

STATUS OF SEA-COW *DUGONG DUGON* (MÜLLER) ALONG  
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Observations on the stranding and incidental catch of Sea-cow *Dugong dugon* (Müller) along the southeast coast of India are reviewed here. The number of incidental catch and stranded Dugongs were greater in the Gulf of Mannar than in the Palk Bay region during 1994-2000. The need for protection and conservation of Dugongs from indiscriminate exploitation are stressed upon to evolve suitable management strategies.

**Key words:** *Dugong dugon*, distribution, stranding, incidental catch, conservation

## INTRODUCTION

The Dugong *Dugong dugon* (Müller), popularly known as Sea-cow, is a marine mammal, which enjoys a wide distribution in the Indo-Pacific region from the east coast of Africa and Red Sea to Australia. In India, it occurs in the southeast coast in the Gulf of Mannar and Palk Bay, on the Saurashtra coast and in the Andaman Sea of South and Middle Andamans.

In the 18th Century, naturalists like Müller, Lacepede and Erxleben reported the occurrence of Dugong in different parts of the Indian Ocean. In the early 20th Century, Annandale (1905, 1907) and Thomas (1966) gave an account of the identity, external features, habits and osteology of the Indian Dugongs. Jones (1959, 1967a, 1967b), and Nair and Lal Mohan (1975) dealt with the distribution, abundance, habits and food, giving a lot of information on a pair of captive Dugongs in the aquarium of the Central Marine Fisheries Research Institute at Mandapam Camp. Jones (1966) pointed out the need for protection and conservation of Dugongs from indiscriminate exploitation. Mani (1960) and Silas (1961) reported the occurrence of Dugongs on the Saurashtra coast. Lal Mohan (1963, 1980) reported their occurrence in the Gulf of Kutch and described the major fishing grounds, seasonal occurrence, size distribution, sex ratio and breeding habits of Dugongs for 1971-1975 from Palk Bay and Gulf of Mannar. James (1979) made an osteological study of Dugongs. James (1985), James and Lal Mohan (1987) and Lal Mohan (2000) stressed the need for the conservation of marine mammals with particular reference to the Sea-cow.

Recently, Krishnapillai *et al.* (1989) studied the internal organs of Sea-cow; Krishnapillai *et al.* (1991) reported incidental catch of Dugongs; Victor *et al.* (1999), Bose and Gandhi (1999), and Balasubramanian and Easterson (2000)

have reported stranded Dugongs from the Mandapam waters. The Wildlife Warden of Gulf of Mannar Marine National Park, Ramanathapuram periodically observed stranded Dugongs (*pers. comm.*).

Designated as a National Biosphere Reserve, the Gulf of Mannar and its 3,600 species of flora and fauna is one of the biologically richest coastal regions of India. It is equally rich in sea weeds, algae, sea grass, coral reefs, pearl banks, sacred chank beds shellfish resources, mangroves and the endemic and endangered marine mammal — Dugong.

The first author made personal observations, as well as extensive enquiries with fishermen on stranded Dugong along the Gulf of Mannar and Palk Bay coasts during 1994-1998, the details of which are presented in this paper. The present study may throw more light on the need for conservation of these endangered species along the Indian Coasts.

## METHODS

Dugongs entangled in incidental catches and stranded in the Gulf of Mannar and Palk Bay regions were considered for the studies. Details of sex, length, weight and other morphometric characters were noted.

## Distribution

Dugongs are widely distributed in the tropical Indo-Pacific region. According to Macmillan (1955), they are distributed from East Africa, Madagascar, Red Sea, India, Ceylon (= Sri Lanka), Malaya, Philippine Island, Australia, New Guinea to Marshall Islands.

Prater (1928), Petit (1924, 1927a, b, c), Bertram and Bertram (1964, 1968) and Bertram and Colin (1964) have studied various aspects of the Dugong. In Indian waters, Jones (1959,

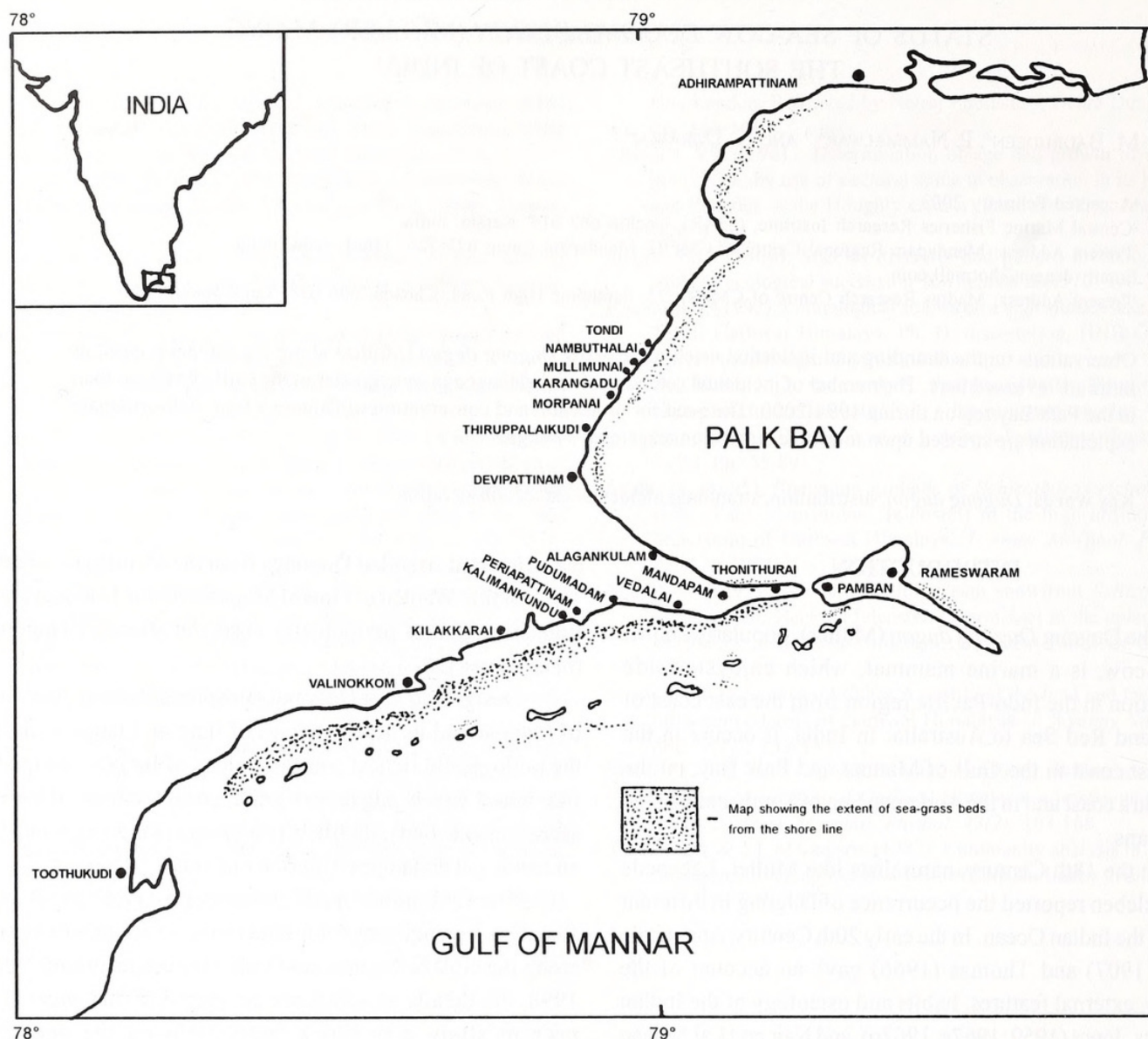


Fig. 1: Map showing the incidental catch / stranding centres of Sea-cow and extent of sea-grass bed in the Gulf of Mannar and Palk Bay

1966, 1967a, b) and Lal Mohan (1963) recorded stranding of Dugong and gave detailed information of skeletons.

In Palk Bay, occurrences of Dugongs were reported at Rameswaram Bay, Olaikuda, Devipattinam, Thondi, Sundarapandianpattinam and Adirampattinam.

#### Food and feeding habits

Dugong is a herbivorous feeder on sea grasses found in abundance in the shallow regions of coastal waters. The stomach contents of Dugongs captured in the Gulf of Mannar and Palk Bay near Mandapam were found to contain the sea grass *Cymodacea serrulata*, *C. isoetifolia*, *Halodule uninervis*, *Halophila ovalis* and *Enhalus acoroides*. *Cymodacea serrulata* was the main food item, while *Halophila ovalis*, and *Halodule uninervis* formed a minor food item of the Dugong in Mandapam (Nair *et al.* 1975).

#### Age and growth

The only available references on longevity are those of Dugongs reared in captivity at Mandapam Camp for 11 years. However, the longevity of Dugong has been reported to be about twenty years (Nair *et al.* 1975).

#### Reproduction

The female Dugong gives birth to one young at a time. Jones (1959) recorded a free-living young Dugong with a total length of 95 cm from Mandapam. The CMFRI Museum at the Mandapam Camp has a 113 cm long stuffed young dugong. A 302 cm long dugong stranded near Kilakkarai on December 11, 1995 was found to have a foetus, which measured 150 cm in length and 40 kg in weight (Table 2).

Observations were made on the growth of two dugongs reared in captivity in the Marine Aquarium at the CMFRI,

Mandapam Camp during 1959-1970. Two males, 160 cm and 196 cm long, were 207 cm and 226 cm respectively at the time of their death. The first individual grew 47 cm long with an average growth rate of 4.3 cm per year, while the second grew by 30 cm with an average growth rate of 2.8 cm per year in an eleven year period. The growth of the first Dugong was faster than the second one because it was younger (Nair *et al.* 1975). The captive Dugongs were not weighed when alive, hence there is no information on the rate of increase in weight.

### Fishing

In earlier years, in the Gulf of Mannar, Dugongs were caught mostly in turtle nets, dugong nets, and shore-seines. Turtle net is a gill-net made of twisted cotton twine or twisted

*Acacia* fibre with a mesh size of 10-15 cm. Dugong net is a bottom set gill-net made of cotton or nylon twine, with mesh size of 15-18 cm. These nets were not in use after the promulgation of the Indian Wildlife (Protection) Act, 1972. Occasionally, dugongs get entangled in 'Thirukai Valai', a gill net with large meshes exclusively used for catching rays.

### OBSERVATIONS

In the present study, information on stranding and incidental catch of Dugongs in Palk Bay and Gulf of Mannar was collected by direct observation and enquiry with fishermen as well as from local newspapers. These investigations revealed that 25 Dugongs were stranded or

Table 1: Morphometric measurements (in cm) of Dugongs recorded in Indian waters

Morphometric measurements	1	2	3	4	5	6	7	8	9	10
Date of reporting	-	-	-	16.12.86	20.3.98	30.4.98	-	28.3.99	-	23.3.99
Total length	240	242	226	310	245	281	268	162	113	95
Forkal length	-	-	-	-	-	265	252	-	110	93
Length of muzzle	14.8	14.5	24.8	-	18	18	22	-	9.5	7
Breadth of muzzle	21.0	24.5	22.0	-	24	24	26	-	5	5
Length of chin	11	14	14.3	-	-	12	-	-	-	-
Breadth of chin	12.5	17.5	14.5	-	-	18	-	-	-	-
Length of flipper	41	43.5	34.5	54	35	40	31	27	14.5	19.3
Breadth of flipper	-	-	11.5	-	-	18	-	-	-	-
Circumference of belly	174	156.5	150.2	-	164	-	120	-	97	58
Distance between submental sulcus and genital orifice	995	124.5	115	-	-	-	-	-	-	-
Length of genital orifice	-	-	8.8	-	-	-	-	-	-	-
Distance between genital orifice and anus	31.7	-	10	-	33	-	-	-	-	-
Breadth of tail fluke	70	80.5	62.6	-	-	-	-	-	-	-
Distance between snout to anus	-	-	270	160	-	-	-	-	-	-
Snout to origin of genital opening	-	-	-	160	121	-	-	-	-	-
Snout to flipper	-	-	-	60	-	-	-	-	-	-
Distance between flippers	-	-	-	59	-	-	-	-	-	-
Snout to eye	-	-	-	58	-	-	26	14.5	9	9
Distance between eyes	-	-	-	58	-	-	-	-	-	15.2
Snout to nostrils	-	-	-	18	-	13	-	-	8	8
Girth at neck (Origin of flipper)	-	-	-	-	-	-	-	-	-	-
Girth at genital opening	-	-	-	200	-	-	-	-	-	-
Girth at anus	-	-	-	135	-	-	-	-	-	-
Circumference in origin of flipper	-	-	-	180	-	-	-	-	-	52
Sex	Male	Female	Female	Male	Male	Male	Male	Male	-	-
Wt (in kilograms)				400	200	210	-	180		
Remarks	Baby Dugong stuffed and preserved									

Table 2: Incidental catch and stranding of Sea-cow in the Gulf of Mannar

S. No.	Date	Place of capture and stranding	Method of capture	Approximate Length (cm)	Approximate Weight (kg)	Sex	Source of information	Remarks
1.	23.03.1955	-	-	95	-	-	Reported by CMFRI Staff	
2.	14.06.1955	-	-	212	-	-	"	
3.	26.12.1956	-	-	150	-	Female	"	
4.	02.10.1959	-	-	160	-	Male	"	
5.	06.12.1959	-	-	196	-	Male	"	
6.	"	-	-	240	-	Male	"	
7.	"	-	-	242	-	Female	"	
8.	"	-	-	226	-	Female	"	
9.	16.12.1986	-	-	310	400	Male	"	
10.	14.12.1994	Periapattinam	Died due to shock from dynamiting	-	300	-	Reported by fishermen, sold at shore	
11.	02.06.1995	Pudumadam	Caught in shore seine	-	250	Female	"	
12.	17.06.1995	Appa Island	"	-	80	Female	"	
13.	30.10.1995	Periapattinam	"	-	60	Female	"	
14.	25.11.1995	Kilakkarai	Not known	-	75	Female	"	
15.	11.12.1995	Kilakkarai	Washed ashore	302	500	Female	Reported by Wildlife Warden Ramanathapuram	
16.	21.12.1995	Mundai (Valinokkam)	Washed ashore in semi-decomposed condition	-	400	-	Informed by CMFRI staff	
17.	10.01.1996	Kannirajapuram	Not known	-	120	-	Brought to Periapattinam and sold	
18.	14.03.1996	Valinokkam	Washed ashore	-	200	-	Inspected by Wildlife Warden and buried	
19.	14.06.1996	Periapattinam	Not known	-	45	-	Sold at shore	
20.	20.06.1996	Kalimankundu	Shore seine	-	25	-	"	
21.	05.08.1996	Periapattinam	Shore seine	-	70	-	"	
22.	07.09.1996	Rameswaram	Not known	-	100	-	"	
23.	11.01.1997	Seeniappa Darha	Thirukkai Valai (net)	-	60	-	"	
24.	12.01.1997	Valinokkam	Not known	-	-	-	Sold at shore, flesh confiscated by official, seller fined Rs. 3000/-	
25.	14.01.1997	Kilakkarai	Mayavalai (net)	-	-	-	Sold at shore	
26.	15.01.1997	Seeniappa Darha	Thirukkai Valai (net)	-	160	-	"	
27.	26.01.1997	Kilakkarai	Shore seine	-	60	Female	"	
28.	10.02.1997	Valinokkam	Dead washed ashore, body with shark bite	240	280	-	Inspected by NPM office also and buried	
29.	08.09.1997	Muthupettai	Bottom set gill net	-	35	-	"	
30.	03.11.1997	Periapattinam	Thirukkai Valai	-	74	Male	"	
31.	07.12.1997	Seeniappa Darha	Thirukkai Valai	-	30	-	"	
32.	10.12.1997	Seeniappa Darha	Thirukkai Valai	-	35	-	"	
33.	02.02.1998	Periapattinam	Caught in gill net	-	120	-	Sold at shore	
34.	20.03.1998	Alagankulam	Found dead in the sea no-injuries	45	200	Male	Inspected by Wildlife Warden, buried	
35.	30.04.1998	CMFRI Jetty	Washed ashore with propeller injuries, partially damaged	281	210	Male	Buried	
36.	28.03.1999	Mandapam (Gulf of Mannar)	Washed ashore	162	803	Male	Semi decomposed condition; buried.	
37.	14.01.2000	Tharuvaikulam	Caught in drift gill net	121	30	Male	Informed by CMFRI Staff	

caught in fishing nets. Tables 1-3 give the number of Dugongs caught during 1994-98. Out of 25 Dugongs, three were stranded at Kilakkarai and two at Valinokkam in the Gulf of Mannar region.

A total of four dugongs were caught in Palk Bay region, out of which two were stranded, one at Alagankulam and another at Morpannai (found in decomposed condition), and two were caught in gill nets, one at Jegathapattinam and another at Alagankulam (Table 3). In most cases, only sex and approximate weight of the animals could be estimated.

More Dugongs were stranded in the Gulf of Mannar than in Palk Bay region. This may be due to extensive sea grass beds distributed from Rameswaram to Pamban near the sea shore, as well as in and around the islands of Gulf of Mannar at depths up to 5 m. It also forms a congenial habitat for breeding and feeding, including the Gulf of Kutch region.

### Incidental catch

In the Palk Bay region, Dugongs were captured at Tondi and Thirupalaikudi, Karankadu, Nambuthalai, Mullimunai and Morpannai (Fig. 1). The catches were either locally consumed or transported to Kilakkarai or Tondi. In the Gulf of Mannar, the chain of islands comprising Hare Island, Talayari Island, Valai Island, Appa Island, Valiamunai Island, and Anaipar Island, and particularly near Sethukkari are potential grounds for occurrence of Dugongs.

The data showed that the majority of Dugongs were caught as incidental catches near shore waters of Valinokkam, Kilakkarai, Kalimankundu, Periapattinam, Seeniappadarha, Vedalai and Thonithurai in the Gulf of Mannar (Table 2). Fishermen also reported that the sightings of Dugongs are very common between Thonithurai and Periapattinam.

The incidental catch and stranding of Dugongs were also observed from Alagankulam and Jegathapattinam, and stranding at Morpannai and Alagankulam in the Palk Bay (Table 3).

The net called "Avolia Valai" which was once used in the Gulf of Mannar and Palk Bay is not in operation due to the effective watch and frequent inspection of the staff of the Marine National Park. For dugongs entangled in this net, death is immediate due to struggle to escape. Dugongs caught in shore-seines were found alive and released in the sea. Most Dugongs caught dead were disposed of secretly. The price of the meat ranged from Rs. 35 to Rs. 50 per kg and the skeletal parts were buried.

Most of the Dugongs captured in the Gulf of Mannar and Palk Bay were between 170 and 280 cm long, according to Nair *et al.* (1975). The largest individual of 406 cm length was reported from Saurashtra coast, but the accuracy of the measurements is doubtful (Silas 1961).

Turner (1894) described a captive dugong fetus measuring 1 to 1.5 m in length. Jones (1959) recorded a 95 cm long juvenile kept alive in an aquarium and stuffed in the CMFRI Museum at Mandapam camp after its death; an c.110 cm long juvenile caught in a bottom set gill-net on September 8, 1955 at Adirampattinam and 150 cm long juvenile collected on December 26, 1956 reared in the marine fish pond that lived for 4 months. Recently, a Dugong stranded near Kilakkarai was found with a foetus of about 150 cm. From the above observations, it is clear that a young Dugong at birth may be 95 to 150 cm long and weigh c. 20 kg.

### Stranding

Stranding of Dugongs was rare. Most animals landed in decomposed condition and the nature of the wound could not be established. One Dugong stranded at Alagankulam on March 20, 1998 had no injury, but a dugong stranded at the CMFRI jetty on April 30, 1998 had a cut made by the propeller of a mechanised trawler in near shore waters (Victor *et al.* 1999). One dugong landed on the Gulf of Mannar side of Mandapam on March 28, 1999 in semi-decomposed condition.

Table 3: Incidental catch and strandings of Dugongs in the Palk Bay

S. No.	Date	Place of capture and stranding	Method of capture	Approximate Length (cm)	Approximate Weight (kg)	Sex	Source of information and remarks
1.	16.02.1995	Jegathapattinam	Gill net	-	150	-	Reported by fishermen, brought to Periapattinam and sold at sea shore
2.	11.10.1997	Morpannai	Washed ashore in decomposed condition	-	-	Male	Informed by FRAD staff, buried
3.	20.03.1998	Alagankulam	Found dead, brought ashore by fishermen	245	200	Male	Inspected by CMFRI staff and Wildlife Warden and buried
4.	02.07.1998	Alagankulam	Caught in gill net, died	-	60	Male	Reported by fishermen, was cut and sold at sea shore

There were some reports of stranded Dugongs with no injuries.

Dynamite fishing is another cause of the death of Dugongs in this area. Explosives are usually used for fish shoals, but they affect nearby dugongs, which mostly die due to shock. On December 14, 1994 a Dugong was found dead after use of dynamite for fishing. Krishnapillai *et al.* (1989) reported killing of Dugong by dynamite at Mandapam.

### Conservation and Management

Annandale (1905) has reported non-availability of more than one dugong at a time in the Gulf of Mannar. Many hundreds were reported in the area earlier. Jones (1967b) has stated that there has been a considerable fall in the Dugong population, and he also cited fishermen reporting that a large number of Dugongs were found dead and that thereafter they have become rare. Fishermen also attributed the mortality of dugongs to scarcity of sea grass beds which perished after flooding of rain water. Silas and Fernando (1985) stressed the need for conservation of Dugongs and proposed several conservation and management strategies. Lal Mohan (1991), Silas *et al.* (1985) and James (1985) stressed upon the need for the effective conservation of dugongs, marine mammals and other marine animals, proposing several conservation programmes and the formation of a National Marine Park in the Gulf of Mannar.

There is global concern for the protection of the Dugong, and in India today the residual population of this species in the Gulf of Mannar and Palk Bay is the most vulnerable and facing extinction. Dugongs are not prolific breeders. Moreover, the destruction of grazing beds has confined the animals to a restricted belt of sea grass. Earlier reports as well as the recent stranding and incidental catches, prescribe the need for intensified efforts to conserve marine mammals, particularly Dugongs.

Indian Ocean Alliance Conference held in the Seychelles in 1981 recommended that priority be given to Dugong survey in the Indian Ocean, with the aim of monitoring and protecting local populations and consider the feasibility of re-establishment.

The IUCN Commission of National Park and World Wide Fund (WWF) identified the Reserve as being an area of "Particular concern" due to its diversity and special multiple-use management status. In addition, Gulf of Mannar, as the first marine biosphere reserve declared in India, has long been a national priority.

The Government of India and state of Tamil Nadu jointly set up the Gulf of Mannar Marine Biosphere Reserve

(GOMMBRE) on February 18, 1989. The Government of Tamil Nadu in the GOMs. No. 962 dated September 10, 1986 notified under section 35(1) of the Wildlife (Protection) Act 1972 its intention to declare the 21 islands as Marine National Park for the purpose of protecting marine wildlife and its environment, including 3.5 fathoms depth on bayside to 5 fathoms depth on the seaward side.

The Gulf of Mannar Marine National Park is managed by the wildlife wardens of Ramanathapuram, Mandapam, Kilakkarai and Tuticorin, who are provided with an effective wireless communication network and boats for inspection and patrolling.

### Action plan

Effective steps are required towards conservation and management of marine mammals, particularly the Dugongs in the Gulf of Mannar and Palk Bay, and an action plan is urgently needed.

1. Staff strength of Gulf of Mannar National Park under Wildlife Warden needs to be increased. Frequent visits should be made to the villages where illegal fishing and cutting of Dugong is done. Intensive watch has to be made near the shore to stop setting of nets in the sea grass beds.
2. Action needs to be taken to create greater awareness and interest in Dugongs and a detailed study of the habits, habitats and behaviour needs to be carried out.
3. Scientific data, such as length, weight, stomach contents should be updated.
4. Mechanized trawlers should be stopped within 5 km from the shore where there is extensive growth of sea grass.
5. Fishing zones and sanctuaries must be established to protect the fauna.
6. Illegal fishing using dynamite must be stopped and laws enacted to curb it.
7. Public awareness has to be created, especially in the fishing villages. The village Panchayat can play a major role in creating awareness. Warnings have to be issued through posters and other publicity systems proclaiming severe punishment for catching and cutting up Dugongs.

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