[2009-2011]

Ecological studies on the *Dugong dugon* of the Andaman and Nicobar Islands: A step towards species conservation

By

Elrika D'souza and Vardhan Patankar

Nature Conservation Foundation, Mysore

3076/5, IV Cross, Gokulam Park,

Mysore - 570 002, Karnataka, INDIA

Email: **elrika@ncf-india.org**

vardhan@ncf-india.org

2011

Contents

Although widely distributed, little is known about the dugong in most of the areas of occurrence. In India, information about the animal is patchy and restricted to sighting, stranding and mortality records. Historically dugongs were abundant in the Andaman and Nicobar islands, but hunting and habitat loss has led to the decline in their numbers. Conservation efforts for dugongs around the Andaman and Nicobar islands have been hindered due to the vastness of the area and a lack of understanding of the species and its habitat. Our project aimed at a gaining local knowledge of the species through a study on its habitat and characteristics of seagrass meadows that affect site use by dugongs. The project was also trageted to increase awareness among local communities in order to contribute to an increased protection of the animal. Through our project, we have identified seagrass meadows that are used and likely to be used by dugongs, carried out education programs in different villages where dugongs are known to occur and identified seagrass meadow characteristics that lead to habitat use by dugongs. The study forms a baseline for future studies and importance of dugong habitat monitoring on a longer timescale is outlined.

Background

The sea cow, *Dugong dugon* (Muller) is the only existing species of the Dugongidae family in the Order Sirenia, the others being extinct. It is a herbivore and inhabits coastal and near shore waters. The documented geographical range of the dugong extends over the coastal waters of almost 37 countries ranging from east Africa, through south and south-east Asia to Australia. Though widely distributed, little is known about the animal in most of the areas of occurrence. This herbivorous mammal, inhabiting the marine environment was once abundant in many parts of its range but numbers have declined and its area of occupancy has decreased in recent times due to exploitation and loss of habitat. The dugong is currently listed in the IUCN Red List of Threatened Species as being vulnerable to extinction. In India, dugongs have been given the highest level of legal protection and listed under Schedule I of the Indian Wildlife Protection Act, 1972.

In India, dugongs have been reported from the Gulf of Kutch in the north-west, Gulf of Mannar and Palk Bay in southeast and the Andaman and Nicobar islands (Annandale 1905; James 1974; Jones 1959, 1980; Jonklass 1961; Lal Mohan 1963, 1976, 1980; Mani 1960; Nair et al. 1975; Prater 1928; Silas 1961; Silas & Fernando 1985, Husar 1978; Jones 1980; James 1988). There are no records from further north along the east coast of India or from the Sunderbans (Nishiwaki & Marsh 1985), although there are records from the Chittagong coast of Bangladesh and Burmese waters (Yin 1971). They were previously reported (as seals) along the west coast of India (Jerdon 1874), from salt water inlets off the south Malabar and Konkan coasts as far north as Canara (which corresponds to southern Maharashtra, Goa, Karnataka and Kerala today). The occurrence of dugongs along the Malabar Coast was also mentioned in the Imperial Gazetteer (Anon 1909). Dugongs have also been reported from the Maldives and Laccadive Islands (Husar 1975)but are now believed to be extinct (Jethva and Solanki 2008).

Dugongs were common in the Andaman and Nicobar Islands until the 1950s but currently there are only sporadic sightings and poaching records (Das and Dey 1999). A first study on the distribution of seagrass meadows was carried out in 1995. This study estimated , presence of 40 dugongs based on interviews with fishermen and regular divers (Das and Dey, 1999). Das and Dey (1999) estimated around 40 dugongs in 1994-95 based on chance encounters with fishers and dive operators. D'souza and Patankar (2008; 2009) sighted three dugongs in the wild at Neil, Havelock and Kodiaghat Islands in the southern Andaman Islands, and three dugongs were sighted near Neil Island by Jethva and Solanki (2008). In 2008, we collated all available information on dugong occurrences from records available since 1956 and found that there were 58 records of mortality in the past 50 years and in the past 20 years there were 10 records of mortality indicating a possibility of a further decline in numbers since the 1999 report.

Aim and objectives

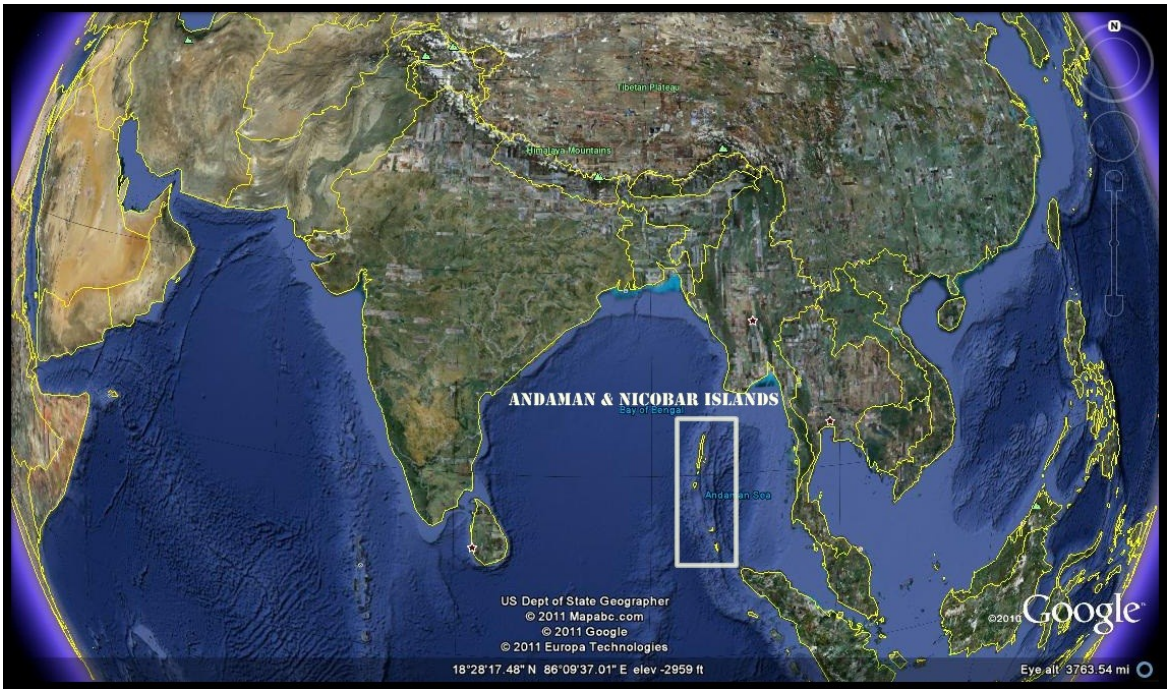
Given these more current estimates of the dugong population in the Andaman and

Nicobar islands, this population could already be genetically extinct with its surviving members restricted to isolated pockets of interacting individuals. Further, the limited information on the habitat and the vastness of the area had been hindering conservation efforts. Under these circumstances, it was imperative to identify the present dugong habitats across the islands and understand how dugongs use these habitats in space and time. The present study was therefore aimed at identifying all dugong habitats and characteristics of seagrass meadows that are responsible for habitat use.

Project members

Name	Age	Academic qualifications	Experience	Role in the project
Elrika D'souza	29	PhD Student	Has been part of 3 research projects in the Andaman and Nicobar island, familiar with the area and has a good rapport with local communities and authorities	Team Leader Carry out field surveys Communicate research findings to stakeholders
Vardhan Patankar	28	PhD Student	Has been part of 2 research projects in the Andaman and Nicobar islands, familiar with the area, trained SCUBA diver	Carry out field surveys Data analysis Documentation (Photography and Video)
Saw Yoayela	24	Secondary school	A good swimmer and skin diver, familiar with the area	Assist in field surveys
Euriel	26	Primary school	Has worked with researchers in the past, familiar with the area	Assist in field surveys Interpreter in the Nicobar islands

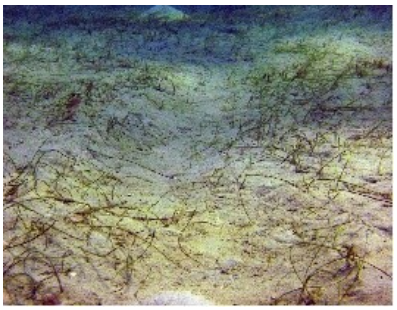
The Andaman and Nicobar groups of islands are one of the most biodiversity-rich regions of India (Davidar *et al*., 1994) and are located in the south-eastern part of the Bay of Bengal, between Latitude 60° and 14° N and longitude 91° and 94° E (Srinivasan, 1986). This group, commonly known as the Bay islands, consisting of more than 300



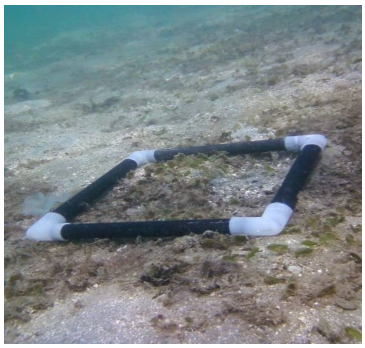
islands, stretches from Landfall Island in the North to the Great Nicobar Islands in the south. Biogeographically the 10 degree channel separates the 2 island groups into the Andaman archipelago and Nicobar archipelago (Rodgers and Panwar, 1988). The Andamans are considered to be extensions of the Arakan Yomas range, a southward trending branch of the eastern Himalayas that merges in the north with the ranges in north-east India ridges. The Nicobar group is the continuation of the Mentaweri islands to the south and south west of Sumatra (Rodolofo, 1969; Das, 1999c) (Fig. 1). The 5,000 km^2 Andaman Islands are in the south-east Bay of Bengal in the Indian Ocean. The archipelago comprises 4 large islands, North, Middle, Baratang and South Andaman Islands and surrounded by many small isolated islands (Davidar *et al*., 1994). The 2,000 km^2 Nicobar comprises 21 large and small islands, of which 12 are inhabited (Fig. 1). The western side of these islands is strongly influenced by waves and currents during the south-west monsoon of May-September. The eastern side is influenced by waves and currents during the north-east monsoon of September-January (Fig. 1). The islands contain some of the last remaining pristine rainforest habitats, with unique assemblage of flora and fauna distinct from the mainland (Rodgers and Panwar, 1988) and form the western boundary of the Indo-Burma biodiversity hotspot (Mayers et al., 2000).

Based on a past report on seagrass meadows and information from fishermen and regular sea-farers, we prepared a rough map of the distribution of seagrass meadows and accessed each of these meadows by boat. At each meadow we searched for the feeding trails of dugongs by snorkelling. Dugong feeding trails are serpentine cleared patches with seagrass along the edges. Meadows that had feeding trails was marked as sites used by dugongs. We also collected data on variables such as depth, fragmentation of a meadow (classified as patchy or continuous), exposure and size of meadow. Samples of seagrasses from each meadow were collected within 20X20 cm quadrats. These samples were analysed for seagrass species composition and shoot density and then sun-dried and stored for further analysis. All data was entered in Excel worksheets.

Snorkelling in a seagrass meadow



Feeding trail of a dugong



Sample collection within a quadrat

We then compared data on the distribution of seagrass meadows pre-tsunami and that obtained during our present survey and represented it on a map to see if the tsunami had an affect on seagrass meadows. We also compared the past records on dugong occurrences with the present site occupancy data and represented it on a map. A map on the present distribution of dugong habitat was also prepared. All maps were prepared using Quantum GIS software.

Results

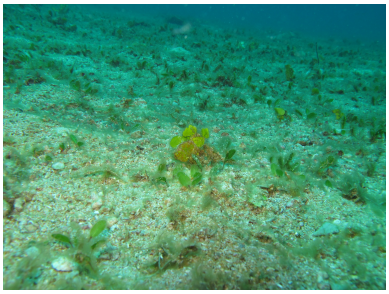
Based on the past data on seagrass meadows and secondary information, we surveyed sixteen seagrass medows around the Andaman and Nicobar islands. From all the seagrass medows we collected quantiatative information on the distribution of these meadows along with information on habitat use by dugongs and meadow characteristics (Table 1).

Five of the sixteen meadows surveyed showed the presence of dugong feeding trails (Fig.1). Data on sighting records showed that dugong occurrences have reduced in the past fifty years and are now restricted to four sites around the Andaman islands and three sites around the Nicobar islands which coincide with the records of feeding signs obtained during the present survey (Fig.2).

A comparison of seagrass distribution prior to the tsunami of 2004 (Fig.3) showed that a few meadows around the central and southern Nicobar group of islands were absent after the tsunami (Fig.4).

A fragmented meadow

We found two characteristics of the meadow that governed dugong habitat use namely, **seagrass species composition** and the **spread of seagrass within a meadow**. All seagrass meadows that had dugong feeding signs comprised *Halophila ovalis* and *Halodule uninervis*. Within each of these meadows, seagrass shoots were spread evenly and continuously.



A continuous meadow

Halodule uninervis

Halophila ovalis

Location	Site name	Feeding signs	Meadow characteristics					
			Seagrass species composition	Shoot density	Depth (0-5=1, 6-10=2, >10=3)	Meadow size (m^2)	Exposure	Spread
Great Nicobar	B-Quarry	Absent	Halodule uninervis	65	2	1500	Exposed	Patchy
Camorta	Derring Bay	Absent	Halophila Minor	112	1	60000	Sheltered	Patchy
	Navy	Absent	Enhalus	5	1	100	Exposed	Patchy
Nancowry	Balu Basti	Absent	Halophila ovalis, Enhalus	118	1	300	Partial	Patchy
	Tapong	Absent	Syringodium, Halodule uninervis, Cymodocea rotundata, Thallasia	146	1	7500	Exposed	Patchy
Katchall	Marine	Present	Halophila ovalis Halodule uninervis	84	1	15000	Partial	Continuous
Tillangchong	Police Camp	Absent	Halodule, Halophila	39	1	750	Exposed	Patchy
Nancowry-Camorta Harbour	Nancowry-Camorta Harbour	Absent	Halophila ovalis, Halodule uninervis	72	1	100000	Sheltered	Patchy
Neil	Point	Present	Halophila ovalis	115	3	40000	Exposed	Continuous
	Tango	Present	Halophila ovalis	112	3	45000	Exposed	Continuous
	Jetty right	Present	Halophila ovalis, Halodule uninervis	62	3	15000	Exposed	Continuous
Hugh Ross	Beach Front	Present	Halophila ovalis	101	3	20000	Exposed	Continuous
Little Andaman	Butler Bay	Absent	Halophila	69	3	5000	Exposed	Patchy
Craggy	Channel	Absent	Halodule pinnifolia	25	2	2500	Exposed	Patchy
Ross Smith	Beach Front	Absent	Halophila, Halodule	46	1	12500	Exposed	Patchy
Mayabunder	Bay	Absent	Halodule	151	1	250000	Partial	Patchy

Table 1: Summary of data collected

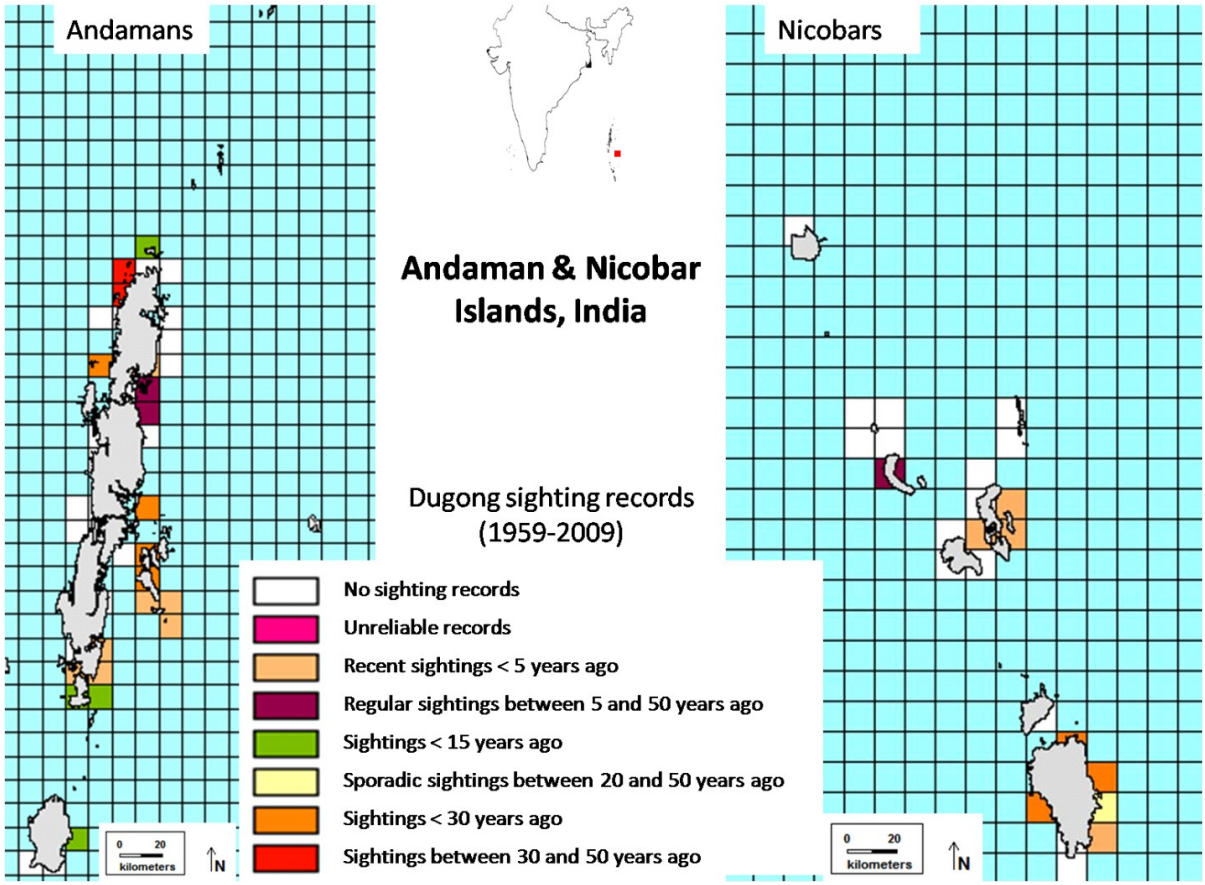


Figure 2: Dugong occurrences based on sighting, stranding and mortality records

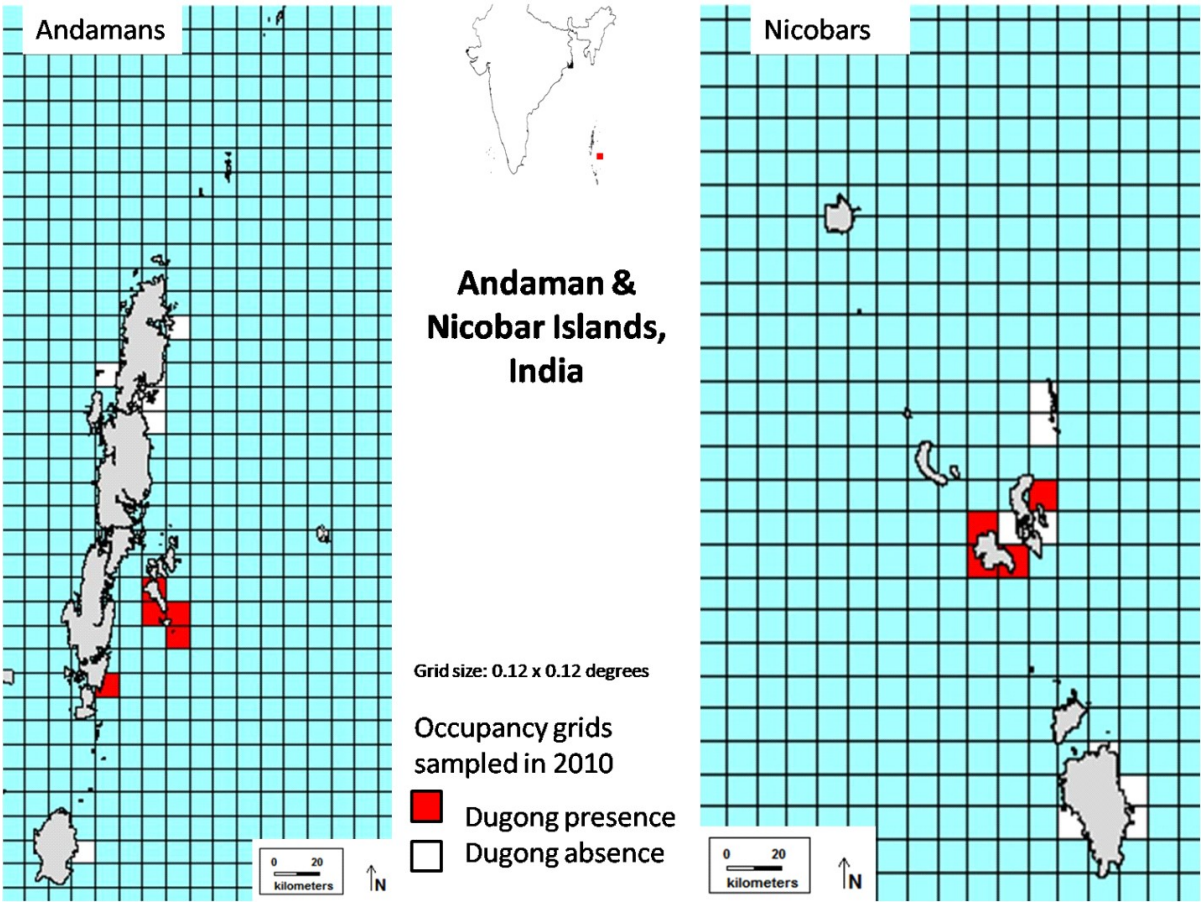


Figure 1: Seagrass meadows that showed the presence of dugong feeding signs

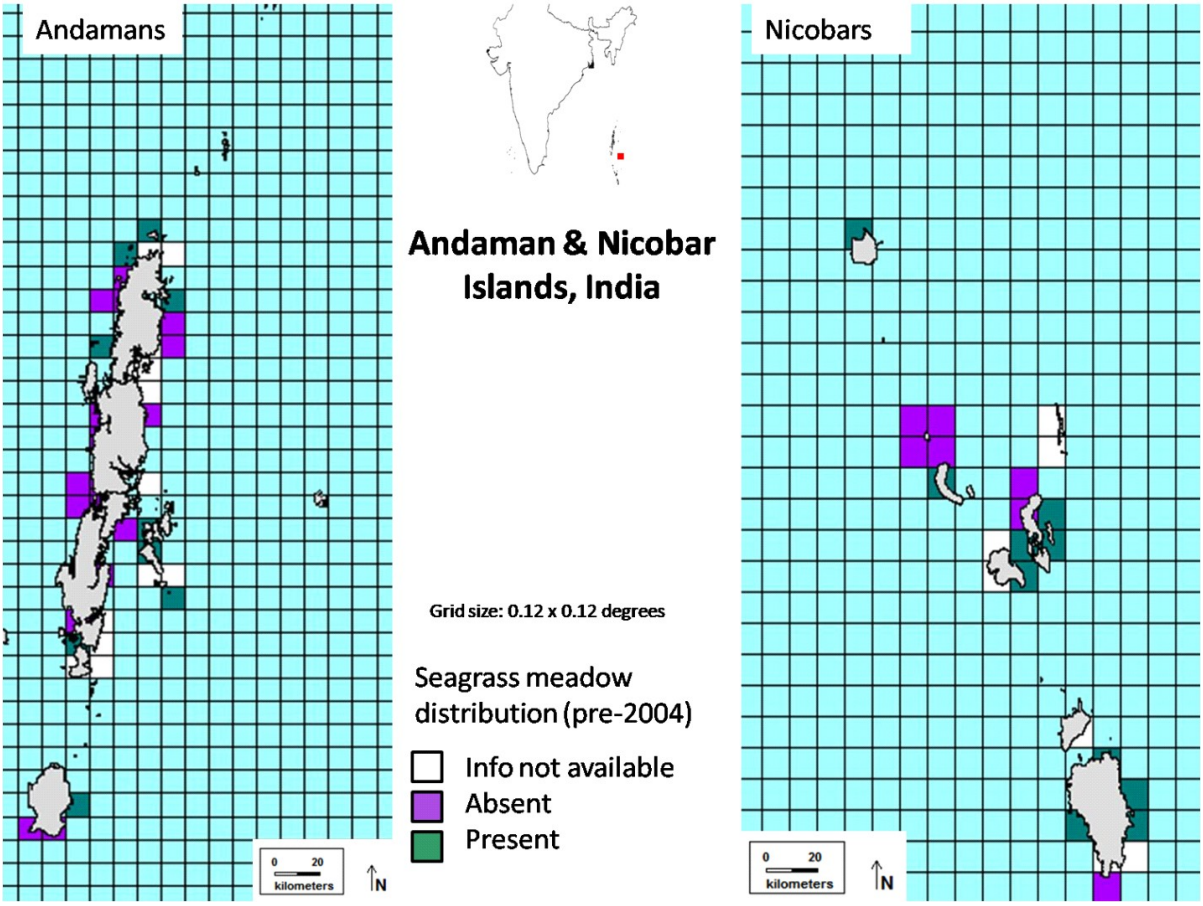


Figure 3: Distribution of seagrass meadows prior to the tsunami of 2004

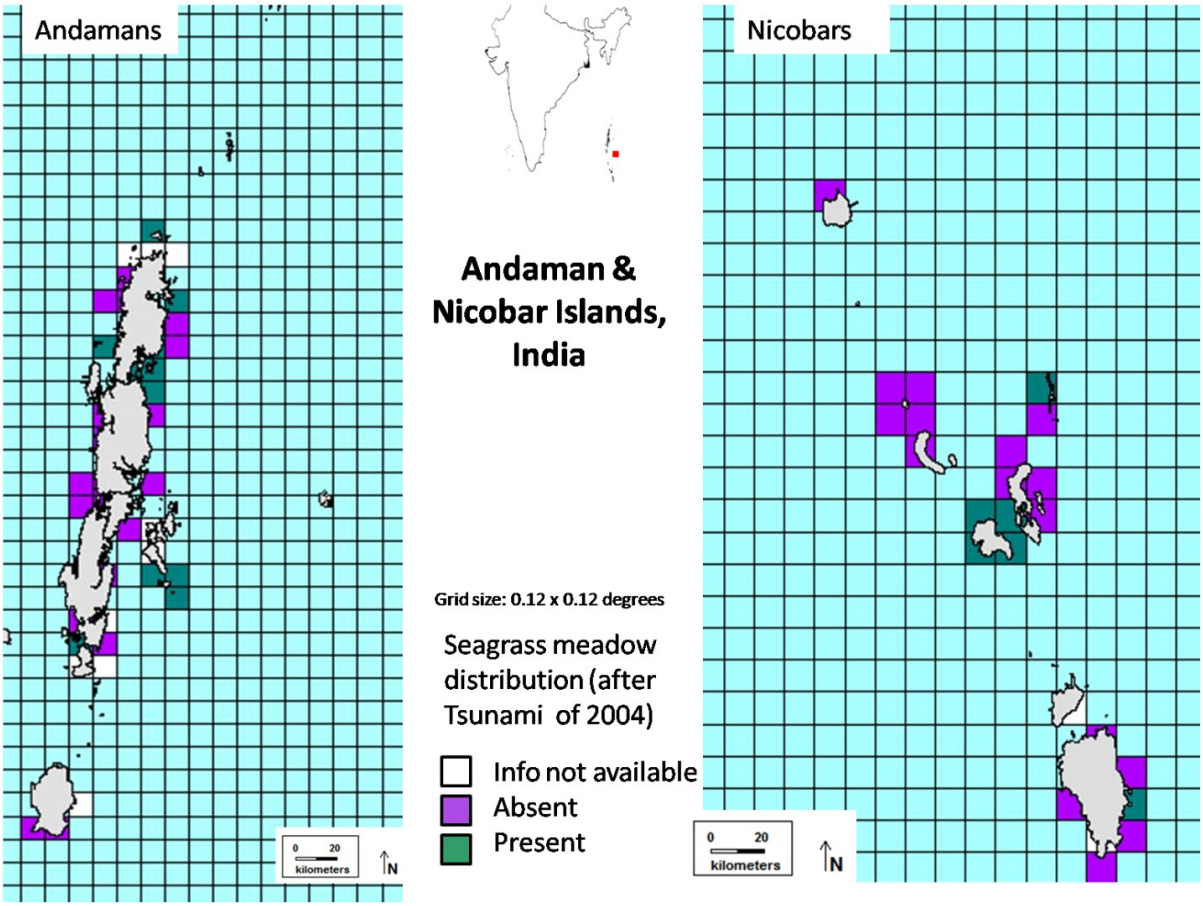


Figure 4: The present distribution of seagrass meadows

Dugongs were once abundant across the Andaman and Nicobar islands. Occurrences were spread across the island chain. A comparison of past records indicates that there has been a decline in sightings and the areas of occupancy have now reduced to a few isolated pockets around some islands. The increasing anthropogenic pressures coupled with the higher frequencies of catastrophic disturbances could be responsible for declines in habitat quality and subsequently dugong populations.

The tsunami of 2004 resulted in the loss of some seagrass meadows where dugongs were reported in the past. There is a possibility that the populations in these regions were affected and perished or migrated to nearby seagrass meadows or neighbouring islands. However, the absence of prior data makes it difficult to confirm mortality or migration. Under these circumstances, monitoring the present dugong habitats is important along with attention to sites with past records to see if habitats have recovered and dugongs once again use the habitats.

A comparison with past and present occurrences shows that although reduced, locations of sightings and consequently areas of occupancy of dugongs have remained the same since the past 50 years. This is possibly due to the persistence of seagrass meadows in these areas. It is known that there is seasonality in production within seagass meadows. As spread of seagrass within a meadow was identified as one of the factors affecting dugong habitat use, there could be a variation in spread across seasons which could affect habitat use at different times of the year. We will be investigating this idea as the follow-up work to this project.

With the data available on present dugong occurrences, it is possible for managers to concentrate conservation efforts on these sites so that further mortality of dugongs is reduced. As all seagrass habitats around the islands could not be surveyed due to logistic and weather constraints, there is a possibility of identifying more sites used by dugongs and hence this study needs to be continued along with conservation efforts in the identified areas.

The study forms a baseline for future studies and could also serve as an example and importance of dugong habitat monitoring on a longer timescale is outlined. Based on the success, this project can form a case study and can be replicated in other parts of India where dugongs are known to occur. With India signing an MoU at the Convention on the Conservation of Migratory species of wild animals (CMS) in 2008 under the United Nations Environment programme, the results of the study will contribute to global conservation efforts of dugongs.

Acknowledgements

We greatly acknowledge the financial support received for the project from the Conservation Leadership Programme. We thank the Chief Wildlife Warden Shri. D.V. Negi for permitting us to carry out the study. We also thank all the staff in the Department of Environment and Forests for supporting us during the study. We specially thank Dr. A.K. Kumaraguru, Dr. Rohan Arthur, Dr. Teresa Alcoverra and Dr. Nuria Marba for their guidance, our field assistants for their inputs and efforts during our field surveys. We thank Nachiket Kelkar for helping us with the maps and Reef Watch Marine Conservation for the equipment support.

Annandale, N. 1905. Notes on the species, external characteristics and the habits of the Dugong. Journal of the Asiatic society of Bengal 1:238-243.

Anon 1909. The Imperial Gazetteer of India. The Indian Empire Vol 1. Descriptive. Clarendon, Oxford, xxxi + 568pp.

Aragones, L. V., T. A. Jefferson, and H. D. Marsh. 1997. Marine mammal survey techniques applicable in developing countries. Asian Marine Biology 14:15-39.

D' souza, E., and V. Patankar. 2009. First underwater sighting and preliminary behavioural observations of Dugongs (Dugong dugon) in the wild from Indian waters, Andaman Islands. Journal of Threatened Taxa 1: 49-53.

D' souza, E. V. P. 2008. Out of the blue. Sanctuary Asia 28:40-45.

Das, H. S. 1996. The vanishing mermaids of Andaman and Nicobar islands. Sirenews: Newsletter of the IUCN/SSC Sirenia Specialist group 26:5-6.

Das, H. S. 2000. Onges and their vanishing mermaids. Pages 4-8. Hornbill.

Das, H. S., and S. C. Dey. 1999. Observations on the dugong, Dugong dugon (Muller), in the Andaman and Nicobar Islands, India. Journal of the Bombay Natural History Society 96:195-198.

Frazier, J. G. a. M., T. 1990. Dugong, *Dugong dugon*(Muller) in the Gulf of Kutch, Gujarat. Journal of the Bombay Natural History Society. 87:368-379.

Husar, S. L. 1975. Survey of the order Sirenia: Part 1 the dugong (*Dugong dugon*). Page 40 + figures and references in N. M. o. N. H. Fish and wildlife Laboratory, editor, Washington D.C.

Husar, S. L. 1978. Dugong dugon. Mammalian Species 88:1-7.

Ilangakoon, A. D., D. Sutaria, E. Hines, and R. Raghavan. 2008. Community interviews on the status of the dugong (*Dugong dugon*) in the Gulf of Mannar (India and Sri Lanka). Marine Mammal Science 24:704-710.

James, D. B. 1988. Some observations and remarks in the Endangered Marine Animals of Andaman and Nicobar Islands. Proc. Symp. Endangered Marine Animals and Marine Parks:337-340.

James, P. S. B. R. 1974. An osteological study of the Dugong *Dugong dugon* (Sirenia) from

India. Marine Biology 27:173-184.

James, P. S. B. R., and R. S. L. Mohan. 1987. The marine mammals of India. Marine Fisheries Information Service. Technical and Extension Series. 71:1-13.

Jerdon, T. C. 1874. The mammals of India; a natural history of all animals known to inhabit continental India. J.Wheldon, London.

Jones, S. 1959. On a pair of Captive Dugongs. Loris (Journal of Ceylon Wildlife Protection Society) December:83-87.

Jones, S. 1967a. The dugong *Dugong dugon* (Muller) its present status in the seas around India with observations on its behaviour in captivity. Int. Zoo. Yearb 7:215-220.

Jones, S. 1967b. The dugong, its presence status in the seas round India with observatins on its behaviour in captivity in C. Jarvis, editor. Huspandary and Research: Internatinal Zoo Yearbook No. 7.

Jones, S. 1980. The dugong or the so-called mermaid, *Dugong dugon*(Muller) of the Indo-sri Lanka waters - Problems of research and conservation. Spolia Zeylanica 35:22--260.

Jonklass, R. 1961. Some observations on dugongs (Dugong dugon Erxleben). Loris 9:1-8.

Kulkarni, S., Patankar, V. and D'souza, E. (2008). 2008. Status of earthquake and tsunami affected coral reefs in the Andaman and Nicobar islands, India. Pages 173-183. In CORDIO Status Report 2008.

Lal Mohan, R. S. 1963. On the occurrence of dugonh dugon (muller) in the Gulf of Clutch. J. Mar. Biol. Ass. India 5:152.

Lal Mohan, R. S. 1976. Some observations on the Sea cow, Dugong dugon in the Gulf of Kutch. Journal of Marine Biological Association of India 18:391-397.

Lal Mohan, R. S. 1980. Some observations on the sea cow, *Dugong dugong* from the Gulf of Mannar and Palk Bay during 1971-1975. Journal of the Marine Biological Association of India 18:391-396.

LalMohan, R. S. 1994. Review of Gillnet Fisheries and Cetacean Bycatches in the Northeastern Indian Ocean. Report for the International Whaling Commission:329-343.

Mani, S. B. 1960. Occurrence of the sea cow, *Halicore dugong* (Exrl.) off the Saurashtra coast. journal bombay natural historical society 57.

Marsh, H., H. Penrose, C. Eros, and J. Hugues 2002. Dugong: Status Report and Action Plans for Countries and Territories. UNEP.

Nair, R., R. S. Lal Mohan, and K. Satyenarayana Rao. 1975. The Dugong *Dugong dugon*. Page 45. ICAR Bulletin of the Central Marine Fisheries Research Institute. Central Marine Fisheries Research Institute, Cochin, India.

Nishiwaki, M., and H. D. Marsh. 1985. The Dugong *Dugong dugon* (Muller, 1776). Pages 1-31 in S. H. Ridgeway, and R. J. Harrison, editors. Handbook of Marine Mammals. Academic Press, London.

Prater, S. H. 1928. The dugong or sea cow (Halicore dugong). J. Bombay Nat. Hist. Soc 1999, 33: 84-99 + 84 pls.

Ramachandran, S., S. Anitha, V. Balamurugan, K. Dharanirajan, K. E. Vendhan, M. I. P. Divien, A. S. Vel, I. S. Hussain, and A. Udayaraj. 2005. Ecological impact of tsunami on Nicobar Islands (Camorta, Katchal, Nancowry and Trinkat). Current Science 89:195-200.

Sankaran R., H. Andrews, and A. Vaughan. 2005. The Ground beneath the waves. Pages 22-25. In Post-tsunami Impact assessment of Wildlife and their habiats in India.

Silas, E. G. 1961. Occurrence of the sea cow, Halicore dugong (Exrl.) off the Saurashtra coast. Journal of the Bombay Natural History Society. Bombay 58:263-266.

Silas, E. G., and B. Fernando. 1985. The Dugong in India - is it going the way of the Dodo? Page 18. Central Marine Fisheries Research Institute. Commission on Endangered Marine Animals and Marine Parks, Cochin, India.

Sutaria, D., and, and T. Jefferson. 2004. Records of Indo-Pacific Humpback Dolphins (Sousa chinensis, Osbeck, 1765) along the Coasts of India and Sri Lanka: An Overview. Aquatic Mammals 30 125-136.

Yin, T. 1971. The dugong Dugong dugon (Müller) in Burmese waters. Journal of Bombay Natural History Society 67 326-327.