found to be widely distributed across multiple locations, indicating their ecological adaptability and tolerance to varying environmental conditions. The high representation of economically important genera further highlights the ecological as well as applied significance of Gujarat's macroalgal flora. Notably, the island systems of the Gulf of Kachchh, including Narara, Dani, Dhabdhaba, Kalubhar and Monmoradi, support exceptionally high diversity, collectively accounting for nearly 130 species (Jha *et al.*, 2009).

### **Spatial Distribution Patterns**

The spatial distribution of macroalgae along the Gujarat coast is heterogeneous and largely influenced by substrate type, tidal amplitude, salinity gradients, and coastal geomorphology. Distinct biodiversity hotspots have been identified across different coastal regions, each supporting characteristic algal assemblages. The Gulf of Kachchh represents one of the main centers of macroalgal diversity, particularly across its island systems and coastal stretches. Rocky shores, mudflats, and saline habitats in areas such as Mandvi, Mundra, Kandla, Jakhau, Koteshwar, and Narayan Sarovar provide suitable niches for diverse macroalgal communities. The presence of extensive intertidal zones and variable substrata enhances species richness in this region. Similarly, the rocky shores of the Saurashtra coast, including Okha, Dwarka, Porbandar, Veraval, Mithapur, Poshitra, Bet Dwarka, Sutrapada, Mangrol, and Somnath, support a rich and diverse macroalgal flora (Table-2; Fig-1). These regions are characterized by firm substrates and favourable tidal exposures, which facilitate the attachment and growth of a wide range of algal species.

Notably, island ecosystems such as Pirotan Island and Narara Reef, located within the Marine National Park Jamnagar, exhibit exceptionally high species richness. This is attributed to the diversity of microhabitats, including coral reefs, rocky platforms, and tide pools, along with pronounced tidal fluctuations (Roy *et al.*, 2015; Pathak *et al.*, 2020). In contrast, the Gulf of Khambhat is characterized by tidal mudflats, estuarine zones, and semi-saline environments. Coastal areas such as Bhavnagar, Diu, Ghogha, Alang, and Gopnath support comparatively fewer macroalgal species due to high turbidity and unstable substrates. However, these regions still harbor specialized algal communities adapted to

fluctuating salinity and sediment-rich conditions. Overall, the spatial distribution of macroalgae along the Gujarat coast reflects the interplay between environmental conditions and habitat diversity, with island ecosystems and rocky shores serving as main biodiversity hotspots.

### Habitat and Depth-wise Distribution

Marine macroalgae along the Gujarat coast are predominantly benthic and occur attached to hard substrata such as rocks, dead corals, shells and other stable surfaces in intertidal and subtidal zones. Their distribution is largely governed by environmental factors such as light availability, tidal exposure, temperature, salinity and substrate characteristics. The majority of species are concentrated in the intertidal to shallow subtidal regions, where sufficient light is available for photosynthesis.

The high tidal amplitude characteristic of the Gujarat coast imposes periodic exposure stress, favouring species that are morphologically robust and tolerant to desiccation. However, deeper-water macroalgae remain relatively underexplored, although available records indicate that several taxa extend to depths of 30–40 m on suitable hard substrata. (Norashikin et al, 2013; Thaker et al, 2023). This suggests the presence of a potentially rich but under-documented deep-water macroalgal flora in the region, warranting further investigation.

**Table 1: List of Marine Macroalgae of Gujarat**

Sr. No.	Phylum (Division)	Family	Species Name	Distribution (Locations in Gujarat)	References
1	Chlorophyta	Acrosiphoniaceae	<i>Acrosiphonia orientalis</i> (J.Agardh) P.C.Silva	Porbandar, Dwarka, Okha, Veraval, Kotda	Jadeja & Kaneria, (2025); Jha et al., (2009)
2		Polyphysaceae	<i>Acetabularia moebii</i> Solms-Laubach	Okha	Nakar et al., (2011)
3			<i>Acetabularia calyculus</i> J.V.Lamouroux	Okha, Kachchh	Roy et al., (2015); Jha et al., (2009)
4		Bryopsidaceae	<i>Bryopsis plumosa</i> (Huds) C. Agardh	Kachchh, Sikka, Veraval, Dwarka, Shivrajpur, Okha, Dwarka, Porbandar	Athulya et al., (2019); Dhargalkar & Deshmukhe (1996); Sanghvi et al., (2020); Hakim et al., (2022); Pathak et al., (2020); Ishakani et al., (2016); Nakar et al., (2011); Pathak et al., (2021); Jadeja et al., (2025); Vagh et al., (2022)
5			<i>Bryopsis hypnoides</i> J.V.Lamouroux	Shivrajpur	Hakim et al., (2022)

Sr. No.	Phylum (Division)	Family	Species Name	Distribution (Locations in Gujarat)	References
6			<i>Bryopsis pennata</i> J.V.Lamouroux	Veraval, Shivrajpur, Dwarka	Sanghvi et al., (2020); Hakim et al., (2022)
7		Boodleaceae	<i>Boodlea composita</i> (Harvey) Brand	Loej, Veraval, Sikka, Mandvi, Dwarka, Okha, Porbandar, Kachchh	Tandel & Kuhada (2024); Sanghvi et al., (2020); Dave et al., (2019); Pathak et al., (2020); Katara et al., (2023); Jadeja et al., (2025); Vagh et al., (2022)
8		Siphonocladaceae	<i>Boergesenia forbesii</i> (Harvey) Feldmann	Porbandar	Jadeja et al., (2025)
9		Caulerpaceae	<i>Caulerpa racemosa</i> var. <i>occidentalis</i>	Beyt Dwarka, Kachchh, Porbandar, Veraval	Tandel & Kuhada (2024); Sanghvi et al., (2020); Hakim et al., (2022); Roy et al., (2015)
10			<i>Caulerpa lentillifera</i> J.Agardh	Kachchh, Okha, Veraval	Chandra et al., (2004)
11			<i>Caulerpa macrophysa</i> (Sonder ex Kützing) G. Murray	Kachchh, Okha, Veraval	Jha et al., (2009)
12			<i>Caulerpa microphysa</i> (Weber-van Bosse) Feldmann	Okha, Porbandar	Roy et al., (2015); Jha et al., (2009)
13			<i>Caulerpa veravalensis</i> Thivy & Chauhan	Kachchh, Sikka, Veraval, Beyt Dwarka, Okha, Narara	Sanghvi et al., (2020); Kalasariya et al., (2019); Dave et al., (2019); Hakim et al., (2022); Ishakani et al., (2016); Katara et al., (2023); Thakur et al., (2008); Vagh et al., (2022)
14			<i>Caulerpa scalpelliformis</i>	Loej, Narara, Sikka, Veraval,	Athulya et al., (2019); Dhargalkar &

Sr. No.	Phylum (Division)	Family	Species Name	Distribution (Locations in Gujarat)	References
			(R.Brown ex Turner) C.Agardh	Dwarka, Porbandar, Okha, Beyt Dwarka	Deshmukhe (1996); Tandel &Kuhada (2024); Sanghvi et al., (2020); Kalasariya et al., (2019); Pathak et al., (2020); Ishakani et al., (2016); Katara et al., 2023; Nakar et al., (2011); Thakur et al., (2008); Roy et al., (2015); Thaker et al., (2023)
15			<i>Caulerpa sertularioides</i> (S.G.Gmelin) M.Howe	Loej, Sikka, Dwarka, Shivrajpur, Veraval, Beyt Dwarka, Okha, Kachchh, Porbandar	Dhargalkar & Deshmukhe (1996); Tandel & Kuhada (2024); Sanghvi et al., (2020); Hakim et al., (2022); Kalasariya et al., (2019); Dave et al., (2019); Ishakani et al., (2016); Nakar et al., (2011); Pathak et al., (2021); Thakur et al., (2008); Jadeja et al., (2025); Vagh et al., (2022)
16			<i>Caulerpa taxifolia</i> (M.Vahl) C.Agardh	Mandvi, Loej, Sikka, Okha, Dwarka, Veraval, Porbandar, Kachchh	Sanghvi et al., (2020); Hakim et al., (2022); Dave et al., (2019); Pathak et al., (2020); Ishakani et al., (2016); Katara et al., 2023; Malsatar & Mehta (2017); Nakar et al., (2011); Pathak et al., (2021); Thakur et al., (2008); Roy et al., (2015); Jadeja et al., (2025); Thaker et al., (2023); Vagh et al., (2022)
17			<i>Caulerpa racemosa</i>	Mandvi, Loej, Narara, Sikka, Beyt Dwarka,	Sanghvi et al., (2020); Hakim et al., (2022); Kalasariya et al.,

Sr. No.	Phylum (Division)	Family	Species Name	Distribution (Locations in Gujarat)	References
			(Forsskål) J.Agardh	Porbandar, Veraval, Diu, Mahuva, Jafrabad, Okha, Shivrajpur, Kachchh	(2019); Dave <i>et al.</i> , (2019); Pathak <i>et al.</i> , (2020); Ishakani <i>et al.</i> , (2016); Katara <i>et al.</i> , 2023; Nakar <i>et al.</i> , (2011); Pathak <i>et al.</i> , (2021); Temkar <i>et al.</i> , 2018; Thakur <i>et al.</i> , (2008); Roy <i>et al.</i> , (2015); Jadeja <i>et al.</i> , (2025); Thaker <i>et al.</i> , (2023); Vagh <i>et al.</i> , (2022)
18			<i>Caulerpa verticillata</i> J.Agardh	Sikka, Okha, Veraval	Katara <i>et al.</i> , (2023); Roy <i>et al.</i> , (2015)
19			<i>Chamaedoris auriculata</i> Børgesen	Veraval, Okha	Ishakani <i>et al.</i> , (2016); Thakur <i>et al.</i> , (2008)
20		Siphonocladaceae	<i>Cladophoropsis javanica</i> (Kützing) P.C.Silva	Shivrajpur, Gulf of kuchchh, Porbandar	Hakim <i>et al.</i> , (2022); Roy <i>et al.</i> , (2015); Jadeja <i>et al.</i> , (2025)
21			<i>Codium decorticatum</i> (Woodward) M.A.Howe	Loej, Sikka	Tandel & Kuhada (2024); Sanghvi <i>et al.</i> , (2020)
22			<i>Codium elongatum</i> (Turner) C.Agardh	Kachchh, Loej, Okha	Tandel & Kuhada (2024); Dave <i>et al.</i> , (2019); Vagh <i>et al.</i> , (2022)
23		Codiaceae	<i>Codium dwarken</i> Børgesen	Veraval, Okha, Porbandar, Sikka	Athulya <i>et al.</i> , (2019); Dhargalkar & Deshmukhe (1996); Sanghvi <i>et al.</i> , (2020); Ishakani <i>et al.</i> , (2016); Katara <i>et al.</i> , (2023); Nakar <i>et al.</i> , (2011); Thakur <i>et al.</i> , (2008); Roy <i>et al.</i> , (2015); Jadeja <i>et al.</i> , (2025); Thaker <i>et al.</i> , (2023)

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24			<i>Codium tomentosum</i> Stackhouse	Veraval, Okha, Diu	Ishakani et al., (2016); Thakur et al., (2008)
25			<i>Codium indicum</i> S.C.Dixit	Veraval, Sikka, Okha	Pathak et al., (2020); Ishakani et al., (2016); Pathak et al., (2021); Thakur et al., (2008)
26			<i>Codium geppiorum</i> O.Schmidt	Narara, Okha, Dwarka,	Katara et al., (2023); Jha et al., (2009)
27	Cladophoraceae		<i>Chaetomorpha antennina</i> (Bory) Kützing	Loej, Veraval, Sikka, Dwarka, Porbandar	Tandel & Kuhada (2024); Sanghvi et al., (2020); Pathak et al., (2020); Pathak et al., (2021); Jadeja et al., (2025)
28			<i>Cladophora glomerata</i> (Linnaeus) Kützing	Mandvi, Sikka, Dwarka	Sanghvi et al., (2020); Katara et al., (2023); Malsatar & Mehta (2017)
29			<i>Cladophora vagabunda</i> (Linnaeus) van den Hoek	Kachchh, Okha, Porbandar	Dave et al., (2019); Roy et al., (2015); Jadeja et al., (2025)
30			<i>Chaetomorpha crassa</i> (C. Agardh) Kützing	Kachchh, Loej, Shivrajpur, Dwarka, Veraval, Okha	Tandel & Kuhada (2024); Sanghvi et al., (2020); Hakim et al., (2022); Roy et al., (2015); Jadeja et al., (2025); Jha et al., (2009); Vagh et al., (2022)
31			<i>Chaetomorpha spiralis</i> Okamura	Loej, Sikka, Veraval, Shivrajpur, Narara, Dwarka	Tandel & Kuhada (2024); Sanghvi et al., (2020); Pathak et al., (2020); Hakim et al., (2022); Ishakani et al., (2016); Pathak et al., (2021); Thakur et al., (2008); Roy et al., (2015)
32			<i>Cladophora socialis</i> Kützing	Veraval, Sikka	Pathak et al., (2020); Pathak et al., (2021)

Sr. No.	Phylum (Division)	Family	Species Name	Distribution (Locations in Gujarat)	References
33			<i>Chaetomorpha darwinii</i> (Hooker f. & Harvey) Kützing	Veraval, Okha, Porbandar, Sikka	Ishakani et al., (2016); Thakur et al., (2008)
34		Siphonocladaceae	<i>Dictyosphaeria cavernosa</i> (Forsskål) Børgesen	Dwarka	Sanghvi et al., (2020)
35		Halimedaceae	<i>Halimeda macroloba</i> Decaisne	Kachchh, Veraval, Sikka, Shivrajpur, Narara, Dwarka, Okha	Sanghvi et al., (2020); Hakim et al., (2022); Dave et al., (2019); Pathak et al., (2020); Katara et al., (2023); Pathak et al., (2021)
36			<i>Halimeda discoidea</i> Decaisne	Shivrajpur	Hakim et al., (2022)
37			<i>Halimeda tuna</i> (Ellis & Solander) J.V.Lamouroux	Veraval, Sikka, Okha, Narara, Porbandar, Shivrajpur, Dwarka, Kachchh	Dhargalkar et al., (1996); Sanghvi et al., (2020); Hakim et al., (2022); Dave et al., (2019); Pathak et al., (2020); Ishakani et al., (2016); Katara et al., 2023; Nakar et al., (2011); Pathak et al., (2021); Thakur et al., (2008); Roy et al., (2015); Jadeja et al., (2025); Thaker et al., (2023); Vagh et al., (2022)
38		Boodleaceae	<i>Phyllodictyon anastomosans</i> (Syn: <i>Boodlea anastomosans</i> )	Sikka, Gulf of kachchh	Katara et al., 2023
39			<i>Phyllodictyon pulcherrimum</i> J.E.Gray	Kachchh, Okha	Dave et al., (2019)
40		Siphonocladaceae	<i>Struvea anastomosans</i> (Harvey)	Shivrajpur, Okha, Veraval,	Jha et al., (2009)

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			Piccone & Grunow		
41		Ulvaceae	<i>Ulva intestinalis</i> (Linnaeus) Nees (Syn: <i>Enteromorpha</i> )	Kachchh, Mandvi, Sikka, Okha, Gopnath	Dave et al., (2019); Katara et al., 2023; Malsatar & Mehta, (2017); Roy et al., (2015); Jha et al., (2009); Vagh et al., (2022)
42			<i>Ulva flexuosa</i> (Wulfen) J.Agardh (Syn: <i>Enteromorpha</i> )	Mandvi, Sikka, Kachchh	Katara et al., (2023); Mantri et al., (2019); Malsatar & Mehta (2017)
43			<i>Ulva compressa</i> Linnaeus (Syn: <i>Enteromorpha</i> )	Mandvi, Veraval, Sikka, Okha, Shivrajpur, Porbandar	Hakim et al., (2022); Pathak et al., (2020); Ishakani et al., (2016); Malsatar & Mehta (2017); Pathak et al., (2021); Thakur et al., (2008); Jha et al., (2009)
44			<i>Ulva linza</i> Linnaeus (Syn: <i>Enteromorpha</i> )	Mandvi, Shivrajpur, Narara, Okha, Veraval, Dwarka, Kuda, Khadsaliya, Gopnath, Unchakotda, Pingaleshwar	Hakim et al., (2022); Malsatar & Mehta (2017); Roy et al., (2015); Malsatar & Mehta (2017); Jha et al., (2009)
45			<i>Ulva prolifera</i> O.F.Müller (Syn: <i>Enteromorpha</i> )	Porbandar, Okha, Dwarka, Veraval, Sikka	Tandel &Kuhada (2024); Roy et al., (2015); Jadeja et al., (2025); Jha et al., (2009)
46			<i>Ulva fasciata</i> Delile	Kachchh, Veraval, Sikka, Dwarka, Okha, Porbandar, Diu, Dwarka, Mahuva, Jafrabad	Athulya et al., (2019); Dhargalkar & Deshmukhe (1996); Tandel & Kuhada (2024); Sanghvi et al., (2020); Dave et al.,

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					(2019); Pathak <i>et al.</i> , (2020); Ishakani <i>et al.</i> , (2016); Pathak <i>et al.</i> , (2021); Temkar <i>et al.</i> , 2018; Thakur <i>et al.</i> , (2008); Jadeja <i>et al.</i> , (2025); Vagh <i>et al.</i> , (2022)
47			<i>Ulva reticulata</i> Forsskål	Mandvi, Loej, Veraval, Sikka, Okha, Kachchh, Beyt Dwarka	Tandel & Kuhada (2024); Kalasariya <i>et al.</i> , (2019); Dave <i>et al.</i> , (2019); Pathak <i>et al.</i> , (2020); Katara <i>et al.</i> , 2023 Malsatar & Mehta (2017); Nakar <i>et al.</i> , (2011); Roy <i>et al.</i> , (2015); Vagh <i>et al.</i> , (2022)
48			<i>Ulva clathrata</i> (Roth) C.Agardh	Kachchh, Okha	Dave <i>et al.</i> , (2019)
49			<i>Ulva rigida</i> C.Agardh	Kachchh, Shivrajpur, Veraval, Porbandar, Okha	Hakim <i>et al.</i> , (2022); Dave <i>et al.</i> , (2019); Roy <i>et al.</i> , (2015); Jadeja <i>et al.</i> , (2025); Vagh <i>et al.</i> , (2022)
50			<i>Ulva lactuca</i> Linnaeus	Mandvi, Loej, Veraval, Sikka, Okha, Dwarka, Veraval, Porbandar, Shivrajpur, Narara, Kachchh	Tandel & Kuhada (2024); Sanghvi <i>et al.</i> , (2020); Hakim <i>et al.</i> , (2022); Dave <i>et al.</i> , (2019); Pathak <i>et al.</i> , (2020); Ishakani <i>et al.</i> , (2016); Katara <i>et al.</i> , (2023); Malsatar & Mehta (2017); Mantri <i>et al.</i> , (2019); Nakar <i>et al.</i> , (2011); Pathak <i>et al.</i> , (2021); Thakur <i>et al.</i> , (2008); Roy <i>et al.</i> , (2015); Jadeja <i>et al.</i> , (2025); Thaker <i>et al.</i> , (2023); Vagh <i>et al.</i> , (2022)

Sr. No.	Phylum (Division)	Family	Species Name	Distribution (Locations in Gujarat)	References	
51			<i>Ulva conglobata</i> Kjellman	Veraval, Shivrajpur, Dwarka	Sanghvi et al., (2020); Hakim et al., (2022); Jadeja et al., (2025)	
52			<i>Ulva beytensis</i> Thivy & Sharma	Beyt Dwarka, Okha	Jha et al., (2009)	
53			<i>Ulva ovata</i> Thivy & Visalakshmi	Gopnath	Jha et al., (2009)	
54			<i>Udotea indica</i> A. & E.S.Gepp	Kachchh, Shivrajpur, Veraval, Okha	Dhargalkar & Deshmukhe (1996); Sanghvi et al., (2020); Hakim et al., (2022); Ishakani et al., (2016); Nakar et al., (2011); Thakur et al., (2008); Jadeja et al., (2025); Vagh et al., (2022)	
55			Valoniaceae	<i>Valoniopsis pachynema</i> (G.Martens) Børgesen	Loej, Veraval, Sikka, Okha, Dwarka	Tandel & Kuhada (2024); Sanghvi et al., (2020); Ishakani et al., (2016); Thakur et al., (2008)
56				<i>Valonia aegagropila</i> C.Agardh	Veraval, Sikka, Okha, Dwarka	Sanghvi et al., (2020); Ishakani et al., (2016); Thakur et al., (2008)
57				<i>Valonia sp.</i>	Veraval, Sikka	Pathak et al., (2020)
58				<i>Valonia utricularis</i> (Roth) C.Agardh	Okha	Jha et al., (2009)
	Phylum	Family	Species Name	Location	References	
59	Phaeo- phyta	Scytosiphonaceae	<i>Colpomenia sinuosa</i> (Mertens ex Roth) Derbès & Solier	Mandvi, Shivrajpur, Okha, Veraval, Kachchh	Hakim et al., (2022); Ishakani et al., (2016); Malsatar & Mehta (2017); Roy et al., (2015); Vagh et al., (2022)	
60		Sargassaceae	<i>Cystoseira indica</i> (Thivy & Doshi) Mairh	Narara, Sikka, Veraval, Shivrajpur, Okha, Porbandar, Dwarka, Kachchh	Tandel & Kuhada (2024); Hakim et al., (2022); Dave et al., (2019); Pathak et al., (2020); Bhavika et al.,	

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					(2021); Ishakani <i>et al.</i> , (2016); Pathak <i>et al.</i> , (2021); Pathak <i>et al.</i> , (2020); Roy <i>et al.</i> , (2015); Jadeja <i>et al.</i> , (2025); Thaker <i>et al.</i> , (2023)
61			<i>Cystoseira trinodis</i> (Forsskål) C.Agardh	Porbandar	Jadeja <i>et al.</i> , (2025)
62		Dictyotaceae	<i>Dictyota bartayresiana</i> J.V.Lamouroux	Dwarka, Shivrajpur, Veraval, Okha	Hakim <i>et al.</i> , (2022); Ishakani <i>et al.</i> , (2016); Thakur <i>et al.</i> , (2008)
63			<i>Dictyota ceylanica</i> Kützing	Loej	Tandel & Kuhada (2024)
64			<i>Dictyota ciliolate</i> Sonder ex Kützing	Okha, Kachchh	Dave <i>et al.</i> , (2019); Vagh <i>et al.</i> , (2022)
65			<i>Dictyota dichotoma</i> (Hudson) J.V.Lamouroux	Mandvi, Okha, Veraval, Shivrajpur, Narara	Tandel & Kuhada (2024); Hakim <i>et al.</i> , (2022); Ishakani <i>et al.</i> , (2016); Malsatar & Mehta (2017); Roy <i>et al.</i> , (2015)
66			<i>Dictyota cervicornis</i> Kützing	Mandvi, Shivrajpur, Narara	Hakim <i>et al.</i> , (2022); Malsatar & Mehta (2017); Roy <i>et al.</i> , (2015)
67			<i>Dictyopteris australis</i> (Sonder) Askenasy	Narara, Shivrajpur, Beyt Dwarka	Dhargalkar & Deshmukhe (1996); Hakim <i>et al.</i> , (2022); Kalasariya <i>et al.</i> , (2019)
68			<i>Dictyopteris acrostichoides</i> (J.Agardh) Börgesen	Narara, Shivrajpur, Beyt Dwarka	Hakim <i>et al.</i> , (2022); Kalasariya <i>et al.</i> , (2019)
69			<i>Dictyopteris woodwardia</i> (R.Brown ex Turner) C.Agardh	Veraval, Okha	Ishakani <i>et al.</i> , (2016); Thakur <i>et al.</i> , (2008)

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70			<i>Dictyopteris delicatula</i> J.V.Lamouroux	Shivrajpur	Jha et al., (2009)
71			<i>Dictyota pinnatifida</i> Kützing	Sikka, Okha, Shivrajpur	Roy et al., (2015)
72		Ectocarpaceae	<i>Ectocarpus confervoides</i> (Roth) Le Jolis	Narara, Veraval, Sikka	Pathak et al., (2020); Pathak et al., (2021)
73			<i>Ectocarpus siliculosus</i> (Dillwyn) Lyngbye	Narara, Veraval, Sikka	Pathak et al., (2020)
74		Acinetosporaceae	<i>Giffordia mitchelliae</i> (Harvey) Hamel (Syn: <i>Hincksia</i> )	Shivrajpur	Hakim et al., (2022)
75		Scytosiphonaceae	<i>Hydroclathrus clathratus</i> (C.Agardh) M.A.Howe	Narara, Shivrajpur, Sikka,	Hakim et al., (2022); Bhavika et al., (2021); Roy et al., (2015)
76		Ectocarpaceae	<i>Hincksia mitchelliae</i> (Harvey) Silva	Shivrajpur	Jha et al., (2009)
77		Scytosiphonaceae	<i>Iyengaria stellata</i> (Børgesen) Børgesen	Mandvi, Loej, Kachchh, Sikka, Shivrajpur, Veraval, Okha, Kachchh	Tandel & Kuhada (2024); Hakim et al., (2022); Dave et al., (2019); Pathak et al., (2020); Bhavika et al., (2021); Malsatar & Mehta (2017); Pathak et al., (2021); Vagh et al., (2022)
78		Dictyotaceae	<i>Lobophora variegata</i> (J.V.Lamourou x) Womersley	Loej	Tandel & Kuhada (2024)
79	Laminariaceae	<i>Laminaria hyperborea</i> (Gunnerus) Foslie (Note: Likely	Mandvi	Malsatar & Mehta (2017)	

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			misidentification)		
80			<i>Pocockiella variegata</i> (J.V.Lamouroux) Papenfuss (Syn: <i>Lobophora</i> )	Dwarka, Okha, Veraval	Dhargalkar & Deshmukhe (1996); Ishakani et al., (2016); Nakar et al., (2011)
81			<i>Padina gymnospora</i> (Kützinger) Sonder	Loej, Sikka, Veraval, Okha, Dwarka, Porbandar, Varaval	Tandel & Kuhada (2024); Pathak et al., (2020); Bhavika et al., (2021); Ishakani et al., (2016); Pathak et al., (2021); Thaker et al., (2023)
82		Dictyotaceae	<i>Padina tetrastromatica</i> Hauck	Mandvi, Dwarka, Veraval, Shivrajpur, Sikka, Okha, Porbandar, Kachchh, Beyt Dwarka	Athulya et al., (2019); Dhargalkar & Deshmukhe (1996); Tandel & Kuhada (2024); Hakim et al., (2022); Kalasariya et al., (2019); Dave et al., (2019); Pathak et al., (2020); Ishakani et al., (2016); Malsatar & Mehta (2017); Nakar et al., (2011); Pathak et al., (2021); Thaker et al., (2023); Vagh et al., (2022)
83			<i>Padina boryana</i> Thivy	Narara, Veraval, Shivrajpur	Hakim et al., (2022); Roy et al., (2015);
84			<i>Padina boergesenii</i> Allender & Kraft	Narara, Kachchh, Shivrajpur, Okha, Dwarka, Porbandar, Veraval, Okha	Hakim et al., (2022); Dave et al., (2019); Pathak et al., (2020); Roy et al., (2015); Thaker et al., (2023)
85		Scytosiphonaceae	<i>Rosenvingea intricata</i> (J.Agardh) Børgesen	Narara, Sikka, Shivrajpur	Bhavika et al., (2021); Roy et al., (2015); Jha et al., (2009)
86			<i>Rosenvingea orientalis</i>	Sikka, Okha, Shivrajpur	Bhavika et al., (2021); Jha et al., (2009)

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			(J.Agardh) Børgesen		
87			<i>Rosenvingea</i> complex	Veraval, Okha	Thakur et al., (2008)
88		Rhodymeniaceae	<i>Rhodymenia australis</i> Sonder	Veraval, Okha	Thakur et al., (2008)
89		Sargassaceae	<i>Sargassum asperum</i> (Status doubtful, possibly <i>S. asperifolium</i> )	Dwarka, Okha, Porbandar, Veraval, Sikka	Tandel & Kuhada (2024); Bhavika et al., (2021)
90			<i>Sargassum cinctum</i> J.Agardh	Narara, Sikka, Shivrajpur, Beyt Dwarka	Tandel & Kuhada (2024); Hakim et al., (2022); Bhavika et al., (2021); Roy et al., (2015); Kalasariya et al., (2019)
91			<i>Sargassum cinereum</i> J.Agardh	Narara, Porbandar, Veraval, Diu, Mahuva, Jafrabad, Dwarka, Sikka, Shivrajpur	Athulya et al., (2019); Hakim et al., (2022); Pathak et al., (2020); Bhavika et al., (2021); Temkar et al., 2018; Roy et al., (2015)
92			<i>Sargassum echinocarpum</i> J.Agardh	Mandvi	Malsatar & Mehta (2017)
93			<i>Sargassum johnstonii</i> Setchell & Gardner	Narara, Sikka, Okha, Dwarka, Beyt Dwarka, Porbandar, Veraval, Shivrajpur	Hakim et al., (2022); Kalasariya et al., (2019); Pathak et al., (2020); Bhavika et al., (2021); Thaker et al., (2023)
94			<i>Sargassum marginatum</i> (c.Agardh) J.Agardh	Kachchh	Dave et al., (2019)
95			<i>Sargassum linearifolium</i> (Turner) C.Agardh	Loej, Porbandar	Tandel & Kuhada (2024); Jadeja et al., (2025)

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96			<i>Sargassum plagiophyllum</i> C.Agardh	Okha, Veraval, Sikka, Shivrajpur, Narara	Hakim <i>et al.</i> , (2022); Pathak <i>et al.</i> , (2020); Ishakani <i>et al.</i> , (2016); Pathak <i>et al.</i> , (2021); Jadeja <i>et al.</i> , (2025)
97			<i>Sargassum polycystum</i> C.Agardh	Veraval, Sikka	Pathak <i>et al.</i> , (2020); Pathak <i>et al.</i> , (2021)
98			<i>Sargassum prismaticum</i> Chauhan	Narara, Sikka, Shivrajpur	Hakim <i>et al.</i> , (2022); Bhavika <i>et al.</i> , (2021); Roy <i>et al.</i> , (2015)
99			<i>Sargassum sp.</i>	Dwarka, Okha, Porbandar, Veraval	Dhargalkar & Deshmukhe (1996); Thaker <i>et al.</i> , (2023)
100			<i>Sargassum swartzii</i> C.Agardh	Mandvi, Sikka, Shivrajpur, Okha	Hakim <i>et al.</i> , (2022); Dave <i>et al.</i> , (2019); Bhavika <i>et al.</i> , (2021); Malsatar & Mehta (2017); Roy <i>et al.</i> , (2015); Jadeja <i>et al.</i> , (2025)
101			<i>Sargassum tenerrimum</i> J. Agardh	Mandvi, Shivrajpur, Veraval, Sikka, Okha, Beyt Dwarka, Dwarka	Athulya <i>et al.</i> , (2019); Dhargalkar & Deshmukhe (1996); Hakim <i>et al.</i> , (2022); Kalasariya <i>et al.</i> , (2019); Dave <i>et al.</i> , (2019); Pathak <i>et al.</i> , (2020); Ishakani <i>et al.</i> , (2016); Malsatar & Mehta (2017); Nakar <i>et al.</i> , (2011); Pathak <i>et al.</i> , (2021); Jadeja <i>et al.</i> , (2025)
102			<i>Sargassum vulgare</i> C. Agardh	Dwarka, Shivrajpur	Hakim <i>et al.</i> , (2022)
103			<i>Sirophysalis trinodis</i> (Forsskål) Kützing (Syn: <i>Cystoseira</i> )	Loej, Kachchh, Okha	Tandel & Kuhada (2024); Dave <i>et al.</i> , (2019)
104			<i>Turbinaria sp.</i>	Beyt Dwarka	Kalasariya <i>et al.</i> , (2019)

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105		Dictyotaceae	<i>Turbinaria conoides</i> (J.Agardh) Kützing	Okha	Nakar et al., (2011)
106			<i>Sargassum tetrastromatica</i>	Porbandar, Okha	Dave et al., (2019)
107			<i>Spatoglossum asperum</i> J.Agardh	Kachchh, Narara, Okha, Dwarka, Sikka, Porbandar, Veraval, Diu, Mahuva, Jafrabad, Shivrajpur, Beyt Dwarka	Athulya et al., (2019); Hakim et al., (2022); Kalasariya et al., (2019); Dave et al., (2019); Pathak et al., (2020); Ishakani et al., (2016); Nakar et al., (2011); Pathak et al., (2021); Temkar et al., (2018); Thaker et al., (2023); Vagh et al., (2022)
108			<i>Stoechospermum marginatum</i> (C.Agardh) Kützing	Dwarka, Veraval, Kachchh, Okha, Porbandar, Loej	Athulya et al., (2019); Dhargalkar & Deshmukhe (1996); Hakim et al., (2022); Ishakani et al., (2016); Jha et al., (2009)
109			<i>Stoechospermum polypodioides</i> (J.V.Lamouroux) J.Agardh	Loej, Dwarka, Okha, Sikka, Veraval, Beyt Dwarka, Porbandar,	Tandel & Kuhada (2024); Jha et al., (2009)
	<b>Phylum</b>	<b>Family</b>	<b>Species Name</b>	<b>Location</b>	<b>References</b>
110	<b>Rhodo-phyta</b>	Bonnemaisoniaceae	<i>Asparagopsis</i> sp.Montagne, 1840	Loej	Tandel & Kuhada (2024)
111			<i>Asparagopsis taxiformis</i> (Delile) Trevisan	Mandvi, Okha, Shivrajpur, Porbandar, Narara, Veraval, Diu, Mahuva, Jafrabad	Hakim et al., (2022); Malsatar & Mehta (2017); Temkar et al., 2018

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112		Ahnfeltiaceae	<i>Ahnfeltia plicata</i> (Hudson) Fries	Narara	Roy et al., (2015)
113		Corallinaceae	<i>Amphiroa anceps</i> (Lamarck) Decaisne	Narara, Veraval, Okha, Sikka, Porbandar	Dave et al., (2019); Hakim et al., (2022); Ishakani et al., (2016); Nakar et al., (2011); Thakur et al., (2008); Roy et al., (2015); Jadeja et al., (2025)
114			<i>Amphiroa fragilissima</i> (Linnaeus) J.V.Lamouroux	Narara, Dwarka, Veraval, Porbandar, Gopnath	Athulya et al., (2019); Dhargalkar & Deshmukhe (1996); Tandel & Kuhada (2024); Roy et al., (2015)
115		Rhodomelaceae	<i>Acanthophora spicifera</i> (M.Vahl) Børgesen	Mandvi, Dwarka, Veraval, Beyt Dwarka, Sikka, Porbandar	Athulya et al., (2019); Dhargalkar & Deshmukhe (1996); Tandel & Kuhada (2024); Kalasariya et al., (2019); Pathak et al., (2020); Ishakani et al., (2016); Malsatar & Mehta, (2017); Pathak et al., (2021); Thakur et al., (2008); Jadeja et al., (2025)
116			<i>Acanthophora nayadiformis</i> (Delile) Papenfuss	Narara, Chaad, Dwarka, Shivrajpur, Okha	Hakim et al., (2022); Ishakani et al., (2016); Thakur et al., (2008); Roy et al., (2015)
117			<i>Acanthophora dendroides</i> Harvey	Narara, Shivrajpur, Chaad, Dedeka, Mundeka	Hakim et al., (2022); Roy et al., (2015)
118		Wrangeliaceae	<i>Anotrichium tenue</i> (C.Agardh) Nägeli	Shivrajpur, Dwarka, Okha, Porbandar, Veraval	Hakim et al., (2022); Jha et al., (2009)
119		Solieriaceae	<i>Agardhiella robusta</i> (Greville) Børgesen	Okha, Veraval	Ishakani et al., (2016); Thakur et al., (2008)

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120		Rhodymeniaceae	<i>Botryocladia leptopoda</i> (J.Agardh) Kylin	Beyt Dwarka, Okha, Veraval, Kachchh, Porbandar	Dhargalkar & Deshmukhe (1996); Kalasariya et al., (2019); Dave et al., (2019); Ishakani et al., (2016); Nakar et al., (2011); Thaker et al., (2023)
121		Rhodymeniaceae	<i>Bostrychia tenella</i> (Lamouroux) J. Agardh	Nava Bander, Samiani island	Jha et al., (2009)
122		Cystocloniaceae	<i>Calliblepharis jubata</i> (Goodenough & Woodward) Kützing	Dwarka, Okha, Sikka	Dhargalkar & Deshmukhe (1996)
123		Rhodymeniaceae	<i>Cylarthrum muelleri</i> (Likely <i>Coelarthrum</i> )	Beyt Dwarka, Okha, Porbandar, Sutrapada, Verval	Kalasariya et al., (2019); Jha et al., (2009)
124			<i>Coelarthrum muelleri</i> (Sonder) Børgesen	Dwarka	Dhargalkar & Deshmukhe (1996)
125		Champiaceae	<i>Champia parvula</i> (C.Agardh) Harvey	Dwarka, Shivrajpur, Veraval	Dhargalkar & Deshmukhe (1996); Hakim et al., (2022); Ishakani et al., (2016); Jadeja et al., (2025)
126			<i>Champia ceylanica</i> Harvey	Loej	Tandel & Kuhada (2024)
127			<i>Champia somalensis</i> Hauck	Loej, Shivrajpur, Porbandar	Tandel & Kuhada (2024); Hakim et al., (2022); Jadeja et al., (2025)
128			<i>Champia globulifera</i> Børgesen	Narara, Shivrajpur	Hakim et al., (2022); Roy et al., (2015)
129			<i>Champia compressa</i> Harvey	Narara, Dwarka, Veraval, Shivrajpur	Athulya et al., (2019); Hakim et al., (2022); Ishakani et al., (2016); Roy et al., (2015)

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130			<i>Champia indica</i> Børgesen	Narara, Shivrajpur, Veraval, Sikka, Okha	Hakim <i>et al.</i> , (2022); Pathak <i>et al.</i> , (2020); Ishakani <i>et al.</i> , (2016); Nakar <i>et al.</i> , (2011); Pathak <i>et al.</i> , (2021); Roy <i>et al.</i> , (2015)
131			<i>Champia parola</i> (Likely <i>parvula</i> )	Okha	Nakar <i>et al.</i> , (2011)
132		Ceramiaceae	<i>Centroceras clavulatum</i> (C.Agardh) Montagne	Mandvi, Shivrajpur, Narara, Okha	Hakim <i>et al.</i> , (2022); Dave <i>et al.</i> , (2019); Malsatar & Mehta <i>et al.</i> , (2017); Roy <i>et al.</i> , (2015)
133			<i>Ceramium cruciatum</i> Collins & Harvey	Narara, Veraval, Sikka, Okha, Jakhau, Mahuva, Porbandar, Dwarka	Pathak <i>et al.</i> , (2020); Pathak <i>et al.</i> , (2021); Roy <i>et al.</i> , (2015)
134			<i>Ceramium tenerrimum</i> (G.Martens) Okamura	Veraval, Sikka, Kachchh, Narara, Okha	Dave <i>et al.</i> , (2019); Pathak <i>et al.</i> , (2020)
135			<i>Ceramium rubrum</i> (Syn: <i>Ceramium virgatum</i> )	Veraval, Sikka, Okha	Pathak <i>et al.</i> , (2020); Ishakani <i>et al.</i> , (2016); Pathak <i>et al.</i> , (2021); Thakur <i>et al.</i> , (2008)
136			Lomentariaceae	<i>Ceratodictyon variabile</i> (J.Agardh) R.E.Norris	Loej, Okha, Veraval, Sikka
137		Gigartinaceae	<i>Chondracanthus acicularis</i> (Roth) Fredericq	Loej	Tandel & Kuhada (2024)
138		Corallinaceae	<i>Corallina chilensis</i> Decaisne	Gulf of Kachchh, Veraval	Hakim <i>et al.</i> , (2022)
139		Rhodomelaceae	<i>Chondria armata</i> (Kützing) Okamura	Okha, Dwarka, Veraval, Sikka, Porbandar	Pathak <i>et al.</i> , (2020); Ishakani <i>et al.</i> , (2016); Pathak <i>et al.</i> , (2021); Thakur <i>et al.</i> , (2008); Jadeja <i>et al.</i> , (2025)

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140			<i>Chondria dasyphylla</i> (Woodward) C.Agardh	Beyt Dwarka, Shivrajpur	Hakim et al., (2022); Kalasariya et al., (2019); Ishakani et al., (2016); Thakur et al., (2008); Jadeja et al., (2025)
141		Liagoraceae	<i>Dermonema virens</i> (J.Agardh) Pedroche & Ávila Ortíz	Beyt Dwarka, Kachchh, Okha, Porbandar	Kalasariya et al., (2019); Dave et al., (2019); Jadeja et al., (2025)
142		Rhodomelaceae	<i>Digenea simplex</i> (Wulfen) C.Agardh	Kachchh, Dwarka, Okha, Verval	Roy et al., (2015); Jha et al., (2009)
143		Gracilariaceae	<i>Gracilaria veravalensis</i> (Uncertain ID)	Beyt Dwarka, Veraval, Sikka	Kalasariya et al., (2019)
144			<i>Gracilaria dura</i> (C.Agardh) J.Agardh	Beyt Dwarka, Shivrajpur, Loej	Tandel & Kuhada (2024); Hakim et al., (2022), Kalasariya et al., (2019)
145			<i>Gracilaria textorii</i> (Suringar) De Toni	Beyt Dwarka, Shivrajpur, Narara	Hakim et al., (2022); Kalasariya et al., (2019)
146			<i>Gracilaria corticata</i> (J.Agardh) J.Agardh	Beyt Dwarka, Veraval, Okha, Narara, Porbandar, Dwarka, Sikka	Athulya et al., (2019); Tandel & Kuhada (2024); Kalasariya et al., (2019); Dave et al., (2019); Pathak et al., (2020); Hakim et al., (2022); Ishakani et al., (2016); Malsatar & Mehta et al., (2017); Pathak et al., (2021); Thakur et al., (2008); Roy et al., (2015); Jadeja et al., (2025); Thaker et al., (2023)
147			<i>Gracilaria canaliculata</i> Sonder	Loej, Okha, Veraval	Tandel & Kuhada (2024)

Sr. No.	Phylum (Division)	Family	Species Name	Distribution (Locations in Gujarat)	References
148			<i>Gracilaria mammillaris</i> (Montagne) M.A.Howe	Mandvi, Veraval, Porbandar, Okha, Sikka, Dwarka	Malsatar & Mehta (2017)
149			<i>Gracilaria folifera</i> (Forsskål) Børgesen	Mandvi, Veraval, Beyt Dwarka, Sikka, Narara	Kalasariya et al., (2019); Pathak et al., (2020); Hakim et al., (2022); Malsatar & Mehta (2017); Pathak et al., (2021)
150			<i>Gracilaria salicornia</i> (C.Agardh) E.Y.Dawson	Mandvi, Sikka, Veraval, Shivrajpur, Narara	Hakim et al., (2022); Pathak et al., (2020); Malsatar & Mehta, (2017); Pathak et al., (2021); Roy et al., (2015)
151			<i>Gracilaria verrucosa</i> (Hudson) Papenfuss	Narara, Okha, Diu, Sikka	Roy et al., (2015)
152			<i>Gracilaria millardetii</i> (Montagne) J.Agardh	Veraval, Okha	Ishakani et al., (2016); Thakur et al., (2008)
153			<i>Gracilaria pusilla</i> (Stackhouse) Le Jolis	Veraval, Sikka, Okha, Narara, Porbandar, Dwarka	Pathak et al., (2021); Thakur et al., (2008); Pathak et al., (2020)
154			Gelidiellaceae	<i>Gelidiella acerosa</i> (Forsskål) Feldmann & Hamel	Loej, Okha, Veraval, Sikka, Dwarka, Porbandar
155	Gelidiaceae	<i>Gelidium micropterum</i> Kützinger	Narara, Dwarka, Okha, Porbandar, Kotda, Shivrajpur, Veraval	Tandel & Kuhada (2024); Roy et al., (2015); Jha et al., (2009)	

Sr. No.	Phylum (Division)	Family	Species Name	Distribution (Locations in Gujarat)	References
156		Halymeniaceae	<i>Grateloupia lithophila</i> Børgesen	Okha, Veraval, Gopnath, Diu, Porbandar, Dwarka	Ishakani et al., (2016); Thakur et al., (2008)
157			<i>Grateloupia indica</i> Børgesen	Okha, Shivrajpur, Veraval	Hakim et al., (2022); Ishakani et al., (2016); Nakar et al., (2011); Thakur et al., (2008); Jadeja et al., (2025)
158			<i>Grateloupia filicina</i> (J.V.Lamourou x) C.Agardh	Shivrajpur, Kodinar, Mahuva, Okha, Veraval, Porbandar	Hakim et al., (2022); Jha et al., (2009)
159		Lomentariaceae	<i>Gelidiopsis variabilis</i> (Greville) Schmitz	Okha, Veraval, Porbandar, Diu, Dwarka, Sikka	Hakim et al., (2022); Ishakani et al., (2016); Thakur et al., (2008)
160			<i>Gelidiopsis repens</i> (Kützing) Weber-van Bosse	Shivrajpur	Jha et al., (2009)
161		Wrangeliaceae	<i>Griffithsia opuntioides</i> J.Agardh	Veraval, Okha, Porbandar, Shivrajpur	Hakim et al., (2022); Jha et al., (2009)
162		Champiaceae	<i>Gastroclonium iyengarii</i> Srinivasan	Narara, Okha, Sikka, Porbandar, Veraval	Ishakani et al., (2016); Jha et al., (2009)
163		Galaxauraceae	<i>Galaxaura indica</i> Hettterscheid & Huisman	Okha, Dwarka, Porbandar, Veraval, Diu, Sikka	Nakar et al., (2011)
164		Halymeniaceae	<i>Halymenia porphyraeformis</i> (Parkinson) Parkinson	Beyt Dwarka, Narara, Loej, Veraval, Shivrajpur, Okha, Sikka, Kachchh	Tandel & Kuhada (2024); Hakim et al., (2022); Kalasariya et al., (2019); Dave et al., (2019); Pathak et al., (2020) Ishakani et al., (2016); Pathak et al., (2021); Thakur et al., (2008)

Sr. No.	Phylum (Division)	Family	Species Name	Distribution (Locations in Gujarat)	References	
165			<i>Halymenia venusta</i> Børgesen	Beyt Dwarka, Kachchh, Shivrajpur, Narara, Veraval, Sikka, Okha, Porbandar	Dhargalkar & Deshmukhe (1996); Tandel & Kuhada (2024); Hakim et al., (2022); Kalasariya et al., (2019); Dave et al., (2019); Pathak et al., (2020); Ishakani et al., (2016); Pathak et al., (2021); Thakur et al., (2008); Jadeja et al., (2025); Thaker et al., (2023)	
166		Dasyaceae	<i>Heterosiphonia muelleri</i> (Sonder) De Toni	Beyt Dwarka, Kachchh	Kalasariya et al., (2019); Vagh et al., (2022)	
167		Wrangeliaceae	<i>Haloplegma duperreyi</i> Montagne	Veraval, Okha	Dhargalkar & Deshmukhe (1996)	
168		Rhodymeniaceae	<i>Halopeltis australis</i> (J.Agardh) G.W.Saunders (Rhodymenia sonderi P.C.Silva, 1996)	Loej, Porbandar	Tandel & Kuhada (2024); Hakim et al., (2022); Roy et al., (2015); Jadeja et al., (2025)	
169		Cystocloniaceae		<i>Hypnea sp.</i>	Beyt Dwarka, Loej, Shivrajpur, Diu, Veraval, Sikka	Tandel & Kuhada (2024); Kalasariya et al., (2019)
170				<i>Hypnea flagelliformis</i> Greville ex. J.Agardh	Shivrajpur	Hakim et al., (2022)
171				<i>Hypnea musciformis</i> (Wulfen) J.V.Lamouroux	Beyt Dwarka, Shivrajpur, Dwarka, Kachchh, Veraval, Porbandar, Okha	Athulya et al., (2019); Dhargalkar & Deshmukhe (1996); Tandel & Kuhada (2024); Hakim et al., (2022); Kalasariya et al., (2019); Dave et al., (2019); Pathak et al.,

Sr. No.	Phylum (Division)	Family	Species Name	Distribution (Locations in Gujarat)	References
					(2020); Ishakani <i>et al.</i> , (2016); Mantri <i>et al.</i> , (2019); Nakar <i>et al.</i> , (2011); Pathak <i>et al.</i> , (2021); Temkar <i>et al.</i> , 2018; Thakur <i>et al.</i> , (2008); Roy <i>et al.</i> , (2015)
172			<i>Hypnea pannosa</i> J.Agardh	Loej, Veraval, Okha, Porbandar, Dwarka, Sikka	Tandel & Kuhada (2024); Hakim <i>et al.</i> , (2022); Jadeja <i>et al.</i> , (2025)
173			<i>Hypnea valentiae</i> (Turner) Montagne	Mandvi, Veraval, Beyt Dwarka, Okha, Narara, Shivrajpur	Hakim <i>et al.</i> , (2022); Kalasariya <i>et al.</i> , (2019); Ishakani <i>et al.</i> , (2016); Malsatar & Mehta (2017); Thakur <i>et al.</i> , (2008); Roy <i>et al.</i> , (2015)
174			<i>Hypnea esperi</i> Bory	Narara, Veraval, Loej	Tandel & Kuhada (2024); Hakim <i>et al.</i> , (2022); Roy <i>et al.</i> , (2015)
175			<i>Hypnea spinella</i> (C.Agardh) Kützing	Veraval, Shivrajpur, Dwarka, Okha, Porbandar	Tandel & Kuhada (2024); Hakim <i>et al.</i> , (2022); Roy <i>et al.</i> , (2015), Jadeja <i>et al.</i> , (2025)
176		Corallinaceae	<i>Jania spectabile</i> (Harvey ex Grunow) J.H.Kim	Loej	Tandel & Kuhada (2024)
177			<i>Jania rubens</i> (Linnaeus) J.V.Lamouroux	Loej, Kachchh, Okha, Veraval, Kachchh	Tandel & Kuhada (2024); Ishakani <i>et al.</i> , (2016); Vagh <i>et al.</i> , (2022)
178		Rhodomelaceae	<i>Laurencia claviformis</i> Børgesen	Beyt Dwarka, Porbandar,	Kalasariya <i>et al.</i> , (2019)
179			<i>Laurencia papillosa</i> (C.Agardh) Greville	Beyt Dwarka, Dwarka, Okha, Veraval, Loej	Tandel & Kuhada (2024); Kalasariya <i>et al.</i> , (2019); Ishakani <i>et al.</i> , (2016); Thakur <i>et</i>

Sr. No.	Phylum (Division)	Family	Species Name	Distribution (Locations in Gujarat)	References
					<i>al.</i> , (2008); Hakim <i>et al.</i> , (2022)
180			<i>Laurencia cruciata</i> Harvey	Dwarka, Okha, Veraval, Loej	Dhargalkar & Deshmukhe (1996); Tandel & Kuhada (2024); Ishakani <i>et al.</i> , (2016); Thakur <i>et al.</i> , (2008)
181			<i>Lophocladia lallemandii</i> (Montagne) F.Schmitz	Narara, Adri, Okha, Porbandar, Verval	Roy <i>et al.</i> , (2015); Jha <i>et al.</i> , (2009)
182			<i>Laurencia obtusa</i> (Hudson) J.V.Lamouroux	Narara, Dwarka, Veraval, Okha, Porbandar, Sikka	Athulya <i>et al.</i> , (2019); Dhargalkar & Deshmukhe (1996); Roy <i>et al.</i> , (2015)
183		Liagoraceae	<i>Liagora ceranoides</i> J.V.Lamouroux	Shivrajpur, Okha, Porbandar, Dwarka	Hakim <i>et al.</i> , (2022); Jha <i>et al.</i> , (2009)
184		Corallinaceae	<i>Pneophyllum conicum</i> (E.Y.Dawson) Y.M.Chamberlain	Dwarka, Veraval, Okha, Kachchh	Roy <i>et al.</i> , (2015)
185		Bangiaceae	<i>Porphyra vietnamensis</i> Tanaka & P.H.Ho	Okha, Porbandar	Dave <i>et al.</i> , (2019)
186		Galaxauraceae	<i>Pseudogloiophloea fascicularis</i> (Børgesen) Desikachary	Dwarka	Dhargalkar & Deshmukhe (1996)
187			<i>Polysiphonia marina</i> (Likely <i>P. platycarpa</i> )	Beyt Dwarka, Gopnath, Veraval, Sikka, Okha	Kalasariya <i>et al.</i> , (2019)
188		Rhodomelaceae	<i>Polysiphonia sp.</i>	Dwarka, Gopnath, Okha, Sikka, Porbandar	Dhargalkar & Deshmukhe (1996)
189			<i>Polysiphonia variegata</i> (C.Agardh) Zanardini	Dwarka, Okha	Dhargalkar & Deshmukhe (1996)

Sr. No.	Phylum (Division)	Family	Species Name	Distribution (Locations in Gujarat)	References
190			<i>Palisada cruciata</i> (Harvey) K.W.Nam	Loej	Tandel & Kuhada (2024)
191			<i>Palisada perforata</i> (Bory) K.W.Nam	Loej	Tandel & Kuhada (2024)
192			<i>Polysiphonia denudata</i> (Dillwyn) Greville ex Harvey	Okha	Dave et al., (2019)
193			<i>Polysiphonia ferulacea</i> Suhr ex J.Agardh	Shivrajpur	Hakim et al., (2022)
194			<i>Polysiphonia platycarpa</i> Børgesen	Veraval, Sikka, Okha	Pathak et al., (2020); Ishakani et al., (2016); Pathak et al., (2021); Thakur et al., (2008)
195		Peyssonneliaceae	<i>Peyssonnelia obscura</i> Weber-van Bosse	Gulf of Kachchh	Roy et al., (2015)
196		Sarcomeniaceae	<i>Platysiphonia delicata</i> (Clemente) Cremades	Loej, Beyt Dwarka, Shivrajpur, Sikka	Tandel & Kuhada (2024); Hakim et al., (2022); Kalasariya et al., (2019); Pathak et al., (2020)
197		Scinaiceae	<i>Scinaia fascicularis</i> (Børgesen) Huisman	Beyt Dwarka, Porbandar, Veraval, Sutrapada	Kalasariya et al., (2019); Roy et al., (2015); Jadeja et al., (2025)
198			<i>Scinaia hatei</i> Børgesen	Dwarka, Veraval, Sikka, Narara, Okha, Porbandar, Shivrajpur	Dhargalkar & Deshmukhe (1996); Hakim et al., (2022); Pathak et al., (2020); Ishakani et al., (2016); Nakar et al., (2011); Pathak et al., (2021); Thaker et al., (2023)
199			<i>Scinaia carnosa</i>	Mandvi, Okha, Dwarka, Porbandar,	Tandel & Kuhada (2024); Dave et al., (2019); Pathak et al.,

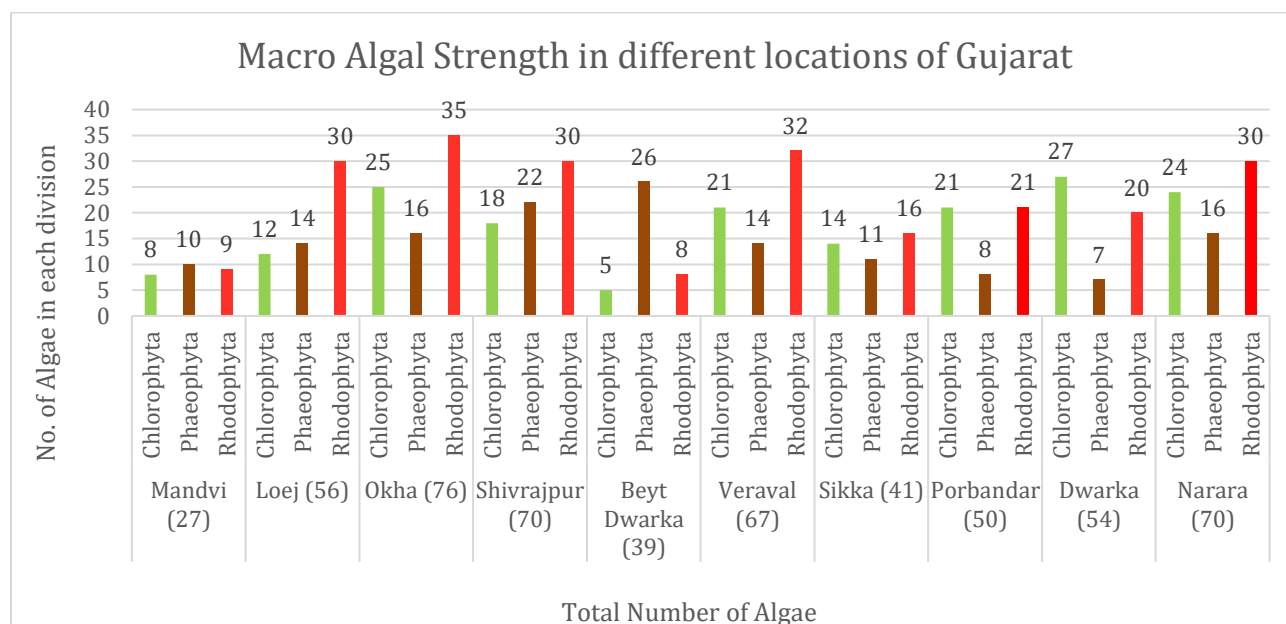
Sr. No.	Phylum (Division)	Family	Species Name	Distribution (Locations in Gujarat)	References
			(Kützing) J.Agardh	Veraval, Narara, Loej	(2020); Malsatar & Mehta (2017); Jadeja et al., (2025); Thaker et al., (2023)
200		Sebdeniaceae	<i>Sebdenia polydactyla</i> (Børgesen) Balakrishnan	Beyt Dwarka, Okha, Veraval, Sikka, Porbandar	Dhargalkar & Deshmukhe (1996); Kalasariya et al., (2019); Nakar et al., (2011)
201		Solieriaceae	<i>Sarconema muelleri</i>	Beyt Dwarka, Okha	Kalasariya et al., (2019)
202			<i>Solieria robusta</i> (Greville) Kylin	Dwarka, Okha, Veraval, Narara, Shivrajpur	Dhargalkar & Deshmukhe (1996); Tandel & Kuhada (2024); Hakim et al., (2022); Nakar et al., (2011); Thakur et al., 2008
203			<i>Solieria chordalis</i> (C.Agardh) J.Agardh	Okha, Veraval, Narara	Tandel & Kuhada (2024)
204			<i>Sarconema filiforme</i> (Sonder) Kylin	Narara, Shivrajpur, Okha, Dwarka, Porbandar, Veraval	Hakim et al., (2022); Ishakani et al., (2016); Thakur et al., (2008); Roy et al., (2015); Thaker et al., (2023)
205			<i>Sarconema scinaoides</i> Børgesen	Shivrajpur	Hakim et al., (2022)
206		Galaxauraceae	<i>Scinaia moniliformis</i> J.Agardh	Narara, Veraval, Sikka, Porbandar	Pathak et al., (2020); Ishakani et al., (2016); Pathak et al., (2021); Roy et al., (2015); Jadeja et al., (2025)
207			<i>Scinaia complanata</i> (Collins) Cotton	Narara, Porbandar	Roy et al., (2015); Jadeja et al., (2025)
208		Spyridiaceae	<i>Spyridia filamentosa</i> (Wulfen) Harvey	Narara, Shivrajpur	Tandel & Kuhada (2024); Hakim et al., (2022); Roy et al., (2015)

Sr. No.	Phylum (Division)	Family	Species Name	Distribution (Locations in Gujarat)	References
209			<i>Spyridia fusiformis</i> Børgesen	Veraval, Chhad, Dedeka, Mundeka, Goose, Narara, Sikka, Okha	Dhargalkar & Deshmukhe (1996)
210			<i>Spyridia hypnoides</i> (Bory) Papenfuss	Beyt Dwarka	Kalasariya et al., (2019)
211			<i>Spyridia alternans</i> Børgesen	Kachchh, Okha, Veraval, Dwarka, Sikka, Porbandar	Dave et al., (2019); Roy et al., (2015)
212		Galaxauraceae	Tricleocarpa fragilis (Linnaeus) Huisman & Townsend	Veraval	Dhargalkar & Deshmukhe (1996)
213		Wrangeliaceae	<i>Wrangelia tanegana</i> Harvey	Adri, Navabandar, Okha	Jha et al., (2009)

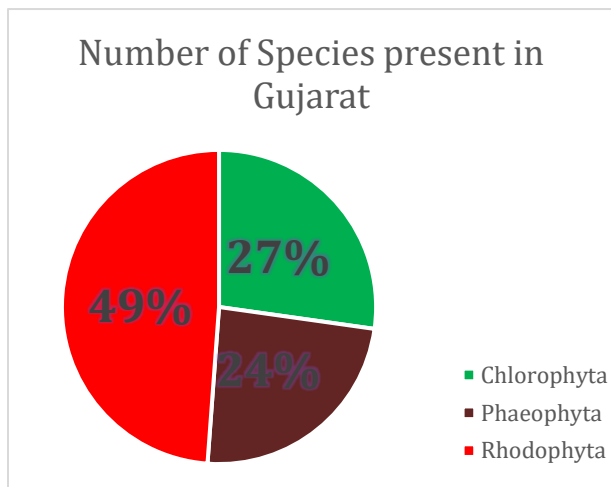
**Table 2: List of Marine Algal Species at Different Area**

Location	Division	No of Algae	Total No of Algae	References
<b>Mandvi</b>	Chlorophyta	8	27	Malsatar & Mehta, 2017
	Phaeophyta	10		
	Rhodophyta	9		
<b>Loej</b>	Chlorophyta	12	56	Tandel & Kuhada, 2024
	Phaeophyta	14		
	Rhodophyta	30		
<b>Okha</b>	Chlorophyta	25	76	Nakar et al., 2011; Thakur et al., 2008; Thaker et al., 2023
	Phaeophyta	16		
	Rhodophyta	35		
<b>Shivrajpur</b>	Chlorophyta	18	70	Hakim et al., 2022
	Phaeophyta	22		
	Rhodophyta	30		
<b>Beyt Dwarka</b>	Chlorophyta	5	39	Kalasariya et al., 2019
	Phaeophyta	26		
	Rhodophyta	8		

Location	Division	No of Algae	Total No of Algae	References
Veraval	Chlorophyta	21	67	Pathak <i>et al.</i> , 2020; Ishakani <i>et al.</i> , 2016; Thaker <i>et al.</i> , 2023
	Phaeophyta	14		
	Rhodophyta	32		
Sikka	Chlorophyta	14	41	Pathak <i>et al.</i> , 2020; Katara <i>et al.</i> , 2023; Pathak <i>et al.</i> , 2021; Thaker <i>et al.</i> , 2023
	Phaeophyta	11		
	Rhodophyta	16		
Porbandar	Chlorophyta	21	50	Jadeja <i>et al.</i> , 2025; Temkar <i>et al.</i> , 2018; Thaker <i>et al.</i> , 2023
	Phaeophyta	8		
	Rhodophyta	21		
Dwarka	Chlorophyta	27	54	Athulya <i>et al.</i> , 2019; Mantri <i>et al.</i> , 2019; Thaker <i>et al.</i> , 2023; Sanghvi <i>et al.</i> , 2020; Dhargalkar <i>et al.</i> , 1995
	Phaeophyta	7		
	Rhodophyta	20		
Narara	Chlorophyta	24	70	Roy <i>et al.</i> , 2015
	Phaeophyta	16		
	Rhodophyta	30		



**Figure 1: Macroalgal Diversity at Different Coastal Locations of Gujarat**



**Figure 2: Distribution of Marine Macroalgae of Gujarat**

### **ECOLOGICAL SIGNIFICANCE OF MACROALGAE**

Macroalgae play a fundamental role in maintaining the structure and function of coastal ecosystems. As primary producers, they form the base of marine food webs and contribute significantly to carbon fixation and nutrient cycling. Dense macroalgal assemblages, particularly those formed by genera such as *Sargassum* and *Gracilaria*, provide habitat, shelter and feeding grounds for a wide range of marine organisms, including invertebrates and fishes.

In addition, macroalgal beds enhance habitat complexity and contribute to sediment stabilization in coastal environments. Seasonal variations, influenced by monsoonal cycles, temperature fluctuations and salinity changes, play a crucial role in determining species composition and biomass. Peak diversity and abundance are generally observed during post-monsoon and winter seasons, although detailed long-term phenological studies for the Gujarat coast remain limited (Pathak et al, 2020). In ecological studies, it is often the transformation of the entire community that matters, not simply the variation in one or a few species. The change in environmental factor associated with tides makes the intertidal zone most vulnerable and extreme of any marine environment. (Dave et al., 2019).

### **SOCIO-ECONOMIC USES & PROSPECTS:**

#### ***Traditional and commercial uses***

Macroalgae are used as food, fodder, fertilisers, as raw materials in industries, medicines, etc. (Dhargalkar & Kavlekar, 2001). Seaweed are traditionally been used by the western food industry for their polysaccharide extractives (agar, carrageenan, alginates) have potential nutritional benefits. (Mabeau & Fleurence, 1993) but Gujarat has had limited commercial cultivation compared to southern India. (Jha et al., 2009). Direct consumption of seaweed as food in form of salads, soups and a number of food preparations is very common in Southeast Asian countries. Japan, China and Korea stand at the forefront of seaweed utilization in human food preparations, whereas in India, seaweed are used only for extraction of industrially important. (Ganesan et al., 2019). Economic uses of seaweeds particularly for phycocolloids and agro-based products, are well known for centuries and are now being extensively investigated for their application in bio-fuel, nutraceutical, medicinal, personal-care and food additive industries. (Hafting et al., 2015; Kim et al., 2017). They are also a source of fine chemical such as natural pigments, mannitol, iodine

and cosmetic and therapeutically active products. (Mantri *et al.*, 2019). Algae are among the most valuable marine biological renewable resources, utilized in nutrition for humans and animal. They are also applied as bio-fertilizers for various terrestrial crop and are essential in medicinal and other industrial contexts. (Chanda *et al.*, 2010; Gupta *et al.*, 2011; Annie 2014; Rakholiya *et al.*, 2017). In addition, algae are used in different meat products as pasty, steaks, frankfurters, sausages, and also used in fish foodstuffs, and oils for long-term storage. The algae are also used in cereal or crops, as pasta, flour, and bread. Although, algae are used used for the fermentation of food as cheese, and processed cheese. (Nayak et al.,(2022).

### ***Seaweed farming and value-addition potential***

Seaweed farming technology encompasses various innovative method and systems designed to enhance cultivative method and system designed to enhance cultivation efficiency and sustainability. (Bambhaniya *et al.*, 2024). Seaweed farming in Gujarat hold substantial promise for fostering economic growth and promoting environmental sustainability. Recent assessments and national programs identify Gujarat as a promising region for mariculture diversification. Opportunities include integrated multi-trophic aquaculture (IMTA), phycocolloid extraction, nutraceuticals, and bioactive compounds. Organized large-scale farming remains limited and requires capacity building, seedstock protocols, and market linkages (Behera et al, 2022).

## **THREATS & CONSERVATION CONCERNS:**

### ***Anthropogenic pressures***

The macroalgal diversity of the Gujarat coast is increasingly threatened by anthropogenic and environmental pressures. Rapid industrialization, coastal development activities such as port construction and dredging, discharge of industrial effluents and oil pollution have led to habitat degradation and decline in macroalgal populations. Additionally, unregulated harvesting and physical disturbances further exacerbate the vulnerability of these ecosystems. Heavy metal pollution causes a widespread environmental problem in coastal areas, lakes, and rivers by anthropogenic activities like industrial discharges, domestic wastewater, agriculture runoff, and improper disposal of hazardous materials (Tatsumoto *et al.*, 2004). The intertidal zones, being highly dynamic and sensitive to environmental changes, are particularly susceptible to such disturbances. These pressures not only affect species richness but also alter community structure and ecological balance. Therefore, effective conservation strategies, including habitat protection, pollution control and sustainable harvesting practices, are essential to preserve the macroalgal diversity of the region. (Rathod *et al.*, 2025). Gaining insight into their distribution and ecological needs is crucial for developing conservation strategies that support the overall stability and health of ecosystem (O’Hara *et al.*, 2019).

### ***Climate change impact***

Climate change and human interference affect the food chain, prompting species to evolve morphologically and genetically to adapt better. (Jadeja *et al.*, 2015). Rising ocean temperature, changing rainfall and monsoon dynamics, and the increasing frequency of extreme weather events are transforming the structure of algal ecosystems. These shifts can alter species distribution patterns, disrupt seasonal growth cycle, and create favorable conditions for invasive species to establish and spread. Rising sea surface temperature, changes in salinity, and increasing frequency of extreme weather events such as cyclones and irregular monsoon patters-have begin to reshape the composition and distribution of algal species along Gujarat’s coast. Climate with three distinct seasons: the “cool” season from October to March “wet” season from June to September. Seaweed can be found in coastal area of Gujarat from October to February, particularly in the intertidal zone (Jadeja *et al.*, 2025).

### **Prospects for Sustainable Development**

Gujarat's extensive coastline and diverse macroalgal assemblages present opportunities for seaweed-based industries (phycocolloids, nutraceuticals), ecosystem restoration, and potential carbon sequestration. Targeted investments in science, farmer training, and market infrastructure could allow seaweeds to augment coastal livelihoods while supporting biodiversity conservation (Behera et al, 2022).

### **CONCLUSION**

Overall, the Gujarat coast represents a significant macroalgal biodiversity hotspot characterized by high species richness, diverse habitats and strong ecological gradients. The dominance of Rhodophyta, coupled with the wide distribution of ecologically important genera, reflects the ecological complexity and productivity of the region. However, the observed spatial heterogeneity, underexplored deep-water habitats and increasing anthropogenic pressures highlight the need for comprehensive and integrated research efforts. Sustainable utilization and conservation of macroalgal resources will be critical for maintaining ecological balance and supporting future economic development along the Gujarat coast.

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