

# National Conservation Strategy and Action Plan for the Dugongs and their Habitats in India

*Prepared by*

The Task Force for Conservation of Dugongs in India



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## ***Executive Summary***

Dugong (*Dugong dugon*) also called as ‘Sea Cow’ is one of the four surviving species in the Order Sirenia and it is the only existing species of herbivorous mammal that lives exclusively in the sea including in India. Dugongs are protected in India and occur in Gulf of Mannar, Palk Bay, Gulf of Kutch and Andaman and Nicobar islands. Once abundant in Indian waters, Dugong population has now reduced to about 200 individuals and is believed to be continuously declining in its number and range. Dugong conservation is nothing but coastal conservation being a flagship species in its range.

In order to conserve and manage the declining populations of dugong in India, a ‘Task Force for Conservation of Dugong in India’ was visualized in the First Official Signatory State Meeting of UNEP/CMS Memorandum of Understanding for the Conservation and Management of Dugong and their Habitats throughout their Range States, held at Abu Dhabi from 4<sup>th</sup> to 6<sup>th</sup> October 2010. With India having the largest population of dugongs in the South Asia Sub-region, it has a significant role to play in dugong conservation at global level in general and in the South Asia Sub-region in specific. In this context the Ministry of Environment and Forests under the Government of India constituted a ‘Task Force for Conservation of Dugongs’ to look into the entire gamut of issues related to conservation of dugongs and implementation of the ‘UNEP/CMS Dugong MoU’ in India and also to facilitate the country to act as the leading nation in the South Asia Sub-region with respect to dugong conservation (Appendix I).

The Task Force has analysed the entire spectrum of issues linked to dugong and their habitat conservation in India and herewith recommends following goals and objectives for Conservation and Management Plan for Dugongs (*Dugong dugon*) and their habitats in India;

### **Goal 1: Improve Understanding**

Objective 1. Improve our understanding of dugong through research and monitoring

Objective 2. Improve our understanding of dugong habitats through research and monitoring

### **Goal 2. Conserve Species**

Objective 3. Reduce direct and indirect causes of dugong mortality

### **Goal 3. Conserve Habitat**

Objective 4. Conserve and manage dugong habitats.

### **Goal 4. Promote Awareness and Education**

Objective 5. Develop awareness for conservation of dugong and its habitat

### **Goal 5. Develop legal framework**

Objective 6. Develop legal protection of dugongs and their habitats.

### **Goal 6: Enhance national, regional and international cooperation**

Objective 7. Develop national, regional and international cooperation on dugong research and conservation

Objective 8. Promote Implementation of the MoU

Detailed actions with priority level, time-scale and expected outcome for all objectives are provided in the report. This action plan is being developed to double the population of dugongs in India by 2020.

## Introduction

Dugong (*Dugong dugon*) also called as 'Sea Cow' is one of the four surviving species in the Order Sirenia and it is the only existing species of herbivorous mammal that lives exclusively in the sea (Heinsohn, 1972). Dugong are usually found in calm sheltered, nutrient-rich water, generally in bays, shallow island and reef areas which are protected against strong winds and heavy seas (Heinsohn et al., 1977) and which coincide with extensive sea grass beds (Marsh et al., 2002) and such seagrass habitats are still available in Gulf of Mannar, Palk Bay, Gulf of Kutch and Andaman and Nicobar islands in India (Kannan et al., 1999). However, dugongs are not confined to only inshore waters and have been sighted near reefs up to 80 km offshore in waters up to 37 m deep (Ripple, 1999).

### Status of Global distribution of Dugong and their habitats

Dugongs only occur in tropical and sub-tropical waters of the Indo-Pacific region. Their range is extensive, spanning 37 countries and territories from East Africa to Vanuatu (Marsh et al., 2002). Approximately 85,000 of the world's dugongs are found in the inshore waters of northern Australia (Marsh & Lefebvre, 1994). This is likely to be at least three quarters of the global population, possibly even more (Marsh et al., 2002). The second largest dugong population occurs in the Arabian Gulf where the population was estimated in 1987 at 7,310 dugongs (Preen, 1989; Preen et al., 1989). Elsewhere, populations are small and fragmented and in some areas, such as Mauritius, the Maldives and parts of Cambodia and Laos, dugongs may already have become extinct (Marsh et al., 2002).

Dugongs are classified on the global Red List of IUCN as 'Vulnerable to extinction' (IUCN, 2006) and are included (like all Sirenia) in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2007).

Based on resolutions during the World Conservation Congress in Buenos Aires (1995) a Global Dugong Status Report and Action Plan was developed and published in 2002 (Marsh et al., 2002). Several countries and territories have already started working on national or regional dugong conservation strategies. A Dugong Conservation Strategy was developed for the Philippines in 1995 (Kataoka et al., 1995). A western Indian Ocean Dugong Conservation Strategy covering the countries Kenya, Tanzania, Mozambique, Madagascar, Seychelles, Union of the Comoros, Mayotte and Reunion was published in 2004 (WWF, 2004). In Queensland a Nature Conservation (Dugong Conservation) Plan was developed in 1999 (Nature Conservation Dugong Conservation Plan, 1999). Also local management plans were developed. A Dugong Management and Conservation Project for the Moluccas was implemented with EU support during 1989 until 1993, resulting in recommendations for local dugong sanctuaries and community based conservation (De longh and Persoon, 1991).

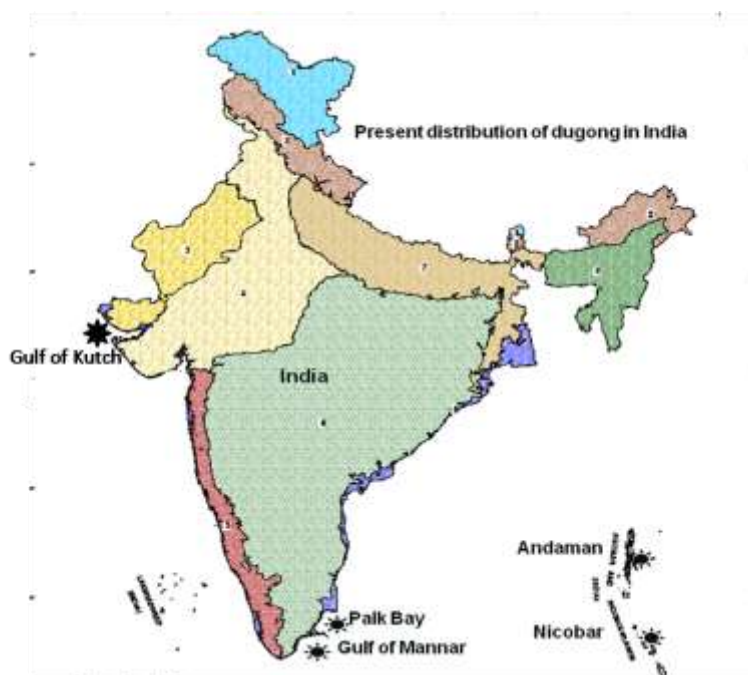
### **Status of Regional distribution of Dugong and their habitats**

Historically, the dugong distribution in India was reported as abundant but limited to Andaman and Nicobars Islands, Gulf of Mannar, Palk Bay, Gulf of Kutch, and Lakshadweep Islands (Annandale, 1905; James, 1974; Jones, 1959, 1967, 1977, 1980, 1981; Mani, 1960; Mohan, 1963; Moses, 1942; Nair *et al.*, 1975; Pocock, 1941; Prater, 1928; Silas, 1961; Marsh *et al.*, 2002). The most favored dugong habitats were the Gulf of Mannar, Interview Island and several inlets and bays around the Little Nicobar and Great Nicobar. About 250 dugongs were illegally caught and butchered at the villages of Kilakarei and Peripattinum alone between April 1983 and August 1984 (Silas and Fernando, 1985). This information clearly shows that once the Gulf of Mannar had a good population of dugong but due to illegal take of this species let the population under threat. Marsh (1989) concluded that Palk Strait and the Gulf of Mannar should be important areas for dugongs in India. The status of dugongs in this region is unknown, however it was suspected that they have almost completely depleted (UNDP - Dugong Status Report and Action Plans for Countries and Territories).

There were sporadic records of dugongs on the west coast of peninsular India (Frazier & Mundkur, 1990), however, the only known dugong population remaining in western India is in the Gulf of Kutch (Lal Mohan, 1963; Frazier & Mundkur, 1990). Due to intensive fishing and various developmental activities, the dugong population in the Gulf of Kutch is at the verge of extinction (Singh, 2003). Dugong population off-coast of Lakshadweep Islands also seems to be extinct as there are no recent sightings of this species in this region.

Dugongs were common in Andaman & Nicobar Islands during the British era, but steeply declined later due to poaching and habitat destruction (Das, 2000). Dugongs were reported in Ritchie's Archipelago and Dugong Creek in Little Andaman are/were well known areas for dugong in Andamans. Dugongs are not found in Dugong Creek at present. Moreover, large populations of Andaman & Nicobar islands are no longer seen and numbers are believed to have been declining since the 1950s (Das, 1996).





Dugongs continue to occur in Gulf of Mannar and Palk Bay along east coast and in Gulf of Kutch along west coast of India. Dugongs also occur in Andaman and Nicobar islands. Results of a national level interview based survey conducted by the Ministry of Environment and Forests, Government of India with help of GEER Foundation, Gujarat on dugong population and also observations made by the Central Marine Fisheries Research Institute and various other organizations in India have revealed that the dugong populations all over India are at the verge of extinction. At present, it seems that the largest populations of dugong in India are in Gulf of Mannar and Palk Bay region followed by Andaman and Nicobar islands, although the population size is presumed to be very small (Sivakumar, 2006; Choudhury and Sivakumar, 2008). Dugong population in Gulf of Kutch is already critically endangered (Singh, 2003). Tsunami of 2004 damaged much of the dugong habitats in the Nicobar regions, further threatening the dugong population here (Sivakumar, 2006). However, quantitative data on status of population of dugong in India is not available.

In 2009, the population of dugong in India was estimated between 131 and 254 individuals using an interview based survey conducted by the GEER Foundation. Of these, about 77 to 158 individuals were suspected to be occurring in the Gulf of Mannar, 44 to 81 individuals in the Andaman and Nicobar Islands and 10 to 15 dugongs were estimated in the Gulf of Kutch.

Region-specific threats to the dugong and its habitat were identified by the Wildlife Institute of India (Sivakumar and Nair, 2013). Fishing is a major threat to dugong in Gulf of Mannar, Palk Bay and Gulf of Kutch, poaching/hunting is prevalent in Andaman and Nicobars, and pollution seems to be major threat to dugongs in Gulf of Kutch (Sivakumar and Nair, 2013). Occupancy models were built in the

program PRESENCE to identify critical dugong habitats using dugong sighting data from the past 5 years (2008 to 2012). The range of variables that influenced occupancy and detection were also assessed. Dugong occupancy was greatest in the Gulf of Mannar and Palk Bay, followed by the Andaman and Nicobar Islands, and lowest in the Gulf of Kutch. At present, the overall occupancy of the dugong in Indian waters is estimated to be 11% of the historical distribution (from 1950s) area. Only 21% of the area sampled in Tamil Nadu was found to be occupied by dugongs. The corresponding proportion was 12% in the Andaman and Nicobar Islands and 1% in the Gulf of Kutch. Status of dugong in some of inaccessible areas such as West Coast of South and Middle Andaman were not known as these areas are Tribal Reserve. Overall, the dugong distribution range has significantly decreased by about 85% in the distribution range of the dugong in India (Sivakumar and Nair, 2013). Similarly an another observation could estimate 60% decline in dugong occupancy in last 20 years in Andaman and Nicobar Islands (Dsouza et al, 2013).

### **Dugong in Indian Mythology**

Local people in India especially along Tamil Nadu coasts relate dugong as 'kadal kanni – Angel of sea' and do believe that dugongs are with human head. In Gujarat, it is believed that the King of Dwarka (coastal town in Gulf of Kutch) the Lord Krishna loved cows had many of them in his kingdom. Before Dwarka sank in the ocean, Lord Krishna provided adoptive features to these cows so that they could live in sea. Local people in Pamban Islands, (Gulf of Mannar) believe that there would be box of money in stomach of every dugong. Onges believe that keeping tooth of dugong would bring more fortune and especially make them more successful in hunting in the ocean as well as in the forests (Pers. Comm. K. Sivakumar). Further, indigenous people in Andaman and Nicobar traditionally hunt dugongs especially Great Andamanese and Onges. Local PAT Regulations, 1956 permit these people to hunt any wild animals in ANI. Further, settlers from Bengal name dugong as 'Pani ka swar' and that perhaps prompt them to poaching. In this context, local NGOs/Drive operators working in Niel Islands name this animal as 'Pani ki gai' so that it would psychologically deter them to poach.

### **Major Threats**

Several reasons have been attributed for dugong population decline, some of which include sea grass habitat loss and degradation, gill netting, disease, chemical pollutants, indigenous use and hunting etc. Dugongs are vulnerable to anthropogenic pressures as they are solely dependent on sea grasses in coastal areas which now have been seriously damaged by fishing, trawling and dredging, etc (Marsh *et al.*, 2002, Nair *et al.*, 1975, Das and Dey, 1999). Dugongs have also been hunted for their meat, oil, hides, bones and teeth. However, hunting has been totally banned in several countries including India.

Feeding grounds of dugong i.e. sea grass beds are highly degraded due to changes in the fishing methodology. Traditionally, fishermen used non-mechanized boats for fishing in the shallow water especially seagrass beds, however, due to modernization of fishing technology, traditional crafts were gradually replaced by mechanized crafts which have never been friendly with seagrass beds and degraded this habitats swiftly. Moreover, water pollution and siltation have also hampered this unique habitat of dugong. Although dugong is getting highest level

of protection by law but still there has been reports of poaching done by fishermen for dugong meat. In Ritchie's Archipelago growing tourism activities specially high speed vessels and speed boats are becoming a major threat for local Dugong population.

### **Current Status of Regional Conservation**

The Dugongs are protected under the Schedule-I of the Wildlife (Protection) Act 1972, which provides the maximum protection to a species in the Indian territory and also prevent any kind of trade on this species. The Dugong population across the world is also declared as Vulnerable by IUCN and listed in Appendix-I of CITES, which prevent international trade on this species. Being a signatory, the Government of India strictly adheres to the CITES rules and regulations to prevent trade on protected endangered species including dugong. Moreover, large portions of dugong habitat in India have been included in the existing Wildlife Protected Areas Network, for example, Gulf of Mannar Marine National Park, Gulf of Kutch Marine National Park, M.G. Marine National Park etc. A study carried out by Ilangakoon et al (2008) during 2004 had also revealed that the incidental catch of dugong by fishermen is significantly lower in Indian part of Gulf of Mannar than Sri Lanka and it was due to awareness and protection provided by joint efforts of Government of India and Tamil Nadu Forest Department. Government of India has also signed the Memorandum of Understanding on the conservation and management of Dugongs and their habitats throughout their range in April 2008 to strengthen the ongoing protection and management of dugongs and their habitats in the Indian water with the support of international community. Additionally Government of India along with State Forest Departments has initiated awareness programme among fishermen communities to minimise the incidental capture of this species and also to protect their sea grass habitats (Choudhury and Sivakumar, 2008). Further, the National Board for Wildlife under the Chairmanship of the Hon'ble Prime Minister constituted two Sub-Committees comprising conservation experts for recovery of threatened Terrestrial and Aquatic species in India. These Committees have already developed Guidelines for Threatened Species Recovery Plan and also selected certain threatened species on priority basis which include dugong.

### **Background Context**

#### **About CMS Dugong MoU**

The Agreement - Memorandum of Understanding on the Conservation and Management of Dugongs and their Habitats throughout their Range (UNEP/CMS Dugong MoU) - entered into force on 31 October 2007 after being signed by 7 range states (Australia, Eritrea, France, Madagascar, Myanmar, the United Arab Emirates and the United Republic of Tanzania) and they have since been joined by four additional signatories (India, the Comores, Kenya and the Philippines) to raise the number of signatories to 11 range states to date.



The UNEP/CMS Dugong MoU (**Annexure I**) provides a platform for the long-term survival of the Dugong by coordinating conservation and management throughout its extensive range.

**Actions taken by the Government of India with respect to MoU on the conservation and management of Dugongs and their habitats throughout their range.**

In April 11, 2008, with the approval of the Union Cabinet, India joined the Memorandum of Understanding on the conservation and management of Dugongs and their habitats throughout their range. Since then the ongoing protection and management of dugongs and their habitats have been strengthened by the following actions;

1. Identified populations of dugong in Gulf of Mannar, Gulf of Kutch and in Andaman & Nicobar Islands have been under strict protection to reduce the direct and indirect causes of dugong mortality. Various conservation awareness programme targeting fishermen communities of these regions have been initiated to minimise the mortality of dugong due to fishing. Surveys have also been initiated to assess the population status of dugong in India, however, combination of different survey techniques including aerial surveys would be carried out to find out the status of dugong populations as well as their habitats soon. Necessary steps to restore the degraded grasslands in the Gulf of Mannar have already been initiated and the same kind of initiative would be followed in other regions where seagrasses are degraded due to various anthropogenic activities. In this connection, technical supports would be sought from international agencies.
2. A study to understand the dugong ecology, behavior along with various aspects of their habitat is undergoing in the Andaman and Nicobar islands (D' souza. & Patankar, 2009). Similar kind of study would be initiated at national level to assess and monitor the ecology and habitat of dugong in Gulf of Mannar, Palk Bay and Gulf of Kutch.
3. Possibility of initiating a study on satellite tracking of dugong in Gulf of Mannar and Palk Bay to understand their trans-boundary movement along with aerial survey is also in priority.
4. Government of India has already placed the dugong in the Schedule I of the Wildlife (Protection) Act, 1972 which prevent any kind of trade on this species in the Indian territory. Killing of this species is punishable offence as per the Act. Considerable area of habitat of dugong is under protection and already these areas have been declared as Wildlife Protected Areas. However, some more areas have been identified by the Wildlife Protected Areas. However, some more areas have been identified by the Wildlife Institute of India as potential habitats of dugong which need to be brought under the Wildlife Protected Area Network with the participation of local communities.

### **First Meeting of signatories of UNEP/CMS Dugong MoU**

The first official signatory State meeting of the Memorandum of Understanding on the Conservation and Management of Dugongs (*Dugong dugon*) and their Habitats throughout their Range was held at the Radisson Blu Hotel, Abu Dhabi, United Arab Emirates, 4–6 October 2010. The meeting was organized by the office of the United Nations Environment Programme/Convention on the Conservation of Migratory Species of Wild Animals (UNEP/CMS), in Abu Dhabi, supported by the Environment Agency–Abu Dhabi.

The development of a memorandum of understanding for the conservation of dugongs had been supported by recommendations 7.5 and 8.5 of the Conference of the Parties to the Convention on Migratory Species, in 2002 and 2005 respectively. A draft memorandum of understanding and associated conservation and management plan had been developed at two meetings on dugong conservation and management in Bangkok, Thailand, in August 2005 and May 2006. The negotiations were concluded at a third meeting in Abu Dhabi in October 2007, at which agreement was reached on the final text of the Memorandum of Understanding on the Conservation and Management of Dugongs (*Dugong dugon*) and Their Habitats throughout their Range. The Memorandum of Understanding entered into force on 31 October 2007 after being signed by seven range States: Australia, Eritrea, France, Madagascar, Myanmar, United Arab Emirates and the United Republic of Tanzania. An informal meeting of signatory States had subsequently been convened in Bali, Indonesia, August 2008.

The purpose of the current meeting was to extend the ambit of the Memorandum of Understanding through the addition of further range States as signatories, to update on activities undertaken thus far, and to discuss how best to advance implementation of the Memorandum of Understanding and its associated Conservation and Management Plan.

## **Constitution of Task Force for Dugongs and their habitat conservation in India**

In order to conserve and manage the Dugongs at global level, the 7<sup>th</sup> meeting of the Conference of Parties of the Convention on Migratory Species (CMS) had passed a resolution and urged all Dugong range states to cooperate among themselves to develop and adopt a 'Memorandum of Understanding' and an Action Plan for the Conservation and management of Dugongs throughout the species range. In this connection, in October 2007, UNEP/CMS organized an Intergovernmental Meeting in Abu Dhabi to conclude the Memorandum of Understanding on the Conservation and Management of dugongs and their habitats throughout their range. The agreement entered into force on 31 October 2007 with the signature of seven range states and later with the approval of Union Cabinet, the Government of India has also signed this Memorandum of Understanding in April 2008 to strengthen the ongoing conservation programme of dugongs and their habitats in the Indian water with the support of international community.

The CMS Secretariat then sought for the advice of Signatory States on the need for a sub-regional grouping for active implementation of Dugong MoU in the range states. Five sub-regions viz. South West Indian Ocean, North West Indian Ocean, South Asia, South East Asian and Pacific sub-regions have been identified. Of these, India, Bangladesh, Pakistan, Maldives and Sri Lanka fall in the South Asia Sub-region. Home to thee largest habitat for dugongs and with perhaps the highest population in the region, India may volunteer to lead the South Asia sub-region in implementing the recommendations of CMS-Dugong MoU by developing a comprehensive proposal for survey, assessment and conservation of dugongs in active collaboration with UNEP-CMS, Signatory States, particularly South Asian nations, concerned research and academic institutions, State/UT Governments, NGOs and the local communities particularly the fishermen.

In this connection, A '**Task Force for Conservation of Dugong in India**' was visualized in the First Official Signatory State Meeting of UNEP/CMS Memorandum of Understanding for the Conservation and Management of Dugong and their Habitats throughout their Range States, held at Abu Dhabi from 4<sup>th</sup> to 6<sup>th</sup> October 2010. With India having the largest population of dugongs in the South Asia Sub-region, it has a significant role to play in dugong conservation at global level in general and in the South Asia Sub-region in specific. Among the five sub-regions identified for dugong conservation at global level by CMS, the status and conservation actions for dugong in South Asia Sub-region is not satisfactory and it needs to be addressed immediately to prevent further decline of dugong numbers and degradation of its habitat.

In this context the Ministry of Environment and Forests under the Government of India constituted a 'Task Force for Conservation of Dugongs' to look into the entire gamut of issues related to conservation of dugongs and implementation of the 'UNEP/CMS Dugong MoU' in India and also to facilitate the country to act as the leading nation in the South Asia Sub-region with respect to dugong conservation (Appendix I).

## 2.0 Dugong Life History and Biology

### 2.1 Classification

Phylum :	Chordata
Class :	Mammalia
Order :	Sirenia
Family :	Dugongidae
Genus :	Dugong
Species :	<i>Dugong dugon</i> (Müller, 1776)

The order Sirenia contains five species of aquatic marine mammals under two families; three species of manatee in the family Trichechidae and two in Dugongidae. The four surviving species include: the Amazon Manatee (*Trichechus inunguis*), the West Indian Manatee (*Trichechus manatus*), the West African Manatee (*Trichechus senegalensis*), and the Dugong (*Dugong dugon*). Another member of the family Dugongidae, Steller's Sea Cow (*Hydrodamalis gigas*), was exterminated by North Pacific seal hunters in the 18th century (Domning 1978).

#### a) Characteristics features

The dugong (*Dugong dugon*) is a grey brown animal, which looks a bit like a cross between a seal and a whale. It has powerful fluked tail and small front flippers, which act like paddles to stabilize it, when it swims. The forelimbs are also used for scratching, mouth-cleaning and supporting the body when resting on the bottom. Their movement is often slow and graceful. It measures about 2-4 meters in length and weighs up to 400 kg. An air breathing mammal, totally adapted to life in the sea, dugong spends much of its time grazing on the seagrass. For this reason it is often called sea cow.

Dugongs are shy, secretive animals and very difficult to approach. They have poor eyesight but their hearing is sharp. Even though the external ear opening is tiny, their large internal ears enable them to hear well, both on the surface and under water. They must surface regularly but are often hard to see as they can take a breath by exposing only the nostrils on the top of their snout. Although capable of staying submerged for 6 minutes or more, dugongs must surface regularly, albeit for only 1-2 seconds (Anderson, 1981).

#### b) Breeding behaviour

Dugongs can live for about seventy years. They breed very slowly and females start breeding at an age between ten and seventeen. Breeding occurs throughout the year and peak months for birth vary geographically. The exact length of gestation is unknown, but it is presumed to be about 12-14 months (Marsh 1986a). Single calves are the norm and twins are rare. Parturition takes place in shallow water, and newborn calves are able to swim immediately to the surface for their first breath of air. Newborn calves are about 100-120 cm long and weigh 20-35 kg.

Newborns cling to the mother's back and ride from the surface to grass beds along with the feeding mother. Young suckle underwater beneath the mother in an inverted position. Lactation lasts approximately 18 months, but calves are known to eat grass at 3 months and may remain with the mother for a year. Dugongs have a slow reproductive rate. A female will raise only one calf every 3-7 years (Marsh et al. 1984d; Marsh 1986a).

### **c) Feeding Behaviour**

The dugongs are the only strictly marine herbivores and feed mainly on seagrass. If the seagrass is short, they root to the bottom eating rhizomes, stems and leaves, and cause sediments to cloud the water. If the seagrass is tall they just strip the leaves from the stems. Given a choice, they select younger and softer plants but they will eat any species available. Small amount of algae is also eaten in the process. Seagrass is nutritionally low, so they must consume vast amounts. In captivity, they eat 20 to 30 kilograms a day. Most marine animals do not eat seagrass for they cannot digest cellulose. Dugongs crush the leaves and roots against the special horny plates in their mouth before passing it back to their teeth. The seagrasses quickly wears the teeth down and to compensate, dugongs have evolved a special way of replacing them and throughout their lives some of their molars continue to grow.

Feeding is the principal activity of dugongs and typically occurs in water 1-5 m deep. Wear on the tusks and trails through grass beds suggest that some digging or rooting is part of the feeding behavior. Head shaking during feeding appears to be useful in cleaning sediments from the food before ingesting, as little sediment is reported in the stomach contents of animals examined. The timing of feeding seems to be most closely related to tides, not photoperiod.

### **d) Habitat use and movement**

Dugongs inhabit shallow, tropical marine coastal water and are more strictly marine than manatees. Since their main source of food is seagrasses, by and large their habitat mirrors that of seagrasses. Thus, they are shallow-water animals feeding in waters just a few meters deep. Long distance migration of dugong is unknown, but some daily and seasonal movements do occur in some populations. Tides, water temperature and food abundance are probably the main factors involved in these movements.

### **e) Economic and cultural significance of dugong**

Traditionally dugongs were hunted by some of the tribes in Andaman and Nicobar Islands, fishermen and local people in Tamilnadu and Sri Lanka. However, currently, due to their low abundance, dugongs are not the target species for hunting in most of these areas. Ongese in Little Andamans use bones of dugongs (tusk, rib bones, pelvic / pectoral girdle) as ornament. There are several myths related to dugongs and their bones such as carrying decorated dugong bones make hunting successful (Ref).



## f) Seagrass ecology

Seagrasses are submerged vascular plants belonging to two families Hydrocharitaceae and Potamogetonaceae, which totally contain twelve genera.. They are adapted to the marine environment and complete their life cycle underwater. In contrast to other submerged marine plants (e.g. seaweeds), seagrasses flower, fruit and produce seeds. They also have true roots and an internal system for the transport of gases and nutrients. They generally grow in shallow coastal water from the intertidal zone to depths up to 10 m. In turbid estuarine environments, such as the Indian coast, where there is an enormous deposition of silt into the sea by major rivers, seagrasses are rarely encountered at depths below 10 m. In less turbid areas, such as the Caribbean Sea and Australian coast, seagrasses can be found at depths of 50 m (Orth et al., 1990).

Seagrasses are extremely widespread, occurring in the shallow waters of every coast and sea except the polar region. Of the twelve genera, seven are considered tropical while the remaining five are mostly confined to temperate waters. The tropical seagrasses are not homogeneously distributed (Phillips & Menez 1988). The Indo-West Pacific has all seven genera of seagrasses of the tropics. The geographic distribution of the seagrasses is well known in South East Asian Countries, Australian and Caribbean coast. Areas from which records are scarce include parts of South America, Africa and the Indian subcontinent.

In the recent decades, destruction of seagrass meadows has occurred worldwide (Kemp *et al.*, 1983; Orth & Moor,e 1983; Cambridge & McComb, 1984; Neverauskas, 1987, Short & Sandy, 1996). The loss may result from natural events (den Hartog, 1987), such as high energy storms (Patriquin, 1975), but most seagrass loss has resulted from human activities, such as eutrophication (Orth & Moor,e 1983; Cambridge & McComb, 1984; Short & Sand,y 1996), land reclamation, or changes in land use (Kemp *et al.*, 1983). The apparent sensitivity of seagrasses to external environmental change, often induced by man, can be expected to cause wide fluctuations in the populations of marine fauna that they support (Carter, 1988), for example the dugong (*Dugong dugon*) which is one of the most threatened marine mammals of the Indian Ocean (Anderson, 1985: Das, 1996 Sirenew).

### Importance of seagrass habitats

Seagrass meadows play a significant role in the processes and resources of near shore coastal ecosystems, as they have physical, chemical and biological effects on habitats. These include prevention of erosion; the trapping and binding of sediments and organic detritus; provision for a stable habitat for epiphytes, and high rate of production and contribution to the detritus food chain (Walker & McComb 1992). The leaves of the seagrass plants provide space for microscopic plants and animals (epiphytes) to colonise. When the leaves die they are degraded by microbes. Many species of fish, echinoderms, crabs, shrimps and snails feed on the tiny organisms on both the live and decomposing seagrass leaves. While few animals namely, sea turtles and dugong, feed on the seagrass leaves, the dense canopy formed by the leaves under the water provides valuable shelter from predators for a variety of animals. Economically, seagrasses can be utilised for paper production, green manuring and fodder in many south-east Asian nations.

## Distribution and status of seagrass habitat in India

Seagrasses are a type of submerged aquatic vegetation, which have evolved from terrestrial plants and have become specialized to live in the marine environment. Various fishes, molluscs, crustaceans, and echinoderms form the predominant associated fauna of the sea grass habitats. Macrofauna mainly comprised of oligochaetes, polychaetes, crustaceans and nematods, while meiofaunal groups mainly consist of turbellaria, nematode and harpacticoida live in this habitat type (Eiseman et al., 1976). Under normal conditions, seagrasses maintain water clarity by trapping silt, dirt, and other sediments suspended in the water column. These materials are then incorporated into the benthic substratum, where they are stabilized by seagrass roots. However, when sediment loading becomes excessive, turbidity in the water column increases and the penetration of sunlight is inhibited. In extreme cases, excessive sediment loading can actually smother seagrasses.

Although sea grass beds are distributed sporadically all along Indian coasts including Andaman and Nicobar and Lakshadweep Islands, major concentration were in Gulf of Mannar, Andaman and Nicobar islands, Lakshadweep islands and along Gulf of Kutch. Of these regions, dugong occurs in all except Lakshadweep (Mohan, 1963; Nair *et al.*, 1975; Silas, 1961; Marsh et al., 2002). The flora is dominated by *Cymodocea rotundata*, *C. serrulata*, *Thalassia hemprichii*, *Halodule uninervis*, *H. pinifolia*, *Halophila beccarii*, *H. ovata*, and *H. ovalis* (Jagtap et al., 2003). Distribution occurs from the intertidal zone to a maximum depth of ~15 m. A significant correlation was observed between depth and biomass from major seagrass meadows. The Gulf of Mannar is well known for its rich diversity of sea grasses along with dugong. Wildlife Institute of India (2009) had estimated that the total extent of seagrass beds around all islands of the Gulf of Mannar Biosphere Reserve was about 80.7 km<sup>2</sup>. The species composition of seagrass community in the Gulf of Mannar region include *Enhalus acoroides*, *Halophila ovalis*, *Halophila ovata*, *Halophila beccari*, *Halophila stipulacea*, *Thalassia lemprichii*, *Cymadocea serrulata*, *Cymadocea rotundata*, *Halodule uninervis* and *Syringodium isoetifolium* etc. In Andaman and Nicobar islands seven species of seagrasses were discovered at a single site in Dugong creek (Das & Dey 1999).

Seagrasses are subject to a number of biotic and abiotic stresses such as storms, excessive grazing by herbivores, disease, and anthropogenic threats due to point and non-point sources of pollution, decreasing water clarity, excessive nutrients in runoff, sedimentation and prop scarring. What effect these stresses have on seagrasses is dependent on both the nature and severity of the particular environmental challenge. Generally, if only leaves and above-ground vegetation are impacted, seagrasses are generally able to recover from damage within a few weeks; however, when damage is done to roots and rhizomes, the ability of the plant to produce new growth is severely impacted, and plants may never be able to recover (Zieman et al., 1984, Fonseca et al., 1998).

## Problems and Issues

### Threats

Dugong is a long-lived animal with a life span of up to 70 years, a minimum pre-reproductive period of 9-10 years, and an estimated mean calving interval of 3-7 years (Marsh et al. 1984d; Marsh 1986a). With the low reproductive rate, long generation time and a large interval between offspring, it is estimated that the maximum rate of increase is likely to be about 5 % per year (Marsh 1995a, 1999). As such, they are susceptible to over-exploitation. Their vulnerability is increased by dependence on a specialized environment, the sea grass habitat.

Dugong distribution is mainly confined to seagrass beds, which occur in calm sheltered habitats, such as bays and lagoons. There is an increasing demand to use these coastal zones for residential, recreational, and agricultural purposes. These activities will make the coastal zone more susceptible to the pollution, which cause the destruction and degradation of the sea grass beds (Sivakumar, 2012). Pollution can also affect dugong physiologically through the bioaccumulation of toxic compounds. Dugong has been reported to accumulate mercury and organochlorine compounds in the muscles (Haynes, et al., 2001).

Several reasons have been attributed for dugong population decline, some of which include sea grass habitat loss and degradation, gill netting, disease, chemical pollutants, indigenous use and hunting etc. Dugongs are vulnerable to anthropogenic pressures as they are solely dependent on sea grasses in coastal areas which now have been seriously damaged by fishing, trawling and dredging, etc (Marsh *et al.*, 2002, Nair *et al.*, 1975, Das and Dey, 1999). Dugongs have also been hunted for their meat, oil, hides, bones and teeth. However, hunting has been totally banned in several countries including India.

Feeding grounds of dugong i.e. sea grass beds are highly degraded due to changes in the fishing methodology. Traditionally, fishermen used non-mechanized boats for fishing in the shallow water especially seagrass beds, however, due to modernization of fishing technology, traditional crafts were gradually replaced by mechanized crafts which have never been friendly with seagrass beds and degraded this habitats swiftly (Choudhury and Sivakumar, 2008; Sivakumar, 2012). Moreover, water pollution and siltation are also hampered this unique habitat of dugong. Although the dugong is getting highest level of protection by law but still this species have been reported with poaching by fishermen for their meat (Pers. Comm. K. Sivakumar, WII).

In brief, in all places of their distribution, dugongs are increasingly under pressure due to habitat loss (destruction of seagrass beds), marine pollution (especially oil spills e.g. Gulf of Kutch), fishing and coastal development that increases anthropogenic pressure on dugong habitat.

## Gaps in dugongs and their habitat research in India

In India, studies on dugong have been limited to their distribution status that too largely based on their stranding records on the land (Annandale, 1905; James, 1974; Jones, 1959, 1967, 1977, 1980, 1981; Mani, 1960; Mohan, 1963; Moses, 1942; Nair *et al.*, 1975; Pocock, 1941; Prater, 1928; Silas, 1961; Marsh *et al.*, 2002; Silas and Fernando, 1985; Frazier and Mundkur 1990; Lal Mohan 1963; Singh, 2003). Studies on their habitat (Das, 1996) and observations of *ad libitum* behaviour in native habitat (D' souza, E. & V. Patankar, 2009) are rare. In 2009, an attempt was made to estimate the population of dugong in India using an interview based survey conducted by the GEER Foundation. There is a paucity of detailed ecological studies on this species in India. Even the status of dugong and their habitat is not known properly. Consequently, following research gaps have been identified;

1. Identification of critical habitat of the dugong in India
2. Assessment of dugong population and their habitats in India.
3. Long term monitoring of dugong population and their habitat in India.
4. A study on impact of coastal industrial activities including fisheries on dugong and their habitat.
5. Study on impact of climate change on dugongs and their habitat.
6. A study to develop a long term site specific conservation plan by integrating industrial sectors in dugong conservation in India.
7. Feeding and breeding behavior of dugong.
8. Development of 'Dugong Knowledge Management System' in India

## Need for regional cooperation in dugong conservation

In a major step towards enhanced regional cooperation for the conservation of dugongs, India hosted the **First South Asia Sub-Regional Workshop on the Conservation and Management of Dugongs** on 6th and 7th June 2011, in Tuticorin, Tamil Nadu. The Ministry of Environment and Forests, UNEP/CMS Dugong MoU Secretariat and the Wildlife Institute of India jointly organized the workshop. The policy and conservation management experts from India, Pakistan, Sri Lanka and Bangladesh, experts from UNEP/CMS Dugong MoU Secretariat, the Environment Agency – Abu Dhabi, State Forest Departments of Tamil Nadu, Gujarat and Andaman and Nicobar Islands, field officers of the Gulf of Mannar Biosphere Reserve, representatives of the State Fisheries Department, Central Marine Fisheries Research Institute, Wildlife Trust of India, Reefwatch Marine Organization, Wildlife SOS, GEER Foundation, and various other stakeholders attended the workshop.

Participating South Asian countries and organizations including UNEP/CMS strongly encouraged the Governments of Bangladesh, Pakistan and Sri Lanka to sign the UNEP/CMS Dugong MoU early, and latest before second meeting of the Signatory States; And decided to:

- (a) Develop and deliver a practical and resource-efficient strategy to collaborate in, and implement regional conservation and management initiatives for the conservation of dugongs and their habitats.
- (b) Enhance communication among participating countries and organizations including UNEP/CMS so that issues, opportunities and management interventions related to the trans-boundary conservation of dugongs and their habitats can be addressed in a collaborative, effective and timely manner.
- (c) Identify individually and collectively, with guidance from UNEP/CMS, the financial and technological resources to support implementation of these recommendations.

It is important to implement the recommendations made during this meet by all range states that will help the dugong conservation in India as well as in the South Asia Region in general.

### **Existing Conservation and Management Measures**

Identified populations of dugong in Gulf of Mannar, Gulf of Kutch and in Andaman & Nicobar Islands have been under strict protection to reduce the direct and indirect causes of dugong mortality. Majority of their habitats have been brought under the wildlife protected areas network of the country. Various conservation awareness programme targeting fishermen communities of these regions have been initiated to minimise the mortality of dugong due to fishing. Surveys have also been initiated to assess the population status of dugong in India, however, combination of different survey techniques including aerial surveys would be carried out to find out the status of dugong populations as well as their habitats soon. Necessary steps to restore the degraded grasslands in the Gulf of Mannar have already been initiated and the same kind of initiative would be followed in other regions where seagrasses are degraded due to various anthropogenic activities. In this connection, technical supports would be sought from international agencies.

In April 11, 2008, with the approval of the Union Cabinet, India joined the Memorandum of Understanding on the conservation and management of Dugongs and their habitats throughout their range. Since then the ongoing protection and management of dugongs and their habitats have been strengthened by the following actions;

Government of India has already placed the dugong in the Schedule I of the Wildlife (Protection) Act, 1972 which prevent any kind of trade on this species in the Indian territory. Killing of this species is punishable offence as per the Act. Considerable area of habitat of dugong is under protection and already these areas have been declared as Wildlife Protected Areas. However, some more areas have been identified by the Wildlife Institute of India as potential habitats of dugong which need to be brought under the Wildlife Protected Area Network with the participation of local communities.



## CONSERVATION STRATEGY AND ACTION PLAN

The main objective of this action plan is to at least double the population of dugong in India by 2020. Accordingly the Conservation and Management Plan for Dugongs (*Dugong dugon*) and their habitats in India is being presented herewith in consultation with 'Conservation and Management Plan for Dugongs (*Dugong dugon*) and their habitats in the world' prepared by the CMS-Dugong Secretariat.

Goals and objectives of the 'Conservation strategy and action plan for dugongs and their habitat in India are follows;

### Goal 1: Improve Understanding

Objective 1. Improve our understanding of dugong through research and monitoring			
Action	Priority	Time-scale	Expected Outcome
1.1 Determine the distribution and abundance of dugong populations	High	Immediate	Information population estimates and distribution patterns
1.2 Conduct research and monitoring of dugongs	High	Continuous	Regular research and monitoring to assess and review conservation efforts
1.3 Identify causes of mortality and other possible threats to dugongs and their habitat.	High	Continuous	Information and data to improve conservation practices

Objective 2. Improve our understanding of dugong habitats through research and monitoring			
Action	Priority	Time-scale	Expected Outcome
2.1 Identify dugong habitats including foraging areas and migratory routes	High	Immediate	To identify important and critical areas for conservation
2.2 Conduct research and monitoring of dugong habitats	High	Continuous	Promote dugong conservation on the basis of findings of research and monitoring

#### *Example of Specific Actions:*

- (1) Conduct baseline studies (population, distribution, threats and possible cause of mortality)
- (2) (a) Undertake long term monitoring of dugong populations, (b) Identify migratory routes using available techniques, (c) Review periodically and evaluate research and monitoring activities, (d) Study on population dynamics and survival rates (e) Involve local communities in research and monitoring

## Goal 2. Conserve Species

Objective 3. Reduce direct and indirect causes of dugong mortality			
Action	Priority	Time-scale	Expected Outcome
3.1 Identify, assess and evaluate threats to dugong populations and develop appropriate measures to address these threats	High	Continuous	Data will help develop the appropriate conservation measures for the different types and levels of threats.
3.2 Reduce illegal take of dugongs.	High	Continuous	Control of illegal take of dugongs
3.3 Reduce incidental capture and mortality of dugongs	High	Continuous	Reduce mortality rates
3.4 Reduce dugong mortality due to other direct anthropogenic activities such as boat hits.	High	Continuous	Reduce mortality rates
3.5 Reduce indirect anthropogenic threats e.g. marine pollution	High	Continuous	Reduce mortality rates

### *Example of Specific Actions:*

1. *Establish baseline data on nature and magnitude of threats*
2. *Conduct socio-economic studies among communities that interact with the dugongs and their habitats*
3. *Develop and use gear, devices and techniques to minimize incidental capture of dugongs in fisheries*
4. *Exchange information and, upon request, provide technical assistance to other signatory and cooperating states to promote these activities*
5. *Develop and implement net retention and recycling schemes to minimize the disposal of fishing gear at sea and on beaches*
6. *Assess the level, location and impact of the illegal takes of dugong*
7. *Establish appropriate management programs to ensure that the illegal take of dugongs is addressed*

### Goal 3. Conserve Habitat

Objective 4. Conserve and manage dugong habitats.			
Action	Priority	Time-scale	Expected Outcome
4.1 Identify and map dugong habitats such as seagrass beds and migratory routes	High	Immediate	Critical habitats identified and mapped
4.2 Identify direct and indirect pressures on dugong habitats	High	Immediate	Prioritize pressures on dugong habitats.
4.3 Develop and implement necessary measures to protect and /or conserve dugong habitats	High	Continuous	Dugong habitat is protected
4.4 Rehabilitate degraded dugong habitats	Medium	Continuous	Recovery of degraded dugong habitats

*Example of Specific Actions:*

1. Identify critical dugong habitats such as seagrass beds, migratory routes and dugong congregation sites.
2. Designate and manage protected areas including sanctuaries and reserves in areas of critical dugong habitats.
3. Assess the environmental impact of marine and coastal development and other human activities on dugong populations and their habitats.
4. Monitor marine water quality from land based and maritime pollution, including marine debris, which may adversely affect dugongs and their habitats. Identify and enhance recovery of degraded seagrass habitats used by dugongs.
5. Undertake measures to restore degraded habitats.

#### Goal 4. Promote Awareness and Education

Objective 5. Develop awareness for conservation of dugong and its habitat			
Action	Priority	Time-scale	Expected Outcome
5.1 Develop and implement education and awareness programs	High	Continuous	Increase awareness of the different stakeholders
5.2 Encourage participation of local communities and private sector in conservation efforts	High	Continuous	Involvement of local communities and private sector in conservation activities
5.3 Work towards including marine biodiversity particularly endangered species such as dugongs in school curriculum.	Medium	Continuous	Increase awareness on dugongs and their habitats

##### *Example of Specific Actions:*

1. *Collect, develop and disseminate education materials and dedicated local / regional websites*
2. *Establish community learning and information centers and community-based conservation programs*
3. *Develop and conduct focused education and awareness programs for target groups (ex: policy makers, students, teachers, fishing communities, media etc.)*
4. *Encourage the incorporation of dugong biology and conservation issues into school curricula*
5. *Organize special events related to dugong conservation (ex: Dugong day, Painting or debate competitions)*
6. *Encourage the participation of all stakeholders (government institutions, NGOs, private sectors, local and general communities) in research, conservation and management effort.*
7. *Promote the dugong as a flagship species similar to the panda and dolphin.*

## Goal 5. Develop legal framework

Objective 6. Develop legal protection of dugongs and their habitats			
Action	Priority	Time-scale	Expected Outcome
6.1 Work towards incorporating dugong and habitat conservation measures into national legislation.	High	Immediate	Dugong and its habitats that are outside the protected areas are need to be provided with appropriate legal protection
6.2 Review, and where necessary, strengthen national legal protection for dugongs and their habitats	High	Continuous	Laws and regulations protecting dugongs habitat are strengthened

### *Example of Specific Actions:*

1. *Review domestic policies and laws to address gaps or impediments to dugong conservation*
2. *Encourage the establishment of national legislation to protect dugongs and their habitats that take into consideration regional and international conventions and protocols*
3. *Review at a national level, compliance with obligations under relevant regional and international conventions (e.g. CITES & CBD) relating to illegal trade in dugong parts or products*



**Goal 6: Enhance national, regional and international cooperation**

Objective 7. Develop national, regional and international cooperation on dugong research and conservation

Action	Priority	Time-scale	Expected Outcome
7.1 Develop and adopt mechanism for effective exchange of information	High	Continuous	Mechanism for cooperation and information sharing by range states are established.
7.2 Improve coordination within and between countries for the conservation of dugongs and their habitats.	High	Continuous	Coordination between various agencies established.
7.3 Develop regional database of relevant information in relation to dugong conservation and management	Medium	Continuous	Shared database on dugongs and their habitats.
7.4 Promote capacity building at all levels to strengthen conservation measures	High	Continuous	Capacity to effect dugong conservation enhanced

*Example of specific Actions:*

1. Encourage signatory states to join the relevant regional and international conventions and organizations
2. Strengthen mechanism for cooperation at the regional and sub-regional level
3. Develop network for cooperative management of shared populations, within or across sub-regions.
4. Develop a web-based information resource for dugong conservation
5. Identify and strengthen existing mechanisms for cooperation at regional level

Objective 8. Promote Implementation of the UNDP-CMS Dugong MoU			
Action	Priority	Time-scale	Expected Outcome
8.1 Encourage all range states to participate in the dugong MoU and its activities	High	Continuous	The MoU includes all the range states
8.2 Seek resources to support the implementation of the MoU	Medium	Continuous	Sufficient resources available to implement the MoU
8.3 Create links and develop synergies with other relevant regional conservation conventions, MoU's and agreements	Medium	Continuous	Support from other conventions for the conservation of dugongs and their habitats

Example of specific Actions:

1. Encourage non-signatory states to sign the MoU
2. Arrange regional and sub-regional workshops involving non-signatory states to raise awareness of the MoU
3. Develop and secure reliable source of funding and resources
4. Involving the private sector in the implementation of the MoU
5. Encourage more bilateral and regional cooperation in the implementation of the MoU
6. Explore links to international, regional and sub-regional fora, conventions, agreements and MoU's

## **Dugong Research Strategy for dugong areas of India**

A coordinated research strategy is developed in response to requests from the task force members representing dugong states / union territories, namely Andaman Nicobar Islands, Tamilnadu and Gujarat. The aim of this strategy is to advise researchers, forest managers, NGO's and universities of the priorities for information that will assist in the recovery and maintenance of dugong populations in India. This strategy includes a prioritised list of research projects according to areas of need as specified in the National Action Plan.

### Priority – HIGH

1. Survey and Long term monitoring of dugongs in Andaman Nicobar Islands / Gulf of Mannar Biosphere Reserve / Gulf of Kutch.
2. Aerial surveys by fixed wing aircrafts to assess the population status of dugong in collaboration with Indian Coast Guard/ other agencies.
3. Mapping, characterisation, research and management of seagrass resources in dugong important areas.
4. Investigation of dugong stranding – causes of mortality.
5. Status of implementation of UN-CMS CMP for dugongs.
6. Identify critical dugong habitats such as seagrass beds, migratory routes and dugong congregation sites.
7. Designate and manage protected areas including sanctuaries and reserves in areas of critical dugong habitats.
8. Study of effects of boat traffic on dugongs in India.

### Priority – Medium

1. Study of factors influencing the mortality of dugongs in shark nets / fishing nets
2. Developing community based management for dugongs
3. Review domestic policies and laws to address gaps or impediments to dugong conservation
4. Develop and conduct focused education and awareness programs for target groups (ex: policy makers, students, teachers, fishing communities, media etc.)
5. Encourage the establishment of national legislation to protect dugongs and their habitats that take into consideration regional and international conventions and protocols

### Priority – Low

1. Study on organochloric and heavy metal concentration in dugongs
2. Develop a web-based information resource for dugong conservation

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**Table 1a. Specific recommendations for conservation action with tentative cost estimates for Andaman and Nicobar Islands (Five Year Plan)**

Objective	Action	Priority	Time Scale	Expected Outcome	Approximate Cost (Rs. Lakhs)	Implementation
Objective 1. Improve our understanding of dugong through research and monitoring	1.1 Determine the distribution and abundance of dugong populations	High	Immediate	Information population estimates and distribution patterns	100	State Forest Department, WII, ZSI, CMFRI, NGOs
	1.2 Conduct research and monitoring of dugongs	High	Continuous	Regular research and monitoring to assess and review conservation efforts	200	MoEF (GoI), State Forest Department, WII, ICMAM, NIOT,/ANCOST, ZSI, CMFRI, CMLRE, NIO, NGOs
	1.3 Identify causes of mortality and other possible threats to dugongs and their habitat.	High	Continuous	Information and data to improve conservation practices	50	State Forest Department, NGOs
Objective 2. Improve our understanding of dugong habitats through research and monitoring	2.1 Identify dugong habitats including foraging areas and migratory routes	High	Immediate	To identify important and critical areas for conservation	50	State Forest Department, NCSCM, SAC, ANCOST, ICMAM, ZSI, CMFRI, CMLRE, NIO, NGOs

	2.2 Conduct research and monitoring of dugong habitats	High	Continuous	Promote dugong conservation on the basis of findings of research and monitoring	50	State Forest Department, NCSCM, SAC, ANCOST, ICMAM, ZSI, CMFRI, CMLRE, NIO, NGOs
Objective 3. Reduce direct and indirect causes of dugong mortality	3.1 Identify, assess and evaluate threats to dugong populations and develop appropriate measures to address these threats	High	Continuous	Data will help develop the appropriate conservation measures for the different types and levels of threats.	50	State Forest Department, NGOs
	3.2 Reduce illegal take of dugongs.	High	Continuous	Control of illegal take of dugongs by providing alternate livelihoods	100	State Forest Department and State Fisheries Department
	3.3 Reduce incidental capture and mortality of dugongs	High	Continuous	Reduce mortality rates and with alternate livelihoods	200	State Forest Department and State Fisheries Department
	3.4 Reduce dugong mortality due to other direct anthropogenic activities such as boat hits.	High	Continuous	Reduce mortality rates	100	State Forest Department and State Fisheries Department & NGOs

	3.5 Reduce indirect anthropogenic threats e.g. marine pollution	High	Continuous	Reduce mortality rates	100	State Forests Department and Pollution Control Board
Objective 4. Conserve and manage dugong habitats.	4.1 Identify and map dugong habitats such as seagrass beds and migratory routes	High	Immediate	Critical habitats identified and mapped	50	State Forest Department, WII, ZSI, NGOs
	4.2 Identify direct and indirect pressures on dugong habitats	High	Immediate	Prioritize pressures on dugong habitats.	50	State Forests Department and Pollution Control Board
	4.3 Rehabilitate degraded dugong habitats	Low	Continuous	Recovery of degraded dugong habitats	200	State Forests Department, WII, NIO, CMFRI, ZSI, NGOs, Universities
Objective 5. Develop awareness for conservation of dugong and its habitat	5.1 Develop and implement education and awareness programs	High	Continuous	Increase awareness of the different stakeholders	25	State Forests Department, NGOs
	5.2 Encourage participation of local communities and private sector in conservation efforts	High	Continuous	Involvement of local communities and private sector in conservation activities	25	State Forests Department, State Fisheries Department, NGOs

	5.3 Work towards including marine biodiversity particularly endangered species such as dugongs in school curriculum.	Medium	Continuous	Increase awareness on dugongs and their habitats	50	State Forests Department, State Education Department, NGOs
Objective 6. Develop national, regional and international cooperation on dugong research and conservation	7.1 Develop and adopt mechanism for effective exchange of information	High	Continuous	Mechanism for cooperation and information sharing by range states are established.	25	MoEF, MoES, BOBP, CMFRI, CSIR, WII, State Forest Department
	7.2 Promote capacity building at all levels to strengthen conservation measures	High	Continuous	Capacity to effect dugong conservation enhanced	100	MoEF, MoES, BOBP, CMFRI, CSIR, WII, State Forest Department

**Table 1b. Specific recommendations for conservation action with tentative cost estimates for Gulf of Mannar & Palk Bay (Five Year Plan)**

Objective	Action	Priority	Time Scale	Expected Outcome	Approximate Cost (Rs. Lakhs)	Implementation
Objective 1. Improve our understanding of dugong through research and monitoring	1.1 Determine the distribution and abundance of dugong populations	High	Immediate	Information population estimates and distribution patterns	100	State Forest Department, WII, ZSI, CMFRI, NGOs, State Universities
	1.2 Conduct research and monitoring of dugongs	High	Continuous	Regular research and monitoring to assess and review conservation efforts	150	MoEF (GoI), State Forest Department, WII, ICMAM, NIOT,/ANCOST, ZSI, CMFRI, CMLRE, NIO, NGOs
	1.3 Identify causes of mortality and other possible threats to dugongs and their habitat.	High	Continuous	Information and data to improve conservation practices	50	State Forest Department, NGOs
Objective 2. Improve our understanding of dugong habitats through research and monitoring	2.1 Identify dugong habitats including foraging areas and migratory routes	High	Immediate	To identify important and critical areas for conservation	50	State Forest Department, NCSCM, SAC, ANCOST, ICMAM, ZSI, CMFRI, CMLRE, NIO, NGOs



	2.2 Conduct research and monitoring of dugong habitats	High	Continuous	Promote dugong conservation on the basis of findings of research and monitoring	50	State Forest Department, NCSCM, SAC, ANCOST, ICMAM, ZSI, CMFRI, CMLRE, NIO, NGOs
Objective 3. Reduce direct and indirect causes of dugong mortality	3.1 Identify, assess and evaluate threats to dugong populations and develop appropriate measures to address these threats	High	Continuous	Data will help develop the appropriate conservation measures for the different types and levels of threats.	25	State Forest Department, NGOs
	3.2 Reduce illegal take of dugongs.	High	Continuous	Control of illegal take of dugongs by providing alternate livelihoods	300	State Forest Department and State Fisheries Department
	3.3 Reduce incidental capture and mortality of dugongs	High	Continuous	Reduce mortality rates and with alternate livelihoods	300	State Forest Department and State Fisheries Department
	3.4 Reduce dugong mortality due to other direct anthropogenic activities such as boat hits.	High	Continuous	Reduce mortality rates	300	State Forest Department and State Fisheries Department & NGOs

	3.5 Reduce indirect anthropogenic threats e.g. marine pollution	High	Continuous	Reduce mortality rates	100	State Forests Department and Pollution Control Board
Objective 4. Conserve and manage dugong habitats.	4.1 Identify and map dugong habitats such as seagrass beds and migratory routes	High	Immediate	Critical habitats identified and mapped	20	State Forest Department, NCSCM, SAC, ZSI, NGOs
	4.2 Identify direct and indirect pressures on dugong habitats	High	Immediate	Prioritize pressures on dugong habitats.	15	State Forests Department and Pollution Control Board
	4.3 Rehabilitate degraded dugong habitats	Medium	Continuous	Recovery of degraded dugong habitats	200	State Forests Department, WII, NIO, CMFRI, ZSI, NGOs, Universities
Objective 5. Develop awareness for conservation of dugong and its habitat	5.1 Develop and implement education and awareness programs	High	Continuous	Increase awareness of the different stakeholders	50	State Forests Department, NGOs
	5.2 Encourage participation of local communities and private sector in conservation efforts	High	Continuous	Involvement of local communities and private sector in conservation activities	50	State Forests Department, State Fisheries Department, NGOs

	5.3 Work towards including marine biodiversity particularly endangered species such as dugongs in school curriculum.	Medium	Continuous	Increase awareness on dugongs and their habitats	50	State Forests Department, State Education Department, NGOs
Objective 6. Develop national, regional and international cooperation on dugong research and conservation	7.1 Develop and adopt mechanism for effective exchange of information	High	Continuous	Mechanism for cooperation and information sharing by range states are established.	10	MoEF, MoES, BOBP, CMFRI, CSIR, WII, State Forest Department
	7.2 Promote capacity building at all levels to strengthen conservation measures	High	Continuous	Capacity to effect dugong conservation enhanced	25	MoEF, MoES, BOBP, CMFRI, CSIR, WII, State Forest Department

**Table 1c. Specific recommendations for conservation action with tentative cost estimates for Gulf of Kutch (Five Year Plan)**

Objective	Action	Priority	Time Scale	Expected Outcome	Approximate Cost (Rs. Lakhs)	Implementation
Objective 1. Improve our understanding of dugong through research and monitoring	1.1 Determine the distribution and abundance of dugong populations	High	Immediate	Information population estimates and distribution patterns	100	State Forest Department, WII, ZSI, CMFRI, GEERF, NGOs
	1.2 Conduct research and monitoring of dugongs	High	Continuous	Regular research and monitoring to assess and review conservation efforts	25	MoEF (GoI), State Forest Department, WII, ICMAM, NIOT,/ANCOST, ZSI, CMFRI, CMLRE, NIO, NGOs
	1.3 Identify causes of mortality and other possible threats to dugongs and their habitat.	High	Continuous	Information and data to improve conservation practices	25	State Forest Department, NGOs
Objective 2. Improve our understanding of dugong habitats through research and monitoring	2.1 Identify dugong habitats including foraging areas and migratory routes	High	Immediate	To identify important and critical areas for conservation	25	State Forest Department, NCSCM, SAC, ANCOST, ICMAM, ZSI, CMFRI, CMLRE, NIO, NGOs

	2.2 Conduct research and monitoring of dugong habitats	High	Continuous	Promote dugong conservation on the basis of findings of research and monitoring	25	State Forest Department, NCSCM, SAC, ANCOST, ICMAM, ZSI, CMFRI, CMLRE, NIO, NGOs
Objective 3. Reduce direct and indirect causes of dugong mortality	3.1 Identify, assess and evaluate threats to dugong populations and develop appropriate measures to address these threats	High	Continuous	Data will help develop the appropriate conservation measures for the different types and levels of threats.	20	State Forest Department, NGOs
	3.2 Reduce illegal take of dugongs.	High	Continuous	Control of illegal take of dugongs by providing alternate livelihoods	100	State Forest Department and State Fisheries Department
	3.3 Reduce incidental capture and mortality of dugongs	High	Continuous	Reduce mortality rates and with alternate livelihoods	100	State Forest Department and State Fisheries Department
	3.4 Reduce dugong mortality due to other direct anthropogenic activities such as boat hits.	High	Continuous	Reduce mortality rates	100	State Forest Department and State Fisheries Department & NGOs

	3.5 Reduce indirect anthropogenic threats e.g. marine pollution	High	Continuous	Reduce mortality rates	100	State Forests Department and Pollution Control Board
Objective 4. Conserve and manage dugong habitats.	4.1 Identify and map dugong habitats such as seagrass beds and migratory routes	High	Immediate	Critical habitats identified and mapped	10	State Forest Department, NCSCM, SAC, ZSI, NGOs
	4.2 Identify direct and indirect pressures on dugong habitats	High	Immediate	Prioritize pressures on dugong habitats.	10	State Forests Department and Pollution Control Board
	4.3 Rehabilitate degraded dugong habitats	Medium	Continuous	Recovery of degraded dugong habitats	50	State Forests Department, WII, NIO, CMFRI, ZSI, NGOs, Universities
Objective 5. Develop awareness for conservation of dugong and its habitat	5.1 Develop and implement education and awareness programs	High	Continuous	Increase awareness of the different stakeholders	15	State Forests Department, NGOs
	5.2 Encourage participation of local communities and private sector in conservation efforts	High	Continuous	Involvement of local communities and private sector in conservation activities	10	State Forests Department, State Fisheries Department, NGOs



	5.3 Work towards including marine biodiversity particularly endangered species such as dugongs in school curriculum.	Medium	Continuous	Increase awareness on dugongs and their habitats	10	State Forests Department, State Education Department, NGOs
Objective 6. Develop national, regional and international cooperation on dugong research and conservation	7.1 Develop and adopt mechanism for effective exchange of information	High	Continuous	Mechanism for cooperation and information sharing by range states are established.	10	MoEF, MoES, BOBP, CMFRI, CSIR, WII, State Forest Department
	7.2 Promote capacity building at all levels to strengthen conservation measures	High	Continuous	Capacity to effect dugong conservation enhanced	25	MoEF, MoES, BOBP, CMFRI, CSIR, WII, State Forest Department

**Annexure I****MEMORANDUM OF UNDERSTANDING  
ON THE CONSERVATION AND MANAGEMENT OF DUGONGS (*Dugong dugon*)  
AND THEIR HABITATS THROUGHOUT THEIR RANGE**

The Signatory States,

*Aware* that the populations of dugongs are seriously threatened throughout the range of the species and that effective conservation and management requires an integrated ecosystem approach;

*Recognising* that dugongs migrate and disperse over vast distances, which makes their survival dependent on their conservation and management over a wide area and in a wide range of marine and coastal habitats;

*Acknowledging* that human activities that may threaten dugong populations directly or indirectly include destruction or modification of habitat, coastal development, pollution, fishing activities, vessel strikes, unsustainable hunting or poaching, uncontrolled mariculture and tourism;

*Concerned* about the harm caused to dugongs by the gear used in some forms of fishing, such as coastal trawling and driftnet fishing, including activities by vessels of Distant-Water Fishing Nations, while recognizing that some fishing activities are conducted responsibly;

*Acknowledging* their shared responsibility for the conservation and management of dugong populations and their habitats highlighting the importance of seagrass beds;

*Recognising* the desirability of involving other States whose nationals or vessels conduct activities that may affect dugongs of the region, as well as States that may be in a position to contribute resources or expertise that may promote the implementation of this Memorandum of Understanding;

*Noting* that dugongs have a priority for conservation action through their listing in the respective appendices of the Convention on the Conservation of Migratory Species of Wild Animals (CMS) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);

*Noting* that CMS calls for international cooperative action to conserve migratory species, and that CMS Article IV encourages CMS Contracting Parties to conclude Agreements, including non-legally binding agreements, in respect of any population of migratory species;

*Recalling also* Resolution 2.6 of the Second Meeting of the CMS Conference of the Parties which recommended that Parties implement where appropriate CMS Article IV, paragraph 4, within the spirit of the Convention through the use of instruments such as memoranda of understanding; and

*Further noting* recommendation 7.5 and resolution 8.5 of the Seventh and Eighth Meetings of the CMS Conference of the Parties called on Range States of dugongs to cooperate among themselves, as appropriate, and participate actively to develop and conclude a Memorandum of Understanding and a Conservation and Management Plan to conserve and manage dugongs throughout the species' range;

Express their desire to work closely together to improve the conservation status of dugongs and the habitats on which they depend. To this end, the Signatory States to this Memorandum of Understanding, in the spirit of co-operation, have reached the following understandings.

They will:

1. Endeavour to co-operate closely in order to restore, or where appropriate maintain, a favourable conservation status for dugongs and the habitats on which they depend, taking into account, where appropriate, subsistence and customary use of dugongs in those States where it is permitted.
2. Consider joining those international instruments most relevant to the conservation and management of dugongs and their habitat, in order to enhance the legal protection of the species in the region.
3. Make every effort to review, formulate, revise and harmonise national legislation or regulations, as necessary, relevant to the conservation and management of dugongs and their habitats.
4. Implement, subject to the availability of necessary resources, the Conservation and Management Plan annexed to this Memorandum of Understanding. The Conservation and Management Plan will address:
  - (a) Direct and indirect causes of dugong mortality;
  - (b) Research and monitoring of dugong populations;
  - (c) Protection, conservation and management of habitats;
  - (d) Research into and monitoring of important dugong habitats;
  - (e) Awareness of dugong conservation;
  - (f) National, regional and international cooperation;
  - (g) Implementation of the MoU;
  - (h) Legal protection of dugong and their habitats; and
  - (i) Capacity building at all levels.
5. Establish a Secretariat, based in an appropriate organisation or institution, to be decided by consensus of the Signatory States, to assist in the administration and implementation of this Memorandum of Understanding by communicating with, reporting on and facilitating activities between and among Signatory States and performing such other functions as may be assigned by the Signatory States, such as convening meetings.
6. Assess the implementation of this Memorandum of Understanding, including the Conservation and Management Plan, at regular meetings to be

attended by representatives of each of the Signatory States concerned, and persons or organisations technically qualified in dugong conservation and management. Facilitate the timely exchange of relevant information necessary to coordinate conservation and management measures and to cooperate with relevant organizations and recognized experts and so as to facilitate the work conducted in relation to the Conservation and Management Plan.

7. Designate a competent national authority to serve as a focal point for communication among Signatory States and for implementing activities under this Memorandum of Understanding, and communicate the complete contact details of this authority (and any changes thereto) to the Secretariat.
8. Provide to the Secretariat a regular report on their implementation of this Memorandum of Understanding, the frequency of which will be determined at the first meeting of the Signatory States. The Secretariat will make available to the Signatory States the national reports received and will prepare a periodic review of progress made to implement the Memorandum of Understanding and the Conservation and Management Plan.
9. Assess at the first meeting of Signatory States, and review periodically, the need for and possibilities of obtaining financial resources, as well as the establishment of a special fund for purposes such as:
  - a) Contributing towards any expenses required to operate the Secretariat and activities carried out under this Memorandum of Understanding;
  - and b) Assisting the Signatory States to carry out their responsibilities under this Memorandum of Understanding.

### **Basic Principles**

10. This Memorandum of Understanding is an agreement under Article IV, paragraph 4, of CMS and is not legally binding.
11. The Conservation and Management Plan is an integral part of this Memorandum of Understanding.
12. This Memorandum of Understanding is open for signature by the Range States of the dugong. It will take effect with two signatures. It will become effective for each subsequent signatory on the date of signature.
13. This Memorandum of Understanding will remain open for signature indefinitely, and will remain in effect indefinitely subject to the right of any Signatory State to terminate its participation by providing one year's written notice to all other signatories.
14. The Memorandum of Understanding, including the Conservation and Management Plan, may be amended by a consensus of the Signatory States.

15. Signatory States acknowledge that they may implement more stringent measures domestically than those specified in the Conservation and Management Plan.
16. Signatory States may establish, by mutual agreement, bilateral, sub-regional or regional management plans that are consistent with this Memorandum of Understanding.
17. Actions under this Memorandum of Understanding will be coordinated with Signatory States, as well as with sub-regional institutions in the Region.
18. The original text of this Memorandum of Understanding, in the Arabic, English, French and Chinese languages, each language version being equally authentic, shall be deposited with the CMS Secretariat, which will act as the depositary. The working language for all matters related to this Memorandum of Understanding will be English.

*Signed at Abu Dhabi on 31st of October 2007*

## Annexure II Constitution of Task Force

E. No. 4-24/2010 WL-I  
Government of India  
Ministry of Environment & Forests  
(Wildlife Division)

Paryavaran Bhawan,  
CGO Complex, Lodhi Road,  
New Delhi - 110003.  
Dated: 13<sup>th</sup> October, 2010

### Office Memorandum

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**Sub: Constitution of 'Task force for conservation of dugongs'.**

The Ministry of Environment & Forests has decided to constitute a Task force for conservation of dugongs. The Constitution & Terms of Reference of the Task force for conservation of dugongs is as given below:

1.	Additional Director General of Forests (Wildlife), MoEF	Chairman
2.	Inspector General of Forests (Wildlife), MoEF	Member
3.	Director, Wildlife Institute of India, Dehradun	Member
4.	Director, Central Marine Fisheries Research Institute, Cochin	Member
5.	Director, Reefwatch Marine Conservation, Mumbai	Member
6.	Chief Wildlife Wardens of Tamil Nadu, Gujarat & Andaman and Nicobar Islands	Members
7.	Dr. H. S. Das, Dugong Expert, Environment Agency, Abu Dhabi, United Arab Emirates	Member
8.	Dr. K. Sivakumar, Wildlife Institute of India,	Member
9.	Deputy Inspector General of Forests (Wildlife), MoEF, GOI	Member Secretary

#### Terms of Reference:

1. To look into the entire gamut of issues related to conservation of dugongs and implementation of the 'UNEP/CMS Dugong MoU' in India.
2. Provide detailed recommendations to bring about a more effective conservation and management regime for the species in India as well as in the south Asia sub-region.
3. Devise an institutional framework explaining the functioning of the same at the Centre and State level with the objective of ensuring proper coordination in implementing the conservation programmes of dugong.
4. Develop a 'National Conservation Strategy and Action Plan for dugongs and their habitats in India'.
5. Examine issues relating to fishermen-dugong conservation interface and recommend appropriate short-term and long-term solutions.
6. Recommend appropriate methodology and institutional framework for monitoring the status of dugong with their habitats in India as well as in the south Asia sub-region.
7. Recommend appropriate methodology and institutional framework to recover the dugongs and their habitats in India.

*Contd...2*



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The Committee may co-opt other experts as per the requirement. The non-official members of the Committee would be entitled for travelling and all other allowances as applicable to the non-official members as per Rule SR 190, except in case of Dr. H.S. Das who has kindly agreed to meet his international travel expenditure. However, his travel within India could be paid by this Ministry, if so desired by him.

The Task Force will submit its Report by the end of end of April 2011.

This issues with the approval of competent authority.

  
(Prakriti Srivastava)  
Deputy Inspector General (WL)

**Distribution:**

1. PS to Hon'ble MOS (DC) E & F.
2. PPS to Secretary, E&F.
3. PPS to DGF & SS.
4. PPS to Addl DGF (WL).
5. PS to IGF (WL)
6. All Members of Task force for conservation of dugongs.
7. ✓ NIC Cell- with a request to kindly upload the above order on the official website of the Ministry.