Chapter 7
Seagrasses in the Indian Ocean Region with Special Reference to Urbanization

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7.1 Introduction

Seagrasses are a functional group of plants (Short et al. 2011), living in the marine environment (Short et al. 2016) and form the submerged aquatic vegetation (Koch et al. 2006). Like terrestrial plants, they have roots, leaves, rhizomes, seeds and they reproduce through vegetative and sexual methods. Seagrasses grow naturally between high tide and low tide areas (intertidal areas), and also the majority of them are found completely submerged underwater and are distributed in tropical and sub-tropical areas; they can grow in various substrata like sand, silt, clay and coral rubbles

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(Parthasarathy et al. 1991). Seagrasses comprise $<0.02\%$ of the angiosperm flora, represented by 72 species. They are assigned mainly to six families encompassing 14 genera and are often separated into tropical and temperate genera, with 7 genera each. Seagrasses occur in all the coastal areas of the world except the polar regions because of ice scouring. Seagrasses are one of the most widespread coastal vegetational types and highly productive ecosystems in the world; they support rich biological diversity as well as offer many ecological services to maintain the integrity of the coast and sustainability of local communities. They protect the shorelines against erosion in the middle and lower intertidal and subtidal zones with their gregarious growth and dense root systems. Seagrass ecosystem is conspicuous and often a dominant habitat in shallow coastal waters and well known for its higher primary and secondary productivity, generation of vast quantities of detritus and supporting diverse floral and faunal communities as associated organisms.

Seagrasses have developed unique morphological, ecological and physiological adaptations for a completely submerged existence, including internal gas transport, epidermal chloroplasts, submarine pollination and marine dispersal which provide with important ecological services to the marine environment and profoundly influence the physical, chemical and biological environments in the coastal waters by acting as ecological engineers. Seagrasses alter water flow, nutrient cycling and food web. They are considered to be critical aquatic plants as they maintain the water quality by effectively removing nutrients from marine waters and settling surface sediments in the coastal areas. They are an important food source for mega herbivores such as green turtles, dugongs and manatees and provide with critical habitat for many animals, including commercially and recreationally important fishery species. Seagrass leaves, rhizomes and roots are used as food source by dugongs, sea urchins, herbivorous fishes and many other invertebrates feed on the decomposed seagrasses.

Seagrasses require high light levels (25% of the incident radiation) than any of the plant groups (1 or $<1\%$) in the world. These extreme high light requirements mean that seagrasses respond acutely to environmental changes, especially those that alter water clarity. Distribution and growth of the seagrasses are regulated by a variety of environmental characteristics such as temperature, turbidity, salinity, irradiance, nutrient availability and sediment characteristics. Nutrient characteristics and the sediment texture, which are influenced by human activities and climate change, have a control over seagrass distribution and productivity.

7.2 Seagrasses in Indian Subcontinent

India is one of the fast-developing economies in the world, due to its strong growth in its industries (United Nations Department for Economic and Social Affairs 2020). Climate change is a worldwide issue that affects all nations and their sustainable development plans (Gopalakrishnan et al. 2019) including India. Rapid urbanization without proper planning in coastal areas leads to the decline of coastal habitats (Dhiman et al. 2019).

Fig. 7.1 *Cymodocea serrulata* bed at Palk Bay, India (Photo Credit: V Balaji)

India, with a long coastline of 7517 km, is endowed with a variety of coastal habitats including seagrasses. Nonetheless, seagrasses have remained a highly ignored ecosystem for research and conservation in India (Jagtap et al. 2003); however, recently MoEF and CC have taken efforts to promote research and better conservation and management of seagrass meadows along the Indian coast (Thangaradjou and Bhatt 2018). Seagrass ecosystem in the tropics and particularly in India has always been given a low priority in studies by the scientific communities and environmentalists. But, in the late 1990s and early 2000s, the scenario has changed slowly and started to gain momentum. Indian seagrass habitats are mainly limited to mud flats and sandy regions, extending from the lower inter tidal zone to a depth of 10–15 m along the open shores and in the lagoons around the islands. Seagrass flora of India are represented by 7 genera and 15 species, out of which the Gulf of Mannar and Palk Bay (Fig. 7.1) harbour the higher number of species followed by Andaman and Nicobar (Fig. 7.2) and Lakshadweep islands (Fig. 7.3). Seagrasses serve as a habitat for endemic species (Kumaraguru et al. 2008), where the seagrass beds in the southeast coast of India serve as a biodiversity hotspot and support fisheries and livelihood of a large number of coastal communities (Jeyabaskaran et al. 2018).

In India, there are 16 species of seagrasses, as reported by Geevarghese et al. (2018), which are growing in various substrata such as sand, mud and mixed substrata and depths (Parthasarathy et al. 1991). Palk Bay and Gulf of Mannar in the Southeast coast of India are the two important and large seagrass areas, which support a variety of associated flora and fauna (Manikandan et al. 2011). In addition to this, the seagrass beds are also found in Gulf of Kachchh (Kamboj 2014) and

Fig. 7.2 Huge seagrass bed found at AN Islands, India (Photo Credit: P Ragavan)

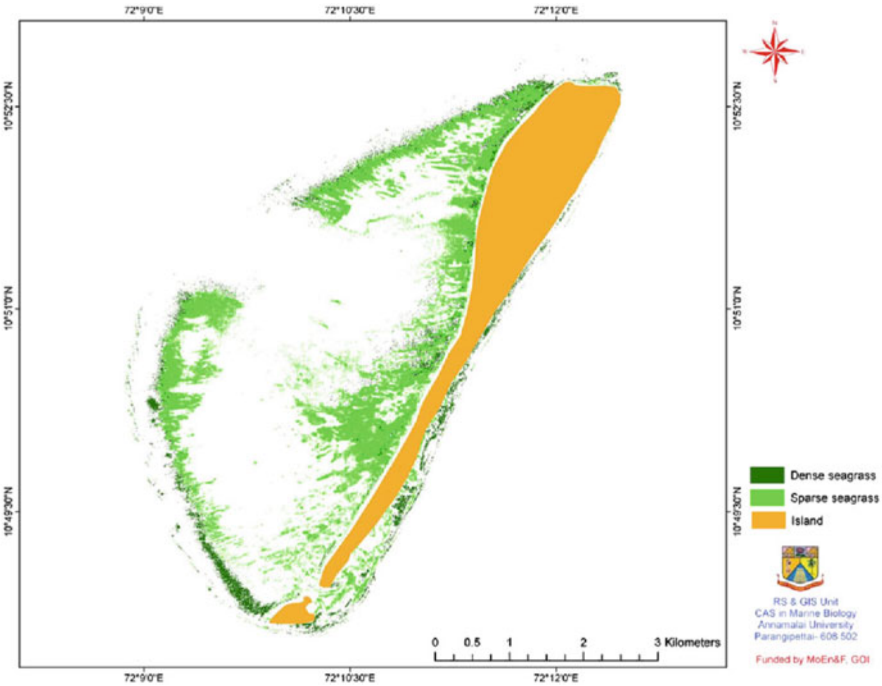

Fig. 7.3 Classified seagrass map of Agathi island, India (49 B/1) using IRS LISS IV data of 9 January 2007 (Source: Nobi et al. 2012)

Chilika lake (Geevarghese et al. 2018). In addition to this, seagrass beds have been identified in estuaries, lagoons and backwaters in most of the coastal states of India (Saravanan et al. 2013), such as Maharashtra, Kerala (Abhijith 2019), Tamil Nadu (Parthasarathy et al. 1991; Bharathi et al. 2014), Andhra Pradesh (Patro et al. 2017) and Odisha (Pati et al. 2014; Nayak 2014). *Halophila beccarii* is the most widely distributed species in India (Mishra et al. 2020).

Costanza et al. (2014) stated that the seagrass beds are highly productive ecosystems, and the estimated loss of ecological services from seagrass beds, due to land use change is at the rate of $4.3–20.2 trillion per year during the period from 1997 to 2011.

Seagrasses are used by farmers in the Palk Bay in Tamil Nadu as fertilizer for coconut trees. Similarly, they are used in other parts of the world for bedding and roofing and also for many other services (Nordlund et al. 2016).

Seagrass meadows mitigate the impacts of waves on the shorelines and erosion (Christianen et al. 2013), and the beach cast seagrasses are playing key role in protecting the shorelines from waves and erosion (Nordlund et al. 2018).

Seagrass locations in India are also the prime spots of fast-developing urbanization related activities, which threaten the existence of seagrass beds and their services. Impacts of degradation of seagrasses in Indian coastal areas directly affect their fishery productivity and livelihood of dependent fishers (Jeyabaskaran et al. 2018). In the Gulf of Kutch of north western India, the seagrass beds are facing the impacts of poor water quality due to industrial activities such as dredging, ship hot water discharge, oil spillage, port development (Kamboj 2014) and ship breaking yards (Deshpande et al. 2012). The waste waters discharged from coastal urban areas directly affect the seagrass meadows by enriching with nutrients in water and sediments (Cabaço et al. 2008). This is applicable to all the coastal urban areas of India and other parts of the world. Increased urbanization and tourism activities in the Palk Bay and Gulf of Mannar and other islands including Rameswaram would affect the seagrass beds and coral reefs in the southeast coast of India, in future.

In India, seagrass beds are not studied completely, however they are recognized as one of the sensitive ecosystems in the Coastal Regulation Zone (Patro et al. 2017). Seagrasses serve as a nursery ground (Heck et al. 1997; Jiang et al. 2020; McDevitt-Irwin et al. 2016) and breeding ground for marine animals (Bujang et al. 2006). Significant attempts have been carried out in India for the conservation and restoration of seagrass beds. Laboratory based axenic seagrass seedlings were developed by Thangaradjou and Kannan (2008). In situ seagrass restoration method was performed in the Gulf of Mannar, using PVC frames which showed higher survival rate (Patterson Edward et al. 2019). The method was further improved by using low cost and eco-friendly materials such as bamboo frames and coconut ropes (Balaji et al. 2020). Seagrass habitats in Palk Bay of Tamil Nadu are now being considered for declaring them as a “Dugong Conservation Reserve” by the State and Central Governments, recently.

Unfortunately, these seagrasses have significantly declined in their coverage and density in several parts of the country. The largest seagrass beds in India are located along the southeast coast of India, which are affected by aquaculture farms, domestic sewage from coastal towns, tourism, fishery-related disturbances and factories. Jeyabaskaran et al. (2018) mentioned that the Palk Bay seagrass beds in southeast coast of India as "biodiversity hotspots" and are disappearing faster than that of the Gulf of Mannar, which may be due to the threats to seagrass beds in Palk Bay (Kumaraguru et al. 2008). Such large-scale losses of seagrass beds have led to numerous restoration programmes worldwide. In this respect, the need to transplant in affected seagrass habitats and to collect donor materials from healthy seagrass habitats are critically important. Careful site selection is very important, and several conceptual models to optimize site selection have also been developed for seagrass restoration.

7.3 Seagrass in the Andaman and Nicobar Islands of India

As per an estimate, seagrass cover in India is 517 km^2 (Geevarghese et al. 2018), of which, 15 km^2 of seagrass beds are spread around the Andaman and Nicobar Islands (ANI) with 10 species belonging to 6 genera (Geevarghese et al. 2018; Ragavan et al. 2016). Seagrass beds in the Andaman Islands (5.79 km^2) are highly scattered, whereas in Nicobar Islands (8.81 km^2), seagrass beds are luxuriant and dense (Geevarghese et al. 2018; Ragavan et al. 2016). By surveying a total of 44 seagrass sites in the ANI, 8 sites were identified as feeding sites for dugongs through the distinct feeding trails observed at these sites (D'Souza et al. 2015). In addition, Seagrass meadows of the ANI were found to be the hot spots for blue carbon storage in Southeast Asia with the highest ecosystem carbon stock of 184.24 ± 23.84 Mg C ha^{-1}, followed by Myanmar (136.67 ± 64.77 Mg C ha^{-1}), Thailand and Vietnam (134.20 ± 73.89 and 133.16 ± 36.97 Mg C ha^{-1}, respectively), Philippines (123.49 ± 63.38 Mg ha^{-1}), Malaysia (108.63 ± 89.43 Mg ha^{-1}) and Indonesia (97.60 ± 41.49 Mg ha^{-1}) (Stankovic et al. 2021). Recently, Mishra et al. (2021) also reported relatively higher carbon stock in the seagrass beds of the Andaman Islands (128.79 ± 55.89 and 272.54 ± 164 Mg C ha^{-1}) than the other parts of India. Further, they have noted that outwelling of organic carbon from highly productive adjacent dense mangroves of the Andaman Islands would play a major role in carbon storage in the seagrass meadows of these islands. So, maintaining the ecological connectivity is imperative for the use of this valuable ecosystem for countries' climate change mitigation and adaptation measures and protecting the critically endangered dugongs.

Despite the ecological and economic benefits, seagrasses are witnessing rapid depletion around the world as well as in the ANI (Thangaradjou and Bhatt 2018). Manmade activities such as fishing, anchoring, boating and development of infrastructures in the coastal areas severe the impacts on seagrasses and their biodiversity (Ramesh and Mohanraju 2020). Recently, it has been highlighted that climate change consequences like sea-level rise and its associated soil erosion and increasing frequency of natural catastrophic events like cyclones and tsunamis would be the major factors for the degradation of coastal systems (Goldberg et al. 2020; Adame et al. 2021). Tsunami in 2004 destroyed large areas of seagrass meadows in the Nicobar Islands (D'Souza and Patankar 2011) and Lehar's cyclone damaged about 1.96 ha of seagrass beds in the Andaman Islands (Sachithanandam et al. 2014). Furthermore, the frequent occurrence of leaf reddening and leaf burning in seagrasses of the ANI indicates that seagrass meadows of the ANI are highly vulnerable to stresses like high temperatures, intense light and release of toxic sulphides (Ragavan et al. 2013; Ramesh and Mohanraju 2020). In the recent years, the seagrass research is getting more attention, which further needs to provide us with answers for conservation and management (Thangaradjou and Bhatt 2018). Since the knowledge of exact species composition and distribution is a prerequisite for better conservation and management of an ecosystem, spatial and temporal distribution of seagrass meadows in the ANI needs to be documented at the earliest irrespective of dugong represented meadows.

7.4 Seagrasses in Maldives–Lakshadweep–Chagos Archipelago

There is only limited literature about the seagrasses of the Maldives. When analysing the satellite images, seagrasses are visible in the Maldivian seas, especially around the densely populated islands or islands with more economic activities. Researches indicate that there are five species of seagrasses under four genera in the Maldives. These species are *Syringodium isoetifolium, Thalassia hemprichii, Thalassodendron ciliatum, Cymodocea rotundata* and *Cymodocea serrulata* and of these, *T. hemprichii* is the most abundant in the country. In the Maldives, seagrasses are mostly widespread in shallow reef flats and can also be observed in mangrove habitats. These are habitats of important fish species such as rabbit fishes, shrimps, sea cucumbers, sea urchins, seahorses, crabs, scallops, mussels and snails (Paz-Alberto and Sigua 2015).

The seagrass meadows around the Maldives are under threat. But the government now plans to place this valuable ecosystem under protection, as they are serving as nurseries for sea life, act as carbon sinks and protect the atolls from erosion. The Maldives welcomes tourists from around the world; many of them come here to enjoy its crystal-clear blue waters and tropical coral reefs along with seagrass meadows. Unfortunately, the meadows are not enjoying the same environmental protection as that of the better-known coral reefs. For years, tourist resorts and development projects have dredged and destroyed seagrass meadows across the country. It is thought that up to 30% of seagrass habitats have been lost over the last century.

Conservationists in the country are fighting back and have launched a campaign to help bring the spotlight to the rich biodiversity of these ecosystems and their importance for the future of the country. In 2019, Six Senses Laamu and Blue Marine Foundation (BLUE) launched the Protect Maldives Seagrass campaign which convinced more than 25% of the country's high-end resorts to protect the seagrass meadows; **37 resorts** joined the campaign and collectively pledged to protect more than **910,000m^2** of seagrass beds around the resort islands across the country. The Maldives' Ministry of Tourism also supported the campaign.

Nobi et al. (2012) recorded the seagrass cover using IRS P^ LISS IV satellite data and found 2590.2 ha of seagrass meadows in the Lakshadweep islands of which 1310.8 ha of dense seagrasses and 1279.4 ha of sparse seagrasses were mapped. In Lakshadweep, seven species of seagrasses that belong to five genera were recorded and the spatial cover of the seagrasses was healthy in all the islands. *Cymodocea serrulata* was observed as the dominant species in Lakshadweep islands. Coral reefs and seagrasses were found associated, and this coexistence showed the mutual relationship between these two adjacent ecosystems, where coral reefs protect seagrasses from waves and at the same time, seagrasses prevent erosion. Diversity of seagrasses was comparatively lesser in Lakshadweep than that of mainland of India. Although seagrasses of Lakshadweep islands are healthy, increase in sea surface water temperature and anthropogenic activities cause the decrease of seagrass beds in certain islands, which are to be addressed properly for the sound management of fragile seagrass beds in order to sustain their ecosystem services. Agathi and Kadamath islands have wide seagrass beds, which serve as a feeding habitat for a large number of green turtles. The study carried out by Nobi et al indicates that increase in surface water temperature and decrease in pH are the key threats to the seagrass beds in Lakshadweep.

Kaladharan (2013) reported that there is a steep decline of standing stock of seagrass vegetation and wet biomass in four atolls such as Agatti, Chetlet, Kavaratti and Kiltan and in 5 years, which was due to the settlement of fine silt and coral rubbles possibly due to periodical dredging activities. Recently, Kaladharan et al. (2020) reported that four atolls in Lakshadweep are highly populated, which leads to the disposal of untreated domestic wastes directly into the atolls which causes increased nutrients in the lagoons that adversely alter the quality of water and algal blooming that hinder the growth of seagrasses. In the Lakshadweep Islands, the Union Territory of Lakshadweep (UTL) Administration is playing, through the Department of Environment and Forestry and Department of Science and Technology, a key role in conserving the coastal and marine ecosystems of the islands and creating new Marine Protected Areas (MPAs). The Department of Science and Technology and Department of Biotechnology, Government of India have meanwhile supported work on genomics as well as the search for novel metabolites. A Lakshadweep Action Plan on Climate Change (LAPCC) has been formulated in accordance with the principles and guidelines of the Indian National Action Plan on Climate Change (NAPCC). The LAPCC included the environmental parameters in present and future development plans in UTL along with the NAPCC guidelines and principles. Moreover, National Centre for Sustainable Coastal Management (NCSCM) of the Ministry of Environment, Forest and Climate Change, Government of India has mentioned that the integrated Island Management Programme will be implemented to promote social and ecological sustainability of the Lakshadweep.

Thalassodendron ciliatum (Forsk.) den Hartog is more extensively distributed in the Chagos Archipelago than previously reported, and *Halophila decipiens* is reported from a single locality. Extensive meadows of *Thalassodendron* are confined to the submerged banks in the north of the Great Chagos Bank, extending to the lagoon reef-flat of the Diego Garcia atoll, to the south. Vast areas of apparently suitable substrates around the other atolls and the few islands on the Chagos Bank itself are totally uncolonized by seagrasses. High water temperatures caused by coincidence of extreme low water spring tides and intense midday insolation are suggested as the main reasons for the restricted distribution of *Thalassodendron* around the atolls and islands whilst extreme geographical isolation may explain the very restricted seagrass flora (Drew 1980).

Through satellite data, Esteban et al. (2018) tracked green turtles (*Chelonia mydas*) which are known to fed on seagrasses in the remote, pristine deep-water environment in the Great Chagos Bank (Indian Ocean) which lies in the heart of one of the world's largest Marine Protected Areas (MPAs). Subsequently the study used in situ SCUBA and baited video surveys to study the day-time sites occupied by turtles and discovered extensive monospecific seagrass meadows of *Thalassodendron ciliatum*. Higher fish abundance and large predatory sharks were recorded at all sites. Given that the Great Chagos Bank extends over approximately 12,500 km^2 and many other large deep submerged banks exist across the world's oceans, it can be understood that deep-water seagrasses may be far more abundant than previously thought. Due to the remote location and lesser anthropogenic activity in the Chagos bank possibly gives space for the survival of seagrasses in the region. However, more seagrass studies are needed to know the impacts of climate change on the ecosystem of Chagos bank.

7.5 Seagrasses of Western Indian Ocean Regions

Colonial trading led to the development of many east African coastal urban centres which have been expanding with economic growth (Georgulas 1964). Majority of the coastal cities in east African coast are located adjacent to sensitive coastal habitats, which are developing faster than the predicted rate, and this urban growth leads to increasing requirement for both renewable and non-renewable resources, with negative impacts on coastal biodiversity (Celliers and Ntombela 2016).

Western Indian Ocean region includes the countries such as South Africa, Tanzania, Kenya, Somalia, Mozambique, Comoros, Reunion, Seychelles, Madagascar and Mauritius. In the western Indian Ocean region, the coastal cities such as Durban (South Africa), Maputo (Mozambique), Dar es Salaam (Tanzania), Mombasa (Kenya), Mogadisu (Somalia), Port Louis (Mauritius), Saint Denis (Reunion) and Victoria (Seychells) are developing dramatically in the twenty-first century and all these cities are vulnerable to natural disasters and climate change (Celliers and Ntombela 2016).

There are 13 seagrass species reported from Western Indian Ocean region, covering 12,000 km coastline, which are found in intertidal regions up to 40 m depths that support a variety of fishes belonging to Terapontidae, Apogonidae, Lethrinidae, Labridae, Gerridae, Centriscidae, Blenniidae, Apogonidae, Lutjanidae, Scorpaenidae, Scaridae and Monacanthidae (Gullström et al. 2002). There are only a limited number of publications about the seagrass ecosystems in Western Indian Ocean region when compared to mangroves and coral reefs (Gullström et al. 2002). Destruction of forests in the inland areas, unlawful fishing methods, discharge of untreated wastes from urban areas, sedimentation, development of unplanned infrastructures, agricultural run-off and shipping activities are the major threats to the seagrass beds in the western Indian Ocean region (Bandeira 1995).

Seagrasses serve as a source of income for many African and island countries in the Western Indian Ocean region; however, there has been an increase of pressure on seagrass beds due to expansion of urban areas and surrounding population causes manmade disturbances to the seagrass beds (Gullström et al. 2002). Urban waste disposal is mostly untreated due to the non-availability of technologically sound waste treatment infrastructure facility. So, the poor water quality, sedimentation, and salinity directly affect the health of the seagrass ecosystems in the Western Indian Ocean region countries (Ingram and Dawson 2001).

The lower part of western Indian Ocean has also experienced the impacts of urbanization. In South Africa, Durban is one of the prominent coastal cities, where Adams (2016) has reported that *Zostera capensis* is the dominant seagrass species but a huge expanse of seagrass beds of *Z. capensis* (declared as vulnerable seagrass species in the IUCN Red list) has disappeared from Durban Bay due to harbour development during the mid-decades of the twentieth century and also recently (Short et al. 2011).

Seagrass beds in urban areas of other countries in Western Indian Ocean are also facing threats in the Maputo, capital of Mozambique, due to flooding, sedimentation and pollution; however, the seagrass distribution data is not available from other urban areas of Tanzania, Zanzibar and Madagascar (Bandeira et al. 2014). In the recent years, there has been a vigorous growth of urbanization in Arabian Gulf areas due to the establishment of new industries, land reclamation projects, construction of new residential and tourism infrastructures. But there is no published reports about the degradation of seagrass beds in Arabian Gulf (Erftemeijer and Shuail 2012).

Arabian Gulf is inhibited by a large population of Dugongs (*Dugong dugon*) or sea cows that are mainly grazing seagrasses (Sheppard et al. 2010). This can be taken as evidence showing the presence of vast seagrass beds in the Arabian Gulf that includes Bahrain, Saudi Arabia, Qatar, UAE and Abu Dhabi (Green and Short 2003; Erftemeijer and Shuail 2012). Changes in the nearshore waters due to urbanization were observed about 30 years ago in Bahrain, Arabian Gulf (Zainal et al. 1992), which is a part of the Western Indian Ocean region.

7.6 Threats to Seagrasses by the Urbanization

According to Weeks (2010), urbanization is defined as “a place-based characteristic that incorporates elements of population density, social and economic organization and the transformation of a natural environment into the built environment”. About 40% of the world’s population is living in coastal urban areas and so the changes caused by anthropogenic factors of urban settlements in the coastal areas are altering the sediments and coastal ecosystems (Mentaschi et al. 2018).

Human activities have caused huge loss of seagrass beds all over the world (Duarte et al. 2008). Two main coastal infrastructure development activities due to urbanization are dredging and land reclamation, and it is stated that they have severe impacts on coral reefs and seagrass beds (Erftemeijer and Robin Lewis 2006). High turbidity caused by dredging, proliferation of marine algae and eutrophication in the water column by untreated sewage disposal cause the loss of seagrasses (Duarte et al. 2008). Turbidity caused by dredging activities in ports is one of the key factors limiting the seagrass distribution in urban coastal areas and has a direct impact on urban seagrass beds (Sabol et al. 2005). Removal of seabed and deposition of landfills (Newell et al. 1998) are also directly affecting the natural ecosystem in coastal urban areas.

It is true that the global distribution and abundance of seagrasses have changed over evolutionary time in response to sea-level change, physical modification of coastlines and global climate changes. But, losses of seagrasses due to anthropogenic pressures are even much more than the past. Multiple stressors including sediment and nutrient run-off, physical disturbances, invasive species, diseases, commercial fishing practices, aquaculture, overgrazing, algal blooms and global warming cause the seagrass declines at scales of square meters to hundreds of square kilometres.

Urbanization affects the function and biodiversity of an ecosystem, as it will induce the split of natural habitats and degradation (Alberti and Marzluff 2004). One of the important impacts of urbanization is the construction of barriers, landing centres and harbours in the coastal and marine environments, and it is reported that such infrastructures in the marine environment alter the species composition by favouring the growth of non-native species (Airoldi et al. 2015). So, urbanization in coastal zones threatens the coastal landscapes and ecosystems (Pasquali and Marucci 2021) including mangroves (Stiepani et al. 2021), coral reefs Eliza and significantly affect the seagrass beds (Tu et al. 2021). It is also observed that the urbanization in the marine environment affects biodiversity and leads to the overlapping of species of artificial and natural habitats (Momota and Hosokawa 2021) including coral reefs and seagrass beds.

Dredging is the major cause for seagrass degradation worldwide, which can be controlled by strict laws, periodical monitoring, assessing the impacts and taking mitigation procedures (Erftemeijer and Robin Lewis 2006). Natural recovery of seagrass beds after the manmade activities and natural disasters will take few weeks up to 5 years, based on the environmental conditions (Erftemeijer and

Robin Lewis 2006). Anthropogenic pressures exerted on the seagrass beds (a by-product of urbanization development in coastal areas) have an adverse impact on the seagrasses around the world (Unsworth et al. 2019; Erftemeijer and Robin Lewis 2006; Newell et al. 1998; Sabol et al. 2005), including India (Thangaradjou et al. 2008), Sri Lanka (Ranahewa et al. 2018), Singapore (Stéphanie and Doorn 2007), Malaysia (Freeman et al. 2008), Indonesia (Karlina et al. 2018; Riani and Purbayanto 2011), Western Australia (Fraser et al. 2017) and other southeast Asian countries (Fortes et al. 2018).

Seagrass ecosystems are among the least considered coastal habitats which frequently face cumulative pressures from coastal development, nutrient run-off and climate change. It is a well-known fact that the seagrasses of the Indian Ocean region are facing severe threats due to anthropogenic and natural pressures; even then, seagrass restorations have been undertaken only on experimental basis. Loss of seagrass habitats and its impacts on the marine ecosystems can be slowed down or even reversed by planned and effective seagrass transplantations. Healthy seagrasses provide with prospects to alleviate climate change impacts, adapt to future changes and develop resilience and the source of multiple societal benefits. This is the apt time to protect seagrasses by prioritizing timely, ambitious and coordinated programmes, relating to restoration, conservation and sustainable management.

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