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BIOLOGY AND STATUS OF SEAGRASSES IN GULF OF KACHCHH MARINE NATIONAL PARK AND SANCTUARY, INDIA

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The lesser known but vibrant coastal ecosystem of seagrass meadows are very important for coastal communities as they are a critical component of the interdependent and interconnected series of coastal ecosystems; coastal mangroves, coral reefs, seagrasses and sand dunes that are often in close proximity and form a mosaic of micro-organism, algal, fungal,

floral and faunal communities (Kallesoe *et al.*, 2008).

Seagrass components and habitat

Seagrasses are seed-bearing, flowering, rooted plants, which grow submerged, exclusively in marine coastal waters and coastal wetlands. Like grasses in terrestrial

habitats, they form meadows on the bed of coastal seas. They are dependent on light for photosynthesis, and therefore, seagrass generally grows only in clear and shallow waters in estuaries and coastal seas. Seagrass cannot survive exposure out of water, so often survives

behind shelter from a sand bar or coral reef. Seagrasses are different from the seaweeds, which lack the vascular system for transport of food and water possessed by seagrasses. Similarly, seaweed also lack specialized reproductive structures, such as flowers and fruits,

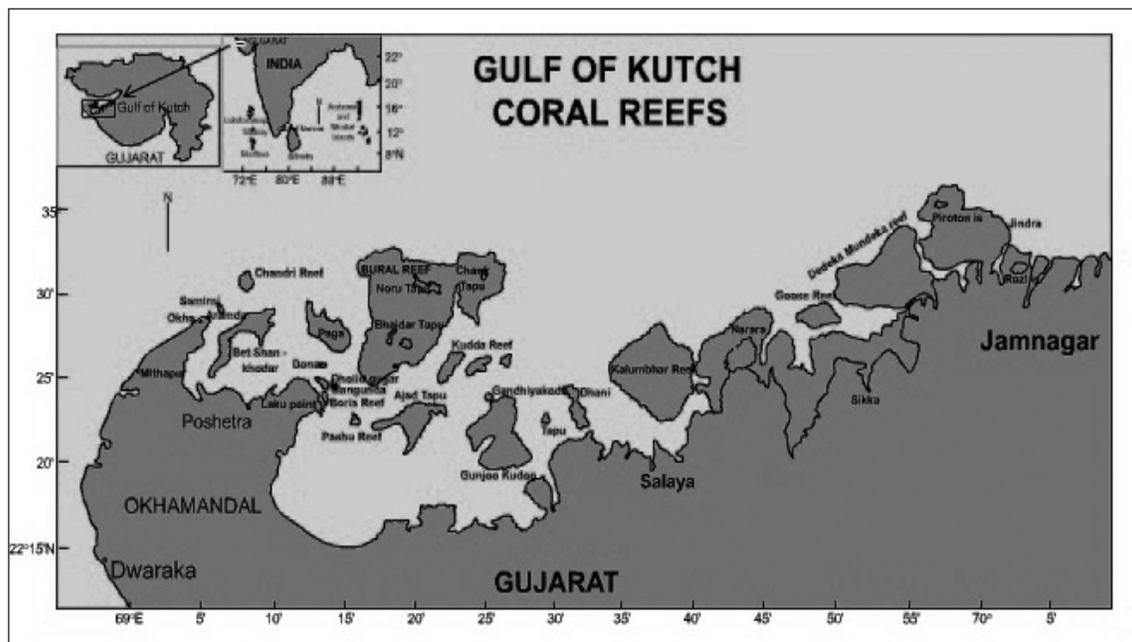


Figure 1. Gulf of Kachchh Marine National Park and Sanctuary, Gujarat, India.

and roots. Seagrasses are the only flowering plants that have adapted to a completely submerged life in the tidal and sub-tidal marine environment, where they must withstand the wave energy of the sea and sub-marine pollination. Air-filled tissues in the leaves facilitate gas exchange with the environment. The underground rhizomes and roots anchor the plants; sugars and oxygen are produced during photosynthesis. Seagrasses need more sunlight (10% of the light at the water surface) than algae (1% of the light at the water surface), which do not have underground components (Bjork *et al.*, 2008). This necessity limits the depth to which seagrasses can grow (Orth *et al.*, 2006).

Importance of seagrass

Seagrass meadows constitute ecologically and economically important habitats. Many edible fish inhabit seagrass beds, which also act as nurseries for many commercial fish and shellfish species. Seagrass meadows prevent coastal erosion and pollution and sedimentation of coastal waters, stabilize the floor of coastal seas, are primary producers in coastal ecosystems, support coastal biodiversity, enrich nutrients in coastal waters, and may be monitored as an indicator of coastal ecosystem health. They also act

as filters for coastal waters, slowing water currents and trapping inorganic particles, organic nutrients and pollutants washed from inland waters to coastal areas.

Distribution of seagrass in Gulf of Kachchh Marine National Park and Sanctuary

The Gulf of Kachchh Marine National Park and Sanctuary (MNP&S) is situated in Jamnagar and Rajkot districts along the southern coast of India, between 20°15'N to 23°40'N latitude and 68°20' to 70°40'E longitude (Figure 1). An area of 620 km², was declared a MNP&S by Government of Gujarat in 1980 and 1982, includes 42 islands ranging from a few hectares to ~7,000 hectares in size. The MNP&S comprises a variety of habitats; including coral reefs, mangrove forests, sandy beaches, mudflats, rocky coast, seagrass beds, and wide intertidal areas the greatest depth of water is 10-15m around most islands (Satyanarayana & Ramakrishna, 2009; Dixit *et al.*, 2010).

Six species of seagrass are reported from the region, constituting 10% of the total number described worldwide (Phillips & Menez, 1988). There are few published studies on seagrasses in the Gulf of Kachchh MNP&S, but the distribution of seagrass has been recorded by various

agencies/organizations working among the mangroves, coral reefs and other habitats. Jagtap (1991) reported the occurrence of four species of seagrass from Gulf of Kachchh: *Halophila beccarii* was reported to be common while *Halodule uninervis*, *Halophila ovalis* and *Halophila ovata* were very rare. The status of seagrass was reported to be degraded. Nair (2002) reported three species, *Halodule uninervis*, *Halophila ovate* and *Halophila beccarii* on sandy regions of Narara and Kalubhar reefs. A comprehensive study on biodiversity and management issues of the MNP&S by Singh *et al.* (2004) indicates the status of seagrass in different locations. Maximum abundance was observed at Paga Reef, Chandri Reef, Noru Reef, Bhural Chank Reef, Kalubhar Reef, Narara Reef, Boria Reef, Mangunda Reef, Goose Reef and Pirotan Island. Low density seagrass meadows were reported at Meetha Chusna Island, Bhaidar Island, Chank Island, Ajad Island, Jindra Island, Chhad Island and Poshitra reef (see Table 1). Areas without seagrass included Bet Dwarka Island, Khara Chusna Island, Dedeka Island, Mundeka Island, Okha Village and Arambhda Village. Singh *et al.* (2004) reported only three species of seagrass from the intertidal reef areas of Gulf of Kachchh MNP&S compared with the six species reported by SAC (2010).

Thalassia hermprichii and algae were mapped on the coastal side of the reef flats of Bural Chank and Paga Reefs, Kalubhar Island, Narara Reef and Pirotan Island. Common seagrasses found growing on the muddy substrate of the seaward side of reef flats are *Halophila ovalis*, *Halophila beccarii* and *Zostera marina* (SAC, 2010).

Table 1. Size of seagrass meadows in Gulf of Kachchh Marine National Park and Sanctuary.

Seagrass Location	Area Covered (ha.)
Bhural Reef	1321.72
Ajad Island	8.94
Gandhio kado Island	3.01
Goose Reef	15.65
Sikka Reef	198.81
Dedika-Mundika Reef	354.62
Pirotan Island	504.18
Chhad and Jindra Islands	25.38
Total	2432.31

Marine megafauna associated with seagrass in the Gulf of Kachchh MNP&S

Dugong feeding trails among beds of *Halophila* spp. adjoining Pirotan Island (22°34'40.4''N; 69°59'07.3'')

in Gulf of Kachchh (Pandey *et al.*, 2010) and Yogesh Kumar *et al.*, (2013) observed dead dugong in Gulf of Kachchh. Green sea turtle carcasses found on the Bhaider island and Narara reef itself during the study period (pers. obs.) suggest seagrass meadows in the Gulf of Kachchh MNP&S support herbivorous marine megafauna and may be important feeding sites.

Potential threats to seagrass meadows in Gulf of Kachchh Marine National Park and Sanctuary

Like all coastal ecosystems, seagrass meadows are subjected to multiple impacts at local, national and global levels. Many anthropogenic activities impact seagrass ecosystems, and it is estimated that 65% of the seagrass meadows have been lost as a result of coastal development and alteration (Bjork *et al.*, 2008). Both natural and anthropogenic threats to seagrass occur in Gulf of Kachchh MNP&S.

One of the major threats to the seagrass meadows in Gulf of Kachchh MNP&S is pollution, due to various industries, and sedimentation affecting the water quality. Because sea grass meadows are dependent on sunlight for photosynthesis, water clarity and quality are important for the productivity of this ecosystem. Excessive sedimentation and turbidity often occur after dredging and coastal development.

- Industrial and domestic pollution and runoff from inland areas carrying nitrogen and phosphorus from fertilizers, animal and domestic waste leads to eutrophication and increased algal growth which reduces light and oxygen penetrating to depths at which seagrasses grow. Other sources of pollution, such as oil spillage from tankers, ships and sub-sea pipelines, and hot water discharge from industries also affect the condition of seagrasses.
- Coastal port, harbor and jetty developments lead to the increase of sedimentation, solid waste and marine pollution. Fishing activities, in particular trawling, shore seine and gill net operations and boat anchorage adversely affect seagrasses. Boat propellers can slash seagrass leaves and rhizomes, leading to fragmentation.
- Seagrass meadows are at risk from climate change-induced changes in marine conditions, including higher water temperature, acidification, sea level rise, increased intensity and frequency of storms and extreme weather events, season and amount of rainfall, wave height and frequency, and fresh water intrusion (IUCN, 2007).

Conclusion

The seagrass are the one of the important producer in the marine environment; serves as feeding and nursery habitat for endangered species like dugong, sea turtles and many recreationally important fish species. Seagrass diversity in the marine environment of Gulf of Kachchh Marine National Park and Sanctuary in India is being affected due to increase in Coastal port, harbor and jetty developments and fishing activities. The attempt revealed that seagrass distribution was significantly decreased in lead to the increase of sedimentation, solid waste, trawling, shore gill net operations and boat anchorage. Sea grass areas should be regulated as boat restriction zone especially for mechanised boats. Hence, it is essential to monitor the status of the seagrass in the marine environment of Gulf of Kachchh.

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