



Ramsar Information Sheet

Published on 3 August 2022

India

Gulf of Mannar Marine Biosphere Reserve



Designation date	8 April 2022
Site number	2472
Coordinates	09°06'57"N 78°47'12"E
Area	52 671,88 ha

Color codes

Fields back-shaded in light blue relate to data and information required only for RIS updates.

Note that some fields concerning aspects of Part 3, the Ecological Character Description of the RIS (tinted in purple), are not expected to be completed as part of a standard RIS, but are included for completeness so as to provide the requested consistency between the RIS and the format of a 'full' Ecological Character Description, as adopted in Resolution X.15 (2008). If a Contracting Party does have information available that is relevant to these fields (for example from a national format Ecological Character Description) it may, if it wishes to, include information in these additional fields.

1 - Summary

Summary

Gulf of Mannar Biosphere Reserve (GoMBR), extends between Toothukudi and Ramanathapuram districts. It is located in the southeastern coastline of India, and is a unique marine environment rich in biodiversity. This is the first Marine Biosphere Reserve in South & South-East Asia. GoMBR is situated between Longitudes 78°08'E to 79°30'E and along Latitudes from 8°35'N to 9°25'N, with a total area of 52671.876 hectares, running along the mainland coast for about 170 nautical miles encompassing a chain of 21 islands adjoining coral reefs off the coasts forming the core zone, i.e., the Marine National Park (MNP). The surrounding seascape of the National Park and a 10 km strip of the coastal landscape together make up the total area. GoMBR is influenced by both SW and NE monsoons and hence, physical, chemical, and biological characteristics are unique. The GoMBR is part of the southward extension of the Bay of Bengal, meeting the Indian Ocean, and straddling India and Sri Lanka.

The GoMBR came into existence on 18th February 1989, by a joint declaration of the Government of India and the Government of Tamil Nadu. The same has been recognized by the Man and Biosphere (MAB) Programme of UNESCO. Nestled within the GoMBR, is the Gulf of Mannar Marine National Park that surrounds 21 islands and was set up by Forest & Fisheries departments, on 10th September 1986. Fishing is the predominant livelihood here. GoMBR is one of the most biologically diverse regions in India, comprising 117 species of corals, >450 species of fishes, 4 species of sea turtles, 38 species of crabs, 2 species of lobsters, 12 species of sea grasses, 147 species of marine algae, 160 species of birds, 641 species of crustaceans, 108 species of sponges, 731 species of molluscs, 99 species of echinoderms, 4 species of sea horses, 12 species of sea snakes, besides 11 species of mangroves. The Reserve is also home to several globally important and highly threatened species like the Dugong, whale shark, sea horses, Balanoglossus, green sea turtle, Hawksbill turtle, dolphins, sacred chanks etc. The influence of oceanic water mass appears to be conspicuous in the Gulf. The strong currents from the north from November to March flow southward; the direction of the current reverses between April to October flowing from the South towards the North bringing the Indian Ocean waters into the Gulf.

2 - Data & location

2.1 - Formal data

2.1.1 - Name and address of the compiler of this RIS

Responsible compiler

Institution/agency	Tamil Nadu State Wetland Authority
Postal address	O/o Additional Principal Chief Conservator of Forests & Member Secretary Tamil Nadu State Wetland Authority No.1, Jeeenis Road, Panagal Building, VIII Floor, Saidapet, Chennai 600 015 Tamil Nadu, INDIA

National Ramsar Administrative Authority

Institution/agency	Ministry of Environment, Forest & Climate Change
Postal address	Office of the Secretary Ministry of Environment, Forest & Climate Change Indira Paryavaran Bhavan, Jorbagh Road New Delhi - 110 003 INDIA

2.1.2 - Period of collection of data and information used to compile the RIS

From year	<input type="text" value="2012"/>
To year	<input type="text" value="2020"/>

2.1.3 - Name of the Ramsar Site

Official name (in English, French or Spanish)	<input type="text" value="Gulf of Mannar Marine Biosphere Reserve"/>
Unofficial name (optional)	<input type="text" value="Mannar Valaiguda (in Tamil)"/>

2.2 - Site location

2.2.1 - Defining the Site boundaries

b) Digital map/image

<1 file(s) uploaded>

Former maps	<input type="text" value="0"/>
-------------	--------------------------------

Boundaries description

Palk strait is the northern boundary of GoM & Indian Ocean at Kanyakumari is the southern boundary. The reserve is made up of a chain of 21 islands adjoining coral reefs, off the coasts of Ramanathapuram and Tuticorin districts, extending from Rameshwaram Island. The total area is covered with the surrounding seascape along with the 10 km strip of the coastal landscape.

GoMBR is basically an inlet of the Indian Ocean, between S.E.India & W.Sri Lanka, bounded by Rameswaram island in the NE, and a chain of shoals and Mannar Island. The 20 m deep SE boundary of the Reserve may change due to the dynamic nature of the bathymetry of the region. All 19 islands, 2 submerged islands, and the seascape surrounding the islands up to 6.4 m (3.5 fathoms) on the bayside and 9.5 m (5 fathoms) deep, toward the seaward side, constituting the National Park area, are assigned as the Core Zone. The rest of the seascape; i.e., up to 20 m depth and coastal terrestrial areas (10 km from the high tide mark to the landward side) forms the Buffer Zone. Karaichalli is an island recently included.

MNP has been partitioned into five clusters of Core Zones, providing options for planning navigation routes, better policing, protection, opportunities for sustainable migration, and harvest of resources from the core to the buffer. The total area of the MNP constitutes 10% of the northern half of the Biosphere Reserve and only 4% of the total GoMBR is undisturbed and closed to anthropogenic activities. The demarcation of the GoMBR, especially the seascape side needs to be reviewed every five years as bathymetry of the sea is highly dynamic. The different zones are: (1) Eco-developmental zone (terrestrial) is a 10 km stretch of coastal land starting from the shoreline, all along the Reserve; also called as Utilization zone. (2) Restoration zone enables damaged areas to be set aside for recovery. Both core and buffer zones can be used for restoration of habitat / species. Northern chain of islands such as Mandapam and Keezhakarai groups are used for restoration of mangrove habitat. (3) Tourism zone is for recreational activities. 50 km land stretches around the Biosphere Reserve have been identified and proposed as 'Tourism Zone for Value Addition' with community participation. All the tourist centers in this zone have been assessed and included as potential tourism resources in the Eco-tourism sub-plan. Kurusadai Island has been identified for tourism within MNP.

2.2.2 - General location

a) In which large administrative region does the site lie?	<input type="text" value="Gulf of Mannar Biosphere Reserve (GoMBR), extends between Toothukudi & Ramanathapuram districts; joint declaration of Government of India & Government of Tamil Nadu."/>
--	--

b) What is the nearest town or population centre?

2.2.3 - For wetlands on national boundaries only

a) Does the wetland extend onto the territory of one or more other countries? Yes No

b) Is the site adjacent to another designated Ramsar Site on the territory of another Contracting Party? Yes No

2.2.4 - Area of the Site

Official area, in hectares (ha):

Area, in hectares (ha) as calculated from GIS boundaries

2.2.5 - Biogeography

Biogeographic regions

Regionalisation scheme(s)	Biogeographic region
Marine Ecoregions of the World (MEOW)	Western Indo-Pacific Realm; the specific ecoregion no.104, being South India and Sri Lanka

Other biogeographic regionalisation scheme

Gulf of Mannar Biosphere Reserve comes in the "Semi-Arid" under the classification of the bioclimatic zones of India. It comes under the 'East-Coasts (8B)' zone in the bifurcation of the different biogeographic zones of India, the classification by Rodgers et. al., (2002) and biogeographic province of Deccan Peninsula-Deccan South (6E). Therefore, major vegetation types in this region are scrub jungle and mangroves.

3 - Why is the Site important?

3.1 - Ramsar Criteria and their justification

- Criterion 1: Representative, rare or unique natural or near-natural wetland types

Ramanathapuram, one of the districts in southern Tamil Nadu is well known for having maximum wetlands and hence people significantly depend upon wetland-based irrigation system for agriculture (sustenance and livelihood). The region has a recorded history of over 2000 years of settled agriculture, well established human-made tanks and supportive water bodies.

One of the main hydrological services is surface runoff; the surface water flowing out of the three districts are drained into GoMBR, thereby acting as a catchment area. The eastern coastline of India, known as the Coromandel coast is a known zone for severe cyclonic storms. Each year, the Northeast monsoon causes havoc along the east coast, flooding many low-lying areas and damaging cultivated crops and yield, which in turn affects livelihood of farmers and total crop production. The broad coastal plain runs along the eastern part of Tamil Nadu, covers an extensive area of 22,800 km², bound by Bay of Bengal to the east, Kaveri delta to the south and Eastern Ghats to the west. Extensive diversity of corals in the region actually helps in cyclone mitigation. Major reef areas are shallow, occurring at depths between 0.5–6 m deep.

Hydrological services provided

The influence of oceanic water mass appears to be conspicuous in the Gulf. The strong currents from the north during November to March flows southward; direction of the current reverses between April to October flowing from the south towards north bringing in the Indian Ocean waters into the Gulf. The Gulf is also influenced by a trough of west wind drift through the Agulhas and Mozambique currents and drift; a tributary of Australian current that is influenced by a trough of west Australian cold current joins Agulhas.

Promote Accretion: Sea grasses, corals and mangroves' function much like a living groove to build up sediment, stabilize the ground and fix mud banks, thereby preventing erosion. Sea grasses help trap sediments, and function as filters to sift out pollutants reaching the sea from inland waters.

Supporting rich faunal diversity: The region is known for rich diversity, due to availability of diverse habitats like corals, sea meadows, mangroves etc. Mangroves soils are soft, mix of sand and mud sustaining fauna that are not found along rocky shores – from birds, fishes, invertebrates, microbes etc. The canopy is ideal for heronries.

Primary production: Seagrasses are one of the most productive ecosystems in the World being one of the crucial primary producers, they are aptly referred as the 'Prairies of the Ocean'. Seagrasses provide immense indirect ecosystem services to commercially important fishes and macroinvertebrates by acting as nesting and nursery grounds. Global mangrove primary production is estimated at about 218 ± 72 Tg C, whereas annual net primary production of mangroves in India is estimated at 6.05604 Tg C. Both the habitats are important primary producers of the region, apart from seaweeds and phytoplankton. This high primary production supports several hundred species important for sustaining livelihood of more than half a million people.

Provisioning services- (1) Food: Diverse ecosystems permanent and temporary habitats for many aquatic organisms like fish, crabs, catfish, prawns, etc. They also act as hatching and nursery grounds for many marine fishes. It is estimated that most of the local fish catch are directly dependent on this region. The Biosphere Reserve supports minimum 1,10,000 families from 268 fishing villages. (2) Enrichment of Coastal Habitats: Coastal vegetation like Algae, seagrasses, sea weeds, corals & mangroves play a significant role in enriching the region with respect to biodiversity. They transport the dissolved organic matter, nutrients etc., besides serving as a nursery area for marine organism and residential and migratory birds, mammals and fishes. (3) Spawning Ground: GoMBR & MNP are home to a variety of commercially important fishes, crabs, prawn, etc., thereby providing economically important resources to the local fishermen communities and to the State. There are more than 50 fishing villages along the coasts, near the MNP and more than 90% of the villages are dependent on the BR for their livelihood. Abundance of fish larvae in the seagrass bed, reported at 198 individuals/100 m², was higher than the open sandy areas, with 112 individuals/100m² in GoMNP in 2008. This revealed the importance of the seagrass habitat in fisheries. Further, a study by ZSI (Zoological Survey of India) showed that abundance of sea cucumbers was higher in seagrass beds than other habitats in Andamans. Economically important fish larvae inhabiting this area belong to families like Carangidae, Nemipteridae, Engraulidae and Mullidae.

Regulatory Services: (1) Protection of Shorelines: Corals and sea grasses act as physical buffer, between the elements and shore, absorb 70-90% of tidal and wave energy, depending on their ecological condition. Carbon Sequestration: Sea grasses, seaweeds, mangroves etc., are important carbon sinks. In GoM, National Centre for Sustainable Coastal Management (NCSCM) estimated that an acre of sea grass habitat sequesters 3,350 kg of Carbon/year (Rs.1,100,000/acre/year). A 20-year-old mangrove plant has a carbon burial rate of 580 grams/m²/year. It inhibits more greenhouse gases accumulating in the atmosphere.

Other ecosystem services provided

Religious Values: Importance of the Gulf of Mannar region dates back to 2nd century AD with its highly productive pearl banks and other religious significance. Gulf of Mannar means the Gulf of Lord Krishna, a place of mythical importance, having religious significance owing to the belief that Lord Rama is said to have constructed a bridge from here over the sea waters to reach Sri Lanka. It is a holy place place for Hindus as they perform their religious rites in this place. Rameswaram, Thiruchendur and Kanyakumari are important pilgrimage centers for Hindu religion. Similarly, there are several Churches and Mosques located along the coast of GoMBR. Panimaya Matha Church, Dhanuskodi Heritage church, Uvari Church, Mosques at Keezhakarai, Ervadi and Thondi are important pilgrimage centers. The swamp near the Kodandaraman temple of Rameswaram provides shelter to thousands of Flamingos during the months of December to March, along with other species of waders and wetland birds.

Eco-tourism: The region has a high potential for eco-tourism, as the MNP is situated between Rameswaram and Tuticorin, with rich coral reefs and seagrass. It also acts as an educational site, where researchers, bird watchers have studied the area for years.

Other reasons

Traditional fishing: Apart from mechanized fishery, which is the major economic activity of coastal communities, traditional fisheries are also being sustained here, because of sea grasses and coral reefs. Fishing is chief livelihood for more than a hundred thousand families, which depend on coastal and marine resources. There are 47 fishing villages along GoMBR coast, of which 38 are in Ramanathapuram and 9 in Tuticorin district. There are about 50,000 fisher-folks living in these villages, of which >12,000 are active fishermen. Fisher-women are engaged in allied activities such as marketing dry fish and net mending. This site is an important breeding area for many migratory birds from Europe and Australia during winter (Nov-Mar/Apr) every year, which is nestled within the BR but on the leeward side. Grey pelican & Painted Stork are among the important visitors. A small village in the far south, Koonthankulam in Nanguneri Taluk (Tirunelveli District) is emerging as a new destination for migratory birds. It may soon be catapulted into the list of popular bird sanctuaries in India. Similarly, Flamingoes also fly-in mainly from Rann of Kutch to lay, hatch and rear the fledglings in the village. The swamp near Kodandaraman Temple near Rameswaram, shelter thousands of Flamingos each year, between Dec to Mar, along with other waders and wetland birds. A large depression in the southern side of Upputhanni island formed by coral mining couple of decades ago collects and stagnates rain and sea water, serving as natural heronries for sea birds.

Criterion 2 : Rare species and threatened ecological communities

Criterion 3 : Biological diversity

Justification

There are 117 coral species identified in GoMBR, belonging to 40 genera & 14 families; all protected under Schedule-I of the Indian Wildlife Protection Act (1972). GoMBR has 181 species of seaweeds-comprising green, brown, red & blue-green algae out of 1158 species found in the country. 17 economically important species from agarophytes, carrageonophytes, alginophytes and edible seaweeds are recorded here. Seagrasses are marine angiosperms. *Halodule uninervis* is the dominant primary species in the intertidal zone occurring on sandy and muddy substratum. *H.uninervis* act as stabilizer and sediment accumulator; occur as a bed of monospecific community or mixed with *Cymodocea rotundata*, *C.serrulata*, *Halophila ovalis* & *Enhalus acoroides*. *C.serrulata* occurs extensively in most islands forming significant browsing ground for endangered Dugongs. *Thalassia hemprichii* and *H.uninervis* beds are important habitats for Holothurids. A total of 11 mangrove species, 17 mangrove associates & 201 flowering plants are identified; *Avicennia marina*, *Bruguiera cylindrica*, *B.gymnorhiza*, *Cerriops tagal*, *Excoecaria agallocha*, *Lumnitzera racemosa*, *Pemphis acidula*, *Rhizophora apiculata* & *R.mucronata* – belonging to 5 families predominating Rhizophoraceae. GoMBR is the only region in India reported to have all 5 sea turtle species. 4 of the 7 sea turtle species found worldwide are reported here-Olive Ridley (*Lepidochelys olivacea*), Green Turtle (*Chelonia mydas*), Hawksbill Turtle (*Eretmochelys imbricata*) & Leatherback Turtle (*Dermochelys coriacea*). All 4 species are protected under Schedule-I of the Indian Wildlife Protection Act (1972), and also listed in Appendix-I of Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES). Dugong distribution is discontinuous & patchy in the tropical Indo-Pacific region. In India, dugongs are presently recorded in Gulfs of Mannar & Kutch and Andaman & Nicobar Islands. They are protected under Schedule-I of the Indian Wildlife Protection Act (1972), usually found in calm, sheltered, nutrient-rich water, <5 m deep, usually in bays, shallow island & reef areas with extensive seagrass beds. However, they are sighted near reefs up to 80 km offshore at 37 m depth. It is considered to be rare over most of its range (Bertram& Bertram, 1968). Fishermen along coastal Tamil Nadu are familiar with Whale Shark (*Rhincodon typus*), locally known as 'Panai meen'. As per Bird Life International, 187 species of aquatic (shore & pelagic) and terrestrial birds are identified from GoMBR. Red Knot is a regular winter visitor in small numbers; Crab Plovers, Bar-tailed Godwit occur in Manali and Muyal islands; Greater flamingos frequent GoMBR, making it the 3rd largest IBA & an important wintering ground along E. coastline. Rare waders include Broad-billed Sandpiper, Eastern Knot, Dunlin, Long-toed Stint and Red-necked Phalarope. The region lies within the passage of many migrants-Black tailed Godwit & Broad-billed Sandpiper.

Criterion 4 : Support during critical life cycle stage or in adverse conditions

Optional text box to provide further information

The wetland's proximity to Sri Lanka makes it an important flyway site for migratory birds. More than 35 species are supported by this wetland during one or the other critical stage in the life cycle including loggerhead sea turtle, common green sea turtle, leatherback turtle, olive ridely turtle, Bengal monitor lizard, banded eagle ray, atlantic thresher, african mottled eel, bumphead parrotfish, bengal whipray, dwarf whipray, blackspot shark, australian blacktip shark, hardnose shark, black finned shark, black-tip shark, balfour's shark, acropora butterfly, banded dogfish, catshark, butterfly ray, Coach whipray, great seahorse, common seahorse, hedgehog seahorse, flat-faced seahorse, small spot numbfish, cownose ray, australian sharpnose shark, dog shark, african ray, pale-edged stingray, barred mackerel, common hammerhead shark, black-blotched stingray, black-bellied tern, spoon-billed sandpiper.

Criterion 5 : >20,000 waterbirds

Overall waterbird numbers

Start year

Source of data:

Criterion 6 : >1% waterbird population

Optional text box to provide further information

Waterbirds observed to have more than 1% population are listed in Table-3.3

Criterion 7 : Significant and representative fish

Justification

The Gulf of Mannar Marine Biosphere Reserve is known for its pearl oyster fisheries and chank fisheries since 1900s. The coral islands form a network of habitats for different kind of fishes, both resident and migratory. Due to peculiarities of the ecosystem and protective nature of habitats, several species of fishes undertake breeding migration to Gulf of Mannar area. Different species include pelagic, benthic, benthopelagic, deep sea, estuarine, brackish water, migratory and cave dwelling forms. Sharks-are mainly represented by Carcharhinidae, Echinorhinidae, Hemiscyllidae, Alopiidae, Sphyrnidae and Squalidae. Sudarsan et al. (1988) identified potential rich grounds for pelagic sharks off GoM. Non-conventional deep-sea shark species are also reported from Tuticorin region of GoM by the deep-sea trawlers (Devadoss, 1996). Nair & Mohan (1973) reported deep sea sharks-Halaelurus hispidus, Eridacnis radcliffei and Eugaleus omanensis at depths of 200 fathoms. Landings of whale shark (Rhincodon typus) Vernacular (Local Name): Panai Meen (or) Ammani Uluvai (Kasinathan et al. 2006; Ranjith et al. 2014) and thresher sharks (Ranjith et al., 2014; Gowthaman et al., 2013) are also reported from Tuticorin waters of GoM. Others are-pointed saw fish (Anoxypristis cuspidata); Vernacular (Local Name): Vezha, Velameen; spinner shark / Pondicherry shark (Carcharhinus hemiodon) Vernacular (local Name): Pal Sura. This species is critically endangered; does not pose threat to humans. Demersal Fishes-The Island system and coral reefs spread over this region offer shelter for diverse marine fauna and flora. The major teleost demersal fishes caught between Mandapam region of Palk Bay (PB) and GoMBR; include silver bellies, croakers, goatfish, emperors, snappers, groupers, threadfin breams, flatfishes rabbit fish, pomfrets, whitefish, terapons, and catfish, landing either throughout the year or seasonally. Ornamental fishes-128 species are recorded, of which 91 species occur around Mandapam Island group. Dominant species belong to families Chaetodontidae, Pomacentridae, Balistidae and Apogonidae. 100 Species are recorded around Keezhakarai group, belong to families Pomacentridae, Chaetodontidae, Lutjanidae and Holocentridae. Many highly priced Ornamental reef fishes inhabit GoMBR. Among 113 marine ornamental finfish species recorded, parrotfishes of family Scaridae, show high species richness. Studies on biodiversity of parrotfishes of GoM, revealed presence of 9 species, of which Scarus gibbus formed a year round fishery in GoM (9.4 tonnes).

Criterion 8 : Fish spawning grounds, etc.

Justification

Milk fish (*Chanos chanos*) spawn here in favorable season and the larvae are seen in millions, in the months of March, April and May. The peak spawning period for the Becheder-mer falls between July to October. Many of the reef fishes in Gulf of Mannar are known to spawn in the reef. Eg - *Scarus gibbus*. The occurrence and diversity are high in Gulfs of Kutch & Mannar, Palk Bay, Andaman & Nicobar Islands and Lakshadweep islands. It was observed that *Scarus gibbus* has an extended breeding season, peaking in Mar-Apr and another phase in Dec. Life span is 7 years, attaining maturity at two years of age. Mature males and females were collected in large numbers in the Kuswari, Vilangu Shuli, Nallathanni and Krusadai islands at a depth of 15 to 20 m. Mature males and females were in initial phase of bright red/green coloration. The number of mature ova ranged from 58,200 to 1,15,000, in specimens measuring from 35 to 38 cm. The recruitment was also observed round the year. Green hump head Parrotfish, which is a new record to Indian coast, was collected for the first time, in GoM. This species was collected at Villangu Shuli island, at a depth of 20 m. The specimen was a juvenile measuring 32 cm. Lifespan is 35 years and attains maturity; however, this was identified to be around 10 years. Rusty Parrotfish occur at depths between 2 to 20 m, recorded in Musal, Nallathanni and Krusadai islands; attains maturity at 2 years. Specimens with mature testis and ovary were also collected and measured 24 – 26 cm. Fecundity and the number of mature ova ranged from 61,280 to 1,14,250 at a length range of 23 – 27 cm. Other parrot fishes include Yellow scale parrotfish, Heavy beak parrotfish, Globe head parrotfish, Dusky parrotfish, Ember parrotfish and Eclipse parrotfish. *Scarus gibbus* and *Scarus russelii* are observed to produce mucous cocoon around themselves at night in Krusadai island.

Criterion 9 : >1% non-avian animal population

3.2 - Plant species whose presence relates to the international importance of the site

Mangroves in Manoli are healthy and more diverse. GoM mangroves are short, owing to strong winds during monsoon/cyclones; nutrient poor sandy soil, nil freshwater & sediment supply. Mangroves of Mandapam & Keezhakarai islands are diverse and healthier than Vembar Tuticorin islands. Punnakayal Island is occupied by *Avicennia marina*, *Suaeda* sp., *Arthrocnemum glaucum* & *Salicornia brachiata* and *Pemphis acidula*. In Krusadai Island Iyengar (1927) recorded *Avicennia officinalis*, *Excoecaria agallocha*, *Bruguiera cylindrica*, *Ceriops tagal*, *Lumnitzera racemosa*, *Suaeda maritima*, *S. monoica* & *Sesuvium portulacastrum*. Krishnamurthy et al. (1987) recorded 9 species of mangroves & 7 associate species; Perichiappan et al. (1995) reported 13 mangrove & associate species. Mandapam group of islands recorded maximum no. of species (Daniel, 1998). Dominant genera include *Avicennia*, *Rhizophora*, *Lumnitzera*, *Ceriops* and *Pemphis*. Krusadai and Pullivasal have mangrove diversity of 11, followed by Manoli (10), Poomarichan & Muyal islands (9), Manoliputti (8) & Shingle (7). *P. acidula* & *A. marina* were recorded in 13 islands; *Sesuvium* in 15 islands. Krusadai, Poomarichan, Pullivasal, Manoli & Manoliputti Islands have *Aegiceras corniculatum*, *A. marina*, *Bruguiera cylindrica*, *Ceriops tagal*, *L. racemosa*, *Rhizophora apiculata* & *R. mucronata*; Muyal & Shingle Islands, have *A. marina*, *L. racemosa* & *E. agallocha*; Keezhakarai, Talaiari & Valai Islands have *A. marina* & *P. acidula*; Tuticorin group of Islands is poor in mangrove diversity. Upputhanni island has only *A. marina*. Kasuwari Island has a small patch of *A. marina* & *P. acidula*. Mangrove associates - *Aeluropus lagopoides*, *A. glaucum*, *Atriplex repens*, *Clerodendrum inerme*, *Fimbristylis ferruginea*, *F. polytrichoides*, *Halosarcia indica*, *Ipomoea violacea*, *Pandanus fascicularis*, *S. brachiata*, *Salvadora persica*, *S. portulacastrum*, *Sporobolus tremulus*, *S. maritima*, *S. monoica*, *S. nudiflora* are present in the GoM; *Thespesia populnea* is a common tree.

Seagrass meadows: occur within BR, identified as an IMMA (International Marine Mammal Area), as they support unique and globally NT marine mammal - "Dugong", where small populations are found to thrive; also supports healthy Shark population; important in sustaining seagrass & coral reefs

Seaweeds: encompass macroscopic, multicellular Benthic marine algae; 147 species are recorded, estimated to occur in an area of 171.25 sq.km. Luxuriant seaweed growth between Mandapam & Keezhakarai, while comparatively lesser in the S. side of the reserve (between Tuticorin & Kanyakumari). Seaweeds namely *Sargassum*, *Turbinaria*, *Gelidiella acerosa* & *Gracilaria* are collected for making agar, cellulose and algin.

Coral Reefs: play an important role in biochemical processes; forms important food resources for fauna and humans; act as barriers against coastal wave action preventing erosion, protects mangroves & seagrass beds; are important breeding/spawning/nesting & feeding grounds for many commercially important fishes and other marine organisms

3.3 - Animal species whose presence relates to the international importance of the site

Phylum	Scientific name	Species qualifies under criterion				Species contributes under criterion				Pop. Size	Period of pop. Est.	% occurrence 1)	IUCN Red List	CITES Appendix I	CMS Appendix I	Other Status	Justification
		2	4	6	9	3	5	7	8								
Others																	
CHORDATA / REPTILIA	<i>Caretta caretta</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	2021	1	VU	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Vulnerable and representative of the biodiversity of the region.
CHORDATA / REPTILIA	<i>Chelonia mydas</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	100	2004	2	EN	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Endangered and representative of the biodiversity of the region.
CHORDATA / REPTILIA	<i>Dermochelys coriacea</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	50	2013	1	VU	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Vulnerable and representative of the biodiversity of the region.
CHORDATA / MAMMALIA	<i>Dugong dugon</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	150	2013	1.5	VU	<input checked="" type="checkbox"/>	<input type="checkbox"/>		Vulnerable and representative of the biodiversity of the region.
CHORDATA / REPTILIA	<i>Eretmochelys imbricata</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	250	2008	5	CR	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Warrants protection/ conservation
CHORDATA / REPTILIA	<i>Lepidochelys olivacea</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2500	2008	5	VU	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Warrants protection/ conservation
CHORDATA / MAMMALIA	<i>Sousa chinensis</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	260	2017	2	VU	<input checked="" type="checkbox"/>	<input type="checkbox"/>		Vulnerable; needs protection
Fish, Mollusc and Crustacea																	
CHORDATA / ELASMOBRANCHII	<i>Aetobatus narinari</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	2021	2	EN	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.

Phylum	Scientific name	Species qualifies under criterion				Species contributes under criterion				Pop. Size	Period of pop. Est.	% occurrence 1)	IUCN Red List	CITES Appendix I	CMS Appendix I	Other Status	Justification
		2	4	6	9	3	5	7	8								
CHORDATA / ELASMOBRANCHII	<i>Aetomylaeus maculatus</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2000	2020	4	EN	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Aetomylaeus nichofii</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	200	2016	1	VU	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Alopias vulpinus</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4000	2018	8	VU	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Anoxypristis cuspidata</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	750	2013	5	EN	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Listed in Appendix II of CITES	Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ACTINOPTERYGII	<i>Bolbometopon muricatum</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	14000	2012	7	VU	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Brevitrygon imbricata</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2000	2021	10	VU	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Carcharhinus dussumieri</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5	2019	1	EN	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Carcharhinus falciformis</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	50	2017	1	VU	<input type="checkbox"/>	<input type="checkbox"/>	Listed in Appendix II of CMS and CITES	Warrants protection/ conservation
CHORDATA / ELASMOBRANCHII	<i>Carcharhinus hemiodon</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	2021	2	CR	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Carcharhinus limbatus</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	20000	2021	10	VU	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Carcharhinus melanopterus</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3500	2020	7	VU	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Chaenogaleus macrostoma</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3000	2021	6	VU	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Chiloscyllium griseum</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	50	2020	1	VU	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Chiloscyllium indicum</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5000	2020	10	VU	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Echinorhinus brucus</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	450	2020	3	EN	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.

Phylum	Scientific name	Species qualifies under criterion				Species contributes under criterion				Pop. Size	Period of pop. Est.	% occurrence 1)	IUCN Red List	CITES Appendix I	CMS Appendix I	Other Status	Justification
		2	4	6	9	3	5	7	8								
CHORDATA / ELASMOBRANCHII	<i>Eusphyra blochii</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	300	2016	2	EN	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Glaucostegus granulatus</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	150	2019	30	CR	<input type="checkbox"/>	<input type="checkbox"/>	Listed in Appendix II of CITES	Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Gymnura poecilura</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	400	2021	8	VU	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Himantura uarnak</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1000	2021	2	EN	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Himantura undulata</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1000	2019	2	EN	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ACTINOPTERYGII	<i>Hippocampus kelloggi</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	80000	2017	40	VU	<input type="checkbox"/>	<input type="checkbox"/>	Listed in Appendix II of CITES	Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ACTINOPTERYGII	<i>Hippocampus kuda</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4000	2014	2	VU	<input type="checkbox"/>	<input type="checkbox"/>	Listed in Appendix II of CITES	Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ACTINOPTERYGII	<i>Hippocampus spinosissimus</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	20000	2017	10	VU	<input type="checkbox"/>	<input type="checkbox"/>	Listed in Appendix II of CITES	Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ACTINOPTERYGII	<i>Hippocampus trimaculatus</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	40000	2015	20	VU	<input type="checkbox"/>	<input type="checkbox"/>	Listed in Appendix II of CITES	Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Isurus oxyrinchus</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	150	2019	1	EN	<input type="checkbox"/>	<input type="checkbox"/>	Listed only in Appendix II of CMS and CITES	Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Maculabatis gerrardi</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2000	2020	4	EN	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Mobula mobular</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	127	2020	1	EN	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Listed in Appendix II of CITES	Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Narcine prodorsalis</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2500	2020	1	EN	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Narcine timplei</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2000	2020	10	VU	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.

Phylum	Scientific name	Species qualifies under criterion				Species contributes under criterion				Pop. Size	Period of pop. Est.	% occurrence 1)	IUCN Red List	CITES Appendix I	CMS Appendix I	Other Status	Justification
		2	4	6	9	3	5	7	8								
CHORDATA / ELASMOBRANCHII	<i>Pateobatis bleekeri</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1500	2020	3	EN	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Pristis pristis</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	50	2013	10	CR	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Pristis zijsron</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	30	2013	6	CR	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Listed in Appendix II of CITES	Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Rhina ancylostoma</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	300	2019	6	CR	<input type="checkbox"/>	<input type="checkbox"/>	Listed in Appendix II of CITES	Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Rhincodon typus</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	70	2016	1	EN	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Recently added in Appendix I of CMS. Exist already in Appendix II and is also an Appendix II species of CITES	Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Rhinoptera javanica</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	600	2021	3	EN	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Rhizoprionodon acutus</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5000	2020	10	VU	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Rhynchobatus djiddensis</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10	2019	2	CR	<input type="checkbox"/>	<input type="checkbox"/>	Listed in Appendix II of CITES	Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Sphyrna zygaena</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	150	2019	3	VU	<input type="checkbox"/>	<input type="checkbox"/>	Listed in Appendix II of CMS and CITES	Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Stegostoma fasciatum</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	150	2019	1	EN	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Taeniurops meyeri</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1000	2015	1	VU	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Telatrygon zugei</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	80000	2020	40	VU	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
CHORDATA / ELASMOBRANCHII	<i>Urogymnus asperrimus</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1000	2016	5	VU	<input type="checkbox"/>	<input type="checkbox"/>		Endangered. Vulnerable. Representative of the biodiversity of the region. The wetland supports a significant population of this species which uses it as a spawning ground.
Birds																	
CHORDATA / AVES	<i>Aquila nipalensis</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	50	2020	10	EN	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Listed under Appendix II of CITES	Supported at a critical stage in the life cycle by the wetland. More than 1% of the population of this species is supported by the wetland, this species is representative of the biodiversity of the region. Endangered species.

Phylum	Scientific name	Species qualifies under criterion				Species contributes under criterion				Pop. Size	Period of pop. Est.	% occurrence 1)	IUCN Red List	CITES Appendix I	CMS Appendix I	Other Status	Justification
		2	4	6	9	3	5	7	8								
CHORDATA/AVES	<i>Calidris pygmaea</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4	2018	1	CR	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Supported at a critical stage in the life cycle by the wetland. More than 1% of the population of this species is supported by the wetland, this species is representative of the biodiversity of the region.
CHORDATA/AVES	<i>Calidris tenuirostris</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4560	2019	12	EN	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Supported at a critical stage in the life cycle by the wetland. More than 1% of the population of this species is supported by the wetland, this species is representative of the biodiversity of the region.
CHORDATA/AVES	<i>Neophron percnopterus</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2	2019	1	EN	<input type="checkbox"/>	<input checked="" type="checkbox"/>		Supported at a critical stage in the life cycle by the wetland. More than 1% of the population of this species is supported by the wetland, this species is representative of the biodiversity of the region.
CHORDATA/AVES	<i>Phoenicopterus roseus</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	27500	2019	5	LC	<input type="checkbox"/>	<input type="checkbox"/>	Appendix II of CMS and CITES	Supported at a critical stage in the life cycle by the wetland. More than 1% of the population of this species is supported by the wetland, this species is representative of the biodiversity of the region.
CHORDATA/AVES	<i>Sterna acuticauda</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2550	2017	15	EN	<input type="checkbox"/>	<input type="checkbox"/>		Supported at a critical stage in the life cycle by the wetland. More than 1% of the population of this species is supported by the wetland, this species is representative of the biodiversity of the region.

1) Percentage of the total biogeographic population at the site

3.4 - Ecological communities whose presence relates to the international importance of the site

Name of ecological community	Community qualifies under Criterion 2?	Description	Justification
Coral reef Community	<input checked="" type="checkbox"/>	94 species of Corals belonging to 37 genera are found in Gulf of Mannar. The most commonly occurring genera of corals are Acropora, Montipora, Porites, Astreopora and Pocillopora sp.	Sea grasses & mangroves-dependent on hydrodynamic barriers of coral reefs; dissipate wave energy; vital part of ocean ecosystems; feeding/ breeding grounds to nearly 1/4 of all marine life; used in siddha medicine for cough/nervous disorder/T.B
Mangrove Community	<input checked="" type="checkbox"/>	The dominant genera include Avicennia, Rhizophora, Bruguiera, Lumnitzera, Ceriops and Pemphis.	Are highly productive, ecologically sensitive; flow of dissolved nutrients enhance seagrass primary productivity. Mangroves & seagrass enhance coral reef secondary productivity by feeding grounds; efficient sediment binders; has medicinal properties
Sea grass Meadows	<input checked="" type="checkbox"/>	Of the 52 species of sea grasses worldwide, 12 species are recorded here. Dominant genera include cymodocea – Thalassia hemprichii, Halodule, Enhalus and Syringodium isoetifolium and Cymodocea serrulata	Sea grass beds-highly productive; act as breeding/nursery grounds for VU sea cow (Dugong dugon); roots bind the sediments, prevent erosion; they trap, stabilize sediments & protect the reefs from abrasion.
Seaweeds	<input type="checkbox"/>	About 147 species of seaweeds are reported in the GoMBR	Seaweeds are reported to have multi-faceted medicinal and pharmaceutical properties. More than 14 different seaweeds are reported in Indian Traditional medicine mostly for intestinal disorders. They are used as vermicides and prepared in the form of

4 - What is the Site like? (Ecological character description)

4.1 - Ecological character

Gulf of Mannar Biosphere Reserve (GoMBR), (Longitudes 78o08'E to 79o30'E and Latitudes 8o35'N to 9o25'N,) is located in the southeastern coastline of India. The wetland is a unique marine environment rich in biodiversity. The origin of the island chains which constitute Gulf of Mannar is the product of complex bio geomorphic processes that began in the last interglacial period, when during the lag phase, the sea level regressed up to 6 to 8 meters, thereby exposing the sandy substratum around the island system. This initiated the coral growth around the present-day islands. When the sea level began rising, coral arose too, keeping in pace with the sea level increase; thus, developing the barrier island system. Due to the tectonic movements, a certain area of land emerged in the Gulf of Mannar (Ramasamy, 1996). Infilling of lagoon with reef sediment and the evolution of incipient cay gave shape to the island. Mangroves, Coral reefs and Sea Grass ecosystems are the three important and sensitive ecosystems along coastal zones. GoMBR is no exception and possesses all these unique ecosystems and has become significant because of the presence of other associated resources such as fishes, sponges, gorgonids, holothurians, pearl beds, chank beds, sea horses, turtles and the sea cow, Dugong dugon. The floral components comprise of economically viable species of seaweeds such as *Gracilaria* sp., *Gelidiella* sp., *Caulerpa* sp, *Sargassum* sp. and *Turbinaria* sp. The sea grass communities of GoM MBR tops the list of marine flora of India, with the highest number of sea grass species recorded, providing important feeding grounds for the endangered Dugong dugon.

The topography is diverse; including beaches, spits, beach ridges, swales, backwaters, mudflats offshore islands flanked by coral reefs, wave cut platforms, sea cliffs, sea caves, and water-logged land.

GoMBR is a combination of unique systems such as (1) Sand Dunes and beaches: along the shoreline the beaches are gently sloping and marked with altered crusts and troughs that are formed due to wave action. There are also beaches available along the coasts of Tirunelveli and Kanyakumari districts, which forms a part of the Biosphere Reserve (2) Spit: GoMBR-on the leeward side of NE monsoon, SW shore line of Rameswaram has a tongue shaped spit, may have been the result of littoral current from Palk Bay to GoMBR monsoon period. (3) Mud flat: are a wide expanse of deposit of clay, silt, ooze, etc (Davies 1972), covering 14.50 km², observed near Vaippar River mouth, around Valinokkam backwater lagoon, Kallar and Gundar River mouths. The area covered by mudflat is (4) Sea cliff and sea cave: Along the coast of Gulf of Mannar, cliffs have been observed in Mandapam (5) Beach Ridges: are moderately undulating terrain of marine depositional type, formed during Pleistocene to current, in the plains of GoMBR coastline & coastal areas between Mandapam & Vaippar River, East. There are 12 beach ridges parallel to each other, covering an area of 155.49 km² running from E to W and NW to SW direction grouped as per nature and dispositions of beach ridges- (i) Beach ridges South of Vaigai River, (ii) Beach ridges between Kotangudi River and Palar River, (iii) Beach ridges between Palar River and Gundar River system, (iv) Beach ridges between Gundar River and Vaippar River and (v) Beach ridges South of Vaippar River. Swales & Backwater: Swales and backwater zones between coastal plains of Mandapam & Kottakkarai River situated parallel to the coastline. Prominent zones-coastal plains between Valinokkam & Vaippar River, Mandapam & SE Tiruppullani. The basin bed is composed of silt & mud, adjacent low-lying area is used for salt production. (6) Wavecut Platform: common along the coast of Mandapam, Ramaswami Matam, Pudhumatam, Valinokkam etc. (7) Strand lines: along GoM coastline from Tiruppullani to Mandapam, 8 series of strandlines in curvilinear form in an eastern to western direction.

4.2 - What wetland type(s) are in the site?

Marine or coastal wetlands

Wetland types (code and name)	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type	Justification of Criterion 1
A: Permanent shallow marine waters	Mannar Valaiguda	1	52671.876	Representative

Other non-wetland habitat

Other non-wetland habitats within the site	Area (ha) if known
Surrounding islands and patches of agricultural land	2157

4.3 - Biological components

4.3.1 - Plant species

Invasive alien plant species

Phylum	Scientific name	Impacts
RHODOPHYTA/FLORIDEOPHYCEAE	<i>Kappaphycus alvarezii</i>	Actual (major impacts)
TRACHEOPHYTA/MAGNOLIOPSIDA	<i>Prosopis juliflora</i>	Actual (major impacts)

Optional text box to provide further information

Kappaphycus alvarezii is a commercially important red alga being intentionally introduced in marine waters worldwide for the production of kappa carrageenan. Its introduction into the GoMBR during the 1990s and its subsequent escape from cultivation sites have paved way for its invasion into the coral reefs of Kurusadai Island. Since the report of its invasion in 2008, removal of *K.alvarezii* from the reefs started by means of manual removal (hand plucking). Regrowth of *K. alvarezii* from removal points and drifting broken fragments resulting during removal have led to further establishment in the reef environment. Variation in the morphology of *K. alvarezii* populations after their removal was studied by Kamalakannan et al (2014). Significant reduction in corals and native algae due to increased abundance of *K. alvarezii* was evident and need for immediate scientific control measures to eradicate the invasive alga was put forth.

The introduction of this invasive species to address erosion problems, has turned this into an invader species. It has started off invading the river banks and slowly extended to the agricultural lands, as well as adjacent dryland areas. The negative impacts of this species are that its rapid spread has a bearing on the Ecosystem Services. Despite partially the invasion offsets by provisioning of firewood and charcoal needs of the local communities, there is difficulty in controlling its rapid growth as the threats to Ecosystems Service, people's livelihoods and lifestyles exceed the benefits it may offer.

4.3.2 - Animal species

Other noteworthy animal species

Phylum	Scientific name	Pop. size	Period of pop. est.	% occurrence	Position in range /endemism/other
CHORDATA/ACTINOPTERYGII	<i>Anguilla bengalensis</i>	80000	2020	40	IUCN (NT)
CHORDATA/AVES	<i>Anhinga melanogaster</i>	440	2016	2	IUCN (NT)
CHORDATA/ELASMOBRANCHII	<i>Brevitrygon walga</i>	1000	2017	5	IUCN (NT)
CHORDATA/AVES	<i>Calidris canutus</i>	4500	2018	15	IUCN (NT)
CHORDATA/AVES	<i>Calidris ferruginea</i>	27000	2020	16	IUCN (NT)
CHORDATA/ELASMOBRANCHII	<i>Carcharhinus macloti</i>	60000	2021	30	IUCN (NT)
CHORDATA/ELASMOBRANCHII	<i>Carcharhinus sorrah</i>	30000	2015	15	IUCN (NT)
CHORDATA/ACTINOPTERYGII	<i>Chaetodon trifascialis</i>	10000	2010	5	IUCN (NT)
CHORDATA/AVES	<i>Ciconia episcopus</i>	500	2020	1	IUCN (NT)
CHORDATA/AVES	<i>Circus macrourus</i>	27	2018	30	IUCN (NT)
CHORDATA/AVES	<i>Esacus recurvirostris</i>	200	2017	3	IUCN (NT)
CHORDATA/AVES	<i>Haematopus ostralegus</i>	350	2019	7	IUCN (NT) and Appendix II of CMS
CHORDATA/AVES	<i>Limosa lapponica</i>	32970	2017	3	IUCN (NT) and Appendix II of CMS
CHORDATA/AVES	<i>Limosa limosa</i>	15000	2017	10	IUCN (NT) and Appendix II of CMS
CHORDATA/AVES	<i>Mycteria leucocephala</i>	1920	2016	8	IUCN (NT)
CHORDATA/AVES	<i>Numenius arquata</i>	12525	2017	1.5	IUCN (NT) and Listed under Appendix II (CMS) includes the sub-family Phalaropodinae, formerly listed as the family Phalaropodidae
CHORDATA/AVES	<i>Phoeniconaias minor</i>	65	2018	1	IUCN (NT) and Appendix II of CMS and CITES
CHORDATA/MAMMALIA	<i>Pseudorca crassidens</i>	30	2018	2	IUCN (NT)
CHORDATA/ELASMOBRANCHII	<i>Scoliodon laticaudus</i>	70000	2017	35	IUCN (NT)
CHORDATA/ACTINOPTERYGII	<i>Scomberomorus commerson</i>	10000000	2011	50	IUCN (NT)
CHORDATA/AVES	<i>Threskiornis melanocephalus</i>	950	2016	5	IUCN (NT)
CHORDATA/REPTILIA	<i>Varanus bengalensis</i>	2000	2021	2	IUCN (NT)

4.4 - Physical components

4.4.1 - Climate

Climatic region	Subregion
A: Tropical humid climate	Am: Tropical monsoonal (Short dry season; heavy monsoonal rains in other months)

GoMBR is vulnerable to natural disasters, like cyclonic storms, tsunamis, floods; prone to recurrent droughts & sea level rise threat. Villanguchalli island covering 95 ha & 15 km off Tuticorin port city got submerged few decades ago due to coral mining. Isolated patches of thin coral reefs occur along SE side of the island. 2015 was the hottest year. High sea temperature directly affected metabolism of seagrass, photosynthesis & respiration, limiting its abundance & distribution. Mass mortality of sea urchins over Dhanushkodi beach-observed in Feb'19. >100s. of dead/dying specimens found within 10 m² area. In April'19, massive blooms of *Trichodesmium erythraeum* (8×10⁵ filaments/ml) extended upto few kms near Mandapam islands & *Synechococcus* bloom (3×10⁵ cells/ml) near Kundukal jetty triggered by increased temp. & salinity. Beaches indicated withering seagrasses & 100s of exoskeletons of dead sea urchins washed ashore & buried in the sand; could be due to strong near shore waves & currents.

4.4.2 - Geomorphic setting

a) Minimum elevation above sea level (in metres)

a) Maximum elevation above sea level (in metres)

- Entire river basin
- Upper part of river basin
- Middle part of river basin
- Lower part of river basin
- More than one river basin
- Not in river basin
- Coastal

Please name the river basin or basins. If the site lies in a sub-basin, please also name the larger river basin. For a coastal/marine site, please name the sea or ocean.

Gulf of Mannar Marine Biosphere Reserve is situated along the coastline of eastern edges of southern part of Tamil Nādu. It is a marine ecosystem and the sea associated with it is "The Bay of Bengal"

4.4.3 - Soil

- Mineral
- Organic
- No available information

Are soil types subject to change as a result of changing hydrological conditions (e.g., increased salinity or acidification)? Yes No

Please provide further information on the soil (optional)

The soil is typical coastal sand, strewn with shingles, and there are swamps in areas of Van Island, Kasuwari Island, Poomarichan Island, Pullivasal Island, Krusadai and Shingle islands. Quick sand is seen in parts of Mulli and Krusadai Island. Mangrove soils are slightly acidic. Anaerobic condition in the soils helps sulphate-reducing bacteria to produce hydrogen sulphide. The characteristic black or grey colour of the soil is due to reduction of ferric compounds to ferrous sulphides.

4.4.4 - Water regime

Water permanence

Presence?	
Usually permanent water present	No change

Source of water that maintains character of the site

Presence?	Predominant water source	
Water inputs from precipitation	<input checked="" type="checkbox"/>	No change
Marine water	<input checked="" type="checkbox"/>	No change

Water destination

Presence?	
Marine	No change

Stability of water regime

Presence?	
Water levels largely stable	No change

Please add any comments on the water regime and its determinants (if relevant). Use this box to explain sites with complex hydrology.

Landscape composed of beaches, algal beds, minor deltas, backwater areas, creeks, mudflats, sea grass beds, coral reef, salt marshes& mangroves. Beaches-extensively spread along GoM coast. It is gently sloping marked with altered crusts& troughs formed by wave action; coastal areas between Mandapam & E of Vaippar River-covered by 12 beach ridges; sand spits are in the S. side of Tuticorin& SW Rameswaram shore. Swales& backwater zones are between coastal plains of Mandapam& Kottakkarai River. Mudflats are near Vaippar River mouth, around Valinokkam backwater lagoon, Kallar River mouth& Gundar River mouth; 21 offshore islands-made up of calcareous dead reef & sand. Coral reefs extend from S of Rameswaram-Tuticorin, believed to be once covered with dense mangrove forests. Almost all estuaries/ rivers in the 4 districts through which GoMBR is situated& flows, opens into sea& influenced by tidal water. None of them belong to perennial water source. Most of the river mouths in the GoM remain closed during dry seasons (May-Aug). Due to lack of continuous freshwater flow, entire river mouth & adjacent mudflats are dominated by tidal flush, hence heavily influenced by high salinity.

(ECD) Connectivity of surface waters and of groundwater	Presence of dunes (essentially sand reserves); sand accumulates during normal conditions& released to the beach & offshore zones, during high waves& storms; acts as groundwater reservoir, supports freshwater for vegetation, prevents salt water intrusion
(ECD) Stratification and mixing regime	G.water-in unconfined condition;thickness 15-20m;water-bearing properties of crystalline formation lack pri. porosity;depend on sec. intergranular porosity;confined to rocks in weathered mantle& semi-confined conditions in deeper fissured fractured zones

4.4.5 - Sediment regime

Significant erosion of sediments occurs on the site

- Significant accretion or deposition of sediments occurs on the site
- Significant transportation of sediments occurs on or through the site
- Sediment regime is highly variable, either seasonally or inter-annually
- Sediment regime unknown

Please provide further information on sediment (optional):

Presented in a separate document	
(ECD) Water turbidity and colour	In non-monsoon season waters-clear, light penetrates even upto 100 m depth; water becomes more turbid during monsoon
(ECD) Light - reaching wetland	Inshore-7.5m; summer-euphotic zone>100m deep; monsoon-turbid<2m-due to agitation of H2Ocolumn/re-suspension of sediments
(ECD) Water temperature	Feb-May-exceeds atmospheric temp; peaks to 32oC in May; gradually declines till Aug; peaks Sep-Oct; declines Nov-Jan.

4.4.6 - Water pH

- Acid (pH<5.5)
- Circumneutral (pH: 5.5-7.4)
- Alkaline (pH>7.4)
- Unknown

4.4.7 - Water salinity

- Fresh (<0.5 g/l)
- Mixohaline (brackish)/Mixosaline (0.5-30 g/l)
- Euhaline/Eusaline (30-40 g/l)
- Hyperhaline/Hypersaline (>40 g/l)
- Unknown

Please provide further information on salinity (optional):

Salinity values of GoM range between 31.7 to 35.2 ppt (part per thousand). Peak salinity values coincide with peak temperatures in the Gulf. Coastal areas-the rate of evaporation exceeds rate of freshwater input; hence salinity has been reported to exceed 40 ppt. Freshwater input from rivers in the GoM region is limited. The only perennial river is Thamiraparani and that has its own limitations because of dams constructed across. There are other minor rivers, which bring in freshwater only during the NE monsoon and that too only in small quantities. Therefore, the influence of freshwater drainage on the salinity of GoM waters is only limited; therefore limits the distribution of mangrove vegetation in GoM. Coral reef sediments recorded low salinity, compared to seagrass beds and adjacent areas. Salinity of mangroves fluctuates considerably ranging from 3 to 33 ppt.

(ECD) Dissolved gases in water

Dissolved Oxygen (DO) in the waters GoM is dependent on temperature, salinity, oxygen solubility, consumption and production. The highest value of 6.2 ml per liter is found to occur Apr to May, associated with maximum organic production. The DO content of water during most part of the year is below its solubility, which is due to sustained regeneration of nutrients, from organic matter of untreated sewage discharged from coastal towns. Such a condition is known to reduce oxygen availability in nearshore water. Hydrogen sulphide production due to sulphate reduction may scavenge the available oxygen. Thus, the fishing harbor of Tuticorin which is under the influence of municipal sewage is found to contain only 0.5 ppm of DO. The COD (Chemical Oxygen Demand) & BOD (Biological Oxygen Demand) values of seashore waters of GoM are 13.6 to 44 ppm (parts per million) and 1.5 to 16 ppm respectively.

4.4.8 - Dissolved or suspended nutrients in water

- Eutrophic
- Mesotrophic
- Oligotrophic
- Dystrophic
- Unknown

Please provide further information on dissolved or suspended nutrients (optional):

Studies on nutrients such as nitrate, phosphate and silicate in GoM are limited. Nitrite nitrogen occurs in small concentrations=<0.5 µg at NO2 - N/l; Nitrate nitrogen content=<5 µg at NO3 -N/l; occurring in shallow waters with high organic matter & low DO. Phosphate occurs in traces=3 µg at PO4 -P/l. Tuticorin sewage waters supply large quantities of water-soluble organic Phosphorus (65% total soluble P). Exchangeable P in sediments of Tuticorin coastal waters is very high=81% & sedimentary organic P=12%. Biologically unstable iron & aluminum P =1.5%; can cause phytoplankton bloom. Monsoon current systems flush nutrients diluting their loads. Silicate nutrient in GoM varies from 85-16,725 µg at Si/l; has negative correlation with salinity. D-Silica is not yet reported important for phytoplankton production. Higher concentrations of total N & P-found in coral reef zones& seagrass beds, than surroundings; can be viewed as nutrient sinks adjacent areas being nutrient reservoirs

(ECD) Dissolved organic carbon	GoM sediment-coarse-fine sand; PalkBay-fine sand-clay; mean=0.08±0.02%; subsurface=0.03-0.24%; Soil OC<in GoM >in Palk B
--------------------------------	--

(ECD) Water conductivity

Salinity=conc.of dissolved salts; contributes conductivity; electrolytes of ionic particles dissolve with +ve&-ve charge

4.4.9 - Features of the surrounding area which may affect the Site

Please describe whether, and if so how, the landscape and ecological characteristics in the area surrounding the Ramsar Site differ from the i) broadly similar ii) significantly different site itself:

- Surrounding area has greater urbanisation or development
- Surrounding area has higher human population density
- Surrounding area has more intensive agricultural use
- Surrounding area has significantly different land cover or habitat types

Please describe other ways in which the surrounding area is different:

A chain of 21 islands+surrounding sea scape; low &narrow coastline-sandy; islands rocky. Raised reef &wave terraces in some islands indicate past SLR &tectonic activities. Mining of coral reefs for construction/industries-resulted in strong waves hitting shores on windward side; extensive erosion; topography diverse-beaches, beach ridges, spits, swales, backwaters, mudflats, wave cut platforms, strandlines &sea cliffs. 19 islands+2 submerged+sea water surrounding the islands=6.4 m on bay side &9.5 m deep, toward seaside-National Park area forming Core Zone. Rest of seascape=20 m depth &coastal terrestrial areas (10 km from high tide mark to landward side) is the GoMBR forming buffer zone. Van Island >40 fully grown trees of Prosopis; ground vegetation-halophytic herbs, creepers/grasses. Degraded seagrasses+few depressions; mangroves absent; open areas planted with Thespesia, Pungam, Neem, Delonix alata. Kasuwari Island-Prosopis &Salvadora trees dominant; ground vegetation-herbs, creepers/grasses. Fresh coral debris& sand accretions present; ground vegetation/grasses-establishing over newly built-up land, due to control over coral removal. Same vegetation in Kariachalli island; Caralluma circarii absent; Natural depressions-good growth of Avicenna spp; Suaeda, Pithecellobium dulce, Vagai +Thespesia well grown. Velanguchalli Island-submerged; looks like a small sand mound; good fringing corals+seagrass patches present in shallow waters; Upputhanni Island-good& natural vegetation; Thespesia+Neem-main trees grow from cut stumps. Large depression in S side of island due to coral mining; stagnation of rain+sea water; serves as natural heronry for sea birds. Nallathanni Island-about 150 coconut trees+300 palmyra palms. Anaippar Island-good coral reef formations; no mangroves on the shore. Man-made depressions within island, predominant vegetation-Prosopis &few Salvadora.

4.5 - Ecosystem services

4.5.1 - Ecosystem services/benefits

Provisioning Services

Ecosystem service	Examples	Importance/Extent/Significance
Food for humans	Sustenance for humans (e.g., fish, molluscs, grains)	High
Biochemical products	Extraction of material from biota	High

Regulating Services

Ecosystem service	Examples	Importance/Extent/Significance
Maintenance of hydrological regimes	Groundwater recharge and discharge	High
Maintenance of hydrological regimes	Storage and delivery of water as part of water supply systems for agriculture and industry	High
Erosion protection	Soil, sediment and nutrient retention	High
Pollution control and detoxification	Water purification/waste treatment or dilution	Medium
Climate regulation	Local climate regulation/buffering of change	High
Climate regulation	Regulation of greenhouse gases, temperature, precipitation and other climactic processes	High
Hazard reduction	Flood control, flood storage	High
Hazard reduction	Coastal shoreline and river bank stabilization and storm protection	High

Cultural Services

Ecosystem service	Examples	Importance/Extent/Significance
Recreation and tourism	Nature observation and nature-based tourism	High
Recreation and tourism	Picnics, outings, touring	High
Scientific and educational	Educational activities and opportunities	High
Scientific and educational	Important knowledge systems, importance for research (scientific reference area or site)	High
Scientific and educational	Long-term monitoring site	High

Supporting Services

Ecosystem service	Examples	Importance/Extent/Significance
Biodiversity	Supports a variety of all life forms including plants, animals and microorganisms, the genes they contain, and the ecosystems of which they form a part	High
Soil formation	Sediment retention	High
Soil formation	Accumulation of organic matter	High
Nutrient cycling	Storage, recycling, processing and acquisition of nutrients	High
Nutrient cycling	Carbon storage/sequestration	High

Other ecosystem service(s) not included above:

GoMBR provides the ecosystem services of a typical wetland i.e., provisioning, supporting & regulatory. Other ecosystem based (provisioning) services are livelihood benefits to the people.

Mariculture-in addition to fisheries-related occupation, there are other opportunities for employment-salt extraction in the W side of the Gulf, Palmyra (toddy) tapping& agriculture. Skilled works are-mat weaving in Ramanathapuram.

Moving inland from the coastal toddy tapping and agriculture are predominant occupations with small business-related opportunities near Rameswaram in connection with the tourism in this area (SSFRD, 1998). Supplementary activities include charcoal making, salt making, mat weaving, coir making +agriculture & allied activities. Drift wood/dry twigs collected from the islands by fisherwoman as firewood and sold. Though this is not a major occupation, is taken up for supplementing family income.

Sandy Beaches contributes sand, minerals and better catchment area. Coral reefs are tapped for building material, live trade and as source material for medicine.

Sea grasses have been used by humans >10,000 years as fertilizers in agricultural fields, insulating houses, weaving furniture, thatch roofs, making bandages, and filling for mattresses, even car seats. They are believed to be the third most valuable ecosystem in the world (only preceded by estuaries and wetlands). One hectare of sea grass (about two football fields) is estimated to be worth over \$19,000 per year, making them one of the most valuable ecosystems on the planet. They are also referred as "Ecosystem Engineers" because they modify their environments to create unique habitats. One square meter of seagrass can generate 10 liters of oxygen, every day through photosynthesis.

Within the site: 100s

Outside the site: 10000s

Have studies or assessments been made of the economic valuation of ecosystem services provided by this Ramsar Site? Yes No Unknown

4.5.2 - Social and cultural values

i) the site provides a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland

Description if applicable

of three types of concrete artificial reef structures namely grouper module, reef fish module and well ring module by improving their longevity and ecosystem services, in order to suit the modern requirements, so that it will serve not only as biodiversity enhancement tool but also a technology to improve livelihood options and socio economic conditions of the poor traditional coastal fishers (Kasim 2015). Maturation process of artificial reef structures, such as biological processes, composition of sessile benthic organisms, fouling biomass, assemblage of fauna, predation on the fouling organisms, succession of different species and enhancement value of biomass are being addressed and taken care of. 137 taxa were identified living within the artificial reef habitats and colonized by on an average 423,948 individuals of marine organisms and had a total mean biomass of individual and colonial organisms of 5,835g per m². Fossil fuel is saved and CO₂ emission is reduced leading to a nominal reduction of global warming and a considerable savings on fuel cost Robust economic benefit is recorded with a short duration payback period coupled with gain in empowerment of the fisher community which enjoys a series of social benefits. Reef habitats provided refuge cover for a large number of small and bigger fish (135.3/m²), crab (3,445.9/m²) and lobster (22.9/m²). Hence this model is strongly recommended all along Indian coastal waters.

ii) the site has exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland

Description if applicable

GoMBR does not possess any sacred site/groves within its boundaries; complemented by several areas with potential to provide variety of tourism/eco-tourism activities; Kodandaraman Temple: situated on the way to Dhanushkodi, 30 km from Rameswaram; Darbhasayanam: Vishnu temple-64 km from Rameswaram on the way to Sethukkarai; Sethukkarai: a place of mythical importance, a pilgrimage center, where Lord Rama is believed to have constructed a bridge over the sea to reach Lanka; Uthirakosamangai: ancient Siva temple-deity carved in emerald; 20 km from Ramanathapuram; Navabhashanam: coastal village, known as Navashabashanam; believed that Lord Rama worshipped Navagraha here. Nearby Devi temple, who killed demon Mahishasura. Hindus perform religious rites for their forefathers here; pilgrims visiting Rameswaram visit here. Mangrove swamp beside-an important nesting/breeding area for birds, attracts many bird watchers; Nainar Kovil village: named after the temple, along Ramanathapuram-Sivaganga State highway. Lord Shiva-main deity here; Oriyur: one of the most revered pilgrim centers for Christians world over; home to martyrdom of St.John De Britto, a Portugese Jesuit, known as Arul Anandhar; place where the saint was beheaded in 1693; sand dune is said to have turned red, believed to be stained by saint's blood; Ervadi Dargha: tomb of Sultan Ibrahim Syed Aulia, who came from Arabia via Cannanore; 800 yrs old. Pilgrims from countries like Sri Lanka, Malaysia, Singapore visit the tomb. "Santhanakoodu" festival is celebrated Feb-Mar attracting thousands; landing center& and boat building yard can be converted into a place of experience for visitors. HERITAGE/ HISTORICAL TOURISM:- Dhanushkodi: fishing village on NE tip of Rameswaram Island, 40km from Rameswaram; Ruins of Church& other Govt. buildings constructed during British rule, are of archaeological value; marsh attracts migratory birds from Europe/Australia during Oct-Jan every year; Sethupathy Raja Palace: early 15th century, current territories of Ramanathapuram district-under Pandiyan Kingdom; for a short period-under Chola empire; Rajendra Chola in 1063 AD; in 1520 AD, Nayaks of Vijayanagar took over Pandiyan dynasty, for about 2 centuries; Marava chieftains-Sethupathis, Lords under Pandiyan Kings reigned over this part (17th century); beginning of 18th century, family disputes over succession resulted in division of Ramanathapuram. King of Thanjavur in 1730 A.D& a chieftain deposed Sethupathy and became Raj

iii) the ecological character of the wetland depends on its interaction
with local communities or indigenous peoples

Description if applicable

The inhabitants of GoMBR are mainly "Marakeyars", principally engaged in fisheries. There are about 47 villages along the coastal region of the reserve supporting some 100,000 people. The Global Environmental Facility (GEF) provided support to the establishment of the BR, including setting up and functioning of the GoMBR Trust (GoMBRT), responsible for coordination of the management plan for the BR along with Govt. agencies, private entrepreneurs& local people's representatives. Priority is being given to enhance community-based management. Major ecosystem type Islands include coastal/marine component; coral reefs, mangrove habitats & land cover types. Livelihoods of people in the coastal buffer zone of GoMBR largely depends on coastal/marine resources. However, agriculture & allied activities also play significant role in providing livelihoods. The activities of coastal-based people include fishing, salt-making and seaweed collection. Rapidly expanding scientific knowledge on seagrasses has led to a growing awareness on their resource values (Marten and Carlos, 2000). Recognition of Seagrass ecosystem as breeding habitat for cephalopods, holding sediments, thriving habitat for seahorses, turtles& anemones by fishermen has helped in reducing misuse of seagrasses. In GoM coral reefs fringe a chain of 21 islands, sheltering mangroves, lagoons and a shallow 'trapped sea' with extensive seagrass beds. This mosaic of ecosystems form the basis for livelihoods among coastal communities, including extraction of seaweed, shells, lobsters, sea cucumbers, crabs, squid and reef fish from reef flats/lagoons trapped between the islands& the mainland. Coastal people of the GoM perceive coral reefs as part & parcel of the ocean, referring them as-from where everything sprouts & spreads throughout the sea; a natural nursery; reef fertility enhances fish varieties.

Chank fishing was recorded as early as 88 AD (Arockiaraj, 2016). Chank and Pearl divers of Thoothukudi are known for their ability to dive into deeper depths of the sea, without the help of any modern equipment. In 1962, pearl fishery was stopped due to declining population. There were about 80 pearl banks in this region. These banks varied in depth from 10-20 meters. Maximum numbers of pearl banks were along Thoothukudi coast.

iv) relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological
character of the wetland

Description if applicable

GoMBR-no sacred sites; areas around-potential tourism. Kodandaraman Temple: way to Dhanushkodi, 30km from Rameswaram; Darbhasayanam: Vishnu temple-64km from Rameswaram; way to Sethukkarai-mythically important pilgrimage-Lord Rama is believed to have constructed a bridge over sea to reach Lanka; Uthirakosamangai: ancient Siva temple-deity carved in emerald; 20km from Ramanathapuram; Navabhashanam: coastal village, where Lord Rama worshipped Navagraha; Nearby-Devi temple, who killed demon Mahishasura. Hindus perform religious rites for forefathers; Mangrove swamp beside-important nesting/breeding site for birds, attracts many bird watchers; Nainar Kovil village: named after temple, at Ramanathapuram-Sivaganga State highway. Lord Shiva-main deity; Oriyur: most revered pilgrimage for Christians world over; martyrdom of St.John De Britto, a Portugese Jesuit (Arul Anandhar); where he was beheaded in 1693; sand dune-said to have turned red, believed to be stained by saint's blood; Ervadi Dargha: tomb of Sultan Ibrahim Syed Aulia-came from Arabia via Cannanore; 800 yrs old. Pilgrims from Sri Lanka, Malaysia, Singapore visit tomb. "Santhanakoodu" festival-celebrated Feb-Mar attracting thousands; landing center/boat building yard can be converted into visiting spot; HERITAGE TOURISM:-Dhanushkodi: fishing village-40km away, NE tip of Rameswaram; ruins of Church& Govt. buildings constructed during British rule-archaeological value; marsh attracts migratory birds (Europe/ Australia)-Oct-Jan every year; Sethupathy Raja Palace: early 15th century, Ramana-thapuram district-under Pandiyan Kingdom; short period-1063 AD-under Chola empire Rajendra; 1520 AD-Nayaks of Vijayanagar took over the Pandiyans for 2 centuries; Marava chieftains-Sethupathis/Lords under Pandiyans reigned 17th century; 18th century-family disputes resulted in divide of Ramanathapuram; 1730 AD-Thanjavur King helped a chieftain depose Sethupathy& became King; WILDLIFE TOURISM:-Melaselvanur Bird Sanctuary (BS)-migratory birds breed; 35km from Ramanathapuram; near Chitragudi, Vettangudi, Kanjirankulam BSs; Pudumadam-fishing village-calm shore waters, good recreation-swimming, snorkelling& water sports; Mandapam-Rameswaram highway-aquarium set up by TN Fisheries Development Corporation; Pamban Rail Scissors bridge-connects Rameswaram to mainland; Vallanad Sanctuary-Tuticorin-Kanyakumari Road; 1641 ha; Blackbuck, Spotted deer, Macaques, Jungle cats, Mongoose, Hares etc.

4.6 - Ecological processes

(ECD) Primary production	Production in the Gulf of Mannar has been reported to be 500 mg C/ day.
(ECD) Nutrient cycling	Gulf of Mannar revealed a clear seasonal trend influenced by prevailing monsoon system in the east coast of India.
(ECD) Carbon cycling	Ratio of AGB & BGB ranged from 1:1.25-1:1.30; Blue C stock of seagrass meadows of GoMBR-estimated as 0.001782 Tg& PB as 0.043996 Tg; blue-C stored in GoM+PB-seagrass-value=17820&4399682 US\$ respectively

(ECD) Animal reproductive productivity	Average annual fish landings from Marine Park-bet 1985-89 was 46,000 tonnes of demersal fishes; 33,000 T of pelagic fish; in 33 fish landing centers along coast bordering the park
(ECD) Vegetational productivity, pollination, regeneration processes, succession, role of fire, etc.	Seagrasses-submarine pollination-asexual clonal growth& sexual reproduction-amphipods(shrimp-like crustaceans),Polychaetes(marine worms),fishes/turtles-feed on pollen/ seagrass-help in fertilization; few spp.self-pollination-reduced genetic variation
(ECD) Notable species interactions, including grazing, predation, competition, diseases and pathogens	Avian flu threat; Corals-tissue loss disease-White Syndrome;high temp+algal competition-disrupt coral symbiotic microorganisms;building corals deposit CaCo3-build ornate+large colonies;polyps retract by day,protrude tentacles at night, feed on planktons
(ECD) Notable aspects concerning animal and plant dispersal	Seagrass dispersal-through interactions with vertebrates-fishes/dugong which eat the seeds of seagrass; Dugong-aquatic herbivore prefers seagrass meadow habitat; help in seed dispersal& germination
(ECD) Notable aspects concerning migration	The site is noteworthy as it is located in one of the major bird migratory routes; called "Flyways". It lies in CAF (Central Asian Flyway), of the international flyway zones
(ECD) Pressures and trends concerning any of the above, and/or concerning ecosystem integrity	Coral mining or dredging; Anchoring of boats; Coral Bleaching; Predator-Crown of Thorn starfish-Siliceous Sponges-fragment the corals; Over exploitation-especially-Holothurians+Ornamental fishes; Pollution; Tsunami threat

5 - How is the Site managed? (Conservation and management)

5.1 - Land tenure and responsibilities (Managers)

5.1.1 - Land tenure/ownership

Public ownership

Category	Within the Ramsar Site	In the surrounding area
Public land (unspecified)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Other public ownership	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Other

Category	Within the Ramsar Site	In the surrounding area
Commoners/customary rights	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Provide further information on the land tenure / ownership regime (optional):

All islands except Nallathanni & Hare-fallow lands. Moyal island-owned by Mandapam Markayar-purchased by State Govt.-for Rs.29,88,216/, Nallathanni for Rs.9,03,138/-; 21 islands-proposed for notifying as reserve lands-Sec.26 of TN Forest Act. Notification of the islands+sea around (3.5-5 fathom depth)as National Park-Wildlife Protection Act 1972-published. Draft notification of islands-Sec.-4 of TN Forest Act 1882-under scrutiny. Further action taken-Secs.19 to 7.5, Wildlife Protection Act 1972 to constitute islands+area around as Marine BR; From 1.11.1989 Forest Dept. took over management-8 islands off Ramanathapuram coast from Revenue dept.-12.10.91; 4 islands off Chidambar-anar coast from Rev. dept.-Aug'91; 8 islands off Ramanathapuram coast,except Krusadai from Fisheries dept.-Dec'92.GoM research activities undertaken by TN Fisheries Dept.from 1990; Forest Dept.action plans-undertaken. Krusadai-separated by 250m of sea from Rameswaram-acquired 75 yrs ago by Govt now under Fisheries

5.1.2 - Management authority

Please list the local office / offices of any agency or organization responsible for managing the site:

Decide earlier to convert GoMBR Trust to GoMBR Management Authority for unified control& management of all core are activities-Marine National Park, buffer+BR area, better coordination+synergy with multiple stakeholders for sustain-able management; idealized from Chilka Development Authority-Orissa& Loktak Development Authority-Manipur (RAMSAR sites). It was suggested-Chief Executive of GoMBRA will be Chief Conservator of Forests+Chairperson Governing Council with TN Chief Minister/Chief Secretary. However was not accepted by the Govt. of TN and it established the GoMBR under TN Society Registration Act 1975 vide TN G.O.Ms.No.263,E&F-FR(V), dated 18.12.2000, as a SPV to coordinate& ensure effective inter-sectoral coordination, facilitate mainstreaming of biodiversity conservation into productive sector& policy development. Hence, in addition to Wildlife Warden, GoM Marine National Park, Directors-GoMBR& GoMBRT-jointly responsible for protection, management & development of G0MBR.

Provide the name and/or title of the person or people with responsibility for the wetland:

Wildlife Warden, Gulf of Mannar Marine National Park, Ramanathapuram

Postal address:

Wildlife Warden Office
Gulf of Mannar Marine National Park,
Mandapam Road, Collectorate Post,
Ramanathapuram District,
Tamil Nadu - 623503
INDIA

E-mail address:

gommnp@gmail.com

5.2 - Ecological character threats and responses (Management)

5.2.1 - Factors (actual or likely) adversely affecting the Site's ecological character

Human settlements (non agricultural)

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Commercial and industrial areas	Medium impact		<input type="checkbox"/>	<input checked="" type="checkbox"/>
Unspecified development	Medium impact		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Water regulation

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Drainage	Medium impact		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Water abstraction	Medium impact		<input type="checkbox"/>	<input checked="" type="checkbox"/>
Water releases	Medium impact		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Agriculture and aquaculture

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Marine and freshwater aquaculture	Medium impact		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Energy production and mining

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Mining and quarrying	High impact		<input type="checkbox"/>	<input checked="" type="checkbox"/>

Transportation and service corridors

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Shipping lanes	Medium impact	Medium impact	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Biological resource use

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Fishing and harvesting aquatic resources	High impact		<input type="checkbox"/>	<input checked="" type="checkbox"/>
Logging and wood harvesting	Medium impact		<input type="checkbox"/>	<input checked="" type="checkbox"/>

Human intrusions and disturbance

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Recreational and tourism activities	Medium impact		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Unspecified/others	Medium impact		<input type="checkbox"/>	<input checked="" type="checkbox"/>

Natural system modifications

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Vegetation clearance/ land conversion	Medium impact		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Unspecified/others	Medium impact		<input type="checkbox"/>	<input checked="" type="checkbox"/>

Invasive and other problematic species and genes

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Invasive non-native/ alien species	Medium impact		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Pollution

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Household sewage, urban waste water	Medium impact		<input type="checkbox"/>	<input checked="" type="checkbox"/>
Industrial and military effluents	Medium impact		<input type="checkbox"/>	<input checked="" type="checkbox"/>
Agricultural and forestry effluents	Medium impact		<input type="checkbox"/>	<input checked="" type="checkbox"/>

Geological events

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Earthquakes/tsunamis	High impact		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Climate change and severe weather

Factors adversely affecting site	Actual threat	Potential threat	Within the site	In the surrounding area
Droughts	High impact		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Temperature extremes	High impact		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Storms and flooding	High impact		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Please describe any other threats (optional):

Killing of dugongs and dolphins-locally known as "Avolia" and "oongi"+turtles for sale of meat has reduced at the moment, owing to the implementation of Wildlife (protection) Act 1972 & publicity given about protection accorded to mammals in the Act. However stray incidents of poaching/incidental catches still occur. Tuticorin Port & establishment of Sethusamuthram Canal-chances of acute oil spill. Recent oil exploration+potential of hydrocarbon in GoM offshores will increase probability of hydrocarbon related disasters. S. chain of islands-observed to erode at faster rate due to Port+expansion. Saline lakes/pans-important sources of salt for human use, traditionally. Extraction methods range from small local evaporation process that is observed in BR area to large commercial operations. Coral mining for construction/industrial purposes in past decades-resulted in waves hitting shores of islands, changed geomorphology, consequent erosion& submergence of islands. The area surrounding Kasuwari island is famous for chank, due to sacred chank beds, attracts nearby fishermen to collect them illegally. Expansion of salt pans in & around Tuticorin-is leading to shrinkage of mangroves. In addition mangroves are harvested in Moyal and Pullivasal islands by the local community for firewood. No adequate income form existing livelihoods; hence seagrasses& corals over-harvested for alternative income. Other threats include-Sand mining along coast, Mineral extraction from sea bed & SEZ. Sewage and waste disposal from the surrounding settlements is posing pollution problems. Pressing socio-economic issues-poor socio-economic condition of local people, lack of additional livelihoods, lack of inter-sectoral coordination in planning& management of BR, and bioaccumulation of inorganics+heavy metals in fauna+flora-will lead to health hazards of fisherfolk.

5.2.2 - Legal conservation status

Global legal designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
UNESCO Biosphere Reserve	Gulf of Mannar Biosphere Reserve	https://en.unesco.org/biosphere/aspac/gulf-mannar	whole

National legal designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
Marine National Park	Gulf of Mannar Biosphere Reserve	https://www.forests.tn.gov.in/pages/view/gulf_of_mannar_mnp	whole

Non-statutory designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
Important Bird Area	Gulf of Mannar Marine Biosphere Reserve	http://datazone.birdlife.org/site/factsheet/gulf-of-mannar-marine-national-park-iba-india https://www.marinemammalhabitat.org/portfolio-item/gulf-mannar-palk-bay/#:~:text=The%20Gulf%20of%20Mannar%20and,meadows%20occur%20within%20the%20IMMA.	whole
Other non-statutory designation	Gulf of Mannar Marine Biosphere Reserve	http://datazone.birdlife.org/site/factsheet/gulf-of-mannar-marine-national-park-iba-india https://www.marinemammalhabitat.org/portfolio-item/gulf-mannar-palk-bay/#:~:text=The%20Gulf%20of%20Mannar%20and,meadows%20occur%20within%20the%20IMMA.	whole

5.2.3 - IUCN protected areas categories (2008)

- Ia Strict Nature Reserve
- Ib Wilderness Area: protected area managed mainly for wilderness protection
- II National Park: protected area managed mainly for ecosystem protection and recreation
- III Natural Monument: protected area managed mainly for conservation of specific natural features
- IV Habitat/Species Management Area: protected area managed mainly for conservation through management intervention
- V Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation and recreation
- VI Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems

<no data available>

5.2.4 - Key conservation measures

Legal protection

Measures	Status
Legal protection	Implemented

Habitat

Measures	Status
Catchment management initiatives/controls	Partially implemented
Habitat manipulation/enhancement	Proposed
Hydrology management/restoration	Partially implemented
Re-vegetation	Proposed

Species

Measures	Status
Threatened/rare species management programmes	Partially implemented

Human Activities

Measures	Status
Fisheries management/regulation	Implemented
Harvest controls/poaching enforcement	Implemented
Regulation/management of recreational activities	Implemented
Communication, education, and participation and awareness activities	Implemented

Other:

Climate change and sea level rise have various significant impacts on economy, environment and security not just for GoMNP (Gulf of Mannar National Park) and BR (Biosphere Reserve) but also for worldwide coastal ecosystems and if these impacts are not integrated into the regional development plans of coastal districts, starting from Kanyakumari to Thanjavur, it will fail to attain the desired sustainability. In this context, the following strategies are suggested: 1) Maintenance of a Mangrove plant nursery, so that in case of mass mangrove die offs on the island and along the coastline, due to climate change or disease, the green cover can be managed. 2) Strengthening public participation in the management of Buffer Zone 3) Promote drought-resistant crops in these coastal districts.

State level Stakeholders Consultation Workshops in Tamil Nadu was held and the modalities related to implementation of Dugong Recovery Programme with actionable conservation measures on priority were finalized. Indian Navy and the Indian Coast Guard have also supported this programme. More than 20,000 school children and fisherfolks have participated in awareness programs organized jointly by TNFD (Tamil Nadu Forest Department) and WII (Wildlife Institute of India, Dehradun). Further, immediate removal of ghost nets from all seagrass beds and inter-tidal beds of Marine National Park and Biosphere Reserve. Ghost nets have been observed as most detrimental threat to the highly endangered dugongs.

5.2.5 - Management planning

Is there a site-specific management plan for the site? Yes

Has a management effectiveness assessment been undertaken for the site? Yes No

If the site is a formal transboundary site as indicated in section Data and location > Site location, are there shared management planning processes with another Contracting Party? Yes No

Please indicate if a Ramsar centre, other educational or visitor facility, or an educational or visitor programme is associated with the site:

The site is well known amongst researchers and students of Botany and Zoology as a specimen collection site. Notwithstanding, it has also been identified as an eco- tourism zone. The management plans proposed include: species recovery program, Restoration of degraded habitat, management of invasive species and fisheries, mitigating climate change, Rescue and rehabilitation of marine mammals, ecotourism, education and visitor management.

URL of site-related webpage (if relevant): https://www.forests.tn.gov.in/pages/view/gulf_of_mannar_mnp

5.2.6 - Planning for restoration

Is there a site-specific restoration plan? No need identified

5.2.7 - Monitoring implemented or proposed

Monitoring	Status
Plant community	Implemented
Plant species	Implemented
Animal community	Implemented
Animal species (please specify)	Implemented

Habitat monitoring-Activity in the NP & BR to be closely monitored & regulated such that no alteration or dilution is carried out on the existing zone of influence (buffer zone) so as to buffer the National Park and thereby conserve the biodiversity of the area. GoMBR is to be strengthened with extending its activities till Kanyakumari & Palk Bay coast in the future. Biodiversity Monitoring-Forest dept. along with few dedicated organizations should conduct regular surveys on avifauna, as it supports huge population of resident/migratory birds. Migratory water birds should be monitored every year to understand population dynamics, from movement, foraging, site selection, territoriality, breeding/nesting, reproduction to survival rates. Monitoring impact of breeding resident species, & impact of wetland degradation on birds need to be brought under scanner. A portion of "Critical Dugong Habitat" falls outside MNP, i.e., Palk Bay, thus, these areas need monitoring. Monitoring dugong population using drone & acoustic techniques & establishment of marine mammals rescue & rehabilitation facility. Efforts are required to manage "Critical Dugong Habitats" inside buffer zone of BR. Wildlife Institute of India-identified habitats needing monitoring; Strict vigilance against poachers & traders & making more boats available for patrolling-current system of management & protection-not enough to guarantee protection. There is an urgent need for increasing the no. of protection guards with at least 2 guards permanently with 2 helpers at all times, in each island; increase in the no. & frequency of boats patrolling; Most of the sub-tidal ecosystems in the islands of GoM-relatively good condition; but disturbances have become localized & relatively small scale; include islands of Mandapam, Keezhakarai & Vembar group & Karaichalli & Vilanguchalli of Tuticorin group. Most threats in GoMMNP-due to anthropogenic effects-seaweed collection, destructive fishing practices, over fishing & coral mining. Stricter vigilance of islands needed; these ecosystems have high chance of recovering naturally; needs constant monitoring for progress & plans for a small-scale in-house annual monitoring projects; Scaling up Assisted coral restoration+monitoring through permanent yearly monitoring plots; Monitoring bird population & their health-bird population-by line transects & statistical analysis. Study on biology & bird behaviour will be carried out with scientists, researchers from Bombay Natural History Society/similar organizations; census to be carried out 2 seasons a year; Vegetation Monitoring-Estimation of annual ground cover %age of tree cover & rate of regeneration. Photographic recording for visual understanding of changes over time; Environmental Monitoring-Testing Water Testing Water & Soil Quality to be carried out; Bathymetric profiling of siltation-every 2 years; Wildlife & Health Monitoring-shark occurrences & landings; critical mollusc beds; health monitoring to avoid diseases

6 - Additional material

6.1 - Additional reports and documents

6.1.1 - Bibliographical references

- 1.A field guide to Birds of Ramanthapuram District – by Ramanathapuram Wildlife Division, Tamil Nadu Forest Department
- 2.Abdul Azis, P.K. and N.B. Nair, (1982) Ecology of the crustacean plankton of the retting zone with special reference to Sulphide pollution in a backwater system of Kerala, Mahasagar. Bulletin of National Institute of Oceanography, 15(3): 175-182
- 3.Ajmal Khan. S.,Rajendran. N, et.al Research need for Gulf of Mannar; Center for Advanced Study in Marine Biology; Annamalai University
- 4.An Atlas on Elasmobranch Fishery Resources of India-CMFRI (Center for Marine Fisheries Research Institute; Indian Council of Agricultural Research) – 2007 (Number:95)
- 5.Arockiaraj John Bosco: For survival, pearl fishers take to perilous chank harvesting. Tol, 31, August, 2016.
- 6.Arumugam. R., Anantharaman. P et.al (2013) Hydrographic and sediment characteristics of Seagrass meadows of the Gulf of Mannar Marine Biosphere Reserve, South India; Environmental Monitoring and Assessment; Vol 185; 8411-8427
- 7.Arun Prabu. S., Dinesh. P and Ramanathan. T (December 2016) SURVEY OF MANGROVES AND THEIR ASSOCIATES IN KEEZHAKARA GROUP OF ISLANDS, GULF OF MANNAR BIOSPHERE RESERVE. (International Journal of Advanced Research)
- 8.Balaji. S., Patterson Edward. J.K and Deepak Samuel. V “Coastal and Marine Biodiversity of Gulf of Mannar, Southeastern India” A comprehensive updated species list (GoMBRT Publication No. 22)
- 9.Baskara Sanjeevi. Ajmal Khan. S “Status, Problem and Management strategies in Gulf of Mannar coral reefs
- 10.Bigelow and Schroeder (1948) The Fishes of the Western North Atlantic
- 11.Biodiversity and Socio-economic Information of Selected Areas of Sri Lankan Side of the Gulf of Mannar – IUCN Report (2011)
- 12.Common Molluscs of Gulf of Mannar (2012) – Published by Gulf of Mannar Biosphere Reserve Trust (GoMBRT)
- 13.Database on Gulf of Mannar Biosphere Reserve (2015) – ENVIS report
- 14.Deepak Samuel. V (2016) Biodiversity of the Marine Molluscs in Gulf of Mannar, South east coast of India
- 15.District Groundwater Brochure, Ramanathapuram District, Tamilnadu (2009) – Technical Report (Chennai Central Ground Water Board: Chennai)
- 16.District wise climate change information for the state of Tamilnadu temperature projections for Ramanathapuram
- 17.Finlayson C.M., William R. Moomaw., Gillian T. Davies et.al (2018) Wetlands in a Changing Climate: Science, Policy and Management.
- 18.Gopi. M., Praveen Kumar. M., Raja. S et.al (2019) Distribution and Biodiversity of Tropical Saltmarshes: Tamil Nadu and Puducherry, South East Coast of India (National Centre for Sustainable Coastal Management, Ministry of Environment, Forest and Climate Change, Anna University Campus, Chennai)
- 19.GoMBR: Strategies for Conservation and Management – A Report submitted to The Rajiv Gandhi Foundation, New Delhi, by M.S. Swaminathan Research Foundation, Centre for Research on Sustainable Agricultural and Rural Development (CRSARD). Authors: Venkataramani. G and Deshmukh. V; under The National

6.1.2 - Additional reports and documents

i. taxonomic lists of plant and animal species occurring in the site (see section 4.3)

<1 file(s) uploaded>

ii. a detailed Ecological Character Description (ECD) (in a national format)

<no file available>

iii. a description of the site in a national or regional wetland inventory

<no file available>

iv. relevant Article 3.2 reports

<no file available>

v. site management plan

<1 file(s) uploaded>

vi. other published literature

<no file available>

6.1.3 - Photograph(s) of the Site

Please provide at least one photograph of the site:



Olive ridley Turtle, corals (Care Earth Trust, Chennai, 18-09-2021)



Sea Grass over shallow water surface (Care Earth Trust, Chennai, 18-09-2021)



Dugong (Tamil Nadu State Wetland Authority, 18-09-2021)



Panoramic view of Gulf of Mannar Marine Biosphere Reserve (Tamil Nadu State Wetland Authority, 18-09-2021)



Mangrove cover in Mannar Biosphere Reserve (Tamil Nadu State Wetland Authority, 18-04-2021)

6.1.4 - Designation letter and related data

Designation letter

<1 file(s) uploaded>

Date of Designation